Pierce County Flood Control Zone District

RESOLUTION NO. 2019-2

A Resolution of the Pierce County Flood Control Zone District, Amending Resolution Nos. 2013-3s and 2015-2, and Adopting an Update to the District Comprehensive Plan of Development.

Whereas, by Resolution No. 2013-3s, the Board of Supervisors adopted the "Pierce County Flood Control Zone District Comprehensive Plan of Development," which was based on the Pierce County Rivers Flood Hazard Management Plan, 2013; and

Whereas, by Resolution No. 2015-2, the Board of Supervisors adopted three new sections to Resolution No. 2013-3s; and

Whereas, by Ordinance No. 2018-83, the Pierce County Council adopted the "2018 Pierce County Rivers Flood Hazard Management Plan—Vol. I and Vol. II, dated November 2018 ("Flood Hazard Management Plan Update")," as an update to the Pierce County Rivers Flood Hazard Management Plan, 2013; and

Whereas, the District Advisory Committee reviewed the Flood Hazard Management Plan Update at meetings held in 2017-2018; and

Whereas, the District Executive Committee considered and reviewed the Flood Hazard Management Plan Update on February 20 and March 20, 2019; and

Whereas, the Board of Supervisors held a public hearing on the adoption of the Flood Hazard Management Plan Update as an amendment to the District Comprehensive Plan of Development on April 10, 2019; and

Whereas, the Board of Supervisors desires to adopt the Flood Hazard Management Plan Update as an amendment to the District Comprehensive Plan of Development; Now, therefore

BE IT RESOLVED by the Board of Supervisors of the Pierce County Flood Control Zone District as follows:

Section 1. Pursuant to RCW 86.15.110, the Board of Supervisors of the District adopts the document titled "2018 Pierce County Rivers Flood Hazard Management Plan – Volumes I and Volume II, dated November 2018 ("Flood Hazard Management Plan Update")," adopted by the Pierce County Council in Ordinance No. 2018-83 and shown in Exhibit A, which is attached hereto and incorporate herein, as an amendment to the District Comprehensive Plan of Development.

Section 2. The District Executive Director, with the assistance of the District Administrator, is authorized and directed to submit the amended District Comprehensive Plan of Development to the Department of Ecology, as required by RCW 86.15.110. If the Board of Supervisors adopts a resolution approving an improvement that is described only in the Flood Hazard Management Plan Update, such improvement may be commenced ninety (90) days or more after submittal of the amended District Comprehensive Plan of Development to the Department of Ecology.

Section 3. Except as modified by this Resolution, Resolution Nos. 2013-3s and 2015-2 shall continue to apply to the District Comprehensive Plan of Development.

ADOPTED this 10th **day of** April **, 2019.**

ATTEST:

Kate Kennedy

Kate Kennedy, Clerk of the Board

PIERCE COUNTY FLOOD CONTROL ZONE DISTRICT
Pierce County, Washington

Derek Young, Board Chair

Rivers Flood Hazard Management Plan—Vol. I

2018 Update adopted Pierce County Council Ordinance No. 2018-83

Pierce County

Flood Control Zone District
Exhibit A Attachment to
Resolution No. 2019-2

Rivers Flood Hazard Management Plan—Vol. II

2018 Update

Adopted Ordinance

Pierce County

Contents

VOLUME II PROGRESS REPORT

Appendix B Update

A project prioritization criteria was created in the 2013 to help prioritize projects for implementation. A status update has been provided to include additional information on the lower White River flood protection projects.

PROJECT PRIORITIZATION RESULTS

		#1	#2	#3	#4	#5	#6	#7	#8			#7 - Multiple Benefits				#8 - Partnerships and Opportunity					
CIP#	Project Name/Location	Land Use	Severity of Impact	Area of Impact	Frequency	Project Effectiveness	Benefit-Cost Analysis	Mulitple Benefits	Partnerships and Opportunity	Total Score	Problem Area Reference	Habitat	Water Quality	Public Access	Total	Partner-ships/ Funding	Land Ownership	Project Readiness	Total	Sub-Total #1-4	Sub-Total #5-8
	Maximum Score	20	10	10	10	10	10	10	10	**90**		4	4	2	10	4	3	3	10	50	40
UP1	Calistoga Setback Levee (RB RM 19.9- RM 21.3)	17	6	6	9	7	6	7	8	**66**	LROB#25	4	2	1	**7**	3	3	2	**8**	38	28
Complete	Sumner WWTP Flood Wall (LB RM 10.4 - RM 10.6)	15	8	10	2	8	9	4	9	**65**	LROB#12	0	4	0	**4**	3	3	3	**9**	35	30
LP1	Tacoma WWTP Flood Wall (LB RM 2.9 - RM 3.1)	18	8	10	1	7	10	4	7	**65**	LROB#1	0	4	0	**4**	2	3	2	**7**	37	28
LP4	North Levee Rd Setback Levee (RB RM 2.8 - RM 8.15 (I-5 to SR161)	16	8	8	1	7	8	8	5	**61**	LROB#2	4	3	1	**8**	4	1	0	**5**	33	28
UN2	Upper Nisqually/Mt. Rainier National Park Revetment Retrofit/ELJs (RB RM 64.9 - RM 65.3)	18	8	8	8	4	4	4	7	**61**	CM#21	3	1	0	**4**	3	3	1	**7**	42	19
LP5	Puyallup WWTP Flood Wall (LB RM 6.8 - RM 6.9)	15	8	10	3	8	6	4	6	**60**	FSI#9	0	4	0	**4**	2	3	1	**6**	36	24
C4	Alward Rd Floodplain Acquisition and Setback Levee (LB 6.4-8.3)	12	8	5	10	8	4	6	3	**56**	**LROB#38**, PS#10	4	2	0	**6**	0	2	1	**3**	35	21
MP1	Rainier Manor/Riverwalk/Rivergrove and SR-410 Flood Wall and Levee (RB RM 10.6 - RM 11.8)	13	7	7	9	8	5	0	6	**55**	**LROB#13**, FSI#16	0	0	0	**0**	3	2	1	**6**	36	19
LP2	Clear Creek Acquisition/Levee (LB RM 2.9)	11	9	6	10	6	5	5	1	**53**	TBF#2, **PS#1**	4	1	0	**5**	0	1	0	**1**	36	17
LW1	State St. FloodWall or Emergency Access (LB RM 0.2 - RM 0.3)	17	4	4	9	8	6	2	3	**53**	FSI#27	0	2	0	**2**	2	1	0	**3**	34	19
Project Removed from RFHMP - Outside of Pierce County	SR-410 ELJs and Road Elevation (RB 43.5-43.8: WSDOT Problem Site 9, Milepost 41.4-42.0)	15	8	8	4	6	5	1	6	**53**	PS#9	1	0	0	**1**	1	3	2	**6**	35	18
SP1	S. Prairie Floodplain Acquisitions (RB RM1.6 - RM 3.5)	12	8	4	8	10	4	3	4	**53**	PS#11	2	1	0	**3**	0	2	2	**4**	32	21
M1	SR-161 Mashel River Bridge Scour and Slope Repair (LB RM 5.2 - RM 5.3 and RB RM 5.5)	14	6	5	4	6	4	4	9	**52**	CM#22	3	1	0	**4**	4	2	3	**9**	29	23
LP3	Oxbow Lake Flooding /Sewer Lift Station Protection (RB RM 5.0 and backwater area)	17	3	7	1	9	6	3	5	**51**	TBF#4	0	3	0	**3**	2	3	0	**5**	28	23
MP2	McCutcheon Rd & 96th St. E Road Baricade (RB RM 14.2 - RM 14.9)	10	9	4	8	7	8	0	4	**50**	LROB#17, **PS#5**, FSI#20	0	0	0	**0**	0	3	1	**4**	31	19
MP4	McCutcheon Rd & 128th St. E Levee Setback (LB/RB RM 16.7 - RM 17.3)	10	9	5	8	7	3	7	1	**50**	LROB#21, **PS#6**	4	2	1	**7**	0	1	0	**1**	32	18
UP6	Puyallup River/Orville Rd Revetment and Riparian Habitat Restoration Project (LB RM 26.7 - RM 27.1)	13	6	5	8	6	4	4	4	**50**	CM#5	3	1	0	**4**	1	2	1	**4**	32	18
UP4	Orville Road Revetment at Kapowsin Creek (LB RM 26.2 - RM 26.4)	13	6	5	6	6	6	0	8	**50**	CM#4	0	0	0	**0**	4	2	2	**8**	30	20
SP2	S. Prairie Fire Station Flood Protection (LB RM 6.0)	9	8	7	4	7	9	0	6	**50**	FSI#42.2	0	0	0	**0**	2	3	1	**6**	28	22

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CIP#	Project Name/Location	Land Use	Severity of Impact	Area of Impact	Frequency	Project Effectiveness	Benefit-Cost Analysis	Mulitple Benefits	Partnerships and Opportunity	Total Score	Problem Area Reference		Habitat	Water Quality	Public Access	Total	Partner-ships/ Funding	Land Ownership	Project Readiness	Total	Sub-Total #1-4	Sub-Total #5-8
UN1	Nisqually Park Levee Protection (RB RM 64.3 - 64.9)	14	8	5	8	4	4	4	3	**50**	CM#21		3	1	0	**4**	0	2	1	**3**	35	15
UP5	Orville Rd. Channel Migration Project (LB RM26.3 - RM 28.6)	13	6	6	6	6	4	5	3	**49**	CM#4-6, 8		4	1	0	**5**	1	2	0	**3**	31	18
UP4	Neadham Rd Flooding/Channel Migration Protection (RB RM 25.3 - RM 27.0)	9	8	4	6	9	6	5	2	**49**	CM#3, **PS#7**, TBF#10		4	1	0	**5**	0	1	1	**2**	27	22
LP7	Puyallup Executive Park (LB RM 9.1 - RM 9.25)	11	5	5	9	7	9	0	2	**48**	LROB#8		0	0	0	**0**	0	2	0	**2**	30	18
C2	Carbon Levee Bank Stabilization/Flow Deflection and Coplar Cr. Backwater Improvements (LB RM 3.2 - RM 4.9)	13	4	6	10	5	4	3	3	**48**	**LROB#34**, TBF#16		2	1	0	**3**	1	2	0	**3**	33	15
C5	Upper Carbon/Fairfax Rd Bank Stabilization (LB RM 22.4 - RM 24.0)	13	8	4	8	5	3	2	5	**48**	CM#14		2	0	0	**2**	2	3	0	**5**	33	15
C3	Alward Rd Floodplain Acquisition (LB RM 6.0 - RM 6.4)	11	3	4	8	10	5	2	4	**47**	LROB#36		1	1	0	**2**	1	1	2	**4**	26	21
LW3	Butte Ave Levee/Berm (RB RM 4.9 - RM 5.5)	16	6	4	6	4	5	1	3	**45**	LROB#31		0	1	0	**1**	1	2	0	**3**	32	13
C1	Carbon Confluence Setback Levee (LB RM 0 - RM 0.4)	15	4	5	4	7	2	6	2	**45**	LROB#32		4	2	0	**6**	0	2	0	**2**	28	17
MN1	McKenna Area Floodplain Acquisition (RB RM 21.6 - RM 22.0)	12	8	6	4	8	2	2	3	**45**	**PS#12**, FSI#43		1	1	0	**2**	1	1	1	**3**	30	15
LP6	Tiffany's Skate Inn/Riverwalk Floodwall (RB RM 8.1 - RM 8.6)	13	5	5	8	6	5	0	2	**44**	**LROB#6**, FSI#12		0	0	0	**0**	0	2	0	**2**	31	13
LW2	Lower White River Flood Protection (Restoration; 24th Street RM 2.5-RM 4.2)	19	7	9	9	7	6.85	9	8	**68**	FSI#28, SGBA#10		4	4	1	9	4	3	1	8	9	8
LW2	Lower White River Flood Protection(Pacific Point Bar; RM 3.9-RM 4.5)	19	6	9	7	10	6.85	7	7	**65**	FSI#29, SGBA#14		3	3	1	7	4	2	1	7	7	7
LW2	Lower White River Flood Protection (Left Bank Setback; RM 4.4-RM 4.9)	9	5	4	9	9	6.85	5	6	**47**	FSI#30, SGBA#15		2	2	1	5	4	1	1	6	5	6
This project has received additional study by the City of Puyallup. The project needs to be re-evaluated using the project prioritization criteria																						
LP8	Linden Golf Course Oxbow Setback Levee (LB RM 9.6 -RM 10.5)	6	4	4	9						LROB#9										23	
Projects below had two or more options evaluated, but at this time the "No Action" option is proposed for the Flood Plan; future information about the problem or changed conditions would lead to a further evaluation of options																						
LP9	Rite Aid Flooding (LB 9.3-9.5) and Deer Cr Backwater Flooding (LB 9.4)	9	4	5	9						**LROB#10**, TBF#7										27	
LP10	Clarks Cr Home/Structure Elevation and Acquisition (LB 5.8)	10	4	4	8						TBF#3										26	
MP5	Bowman Hilton Mobile Home (LB 13.0-13.4)	6	4	2	9						LROB#16										21	
MP6	Riverside Dr. Setback Levee (LB 12.4-12.8)	10	5	4	9						**LROB#14**, FSI#18										28	
MN2	SR-507 Bridge Approach Protection/Bank Stabilization (RB 21.9)	9	7	5	2						FSI#45										23	
UN3	Kernahan Bridge Abutment Protection (RM 61.7)	10	7	5	6						**CM#19**, FSI#46										28	

CIP = Capital Improvement Project; RM = River Mile; RB/LB = Right/Left Bank; SR = State Route
CM = channel migration; FSI = flooding of structures and infrastructure; LROB = levee/revetment overtopping or breaching; PS = public safety/emergency rescue; TBF = tributary backwater flooding;
LP = Lower Puyallup; MP = Middle Puyallup; UP = Upper Puyallup; LW = Lower White; UW = Upper White; C = Carbon; SP = South Prairie; MN = Middle Nisqually; UN = Upper Nisqually; M = Mashel

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APPENDIX C

The following three tables below include the names of those committee members that were a part of the 2018 Flood plan update. Without these key individuals, this plan update would not have been possible. A flood plan engagement process chart has also been developed to illustrate the plan update process.

Pierce County Rivers Flood Hazard Management Plan Advisory Committee Members	
First Name	**Organization or Interest**
Doug Beagle	City of Sumner
Liz Bockstiegel	Washington Department of Fish and Wildlife
Gary Brackett	Business Association
Linda Burgess	Puyallup River Watershed Council/Pierce County Biodiversity Alliance
Mike Dahlem	City of Sumner
John Ernst Berry III	Puyallup Watershed Initiative
Hans Hunger	City of Puyallup
Jordan Jobe	Farming in the Floodplain Project Manager/ WSU Puyallup
Andrew Kinney	Thurston County Emergency Management
Russ Ladley	Puyallup Tribe
Loren Paschich	Drainage District #10/ Volunteer Clear Creek Farmers Association
Jordan Rash	Forterra
Patrick Reynolds	Muckleshoot Indian Tribe Fisheries Division
Richard Schroedel	Resident of Tacoma, Retired Pierce County Emergency Management
Taylor Shanaman	Tacoma -Pierce County Association of Realtors
Jennifer Stebbings	Port of Tacoma
Jeffree Stewart	Washington State Department of Ecology
Monica Walker	King County
Allen Zulauf	Resident of Puyallup

Pierce County Rivers Flood Hazard Management Plan Internal Planning Committee Members	
First Name	**Organization or Interest**
Angela Angove	Pierce County Surface Water Management
Debbie Bailey	Pierce County Department of Emergency Management
Randy Brake	Pierce County Surface Water Management
Dennis Dixon	Pierce County Surface Water Management
Todd Essman	Pierce County Surface Water Management
Tony Fantello	Pierce County Planning and Public Works
Mike Halliday	Pierce County Planning and Public Works
Johnny Mauger	Pierce County Surface Water Management
Anne-marie Marshall-Dody	Pierce County Surface Water Management
Melissa McFadden	Pierce County Surface Water Management
Tiffany O'Dell	Pierce County Planning and Land Services
Harold Smelt	Pierce County Surface Water Management
Jessica Stone	Pierce County Parks and Recreation Services
Erick Thompson	Pierce County Surface Water Management
Rob Wenman	Pierce County Surface Water Management

Pierce County Rivers Flood Hazard Management Plan Steering Committee Members	
First Name	**Organization or Interest**
Tony Fantello	Pierce County Surface Water Management
Kjris Lund	Executive Director for the Pierce County Flood Control Zone District
Anne-marie Marshall-Dody	Pierce County Surface Water Management
Melissa McFadden	Pierce County Surface Water Management
Harold Smelt	Pierce County Surface Water Management

Pierce County Rivers Flood Hazard Management Plan Engagement Process

Public Engagement

Input at Advisory Committee meetings

Virtual Open House participation

Steering Committee	Internal Planning Committee	Advisory Committee	Flood Control Zone District Advisory Committee	Stakeholder Notification
Role Guide planning process Review/amend goals, objectives, and guiding principles from both committees Guide decisions on countywide action plan Guide through Council/Board process Contribute data, projects, and other relevant information Review draft	Role Provide input on goals, objectives, and guiding principles Review goals, objectives, and guiding principles from Advisory Committee Contribute data, projects, and other relevant information Review draft	Role Provide input on goals, objectives, and guiding principles Review goals, objectives, and guiding principles from Internal Planning Committee Contribute data, projects, and other relevant information Review draft	Role Assist with the planning process Contribute data, projects, and other relevant information Attend Advisory Committee meetings Review draft	Role Notified of the plan update process and could attend or provide input on the draft plan at any time Review draft

Membership SWM Management Team	Membership SWM staff DEM staff Parks and Recreation staff	Membership Muckleshoot Indian Tribe Puyallup Tribe of Indians Residents State Agencies Staff from participating cities Private non-profits Neighboring counties Port of Tacoma Association of Realtors	Membership 15 appointed members by the County Executive representing various cities, unincorporated Pierce County, Water Resource Inventory Areas, businesses, Port of Tacoma, Agriculture and/or Forestry Interest Organizations, and the Puyallup Tribe of Indians	Membership Cascade Water Alliance Washington State Department of Commerce Thurston County Emergency Management Union Pacific Rail
Meetings 4 meetings were held during the planning process, more as needed during the comment and adoption phase	Meetings 4 meetings were held, communication by email was used during the plan update process	Meetings 5 meetings were held, communication by email was also used during the plan update process	Meetings Briefings were done during regularly scheduled FCZD Advisory Committee meetings	Notification An email was sent out at the end of each month that provided information on what took place each month during the plan update process

Flood Plain Regulations, County, Cities, Towns, State and Local Agencies

Flood plain regulations for counties and cities have been updated since the 2010 analysis was completed. Pierce County recognizes that these changes have occurred and will include these updated regulations in the 2023 Flood plan update.

Potential Funding Sources for Flood Damage Reduction and Mitigation Projects update

This grant program is offered in the fall of each odd numbered year. It funds large-scale river projects the emphasize the following values; reducing flood risk and damage, ecological restoration and preservation, climate change, tribal support and engagement, enhancing agriculture, creating partnerships and meeting community needs. SWM has received almost $10 million from this program since 2013 and is anticipating upwards of $7.5 million in 2018. These funds are used almost entirely for the Floodplains for the Future program which unites various stakeholders in Pierce County. This program has allowed Pierce County to exponentially expand the scope of the Clear Creek Floodplain Restoration and Acquisition project on the Puyallup River to include agriculture, habitat and flood risk reduction components. This program allows in-kind match which allows Pierce County to ask for larger amounts of grant funding, making this a dependent and successful source of funding for the Flood Plan.

Puget Sound Acquisition and Restoration Fund (PSAR)

The Puget Sound Acquisition and Restoration program was created in 2007 to help implement the most important habitat protection and restoration priorities for Puget Sound. Funding is appropriated by the Legislature through the Salmon Recovery Funding Board. Pierce County has received over $1.5 million just in the 2015-2017 biennium and is anticipating almost $400,000 in the 2017-2019 biennium.

Puget Sound Acquisition and Restoration Fund Large Capital Projects (PSAR Large Cap)

The Puget Sound Salmon Recovery Council and the Puget Sound Partnership are developed a grant program which funds high priority habitat acquisition and restoration capital projects. SWM has been continuously unsuccessful in applying for this program and has decided to postpone any further applications to this particular grant program as the cost of applying for such a large program greatly outweighs the benefit SWM has received from this program. PSAR Large Cap is under review by SRFB and could experience fundamental changes within

the next funding biennium. If the changes to the program increase likeliness of success, SWM will reexamine its decision to withhold applications in the future for large Flood Plan capital improvement projects.

Pierce County-WA Region 5 Hazard Mitigation Plan and Addendum Update

FEMA funds three Hazard Mitigation Assistance (HMA) grant programs. Hazard mitigation measures are any sustainable action taken to reduce or eliminate long-term risk to people and property from future disasters. The Hazard Mitigation Grant Program (HMGP) is the longest running mitigation program. The HMGP supports cost-effective post-disaster projects from a Presidentially Declared Disaster. The Flood Mitigation Assistance (FMA) program provides grant funds for projects and planning that reduces or eliminates long-term risk of flood damage to structures insured under the National Flood Insurance Program (NFIP) on an annual basis. The Pre-Disaster Mitigation Grant Program (PDM) funds grants annually through a nationally competitive basis with the intent to reduce overall risk to the population and structures from future hazard events. The program awards planning and project grants and provides for public outreach opportunities to reduce future losses before disasters occur

In 2004 the Pierce County Department of Emergency Management implemented the planning process for the County's Hazard Mitigation Plan. The eighteen-month process called together County departments to identify their roles in providing and maintaining a disaster resilient county government. A Hazard Mitigation Committee (HMC) was formed including representatives of all Pierce County departments.

Each department identified its role in providing services and its capabilities to protect and preserve Pierce County. The departments listed their "critical infrastructure" and their locations, hazard maps were developed for each natural hazard risk. Departments then identified where their infrastructure was at risk. Mitigation Strategies were then developed to identify the steps necessary to protect and preserve the assets and/or services of each department in line with the goals of the Plan.

The Pierce County Hazard Mitigation Plan was adopted by the County Council in August 2004, and the County then became eligible for funding for disaster relief as well as "pre-disaster funds" for implementing the mitigation strategies of the Plan. Hazard Mitigation Grant Programs. The HMC was to meet annually to review the progress towards mitigation strategies and determine if changes to the Plan were necessary. Mitigation Plans must be reviewed, updated and adopted every five years to retain eligibility for these three grant funding programs.

In 2008, PC DEM undertook the update of the 2004 Plan. The initial effort was for each department to assess the progress made for each of their 2004 Mitigation Strategies, and

determine if other changes to their infrastructure listings were appropriate. One change obvious to the process was a change in the nomenclature from "critical infrastructure" to "infrastructure;" further, a determination was made to include only owned infrastructure for which the County would be responsible.

The new HMC determined the goals of the 2009 Plan update to be:

- Protect Life and Property;
- Ensure Emergency Services;
- Increase Public Preparedness;
- Establish and Strengthen Partnerships for Implementation;
- Preserve or Restore Natural Resources, and;
- Promote a Sustainable Economy

The partner departments identified their natural hazard risks to be the same as the 2004 Plan:

- Earthquake
- Volcano (lahar)
- Flood
- Severe Storms
- Landslide
- Tsunami
- WUI Fire

In addition to the mitigation strategies carried over from the 2004 Plan, new mitigation strategies were added to the update. These mitigation strategies provide a "game plan" for further action by each department.

Additionally, FEMA revised Plan elements to address the National Flood Insurance Plan and "repetitive loss" properties. When losses to properties occurred on an on-going basis and costs of assistance were in excess of 125% of the value, additional losses would not be compensated.

In 2006, PC DEM received a PDM planning grant to undertake a two and one-half year mitigation planning effort on behalf of other local jurisdictions (city and towns/fire districts/school districts/ utilities/special purpose districts). In 2008 the Region 5 Hazard Mitigation Plan was adopted as a "base plan" with 48 addenda plans representing jurisdictions across Pierce County. The Region 5 Plan, highly acclaimed by WA Emergency Management and FEMA, would be the "base plan" to which subsequent plans, including the Pierce County Hazard

Mitigation Plan, would be attached. The 2009 Pierce County Plan was adopted by the Pierce County Council on December 4, 2009.

In September 2008, PC DEM received HMPG grant money and added 12 new additional addendum plans to the Region 5 Hazard Mitigation Plan. The grant funding extended 3 years to September 2011. In June 2009, PC DEM received additional HMPG funding and added 8 new

addendums. This grant funding extended two years to June 2011. The biggest change with the addition of these 20 new plans occurred with the Risk Section and integrating nine man-made and technological hazards with natural hazards. This allowed for mitigation planning beyond natural hazards and jurisdictions to reduce their vulnerability to man-made and technological disasters. The Region 5 Plan became the Region 5 All Hazard Mitigation Plan to embrace the addition of the man-made and technological hazards. The man-made and technological hazards addressed in the Region 5 Plans:

- Abandoned Mines
- Civil Disturbance
- Dam Failure
- Epidemic
- Energy Emergency
- Hazardous Materials
- Pipeline Hazard
- Terrorism
- Transportation Accidents

Multi-Care was awarded a HMGP planning grant in 2011 and PC DEM facilitated meetings for the development of an additional 8 mitigation plans from the medical sector. In December 2011 Pierce County was awarded a PDM grant in 2011 and the first "kick-off" meeting occurred in March 2012. WA-EMD and FEMA were somewhat confused with the Region 5 Mitigation Plan and the Pierce County Plan and it was agreed to bring the Pierce County Plan (Unincorporated Pierce County) under the Region 5 All Hazard Mitigation Plan as an addendum. This grant provided the funding to update the 2008-2013 Region 5 Mitigation Plan and 69 Addendum's. This update was scheduled to be completed by November 2013. An extension was granted to allow for earthquake and flood Hazus mapping of the 69 Addenda Plans. WA-EMD and FEMA approved the Region 5 All Hazard Mitigation Plan and 76 Addenda's (including the medical group) in December 2014 and the first jurisdiction to adopt their plan was February 9, 2015.

In September 2017, PC DEM applied for another HMGP grant to add an additional 3 mitigation plans which includes another city, utility and the Tacoma-Pierce County Health Department to the existing 76 plans. The City of Puyallup has also updated their mitigation plan in alignment with the Region 5 All Hazard Mitigation Plan bringing the total to 80 jurisdictional mitigation

addendums. In October 2017, PC DEM submitted a PDM grant to WA-EMD to update the Region 5 All Hazard Mitigation Plan and 80 jurisdictional addendums. This funding if the grant is awarded will be awarded in 2019 and the update and planning will occur during 2019.

Collaborative planning efforts to build community resiliency to disasters continues through mitigation efforts to reduce their vulnerability through these important mitigation grant programs.

Appendix F

Appendix F has been updated with additional information included in the table along with an updated River Reach Management Strategies- Proposal map.

Pierce County Rivers Flood Hazard Management Plan
River Reach Management Strategies - Proposal

03/01/18

River Segment	Downstream RM	Upstream RM	Bank (R, L)	Levee LOS (200-yr, 100-yr, Maintain Level of Protection (LOP), Maintain Prism)	Revetment LOS (Prevention design, Resistance design)	Non-structural approaches (acquisition, floodplain regulations)	Current Channel Conveyance Capacity (USGS, Aug. 2009) in cfs	Land Uses	Roads (local, arterial, highway, freeway)	Channel Gradient	River channel width	Salmonid Habitat and Use	Sediment Gradations and Bed Elevation Changes (1984-2009)
Lower Puyallup													
Lower Puyallup	0	10.3 10.4	L, R	200-year	Channel Migration Prevention	Floodplain Regs., Acquisition - repetitive loss properties	RM 0-5.9: 48,000-50,000; RM 5.9-10.4: 23,000-48,000	RB - Port, Industrial, Manufacturing, Commercial, Residential (HDR and LDR), Agric.; LB - Resid., Agric., Comm., WWTP	RB - North Levee Road, I-5, local; LB - River Road (SR 162), local	0.035-0.06 %	350-700 feet (about 250 at P56, P58, P61, P62 and P56)	Juvenile Rearing; Marginal spawning by chum and pink (RM 5-10.4)	RM 0-8: Sand, RM 8-10.4: Gravel/sand; -0.5 to +2 feet bed change
Middle Puyallup													
Middle Puyallup	10.3 10.4	12.0 (SR162)	L, R	100-year	Channel Migration Resistance	Floodplain Regs., Acquisition	14,000 to 32,500	RB- HDR, LDR, Ag, Rec.; LB - Ag., MDR	SR 410,	0.17-0.18%	215-260 feet (about 377 at P74)	Juvenile Rearing; Limited spawning	Gravel/sand; -0.1 to +2 feet bed change
Middle Puyallup	12.0 (SR162)	15.6 (112th St Ct. E)	L, R	Maintain LOP	Channel Migration Resistance Design	Floodplain Regs., Acquisition	17,000 to 32,500	LB/RB - Ag, Rec, LDR, Edu	McCutcheon Rd.	0.17-0.24%	220-300 feet (about 206 at P79)	Juvenile Rearing; Some Chinook and steelhead spawning	Gravel/cobble/sand; -2 to +4 feet bed change
Middle Puyallup	15.6 (112th St Ct. E)	17.4	L, R	No established level of service by Pierce Co. (levee along 153rd ave)	Maintain Channel Resistance Design	Floodplain Regs., Acquisition	16,500 to 36,000	LB/RB - Ag, LDR		0.22-0.25%	240-300 feet	Juvenile Rearing; Some Chinook and steelhead spawning	Gravel/cobble/sand; -2 to +1.5 feet
Upper Puyallup													
Upper Puyallup	17.4	19.4 (Orting City limit)	R	Maintain Prism	Channel Migration Resistance Design	Floodplain Regs.	8,500 to 17,000	RB- Rec, MDR, LDR,	159th, 176th,	0.16-0.32%	130-240 feet	Juvenile Rearing; some spawning	Gravel/cobble/sand; 0 to +3.5 feet
Upper Puyallup	19.4 (Orting City limit)	22.5 (200th St. E.)	R	100-year	N/A	Floodplain Regs.	7,700 to 17,000	RB - HDR, Educ., Ag., LDR	Washington Ave (SR 162)	0.32-0.54%	210-370 feet	Juvenile Rearing; some spawning	Gravel/cobble/sand; +1 to +4 feet
Upper Puyallup[1]	17.4	18.5	L	N/A	Channel Migration Resistance Design	Acquisition, Floodplain Regs.	~~9,500~~ 9,100 to 14,500	LB - MDR, Rec., Forest	~~Orville Rd~~ residential	0.16-0.24%	~~180-240~~ 160- 850 feet	Juvenile Rearing; some spawning	Gravel/cobble/sand; 0 to +2 feet
Upper Puyallup	18.5	19.1	L	Valley Wall (no facilities)	Valley Wall (no facilities)	N/A	9,000 to 17,000	Forest	N/A	0.24-0.32%	175-240 feet	Juvenile Rearing; some spawning	Gravel/cobble/sand; +2 to +3.5 feet
Upper Puyallup	19.1 (Horsehaven Creek)	22.5 (200th St. E.)	L	Maintain Prism	N/A	Acquisition, Floodplain Regs.	7,700 to 17,000	LB - LDR, Ag.	181st, 188th,	0.32-0.75%	130-370 feet	Juvenile Rearing; some spawning	Cobble/gravel/sand; +1 to +4 feet
Upper Puyallup	22.5 (200th St. E.)	28.6 (Champion Bridge)	L, R	Maintain Prism	Channel Migration Resistance Design	Acquisition/ Buyout, Floodplain Regs.	6,000 to 17,000	Forest, LDR, Ag.	Orting Kapowsin Hwy., Orville Rd.	0.75-1.14%	135-350 (about 460-690 at P137, P141, and P143)	Juvenile Rearing; some spawning	Cobble/gravel/sand/boulder; -0.5 to +7.5 feet
Lower White													
Lower White	1.8	4.9 (Steward Road Bridge)	R	100-year (where applicable)	Channel Migration Resistance Design	Floodplain Regs.	RM 0-2.0: 10,000-19,000; RM 2.0-5.5: 5,000-19,000	LB- Ag.,Rec., Trans., Indust., WWTP; RB- Indust., Comm., LDR	Stewart Rd., 142nd Ave	0.03-0.23%	160-280 feet	Juvenile Rearing; Limited spawning	RM 0-1.8: Sand, -0.3 to +1.8 ft.; RM 1.8-5.5: Gravel/ cobble/sand; -0.2 to +6 feet
Lower White	4.9	5.5	R	Maintain current level of service	Channel Migration Resistance Design								
Lower White	4.9	5.5	L					Replacement of Potelo w/ Countyline setback					
Lower White	0	4.9	L	N/A	Channel Migration Resistance Design	Floodplain Regs.	RM 0-2.0: 10,000-19,000; RM 2.0-5.5: 5,000-19,000	LB- Ag.,Rec., Trans., Indust., WWTP; RB- Indust., Comm., LDR	Stewart Rd., 142nd Ave	0.03-0.23%	160-280 feet	Juvenile Rearing; Limited spawning	RM 0-1.8: Sand, -0.3 to +1.8 ft.; RM 1.8-5.5: Gravel/ cobble/sand; -0.2 to +6 feet

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River Segment	Downstream RM	Upstream RM	Bank (R, L)	Levee LOS (200-yr, 100-yr, Maintain Level of Protection (LOP), Maintain Prism)	Revetment LOS (Prevention design, Resistance design)	Non-structural approaches (acquisition, floodplain regulations)	Current Channel Conveyance Capacity (USGS, Aug. 2009) in cfs	Land Uses	Roads (local, arterial, highway, freeway)	Channel Gradient	River channel width	Salmonid Habitat and Use	Sediment Gradations and Bed Elevation Changes (1984-2009)
Lower White	0	1.8	R	N/A	Channel Migration Resistance Design	Floodplain Regs.	RM 0-2.0: 10,000-19,000; RM 2.0-5.5: 5,000-19,000	LB- Ag.,Rec., Trans., Indust., WWTP; RB- Indust., Comm., LDR	Stewart Rd., 142nd Ave	0.03-0.23%	160-280 feet	Juvenile Rearing; Limited spawning	RM 0-1.8: Sand, -0.3 to +1.8 ft.; RM 1.8-5.5: Gravel/ cobble/sand; -0.2 to +6 feet
Carbon													
Carbon	0	1.3 1.3	R	Maintain Prism	N/A	Floodplain Regs., Acquis.	15,000 to 23,000	RB- Ag., LDR	Pioneer Way	0.47%	200-290 feet	Juvenile Rearing; spawning unknown	Gravel/cobble/sand; -0.7 to +0.3 feet
Carbon	1.2	5.8 5.9	R	Valley Wall (no facilities)	Valley Wall (no facilities)	N/A	13,000 to 23,000	Forest	Patterson Rd.	0.46-1.12%	160-420 feet; RM 4.0-6.0: 540-890 ft.	Juvenile Rearing; Extensive Chinook spawning	Cobble/gravel/sand; -0.3 to +4 feet
Carbon	5.9 (SR 162)	7.0	R	Maintain Prism	Valley Wall (no facilities)	Acquisition, Floodplain Regs.	2,500 to 15,000	LDR, Forest	176th, 184th,	1.01-1.15%	160-220 feet	Juvenile Rearing; some spawning	Cobble/gravel/sand; -1 to +4 feet
Carbon	0	0.8	L	Maintain Prism	N/A	Floodplain Regs., Acquis.	15,000 to 19,000	MDR	188th,	0.47%	200-275 feet		Gravel/cobble/sand; -0.7 to 0 feet
Carbon	0.8	4.0 3.9 (Voight Creek)	L	100-year	N/A	Floodplain Regs.	19,000 to 23,000	HDR, Ag., LDR	SR 162	0.47-0.60%	200-420 feet; 890 feet at RM 3.5		Cobble/gravel/sand; -0.3 to +4 feet
Carbon	4.0 3.9 (Voight Creek)	8.3	L	Maintain Prism	Channel Migration Resistance Design	Acquisition, Floodplain Regs.	13,000 to 23,000	LDR, Road		0.60-1.15%	160-345 feet; RM 4.0-6.0: 540-760 ft.		Gravel/cobble/sand; -1 to +4 feet
Carbon	21.3	23.0	L	N/A	Channel Migration Resistance Design - Pierce Co. Fairfax Rd.	N/A	N/A	Forest, Road			N/A		N/A
South Prairie													
South Prairie	0	6.5	L, R	Maintain Prism	Channel Migration Resistance Design for County and WSDOT road/bridge revetments	Acquisition/ Buyout, Floodplain Regs.	N/A	RB- Rec., Ag., LDR; LB- Ag., LDR, Rec, Town	SR 162, South Prarie RD			Juvenile Rearing; Extensive Chinook and steelhead spawning	N/A
Upper White													
Upper White	45.0 46.2	45.2 46.4	R	Maintain Prism	Channel Migration Resistance Design	Floodplain Regs.	N/A	Ag., LDR, Forest	SR 410				N/A
Greenwater													
Greenwater	0.7	0.7	L	No established LOS by Pierce Co.	Channel Migration Resistance Design		N/A	LDR					N/A
Greenwater	0	4	L	No established LOS by Pierce Co.		Acquisition, Floodplain Regs.	N/A	LDR, Forest					N/A
Middle Nisqually													
Middle Nisqually	20	26	R	No established LOS by Pierce Co.	Channel Migration Resistance Design WSDOT bridge revetments (SR-507)	Acquisition, Floodplain Regs.	N/A	RB- Rec., LDR, Comm. Ag.	SR 507				N/A
Upper Nisqually													
Upper Nisqually	50.2 (Alder Lake)	64.5 64.2	R	No established LOS by Pierce Co.	Tacoma Power and Kernahan Bridge revetment protection	Acquisition, Floodplain Regs.	N/A	RB- LDR, MDR, Rec., Ag.	Kernahan Rd.			No salmon access above Alder dam	N/A
Upper Nisqually	64.5 64.2	65.05 (MRNP) 6	R	Maintain Prism	N/A	Acquisition, Floodplain Regs.	N/A	RB- Rural Subdivision, Forest				No salmon access above Alder dam	N/A
Upper Nisqually	65.05 (MRNP) 65.1	65.4 65.3	R	Maintain Prism	Channel Migration Prevention Design	N/A	N/A	RB- Rural Subdivision, Forest	SR 706			No salmon access above Alder dam	N/A
Mashel													

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River Segment	Downstream RM	Upstream RM	Bank (R, L)	Levee LOS (200-yr, 100-yr, Maintain Level of Protection (LOP), Maintain Prism)	Revetment LOS (Prevention design, Resistance design)	Non-structural approaches (acquisition, floodplain regulations)	Current Channel Conveyance Capacity (USGS, Aug. 2009) in cfs	Land Uses	Roads (local, arterial, highway, freeway)	Channel Gradient	River channel width	Salmonid Habitat and Use	Sediment Gradations and Bed Elevation Changes (1984-2009)
Mashel	0	7.2	L, R	No established LOS by Pierce Co.	Channel Migration Resistance Design for County and WSDOT road/bridge revetments	Acquisition/ Buyout, Floodplain Regs.	N/A	Forest, LDR, MDR, WWTP	SR-161, Center Street				N/A

LOS = Level of Service; LOP = Level of Protection; RM = River Mile; R, L = Right, Left Bank; SR = State Route
Land Use: LDR, MDR, HDR = Low, Medium and High Density Residential; Comm. = Commercial; Ag. = Agriculture; WWTP = Wastewater Treatment Plant; Educ. and Rec. = Educational and Recreational Facilities
1 The South Fork alignment of the flood risk reduction facility was realigned via setback with a capital project resulting in increased channel capacity.

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Tacoma
Milton
Fife
Edgewood
Auburn
King County
Pierce County
Sumner
Puyallup
Bonney Lake
Orting
Eatonville
Thurston County
Lewis County
White River
Puyallup River
Nisqually River
Mashel River
South Prairie
Carbon River
Greenwater River

Level Of Service

- River Mileposts
- No Level of Service Designated

Levee

- 100 Year
- 200 Year
- Maintain Level of Protection
- Maintain Prism

Revetment

- Protection Design
- Resistance Design

N

3/2/2018

The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. The County assumes no liability for variations ascertained by actual survey. ALL DATA IS EXPRESSLY PROVIDED 'ASIS' AND 'WITH ALL FAULTS'. The County makes no warranty of fitness for a particular purpose.

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Appendix G Update

A prioritization matrix was created in the 2013 to help prioritize the level of effort that will be expended on identified problems in the flood plan. A status update has been provided for some of the identified problems. Project scoring has also been updated for some problem descriptions along the Lower White.

Figure 1: FHPA #20; Image of the completed culvert that was installed by the City of Sumner.

Pierce County Rivers Flood Hazard Management Plan Problem Identification and Inventory Update				
LROB #	**River Segment**	**Problem Description**	**Problem Description update**	**Information provided by**
Levee/Revetment Overtopping or Breaching				
LROB #3	Lower Puyallup	Settlement of levee at the Sha-dax restoration site above the culvert causes dip in levee/road	Project completed in 2014	City of Fife
LROB #4	Lower Puyallup	Flood levels nearly resulted in levee overtopping near 54th Ave E. in 2006 and 2009 (within 2 feet of overtopping). [Note: Concern that if flood waters overtop the levee on North Levee Road, erosion on the back side of the levee will contribute to worse levee breaching because it is unarmored.]	On-going maintenance	City of Fife
LROB #5	Lower Puyallup	Flood levels nearly resulted in levee overtopping downstream of Freeman Road in 1996 (within 2-3 inches) and 2009 (within 2 feet); there has been sloughing of soil and vegetation below the road. [See note in LROB #4 above.]	On-going maintenance	City of Fife
LROB#19	Middle Puyallup	Levee/revetment overtopping occurs during major flood events causing flooding to occur to property located along 151st Ave E and 116th St E. (extent of flooding impact on homes unknown)	Some repair work done on Left Bank in this area	Pierce County Planning and Public Works, Operations and Maintenance
LROB #31	Lower White	Levee overtopping in this vicinity causes flooding of numerous private residential homes in King County and Pierce County, Corliss/Icon equipment yard, other commercial storage and warehouse properties, and Butte Avenue.	Hesco Wall installed. City of Pacific installed interim pump station. The city has initiated the design of a permanent pump station at Government Canal.	Pierce County Planning and Public Works, Operations and Maintenance
Tributary Backwater Flooding				
TBF #2	Lower Puyallup	Puyallup River high water levels during high flows causes Clear Creek to backwater, flooding numerous private properties and structures (approximately 400 acres), including mobile homes and single-family residences (occurred in 1996 and 2009; lesser flooding in 2006 due less localized flow in Clear Creek); Flows from Clear Creek drain through two 48-inch culverts (with tide gates) to the Puyallup River	One tide gate repaired by Planning Public Works in 2017	Pierce County Planning and Public Works, Operations and Maintenance

TBF #4	Lower Puyallup	Oxbow Lake discharge to the Puyallup River backwaters during flood conditions when tide gate does not allow discharge to river, causing potential for flooding, including sanitary sewer pump station. Sedimentation prevents tide gate from opening.	In 2017, the City of Fife continued to work with the Puyallup Tribe on maintenance to remove sediment as needed.	City of Fife
TBF #12	Lower White	Backwater from ditches causes localized flooding at Countyline ditch (RM 5.5), government ditch (RM 5.35) and Steward Rd. ditch (RM 4.9) [see also LROB#30]	City of Sumner has done some Hesco Wall construction south of Stewart, about 500' long.	Pierce County Planning and Public Works, Operations and Maintenance
TBF #15	Carbon	Backwater flooding on Voights Creek Hatchery (1996, 2005, 2006, 2008, 2009)	Hatchery has been relocated	Pierce County Planning and Public Works, Operations and Maintenance
Channel Migration Problem Areas				
CM#3	Upper Puyallup	The right bank of the Puyallup River upstream of the Orville Road high bridge is experiencing channel migration into the forested area and towards Brooks Road East between RM 25.3 and 25.6; the Neadham Levee and upstream areas on the right bank of the Puyallup River has been impacted by channel migration during the Nov. 2006 and Nov. 2008 flood events and recent channel migration in November 2009. The levee has been repaired twice by the Corps of Engineers in the last 3 years and emergency work was done by Pierce County in Nov/Dec 2009. (approx. 20 homes affected). In 1996, Brooks Rd. E failed due to river undermining Brooks Rd. toe/embankment	Some maintenance & operations and capital work has been done to minimize flood damage until full buyout is complete.	Pierce County Planning and Public Works, Operations and Maintenance
Flooding of Structures and Infrastructure (Roads/ Bridges)				
FSI#32/ FS#33	Lower White	Flooding of 3 homes along Butte Ave near county line and flooding of commercial/industrial businesses and equipment (up to $10 million equipment damage in Jan. 2009)	King County completed the left bank setback in 2017. This has increased channel capacity in the White River. In past years the river bank would overtop at 5,000 cfs in Pacific. We have experienced flows of 6,500 cfs without overtopping. King County is working on the right bank setback levee. The City of Pacific has initiated the design of a permanent pump station at Government Canal.	City of Pacific

Sediment/Gravel Bar Accumulation				
SGBA #16	Lower White	Gravel bar accumulation in Lower White River in vicinity of Pacific is reducing carrying capacity of the channel. 2009 Corps of Engineers study indicates capacity could be reduced to as low as 5500 cfs.	King County completed the left bank setback in 2017. This has increased channel capacity in the White River. In past years the river bank would overtop at 5,000 cfs in Pacific. We have experienced flows of 6,500 cfs without overtopping. King County is working on the right bank setback levee. The City of Pacific is working on a pump station on Government Canal. Gravel bar scalping would still be beneficial.	City of Pacific
Facility Maintenance/Repair Needs				
FMR #1	Lower Puyallup	Minor evidence of piping occurred through the levee at the Sha-dax Project upstream and downstream of the new culvert. [See LROB#3]	This project was completed by maintenance and operations	Pierce County Planning and Public Works, Operations and Maintenance
FMR #34	Carbon	Ski Park Levee - This segment of the Carbon River has historically suffered the most significant damage during every large storm events since 1990 (Jan & Nov 1990, 1995, 1996, 2006, 2008 & 2009). Repair work has ranged from minor rehabilitation to completely reconstructing the levee prism. Typical damages entail toe and face scour and structure undermining. One house located at RM 6.0 was washed away during the Nov. 2006 flood event. Flood waters flowed over SR 162. Complete levee failure 7.0(2008), 6.0(2006), 6.4(2006, 1990)), 6.8(2006), 6.9(1996), 7.1(1996)	Maintenance has been performed, work is on-going	Pierce County Planning and Public Works, Operations and Maintenance
Floodplain Development Regulations				
FDR #2	Lower Puyallup	Development regulations in Fife require elevation of 1 foot above the base flood elevation and compensatory storage requirements for all new development. No development is allowed in the FEMA floodway (based on the DFIRM maps). There are no requirements to elevate roads.	City of Fife is currently using the 2017 DFIRMS's	City of Fife

FDR #5	Lower White	Zoning and development regulations in the City of Pacific require elevation above base flood elevation, zero-rise analysis and compensatory storage. Pacific regulates according to best available science (data) - draft FEMA maps; Regulations mostly equivalent to King County	The current FIRM maps do not show the Pierce County area to be within the flood plain. Property owners have been notified of a potential change in the future.	City of Pacific
Fish Habitat Problem Areas				
FHPA #10	Middle Puyallup	Levee and revetment construction cut-off floodplain from river channel, preventing off-channel rearing and refuge for salmonids and flood storage; Fennel Creek, a spawning stream for Chinook and chum also enters Puyallup River in this reach	Site has been protected, planted and allowed to naturally recover but no levee work has been performed. Levee setback may not be necessary due to site elevations and infrequent inundation.	Puyallup Tribal Fisheries
FHPA #19	Lower White	Revetment construction cut-off floodplain from river channel, preventing off-channel rearing and refuge for salmonids and flood storage (left bank revetment along Sumner golf course)	New bridge by Pierce County and Sumner slated for 2022 will incorporate greater span and open up an additional 100' of channel width.	Puyallup Tribal Fisheries
FHPA #20	Lower White	Fish passage barrier at 8th St. Creek inflow to White River; there is suitable coho spawning habitat upstream	Corrected-A new 12' Culvert and pedestrian bridge was installed by City of Sumner in 2013.	Puyallup Tribal Fisheries
Public Access to Rivers				
PA #3	Lower Puyallup	Lack of public access and trail along the river or nearby connecting Puyallup all-purpose trail along River Road at approx. RM 6.5 to the City of Tacoma	SR-167 has now been funded by the legislature	City of Fife

	River Segment	Down-stream RM	Upstream RM	Bank (R, L)	Problem Description	Possible Solution(s)	Source	LU1	LU2	Severity of Problem	Area of Impact	Frequency	Total	Notes
FSI#	**Flooding of Structures and Infrastructure (Roads/Bridges)**													
FSI#1	Lower Puyallup	1.6	2.0	L	High water surface elevations during floods in 1996, 2006 and 2009 threatened flooding of Tacoma central wastewater treatment plant (a critical facility). In 2009, sandbagging of facilities was necessary to prepare for possible flooding the plant, but this was judged to be inadequate. [LROB#1]	Construct 1500 ft x 6 ft. high floodwall surrounding the southern boundary of the WWTP; in the event of major flooding, this would protect the plant from becoming submerged with 3-5 feet of floodwater and sewage.	City of Tacoma							See score for problem in LROB#1
FSI#2	Lower Puyallup	0.7	2.2	L	Three bridges of concern in the Lower Puyallup are 11th Ave (RM 0.7), Lincoln Ave (RM 1.5) and Puyallup Ave. (RM 2.2) - concern is capacity and damage due to wood debris on piers	Need to analyze in more detail; might require replacement with clear span to prevent	City of Tacoma	8	0	4	8	5	**25**	LU1=Comm. road; LU2=0; S=minor/mod.; A=region; F=1
FSI#3	Lower Puyallup	4.0	5.5	R	Tacoma Power's Fife substation on 58th Ave (south of I-5) would be impacted by flooding (overtopping or breaching of levee in vicinity of RM 4.0-5.5) and need to be shut down at a water depth of ?? feet	TBD	City of Tacoma	8	0	4	6	1	**19**	LU1=public utility; LU2=0; S=minor/mod.; A=severe; F=0
FSI#4	Lower Puyallup				Localized road flooding east of Puyallup River and north of I-5 caused by potential levee overtopping upstream at RM 3.1 left bank		City of Tacoma	7	0	3	5	4	**19**	LU1=road; LU2=0; S=minor; A=mod.; F=1
FSI#5	Lower Puyallup	3.5	4.1	L	Flooding of Gay Rd. from Pioneer to Gratzer requires road closures (caused by backwatering of Clear Creek)	Possible solutions include (1) construction of a pump station, (2) buyout of homes and property, or (3) no action. [see also TBF#2]	Pierce County Roads							See score for problem in TBF#2
FSI#6	Lower Puyallup	5.75	5.75	L/R	The Milroy Bridge (Clarks Creek) that crosses the Puyallup River at 66th Avenue East was shown in the recent FEMA analysis as not meeting the modern minimum standard for vertical clearance required above the anticipated 100-year recurrence flood. Floating debris could hang up on the bridge, even if the levees hold, and the bridge could be damaged or destroyed.	Rebuild bridge at higher elevation or wait until replacement associated with Canyon Road crossing	City of Fife, Pierce County Roads	8	0	4	4	4	**20**	LU1=road; LU2=0; S=minor/mod.; A=mod.; F=1
FSI#7	Lower Puyallup	2.9	6.9	R	Potential critical facilities located in the regulatory 100-year floodplain include schools and police station; 54th Ave E. has a high risk of water over roadway flooding.	(1) Setback of North Levee Road, (2) gravel removal, or (3) possible raising of existing levee	City of Fife	9	8	4	6	1	**28**	LU1=critical; LU2=comm.; S=minor/mod.; A=city ctr.; F=0
FSI#8	Lower Puyallup	6.8	6.9	R	There has been limited crawl space flooding (2 homes) and water over roadway (48th St.) in the vicinity of Freeman Road.		City of Fife	5	4	3	2	4	**18**	LU1=road; LU2=LDR; S=minor; A=local; F=1
FSI#9	Lower Puyallup	6.8	6.9	L	High water surface elevations during floods in the Puyallup River threaten flooding of Puyallup wastewater treatment plant (a critical facility). In 2009, pumps were used to prevent flooding of plant.	Possible 100-foot setback of North Levee Road levee and Freeman oxbow wetland setback may relieve some of the flooding conditions here	City of Puyallup	10	5	8	10	3	**36**	LU1=WWTP;LU2=road; S=severe; A=regional; F=1
FSI#10	Lower Puyallup	8.2	8.2	L	Levee overtopping causes flooding of North Meridian underpass to Fred Meyers [see also LROB#6]	Possible 100-foot setback of North Levee Road levee may relieve some of the flooding conditions here	City of Puyallup							See score for problem in LROB#6
FSI#11	Lower Puyallup	8.1	8.2	R	Levee overtopping causes flooding of the North Meridian-north shore underpass causing 4-5 feet of water depth [see also LROB#7]	Possible 100-foot setback of North Levee Road levee and changes due to SR 167 extension may relieve some of the flooding conditions here	City of Puyallup							See score for problem in LROB#7
FSI#12	Lower Puyallup	8.2	8.3	L	Levee overtopping causes flooding of Tiffany's skating rink (finished floor)	Possible 100-foot setback of North Levee Road levee may relieve some of the flooding conditions here	City of Puyallup							See score for problem in LROB#6
FSI#13	Lower Puyallup	9.1	9.25	L	Left bank levee overtopping causes flooding on the 1st floor of the E. Main St. "flash cube" building	Possible setback levees upstream (confluence and Golf course oxbow) and downstream (100-foot setback of North Levee Rd.) may relieve some of the flooding conditions at this site	City of Puyallup							See score for problem in LROB#8
FSI#14	Lower Puyallup	9.1	9.1		SR-512 bridge at Pioneer - problems with large woody debris accumulaton and bed scour at two piers for SR-512 in Puyallup River	Maintenance and monitoring; debris removal after flood events	WSDOT	9	0	3	4	8	**24**	LU1=state hwy, LU2=none; S=minor; A=mod, F=3
FSI#15	Middle Puyallup	10.4	10.6	R	High water surface elevations during floods in the Puyallup and White Rivers threaten flooding of Sumner wastewater treatment plant (a critical facility). In 2009, flows came within 6 inches of flooding the plant.	Construction of a flood wall or ring structure or gravel removal	City of Sumner							See score for problem in LROB#12
FSI#16	Middle Puyallup	10.8	11	R	Right bank levee overtopping causes flooding of SR 410, which occurred in 1996, 2006, 2008 and 2009. Up to 3 feet of maximum depth during worst conditions. Flooding also occurs in adjacent area (Chestnut St. and Christina Dr.), causing water over roadways.		City of Sumner, WSDOT	9	5	6	8	8	**36**	LU1=hwy.; LU2=road; S=severe; A=regional; F=3
FSI#17	Middle Puyallup	11	11.5	R	Flood events in 1996, 2006 and 2009 causing finished floor flooding of Rainier Manor (~50% of 73 homes) and the ground floor of the Rivergrove Apartments. Crawl space flooding occurred in Riverwalk condos.	Three possible solutions have been discussed to address this problem, including: (1) construction of a floodwall along the right bank levee, (2) construction of a setback levee along the left bank (Sumner Setback levee in feasibility report, RM 10.7-11.6), and (3) gravel removal.	City of Sumner, Public Input							See score for problem in LROB#13
FSI#18	Middle Puyallup	12.6	12.8	R	76th St. E & 159th Ave E (off Riverside Drive) - During major flood events, Puyallup River floods road causing road closures (water over roadway, sediment deposits on roadway and infrastructure damage)	Road Closure	Pierce County Roads							See score for problem LROB#14
FSI#19	Middle Puyallup	14.15	14.15	L, R	96th St. E from SR162 to McCutcheon Rd. closed in 1996 due to water over roadway on approaches to bridge; also woody debris buildup on piers	Road Closure; clean woody debris from piers after floods	Pierce County Roads	6	0	3	4	6	**19**	LU1=road; LU2=0; S=minor; A=mod.; F=2

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	River Segment	Down-stream RM	Upstream RM	Bank (R, L)	Problem Description	Possible Solution(s)	Source	LU1	LU2	Severity of Problem	Area of Impact	Frequency	Total	Notes
FSI#20	Middle Puyallup	14.2	14.9	R	McCutcheon Rd. E flooding between 96th St. E and Rhodes Lake Rd E - During major flood events, Puyallup River floods road causing road closures (water over roadway, sediment deposits on roadway and infrastructure damage)	Road Closure	Pierce County Roads							See score for problem LROB#17
FSI#21	Middle Puyallup	16.7	16.7	L, R	128th St. E bridge - woody debris buildup on piers	Clean woody debris from piers after floods	Pierce County Roads	8	0	4	4	6	**22**	LU1=road; LU2=0; S=minor/mod.; A=mod.; F=2
FSI#22	Middle Puyallup	16.7	17.3	R	McCutcheon Rd. E flooding south of 128th St. E to dead end - road closure due to water over roadway	Road Closures	Pierce County Roads							See score for problem LROB#21
FSI#23	Upper Puyallup	20.5	21.3	R	Leach Rd. E, north of Calistoga bridge is subject to flooding and levee overtopping during flood events; sediment and debris buildup on road	Road Closure; follow-up maintenance	Pierce County Roads	6	4	2	4	6	**22**	LU1=road; LU2=0; S=inconvenience; A=mod.; F=2
FSI#24	Upper Puyallup	21.3	21.3	L, R	Calistoga Bridge is a constriction point for the river - concern about gravel deposition and floating large woody debris hitting underside of bridge during flood flows		Pierce County Roads	9	0	4	6	6	**25**	LU1=road; LU2=0; S=minor/mod.; A=severe; F=2
FSI#25	Upper Puyallup	25.4	26.7	R	Needham Rd. E - During major flood events, Puyallup River overtops channel causing road closure, sediment deposits on roadway, road infrastructure damage, and property/house flooding	Road Closure; follow-up maintenance	Pierce County Roads	8	4	4	4	9	**29**	LU1=road; LU2=LDR; S=mod.; A=mod.; F=3
FSI#26	Lower White	0.2	0.2	R	Houston St. E under SR-410 has water over roadway (up to 2+ feet in depth) during flood event - closure from 129th Ave. Ct. E to Sumner city limits	Road Closure; follow-up maintenance	Pierce County Roads	6	0	4	4	9	**23**	LU1=road; LU2=LDR; S=mod.; A=mod.; F=3
FSI#27	Lower White	0.2	0.2	L	Flooding of State St. (access to Sumner wastewater treatment plant)	Place temporary flood control devices (e.g., sand bags, super sacks)	City of Sumner	8	9	4	4	9	**34**	LU1=sole access road; LU2=WWTP; S=mod.; A=mod.; F=>3
FSI#28	Lower White (24th Street Setback)	2.5	4.2	L	The White river is known to carry high sediment loads from glacier melt which settles out once it reaches the flat valley in Sumner. This has caused a high flood risk in the region.	The proposed restoration efforts will include installing large woody debris, side channels, and planting native trees that will provide habitat complexity and resources for wildlife.	City of Sumner	9	10	7	9	9	**44**	
FSI#28a	Lower White	3.4	3.5	L	Flooding of roadways at 24th St E. and 148th Ave.	Possible option to raise the low areas of the levee in this reach; need to review effects on opposite bank and floodplain.	City of Sumner	5	0	4	4	6	**19**	LU1=road; LU2=none; S=mod.; A=mod.; F=2
FSI#29	Lower White (Pacific Point Bar)	3.9	4.5	R	The White river is known to carry high sediment loads from glacier melt which settles out once it reaches the flat valley in Sumner. This has caused a high flood risk in the region.	Elements of this project include setback levees, side channels, back water alcove, channel roughening, engineering log jams, revetments, property acquisitions and other methods to create a more sustainable system.	City of Sumner	10	9	6	9	7	**41**	
FSI#29a	Lower White	4.4	4.5	R	Flooding of 4 houses on right bank, north of 16th St. E.	Possible option to raise the low areas of the levee in this reach; need to review effects on opposite bank and floodplain.	City of Sumner							see score from problem LROB#27
FSI#30	Lower White (Left Bank Setback)	4.4	4.9	L	The White river is known to carry high sediment loads from glacier melt which settles out once it reaches the flat valley in Sumner. This has caused a high flood risk in the region.	Elements of this project include setback levees, channel roughening, revetments, property acquisitions and other methods to create a more sustainable system.	City of Sumner	6	3	5	4	9	**27**	
FSI#31	Lower White (Stewart Road Bridge)	4.9		R/L	The White river is known to carry high sediment loads from glacier melt which settles out once it reaches the flat valley in Sumner. This has caused a high flood risk in the region.	Replace Stewart road bridge to accommodate traffic, improvementfish habitat and flooding impacts.	City of Sumner	10	0	9	9	0	**28**	
FSI#32	Lower White	4.8	5.5	R	Flooding of 3 homes along Butte Ave near countyline and flooding of commercial/industrial businesses and equipment (up to $10 million equipment damage in Jan. 2009)	Possible option to raise the low areas of the levee in this reach; need to review effects on opposite bank and floodplain.	City of Pacific							see score from problem LROB#31
FSI#33	Lower White	4.8	5.3	R	Flooding of Butte Ave (collector road) - had to be closed in 2009		City of Pacific							see score from problem LROB#30
FSI#34	Lower White	4.8	4.8	R	Flooding of Stewart Rd. SE (low point of road ~ 150 feet) experience up to 3 foot depth of flooding in 2006 and 2009		City of Pacific							see score from problem LROB#30
FSI#35	Upper White	48.9	48.9	L, R	Crystal River Ranch Rd. bridge (there are two bridges) - old bridge has two piers in the river that accumulate large wood; new bridge has no intermediate river piers, but abutments are vulnerable to washout)		Pierce County Roads	8	5	4	5	2	**24**	LU1=sole access road; LU2=HDR; S=mod.; A=mod.; F=0
FSI#36	Carbon River	0.0	0.5	R	McCutcheon Rd. closure on the right bank of the Carbon River near the mouth	Road Closure; follow-up maintenance	Pierce County Roads							see score from problem LROB#20
FSI#37	Carbon River	4.2	5.8		SR-162 floods along Carbon River east of Orville Road	Road Closure; follow-up maintenance on road	WSDOT	8	0	4	4	8	**24**	LU1= state hwy, LU2=none; S=mod., A=mod; F=3
FSI#38	Carbon River	6.3	6.5	L	Carbon River overtops channel forcing road closure of Alward Rd. and infrastructure damage (off SR-162) - 6-12 inches of water over roadway	Road closure; Alward levee setback would reduce or eliminate flooding	Pierce County Roads	8	0	4	4	4	**20**	LU1=sole access road; LU2=0; S=mod.; A=mod.; F=1

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	River Segment	Down-stream RM	Upstream RM	Bank (R, L)	Problem Description	Possible Solution(s)	Source	LU1	LU2	Severity of Problem	Area of Impact	Frequency	Total	Notes
FSI#39	South Prairie Cr.	0	3.8	L, R	SR-162 floods in numerous locations forcing closure of road from Carbon River bridge to Soler Farm or Town of South Prairie; three bridges between RM 2.7 and 3.8 on South Prairie Creek are a problem due to large woody debris buildup on piers (#162/016, 162/017, 162/018)	Road Closure; follow-up maintenance on road and bridges	WSDOT	8	0	4	4	8	**24**	LU1= state hwy, LU2=none; S=mod., A=mod; F=3
FSI#40	South Prairie Cr.	1.7	2.5	L	South Prairie Carbon River Rd. E - During major flood events, South Prairie Creek overtops channel causing road closures (water over roadway, sediment deposits on roadway and infrastructure damage) - from SR 162 to 157th St. E	No proposed solution unless flood waters can be kept in creek channel	Pierce County Roads							see score from problem LROB#39
FSI#41	South Prairie Cr.	3.3	3.4	R	Kaperak Rd. E - During major flood events, South Prairie Creek overtops channel causing road closures (water over roadway, sediment deposits on roadway and infrastructure damage) - off SR 162	No proposed solution unless flood waters can be kept in creek channel	Pierce County Roads							see score from problem LROB#41
FSI#42	South Prairie Cr.	3.7	3.7	R	Spring Site Rd. - During major flood events, South Prairie Creek overtops channel causing road closure (water over roadway, sediment deposits on roadway and infrastructure damage) - 100 feet north of SR 162	No proposed solution unless flood waters can be kept in creek channel	Pierce County Roads							see score from problem LROB#41
FSI#43	South Prairie Cr.	5.4	5.9	R	South Prairie Rd. E - During major flood events, South Prairie Creek overtops channel causing road closure (water over roadway, sediment deposits on roadway and infrastructure damage) - from 246th Ave. Ct. E to SR-162	No proposed solution unless flood waters can be kept in creek channel	Pierce County Roads	7	0	4	4	6	**21**	LU1=sole access road; LU2=0; S=mod.; A=mod.; F=2
FSI#43	South Prairie Cr.	0	6.2	R, L	Floods damage trails along South Prairie Creek, requiring repair		S. Prairie Cr. AC member	2	0	3	2	6	**13**	LU1=trail/rec. ; LU2=0; S=mod.; A=mod.; F=2
FSI#43.1	South Prairie Cr.	5.4	5.4	L	Outfall from Town of S. Prairie WWTP becomes covered in sediment as a result of large flood events	Removal of sediment done by hand in July 2009; Need more reliable long-term solution	Town of South Prairie	9	6	4	6	3	**28**	LU1=WWTP; LU2=MDR; S=mod.; A=sev.; F=1
FSI#43.2	South Prairie Cr.	6.0	6.0	L	Town of South Prairie Fire Station floods when S. Prairie Creek jumps its bank upstream of SR-162 crossing (station also used as Emergency Mgt. Center); $36,000 in damage in Jan. 2009	Possible construction of a berm around Fire Station	Town of South Prairie	9	0	8	7	4	**28**	LU1=Crit. Fac.; LU2=none; S=sev.; A=sev.; F=1
FSI#44	Middle Nisqually	21.6	21.9	R	Flooding of all local roads in McKenna area in mapped 100-year floodplain downstream of SR 507 on right bank of Nisqually River (occurred in 1996)	Road Closures	Pierce County Roads							see score from problem PS#12
FSI#45	Middle Nisqually	21.6	21.9	R	Flooding of McKenna in 1996 flood caused innundation of portions of 80 parcels and damaged numerous structures	Possible acquisition of remaining homes and structures most affected by flooding (100-year floodplain)	Pierce Co. Nisqually Basin Plan						**30**	See Score for PS#12
FSI#46	Middle Nisqually	21.9	21.9	R	SR-507: 1996 flood took out SR-507 approach to bridge on Pierce County side resulting in 2 day closure of road; also ongoing scour and LWD accumulation on bridge #507/128		WSDOT	9	0	7	9	2	**27**	LU1= state hwy, LU2=none; S=sev., A=reg.; F=1
FSI#47	Upper Nisqually	50.4	50.4	R	The Elbe Sewer System (a sand septic system located at the confluence of the river and Alder Lake that serves the entire community of Elbe) and the historic Elbe church is at risk of flood damage		Mt. Rainier Nat'l Park; Nisqually AC member	9	6	5	5	2	**27**	LU1=WWTP; LU2=comm.; S=mod., A=sev.; F=0
FSI#48	Upper Nisqually	61.7	61.7	L, R	Kernahan Bridge (aka Skate Bridge) - Due to recent flood events (2006, 2008, 2009), sediment and debris deposition is threatening the Kernahan bridge due to scour of the bridge ends and heavy material buildup under the bridge could cause a washout of the bridge; the bridge is the only access to safety for Lewis County residents in the winter months. In 1996, right bank abutment was washed out in Pierce County		Pierce County SWM, Nisqually Advisory Committee Member							see score from problem CM#20
FSI#49	Mashel River	5.5	5.5		SR-161 crossing (bridge #161/02) - bridge approached were eroded in 2008 flooding; needed to reinforce rip rap to prevent bridge failure		WSDOT	9	0	7	5	2	**23**	LU1= state hwy, LU2=none; S=sev., A=mod; F=3
FSI#50	Mashel River	6.3	6.3		Mashel River bridge (Center St. E and Alder Cutoff Rd. E - main issue is debris buildup on bridge piers on the edge of river	Maintain and remove large woody debris buildup after flood events; inspect bridge piers	Pierce County Roads	8	0	4	4	6	**22**	LU1=sole access road; LU2=0; S=mod.; A=mod.; F=2
SGBA#	**Sediment/Gravel Bar Accumulation**													
SGBA#1	Lower Puyallup	2.9	6.9	R	Bed elevation increases in the Lower Puyallup River between Interstate-5 and Freeman Road are of concern due to reduced carrying capacity	Removal of fine sediment and gravel would temporarily increase the flood carrying capacity of the river channel through this reach	City of Fife, Pierce County River Maint.							see score from problem LROB#2
SGBA#2	Lower Puyallup	5.0	5.2	L	Gravel bar accumulation below left bank across from Fife in this reach is of concern to reduced capacity	Removal of fine sediment/gravel would temporarily increase the flood carrying capacity of the river through this reach	City of Fife							see score from problem LROB#2
SGBA#3	Lower Puyallup	5.8	10.3		Bed elevation increases in the Lower Puyallup River upstream of Clarks Creek to confluence with White River of concern due to reduced carrying capacity	Removal of fine sediment and gravel would temporarily increase the flood carrying capacity of the river through this reach	City of Puyallup, Pierce County River Maint.	9	7	6	6	1	**29**	LU1=Comm., LU2=HDR; S=severe; A=severe; F=0
SGBA#4	Middle Puyallup	10.3	10.7		Gravel bar accumulation in the Puyallup River from the confluence of the White River upstream to Main Ave. bridge	Gravel bar scalping would temporarily increase the flood carrying capacity of the river channel through this reach. Both the Golf Course and Sumner setback levees could create additional capacity in this stretch.	City of Puyallup	7	4	4	2	1	**18**	LU1=HDR, LU2=golf course; S=mod.; A=mod.; F=0

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	River Segment	Down-stream RM	Upstream RM	Bank (R, L)	Problem Description	Possible Solution(s)	Source	LU1	LU2	Severity of Problem	Area of Impact	Frequency	Total	Notes
SGBA#5	Middle Puyallup	10.4	12.0	R	A large gravel bar has formed along the right bank adjacent to Sumner's wastewater treatment plant that is causing flow constriction at the confluence of the White and Puyallup rivers. Constriction is having an upstream impact on river surface elevations and potential for flooding of River Grove and River Walk areas of Sumner and SR410, upstream to SR 162	Gravel bar scalping would temporarily increase the flood carrying capacity of the river channel through this reach, benefitting the Sumner WWTP, residential areas and SR410. Estimated gravel quantity to be removed is XX,000 cubic yards.	City of Sumner, Public Input							see score from problem LROB#12 and 13
SGBA#6	Middle Puyallup	12.2	17.4		Bed elevation increases in the Middle Puyallup River between the Cities of Sumner and Orting are a concern due to reduced carrying capacities. In some cases the gravel bars are causing the river to angle toward the levees increasing the risk of damage to the structures.	Gravel bar scalping would temporarily increase the flood carrying capacity of the river through this reach. Several setback projects in the Middle Puyallup would also increase flood carrying capacity including the Riverside, Sportsman, 116th, and Upper Puyallup setbacks.	Pierce County River Maint.	4	4	4	4	6	**22**	LU1=LDR, LU2=Agric.; S=mod.; A=mod.; F=2
SGBA#7	Upper Puyallup	17.4	19.4		Bed elevation increases in the Upper Puyallup River downstream of the City of Orting are a concern due to reduced carrying capacities. In some cases the gravel bars are causing the river to angle toward the levees increasing the risk of damage to the structures. One specific bar near 116th Ave. E. causes levee overtopping and threaten homes in vicinity of Alderton/McMillin	Gravel bar scalping would temporarily increase the flood carrying capacity of the river through this reach. The Hoursehaven setback project in the Upper Puyallup would also increases in flood carrying capacity.	Pierce County River Maint.	6	4	4	2	6	**22**	LU1=HDR, LU2=Agric.; S=mod.; A=local; F=2
SGBA#8	Upper Puyallup	19.4	22		City of Orting has identified 61 different gravel bars along the city boundary	Gravel bar scalping would temporarily increase the flood carrying capacity of the river channel through this reach	City of Orting	9	7	6	6	6	**34**	LU1=school, LU2=HDR; S=mod./sev.; A=sev.; F=2
SGBA#9	Upper Puyallup	22.5	28.4		Bed elevations increases in the Upper Puyallup River upstream and downstream of the City of Orting are a concern due to reduced carrying capacities. In some cases the gravel bars are causing the river to angle toward the levees increasing the risk of damage to the structures.	Gravel bar scalping would temporarily increase the flood carrying capacity of the river through this reach. Several setback project in the Upper Puyallup would also increases in flood carrying capacity including the 150th Street and the 190th Ave Setback Levees.	Pierce County River Maint.	4	4	4	4	8	**24**	LU1=LDR, LU2=Agric.; S=mod.; A=mod.; F=>3
SGBA#10	Lower White (24th Street Setback)	2.5	4.2	L	The White river is known to carry high sediment loads from glacier melt which settles out once it reaches the flat valley in Sumner. This has caused a high flood risk in the region.	The proposed restoration efforts will include installing large woody debris, side channels, and planting native trees that will provide habitat complexity and resources for wildlife.	City of Sumner	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SGBA#11	Lower White	3.5	4.5		Gravel bar accumulation in the Lower White River from Dieringer flume to beginning of river meander at RM 4.5	Gravel bar scalping would temporarily increase the flood carrying capacity of the river channel through this reach	City of Sumner	7	4	5	5	4	**25**	LU1=Ind., LU2=LDR.; S=mod./sev.; A=mod.; F=1
SGBA#12	Lower White	4.9	5.5		Gravel bar accumulation in the Lower White River from Stewart Rd. crossing to Countyline.	Gravel bar scalping would temporarily increase the flood carrying capacity of the river channel through this reach	City of Sumner	7	4	5	5	4	**25**	LU1=Ind., LU2=LDR.; S=mod./sev.; A=mod.; F=1
SGBA#13	Lower White	3.6	5.5		Concern about debris and log jams at three locations: (1) log jams between RM 5.0-5.5, (2) debris accumulation on Stewart Rd. bridge piers during flood events, and (3) log jam at golf course (RM 3.6-3.9)		City of Sumner	7	4	5	5	4	**25**	LU1=Ind., LU2=LDR.; S=mod./sev.; A=mod.; F=1
SGBA#14	Lower White (Pacific Point Bar)	3.9	4.5	R	The White river is known to carry high sediment loads from glacier melt which settles out once it reaches the flat valley in Sumner. This has caused a high flood risk in the region.	Elements of this project include setback levees, side channels, back water alcove, channel roughening, engineering log jams, revetments, property acquisitions and other methods to create a more sustainable system.	City of Sumner	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SGBA#15	Lower White (Left Bank Setback)	4.4	4.9	L	The White river is known to carry high sediment loads from glacier melt which settles out once it reaches the flat valley in Sumner. This has caused a high flood risk in the region.	Elements of this project include setback levees, channel roughening, revetments, property acquisitions and other methods to create a more sustainable system.	City of Sumner	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SGBA#16	Lower White	4.9	5.5	R	Gravel bar accumulation in Lower White River in vicinity of Pacific is reducing carrying capacity of the channel. 2009 Corps of Engineers study indicates capacity could be reduced to as low as 5500 cfs	Gravel bar scalping would temporarily increase the flood carrying capacity of the river channel through this reach	City of Pacific, Pierce County River Maint.	7	4	5	5	4	**25**	LU1=Ind., LU2=LDR.; S=mod./sev.; A=mod.; F=1
SGBA#17	Lower White (Stewart Road Bridge)	4.9		R/L	The White river is known to carry high sediment loads from glacier melt which settles out once it reaches the flat valley in Sumner. This has caused a high flood risk in the region.	Replace Stewart road bridge to accommodate traffic, improvementfish habitat and flooding impacts.	City of Sumner	10	0	9	9	10	**38**	
SGBA#18	Carbon	0.0	3.0		Masses of gravel and associated bars strewn along this segment. Gravel accumulations diminish the flood carrying capacity of the river contributing to overbank flow. Gravel bars have the added effect of steering the course of the river and contribute to and exacerbate levee damages. City of	Gravel bar scalping to help minimize steering effects. Another possible solution may be create gravel removal locations adjacent to future setback levees.	Pierce County River Maint., City of Orting	6	4	3	2	6	**21**	LU1=HDR, LU2=LDR.; S=minor/mod.; A=local; F=2
SGBA#19	Carbon	3.0	5.9		Masses of gravel and associated bars strewn along this segment. Gravel accumulations diminish the flood carrying capacity of the river contributing to overbank flow. Gravel bars have the added effect of steering the course of the river and contribute to and exacerbate levee damages.	Same comments. However, this segment is considered sensitive salmon habitat and would likely make gravel removal very difficult to permit. Therefore, the setback levee option would likely be the best solution to provide space for the river to meander	Pierce County River Maint.	4	4	4	2	8	**22**	LU1=LDR, LU2=Agric.; S=mod.; A=local; F=3
SGBA#20	Carbon	5.9	8.3		Same comments. This segment has high bluffs along the right bank between RM's 7.0 and 8.0. The toe of the bluffs tend to experience significant erosion primarily during high water events that result in mass wasting contributing tons of soil and gravel to the river system.	Gravel bar scalping to help minimize steering effects. Another possible solution may be create gravel removal locations adjacent to future setback levees.	Pierce County River Maint.	4	2	5	4	8	**23**	LU1=LDR, LU2=Rec.; S=mod./sev.; A=mod.; F=3

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Appendix K

Throughout the year, Pierce County sends notifications about flood insurance and flood risk to more than 19,000 addresses that are in the county's floodplains. The county also provides information on its website about flood insurance and flood preparedness. A property acquisition program is also on the website that focuses on specific neighborhoods where Pierce County is working with willing sellers to purchase their properties at fair market value. This appendix provides a brief overview of some of the methods of notification Pierce County has used over the years.

Neadham Road Property Acquisition

What's Happening

For several years, Pierce County has purchased properties on Neadham Road because of repetitive flooding in the neighborhood. Once the county has finished buying land, the next step will include setting levees back to allow the river more lateral movement and potentially reducing flood risk down river.

In 2016, the county continued purchasing properties from willing sellers using funds from Floodplains by Design and the Flood Control Zone District.

In 2015, nine homes were purchased using funds from the Floodplains by Design program. A grant from the Salmon Recovery Funding Board will allow the purchase of two more homes and some preliminary engineering for restoring the floodplain to the area.

Pierce County was allocated funding in the 2013-2015 Coordinated Investment Funding in the state budget to purchase homes in the flood hazard zone along Neadham Road, south of Orting.

Funding available at the time was about $3.3 million. This was only adequate to buy nine homes. The county's goal is to purchase all of the homes along Neadham Road as funds become available and allow the area to revert back to floodplain.

Existing flood protection facilities will be maintained as the acquisitions proceed. If a major flood severely damages these facilities, the county will assess the damage and decide how to proceed.

Public Meeting About Property Acquisition on Neadham Road
A public meeting was held Oct. 29, 2012, at Orting Lions Club, to give residents more information about the acquisition process. The following resources were shared at the meeting:

- Frequently Asked Questions
- Neadham Road Map: Properties identified for purchase highlighted
- Presentation

Contact Us

Send a message

Ingo Kuchta
Civil Engineer
Phone: (253) 798-6165
Fax: (253) 798-7709

Monday–Friday
7:30 a.m.–4:00 p.m.

Mailing Address:
2702 S 42nd St, Ste 201
Tacoma, WA 98409-7322

Pierce County
Public Works and Utilities
Surface Water Management

Questions?
(253) 798-2725
pcwater@co.pierce.wa.us

KEEPING YOU INFORMED

We are accessing 266th Street to work on county property.

This work is scheduled to begin July 1 until November 1.

Crews will be on site periodically during that time.

If you have questions or concerns please contact: Al Amirzehni, P.E. at (253) 798-4677.

For project information, go to:
www.co.piercecounty.wa.us
and click on
Public Works & Utilities

www.piercecountywa.org/swm

Make a Plan

Know your property's flood risk
Contact your insurance agent or Pierce County's Public Works Department to learn your property's flood risk. Call (253) 798-2725 or go to: **piercecountywa.org/propertyfloodriskmap** and request a flood map.

Buy flood insurance
Flood insurance is peace of mind that can be very affordable.
- Homeowner's insurance is not an alternate to flood insurance
- Your agent can help you buy a flood insurance policy
- Flood insurance typically takes 30 days to become valid

For more information: **floodsmart.gov**

Family Emergency Plan
Your family's emergency plan doesn't need to be complicated, but it should include:
- Where your family will meet during an emergency
- At least two routes away from flooded or damaged areas
- Contact information for your family members and an out-of-state contact (see tear-off below)

For more information: **piercecountywa.org/plan**

Prep your property
- Keep storm drains clear of leaves and debris
- Dispose of fallen leaves and yard debris properly—in compost areas, gardens, or take to the landfill
- Direct downspouts away from your home or business and clear gutters of debris
- Know how to turn off power and gas during an emergency if you can do so safely

Pierce County Alert
Sign up for this free service to receive alerts to 10 different devices including cell phones, home phones, tablets and computers. You can receive notifications about emergencies that may impact you. Sign up at: **piercecountywa.org/alert**

Cover image: The 2008 flood of the Puyallup River was the most recent major flood for Pierce County. The flooding destroyed or damaged levees, private properties and businesses.

Below image: The White River, in 2009, flooded communities, including Pacific, displacing many households and causing thousands of dollars in damage.

Build a Kit

You can't plan where you are going to be when a flood occurs, but you can be ready with a kit. Emergency kits are easy to setup, don't take much investment, and you can build as many as you need. The great bonus about having an emergency kit for flooding is that you can also use it for other disasters. Did someone say earthquake?

- During a major disaster first responders will not be able to respond immediately to every call for help
- Build a kit that will last for three to seven days
- Create an emergency kit for both your home and your car
- Basic items include: flashlights and First Aid kits
- Customize the kit for your needs including medications, toys or small activities for children and supplies for pets

Once these kits are in place, build or buy a kit for work and a grab-and-go bag under your bed in case trouble strikes in the middle of the night. For more information go to: **piercecountywa.org/kit**

Help Others

Help neighbors get prepared before a disaster strikes. When you are prepared, you can help others in a disaster. Specifically, speak to friends and neighbors who have medical or mobility needs. Talk to them about how you can help them during a disaster.

Join a Pierce County Neighborhood Emergency Teams (PC NET). Neighbors form PC NET teams to help their neighborhood during a major disaster by providing: search and rescue, First Aid, sheltering, communications, damage assessment and pet care. To start a team go to: **piercecountywa.org/PCNET**.

Emergency Contact
Name _____
Phone _____
Name _____
Phone _____

Alward Road Property Acquisition

177th/Alward Road Property Acquisition

Pierce County is working with property owners to purchase parcels in the flood hazard zone along 177th/Alward Road near Orting.

Current funding is limited to purchasing parcels. The county's goal is to purchase all of the properties along 177th/Alward Road, as funds become available. As of January 2018, the county has purchased 57 properties from willing sellers.

Existing flood protection facilities will be maintained as the acquisitions proceed. If a major flood severely damages these facilities, the county will assess the damage and decide how to proceed.

Public Meeting About Property Acquisition on Alward Road
A meeting about this project and the property acquisition process was held on Oct. 30, 2013, at Orting Middle School.

Meeting Presentation

Contact Us

Send a message

Ziad Farah

Monday–Friday

Mailing Address:

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ERRATA TO THE 2013 FLOOD HAZARD MANAGEMENT PLAN

Volume II
2018

Contents

ERRATA TO THE 2013 FLOOD HAZARD MANAGEMENT PLAN

In addition to the Progress Update, the following sections of the 2013 Flood Plan have been updated to reflect current information and understanding, correct grammar or other factual errors.

Appendix A

Page A-6, Hydrology

Revised Text:

~~**Hydrology**~~	~~The science of the behavior of water in the atmosphere, on the surface of the Earth, and underground.~~
Hydrology and Hydraulics	The study of how much water will discharge from a watershed (hydrology) and the resulting flood or water inundation elevation (Hydraulics). This is commonly referred to as H & H.

Appendix D

Flood Plains Regulations, County, Cities, Towns, State and Local Agencies

Page D-5, second sentence.

Revised Text:

A 2010 analysis of flood hazard regulations for counties and cities within the Puyallup and Nisqually River watersheds indicates significant differences across the ~~eh~~ 16 categories evaluated.

Page D-5, paragraph one.

Additional Text:

The National Flood Insurance Program (NFIP) regulations identify requirements that communities must fulfill to join and stay in the program. The requirements that apply to a particular community depend on its flood hazard and the level of detail of the data FEMA provides to the community. The NFIP requirements are minimums. As noted in 44 CFR 60.1 (d),

"Any floodplain management regulations adopted by a State or community which are more restrictive than the criteria set forth in this part are encouraged and shall take precedence."

National Flood Insurance Program- Endangered Species Act Model Ordinance

Page D-21, Readers Digest Version of the Biological Opinion, Biological Opinion link.

Revised link: https://www.fema.gov/national-flood-insurance-program-endangered-species-act

Potential Funding Sources for Flood Damage Reduction and Mitigation Projects

Page D-22, paragraph one.

Revised Text:

The primary sources of funding to implement flood damage and mitigation projects are administered by the Federal Emergency Management Agency (FEMA) and State of Washington Department of Ecology (WDOE). Specific programs offered by FEMA include Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM), and Flood Mitigation Assistance (FMA)~~, Repetitive Flood Claims (RFC) and Severe Repetitive Loss (SRL)~~. Programs offered by WDOE include the Flood Control Assistance Account Program (FCAAP) and Floodplains by Design (FbD). Programs offered by the Salmon Recovery Fund Board are the Puget Sound Acquisition and Restoration Fund Board (PSAR) and the Puget Sound Acquisition and Restoration Fund Large Capital Projects (PSAR Large Cap). Community Development Block Grants are typically made available following a Presidential Declared Disaster and are administered by local jurisdictions.

Hazard Mitigation Grant Program

Page D-22, paragraph one.

Revised Text:

Cost share requirement for this grant is 75% federal, 25% ~~12.5% state and 12.5%~~ local. The local applicant and the State may split the cost share based on legislative approval.

Flood Mitigation Assistance

Page D-23, paragraph one.

Revised Text:

The FMA program was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP). The FMA program is focused on mitigating Repetitive Loss (RL) properties and Severe Repetitive Loss (SRL) properties. A Repetitive Loss property is defined as a residential property that is covered under an NFIP flood insurance policy and: (a) has incurred flood-related damage on two occasions, in which the cost of the repair, on the average, equaled or exceeded 25 percent of the market value of the structures at the time of each such event; or (b) at the time of the second incidence of flood-related damage, the contract for flood insurance contains increased cost of compliance coverage. Repetitive Loss properties may receive up to 90 percent Federal funding. A Severe Repetitive Loss property is defined as a residential property that is covered under an NFIP flood insurance policy and: (a) has at least four separate NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amount of such claims payments exceed $20,000; or (b) for which at least two separate claims payments (includes only building) have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the insured building. Severe Repetitive Loss Properties may receive up to 100 percent Federal funding. ~~FEMA provides FMA funds to assist States and communities in implementing measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the National Flood Insurance Program.~~

Repetitive Flood Claim (RFC)

Page D-23, paragraph one.

Deleted Text:

~~Repetitive Flood Claim (RFC)~~

~~The RFC grant program was authorized by the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004 (P.L. 108–264), which amended the National Flood Insurance Act (NFIA) of 1968 (42 U.S.C. 4001, et al). Up to $10 million is available annually for FEMA to provide RFC funds to assist States and communities in reducing flood damages to insured properties that have had one or more claims to the National Flood Insurance Program (NFIP).~~

Cost share requirement for this grant is 100% federal and no local cost share is required. The State does not cost share in RFC grants.

Severe Repetitive Loss (SRL)

Page D-23-24, paragraph one.

Deleted Text:

~~The SRL grant program was authorized by the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004, which amended the National Flood Insurance Act of 1968 to provide funding to reduce or eliminate the long-term risk of flood damage to severe repetitive loss (SRL) structures insured under the National Flood Insurance Program.~~

~~The definition of severe repetitive loss as applied to this program was established in section 1361A of the National Flood Insurance Act, as amended (NFIA), 42 U.S.C. 4102a. An SRL property is defined as a **residential property** that is covered under an NFIP flood insurance policy and: (a) that has at least four NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000; or (b) for which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building. For both (a) and (b) above, at least two of the referenced claims must have occurred within any ten-year period, and must be greater than 10 days apart.~~

National Flood Insurance Program (NFIP) and Community Rating System (CRS)

Page D-25, paragraph six.

Deleted Text:

Flood hazard management regulations are codified in Title 18E~~.70~~ of the Pierce County Code. ~~and criteria, and procedures are laid out in Chapter Nine of the *Pierce County Stormwater Management and Site Development Manual*.~~

Page D-25, paragraph seven.

Deleted Text:

Basin and floodplain management plans serve as part of the flood hazard mitigation plan for Pierce County. Improvement projects associated with the basin plan should, if possible, reduce flood hazards and improve the County's rating. ~~Future flood hazard reductions could help to raise the County's rating from "Class 3" to a better class.~~

Community Rating System (CRS)-Section 510 (Floodplain Management Planning)

Page D-26, paragraph one.

Deleted Text:

The Pierce County Rivers Flood Hazard Management Plan will be used by Pierce County as the comprehensive floodplain management plan, specified in Section 510 of the CRS guidance, for credit points towards the community's National Flood Insurance Program (NFIP). The planning process will follow the guidance as much as is feasible in order to maximize the number of credit points available towards the County's CRS rating. ~~This will also help any other jurisdiction seeking CRS credit points through adoption of the Plan.~~ It is a CRS prerequisite to receive 50% of the points available in several 510 elements to be rated better than a Class 5 community.

Page D-26, Overview, paragraph one.

Revised Text:

Section 510 of the Community Rating System (CRS) program contains the guidance on planning for receiving credit points towards a community's ~~National Flood Insurance Program (NFIP) rating (e.g., Class 3)~~. Credit is provided for preparing, adopting, implementing, evaluating, and updating a comprehensive floodplain management plan or repetitive loss area analyses. The CRS does not specify what must be in a plan, but it only credits plans that have been prepared according to their ~~the standard~~ planning process ~~explained in Section 511~~. The planning process requires implementation of the following 10 planning steps: (1) organize to prepare the plan; (2) involve the public; (3) coordinate with other agencies; (4) assess the hazard; (5) assess the problem; (6) set goals; (7) review possible activities; (8) draft an action plan; (9) adopt the plan; and (10) implement, evaluate, and revise.

Page D-26, Overview, number one.

Revised Text:

1. Organize to prepare the plan – the planning process must be conducted through a committee composed of staff from those community departments that will be implementing the majority of the plan's recommendations. ~~When a multi-jurisdictional plan is prepared, at least one representative from each community seeking CRS credit must be involved on the planning committee that is credited under this item.~~

Legal Agreements

Page D-28, Overview, number 1-3.

Revised Text:

1. T~~t~~he existing embankment (Auburn Wall) erected in King County ~~-~~by the ICRI crews for the purpose of preventing flow northward to Elliott Bay would be strengthened and maintained to ensure flow down the Stuck River channel into the Puyallup River;
2. A~~a~~ drift barrier may be erected near the present embankment to collect and hold drift coming down the river;
3. T~~t~~he channel below the embankment shall be straightened and deepened, and the banks strengthened to permanently confine the waters to the channel and prevent inundation of adjoining lands;

Page D-29, Overview, number 5.

Revised Text:

5. A~~a~~ fund shall be created in each County, to be known as the "Inter-County River Improvement Fund" to support construction work on the rivers. King County's share was 60 percent and Pierce County's share was 40 percent.

Tacoma Power Agreement on Alder and LaGrande Dams

Page D-37, Overview, paragraph two.

Revised Text:

The Nisqually Hydroelectric Project is operated under a license issued by the Federal Energy Regulatory Commission (FERC). The 40-year FERC license (No. 1862) was issued on March 7, 1997. The license contains articles pertaining to operational requirements, including minimum instream flow, lake levels for recreation and ramping rate requirements. There are no requirements for flood control or flood storage. According to Tacoma Power, operator of the dams, the dams provide some incidental attenuation of flood flows, however, there are no flood control requirements in the operating agreement (Nisqually Basin Plan, 2014~~2008~~). When possible and consistent with the federal mandate, Tacoma Power voluntarily uses the available storage to help reduce the downstream crest of the flood. However, Tacoma Power will do so only when these operations remain consistent with prudent operation of the project and the requirements of its federal license (personal communication with Todd Lloyd, Tacoma Power, October 2006).

Page D-37, Overview, paragraph three.

Revised Text:

Articles 402 and 403 of the operating agreement require minimum instream flows to be met downstream of the LaGrande powerhouse and LaGrande Canyon, respectively. The Nisqually River Coordinating Committee (NRCC) made up of the Nisqually Tribe, Washington Department of Fish and Wildlife, and Tacoma Public Utilities establish these instream flows to support fisheries. Article 404 addresses required reservoir water levels for Alder Lake and maximum conservation releases from LaGrande dam and powerhouse. Finally, Article 405 specifies allowable down ramping rates, or the rate at which discharges from the dam are reduced. There are no known operations at the dam to manage sediment transport through the reservoirs. Most of the sediment load (all except fine suspended sediment) originating from the upper reaches of the Nisqually River is trapped in Alder Lake (Nisqually Basin Plan 2014~~2008~~).

Page D-38, References.

Revised Text:

References

Pierce County Public Works and Utilities, Surface Water Management Division. 2014~~2008~~. Nisqually River Basin Plan, Volumes 1 and 2. Pierce County, Washington.

Lake Tapps Agreement

Page D-40, References.

Revised Text:

References:

November 24, 2009 conversation with Bob Barnes, PSE. (JMR)

TIM 7 White River Basin Plan (Draft), Dam Break Analysis

2009 Agreement Regarding Lake Tapps between Cascade Water Alliance and the Lake —Tapps Community

Pierce County Comprehensive Plan (Title 19A)

Page D-53, paragraph one.

Revised Text:

The Pierce County Comprehensive Plan (Comprehensive Plan) is divided into thirteen~~en~~ elements: Land Use, ~~Rural, Economic Development, Environment and Critical Areas, Housing, Transportation, Utilities,~~] Capital Facilities, Cultural Resources, Design and Charter, Economic Development, Environment, Essential Public Facilities, Housing, Open Space Parks and Recreation, Transportation, Utilities, and Community Plans~~, and Essential Public Facilities~~. The Land Use Element, Environment and Critical Areas Element, Utilities Element and Capital Facilities Element include policies regarding flood control for major rivers in Pierce County. The Comprehensive Plan also divides the County into several subareas based upon geographic and community boundaries known as community plan areas. The Alderton-McMillin, Graham, Mid-County, and Upper Nisqually Community Plan areas lie within the Rivers Plan study area.

Page D-53, paragraph three.

Revised Text:

The Environment ~~and Critical Areas~~ Element builds further upon the themes of loss-prevention found in the Land Use Element. It encourages designations of flood-prone areas to rural to prevent high intensity uses generally associated with urban designations from locating in floodplains. Policies of the Environment and ~~Critical Areas~~ Element encourage the mitigation of potential impacts within flood hazard areas, especially to ensure no loss of floodwater storage. This Element calls for the continued maintenance of County flood-control facilities and acquisition and protection of floodplains to prevent future development within these areas.

Pierce County Community Plans (Title 19)

Page D-54, Pierce County Community Plans (Title 19B).

Revised Header:

Pierce County Community Plans (Title 19A, Chapter 14~~B~~)

Upper Nisqually Community Plan

Page D-54, Upper Nisqually Community Plan.

Revised Text:

The Upper Nisqually Community Plan area is also included within the Plan area; however this plan does not include specific policies regarding management of the Mashell or Nisqually Rivers, which fall within the subarea. The Upper Nisqually Community Plan adopted in 2000.

Pierce County Park, Recreation and Open Space Plan (2008)

Page D-55, Pierce County Park, Recreation and Open Space Plan (2008).

Revised Header:

Pierce County Park, Recreation and Open Space Plan (2014)

Page D-55, paragraph one

Revised Text:

The *Pierce County Parks and Recreation Open Space Plan, 2014* (PROS Plan) guides facility development and planning by Pierce County Parks and Recreation Services. It addresses community priorities for county parks and recreation services plan provides regional elements serving a countywide audience, while balancing needs for local park service in urbanized residential unincorporated areas. Plan implementation will provide significant recreation opportunities for many underserved residents by providing parks in areas where they are needed most connected by a system of regional trails. A Regional Trail Plan is incorporated into the PROS Plan.

Pierce County Community Plans (Title 19)

Page D-56, Pierce County Community Plans (Title 19B).

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Pierce County Park, Recreation and Open Space Plan (2008)

Page D-57, Pierce County Park, Recreation and Open Space Plan (2008).

Deleted Page D-57, repetitive page

Appendix F

Page F-2, Structural Approaches: Levee Reaches (Flood Risk Reduction), number one

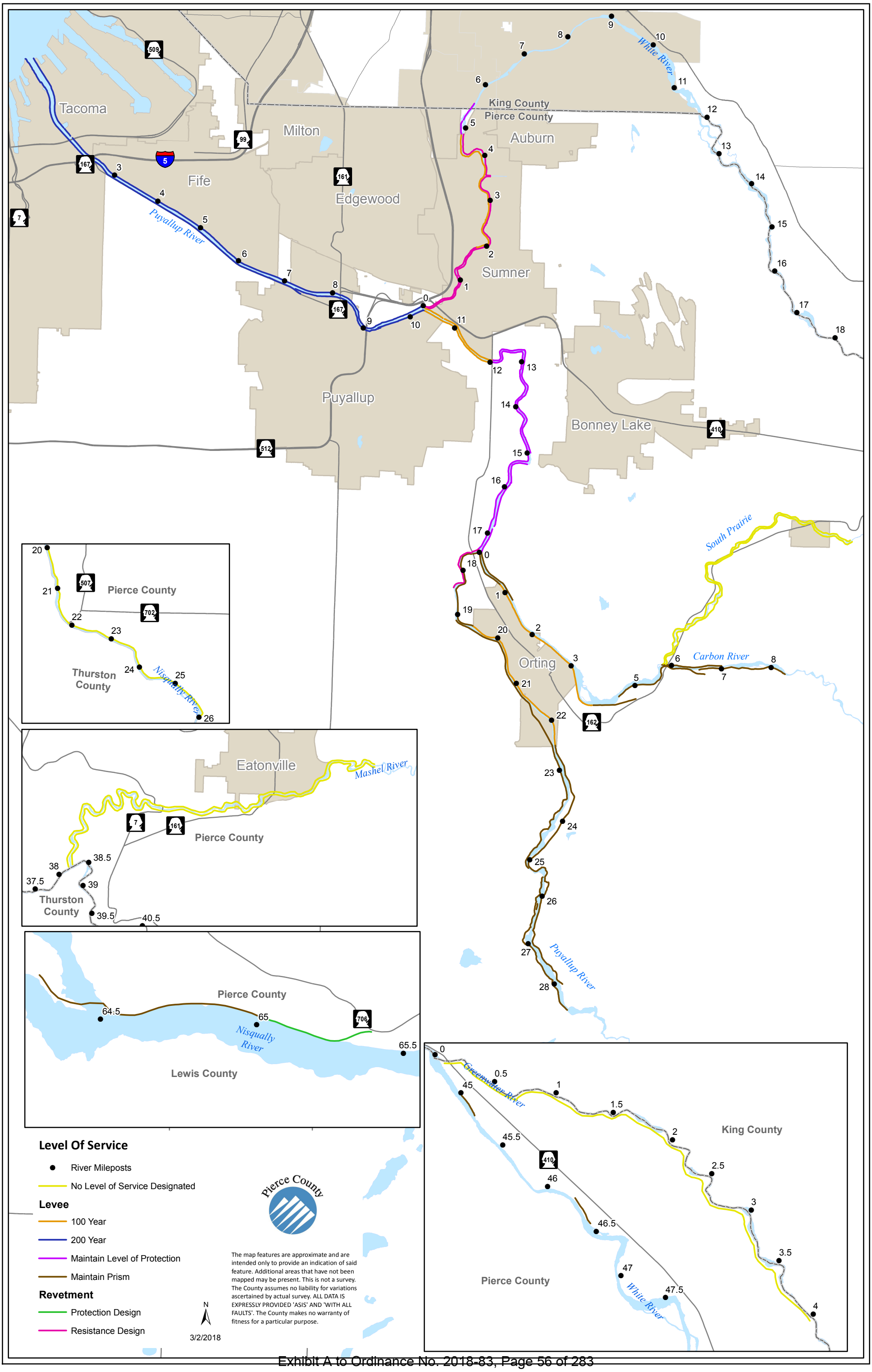
Revised Text:

~~1~~. 200-year Level of Protection – Levees are designed and maintained to safely convey a 200-year storm event. ~~the 200-year level of protection with three feet of freeboard.~~

Page F-2, Structural Approaches: Levee Reaches (Flood Risk Reduction), number two

Revised Text:

2. 100-year Level of Protection – Levees are designed and maintained to safely convey a 100-year storm event. ~~the 100-year level of protection with three feet of freeboard.~~


Tacoma
Fife
Milton
Edgewood
Auburn
King County
Pierce County
Sumner
Puyallup
Bonney Lake
Orting
Eatonville
White River
Puyallup River
Carbon River
South Prairie
Mashel River
Nisqually River
Greenwater River
Thurston County
Pierce County
Lewis County
King County
509
99
5
167
7
161
512
410
507
702
162
706
Level Of Service
River Mileposts
No Level of Service Designated
Levee
100 Year
200 Year
Maintain Level of Protection
Maintain Prism
Revetment
Protection Design
Resistance Design
N
3/2/2018
The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. The County assumes no liability for variations ascertained by actual survey. ALL DATA IS EXPRESSLY PROVIDED 'ASIS' AND 'WITH ALL FAULTS'. The County makes no warranty of fitness for a particular purpose.

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2018 Pierce County Rivers Flood Hazard Management Plan Contributors

Pierce County Elected Officials

Bruce Dammeier
Pierce County Executive

Pierce County Council (2018)

Dan Roach, District 1
Pam Roach, District 2
Jim McCune, District 3
Connie Ladenburg, District 4
Rick Talbert, District 5 (Vice Chair)
Doug Richardson, District 6 (Chair)
Derek Young, District 7

Dennis Hanberg, Director
Planning and Public Works

Flood Plan Advisory Committee

The Flood Plan Advisory Committee consisted of 26 members representing cities, counties, tribes, state and federal agencies, business, environmental and agricultural interests, floodplain residents and citizens outside of the planning area.

Doug Beagle, City of Sumner
Liz Bockstiegel, WA Dept of Fish & Wildlife
Gary Brackett, Business Association
Linda Burgess, Puyallup River Watershed Council/Pierce County Biodiversity Alliance
Mike Dahlem, City of Sumner
John Ernst Berry III, Puyallup Watershed Initiative
Hans Hunger, City of Puyallup
Jordan Jobe, Farming in the Floodplain PM/WSU Puyallup
Andrew Kinney, Thurston County Emergency Management
Russ Ladley, Puyallup Tribe
Loren Paschich, Drainage District #10/Volunteer Clear Creek Farmers Association
Joran Rash, Forterra
Patrick Reynolds, Representative of the Muckleshoot Indian Tribe Fisheries Division
Richard Schrodel, Resident of Tacoma, Retired Pierce County Emergency Management
Taylor Shanaman, Tacoma-Pierce County Association of Realtors
Jennifer Stebbings, Port of Tacoma
Jeffree Stewart, WA State Dept. of Ecology
Monica Walker, King County
Allen Zulauf, Resident of Puyallup

Pierce County Project Team

A Pierce County Project Team made up of representatives from SWM, Transportation Planning, Emergency Management, Planning and Land Services, Economic Development, Government Relations, and Parks and Recreation Services guided development of the Plan.

Angela Angove, Pierce County PPW-SWM
Anne-marie Marshall-Dody, Pierce County PPW-SWM
Brynne Walker, Pierce County PPW-SWM
Debbie Bailey, PC Emergency Management
Dennis Dixon, Pierce County PPW-SWM
Erick Thompson, Pierce County PPW-SWM
Harold Smelt, P Pierce County PPW-SWM
Jessica Stone, Pierce County Parks & Recreation
Johnny Mauger, Pierce County PPW-SWM
Melissa McFadden, Pierce County PPW-SWM,
Mike Halliday, Pierce County PPW
Randy Brake, Pierce County PPW-SWM
Rob Wenman, Pierce County PPW-SWM
Tiffany O'Dell, Pierce County PPW
Todd Essman, Pierce County PPW-SWM
Tony Fantello, Pierce County PPW

Pierce County Steering Committee

An internal Steering Committee (composed of the SWM Management Team) reviewed all elements of the Flood Plan prior to broader external review.

Melissa McFadden, Pierce County Planning & Public Works-SWM
Harold Smelt, Pierce County Planning & Public Works-SWM
Tony Fantello, Pierce County Planning & Public Works
Anne-marie Marshall-Dody, Pierce County Planning and Public Works – SWM
Kjristine Lund, Executive Director for the Pierce County Flood Control Zone District

2013 Pierce County Rivers Flood Hazard Management Plan Contributors

Pierce County Elected Officials

Pat McCarthy
Pierce County Executive

Pierce County Council (2012)

Dan Roach, District 1
Joyce McDonald, District 2 (Council Chair)
Roger Bush, District 3
Timothy Farrell, District 4
Rick Talbert, District 5
Dick Muri, District 6
Stan Flemming, District 7

Pierce County Council (2013)

Dan Roach, District 1
Joyce McDonald, District 2 (Council Chair)
Jim McCune, District 3
Connie Ladenburg, District 4
Rick Talbert, District 5
Douglas Richardson, District 6
Stan Flemming, District 7

Brian J. Ziegler, Director
Public Works and Utilities

Flood Plan Advisory Committee

The Flood Plan Advisory Committee consisted of 26 members representing cities, counties, tribes, state and federal agencies, business, environmental and agricultural interests, floodplain residents and citizens outside of the planning area.

Bill Anderson, Citizens for a Healthy Bay
Nell Batker, Tahoma Audubon Society
Jay Bennett, City of Pacific
Russ Blount, City of Fife
Robert Brenner, Port of Tacoma
Bryan Bowden, Mount Rainier National Park
Richard Carkner, Farmer, Lower Puyallup River
Gail Clowers, Drainage District #10
Buzz Grant, Citizen, South Prairie Creek
Justin Hall, Nisqually River Council
Kathy Hatcher, Citizen, Nisqually River
Marsha Huebner, Pierce County SWM
Steve Kalinowski, WA Dept of Fish and Wildlife
Mart Kask, Town of South Prairie
Mark Palmer, City of Puyallup
Bill Pugh, City of Sumner
Catherine Rudolph, TPC Association of Realtors
Tim Rymer, National Marine Fisheries Service
Richard Schroedel, PC Emergency Management

Dave Seabrook, Pierce Conservation District and Puyallup River Watershed Council
Dan Sokol & Chuck Steele, WA Dept of Ecology
Charlie Solverson, City of Tacoma
Tiffany Speir, Master Builders Association of Pierce County
Jeff Sproul, Citizen, Carbon River
Bill Sullivan, Puyallup Tribe of Indians
Mary Lou Tkach, Citizen, Puyallup River
Ken Wolfe, City of Orting

Pierce County Project Team

A Pierce County Project Team made up of representatives from SWM, Transportation Planning, Emergency Management, Planning and Land Services, Economic Development, Government Relations, and Parks and Recreation Services guided development of the Plan.

Lorin Reinelt, Project Manager
PWU Surface Water Management
Anne-marie Marshall-Dody, PWU SWM
Melissa Paulson, PWU SWM
Rob Allen, Economic Development
Ann Boeholt, PWU SWM
Brynn Brady, Government Relations
Randy Brake, PWU SWM
Dennis Dixon, PWU SWM
Todd Essman, PWU SWM
Skip Ferrucci, Parks and Recreation
David Grinstead, PWU SWM
Marsha Huebner, PWU SWM
Tom Nelson, PWU SWM
Tiffany Odell, Planning and Land Services and PWU SWM
Helmut Schmidt, PWU SWM
Chris Schutz, Tribal Affairs and PWU SWM
Richard Schroedel, Emergency Management
Carrie Sikorski, Farmbudsman
Rance Smith, PWU SWM
Jane Vandenberg, PWU Transportation Planning

Pierce County Steering Committee

An internal Steering Committee (composed of the SWM Management Team) reviewed all elements of the Flood Plan prior to broader external review.

Harold Smelt, Surface Water Management Manager
Tony Fantello, SWM Maintenance and Operations Manager
Marsha Huebner, Environmental Permitting and Planning Manager
Hans Hunger, Capital Improvement Program Manager
Dan Wrye, Water Quality Manager

Consultant Team

Cardon Entrix, Inc. (Facilitation, Geomorphology, Economic Analysis)
Herrera Environmental Consultants, Inc. (Environmental Impact Statement)
Jones and Jones (Policy, Plan Support)
URS (Capital Projects, Risk Assessment, Geotechnical)

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Contents

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INTRODUCTION

In 2013, Pierce County adopted the Pierce County Rivers Flood Hazard Management Plan (Flood Plan) that outlined how Pierce County addressed and managed flooding and channel migration hazards on major rivers, large tributaries and associated floodplains within Pierce County. The Flood Plan was developed to meet the requirements of the Washington Administrative Code (WAC 173-145) related to the Comprehensive Flood Control Management Plans, Revised Code of Washington (RCW 86.12 flood control by counties), and the Community Rating System Guidance for floodplain management planning under the National Flood Insurance Program. The purpose of the Pierce County Rivers Flood Hazard Management Plan is to: recommend regional policies, programs, and projects to reduce risks to public health and safety; reduce infrastructure and property damage; reduce maintenance costs; and improve habitat conditions, while protecting and maintaining the regional economy.

The 2018 Flood Plan Update and Progress Report (Flood Plan Update) is a companion document to the 2013 Flood Plan. This update is a technical update and progress report that reflects new information on hazards, vulnerabilities, and accomplishments since the adoption of the 2013 Flood Plan. The National Flood Insurance Program's Community Rating System (CRS) requires an update to the agency's flood hazard management plan every five years. Currently, Pierce County is a Class 2 rated community. This rating provides a discount of up to forty percent on federally backed flood insurance premiums for unincorporated Pierce County property owners.

Chapters, subsections and appendices of the Flood Plan Update are presented in the same order as the 2013 Flood Plan. Only new and updated information is presented in this edition. This plan does not establish or propose new policy, but it reports on relevant regulatory changes that may have emerged from the 2013 plan. Organization of this plan update is broken out into two sections, a progress report section and errata. Definitions of each section are as follows:

Progress report: The progress report provides a status update, clarifying information or additional details on projects and plans that were listed in the 2013 Flood Plan. The report is listed in the order it appears in the 2013 Flood Plan. Minor updates to cost estimates, current or completed project names, corrected river miles or other minor updated information can be found in the Errata to the Flood Plan.

Errata to the Flood Plan: The errata documents additions, deletions or corrections to the text of the 2013 Flood Plan. These additions, deletions or corrections are to: to correct grammar, minor errors, updated cost estimates to 2017 dollars, correct names or references. Text that has been deleted or changed is shown in strikeout and text that has been added is underlined and listed in the order it appears in the 2013 Flood Plan. If no change was proposed, it is not included.

Purpose of the plan

The purpose of the Pierce County Rivers Flood Hazard Management Plan continues to be to: recommend regional policies, programs, and projects that reduce risks to public health and safety; reduce public and property damage; reduce maintenance costs; and, improve habitat conditions, while protecting and maintaining the regional economy.

Planning process and stakeholder involvement for 2018 Flood Plan Update and Progress Report

Development of the 2018 Flood Plan Update and Progress Report was led by Pierce County Planning and Public Works, Surface Water Management (SWM). Three planning committees were formed to help guide the development of the plan. The Steering Committee is comprised of members from the Surface Water Management leadership team along with the Executive Director of the Pierce County Flood Control Zone District. The Steering Committee had four meetings during the development of the plan and was utilized to make final decisions on various elements throughout the process.

An Internal Planning Committee was also formed that was comprised of key individuals from various departments in Planning and Public Works, the Department of Emergency Management as well as the Department of Parks and Recreation. This committee had four meetings and provided valuable input on modifications to the 2013 goals, objectives, and guiding principles. Lastly, an Advisory Committee was formed that was comprised of local citizens, tribes, private nonprofits, cities, state agencies, the Port of Tacoma, and King and Thurston counties. This committee had five meetings throughout the development of the plan update and provided feedback on how they would modify the 2013 goals, objectives, and guiding principles that were outlined in the plan. Once all elements of the Flood Plan were discussed with both committees, the Steering Committee reviewed the suggested revisions prior to a broader external review. To see a complete list of all the committee members and their affiliation refer to Appendix C.

Individual meetings also took place during the plan update process. Meetings were held with SWM project managers and local officials that were knowledgeable of projects or events that had taken place along the rivers. In addition, a meeting with staff from the Puyallup Tribe of Indians and the Muckleshoot Tribe was held on July 19th, 2017 to update the Roles of the Tribes section of the Flood Plan (6.1.3). This meeting was a crucial part of updating the plan as it provided additional information on how the tribes has assisted the County in improving our flood risk.

The Flood Control Zone District (FCZD) Advisory Committee also played a role in the plan update process. During regularly scheduled FCZD Advisory Committee meetings, presentations were on the Flood Plan Update. Advisory Committee members provided valuable feedback and even requested that notification about the Flood Plan Update go out to the residents in their respective jurisdictions. In January and March 2018, notification was

sent to city officials and residential postal customers throughout Pierce County, informing them of the plan update and inviting their input through the virtual open house. See appendix K for an example of this notification.

A virtual open house for the Flood Plan Update went live April 11, 2018. This open house gave residents an opportunity to provide feedback on the draft plan before it went through various committees for approval and later adoption. This was the first time that this method of public participation was used for the Flood Plan Update. Comments or questions that were submitted were given to the Steering Committee for discussion and consideration.

Notification of the Flood Plan Update was also sent out to all the watershed councils in Pierce County. An email went out to watershed council members in September 2017 to inform them of the plan update process and provide them with an opportunity to participate in the Advisory Committee. SWM staff also partnered with Pierce County Department of Emergency Management Regional Hazard Mitigation groups (total of 5 groups) to inform them of the plan update process and invite them to participate in the Advisory Committee. In addition, SWM collaborated with Pierce County Department of Emergency Management Public Education Department to create a brochure that was used to hand out to residents at fairs and other events that provided information on the plan update process and how they could be involved.

State Environmental Policy Act (SEPA) Environmental Impact Statement (EIS) process for the 2018 plan update

This update is a progress report of the existing projects and recommendations already included in the 2013 Flood Plan. This update does not include new projects or activities that change the original threshold determination or require new analysis, nor does it include significant changes to any project or recommendation. Pierce County has concluded that a Supplemental Environmental Impact Statement (SEIS) or addendum is not required for this update. However, Pierce County will distribute the plan update and progress report for public comment and review.

During the development of the 2013 Pierce County Rivers Flood Hazard Management Plan, a State Environmental Policy Act (SEPA) Environmental Impact Statement (EIS) was published in conjunction with the plan development. The EIS described the potential effects of the proposed activities on the environment that were listed in the flood plan. This process included:

- Preparing and distributing a Determination of Significance and scoping notice during a 21-day scoping period.
- Drafting an EIS to inform the public of the environmental analysis and describe how the public could be involved in the EIS preparation.

- Publishing a Notice of Availability and distributing the draft EIS to inform the public of the preliminary results of the environmental analysis during a 45-day comment period.
- Drafting a final EIS that provided responses to substantive comments received during the draft EIS 45-day comment period.
- Publishing a Notice of Availability in the SEPA Register and distributing the final EIS which explained the agencies decision, the alternatives the agency considered, and the agencies plans for mitigation and monitoring.

PROGRESS REPORT

CHAPTER 1 INTRODUCTION

Goals, Objectives, And Guiding Principles

The Flood Plan Update includes updated goals, objectives, and guiding principles that are more concise and comprehensive to fit the needs of county staff, committee members and residents. Throughout the plan update process, each goal, objective, and guiding principles was reviewed using the 2013 methodology. Below is a summary table of the revised goals, objectives, and guiding principles.

Goals			
2013 Goals	**Kept as is?**	**Revised?**	**New revised language**
Reduce risks to life and property from river flooding and channel migration;	X		N/A
Identify and implement flood hazard management activities in a cost-effective and environmentally-sensitive manner;	X		N/A
Support compatible human uses, economic activities, and improve habitat conditions in flood-prone and channel migration areas; and		X	(3) Support resilient communities, economic activities, and improve habitat conditions in flood-prone and channel migration areas;
Develop a long-term and flexible funding strategy for river flood hazard management;		X	(4) Continue to implement cost effective river flood hazard management activities supported by a long term flexible funding strategy;

Below is a summary table of the revised objectives:

Objectives			
2013 Objectives	**Kept as is?**	**Revised?**	**New Revised language**
(1) Evaluate the risks to public safety and existing development (e.g., critical facilities, infrastructure, and structures) in flood-prone and channel migration hazard areas;	X		N/A
(2) Examine alternatives to reduce risk to life and property, while reducing economic and environmental impacts of flood hazard management actions and programs;		X	(2) Examine and prioritize opportunities to reduce risk to life and property, while reducing economic and environmental impacts of flood hazard management actions and programs;

Objectives			
2013 Objectives	**Kept as is?**	**Revised?**	**New Revised language**
(3) Regulate new development in flood-prone and channel migration hazard areas to minimize risks to life, property, and habitat, and strive for consistency of regulations among affected local governments;		X	(3) Regulate new development in flood-prone and channel migration hazard areas to minimize risks to life, property, and habitat;
(4) Identify current and establish future "Levels of Service" for existing and new flood risk reduction facilities;		X	(4) Review current and establish future "Level of Service" for existing and new flood risk reduction facilities;
Additional added objective		X	(5) Promote coordination among Pierce County Agencies for consistency of regulation among affected local governments; NEW OBJECTIVE
(5) Maintain, repair and modify necessary existing flood risk reduction facilities in a cost-effective manner that makes the facilities less susceptible to future damage, reduces impacts on aquatic and riparian habitat, and ensures consistency with public law (PL) 84-99, or similar federal, tribal and state laws and programs;		X	(6) Manage flood risk reduction facilities in a cost -effective manner that makes the facilities less susceptible to future damage, reduces impacts on habitat, and ensures consistency with public law (PL) 84-99, or similar federal, tribal, and state laws and programs;
(6) Identify repetitive-loss properties and properties needed for future flood risk reduction facilities;	X		RENUMBERED TO OBJECTIVE #7
(7) Prioritize projects and programs based on the level of risk, benefit, cost effectiveness over the life of the plan or facility, and adverse effects on habitat;		X	(8) Identify and examine the connections between floodplain management, salmon recovery, aquatic and riparian habitat, water quality, open space, public access and agricultural resources to take advantage of efficiencies in addressing multiple objectives;
(8) Provide for the participation of stakeholders in the assessment of acceptable risks, evaluation and ranking of alternatives, natural resource management issues and development of recommendations;		X	(9) Prioritize projects and programs based on the level of risk, benefit, cost effectiveness and effects on habitat; over the life of the plan or facility;
(9) Coordinate among Pierce County departments, other agencies and governments (cities, tribes, adjacent counties) to seek consistency in flood hazard management and flood disaster response and recovery;		X	(10) Provide for the participation of stakeholders in the assessment of acceptable risks, evaluation and ranking of alternatives, natural resource management issues and in the development of plan recommendations;

Objectives			
2013 Objectives	**Kept as is?**	**Revised?**	**New Revised language**
(10) Implement a County-wide public education and outreach program to improve flood awareness that includes actions people can take to reduce their risks (e.g., flood insurance, flood proofing);		X	(11) Coordinate among Pierce County departments, other agencies and governments to seek consistency in flood hazard management, development regulations, and flood disaster response and recovery;
(11) Identify possible funding sources for implementing the recommended flood hazard management activities;		X	(12) Implement a County-wide public education and outreach program to improve flood awareness that includes actions people can take to reduce their risks (e.g., flood insurance, flood proofing);
(12) Examine the connections between flood hazard management, river corridors, salmon recovery, aquatic and riparian habitat, water quality, open space, public access and agricultural resources to take advantage of efficiencies in addressing multiple objectives;		X	(13) Identify supplemental funding sources for implementing recommended flood hazard management activities;
(13) Remove or modify existing flood risk reductions facilities, to protect, restore, or enhance critical riparian or instream habitat that benefits threatened or endangered species;			(14) Remove or modify existing flood risk reduction facilities, where feasible, to protect, restore or enhance critical riparian or instream habitat that benefits threatened or endangered species;
Removed objective #14		X	
(15) Protect and enhance natural systems that prevent flooding;		X	(15) Protect and enhance natural systems that reduce flood risk;
(16) Adaptively manage implementation to learn from successes, develop long-term cost-effective approaches and reduce the need for costly solutions;		X	(16) Monitor the effectiveness of projects and repairs to learn from successes, develop long-term cost-effective approaches and reduce the need for costly solutions;
Removed objective #17		X	
(18) Increase our understanding and incorporate information about climate change (including potential increases in rainfall, glacial retreat and changes in sediment transport) into flood hazard management decision-making; and		X	(17) Increased our understanding and incorporate information about climate change into flood hazard management decision-making;
(19) Cooperate with regional agencies in maintaining a network of accurate stream flow and weather gauges, and water quality data.		X	(18) Maintain a network of accurate stream flow, weather gauges, and water quality data to inform management decisions;

Guiding Principles			
2013 Guiding Principles	**Kept as is?**	**Revised?**	**New Revised language**
(1) River flooding and channel migration are natural processes that continually form and alter river valleys and the floodplain landscape. Rivers transport water, sediment, and woody material that may threaten public safety and infrastructure in flood prone areas. Biological productivity and diversity are sustained by natural riverine processes, such as flooding, that create and alter aquatic habitats that sustain fish and wildlife species.	X		N/A
(2) Actions in the upland and upstream portions of watersheds impact flooding, channel migration, and water quality within the river corridor. Sources of sediment and pollution from human activities like logging and urbanization also impact water quality and habitat.		X	**(2) Activities in the watersheds impact flooding, channel migration, habitat, ground water, and water quality** within the river corridor.
(3) Flood damage creates financial costs, both public and private. Effective flood hazard management can reduce long-term damage costs. Public infrastructure, such as roads, utilities, levees, revetments and dams, and private improvements such as homes, businesses and structures located in the floodplain, are vulnerable to flood damage. As the budgets of federal, state, and local governments tighten, the amount of funding available for flood hazard management is reduced.		X	**(3) Flood damage creates financial costs, both public and private. Effective flood hazard management can reduce long-term damage costs.** Public infrastructure and private improvements located in the floodplain are vulnerable to flood damage. Funding for structural flood risk reduction projects is limited and continues to be reduced.
(4) A river and its valley floor, including adjacent floodplains, floodways, and potential channel migration areas, constitute a corridor through which floodwaters flow and within which opportunities exist for various and compatible land uses, including agriculture, recreation and open space. Floodplains are subject to inundation during flooding events, varying in magnitude from the 2-year to 100-year event or larger, depending on the river system and floodplain conditions.		X	**(4) A river and its valley floor, including adjacent floodplains, floodways, and potential channel migration areas, constitute a corridor through which floodwaters flow and within which opportunities exist for agriculture, recreation, and open space.** Floodplains are subject to inundation during flooding events depending on the river system and floodplain conditions.

Guiding Principles			
2013 Guiding Principles	**Kept as is?**	**Revised?**	**New Revised language**
(5) Future development within Pierce County, including cities and unincorporated areas if guided away from flood-prone areas, can reduce future risks to life and property. Adverse impacts of development both inside and outside the floodplain can be minimized by development practices that reduce future risks through appropriate regulation and land use, open land preservation and acquisition, multi-objective planning, relocation or elimination of high hazard structures, prohibiting unacceptable encroachments, and establishing ongoing maintenance practices that preserve and enhance environmental functions.		X	**(5) Future development in flood prone areas should be designed to reduce risks to life and property.** Adverse impacts of development can be minimized by practices that preserve and enhance environmental functions.
(6) Beneficial functions of floodplains and rivers can be achieved by restoring, preserving, and enhancing natural processes – even if these flood-prone and environmentally sensitive areas are not subject to development in the future, past degradation of them needs to be remedied through restoration and enhancement actions.		X	**(6) Beneficial functions of floodplains and rivers can be achieved by restoring, preserving, and enhancing natural processes.**
(7) The levels of funding for floodplain management should meet demand within Pierce County (both incorporated and unincorporated areas) to ensure that necessary infrastructure maintenance and improvements meet citizen's expectations and willingness to pay.		X	(7) Adequate and stable funding is necessary for ongoing flood risk reduction activities and maintenance of existing facilities.
(8) Protecting and working with, rather than trying to control, natural riverine processes generally will reduce flood risks to people and property in a less costly manner than traditional structural approaches to flood hazard management, while also benefiting native fish and wildlife and preserving aesthetic landscapes.		X	**(8) Protecting and working with, rather than trying to control, natural riverine processes generally will reduce flood risks to people and property in a less costly manner than traditional structural approaches.**
(9) Communication with and involvement of a diverse groups of citizens and stakeholders and public and private landowners is vital in developing a responsible, effective flood hazard management plan.		X	**(9) Communication and involvement of diverse groups of citizens, stakeholders, and landowners is vital** in developing a responsible, effective flood hazard management plan.

Guiding Principles			
2013 Guiding Principles	**Kept as is?**	**Revised?**	**New Revised language**
(10) Assume personal and public responsibility – we need to revive our ethic of land and water stewardship. The County needs a framework that will foster localized responsibility for flood risk, water-related resources, and wise use of flood-prone lands. Private property rights should be respected when providing flood protection.		X	**(10) Promote community stewardship and personal responsibility.** Flood risk reduction should be a joint effort with private property owners. Assistance programs exist at the State, Federal, and local level for public agencies and individuals. The county will foster localized responsibility for flood risk, water-related resources, and wise use of flood-prone lands.
(11) Leadership and cooperation among affected governments and public agencies (counties, cities, tribes, and resource agencies) is essential for the success of long-term flood hazard management.		X	**(11) Leadership and cooperation among affected governments and public agencies is essential** for the success of long term flood hazard management.
(12) Advances in technical information and an evolving understanding of flood risks call for an adaptive management approach to implementing the flood hazard management plan. Our knowledge and levels of understanding of risk will change over time – e.g., changing flood maps, new data, etc. We need to learn from approaches and actions that are most effective in achieving the goals and objectives, and then adjust management actions to reflect the latest information.		X	**(12) Use an adaptive management approach when implementing the flood hazard management plan.** Knowledge and levels of understanding will change over time.
(13) Education regarding riverine processes, flooding and preparedness can raise public awareness and reduce future flood damages and costs.		X	**(13) Education regarding riverine processes, flooding, and preparedness can raise public awareness reducing future flood damages and costs.**

Additional Plans and Programs Implemented since the 2013 Flood Plan

United States Army Corps of Engineers General (USACE) Investigation for the Puyallup River

Pierce County and the FCZD have been collaborating on the Lower Puyallup River General Investigation (GI) Study to be eligible for federal funding for flood facility investments needed to protect the Lower Puyallup basin, including the economic assets of the Port of Tacoma. The study area includes 28 levee segments currently in the USACE National Levee Database (NLD). This includes 26 non-federal levees and two federally owned and operated levees.

The current cost estimate for proposed improvements exceeds $340 million. The potential

federal funding share of construction is 65%. Work on the GI began in 2010 and the Chief's report is expected in 2019. Congressional action is needed to authorize additional funding for design and construction once the Chief's report is completed.

The USACE is the lead Federal agency for this study. The non-Federal, cost-sharing sponsor (sponsor) is Pierce County. As the non-Federal sponsor, the County contributes 50 percent of the total feasibility study costs in the form of cash or in-kind contributions. The USACE and County executed a Feasibility Cost Sharing Agreement (FCSA) in September 2010 for a single-purpose, flood risk management feasibility study.

Several local stakeholders have executed an Inter-Local Agreement with Pierce County to financially support the County's non-federal sponsor cost share including: City of Tacoma, City of Sumner, City of Puyallup, City of Orting, City of Pacific, City of Fife, and the Puyallup Tribe of Indians. Additionally, other stakeholders include Federal, state and local agencies such as Washington State Department of Transportation (WSDOT), Port of Tacoma, City of Auburn, other Federally-recognized tribes and the general public.

In April 2018, USACE informed Pierce County that the Corps moved the GI study to inactive status. With this being said, over the next year, the County will begin to put together a plan with options to prioritize, fund, and move forward with projects listed in the study.

System Wide Improvement Framework (SWIF)

In 2014, Pierce County submitted a letter of intent to the United States Army Corps of Engineers (USACE) to develop a System Wide Improvement Framework (SWIF). In 2017, the SWIF was accepted by the USACE and the County is actively working to implement the actions and milestones listed in the plan.

The SWIF represents Pierce County's local approach to improving the system of levees enrolled in the U.S. Army Corps of Engineers (USACE) Public Law (PL) 84-99 Rehabilitation and Inspection Program by addressing identified levee deficiencies, including the correction of unacceptable inspection items, in a prioritized manner to optimize flood risk reduction. The plan is intended to be a "living" document for a 20-year period, and will be amended over time to address evolving river conditions that may affect levee integrity and the associated level of flood risk.

Actions are phased over the implementation of the SWIF into categories of work as near-term, mid-term, long-term, programmatic, and monitoring actions. Near-term actions are typically those that will be addressed within the current budget cycle, such as routine maintenance or response to deficiencies that pose a high level of risk. Mid-term actions are generally those of moderate-high risk, more extensive in scope and cost, including capital improvement projects scheduled to coincide with the county's capital improvement program (CIP) six-year budget cycle. Representative mid-term actions include a capital maintenance project to correct extensive or chronic deficiencies in a levee segment and a capital improvement project listed in the Pierce County Rivers Flood Hazard Management Plan (RFHMP) or Flood Control Zone District Comprehensive Plan of Development. Long term

actions include projects already listed in the RFHMP but not yet included in the current six-year CIP or whose funding source has not yet been identified or programmed into the overall budget. Programmatic actions are ongoing and implement the SWIF over the course of the 20-year planning period. Programmatic actions, such as the levee vegetation management strategy, the asset management program, and the capital maintenance program are important components of the SWIF that will be ongoing through the 20-year course of implementation to maintain and improve the system of levees over time. Monitoring actions are intended to ensure that the SWIF's objectives are met, that levee deficiencies do not worsen, and that programmatic actions are successful.

The SWIF Action Plan describes interim risk reduction measures to apply while the SWIF Plan is being implemented. This strategy relies upon the various programs already in place, coordinated between Pierce County SWM and the Pierce County Department of Emergency Management.

Structural and nonstructural risk reduction measures are employed, depending on the level of risk identified at the levee segment and area of inundation. The SWIF Action Plan also identifies implementation costs and revenue sources. SWIF implementation is dependent upon the appropriate level funding to address identified levee deficiencies, levee maintenance, and capital improvements necessary to improve the PL 84-99 system of levees over time. Current funding ensures that the continued eligible inspections (CEIs) deficiencies identified in the 2010 and 2013 CEI reports will be maintained to at least a minimally acceptable level, as defined by the USACE. Mid-to long-term maintenance objectives will require additional funding beyond current levels to ensure SWIF Plan objectives are met. Funding for full implementation of the vegetation management strategy will be addressed more fully in upcoming budgets. Capital maintenance projects that build additional resiliency into the levee structure will be limited to major repair sites until additional funding is available to expand the program. Capital improvement projects identified in the RFHMP will be implemented through the six-year capital improvement program, subject to limited funding from the SWM and Flood Control Zone District budgets, but mostly dependent upon as-yet unidentified outside sources of revenue.

CHAPTER ONE ERRATA CORRECTIONS

The errata sheet for Chapter One focused on providing clarifications, revised river miles, revised goals objectives and guiding principles, and minor errors in facts or spelling.

CHAPTER TWO
MAJOR RIVER FLOODING IN PIERCE COUNTY

Information provided in Chapter Two was reviewed. The information provided in the 2013 continues to represent the most current understanding of river flooding in Pierce County. No new information is provided in this update.

CHAPTER TWO ERRATTA

The errata sheet for Chapter Two focused on providing clarifications, revised river miles, updated numbers to reflect changes between 2013 and today, included information to reflect adoption of new FEMA maps, and other minor errors in facts or spelling.

CHAPTER THREE
FLOOD HAZARD MANAGEMENT POLICIES

Information provided in Chapter Three was reviewed. The information provided in the 2013 continues to represent the management policies for the creation of the Flood Plan. No new information is provided in this update.

CHAPTER THREE ERRATTA

The errata sheet for Chapter Three focused on providing clarifications and other minor errors in facts or spelling.

CHAPTER 4
PROGRAMMATIC RECOMMENDATIONS

Programmatic Recommendations

The 2013 Rivers Flood Hazard Management Plan recommended 27 programmatic actions to reduce the associated risks of flooding and channel migration problems along the major rivers and streams in Pierce County. Each of the programmatic recommendations provides a description of the issue being addressed as well as background and other supporting information. A status update has been provided in the following table for each programmatic recommendation contained in Chapter 4. Additional information regarding individual elements within this chapter are found in the Progress Update.

Programmatic Recommendations	
Information/Mapping/Technical Assistance	
FPW #1	**Floodplain Mapping** These recommendations address the adoption and use of preliminary FEMA flood maps (DFIRMs) and other flood studies; subsequent periodic update of such studies; related communication with agencies and the public; and other issues related to flood hazard mapping. (Pierce County, cities/towns, other agencies, public) **Status Update: Digital Flood Insurance Rate Maps (DFIRM) were adopted in February 2017**.
FPW #2	**Channel Migration Zone Mapping and Regulation** These recommendations address the completion and adoption of CMZ studies within Pierce County; regulation of severe channel migration zones as floodways; evaluating levees/revetments for resistance to channel migration, revisions to CMZ mapping to reflect changes in risks, and notification of hazards. (Pierce County, cities/towns, public) **Status Update: CMZ studies for Upper Nisqually and South Prairie Creek were adopted as part of DFRIM Adoption in late 2016 or 2017. In 2017 a channel migration zone study was completed for the Greenwater River.**
FPW #3	**Technical Assistance on Floodplain Information** These recommendations address internal Pierce County training; external technical assistance to public and private entities; and coordination on repair and replacement of infrastructure in flood hazard areas. Also includes coordination to ensure compatible uses of floodplains. (Pierce County, cities/towns, public) **Status Update: The County is currently working with the City of Orting on the Levee Analysis and Mapping Procedures (LAMP) process for Calistoga and the Soldiers Home levees. The Calistoga Levee was constructed by the City of Orting; and maintenance and operation is performed by Pierce County. In 2017, Pierce County responded to 1432 calls from homeowners, insurance agents and surveyors relative to flood issues and concerns**.
FPW #4	**Flood Insurance and the Community Rating System (CRS)** These recommendations address participation in the National Flood Insurance Program and the Community Rating System, encouraging communities to achieve a CRS rating of Class 5 or better; and promotion of flood insurance. (Pierce County, cities/towns) **Status update: The Re-Verification process was completed and the County remained a Class 2 community. SWM has held talks with local real estate, surveyors, and hosts a quarterly multi-state CRS User Groups.**

Programmatic Recommendations	
Land Use/Regulatory/Acquisition/Structure Elevation	
FPW #5	**Consistent Floodplain Development Regulations** These recommendations address consistency of floodplain and flood hazard area regulations between Pierce County and cities/towns; regulation based on best available data; zero rise and compensatory storage regulations; establishment of a regulatory working group to support consistency and assess residual flood risks and appropriate regulations behind certified levees. (Pierce County, cities/towns) **Status update: The Cities of Sumner and Puyallup are considering joining the CRS program.**
FPW #6	**Urban Growth Area Expansion** This recommendation extends the current prohibition on expansion of Urban Growth Areas into the 100-year regulatory floodplain of the Flood Plan planning area. (Pierce County, cities/towns) **Status Update: This work is on-going.**
FPW #7	**Agricultural Land Uses and Activities** These recommendations address review of and amendments to Pierce County code to enable agricultural practices in floodplains, including removal of sediment deposited by floods, construction of flow-through non-residential agricultural structures, promoting the leasing of publicly held floodplain lands suitable for agriculture, and allowing composting when accessory to on-site agriculture. (Pierce County, public) **Status update: As part of the Floodplains for the Future Program, PCC Farmland Trust (in collaboration with Environmental Science Associates (ESA), and SWM) completed several agriculture-related memoranda for the Clear Creek area such as: agricultural drainage, sediment, and tide gate assessments. The County has also updated floodplain regulations to allow new agriculture structures in the Clear Creek Deep and Fast Flowing (DFF) floodway**.
FPW #8	**Floodplain Acquisition and Home Buyouts** These recommendations address identification and evaluation of floodplain properties for home buyouts or property acquisition; outreach with floodplain property owners; pursuit of federal and state grant funding, coordination with other agencies, and local funding for proactive floodplain acquisition. (Pierce County, cities/towns, public) **Status update: Since 2013, 50 properties have been purchased in flood hazard areas, recent purchases have been focused in the Clear Creek and Alward Road areas.**
FPW #9	**Home/Structure Elevation and Floodproofing** These recommendations address technical assistance provided to floodplain property owners; identification of areas needing targeted outreach; and pursuit of grant funding to support an elevation program. (Pierce County, public) **Status update: This work is on-going**.
River Channel Management	
FPW #10	**River Channel Monitoring** These recommendations address monitoring of river channel conditions including river stage and flow, cross-sections, conveyance capacity, sedimentation trends, topography (LiDAR), aerial photos during floods, and project-specific monitoring to evaluate project effectiveness. (Pierce County, other agencies) **Status Update: River channel conditions are monitored every fall prior to flood season to identify hot spots. In 2017, river channel monitoring occurred after the three-high water/flood events. A project specific monitoring program is under development.**
FPW #11	**Management of Large Woody Material** These recommendations address the repositioning, relocation and removal of large woody material in Pierce County rivers posing imminent threat, LWM removal when threatening bridge piers and public infrastructure; working with resource agencies and tribes to identify rivers segments that function naturally; and obtaining approvals and coordinating with agencies in emergency and non-emergency situations. (Pierce County, other agencies)

Programmatic Recommendations	
	Status Update: No large woody debris was repositioned, relocated, or removed in 2017.
PR#1/ WR#1/ CR#1	**Sediment Management and Gravel Removal** These recommendations address the approach for sediment management and gravel removal, including use of technical data and studies; pursing levee setback projects as the preferred means to manage downstream sediment transport; conditions under which gravel removal may occur; evaluating alternative approaches to gravel removal; monitoring locations of gravel removal; and convening a sediment management work group to develop a plan to guide sediment management and gravel removal. (Pierce County, cities/towns, resource agencies, tribes) **Status update: The Habitat and Flood Capacity Creation Project formally known as Sediment Management as Risk Reduction Tool (SMRRT) pilot project is being funded by the Flood Control Zone District in 2018.**
Facility Repair/Maintenance	
FPW #12	**Facility Repair & Maintenance – PL 84-99 Program** These recommendations address Pierce County's participation in the Corps of Engineers' PL84-99 program for emergency response activities and rehabilitation of flood risk reduction facilities; engaging in review of levee maintenance standards; maintaining program eligibility while pursuing bio-engineering designs; notifying, coordinating with and seeking input from resource agencies and tribes in implementation. (Pierce County, Corps of Engineers, resource agencies, tribes) Status Update: SWM developed a System Wide Improvement Plan (SWIF) that was completed in January 2017.
FPW #13	**Annual Repair and Maintenance Program** These recommendations address Pierce County's repair and maintenance program for flood facilities, including routine repair and maintenance, evaluating options for long-term capital solutions, implementation of the Puyallup River vegetation management program, update of the County's operations, repair and maintenance manual, and working with resource agencies and tribes to obtain programmatic approval of annual, repair and maintenance activities. (Pierce County, resource agencies, tribes) **Status Update: Beginning in 2013, the Pierce County Flood Control Zone District directed 15 % of the total annual budget (approximately $1.2 million) and Pierce County directed approximately $3 million annually to M & O activities. In 2017 SWM received a 5- year programmatic shoreline, SEPA and HPA approvals for levee repairs.**
Flood Hazard Education and Flood Preparedness, Flood Warning and Emergency Response	
FPW #14	**Flood Education and Outreach Program** These recommendations address consistency of education and outreach activities with the CRS program; outreach to floodplain property owners through an annual mailing; promotion of all aspects of the County's flood hazard management program; promotion of flood preparedness and purchase of flood insurance; internal and external coordination and collaboration. (Pierce County, cities/towns, public) **Status Update: Annually SWM sends direct mailings to residents within unincorporated Pierce County. Each mailing is directed to residents within coastal, urban or riverine flood hazards areas. SWM mailed notifications to property owners and professionals in 2017 when the FEMA DFIRM's became effective. Multiple hearings, press releases and media interviews were done in conjunction with Pierce County Council adoption.**
FPW #15	**Flood Warning and Evacuation System** These recommendations address regional coordination and communication before and during flood events with the National Weather Service, Pierce County's River Watch program, Tacoma Public Utilities and Corps of Engineers (dam operators); and developing technical tools and mapping to improve river flooding forecasts to help guide evacuation decisions. (Pierce County, cities/towns, other agencies, public) **Status Update: The County continued to maintain existing levels of service in all reaches of the Carbon, Puyallup and White Rivers.**
FPW #16	**Emergency Response and Flood Fighting**

Programmatic Recommendations	
	These recommendations address regional coordination of response and recovery services during and after flood events through the Emergency Operations Center; coordination with cities, towns, tribes, state and federal agencies; documenting all costs associated with response activities; sand bagging support; flood emergency exercises; and periodic updating of guidance and protocols. (Pierce County, local jurisdictions, other agencies, public) **Status Update: SWM continues to coordinate with the Department of Emergency Management prior, during, and post flooding.**
Miscellaneous/Other	
FPW #17	**Incidental Take Authorization** These recommendations address Pierce County SWM seeking incidental take authorization for its activities that affect species listed as threatened or endangered under the federal Endangered Species Act (ESA). (Pierce County, other agencies) **Status Update: SWM is currently developing a Habitat Conservation Plan (HCP).**
FPW #18	**Adaptive Management** These recommendations address the use of adaptive management as a component of plan implementation, including evaluation and assessment of project and program performance, cost, and effectiveness, and incorporation of learned information into future project actions. (Pierce County, other agencies) **Status update: Annual lessons learned meetings are held for SWM staff and quarterly performance report publications are published for all Public Works.**
FPW #19	**Climate Change** These recommendations address development of an approach to incorporate information about climate change, including predicted changes in precipitation patterns, future peak flows, and sediment transport into future project designs and program implementation; and working with regional experts. (Pierce County, cities/towns, other agencies) **Status Update: Pierce County is currently developing a Climate Change Resilience Plan that will be completed in 2018.**
FPW #20	**Habitat and Riparian Areas Mitigation** These recommendations address the restoration of fish habitat and riparian areas as part of advance mitigation for flood management projects, for circumstances where mitigation cannot be accomplished onsite; working with resource agencies and tribes to identify sites for mitigation; and allocating funds to a mitigation account to acquire property and construct advance mitigation projects. (Pierce County, other agencies) **Status Update: Two In-Lieu-Fee (ILF) mitigation sites within the Clover/Chambers watershed have been constructed and are active. The Habitat Conservation Plan is being developed to mitigate future levee repair impacts.**
FPW #21	**Public Access to Rivers** These recommendations address public access to rivers, including passive use, shoreline access points, and multi-purpose trails; identifying opportunities for improved public access; recommending appropriate levels of future public access; and educating the public regarding restrictions on public access. (Pierce County, cities/towns, public) **Status Update: Beginning in 2016, Pierce County identified segments of the river system that were available for public access. A website and map identify the locations and access points are identified with signage. Additionally, the Foothills trail, which follows the Puyallup River has been expanded since 2013 and is now 21 miles long and runs from City of Puyallup to the City of Buckley.**
FPW #22	**Minimizing Water Quality Impacts of Flooding** These recommendations address the management of pollutant sources in floodplains subject to flooding, and potential water contamination, including storage of hazardous chemicals, wastes, pesticides, and fertilizers; leveraging of existing resources focused on stormwater and source control; and limitations, inspections,

Programmatic Recommendations	
	operations and maintenance for on-site sewage systems within 100-year floodplains. (Pierce County and cities/towns) **Status Update: Pierce County has a pollutant inspection, elimination, and outreach program.**
FPW #23	**Coordination with Other Jurisdictions, Tribes and Agencies** These recommendations address coordination with other jurisdictions in flood plan implementation, including cities/towns, counties, tribes, state and federal agencies; and coordinating with local governments adjacent to and across the river from proposed capital projects. (Pierce County, cities/towns, tribes, other counties) **Status Update: Participation in the White River Dialogue group (that includes Pierce County, the City of Sumner, the Muckleshoot and Puyallup Indian Tribes) for the development of the Lower White River floodplain restoration and flood protection project.**
PR#2/ WR#2	**Inter-County River Improvement Agreement** These recommendations address collaborating with King County to renew the Inter-County River Improvement Agreement to address necessary maintenance and capital project needs, responsibilities and funding for the Lower White and lower Puyallup Rivers (the original agreement is due to expire in 2013). (Pierce and King counties) **Status update: No update available at this time, the existing agreement will expire in 2020. Pierce and King county are determining next steps.**
Capital Projects	
FPW #24	**River Reach Management Strategies** This recommendation proposes four management strategies (levels of service) for levees, two management strategies for revetments, and two non-structural strategies to address flood and channel migration risk reduction goals for different river reaches in the planning area; and encourages promotion of agriculture, recreation and open space as the most compatible land uses in the floodplain. (Pierce County and cities/towns) **Status update: This work is on-going. The Levee Analysis and Mapping Procedures (LAMP) process will help identify the contemporary level of service following changes to channel geometry and hydrology from recent floods.**
FPW #25	**Levee and Revetment Setback Program** These recommendations address updating the levee and revetment inventory map; updating the Setback Levee Feasibility Study; performing a comprehensive hydraulic study to determine cumulative benefits of flood protection of setback build-out scenario; pursuing funding for design and construction of setback projects; and evaluating additional sites for possible levee/revetment setbacks as new needs are identified. (Pierce County, cities/towns, other agencies) **Status Update: The Setback Feasibility Study was updated in 2014. A small update to include the Clear Creek area is underway**.
FPW #26	**Additional Capital Project Analysis** This recommendation addresses the need to complete further analysis and develop solutions for Tier 2 problem areas for flooding and channel migration that could not be addressed in the Flood Plan due to resource and time constraints. (Pierce County) **Status Update: No update is available at this time**.
FPW #27	**Transportation – Roads and Bridges** These recommendations address the need to examine transportation infrastructure design issues, including road designs accounting for compensatory storage, zero-rise, and elevation above BFE requirements; bridge designs considering scour, freeboard above BFE, assessment of future peak discharge flows and backwater effects, and passage of large woody material; conducting a cost benefit analysis for roads and bridges with high associated flood and erosion protection costs; and designing future roads and bridges (and

Programmatic Recommendations	
	replacements) to accommodate planned levee and revetment setback projects. (Pierce County, cities/towns, WSDOT) **Status Report: Ongoing assistance with planning for the new Puyallup bridge replacements at 128th Street and Milwaukee Ave**.

Agricultural Land Use and Activities

Agriculture Conservation Easements

In February 2015, Pierce County completed one of the largest conservation easements in the county. Forterra, a non-profit land conservancy, and Pierce County were able to preserve the 153-acre Matlock farm in the Puyallup River Valley. Matlock farms had been in operation for over 100 years and was considered an institution in the Puyallup valley, providing food throughout Pierce County. With the owners wishing to retire, Pierce County and Forterra worked to secure funding to purchase a conservation easement and the development rights of 116 acres of the property. This easement protected the land from being developed over time and allowed it to continue in agricultural production. With a grant from the Washington State Department of Ecology's Floodplains by Design Program, the County was also able to purchase the remaining 37-acres of the property along the Puyallup River and Ball Creek to improve the creek conductivity and improve salmon habitat.

Floodplain Acquisition and Home Buyouts

Home Buyouts and Property Acquisitions

Since 2013, Pierce County has acquired an estimated 50 homes in flood prone areas along our major river systems using various funding sources. Funding sources such as Floodplains by Design, FEMA's Hazard Mitigation Grant Program, FEMA's Flood Mitigation Assistance program as well as Pierce County Surface Water Management funds are just some of the funding sources that assist with property acquisitions. Due to various flood events that have taken place in the county, Surface Water Management developed a property acquisition program that assists willing property owners with getting out of the floodplain. These buyouts provide a permanent solution to the risks and damages of repetitive flooding. Interested property owners in the acquisition process are ranked and prioritized to determine which properties will result in the highest benefits in preventing flood damage. However, recently flooded areas and active capital improvement program projects (involving property acquisition) take precedence over other properties. Property buyouts and acquisitions are strategic, as sometime these parcels can provide a more permanent solution to flooding in the area. The county tries to buyout properties in targeted areas so that a permanent solution to flooding can be achieved. This requires a more collaborative approach when working within communities where not all properties will not be purchased. Pierce

County works with the existing community for interim solutions until a more permanent solution such as a flood control structure can be built.

Repetitive Loss Updates

Surface Water Management has been very active in the last two years purchasing properties in the repetitive loss areas and removing the structures from the site. Thirty-nine (39) structures have been demolished in this period with six (6) of these structures located on four (4) repetitive loss properties.

In 2014 Unincorporated Pierce County had 58 Repetitive loss properties listed by FEMA. Of these 31 were unmitigated, 2 were in different communities and 25 had been mitigated.

In 2018 Unincorporated Pierce County has 63 Repetitive loss properties listed by FEMA. Five additional properties have been added. Two from the 2014 coastal winter storms and three from the 2015 riverine flooding in the Clear Creek area. This brings the totals to 29 are unmitigated, while the same 2 properties in other communities continue to be list but 32 of the listed properties have been mitigated.

The county has five primary repetitive loss areas where many properties have experienced flood losses in the last twenty years. These areas are: Clover Creek near Parkland, Coastal Dash Point, Mid Puyallup River south of Sumner, South Prairie Creek and Clear Creek behind the River Road levee. While FEMA has a list of over sixty homes where property owners had purchased flood insurance to mitigate the cleanup and repair cost there are many more homes were flood insurance was purchased after the “big” flood or not at all. This means that many homes will continue to be added to the repetitive loss list until the area can be mitigated.

River Channel Management

Sediment Management and Gravel Removal

In 2010 and 2012, the United States Geological Survey released two sediment studies for Mount Rainier, Lower Puyallup, White, Nisqually, and Carbon Rivers. The 2012 report (USGS 2012-1242) documents:

- Historic and current sediment loads in rivers draining from Mount Rainer;
- Additional sources of sediment within the watershed;
- Important sediment-production and sediment –delivery processes within the watershed;
- Long-term trends of increasing discharge or sediment loads; and,
- The anticipated magnitude of sedimentation 25 and 50 year into the future using public climate-change predictions.

As glaciers continue to recede on Mount Rainier, heavy rainfall, snow melt, and resulting floods can move more sediment materials down the system. An increased amount of sediment can cause some upper river reach channels to widen. The below figure from the USGS report shows how some upper reaches of Mount Rainier river channels have widen over time.

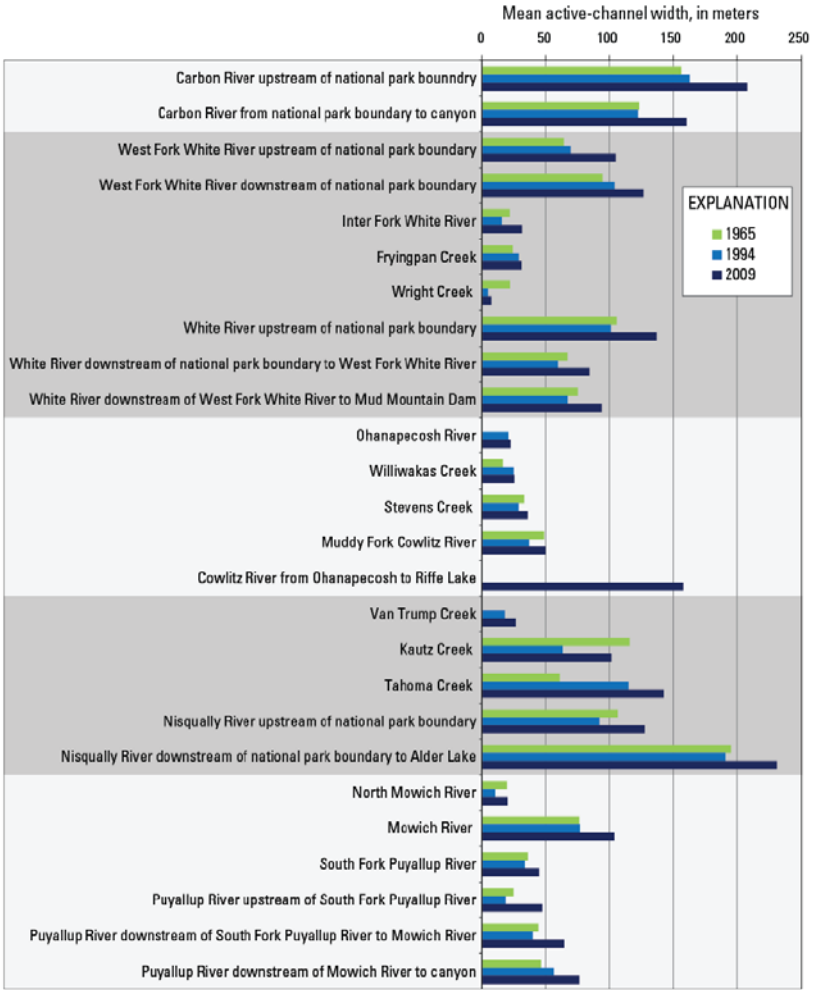

Figure 1: USGS Report 2012-1242

A recent study completed by the USGS in 2012 indicated that sediment is being transported from Mount Rainer to the Puget lowland through a sequence of glacial and fluvial processes that deliver material downstream. Studies found that the total sediment load for the upper Nisqually River from 1945 to 2011 was determined to be 1,200,000 (±180,000) tonnes per year (tonnes/yr). From 1956 to 1985, the total sediment load for the upper Nisqually River was determined to be 860,000 (±370,000) tonnes/yr, which is a significant decrease from 1945 to 2011 (USGS Report 2012-1242). The lower Puyallup River was found to be 860,000 (±300,000) tonnes/yr between 1978 and 1994. Calculations for the White River at R Street

carried a total load of 590,000 tonnes in 2011 with an annualized total load of 420,000 tonnes/yr from April 2010 to March 2012 (USGS Report 2012-1242). The below figure shows the estimated annual bedload which is the volume or mass of sediment being transported along the bed of a river for the White, Carbon, and Puyallup Rivers from 1984 to 2011.

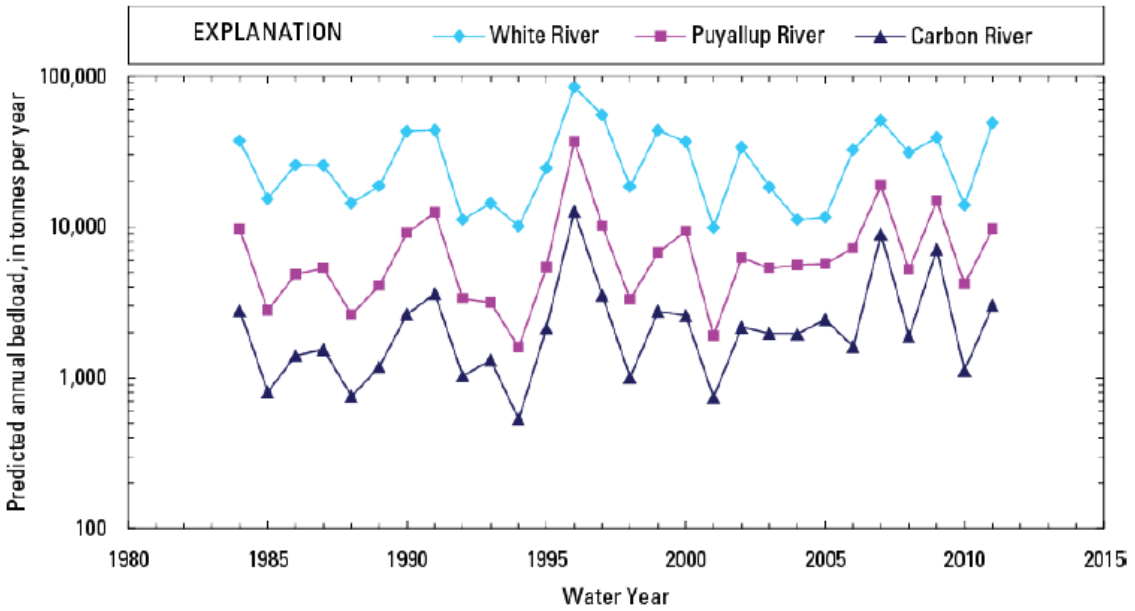

Figure 2. USGS Report 2012-1242

The Puyallup River delivers about four times less bedload than the White River and will experience less severe aggradation, while the Carbon River will experience the least aggradation (USGS Report 2012-1242). Once sediment arrives and deposits in the Puget Lowland, there is limited structural methods for managing sediment to reduce flood risk. Potential sediment-management actions including setback levees and gravel removal would be most effective in reaches that tend to accumulate sediment naturally; these reaches were identified based on geomorphic conditions (USGS 2012-1242).

In summary, rivers draining near Mount Rainier can assume to be in a general state of sediment surplus. As a result, future aggradation rates will be largely influenced by the underlying hydrology carrying sediment downstream. River management actions (such as setback levees, active sediment management, etc) may be more effective in reaches of the river where sediment residence times are large. Long term river management decisions can be improved with the monitoring of suspended-sediment load, bedload, and aggradation in river reaches.

Pierce County Pilot Gravel Removal Project

Since the initiation of the Pilot Gravel Removal Project, Pierce County has continued to study the feasibility of sediment removal to reduce flood risk. In 2014, the Sediment as a Risk Reduction Tool Project began, building on previous work but focused more on public safety and the reduction of flooding during moderate events. It was conceived to be one in a suite of flood management strategies as described in this plan. Other flood risk reduction strategies were presented in the 2013 Flood Plan however, there exists a significant need for shorter-term flood risk reduction tools, such as sediment removal to aid in reducing flood damages during moderate events that are protective of valuable habitat and natural resources. This is especially the case where alternative flood risk reduction strategies such as setback levees are not effective or feasible or could not be implemented for many years.

It was important to choose a suitable site where impacts to resources were minimized and benefits to existing infrastructure were maximized. The project team engaged in a nearly year-long process throughout 2016 to select a site that best met the criteria set early in the process. The team analyzed 41 miles of Pierce County managed river system to look at where rivers were depositing and storing sediment. The reach that scored the highest in the final analysis is an approximately half-mile stretch of the Puyallup River between the cities of Puyallup and Sumner, known as Old Cannery Reach. More information on the site selection process can be viewed in the Habitat and Flood Capacity Creation Project Background and Overview document available here: http://www.co.pierce.wa.us/4487/Habitat-and-Flood-Capacity-Creation-Proj

Following the site selection, Pierce County met with federal and state agencies to seek feedback on the feasibility of the concept of sediment removal specifically at the confluence of the Puyallup and White Rivers. Because of the feedback received during that outreach, Pierce County reevaluated the purpose of the project. Rather than simply mitigating for impacts to habitat caused by sediment removal, the team determined that the project would more likely receive permits if habitat creation was incorporated directly into the design of the project. The project was renamed the Habitat and Flood Capacity Creation Project to reflect the multiple benefits resulting from the project. Various efforts in Pierce County have sought to study if sediment management could be incorporated as a flood risk reduction tool. The Habitat and Flood Capacity Creation Project is set apart from these previous efforts because it incorporates habitat creation in a reach of the Puyallup River where none currently exists or is degraded with the added benefit of flood reduction.

In the coming months, Pierce County will continue project planning, permitting, and design activities at Old Cannery Reach. Once Pierce County receives all permits, construction could begin as early as summer of 2020.

Coordination, Adaptive Management, and Multiple Benefits

Incidental Take Permits (10.a.1(b))

Habitat Conservation Plan

Since the publication of the Flood Plan, Pierce County has continued its pursuit of an Incidental Take Permit (ITP) for Public Works' flood risk reduction maintenance and operations activities. The Habitat Conservation Plan (HCP) which is needed to obtain an ITP describes anticipated effects of proposed maintenance and operations activities along rivers and streams and how county staff and contractors will minimize or mitigate the impacts to habitat and species. Those activities include: managing vegetation along levees for inspection and maintenance, flood fighting or other emergency work on levees, culvert and discharge pipe maintenance, imminent threat projects, and routine levees and revetment maintenance. The ITP will allow Pierce County to conduct routine maintenance activities along segments of the Puyallup, White, Carbon and Nisqually rivers, that might result in incidental takes, without violating the Endangered Species Act (ESA).

Pierce County is working closely with the USFWS and NMFS in the development of the HCP. Several draft versions of the HCP have been reviewed by the USFWS, NMFS, and tribes. Issuance of an ITP is a federal action subject to National Environmental Policy Act (NEPA) compliance. The USFWS and NMFS are preparing a joint NEPA environmental assessment (EA) that will analyze the potential impacts of USFWS and NMFS each issuing an ITP to Pierce County. The EA does not address the impacts of the County's flood risk reduction activities, which necessarily would take place with or without the issuance of an ITP.

Pierce County has also continued coordination with federal, state, and local agencies, tribes, and other stakeholders throughout the development of the HCP. Publication of the final draft HCP and draft EA is anticipated to occur sometime in 2018. Following that publication Pierce County, USFWS and NMFS will solicit public comments during a 45-day comment period before issuing the ITP.

Updates on the project and materials can be found on the project webpage located here:

http://www.co.pierce.wa.us/4488/Habitat-Conservation-Plan-HCP

Public Access to Rivers

Rivers and associated riparian corridors are desirable locations for passive or active recreational uses. A survey conducted during development of the 2014 Pierce County Park, Recreation, and Open Space (PROS) Plan (Chapter 19D.160) confirms that riverfront water access has high priority and value for the public. Desired activities include trail use, fishing, boating, and passive recreation.

Public access has been limited along much of the river corridor within the planning area. Although some public lands near rivers may be suitable for public use, supported use of many publicly-managed properties is constrained. Conditions such as lack of legal access,

absence of supporting infrastructure, safety concerns, regulatory issues, maintenance issues, and potential conflicts with other uses restrict use of the areas. In spite of those problems, many fisherman and boaters access the river at unauthorized locations, and numerous people use the riparian areas with few appropriate supporting facilities (e.g., parking, restrooms).

Legal access is a significant concern. The county owns and maintains levees and revetments along the rivers, but sometimes does not own the underlying land or roadway. In these instances, property owners have granted the county easements exclusively for flood management purposes. The county can not authorize use of those properties by others.

Construction of public access areas is prohibitively expensive. At a minimum, there must be signage and parking. Properties must contain sufficient area to accommodate improvements, and measures must be undertaken to prevent environmental degradation. Impacts to surrounding uses must be mitigated. Ongoing maintenance of the access areas can be time consuming and expensive.

In recent years PPW-SWM has evaluated a number of properties along the rivers for public access potential. Properties that provide a level of informal access to the river are identified on the county website https://www.co.pierce.wa.us/4740/Our-Properties.

The website contains information about property locations and allowable activities. No improvements have been installed at these locations. Additional information about recreational opportunities along the water is available on the Parks and Recreation Services website https://www.co.pierce.wa.us/1474/Resource-Stewardship.

CHAPTER FOUR ERRATA

The errata sheet for Chapter Four focused on providing clarifications, updated citations to reflect changes between 2013 and today, clarification of Level of Service with a corrected map, additional information of agricultural ditches, additional information on SWIF Levee Vegetation Management Strategy, updates of Community Rating System Outreach material, deleted outdated information on public access to rivers, and other minor errors in facts or spelling.

CHAPTER 5
RIVER REACH CHARACTERIZATION, MANAGEMENT STRATEGIES AND RECOMMENDED CAPITAL PROJECTS

LOWER PUYALLUP UPDATES

Flood Damage to Facilities

Since 2013, there has been one repair project completed along this reach. The project entailed the restoration of the Benston/Boatman Revetment. Concrete panels which provide bank protection were severely undermined by erosion resulting in significant damage and increased risk to the remaining structure and adjacent homes.

A new summary table of damages to flood facilities in the lower Puyallup River between 1996 and 2017 has been created for this update. The original 2013 Flood Plan did not include this table.

Summary of Damages to Lower Puyallup River Facilities (1996-2017)					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
1996					
1996	Tiffany's	Left	9.2	100	Toe and slope failure.
2005					
2005	River road	Left	7.2	540	Concrete panel repair.
2009					
2009	North levee road	Right	5.3	190	Silt bench repair – Dolos.
2010					
2010	Benston/boatman	Right	9.35	100	Moderate slumping.
2010	Benston/boatman	Right	9.35	200	Moderate slumping, Major erosion; concrete panels collapsed.
2011					
2011	Benston/boatman	Right	9.35	200	Four-foot deep slump. Exposed concrete at toe.
2011	Murphy	Right	8.47 - 8.54	390	Scour and minor cracking in silt bench. Scour five feet in areas.
2011	North levee road	Right	4.27	105	Four-foot slump.
2011	North levee road	Right	4.45	106	Sha Dadx Seepage Control Buttress and drainage.

Summary of Damages to Lower Puyallup River Facilities (1996-2017)					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2011	Old cannery	Right	10.3	60	Toe rock failure.
2011	River road	Left	6.4	30	Six-foot deep scour.
2012					
2012	Murphy	Right	8.5	200	Toe and rock failure, some slump and erosion.
2012	Murphy	Right	8.55	30	Scour pocket out of face, downed tree.
2012	North levee road	Right	4.3	30	Four-foot slump.
2012	North levee road	Right	4.45	180	Sha Dadx: soil buttress - sand boils
2012	North levee road	Right	5.8	100	Melroy Bridge partial scour/slumping.
2012	River road	Left	3.05	40	Cave dug into silt on LB, 5' scour depth.
2012	River road	Left	6.4	30	6ft deep scour in silt bench due to culvert outfall.
2014					
2014	River road	Left	7.45	45	Toe and face rock failure.
2015					
2015	Benston/boatman	Right	9.35	150	Slump in revetment. Concrete Panel missing.
2017					
2017	Benston/boatman	Right	9.35	200	Storm drainage outlet onto revetment face has caused severe scour to occur and end segments of the outlet pipe have failed.
2017	Benston/boatman	Right	9.3	140	Potential scour.
2017	Murphy	Right	8.4	120	Silt bench scour.
2017	Murphy	Right	8.41	25	Scour

Figure 3

River Flood Hazard Management Plan

Pierce County Levees and Revetments: Lower Puyallup River

Tacoma
Port Of Tacoma Rd
509
54th Ave E
Milton
King County
Pierce County
Jovita Blvd E
Pacific
Stewart Rd Sw
Eells St
Pacific Hwy E
99
5
Fife
70th Ave E
Edgewood
167
River Road
Puyallup River
North Levee Road
Valley Ave E
Valley Ave Nw
Valley Ave Ne
Sumner
Tiffanys
Murphy
512
Puyallup
Old Cannery
Linden Flash Cube
410
Benston Boatman
Canyon Rd E
72nd St E
N Meridian
2nd St Ne
S Meridian
3rd St Se
W Pioneer
E Pioneer

- Levee
- Revetment
- Highway
- Major Road
- Water Body
- City
- County Boundary

Pierce County

N

3/6/2018

0 0.25 0.5 Miles

The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. The County assumes no liability for variations ascertained by actual survey. ALL DATA IS EXPRESSLY PROVIDED 'ASIS' AND 'WITH ALL FAULTS'. The County makes no warranty of fitness for a particular purpose.

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Land Purchases

Since 2013, eighteen properties have been purchased totaling 61 acres. This brings the number of acquired acres in the Clear Creek area to an estimated 117 acres.

Partnerships

Key partnerships with non-profits organizations has been essential for the county to accomplish work along the Puyallup watershed. Partnerships with organizations such as Forterra, the Pierce County Conservation District, and PCC Farmland Trust have assisted the county with identifying and providing funding to complete projects in the Clear Creek area. In addition, since 2016 SWM has received an estimated $4.9 million for projects in the Clear Creek watershed from the Floodplains by Design program.

Status Update on Recommended Capital Projects

LP1 Tacoma Wastewater Treatment Plant Flood Wall

Project Update: This project is complete. The City of Tacoma designed a floodwall with automatic gates at vehicle entrances and an emergency pump station inside the Central Wastewater Treatment Plant. This project also earned the American Public Works Association 2016 Public Works Project of the Year Award.

Estimated Cost: **$8,420,966**

Figure 4: Image of the East Side wall

Figure 5: Image of the south wall with grass art panel

LP2 Clear Creek Acquisition and Levee

Project Update: The primary objective of this project is to minimize the impacts of flooding on the lowlands behind the existing levee while preserving existing farmland. Preliminary design efforts also revealed that with proper design, the project will be able to provide refuge and habitat for juvenile salmon and other wildlife in the lower Puyallup River system. Given the size of the project and the complexity surrounding property acquisition, the project has been broken into phases. Phase one will identify and analyze alternatives, develop a property acquisition plan and prepare construction plans and specifications. The alternative analysis developed in cooperation with the Floodplains for the Future stakeholders group will take into consideration potential mitigation benefits, agricultural sustainability, and mitigation projects within the area currently being developed by other stakeholders. A prioritized property acquisition schedule will be developed to acquire properties that meet the needs of the project. Preliminary engineering will be completed to 60%, and construction will be completed at a future date.

Estimated Cost: ***$55,744,043***

Figure 6: Clear Creek Floodplain during the 2009 flood event

LP3 Oxbow Lake Flooding/Sewer Lift Station Protection

Project Update: This project is being constructed by the City of Fife. A contractor has been selected and design and permitting will be completed in 2018.

Estimated Cost: **$460,624**

Figure 7: Location of Oxbow Lake Flooding Sewer Lift Station Protection

LP4 North Levee Road Setback Levee

Project Update: This project is a part of the United States Army Corps of Engineers, Seattle District Office General Investigation study for the Puyallup River Basin. As of January 2018, the USACE completed a draft report called the Integrated Feasibility Report and Environmental Impact Statement. This draft report went through a public review and comment period in April 2016. The draft report is being updated with additional information and findings from public comments and additional analysis. The update will also include development of 30% designs for the conceptual identified flood reduction measures and features.

Estimated Cost: ***$315,878,160***

LP5 Puyallup Wastewater Treatment Plant Flood Wall

Project Update: This project was designed to protect the City of Puyallup's Water Pollution Control Plant (WPCP). In lieu of constructing a wall around the plant, the City decided it was more efficient to provide protection through a combination of flood proofing and elevation of critical infrastructure within the plant. This project began construction in October 2017 and is anticipated to be completed in October 2018.

Estimated Cost: $6,300,000

Figure 8: Puyallup Wastewater Treatment Plant, Digester East

LP6 Tiffany's Skate Inn/Riverwalk Flood Wall

Project Update: This project is in the General Investigative study with the United States Army Corps of Engineers (USACE).

Estimated Cost: **$ 5,055,633**

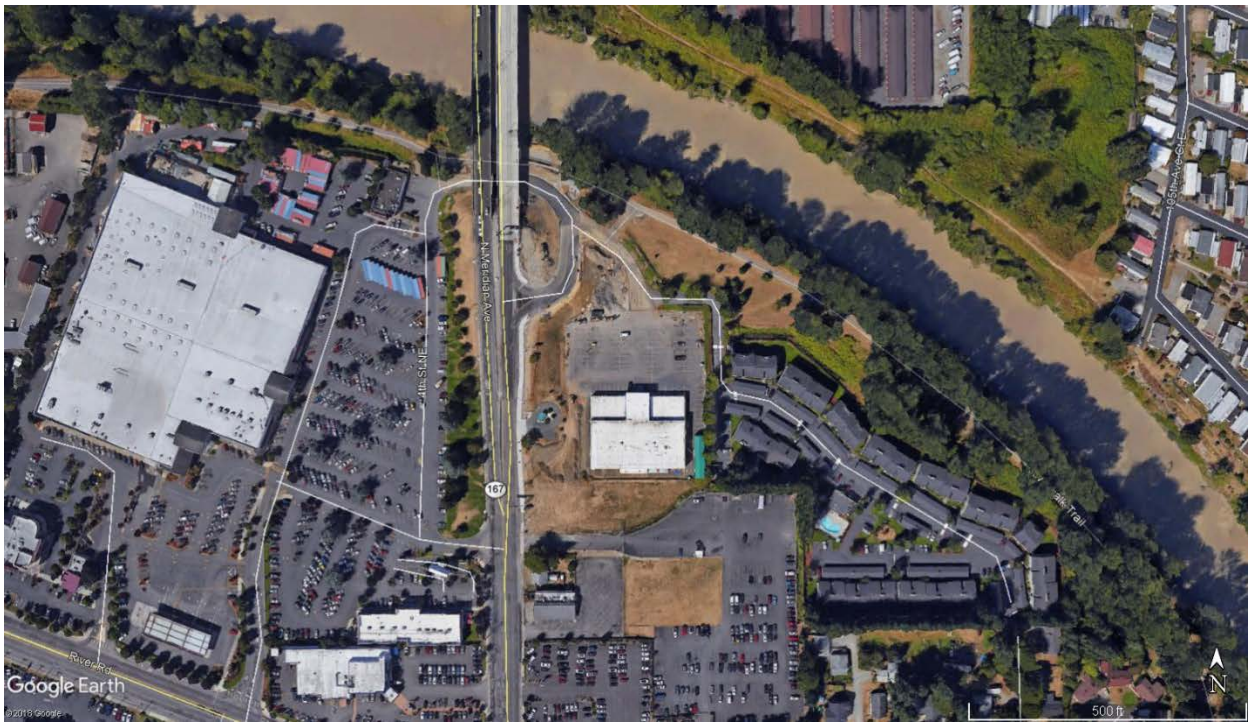

Figure 9: Location of Tiffany Skate Inn/ Riverwalk Flood

LP7 Puyallup Executive Park Flood Wall

Project Update: No project update is available at this time.

Estimated Cost: ***$179,755***

LP8 Linden Golf Course Oxbow Setback Levee

Project Update: No project update is available at this time.

Estimated Cost: **$48,309,389**

MIDDLE PUYALLUP UPDATES

Major Flooding

Since the plan was adopted in 2013, there has been no major flooding in this reach.

Flood Damage to Facilities

Flood damages to Middle Puyallup River flood risk reduction facilities range from mild to moderate in the past three decades. Damages sustained generally range from partial washout of the flood risk reduction structure over a few hundred lineal feet to localized moderate scour and erosion. Damages from major floods and high-water events between 1990 – 2017 have resulted in approximately 91 identified damage locations comprising 3.6 mile of levees and revetments. Damages have been estimated at nearly $7.37 million (based on 2017 dollars). The middle portion of the Middle Puyallup River reach between RM 12.2 and RM 14.2 has historically been most vulnerable to repetitive damages requiring repair actions to restore the structures. Since 2013, levees and revetments that have experienced repetitive damages include WAZZU, Bowman-Hilton, Van Ogles, and Sportsman.

Table 5.10 Summary of Damages to Middle Puyallup River Facilitates (1991 – 2009) has been reformatted, revised and updated to include current damages since prior to 1991 and after 2009.

Table 5.10 Summary of Damage to Facilities in the Middle Puyallup 1990-2017

Storm Season	Segment Name	Bank	River Mile	Damage Lineal Feet	Damage
1995					
1995	Bowen/Parker	Left	16.8	50	Toe/slope failure.
1995	Bowman-Hilton	Left	13.2	150	Partial Washout. Toe and face rock.
1995	Bowman-Hilton	Left	13.2	600	Toe/slope failure.
1995	Mosby - Historic	Right	16.0	400	Toe/slope failure with spots of total failure.
1995	Mosby - Historic	Right	16.2	250	Partial Washout. Toe and face rock.
1995	Riverside Revetment	Right	12.8	600	Some Toe/slope failure
1995	Van Ogle Revetment	Right	13.4	225	Partial washout. Toe and face rock.
1996					
1996	Bowen/Parker	Left	16.7	100	Total failure
1996	Bowen/Parker	Left	16.8	200	Toe/slope failure
1996	Bowen/Parker	Left	17.4	100	Toe/slope failure
1996	Bowman-Hilton	Left	13.2	500	Toe/slope failure
1996	Dollar Creek	Right	16.8	800	Toe/slope failure

Table 5.10 Summary of Damage to Facilities in the Middle Puyallup 1990-2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
1996	Mcmillin	Left	16.0	600	Toe/slope failure with spots of total failure.
1996	Mcmillin	Left	16.2	250	Toe/slope failure with spots of total failure.
1996	Mosby - Historic	Right	16.0	400	Toe/slope failure
1996	Riverside Revetment	Right	12.8	600	Toe/slope failure
1996	Sportsman	Left	14.2	100	Slope failure
1996	Wazzu Revetment	Left	12.2	600	Toe/slope failure
2002					
2002	Van Ogle Revetment	Right	13.0	50	Toe and face repair
2004					
2004	Riverside	Right	12.7	100	Partial washout of the toe and levee facing.
2005					
2005	Evanger/White	Right	14.2	450	Repair/replace toe and face rock
2006					
2006	Bowen/Parker	Left	17.3	220	Face erosion
2006	Bowman-Hilton	Left	13.2	500	Fracture: scour
2006	Evanger/White	Right	15.0	300	Face erosion
2006	River Grove	Right	11.0 - 11.5	0	Overtopping with minor levee damage
2006	Sportsman	Left	13.6	40	Fracture
2006	Sportsman	Left	14.0	300	Washout
2006	Wazzu Revetment	Left	12.2	300	Face erosion
2007					
2007	Bowman-Hilton	Left	13.2	880	Repair scour from levee being overtopped
2007	Mcmillin	Left	16.3	50	
2008					
2008	128th & Mccutcheon	Right	16.7	12	Top of levee/access road scour
2008	Bowen/Parker	Left	16.8	75	Toe rock failure
2008	Bowen/Parker	Left	16.81	50	Toe rock failure and partial face rock failure
2008	Bowman-Hilton	Left	13.2	60	Minor top coat damage
2008	Mcmillin	Left	15.7	30	Damaged toe and face rock
2008	Mcmillin	Left	16.1 - 16.2	30	Toe and face rock failure
2008	Riverside	Right	12.0	30	Damaged toe and face rock
2008	Riverside	Right	12.4	236	Damaged toe and face rock

Table 5.10 Summary of Damage to Facilities in the Middle Puyallup 1990-2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2008	Riverside	Right	12.7	5	Minor top coat damage
2008	Sportsman	Left	13.75	0	Blocked culvert
2008	Van Ogle Revetment	Right	13.5	30	Damaged face rock
2008	Wazzu Revetment	Left	12.2	148	Wazzu partial washout
2009					
2009	128th & Mccutcheon	Right	16.75	20	Toe and face rock failure
2009	Bowen/Parker	Left	16.7	12	Top of levee/access road scour. Tide gate damaged.
2009	Bowen/Parker	Left	16.7	300	Access road scour, face rock failure.
2009	Bowen/Parker	Left	16.8	75	Toe rock failure.
2009	Bowman-Hilton	Left	13.2	200	Scour 200 LF facing rock failure.
2009	Bowman-Hilton	Left	13.3	50	Scour 1/2 feet deep for 50 LF.
2009	Evanger/White	Right	15.0	200	Total levee failure/ end of levee.
2009	Mcmillin	Left	16.1 - 16.2	60	Toe and face rock failure.
2009	River Grove	Right	11.0 - 11.5	0	Overtopping with minor levee damage.
2009	Riverside	Right	12.6	15	Scour over top of rev. 1-2Ft
2009	Sportsman	Left	13.75	200	Blocked culvert.
2009	Sportsman	Left	13.9	250	Damaged toe and face rock.
2009	Sportsman	Left	14.00	300	Major scour.
2009	Sportsman	Left	14.10	150	Head cutting on back side of levee.
2009	Wazzu Revetment	Left	12.2	65	Partial washout
2010					
2010	Riverside Revetment	Right	12.8	50	Minor face rock slippage and possible toe rock misplaced.
2010	Sportsman	Left	14.05 - 14.17	650	Slump and scour near Sportsman Club.
2010	Sportsman	Left	14.05 - 14.17	650	Slump and scour near Sportsman Club.
2010	Van Ogle Revetment	Right	13.65	100	Slump in front of Knobloch residence.
2010	Van Ogle Revetment	Right	14.14	120	Toe rock and face rock failure.
2011					
2011	128th & Mccutcheon	Right	16.8	440	Major scallop scour missing levee.
2011	Evanger/White	Right	14.2	75	Toe rock failure.
2011	Evanger/White	Right	14.9	200	Toe and face rock failure.

Table 5.10 Summary of Damage to Facilities in the Middle Puyallup 1990-2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2011	Fennel Creek	Right	15.4	45	6ft deep scour.
2011	River Grove	Right	11.42	50	3ft slump.
2011	River Walk Revetment	Right	11.9	60	Minor toe scour.
2011	Riverside	Right	12.3 - 12.4	425	Toe rock failure.
2011	Riverside Revetment	Right	12.8	70	Toe and face rock failure.
2011	Sportsman	Left	14.05 - 14.17	650	Slump and scour.
2011	Sportsman	Left	14.2	220	Toe rock failure.
2011	Van Ogle Revetment	Right	13.65- 13.66	100	Slump in front of Knobloch residence.
2011	Van Ogle Revetment	Right	14.14 - 14.16	120	Toe and face rock failure.
2012					
2012	Ball Creek	Left	15.3	100	Toe and face rock failure.
2012	Bowen/Parker	Left	16.7 - 16.8	300	Face rock failure.
2012	Mcmillin	Left	16.1	100	Toe and face rock failure.
2012	Riverside	Right	12.3 - 12.4	425	Toe rock failure.
2012	Riverside Revetment	Right	12.8	100	Missing face rock.
2012	Van Ogle Revetment	Right	14.1	120	Toe and face rock failure.
2012	Wazzu Revetment	Left	12.2	50	Over steepened, loss of face and toe rock.
2013					
2013	Mcmillin	Left	16.1	100	Toe & face rock failure
2013	Riverside Revetment	Right	12.8	100	Missing face rock.
2013	Wazzu Revetment	Left	12.2	50	Toe & face rock failure.
2015					
2015	River Grove	Right	11.2	75	Tree root pulled out section of levee.
2015	Sportsman	Left	13.7	250	Partial erosion of revetment face rock.
2015	Wazzu Revetment	Left	12.2	150	Missing rock and over steepened
2015	Wazzu Revetment	Left	12.2	150	Missing rock and over steepened.
2017					
2017	River Grove	Right	11.2	110	Overly steep. Sloughing. USACE repair.
2017	Wazzu Revetment	Left	12.1	60	Levee damage.

Figure 10

River Flood Hazard Management Plan

Pierce County Levees and Revetments: Middle Puyallup River

Valley Ave E
Traffic Ave
Traffic Ave Revetment
Sumner
River Grove
Riverwalk Revetment
Riverside
Van Ogle Revetment
Sportsman
Evanger White
Bonney Lake
W Pioneer
E Pioneer
N Meridian
2nd St Ne
3rd St Se
S Meridian
Puyallup
112th St E
39th Ave Sw
Ball Creek
Mcmillin
Puyallup River
Bowen Parker

1. Riverside Revetment
2. Bowman Hilton Revetment
3. Bowman Hilton
4. Wazzu Revetment
5. Fennel Creek
6. Bowen Parker Revetment
7. 128th - Mccutcheon

- Levee
- Revetment
- Highway
- Major Road
- Water Body
- City

Pierce County

N

3/6/2018

0 0.25 0.5 Miles

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Land Purchases

In 2015, one property near Riverside Drive was purchased for flood damage mitigation. This parcel was an estimated .75 acres.

Status Update on Recommended Capital Projects

MP1 Rainier Manor/Riverwalk/ Rivergrove and SR-410 Flood Wall and Levee

Project Update: Currently, the United States Army Corps of Engineers (USACE) is doing a repair on this structure.

***Estimated Cost:* $12,358,215**

Figure 11: Sand bag berm installed along top of levee as an interim flood risk reduction measure

MP2 McCutcheon Rd & 96th St E Road Barricade

Project Update: No project update is available at this time.

Estimated Cost: ***$56,173***

See Figure 12

MP3 116th St E. Point Bar Gravel Removal

Project Update: No project update is available at this time.

Estimated Cost: ***$247,164***

See Figure 13

*MP4 Middle Puyallup and 128th St East

(formally known McCutcheon Rd and 128th St East)

Project Update: This project is currently in the Pierce County Surface Water Management Capital Facilities plan to begin preliminary design and engineering in 2019.

Estimated Cost: **$14,700,949**

See Figure 14

* The project name has been changed to be consist with other Pierce County documents.

Figure 12

River Flood Hazard Management Plan

MP2 McCutcheon Rd and 96th St E

- River Milepost
- Levee
- Revetment
- City

Pierce County

N

0 200 400 Feet

3/6/2018

The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. The County assumes no liability for variations ascertained by actual survey. ALL DATA IS EXPRESSLY PROVIDED 'ASIS' AND 'WITH ALL FAULTS'. The County makes no warranty of fitness for a particular purpose.

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Figure 13

River Flood Hazard Management Plan

MP3
116th St E Point Bar Gravel Removal

- River Milepost
- Levee
- Revetment

Pierce County

N

0 125 250 Feet

3/6/2018

The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. The County assumes no liability for variations ascertained by actual survey. ALL DATA IS EXPRESSLY PROVIDED 'ASIS' AND 'WITH ALL FAULTS'. The County makes no warranty of fitness for a particular purpose.

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Figure 14

River Flood Hazard Management Plan

MP4 McCutcheon Rd and 128th St E

- River Milepost
- Proposed Setback Levee
- Levee
- Revetment

Pierce County

N

0 160 320 Feet

3/6/2018

The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. The County assumes no liability for variations ascertained by actual survey. ALL DATA IS EXPRESSLY PROVIDED 'ASIS' AND 'WITH ALL FAULTS'. The County makes no warranty of fitness for a particular purpose.

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UPPER PUYALLUP UPDATES

Major Flooding

Since the plan was adopted in 2013, there have been multiple high-water events that have not resulted in any significant damage to private property or public infrastructure other than flood facilities.

Flood Damage to Facilities

Flood damages to upper Puyallup River flood risk reduction facilities have been extensive in the past three decades. Five significant flood events more than 16,000 cubic feet per second (cfs) have occurred along the study reach since 1990. Damages sustained ranged from full washout of the flood risk reduction structure over several hundred lineal feet to localized moderate scour and erosion. Damages from the major floods and high-water events have resulted in approximately 243 identified damage locations along 16.3 miles of levees and revetments. Damages have been estimated at nearly $41.62 million (based on 2017 dollars). The upper portion of this Puyallup River reach between RM 25.4 and RM 28.6 has historically been the most vulnerable to significant repetitive damages requiring repair and implementation of capital solutions to reduce flood risk.

Table 5.16 Flood Damage to Levees in Upper Puyallup River has been reformatted, revised and updated to include current damages from 1990 to 2017.

Table 5.16 Damage to Facilities along the Upper Puyallup River 1990 - 2017

Storm Season	Segment Name	Bank	River Mile	Damage Lineal Feet	Damage
1990					
1990	McAbee	Left	P-68 23.6	100	Reshape and replace rip rap and toe rock.
1990	Ford - Historic	Right	P-70 24.0	100	Reshape and replace rip rap and toe rock.
1990	The Country - Remnant Iii	Left	P-74: 24.7	200	Partial washout.
1990	High Bridge Revet.	Right	P-76 25.1	600	Restore damaged rip rap.
1990	Fiske Creek Revetment	Right	P-78 25.5	800	Reconstruction
1990	Neadham Road-Historic I	Right	P-80 25.9	280	Reconstruction
1990	Neadham Road-Historic I	Right	P-81: 26.0	900	Reconstruction
1990	Orville-Kapowsin	Right	P-82: 26.2	800	Reconstruction
1990	Orville-Kapowsin	Left	P-82: 26.2	150	Reconstruction
1990	Orville-Kapowsin	Left	P-83 26.4	501	Reconstruction
1990	Orville-Kapowsin	Right	P-83: 26.4	700	Reconstruction

Table 5.16 Damage to Facilities along the Upper Puyallup River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
1990	Orville-Kapowsin	Left	P-84 26.6	600	Washout
1990	Orville-Kapowsin	Left	P-84: 26.6	900	Reconstruction
1990	Orville-Kapowsin	Left	P-85 26.8	350	Partial washout.
1990	Neadham Road	Right	P-85: 26.8	250	Reconstruction
1990	Orville-Kapowsin	Left	P-86: 27.0	800	Reconstruction
1990	Stehn Large Lot	Left	P-87 27.2	500	Washout
1990	Stehn Large Lot	Left	P-88 27.4	632	Reconstruction
1990	Griessel	Left	P-89: 27.6	1000	Reconstruction
1990	Griessel	Left	P-90 27.7	200	Partial washout.
1990	Champion Bridge	Left	P-94 28.5	400	Washout restore channel alignment.
1991					
1991	Neadham Road	Right	P-85: 26.8	250	Reconstruction
1992					
1992	High Bridge Revet.	Right	P-78: 25.4	160	Reconstruction
1992	Neadham Road-Historic Ii	Right	P-82: 26.2	150	Reconstruction
1994					
1994	Jones	Right	21.8	20	Repair of levee damages.
1994	Ford - Historic	Right	23.6	20	Repair of levee damages.
1994	Ford - Historic	Right	23.8	20	Repair of levee damages.
1995					
1995	Calistoga	Right	19.8 - 20.2	500	Total levee failure
1995	Calistoga	Right	20.0	375	Partial washout.
1995	Leach Road	Left	20.0	195	Reshape and replace riprap and toe rock.
1995	Leach Road	Left	20.2	300	Mostly toe failure with some slope failure.
1995	Calistoga	Right	20.7	100	Partial Washout.
1995	Leach Road	Left	20.7	200	Partial Washout
1995	Calistoga	Right	20.9	200	Toe/slope failure
1995	Jones	Right	22.3	250	Toe/slope failure
1995	Jones	Right	22.4	200	Toe/slope failure
1995	Soldiers Home - Historic	Left	22.5	200	Partial washout.
1995	Soldiers Home - Historic	Left	22.5	50	Total failure.
1995	Soldiers Home	Left	22.9	200	Partial washout.
1995	Ford - Historic	Right	23.6	900	Total failure.

Table 5.16 Damage to Facilities along the Upper Puyallup River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
1995	Ford - Historic	Right	23.7	200	Partial washout.
1995	The Country - Historic Ii	Left	24.0	200	Partial washout.
1995	The Country - Historic Ii	Left	24.0	800	Total failure.
1995	Mint Creek	Left	25.1	300	Partial washout.
1995	Neadham Road - Remnant I	Right	25.6	200	Partial washout.
1995	Orville-Kapowsin	Left	26.2	1500	Full levee washout
1995	Orville-Kapowsin	Left	26.5	225	Partial washout.
1995	Orville-Kapowsin	Left	26.6	200	Partial washout.
1995	Neadham Road	Right	26.8	500	Partial washout.
1995	Orville-Kapowsin	Left	27.0	500	Full levee washout.
1995	Griessel	Left	27.6	400	Full levee washout.
1995	Griessel-Historic	Left	28.1	300	Cutoff levee, full washout.
1995	Griessel-Historic	Left	28.1	700	Full levee washout.
1996					
1996	High Cedars	Right	17.6	400	Toe failure.
1996	High Cedars	Right	18.0	500	Toe failure.
1996	High Cedars	Right	18.0	400	Total failure.
1996	South Fork	Left	18.2	200	Levee access road damage.
1996	High Cedars	Right	19.0	100	Toe/slope failure
1996	Calistoga	Right	19.8 - 20.2	500	Total levee failure
1996	Calistoga	Right	19.8 - 20.2	1200	Total levee failure
1996	Calistoga	Right	20.0	375	Toe/slope failure
1996	Calistoga	Right	20.2	200	Mostly toe with some slope failure.
1996	Leach Road	Left	20.5	300	Toe/slope failure.
1996	Calistoga	Right	20.7	300	Toe failure.
1996	Calistoga	Right	20.8	100	Toe failure.
1996	Calistoga	Right	20.9	300	Toe/slope failure.
1996	Calistoga	Right	21.2	200	Toe/slope failure.
1996	Soldiers Home - Historic	Left	21.9	400	Toe/slope failure.
1996	Jones	Right	22.3	250	Toe/slope failure.
1996	Jones	Right	22.4	200	Toe/slope failure.
1996	Jones	Right	22.5	200	Total failure.
1996	Ford	Right	22.9	300	Toe/slope failure.
1996	Ford	Right	23.1	200	Total failure.
1996	Ford - Historic	Right	23.6	900	Total failure.

Table 5.16 Damage to Facilities along the Upper Puyallup River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
1996	McAbee	Left	23.6	1200	Total failure.
1996	The Country - Historic Ii	Left	24.0	500	Total failure.
1996	The Country - Historic Ii	Left	24.1	300	Total failure.
1996	Ford - Historic	Right	24.6	1200	Total failure.
1996	High Bridge Revet.	Right	25.1	200	Total failure.
1996	Mint Creek	Left	25.15	250	Toe/slope failure.
1996	Neadham Road - Remnant I	Right	25.6	1300	Total failure.
1996	Neadham Road-Historic Ii	Right	26.2	2000	Total failure.
1996	Neadham Road	Right	26.4	600	Total failure.
1996	Neadham Road	Right	26.6	1000	Total failure.
1996	Orville-Kapowsin	Left	26.6	900	Toe/slope failure.
1996	Orville-Kapowsin	Left	26.7	1200	Toe/slope failure.
1996	Neadham Road	Right	26.8	1000	Total failure.
1996	Orville-Kapowsin	Left	26.8	2000	Total failure.
1996	Griessel	Left	27.6	2000	Toe/slope failure.
1996	Griessel-Historic	Left	28.0	2500	Toe/slope failure.
1996	Orville-Kapowsin	Left	26.7 - 27.6	3000	Total failure
2003					
2003	Calistoga	Right	21.0	300	Partial washout of the toe and levee facing.
2003	Soldiers Home	Left	22.8	220	Partial washout of the toe and levee facing.
2003	Orville-Kapowsin	Left	26.2	360	Partial washout of the toe and levee facing.
2003	Champion Bridge	Left	28.2	40	Partial washout of the toe and levee facing.
2004					
2004	High Cedars	Right	17.8	1,300	Partial washout of the toe and levee facing.
2004	High Cedars	Right	19.6	250	Partial washout of the toe and levee facing.
2004	Leach Road	Left	20.7	10	Re-establish heavy rip-rap around outfall pipe.
2004	Soldiers Home - Historic	Left	22.3	250	Partial washout of the toe and levee facing.
2005					
2005	Soldiers Home - Historic	Left	22.3	100	Repair/replace toe and face rock.

Table 5.16 Damage to Facilities along the Upper Puyallup River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2006					
2006	South Fork	Left	17.7	40	Washout
2006	High Cedars	Right	18.0	50	Washout
2006	South Fork	Left	18.0	350	Washout
2006	High Cedars	Right	19.4	150	Washout
2006	Leach Road	Left	19.4	50	Washout
2006	Calistoga	Right	19.8	100	Washout
2006	Leach Road	Left	19.8	200	Washout
2006	Soldiers Home	Left	22.6	100	Face erosion
2006	Ford	Right	22.8	350	Washout
2006	McAbee	Left	23.6	600	Washout
2006	Orville-Kapowsin	Left	26.3	415	Washout
2006	Champion Bridge	Left	28.4	450	Washout
2006	Champion Bridge	Left	28.6	150	Washout
2006	Champion Bridge	Left	28.6	700	Washout
2006	Neadham Road-Historic Iii	Right	26.7 - 27.0	1500	Washout
2007					
2007	High Cedars	Right	18.0	70	Washout
2007	Jones	Right	22.0	200	Repair
2007	Orville-Kapowsin	Left	25.7	500	Washout
2007	Orville-Kapowsin	Left	26.2	200	Washout
2007	Neadham Road	Right	26.7	330	Cut-off construction.
2007	Neadham Road	Right	26.4 - 26.8	1,600	Washout - USACE Assistance.
2008					
2008	High Cedars	Right	18.2	75	Toe rock failure and partial face rock failure.
2008	High Cedars	Right	18.5	175	Toe rock & partial face failure.
2008	Leach Road	Left	19.3	250	Top of levee/access road scour.
2008	Leach Road	Left	19.75	350	Partial washout of the toe and levee facing.
2008	Jones	Right	21.7 - 22.4	600	Partial washout of the toe and levee facing.
2008	The Country - Historic I	Left	23.6 - 23.8	620	Washout
2008	Calistoga	Right	19.82	200	Top surface access road scour.
2008	Calistoga	Right	20.78	130	Potential toe rock failure and face rock failure.

Table 5.16 Damage to Facilities along the Upper Puyallup River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2008	Calistoga	Right	21.15	120	Potential toe rock failure and face rock failure.
2008	Jones	Right	21.3	450	Toe rock failure.
2008	Soldiers Home	Left	21.30	120	Toe rock failure.
2008	Jones	Right	22.0	300	Toe rock failure.
2008	Jones	Right	22.05	100	Toe rock failure.
2008	Ford	Right	22.8	150	Toe rock failure.
2008	Soldiers Home	Left	23.0	600	Toe rock failure.
2008	McAbee	Left	23.6	150	Partial levee core failure.
2008	Ford	Right	24.6	100	Toe rock failure.
2008	Neadham Road-Historic Ii	Right	26.3	738	Complete washout
2008	Champion Bridge	Left	28.3	127	Toe and Face Rock Failure.
2008	Champion Bridge	Left	28.5	299	Partial washout.
2009					
2009	High Cedars	Right	18.2	75	Toe rock failure and partial face rock failure.
2009	High Cedars	Right	18.8	700	High cedars facing rock failure.
2009	Leach Road	Left	19.3	250	Top of levee/access road scour.
2009	High Cedars	Right	19.4	120	Face rock failure.
2009	Leach Road	Left	19.8	520	Revetment 30% of facing rock missing.
2009	Jones	Right	22.1	200	Primarily face scour loss of face rock.
2009	Jones	Right	22.35	60	Primarily face scour loss of face rock.
2009	Ford	Right	22.7	150	Primarily face scour loss of face rock.
2009	Soldiers Home	Left	22.7	141	Primarily scour along the lower portion of the face rock.
2009	McAbee	Left	23.3	200	Primarily face scour loss of face rock.
2009	McAbee	Left	23.6	150	Partial Levee Core failure.
2009	Neadham Road	Right	26.8	130	Cut-off extension.
2009	Champion Bridge	Left	28.15	150	Complete washout of levee.
2009	Champion Bridge	Left	28.2	168	Primarily face scour loss of face rock.
2009	Champion Bridge	Left	28.25	300	Primarily face scour loss of face rock.
2009	Champion Bridge	Left	28.3	135	Toe scour causing face rock to slough away.
2009	Champion Bridge	Left	28.5	435	Primarily face scour loss of face rock.
2010					
2010	High Cedars	Right	18.18	10	Small face scour pocket.

Table 5.16 Damage to Facilities along the Upper Puyallup River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2010	Leach Road	Left	19.8	550	Toe and face scour - USACE assistance.
2010	Soldiers Home	Left	21.3	150	Slope and toe scour - USACE assistance.
2010	Jones	Right	21.4	500	Toe and partial embankment scour - USACE assistance.
2010	Soldiers Home	Left	22.5	140	Slope and toe scour - USACE assistance.
2010	Soldiers Home	Left	22.7	175	Slope and toe scour - USACE assistance.
2010	Neadham Road	Right	26.8 - 27.0	550	Levee extension.
2011					
2011	Leach Road	Left	19.9	60	Partial failure.
2011	Ford	Right	23.4	120	Face and toe rock failure.
2011	Ford	Right	24.7	300	Lower face scour.
2011	High Bridge Revet.	Right	25.3	90	Major face scour/scarp.
2011	Neadham Road	Right	26.45	120	Face and toe rock failure.
2011	Champion Bridge	Left	28.3	100	Face rock failure & sloughing.
2011	Champion Bridge	Left	28.15 - 28.3	700	Face & toe rock failure.
2012					
2012	High Cedars	Right	19.3	75	Toe scour.
2012	Leach Road	Left	19.9	60	Partial failure upstream end of Corp.
2012	Calistoga	Right	20.7	25	Knick point.
2012	Soldiers Home	Left	21.45	50	Lower face and possible toe scour.
2012	Soldiers Home	Left	22.6	50	Lower face erosion.
2012	Ford	Right	23.5	200	Toe scour.
2012	McAbee	Left	23.6	80	End of levee @ rock point washed out to river mile post sign.
2012	Soldiers Home	Left	23.6	80	End of levee @ rock point washed out to river mile post sign.
2012	Ford	Right	24.7	200	Toe scour & loss of lower face.
2012	High Bridge Revet.	Right	25.2	30	Knick point in revetment.
2012	High Bridge Revet.	Right	25.4	50	Over steepened w/ lots of rock missing.
2012	Neadham Road	Right	26.5	240	Face rock sloughing along entire length due to lost toe rock or toe being lost.
2012	Neadham Road	Right	26.65	210	Toe rock missing causing face to slough.
2012	Neadham Road	Right	26.7	75	Several upper level toe rocks rolled out.
2012	Champion Bridge	Left	28.15	200	Continued damage from last year.
2012	Champion Bridge	Left	28.45	100	Sloughing moving upstream.
2012	Champion Bridge	Left	28.1- 28.2	700	Sloughing.

Table 5.16 Damage to Facilities along the Upper Puyallup River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2013					
2013	High Cedars	Right	18.70	30	Toe rock and face rock missing with some core erosion.
2013	High Cedars	Right	19.4	75	Knick point. Toe rock loss and face sloughing.
2013	Ford	Right	23.50	200	Toe scour.
2013	Neadham Road	Right	26.65	210	Toe rock missing causing face to slough.
2013	Neadham Road	Right	26.70	60	Toe rock is being scoured and causing the face to slough.
2013	Champion Bridge	Left	28.3	100	Revetment repair.
2014					
2014	Soldiers Home	Left	21.45	100	Lower face scour.
2014	Neadham Road	Right	26.4	300	Thalweg against toe causing scour along the lower face and toe.
2014	Neadham Road	Right	26.6 & 26.7	285	Toe scour causing lower face to slough.
2014	Champion Bridge	Left	28.2 - 28.3	400	Toe rock rolling out and face sloughing.
2015					
2015	High Cedars	Right	18.15	100	Maintenance
2015	High Cedars	Right	18.25	160	Missing face rock.
2015	High Cedars	Right	18.3	130	Missing face rock.
2015	High Cedars	Right	19.4	200	Maintenance
2015	Leach Road	Left	19.4	200	Overtopping & scour over access road.
2015	Leach Road	Left	19.6	150	Overtopping and facing rock damaged.
2015	Leach Road	Left	20.3	10	Tree pulled in a chunk of levee.
2015	Leach Road	Left	21.0	75	Toe and face rock missing.
2015	Soldiers Home	Left	21.45	40	Levee rehabilitation.
2015	McAbee	Left	23.2	100	Core exposed.
2015	Ford	Right	23.60	100	Missing face and toe rock.
2015	McAbee	Left	23.6	100	Buttress end has started to erode.
2015	Ford	Right	24.70	300	Full washout over 200 LF. Orville road only 40 feet away.
2015	Ford	Right	24.70	400	Washout of levee. Emergency repair.
2015	High Bridge Revet.	Right	25.2	60	Face scour, sloughing, loss of toe rock.
2015	High Bridge Revet.	Right	25.35	350	Face scour & loss of toe rock.
2015	Neadham Road	Right	26.4	150	Missing face rock.
2015	Griessel	Left	27.7	30	Access road at culvert damaged.

Table 5.16 Damage to Facilities along the Upper Puyallup River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2015	Champion Bridge	Left	28.15	40	Erosion at end of Champion Bridge Levee.
2015	Champion Bridge	Left	28.2	110	Missing toe and face rock.
2015	Champion Bridge	Left	28.2	220	Severe face scour.
2015	Champion Bridge	Left	28.2	450	Emergency - levee rehab
2015	Champion Bridge	Left	28.25	150	Missing face rock and over steepened.
2015	Champion Bridge	Left	28.25	100	Project has grown from 150 to 250 from November Flood.
2015	Neadham Road	Right	26.6 & 26.7	80	Levee rehabilitation.
2017					
2017	High Cedars	Right	17.6	1	Over steepened.
2017	High Cedars	Right	18.6	100	Toe and face rock failure.
2017	High Cedars	Right	18.77	40	Toe and face rock failure.
2017	Leach Road	Right	19.3	800	Access Rd damage.
2017	Soldiers Home	Left	22.8 - 22.9	900	Levee rehabilitation.
2017	Leach Road	Right	19.9	25	Scour at top of levee
2017	Leach Road	Left	20.2	60	Localized scour. Missing toe and face rock.
2017	Leach Road	Left	20.7	50	Localized scour. Missing toe and face rock.
2017	Leach Road	Left	21.0	310	Face and toe rock failure.
2017	Jones	Right	22.2	500	Toe rock failure.
2017	McAbee	Left	23.6	160	Further erosion of buttress.
2017	Ford	Right	24.6	400	Levee washout.
2017	High Bridge Revet.	Right	25.4	50	Upstream end of past repair project is damaged.
2017	Neadham Road	Right	26.65	125	Thalweg against toe causing scour along the lower face and toe.
2017	Champion Bridge	Left	28.2	150	Emergency - levee rehabilitation.
2017	Champion Bridge	Left	28.2	175	Further damage at end of levee.
2017	Champion Bridge	Left	28.25	50	Project has grown from 150 to 250 from November Flood.
2017	Champion Bridge	Left	28.25	50	More toe and face rock missing .

Figure 15

River Flood Hazard Management Plan

Pierce County Levees and Revetments: Upper Puyallup River

Orting
Soldiers Home
Jones
Mcabee
Ford
224th St E
264th St E
Neadham Road
Puyallup River
Greissel

1. Soldiers Home - Ring Levee
2. The Country - Remnant 2
3. The Country - Remnant 1
4. The Country - Remnant 3
5. Mint Creek
6. High Bridge Revetment
7. Neadham Road - Remnant 1
8. Lindberg
9. Larson Revetment
10. Neadham Road - Remnant 2
11. Orville Road Setback Revetment
12. Stehn Large Lot

- Levee
- Revetment
- Highway
- Major Road
- Water Body
- City

Pierce County

N

3/6/2018

0 0.25 0.5 Miles

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Key Accomplishments since the 2013 Flood Plan

Table 5.17 has been updated to include major projects completed between 2013 and 2017. This table replaces the 2013 version.

Table 5.17 Major Projects Completed on Upper Puyallup River Since 1991 Flood Plan					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2014					
2014	Champion Bridge	Left	28.2 - 28.3	400	Toe rock rolling out face sloughing. Face scour, face rock missing and sloughing.
2015					
2015	Ford	Right	24.70	400	Washout of levee. Emergency repair.
2015	Champion Bridge	Left	28.2	450	Emergency - levee rehab.
2017					
2017	Soldiers Home	Left	22.8 - 22.9	900	Levee Rehabilitation..
2017	Jones	Right	22.2	500	Toe Rock Failure 300 -500LF.
2017	Ford	Right	24.6	400	Levee Washout.

Land Purchases

The following land and home acquisitions have occurred since 2013, using a combination of federal, state, and local funds.

- In 2014, three properties were acquired in the Neadham Road area (17 acres);
- In 2015, six properties were acquired along Neadham Road and one property was acquired near Orville Road Kapowsin Creek (40 acres);
- In 2016, one property was acquired along Orville Road and one property was acquired near Neadham road (7 acres); and
- In 2017, three properties were acquired along Orville Road (73 acres).

Partnerships

Since the adoption of the 2013 Flood Plan, Pierce County has partnered with the Salmon Recovery Funding Board to acquire five parcels which totaled an estimated $1 million of grant funds. The department of Ecology's Floodplains by Design program also contributed $700,000 in grant funds to acquire a property located along Neadham Road.

Status Update on Recommended Capital Projects

UP1 Calistoga Setback Levee

Project Update: This project was completed in 2015 by the City of Orting. Currently this levee is undergoing the FEMA Levee Analysis and Mapping Procedures (LAMP) process that will certify the levee.

Estimated Cost: **$18,000,000**

See Figure 16

UP2 Ford Levee Setback-Gravel Removal

Project Update: No project update is available at this time.

Estimated Cost: **$1,011,126 plus study, design, and permitting costs**

See Figure 17

UP3 Neadham Road Floodplain Reconnection

Project Update: This project is currently in the property acquisition phase. When this project is complete, it will improve channel migration protection in the Neadham Road area along the upper Puyallup River. Pierce County continues to acquire properties located at RM 5.5 south of Orting. When the property acquisition phase is complete, the existing levee will be removed along Neadham Road. This will allow the river to access its full historical right bank floodplain for the first time in a century. This project is one step of many which ultimately will result in the reconnection of 1.3 miles of uninterrupted floodplain and riparian area along the right bank of the Puyallup River.

Estimated Cost: **$14,000,000**

See Figure 18

Figure 16

River Flood Hazard Management Plan

UP1 Calistoga Setback Levee

19.8
20
20.2
20.4
20.5
20.6
20.8
21
21.2
21.4
2.2
2.4
2.5
2.6
Current Calistoga Alignment
Historic Calistoga Alignment
Leach Road
Puyallup River
Carbon River
Orting Treatment Plant
Orting
Calistoga St W
Orting-Kapowsin Hwy E
Soldiers Home
Jones
162

- River Milepost
- Historic Levee
- Levee
- Highway
- Major Road
- Residential Road
- Water Body
- City

Pierce County

N

3/6/2018

0 390 780 Feet

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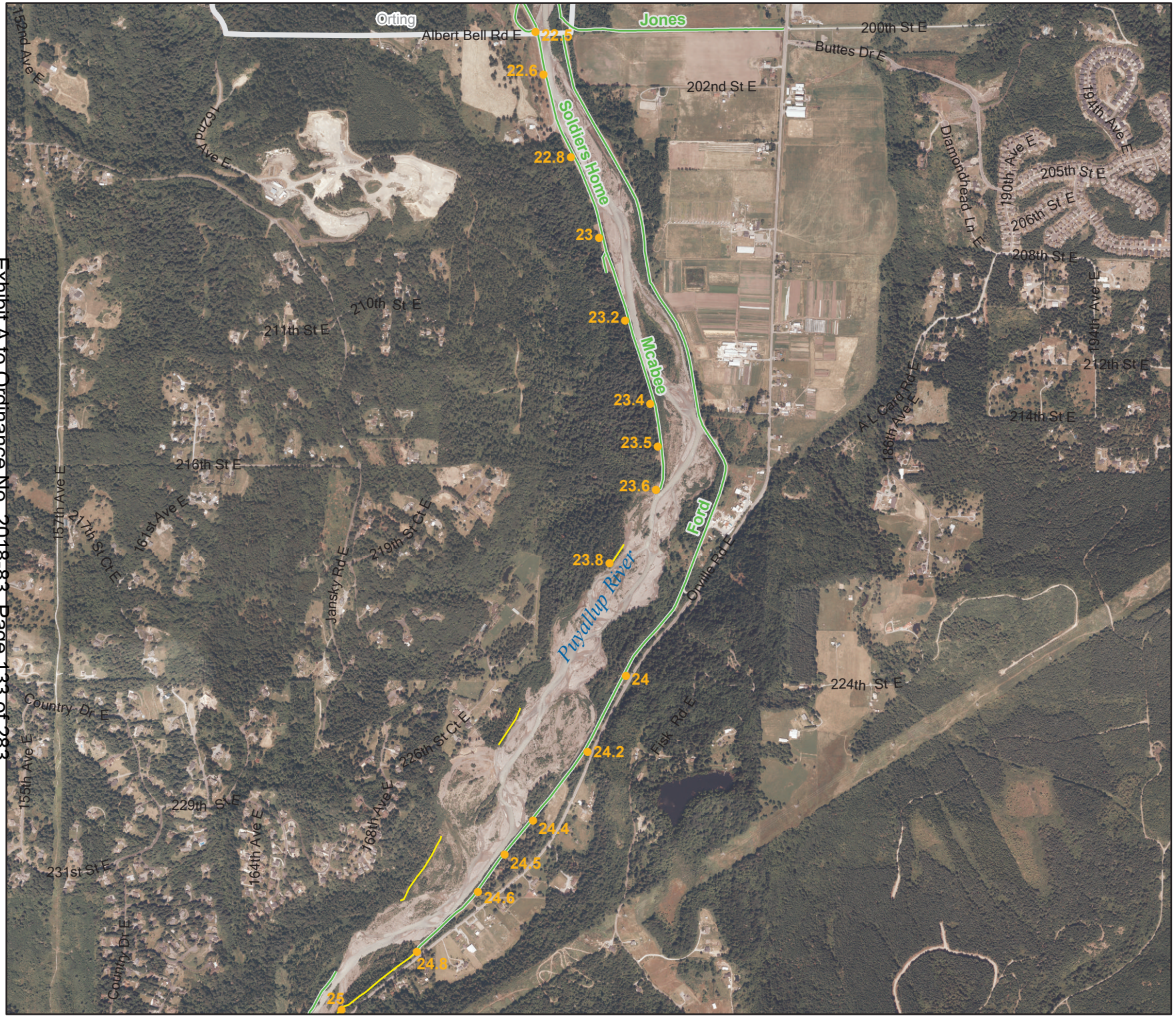

Figure 17

River Flood Hazard Management Plan

UP2
Ford Levee Setback
Gravel Removal

- River Milepost
- Levee
- Revetment
- City

Pierce County

N

0 437.5 875
Feet

3/6/2018

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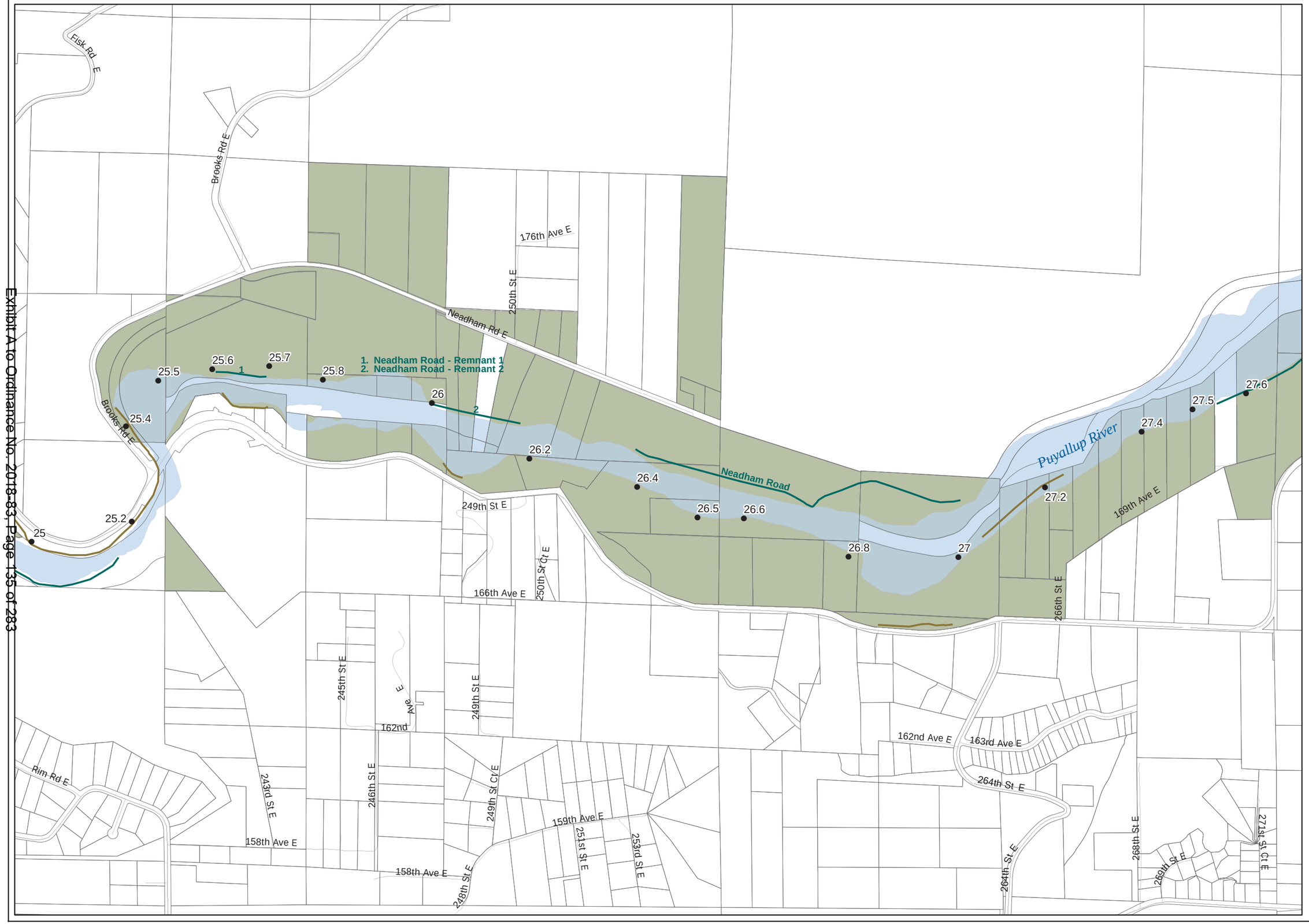
Figure 18

River Flood Hazard Management Plan

UP3 Neadham Road



- River Milepost
- Levee
- Revetment
- Major Road
- Residential Road
- Surface Water Management Properties
- Tax Parcels
- Water Body

Pierce County

N

3/6/2018

0 465 930 Feet

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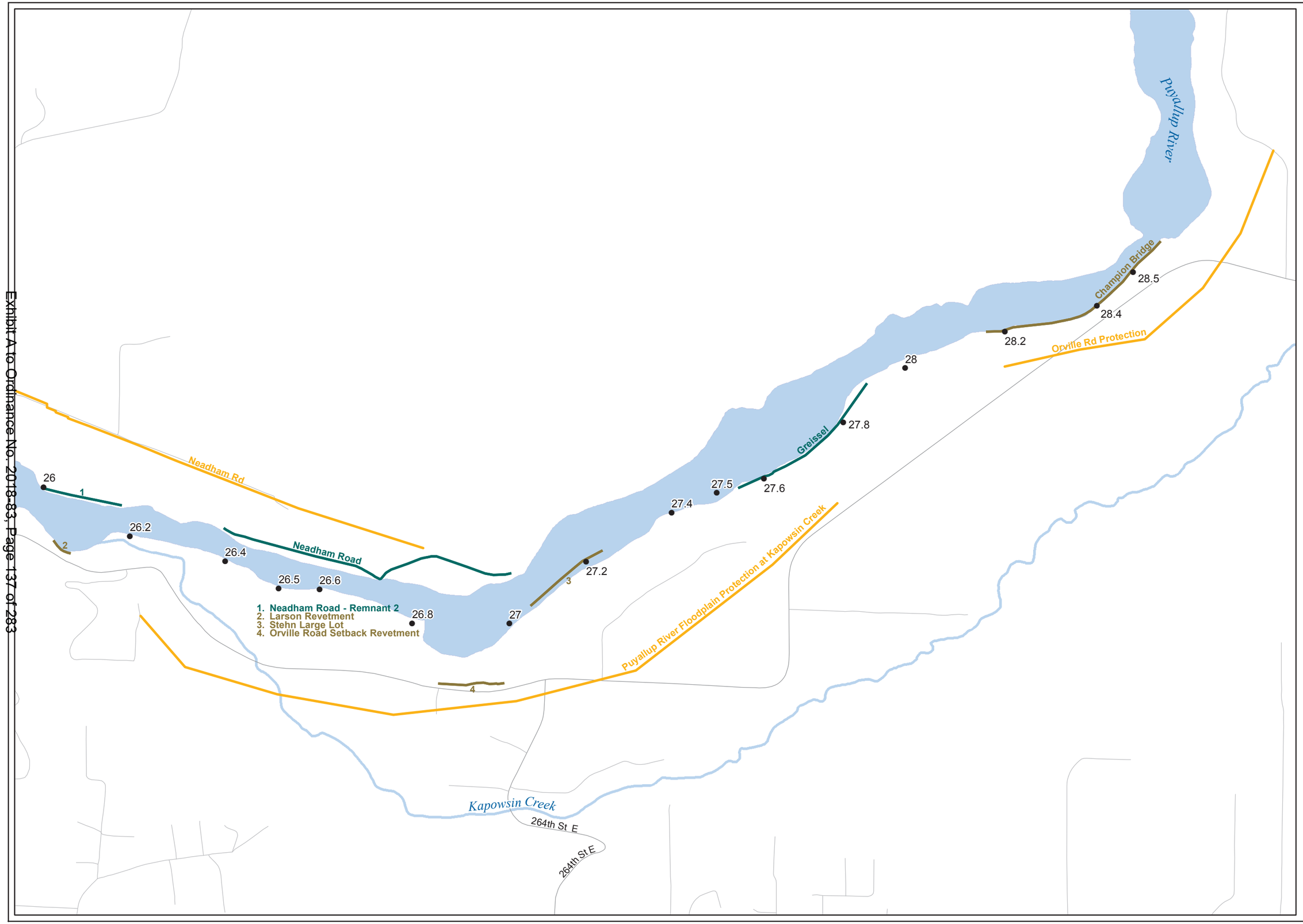

Figure 19

River Flood Hazard Management Plan

UP4 Orville Road Revetment at Kapowsin Creek, UP5 Orville Road Channel Migration Protection, and UP6 Puyallup River/ Orville Road Revetment and Riparian Habitat Restoration

- River Milepost
- Levee
- Revetment
- Major Road
- Residential Road
- Watercourse
- Water Body

Pierce County

N

3/5/2018

0 500 1,000 Feet

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The following three Orville Road projects are a part of a much larger project that have been broken up into phases. A reach analysis of the Puyallup River from RM 25.3 to RM 28.6 was completed in July 2011 that developed cost effective solutions that inhibit further expansion of the channel migration zone. Since this study was completed and the Flood Plan was adopted, these three projects have further developed. Figure 19 shows the proposed Orville Road project in its entirety.

UP4 Orville Road Revetment at Kapowsin Creek

Project Update: This project is currently in the monitoring phase. The remaining 600 feet of levee was destabilized in 2013 and the river continues to re-occupy a portion of the channel. The adjacent properties have been purchased and the residences have been removed. A proposal to construct a 750-lineal foot combination of engineered log jam (ELJ) and dolo timber structures would provide scour and erosion protection for Orville Road. Recent shifts in the mainstem channel and the proposed right bank projects have decreased the urgency for this project. Channel changes following the completion of the right bank project will be analyzed to assess the left bank needs.

Estimated Cost: **Approximately $6,773,885**

Figure 20: Upper Puyallup river re-occupying remnant levee section 26.2

UP5 Orville Road Channel Migration Protection

Project Update: This project is currently under construction and will be completed in Spring 2018. The Orville Road setback revetment project will construct two miles of setback revetment to protect Orville Road from the upper Puyallup River left bank channel migration. At the closest point, the river channel is about 200 feet away from Orville Road. This project will be constructed in five phases. Phase one construction was completed in 2013, and a portion is currently under construction and anticipated to be completed in Spring 2018. The remaining portion will be completed upon funding availability. This project provides flood protection benefit and will improve salmonid habitat. Upon completion of all phases, a portion of existing levees will be removed and the river will occupy its historic channel and flood plain.

Estimated Cost: **$8,917,149**

Figure 21: Crews installing an engineered log jam along the Puyallup River in December 2017

UP6 Orville Road Revetment and Riparian Habitat Restoration

Project Update: This project was completed in 2014.

Estimated Cost: **$1,891,531**

Figure 22: Photo of the finished Orville Road Revetment and Riparian Habitat Restoration

LOWER WHITE RIVER UPDATES

Flood Damage to Facilities

Flood damages to lower White River flood risk reduction facilities in the past three decades have not been significant. Damages from major floods and high-water events between 1990 – 2017 have resulted in approximately 17 identified damage locations comprising 0.7 mile of levees and revetments. Damages have been estimated at nearly $1.54 million dollars (based on 2017 dollars).

Since 1990, the levees and revetments along the lower White River have been stable requiring minimal repairs. However in 2009, sediment accumulation became more apparent as there was a rapid diminishment of channel capacity resulting in increased flood risk. In 2017, King County constructed a new setback levee to improve channel capacity and habitat. The new County Line Setback levee was constructed on the left bank between RM 5.0 and 6.2. It was designed to provide capacity for the 1% chance storm event with sufficient free-board. King County is scheduled to monitor and maintain the project into the future.

Damage to the Sumner Commercial Revetment segment was identified in 2011 during an annual condition assessment. Over the course of the following storm season the damage rapidly increased in length and severity and is scheduled for repair. Due to the complexities associated with the site, developing a solution amicable to the stakeholders involved has delayed the repair of this revetment.

Table 5.22 Damage to Facilities in the Past 20 Years along the Lower White River has been reformatted, revised and updated to include current damages from 1990 and 2017.

Table 5.22 Damage to Facilities the along the Lower White River (1990-2017)

Storm Season	Segment Name	Bank	River Mile	Damage Lineal Feet	Damage
1990					
1990	Sumner Commercial Revetment	Right	W-49 2.0 & W-58 3.8	400	Partial washout.
1993					
1993	Sumner Commercial Revetment	Right	3.4	100	Toe and face scour.
2008					
2008	Potelco	Left	5.4	20	Damaged face rock.

Table 5.22 Damage to Facilities the along the Lower White River (1990-2017)					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2009					
2009	Potelco	Left	5.25	20	Damaged face rock.
2011					
2011	Potelco	Left	5.05 - 5.15	650	Levee overtopping from wetland.
2011	Potelco	Left	5.35 - 5.5	570	Levee overtopping flowing to wetland.
2011	Sumner Commercial Revetment	Right	3.85	100	Levee core erosion, toe and face rock failure.
2011	Sumner Industrial Revetment	Right	0.03	30	Culvert replacement.
2012					
2012	Sumner Commercial Revetment	Right	3.85	400	Levee core erosion, toe and face rock failure.
2012	Sumner Industrial Revetment	Right	0.03	30	Culvert replacement.
2013					
2013	Dierenger	Left	4.0	135	Erosion and scour protection installed by the City of Sumner's.
2014					
2014	Dierenger	Left	4.0	50	Erosion and scour of the City of Sumner's soft armoring.
2014	Potelco	Left	5.35 - 5.5	570	Levee overtopping flowing to wetland.
2015					
2015	Potelco	Left	5.3	50	Repairs spots where trees overtopped and damaged levee.
2017					
2017	Dierenger	Left	4.0	75	Old Sumner Levee repair site.
2017	Sumner Commercial Revetment	Right	3.8	530	Levee damage.

Figure 23

River Flood Hazard Management Plan

Pierce County Levees and Revetments: Lower White River

Levee
Revetment
Highway
Major Road
Water Body
City
County Boundary

Pierce County

N

6/26/2018

0 0.25 0.5 Miles

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Milton
Edgewood
Pacific
Auburn
Sumner
Puyallup
Bonney Lake
King County
Pierce County
Military Rd S
Jovita Blvd E
Stewart Rd Sw
Stewart Rd
Lake Tapps Pkwy Se
Valley Ave E
Valley Ave NW
Valley Ave Ne
Traffic Ave
W Pioneer
E Pioneer
N Meridian
S Meridian
2nd St Ne
3rd St Se
White River
Pacific Park
Pollelco
Butte Pit
Dieringer
24th St E Revetment
Sumner Commercial Revetment
Sumner Industrial Revetment
Fleischman
Puyallup River
167
512
410
162

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Key Accomplishments since the 2013 Flood Plan

The Lower White River Countyline Levee Setback Project (LB 5.0 - RB 6.33)

In 2009, significant flooding occurred in the City of Pacific affecting more than 100 residences. This flooding was caused by ongoing sedimentation in the White River. King County constructed a 6,000-foot setback levee to help address the loss of channel capacity and reduce flood elevations in the City of Pacific. This project was completed in the fall of 2017 and now provides significant flood risk reduction benefits. Project funding was provided by the King County Flood Control Zone District with partial funding from Pierce County, the Salmon Recovery Funding Board, and the Natural Resource Damage Assessment. Total project cost was $24 million. For more information about this project, please see the King County Natural Resources and Parks webpage.

https://www.kingcounty.gov/depts/dnrp/wlr/sections-programs/river-floodplain-section/capital-projects/lower-white-river-countyline-a-street.aspx

The Pacific Right Bank Flood Protection Project (RM 6.3 – RM 5.5)

The Pacific Right Bank Flood Protection Project is the second of two projects along the Countyline reach of the White River. This project will be designed to reduce flood risk to homes and properties along the river's right (northwestern) bank in the City of Pacific. It will also provide habitat for threatened Chinook Salmon. Currently, this project is still in the initial scoping and design phase with an estimated project completion date of 2022. For more information about this project, please see the King County Natural Resources and Parks webpage.

https://kingcounty.gov/depts/dnrp/wlr/sections-programs/river-floodplain-section/capital-projects/lower-white-river-right-bank.aspx

Land Purchases

There have been no land purchases or buyouts along the lower White River by Pierce County since 2013. However, 14-acres of property have been acquired by the City of Sumner between RM 3.8 and RM 4.9 for future use as a part of the Stewart to 16th street setback levee, Pacific Point Bar Setback Levee, and the White River Restoration. Additional floodplain property is anticipated to be purchased in the future.

Status Update on Recommended Capital Projects

LW1 State Street Flood Wall or Emergency Access

Project Update: The City of Sumner purchased the remaining private residents surrounding the Sumner Wastewater Treatment Plant and reached an agreement with Washington State Department of Transportation to allow for temporary emergency access from the Traffic Avenue exit ramp. This is not considered a permanent solution. The City has indicated a desire to continue to pursue the State Street Floodwall in the future.

Estimated Cost: **$1,150,000**

LW2 Lower White River Floodplain Restoration and Flood Protection

Project Update: Understanding of river conditions in the Lower White continue to evolve. A series of high water events between 2015 and 2016 revealed that the White River had a diminished carrying capacity and local areas were experiencing an increased risk of flooding at lower flow levels. The proposal identified in the 2013 Flood Plan anticipated a combination of setback levees, revetments and other methods to increase the capacity of the river during flood events. Beginning in late 2016, the City of Sumner initiated an effort to develop a comprehensive strategy for addressing increased flood risk on the river through the City. Early partners included: City of Sumner, Pierce County, Muckleshoot Indian Tribe, and the Puyallup Tribe of Indians. These efforts led to a common understanding of the issues presented by this section of the river and the development of an approach to concurrently reduce flood risk and increase floodplain habitat. The overall intent is to create a sustainable river system to the extent feasible in this reach of the river. The project area includes both left and right banks between RM 1.8 and RM 4.9 and will include setback levees, side channels, channel roughening, engineered log jams, revetments, property acquisitions and other methods to create a more sustainable system. This project has been divided up into segments:

- ***White River Restoration***, left bank RM 2.5 - RM 4.2
  Estimated Cost: $29,783,896; $20,000,000 for construction and remaining in engineering
- ***Pacific Point Bar***, right bank RM 3.9 – RM 4.9
  Estimated Cost: $4,596,280 for construction and engineering plus $8,000,000 for property acquisition
- ***Left Bank Setback***, left bank between RM 4.4 - RM 4.8
  Estimated Cost: $3,677,024 for construction and engineering plus $7,000,000 for property acquisition
- ***Stewart Road Bridge*** replacement (left and right bank RM 4.9)
  Estimated Cost: $35,438,708

Estimated Total Cost: Approximately: $88,495,909

Phase I of the project is led by the City of Sumner and will be located on the left bank between RM 2.5 and 4.2 and includes approximately 162 acres. More natural riverine processes will be created in part by excavating floodplain areas to create wetland and slough habitats. This will allow the river to interact with its floodplain at lower flows than it currently does. This strategy will also allow for some natural channel migration which is essential for the creation and maintenance of fish habitat. The side channels will be designed to provide off-channel habitat that juvenile fish need. Large woody debris in the main channel and side channels will also be designed to provide essential cover, pools and refugia

for juvenile and adult fish. The project is also expected to include riparian forest areas that will provide for long term accumulation of the large woody debris while also providing shade.

LW3 Butte Avenue Levee and Berm

Project Update: This project is currently within the Pierce County Surface Water Management Capital Facilities plan to begin preliminary design and engineering in 2019. Changes in the conditions in the river channel caused flooding in 2015 and 2016. As a result of this flooding, the City of Pacific installed a temporary pump station in Government Canal at the county boundary line to address back water flooding of surrounding properties. Additionally, Pierce County installed HESCO barriers to provide protection to Butte Avenue. A more permanent solution will be influenced by projects in King County (the Pacific Right Bank project), the Lower White River Floodplain Restoration and Flood Protection project and the City of Pacific's permanent pump station. All of these projects will become part of a longer-term strategy for the lower White River.

***Estimated Cost:* $6,334,770**

UPPER WHITE RIVER UPDATES

Flood Damage to Facilities

The Greenwater Village Levee continued to experience partial toe rock displacement. Since the last update, the residents of Crystal Village Ranch funded, permitted and installed a buried rock groin along the left bank of the White River. The groin was installed to address the residents concern about the possibility of channel migration continuing to impact their development.

Table 5.27 Damage to Facilities in the Past 20 Years along the Upper White River has been reformatted, revised and updated to include current damages from 1990 to 2017.

Table 5.27 Damage to Facilities along the Upper White River 2013-2017

Storm Season	Segment Name	Bank	River Mile	Damage Lineal Feet	Damage
1996					
1996	Greenwater	Right	46.2	150	Toe/slope failure
1996	Greenwater	Right	46.2	100	Toe failure.
2006					
2006	Greenwater	Right	46.2	300	Face erosion.
2007					
2007	Greenwater	Right	45.0- 45.2	750	Face erosion.
2015					
2015	Greenwater	Right	45.2	30	Partial toe rock displacement and missing face rock.
2015	Greenwater	Right	45.2	20	Missing toe rock

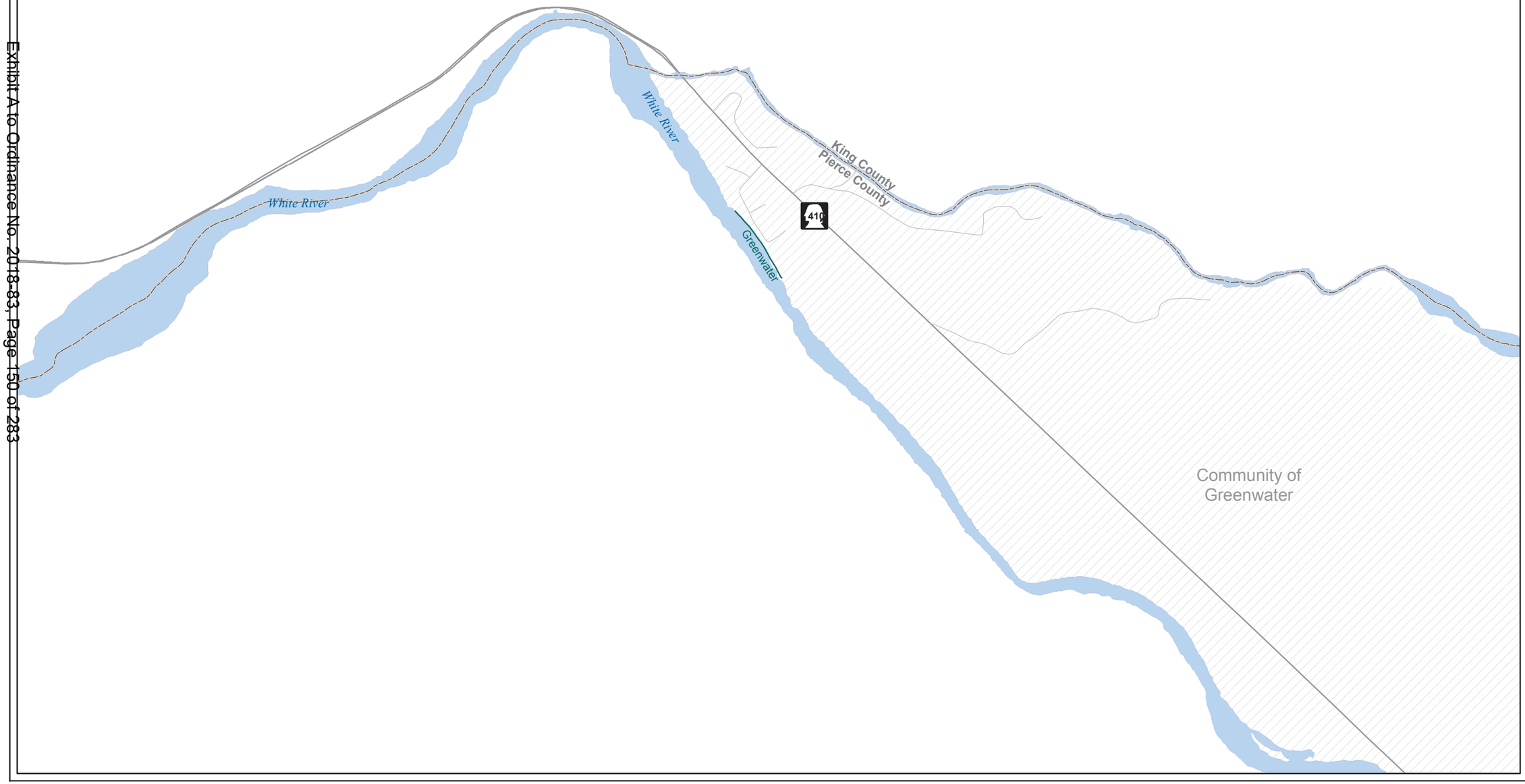
Land Purchases

There have been no land purchases or buyouts along the upper White River from 2013-2017.

Figure 24

River Flood Hazard Management Plan

Pierce County Levees and Revetments: Upper White River



Levee
Highway
Residential Road
Water Body
Community
County Boundary

Pierce County

N

3/6/2018

0 0.1 0.2 Miles

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GREENWATER RIVER UPDATES

Major Flooding

There has been no major flooding on the Greenwater River since 2013.

Key Accomplishments since the 2013 Flood Plan

Pierce County completed a Channel Migration Zone study in October 2017. The study focused on the lower 1.25 miles of the river where roads and homes are located. Above RM 1.25 is forest lands. A public meeting was held at the Greenwater Fire Station on November 29, 2017 to discuss this study with the residents of Greenwater as well as the process the County will use to adopt this stud.

Channel Migration Hazard Mapping

A channel migration zone study for the Greenwater was completed in October 2017. Pierce County contracted with Geo Engineers to study the lower 1.25 mile of the Greenwater River. This study is still in the early stages of the adoption process.

CARBON RIVER UPDATES

Flood Damage to Facilities

Table 5.36 Damage to Facilities in the Past 20 Years along the Carbon River has been reformatted, revised and updated to include current damages since between 1990 and 2017.

Table 5.36 Damage to Facilities along the Carbon River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
1990					
1990	Alward 1	Left	C-36 6.8	750	Reconstruction
1990	Alward 1	Left	C-37 & 38 7.2	1300	Reconstruction
1990	Bridge Street	Left	C-17 3.2	175	Washout
1990	Guy West	Left	C-31 5.9	400	Reconstruction
1990	Lindsay	Right	C-2 0.4	250	Levee slope protection damage.
1990	Lindsay	Right	0.8	400	Reslope and replace levee washed out by flood.
1990	Riddell	Left	C-2 0.4	400	Reslope and replace levee washed out by flood.
1990	Riddell	Both	0.9	400	Reslope and replace levee washed out by flood.
1990	Riddell	Left	C-5 0.9	150	Levee slope protection damage.
1990	Ski Park	Right	6.0	770	Flood damage repair.
1990	Ski Park	Right	C-34 6.4	300	Washout
1990	Ski Park	Right	C-34 6.4	500	Reconstruction
1990	Ski Park	Right	6.5	300	Reshape and replace rip rap and toe rock.
1990	Ski Park	Right	6.8 and 7.6	1550	Flood damage repair.
1990	Ski Park	Right	C-32 6.1	900	Reconstruction
1990	South Prairie Confluence	Right	C-31 5.9	100	Reconstruction
1995					
1995	Alward 1	Left	6.7	350	Partial washout
1995	Alward 1	Left	6.9	150	Full levee washout.
1995	Alward 1	Left	7.1	700	Full levee washout.
1995	Alward 1	Left	7.3	100	Partial washout.

Table 5.36 Damage to Facilities along the Carbon River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
1995	Alward 2	Left	6.2	255	Repair partially failed embankment.
1995	Alward 2	Left	6.3	250	Partial washout.
1995	Guy West	Left	4.6	100	Full levee washout
1995	Guy West	Left	4.9	100	Partial washout.
1995	Lindsay	Right	0.8	379	Toe/slope failure.
1995	Ski Park	Right	6.9	200	Partial washout.
1995	Ski Park/Alward 1	Both	6.9, 7.3, & 7.4	730	Rebuild fully washed out levee.
1996					
1996	Alward 1	Left	6.6	400	Toe failure.
1996	Alward 1	Left	6.9	200	Toe failure.
1996	Alward 1	Left	7.2	400	Total levee failure.
1996	Alward 1	Left	7.2	850	Total levee failure.
1996	Alward 2	Left	6.05	250	Toe/slope failure.
1996	Alward 2	Left	6.25	250	Toe/slope failure.
1996	Alward 2	Left	6.3	100	Toe/slope failure.
1996	Bridge street	Left	3.2	50	Toe/slope failure.
1996	Bridge street	Left	3.6	350	Total levee failure.
1996	Fish Ladder	Left	6.4	50	Toe/slope failure.
1996	Guy West	Left	4.6	100	Total levee failure.
1996	Guy West	Left	4.9	100	Toe/slope failure.
1996	Lindsay	Right	0.2	450	Toe/slope failure.
1996	Lindsay	Right	0.5	50	Toe/slope failure.
1996	Lindsay	Right	0.6	80	Toe/slope failure.
1996	Lindsay	Right	0.95	50	Toe/slope failure.
1996	Lindsay	Right	1.0	30	Toe failure.
1996	Lindsay	Right	1.1	40	Toe failure.
1996	Lindsay	Right	1.2	125	Toe/slope failure.
1996	Orting Treatment Plant	Left	2.7	20	Toe/slope failure.
1996	Riddell	Left	0.4	100	Toe/slope failure.
1996	Riddell	Left	0.8	30	Toe/slope failure.
1996	Riddell	Left	1.05	20	Toe/slope failure.
1996	Ski Park	Right	7.1	800	Total levee failure.

Table 5.36 Damage to Facilities along the Carbon River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
1996	Ski park	Right	6.18	40	Toe/slope failure.
1996	Ski park	Right	6.9	320	Total levee failure.
1998					
1998	Alward 1	Left	6.9	150	Repair levee.
1998	Alward 1	Left	7.6	150	Repair levee.
1998	Alward 1	Left	8.0	200	Repair levee.
2003					
2003	Guy West	Left	5.4	260	Partial washout of the toe and levee facing.
2003	Ski Park	Right	6.6	450	Partial washout of the toe and levee facing.
2005					
2005	Alward 1	Left	6.6	450	Replace/ reconstruct/repair.
2005	Alward 1	Left	7.6	750	Replace/ reconstruct/repair.
2006					
2006	Alward	Left	8.3	100	Face erosion.
2006	Alward	Left	8.3	300	Face erosion.
2006	Alward 1	Left	7.2 - 7.4	750	Washout
2006	Alward 1	Left	7.5	1200	Washout
2006	Alward 1	Left	7.6	700	Washout
2006	Alward 1	Left	8.2	150	Face erosion.
2006	Alward 2	Left	6.0 - 6.1	600	Face erosion.
2006	Alward 2	Left	6.3	600	Washout
2006	Bridge street	Left	3.2	50	Washout
2006	Bridge street	Left	3.6	120	Washout
2006	Bridge street	Left	3.6	200	Face erosion.
2006	Guy west	Left	4.6 - 4.9	1700	Toe erosion/undercut bank
2006	Guy west	Left	4.8	150	Washout
2006	Guy west	Left	4.8	100	Washout
2006	Guy west	Left	4.8	140	Washout
2006	Guy west	Left	5.0	270	Face erosion.
2006	Guy west	Left	5.2	150	Face erosion.
2006	Guy west	Left	5.4	30	Washout
2006	Lindsay	Right	0.8	60	Fracture
2006	Lindsay	Right	1.2	150	Washout
2006	Lindsay	Right	17.4	50	Face erosion.

Table 5.36 Damage to Facilities along the Carbon River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2006	Riddell	Left	0.2	50	Slump
2006	Riddell	Left	0.4	0	Overtopping
2006	Riddell	Left	1.2	0	Overtopping
2006	Ski park	Right	6.0	500	Washout
2006	Ski park	Right	6.0	300	Washout
2006	Ski park	Right	6.3	100	Face erosion.
2006	Ski park	Right	6.4	500	Washout
2006	Ski park	Right	6.8	550	Washout
2006	Voights d.s.	Left	3.8	180	Face erosion.
2006	Voights u.s.	Left	4.2	20	Fracture
2006	Voights u.s.	Left	4.4	110	Restore levee face and toe.
2007					
2007	Alward 1	Left	6.6 - 6.7	810	Reconstruct new levee prism and set new face rock.
2007	Alward 1	Left	6.8 - 7.0	1250	Reconstruct levee prism, set new toe, and face.
2007	Alward 1	Left	7.2 - 7.4	850	Reconstruct new levee prism and set new face rock.
2007	Alward 1	Left	8.1	390	Replaced toe and re-slope and replaced face rock.
2007	Alward 1	Left	8.0	450	Re-establish toe and repair face.
2007	Bridge Street	Left	3.6 - 3.7	0	Overtopping
2007	Guy West	Left	5.0	500	Set new toe and re-slope face.
2007	Lindsay	Right	0.8	600	Replace/ reconstruct/repair
2007	Lindsay	Right	1.2	450	Re-establish toe and repair face.
2007	Ski Park	Right	6.0	540	Replace/ reconstruct/repair
2007	Ski Park	Right	6.8	800	Re-establish toe and repair face.
2008					
2008	Alward 1	Left	7.0	100	Face scour and loss face rock.
2008	Alward 1	Left	7.2 - 7.3	796	Toe scour and loss of face rock. Lower face slumping.
2008	Alward 1	Left	8.0	100	Toe scour and loss of face rock. Lower face slumping.
2008	Alward 1	Left	8.1	100	Toe scour and loss of face rock. Lower face slumping.

Table 5.36 Damage to Facilities along the Carbon River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2008	Alward 1	Left	8.25	150	Toe scour and loss of face rock. Lower face slumping.
2008	Alward 2	Left	6.0	824	Face rock thin due to scour.
2008	Alward 2	Left	6.25	302	Toe scour and loss face rock.
2008	Alward 2	Left	6.35	136	Toe scour and loss face rock.
2008	Bridge Street	Left	3.5	300	Toe scour and loss face rock
2008	Bridge Street	Left	3.55 - 3.7	325	Routine maintenance to the existing levee structure.
2008	Bridge Street	Left	3.6 - 3.7	380	Toe and face scour.
2008	Fish Ladder	Left	6.4	171	Toe scour and loss face rock.
2008	Guy West	Left	4.7	296	Scalloped washout.
2008	Guy West	Left	4.8	1,200	Re-establish levee core to inhibit lateral piping during high water.
2008	Guy West	Left	5.0	290	Replace undersized face rock.
2008	Guy West	Left	5.2	196	Replace undersized face rock.
2008	Guy West	Left	5.3	253	Toe scour and loss face rock.
2008	Lindsay	Right	1.0	50	Toe rock failure and partial face rock failure.
2008	Orting Treatment Plant	Left	2.0	25	Toe scour and loss face rock.
2008	Riddell	Left	0.4 - 0.5	634	Toe scour and loss face rock.
2008	Riddell	Left	0.9 - 1.10	500	Washout of the toe and levee face.
2008	Ski Park	Right	6.0	336	Toe scour and loss of face rock.
2008	Ski Park	Right	6.25	140	Toe scour and loss of face rock.
2008	Ski Park	Right	6.45 - 6.6	900	Face scour and loss face rock.
2008	Ski Park	Right	7.0	139	Washout
2008	Voights u.s.	Left	4.2	324	Washout
2008	Voights u.s.	Left	4.4	123	Toe and face scour.
2009					
2009	Alward 1	Left	7.5	118	Face scour with core exposure. Possibly some toe loss. Bank is undercutting.
2009	Alward 2	Left	6.35	140	Toe scour and loss face rock.
2009	Fish Ladder	Left	6.4	110	Lower face scour.

Table 5.36 Damage to Facilities along the Carbon River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2009	Lindsay	Right	0.6	30	Facing rock failure.
2009	Lindsay	Right	0.9	75	Facing rock failure.
2009	Lindsay	Right	0.9	180	Re-establish toe and repair face.
2009	Lindsay	Right	16.9 - 16.95	100	Toe and facing rock failure.
2009	Riddell	Left	0.4	0	Overtopping
2009	Ski Park	Right	5.95	50	armored spillway/notch
2009	Ski Park	Right	6.2	255	Face scour with loss of most face rock.
2009	Ski Park	Right	6.25	144	Primary lower face scour causing upper face to slough.
2009	Ski Park	Right	6.4	310	Face scour with loss of most face rock.
2009	Ski Park	Right	6.75	200	Lower face scour.
2009	Ski Park	Right	6.45 - 6.6	400	Toe scour and loss of embankment.
2011					
2011	Alward 1	Left	7.1	75	Face and potential toe rock failure.
2011	Alward 1	Left	7.55	90	Toe and face rock failure.
2011	Alward 1	Left	8.05	130	Toe and face rock failure.
2011	Alward 1	Left	8.15	50	Face rock failure.
2011	Bridge Street	Left	3.35	30	Toe and face rock failure.
2011	Bridge Street	Left	3.45	120	Face rock failure.
2011	Guy West	Left	4.8	270	Undermining levee.
2011	Guy West	Left	5.3	70	Toe/face scour.
2011	Orting Treatment Plant	Left	2.0	129	Toe and rock failure.
2011	Riddell	Left	1.0	140	Toe is scoured out along with some face rock.
2011	Riddell	Left	1.1	400	Toe is scoured out along with some face rock.
2011	Riddell	Left	1.6	210	Undermined section with prism showing in sections.
2011	Voights d.s.	Left	3.75	90	Partial damage to facing rock.
2011	Voights d.s.	Left	3.8	130	Damage to toe and face rock.
2011	Voights u.s.	Left	4.2	700	Some toe rock failure.
2012					
2012	Alward 1	Left	7.1	250	Face and potential toe rock failure

Table 5.36 Damage to Facilities along the Carbon River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2012	Alward 1	Left	8.05 - 8.15	350	Toe and face rock failure.
2012	Bridge Street	Left	3.35	60	Face and toe scour.
2012	Bridge Street	Left	3.4	45	Facing and toe scour.
2012	Bridge Street	Left	3.45	120	Face rock is gone.
2012	Guy West	Left	4.8	270	Levee undermined along toe.
2012	Guy West	Left	5.3	170	Toe & face rock failing.
2012	Orting Treatment Plant	Left	2.0	129	Toe and face rock failure.
2012	Riddell	Left	0.4	634	Toe scour and loss of face rock.
2012	Riddell	Left	1.0	140	Toe is scoured out along with some face rock.
2012	Riddell	Left	1.6	210	Undermined trees are pulling apart face rock.
2012	Voights d.s.	Left	3.8	130	Some minor damage to face rock.
2012	Voights u.s.	Left	4.2	700	Some toe rock failure.
2013					
2013	Alward 1	Left	7.0 - 7.1	400	Toe & face rock failing.
2013	Alward 1	Left	7.2	150	Minor toe rock repair.
2013	Fish Ladder	Left	6.4	100	Toe & face rock failure.
2013	Guy West	Left	5.5	250	Toe & face rock failing.
2013	Orting Treatment Plant	Left	2.0	150	40 LF of prism core exposed.
2013	Riddell	Left	1.6	250	Missing face and toe rock.
2014					
2014	Guy West	Left	5.75	250	Face rock failure.
2014	Riddell	Left	0.5	500	Toe scour and loss face rock.
2014	Riddell	Left	1.6	260	Toe & face rock failure.
2014	Ski Park	Right	6.0	100	Toe and face erosion.
2015					
2015	Alward 1	Left	6.55	200	Levee Rehabilitation
2015	Alward 1	Left	7.1	40	Missing toe rock.
2015	Alward 1	Left	7.2	390	Levee rehabilitation.
2015	Alward 1	Left	7.9	100	Large log jam diverting flows/jet scour into levee.
2015	Alward 1	Left	7.9	20	Log jam is gone that forced flows into levee.
2015	Alward 1	Left	7.9	120	Toe and face rock damaged from large log Jam.

Table 5.36 Damage to Facilities along the Carbon River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2015	Alward 1	Left	8.1	60	Toe rock missing.
2015	Alward 1	Left	8.2	40	Missing Toe Rock in 3 locations.
2015	Alward 1	Left	8.2	30	Missing Toe Rock in 3 locations.
2015	Alward 1	Left	8.2	150	Large scour has formed at the toe of the levee. Toe and face rock has fallen into scour hole.
2015	Alward 2	Left	6.35	100	Levee rehabilitation.
2015	Alward 2	Left	6.2 -6.3	490	Levee rehabilitation.
2015	Bridge Street	Left	3.35	200	Levee rehabilitation.
2015	Bridge Street	Left	3.4	130	Face rock missing.
2015	Fish Ladder	Left	6.35 - 6.4	200	Rock displaced
2015	Fish Ladder	Left	6.35	100	Levee rehabilitation
2015	Fish Ladder	Left	6.4	34	Missing Toe rock.
2015	Fish Ladder	Left	6.4	16	An additional 16 feet of revetment damaged from flood event.
2015	Fish Ladder	Left	6.4	100	Emergency repair
2015	Fish Ladder	Left	6.45	150	Face and Toe Rock missing.
2015	Guy West	Left	4.65	150	Levee rehabilitation.
2015	Guy West	Left	4.8	360	Levee rehabilitation.
2015	Guy West	Left	5.3 - 5.35	375	Levee rehabilitation.
2015	Guy West	Left	5.2	40	Missing toe and face rock.
2015	Guy West	Left	5.75	150	Missing toe rock
2015	Lindsay	Right	1.2	150	Toe rock missing.
2015	Lindsay	Right	0.8	30	Missing toe rock and face rock slumping.
2015	Lindsay	Right	0.8	200	Trees were undermined and then pulled out a section of face rock in several locations.
2015	Lindsay	Right	0.8	125	Missing toe rock and face rock.
2015	Riddell	Left	0.55	60	Missing face rock
2015	Ski Park	Right	6.2 - 6.3	735	Levee rehabilitation.
2015	Ski Park	Right	6.20	40	Section of toe rock missing.
2015	Ski Park	Right	6.25	180	Missing toe and face rock.
2015	Ski Park	Right	6.80	200	Vertical face along inside radius of river bend.
2015	Ski Park	Right	6.80	200	Vertical face.
2015	Voights d.s.	Left	3.8	120	Missing toe and face rock.
2015	Voights d.s.	Left	3.8	140	Levee rehabilitation

Table 5.36 Damage to Facilities along the Carbon River 1990 - 2017					
Storm Season	**Segment Name**	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2015	Voights u.s.	Left	4.2	40	Partial undermining thru two repair sites in trees section.
2015	Voights u.s.	Left	4.2	80	Missing toe and face rock.
2015	Voights u.s.	Left	4.2	90	Missing toe and face rock.
2015	Voights u.s.	Left	4.3	20	Tree pulled out a chuck of face and toe rock.
2015	Voights u.s.	Left	4.3	50	Tree pulled out a chuck of face and toe rock
2015	Voights u.s.	Left	4.3	100	Large Cedar tree and Alder tree pulled a section of levee down.
2017					
2017	Alward 1	Left	7.9	120	Toe and face rock damaged from large log Jam.
2017	Alward 1	Left	8.1	100	Toe rock missing. Scalloped along toe.
2017	Alward 2	Left	6.20	478	Reconstruction/preservation.
2017	Alward 2	Left	6.000	150	Unacceptable PL 84-99 tie in, proposing slightly setback levee alignment to tie into former Railroad embankment.
2017	Bridge Street	Left	3.4	130	Face rock failure. Face rock missing.
2017	Bridge Street	Left	3.7	120	Toe and face rock.
2017	Bridge Street	Left	3.4	340	Loss of toe and face rock.
2017	Bridge Street	Left	3.1	200	Loss of toe rock.
2017	Fish Ladder	Left	6.4	200	Loss of bank between 177th and the end of Alward 1 Levee.
2017	Guy West	Left	5.75	150	Toe & face rock failure.
2017	Orting Treatment Plant	Left	2.3	20	Portion of face rock missing.
2017	Orting Treatment Plant	Left	2.7	40	Toe rock failure.
2017	Orting Treatment Plant	Left	2.7	140	Partial of face rock missing.
2017	Orting Treatment Plant	Left	2.1	75	Levee face damage.
2017	Riddell	Left	1.2 - 1.3	500	Toe rock failure.

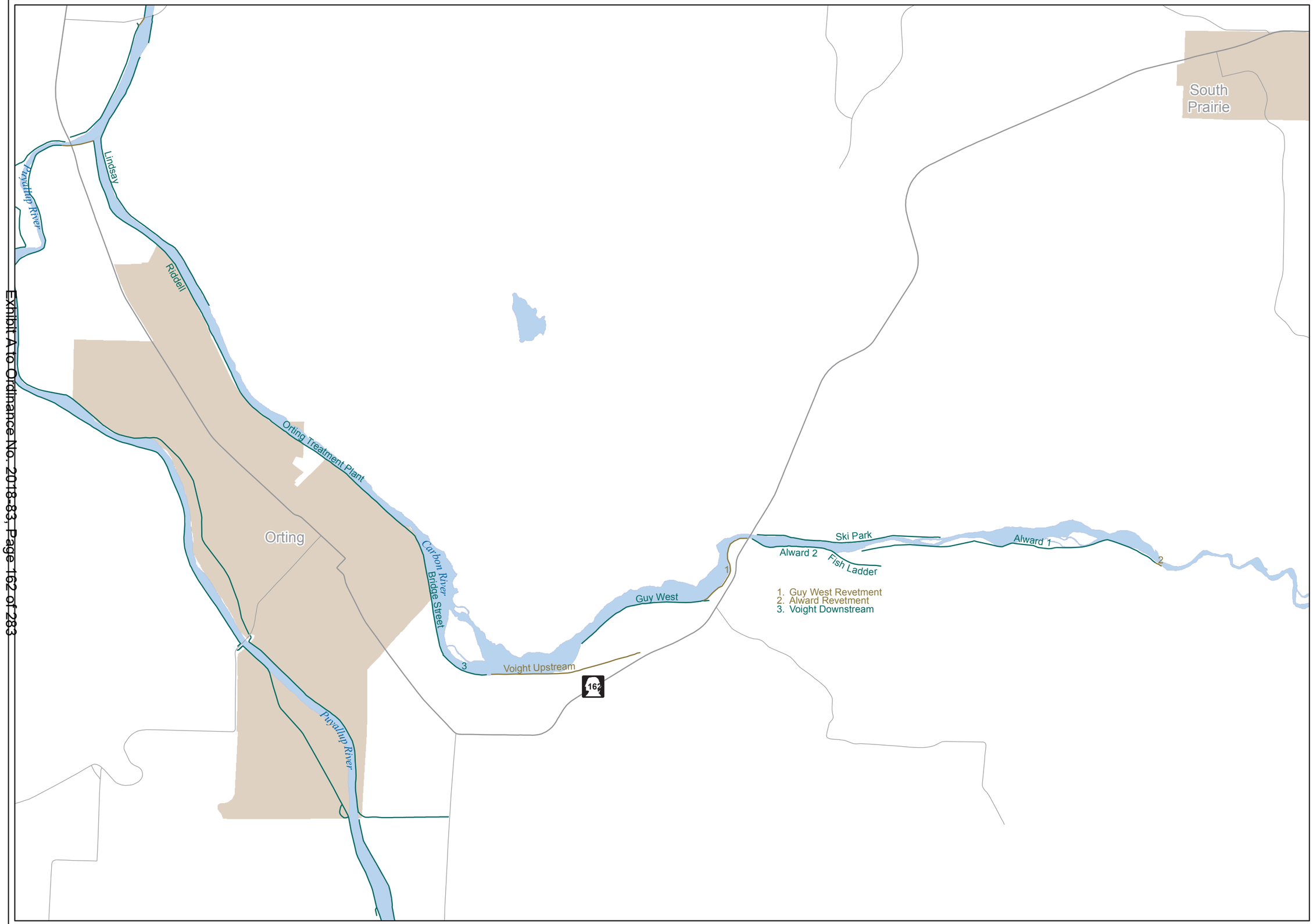

Figure 25

River Flood Hazard Management Plan

Pierce County Levees and Revetments: Carbon River

- Levee
- Revetment
- Highway
- Major Road
- Water Body
- City

Pierce County

N

3/6/2018

0 0.25 0.5 Miles

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Key Accomplishments since the 1991 Flood Plan

During the January 2009 storms, the Voights Creek Fish Hatchery facilities was just one of many facilities that was damaged due to record flooding. This event triggered a presidential disaster declaration, making funds available to public entities for disaster-related damage. FEMA provided financial assistance to the Washington State Department of Fish and Wildlife (WDFW) to replace and relocate the fish hatchery with a new facility outside of the 100-year floodplain. WDFW requested funding assistance from the State Legislature for the repair and replacement of the flood-damaged fish hatchery. The project was approved for funding using state appropriations and federal funds. Since the 2013 Flood Plan was adopted, this project has been completed with coordination and support from the Puyallup Tribe of Indians.

Land Purchases

The following land and home acquisitions have occurred since 2013, using a combination of federal and state grant funds and local match.

- In 2014, one property was acquired along Alward Road area (1.05 acres);
- In 2015, one property was acquired along Alward Road area (5.69 acres);
- In 2016, five properties were acquired along Alward Road area (4.36 acres);
- In 2017, four properties were acquired along Alward Road (4.54 acres).

Status Update on Recommended Capital Projects

C1 Carbon Confluence Setback Levee

Project Update: No project update is available at this time.

Estimated Cost: **$5,954,413**

C2 Carbon Levee Bank Stabilization / Flow Deflection and Cheese Creek Backwater improvements

Project Update: There has been an interest by local stakeholders to modify this project to include the construction of the Bridge Street Setback Levee identified in the 2008 Setback Feasibility Study. The goal and objective for this project is to construct a setback levee that has multiple benefits such as flood reduction, floodplain reconnection, and fish habitat. The concept is preliminary planning and conceptual design and will be looked at in future updates for inclusion within the Flood Plan.

Estimated Cost: **$3,033,380**

C3 Alward Road Floodplain Acquisition

Project Update: No project update is available at this time.

Estimated Cost: **$1,348,169**

C4 Alward Road Floodplain Acquisition and Setback Levee

Project Update: This project is currently in the project acquisition phase. Once this project has been completed, it will allow the river to revert back to its natural condition in perpetuity. -To date, SWM has purchased 53 of 81 properties between the river and 177th Street East. This project was originally scoped to include a setback levee however, a value engineering study will be conducted in 2019 to evaluate other alternatives.

Estimated Cost: **$27,517,187**

See Figure 26

C5 Upper Carbon/Fairfax Road Bank Stabilization

Project Update: No project update is available at this time.

Estimated Cost: **$ 1,685,211**

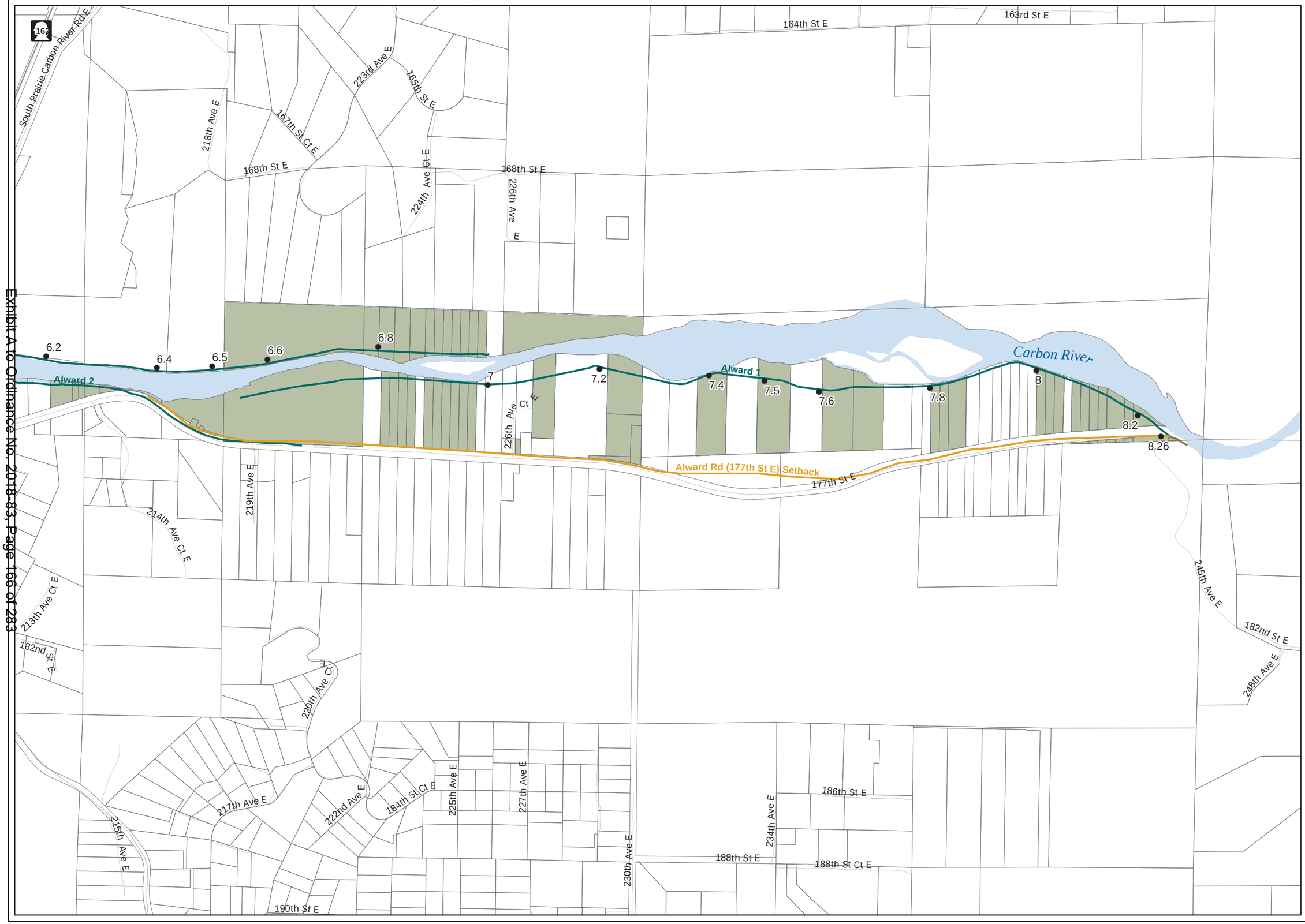

Figure 26

River Flood Hazard Management Plan

C4 Alward Road Floodplain Acquisition and Setback Levee

- River Milepost
- Proposed Setback Levee
- Levee
- Revetment
- Highway
- Major Road
- Residential Road
- Surface Water Management Properties
- Tax Parcels
- Water Body

Pierce County

N

3/6/2018

0 462.5 925 Feet

The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. The County assumes no liability for variations ascertained by actual survey. ALL DATA IS EXPRESSLY PROVIDED 'ASIS' AND 'WITH ALL FAULTS'. The County makes no warranty of fitness for a particular purpose.

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SOUTH PRAIRIE CREEK UPDATES

Flood Damage to Facilities

Since the plan was adopted in 2013, there has been no damage to facilities located on South Prairie Creek.

Status Update on Recommended Capital Projects

SP1 South Prairie Floodplain Acquisition

Project Update: No project update is available at this time.

Estimated Cost: $ 640,380

SP2 South Prairie Fire Station Flood Protection

Project Update: Flood valves on the storm drains in the Fire Station were installed in 2010. This project is complete.

Estimated Cost: **$ 446,400**

See Figure 27

Figure 27

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MIDDLE NISQUALLY RIVER UPDATES

Flood Damage to Facilities

There are no flood control facilities in this reach.

Status Update on Recommended Capital Projects

MN1 McKenna Area Flood Plain Acquisition and Structure Elevation

Project Update: No project update is available at this time.

Estimated Cost: **$12,245,868**

UPPER NISQUALLY RIVER UPDATES

Flood Damage to Facilities

Table 5.48 Damage to Facilities in the Past 20 Years along the Upper Nisqually River has been reformatted, revised and updated to include current damages since between 1990 and 2017.

Table 5.48 Damage to Facilities in the Upper Nisqually River 1990-2017

Storm Season	Bank	River Mile	Damage Lineal Feet	Damage
1991				
1991	Right		0	Gravel removal & dike construction.
2003				
2003	Right	64.7	219	Partial washout of the toe and levee facing.
2003	Right	64.8	137	Partial washout of the toe and levee facing.
2003	Right	65.0	547	Partial washout of the toe and levee facing.
2004				
2004	Right	64.8	1200	Partial washout of the toe and levee facing.
2005	Right	65.1	850	Partial washout of the toe and levee facing.
2005	Right	65.13	70	Partial washout of the toe and levee facing.
2006				
2006	Right	64.6	200	Face erosion.
2006	Right	64.9	100	Washout
2006	Right	65.1 - 65.4	1600	Washout
2008				
2008	Right	64.8	400	Toe scour and loss of face rock.
2008	Right	65.1 - 65.3	1150	Toe Scour and Loss of face rock.
2008	Right	65.3 - 65.4	600	Toe scour and loss of face rock.
2010				
2010	Right	65.25 - 65.4	700	Severe toe scour.
2011				
2011	Right	64.6	150	Toe & face scour.
2011	Right	65.05 - 65.25	1100	Severe toe scour.

Table 5.48 Damage to Facilities in the Upper Nisqually River 1990-2017				
Storm Season	**Bank**	**River Mile**	**Damage Lineal Feet**	**Damage**
2012				
2012	Right	64.65	100	Active toe scour w/ face sloughing.
2012	Right	64.75	100	Active toe scour w/ face sloughing.
2012	Right	64.85 - 65.05	1000	Severe toe scour and loss of lower face.
2015				
2015	Right	64.8	320	Missing face rock near toe.
2015	Right	65.4	300	Major toe scour along the road.
2017				
2017	Right	65.4	300	Toe scour and loss of face rock.
2017	Right	64.77	90	Under cut toe, dislodged riprap, voids.
2017	Right	64.97	200	Toe rock failure.
2017	Right	65.02	30	Toe rock may be missing.
2017	Right	64.6	150	Toe rock has been scoured out.

Status Update on Recommended Capital Projects

See Figure 29

Figure 28: Image of the Upper Nisqually site. December 2017.

UN1 Nisqually Park Subdivision Levee Protection/ UN 2 Upper Nisqually/Mt. Rainier National Park Revetment Retrofits/ELJs

Project Update: The UN1/UN2 projects have been combined into one project and are delineated by the Mount Rainier National Park (MNRP) boundary. The project continues upstream from the park boundary 2100 L and downstream 2600LF. This project consists of constructing 28 flow deflectors along the existing levee to redirect damaging high flows away from the face of the levee, reducing reoccurring damages, and increasing the flood protection of the MRNP access road. Primary benefits for this project are habitat improvement and flood risk reduction.

Estimated Cost: **$1,683,172**

564th St Ct E
380th Ave Ct E
565th St Ct E
382nd Ave Ct E
566th St E
383rd Ave Ct E
567th St Ct E
382nd Ave Ct E
568th St Ct E
384th Ave Ct E
386th Ave E
387th Ave Ct E
570th St Ct E

Mount Rainier
National Park

706

64.3
64.4
64.5
64.6
64.7
64.8
64.9
65
65.1
65.2
65.3
65.4
65.5

Nisqually River
Pierce County
Lewis County
Nisqually Park

Figure 29

River Flood Hazard Management Plan

UN1 Nisqually Park Levee Protection and UN2 Upper Nisqually/ Mt. Rainier National Park Revetment Retrofit/ELJs

- River Milepost
- Levee
- Highway
- Residential Road
- Water Body
- National Park
- County Boundary

Pierce County

N

3/6/2018

0 250 500 Feet

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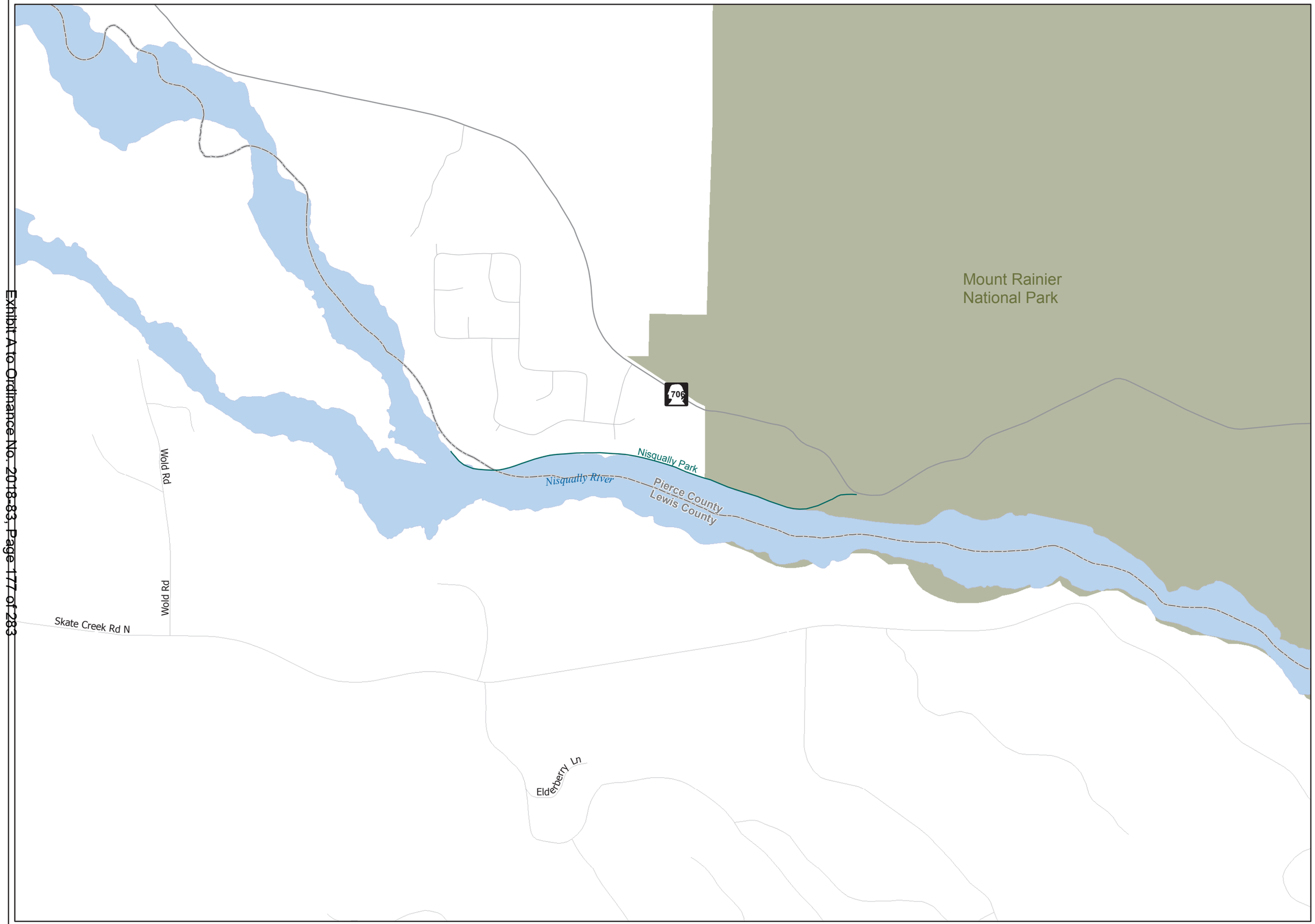

Figure 30

River Flood Hazard Management Plan

Pierce County Levees and Revetments: Upper Nisqually River

- Levee
- Highway
- Residential Road
- Water Body
- National Park
- County Boundary

Pierce County

N

3/6/2018

0 0.1 0.2 Miles

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MASHEL RIVER UPDATES

Status Update on Recommended Capital Projects

M1 – SR-161 Mashel River Bridge – Bridge Scour and Slope Repair Project

Project Update: WSDOT completed this project.

Estimated cost: $2,246,948- $2,808,685

CHAPTER FIVE ERRATTA

The errata sheet for Chapter Five focused on providing clarifications, revised river miles, updated numbers to reflect changes between 2013 and today, updated information on current flood damages, updates on channel migration hazards, and other minor errors in facts or spelling.

CHAPTER SIX
FLOOD PLAN IMPLEMENTATION AND FUNDING

PLAN IMPLEMENTATION

Role of Tribes in Implementation

Representatives from two tribes were invited and participated in the Flood Plan Advisory Committee to provide input on Plan development and ensure their views and concerns were addressed. The importance of maintaining good relationships with the local tribes cannot be understated. Pierce County is committed to continuing to coordinate and communicate with the tribes as the projects, policies, and strategies described in this plan and future updates are implemented.

Role of Tribes in Flood Hazard Management Planning

The Disaster Mitigation Act of 2000 requires a FEMA mitigation plan for State, local, and tribal governments as a condition of mitigation grant assistance. The Puyallup Tribe of Indians Mitigation plan was completed in 2012 and was a compilation of over five years of work. In accordance with Federal requirements, the Puyallup Tribe of Indians developed an All Hazards Mitigation plan that was adopted and approved in 2017 and will expire in 2022.

One of many elements to having a FEMA approved mitigation plan is to develop mitigation measures to help achieve goals and objectives to reduce the effects of flood hazards on the reservation. Strategies identified within the Puyallup Tribe of Indians Hazard Mitigation Plan include:

- Join the NFIP- The Tribe will continue to evaluate joining the National Flood Insurance Program over the next five years and the county is committed to providing assistance throughout this process.
- Development of a floodplain ordinance and resolution. Currently, the tribe does not have an ordinance that outlines floodplain regulations but they continue to make progress to develop one.

For additional information on the Puyallup Tribe of Indians All Hazards mitigation strategies, please refer to the link below:

http://www.puyallup-tribe.com/publicsafety/hazard_mitigation_plan/2017Section_5_PTI%20Mitigation.pdf

As a result of extensive research that has been developed on the impacts of climate change, the Puyallup Tribe of Indians also developed a Climate Change Impact Assessment and Adaptation Plan in 2016. This plan is being used as one of many models to develop the Pierce County Climate Change Resilience Strategy.

For additional information on this climate plan, please refer to the link below:

http://www.puyallup-tribe.com/tempFiles/PuyallupClimateChangeImpactAssessment_2016_FINAL_pages.pdf

Role of Tribes in Planning, Implementation, and Permitting

The county and the tribes have continued to work collaboratively before and after flood events. Repairs of levee damage continue to be expedited when scour cuts occur along the face of levees that are near the reservations. A levee vegetation management program was started in 1985 which outlined a basic policy of cooperation between the Puyallup Tribe of Indians and Pierce County. The goal of this program was to set standards for riparian vegetation management, removal, and maintenance.

The tribes have also assisted the county with long term habitat improvements through improved flood risk reduction and mitigation efforts. The Puyallup Tribe of Indians was highly instrumental in assisting the County with the Soldiers Home Setback project (RM 21.3 and 22.3). The project restored an estimated 70-acres of Puyallup River floodplain to historic pre-levee conditions for fish and wildlife. Restoration was accomplished by constructing a new setback levee and setting it back approximately 950 feet from the Puyallup River. The new setback levee provides increased flood protection (100-year level of protection) as well as it allows the river to naturally meander in the opened floodplain area. The Puyallup tribe contributed $2.3 million in Natural Resource Damage Assessment (NRDA) funding for this project. This grant program provides for the protection of public resources through

Figure 31: Image of the Soldiers Home Setback Levee

Figure 32: Image of the Soldiers Home Setback Levee

mitigation planning and approval.

The Puyallup Tribe of Indians also assisted the county with the 96th Street Oxbow which was an identified project in the Puyallup Tribe Fisheries Site Restoration Catalog. This project replaced an existing culvert under the Puyallup River levee located north of the 96th Street East bridge along the Puyallup River (about RM 14.1) and reconnected an oxbow and an associated wetland to the main stem of the Puyallup River. A $60,000 flood study was

required as a part of this project. This cost was split between the Puyallup Tribe of Indians and the United States Army Corps of Engineers (USACE).

The Muckleshoot and the Puyallup Tribe of Indians have also partnered with the County to reduce flood risks and channel migration zone issues along the major rivers. In 2003, the Muckleshoot Tribe provided input on the Geomorphic Evaluation and Channel Migration Zone Analysis for the Puyallup, Carbon, and White Rivers. In 2008, the Puyallup Tribe provided valuable input on the Levee Setback Feasibility Analysis for the Puyallup River. More recently in 2017, the County conducted a channel migration zone (CMZ) study along the Greenwater River where the Muckleshoot tribe provided valuable data and aerial photos to assist Geo Engineers with completing this study.

FUNDING

The 2013 Flood Plan recommended a new county-wide funding source which has since been implemented. SWM expends up to $8 million per year on floodplain maintenance, programs and capital improvement projects. SWM funds the feasibility, engineering, and construction of capital projects through local and external funding sources. Local funding sources are the SWM Utility Service Charge (SWM Fees) Real Estate Excise Tax (REET), and Flood Control Zone District (FCZD). External funds consist of grants and partnerships from state, local and federal agencies and jurisdictions.

Local Sources of Funding

Grants and Cost-Share Funding

In 2018, external funds such as Flood Control Zone District, and state and federal grants accounted for 54 percent of SWM's River projects, while local funds only made up 46 percent. The primary sources of external funding to implement flood damage and mitigation projects include: The Federal Emergency Management Agency (FEMA), State of Washington Department of Ecology (WDOE) and Salmon Recovery Board Funding (SRFB). Some of SWM's larger capital projects highlighted in the Flood Plan, such as The Orville Road Acquisition and Revetment Phase 2 project (1413) received hundreds of thousands of dollars from multiple agencies simultaneously by leveraging local funds to external grant revenue. This project is one of the County's largest undertakings in achieving multiple benefits with the least amount of local funds. The County was successful by leveraging local funds to maximize external grant revenue. By expanding the scope of the project by including habitat restoration components, the County reduced flood risk to the rural Orting community in a way that benefits threatened species of salmon. This inclusion of habitat restoration for endangered salmonid species increased the ability to obtain state and federal grant funds, which allowed the County to complete a large scale, multiple benefit project with only $300,000 of local SWM funds. The total project cost is almost $8.5 million, approximately $1 million of which is budgeted as local funds. Flood Control Zone District, state and federal grants will account for 88 percent of the total project cost.

This example of the leveraging of funds is the reason SWM can sustain over 30 capital projects at one time. Operating on local funding alone would require more than an 80 percent reduction in capital projects in the Flood Plan.

Surface Water Management Service Charge

In 2018, $3.4 million of the SWM service charges will be directed toward capital projects. This includes $1.7 million of SWM's cash reserve. Capital projects will see a $1 million increase in SWM fee revenue from 2017.

Flood Control Zone District

Since 2014, SWM has received an estimated $11 million for capital projects from the Flood Control Zone District to reduce flood risk and address channel migration problems. For additional information on the projects that the Pierce County Flood Control Zone District funds, please see the link below:

https://www.piercefloodcontrol.org

Future Plan Revisions

Progress of the River Flood Hazard Management plan has been monitored on an annual basis to support the CRS recertification process. This annual reporting will continue. In addition, Pierce County has committed to looking at a full update of the 2013 Pierce County Rivers Flood Hazard Management Plan on a 10-year schedule. The next scheduled full update is targeted for adoption in 2023. Our understanding of flood hazards continues to be more refined. Based on new and emerging information, and a need to update the nine basin plans which address urban flooding, the Pierce County Rivers Flood Hazard Management Plan will be revised to become a comprehensive Pierce County Flood Hazard Management Plan. The plan will be expanded to include sections on:

- Urban flooding;
- Groundwater flooding; and
- Coastal Flooding.

Work on this effort is scheduled to begin in 2019. The new plan will follow the basic concept and layout used in the 2013 Flood Plan and will meet the requirements of Washington Administrative Code (WAC 173-145) related to Comprehensive Flood Control Management Plans, Chapter 86-12 RCW (flood control by counties), the National Flood Insurance Program, and the Community Rating System Program. The plan will use a targeted approach to identify top concerns, problems and priorities and develop programs and project to address these issues.

CHAPTER SIX ERRATTA

The errata sheet for Chapter Six focused on providing clarifications, updated numbers to reflect changes between 2013 and today, and other minor errors in facts or spelling.

REFERENCES

King County. 2013 Flood Hazard Management Plan Update: King County, Washington. King County Department of Natural Resources and Parks, Water and Land Resources Division. Seattle, Washington.

Mauger, G.S., J.H. Casola, H.A. Morgan, R.L. Strauch, B. Jones, B. Curry, T.M. Busch Isaksen, L. Whitely Binder, M.B. Krosby, and A.K. Snover, 2015. State of Knowledge: Climate Change in Puget Sound. Report prepared for the Puget Sound Partnership and National Oceanic and Atmospheric Administration.

Thurston County. 2017 Thurston County Flood Hazard Mitigation Plan. Thurston Regional Planning Council. Thurston County, Washington.

VOLUME II-APPENDICES

Updates to Volume II of the Pierce County Rivers Flood Hazard Management Plan were minor in nature. Minor updates were done in Appendices A, B, C, D, F, and G. Those updates can be found on the website using the link provided below. In addition, a new appendix was added to the document, Appendix K. This appendix provides a brief overview of some of the notifications Pierce County sends out throughout the year regarding flood risk and flood insurance in the county. This appendix can also be found here. No updates were done for Appendices E, H, I, and J.

ERRATA TO THE 2013 FLOOD HAZARD MANAGEMENT PLAN

Volume I
2018

Contents

ERRATA TO THE 2013 FLOOD HAZARD MANAGEMENT PLAN

In addition to the Progress Update, the following sections of the 2013 Flood Plan have been updated to reflect current information and understanding, correct grammar or other factual errors.

EXECUTIVE SUMMARY

ES.2 GOAL AND OBJECTIVES

Page ES-3

Revised Goal 3 and 4:

(1) Reduce risks to life and property from river flooding and channel migration;

(2) Identify and implement flood hazard management activities in a cost-effective and environmentally-sensitive manner;

(3) Support resilient communities, economic activities, and improve habitat conditions in flood-prone and channel migration areas; ~~compatible human uses, economic activities, and improve habitat conditions in flood-prone and channel migration areas; and~~

(4) Continue implementing cost effective river flood hazard activities supported by a long term flexible funding strategy. ~~Develop a long-term and flexible funding strategy for river flood hazard management.~~

Page ES-3 and ES-4

Revised objectives:

(1) Evaluate the risks to public safety and existing development (e.g., critical facilities, infrastructure, and structures) in flood-prone and channel migration hazard areas;

(2) Examine and prioritize opportunities to reduce risk to life and property, while reducing economic environmental impacts of flood hazard management actions and programs; ~~alternatives to reduce risk to life and property, while reducing economic and environmental impacts of flood hazard management actions and programs;~~

(3) Regulate new development in flood-prone and channel migration hazard areas to minimize risks to life, property, and habitat;~~,~~ ~~and strive for consistency of regulations among affected local governments;~~

(4) Review ~~Identify~~ current and establish future "Levels of Service" for existing and new flood risk reduction facilities;

(5) Promote coordination among Pierce County Agencies for consistency of regulations among affected local governments;

~~(5)~~(6) Manage~~tain~~, ~~repair and modify necessary existing~~ flood risk reduction facilities in a cost-effective manner that makes the facilities less susceptible to future damage, reduces impacts on ~~aquatic and riparian~~ habitat, and ensures consistency with public law (PL) 84-99, or similar federal, tribal and state laws and programs;

~~(6)~~(7) Identify repetitive-loss properties and properties needed for future flood risk reduction facilities;

~~(7)~~(8) Identify and examine the connections between floodplain management, salmon recovery, aquatic and riparian habitat, water quality, open space, public access and agricultural resources to take advantage of efficiencies in addressing multiple objectives; ~~Prioritize projects and programs based on the level of risk, benefit, cost-effectiveness over the life of the plan or facility, and adverse effects on habitat;~~

~~(8)~~(9) Prioritize projects and programs based on the level of risk, benefit, cost effectiveness and effects in habitat; over the life of the plan or facility;~~Provide for the participation of stakeholders in the assessment of acceptable risks, evaluation and ranking of alternatives, natural resource management issues and development of recommendations;~~

~~(9)~~(10) Provide for the participation of stakeholders in the assessment of acceptable risks, evaluation and ranking of alternatives, natural resource management issues and in the development of plan; ~~Coordinate among Pierce County departments, other agencies and governments (cities, tribes, adjacent counties) to seek consistency in flood hazard management and flood disaster response and recovery;~~

~~(10)~~(11) Coordinate among Pierce County departments, other agencies and governments to seek consistency in flood hazard management, development regulations and flood disaster response and recovery. ~~Implement a County-wide public education and outreach program to improve flood awareness that includes actions people can take to reduce risks (e.g., flood insurance, flood proofing);~~

~~(11)~~(12) Implement a County-wide public education and outreach program to improve flood awareness that includes actions people can take to reduce their risks (e.g., flood insurance, flood proofing); ~~dentify possible funding sources for implementing the recommended flood hazard management activities;~~

~~(12)~~(13) Identify supplemental funding sources for implementing recommended flood hazard management activities; ~~Examine the connections between flood hazard management, river corridors, salmon recovery, aquatic and riparian habitat,~~

~~water quality, open space, public access and agricultural resources to take advantage of efficiencies in addressing multiple objectives;~~

~~(13)~~(14) Remove or modify existing flood risk reduction facilities, where feasible, ~~-~~to protect, restore, or enhance critical riparian or instream habitat that benefits threatened or endangered species;

~~(14) Identify important riparian, aquatic, fish and wildlife habitat;~~

(15) Protect and enhance natural systems that ~~-~~reduce flood risk ~~prevent flooding~~;

(16) Monitor the effectiveness of projects and repairs to learn from successes, develop long term cost-effective approaches and reduce the need for costly solutions; ~~Adaptively manage implementation to learn from successes, develop long-term cost-effective approaches and reduce the need for costly solutions;~~

~~(17) Incorporate a science-based approach in developing and evaluating alternatives and to monitor implementation;~~

~~(18)~~(17) Increase our understanding and incorporate information about climate change ~~(including potential increases in rainfall, glacial retreat and changes in sediment transport)~~ into flood hazard management decision-making; ~~and~~

(18) Maintain a network of accurate stream flow, weather gauges, and water quality data to inform management decisions. ~~Cooperate with regional agencies in maintaining a network of accurate stream flow and weather gauges, and water quality data.~~

ES.4.1 Guiding Principles and Policies

Page ES-9, third paragraph

Revised text:

Project policy #5 – Flood and Channel Migration Risk Reduction Goals – This policy proposes four "Levels of Service~~flood protection levels~~" for levees that would be applied to different river reaches based on the recommended reach management strategy. The four Levels of Service ~~flood protection levels~~ are:

ES 5.2 PROGRAMMATIC RECOMMENDATIONS

Page ES-14, FPW #14

Revised text:

FPW #14	Flood Education and Outreach Program These recommendations address consistency of education and outreach activities with the CRS program; outreach to floodplain property owners through ~~the annual flood bulletin~~ an annual mailing; promotion of all aspects of the County's flood hazard management program; promotion of flood preparedness and purchase of flood insurance; internal and external coordination and collaboration. *(Pierce County, cities/towns, public)*

Page ES-15, FPW #24

Revised Text:

FPW #24	River Reach Management Strategies This recommendation proposes four management strategies (levels of service ~~protection~~) for levees, two management strategies for revetments, and two non-structural strategies to address flood and channel migration risk reduction goals for different river reaches in the planning area; and encourages promotion of agriculture, recreation and open space as the most compatible land uses in the floodplain. *(Pierce County and cities/towns)*

ES 5.3 CAPITAL PROJECTS

Page ES-17 and ES-18, first paragraph.

Revised text:

The capital improvement projects recommended within the Flood Plan address flooding and channel migration problems which have been identified for each river reach in Chapter 5. Each section of Chapter 5 provides a list of problems identified for the river reach and a description of recommended capital project solutions. The project descriptions provide a general overview of each project. Projects were selected after the completion of an initial feasibility analysis, permitting considerations, assessment of benefits, and project cost estimates. The cost estimates are for capital expenditures only and are preliminary, based on 2017~~1~~ costs at planning design level (approximately 15 percent design level) and the information available at the time. For many of the projects multiple options were considered, however alternatives also had to be compared and filtered to be consistent with the policies and programmatic recommendations in the plan. Of the remaining alternatives, only those ~~which~~ that provided the most benefit for the least project cost were recommended for inclusion in the Plan. Initial project analysis for each project was completed by multi-disciplinary teams of Pierce County staff. The estimates and descriptions provided have been updated to reflect current costs ~~. are~~ and are a starting point for further project development as the Flood Plan is implemented. Additional design and engineering ~~will be~~ is still required for many of the ~~each~~ projects. ~~as they are developed and will be included within the Capital Improvement Element of the Pierce County Comprehensive Plan.~~ The total estimated cost ~~of~~ the 32 capital projects is between ~~$350.8~~ $673,974,588 and ~~$396.4~~ $676,783,273 million (Table ES.4).

Page ES-18, Table ES 4- Proposed Capital Improvement Projects.

Revised estimated costs:

Table ES 4 – Proposed Capital Improvement Projects				
CIP#	**Project Name/Location**	**Preferred Solution(s)**	**Score**	**Estimated Cost (~~2011~~ 2018$)**
Lower Puyallup River				

Table ES 4 – Proposed Capital Improvement Projects				
CIP#	**Project Name/Location**	**Preferred Solution(s)**	**Score**	**Estimated Cost (~~2011~~ 2018$)**
LP1	**Tacoma Wastewater Treatment Plant Flood Wall**, Left bank (RM 2.9 – RM 3.1)	Construct flood wall and storm drain backwater retrofit	65	~~$5,200,000~~ $8,420,966
LP2	**Clear Creek Acquisition/Levee,** Left bank (RM 2.9 and backwater area)	Acquiring floodplain properties and construct a levee along Clear Creek	53	~~$36,000,000 - $55,000,000~~ $55,744,043
LP3	**Oxbow Lake Flooding / Sewer Lift Station Protection**, Right bank (RM 5.0 and backwater area)	Elevate sewer lift station	51	~~$410,000~~ $460,624
LP4	**North Levee Road Setback Levee**, Right bank (RM 2.8 – RM 8.15)	Construct setback levee landward of N. Levee Road	61	~~$104,000,000~~ $315,878,160
LP5	**Puyallup Wastewater Treatment Plant Flood Wall**, Left bank (RM 6.8 – RM 6.9)	Construct flood wall	60	~~$2,500,000 $3,500,000~~ $6,300,000
LP6	**Tiffany's Skate Inn/Riverwalk Flood Wall,** Left bank (RM 8.1 – RM 8.6)	Construct flood wall, and close road at underpass during flood events	44	~~$4,500,000~~ $5,055,633
LP7	**Puyallup Executive Park**, Left bank (RM 9.1 - RM 9.25)	Construct flood wall and establish evacuation plan	48	~~$160,000~~ $179,755
LP8	**Linden Golf Course Oxbow Setback Levee**, Left bank (RM 9.6 – RM 10.5)	Construct setback levee, side channel habitat. Phase II would remove 14-acre landfill	TBD	~~43,000,000~~ $48,309,389
Middle Puyallup River				
MP1	**Rainier Manor / Riverwalk / Rivergrove and SR-410 Flood Wall and Levee**, Right bank (RM 10.6 – RM 11.8)	Construct a flood wall	55	~~$11,000,000~~ $12,358,215
MP2	**McCutcheon Road & 96th Street E. Road Barricade**, Right bank (RM 14.2 – RM 14.9)	Close road with immovable barricade during flood events and conduct post-flood repair	50	~~$50,000~~ $56,173
MP3	**116th Street E. Point Bar Gravel Removal**, Left bank (RM 15.8 – RM 16.0)	Remove 13,700 CY gravel	33	~~$220,000~~ $247,164
MP4	**Middle Puyallup & 128th Street Comp study**, Left and right bank (RM 16.7 – RM 17.4)	Construct setback levees on both left and right banks.	50	~~$12,500,000~~ $14,700,949 (per 2008 Levee Feasibility Study)
Upper Puyallup River				
UP1	**Calistoga Setback Levee,** Right bank (RM 19.9 – RM 21.3)	Construct setback levee and reconnect 46 acres of floodplain	66	~~$18,000,000 - $12,000,000~~

Table ES 4 – Proposed Capital Improvement Projects				
CIP#	**Project Name/Location**	**Preferred Solution(s)**	**Score**	**Estimated Cost (~~2011~~ 2018$)**
				$18,000,000
UP2	**Ford Levee Setback Reach Gravel Removal**, Right bank (RM 24.0 – RM 24.4)	Remove 36,000 CY gravel and construct up to 12 engineered log jams	35	~~$900,000~~ $1,011,126
UP3	**Neadham Road Flooding / Channel Migration Protection**, Right bank (RM 25.3 – RM 27.0)	Construct levee and engineered log jams (phase 1); acquire floodplain properties and abandon roadway (phase 2)	49	~~$8,100,000~~ $14,000,000
UP4	**Orville Road Revetment at Kapowsin Creek**, Left bank (RM 26.2 - RM26.4)	Property acquisition and demolition, removal of remnant levee and construction of engineered log jam/dolotimber revetment	50	~~$1, 500,000~~ $6,773,885
UP5	**Orville Road Channel Migration Protection**, Left bank (RM 26.3 -RM 28.6)	Construct revetment and install engineered log jams; secondary option (and possible long-term solution) is relocation of Orville Road	49	~~$17,300,000 - $38,000,000~~ $8,917,149
UP6	**Puyallup River/Orville Road Revetment and Riparian Habitat Restoration**, Left bank (RM 26.7 – RM 27.1)	Acquire floodplain properties, construct setback revetment along Orville Road, and install engineered log jams	50	~~$3,700,000~~ $1,891,531
Lower White River				
LW1	**State Street Flood Wall or Emergency Access**, Left bank (RM 0.2 – RM 0.3)	*Multiple Solutions*: Construct flood wall or acquire a nearby property and provide emergency access off SR-410 Traffic Ave. exit	53	Up to ~~$2,000,000~~ $1,150,000
LW2	**Lower White River Flood Protection,** Right and~~/or~~ left bank (RM 1.8 – RM 4.9)	*Multiple Solutions*: A combination of log jams, revetments, property acquisition, habitat features, another techniques for flood risk reduction. *(*Project to be completed in multiple phases)*	TBD	~~$28,627,000~~ $88,495,909
LW3	**Butte Avenue Levee/Berm;** Right bank (RM 4.9 – RM 5.5)	Construct a berm and levee	45	~~$1,700,000~~ $6,334,770
Upper White River				
None				

Table ES 4 – Proposed Capital Improvement Projects				
CIP#	**Project Name/Location**	**Preferred Solution(s)**	**Score**	**Estimated Cost (~~2011~~ 2018$)**
Greenwater River				
None				
Carbon River				
C1	**Carbon Confluence Setback Levee**, Left bank (RM 0 – RM 0.4)	Construct setback levee	45	~~$5,300,000~~ $5,954,413
C2	**Carbon Levee Bank Stabilization / Flow Deflection and Coplar Creek Backwater Improvements**, Left bank (RM 3.2 – RM 4.9)	*Multiple Solutions*: Construct engineered log jams and box culvert for Coplar Creek	48	~~$2,700,000~~ $3,033,380
C3	**Alward Road Floodplain Acquisition**, Left bank (RM 6.0 – RM 6.4)	Acquire flood-prone properties	47	~~$1,200,000~~ $1,348,169
C4	**Alward Road Floodplain Acquisition and Setback Levee**, Left bank (RM 6.4 – RM 8.3)	Acquire floodplain properties and construct setback levee	56	~~$29,600,000~~ $27,517,187
C5	**Upper Carbon/Fairfax Road Bank Stabilization**, Left bank (RM 22.4 – RM 24.0)	Construct engineered log jams	48	~~$1,500,000~~ $1,685,211
South Prairie Creek				
SP1	**South Prairie Floodplain Acquisition**, Right bank (RM 1.6 – RM 3.5)	Acquire floodplain properties	53	~~$570,000~~ $640,380
SP2	**South Prairie Fire Station Flood Protection**, Left bank (RM 6.0)	Extend existing flood berm and install backflow prevention valve	50	~~$27,000~~ $446,400
Middle Nisqually River				
MN1	**McKenna Area Floodplain Acquisition**, Right bank (RM 21.6 – RM 22.0)	Elevate existing residential structures and acquire flood prone properties	45	~~$10,900,000~~ $12,245,868
Upper Nisqually River				
UN1*	**Nisqually Park Levee Protection**, Right bank (RM 64.3 – RM 64.9)	Construct engineered log jam structures adjacent to existing levee	50	~~$2,000,000~~ ~~$4,000,000~~ $841,586
UN2*	**Upper Nisqually / Mt. Rainier National Park Revetment Retrofit / ELJs**, Right bank (RM 64.9 – RM 65.3)	Construct engineered log jam structures adjacent to existing levee/revetment	61	~~$,500,000~~ ~~$3,500,000~~ $841,586
Mashel River				
M1	**SR-161 Mashel River Bridge Scour and Slope Repair,** Left	Construct bank roughening log structures	52	~~$2,000,000~~ $2,246,948- ~~$2,500,000~~ $2,808,685

Table ES 4 – Proposed Capital Improvement Projects				
CIP#	**Project Name/Location**	**Preferred Solution(s)**	**Score**	**Estimated Cost (~~2011~~ 2018$)**
	bank (RM 5.2 – RM 5.3) and right bank (RM 5.5)			
Total Project Costs				**~~$350,864,400 - $396,364,000~~, $671,086,569 - $673,895,254**

*UN1 and UN2 have been combined into one project.

A cost of inflation calculator was used to update the project costs (https://westegg.com/inflation/), along with the Surface Water Improvement Program document 2018-2023 (https://www.co.pierce.wa.us/ArchiveCenter/ViewFile/Item/5814)

ES.6 PLAN IMPLEMENTATION AND FUNDING

Page ES-21, first paragraph, second sentence.

Revised text:

Pierce County faces significant challenges in the years ahead. The aging system of flood risk reduction facilities, many of which were built in the 1960s or earlier, were built to a lower level of service ~~protection~~ than what is now required to protect transportation, commercial, and residential structures.

ES 6.2 Funding

Page ES-22 to ES-23

Revised text:

One of the four goals of the Flood Plan is to develop a long-term and flexible funding strategy for river flood hazard management (section 1.4). The 2013 Flood Plan recommended a new county wide funding source be established. This recommendation has since been implemented. Current sources of funding include the Pierce County Surface Water Management Fund, which is paid by residents within unincorporated Pierce County, and Real Estate Excise Tax (REET), which is a 0.25 percent tax on the property selling rate prices throughout the county. Other sources of funds consist of grants and partnerships from state, local, federal agencies, and cost sharing with local jurisdictions.

RCW 86.15.025 gave the Pierce County Council the authority to establish ~~either~~a countywide flood control zone districts (FCZD). A FCZD is a special purpose district (government agency) established to specifically address flooding issues. The Pierce County Council authorized the creation of the Pierce County Flood Control Zone District ("District") on April 3, 2011, Ordinance 2011-95S. The District is authorized to construct, operate, and maintain flood control projects to reduce flooding and channel migration risks. Funding for the District is authorized annually through a property tax levy based on total assessed value of taxable property within the district's designated boundaries. The District tax levy under state law

may not exceed 50 cents per thousand dollars of assessed value. Due to potential levy suppression issues as a junior taxing district, the District may not exceed 25 cents per thousand of assessed value. Since the District's formation the property tax levy for the flood control zone has not exceeded 10 cents per thousand.

~~One of the four goals of the Flood Plan is to "develop a long-term and flexible funding strategy for river flood hazard management" (see Section 1.4). This Plan recommends that a new county-wide funding source be established to ensure equitable funding for ongoing implementation of the flood plan, as well as to support system-wide consistency and continuity of flood control maintenance, operations, and improvements.~~

~~Current sources of funding include the Pierce County Surface Water Management Fund, which is paid by residents within unincorporated Pierce County, and Real Estate Excise Tax (REET), which is a 0.25 percent tax on property rates throughout the county. Other sources of funds include designated federal and state funds that are limited and conditionally available in declared flood disasters and through grants. Over the past 20 years (1991-2011) the amount of local funds in total, together with some federal and state funds, expended by Pierce County SWM on river programs, maintenance and operations, capital projects and acquisitions has exceeded $155 million. This averages out to about $7.7 million year over the past 20 years for all maintenance and construction for flood protection on the Puyallup and Nisqually river systems.~~

~~Pierce County's current funding levels do not provide sufficient funding to address the existing needs for flood risk reduction facilities, including maintenance, repair, and capital needs. Existing dedicated funding sources must be enhanced in order for Pierce County to provide adequate flood and channel migration zone hazard services and implement preventive projects and programs to reverse the trends of declining levels of protection~~

ES.6.2.1 Potential New and Enhanced Local Funding

Page ES-23, first paragraph.

Deleted text:

~~RCW 86.15.025 gives the Pierce County Council the authority to establish either countywide or basin-level flood control zone districts (FCZD) that create additional opportunities for new, dedicated funding sources. A FCZD is a special purpose district (government agency) established to specifically address flooding issues. The purpose of the FCZD is to construct, operate, and maintain flood control projects to reduce flooding and channel migration risks. Funding for a FCZD can be initiated through a levy based on total assessed value of taxable property within the district's designated boundaries or through the imposition of fees. A FCZD was created by Pierce County Council Ordinance 2011.95S on April 3, 2012.~~

ES.6.2.2 Future Funding

Page ES-24, first paragraph.

Deleted text:

Future funding of plan implementation is being determined in a separate process carried out by the Pierce County Council. The ~~initiation of the~~ Pierce County Flood Control Zone District was established in 2012. ~~is being evaluated with input from cities, special purpose districts and other stakeholders.~~

CHAPTER ONE
INTRODUCTION

1.2 GEOGRAPHIC SCOPE

Page 1-3, Table 1.2 Planning Area.

Revised Planning Area Table:

Table 1.2 Planning Area	
Puyallup River System (Lower, Middle and Upper)	
Puyallup River From Commencement Bay at RM 0 to Champion Bridge at RM 29	
Lower Puyallup Commencement Bay at RM 0 to the confluence of the White River at RM 10.3	
~~Mid-Puyallup~~ ~~Confluence of the White River at RM 10.3 to the confluence of the Carbon River at RM 17.4~~	
White River	
Lower White From its confluence with the Puyallup River at RM 0 to the King/Pierce County boundary at RM 5.5	
Upper White Near the community of Greenwater from RM 44.4 to RM 50.5	**Greenwater River** From its confluence with the White River at RM 0 to RM 4.0
Mid-Puyallup Confluence of the White River at RM 10.3 to the confluence of the Carbon River at RM 17.4	
Carbon River	
From its confluence with the Puyallup River at RM 0 to RM 8.4 near the intersection of Alward Rd. and 245th Ave E. Upper Carbon River near Fairfax at RM 22.0 – 24.0.	**South Prairie Creek** From its confluence with Carbon River at RM 0 to RM 6.4 at the Town of South Prairie
Upper Puyallup Confluence of the Carbon River at RM 17.4 to Champion Bridge at RM 29	
~~**Carbon River**~~ ~~From its confluence with the Puyallup River at RM 0 to RM 8.4 near the intersection of Alward Rd. and 245th Ave E~~	~~**South Prairie Creek**~~ ~~From its confluence with Carbon River at RM 0 to RM 6.4 at the Town of South Prairie~~
Nisqually River System (Middle and Upper)	
Nisqually River From the McKenna area to Mt. Rainier National Park	

Middle Nisqually McKenna area between RM 21.3 to RM 26	**Mashel River** From the confluence with Nisqually River at RM 0 to the Town of Eatonville at RM 6.8
Upper Nisqually From the community of Elbe at RM 50.5 to Mt. Rainier National Park at RM 65.8	

1.4 GOALS AND OBJECTIVES

Page 1-8, first paragraph.

Revised text:

The 2018 Flood Plan Update and Progress Report ~~and Uupdate~~ includes updated goals and objectives that are more concise to fit the needs of the County staff and the committee members. The 2013 methodology was used to update the goals and objectives. ~~Goals describe broad outcomes that the Flood Plan should achieve as agreed upon by the Flood Plan Advisory Committee. The Goals provide direction and focus towards the end results. The Plan Objectives are more specific statements of action that the Committee agreed would move the Plan towards attainment of the Plan's Goals.~~

Page 1-8, Goal 3 and 4.

Revised Goal 3 and 4:

(1) Reduce risks to life and property from river flooding and channel migration;

(2) Identify and implement flood hazard management activities in a cost-effective and environmentally-sensitive manner;

(3) Support resilient communities, economic activities, and improve habitat conditions in flood-prone and channel migration areas; ~~compatible human uses, economic activities, and improve habitat conditions in flood-prone and channel migration areas; and~~

(4) Continue implementing cost effective river flood hazard activities supported by a long term flexible funding strategy. ~~Develop a long-term and flexible funding strategy for river flood hazard management.~~

Page 1-9 and 1-10.

Revised objectives:

(1) Evaluate the risks to public safety and existing development (e.g., critical facilities, infrastructure, and structures) in flood-prone and channel migration hazard areas;

(2) Examine and prioritize opportunities to reduce risk to life and property, while reducing economic environmental impacts of flood hazard management actions and programs; ~~alternatives to reduce risk to life and property, while reducing~~

~~economic and environmental impacts of flood hazard management actions and programs;~~

(3) Regulate new development in flood-prone and channel migration hazard areas to minimize risks to life, property, and habitat~~;~~ ~~and strive for consistency of regulations among affected local governments;~~

(4) Review ~~Identify~~ current and establish future "Levels of Service" for existing and new flood risk reduction facilities;

(5) Promote coordination among Pierce County Agencies for consistency of regulations among affected local governments;

~~(5)~~(6) Manage~~tain~~, ~~repair and modify necessary existing~~ flood risk reduction facilities in a cost-effective manner that makes the facilities less susceptible to future damage, reduces impacts on ~~aquatic and riparian~~ habitat, and ensures consistency with public law (PL) 84-99, or similar federal, tribal and state laws and programs;

~~(6)~~(7) Identify repetitive-loss properties and properties needed for future flood risk reduction facilities;

~~(7)~~(8) Identify and examine the connections between floodplain management, salmon recovery, aquatic and riparian habitat, water quality, open space, public access and agricultural resources to take advantage of efficiencies in addressing multiple objectives; ~~Prioritize projects and programs based on the level of risk, benefit, cost-effectiveness over the life of the plan or facility, and adverse effects on habitat;~~

~~(8)~~(9) Prioritize projects and programs based on the level of risk, benefit, cost effectiveness and effects in habitat; over the life of the plan or facility;~~Provide for the participation of stakeholders in the assessment of acceptable risks, evaluation and ranking of alternatives, natural resource management issues and development of recommendations;~~

~~(9)~~(10) Provide for the participation of stakeholders in the assessment of acceptable risks, evaluation and ranking of alternatives, natural resource management issues and in the development of plan; ~~Coordinate among Pierce County departments, other agencies and governments (cities, tribes, adjacent counties) to seek consistency in flood hazard management and flood disaster response and recovery;~~

~~(10)~~(11) Coordinate among Pierce County departments, other agencies and governments to seek consistency in flood hazard management, development regulations and flood disaster response and recovery. ~~Implement a County-wide public education and outreach program to improve flood awareness that includes actions people can take to reduce risks (e.g., flood insurance, flood proofing);~~

~~(11)~~(12) Implement a County-wide public education and outreach program to improve flood awareness that includes actions people can take to reduce their risks (e.g., flood insurance, flood proofing); ~~dentify possible funding sources for implementing the recommended flood hazard management activities;~~

~~(12)~~(13) Identify supplemental funding sources for implementing recommended flood hazard management activities; ~~Examine the connections between flood hazard management, river corridors, salmon recovery, aquatic and riparian habitat, water quality, open space, public access and agricultural resources to take advantage of efficiencies in addressing multiple objectives;~~

~~(13)~~(14) Remove or modify existing flood risk reduction facilities, where feasible, ~~-~~to protect, restore, or enhance critical riparian or instream habitat that benefits threatened or endangered species;

~~(14) Identify important riparian, aquatic, fish and wildlife habitat;~~

(15) Protect and enhance natural systems that ~~-~~reduce flood risk ~~prevent flooding~~;

(16) Monitor the effectiveness of projects and repairs to learn from successes, develop long term cost-effective approaches and reduce the need for costly solutions; ~~Adaptively manage implementation to learn from successes, develop long-term cost-effective approaches and reduce the need for costly solutions;~~

~~(17) Incorporate a science-based approach in developing and evaluating alternatives and to monitor implementation;~~

~~(18)~~(17) Increase our understanding and incorporate information about climate change ~~(including potential increases in rainfall, glacial retreat and changes in sediment transport)~~ into flood hazard management decision-making; ~~and~~

(18) Maintain a network of accurate stream flow, weather gauges, and water quality data to inform management decisions. ~~Cooperate with regional agencies in maintaining a network of accurate stream flow and weather gauges, and water quality data.~~

1.5 GUIDING PRINCIPLES

Page 1-10, first paragraph.

Revised text:

Guiding principles are the facts, scientific foundation, and broad philosophy agreed upon by the Flood Plan Advisory Committees. ~~-~~The 2013 Guiding principles were updated during the plan update process to be more concise and comprehensive based on input from ~~to fit the needs of~~ County staff~~-~~ and the committee members. The 2013 methodology was used to update the guiding principles. Below is a summary table of the changes. ~~The guiding principles from the 2013 flood plan were updated to be more concise to fit the needs of County staff and the committee members. that guided development of plan~~

~~recommendations and capital projects. These principles serve as a frame of reference for evaluating flood risks, identifying the range of management alternatives, and developing recommendations. Together, the goals and objectives, and guiding principles also provided a basis for the development of the flood plan policies presented in Chapter 3.~~

Page 1-10 and 1-11.

Revised guiding principles:

(1) River flooding and channel migration are natural processes that continually form and alter river valleys and the floodplain landscape. Rivers transport water, sediment, and woody material that may threaten public safety and infrastructure in flood prone areas. Biological productivity and diversity are sustained by natural riverine processes, such as flooding, that create and alter aquatic habitats that sustain fish and wildlife species.

(2) Activities in the watersheds impact flooding, channel migration, habitat, ground water, **and water quality** within the river corridor**.** ~~**ons in the upland and upstream portions of watersheds impact flooding, channel migration, and water quality** within the river corridor. Sources of sediment and pollution from human activities like logging and urbanization also impact water quality and habitat.~~

(3) Flood damage creates financial costs, both public and private. Effective flood hazard management can reduce long-term damage costs. Public infrastructure~~, such as roads, utilities, levees, revetments and dams,~~ and private improvements ~~such as homes, businesses and structures~~ located in the floodplain~~,~~ are vulnerable to flood damage. ~~As the budgets of federal, state, and local governments tighten, the amount of funding available for flood hazard management is reduced.~~ Funding for structural flood risk reduction projects is limited and continues to be reduced.

(4) A river and its valley floor, including adjacent floodplains, floodways, and potential channel migration areas, constitute a corridor through which floodwaters flow and within which opportunities exist for ~~various and compatible land uses, including~~ agriculture, recreation, and open space. Floodplains are subject to inundation during flooding events~~,~~ ~~varying in magnitude from the 2-year to 100-year event or larger,~~ depending on the river system and floodplain conditions.

(5) Future development in flood prone areas should be designed to reduce risks to life and property. ~~**within Pierce County, including cities and unincorporated areas if guided away from flood-prone areas, can reduce future risks to life and property.**~~ Adverse impacts of development ~~both inside and outside the floodplain~~ can be minimized by practices that preserve and enhance environmental functions. ~~by development practices that reduce future risks through appropriate regulation and land use, open land preservation and acquisition, multi-objective planning, relocation or elimination of high hazard structures, prohibiting unacceptable encroachments, and establishing ongoing maintenance practices that preserve and enhance environmental functions.~~

(6) Beneficial functions of floodplains and rivers can be achieved by restoring, preserving, and enhancing natural processes. ~~– even if these flood-prone and environmentally sensitive areas are not subject to development in the future, past degradation of them needs to be remedied through restoration and enhancement actions.~~

(7) Adequate and stable funding is necessary for ongoing flood risk reduction activities and maintenance of existing facilities. ~~**The levels of funding for floodplain management should meet demand** within Pierce County (both incorporated and unincorporated areas) to ensure that necessary infrastructure maintenance and improvements meet citizen's expectations and willingness to pay.~~

(8) Protecting and working with, rather than trying to control, natural riverine processes generally will reduce flood risks to people and property in a less costly manner than traditional structural approaches. ~~to flood hazard management, while also benefiting native fish and wildlife and preserving aesthetic landscapes.~~

(9) Communication ~~**with**~~ **and involvement of a diverse groups of citizens,** ~~**and**~~ **stakeholders and** ~~**public and private**~~ **landowners is vital** in developing a responsible, effective flood hazard management plan.

(10) Promote community stewardship and personal responsibility. Flood risk reduction should be a joint effort with private property owners. Assistance programs exist at the State, Federal, and local level for public agencies and individuals. The county will foster localized responsibility for flood risk, water-related resources, and wise use of flood-prone lands. ~~**Assume personal and public responsibility –** we need to revive our ethic of land and water stewardship. The County needs a framework that will foster localized responsibility for flood risk, water-related resources, and wise use of flood-prone lands. Private property rights should be respected when providing flood protection.~~

(11) Leadership and cooperation among affected governments and public agencies ~~**(counties, cities, tribes, and resource agencies)**~~ **is essential** for the success of long-term flood hazard management.

(12) Use an ~~**Advances in technical information and an evolving understanding of flood risks call for an**~~ **adaptive management approach when implementing the flood hazard management plan.** Knowledge and levels of understanding will change over time. ~~**to implementing the flood hazard management plan.** Our knowledge and levels of understanding of risk will change over time – e.g., changing flood maps, new data, etc. We need to learn from approaches and actions that are most effective in achieving the goals and objectives, and then adjust management actions to reflect the latest information.~~

(~~**13)Education**~~**13) Education regarding riverine processes, flooding, and preparedness can raise public awareness** ~~**and**~~ **reduc**~~**e**~~**ing future flood damages and costs.**

1.7.1 Pierce County Comprehensive Plan, Community Plans and Environmental Regulations

Page 1-14, first paragraph.

Revised text:

The Pierce County Comprehensive Plan was developed and adopted in 1995 in response to the requirements of the Growth Management Act and is codified in Title 19A of the Pierce County Code. The Comprehensive Plan addresses thirteen~~ten~~ elements of the natural and built environment: Land Use, Capital Facilities, Cultural Resources, Design and Character~~Rural,~~ Economic Development, Environment, Essential Public Facilities ~~and Critical Areas,~~ Housing, Open Space, Parks and Recreation, Transportation, Utilities, Capital Facilities, and Community Plans~~, and Essential Public Facilities.~~ The Land Use Element, Environment ~~and Critical Areas~~ Element, Utilities Element and Capital Facilities Element include policies regarding flood control for major rivers in Pierce County. Where the Flood Plan departs from the policies within the Comprehensive Plan, future updates, and amendments of the Comprehensive Plan will be necessary.

1.7.2 Surface Water Management Basin Plans

Page 1-14, first paragraph, first sentence.

Corrected text:

Surface water management within unincorporated Pierce County is guided by a series of nine~~ten~~ basin specific plans which address flooding of the regulated flood plain within the watershed for tributaries and other water bodies, identify existing conditions which affect storm drainage and surface water, forecasts future drainage conditions, and identify potential solutions for the streams and tributaries not included within the Flood Plan.

Page 1-15, eighth, ninth, and tenth bullets.

Revised text:

- Nisqually Basin ~~(in adoption process)~~
- ~~Upper Puyallup/Carbon River Basin (in development)~~
- White River Basin ~~(in adoption process)~~

1.7.3 Pierce County Natural Hazards Mitigation Plan (PCNHMP)

Page 1-15, second, third, fifth, sixth bullet.

Revised text:

- Protect Life and Property
- Ensure Emergency Services; ~~Continuity of Operations~~
- Increase Public Preparedness

- Establish and Strengthen Partnerships for Implementation
- ~~Protect the Environment~~ Preserve or Restore Natural Resources, and;
- ~~Increase Public Preparedness for Disasters~~
- Promote a Sustainable Economy

Page 1-15 and 1-16, third paragraph.

Deleted text:

The Pierce County Department of Emergency Management is responsible for coordinating the development of the *Pierce County Natural Hazard Mitigation Plan* which includes the divisions and agencies of Pierce County Government. This Pierce County Natural Hazard Mitigation Plan is part of the larger *Region 5 Hazard Mitigation Plan* that includes the mitigation planning of all other governments and local jurisdictions within Pierce County. ~~As part of the adoption process the *Pierce County Rivers Flood Hazard Management Plan* will need to be incorporated by reference into the *Pierce County Natural Hazard Mitigation Plan*.~~

1.7.4 Inter- County River Improvement Agreement

Page 1-16, first paragraph, last sentence.

Corrected text:

Because the Agreement is due to expire at the end of 2020~~19~~, a new agreement will need to be negotiated.

1.7.5 Settlement Agreement between the Puyallup Tribe of Indians and the Federal Government, State of Washington, Local Governments of Pierce County and Private Interests

Page 1-16, first paragraph.

Corrected text:

In 1990, a Settlement Agreement was reached between the Puyallup Tribe of Indians, local governments in Pierce County, the State of Washington, the United States of America, Port of Tacoma, and certain private property owners. Key provisions of this agreement that affect flood hazard management planning, include: (1) numerous additions to the tribe's land base including the submerged lands below the mean ~~ordinary~~ high water ~~mark~~line (riverbed) within the Puyallup River within the 1873 survey area (approximately RM 1.4 to RM 7.2); (2) provisions for substantial restoration of the fishery resource, allowing for future development while lessening impacts on fisheries; (3) resolution of conflicts over governmental jurisdiction; and (4) establishment of a consultation process. A more complete summary may be found in Appendix D.

1.7.6 Vegetation Management Agreement with Puyallup Tribe of Indians

Page 1-16, first paragraph, third sentence.

Corrected grammar:

The Agreement specifies allowable vegetation removal for maintenance activities, sediment berm, ~~and~~ gravel removal, and levee and revetment reconstruction in the Puyallup River Basin.

CHAPTER TWO
MAJOR RIVER FLOODING IN PIERCE COUNTY

2.1.5 Effects of Sediment and Wood on River Flooding and Channel Migration

Page 2-7, first full sentence on page.

Corrected spelling:

Finally, it is difficult to get authorization from permitting agencies, including the Washington State Departments of Ecology, and Fish and Wildlife, the U.S. Army Corps of Engineers, National Marine Fisheries Service, and U.S. Fish and Wildlife Service, and support from the Puyallup, Muckle~~el~~shoot, and Nisqually tribes.

2.2 FLOODING AND FUTURE TRENDS

Page 2-8, third paragraph.

Corrected text:

Since 1962 there have been 16~~15~~ Presidential Disaster Declarations that included flooding in Pierce County. These declarations do not include the many flood responses that Pierce County has responded to that do not qualify as a federal disaster.

2.3 FLOOD HAZARDS AND IMPACTS

2.3.1 Types of Flood-Related Hazards

Page 2-11, second paragraph, first sentence.

Deleted text:

Channel migration results from bank erosion caused by high ~~peak~~ flows and erosive velocities.

2.3.2 Flood and Channel Migration Hazard Mapping

Page 2-13, first paragraph.

Revised text:

Flooding and channel migration potential are mapped by FEMA and Pierce County as a means to identify risks. Flood hazard mapping is carried out by plotting estimated flood elevations generated in a hydraulic analysis onto a topographic map of the river valley. Typically, flood hazard mapping plots ~~maps~~ the extent of water inundation for the one percent annual chance flood (100-year flood event or base flood), and the 0.2 percent annual chance flood (500-year flood event). FEMA's National Flood Insurance Program (NFIP) established the one percent annual chance floodplain as a special flood hazard area

(SFHA) and ~~100-year standard for floodplain mapping as~~ a minimum standard for regulatory and insurance purposes.

Page 2-13, second paragraph.

Revised text:

Flood hazard studies and associated mapping provide critical baseline information for flood hazard management and flood risk reduction. This information is then used to inform land-use decisions, regulate existing and proposed floodplain development, and to evaluate and design flood hazard management projects. If maps are outdated and no longer reflect actual floodplain conditions, there is high likelihood that land use decisions and new development will be allowed that put property and people in flood-prone areas, which increases risk. Inaccurate maps can also put unnecessary building restrictions on some parcels that are mapped as flood prone, but are not in a floodplain. ~~As of the publication of this document, updated floodplain maps (Preliminary DFIRM) have not yet been finalized by FEMA for the Puyallup, Carbon, White, and Mashel rivers and South Prairie Creek. However, these preliminary maps are the best available data and are being used to regulate floodplain development in unincorporated Pierce County~~. On March 7, 2017 Pierce County adopted floodplain maps for all communities in the county except for the Puyallup river near Orting, the lower eight miles of the Puyallup River, and the Carbon River. These areas were secluded from the update due to non-accredited or non-certified levees being in the floodplain. However, these secluded areas do have a flood risk shown on FEMA preliminary maps from 2007 and 2009 that are regarded as best available data. These maps are currently being used along with best available data for changing flood risk.

Page 2-13, third paragraph.

Revised text:

Mapping of the special flood hazard areas (SFHA) was updated by FEMA and ~~preliminary~~ digital flood insurance rate maps (DFIRMs) were issued in 2007~~2005~~ for many of the sub-planning areas (SPAs) as shown in Table 2.4. The extent of increase in SFHA was significant for several SPAs, including the lower Puyallup, upper Puyallup, and Carbon rivers. In particular, the lower Puyallup River experienced an increase of over 300 percent due to the de-accreditation of the levees. When flood mapping was originally undertaken by FEMA in the late 1970's, there was no federal standard for accrediting levees to show protection from the one percent chance flood. ~~1987, the lower Puyallup levees met federal regulations for accreditation as 100-year levees.~~ In 1986, the Code of Federal Regulations, which governs the NFIP, added section 65.10 "mapping of areas protected by levees" which established standards for accrediting levees. However, more recent sediment deposition along the river bed and increases in the estimate of the one percent annual chance flood from 36,800 to 48,000 cfs have raised river water levels so that the levees no longer meet the three feet freeboard requirement for predicted 100-year water levels, which is one of the requirements for federal certification.

Page 2-15, Table 2.5 Area of Severe CMZ within each SPA.

Revised text:

Table 2.5 Area of Severe CMZ within each SPA		
	Sub-Planning Area	**Severe CMZ Area (Acres)**
SPA 1	Lower Puyallup River	38~~75~~
SPA 2	Mid Puyallup River	1019~~1,047~~
SPA 3	Upper Puyallup River	1329~~1,325~~
SPA 4	Lower White River	~~216~~230
SPA 5	Upper White River [a]	NA
SPA 6	Greenwater River [a]	19~~NA~~
SPA 7	Carbon River	~~999~~1,008
SPA 8	South Prairie Creek	~~183~~182
SPA 9	Middle Nisqually River [a]	NA
SPA 10	Upper Nisqually River	~~1,830~~1,546
SPA 11	Mashel River [a]	NA

[a] CMZ has not yet to be determined for these rivers
b CMZ study has not been adopted

2.3.3 Flood Hazard Risk Assessment

Page 2-16, sixth bullet, removed extra period.

Corrected grammar:

- A total of 17 properties were previously considered repetitive loss properties, but have since been mitigated (i.e., purchased and removed from the floodplain). The mitigated properties are all located within unincorporated areas of the Lower Puyallup River SPA. The unmitigated repetitive loss properties are located primarily in the Lower Puyallup River, Middle Puyallup River, and South Prairie Creek SPAs. Of the unmitigated repetitive loss properties, approximately 90 percent have active flood insurance policies in force. ~~.~~

2.3.4 Flood Damages and Impacts

Page 2-20, first bullet, removed semi-colon.

Corrected grammar:

- Category A – Debris Clearance ($3.2 million)~~;~~

2.4 PIERCE COUNTY PARTICIPIATION IN THE NFIP COMMUNITY RATING SYSTEM

Page 2-22, Heading

Corrected spelling

Page 2-22, paragraph 2.

Revised text:

The NFIP provides the financial backing for flood insurance policies within participating communities, making them more affordable to private property owners. The NFIP makes available affordable flood insurance to residents within communities that adopt approved floodplain management regulations that meet or exceed FEMA standards. ~~There~~ The Community Rating System or CRS is an incentive for jurisdictions who practice comprehensive floodplains management and ~~to~~ adopt standards that exceed the minimum standards of the NFIP ~~by reducing the cost of flood insurance premiums within jurisdictions with higher standards. The NFIP makes available affordable flood insurance to communities that adopt approved floodplain management regulations that meet or exceed FEMA standards.~~

Page 2-22, paragraph 3, last sentence.

Revised text:

To continue flood insurance coverage, and be eligible for federal assistance, the County must remain in the NFIP and maintain and enforce its adopted ~~minimum~~ floodplain management regulations.

Page 2-22, paragraph 4.

Revised text:

FEMA created the Community Rating System (CRS) as a reward for communities that do more than meet minimum NFIP requirements. The CRS goals are to reduce or avoid flood damage to insurable property; strengthen and support insurance aspects of the NFIP; and foster comprehensive floodplain management. ~~by taking actions to minimize flood losses and promote public awareness of flood hazards.~~ Community participation in the CRS is voluntary. The CRS offers reduced insurance rates based upon the class rating of a community. The CRS contains ten classes. "Class 1" gives the greatest insurance premium reduction of 45 percent. A "Class 10" community receives no premium reduction. Pierce County entered the program in 1995 and was the first county in the nation to earn a "Class 5" rating and has continued to strive for even better ratings. Pierce County currently holds a "Class 2" rating, ~~one of only three communities in the nation,~~ which results in a premium reduction of 40 percent. Pierce County is one of only three counties in the nation to have a "Class 2" rating, the others are ~~our neighbors~~ King County and Thurston County. ~~Two cities~~ Orting is the only other community in Pierce County currently ~~also~~ participatinge in the CRS

program. ~~The City of Fife entered the CRS program in 2006 and currently has a Class 5 rating, resulting in a 25 percent discount.~~ The City of Orting entered the program in 2008 ~~and has~~ at a Class 6 rating, and currently has a Class 5 ~~-~~rating resulting in a 25~~20~~ percent discount. The County continues to work with other communities to join the program.

Page 2-22, paragraph 5.

Revised text:

Table 2.9 shows a breakdown of Pierce County's 2014~~2011~~ CRS credit. Pierce County continues to strive to improve its program and rating under the CRS program. This will continue to be aided by implementation of the *Pierce County Rivers Flood Hazard Management Plan*.

CHAPTER THREE
FLOOD HAZARD MANAGEMENT POLICIES

3.2 PROJECT POLICIES

Page 3-3, number 5, Flood and Channel Migration Risk Reduction Goals.

Revised text:

5. Flood and Channel Migration Risk Reduction Goals – Flood risk reduction facilities designed to contain floodwaters (e.g., levees), or reduce channel migration (e.g., revetments) should be designed to be consistent with the adopted river reach management strategy. Four levels of service~~flood protection levels~~ for levees include:

Page 3-3, number 5, Flood and Channel Migration Risk Reduction Goals.

Revised text:

Deviations from the level of ~~protection~~ service shall be approved by the manager of the Surface Water Management Division.

3.3 FLOODPLAIN LAND USE POLICIES

Page 3-5, number 2, National Flood Insurance Program.

Deleted text:

2. National Flood Insurance Program – Pierce County and cities and towns with floodplains should participate and maintain good standing in the National Flood Insurance Program and its Community Rating System in order to better protect public safety, reduce the risk of flooding and channel migration hazards to existing ~~public and private~~ property, and achieve flood insurance premium discounts.

CHAPTER FOUR
PROGRAMMATIC RECOMMENDATIONS

4.0 PROGRAMMATIC RECOMMENDATIONS

Page 4-0, Updated Programmatic Recommendations table to include the SWIF elements.

Additional Text:

Programmatic Recommendations							
		Pierce County	Cities	Tribes	Other Agencies	SWIF	SWIF Chapters
4.1 Flood Hazard Information/Mapping/Technical Assistance							
4.1.1	FPW #1 Floodplain Mapping	*	*		*	*	Ch. 5: Risk Assessment Report,
4.1.2	FPW #2 Channel Migration Zone Mapping and Regulation	*	*			*	Ch. 5: Risk Assessment Report
4.1.3	FPW#3 Technical Assistance on Floodplain Information	*			*	*	Ch. 5: Risk Assessment Report
4.1.4	FPW#4 Flood Insurance and the Community Rating System (CRS)	*	*		*	*	Ch. 4: Regional Considerations and Approaches, Ch. 5: Interim Risk Reductions Measures Plan
4.2 Regulations and Management of Land Uses							
4.2.1	FPW #5 Consistent Floodplain Development Regulations	*	*			*	Ch. 4: Regional Considerations and Approaches
4.2.2	FPW #6 Urban Growth Area Expansion	*	*			*	Ch. 5: Risk Assessment Report (pop. at risk, infrastructure at risk, property at risk i.e. economic impacts)
4.2.3	FPW #7 Agricultural Land Uses and Activities	*	*			*	Ch. 4: Regional Considerations and Approaches Ch. 5: Risk Assessment Report Ch. 6: Interim Risk Reduction Measures
4.2.4	FPW #8 Floodplain Acquisition and Home Buyouts	*	*			*	Ch. 4: Regional Considerations and Approaches Ch. 6: Interim Risk Reduction Measures
4.2.5	FPW #9 Home/Structure Elevation and Floodproofing	*	*			*	Ch. 4: Regional Considerations and Approaches Ch. 6: Interim Risk Reduction Measures
4.3 River Channel Management							
4.3.1	FPW #10 River Channel Monitoring	*		*	*	*	Ch. 6: Interim Risk Reduction Measures

Programmatic Recommendations							
		Pierce County	Cities	Tribes	Other Agencies	SWIF	SWIF Chapters
4.3.2	FPW #11 Management of Large Woody Material	*			*		
4.3.3	PR#1/ WR#1/ CR#1 Sediment Management and Gravel Removal	*	*		*	*	Ch. 6: Interim Risk Reduction Measures
4.4 Flood Risk Reduction Facility Repair and Maintenance							
4.4.1	FPW #12 Facility Repair & Maintenance – PL 84-99 Program	*				*	Ch 4: SWIF Vegetation Strategy Ch. 8: SWIF Action Plan
4.4.2	FPW #13 Annual Repair and Maintenance Program	*				*	Ch. 8: SWIF Action Plan
4.5 Flood Education, Flood Warning and Emergency Response							
4.5.1	FPW #14 Flood Education and Outreach Program	*	*	*	*	*	Ch.6 Interim Risk Reduction Measures
4.5.2	FPW #15 Flood Warning and Evacuation System	*	*			*	Ch.6 Interim Risk Reduction Measures
4.5.3	FPW #16 Emergency Response and Flood Fighting	*	*	*		*	Ch.6 Interim Risk Reduction Measures
4.6 Coordination, Adaptive Management and Multiple Benefits							
4.6.1	FPW #17 Incidental Take Authorization	*		*	*		Ch.4: Regional Considerations and Approaches
4.6.2	FPW #18 Adaptive Management	*					
4.6.3	FPW #19 Climate Change	*			*		
4.6.4	FPW #20 Habitat and Riparian Areas Mitigation	*		*	*		Ch.4: Regional Considerations and Approaches
4.6.5	FPW #21 Public Access to Rivers	*	*			*	
4.6.6	FPW #22 Minimizing Water Quality Impacts of Flooding	*	*	*	*	*	
4.6.7	FPW #23 Coordination with Other Jurisdictions, Tribes and Agencies	*	*	*	*	*	Ch.1: SWIF Communication Plan Ch. 4 Regional Considerations and Approaches
4.6.8	PR#2/ WR#2 Inter-County River Improvement Agreement	*			*		Ch. 4 Regional Considerations and Approaches
4.7 Implementation of Capital Projects							
4.7.1	FPW #24 River Reach Management Strategies	*					Ch. 5: Risk Assessment Report Ch. 8: SWIF Action Plan
4.7.2	FPW #25 Levee and Revetment Setback Program	*					Ch. 4: Regional Considerations and Approaches Ch. 8: SWIF Action Plan
4.7.3	FPW #26 Additional Capital Project Analysis	*					

Programmatic Recommendations							
		Pierce County	Cities	Tribes	Other Agencies	SWIF	SWIF Chapters
4.7.4	FPW #27 Transportation – Roads and Bridges	*	*		*	*	Ch. 5: Risk Assessment Report

4.1.1.3 Future Mapping Needs

Page 4-7, paragraph one, fourth sentence.

Corrected spelling:

These floods resulted in damage to areas outside the FEMA~~MEA~~ mapped areas.

4.1.4.1 NFIP and Community Rating System Program

Page 4-15, paragraph two.

Revised text:

Special Flood Hazard Area (SFHA). Policy holders residing outside of the SFHA, a 10 percent discount is given for communities having a CRS Class Rating between 1 and 6; and a 5 percent discount given for communities having a Class Rating between 7 and 9. ~~The City of Fife entered the CRS program in 2006 and currently has a Class 5 rating, resulting in a 25 percent discount.~~ The City of Orting entered the program in 2008 and currently has a Class 5~~6~~ rating, resulting in a ~~20~~25 percent discount.

4.1.4.2 Flood Insurance Participation

Page 4-15, paragraph two.

Revised text:

All homeowners in a special flood hazard area (SFHA) with mortgages from federally regulated or insured lenders are required to buy flood insurance. In recent years there has been an increase in the purchase of flood insurance in the mapped~~-~~ SFHA~~100-year floodplain areas~~. This could be due to recent flood events raising awareness or changes by Congress to the NFIP that greatly increased penalties to lenders for not requiring the insurance. ~~All homeowners in these areas with mortgages from federally regulated or insured lenders are now required to buy flood insurance. However, this only applies to approved and adopted FEMA maps, which are now over 20 years old (mostly dating to 1987). When the new FEMA maps are approved, substantially more residential and commercial structures will require flood insurance.~~

4.2 REGULATIONS AND MANAGEMENT OF LAND USES

4.2.1 Consistent Flood Plain Development Regulations

Page 4-16, header.

Corrected header spelling:

Consistent Flood<u>p</u>~~P~~lain Development Regulations

Page 4-16, FPW #5

Revised text:

FPW #5 – Consistent Floodplain Development Regulations
Recommendations
1. Cities and towns in the planning area of the Flood Plan should adopt policies and regulations that are consistent with <u>current</u>~~2011~~ unincorporated Pierce County critical area regulations for flood hazard areas, including regulating based on the best available data, such as updated flood studies. Regulations should address development in the floodway, zero-rise, compensatory storage and critical facilities (see policies in Chapter 3). Other important considerations include locating development out of the floodplain as feasible, elevating above the base flood elevation, substantial damage and improvement calculations, and non-residential flood-proofing. 2. A regulatory working group should be established to support development of more consistent regulations across jurisdictions and to meet the goals and objectives of the Flood Plan. The group should promote a regional discussion about residual flood risks and appropriate development regulations behind certified levees. 3. Pierce County will provide technical assistance to cities and towns within the planning area of the Flood Plan, in support of aligning their flood hazard regulations with unincorporated Pierce County critical area regulations for flood hazard areas.

4.2.1.1 Management of Floodplain Development

Page 4-17, paragraph two.

Revised text:

An important issue in the management of floodplain development is the data utilized to determine flood risk and the applicability of regulations. As noted in FPW #1, flood insurance studies and FIRMs have been updated for most of Pierce County's major rivers in the past seven years<u>.</u>~~,~~ <u>The maps were adopted in March 2017.</u> ~~but the FEMA maps have not yet become effective and therefore are not required to be adopted by local jurisdictions.~~ Some, but not all, jurisdictions use this best available data for regulating floodplains and floodways. Because of the long process of updating floodplain maps, all jurisdictions should use best available data for development regulation.

4.2.1.4 Development within the Floodway

Page 4-20, paragraph five.

Corrected spelling:

The genesis for the DFF Floodway came from the 1988 US Department of Reclamations study on Dam Failures and downstream hazards which calculated the depths and velocities that are dangerous to structures and a person trying to walk through the flow.

4.2.2 Urban Growth Area Expansion

Page 4-21, paragraph two, first sentence.

Revised text:

Effective June 2010, ~~Chapter 19A.30.010 (Comprehensive Plan – Urban Growth Areas)~~ Title 19A Comprehensive Plan, Chapter 2 Land Use Element of the Pierce County Code was amended to prohibit the expansion of the UGA into the 100-year floodplains of rivers or river segments above 1000 cfs of mean annual flow.

4.2.2.1 Urban Growth Area Expansion

Page 4-22, paragraph three.

Revised text:

Pierce County Surface Water Management should work with Planning and Land Services to revise Chapter 19A~~.30.010~~ to implement the recommendation through a Comprehensive Plan amendment. The jurisdictions of Eatonville, Orting and South Prairie are adjacent to floodplain not covered by RCW 36.70A.110 and should modify their local ordinance to implement this recommendation.

4.2.3 Agricultural Land Use and Activities

Page 4-23, Table FPW#7

Additional text:

FPW #7 – Agricultural Land Use and Activities
Recommendations
1. Pierce County should amend regulations to authorize farmers to quickly and inexpensively remove sediment deposited by floods from productive agricultural land. 2. Pierce County should amend development regulations to allow construction of flow-through nonresidential agricultural structures per the flood fringe standards (such as pier and pile) in the floodway of the lower Puyallup River downstream of Clarks Creek, excluding the Clear Creek floodway. 3. Pierce County should identify publicly owned floodplain lands suitable for agricultural use and work with the agricultural community to improve and promote the current leasing program. 4. Pierce County should amend development regulations to allow composting in floodways and floodplains when accessory to on-site agriculture. Composting activities should be sited in such a location as to comply with fish and wildlife habitat area requirements.

5. Develop a Drainage Management Program to improve drainage on agricultural lands located in floodplains and flood prove areas that includes programmatic permitting for maintenance and provides technical assistance to drainage districts and farmers.
6. Pierce County should work with drainage districts and the farming community to develop a program to separate agricultural drainage ditches from streams and creeks where possible.

4.2.3.2 Farm Support Structures in Lower Puyallup Floodplain and Floodways

Page 4-23, Title.

Revised text: **Support Structures in Lower Puyallup Floodplain and Floodways**

Page 4-23 and 4-24, paragraph one.

Additional text:

The County provides an agriculture building exemption for one story detached agriculture buildings up to 600 square feet. The International Building Code defines an agriculture building as a structure designed and constructed to house farm implements, hay grain, poultry, livestock or other horticulture products. Agricultural structures may not be used as housing, agricultural production, businesses or as a public venue. Agriculture buildings are only exempt from review if they comply with the provisions of Pierce County Code, and are not located within a floodway, wetland, or regulated fish and wildlife species area. Additional information can be found in Pierce County Code 17C.

Page 4-24, paragraph two.

Additional text:

Regulations for the flood fringe allow new structures when meeting certain requirements, such as having the first horizontal member above the base flood elevation (BFE) and having areas below BFE constructed to allow the passage of floodwater, such as pier and pile construction. Piles are mechanically driven or jetted deep into the ground. Piers are vertical structural members that are supported entirely by concrete footings. Both must be embedded sufficiently below the expected depth of erosion to remain stable during floods. These standards can be applied to the lower Puyallup floodway and allow non-residential agricultural buildings with low risk of creating adverse conditions for adjoining areas. Potential Action that could protect farms, farm buildings and equipment, crops and livestock is to allow for the construction of a critter pad/farm sanctuary mound on different areas of a property including floodplain and floodway areas. A critter pad/farm sanctuary mound is an area where approved fill materials raise the ground above base flood elevation (BFE). During flood events, farm equipment, crops harvested and stored, and livestock can move to these elevated safety zones.

King County recently established a program to provide technical assistance to help farmers in the Snoqualmie Valley to locate and construct elevated farm pads including assistance with permits. Since the installation of these elevated pads, the farm community has overall

experienced substantially less losses due to floods. Pierce County should consider doing the same

Page 4-26, Agricultural Ditch Maintenance and Invasive Plants

Add new section and text:

4.2.3.5 Agricultural Ditch Maintenance and Invasive Plants

Poor drainage is a limiting factor for agricultural properties within the floodplain or flood prone areas, particularly in the Puyallup Watershed. Draining excess water off agriculture lands primarily relies on a system of drainage ditches and nearby creeks and streams. Existing drainage systems are constrained by reliance on the county's streams and ditches. The ability of these streams and ditches to be effective are impacted by deferred ditch maintenance by the county or inactive or ineffective Drainage Districts; excessive sediment or invasive plants which clog the streams, and regulatory barriers such as the presence of threatened and endangered fish species which impact the timing and method of ditch or stream improvements.

As part of the Floodplains for the Future Program, a sub group called Farming in the Floodplain Project (FFP) was formed in 2015 to begin looking at agricultural issues within the Clear Creek area, a sub-basin of the Puyallup Watershed. Beginning in 2016 the Farming in the Floodplain Project (FFP) conducted a drainage inventory to understand the complexities of the drainage system and what drainage ditches were a priority to enhance drainage efficiency. Through this experience the FFP worked with stakeholders to identify multiple recommendations to improve drainage on agriculture lands in flood prone and floodplain areas. Although the project was focused on the Clear Creek sub-basin of the Puyallup Watershed, many of the recommendations may apply to improving drainage on agriculture lands located in floodplain and flood prone areas of other parts of the County.

As a first effort towards improving drainage in the Clear Creek area, the FFP conducted an invasive plant removal from drainage ditches in the Clear Creek area. The project involved landowners, farmers, Drainage District 10, and multiple regulatory agencies such as Washington State Department of Fish and Wildlife, Pierce County Planning and Public Works, Tribes, and Washington State Department of Ecology. Following removal of the invasive plants, the FFP and Pierce Conservation District recruited local community volunteers to replant sections of the cleared ditches in an effort to shade out the regrowth of the invasive plants. This work continues to be maintained and monitored for effectiveness.

4.2.4 Floodplain Acquisition and Home Buyouts

4.2.4.3 Grants and Cost-Share Funding

Page 4-26, paragraph one, second sentence.

Revised text:

Specific programs offered by FEMA include Hazard Mitigation Grant Program (HMGP), Pre-

Disaster Mitigation (PDM), and Flood Mitigation Assistance (FMA)., ~~Repetitive Flood Claims (RFC) and Severe Repetitive Loss (SRL)~~.

Page 4-27, bullet three.

Revised text:

- **Flood Mitigation Assistance (FMA)**. The FMA program was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP). The FMA program is focused on mitigating Repetitive Loss (RL) properties and Severe Repetitive Loss (SRL) properties.
  - A **Repetitive Loss** property is defined as a residential property that is covered under an NFIP flood insurance policy and: (a) has incurred flood-related damage on two occasions, in which the cost of the repair, on the average, equaled or exceeded 25 percent of the market value of the structures at the time of each such event; or (b) at the time of the second incidence of flood-related damage, the contract for flood insurance contains increased cost of compliance coverage. Repetitive Loss properties may receive up to 90 percent Federal funding.
  - A **Severe Repetitive Loss** property is defined as a residential property that is covered under an NFIP flood insurance policy and: (a) has at least four separate NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amount of such claims payments exceed $20,000; or (b) for which at least two separate claims payments (includes only building) have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the insured building. Severe Repetitive Loss Properties may receive up to 100 percent Federal funding. ~~The FMA program was created as part of the National Flood Insurance Reform Act of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP). FEMA provides FMA funds to assist states and communities in implementing measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. Cost share for this grant is 75 percent federal and 25 percent local. The State does not cost share in FMA grants.~~

Page 4-27, bullet four and five.

Deleted text:

- ~~**Repetitive Flood Claim (RFC)**. The RFC grant program provides up to $10 million nationwide annually for FEMA to assist states and communities in reducing flood damages to insured properties that have had one or more claims to the NFIP. Cost share for this grant is 100 percent federal and no local cost share is required.~~
- ~~**Severe Repetitive Loss (SRL)**. The SRL grant program provides funding to reduce or eliminate the long-term risk of flood damage to SRL structures insured under the~~

~~NFIP. An SRL property is defined as a residential property that is covered under an NFIP flood insurance policy and: (a) that has at least four NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000; or (b) for which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building. For both (a) and (b) above, at least two of the referenced claims must have occurred within any ten-year period. Cost share for this grant is 75 percent federal and 25 percent local. Local jurisdictions that have an adopted repetitive loss plan strategy qualify for federal share increases to 90 percent with 10 percent local share.~~

Page 4-28, bullets seven, eight, and nine.

Additional text:

- **Floodplains by Design (FbD).** This grant program is offered in the fall of each odd numbered year. It funds large-scale river projects the emphasize the following values; reducing flood risk and damage, ecological restoration and preservation, climate change, tribal support and engagement, enhancing agriculture, creating partnerships and meeting community needs. SWM has received almost $10 million from this program since 2013 and is anticipating upwards of $7.5 million in 2018. These funds are used almost entirely for the Floodplains for the Future program which unites various stakeholders in Pierce County. This program has allowed Pierce County to exponentially expand the scope of the Clear Creek Floodplain Restoration and Acquisition project on the Puyallup River to include agriculture, habitat and flood risk reduction components. This program allows in-kind match which allows Pierce County to ask for larger amounts of grant funding, making this a dependent and successful source of funding for the Flood Plan.

- **Puget Sound Acquisition and Restoration Fund (PSAR).** The Puget Sound Acquisition and Restoration program was created in 2007 to help implement the most important habitat protection and restoration priorities for Puget Sound. Funding is appropriated by the Legislature through the Salmon Recovery Funding Board. Pierce County has received over $1.5 million just in the 2015-2017 biennium and is anticipating almost $400,000 in the 2017-2019 biennium.

- **Puget Sound Acquisition and Restoration Fund Large Capital Projects (PSAR Large Cap).** The Puget Sound Salmon Recovery Council and the Puget Sound Partnership are developed a grant program which funds high priority habitat acquisition and restoration capital projects. SWM has been continuously unsuccessful in applying for this program and has decided to postpone any further applications to this particular grant program as the cost of applying for such a large program greatly outweighs the benefit SWM has received from this program. PSAR Large Cap is under review by SRFB and could experience fundamental changes within the next funding biennium. If the changes to the program increase likeliness

of success, SWM will reexamine its decision to withhold applications in the future for large Flood Plan capital improvement projects.

4.4.2 Annual Repair and Maintenance Program

Page 4-47, FPW #13.

Revised text:

FPW #13: Annual Repair and Maintenance Program
Recommendations
1. Pierce County should continue to perform routine repair and preventive maintenance activities on flood risk reduction facilities damaged from annual high water or flood events and normal wear and tear. 2. The SWIF Plan should be followed as the guide for maintenance of the levees enrolled in the PL84-99 Program. The implementation of the SWIF should be aligned with programmed funding over a 20-year period of implementation (2017-2036). 3. Maintenance work will be prioritized to optimize flood risk reduction. Maintenance deficiencies will be resolved through implementation of the Pierce County SWIF; extended to non-PL84-99 program structures 4. For flood risk reduction facilities where recurring repairs are necessary, Pierce County should continue to evaluate options for focused capital maintenance to build increased structural resiliency and long-term capital solutions to reduce the need for recurring repairs. 5. Pierce County should continue with its current Puyallup River vegetation management program in cooperation with the Puyallup Tribe and in coordination with the U.S. Army Corps of Engineers. 6. The county has implemented the SWIF levee vegetation management strategy. 7. Pierce County should create a Best Management Practices manual that defines the operations, repair and maintenance program and details how to complete the various tasks in a way that minimizes adverse impacts on water resources and habitat. 8. Pierce County should continue to work with resource agencies and tribes to maintain programmatic approval of annual repair and maintenance activities. 9. Pierce County obtained programmatic approval for levee and culvert maintenance work in 2017.

4.4.2.1 Vegetation Management

Page 4-48, Vegetation Management.

Additional section and text:

SWIF- Levee Vegetation Management Strategy

The USACE PL 84-99 program provides an interim vegetation policy allowing for alternative vegetation management strategies to be incorporated into a System Wide Improvement Framework. Vegetation is currently no longer directly a criterion for determining program eligibility (footnote USACE Interim Policy). Indirectly, vegetation may impact the ability to undertake proper visual inspection of the levee, impede vehicular access, or pose a hazard to the structural integrity or operation of the levee structure.

The Pierce County SWIF levee vegetation management strategy (SWIF strategy) represents a local preferred approach to levee vegetation management that balances the needs of flood risk reduction with the habitat needs of salmonids and other aquatic species found within Pierce County river systems. Currently, three of these species are listed as threatened under the Endangered Species Act. The SWIF strategy acknowledges the agreement established by federal decree (United States District Court, Western District of Washington at Tacoma, Case No. C79-269T) between Pierce County and the Puyallup Tribe of Indians relating to vegetation management along the Puyallup River system (Puyallup River Vegetation Management Program (PRVMP)). The SWIF strategy works within the constraints of that Court-ordered agreement and the USACE SWIF interim guidance policy (USACE 2014b). The levee vegetation strategy is driven by Pierce County's need to ensure all PL 84-99 levees within the county's river system meet the USACE inspection criteria to retain PL 84-99 program eligibility.

It is understood that the vegetation management strategy developed for the SWIF may need to be revised as necessary to comply with the PL 84-99 program levee maintenance standards once the USACE provides updated guidance on vegetation management. Current understanding is that vegetation management strategies developed through the SWIF once approved will be honored through the implementation lifetime of the plan.

The goal of the SWIF vegetation management strategy echoes the goal stated in the Puyallup River Vegetation Management Program (PRVMP): to provide for the riparian vegetation habitat requirements of the fish and wildlife resources in conjunction with the basic requirements entrusted to Pierce County of revetment (and levee) integrity and inspection, emergency revetment repairs, river channel capacity, and County road maintenance along tributary streams.

The SWIF strategy provides basic guidelines to help establish an appropriate balance between maintenance of flood risk reduction structures and habitat considerations. The strategy will be implemented annually and monitored for effectiveness and potential impacts to fish and wildlife. The program will be adaptively managed to adjust as identified through routine annual monitoring. This SWIF strategy will be extended as practical to the rivers revetment structures as resources are available for implementation.

The SWIF vegetation management strategy is performance-driven, centered by three main performance considerations:

- Risk – Vegetation management will be performed in a manner to minimize risk to both habitat and flood risk reduction structures.
- Habitat – Vegetation management will be performed in a manner that avoids or minimizes impacts upon fish and wildlife habitat.
- Maintenance – A vegetation management strategy will be developed that is cost-effective and practical to implement

General Levee Vegetation Management Strategies

The following strategies are applied as the basic protocols for all vegetation management applied across the levee prism:

- **Levee vegetation management zones** – Levee vegetation management subzones will be established to reflect the various components of the levee structure relative to the adjacent river habitat. This vegetation management zone guidance is not intended to be prescriptive, but is intended to guide design, construction, long-term maintenance and operations, and decision-making. These concepts may be customized to best serve the unique conditions of each individual PL 84-99 shoreline reach.
- **Levee structure schematics** – Levee vegetation management strategies are applied to various levee structure scenarios, each representing a unique levee construction and orientation to the adjacent river and habitat.
- **Vegetation Removal** - Vegetation will be managed in a manner to maintain PL 84-99 eligibility while minimizing impacts to adjacent habitat. Vegetation will be managed to maintain levee accessibility, "inspectability," and structural integrity.
    - Levee vegetation understory will be thinned to provide visibility and physical access for inspections, retaining clusters of native shrubs and saplings approximately 10 to 25 feet in diameter, for recruitment of future understory native vegetation and overstory trees. The cleared area around the native shrubs will be approximately 8 to 25 feet between clusters, depending on site conditions and character of vegetation present (additional detail is provided in Section 4.8.6).
    - Woody riparian vegetation will be preserved as feasible on the riverside levee slope to provide riparian functions including bank stability, roughness, cover, shade, wood and nutrient contribution, water quality filtering, and moderation of water temperature. Vegetation that provides for shading of adjacent waters will be retained to the fullest extent feasible. Generally, trees six inches in diameter or greater will be retained where possible, unless the tree interferes with minimum inspection access standards, or is considered a hazard tree. The retention of mature trees is a priority, and these trees will not be removed unless the tree presents an unacceptable hazard to people, levee structural integrity, public infrastructure, or adjacent private property. Vegetation maintenance work should be conducted in a way that does not kill or weaken the remaining trees, and retains saplings for continued growth of desirable species. Efforts will be made to identify and retain sapling trees within cluster areas to provide for long-term successional growth of trees. Vegetation on silt benches formed upon levee structures will be

preserved as feasible, unless site conditions indicate underlying structural concerns that necessitate removal.

- Major vegetation clearing to allow for levee repairs will follow the standards of the Puyallup River Vegetation Management Program. At all times, precautions will be taken to protect trees that might be retained as feasible. This may include flagging trees for retention, installing protective construction fencing, and working from the riverside upon a gravel bar in the dry when site conditions allow retention of the larger trees on the levee structure. Areas where vegetation is cleared to facilitate repairs or to remove undesirable vegetation (hazard trees or invasive species) will be replanted with native vegetation per plan details (additional detail is provided in Section 4.8.6).

- **Targeted invasive species removal** – Specified non-native invasive species will be controlled through a programmatic approach of working with resource agencies, tribal biologists, and private property owners.
- **Mature tree preservation** – Mature trees (i.e., those whose diameter at breast height exceeds 12 inches) may exist in sections of the levee where the general maintenance schematics would suggest their removal. Often these trees are integral to the structural integrity of the levee. These special situations will be evaluated on a case-by-case basis using a site-specific levee vegetation risk matrix. Given the importance of retaining large trees within the riparian zone, mature trees will be retained to the fullest extent feasible.
- **Hazardous trees** – Trees that pose a threat to levee structural integrity, nearby structures, people, public infrastructure, or pose an elevated danger to the safety of maintenance personnel will be surveyed and monitored for degree of hazard based on level of risk. High-risk hazard trees will be cut and typically left on site or placed within the river channel to integrate with existing habitat. Medium- and low-risk hazard trees will be monitored. Strategies for assessing and addressing potential hazard trees and reducing the impacts of vegetation removal will be developed.
- **Riparian habitat protection/enhancement** – Riparian vegetation along the levees will be maintained and enhanced with native plantings, and invasive plants removed, to support habitat functions critical to fish and wildlife resources. Riparian native plantings will be provided within the levee vegetation management zone to offset the removal of hazardous trees and removal of vegetation necessary to perform levee repairs
- **Upland zone** – long-term tree preservation and conservation – Due to the dynamic nature of the levee face, interests for long-term riparian tree preservation should be directed to the area beyond the upland side of the levee, with a focus upon the first 200 feet of property (from OHWM) contained within the riverine riparian zone. Efforts will generally be directed to retain the largest mature trees that provide

benefit to thermal cooling, as well as other benefits to habitat. Trees that are removed for levee maintenance or repair will be replaced with replanting upon the upland side of the levee structure for long-term preservation. Since approximately only 20 percent of the riparian corridor associated with the system of PL 84-99 levees is under the control of Pierce County, it will be necessary to work closely with owners of private holdings to provide for additional long-term preservation. As opportunities are made available, land may be set aside in conservation easements where existing native trees will be preserved and the area enhanced with appropriate conifer and deciduous trees. These efforts are best pursued through conservation groups and land trusts outside of the efforts to implement this SWIF. Once implemented, these efforts should help to offset perceived impacts from levee maintenance activities.

- **Large woody debris placement program** – LWD is placed in the river channel to offset the loss of vegetation when levees are repaired, and to offset the short-term impact from in-water levee maintenance work. LWD will generally be placed within the wetted river channel where there is immediate habitat benefit to resident fish in the form of cover, refuge, and rearing habitat. LWD will be allowed to naturalize in the system with root wads intact. LWD will begin to function immediately after placement. LWD will be placed at a ratio commensurate with level of impact.

4.5.1.1 CRS Outreach Criteria

Page 4-51, paragraph one.

Revised text:

The Community Rating System (CRS) ~~currently awards up to 380 points for flood hazard~~ credits education and outreach activities under Activity 330. Activity 330 credits messages that either clearly state what the audience should do (e.g., "Turn around, don't drown" or "Get a floodplain permit from . . .") or that provide some basic information with a note on where to get more information (e.g., "You may live in a floodplain. Find out by calling 555-1234" or "Information on ways to protect your property from flooding can be found at http://piercecountywa.org/3945/Flooding

There are six priority topics that the CRS want to see delivered:

- Know your hazards
- Insure your property for your flood hazard
- Protect people from the hazards
- Protect your property from the hazards
- Build responsibly
- Protect natural floodplain functions

Page 4-51, paragraph one.

Deleted text:

~~A total of 774 points are available for public information activities and approximately 15,000 points are available overall. To receive maximum CRS credit, information must be conveyed to the entire community and floodplain residents on the following ten topics: (1) local flood hazards, (2) flood safety, (3) flood insurance, (4) property protection measures, (5) natural and beneficial functions of the local floodplain, (6) mapping of local flood hazards, (7) flood warning systems, (8) floodplain development permit requirements, (9) substantial improvement/damage requirements, and (10) drainage system maintenance.~~

Page 4-51, paragraph two.

Deleted text:

~~Maximizing CRS credits for flood education and outreach contributes to Pierce County's overall CRS credit which, in turn, reduces flood insurance premium rates. Lower insurance rates are an incentive for residents to purchase and maintain flood insurance.~~

Page 4-51, paragraph three**.**

Revised text:

~~The National Flood Insurance Program (NFIP) is currently revising the 2012 Community Rating System (CRS) manual and proposing significant changes to Activity 330. The proposed changes should allow greater flexibility in planning for and implementing Pierce County's flood education and outreach program.~~ The CRS program recognizes education and outreach projects tailored to the communities needs and delivered on an annual basis and for delivering messages as a response to a flood event. The credit points for annual outreach and flood response projects can be increased by 40% if they are developed and implemented pursuant to a Program for Public Information (PPI). Pierce County should develop and implement a Program for Public Information Program (PPI~~PIP~~) to meet the ~~2012~~ CRS Manual education and outreach requirements. The PIP should be developed by a committee comprised of Pierce County staff and stakeholders, who will conduct a needs assessment, identify target audiences, messages, and projects to implement, and include monitoring and evaluation to ensure the program is efficient and effective. The PIP would be a comprehensive flood education and outreach program.

Page 4-51, paragraph four.

Additional text:

Maximizing CRS credits for flood education and outreach contributes to Pierce County's overall CRS credit which, in turn reduces flood insurance premium rates. Lower insurance rates are an incentive for residents to purchase and maintain flood insurance.

Page 4-51, paragraph five.

Revised text:

The number of homeowners and citizens purchasing and maintaining flood insurance is low in Pierce County. The ~~draft 2012 CRS Manual proposes addition~~ CRS Manual has ~~of~~ a new activity (370) to improve flood insurance coverage in communities. ~~This new activity will provide additional CRS credits to communities.~~ Credit is given for performing a comprehensive assessment of insurance coverage and for developing a program to make improvements. Additional credit is given for monitoring the results of the program.~~who actively encourage citizens and businesses to purchase and maintain flood insurance coverage. Promotion of the flood insurance program, education about flood risks, and awareness about the flood insurance discounts available should increase participation. Prior to~~ With the adoption of the new countywide FEMA floodplain maps, Pierce County should continue to conduct education and outreach to residential and commercial property owners impacted by revised flood insurance coverage requirements.

4.5.2 Flood Warning and Evacuation System

Page 4-52, FPW #15 Flood Warning and Evacuation System, number 4.

Revised text:

FPW #15 – Flood Warning and Evacuation System
Recommendations
1. Pierce County should continue to monitor National Weather Service (NWS) flood information bulletins, advisories, watches, and warnings for information that could impact Pierce County operations, facilities and citizens. 2. Pierce County should monitor the river gauges along all rivers and match the results against the forecast information from the NWS. If there is a discrepancy in the information received, a physical check of the river should be conducted by Pierce County River Watch and/or Surface Water Management. 3. Pierce County should continue to coordinate with Tacoma Public Utilities (operators of Alder Dam) and the USACE (operators of Mud Mountain Dam) and King County (for flows along the White River) regarding reservoir levels, inflows and release rates that affect the magnitude and timing of downstream flood flows and incorporate this information into flood warnings. 4. Pierce County should coordinate with and disseminate information to local public safety answering points (PSAPs) concerning flood advisories, watches and warnings, and conditions as they become available. When required, Pierce County should work with the NWS to alert the public of imminent flooding through various methods, including ~~National~~ NOAA Weather Radio, Pierce County Alert, and when necessary door-to-door notification. In portions of the Puyallup Valley, Pierce County should use the voice messaging from ~~portion of~~ the lahar warning AHAB sirens and the AM 1580 emergency radio station. 5. Pierce County should continue to support the River Watch Program in support of County flood response activities. 6. Pierce County should continue to work in collaboration with the NWS to assist them with climatic gauge station installations so that the NWS can develop and implement new technology for more accurate river flooding forecasts. Pierce County should encourage NWS efforts to develop technology to provide probabilistic river forecasts to improve the information available to emergency managers and responders.

FPW #15 – Flood Warning and Evacuation System

Recommendations

7. Pierce County should develop a stage-discharge/evacuation rating curve or chart for each river system. Pierce County should work with local partners to develop protocols or criteria to guide when evacuation procedures should be implemented.
8. Pierce County should develop flood inundation mapping for various river flow peaks. The range of peaks should reflect 10-yr, 25yr, 50-yr, and 75-yr recurrence intervals.

4.5.3 Emergency Response and Flood Fighting

Page 4-57, Table 4.3

Additional text:

Table 4.3 Federal Flood Disaster Declarations 1964- 2012	
Federal Flood Disaster Declarations	**Notes**
DR-1817-WA—01/06-16/2009	Flooding from a severe storm throughout much of Washington. 23 counties declared.
DR-1734-WA—12/1-17/2007	Flooding throughout most of W. Washington. Pierce County, while having flooding, was not declared.
DR-1671-WA--11/5-6/2006	Major flooding on the Puyallup, Carbon, White, Stuck and Nisqually rivers.
DR-1499-WA--10/2003	Surface flooding
DR-1159-WA--12/96-2/1997	Ice storm, snow and flood. Stafford Act assistance - $83 million, SBA $31.7 million.
DR-1100-WA--1-2/1996	Three deaths in Washington. Stafford Act disaster assistance provided – $113 million. SBA disaster loans approved - $61.2 million
DR-1079-WA--11-12/1995	100-year flood at Alderton on the Puyallup and 50-year flood at La Grande
DR-896-WA--12/1990	Stafford Act assistance provided $5.1 million
DR-883-WA--11/1990	Stafford Act assistance provided $57 million
DR-852-WA--1/1990	Stafford Act assistance provided $17.8 million
DR-784-WA--11/1986	Two deaths. $11 million in private property damage and $6 million in public damage
DR-545-WA--12/1977	16 counties were declared. Very heavy rain in the upper Nisqually caused significant damage.
DR-492-WA--12/1975	13 counties flooded
DR-328-WA--2/1972	King, Pierce and Thurston counties flooding
DR-185-WA--12/1964	Wide ranging flooding affected 19 counties in both eastern and western Washington
DR-4056-WA—1/2012	Washington Severe Winter Storm, Flooding, Landslides, and mudslides

4.5.3.1 County Department Standard Operation Procedures, Mutual Aid and Finance

Page 4-58, paragraph four.

Revised text:

Pre-incident resources, like acquisition of sandbags and sandbagging equipment, are usually funded by grants or approved general fund purchases. Incident specific acquisitions may be purchased outright, come through local agency mutual aid, pre-arranged contracts, or EMAC requests submitted through the Washington State Emergency Management ~~Department~~Division.

4.6.3 Climate Change

Page 4-65, paragraph one.

Revised text:

Climate change in the Pacific Northwest is predicted to have significant effects on flooding and channel migration within Pierce County river systems. More precipitation is expected to fall as rain instead of snow, which could increase the magnitude of fall and winter flooding along the major rivers. ~~As a result,~~ As heavy rain events become more intense, the rates of both erosion and sediment transport are expected to increase (Mauger et al., 2015). ~~flood events may be more frequent and longer in duration.~~ Glacial retreat on Mt. Rainier is expected to continue, exposing large quantities of sediment to transport downstream, potentially increasing aggradation and channel migration in river valleys. It is necessary to account for these changes as part of project and program implementation within the river corridors and floodplains of the planning area.

Page 4-67, paragraph one.

Revised text:

The Climate Impacts Group at the University of Washington completed a report in November 2015 that summarizes the current state of knowledge concerning observed and likely future climate trends in the Puget Sound (Mauger et al., 2015). ~~has made projections for some local rivers based on different modeling scenarios.~~ For example, the extent and the frequency of flooding is projected to increase. Heavy rain events are projected to intensify, increasing flood risk in all Puget Sound watersheds. Continued sea level rise will extend the reach of storm surge, putting coastal areas at greater risk of inundation. In snow-accumulating watersheds, winter flood risk will increase as the snowline recedes, shifting precipitation from rain to snow (Mauger et al., 2015). As watersheds become increasingly rain dominant, streamflow is projected to increase in winter by +28% to 34% on average ~~-~~and decrease in spring and summer by -24% to -31% on average by the 2080's~~, and the timing of peak flow is projected to shift earlier~~ (Mauger et al., 2015). Additionally, t~~T~~he highest river flows are expected to increase by +18% to +55% on average by the 2080s (Mauger et al., 2015). ~~the average increase in 100 year flood flows for the Snohomish River at Monroe for the 2040s is estimated at +20 percent under the A1B greenhouse gas emissions scenario. Generally speaking, 100 year flood magnitudes (Q100 values) are projected to systematically increase in many areas of the PNW due to increasing precipitation and rising snowlines. (The Pacific Northwest Climate CIGnal, Issue #24, Winter 2011).~~

Page 4-67, paragraph two.

Additional text:

The effects of climate change ~~is~~ are also being seen on our glaciers. From 1913 to 1994, Mt. Rainier glaciers decreased by approximately 25 percent. Preliminary data from Mount Rainier National Park indicates that the glacier has lost another 18 percent since 2003. The south-facing Nisqually Glacier has retreated more than one mile since 1840, but in the last

seven years its recession rate has seen a three-fold increase (Abbe et al., 2010). The Emmons and Nisqually glaciers have been measured using a mass balance approach to look at annual changes, comparing winter accumulation and summer melting. In all years between 2003 and 2009, there has been a net melting of the both glaciers between 0.5 and 2.0 m water equivalent (Kennard et al., 2010). Current trends indicate that Mt. Rainer's glaciers and others contributing to summertime stream flows and sedimentation in Puget Sound watersheds will continue to melt as temperatures warm.

Page 4-67, paragraph three.

Additional text:

The Pierce County Council passed Resolution No. R2016-56 which endorsed the Sustainability 2020 Plan on April 26, 2016. One of the goals of this plan is to complete a Climate Change Resilience Strategy for Pierce County. SWM along with other departments have been participating in the development of this plan which is projected to be completed in 2018. Updates on this planning effort can be found on the following webpage;

https://www.co.pierce.wa.us/5558/Climate-Change-Resilience

4.6.5 Public Access to Rivers

Page 4-70 and 4-71.

Deleted text:

~~Rivers and associated riparian corridors are desirable locations for passive or active recreational uses for the citizens of Pierce County. Activities include trail use, fishing, boating, and passive recreation. Within the planning area, there is extensive river mileage with minimal public access. Many fisherman and boaters access the river at unauthorized locations, and numerous people are using the river with few appropriate supporting facilities (e.g., parking, restrooms). The Pierce County Park, Recreation and Open Space (PROS) Plan (Chapter 19D.160) identifies riverfront water access as a high priority and value.~~

~~Some public lands in flood hazard areas may be highly suitable for public use, whereas others may not be due to regulatory issues, liability concerns, easement issues, or compatible use. Levees and revetments that appear to provide public access may be limited by an easement granted exclusively to Pierce County for flood management purposes. Such lands cannot legally be used for public access. Other issues include costs to make improvements for public access, available net-useable land, ongoing operation and maintenance costs, and concerns about potential environmental degradation such as impacts on habitat and water quality due to human traffic and incompatible uses.~~

~~Public access may be appropriate at suitable locations along river corridors, but it is necessary to balance costs, liability, and environmental considerations.~~

4.6.6 Minimizing Water Quality Impacts of Flooding

Page 4-72, paragraph three.

Deleted text:

~~Septic systems and drainfields located in floodplains are at risk of inundation and failure.~~ New development requirements prevent the construction of septic systems and drain fields in floodplains, but pre-existing systems remain a problem in some areas. Such systems need to be carefully managed to reduce risks to water quality.

Page 4-74, paragraph one.

Deleted text:

Pierce County Code 18E.70~~.040.B.8.k~~ addresses chemical storage in floodways. It specifies that "storage of agricultural chemicals, fertilizers, pesticides, and similar hazardous materials shall be permitted only where no other on-site storage alternative outside of the floodplain exists."

4.6.8 Inter-County River Improvement Agreement

Page 4-75, paragraph one, second to last sentence.

Corrected text:

Because this 105-year agreement is due to expire in 2020~~01~~9, it is for both counties to discuss renewal of the agreement before that time. Any proposed changes to the existing agreement need to be negotiated between the two counties, with input as necessary from other impacted parties.

Page 4-76, PR#2/WR#2.

Revised text:

PR#2/WR #2* – Inter-County River Improvement Agreement
Recommendations
1. Pierce County should collaborate with King County to revisit~~new~~ the Inter-County River Improvement Agreement to address flood hazard management activities for the lower White and lower Puyallup River systems. This should include a discussion of capital and maintenance needs, responsibilities, and funding considerations. 2. Pierce County and King County should convene a work group to develop a list of issues for discussion and establish a process and timeline to develop and ratify an agreement to cooperatively fund necessary flood hazard management needs.

4.7 IMPLEMENTATION OF CAPITAL PROJECTS

4.7.1 River Reach Management Strategies

Page 4-78, paragraph one, last sentence.

Revised text:

The ~~vast~~ majority of river risk reduction facilities, ~~which total over~~ is approximately 70 miles

in length (the sum of both left and right banks), lay along the lower 29 miles of the Puyallup River, the lower 5.5 miles of the White River, and the lower 8.4 miles of the Carbon River.

Page 4-78, paragraph two.

Revised text:

Pierce County's Capital Facilities Plan ~~Comprehensive Plan~~ (19E.~~1~~50.130~~1~~0) ~~establishes~~ identifies a level of service for flood risk reduction facilities, and recommends a "storm protection level standard" for water surface elevations of the one percent annual chance flood (i.e., 100-year flood), ~~plus three feet of freeboard for the Puyallup, Carbon, White, Greenwater and Nisqually Rivers~~. The Pierce County Comprehensive Plan (19A.10) refers readers to the Flood Plan for specific information regarding level of service.

Page 4-78, paragraph three.

Deleted text:

~~For several reasons, this level of service has not been achieved. Generally, funds for maintenance and repairs of river management facilities and capital projects have not been enough to achieve the level of service set out in the Comprehensive Plan. Additionally, this "one size fits all" level of service in the Comprehensive Plan does not take into account the significant differences in land use, assessed value, river channel conditions, salmon habitat areas, sediment transport and similar factors~~.

Page 4-78, paragraph four.

Revised text:

This ~~Flood Plan~~Flood Plan recommends levels of service be established which reflect the unique physical and cultural differences~~d~~ among the various reaches of Pierce County's rivers. These recommendations propose to link management strategies to the land uses being protected and other factors noted above. Levels of protection are tailored to flooding and channel migration risks and reach priorities. Management strategies for reaches containing flood risk reduction facilities identify levels of protection goals for levees and revetments. Non-structural management strategies (e.g., floodplain development regulations and acquisition/buyout of flood prone properties) are proposed for all reaches.

Page 4-78 and 4-79, FPW #24.

Revised text:

FPW #24 – River Reach Management Strategies
Recommendation
1. Pierce County should manage flood hazards by river reach and establish structural and non-structural management strategies based on the following factors: (1) existing development and land use patterns in the adjacent floodplain, (2) service level of existing river management facilities (levees, revetments), (3) river channel gradient and width, (4) presence of fish spawning and rearing habitat, and (5) sediment transport conditions (see Appendix F).

FPW #24 – River Reach Management Strategies
Recommendation
2. Pierce County should identify river reach "Levels of Service~~Protection~~" as goals for flood risk reduction facility design and maintenance and to guide future capital projects. Levels of flood protection for levees should include: a. 200-year design, plus three feet of freeboard, b. 100-year design, plus three feet of freeboard, c. Maintenance of existing (2009) conveyance capacity, and d. Maintenance of existing levee prisms. Levels of erosion protection for revetments should include: a. Channel migration prevention design, and b. Channel migration resistance design. 3. Non-structural management strategies (e.g., floodplain development regulations and acquisition, buyout, or purchase of development rights) should be applied to all river reaches to reduce future flood risks. 4. Where feasible, agriculture, recreation, and open space should be promoted as the most compatible land uses within 100-year floodplains.

Page 4-79, paragraph one, last sentence.

Revised text:

If adopted as part of the Rivers Plan, policy changes and amendment of the Capital Facilities Plan ~~Comprehensive Plan~~ will follow.

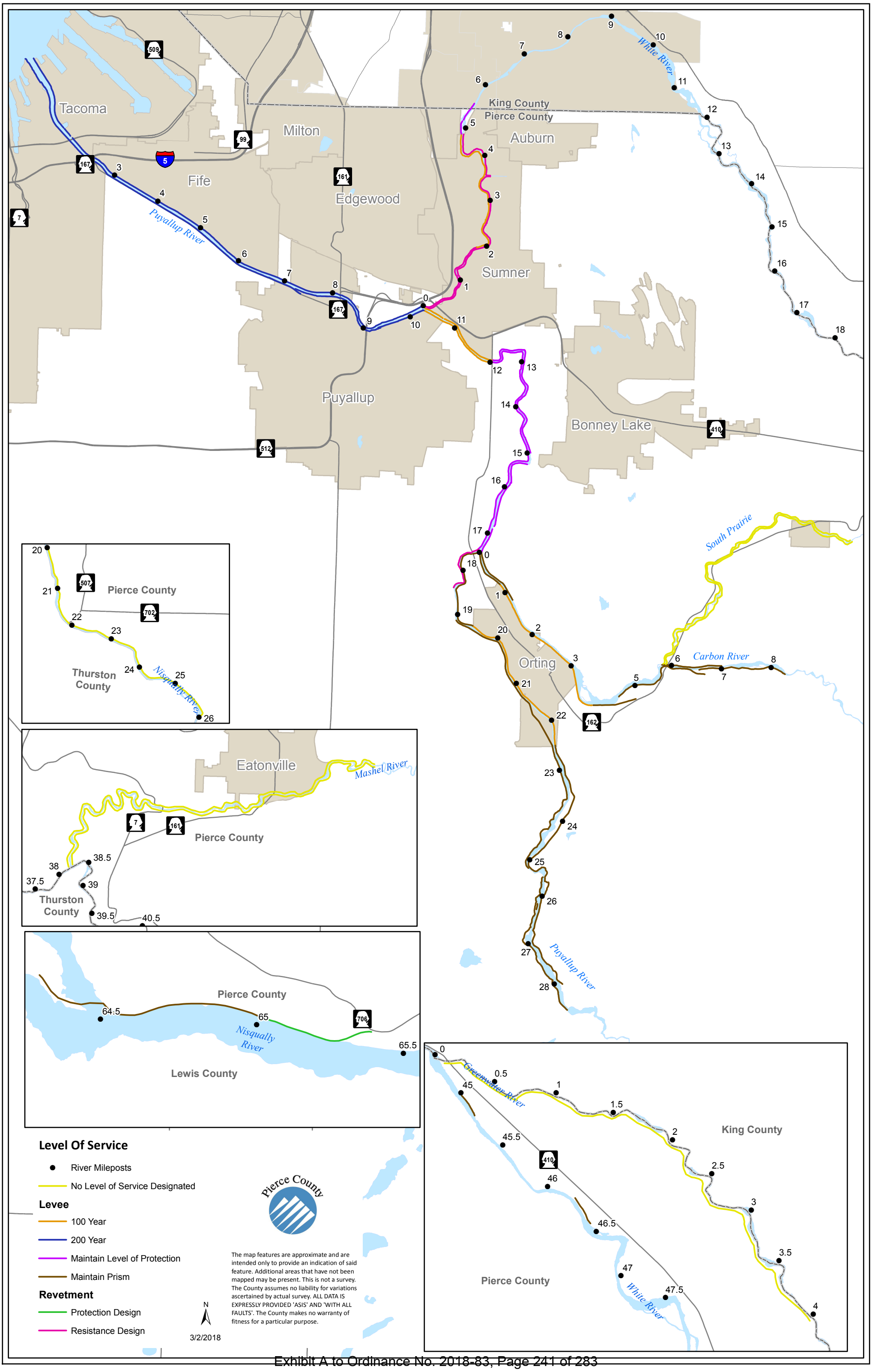
Page 4-80, bullet two.

Revised text:

- **Presence of salmon spawning and rearing habitat** – All rivers in the study area are used by salmon. Salmon presence is impacted in the Upper Puyallup, Upper White, and the Nisqually River by structures that prevent free migration of Salmon & other fish species.~~, with the exception of the upper Nisqually River for which passage is prevented due to existing dams.~~ Migration and rearing occur throughout the study area; however spawning areas vary by species, river gradient and width, substrate conditions and habitat. Chinook, steelhead and bull trout species are listed as threatened under the Endangered Species Act.

Page 4-81, River Reach Management Strategies Map.

Revised map:


Tacoma
Fife
Milton
Edgewood
Auburn
King County
Pierce County
Sumner
Puyallup
Bonney Lake
Orting
Eatonville
White River
Puyallup River
Carbon River
South Prairie
Mashel River
Nisqually River
Greenwater River
Thurston County
Pierce County
Lewis County
King County
509
99
5
167
7
161
512
410
507
702
162
706
Level Of Service
River Mileposts
No Level of Service Designated
Levee
100 Year
200 Year
Maintain Level of Protection
Maintain Prism
Revetment
Protection Design
Resistance Design
N
3/2/2018
The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. The County assumes no liability for variations ascertained by actual survey. ALL DATA IS EXPRESSLY PROVIDED 'ASIS' AND 'WITH ALL FAULTS'. The County makes no warranty of fitness for a particular purpose.

4.7.1.1 Structural Approaches for Levee and Revetment Reaches

Page 4-82, number one.

Revised text:

1. 200-year Level of ~~Protection~~ Service – Levees are designed and maintained to safely convey a 200-year storm event. ~~the 200-year level of protection with three feet of freeboard.~~

   Proposed Application: Lower Puyallup River from the river mouth at Commencement Bay to the confluence of the White River (RM 0 – RM 10.3), including the cities of Tacoma, Fife, and Puyallup, and parts of unincorporated Pierce County. This could include a setback levee along North Levee Road, flood walls or some other approach.

Page 4-82, number two.

Revised text:

2. 100-year Level of ~~Protection~~ Service – Levees are designed and maintained safely convey a 100-year storm event. ~~to the 100-year level of protection with three feet of freeboard.~~

   Proposed application: Most new levees, including setback levees (e.g., Soldiers Home, Calistoga setback levees) and in urban areas (e.g., city centers, high density residential) such as Puyallup, Sumner, Pacific, and Orting, not including the lower Puyallup River.

Page 4-82, number four.

Revised text:

4. Maintenance of Existing Levee Prism – Maintain the existing levee in terms of height, toe and facing rock to ensure minimum standard of levee integrity. In some locations with long-term net sediment accumulation, the level of protection will decrease over time. There is not a commitment to "put the river back" if the levee fails; a repair might be constructed at the new location of the river channel, depending on river conditions, channel migration zone mapping, a post-event evaluation of site conditions, and planned projects. Some river reaches are target for property acquisition and a setback levee or other structures to protect infrastructure and improve habitat.

   Proposed Application: Rural (low density residential) and open space areas, agricultural areas, areas of salmon spawning and rearing (particularly for listed species, including Chinook, steelhead and bull trout). This is proposed for all levee reaches not in the lower and middle Puyallup, lower White or Orting area.

Page 4-83, number two.

Revised text:

2. Channel Migration Resistance Design – This strategy maintains current revetment conditions. Revetment design and river channel management is carried out to "resist" channel migration and river bank erosion. There is not a commitment to "put the river back" if the revetment fails; a revetment repair might be constructed at the new location of the river channel, depending on river conditions, channel migration zone mapping, ~~and~~ a post-event evaluation of site conditions, and planned projects. Some river reaches are target for property acquisition and a setback levee or other structures to protect infrastructure and improve habitat.

   Proposed Application: This design applies to all revetments identified in the 2013 Flood Plan along the Puyallup, Carbon, and White rivers not designated as prevention design, or proposed for conversion to levee to provide flood risk reduction.

4.7.2 Levee and Revetment Setback Program

Page 4-84, paragraph one.

Revised text:

In 2008~~4~~, Pierce County published its Setback Levee Feasibility Study. That study identified 32 potential setback levee flood protection and floodplain/restoration sites for the Puyallup River system. Additionally, in 2014 the Pierce County Water Programs Division hired Natural Systems Design to update the existing Levee Setback Feasibility Study. This update re-evaluated the 32 project sites with respect to existing habitat.

CHAPTER FIVE

5.1 LOWER PUYALLUP RIVER

5.1.1 Overview

Page 5-10, paragraph one.

Revised text:

The lower Puyallup River corridor includes extensive areas mapped as 100-year floodplain, based on the 2009 FEMA Flood Insurance Study (FEMA 2009) and ~~preliminary~~ Digital Flood Insurance Rate Map (DFIRM).

5.1.5 River Management Facilities, Flooding, and Flood Damage

Page 5-18, paragraph two, first sentence.

Revised text:

The lower two and a quarter mile of levee from RM 0.7- RM 3.0 ~~2.8~~ are owned and maintained by the U.S. Army Corps of Engineers.

Page 5-18, paragraph three.

Revised text:

The channel conveyance included straightening of the channel, building levees and making necessary bridge changes to convey 50,000 cfs between the East 11th Street Bridge and RM 2.9. The remaining levees along the lower Puyallup River from RM 3.0 to 10.3 are owned and operated by Pierce County as summarized in Table 5.2.

Page 5-19, Table 5.2 Levees and Revetments in the Lower Puyallup.

Revised text:

Table 5.2 Levees and Revetments in the Lower Puyallup River

Name	Location [a]	Ownership
Right Bank		
Port of Tacoma Revetment	RM 0.0 – RM 0.7	Port of Tacoma
COE Port of Tacoma Levee	RM 0.7 – RM 3.0 ~~2.8~~	US Army Corps of Engineers
North Levee Road Levee	RM 3.0 ~~2.8~~ – RM 8.1~~5~~, PL 84-99	Pierce County
Murphy Levee	RM 8.1 – RM 8.6	Pierce County
Benston/Boatman ~~Levee~~	RM 8.6 – RM 9.7	Pierce County
Old Cannery Levee	RM 9.7 – RM 10.3, PL 84-99	Pierce County
Left Bank		

Table 5.2 Levees and Revetments in the Lower Puyallup River		
Name	**Location [a]**	**Ownership**
Simpson Revetment	RM 0.0 – RM 0.7	Simpson Tacoma Kraft Company
COE Portland Ave Levee	RM 0.7 – RM 3.0 ~~2.8~~	US Army Corps of Engineers
River Road Levee	RM 3.0 ~~2.8~~ – RM 7.45, PL 84-99	Pierce County
Tiffany's Revetment	RM 7.45 – RM 9.4 ~~8.6~~	Pierce County
Linden/Flashcube Revetment	RM 9.35 ~~8.6~~ – 10.7	Pierce County

[a] RM = river mile; PL 84-99 USACE Flood Control and Coastal Emergency Act
Source: USACE and Pierce County Surface Water records

5.1.5.1 Major Flooding

Page 5-21, paragraph one.

Revised text:

Major flooding occurred in the lower Puyallup River in 1917, 1933, 1965, 1977, 1986, 1990, 1996, 2006, and 2009 (see Table 5.4). The largest flood on record since construction of MMD occurred in January 2009, with a flow of 48,200 cfs, an approximately 100-year event in the lower Puyallup River based on current flood frequency flow estimates (FEMA 2009). Flows in excess of 45,000 CFS are considered severe with significant flooding expected. Moderate flooding occurred in the lower Puyallup in November 2014, and again in October, November, and December 2015.

Page 5-21, Table 5.4 Historical Flooding in the Lower Puyallup River.

Revised text:

Table 5.4 Historical Flooding in Lower Puyallup River	
Date	**Puyallup River Flows at Puyallup Gauge (cfs)**
December 1915	39,800
December 1917	40,500[a]
December 1933	57,000[a]
October 1934	39,500
January 1965	41,500
December 1977	40,600
November 1986	43,800
January 1990	44,800
November 1990	41,900
February 1996	46,700
November 2006	39,700

January 2009	48,200
December 2015	39,800

[a] Mud Mountain Dam (constructed on the White River in 1946) not in place
Source of data: USGS Puyallup Gauge flow records

5.1.5.2 Flood Damage to Facilities

Page 5-21 and 5-22, paragraph one.

Additional text:

Flood damages to Lower Puyallup River flood risk reduction facilities generally been pretty mild in the past three ~~-~~decades. However, two substantial repairs have been made to repair damages due to erosion and one repair to fix fractured concrete panels. Damages from major floods and high-water events between 1990 – 2017 have resulted in approximately 24 identified damage locations comprising 0.6 mile of levees and revetments. Damages have been estimated at nearly $2.15 million dollars (based on 2017 dollars). The table listed below summarizes recorded levee and revetment damages. No significant flood damage is currently apparent along the lower Puyallup River reach. There are isolated locations along the reach where repairs have occurred. The system is approximately 100 years and showing signs of its age. Pierce County maintenance crews annually inspect and monitor the reach and implement repairs when necessary.

5.1.6.2 Land Purchases

Page 5-23, Caption for figure 5.8.

Revised caption text:

Figure 5.21 - – (a) RM 11.0-11.5 Flooding of residential structures in Sumner in 2006, and (b) looking downstream from RM 17.0, rural residential and farmland in unincorporated Pierce County in 2006

5.1.7 Flood and Channel Migration Hazard Mapping

5.1.7.1 Flood Hazard Mapping.

Page 5-24, paragraph one.

Revised text:

Hazard mapping in the lower Puyallup River includes detailed flood studies (FEMA ~~2009~~, NHC 2006) showing significant flood hazards in the lower Puyallup ~~v~~Valley. The flood hazards were~~are~~ identified because ~~due to~~ the existing levees are not ~~being~~ built high enough to meet current FEMA standards. ~~accredited by FEMA because they cannot demonstrate that the levees provide enough to show protection from flooding. and the creation of preliminary~~In order to publish the countywide Digital Flood Insurance Rate Maps (DFIRM~~),~~), the areas behind the ~~that were affected by~~ non-accredited levees were ~~"~~secluded from the map update. This means that most of the lower Puyallup valley is ~~still~~ showing the old ~~same~~ flood risk as it was understood in the 1970's. In t~~T~~he FEMA~~a~~/NHC study ~~identified~~which as of ~~this publication of this document have not been issued by FEMA.~~ f ~~F~~lood risk~~prone~~ areas

along the lower Puyallup River ~~that~~ include extensive industrial, commercial, residential, and agricultural land uses along the right bank at the Port of Tacoma; cities of Tacoma, Fife and Puyallup~~; and unincorporated Pierce County~~. ~~In unincorporated Pierce County, these identified areas are being regulated using the best available data even though they do not show up on the DFIRM.~~ Along the left bank, there are fewer commercial and industrial uses, but extensive residential and agricultural uses, and public infrastructure. In unincorporated Pierce County, flood risk areas behind the levees are being regulated based on the risk of a levee failure or overtopping even though this risk is not shown on the DFIRM. The Tacoma wastewater treatment plant, on the left bank between State Route 509 and Lincoln Avenue, is an example of a critical facility along the lower Puyallup River potentially subject to flooding. The ~~preliminary~~ DFIRM maps for the lower Puyallup show ~~4,494~~1211 ~~-~~acres within the special flood hazard area (SFHA) or 100-year floodplain and unincorporated Pierce County regulates an additional 942 acres as flood fringe~~.~~ The mapped deep and fast flowing area is 1,087 acres.

5.1.7.2 Channel Migration Hazard Mapping.

Page 5-24, paragraph one.

Revised text:

Channel Migration methods require measuring changes over the period of record. No channel migration zones have been mapped for the lower river due to the river being confined between the levees for the last hundred years. ~~attenuation of flood flows from Mud Mountain Dam. Few levee repairs have been documented since construction of the dam.~~ The regulated FEMA floodway within existing levees is the default channel migration zone (CMZ) for the lower Puyallup River according to Pierce County Code 18E~~.70.020~~. ~~The severe CMZ covers an area of 27 acres.~~

5.1.8 Problem Identification

Page 5-25, Table 5.6 Priority Problems Identified in Lower Puyallup River.

Revised text:

Table 5.6 Priority Problems Identified in Lower Puyallup River		
Location	**Problem Description**	**Source**
Levee and Revetment Overtopping and Breaching		
RM 2.9 – RM 3.1 LB	Levee overtopping potential upstream threatens Tacoma Wastewater Treatment Plant	City of Tacoma
RM 2.8 - RM 8.15 RB	De-accredited North Levee Rd. levee results in increased flood risk for infrastructure and property	City of Fife, Tacoma, Pierce County, Port of Tacoma
~~RM 4.4 -~~ RM 4.45 RB	Settlement of levee at Sha-Dadx restoration site causes road settling and possible future destabilization	City of Fife
RM 4.6 – RM 4.7 RB	Flood levels in 2006 and 2009 nearly overtopped levee at 54th Ave. E.	City of Fife

Table 5.6 Priority Problems Identified in Lower Puyallup River		
Location	**Problem Description**	**Source**
RM 6.8 – RM 6.9 RB	Flood levels in 1996 and 2009 nearly overtopped levee at Freeman Road	City of Fife
RM ~~8.2~~7.9 ~~–~~ RM 8.~~3~~6 LB	Levee overtopping floods Tiffany's skating rink, Riverwalk Apts., and road underpass	City of Puyallup, Pierce County
RM 8.1 – RM 8.2 RB	Levee overtopping floods N. Meridian-north shore underpass	City of Puyallup
RM 9.1 – RM 9.25 LB	Levee overtopping floods E. Main St. "flash cube" building	City of Puyallup
RM 9.3-9.5 LB	Levee overtopping floods Rite Aid shopping center parking lot and loading docks	Pierce County
RM 9.8 – RM 10.3 LB	Levee overtopping floods Linden golf course	City of Puyallup
RM 9.4 – RM 10.6 LB	Levee overtopping and sedimentation impacts levee access road and public trail	Pierce County
Tributary Backwater Flooding		
RM 2.1 LB	Backwater flooding at Cleveland Way pump station caused extensive flooding in 1996	City of Tacoma
RM 2.9 LB	Clear Creek backwater flooding caused extensive flooding in 1996 and 2009; some flooding in 2006	Pierce County, City of Tacoma
RM 5.0 RB	Oxbow Lake backwater flooding of pump station	City of Fife
RM 5.8 LB	Clarks Creek backwater flooding of homes	Pierce County, Tacoma
RM 6.9 LB	City storm drain flooding (NW 13th Ave.)	City of Puyallup
RM 7.9 LB	City storm drain flooding (4th St. NW)	City of Puyallup
RM 9.4 LB	Deer Creek backwater flooding (Shoppe concrete)	City of Puyallup
Public Safety/Emergency Rescues		
RM 2.9 – RM 4.8 LB	Clear Creek (>10 emergency rescues in 2009)	Pierce County Sheriff
RM 4.2 – RM 8.2 LB	Emergency evacuation in Fife in 2009	City of Fife
Flooding of Structures and Infrastructure (Roads/Bridges) [not already noted above]		
RM 0.7 – RM 2.2 RB~~N~~/LB	Three bridges of concern (11th Ave., Lincoln Ave., and Puyallup Ave.) – wood on piers and capacity	City of Tacoma
RM 2.9 – RM 6.9 RB	Critical facilities (schools, police station) at risk of flooding due to overtopping/breaching of levee	City of Fife
RM 3.1 LB	Localized road flooding north of I-5	City of Tacoma
RM 4.0 – RM 5.5 RB	Potential flooding of Tacoma Power's Fife substation	City of Tacoma
RM 5.75 RB/LB	Milroy bridge fails to meet minimum standard for bridge clearance	Pierce County Transportation, City of Fife
RM 6.8 – RM 6.9 LB	Puyallup Wastewater Treatment Plant flooding	City of Puyallup
RM 9.1	SR-512 bridge at Pioneer – wood accumulation and bed scour at piers	WSDOT
Sediment and Gravel Bar Accumulation		
RM 2.9 – RM 6.9	Bed elevation increases between I-5 and Freeman Rd. a concern due to reduced conveyance capacity	City of Fife, Pierce County

Table 5.6 Priority Problems Identified in Lower Puyallup River		
Location	**Problem Description**	**Source**
RM 5.8 – RM 10.3	Bed elevation increases from Clarks Cr. to White River a concern due to reduced conveyance capacity	City of Puyallup, Pierce County
Facility Maintenance and Repair Needs		
RM 2.8 – RM ~~8.6~~ RB/LB	Concrete panel repair as needed due to veg./roots	Pierce County
Fish Habitat Problem Areas		
RM 2.6 – RM 3.7 RB	Levee separates river from historic estuary on Union Pacific property and adjacent farmland	Pierce County, Puyallup Tribe
RM 5.0 RB	Oxbow Lake is former river meander that has been cut-off from river by levee	City of Fife
RM 6.7 – RM 7.4 RB	Freeman Road Oxbow cut-off from river by levee	Puyallup Tribe, Pierce County
RM 8.2 RB	72" Wapato Cr. outflow to Puyallup River prevents headwater flow to Wapato Cr.	Puyallup Tribe
RM 9.4 – RM 10.3 RB	Levee cuts off confluence wetlands river channel	Puyallup Tribe
RM 9.6 – RM 10.5 LB	Levee cuts off-channel habitat and floodplain from river channel	Puyallup Tribe
Public Access		
RM 0.6 – RM 2.9 RB/LB	Corps of Engineers limits access to levee	City of Tacoma
RM 2.0 – RM 6.5 RB/LB	Lack of connecting trail along river from RM 6.5 to City of Tacoma (on left or right bank)	City of Tacoma, Pierce County Parks
RM 6.8 – RM 10.7	Repeated flood damage to trail limits access; no trespassing sign at RM 6.8 discourages access	City of Puyallup

Source: Pierce County Surface Water Management

5.1.9 River Reach Management Strategies

Page 5-28, Structural management strategy

Revised text:

Structural management strategy:

- RM 0.0 – RM 10.3 left and right bank - The "level of ~~protection~~service" goal for levees should be 200-year design plus three feet of freeboard.

5.1.10.2 LP2 Clear Creek Acquisition and Levee

Page 5-32, second paragraph.

Revised text:

Construction of the project levee preserves existing infrastructure, preserves farmland, and relieves the level of flooding in the Clear Creek floodplain. Removal or modification of the

flood gates will allow for free fish passage in and out of Clear Creek.

5.2 MIDDLE PUYALLUP RIVER

5.2.5 River Management Facilities, Flooding and Flood Damage

Page 5-54, Table 5.8 Levees and Revetments in the Middle Puyallup River.

Revised Text:

Table 5.8 Levees and Revetments in the Middle Puyallup River

Name	Location [a]	Ownership
Right Bank		
Traffic Avenue Revetment	RM 10.3 – RM 11.0	Pierce County
River Grove Levee	RM 11.0 – RM 11.45, PL 84-99	Pierce County
Riverwalk Revetment	RM 11.45 – RM 12.0	Pierce County
Riverside Levee	RM 12.0 – RM 12.75~~8~~, PL 84-99	Pierce County
Riverside Revetment	RM 12.75-12.8	Pierce County
Van Ogle Revetment	RM 12.8 – RM 14.2	Pierce County
Evanger/White Revetment	RM 14.2 – RM 15.0	Pierce County
Fennel Creek Revetment	RM 15.15 – RM 15.9	Pierce County
Mosby Revetment	RM 15.9 – RM 16.65	Private
~~Dollar Creek~~ 128th-McCutcheon	RM 16.65 – RM 16.8~~9~~	Pierce County
Lindsay Levee	RM 16.9 – Carbon RM 1.2	Pierce County
Left Bank		
Knutson Revetment	RM 10.7 – RM 12.0	Pierce County
WAZZU Revetment	RM 12.0 – RM 12.8	Pierce County
Bowman/Hilton Levee	RM 12.8 – RM 13.55~~6~~ , PL 84- 99	Pierce County
Sportsman Levee	RM 13.55~~6~~ – RM 14.4 , PL 84-99	Pierce County
Ball Creek Revetment	RM 14.4 – RM 15.7	Pierce County
McMillin Levee	RM 15.7 - RM 16.65 , PL 84-99	Pierce County
Bowen/Parker Levee	RM 16.65 – RM 17.5 , PL 84-99	Pierce County

[a] RM = river mile; PL 84-99 USACE Flood Control and Coastal Emergency Act
Source: Pierce County Surface Water Management and USACE records

5.2.5.1 Major Flooding

Page 5-55, Table 5.9 Historical Major Flooding on the Middle Puyallup River.

Revised text:

Table 5.9 Historical Major Flooding on the Middle Puyallup River	
Date	**Puyallup River Flow at Alderton Gauge (cfs)**
December 1921	20,000
December 1946	22,600
December 1953	21,900
December 1955	23,300
January 1990	34,600
November 1990	42,300
February 1996	41,500
November 1999	24,800
January 2003	21,000
January 2005	23,300
November 2006	40,300 ~~51,600[a]~~
November 2008	40,200
January 2009	41,600 ~~53,600[a]~~

a These two estimates are questionable because they exceed downstream peak flow estimates
Source: USGS Alderton Gauge flow records

5.2.5.2 Flood Damage to Facilities

Page 5-56 and 5-57, Table 5.10 Summary of Damage to Facilities in the Middle Puyallup 1990-2017.

Delete Table

5.2.6.1 Major Projects

Page 5-58, third paragraph.

Revised text:

Table 5.11 shows major repairs, generally considered 750 lineal feet or more in length, along the middle Puyallup River following significantly large storm events. Records maintained by Pierce County SWM Operations and Maintenance show three several major repairs have been completed between RM 10.3 and RM 17.3.

5.2.7 Flood and Channel Migration Hazard Mapping

Page 5-59, first paragraph.

Revised text:

Hazard mapping in the middle Puyallup River includes detailed flood studies (FEMA-/~~2009~~,

NHC 2006) and the creation of ~~Preliminary~~ Digital Flood Insurance Rate Maps (DFIRM)~~, which as of the publication of this document have not been issued by FEMA~~ which ~~.~~ were adopted in March 2017. In order to publish the countywide Digital Flood Insurance Rate Maps, areas that were affected by non-accredited levees were "secluded" from the map update. This means that the Puyallup River from the Carbon River to the Ford Setback levee shows the same flood risk as it was understood in the 1970's.

5.2.8 Problem Identification

Pages 5-60, Table 5.12 Flooding-related Problems Identified in the Middle Puyallup River.

Revised text:

Tributary Backwater Flooding		
RM 12.8 – RM 13.0 RB	Backwater at tributary floods Pierce County's Riverside Park	Pierce County
RM 15.8~~9~~ RM 16.4 RB	Canyon Falls backwater floods McCutcheon Rd.	Pierce County

Pages 5-60, Table 5.12 Flooding-related Problems Identified in the Middle Puyallup River.

Revised text:

RM 14.15 RB/LB	Flooding of 96th St. E. and bridge closed roads and wood buildup on bridge piers	Pierce County Roads
RM 16.7	128th St. E Bridge woody debris buildup on piers	Pierce County Roads
RM 16.7	Tacoma Water Line Bridge woody debris buildup on piers	Pierce County

Pages 5-61, Table 5.12 Flooding-related Problems Identified in the Middle Puyallup River.

Revised text:

Sediment and Gravel Bar Accumulation		
RM 10.3-10.7	Gravel bar accumulation from the confluence of White River upstream to Main St. bridge	City of Puyallup
RM 10.3~~4~~ 10.7~~2.0~~	Large gravel bar along right bank adjacent to Sumner WWTP causes flow constriction	City of Sumner
RM 12.2-17.4	Gravel accumulation between Sumner and Orting a concern due to reduced conveyance capacity and directing flows at levees, damaging structures	Pierce County

Pages 5-61, Table 5.12 Flooding-related Problems Identified in the Middle Puyallup River.

Revised text:

Public Access		
RM 10.7 – RM 11.5 LB	Lack of connecting trail between Main Street and Foothills trail at East Puyallup Trailhead	Pierce County Parks
RM 12.8~~7~~ – RM 13.4 RB	Desire to maintain public access for boat launch and fishing at Riverside Park if setback levee is constructed	Pierce County Parks

Page 5-64, first paragraph.

Revised text:

The following capital improvement projects are recommended to address the problem areas identified in Table 5.12~~1~~. Capital Projects are defined as construction projects over $75,000 and included within the yearly Capital Improvement Element, of the Comprehensive Plan for Pierce County Washington. Projects less than $75,000 are included within the Maintenance Program.

5.2.9 River Reach Management Strategies

Page 5-62 and 5-63, Structural management strategy

Revised text:

Structural management strategy:

- RM 10.3 – RM 12.0 right and left banks – "Level of ~~protection~~Service" goal for levees should be 100-year design plus three feet of freeboard. Revetments should be designed to resist channel migration.
- RM 12.0 – RM 15.6 right and left banks – "Level of ~~protection~~Service" goal for levees should be to maintain the current (2009) level of protection. Revetments should be designed to resist channel migration.

5.2.10 Recommended Capital Projects

Page 5-69, MP3 McCutheon Rd and 128th St. East.

Revised text:

5.2.10.3 MP~~4~~3 Middle Puyallup 128th Comp Study ~~McCutcheon Rd and 128th St East~~

Page 5-72, MP4 McCutheon 116th St. E Point Bar Gravel Removal

Revised text:

5.2.10.4 MP~~3~~4 116th St E. Point Bar Gravel Removal

5.3 UPPER PUYALLUP RIVER

5.3.5 River Management Facilities, Flooding and Flood Damage

Page 5-81, Table 5.14 Levees and Revetments in the upper Puyallup River.

Revised text:

Table 5.14 Levees and Revetments in the Upper Puyallup River		
Name	**Location [a]**	**Ownership**
Right Bank		

~~High Cedars~~ Bartroff Revetment	RM 17.4 – RM 17.5	Pierce County
High Cedars Levee	RM 17.5 – RM 19.7, PL 84-99	Pierce County
Calistoga Levee	RM 19.7 – RM 21.25, PL 84-99	Pierce County
Jones Levee	RM 21.25 – RM 22.5, PL 84-99	Pierce County
Ford Levee	RM 22.5 – RM 24.8~~9~~, PL 84-99	Pierce County
High Bridge Revetment	RM 24.8~~9~~ – RM 25.45	Pierce County Roads
Neadham Road Levee	RM 26.4 – RM 2~~7~~6.0~~9~~, PL 84-99	Pierce County
Left Bank		
South Fork Levee	RM 17.5 – RM 18.5	Pierce County
Leach Road Levee	RM 19.1 – RM 21.25, PL 84-99	Pierce County
Soldier's Home Levee	RM 21.25 –RM 23.1, PL 84-99	Pierce County
McAbee Levee	RM 23.1 – RM 23.6, PL 84-99	Pierce County
Orville Road Revetment	RM 26,85~~25.6~~ – RM 27.0~~28.1~~	Pierce County
Champion Bridge Levee/Revetment	RM 28.15 – RM 28.6	Pierce County

[a] RM = river mile; PL 84-99 USACE Flood Control and Coastal Emergency Act
Source: Pierce County Surface Water Management records

5.3.5.1 Major Flooding

Page 5-81, first paragraph.

Additional Text:

The categorization of major flooding is based on a threshold of discharges in excess of approximately 16,000 cfs at the Orting gauge.

Page 5-82, Table 5.15 Historical Flooding in Upper Puyallup River.

Additional Text:

Table 5.15 Historical Flooding in Upper Puyallup River

Date	Puyallup River Flow at Orting Gauge (cfs)
November 1932	11,800
December 1933	12,800
December 1955	12,100
November 1959	12,900
November 1962	15,300
January 1965	12,200
December 1977	12,100
January 1990	11,600
February 1996	18,300
November 1999	11,600
November 2006	21,500

November 2008	15,200
January 2009	16,900
November 2014	16,500
December 2015	17,200

Source: United States Geologic Survey records

5.3.5.2 Flood Damage to Facilities

Page 5-83 through 5-85, Table 5.16 Flood Damage to Levees in the Upper Puyallup River.

Delete Existing Table

5.3.6 Key Accomplishments since the 1991 Flood Plan

Page 5-86, number 1.

Revised text:

1. **Ford Levee setback project 1998, RM 23.1 – RM 25.4, right bank**

   The setback project consisted of constructing a new 8,400-foot levee setback up to 600 feet from the main channel of the Puyallup River. Portions of the existing levee structure were removed to allow the river to meander and remove the remainder of the levee over time. The project reconnected 125 acres of floodplain with the river. The total cost is ~~was~~ approximately ~~$3.3~~ 1,011,126 million.

Page 5-86, number 2.

2. **Soldiers Home levee setback project 2006, RM 21.8 - 23.0, left bank**

   The project consisted of constructing a new 5,000-foot levee which was set back 900 feet from the main channel of the river. The existing levee was removed to allow the river to meander in the opened floodplain area. The project reconnected 67 acres of floodplain isolated from the river into a complex of braided channels. Large woody material was placed along the setback levee alignment to enhance habitat. (NOAA, Natural Resource Restoration projects). The levee was tied into high ground at the Calistoga Bridge for compliance with FEMA levee accreditation standards. The total cost was approximately $6.4 million.

5.3.7 Flood and Channel Migration Hazard Mapping

Page 5-88, paragraph 1.

Revised Text:

Hazard mapping in the upper Puyallup includes detailed flood studies (FEMA /~~2009,~~ NHC 2006) and the creation of ~~preliminary~~ Digital Flood Insurance Rate Maps (DFIRM), which became effective March 2017. ~~as of the publication of this document have not been issued by FEMA.~~ Flood prone areas along the upper Puyallup River include the High Cedars Golf

Club, local roads such as Orville Road and Neadham Road, numerous roads and structures in the Village Green area of Orting, agricultural and rural lands and structures in unincorporated Pierce County, and Orting School District property. In order to publish the countywide Digital Flood Insurance Rate Maps (DFIRM) areas that were affected by non-accredited levees were "secluded" from the map update. This means that most of the Puyallup valley in the vicinity of Orting is still showing the same flood risk as it was understood in the 1970's. ~~The preliminary DFIRM maps for the upper Puyallup River show 2,562 acres within the special flood hazard area (SFHA) or 100-year floodplain.~~ The DFIRM maps in the vicinity of Orting show 1830 acres within the special flood hazard area (SFHA) or 100-year floodplain and unincorporated Pierce County regulates an additional 212 acres as flood fringe. The mapped deep and fast flowing area is 119 acres.

5.3.8 Problem Identification

Page 5-88 through 5-90, Table 5.18 Flooding-related problems Identified in Upper Puyallup River.

Revised text:

Table 5.18 Flooding-related Problems Identified in ~~Middle~~ Upper Puyallup River		
Location	**Problem Description**	**Source**
Levee and Revetment Overtopping and Breaching		
RM 17.6 – RM 17.9 LB	Revetment overtopping in 2006 and 2008 deposited debris and blocked access road	Pierce County
RM 18.0 – RM 19.2 RB	Levee overtopping floods High Cedars Golf Course	Pierce County
RM 19.2 – RM 19.8 LB	Levee overtopping damaged levee and levee access road	Pierce County
RM 19.6 – RM 21.25 RB	Levee/revetment overtopping in 1996, 2006, 2009 impacting residential areas, schools and city roads	City of Orting, Pierce County
RM 22.5 – RM 22.55 RB	Levee overtopping floods Calistoga Street and baseball fields	City of Orting
RM 25.4- RM 28.6	Repetitive damages to Neadham Road levee and Champion Bridge revetment	Pierce County
Tributary Backwater Flooding		
RM 25.4~~3~~ RB	Backwater flooding at Fiske Creek results in flooding of Brooks Rd. bridge causing road closure	Pierce County
RM 26.3 LB	Kapowsin Creek backwater flooding impacts Orville Rd. bridge over creek	Pierce County
Public Safety/Emergency Rescues		
RM 25.8 – RM 26.5 RB	Emergency evacuations of Neadham Rd. area occurred during 1996 flood event	Pierce County
Channel Migration Problem Areas		
RM 25.3~~3.6~~ – RM ~~23.9~~25.45 LB	Channel migration occurred numerous times since 1995 eroding left bank levee upstream of Rock Pt.	Pierce County

Table 5.18 Flooding-related Problems Identified in ~~Middle~~ Upper Puyallup River		
Location	**Problem Description**	**Source**
RM 23.9 – RM 25 LB	Channel migration causes bank erosion of threatening 6-8 homes in "The Country"	Pierce County
RM 26.1 – RM 26.3 LB	Channel migration upstream of high bridge eroding bank near Brooks Rd. and upstream during 2006, 2008 and 2009	Pierce County
RM 26.4~~1~~ – RM 27.2~~6.3~~ LB	Channel migration threatens Orville Rd.	Pierce County
~~RM 26.6 – RM 27.1 LB~~	~~Channel migration threatens Orville Rd.~~	~~Pierce County~~
RM 27.2~~1~~ – RM 2~~8~~7.1~~7~~ LB	Channel migration starting in 1996 and ongoing threatens 10-12 homes in Stehn large lot area	Pierce County
RM 28.1 – RM 28.4 RB	Channel migration downstream of Champion Bridge threatens forested area	Pierce County
RM ~~28.2~~ 27.0~~–~~ RM 28.6~~5~~ LB	Channel migration threatens revetment, 6 homes and Orville Rd.	Pierce County
Flooding of Structures and Infrastructure (Roads/Bridges) [not already noted above]		
RM 20.6~~5~~ – RM 21.25~~3~~ L~~R~~B	Leach Rd. E. flooding north of Calistoga bridge	Pierce County Roads
RM 21.25~~3~~ LB/RB	Calistoga bridge is a constriction point for flow (gravel deposition, LWD impacting bridge)	Pierce County Roads
RM 25.4 – RM 2~~7~~6.0~~7~~ RB	Neadham Rd. E. flooding causes road and infrastructure damage during major floods	Pierce County Roads
Sediment and Gravel Bar Accumulation		
RM ~~17.4-19.4~~ 15.8-16.0	Gravel bar accumulation downstream of Orting reduces conveyance capacity; one specific bar at 116th ~~Ave.~~ Street E. causes levee overtopping/threatens homes	Pierce County
RM 19.4-~~22.0~~21.25	Gravel bar accumulation downstream of Calistoga bridge reduces conveyance capacity	City of Orting
RM 22.5-28.64~~4~~	Gravel accumulation upstream of Calistoga Bridge~~Orting~~ reduce conveyance capacity and threaten levee integrity	Pierce County
Facility Maintenance and Repair Needs		
RM 17.54 – RM 19.8 RB	High Cedars levee suffers damage during every large flood (1990, 1995, 1996, 2006, 2008, 2009)	Pierce County
RM 19.8 – RM 28.6	Numerous locations along levees and revetments have required repairs following many flood events (see Table 5.3.4 above)	Pierce County
Fish Habitat Problem Areas		
RM 17.8 - RM 18.1 LB	Historical side channel habitat and wall-based cool water channel has been cut off from Puyallup River by revetment construction	Puyallup Tribe
RM 19.1~~2~~ – RM 20.2 LB	Levee/revetment construction cut off floodplain from river channel, limiting rearing/spawning habitat (Horsehaven and 150th St. setback levee locations)	Puyallup Tribe, Pierce County

Table 5.18 Flooding-related Problems Identified in ~~Middle~~ Upper Puyallup River		
Location	**Problem Description**	**Source**
RM 21.3 – RM 23.0 RB	Levee/revetment construction cut off floodplain from river channel, limiting rearing/spawning habitat (190th Ave. upstream/downstream levee setback locations)	Puyallup Tribe, Pierce County
RM 24.8 – RM 25.2 LB	Mint Creek wetland cutoff from Puyallup River by remnant left bank levee preventing off-channel rearing	Puyallup Tribe
RM 27.0 – RM 28.2 RB	Remnant railroad bed limits channel migration which degrades riparian habitat and connection with floodplain	Puyallup Tribe
Public Access		
RM 17.5 – RM 17.6 RB	McMillan trailhead – Lack of public access to water (e.g., for fishing or viewing)	Pierce County Parks
RM 29 – RM 30 RB	Lack of access to river/water; interest in new regional park in Kapowsin vicinity near river	Pierce County Parks

Source: Pierce County Surface Water Management records

5.3.9 River Reach Management Strategies

Page 5-91, paragraph 2.

Revised text:

The primary objective for the upper Puyallup River is to maintain the structural integrity of the levee and revetment system so the system continues to reduce risks to public health and safety, and reduce ~~public and private~~ property and infrastructure damage. Since the 2013 Flood Plan, the City of Orting has constructed a setback levee which meets the 100-year level of service, with the ability to be added on to as conditions in the river channel change over time. ~~Another objective is to make improvements to the levees so that they provide 100-year level of protection in the urban portion of the City of Orting, on the right bank between RM 19.4 and RM 22.5~~. ~~The final~~An additional management strategy is to realize capital projects that enhance and create aquatic habitat through levee setbacks, riparian re-vegetation, and strategic placement of large woody material. Some river reaches are being targeted for property acquisition, a setback levee, or other structures that are planned to protect public roads and improve habitat.

Page 5-91, Second bullet, Structural management strategy.

Revised and added text:

- RM 19.4 – RM 22.5 (right bank) – The "level of ~~-~~service ~~protection~~" goal for levees should be 100-year design plus three feet of freeboard.

Page 5-91, fourth bullet.

Additional text:

- New revetments designed and constructed to protect Orville Road will implement a preventative design strategy.

Page 5-91, Non- structural management strategy:

Added text:

- Develop a legal process to remove remnant levee segments

5.3.10 Recommended Capital Projects

Page 5-94, UP2 Ford Levee Setback Gravel Removal.

Revised project name:

UP2 Ford Levee Setback - Gravel Removal

Page 5-96, UP3 Neadham Road Flooding/ Channel Migration Protection.

Revised project name:

UP3 Neadham Road Floodplain Reconnection~~Flooding/Channel Migration Protection~~

Page 5-96, UP3 Neadham Road Floodplain Reconnection

Revised text:

River Mile: ~~25.3 –~~ 26.5~~9~~ Right Bank

Page 5-96, UP3 Neadham Road Floodplain Reconnection

Revised text:

Council District: 1~~3~~

Page 5-99, UP4 Orville Road Revetment at Kapowsin Creek

Revised text:

What is the Recommended Solution?

The remaining 600 feet of levee was destabilized in 2013 and the river continues to re-occupy that portion of the channel. in this area would be removed. The adjacent properties have been ~~would be~~ purchased and the residences removed. A proposal to construct a ~~and a new~~ 750-lineal foot combination of engineered log jam (ELJ) and dolo timber structures will provide scour and erosion protection for Orville Road.

Page 5-99, UP4 Orville Road Revetment at Kapowsin Creek

Additional text:

What is the Recommended Solution?

Recent channel shifts and the proposed right bank projects have decreased the urgency for this project. Channel changes following the completion of the right bank project will be analyzed to assess the left bank needs.

Page 5-100, UP4 Orville Road Revetment at Kapowsin Creek

What are the Project Benefits?

Additional text:

Restoration of natural river processes

Page 5-101, UP 5 Orville Road Channel Migration Protection

Revised text:

Basin Plan: Mid-Puyallup and Upper Carbon River/Upper Puyallup River (~~future plan~~ under construction)

Page 5-101, UP 5 Orville Road Channel Migration Protection

Revised text:

River Mile: 2~~7~~6.6~~4~~4 – 28.2~~6~~6 Left Bank

5.4 LOWER WHITE RIVER

5.4.5.1 Major Flooding

Page 5-114, first paragraph.

Revised text:

In the last 3~~2~~0 years major flooding in the lower White River occurred in 1990, 1996, 2006, and 2009 (see Table 5.21). The largest flood on record occurred in December 1933, prior to the construction of Mud Mountain Dam. Increased flood risk in the lower White River has resulted from the reduction of channel capacity. Thresholds for flood warnings has decreased from 10,000 cfs to 5,500 cfs. Since 2013, these events have occurred multiple times a year.

Page 5-114, Table 5.21 Historical Flooding in Lower White River

Additional text:

Table 5.21 Historical Flooding in Lower White River	
Date	**White River Flows near Auburn[a] (cfs)**
December 1933	>28,000
December 1946	>12,300
December 1955	>13,700
November 1959	>13,000
December 1977	>14,800
January 1986	>14,000
November 1986	>15,200

Table 5.21 Historical Flooding in Lower White River	
Date	**White River Flows near Auburn[a] (cfs)**
December 1996	13,600
January 2006	12,400
November 2006	14,700
January 2009	12,000

5.4.5.2 Flood Damage to Facilities

Page 5-115, Table 5.22 Damage to Facilities in the Past 20 Years along the Lower White River.

Delete table

5.4.7 Flood and Channel Migration Hazard Mapping

5.4.7.1 Flood Hazard Mapping.

Page 5-116, first paragraph.

Revised text:

Hazard mapping in the lower White River includes detailed flood studies (FEMA 2009, NHC 2006) which are shown on the ~~and preliminary~~ Digital Flood Insurance Rate Maps (DFIRM), which became effective March 2017 ~~which as of the publication of this document, have not been issued by FEMA~~. Flood prone areas along the lower White River include extensive industrial, commercial, and residential land uses along the right and left banks in the cities of Sumner and Pacific, and a small area of unincorporated Pierce County. This new mapping has been shown to be out of date due to increasing sediment load which has decreased the channel capacity. The ~~preliminary~~ DFIRM maps for the lower White River show 1,043 acres within the special flood hazard area) or 100-year floodplain. The mapped deep and fast flowing area is 312 acres.

5.4.7.2 Channel Migration Hazard Mapping

Page 5-116, first paragraph.

Revised text:

Severe, moderate, and low risk channel migration zones (CMZ) were mapped for the lower White River as part of the upper Puyallup River study (GeoEngineers 2003) and adopted in November 2004. The CMZ refers to the geographic area previously occupied by a stream or river and susceptible to channel erosion and/or channel avulsion (WSDOE 2003). ~~In the lower White River, the severe CMZ covers an area of 227 acres.~~ While the CMZ study identified 227 acres at a severe risk of channel migration, only 46 acres are in Pierce County

and regulated under ~~Pierce County regulates severe CMZ mapped areas as floodway per~~ Chapter 18E.70, Pierce County Code.

5.4.8 Problem Identification

Page 5-117, Table 5.23 Priority Problems Identified in Lower White River.

Revised text:

Flooding of Structures and Infrastructure (Roads/Bridges) [not already noted above]		
RM 0.1~~2~~ – RM 0.2 LB	Flooding of State St. (access to Sumner wastewater treatment plant)	City of Sumner
RM 3.4 – RM 3.5 LB	Flooding of roadways at 24th St. E. & 148th Ave.	City of Sumner

Page 5-118, Table 5.23 Priority Problems Identified in Lower White River.

Revised Text:

Facility Maintenance and Repair Needs		
RM 3.85 RB	Severe bank erosion. Loss of armoring. Warehouses and commercial property threatened by elevated flood risk.	Pierce County

5.4.9 River Reach Management Strategies

Page 5-119, third paragraph

Revised text:

In the near term, the primary objective for the lower White River is to maintain the structural integrity of the revetment and levee system so that the facilities continue to reduce risks to public health and safety, and reduce ~~public and private property~~ damage to property and infrastructure. Another goal is to make improvements to the facilities over time through construction of levees or setback of revetments so that the level of ~~protection~~ service is increased to ~~provide flood protection to the~~meet a 100-year ~~flood~~storm event. The final management strategy objective is to realize capital projects that enhance and create aquatic habitat through levee or revetment setbacks, riparian revegetation, and strategic placement of large woody material.

Page 5-119, Structural management strategy

Revised text:

- RM 0.0 – RM 5.5 left bank; RM 0.0 – RM 1.8 right bank – The "level of ~~protection~~ service goal" for revetments should be channel migration resistance design
- RM 1.8 – RM 5.5 right bank - The "level of ~~protection~~service" goal for levees and flow conveyance should be 100-year design plus three feet of freeboard

Page 5-120, Structural management strategy

Additional text:

Page 5-120, Structural management strategy

Additional text:

For additional information regarding the Lower White River, please refer to the 2006 King County Flood Hazard Management Plan:

https://www.kingcounty.gov/depts/dnrp/wlr/sections-programs/river-floodplain-section/documents/flood-hazard-management-plan.aspx

5.4.10 Recommended Capital Projects

Page 5-121, LW1 State Street Flood Wall or Emergency Access.

Revised text:

Basin Plan: White~~r~~ River ~~(to be adopted)~~ Adopted November 2013

Page 5-123, LW2 Lower White River Flood Protection.

Project Name Change:

5.4.10.2 LW2 Lower White River Floodplain Restoration and Flood Protection

*Projects segments included within the overall project: White River Restoration (left bank RM 2.5- RM 4), Pacific Point Bar Setback Levee (Right Bank, RM 3.9- RM 4.5); Left Bank Setback Levee (Right Bank, RM 4.5-RM 4.8); Stewart Road Bridge replacement (left and right bank RM 4.9),

Page 5-123, LW2 Lower White River Flood Protection.

Revised Text:

Basin Plan: White~~r~~ River ~~(to be adopted)~~ Adopted November 2013

River Mile: 1.8 – 4.9, right and left bank ~~bank~~

Additional text:

Page 5-123, second paragraph.

Revised text:

Since the 2009 study, the channel capacity decreased ~~to~~ from over 15,000 cfs to approximately ~~10,~~5,500~~0~~ cfs at RM 4.7. The reduction in channel conveyance capacity and floodplain area is attributed to several factors, primarily ~~such as commercial, industrial, and residential development in the floodplain,~~ increased deposition of sediments in the channel, encroachment of vegetation, and the restrictions on channel dredging.

Page 5-124, first paragraph.

Revised text:

This project will restore sustainable instream habitat, floodplains, and wetlands in addition to providing flood. protection. ~~Provide a level of protection from the 100-year Flood for the~~

~~Right Bank from RM 4.9 to RM 1.8. In this section of the river flood waters leave the channel in relatively shallow depth as they spill out onto the broad floodplain.~~ A solution, which combines ~~a~~ features such as ~~low~~ setback levees, side channels, channel roughening, engineered log jams, revetments, property acquisitions and other methods, ~~revetments to limit scour and channel widening excavation on the left bank~~ would increase conveyance capacity and create a more sustainable river system~~provide some mitigation benefits~~.

Page 5-124, first and second bullet.

Revised text:

- Reduces or eliminates flood damage to local industrial, commercial, and residential properties and structures
- ~~residential properties and structures,~~

Page 5-125, LW3 Butte Avenue Levee and Berm.

Revised text:

Basin Plan: White~~r~~ River ~~(to be adopted)~~ Adopted November 2013

5.5 UPPER WHITE RIVER

5.5.5.1 Major Flooding

Page 5-132, paragraph one.

Revised Text:

The White River gauge downstream of the Clearwater River confluence has operated intermittently from 1975 to the present, with several data gaps resulting from damage during large floods. In the last 4~~2~~0 years major flooding in the upper White River occurred in 1977 ~~90~~, 1995, 1996, 2006, and 2008~~9~~ (see Table 5.26). Flow values in the table are shown as "less than" due to the larger drainage area for the Clearwater gauge.

Page 5-133, Table 5.26 Historical Flooding in Upper White River.

Revised text:

Table 5.26 Historical Flooding in Upper White River

Date	White River Flows downstream of Clearwater River Gauge (#12097850) (cfs)
December 1977	22,800
January 1990	<17,200
November 1990	<18,400
November 1995	<20,500
February 1996	<30,000[a]

November 2008	<18,100
November 2006	Not Available
January 2009	<18,100
January 2011	28,600
January 2015	22,000

Page 5-133, Table 5.2 Damages to Facilities in the past 20 years along the Upper White

Deleted table

5.5.7 Flood and Channel Migration Hazard Mapping

5.5.7.1 Flood Hazard Mapping

Page 5-134, paragraph one.

Revised text:

The new FEMA DFIRM did not update the flood risk assessment ~~Hazard mapping~~ in the upper White River. The risk assessment continues to be the one completed in the late 1970's. ~~has not been updated since the 1987 flood insurance study.~~ Flood prone areas along the upper White River include State Route 410, Pierce County roads and bridges, and ~~low~~moderate-density ~~residential~~ residential recreation areas. The ~~1987~~ DFIRM maps for the upper White show 443 acres within the special flood hazard area (SFHA) or 100-year floodplain.

5.5.9 River Reach Management Strategies

Page 5-136, bullet two.

Revised text:

River management facilities – There is a single levee and revetment along the right bank at RM 45~~6~~.0 to RM 45~~6~~.2 owned by Pierce County. Bank armoring protects portions of State Route 410 maintained by WSDOT. Limited armoring at the Crystal River Ranch Road Bridge is maintained by Pierce County Transportation Services.

Structural management strategy:

Page 5-136, bullet one and two.

Revised text:

- RM 45~~4~~.0~~4~~ to RM 45.2 ~~50~~.5, right bank - The "level of ~~protection~~service" goal for the existing levees should be to maintain the existing levee prism. ~~The level of erosion protection for revetments should be the channel migration resistance design.~~
- RM 44.4 to RM 50.5, right bank- The "level of ~~protection~~service" goal for the non-county maintained system should be to resist channel migration.

Non-structural management strategy:

Page 5-136, last sentence.

Additional text:

For additional information regarding the Upper White River, please refer to the 2006 King County Flood Hazard Management Plan:

https://www.kingcounty.gov/depts/dnrp/wlr/sections-programs/river-floodplain-section/documents/flood-hazard-management-plan.aspx

2013 King County Flood Hazard Management Plan Update and Progress Report: https://www.kingcounty.gov/depts/dnrp/wlr/sections-programs/river-floodplain-section/documents/flood-hazard-management-plan-update.aspx

5.6 GREENWATER RIVER

5.6.5.2 Flood Damage to Facilities

Page 5-145, first paragraph.

Additional text:

As noted above, there is currently no actively maintained Pierce County flood risk reduction facility on the Greenwater River. The most significant damage occurred during the 1977 peak flood event that affected the State Route 410 Bridge and approaches. Some toe and facing rock protecting the bridge banks and approaches probably have been damaged by the peak flows since 1977. The condition and status of the private revetment is not known. There has been loss of private property. In 1990, the County purchased a home on Lumpy Lane that was falling in the river due to channel migration. The County is currently working with an adjacent property owner whose home is being threatened by channel migration.

5.6.7 Flood and Channel Migration Hazard Mapping

5.6.7.1 Flood Hazard Mapping.

Page 5-146, first paragraph.

Revised text:

Hazard mapping in the Greenwater River has not been updated since the original flood study of the 1970's. The new countywide DFIRM continues to show a detailed study on the lower Greenwater River, with the entire floodplain mapped as a FEMA defined floodway. 1987 flood insurance study. Flood prone areas along the Greenwater River include the State Route 410 crossing and residential areas on the left bank, mostly between RM 0 and RM 1.0. The ~~1987~~ DFIRM maps for the Green Water River show 129 acres within the special flood hazard area or 100-year floodplain. There are no mapped deep and fast flowing areas on the Greenwater River.

5.6.7.2 Channel Migration Hazard Mapping.

Page 5-146, first paragraph.

Revised text:

Severe, moderate, and low channel migration zones (CMZ) have ~~not~~ been mapped for the Greenwater River.

5.6.8 Problem Identification

Page 5-146, Table 5.32 Priority Problems Identified in the Lower White River.

Revised text:

Table 5.32 Priority Problems Identified in Greenwater ~~Lower White~~ River

5.6.9 River Reach Management Strategies

Page 5-147, paragraph 2

Revised text:

In the near term, the primary objective for the Greenwater River is to maintain the structural integrity of the public revetments so the facilities continue to reduce risks to ~~public~~ infrastructure (particularly State Route 410) and ~~private~~ property ~~damage~~. When repairs are necessary, enhancement ~~Another objective is to enhance~~ and creation of ~~e~~ aquatic habitat by replanting riparian areas is preferred and may include ~~, and~~ strategically ~~placing~~ placed large wood material in areas that will not exasperate known channel migration hazard risks identified in the lower reach of the river~~when conducting future repairs~~.

Page 5-147, structural management strategy

Revised text:

Structural management strategy:

- RM 0.0 – RM 4.0 - The "level of ~~protection~~service" for county maintained revetments should be the channel migration resistance design.

Page 5-147, Non-structural management strategy

Added text:

- Relocation of homes to outside of known channel migration hazards should be considered where appropriate.

5.7 CARBON RIVER

5.7.5 River Risk Reduction Facilities, Flooding and Flood Damage

Page 5-157, Table 5.34 Levee and Revetments along the Carbon River.

Revised text:

Table 5.34 Levees and Revetments along the Carbon River		
Name	**Location [a]**	**Ownership**
Right Bank		
Lindsay Levee	RM 16.9 (PR) – RM 1.7, PL 84-99	Pierce County
~~Water~~ Ski Park Levee	RM 5.95 – RM 7.0, PL 84-99	Pierce County
Left Bank		
Riddell Levee	RM 0.0 – RM 1.7, PL 84-99	Pierce County
Orting Treatment Plant Levee	RM 1.7 – RM 3.05, PL 84-99	Pierce County
Bridge Street Levee	RM 3.05 – RM 3.7, PL 84-99	Pierce County
Voight Downstream Revetment	RM 3.7 – RM 4.0	Pierce County
Voight Upstream Revetment	RM 4.0 – RM 4.4	Pierce County
Guy West Levee	RM 4.6 – RM 5.6, PL 84-99	Pierce County
Guy West Revetment	RM 5.6 – RM 5.95	Pierce County
Alward Segment No 2 Levee	RM 5.95 - RM 6.4, PL 84-99	Pierce County
Fish Ladder Revetment	RM6.35- RM 6.65	Pierce County
Alward Segment No 1 Levee	RM 6.55 – RM 8.26, PL 84-99	Pierce County
Alward Revetment	RM 8.26- RM 8.33	Pierce County

[a] RM = river mile; PL 84-99 = USACE Flood Control and Coastal Emergency Act

Source: Pierce County Surface Water Management records

5.7.5.1 Major Flooding

Page 5-157, first paragraph.

Revised text:

Major flooding of the Carbon River has been recorded occurred in 1933, 1959, 1977, 1990, 1996, 2006, 2008, and 2009 (see Table 5.35). The November 2006 flood is the largest on record, with a measured flow of 14,500 cfs. The categorization of major flooding is based on a threshold of discharges in excess of approximately 10,000 cfs at the Fairfax gauge.

Page 5-158, Table 5.35 Historical Major Flooding on Carbon River.

Revised text:

Table 5.35 Historical Major Flooding on Carbon River	
Date	**Carbon River Flows at Fairfax Gauge (cfs) – USGS #12094000[a]**
December 1933	11,000
November 1959	9,970
December 1977	10,000
November 1990	13,000

February 1996	12,000
December 1996	13,600
November 2006	14,500
November 2008	11,700
January 2009	11,300
December 2015	10,200

Note: There is a gap in the USGS record from 1977 to 1989
Source: Pierce County Surface Water Management and United States Geologic Survey records

5.7.5.2 Flood Damage to Facilities

Page 5-158, first paragraph.

Revised text:

Flood damages to Carbon River flood risk reduction facilities have been extensive in the past three ~~two~~ decades. Seven ~~Six~~ significant flood events have occurred along the study reach since 1990. Damages sustained ranged from full washout of the flood control structure over several hundred lineal feet to localized moderate scour and erosion. Damages from the major flood events resulted in approximately 244 ~~99~~ identified damage locations comprising ~~5.9~~12.5 miles of levees and revetments. Damages have been estimated at nearly $~~15~~ 17.34 million dollars (based on 2017~~0~~ dollars). Table 5.36 summarizes recorded levee and revetment ~~segments subject to the most significant and repetitive~~ damages. The upper portion of this Carbon River reach between RM 6.0 and RM 8.3 ~~incurred~~ has historically been the most vulnerable to repetitive damages requiring repair. ~~the most damage.~~ Examples of existing levees on the Carbon River are shown in Figure 5.52.

5.7.5.2 Flood Damage to Facilities

Page 5-158 through 5-160, Table 5.36 Damage to Facilities in the past 20 years along the Carbon River.

Deleted table

5.7.6.2 Land Purchases

Page 5-162, paragraph one.

Revised text:

A significant number of parcels and flood damaged homes have been purchased along the Carbon River since the 1991 ~~flood plan~~ Flood Plan was adopted.~~–~~ Acquisitions have been ~~mostly~~ focused on the Upper Carbon River between RM 6.4 & 8.3 in support of a future setback levee project planned along this reach. The objective of the project is to help resolve repetitive damages to the levee as well as reconnect historic floodplain that is currently cutoff by the existing levee.

5.7.6.3 Partnerships

Page 5-162, paragraph one.

Revised text:

As noted above, Pierce County has partnered with the Floodplains ~~by Design~~ for the Future program to bring in an estimated $600,000 in grant funds that have assisted with property acquisitions along the Carbon river. FEMA following disaster declarations #1671 and #1682 to purchase numerous flood damaged or repetitive loss properties resulting from the November 2006 flood. HMGP grants pay 75 percent of acquisition costs, with match of 12.5 percent from the State of Washington and 12.5 percent from Pierce County.

5.7.7 Flood and Channel Migration Hazard Mapping

5.7.7.1 Flood Hazard Mapping.

Page 5-162, paragraph one.

Revised text:

Flood hazard mapping for the Carbon River includes detailed flood studies (FEMA ~~/2009,~~ NHC 2006) and the creation of ~~preliminary~~ Digital Flood Insurance Rate Maps (DFIRM). The DFIRM maps were adopted in 2017. In order to publish the countywide Digital Flood Insurance Rate Maps (DFIRM) areas that were affected by non-accredited levees were "secluded" from the map update. This means that the Carbon river form the Puyallup River to South Prairie Creek still shows the same flood risk as it was understood in the 1970's. ~~As of the publication of this document FEMA has not issued new maps.~~ Flood prone areas in the City of Orting include; schools, ~~along the Carbon River include~~ residential and commercial lands. ~~, schools in the City of Orting, and agricultural land both upstream and downstream of Orting.~~ In unincorporated areas, agricultural and residential properties are in the flood prone areas. The ~~preliminary~~ FEMA/NHC 2006 flood study ~~DFIRM maps~~ for the Carbon River show 1,317 acres within the special flood hazard area or 100-year floodplain. The FEMA/NHC 2006 flood study is regulated as best available data by Pierce County and used as guidance by the City of Orting. The mapped deep and fast flowing area in unincorporated areas is 945 acres.

5.7.7.2 Channel Migration Hazard Mapping.

Page 5-162 to 5-163, paragraph one.

Revised text:

Severe, moderate, and low channel migration zones (CMZ) were mapped for the Carbon River (GeoEngineers 2003) and adopted in November 2004. The CMZ refers to the geographic area where a stream or river has been and is susceptible to channel erosion and/or channel occupation (WSDOE 2003). The severe CMZ covers an area of 999 acres in unincorporated areas along the Carbon River. Pierce County regulates severe CMZ mapped areas as floodway per Chapter 18E.70, Pierce County Code.

5.7.9 River Reach Management Strategies

Page 5-166, paragraph 2

Revised text:

In the near term, the primary objective for the Carbon River is to maintain the structural integrity of the levee and revetment system so the facilities continue to reduce risks to public health and safety and reduce ~~public and private property~~ damage to property and infrastructure. Another objective is to construct setback levees to increase the level of flood protection to the 100-year flood in the City of Orting. An additional~~The final~~ management strategy objective is to realize capital projects that enhance and create aquatic habitat through levee or revetment setbacks, riparian re-vegetation, and strategic placement of large woody material in addition to providing flood protection.

Page 5-166, Structural management strategies

Revised text:

Structural Management Strategies:

- RM 0.8 to RM 3.9 left bank – The "level of ~~protection~~service" goal for levees and flow conveyance should be the 100-year design ~~plus three feet of freeboard~~ in the City of Orting.
- RM 0.0 to RM 0.8 left bank; RM 3.9 to RM 8.4 left bank; RM 0.0 to RM 1.3 right bank; and RM 5.9 to RM 7.0 right bank – The "Level of service" goal for levees should be to maintain the existing levee prism.

5.7.10 Recommended Capital Projects

Page 5-169, C2 Carbon Levee Bank Stabilization / Flow Deflection and Coplar Creek Backwater Improvements.

Revised text:

5.7.10.1 C2 Carbon Levee Bank Stabilization / Flow Deflection and Cheese~~oplar~~ Creek Backwater Improvements

5.7.10.3 C3 Alward Road Floodplain Acquisition

Page 5-171, Figure 5.55.

Revised text:

Figure 5.55 – Air photo of SR 162 and Foot Hills Trail bridges over the ~~Puyallup~~ Carbon River

5.7.10.4 C4 Alward Road Floodplain Acquisition and Setback Levee

Page 5-173, River Mile.

Revised text:

River Mile: 6.4 – 8.4~~8~~, Left Bank

Page 5-174, What are the Project Benefits?

Revised text:

- Reconnection of ~~1,175~~ 142 acres of riparian floodplain to the Carbon River,

5.8 SOUTH PRAIRIE CREEK

5.8.5.1 Major Flooding

Page 5-183, paragraph 2.

Revised text:

Major flooding occurred in the South Prairie Creek in 1955, 1965, 1990, 1996, 2006, and 2009 (see Table 5.40). The January 2009 flood is the largest on record, with a measured flow of 9,480 cfs, exceeding ~~close to~~ the 100-year flood flow of 8~~9~~,700 cfs estimated by FEMA (FEMA/ ~~2009,~~ NHC 2006). Since the plan was adopted in 2013, there has been no major flooding in this reach.

5.8.5.2 Flood Damage to Facilities

Page 5-184, paragraph 2.

Revised text:

~~Records show that i~~In 1996 South Prairie Creek jumped the right bank and washed out South Prairie Road near 246th Avenue East and did the same, further downstream at Spring Site Road. Road reconstruction, bank stabilization, and an armored overflow flood re-entry channel repaired the flood damage.

5.8.6.3 Partnerships

Page 5-185, paragraph 1.

Additional text:

Inglin Dairy had the most potential for restoring floodplain connectivity and for creating habitat. Natural Systems Design was selected as the consultant to develop a restoration plan for Inglin Dairy. The objective of the project is to construct a side channel to the north, raise the mainstem of South Prairie Creek using 4 channel spanning structures that would encourage bed aggradation. Woody debris jams would also be constructed throughout the side channel and floodplain areas and an aggressive riparian/floodplain planting plan would be developed and implemented by the Pierce Conservation District. The work for this project is scheduled to be done over two construction seasons (2018 and 2019), depending on permitting. Additional partners on this project is the South Puget Sound Enhancement Group and the Puyallup Tribe of Indians.

5.8.7 Flood and Channel Migration Hazard Mapping

5.8.7.1 Flood Hazard Mapping

Page 5-185, paragraph 1.

Revised text:

Hazard mapping along South Prairie Creek includes detailed flood studies (FEMA /~~2009~~, NHC 2006) that was incorporated into the ~~and the creation of preliminary~~ Digital Flood Insurance Rate Maps (DFIRM 2017)~~, which as of the publication of this document had not been issued by FEMA~~. Flood prone areas along South Prairie Creek include rural residential land, agricultural and recreational land, and limited areas in the Town of South Prairie. The DFIRM maps for South Prairie Creek within the study area show 469 acres within the special flood hazard area or 100-year floodplain. The mapped deep and fast flowing area is 247 acres.

5.8.7.2 Channel Migration Hazard Mapping

Page 5-185, paragraph 2.

Revised text:

Severe, moderate and low channel migration potential areas (MPAs) were delineated for South Prairie Creek ~~in 2005~~ (Geo Engineers 2005). The CMZ refers to the geographic area where a stream or river has been located and is susceptible to channel erosion and/or channel occupation (WSDOE 2003). The severe CMZ covers an area of 183 acres along South Prairie Creek. Pierce County regulates severe CMZ mapped areas as floodway per Chapter 18E~~.70~~ and adopted the~~,~~ ~~Pierce County Code, but the~~ South Prairie Creek CMZ in 2017.~~map has not yet been adopted~~.

5.9 MIDDLE NISQUALLY RIVER – MCKENNA AREA

5.9.1 Overview

Page 5-193, paragraph 2.

Revised text:

The drainage area to the USGS gauge on the Nisqually River at McKenna is 517 square miles. The middle Nisqually River at McKenna forms the boundary between Pierce County and Thurston County. Flood risk on this reach is predominately in Thurston and Lewis County, as most of the Pierce County area is on high bank of the river. The focus of this reach is from approximately RM 21.3 to RM 26.0, where the 100-year floodplain is up to 2900 feet wide, and where substantial flooding occurred in the McKenna area during the February 1996 flood event. Land use in the McKenna vicinity consists of medium-density residential, rural residential and agriculture and pasture lands. There are also extensive lakes and wetlands in the surrounding area. Salmonid use in this reach of the Nisqually River includes fall Chinook, coho, chum and pink salmon and winter steelhead trout.

5.9.2 Geology and Geomorphology

Page 5-193, paragraph 1, second sentence.

Revised text:

In the lower half of this reach where the valley is over 2000 feet wide on average, several remnant historical channels are still visible throughout the historical channel migration zone (Nisqually Basin Plan 2014~~08~~).

5.9.3 Hydrology and Hydraulics

Page 5-196, paragraph 1, third sentence.

Revised text:

There are two dams on the Nisqually River LaGrande Dam at RM 42.4 and Alder Dam at RM 44.2 which forms the 3,000-acre Alder Lake. The two dams are part of the Nisqually hydroelectric project owned and operated by Tacoma Power which is part of Tacoma Public Utilities. According to Tacoma Power, the dams provide incidental attenuation of floods, but their Federal Energy Regulatory Commission (FERC) operating agreement and license has no flood control requirements (Nisqually Basin Plan, 2014~~08~~).

5.9.7 Flood and Channel Migration Hazard Mapping

5.9.7.1 Flood Hazard Mapping

Page 5-199, paragraph 1.

Revised text:

Flood hazard mapping in the middle Nisqually River was stripped of detailed flood information that was proven to understate flood risk after the 1996 flood. ~~includes the flood insurance study from 1987 (FEMA 1987).~~ Many of the destroyed properties purchased after the 1996 flood were shown to be outside the Special Flood Hazard Area. A new flood study, in collaboration with Thurston County, was started ~~for this reach~~ in 2011 and has just resumed with new funding in 2017. The new study, funded under RiskMAP, will provide base flood elevation and floodway assessments. Completion of this project is expected by 2020. ~~The data on which that study was based is over 25 years old, and does not include the record 1996 flood.~~ Due to low density in this reach, flood prone areas are limited to sparse residential areas outside of McKenna and some commercial buildings and agricultural uses~~Flood prone areas along the middle Puyallup Nisqually in Pierce County include residential land in McKenna, a few commercial buildings, and State Route 507. Upstream there is low density residential, agricultural and forest land use.~~ The ~~1987~~ DFIRM maps for the middle Nisqually River show 886 acres within the special flood hazard area or 100-year floodplain. ~~Many of the destroyed properties purchased after the 1996 flood were not shown to be within the Special Flood Hazard Area on the 1987 FIRM maps.~~ Deep and fast flowing areas have not been mapped for this reach.

Page 5-201, Non-structural management strategy, below second bullet.

Additional text:

For additional information regarding the Nisqually River, please refer to the 2013 Thurston County Flood Hazard Management Plan: http://www.co.thurston.wa.us/planning/natural-res/docs/flood-plan.pdf

2017 Thurston County Flood Plan: https://www.trpc.org/DocumentCenter/View/4775

5.9.10 Recommended Capital Projects

Page 5-202, Basin Plan.

Revised text:

Basin Plan: Nisqually Adopted January 2012 ~~(to be adopted)~~

5.10 UPPER NISQUALLY RIVER

5.10.2 Geology and Geomorphology

Page 5-208, Figure 5.69.

Reversed pictures to match caption:

5.10.5 River Management Facilities, Flooding and Flood Damage

Page 5-210, Table 5.46 Levees and Revetments on the Upper Nisqually.

Revised text:

Table 5.46 Levees and Revetments on the Upper Nisqually River		
Name	**Location**	**Ownership**
Right Bank		

Nisqually Park Levee	RM 64.5~~67.6~~ – RM 65.4~~68.4~~	Pierce County

[a] RM = river mile; RB = right bank
Source: Pierce County Surface Water Management records

5.10.5.1 Major Flooding

Page 5-210, paragraph one.

Revised text:

Since the USGS gauge was installed in 1942, major flooding has been recorded occurred in the upper Nisqually River in 1974, 1977, 1990, 1996, 2006, and 2008 (see Table 5.47). The February 1996 and November 2006 floods both exceeded 21,000 cfs, and were similar in magnitude to the estimated 1.0 percent annual chance flood (100-year) of 21,950 cfs estimated by Pierce County SWM. The categorization of major flooding is based on a ~~threshold of~~ discharge greater than ~~s in excess of~~ 15~~3~~,000 cfs for the Nisqually River gauge near National, Washington.

Page 5-211, Table 5.47 Historical Major Flooding on Nisqually River.

Revised text:

Table 5.47 Historical Major Flooding on Nisqually River

Date[a]	Nisqually River Flows at National Gauge (cfs) – USGS #12082500
January 1974	**15,000**
December 1975~~January 1974~~	~~15,000~~13,200
January 1974	15,000
December 1977	17,100
January 1990	14,500
February 1996	21,200
November 2006	21,800
November 2008	13,900
January 2009	13,200
December 2015	16,700

[a]Period of record is 1941 – 2010
Source: United States Geologic Survey records

5.10.5.2 Flood Damage to Facilities

Page 5-211, paragraph one.

Revised text:

The only flood control structure Pierce County owns on this reach is the Nisqually Park Entrance levee that extends into Mount Rainier National Park which protects the highway. Due to the high energy of the Nisqually River, the levee is consistently being repaired for loss of face and toe rock that has eroded away. In November 2006, Mt. Rainier experienced a record breaking rain event resulting in severe flood damages throughout the National Park. Eighteen inches of rain fell in 36 hours near Paradise. One of the hardest hit areas was near the Nisqually entrance at the Sunshine Point Campground. More than 1,000 linear feet of ~~river bank revetment and~~ levee ~~providing protection to the Nisqually park entrance and downstream residences~~ was washed away (see Figures 5.71 and 5.72).

Page 5-212, Figure 5.71.

Revised text:

Figure 5.71 - (a) June 30, 2006 aerial photo of Sunshine Point area prior to flood damage (RM 65.5- 65.6), and (b) after repair of revetment and levee following November 2006 flood event

Page 5-212, Figure 5.72.

Revised text:

Figure 5.72 - Aerial photo of Sunshine Point damage area along the upper Nisqually River after November 2006 flood event (RM 65.5-65.6)

Page 5-213, Table 5.48 Damage to Facilities on the past 20 years along the Upper Nisqually River.

Delete table.

5.10.6 Key Accomplishments since the 1991 Flood Plan

5.10.6.1 Major Projects

Page 5-213, paragraph one.

Revised text:

As noted above, flood damages to the Nisqually Park levee have been quite extensive in the past three ~~two~~ decades. Damaged portions of the levee needed repair in 1991, 1992, 1993, 1995, 1996, 2003, 2004, 2005, 2006, 2010~~09~~, and 2011, 2012, and 2017 (see Table 5.49 for total repair costs).

Page 5-214, Table 5.49 Damage Repair Costs to Nisqually Park Levee.

Revised text:

Table 5.49 Damage Repair Costs to Nisqually Park Levee

Year	Repair Costs (Pierce County)	Repair Costs (Corps of Engineers)
1991	$74,610	

Table 5.49 Damage Repair Costs to Nisqually Park Levee		
Year	**Repair Costs (Pierce County)**	**Repair Costs (Corps of Engineers)**
1992	$142,718	
1993	$217,000	
1995	$50,000	$200,000
1996	$50,000	$200,000
2003	$122,500	
2004	$203,000	
2005	$131,000	
2006	$900,760	
2010	$529,500	
2011	$185,682	$752,529~~$928,400~~
2012	$783,185	
2017	$243,440	$973,760
Total	$2,421,088	$1,328,400
Total Cost = $~~3,749,488~~ 5,759,684 (inflation adjusted = $~~4.6~~ 7.09 million)		

Source: Pierce County Surface Water Management records

5.10.7 Flood and Channel Migration Hazard Mapping

5.10.7.1 Flood Hazard Mapping.

Page 5-215, paragraph one.

Revised text:

Hazard mapping in the upper Nisqually River shows an unstudied Zone A SFHA on the old and recently updated FIRM. ~~includes the flood insurance study from 1987 (FEMA 1987). The data on which that study was based is over 25 years old, and does not include the two largest floods of record which occurred in November 1996 and October 2006.~~ Flood prone areas along the upper Nisqually include low- and medium-density residential land, limited commercial areas, and floodplain forests. The ~~1987~~ FIRM maps for the upper Nisqually River show 1,114 acres within the special flood hazard area or 100-year floodplain. Deep and fast flowing areas have not been mapped for this reach.

5.10.7.2 Channel Migration Hazard Mapping.

Page 5-215, paragraph one.

Revised text:

Severe and moderate channel migration zones (CMZ) were mapped for the upper Nisqually River (GeoEngineers 2007). The CMZ refers to the geographic area where a stream or river has been or ~~and~~ is susceptible to channel erosion or channel occupation (WSDOE 2003). The severe CMZ covers an area of 1,830 acres along the upper Nisqually River. Pierce County regulates severe CMZ mapped areas as floodway per Chapter 18E.70, Pierce County Code, ~~but~~ the severe CMZ map was ~~has not been~~ adopted for the upper Nisqually area in 2017.

5.10.8 Problem Identification

Page 5-215, paragraph one.

Additional text:

The primary hazard on the Nisqually ~~r~~River is erosion rather than inundation. Erosion continues to cause damage to levees, bridges, and roadways. It is also the primary flood related risk to residential structures within the floodplain. The few residential communities are built on terraces above the floodplain and the larger lots typically have developable areas above the flood hazard. ~~On the other hand, erosion continues to cause damage to levees, bridges, and roadways. It is also the primary flood related risk to residential structures.~~ Table 5.50 includes the flooding and channel migration problems identified in the upper Nisqually River floodplain. For more detail on these problems, see Appendix G.

Page 5-217, Figure 5.74.

Revised text:

Figure 5.74 - Channel migration near RM 62.0~~at~~ Alpine Village threatens homes and property (2009)

5.10.9 River Reach Management Strategies

Page 5-217, second bullet.

Revised text:

- **River management facilities** – There is a single levee and revetment at the entrance to Mt. Rainier National Park and along State Route 706 and the Nisqually Park subdivision on the right bank (RM 64.5~~3~~ to RM 65.4~~3~~). There is also armoring at bridge crossings and near the community of Elbe.

Structural management strategy:

Page 5-217, first, second, and third bullets.

Revised text:

- RM 50.2 to RM 61~~4~~.7~~2~~ – Tacoma Power, Tacoma Rail and Kernahan Bridge revetment protection (channel migration resistance design),
- RM 64.5~~3~~ to RM 65.1 right bank – "Level of ~~protection~~ Service" goal for the Nisqually Park levee should be to maintain the existing levee prism, and

- RM 65.1 to RM 65.4~~3~~ right bank – “Level of Service” goal for the Mt. Rainier National Park entrance revetment is the channel migration prevention design.

5.10.10 Recommended Capital Projects

5.10.10.1 UN1 Nisqually Park Subdivision Levee Protection

Page 5-219, River Mile.

Revised text:

River Mile: 64.5~~3~~ – 65~~4~~.1~~9~~, Right Bank

5.10.10.2 UN2 Upper Nisqually/Mt. Rainier National Park Revetment Retrofit/ ELJs

Page 5-221, River Mile.

Revised text:

River Mile: 64.5~~3~~ – 65~~4~~.1~~9~~, Right Bank

5.11 MASHEL RIVER

5.11.1 Overview

Page 5-223, paragraph one.

Revised text:

The Mashel River sub basin, covering about 85 square miles, is higher in elevation and steeper than most other tributaries to the Nisqually River. Over 40 percent of the basin has slopes greater than 30 percent (Nisqually Basin Plan 2014~~2008~~). Major tributaries of the Mashel River are the Little Mashel River, Beaver Creek, and Busy Wild Creek. Elevations range from 460 feet at the mouth to 4,845 feet on the flanks of Mount Rainier. The Mashel River winds through a steep, sinuous canyon as it approaches the Nisqually River, where it enters at approximately RM 39.6.

5.11.2 Geology and Geomorphology

Page 5-223, paragraph one, last sentence.

Revised text:

The channel bed material is typically cobbles and large gravel with some bedrock outcrops (Nisqually Basin Plan 2014 ~~2008~~).

5.11.6 Key Accomplishments since the 1991 Flood Plan

5.11.6.1 Major Projects

Page 5-229, paragraph one.

Revised text:

~~Since the *1991 Puyallup River Comprehensive Flood Control Management Plan* was completed, Pierce County has carried out an annual program that includes maintenance and repair of facilities.~~ Specific capital projects are listed below:

Page 5-229, bullet one.

Revised Text:

1. **Mashel River Restoration Project (Nisqually Indian Tribe)**

   Numerous engineered log jam structures have and will be installed in a multiphase project to rehabilitate degraded in-stream and riparian habitat to restore geomorphic and ecological functions beneficial to native salmonid species. An example of these ELJs is located on the right bank of the Mashel River, upstream of the State Route 161 crossing (see Figure 5.80~~37~~)

Page 5-230, paragraph one.

Revised text:

Flood hazard mapping along the Mashel River includes detailed flood studies (FEMA/~~ and~~ NHC 2006) and the creation of preliminary Digital Flood Insurance Rate Maps (DFIRM). As of the publication of this document the DFRIM maps have not been issued by FEMA.

5.11.10.1 M1 – SR-161 Mashel River Bridge – Bridge Scour and Slope Repair Project

Page 5-233, second bullet.

Revised text:

- State Route 161 is at risk of future damage from bank erosion from high flows that result in highway closures, and

CHAPTER SIX
FLOOD PLAN IMPLEMENTATION AND FUNDING

6.1.1 Pierce County Role in Implementation

Page 6-2, paragraph one, first sentence.

Revised text:

The Pierce County Rivers Flood Hazard Management Plan will be adopted by reference as part of Pierce County Code, Title 19D.~~60~~, as well as other comprehensive planning documents and the Pierce County Storm Drainage and Surface Water Management Plan.

Page 6-2, paragraph two.

Revised text:

Since the adoption of the plan, ~~After adoption of the Plan,~~ SWM has ~~will~~ identifiedy the capital improvement projects in the Plan to add to the Capital Facilities Element of the Comprehensive Plan (CFP). The CFP is updated annually and includes projects capital expenses over six years. Typically, annual budgets reflect the adopted CFP. Pierce County will seek to partner with local governments on capital projects and maintenance and operations of flood risk reduction facilities in incorporated areas. For additional information on the CFP for 2018-2023, please ~~refer to the below link~~ visit: http://www.co.pierce.wa.us/ArchiveCenter/ViewFile/Item/5814

6.2.1.1 Current Funding

Page 6-6, paragraph one, first sentence.

Revised text:

Current sources of funding include the Pierce County's Surface Water Management Fund collected from citizens and business in unincorporated Pierce County, a portion of the Real Estate Excise Tax, and occasional designated federal and state funds that are limited and conditionally available in declared flood disasters, and through grants.

Page 6-7, fifth and sixth bullet.

Revised text:

- Federal Emergency Management Agency (FEMA),
  - Hazard Mitigation Grant Program (HMGP)
  - Pre-Disaster Mitigation (PDM)
  - Flood Mitigation Assistance (FMA)
  - ~~Repetitive Flood Claims (RFC)~~
  - ~~Severe Repetitive Loss (SRL)~~

Page 6-7, twelfth bullet.

- State of Washington Department of Ecology (WDOE)
  - Flood Control Assistance Account Program (FCAAP)
  - Floodplains by Design (FbD)

Page 6-7, bullets fifteen through seventeen.

  - Salmon Recovery Fund Board (SRFB)
  - Puget Sound Acquisition and Restoration Fund (PSAR)
  - Puget sound Acquisition and Restoration Fund Large Capital Projects (PSAR Large Cap)

6.2.1.2 Potential New and Enhanced Local Funding Options

Flood Control Zone District Levy or Fee

Page 6-8, paragraph one.

Additional text:

RCW 86.15.025 gives the Pierce County Council the authority to establish either countywide or basin-level flood control zone districts (FCZD) that create additional opportunities for new, dedicated funding sources. A FCZD is a special purpose district (government agency) established to specifically address flooding issues. The purpose of the FCZD is to construct, operate, and maintain flood control projects to reduce flooding and channel migration risks. Funding for a FCZD can be initiated through a levy based on total assessed value of taxable property within the district's designated boundaries or through the imposition of fees. The District tax levy under state law may not exceed 50 cents per thousand dollars of assessed value. Due to potential levy suppression issues as a junior taxing district, the District may not exceed 25 cents per thousand of assessed value. Since the District's formation the property tax levy for the flood control zone has not exceeded 10 cents per thousand.

Only those portions of Chapter 19D.60 that are proposed to be amended are shown. Remainder of text, maps, tables and/or figures is unchanged.

Chapter 19D.60

PIERCE COUNTY STORM DRAINAGE AND SURFACE WATER MANAGEMENT PLAN

The following documents are hereby incorporated by reference to this Plan:

A. Pierce County Storm Drainage and Surface Water Management Plan, James M. Montgomery Consulting Engineers, Inc., March 1991, and area updates as follows:
   1. Clover Creek Basin Plan, Pierce County Public Works, November 2002;
   2. Gig Harbor Basin Plan, Pierce County Public Works, November 2002;
   3. Muck Creek Basin Plan, Pierce County Public Works, April 2003;
   4. Mid-Puyallup Basin Plan, Pierce County Public Works, August 2005;
   5. Clear/Clarks Creek Basin Plan, Pierce County Public Works, November 2005;
   6. Hylebos Browns-Dash Point Basin Plan, Pierce County Public Works, May 2006;
   7. Key Peninsula-Islands Basin Plan, Pierce County Public Works, June 2006;
   8. White River Basin Plan, Pierce County Public Works, November 2013; and
   9. Nisqually River Basin Plan, Pierce County Public Works, January 2014.

B. Clover Creek Basin Drainage Plan, An Engineering Study for Flood Control in Pierce County, Washington, Consoer, Townsend & Associates Consulting Engineers, 1976.

C. Hylebos Basin Drainage Plan, Part A, Engineering Study for the Hylebos Flood Control Zone District, Consoer, Townsend & Associates Consulting Engineers, 1974.

D. 144th Street East Drainage Basin Plan, An Engineering Study for Flood Control in Pierce County, Washington, PRC Consoer Townsend, Inc., 1981.

E. Pierce County Rivers Flood Hazard Management Plan, Pierce County Public Works, August 2012.
   1. Pierce County Rivers Flood Hazard Management Plan, Pierce County Planning and Public Works, November 2018.

Code Revisor's Note: The Storm Drainage and Surface Water Management Plan was adopted by Ordinance No. 91-113 and codified as Chapter 19D.60 PCC by Ordinance No. 96-111.

Pierce County Council
930 Tacoma Ave S, Rm 1046
Tacoma, WA 98402