Recap of Previous Workshops

- Regulated Synthetic Flood Hydrographs
- Evaluation of Existing Conditions
- Flood Peak Reduction Potential of Various Measures
- 100-Year Flood Protection Areas/Certified Levee Reaches
100-Year Flood Hydrographs
Sedro-Woolley
100-Year Flood Hydrographs
Mount Vernon Gage
100-Year Flood Hydrographs
Division Street Bridge

100-Year Flow hydrographs at Downstream of Division Street Bridge (RM 12.84)

- Without left bank levee and with overtop at RM 21.8
- With all existing levee in place and flood fight

100-Year Stage hydrographs at Downstream of Division Street Bridge (RM 12.84)

- Without left bank levee and with overtop at RM 21.8
- With all existing levee in place and flood fight
100-Year Water Surface Profile – No Flood Fight

Water Surface and Levee Elevations at Skagit River

- Division Street Bridge
- Three Bridges Corridor
- Nookachamps Creek
- SR-9 Bridge

Elevation (ft)

Mount Vernon Redevelopment Area

River Mile (RM)

- right bank levee
- left bank levee

100-year flood with all existing levee in place and overtop right levee
100-Year Water Surface Profile – Flood Fight

Water Surface and Levee Elevations at Skagit River

- Division Street Bridge
- Three Bridges Corridor
- Nookachamps Creek
- SR-9 Bridge
- Mount Vernon Redevelopment Area

Legend:
- **right bank levee**
- **left bank levee**
- **100-year flood with all existing levee in place and flood fight**
100-Year Water Surface Profile - FEMA

**Water Surface and Levee Elevations at Skagit River**

- **Division Street Bridge**
- **Three Bridges Corridor**
- **Nookachamps Creek**
- **SR-9 Bridge**

**Legend**:
- **Right bank levee**
- **Left bank levee**
- **100-year flood without left bank levee and with overtop at RM 21.8**

**Elevation (ft)**
- 20.00
- 25.00
- 30.00
- 35.00
- 40.00
- 45.00
- 50.00
- 55.00

**River Mile (RM)**
- 12
- 14
- 16
- 18
- 20
- 22

Mount Vernon Redevelopment Area

Redevelopment Area
100-Year Water Surface Profile

Water Surface and Levee Elevations at Skagit River

Elevation (ft)

River Mile (RM)

Mount Vernon Redevelopment Area

Division Street Bridge

Three Bridges Corridor

Nookachamps Creek

SR-9 Bridge

Mount Vernon

Redevelopment Area

right bank levee

left bank levee

flood fight

FEMA

no flood fight
Methods of Flood Reduction

- Minimize Flood Flows
- Containment
- Hydraulic Efficiency
- Controlled Release
Regulated 100-year Flow Hydrographs at Skagit River near Concrete

- Existing Baker and Ross storage
- Existing Baker storage and additional Ross storage (180,000 AF)
- Existing Baker and Ross storage and additional Lower Baker storage (29,000 AF)
- Existing Upper Baker and additional Ross storage (180,000 AF) and additional Lower Baker storage (29,000 AF)
# Nookachamps Storage Capacity

<table>
<thead>
<tr>
<th>Elevation</th>
<th>Left Bank (acre-ft)</th>
<th>Right Bank (acre-ft)</th>
<th>Total Storage (acre-ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>36 ft</td>
<td>19229</td>
<td>2550</td>
<td>21779</td>
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<tr>
<td>40 ft</td>
<td>42866</td>
<td>7614</td>
<td>50480</td>
</tr>
<tr>
<td>45 ft</td>
<td>68738</td>
<td>11535</td>
<td>80273</td>
</tr>
</tbody>
</table>
Methods of Flood Reduction

• Minimize Flood Flows
• Containment
• Hydraulic Efficiency
• Controlled Release
Methods of Flood Reduction

• Minimize Flood Flows
• Containment
• *Hydraulic Efficiency*
• Controlled Release
Methods of Flood Reduction

• Minimize Flood Flows
• Containment
• Hydraulic Efficiency
• Controlled Release
Regulated Synthetic Flood Hydrographs at Sedro-Woolley and Mount Vernon
Existing Nookachamps Storage Effects on Flood Peak
Regulated 100-year Flow Hydrographs

- Difference = 21,854 cfs
- Difference = 26,310 cfs

Flow at Sedro-Woolley (RM 22.4) with Existing Baker and Ross storage
Flow at BNSF Bridge (RM 17.53) with Existing Baker and Ross storage
Flow at Sedro-Woolley (RM 22.4) with additional Baker and Ross storage
Flow at BNSF Bridge (RM 17.53) with additional Baker and Ross storage
Mount Vernon

Date

Flow (cfs)

Existing conditions with flood fight

Nookachamps flood control storage (75,000AF)

Difference=22,847 cfs
Existing Levees – Certification Issue
Levee Freeboard and Certification

• FEMA Requirements
  – NFIP 100-year flood protection
  – 3 ft freeboard
  – 4 ft freeboard at structures and constrictions
  – Maintenance Plan required

• USACE Requirements
  – 3 ft freeboard
    or
  – Risk analysis based on engineering evaluation of structural and geotechnical conditions required
## 100-Year Flood Peak Reduction Potential

<table>
<thead>
<tr>
<th>Location</th>
<th>Peak Flow – Existing Conditions</th>
<th>Measure</th>
<th>Peak Flow Reduction</th>
<th>Peak Flow – Best Potential Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above Concrete</td>
<td></td>
<td>Ross (180 KAF)</td>
<td>5,000 cfs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lower Baker (29 KAF)</td>
<td>11,000 cfs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Optimized Upper/Lower Baker &amp; Ross</td>
<td>16,000 cfs</td>
<td></td>
</tr>
<tr>
<td>Concrete</td>
<td>192,300 cfs</td>
<td></td>
<td></td>
<td>176,000 cfs</td>
</tr>
<tr>
<td>Between Concrete &amp; Sedro-Woolley</td>
<td></td>
<td>Cockreham Island (5 KAF)</td>
<td>5,000 cfs</td>
<td></td>
</tr>
<tr>
<td>Sedro-Woolley</td>
<td>196,300 cfs</td>
<td></td>
<td></td>
<td>175,000 cfs</td>
</tr>
<tr>
<td>Between Sedro-Woolley and Mt.Vernon</td>
<td></td>
<td>Nookachamps Existing Storage</td>
<td>22,000 cfs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nookachamps Control Storage (Francis Road 45 KAF)</td>
<td>14,000 cfs</td>
<td></td>
</tr>
<tr>
<td>Mt. Vernon</td>
<td>174,200 cfs</td>
<td></td>
<td></td>
<td>139,000 cfs</td>
</tr>
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<td></td>
<td>Big Bend Storage (5 KAF)</td>
<td>3,000 cfs</td>
<td></td>
</tr>
<tr>
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<td></td>
<td>Levee Set-Back Storage (2 KAF)</td>
<td>1,000 cfs</td>
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<td>174,200 cfs</td>
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</table>
Presentation of Measures

- Mount Vernon Floodwall (WWTP) Protection
- DD #17 Levee Alignment Between BNSF and I-5 Bridges
- Anacortes Water Treatment Plant Ring Dike
- Levee/Fill Alignments North of Mount Vernon Westside Bridge
- DD #12 Levee Alignment
  - Sterling Levee
  - Sterling Overflow/Conveyance Area
- Nookachamps Storage
- Water Surface Control Structures
- Sedro-Woolley WWTP Ring Dike
- Baker and Ross Storage Potential
- Level of Design/Cost Estimate
- Prioritization of Remaining Measures List
Water Surface and Levee Elevations at Skagit River

<table>
<thead>
<tr>
<th>River Mile (RM)</th>
<th>Elevation (ft)</th>
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</thead>
<tbody>
<tr>
<td>16.50</td>
<td>32</td>
</tr>
<tr>
<td>16.70</td>
<td>32</td>
</tr>
<tr>
<td>16.90</td>
<td>32</td>
</tr>
<tr>
<td>17.10</td>
<td>32</td>
</tr>
<tr>
<td>17.30</td>
<td>32</td>
</tr>
<tr>
<td>17.50</td>
<td>32</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Scenario Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-year flood with all existing levee in place and overtop the levees</td>
</tr>
<tr>
<td>100-year flood with all existing levee in place and flood fight except levee failure at RM 12 and NF 610</td>
</tr>
<tr>
<td>140,000 cfs flood with all existing levee in place and flood fight</td>
</tr>
<tr>
<td>Phase I development levee top</td>
</tr>
</tbody>
</table>

Legend:
- Right bank levee
- Left bank levee
- 100-year flood with all existing levee in place and overtop the levees
- 100-year flood with all existing levee in place and flood fight except levee failure at RM 12 and NF 610
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<td>13.00</td>
<td>27</td>
</tr>
<tr>
<td>13.50</td>
<td>29</td>
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<tr>
<td>14.00</td>
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<tr>
<td>16.50</td>
<td>41</td>
</tr>
<tr>
<td>17.00</td>
<td>43</td>
</tr>
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- **Right bank levee**
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Water Surface and Levee Elevations at Skagit River

River Mile (RM)

Elevation (ft)

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Markings on the graph:
- Lions Park
- Division Street Bridge
- Mount Vernon WWTP
- Kincaid Street
Water Surface and Levee Elevations at Skagit River

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<tr>
<td>10.40</td>
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<td>10.60</td>
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Confluence to the N. and S. Forks

Mount Vernon WWTP
## 100-Year Flood Peak Reduction Potential

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Flow Hydrographs for 100-year Flood

- Concrete unregulated
- Concrete regulated
- Upper Baker inflow
- Upper Baker regulated
- Lower Baker inflow
- Lower Baker regulated

Flow (cfs)

Time (hour)
Flow Hydrographs for 100-year Flood at Lower Baker

- PIE- Lower Baker Inflow
- PIE-Lower Baker regulated
- COE-Lower Baker Inflow
- COE-Lower Baker regulated

Time (hour)

Flow (cfs)
Flow Hydrographs for 100-year Flood at Skagit River near Concrete

- PIE-unregulated
- PIE-regulated
- COE-unregulated
- COE-regulated
Water Surface and Levee Elevations at South Fork

River Mile (RM) vs. Elevation (ft)

- Right bank levee
- Left bank levee
- 100-year flood with all existing levee in place and overtop the levees
- 100-year flood with all existing levee in place and flood fight except levee failure at RM 12 and NF 610
- 140,000 cfs flood with all existing levee in place and flood fight
Water Surface and Levee Elevations at North Fork

River Mile (RM)

Elevation (ft)

- **Right bank levee**
- **Left bank levee**
- **100-year flood with all existing levee in place and overtop the levees**
- **100-year flood with all existing levee in place and flood fight except levee failure at RM 12 and NF 610**
- **140,000 cfs flood with all existing levee in place and flood fight**