Alternative Fecal Coliform & Stormwater Test Methods

Puyallup Stormwater Conference
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- South Fork of Palouse River (SFPR) CWA-303d listed for FC
- DOE surveyed SFPR and identified FC sources
- SFPR TMDL Report (2009) established targets
- City of Pullman has SWMP to facilitate NPDES Phase II compliance
Overview
• Pullman study background
• Strategy & mindset
• FC Data interpretation
• Alternative FC test
• 5 flow measurement methods

Strategy & Mindset
• Two stages: Investigation followed by performance testing
• Performance testing must use approved methods
• Investigation can use most effective methods
• Quick, easy, & cheap methods give more data, faster
• Investigation data used to direct QAPP
• Share findings, share success
The Palouse in Summer

Dry-land Agriculture: Wheat/Peas/Lentils

The Palouse in Winter

Hydrogeology of the Palouse Basin: A simplified diagram

Image from Moscow City Website
Interpreting FC Results

Fecal Coliform Colonies in FC Membrane Test

Blue due to Aniline Blue pH Indicator
Main lines of Pullman Stormwater Study System

Quick changes within sampling session

FC Monitoring Data (cfu/100ml)

<table>
<thead>
<tr>
<th>Date</th>
<th>Lake</th>
<th>Swale</th>
<th>Outfall</th>
<th>Stadium</th>
<th>Joseph</th>
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<tr>
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<td>200</td>
<td>380</td>
<td>750</td>
<td>72</td>
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<tr>
<td>4/5/2011</td>
<td>700</td>
<td>1600</td>
<td>325</td>
<td>170</td>
<td>285</td>
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<tr>
<td>4/7/2011</td>
<td>775</td>
<td>150</td>
<td>2300</td>
<td>390</td>
<td>84</td>
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<tr>
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<td>0</td>
<td>6</td>
<td>137</td>
<td>152</td>
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<tr>
<td>5/11/2011</td>
<td>36</td>
<td>380</td>
<td>269</td>
<td>210</td>
<td>120</td>
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<tr>
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<td>179</td>
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<td>369</td>
<td>1900</td>
<td>229</td>
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<td>1000</td>
<td>230</td>
<td>1900</td>
<td>112</td>
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</table>

Normalized FC Data

Normalized Distribution
FC Sample Timing

FC Sample collected in Pullman after 12:00
Delivered to Moscow before 17:00
Sent to Spokane and tested before 12:00 the next day

Pour-Plate FC Method

Typical FC Plate Results
5 Alternative Flow Measurement Methods

#1: Paddle-Wheel Flow Meter
Always take the simplest approach...

#2 …Video

• Camera… or phone
  ▶ ON A LANYARD!
• Grass fragments, sawdust, or ice
• Reference dimensions
• Frame by frame
#3: Stream Width

Width – more sensitive than depth

Accurate without confined space entry
Measuring Flow Dimensions with “ImageJ”

Weir character: Width (theory) vs. measured flow

#4: Stream Trajectory
Flow Changes — 12H32 & 16H15 on 3/20/12

Theoretical Flow Trajectories

Trajectory testing possible when reference scale present
#5: Cold Flush™

Onset’s HOBO
U23-004
Temperature
Logger

- **Specification**
  - Range: -40 to 70°C
  - Resolution: 0.02°C
  - Response: 30 s (to 90%) in stirred water
  - Stability: <0.1°C drift/year
  - Readings: ~43,500
Recap

- Many alternative approaches
- Find your best-fit
- Calibrate, test, & record
- Cheap Screen → QAPP
- Fix, then $$$ monitor
- Share insights, share success

Added 25.5kg of 38.5°C water over 10 minutes
Acknowledgements

Dr. Kelly A. Brayton
City of Pullman

• Mark Workman P.E. – City Supervisor
• Kevin Gardes P.E. – Director of Public Works

Questions?

More Tools...
• Temperature pole
• Sampling pole
• Safety!
• Powerful light

Reference dimensions

Temperature (°C)

Irrigation system (times indicated) along with wash-downs (blocked)
Logger modifications before field use
— sleeve addition and trimming

Replacing desiccant before field use

Installing on a ladder rung
### Probability Plots

#### Example Calculation

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<tr>
<th>Data</th>
<th>4.63</th>
<th>5.55</th>
<th>5.41</th>
<th>5.00</th>
<th>4.90</th>
<th>4.34</th>
<th>5.11</th>
<th>4.78</th>
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<tr>
<td>Sorted</td>
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<td>4.63</td>
<td>4.78</td>
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<td>4.90</td>
<td>4.90</td>
<td>5.00</td>
<td>5.11</td>
<td>5.23</td>
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<tr>
<td>Rank</td>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
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<tr>
<td>Probability of Rank</td>
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<td>0.4</td>
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<td>NORMSINV of Probability of Rank</td>
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<td>-0.524</td>
<td>-0.253</td>
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<td>0.253</td>
<td>0.524</td>
<td>0.842</td>
<td>1.282</td>
</tr>
</tbody>
</table>

#### Example Plot

![Example Plot](image-url)
...changing flow conditions at the outfall