Skokomish River Fecal Coliform
TMDL Attainment Monitoring in Washington State

George Onwumere, Ph.D.
Washington State is located in the Pacific Northwest and is bounded by:

- British Columbia, Canada, to the north
- Idaho to the east
- Oregon to the south, and
- Pacific ocean to the west
Introduction/Background

The state has a:

- Population – 5.9 million people
- Land Area – 66,582 mi² (176,000 Km²)
- Average annual Temp. - 4.4 °C (40 °F) East
  - 10.6 °C (51 °F) Coast
- Average annual Rainfall - 6 in (152 mm) East
  - 160 in (4,064 mm) Coast
Based on the 1998 Section 303(d) listing, Washington State has 1,316 impairments:

- 1,110 in stream/creek segments
- 141 in estuaries
- 65 in lakes/reservoirs/ponds
As of 2006, the number of EPA-approved TMDLs in Washington State - 671 TMDLs.

Close to 45% of Washington State approved TMDL is for FC bacteria.

The state FC Bacteria water quality standard has 2 parts:
- A geometric mean value (GMV) number
- A 90th percentile number

Skokomish River is a Class AA waterbody with
- Associated geometric mean value of 50 colony-forming units per 100 mL (cfu/100mL)
- Not more than 10% of the samples used to calculate the GMV should exceed 100 cfu/100mL
Skokomish River Basin

- Skokomish River is located in **Mason County** about 30 miles northwest of Olympia.
- The river drains a basin of about **247 square miles** before discharging into Annas Bay.
- Annas Bay, a rich shellfish harvest area, is located in **southern Hood Canal near Potlatch**.
- Annual rainfall – Between **75 and 230 inches**.
Skokomish River Monitoring Sites

Legend
- Monitoring Stations
- Roads
- Rivers
- Skokomish Watershed

Map Created by Ryan McElroe
Land Use Activities

- Rural residential dwellings
- Commercial and non-commercial agricultural activities
- Scattered pasture lands
- Forestry in the upper watershed (i.e. private land owners and within the Olympic National Forest).
Beneficial Uses of the river

- Fishing
- Primary contact recreation e.g. swimming and boating.
- Habitat for wildlife
- Shellfish resource near the mouth
- Scuba diving near the mouth
Water Quality Problem – FC Bacteria

**Impacts to humans include:**
- Gastrointestinal distress
- Respiratory infection
- Symptoms such as skin irritations (from contact recreation)

**Impacts to the Environment include:**
- Commercial shellfish beach closures
- Recreational shellfish beach closures
Nonpoint Sources of FC Bacteria

- Agriculture
- Humans e.g. failing septic tank systems
- Recreation (uncontrolled human waste)
- Domestic animals
- Wild animals
- No point sources
**FC Bacteria TMDL**

TMDL was developed and approved in 2001.

TMDL target limits were set for 4 compliance points:

<table>
<thead>
<tr>
<th>Site</th>
<th>Study GMV</th>
<th>Target FC GMV</th>
<th>Study 90&lt;sup&gt;th&lt;/sup&gt; Percentile</th>
<th>Target 90&lt;sup&gt;th&lt;/sup&gt; Percentile</th>
<th>Percent Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hwy 106 Bridge*</td>
<td>32.8</td>
<td><strong>18.5</strong></td>
<td>120.3</td>
<td>67.7</td>
<td><strong>44%</strong></td>
</tr>
<tr>
<td>Purdy Creek</td>
<td>54.3</td>
<td><strong>25.7</strong></td>
<td>146.6</td>
<td>69.4</td>
<td><strong>53%</strong></td>
</tr>
<tr>
<td>Weaver Creek</td>
<td>55</td>
<td><strong>17.5</strong></td>
<td>314.6</td>
<td>100.0</td>
<td><strong>68%</strong></td>
</tr>
<tr>
<td>Ten Acre Creek</td>
<td>34.1</td>
<td><strong>25.6</strong></td>
<td>133.2</td>
<td>100.0</td>
<td><strong>25%</strong></td>
</tr>
</tbody>
</table>

* Furthest downstream point of attainment

** Reference site
## Best Management Practices Implemented

<table>
<thead>
<tr>
<th>Activity</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree planting</td>
<td>32,000 trees planted ($1.50 per tree)</td>
</tr>
<tr>
<td>Fencing</td>
<td>24,000 ft of riparian fencing installed ($3.50/ft)</td>
</tr>
<tr>
<td>Land enrolment</td>
<td>62 acres of land enrolled with a buffer with 150ft</td>
</tr>
<tr>
<td>Cascade land acquisition</td>
<td>175 acres of land acquired that is adjacent to prime fish habitat (total cost $350,000.00)</td>
</tr>
<tr>
<td>On-site-septic systems repair</td>
<td>Dept. of Fish &amp; Wildlife inspected and repaired all the fish hatchery septic systems</td>
</tr>
<tr>
<td>Activity</td>
<td>Action</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Port-a-potties installation</td>
<td>Local farm stores <strong>installed port-a-potties</strong> during fishing seasons</td>
</tr>
<tr>
<td>No trespassing signs</td>
<td>Posted <strong>no trespassing signs</strong> resulting in a 40% reduction in trash (total cost $200.00)</td>
</tr>
<tr>
<td>Waste management flyers distribution</td>
<td><strong>Put flyers on fishermen’s windshields on proper waste management and nearby toilet facilities</strong></td>
</tr>
<tr>
<td>On-going educational outreach</td>
<td>Technical assistance on <strong>proper manure handling and storage</strong></td>
</tr>
</tbody>
</table>
Four compliance sites and one reference site established.

Ecology sampled monthly for 2 months and quarterly after 2 months.

Mason Conservation District (MCD) sampled bi-weekly.

Parameter sampled – Fecal coliform.
## Results

<table>
<thead>
<tr>
<th>Site</th>
<th>Study GMV</th>
<th>Target FC GMV</th>
<th>Target Percent Reduction</th>
<th>Current Ecology GMV</th>
<th>Current Ecology Percent Reduction</th>
<th>Current MCD GMV</th>
<th>Current MCD Percent Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hwy 106 Bridge*</td>
<td>32.8</td>
<td>18.5</td>
<td>44%</td>
<td>6.2 (12)</td>
<td>81%</td>
<td>12.0 (27)</td>
<td>63%</td>
</tr>
<tr>
<td>Purdy Creek</td>
<td>54.3</td>
<td>25.7</td>
<td>53%</td>
<td>8.3 (11)</td>
<td>85%</td>
<td>13.4 (26)</td>
<td>75%</td>
</tr>
<tr>
<td>Weaver Creek</td>
<td>55</td>
<td>17.5</td>
<td>68%</td>
<td>15.2 (12)</td>
<td>72%</td>
<td>14.0 (27)</td>
<td>75%</td>
</tr>
<tr>
<td>Ten Acre Creek</td>
<td>34.1</td>
<td>25.6</td>
<td>25%</td>
<td>11.7 (12)</td>
<td>66%</td>
<td>12.0 (26)</td>
<td>65%</td>
</tr>
<tr>
<td>Middle Skokomish **</td>
<td>Ref.</td>
<td>Ref.</td>
<td>Ref.</td>
<td>3.7 (11)</td>
<td>Ref.</td>
<td>3.6 (24)</td>
<td>Ref.</td>
</tr>
</tbody>
</table>

* Furthest downstream point of attainment
** Reference site
Number in bracket – Sample size (n)
Results (Cont’d)
Comparison of Geometric Mean Values at TMDL Compliance Sites

Flower Creek
Purdy Creek
Weaver Creek
Ten Acre Creek

TMDL Compliance Sites

Comparison of Geometric Mean Values at TMDL Compliance Sites

Study GMV
TMDL Target FC GMV
Current Ecology GMV
Current MCD GMV
Comparison of 90th Percentile Values at TMDL Compliance Sites
Results (Cont’d)

Fecal Coliform Bacteria Percent Reductions at TMDL Compliance Sites

Graph showing percent reductions at different sites:
- Hwy 106 bridge
- Purdy Creek
- Weaver Creek
- Ten Acre Creek

Legend:
- TMDL Target % Reduction
- Current Ecology % Reduction
- Current MCD % Reduction
Conclusions

- FC bacteria concentrations comply with TMDL target limits for all the compliance sites.
- FC bacteria concentrations comply with both parts of the state water quality criterion
  - GMV of 50 cfu/100mL
  - Not more than ten percent of the samples used to calculate the GMV should exceed 100 cfu/100mL, except for Weaver Creek
- Implementation of best management practices responsible for the observed water quality improvements.
Recommendation

- Continue the implementation of Watershed Best Management Practices to control nonpoint sources of water pollution.
Washington State Department of Ecology
TMDL Information.

TMDL Website:

TMDL Effectiveness Monitoring Website: