DRAFT SOUTH FORK SKYKOMISH RIVER

Flooding and Erosion Conditions

- 9 levees and revetments / Approximately 1.1 miles of river bank are armored
- Revetments provide limited, localized erosion protection, but impact habitat
- Frequent and costly repairs
- Risks of channel migration and erosion are high
- Several alluvial fans with dynamic channels and ample sediment supply
- Homes threatened in several neighborhoods
- Miller River avulsion closed Old Cascade Highway

Homes along the Skykomish River

Proposed 6-Year Actions

Basin Wide Efforts

South Fork Skykomish River Channel Migration Zone - Complete South Fork Skykomish River Channel Migration Zone Mapping.

Priority Acquisitions – Acquire high priority properties.

Restoration Feasibility Study - Work with US Forest Service and other stakeholders to develop recommended actions to reduce flood hazards and improve salmon habitat.

South Fork Skykomish

Timber Lane Village Home Acquisitions - Purchase homes and property subject to extreme erosion and flooding in this neighborhood.

Town of Skykomish Home Acquisitions - Purchase homes and property subject to flooding risk in the Town of Skykomish.

Skykomish West River Drive Flood Reduction Study - Identify and evaluate alternatives to reduce frequency and severity of flood risks to residential area on West River Drive in the Town of Skykomish (near Maloney Creek confluence).

Miller River

Miller River Alluvial Fan - Road Protection - Develop and implement a strategy for maintenance or removal of flood protection facilities on the Miller River alluvial fan.

Channel Migration Mapping – Map CMZ hazards in the Foss, Tye, Beckler, and Miller Rivers and Money Creek.

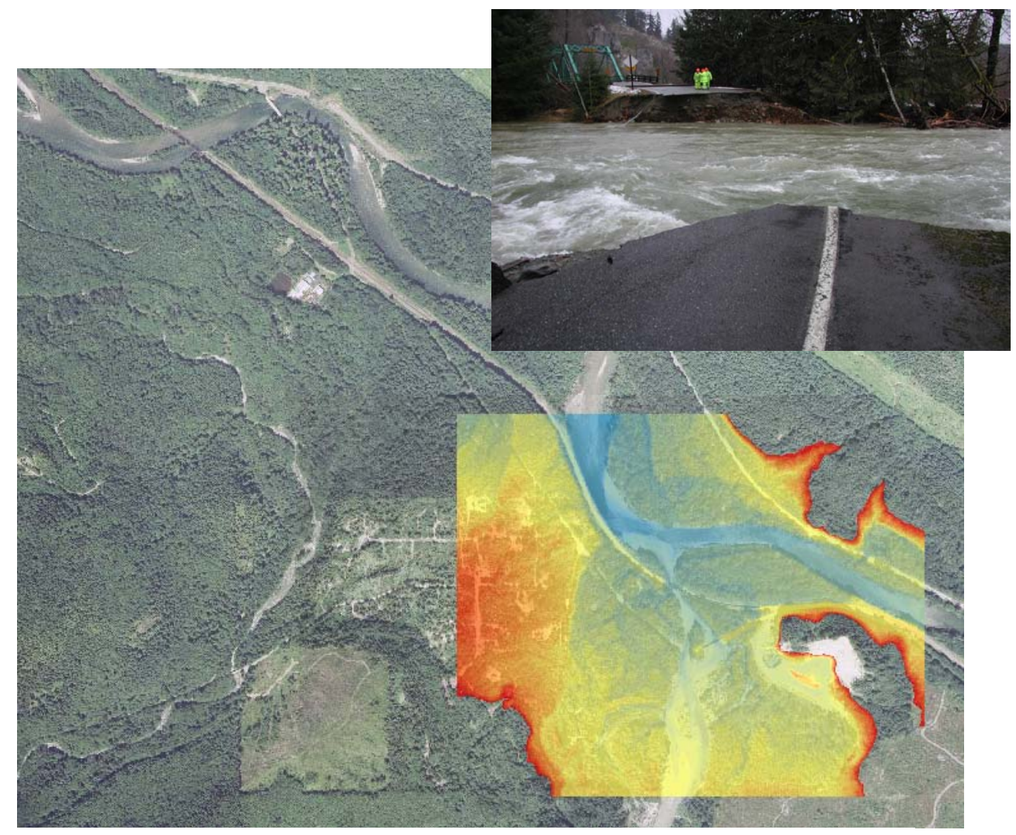
Miller River Home Demolition - Demolish structures on monastery property flood buyout.

Vision & Strategy

The vision for the South Fork Skykomish is to manage flood hazards in a cost-effective way, consistent with protection of natural riverine processes, the scenic designation, forested conditions, and King County's environmental goals.

The strategy for achieving this vision is to:

- Implement a combination of structural and non-structural projects to address the most significant flood risks,
- Map flooding and channel migration hazards and risks to limit development in at-risk areas,
- Work in partnership with the US Forest Service to better define high priority needs in the basin.



Miller River Alluvial Fan

Accomplishments 2006 through 2012

- Acquired five parcels comprising 1.14 acres and three residences in Timber Lane Village
- Acquired four parcels comprising 28 acres and a monastery on the Miller River alluvial fan.
- Repair of McKnight Revetment on the right bank in Baring damaged in the 2009 flood event
- Teamed with King County Roads to assess options for addressing damages to the Old Cascade Highway from the Jan. 2011 Miller River avulsion.
- Donated a parcel to the Town of Skykomish to enable the Town to implement its Maloney Creek project.

DRAFT SOUTH FORK SNOQUALMIE RIVER

Flooding and Erosion Conditions

- Heart of South Fork is leveed reach through North Bend's commercial area
- Private residences also impacted by flooding
- Levees provide about 30-year flood protection, but adversely impact habitat
- Levees have geotechnical and seepage problems
- 28 levees or revetments /approximately 9 miles of armored river bank

Levee Overtopping January 2009

Vision & Strategy

Flood hazard management objectives for the South Fork corridor are focused on:

- Reducing flood risks in and around the Cities of North Bend and unincorporated King County
- Plan actions at a corridor scale rather than stand alone projects one at a time
- Forming and maintaining collaborative relationships with property owners, cities and other partners
- Support habitat restoration through water quality management
- Consider recreation user risks while formulating and implementing flood hazard management projects

Proposed Six Year Actions

Basin Wide

Upper Snoqualmie Valley Residential Flood Mitigation Project - Prioritize and implement residential home relocation and acquisitions and home elevations

Leveed Segment

South Fork Levee Improvement Project - Determine and implement an effective suite of actions to repair, relocate and/or strengthen key portions of the existing levee system to maintain or increases flood hazard protection to surrounding areas. Implement early actions as appropriate and in response to flood events.

North Bend Area Residential Flood Mitigation - Elevate residential structures in the Shamrock Park

Snoqualmie Valley Trail to Confluence segment

Circle River Ranch Alternatives Analysis and Implementation – Develop and analyze alternatives to address geomorphic risks to residential development in Circle River Ranch neighborhood

Accomplishments 2006 through 2012

- Repaired seven facilities including emergency repair during flood events
- Elevated ten homes in the Shamrock Park neighborhood along the left bank of the Leveed segment
- Acquired One property in Shamrock Park neighborhood / all structures have been demolished
- Three additional home elevations, (pending /funded but not completed) in Shamrock Park and four home elevations in the Clough Creek neighborhood
- Completed a Geomorphic Hazards and Risk assessment for the Circle River Ranch neighborhood
- Completed South Fork Gravel study in 2011, quantified impacts of gravel accumulation on flood levels, as well as potential effectiveness of any gravel management actions
- Completed preliminary geotechnical and hydraulic analysis for South Fork Levee Improvement project
- Preliminary design work including development of a suite of alternative actions to be developed and analyzed is underway for South Fork Levee Improvement project

Seepage through levee

DRAFT MIDDLE FORK AND NORTH FORK SNOQUALMIE RIVER

Flooding and Erosion Conditions

- Alluvial fan with dynamic channels and ample sediment supply
- Risks of channel migration and erosion are high
- Revetments provide limited, localized erosion protection, but impact habitat
- Homes and public infrastructure at risk from flooding and erosion
- Frequent and costly repairs
- There are 23 levees and revetments, approximately 3.4 miles of river bank are armored

Vision & Strategy

The multi-objective approach for the Middle Fork and North Fork Corridors is to:

- Promote public safety by reducing flood and channel migration risks
- Reducing flood risks to residences and infrastructure in unincorporated King County and the City of North Bend.
- Plan actions at a corridor scale rather than stand alone projects one at a time
- Provide for long term cost effective floodplain management
- Promote aquatic habitat and riparian restoration
- Consider recreational safety impacts

Proposed Actions

Basin Wide

Recreational Use Study - Conduct a study of type and extent of recreational use to insure project impacts on recreational safety can be addressed

Large Wood Study - Conduct a study of amount, distribution and effects of large wood on flooding and channel migration

Upper Snoqualmie Valley Residential Flood Mitigation Project – Prioritize and implement residential home relocation and acquisitions

Middle Fork Specific

Middle Fork Corridor Management Project - analyze flood, erosion, and channel migration risks and develop suite of management actions to effectively address flooding and geomorphic hazards in a cost effective manner while optimizing environmental benefits

North Fork Specific

North Fork Geomorphic Hazards Assessment - Develop geomorphic assessment of lower 2.5 river miles of the North Fork to identify geomorphic processes, hazards and related risks to residential development, infrastructure and flood protection facilities

Accomplishments 2006 through 2012

- Acquisition negotiations underway at Shake Mill Left on the North Fork
- Completed five repairs on Mason Thorson Extension and Mason Thorson Ells levees on the Middle Fork
- Completed three hazard tree relocations on the Middle Fork
- Completed early planning of comprehensive strategy for flood hazard management along the Middle Fork
- Ongoing monitoring of the Mason Thorson Extension levee
- Developed an emergency action plan be used in response to potentially rapid changes at Mason Thorson Extension
- Initiated assessments to characterize geomorphology, hydraulics, hydrology, habitat conditions, and land use influences on the Middle Fork

DRAFT UPPER MAINSTEM SNOQUALMIE RIVER

Flooding and Erosion Conditions

- Broad deep floodplain
- More than 300 inundated homes and businesses
- Infrastructure also at risk
- Highest number of flood damage claims in Washington State
- 19 levees or revetments, approximately 2.6 miles of armored river bank (6 facilities on Kimball Creek 13 on the upper Snoqualmie)

Vision & Strategy

The strategy for all segments in the upper Snoqualmie is to;

- Focus on reducing flood risks in and around the City of Snoqualmie
- Focus on reducing erosion risks along S.E. Reinig Road
- Promote cost-effective floodplain management
- Promote aquatic and riparian habitat protection and restoration
- Implement actions at a reach scale rather than one stand alone project at a time
- Implement a combination of structural and non-structural solutions
- Collaborate and partner with property owners and City of Snoqualmie

Proposed Six Year Actions

Basin Wide

Upper Snoqualmie Valley Residential Flood Mitigation Project – Prioritize and implement residential home relocation and Acquisitions and elevations

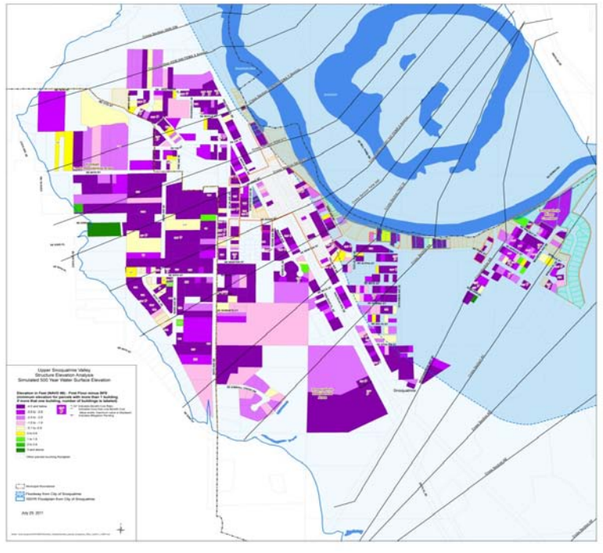
Reinig Road Segment

Reinig Road Revetment - Conduct alternatives analysis to address erosion and facility deficiencies

Snoqualmie Valley Trail to Kimball Creek Segment

Record Office Alternatives Analysis - Conduct alternatives analysis to address erosion and facility deficiencies resulting in multiple damages to the Record Office Facility

Mill Pond Feasibility & Technical Analysis - Conduct technical investigation to determine effectiveness of various flood mitigation actions



Accomplishments 2006 through 2012

- Repaired two facilities including emergency repair during flood events
- Elevated 39 homes with FEMA grant funding, 23 through the City of Snoqualmie's program and 17 by King County
- Contributing 12.5% matching funds for an additional 39 of the City of Snoqualmie's home elevations
- Acquired 3 properties , including Riverside Mobile Home Park / all structures have been demolished
- Completed mitigation needs assessment for residences in the Upper Snoqualmie Valley
- Developed programmatic strategy to prioritize home elevations and acquisitions

DRAFT LOWER SNOQUALMIE RIVER

Flooding and Erosion Conditions

- Deep, broad floodplain; levees limit bank erosion, not inundation
- Homes, farms, businesses impacted
- Several locations with eroding or unstable facilities protecting roads or other infrastructure
- Steeper gradient, more gravel downstream of Tolt and Raging Rivers increase risks of channel migration, fast/erosive flows
- Important salmon habitat (Chinook, coho, steelhead)

Vision & Strategy

Valley wide, work with partners to balance flood and erosion goals with agriculture and habitat needs

Tolt and Raging alluvial fan segments:

- In channel migration areas, allow more room for natural channel processes, increase flood/sediment capacity; potential actions include levee setback projects, voluntary acquisitions; critical to coordinate with affected landowners
- In broader valley where flows are slower, continue to work with farmers to reduce flooding impacts

Outside Tolt and Raging alluvial fan areas:

- Reduce impacts of flooding on farm operations, while protecting floodplain functions
- Potential actions include house and barn elevations, farm pads

Proposed 6-Year Actions

Basinwide

- **Flood-Farm Task Force Implementation** – farm pads, barn elevations; potential study of recent modifications at Snoqualmie Falls; ongoing fish/farm/flood collaboration
- **Lower Snoqualmie Residential and Agricultural Flood Mitigation** - house and agricultural structure elevations, acquisitions of homes in high risk locations
- **Large Wood Study and Recreational Use Study** - studies to better understand how flood/erosion reduction actions might affect wood accumulation in the river, where river recreation is occurring, and how projects and wood accumulation could affect recreational safety

Tolt and Raging Alluvial Fans

- **Aldair/Fall City Acquisitions** - acquisitions of at risk structures; potential support for levee setback projects in Snoqualmie at Fall City segment, and related benefits to ag
- **Snoqualmie at Carnation** – support monitoring and adaptive management of restoration projects in this segment

Chinook Bend to Snohomish County Line

- **Sinnema Quaale Upper Revetment Repair** – Snoqualmie Valley Trail and SR203 (car body curve)
- **Winkelman Revetment Repair** – Tolt water supply pipeline
- **Dutchman Road Revetment Repair** – W. Snoqualmie River Rd.

Accomplishments 2006 through 2012

- 24 farm pads constructed since 2008
- Technical and permitting assistance for 34 farm pads
- 2 barn elevations in 2012 as pilot project
- 12 home elevations, through FEMA, Army Corps, and Flood Control District funding
- 5 acquisitions in Fall City area representing 15 residences and 36 acres
- 2 levees repaired after November 2006 flood event
- Ongoing channel monitoring efforts in two lower Snoqualmie segments below Raging and Tolt Rivers; these are two study reaches in Snoqualmie gravel study currently underway
- Draft FEMA flood insurance study for the entire lower Snoqualmie River, submitted to FEMA in 2006 and awaiting formal adoption

DRAFT TOLT RIVER

Flooding and Erosion Conditions

- Steep, dynamic river; high sediment load
- High channel migration/erosion risk; homes and roads can be undermined and cut off
- Lower two miles leveed except Tolt-MacDonald Park
- City of Carnation located on alluvial fan; flood and erosion risks
- Important salmon habitat (Chinook, coho, steelhead)

Vision & Strategy

Basinwide:

- Plan and implement actions consistent with Tolt River Corridor Action Plan, to be completed in 2013

Upstream of Carnation segment:

- Restore natural river processes to reduce long term costs of flood/erosion management and restore salmon habitat
- Acquire at risk properties and remove flood facilities to allow river to migrate naturally and reconnect to floodplain
- Protect important public infrastructure, e.g., Tolt River Rd.

Carnation segment:

- Maintain existing level of flood protection to City of Carnation and unincorporated King County
- Pursue levee setback projects to expand channel capacity and sediment storage; partner with City of Carnation and habitat recovery proponents on these multi-objective projects
- Work with KC Roads, WSDOT to improve flood conveyance through alterations to roads and bridges

Proposed 6-Year Actions

Basinwide

- **Tolt River Corridor Study** - study underway to update technical information on flood/erosion risk and habitat restoration; will recommend priority actions
- **Priority acquisitions recommended by Tolt Corridor Study** - high priority acquisitions recommended by updated risk assessment
- **Priority modifications to flood facilities or other infrastructure recommended by Tolt Corridor Study** – high priority projects to remove or setback levees or alter roads/infrastructure recommended by updated risk assessment
- **Recreational Use Study** - study to determine reaches used for recreation and how flood/erosion actions could affect recreational safety

Upstream of Carnation

- **San Souci Neighborhood Acquisitions** – acquisitions in high flood and erosion hazard area
- **Tolt River Natural Area Floodplain Reconnection Acquisitions** – acquisitions in high flood and erosion hazard areas associated with Tolt Natural Area (could allow for future setback of Edenholm levee)

Carnation

- **Lower Tolt R. Acquisition** - purchase Swiftwater property to allow for future setback of Upper Frew levee (right bank)
- **Tolt River SR 203 to Trail Bridge Floodplain Reconnection** - setback Frew levee (right bank) to improve conveyance and allow habitat enhancement
- **Tolt R. Mile 1.1 Levee Setback** - setback Highway to RR Bridge levee (left bank) to improve conveyance and allow habitat enhancement; includes ongoing purchase and removal of homes

Accomplishments 2006 through 2012

- Acquisitions at San Souci (12 properties, representing 12 residences and 40 acres), Tolt River Mile 1.1 (10 properties, representing 8 residences, 7 acres), and at Tolt Natural Area Floodplain Reconnection Site (1 residence, 1 acre)
- Emergency repairs to Hwy to RR Bridge and Frew levees during January 2009 flood
- Repair and partial setback of Tolt River Road Protection revetment
- Completion of Lower Tolt River Floodplain Reconnection Project
- Partnered on Tolt River Trail Bridge Approach project to facilitate future levee setback
- Tolt River Corridor Action Plan initiated; includes technical update, alternatives analysis, action recommendations to reduce flood/erosion risk and restore habitat, and public outreach (effort underway)
- Ongoing channel monitoring of lower 1.72 river miles of Tolt River, to quantify sediment deposition, its influence on flood elevations, and potential reduction in flood elevations that could be accomplished with gravel removal

DRAFT RAGING RIVER

Flooding and Erosion Conditions

- Narrow, steep tributary; some of highest channel migration rates in all King County rivers
- Homes/mobile home park above I-90 at risk for channel migration
- Toe of slope at Preston-Fall City Road at risk
- At confluence (Fall City), levees limit channel migration and provide limited flood protection to commercial and residential uses; levees subject to damage
- Important salmon habitat (Chinook, coho, steelhead)

Vision & Strategy

Segments above Fall City:

- Restore natural river processes to reduce long term costs of flood/erosion management and restore salmon habitat
- Acquire at risk properties
- Where no houses or roads are at risk, remove facilities allowing river to migrate and reconnect to its floodplain
- Protect important public transportation infrastructure, e.g., Preston-Fall City Road

Fall City segment:

- Maintain existing level of flood protection for Fall City
- Explore long term options to set back levees to allow more room for natural channel processes and sediment deposition and storage, and to reduce overbank flooding
- Partner with habitat recovery proponents on these multi-objective projects
- Work with KC Roads, WSDOT to improve flood conveyance and reduce erosion risk through alterations to roads/bridges

Proposed Actions

Basinwide

Priority acquisitions - purchase and remove homes from high flood and erosion hazard areas and allow habitat restoration

Upstream of I-90

Alpine Mobile Manor Neighborhood Acquisitions - Purchase and remove homes and mobile home park from high flood and erosion hazard area; in long term, remove bank armoring and restore habitat

Abandoned Bridge Abutment and Waring Revetment Removal - remove old bridge abutment and Waring revetment once affected properties are purchased and demolished

Fall City

Fall City Levee Setback Feasibility Study - analyze potential levee setback projects in leveed segment to improve channel flood and sediment capacity, and to address flood/erosion risks in Fall City vicinity

Accomplishments 2006 through 2012

- 6 acquisitions in Alpine Mobile Manor neighborhood, representing 5 residences and 8 acres
- 7 repairs to the following facilities; Arruda, Bryce, Bridge to Bridge Left (two repairs), Bridge to Bridge Right, Bridge to Mouth Right, and Preston Fall City Lower
- Removal of Carlin levee in I-90 to Fall City segment (more than 1,000 linear feet removed)
- Ongoing channel monitoring of the lower 1.5 river miles of Raging River, to quantify sediment deposition, its influence on flood elevations, and potential reduction in flood elevations that could be accomplished with gravel removal