

Development of a Monitoring Program for Evaluating Water Quality Improvements and TMDL Effectiveness in Bear Creek Oregon



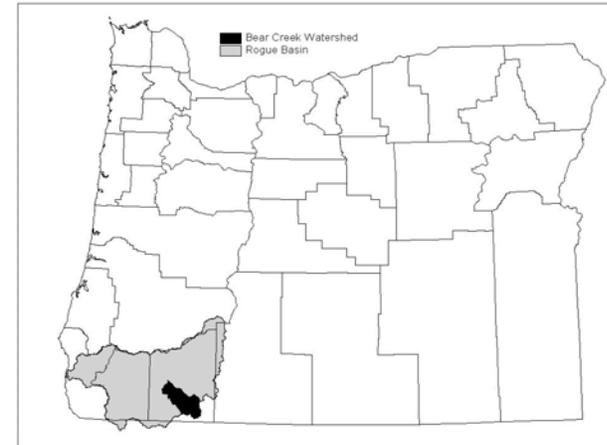
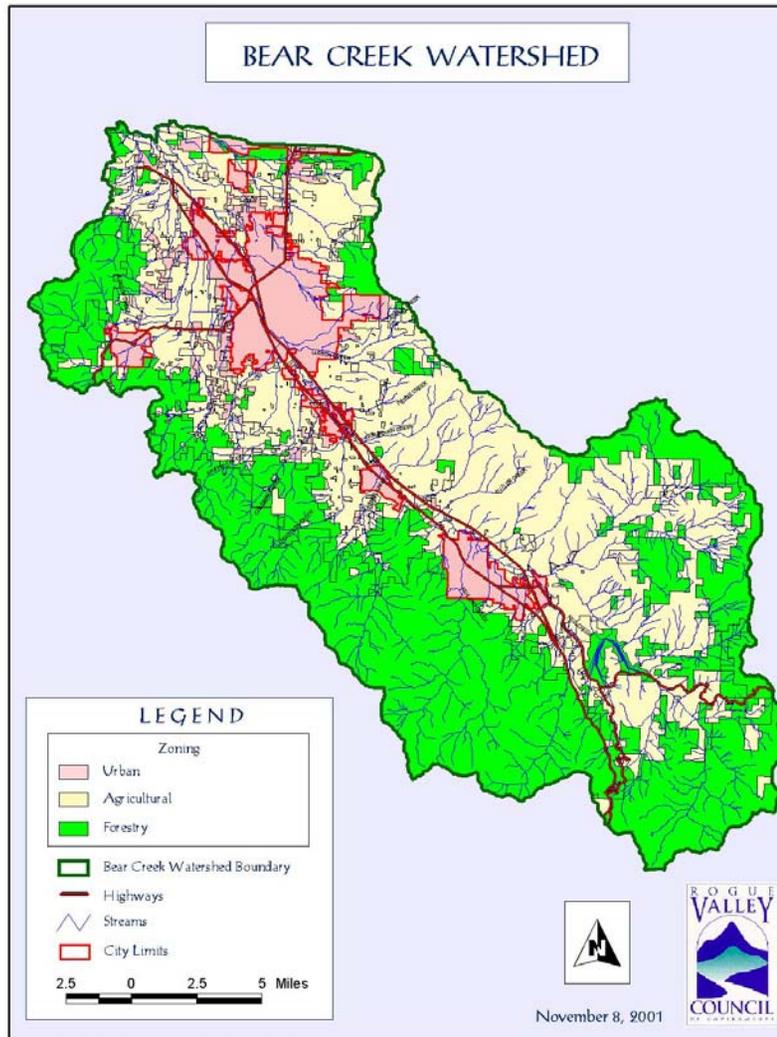
State of Oregon
Department of
Environmental
Quality

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Bear Creek Oregon – Overview

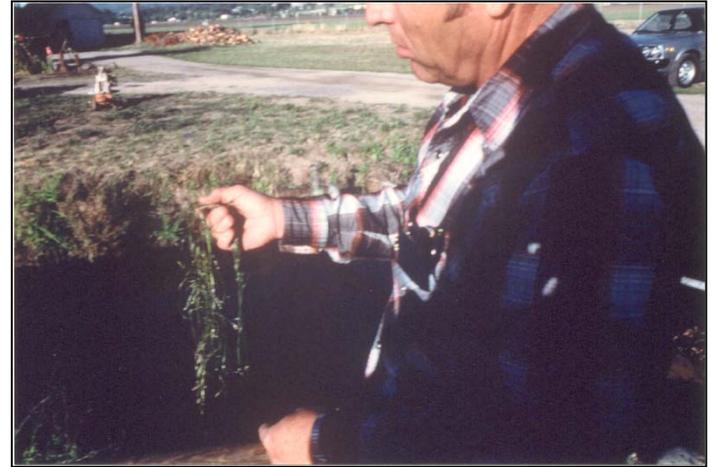


- **361 Square Miles**
- **46% Forest**
- **35% Farmland**
- **8% Urban**
- **7% Rural**

Bear Creek – Original Situation

One of the first TMDLs in Oregon: 1992

- Aquatic Weeds and Algae
- phosphorus
- dissolved oxygen,
- pH, and Ammonia Nitrogen



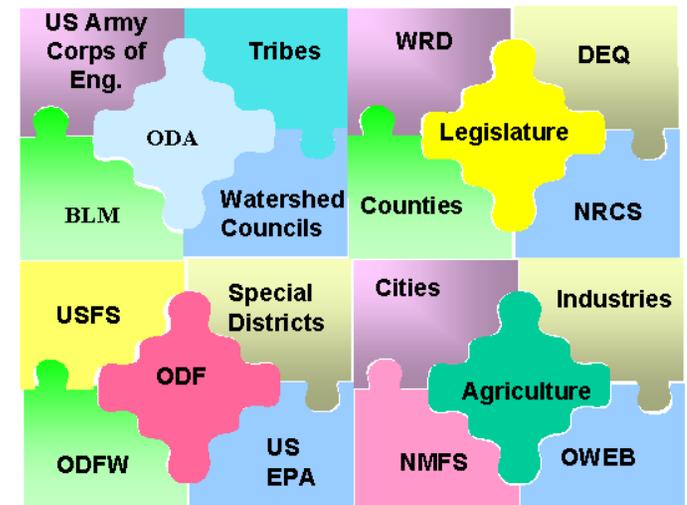
In 2007 TMDL updated:

- Temperature
- Bacteria
- Sedimentation



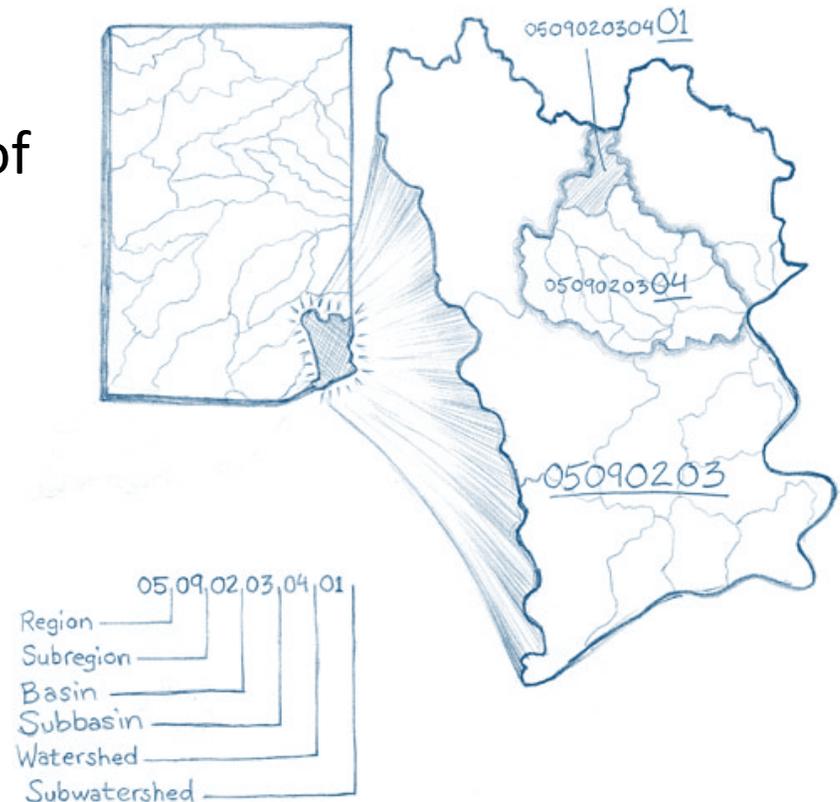
Bear Creek – Need for Better Monitoring

- Urban Designated Management Agencies – 6 cities, 1 County, irrigation districts and others
- Monitoring program began in 1995 to meet TMDL requirements
- Paid for by local jurisdictions and leveraged grants
- Mature program



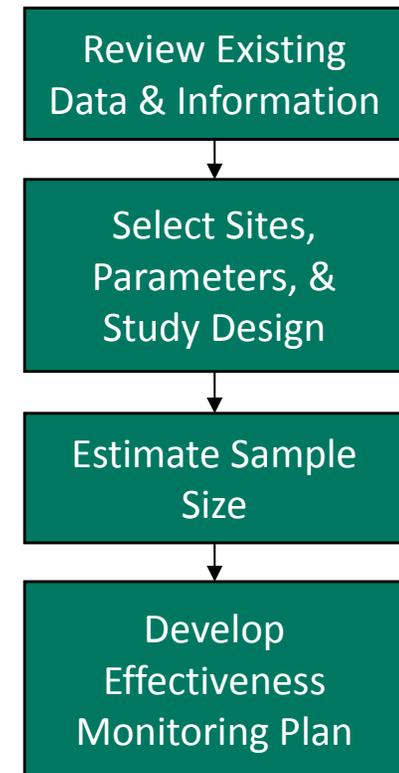
Bear Creek – Need for Better Monitoring

- Need to tell a better story
- Justify past expense and encourage future investment
- EPA measures
- Group embraced the assistance of Cadmus



Bear Creek – Developing a TMDL Effectiveness Monitoring Plan

- Data-driven approach
- Clearly defined objectives
 - Determine the effectiveness of BMPs on improving water quality – actualize the adaptive management process
 - Determine overall TMDL effectiveness on a watershed basis – EPA Measure SP12
- Results in optimized monitoring program for demonstrating statistically significant changes



Bear Creek – Review of Existing Monitoring Program and Data

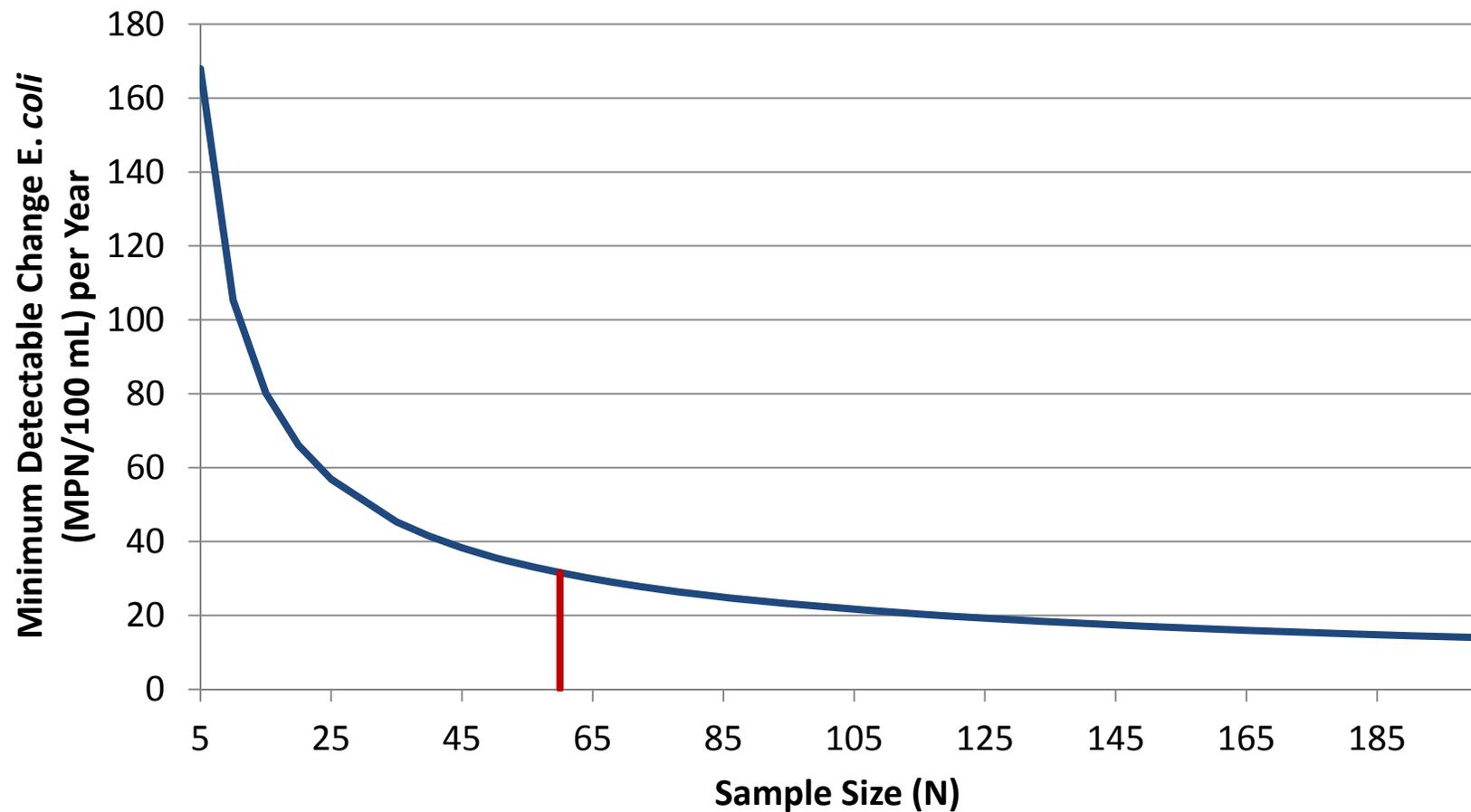
- 24 sites were regularly monitored under previous program
 - 10 monthly
 - 14 biweekly
- TP, NH₄, Temp., E. coli, DO, conductivity, TSS, Turbidity, pH
- Previous objective was to identify impairments and support TMDL development
- New objective is to evaluate for, and demonstrate, TMDL effectiveness

Bear Creek – Preliminary trend Analyses

- Conducted preliminary trend analyses at existing sites for:
 - Temperature
 - E. coli
 - Ammonia
 - Total Phosphorus
- Temperature and E. coli trends varied by site
- Total Phosphorus and Ammonia trends were consistently decreasing
- However, many sites did not have sufficient data to detect trends with any statistical significance

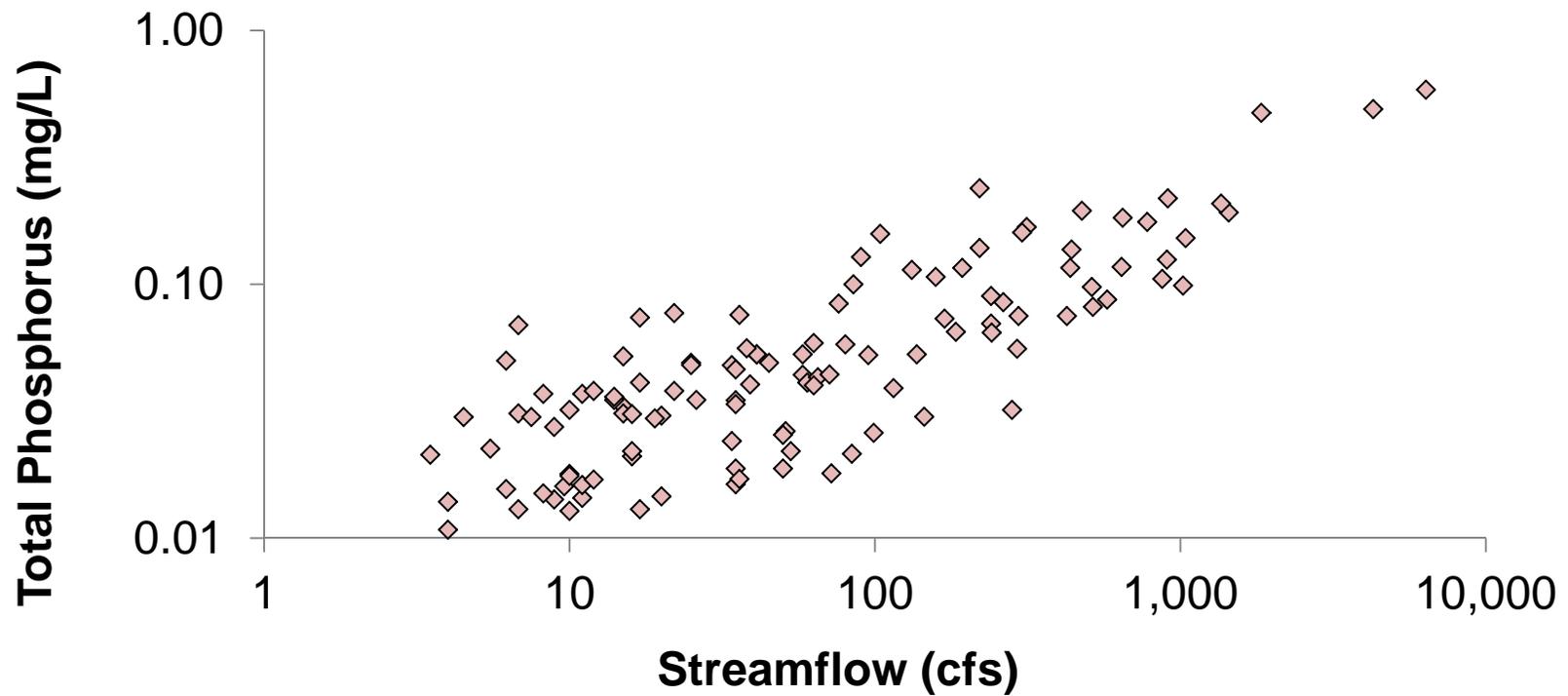
Bear Creek – Power Analysis

Power Analysis for estimating necessary sample size



Bear Creek – Identifying Covariates

Correlation analyses for selecting best suite of parameters to monitor



Bear Creek – Final Recommendations

- Ensure that every HUC-12 subwatershed has at least one monitoring site at its outlet
- Include additional sites at key locations to assist stakeholders in evaluating the effectiveness of their actions
- Begin continuous monitoring of temperature
- Monitor all other parameters on monthly basis
- Eliminate several parameters from the monitoring program
- Add 10 macroinvertebrate monitoring sites
- Place monitoring sites at existing streamflow gages

Bear Creek – Benefits of Improved Monitoring Program

- Sites selected to measure change on 6th field level
- Higher statistical power
- Cost reduction of 16%
- Increased interest in the monitoring program
- Consistent financial commitment



Bear Creek Oregon – Questions?



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