



KING COUNTY  
FLOOD CONTROL  
DISTRICT



**King County**

# Joint Basin Technical Committee (BTC) Meeting

Bellevue City Hall

May 5, 2015

# Meeting Agenda

1. Welcome and Introductions (1:00-1:05)
  
2. River Basin Updates
  - a. Snoqualmie (1:05-1:30)
  - b. Cedar – Sammamish (1:30-1:55)
  - c. Green – Duwamish (1:55-2:20)
  - d. White (2:20-2:35)
  -
  
3. Operating Updates – Hazard Studies (2:35-3:05)
  - a. Landslide Hazard Mapping
  - b. Channel Migration Mapping
  
4. City Project Updates
  - a. Seattle – South Park (3:05-3:10)
  - b. Lake Forest Park – McAleer Lyon Creek (3:10-3:15)
  - c. Renton – Cedar River Corps 205 Gravel Removal (3:15-3:20)
  - d. Kent (multiple projects) (3:20-3:40)



**KING COUNTY**  
**FLOOD CONTROL**  
D I S T R I C T



**King County**

**Basin Technical Committee (BTC)  
Snoqualmie/SF Skykomish  
Update**

**May 5, 2015**



# Basin Characteristics

- No large dams
- Limited levees
- 250 flood protection facilities
- Over 80 river miles with floodplain management needs
- Many subbasins, each with unique challenges



*Extensive flood inundation*



*Bank erosion*

*Channel migration*

# January 5-6, 2015 Flooding



*Tolt River Road inundated*



*Sandbagging in the City of Snoqualmie*



*Stranded car on 428<sup>th</sup> Ave. SE*



*Lower Snoqualmie flooding*

# Overall Snoqualmie Approach

Corridor plans to determine best approaches

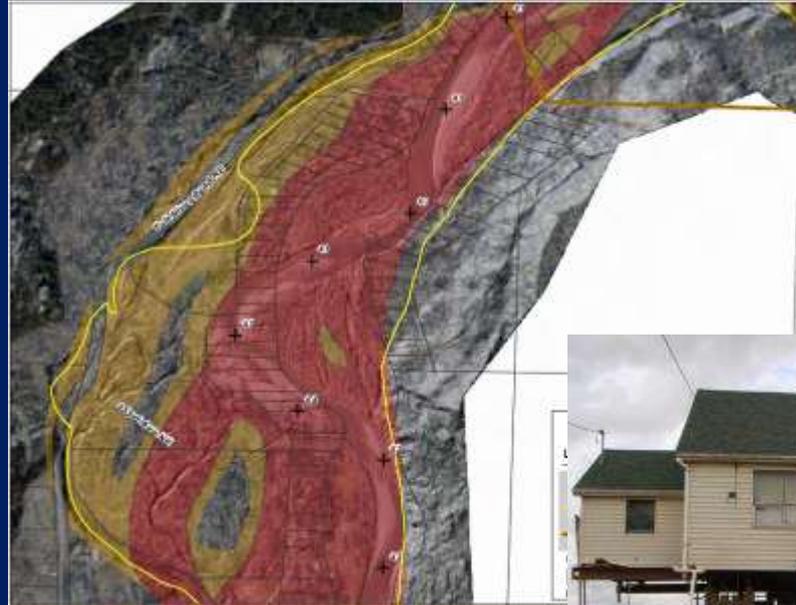
Focus on “non-structural” measures where feasible

- Buyouts
- Home elevations
- Farm pads

Structural fixes to protect critical infrastructure

- Levee retrofits and relocations
- Repairs when needed

Set back levees to allow room for floodwater and gravel storage, increase conveyance



# Corridor Plans

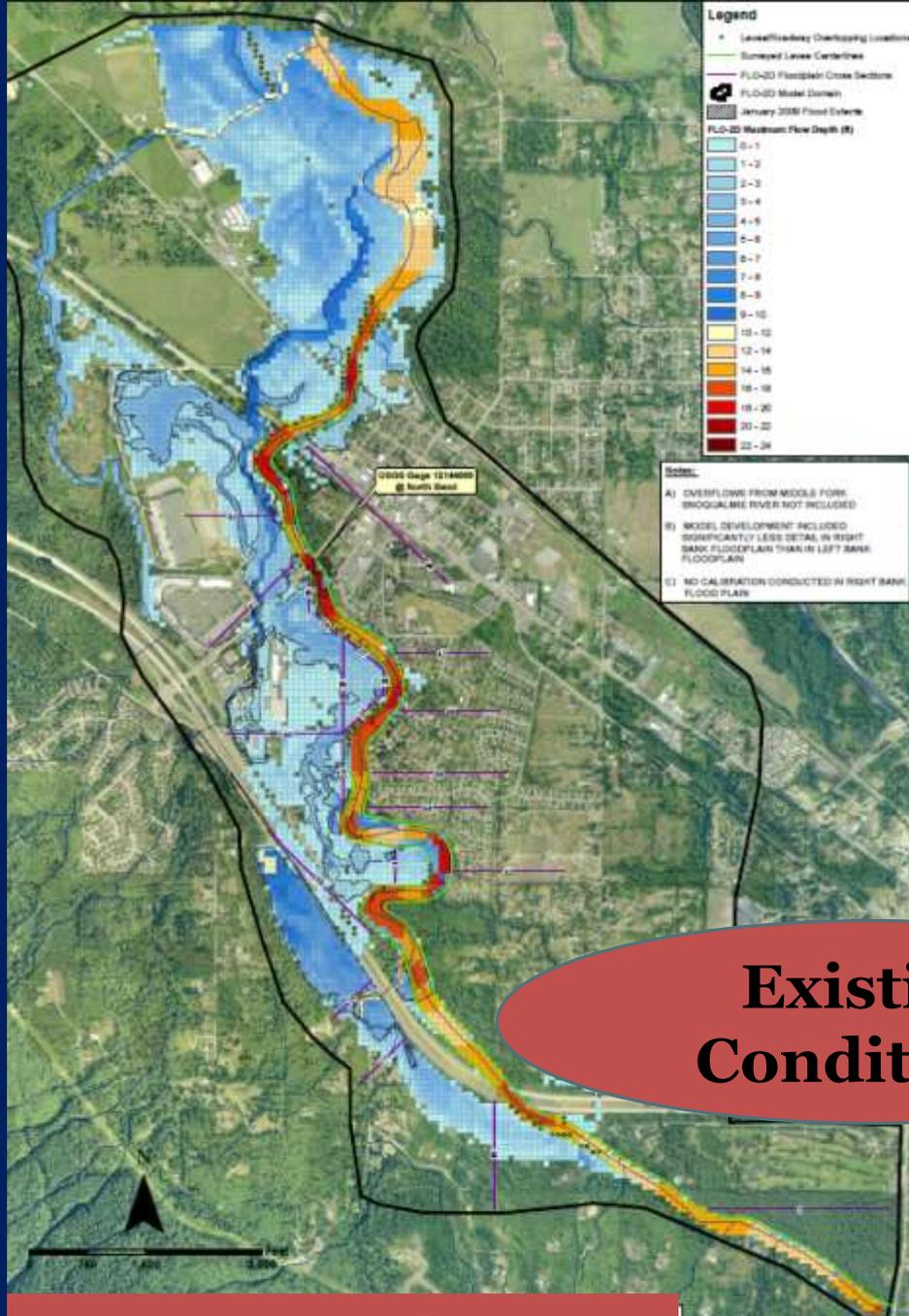
- Multi-objective: Scope and goals based on Flood Plan and County policies
- Characterize existing and potential future conditions
- Develop and evaluate alternatives
  - *Long-term: What will it take to “be done?”*
  - *Near-term: Priority actions for 6-10 year CIP*
- Recommend long-term strategy and near-term actions
- Will be approved by the FCD and adopted by King County

# South Fork Snoqualmie

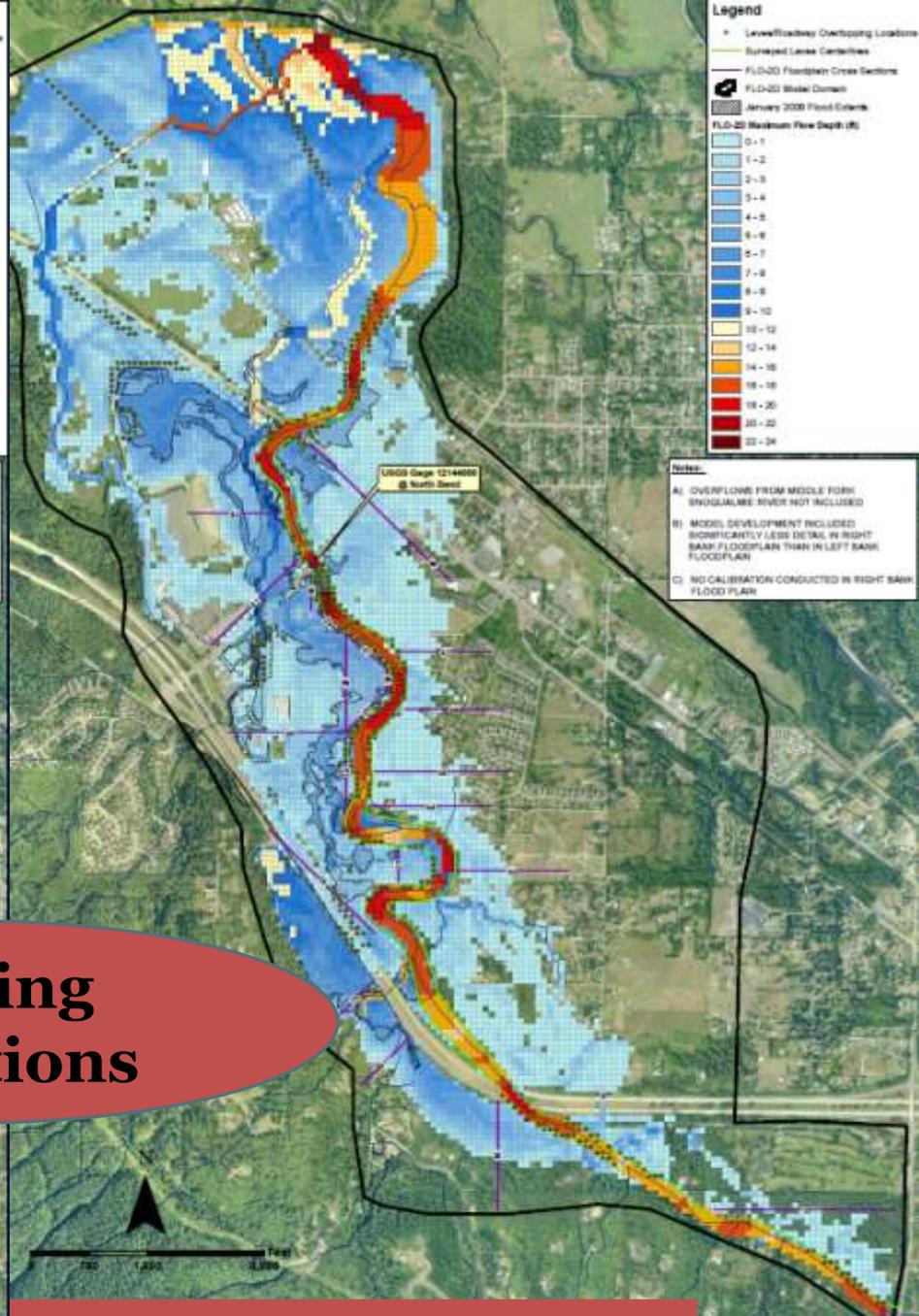
- Lower six river miles
- Slope stability, seepage, scour, overtopping
- Different flood protection levels on left & right
- Potential for I-90 flooding
- Channel migration hazards in Circle River
- Gravel build up between levees
- Poor ecological conditions

Flood Impacts	100-yr	500-yr
Flow (cfs)	15,150	18,968
Structures	135	514
AV (\$million)	53.5	116.1
Roads (mi.)	5.5	14.5
Acres	339	716





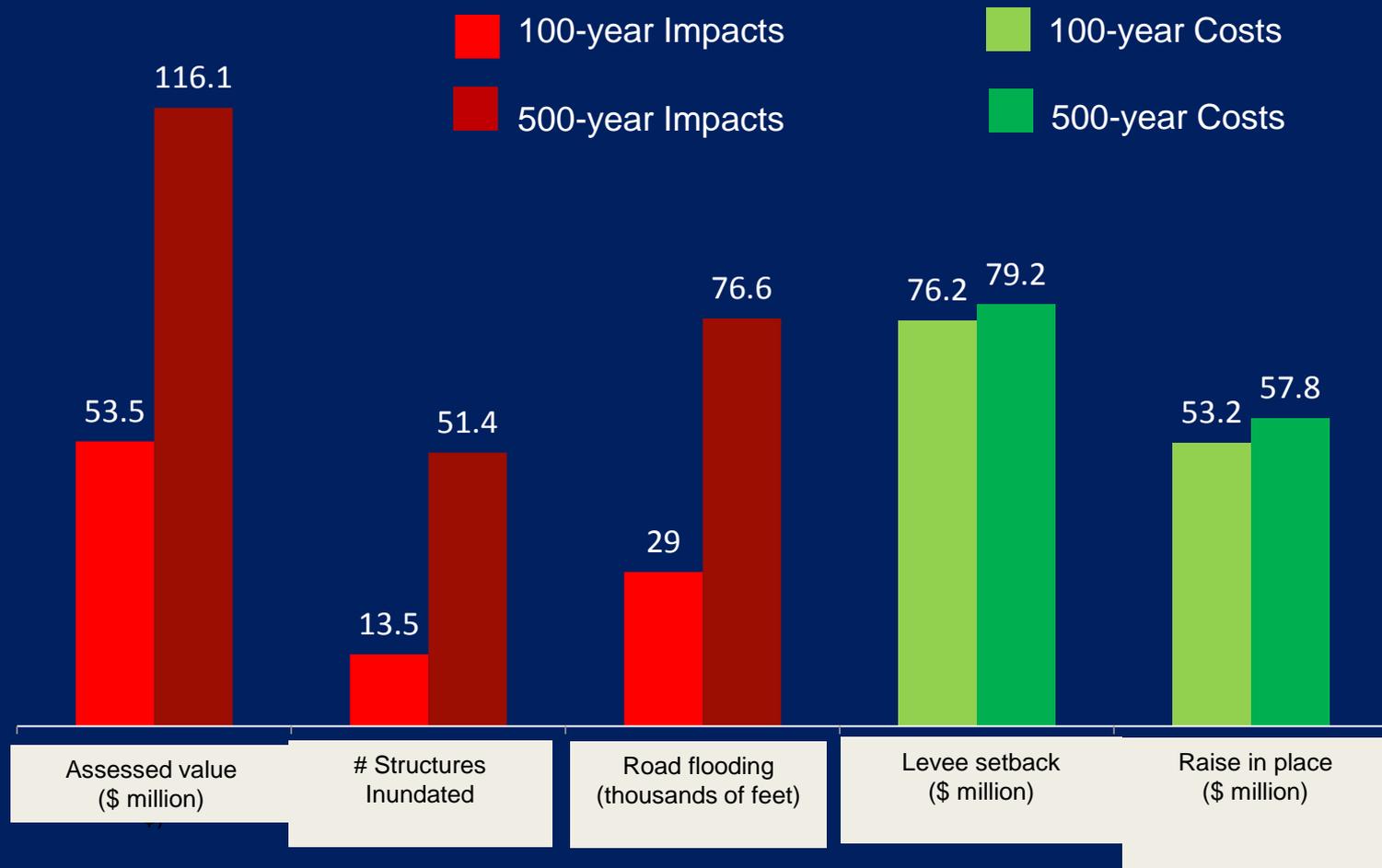
**100-yr Flow**



**500-yr Flow**

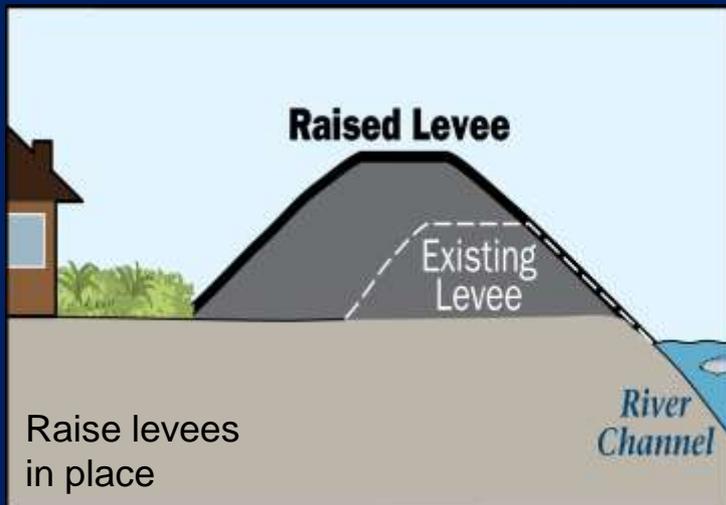
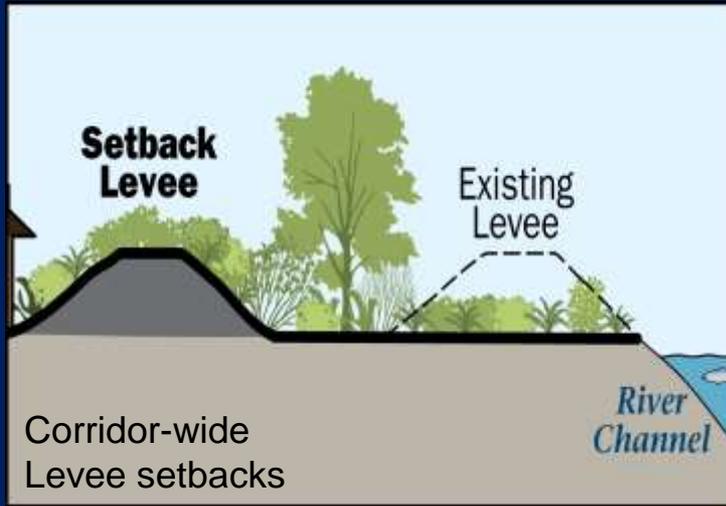
**Existing Conditions**

# 500-yr Standard may be cost effective



*Preliminary cost estimates  
of corridor approaches*

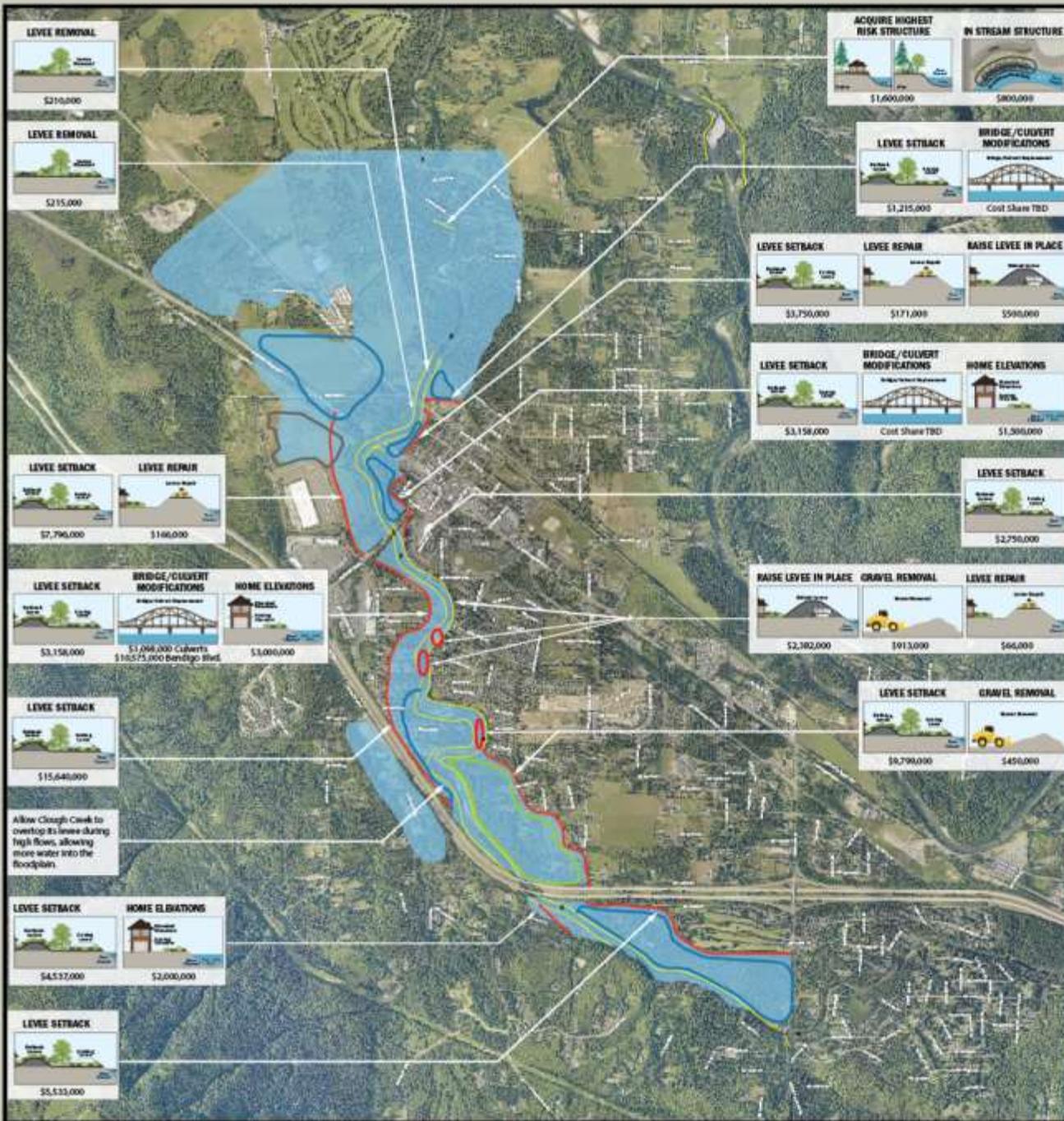
# Possible Corridor Approaches



Tools to augment the corridor-scale approaches to the levees

- In-stream structures
- Road and bridge modifications
- Gravel management
- Home buyouts
- Home elevations

# SOUTH FORK SNOQUALMIE PRELIMINARY RECOMMENDED CORRIDOR APPROACH



-  New levee setback
-  New flood/sediment storage
-  New flood storage
-  River facility
-  Modeled 0.2% Annual Chance Flood Under Recommended Conditions
-  Maintain existing flood storage
-  Gravel Removal



File: 1504\_4683L\_SFenoqCorrMapPROPOSED.ai



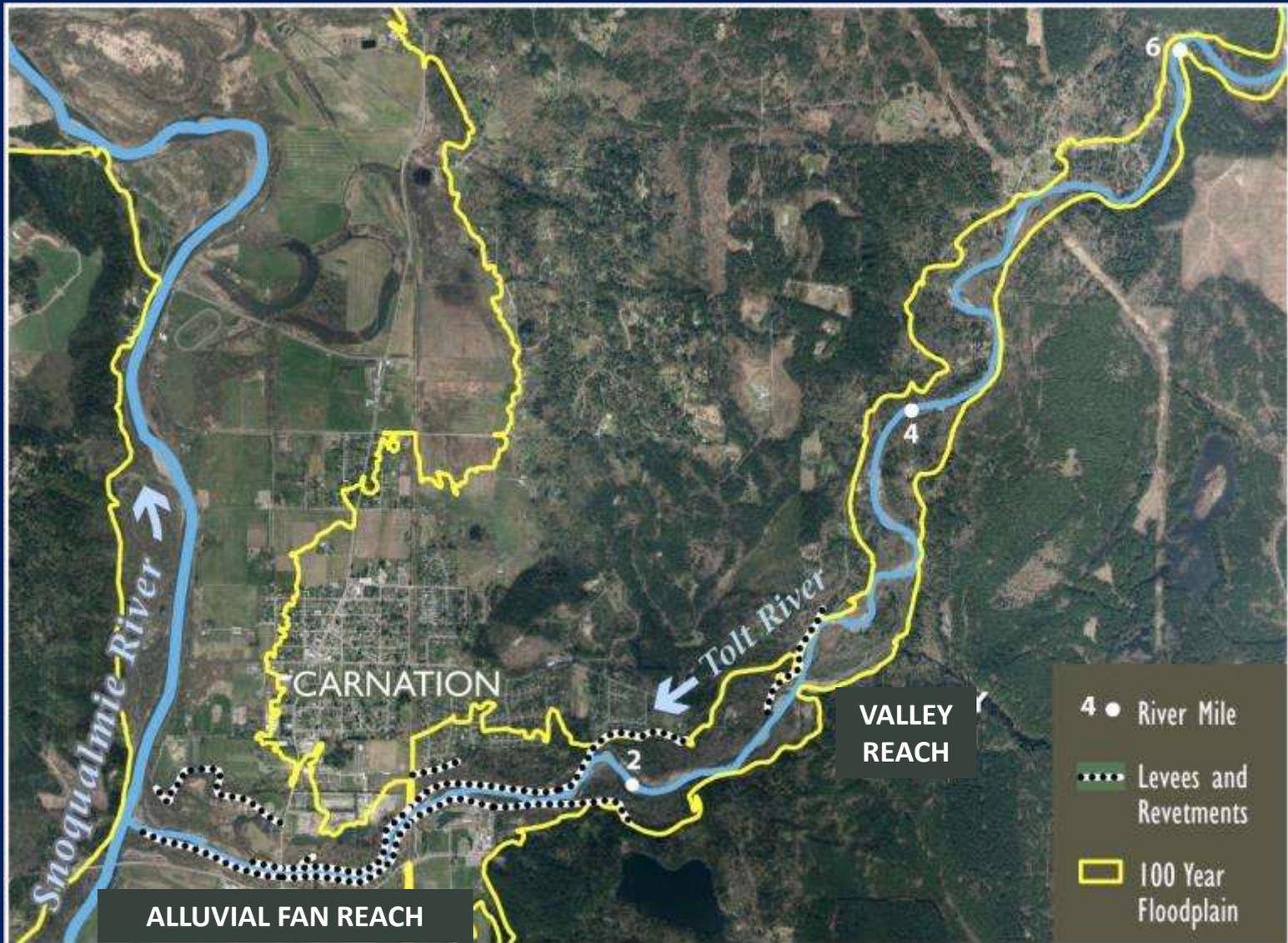
# Project Status

- Adopted framework with goals, objectives, approaches
- Characterization of conditions complete
- Stakeholder and public meetings last October
- Alternatives evaluation nearly complete
- Briefing FCD on options beginning this month



*Setting up for a boring to evaluate levee stability*

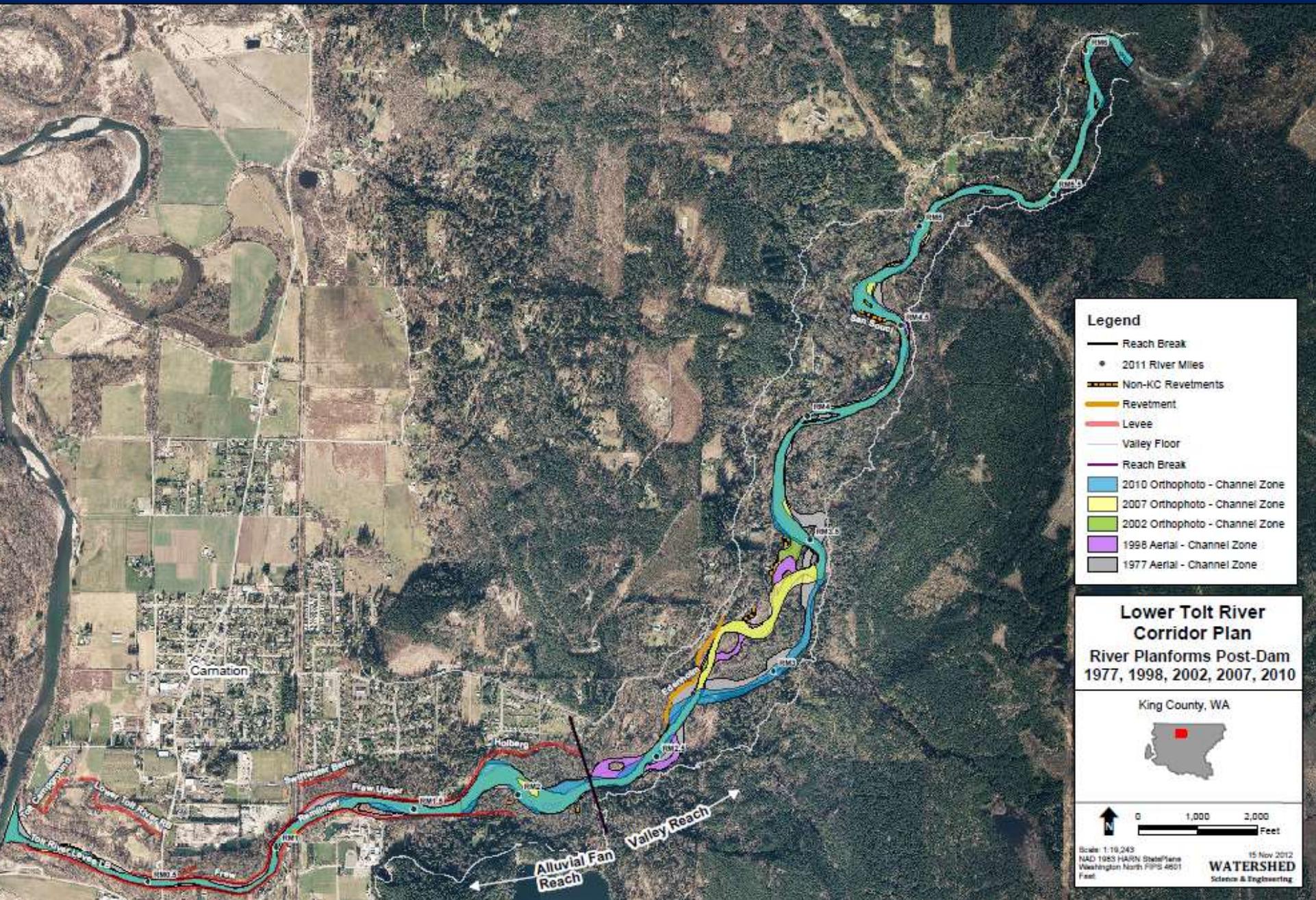
# Tolt River



# Conditions and Problems

- Flooding
  - *Deep and fast flow areas*
  - *Homes access cut off*
- Channel Migration
  - *Lateral migration*
  - *Avulsions*
  - *Breach hazards*
- Landslides
- Impaired Habitat





**Legend**

- Reach Break
- 2011 River Miles
- ▬ Non-KC Revetments
- ▬ Revetment
- ▬ Levee
- ▬ Valley Floor
- ▬ Reach Break
- 2010 Orthophoto - Channel Zone
- 2007 Orthophoto - Channel Zone
- 2002 Orthophoto - Channel Zone
- 1998 Aerial - Channel Zone
- 1977 Aerial - Channel Zone

**Lower Tolt River Corridor Plan**  
**River Planforms Post-Dam**  
**1977, 1998, 2002, 2007, 2010**

King County, WA

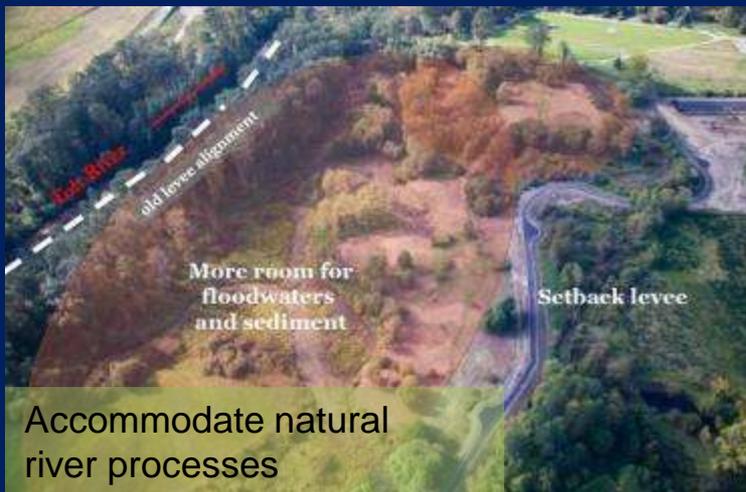
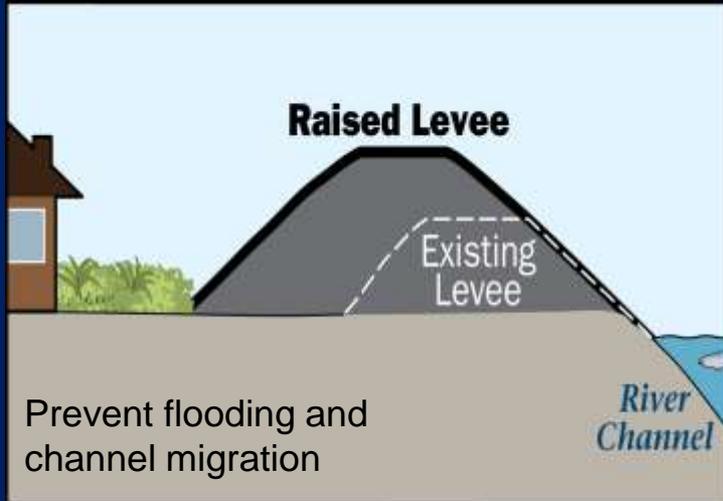
Scale: 1:10,043  
 NAD 1983 HARN StatePlane  
 Washington North FIPS 4601  
 Feet

15 Nov 2012  
**WATERSHED**  
 Science & Engineering

# Key Findings

- Levees unstable, do not contain floodwaters
- 60 homes in high risk areas
- 40 homes isolated at 2-year flow
- Hwy 203 and Tolt River Road subject to inundation and potential channel migration hazards
- Gravel build up worsening conditions
- Habitat impaired, especially in lower 2 river miles

# Possible Corridor Approaches

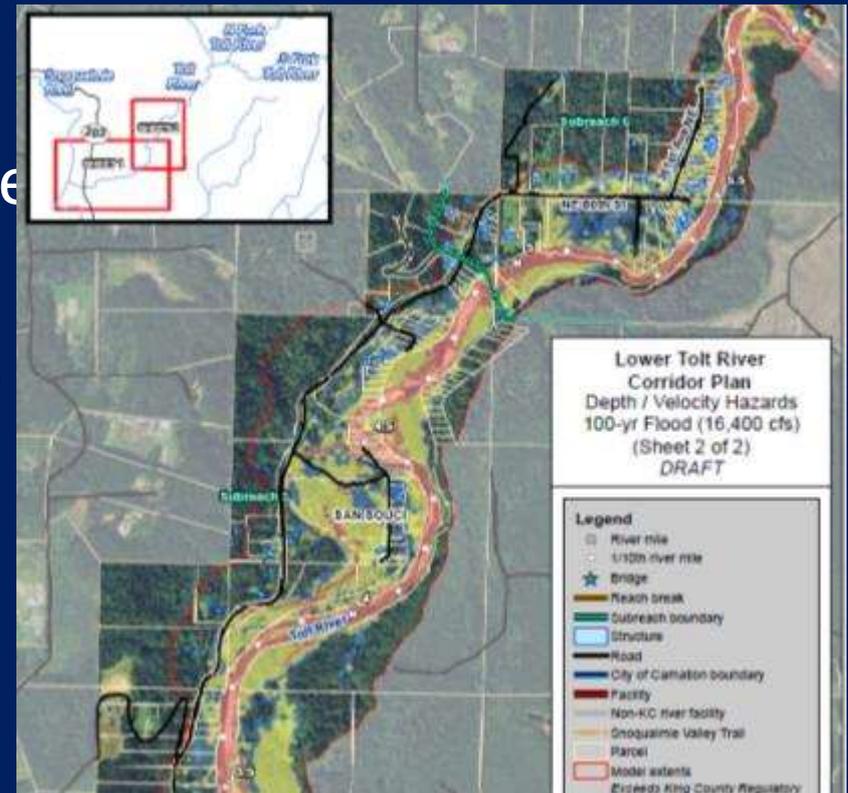


Tools to augment the corridor-scale approaches to the levees

- In-stream structures
- Road and bridge modifications
- Gravel management
- Home buyouts

# Project Status

- Adopted framework with goals, objectives, approaches
- Characterization of conditions nearly complete
- Stakeholder and public meetings this past January
- Gearing up for alternatives evaluation



*Mapping of deep and fast  
flow areas*

# Corridor Plans Schedule

River	Estimated Plan Completion*
South Fork Snoqualmie	December 2015
Tolt	March 2016
Middle Fork Snoqualmie	December 2016
* Estimate assumes three decision points with King County Flood Control District Board of Supervisors.	

# Large Capital Projects (Construction)

## Sinemma Quaale Upper

- Rapidly eroding bank
- Protects SR 203, Snoqualmie Valley Trail, regional fiber optic line
- ELSs, shoring wall, trail reconstruction
- ~\$4.5 million construction cost
- NTP this June



# Large Capital Projects (Design)

## Winkelman

### (Tolt Pipeline Protection)

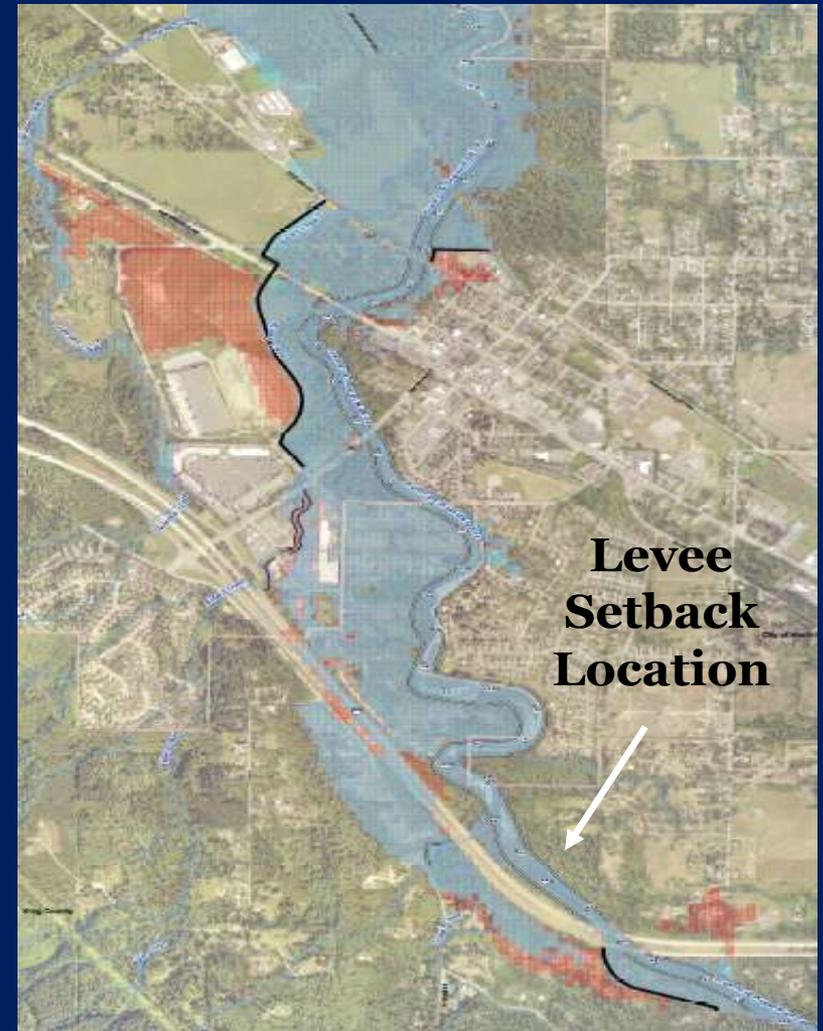
- Rapidly eroding bank
- Protects SPU Tolt water supply pipeline
- ~\$5M construction cost
- Targeting 2016 construction
- Preliminary selected alternative includes boulder-ballasted wood toe, ELSs, and bioengineered upper slope



# Large Capital Projects (Design)

## South Fork/ I-90 Project (Si View Levee Setback)

- Levee overtopping contributes to I-90 flooding potential
- Setback to reduce flooding, store floodwaters and sediment
- Cost TBD, up to \$20M
- Targeting 2017 construction



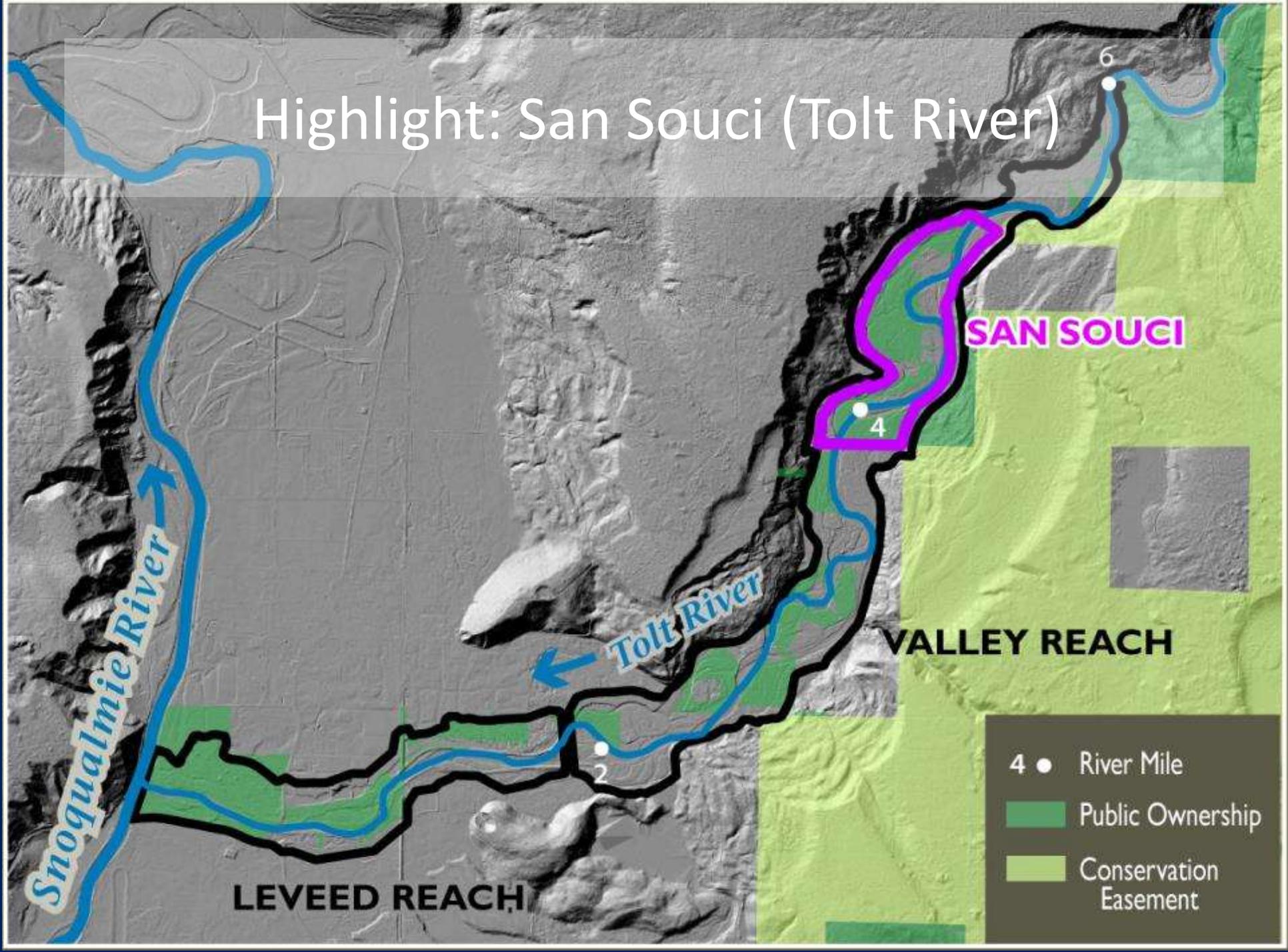
# Rounding out the CIP

Continued emphasis on non-structural projects

- Home buyouts
- Home elevations
- Farm pads
- Barn elevation pilot program

These remain large and essential parts of the Snoqualmie basin CIP program

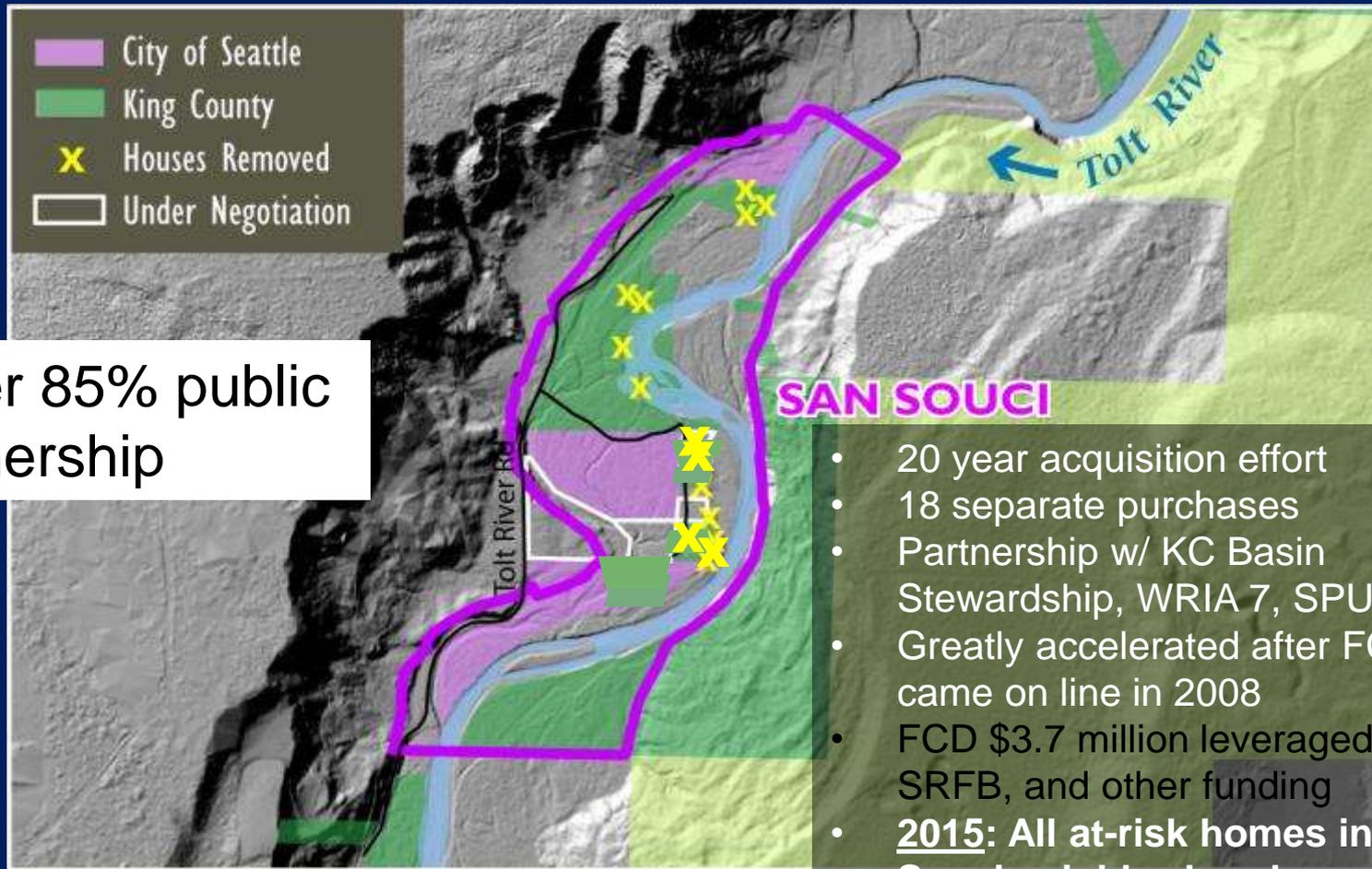
# Highlight: San Souci (Tolt River)



January 2009



# San Souci Buyouts and Public Ownership



Over 85% public ownership

- 20 year acquisition effort
- 18 separate purchases
- Partnership w/ KC Basin Stewardship, WRIA 7, SPU
- Greatly accelerated after FCD came on line in 2008
- FCD \$3.7 million leveraged CFT, SRFB, and other funding
- **2015: All at-risk homes in San Souci neighborhood purchased (2 remaining in reach)**

May 5, 2015  
BTC  
Meeting

Snoqualmie/  
SF Skykomish  
Update



Questions? Comments?

# Cedar River Corridor Plan

## Project Update

- Joint Basin Technical Committee
- June 5<sup>th</sup>, 2015
- John Engel, Cedar River Basin Supervisor

# Plan Approach

- Broad Themes and Goals:
  - Flood Risk Reduction
  - Habitat Protection and Improvement
  - Human Uses – Recreation, Land Use and Development, Diverse Populations, Treaty Rights
  - Cost Effectiveness – Multiple objectives and sustainability of solutions
  - Public Involvement
- Consultant / King County team collaboration
- Coordination with partner agencies – key interests, data sharing, solutions development

# Accomplishments to Date

- Draft Goals and Objectives
- Existing Conditions and Mapping of Hazards
- Identifying key problems and opportunities
- Identified floodplain management tools to be considered when developing solutions
- Public involvement strategy underway

# Public Involvement

- Formed Advisory Committee – active participation
- Formed Recreation Work Group
- Hosted Neighborhood Meetings
- Upcoming Public Meeting
- Website

# Next Steps

- Advisory Committee – Meeting #3 May 7th
- Public meeting – May 18<sup>th</sup> Public input on:
  - Goals and objectives
  - Risks and opportunities
  - Tools for floodplain management
- Field Trip with FCD AC and Corridor Plan AC on June 3<sup>rd</sup>
- Recreation Work Group and Workshop – Beginning in June
- FCD Executive Committee June 15<sup>th</sup>
- Continue technical work to build suite of action alternatives with AC and public involvement.
- Target June 2016 Final Plan with recommendations

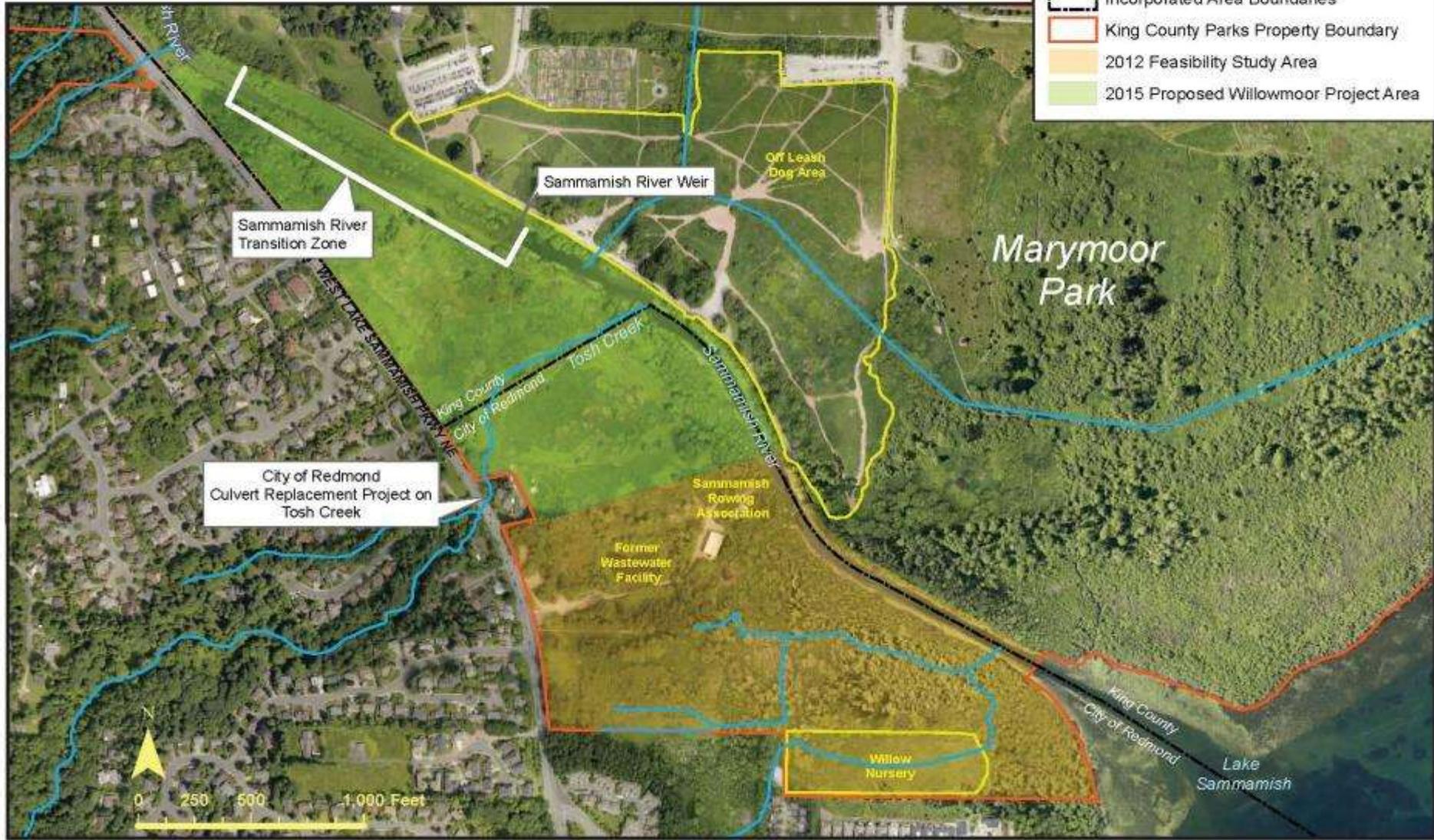


# Study Area Map

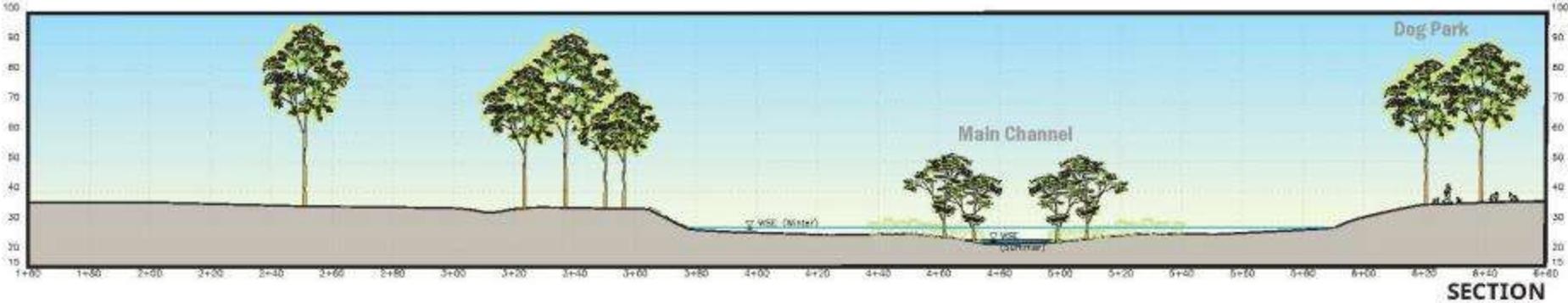
Willowmoor Floodplain Restoration Project  
Sammamish River, King County, Washington



- Tributaries
- Incorporated Area Boundaries
- King County Parks Property Boundary
- 2012 Feasibility Study Area
- 2015 Proposed Willowmoor Project Area

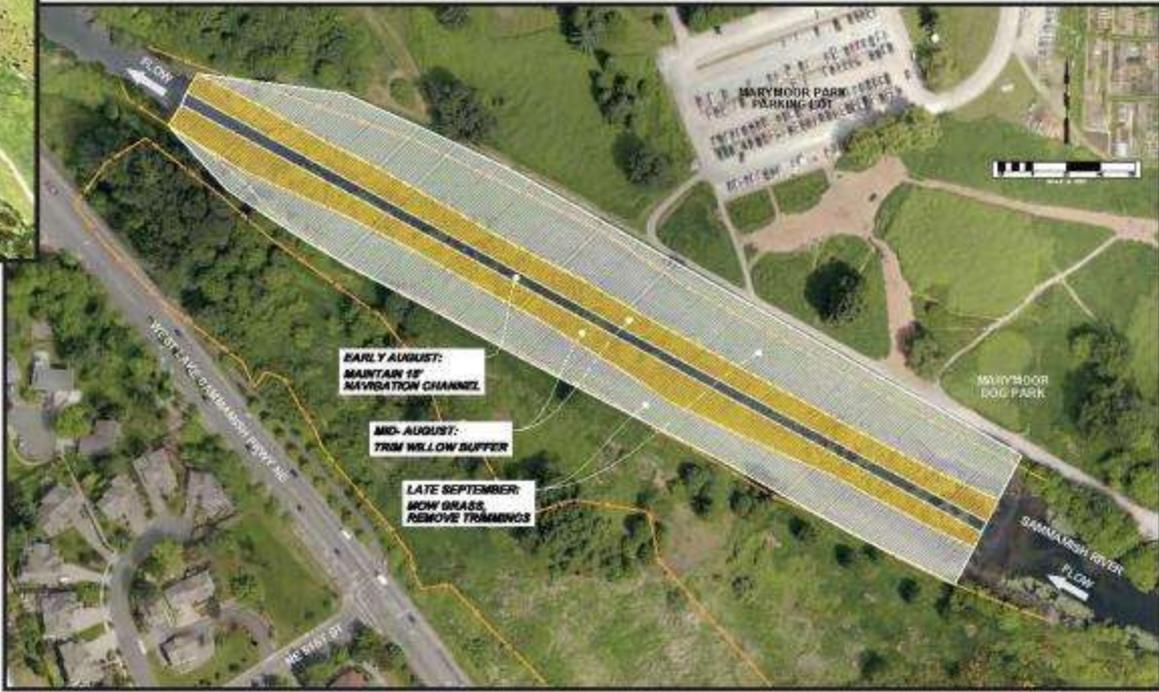


Alternative 1: No Action (Maintenance)



AERIAL PERSPECTIVE

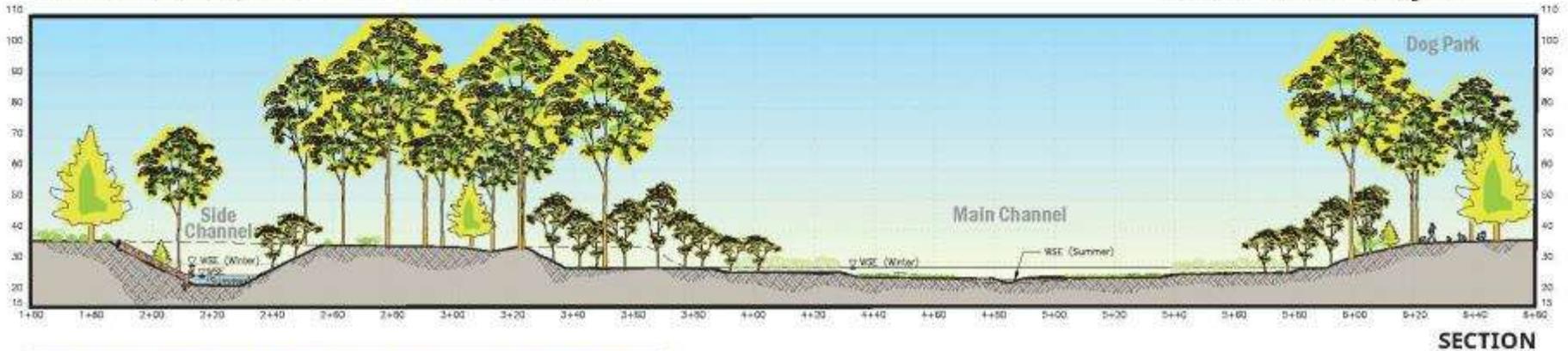
	Total Construction Cost	Average Annual Maintenance
Alt. 1:	\$0	\$38,000
Alt. 4:	\$7.1M	\$11,500
Alt. 5:	\$6.1 M	\$23,500



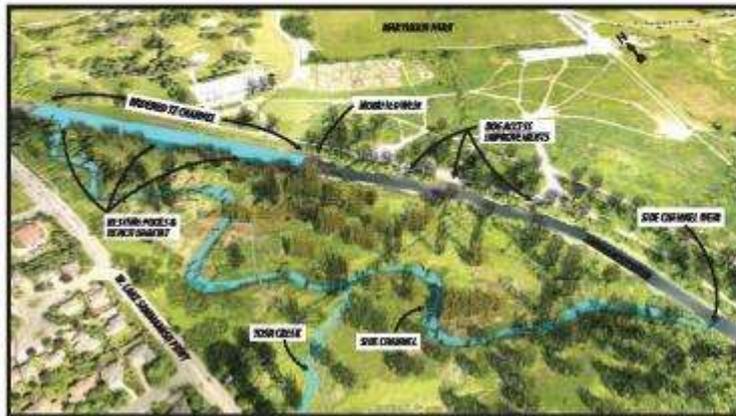
PLAN VIEW

# Alternative 4: Split Channel with Pumped Groundwater

# Willowmoor Floodplain Restoration Project



SECTION



AERIAL PERSPECTIVE

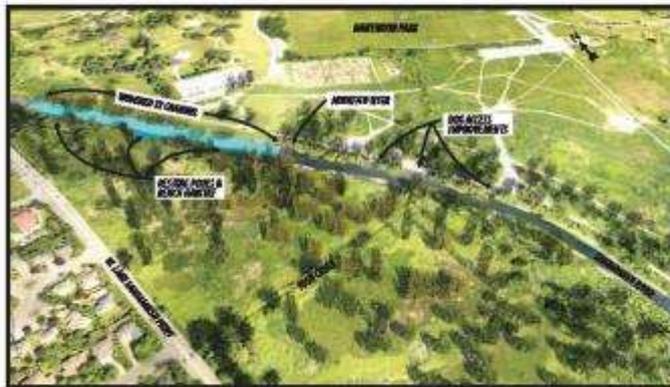
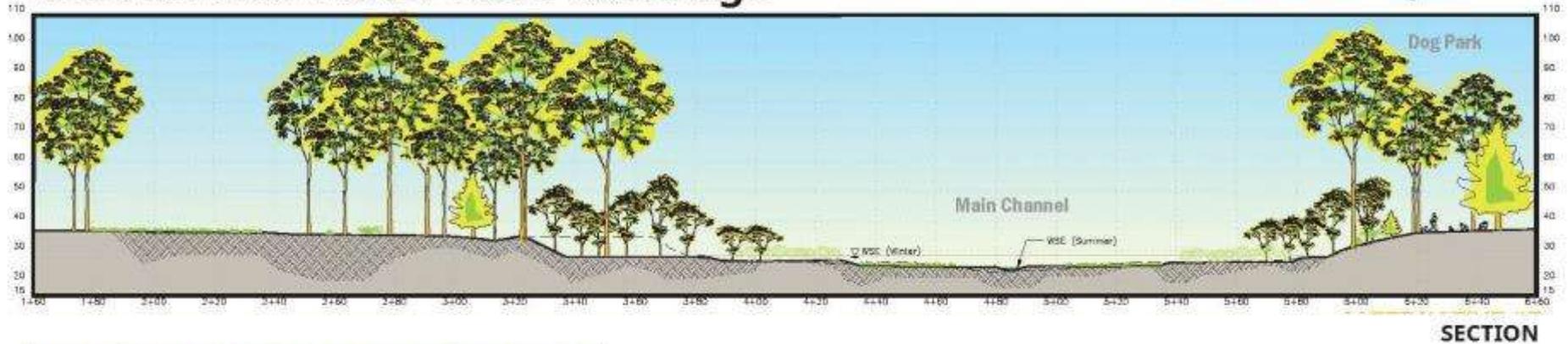
	Total Construction Cost	Average Annual Maintenance
Alt. 1:	\$0	\$38,000
Alt. 4:	\$7.1 M	\$11,500
Alt. 5:	\$6.1 M	\$23,500



PLAN VIEW

# Alternative 5: Widened Existing Channel with Surface Water Heat Exchange

## Willowmoor Floodplain Restoration Project



**AERIAL PERSPECTIVE**



**PLAN VIEW**

	Total Construction Cost	Average Annual Maintenance
Alt. 1:	\$0	\$38,000
Alt. 4:	\$7.1M	\$11,500
Alt. 5:	\$6.1 M	\$23,500

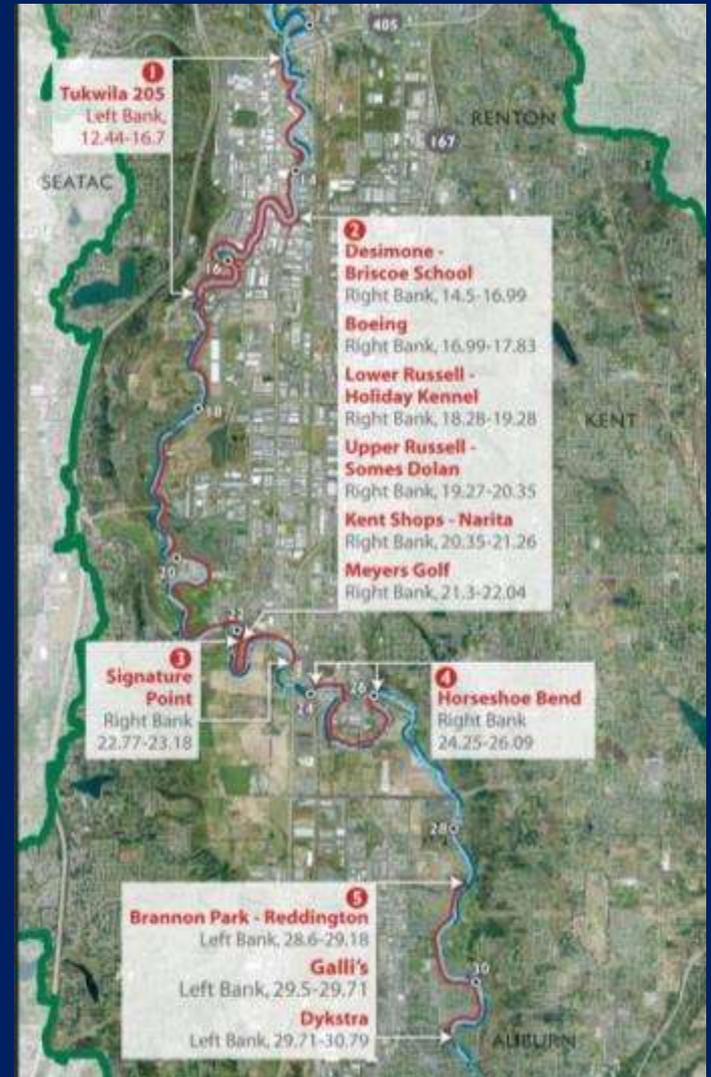
<b>Willowmoor Floodplain Restoration Project</b>		<b>Alternative 1: No Action (Maintenance)</b>	<b>Alternative 4: Split Channel</b>	<b>Alternative 5: Widened Existing Channel</b>
<b>COSTS</b>				
Channel Construction Cost		NA	\$4,600,000	\$2,300,000
Vegetation Construction Cost		NA	\$1,200,000	\$500,000
Cold-Water Construction Cost		NA	\$1,300,000	\$3,300,000
<b>Total Construction Cost</b>		<b>0</b>	<b>\$7,100,000</b>	<b>\$6,100,000</b>
50 year O&M Vegetation (Average Annual)		\$38,000	\$7,100	\$4,900
50 year O&M Cold-Water (Average Annual)		NA	\$4,400	\$18,600
<b>Total 50 year O&amp;M (Average Annual)</b>		<b>\$38,000</b>	<b>\$11,500</b>	<b>\$23,500</b>
<b>FLOOD CONTROL BENEFITS</b>				
Maintains downstream flood levels	100- Year Flood	Yes	Yes	Yes
	10 - Year Flood	Yes	Yes	Yes
Minimizes impacts to downstream stormwater outfalls		Yes	Yes	Yes
Meets Corps flood control criteria		Yes	Yes	Yes
Reduces base winter lake levels		No	Yes	No
Reduces frequency & duration of high lake levels		No	Yes	Yes
Maintains minimum summer lake levels		Yes	Yes	Yes
<b>HABITAT BENEFITS</b>				
Side Channel (lf)		0	3,400	0
Wetland	Creation (ac)	0	2.5	1.2
	Enhancement (ac)	0	15.2	13.6
Resting Pools (#)		0	14	3
Cooled Water		None	Localized (side channel)	Reach scale (TZ to Bear Cr)

# **Green River SWIF, Capital Project Status and Needs**

**Joint BTC Meeting  
May 5, 2015**



# Green - Duwamish River Facilities (RM 5.5-44)



# Green River System-Wide Improvement Framework (SWIF)

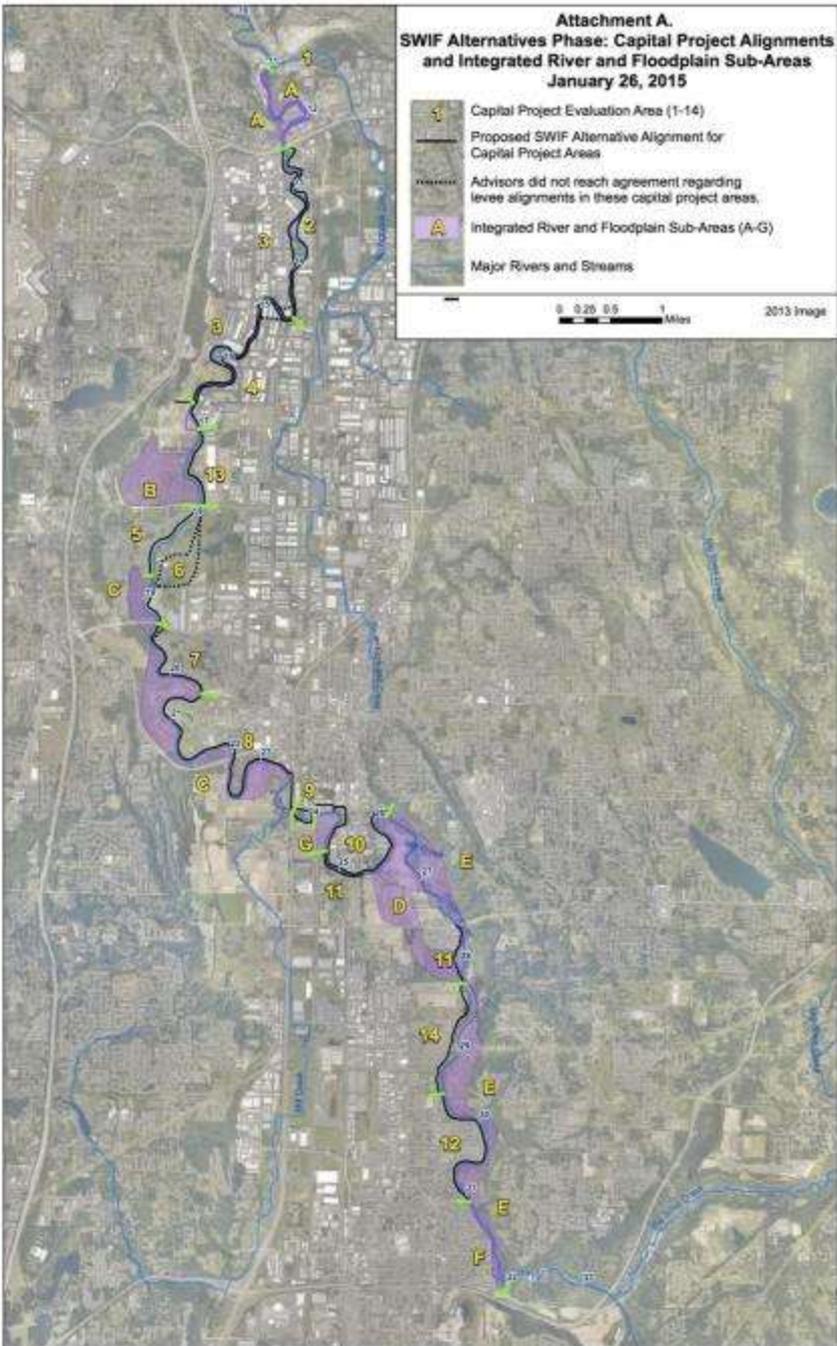
## Most Significant Policy Decision Points



**Attachment A.**  
**SWIF Alternatives Phase: Capital Project Alignments**  
**and Integrated River and Floodplain Sub-Areas**  
**January 26, 2015**


 Capital Project Evaluation Area (1-14)  
 Proposed SWIF Alternative Alignment for Capital Project Areas  
 Advisors did not reach agreement regarding levee alignments in these capital project areas.  
 Integrated River and Floodplain Sub-Areas (A-G)  
 Major Rivers and Streams

0 0.25 0.5 1 Miles 2013 Image



# SWIF Alternatives Phase

## SWIF Alternatives Phase Flood Control District Decisions:

- Capital Project Area Alignments
- Resource Areas (possible new name 'Integrated River and Floodplain Management Sub-Areas')
- SWIF Policies, as proposed by SWIF advisors:
  - Shade Trees
  - Habitat Restoration
  - Resource Areas (name may change)

# Capital Plan

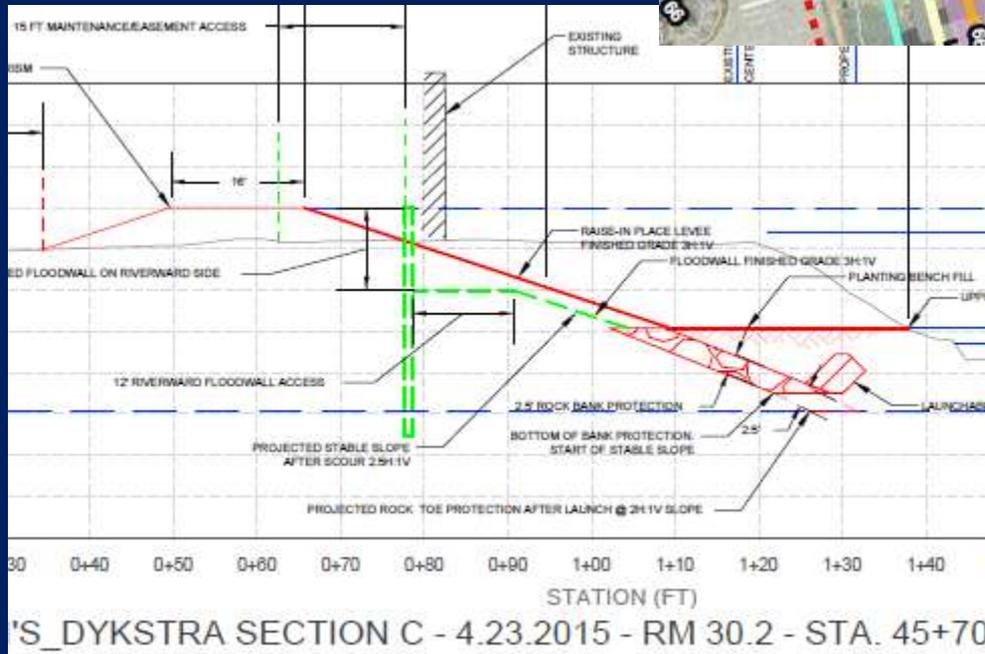
## 12 Capital Project Areas

(red = current PL 84-99 levees)

1. Black River Pump Station
2. Desimone to I-405
3. Tukwila 205
4. Briscoe-Desimone
5. Frager Road
6. Lower Russell Road
7. Upper Russell Road
8. Kent Shops/Narita/Meyer's Golf
9. Kent Airport
10. Horseshoe Bend
11. Reddington to 277<sup>th</sup> and E. Valley Hwy./S. 277<sup>th</sup> APD
12. Galli's/Dykstra

# Galli's/Dykstra Flood Wall or Levee Example

- Two scenarios evaluated: flood wall & in-place replacement levee
- Acquisition
- Preliminary Costs = \$60-75 million



'S\_DYKSTRA SECTION C - 4.23.2015 - RM 30.2 - STA. 45+70

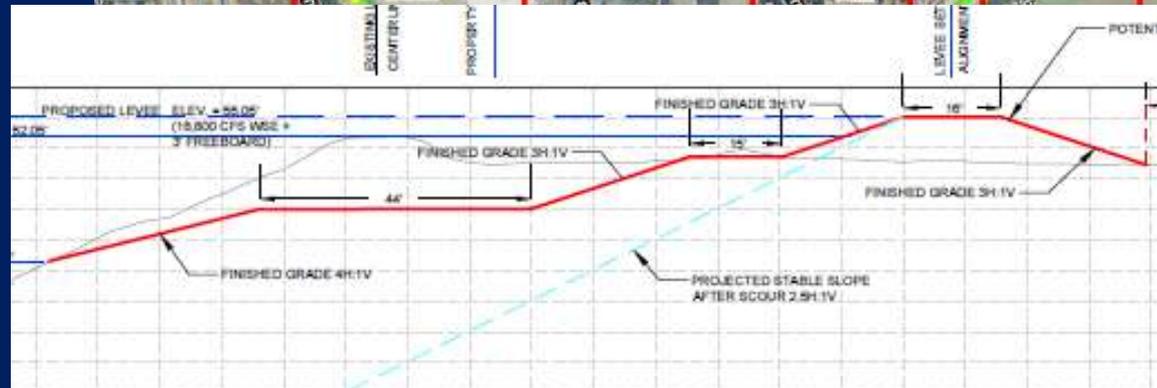


GREEN RIVER SWIF  
GALLI'S/DYKSTRA LEVEE  
LEFT BANK RM 29.48 TO RM 31.16  
SHEET TILE OVERVIEW  
0 500 1,000 Feet

# Horseshoe Bend Setback Levee Example



- In-place replacement and setback levees
- Acquisition
- Preliminary Costs = \$60-80 million



# Green River System Wide Improvement Framework

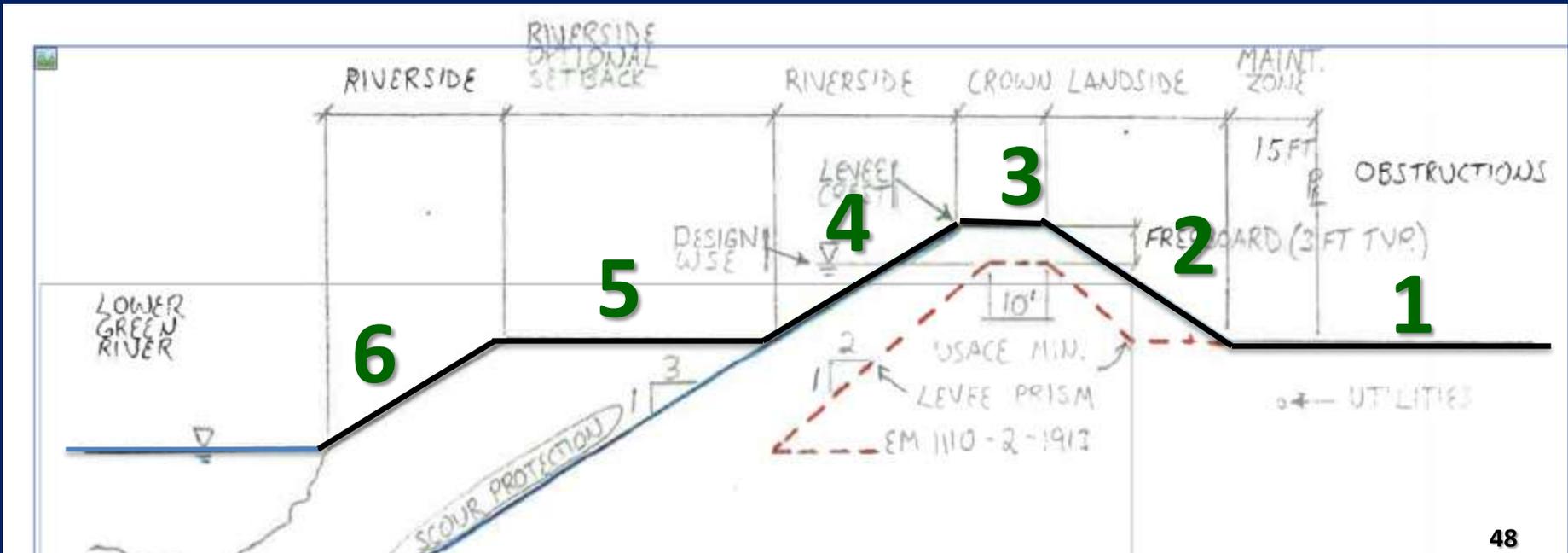
## Vegetation Plan

### What is it?

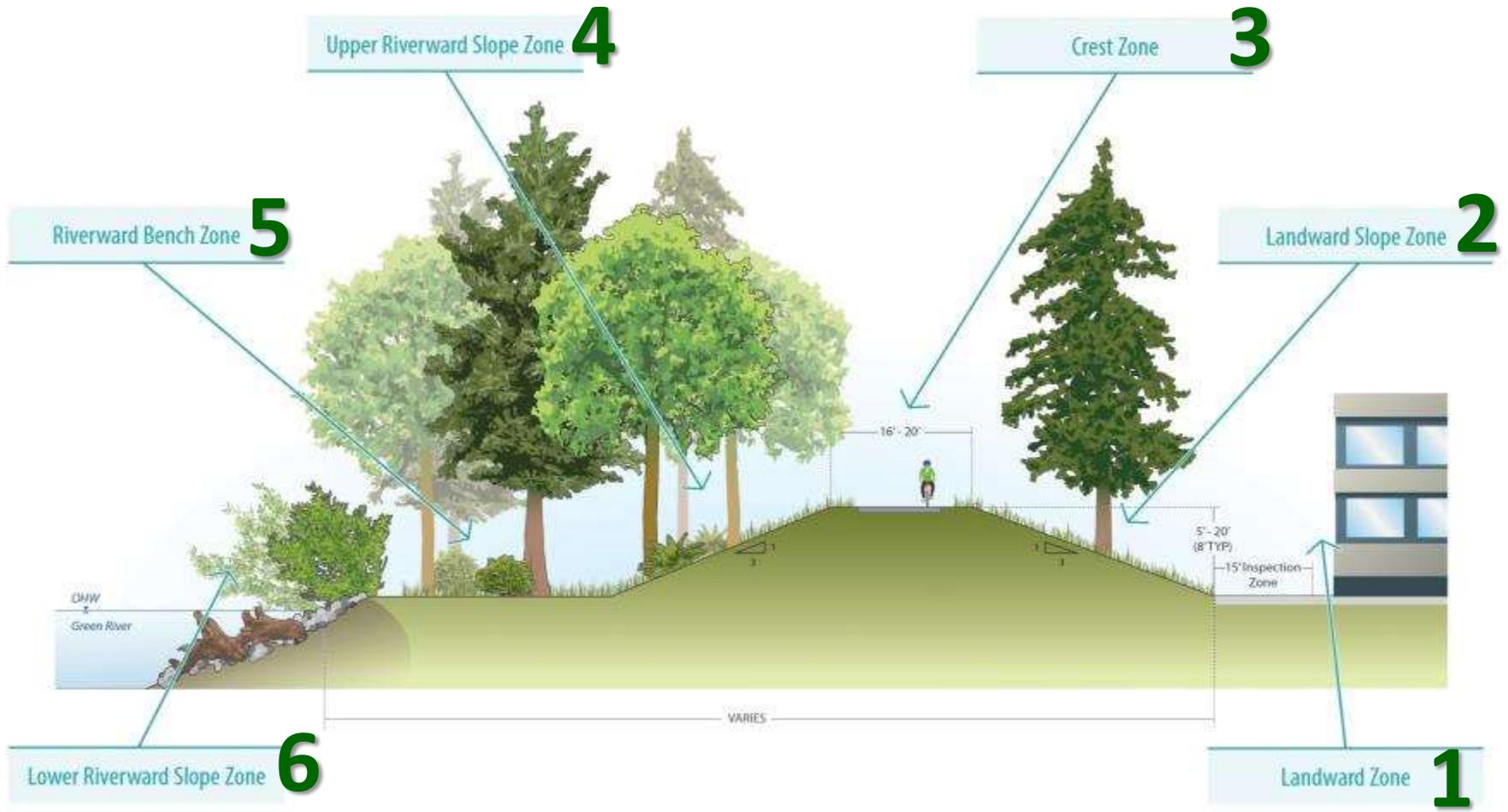
- A shoreline vegetation strategy for up to 25 miles of the Lower Green River (potential PL 84-99 shorelines)
- Establishes 6 vegetation management zones (VMZs)
- Future desired vegetative condition identified for each VMZ
- Responsive to PL 84-99 Interim Guidance (March 2014) and associated inspection goals
- Responsive to the diverse values shared by SWIF advisors, as they relate to vegetation type, structure and location
- Will guide SWIF capital project design, maintenance and operations, associated with vegetation, for all current/future PL 84-99 shorelines

# Six Vegetation Management Zones

1. Landward Zone (includes 15' inspection zone)
2. Landward Slope Zone
3. Levee Crest Zone
4. Upper Riverward Slope
5. Riverward Bench Zone
6. Lower Riverward Slope Zone



Vegetation Management Zones



# Green River SWIF Products & Timeline



- Technical Committee and Advisory Council (Sept. 2013 – May 2015)
- Current Conditions Report: flood risk assessment, vegetation/habitat, socio-economic (May 2014)
- SWIF Alternatives Analysis (May 2015)
- Capital project development and priorities (May 2015)
- Complete SWIF (Aug 2015)
- SWIF funding and implementation (Sept 2015 on)

# Lower Russell Project Location

City of Kent – right bank of Green River between S 212<sup>th</sup> St and Veterans Drive/S. 228<sup>th</sup> St bridges.



# Lower Russell Rd Levee Setback

- Goal: Remove and replace the existing flood containment system of levee and revetments in order to provide long-term flood protection, improve riparian and aquatic habitat, and recreation

- Need: Existing levee/revetments do not meet current engineering design standards. System is prone to scour and slope instability leaving the lower Green River valley at a higher flood risk than desired.



Lower Russell Road Levee 2006 Flood Photo

# Lower Russell Rd Levee Setback

- Objectives:

- Increase the level of flood flow containment bank
- Select flood protection that balances (1) po flood protection, habitat restoration, and recreational use as informed by the SWIF; (2) project site opportunities and constraints; and (3) available funding.



- Current Budget:

- \$17.7 Million from Flood Control District
- \$4.9 Million in possible WA State Floodplain grant funding



# Lower Russell Project Timeline

- Predesign (August 2014 – Nov 2015)
- Final Design (Nov 2015 to July 2016)
- Construction Contract Procurement (Aug 2016 – April 2017)
- Construction (April 2017 to Feb 2018)
  - Construction Substantially Complete by Nov 2017

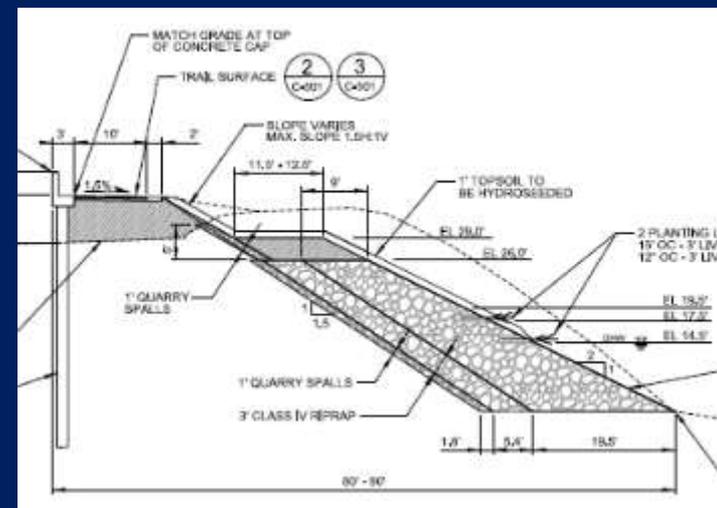
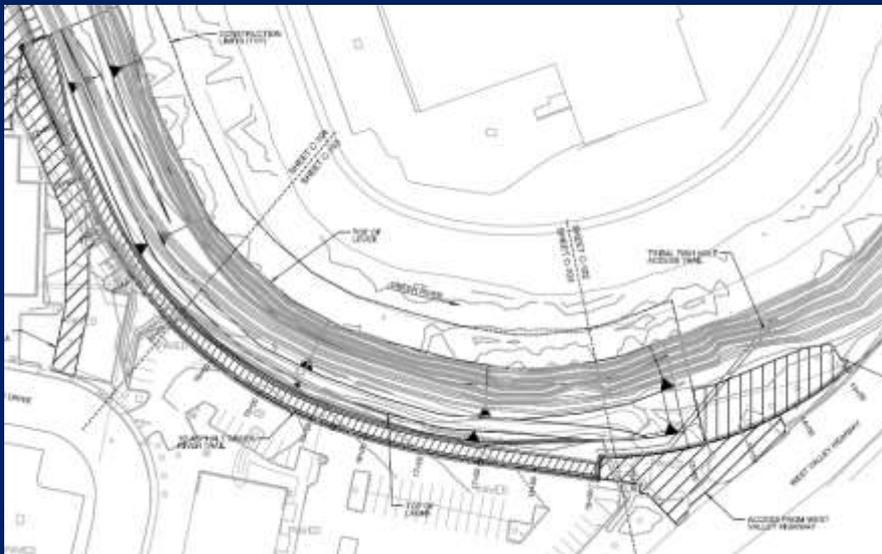


# Desimone USACE PL 84-99 Repair (from March 2014 damage)



Desimone  
(Tukwila)

Total project cost = \$8.8 million  
Local cost share = \$3.3 million  
(Work-in-kind) = \$1.4 million  
Cash contribution = \$1.9 million





# PL 84-99 Tree Cutting Mitigation



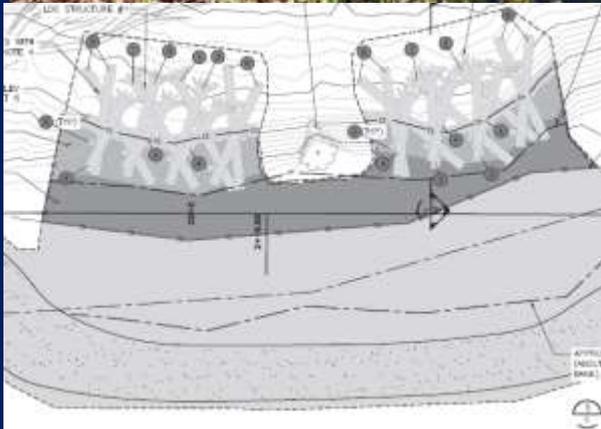
- Place 22 habitat logs at Foster Golf in Tukwila

- Design completed 2014
- Anticipated construction 2015



- Place 110 habitat logs at Wallace/Cook property in the Middle Green

- Design completed 2015
- Anticipated construction 2015



- Place 90 habitat logs at Teufel Nursery site in Kent

- Building demo and contaminated soil assessment 2015
- Project Design 2015-2016
- Project Construction 2016

# Green River Capital Projects

## Recently Completed Construction (2013-2014)



- Reddington setback levee and extension (2013-14)
- Black River Pump Station (2013-15)
- Upper Russell North Reach secondary berm (2013) and intersection reach (2014)
- Briscoe-Desimone flood walls Reaches 2 and 3 (2014), and 1 (2015)



# Green River Capital Projects

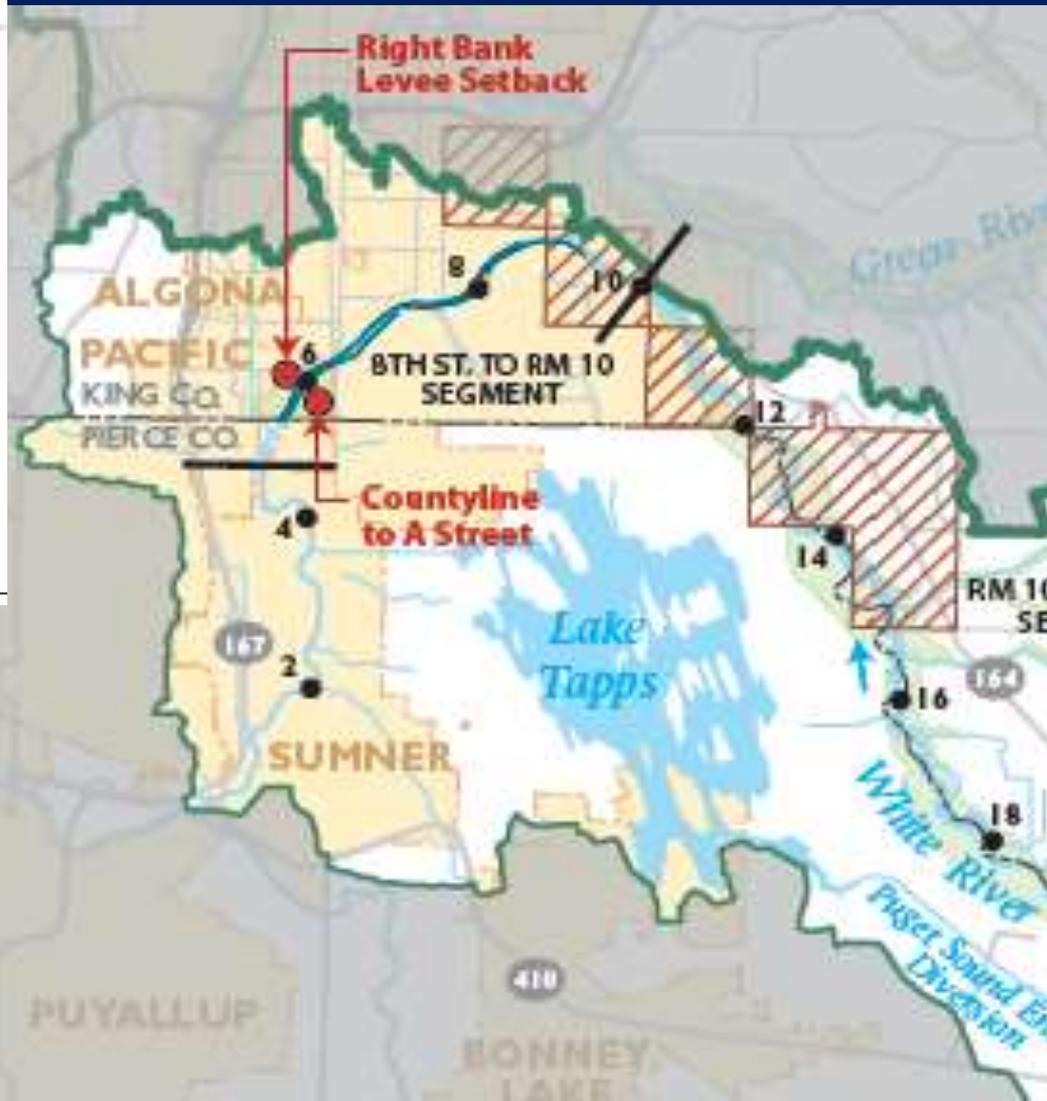
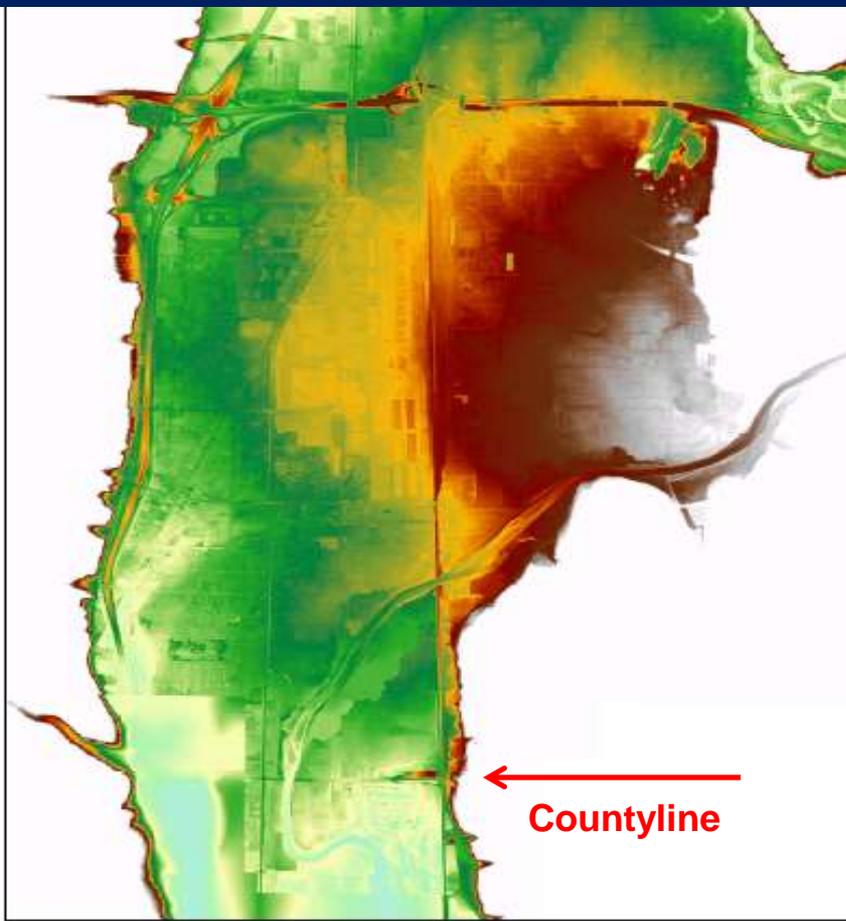
## Proposed for Construction in 2015-2020

- Upper Russell South Reach secondary berm (2015)
- Briscoe-Desimone flood walls - Reaches 1 and 4 (2015)
- Black River Pump Station (2016-2020)
- Lower Russell Rd. levee setback (2017)
- Horseshoe Bend early action (RM 24.5-24.7) (2016-17)
- SWIF Implementation (2016-2020)

# White River Basin



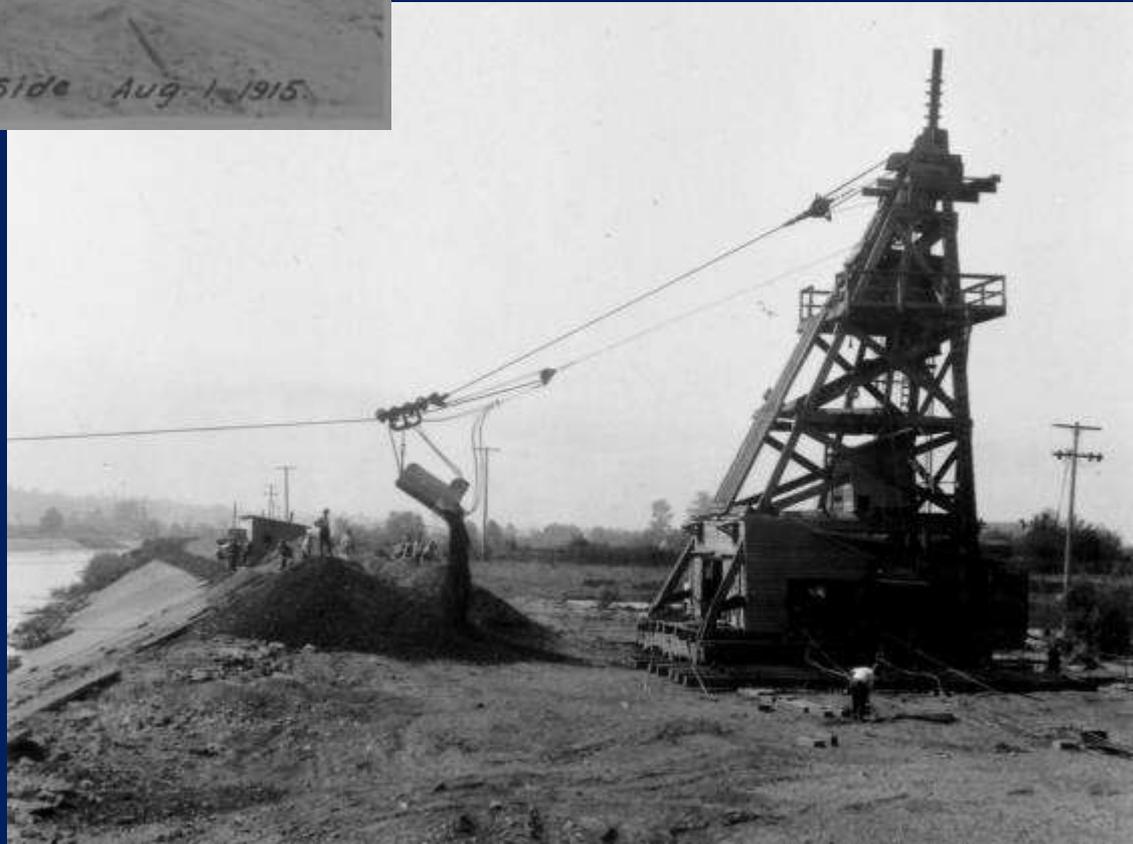
# Where does the sediment deposit?





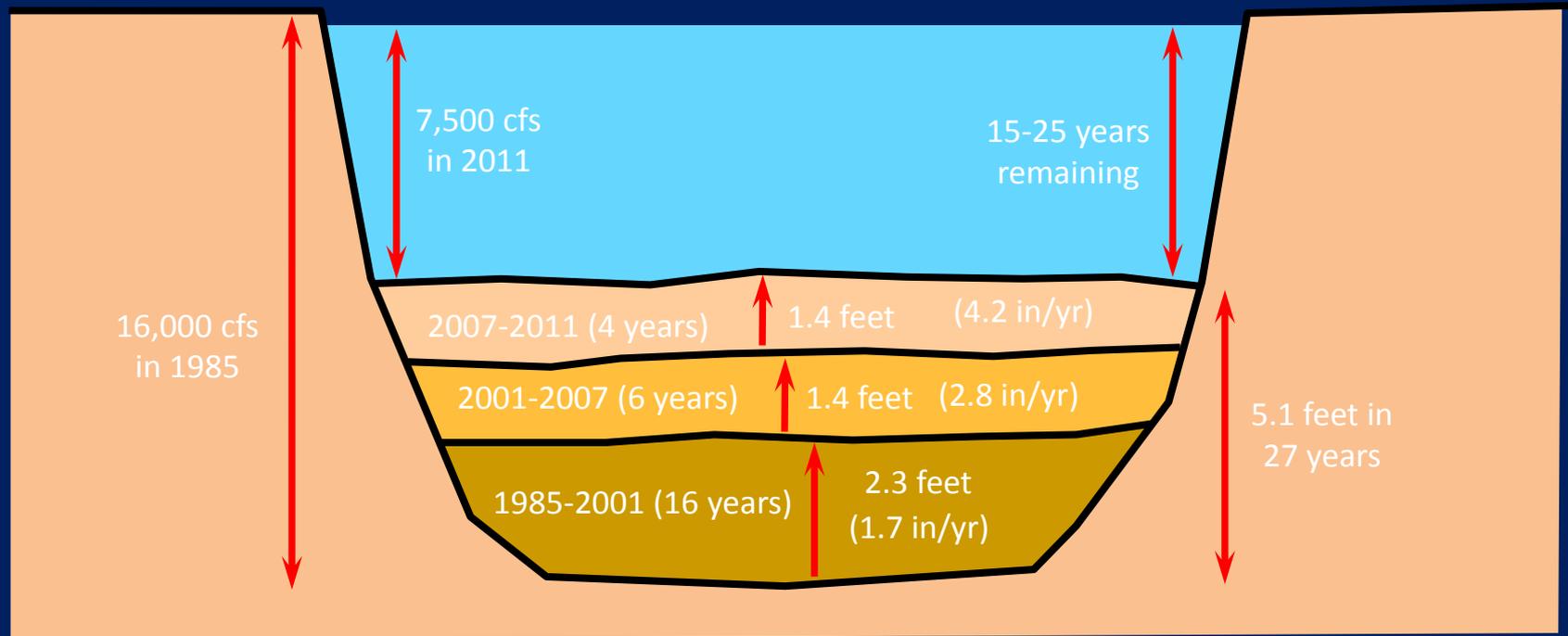
## Channelization and levee construction

## Channel Dredging



# White River at Countyline

## Sediment Deposition and loss of Channel Conveyance (Average rates between A St. and 8<sup>th</sup> St.)



Conveyance capacity

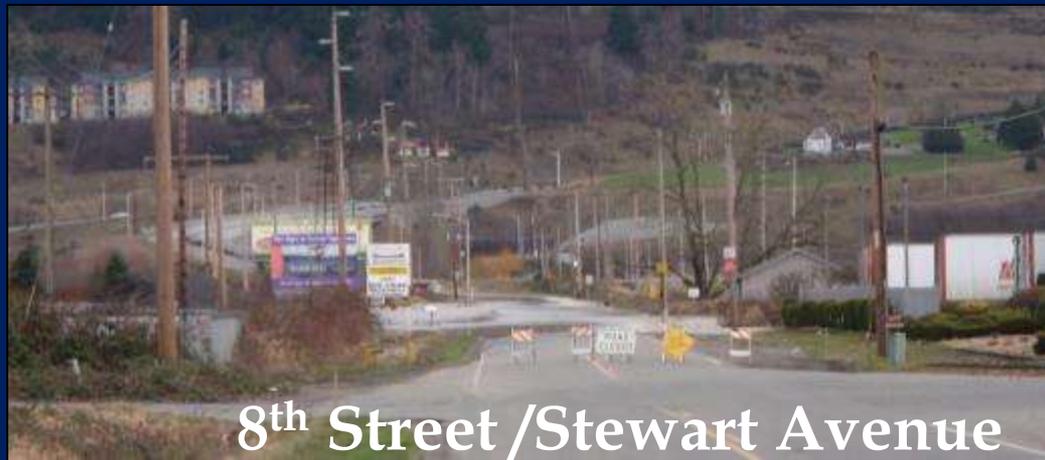
Rate of channel filling

# January 2009 Flood



Pacific Park

White River Estates (Pacific)



8<sup>th</sup> Street / Stewart Avenue



February 2012 -- 7300 cfs

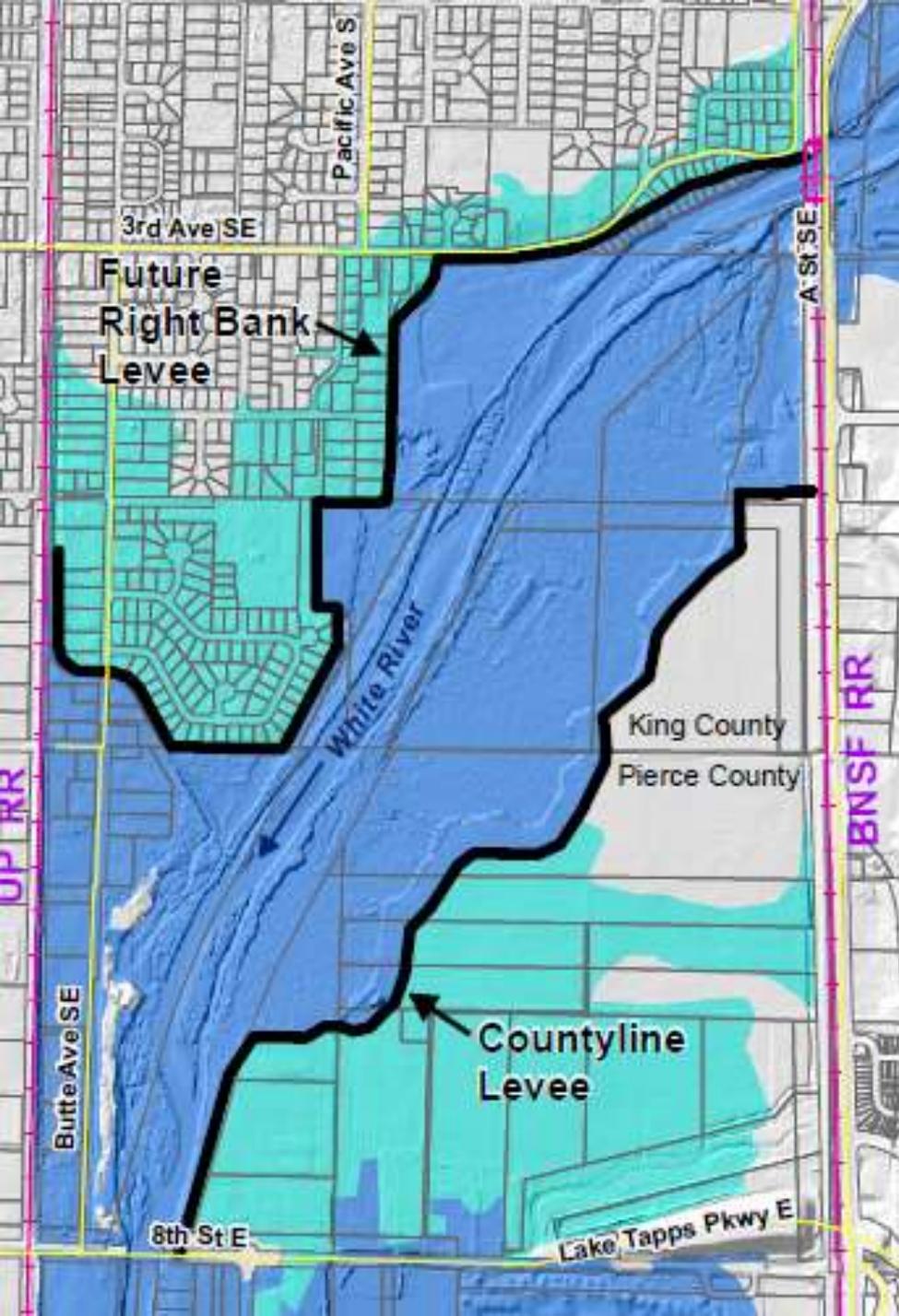


White River  
Estates

White River

Pierce County  
King County

# White River



# Countyline Project Elements



- 6,000 LF setback levee

# Countyline Project Elements

- 6,000 LF setback levee
- 5,000 LF biorevetment
- Four bank deflector ELJs
- Four apex ELJs



# Project Elements

- 6,000 LF setback levee
- 5,000 LF biorevetment
- Four bank deflector ELJs
- Four apex ELJs
- 4,500 LF levee removal



# Countyline Major Milestones

- 2015
  - Permit approvals
  - Condemnation of four properties (FCD 2014 Resolution)
    - (Three negotiated settlements to date)
  - Complete final plans, prepare construction specifications and bid package
  - Execute funding agreements
    - NRDA \$4.775 M
    - Salmon Recovery Funding Board \$823 K
    - Pierce County \$500 K
- 2016 / 2017
  - Two Year Construction Period
  - Estimated total project cost at completion \$ 18.3 M

# Pacific Right Bank Levee Setback Conceptual Alignment



# Pacific Right Bank Feasibility Evaluations

- Geotechnical  
3<sup>rd</sup> Ave / 3<sup>rd</sup> Place / Park
- Levee alignments  
White River Estates  
3<sup>rd</sup> Ave / Park
- Groundwater conditions
- Government Canal / E



# Right Bank Pacific Major Milestones

- 2015
  - Feasibility Studies
  - City and Public involvement in development of alternatives
  - Opportunity acquisitions (surplus or demolition)
- 2016- 2017
  - Selection of Preferred alignment alternative
  - Preliminary Engineering Design and permitting
  - Continue acquisitions
- 2018 / 2019
  - Two-Year construction
  - Estimated total project cost at completion \$25 - \$30 M

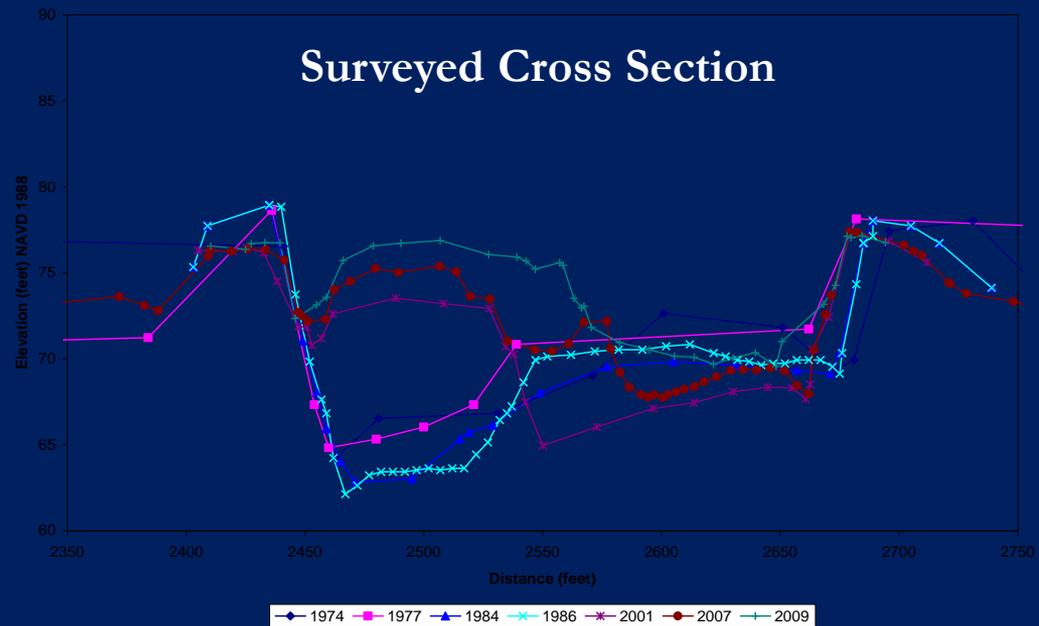
# Temporary Flood Protection Measures

Double tall along Pacific Park, 3<sup>rd</sup> Ave and 4<sup>th</sup> Ave apartment complex



Added protection length 3<sup>rd</sup> Place SE

# Channel Monitoring



# White River Basin

# Questions ?

Jeanne Stypula, Basin Supervising Engineer

[Jeanne.stypula@kingcounty.gov](mailto:Jeanne.stypula@kingcounty.gov)

(206) 477-4833



KING COUNTY  
FLOOD CONTROL  
DISTRICT

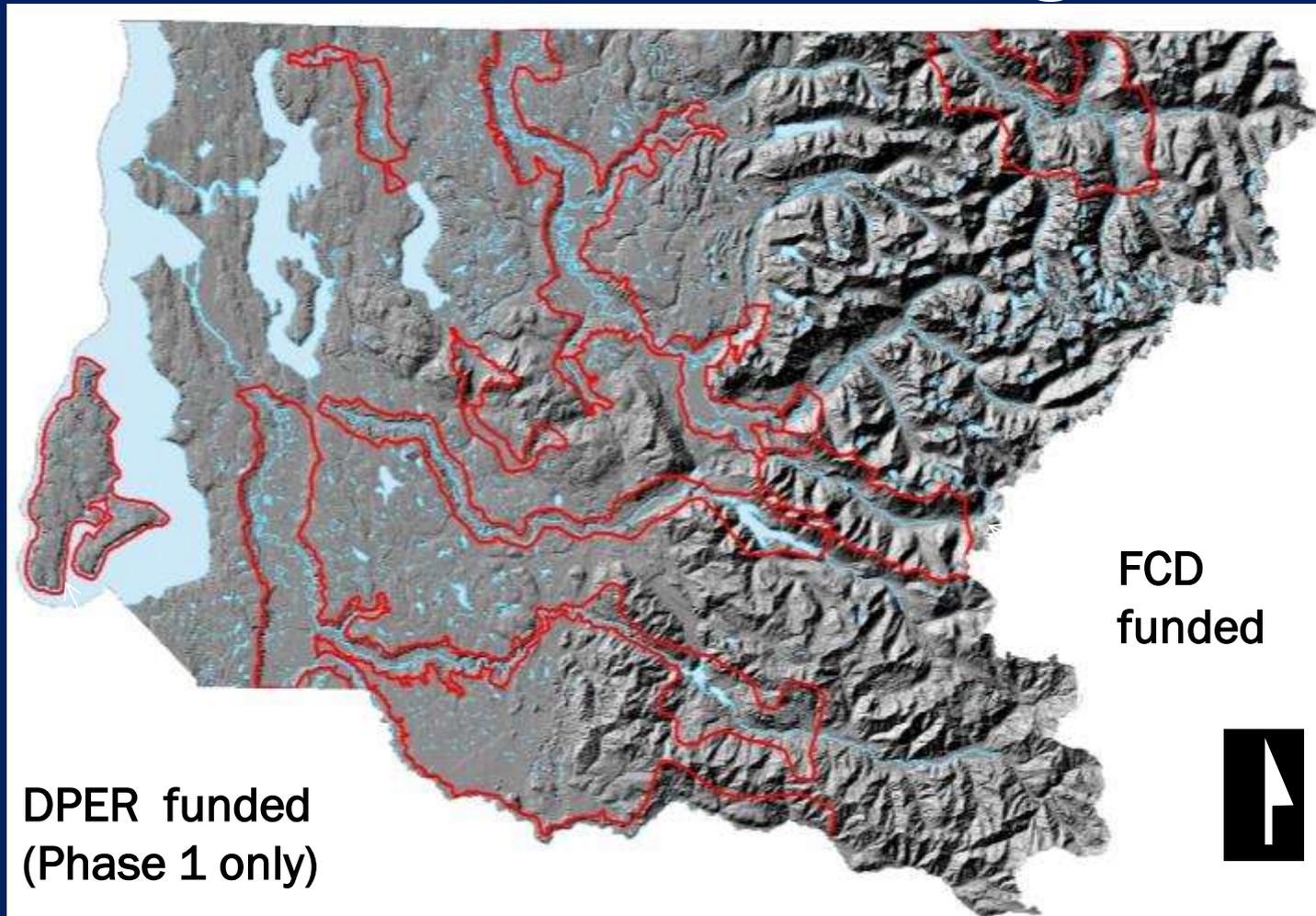


**King County**

# Landslide Investigation Update

Joint Basin Technical Committee  
Meeting  
May 5, 2015

# Areas included in Investigation



Coordinated with the following cities:

Kenmore

Kent

Tukwila

Snoqualmie

Bothell

Auburn

SeaTac

Issaquah

Woodinville

Renton

Skykomish

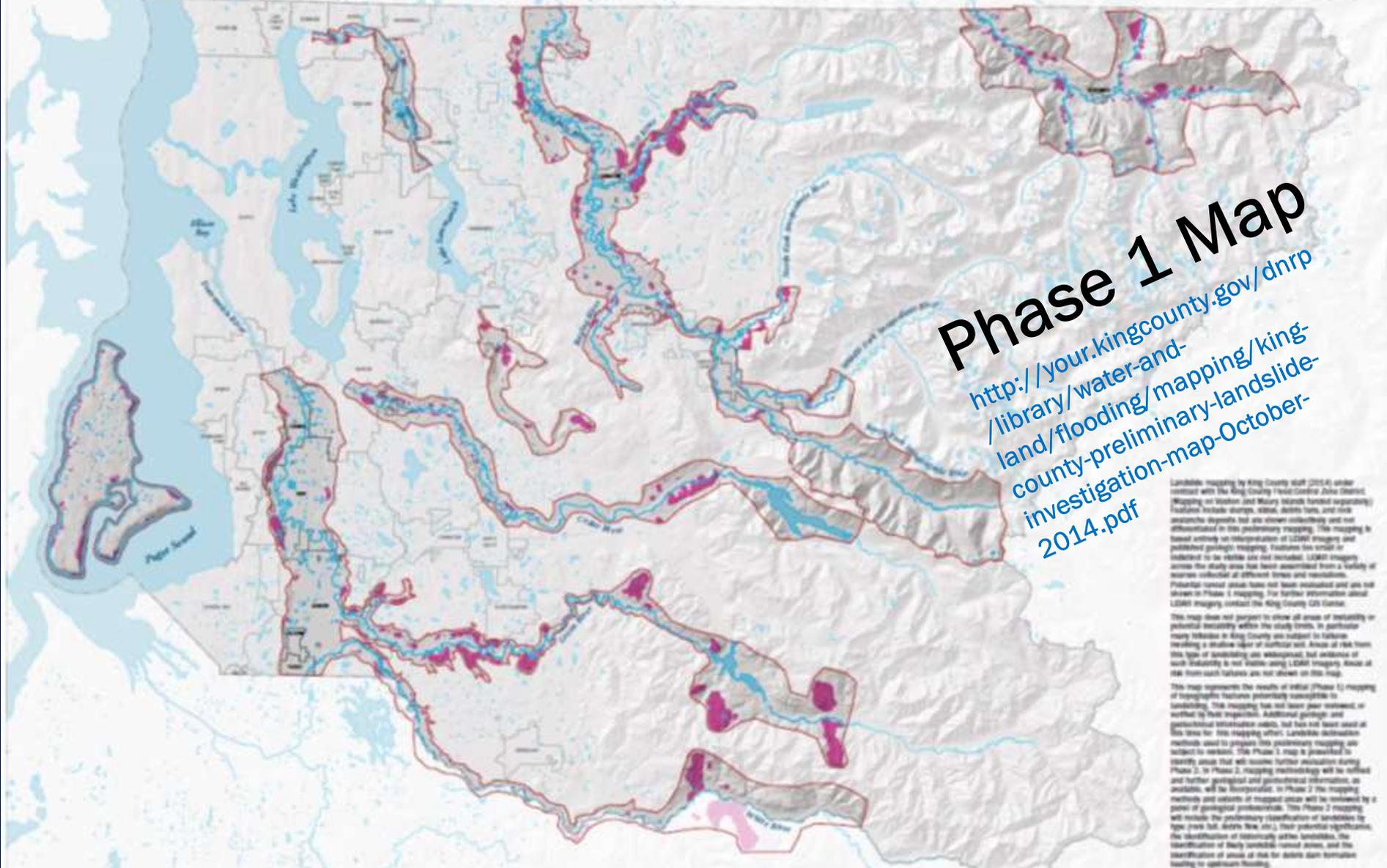
# Landslide Investigation Project Scope

## Phase 1 - Generalized Information

- Used existing LiDAR and best available geologic maps
- Identified landslides visible on LiDAR image
- Phase 1 Map completed October 2014
- Phase 1 Technical Memorandum completed April 2015

## Phase 2 - Detailed Evaluations

- Develop methodologies
- Prepare more detailed mapping



**Phase 1 Map**  
<http://your.kingcounty.gov/dnrp/library/water-and-land/flooding/mapping/king-county-preliminary-landslide-investigation-map-October-2014.pdf>

Landslide mapping by King County staff (2014) under contract with the King County Flood Control District (KCFCD) mapping of landslides and debris flows (landslide susceptibility) including debris chutes, debris flow fans, and rock avalanche deposits has not been collected and not differentiated in this preliminary mapping. This mapping is based entirely on interpretation of LIDAR imagery and geologic mapping. Landslide susceptibility is not intended to be visible and not included. LIDAR imagery across the study area has been assembled from a variety of sources collected at different times and resolutions. Photographic aerial data has not been evaluated and are not shown in Phase 1 mapping. For further information about LIDAR imagery, contact the King County GIS Center.

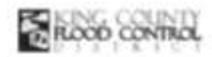
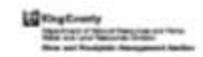
This map does not purport to show all areas of instability or potential instability within the study limits. In particular, many tributaries in King County are subject to failure involving a shallow layer of surficial soil. Areas of risk from this type of landslide are widespread, but evidence of such instability is not visible using LIDAR imagery. Areas at risk from such failures are not shown on this map.

This map represents the results of initial (Phase 1) mapping of topographic features potentially susceptible to landsliding. This mapping has not been peer reviewed, or verified by field inspection. Additional geologic and geomorphological information subjects, but has not been used at this time for this mapping effort. Landslide detection methods used to prepare this preliminary mapping are subject to revision. The Phase 1 map is provided to identify areas that will require further evaluation during Phase 2. In Phase 2, mapping methodologies will be refined and further geologic and geomorphological information, as available, will be incorporated. In Phase 2 this mapping methods and outputs of mapped areas will be reviewed by a panel of geological professionals. The Phase 2 mapping will include the preliminary classification of landslides by flow type, but debris flow, etc.) their potential significance, the identification of potentially active landslides, the identification of likely unstable channel areas, and the identification of areas at risk for debris dam formation leading to upstream flooding.

Funding for the preparation of Phase 1 mapping along major rivers was provided by the King County Flood Control District. King County completed the Phase 1 mapping for the Eastern-Washouli Islands.

**Results of a Preliminary Landslide Investigation in King County, Phase 1**

Study Limits  
 Mapping (2014) by King County Staff  
 Incorporated Areas



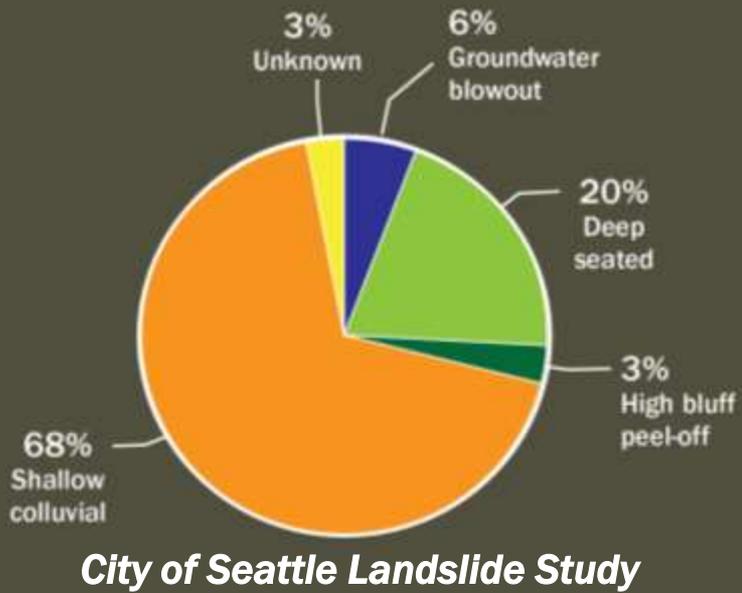
Copyright 2014 by King County Flood Control District. All rights reserved. This map is a preliminary product and is not intended for use as a legal document. The map is provided for informational purposes only. King County Flood Control District is not responsible for any errors or omissions in this map. The map is provided as a service to the public and is not a warranty of any kind. The map is provided as a service to the public and is not a warranty of any kind. The map is provided as a service to the public and is not a warranty of any kind.

# Phase 2 Landslide Investigation Project

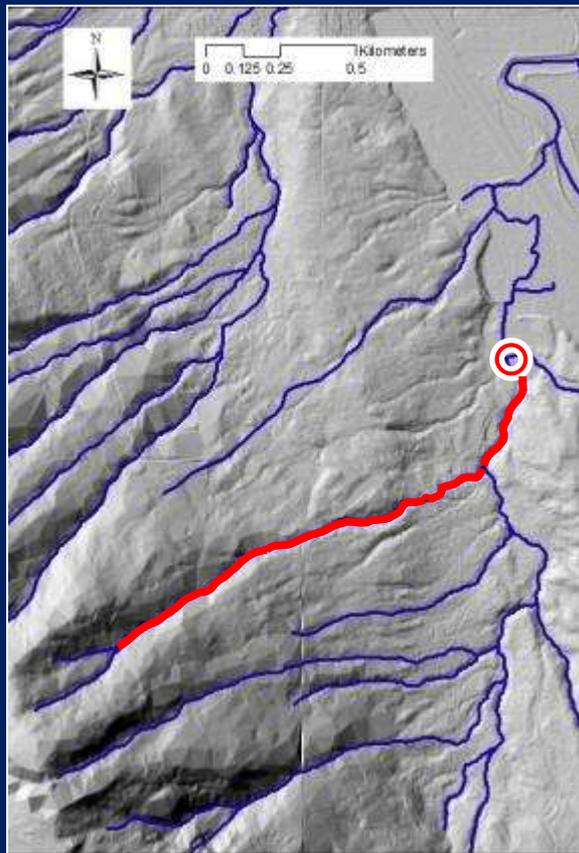
## Detailed Evaluations of Landslide Processes

- **Determine methods for each and then map**
  - Shallow Landslides
  - Debris flows and fans
  - Slumps
  - Rockfall
  - Runout assessment
- **Technical Review Committee meetings**
- **Phase 2 Mapping, Database Inventory, and Report**
- **Public Outreach approach**

# Shallow Landslides



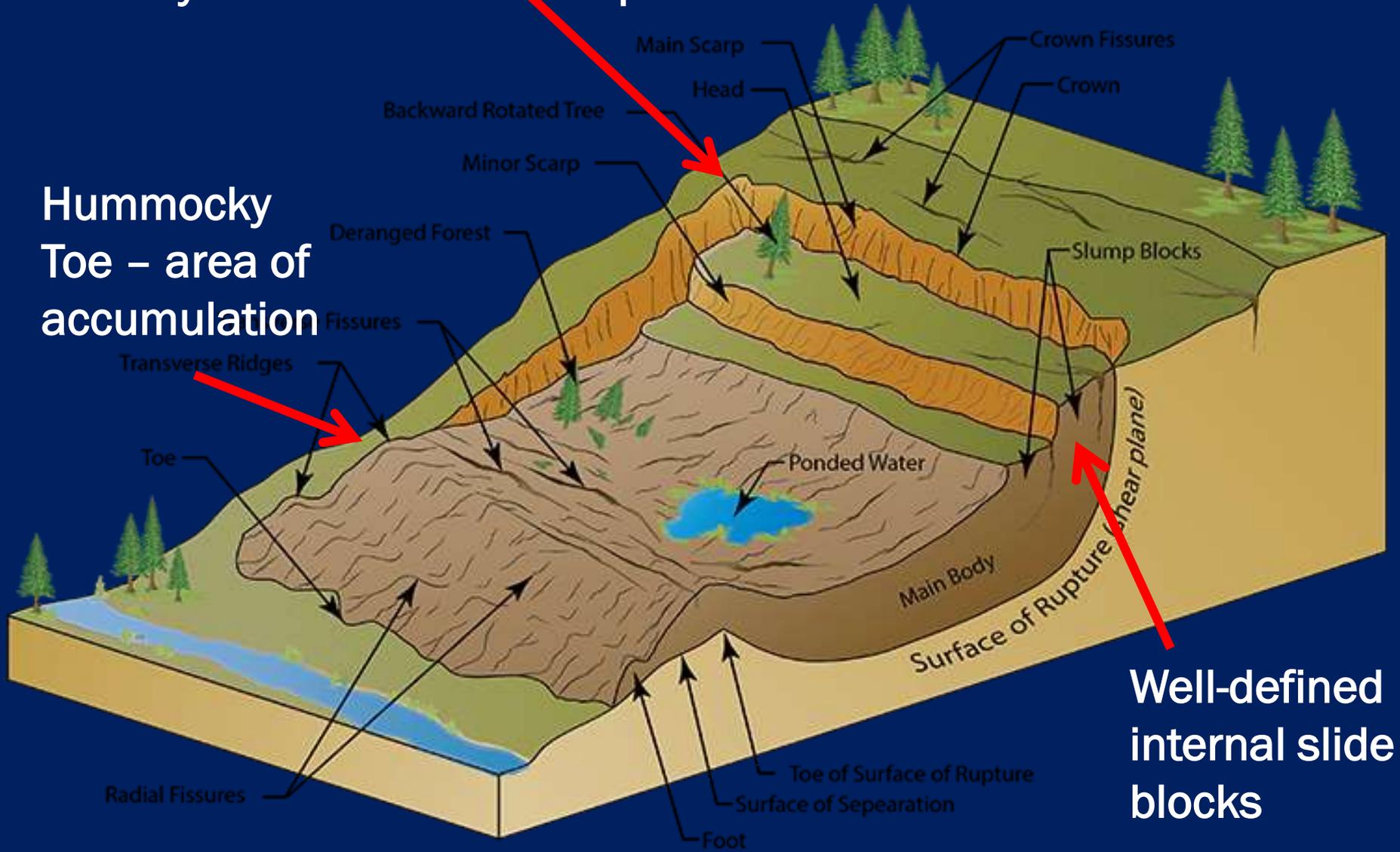
- **Debris Flows and Fans in Bedrock**
  - Common mass wasting process in alpine environments.
  - Similar to Puget Lowlands but occurs with greater frequency and energy.



# Slumps

Easily identified head scarp

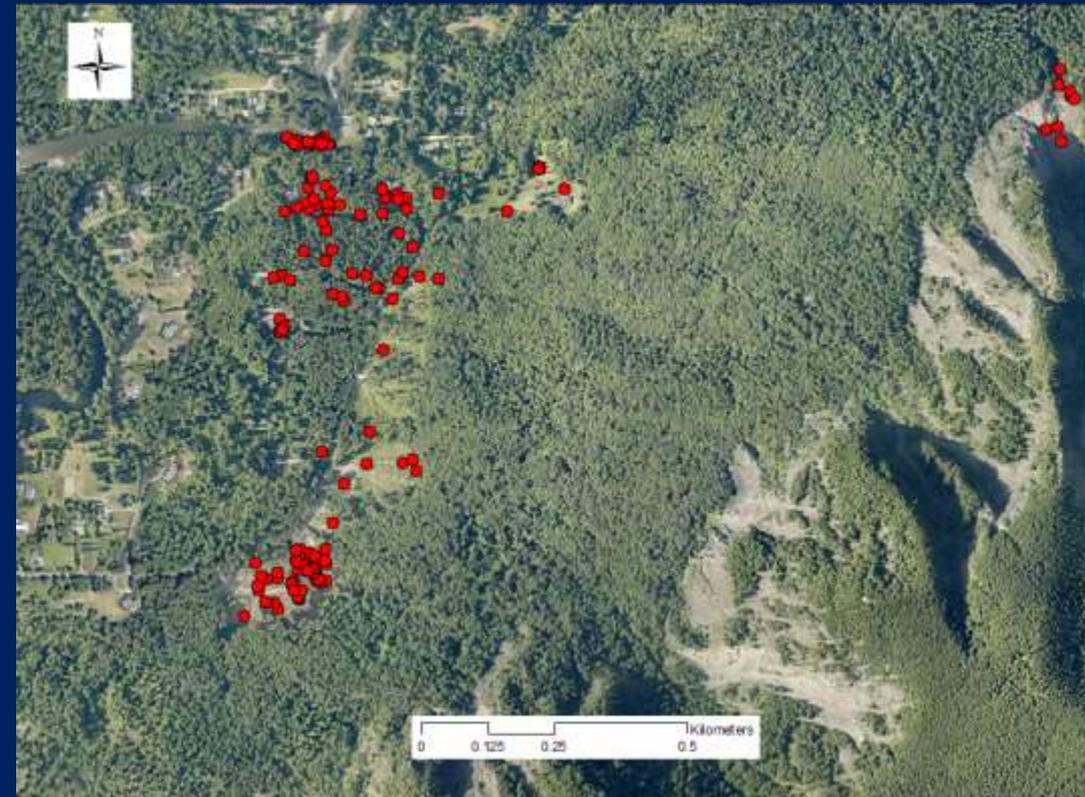
Hummocky  
Toe – area of  
accumulation



Well-defined  
internal slide  
blocks

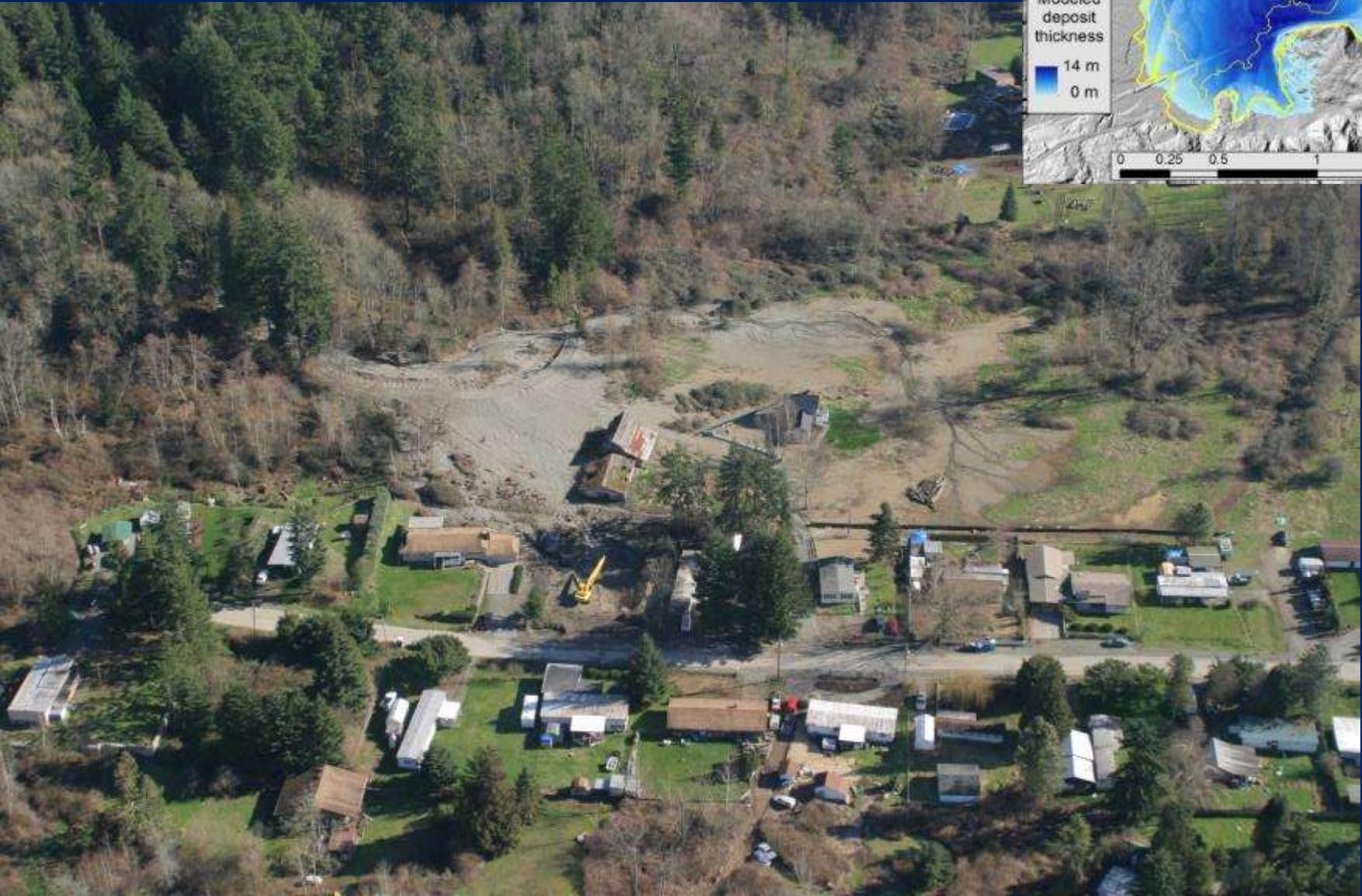
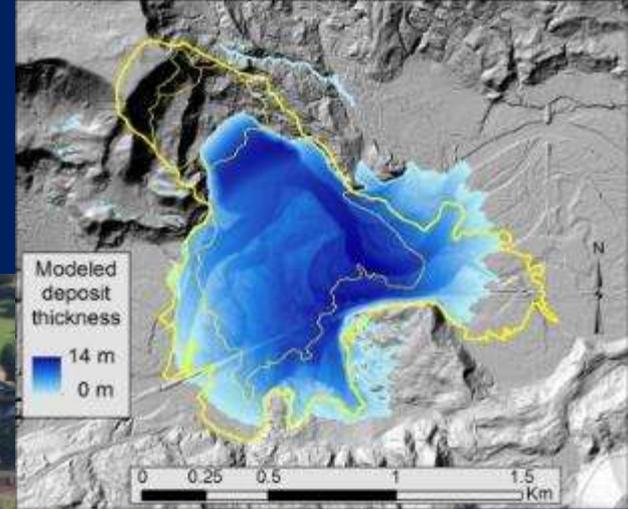
# Rockfall

Photo Courtesy Monty Vanderbilt



# Runout

Iverson et al. (2015)



# Phase 2 Schedule

Where we are now



PHASE 2015 - 2016 BUDGET YEAR	2015				2016			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Shallow Landslides								
Debris flows and fans								
Slumps/Deep seated Landslides								
Runout analysis and debris dams								
Rockfall								
Landslide geodatabase								
Report								
Outreach								

FCD Funded Phase 2 budget

\$584,259

# Landslide Investigation Project

- Copies of Phase 1 Map and Technical Memorandum

<http://www.kingcounty.gov/environment/waterandland/flooding/maps/river-landslide-hazards.aspx>

- Questions ?

Jeanne Stypula, RFMS Supervising Engineer

[Jeanne.stypula@kingcounty.gov](mailto:Jeanne.stypula@kingcounty.gov) (206) 477-4833

Sevin Bilir, Project Manager/Hydrogeologist

[Sevin.bilir@kingcounty.gov](mailto:Sevin.bilir@kingcounty.gov) (206) 477 - 4646

John Bethel, RFMS Geologist

[John.Bethel@kingcounty.gov](mailto:John.Bethel@kingcounty.gov) (206) 477- 4645

**Cedar River  
Channel Migration Zone (CMZ)  
Draft Study and Map**

Joint Basin Technical Committee  
Meeting

May 5, 2015

# Presentation

- Why CMZs are mapped
- Cedar River Study area
- Uses of CMZ maps
- How the Cedar River CMZ mapping was prepared

# Why Map Channel Migration Hazards?

- Channel migration is a type of flood hazard
  - Differs from flood inundation hazard
- Inform public of potential hazards
- Required by State Shoreline Management Act



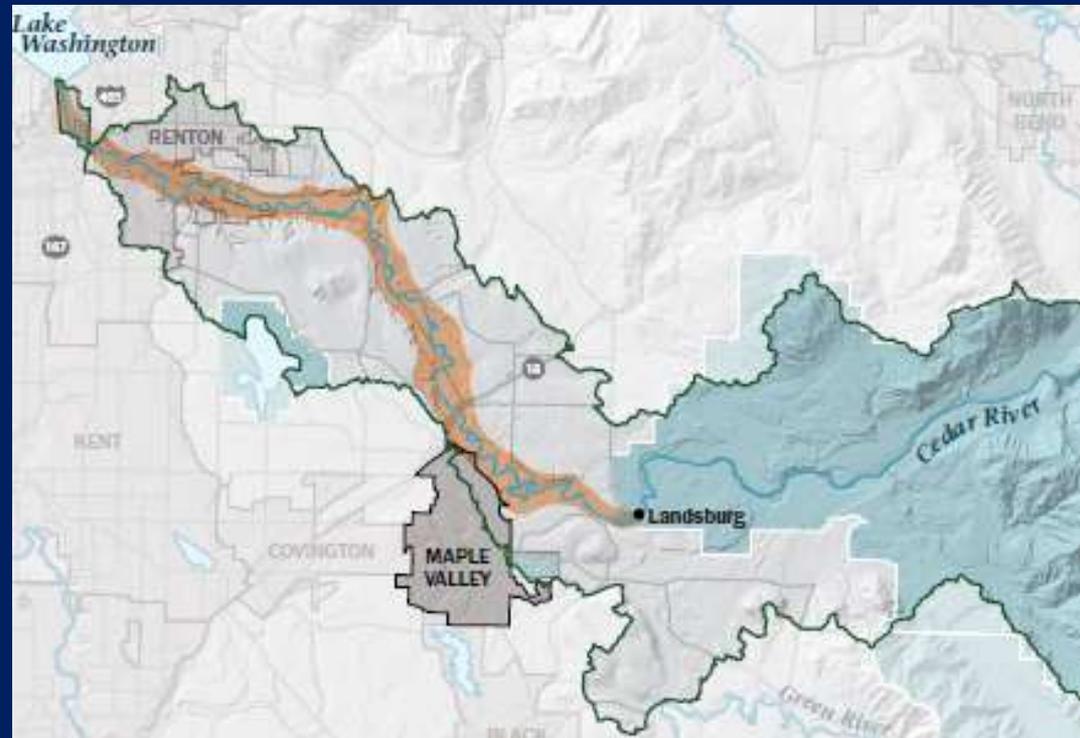
*Residence  
undermined  
along Cedar  
River*

# Study Area

Landsburg to  
Lake Washington

## Uses

- Supports Cedar River Corridor Planning
- Serves as regulatory map in unincorporated areas
- Used by property owners for land use choices

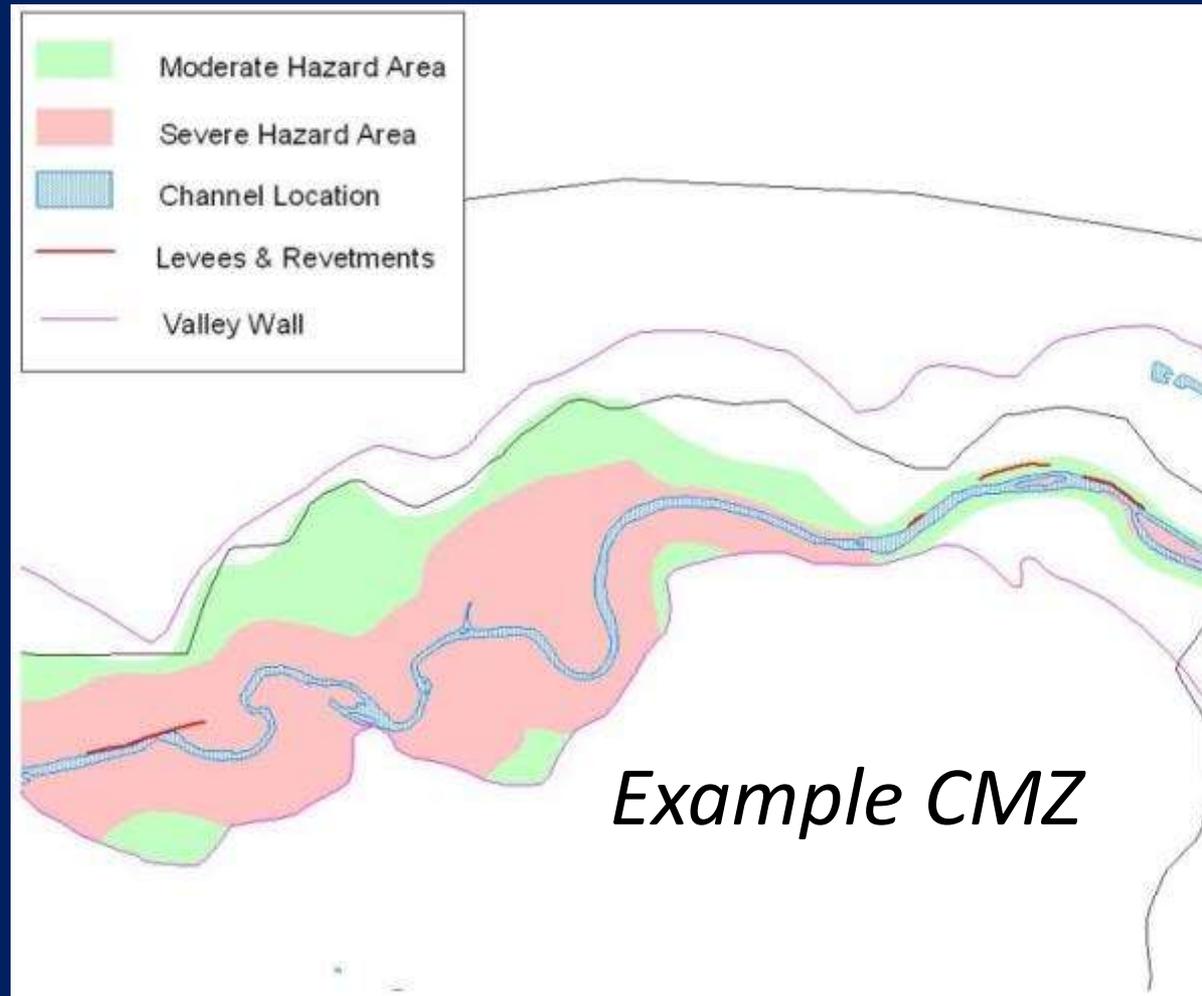


# Channel Migration

The shifting of a river within a river valley

## Channel Migration Zone (CMZ)

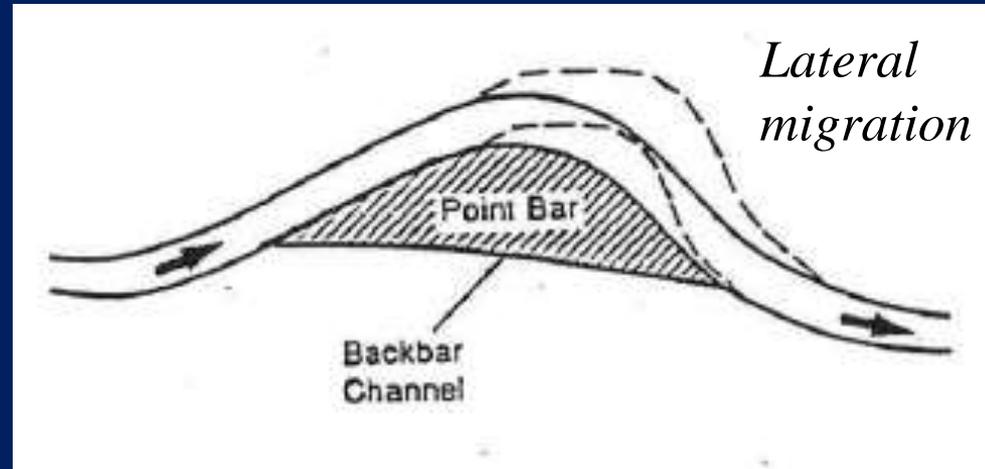
The area within which a river channel can be expected to migrate over time



# Types of Channel Migration

## Lateral migration

Progressive channel movement across floodplain

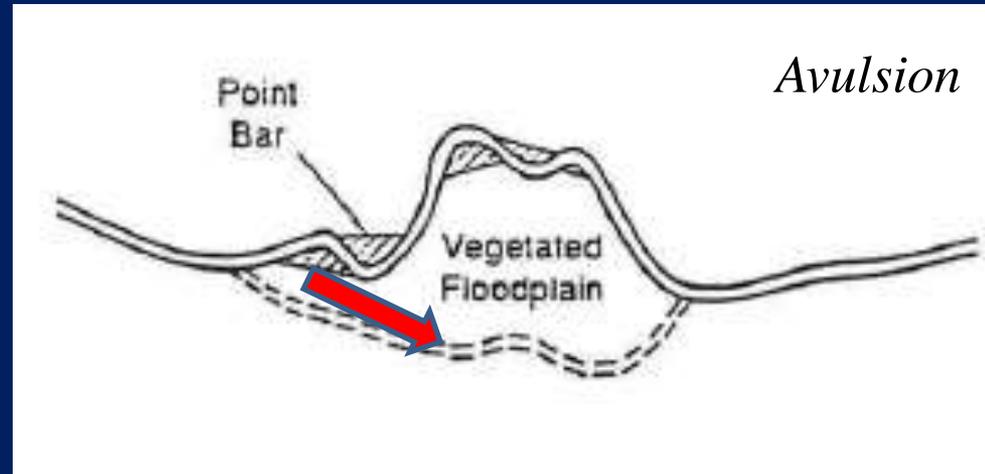


## Channel expansion

Channel widening

## Avulsion

Abrupt shift of channel location



# Cedar River CMZ Mapping

- Evaluate present conditions and historical migration to predict future hazard
  - Geology and riverbank materials
  - Historical channels
  - Lateral migration rates
  - Avulsion pathways
- Field observations and computer analyses
- Map and combine CMZ components

(Landslides into channel are not mapped)

(All consistent with State Ecology guidance)

# Geology and Riverbank Materials



**Erodible alluvium**

# Artificial Riverbank Materials



**Road prisms and  
bridges  
(SR 169, Cedar River Trail)  
constrain the channel**



# Historical Channel Locations

Cedar River 2011 and 1964 channel locations

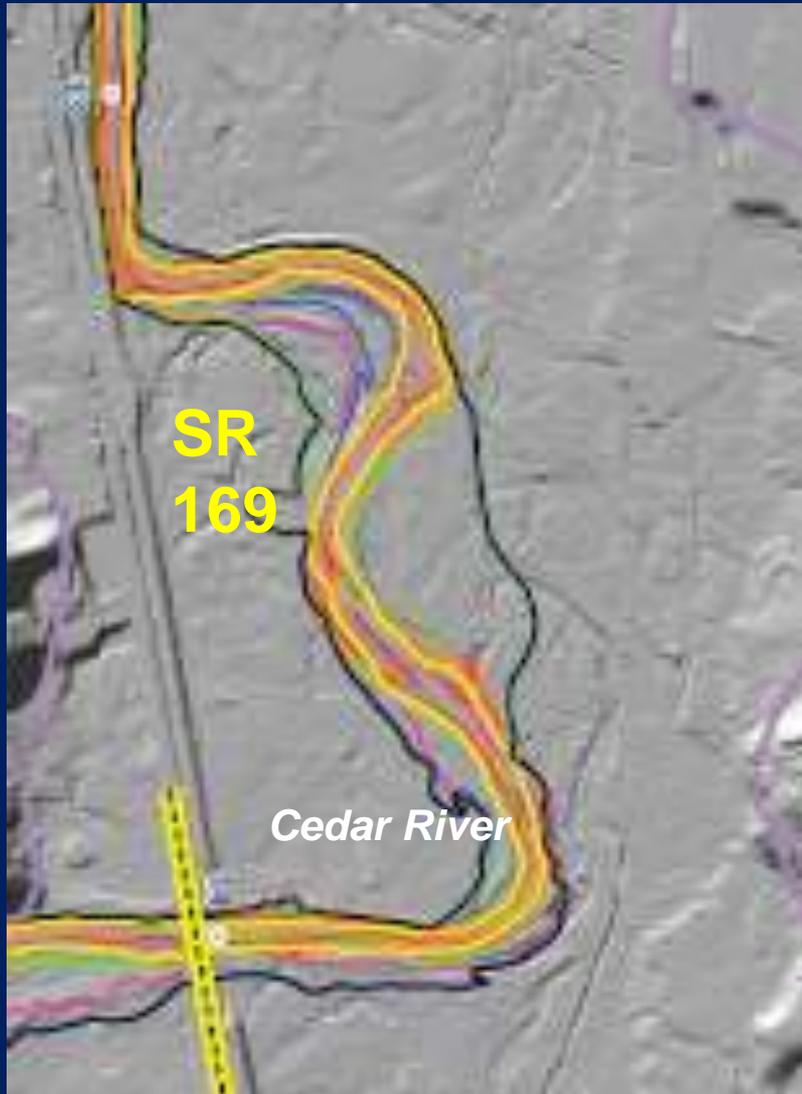


## Aerial Photos

1936  
1948  
1959  
1964  
1970  
1980  
1989  
2000  
2011

Lateral migration rate = distance / time

# Historical Channel Locations and Rates

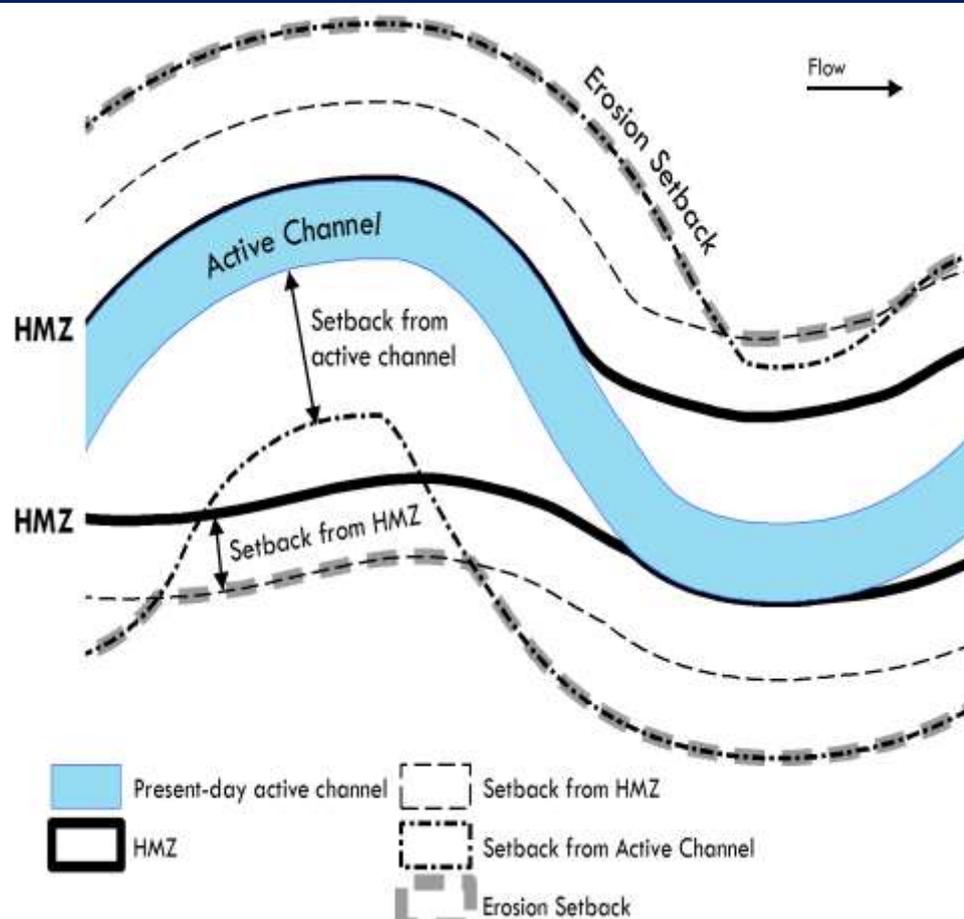


- Shaded relief map
- Colors: Historical channel locations
- Black outline: Historical Migration Zone (HMZ)
- Lateral migration rate = distance / time

*Taylor Creek  
area*

# Lateral Migration - Erosion Hazard Areas

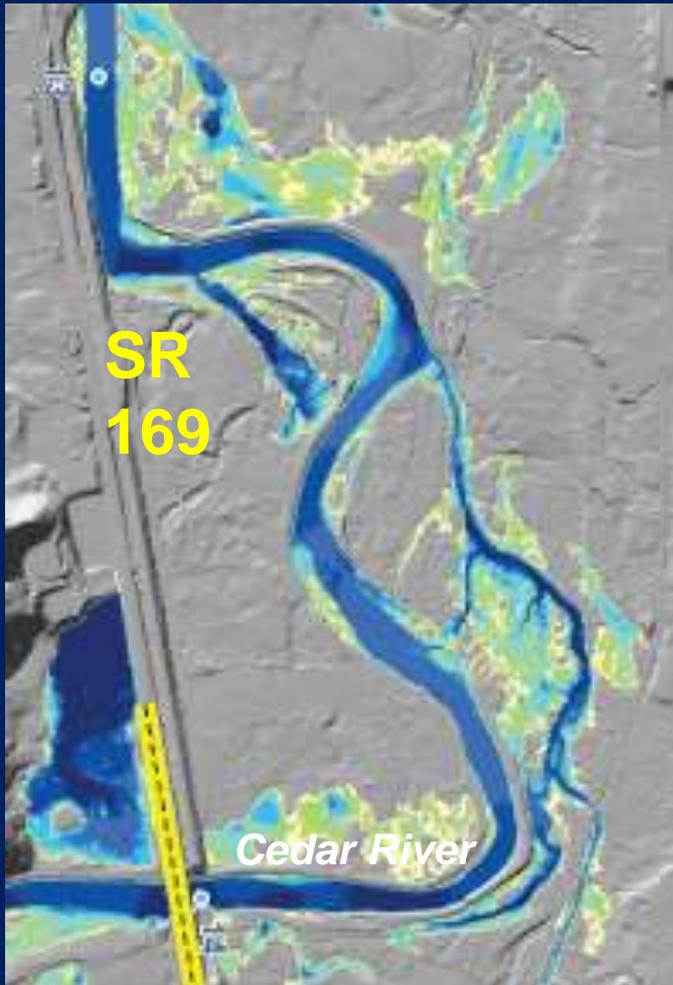
Distance = migration rate x time



- Erosion Hazard Area width is greater of 2 distances:
  - Migration rate x 50 years, applied to the HMZ
  - Migration rate x 100 years, applied to Active Channel

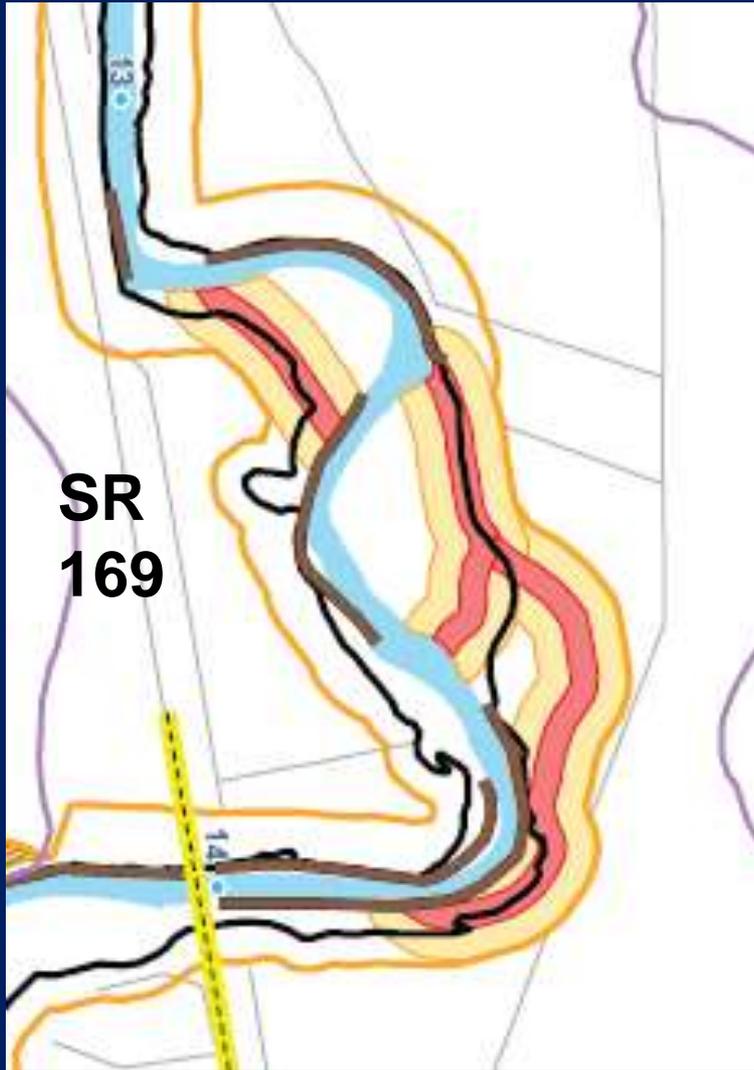
# Potential Avulsion Pathways

- Shaded relief map
- Colors show difference in elevation between floodplain topography and in-channel water surface
- Indicate low-lying areas
- Identify Avulsion Hazard Zone (AHZ)



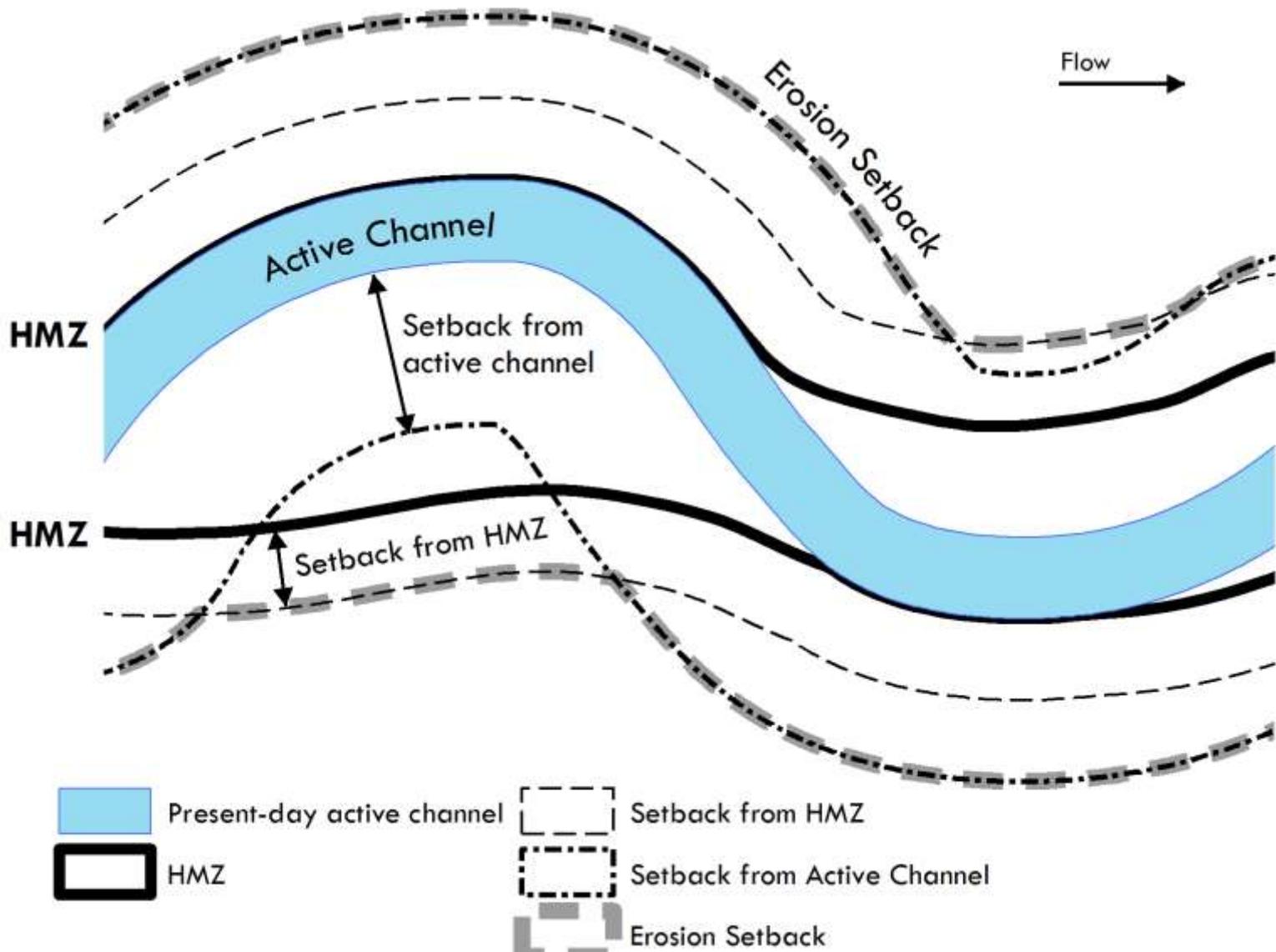
*Taylor Creek area*

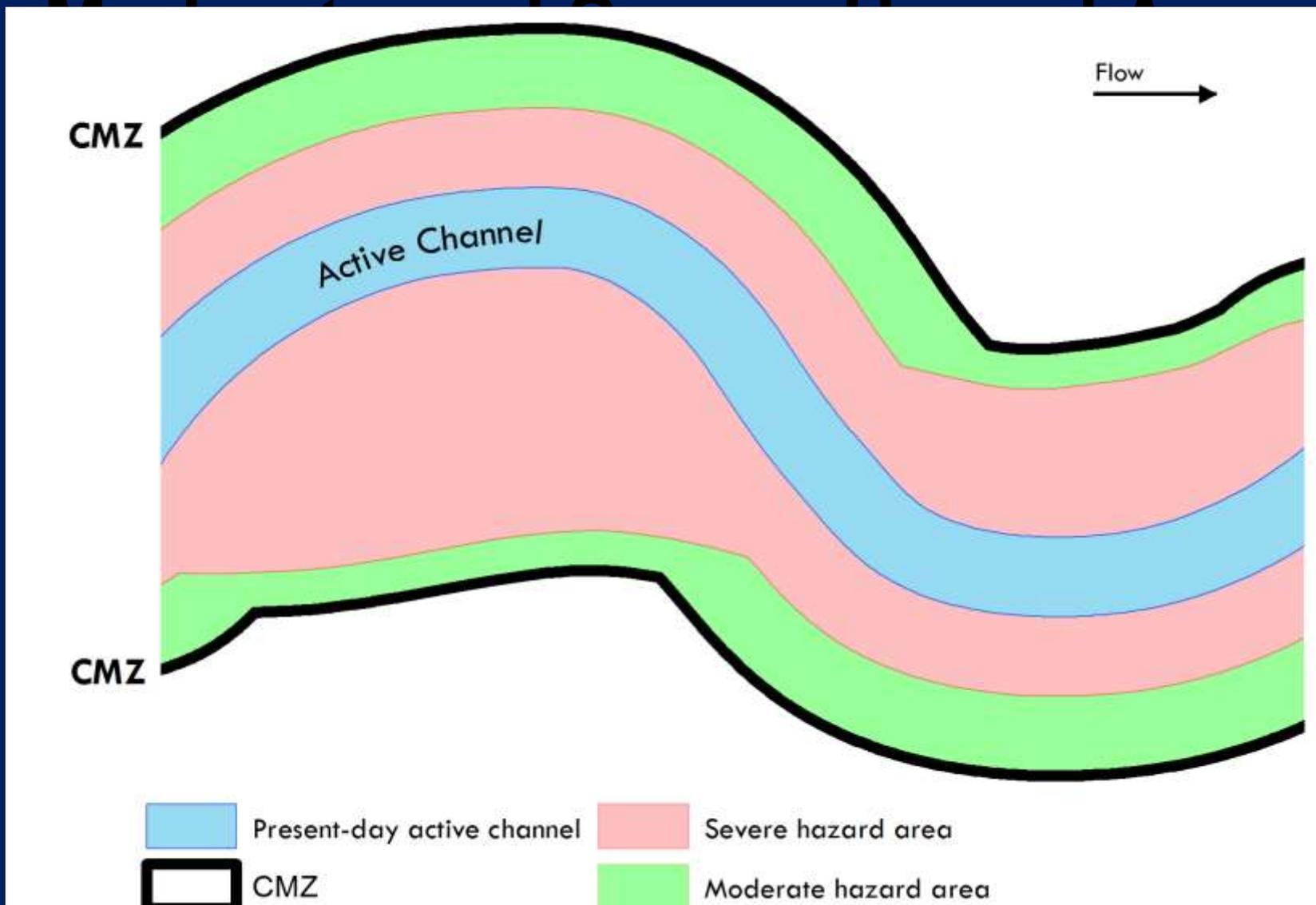
# CMZ Components



- Historical Migration Zone (HMZ); black lines
- Avulsion Hazard Zone (AHZ); red pathways
- Erosion Hazard Area (EHA); gold lines

*Taylor Creek area*

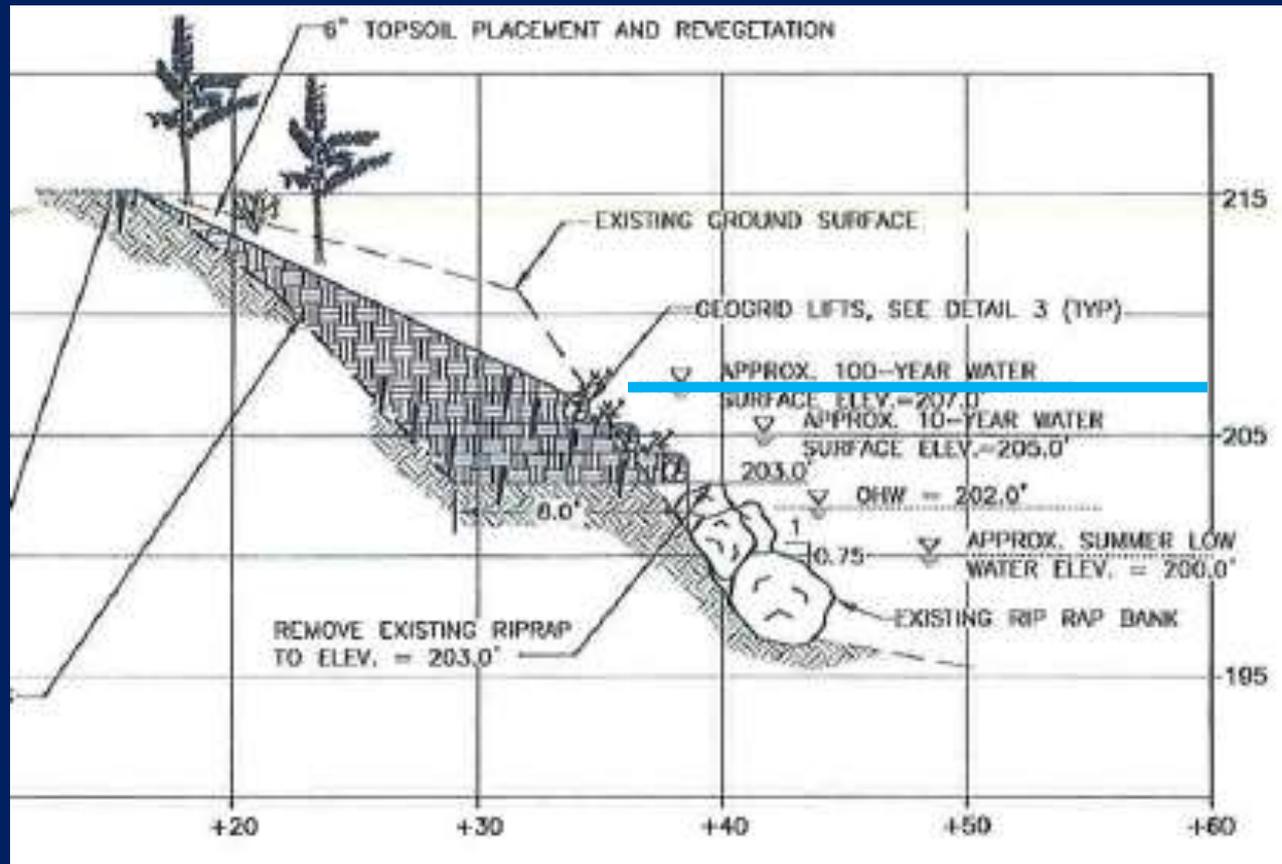




# Mapped Barriers to Channel Migration

An artificial structure (e.g., levee, revetment)

- Likely to restrain channel migration
- Built above the 100-year flood elevation



- Also:
- State highways
  - Active railroads
  - Sole-access roads

# Cedar River CMZ Map



- Severe hazard area; pink
- Moderate hazard area; green
- SR 169 mapped as barrier to channel migration

*Taylor Creek area*

# Cedar CMZ Study Completion Schedule

- Feb 24<sup>th</sup> Public meeting
- March 23<sup>rd</sup> Comment period end
- April 17<sup>th</sup>
  - RFMS staff response to comments, final revisions
  - Final maps/study transmitted to Dept. Permitting and Environmental Review (DPER)
- June 2015
  - Public rule amended by DPER
  - Final map effective 30 days thereafter (June 2015)

# Next CMZ studies...

- South Fork Skykomish River
  - King-Snohomish county line to Tye-Foss confluence (12 miles)
  - Public draft and public meeting -- 3rd QTR 2015
  - Finalize study and maps-- 4<sup>th</sup> QTR 2015
- Tolt River
  - Confluence with Snoqualmie to 6 miles upstream
  - Public draft and public meeting -- 4th QTR 2015
  - Finalize study and maps -- early 2016
- White River
  - SR 410 to Mud Mountain dam (6 miles)
  - Technical analysis 2015 with public draft 2016

- Copies of Cedar CMZ study and map
  - ✓ [www.kingcounty.gov/rivers](http://www.kingcounty.gov/rivers)
  - ✓ DPER Snoqualmie offices
  - ✓ Fairwood and Maple Valley Libraries
  - ✓ RFMS offices (King Street Center Bldg)

- Questions ?

Jeanne Stypula, RFMS Supervising Engineer

[Jeanne.stypula@kingcounty.gov](mailto:Jeanne.stypula@kingcounty.gov) 206-477-4833

Terry Butler, RFMS Geologist

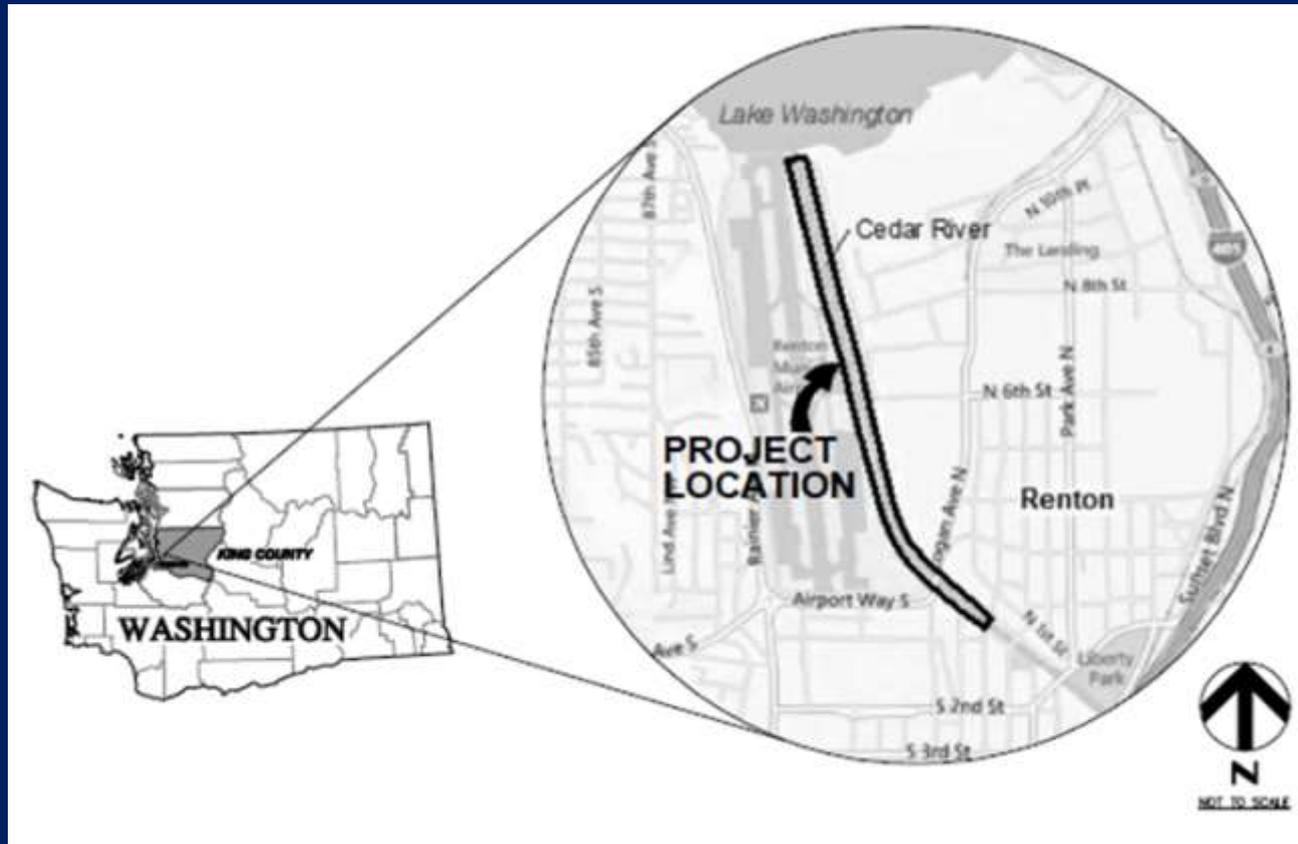
[terry.butler@kingcounty.gov](mailto:terry.butler@kingcounty.gov) (206) 477 - 4660

# Cedar River Gravel Removal Project

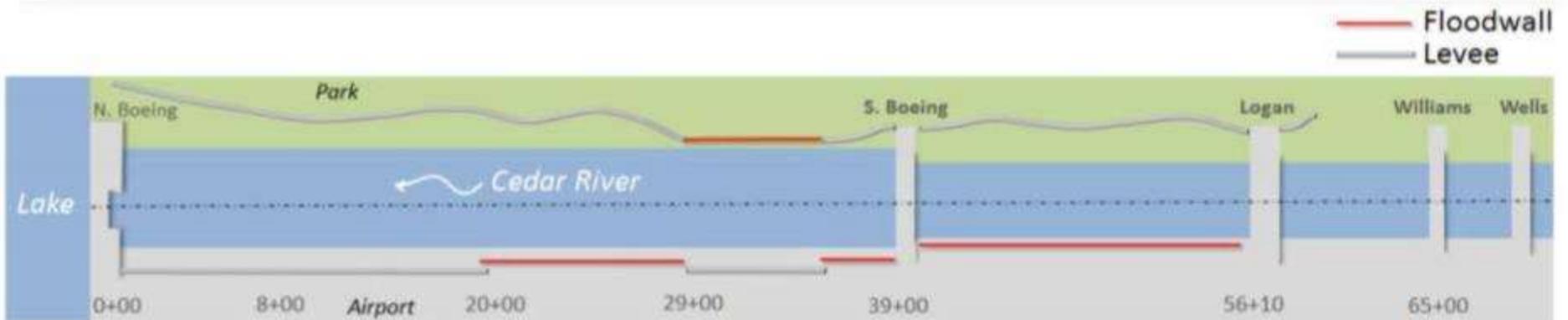
November 1990 Flood



# Project Vicinity Map



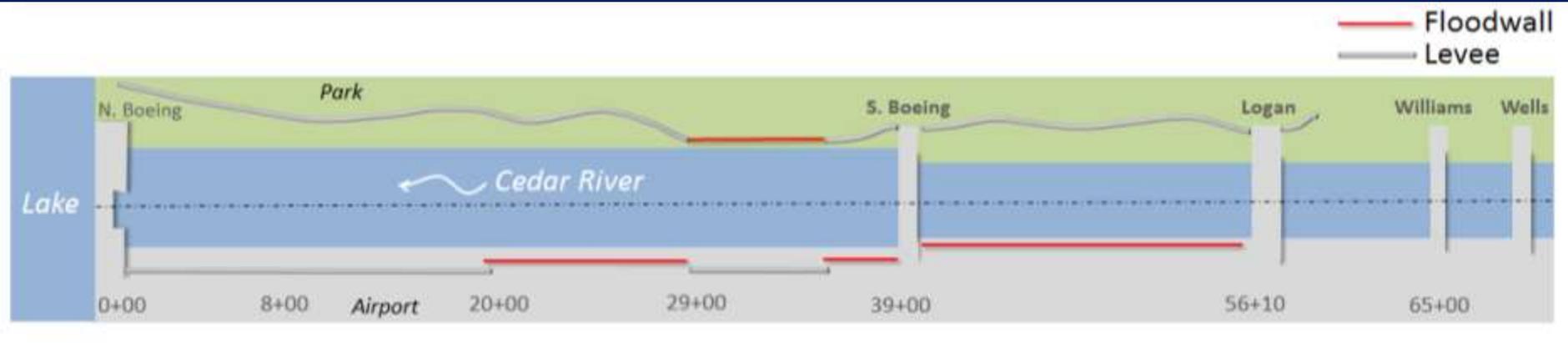
# Project Area



# Purpose and Need

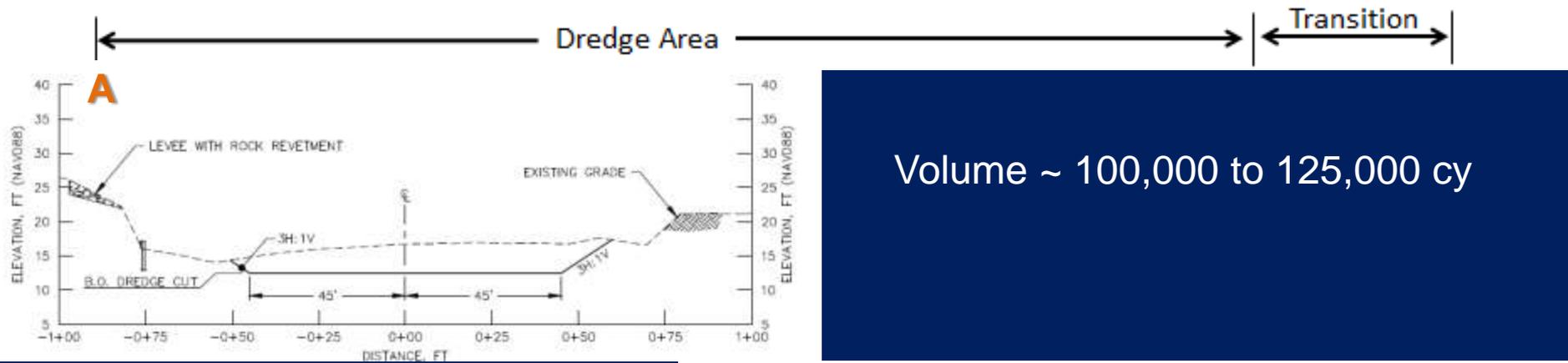
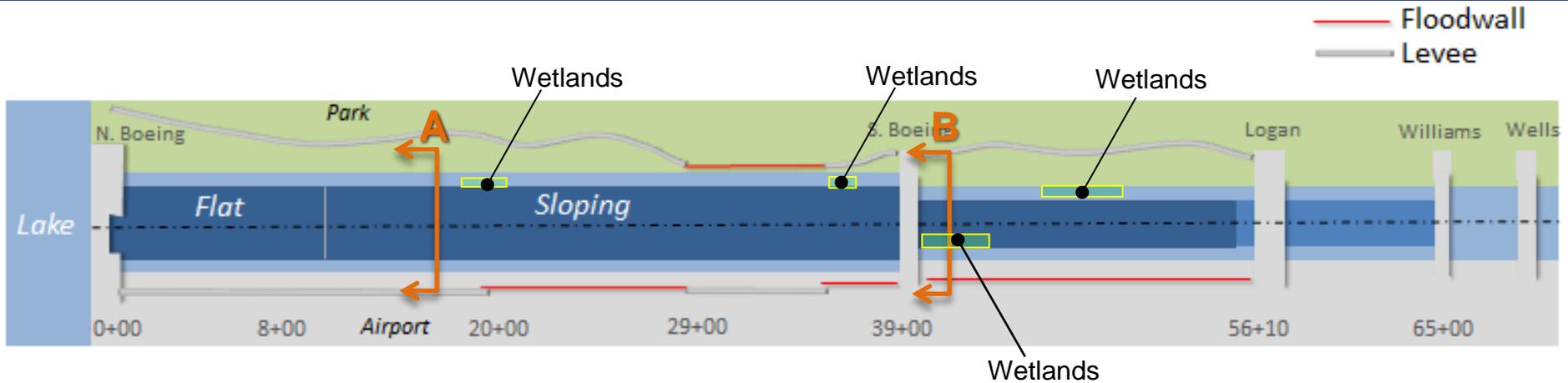
- **Purpose:**
  - Maintenance for existing Lower Cedar River Section 205 Flood Hazard Reduction Project
  - Continuation of 1998 permitted project
- **Need**
  - City O&M Agreement with Corps established monitoring to determine need for maintenance
  - Channel Survey Monitoring indicates allowable bed level to be exceeded in next 2 years

# Lower Cedar R. Section 205 Project



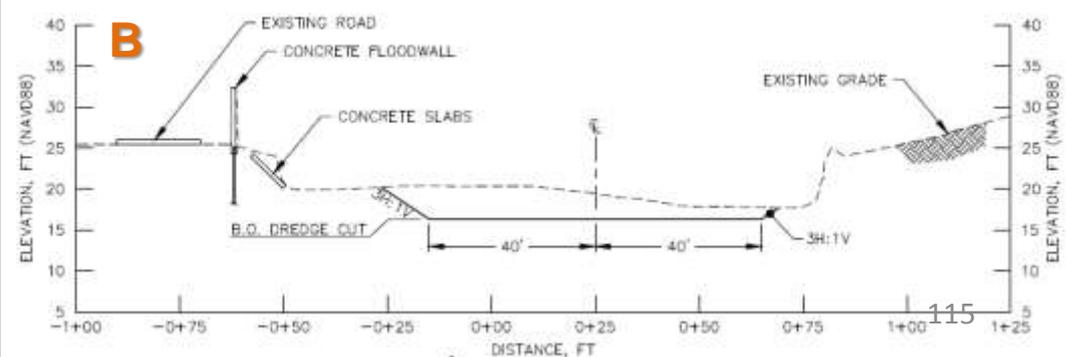
- Dredging
  - Planned 4 ft. average dredge depth
  - Planned gradual slope from N. Boeing Bridge to Logan
  - Steeper transition reach from Logan to Williams
- Concrete Floodwalls
- Earthen Levees set-back in the Cedar River Trail Park
- Bank Stabilization to protect levees and floodwall
- Mitigation provided for initial and required future maintenance dredge
- Future maintenance dredging required to maintain project flood protection benefits (est. every 3-yr)

# Dredging Extents and Depths



Volume ~ 100,000 to 125,000 cy

DMMO Consultation – completed



# Project Status & Schedule

- Project Inter-local Agreement with King County signed January 23, 2013
- Consultant Team contract signed May 17, 2013
- Project 30% design completed (2/3/14)
  - 30% Construction Cost Estimate: \$7.8 million
- Army Corps of Engineers 404 Permit
  - Permit Application (JARPA) submitted (2/10/14)
  - Joint Public Notice issued (7/8/14 to 8/8/14)
  - Project will require an individual 404 USACE permit
  - BA sent to NOAA Fisheries on 2/13/2015
  - Meeting with USACE on May 1<sup>st</sup> 2015
- CZM
  - Ecology received CZM statement 7/8/2015
  - Ecology and the City agreed to CZM Stay until July 8, 2015.
- 401 Water Quality Certification
  - Ecology received the City of Renton's Joint Aquatic Resources Permit Application (JARPA) on February 13, 2014
- Local Permits completed as of May 4, 2015
- Working towards 70-percent design to be completed by fall 2015

# Project Status & Schedule (Cont.)

- Completed
  - Project Biological Assessment for ESA Consultation
  - Cultural Resource Report
  - Mixing Zone Modification Request
  - Water Quality Monitoring Plan
  - Mitigation Plan,
  - Bank use plan
  - Responses to comments
  - Dredge Material Characterization Report
- Construction
  - Summer of 2016 (June 15 – August 31)

# Project Funding

- Funded by King County Flood Control District
  - \$ 7,763,411 - 2015 adopted expenditure authority + 2014 carryover
  - \$150,000 City of Renton's portion of the King County Flood Control District Sub-Regional Opportunity Fund

# Questions?



10.04.2010



KING COUNTY  
FLOOD CONTROL  
DISTRICT

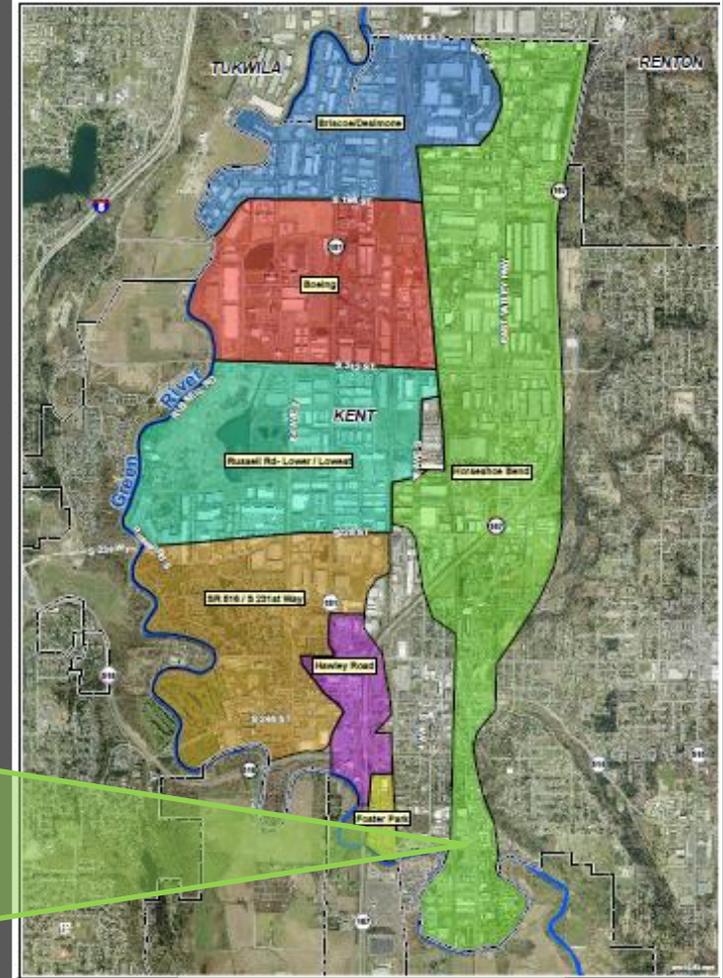
City of  
Renton





# Green River Levees in Kent

Seven Separate Levee Certification Reports "CLOMRs"



Horseshoe Bend CLOMR Received from FEMA in June 2012

# Russell Road Upper Levee



King County Flood Photo Viewer - November 9, 2006



James St/Russell Road Intersection— May 10, 2013

# Russell Road Upper Levee

North Reach Levee – Lakes Community  
Construction Completed in 2013

North Reach Levee



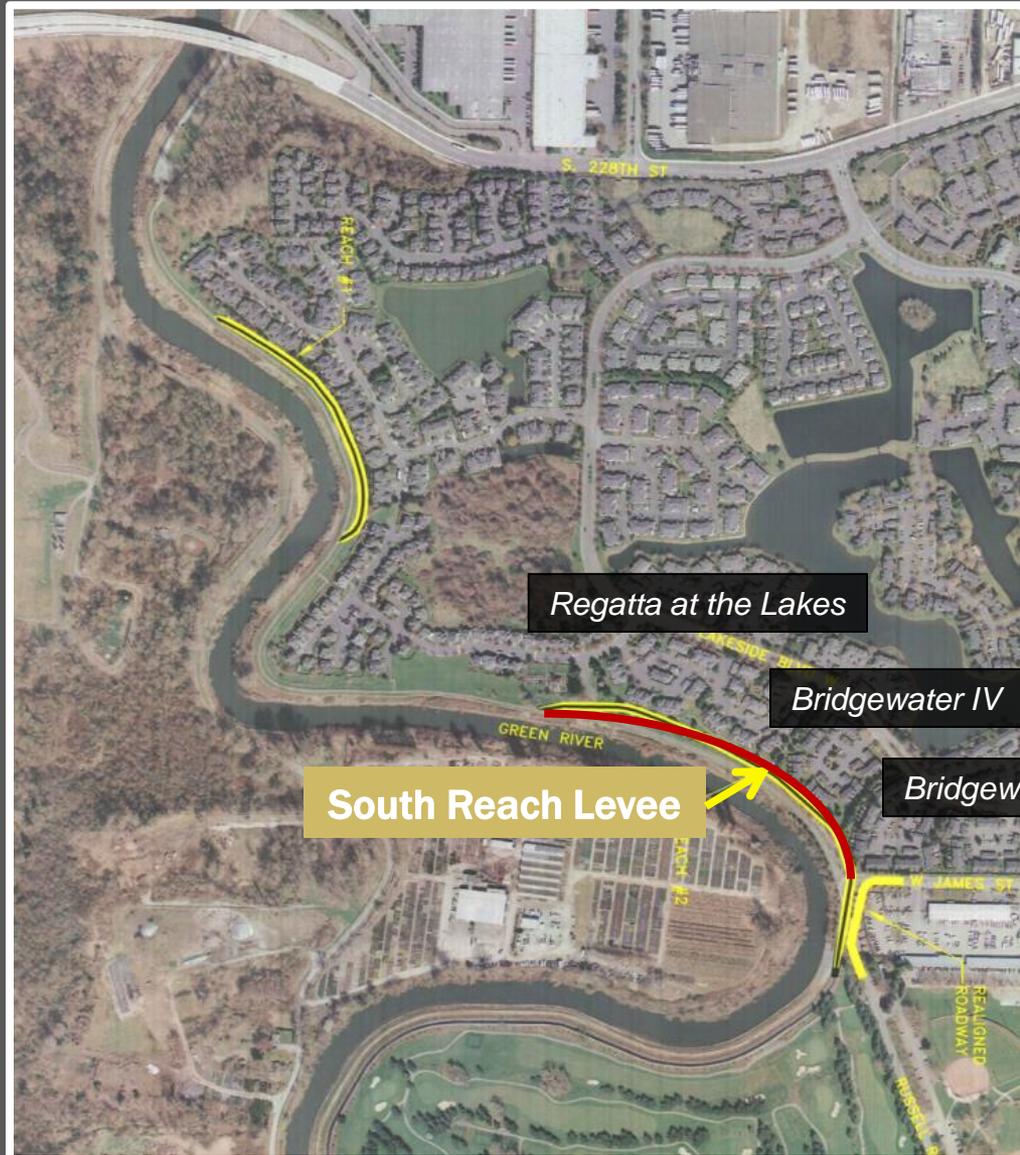
# Russell Road Upper Levee

South Reach Levee – James St / Russell Road Intersection  
Construction Started in 2014



# Russell Road Upper Levee

South Reach Levee – Lakes Community  
Construction to Begin in 2015



# Russell Road Upper Levee

## South Reach – James/Russell Intersection

Existing Conditions

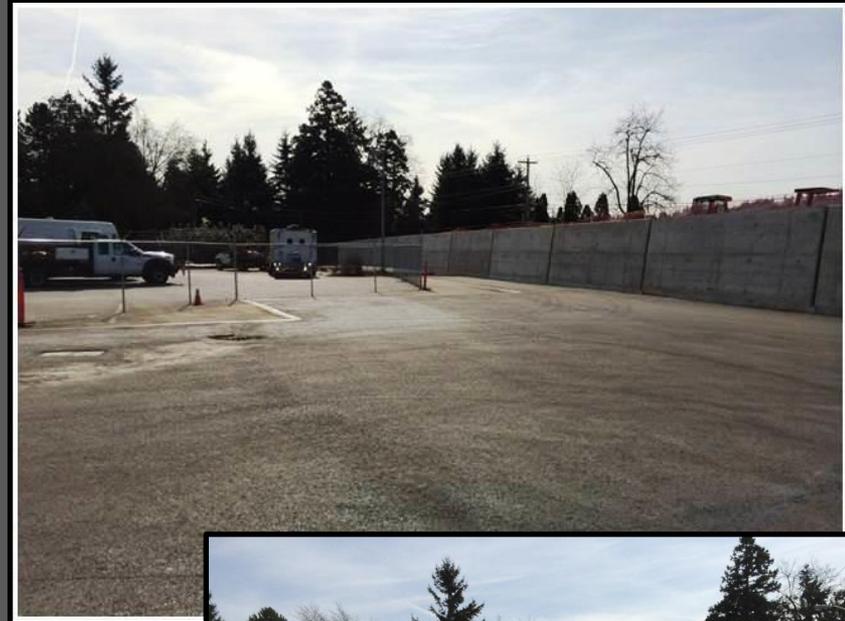


Proposed Conditions

# Russell Road Upper Levee

## South Reach – James/Russell Intersection

Construction Photos – March 2015



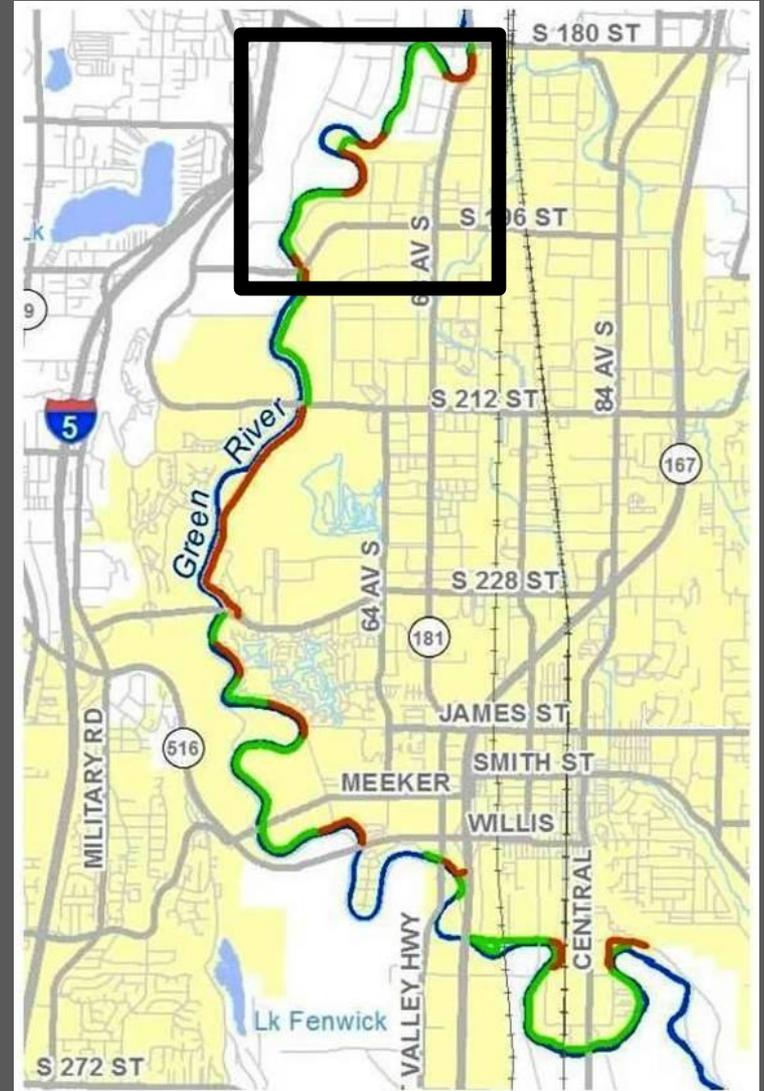
# Russell Road Upper Levee

## South Reach – James/Russell Intersection

### Construction Photos – May 2015

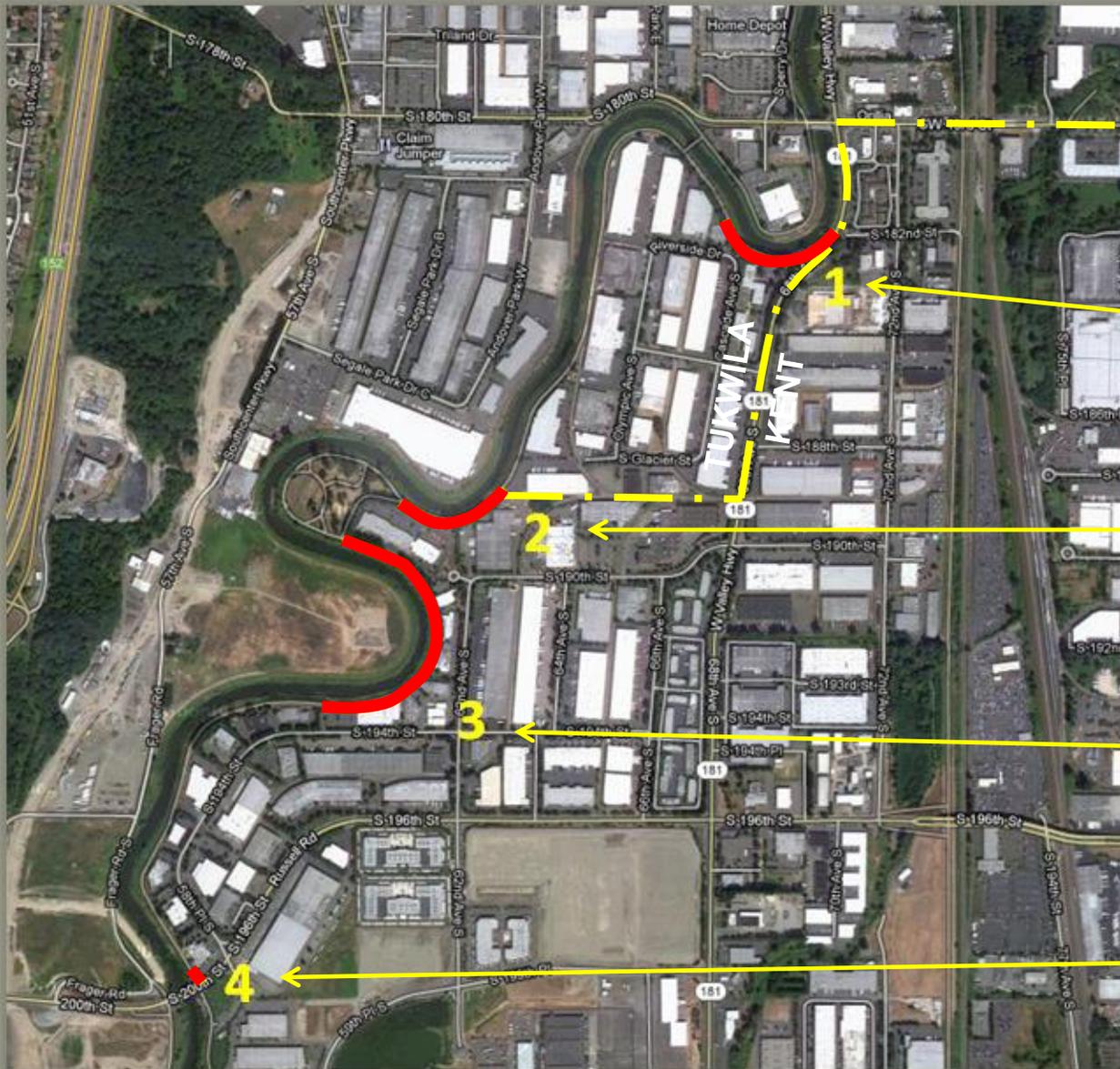


# Briscoe/Desimone Levee



# Briscoe/Desimone Levee

## Four Reaches of Work



**City of Kent, Washington  
Briscoe-Desimone Levee  
System**

**Repair Reach 1:  
(1140 feet)**

**Repair Reach 2:  
(600 feet)**

**Repair Reach 3:  
(2120 feet)**

**Repair Reach 4:  
(200 feet)**

# Briscoe/Desimone Levee – Reach 1

Construction Started in 2015



# Briscoe/Desimone Levee – Reach 2

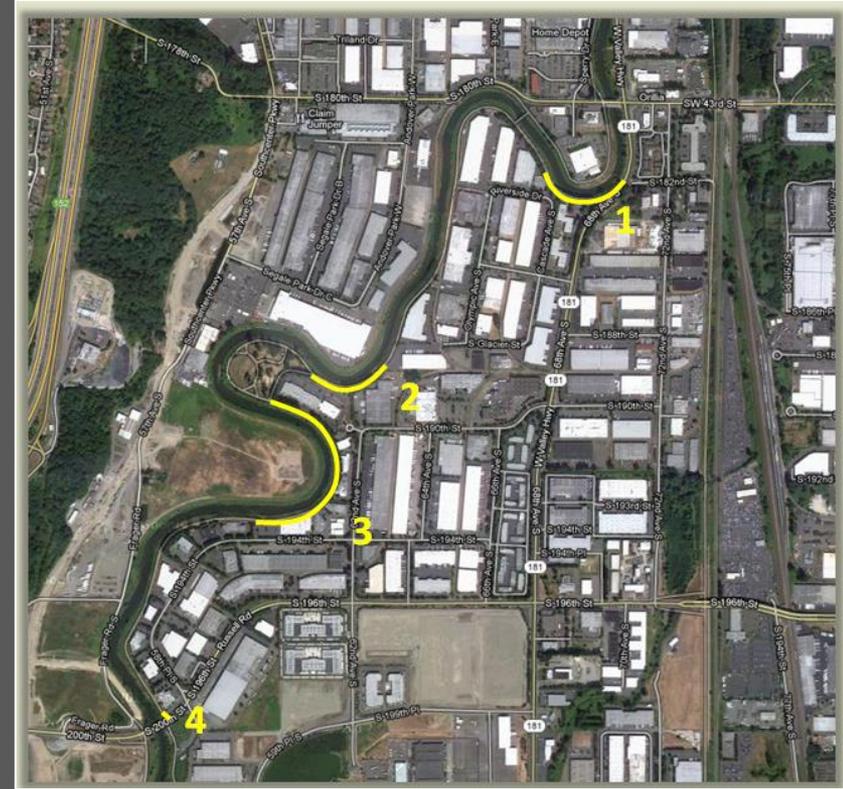
Construction Completed in 2014



# Briscoe/Desimone Levee – Reach 3

Construction Completed in 2014





# Russell Road Upper Levee & Briscoe/Desimone Levee

King County Flood Control District – Joint Technical Committee Meeting

May 5, 2015