Columbia Slough TMDL BOD_5 Benchmark Evaluation

EPA Contract No. EP-C-16-003
Work Assignment 3-75

PG Environmental

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Objectives and Approach

- Columbia Slough TMDLs issued in 1998, including BOD_5
  - Industrial facilities are source of loading to the Slough
  - Only TMDL in Oregon with wasteload allocation (WLA) for industrial stormwater
- Evaluate changes in land use and water quality since TMDL
  - Document review (TMDL, 1200-COLS permit, permit fact sheet, etc.)
  - Evaluate relevant data and information
    - BOD_5 data for industrial facilities
    - GIS data for Columbia Slough watershed
  - Conduct analyses to determine if current benchmark is sufficient and appropriate given changes in land use and water quality conditions

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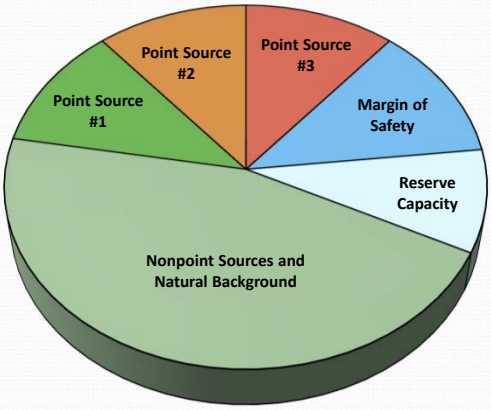
Components of TMDL

TMDL for Pristine Creek – Pollutant X



- Wasteload allocations (WLAs) are assigned to each point source discharge
- Load allocations (LAs) are assigned to nonpoint sources
- WLAs and LAs are established so that predicted receiving water concentrations do not exceed water quality criteria
- Margin of safety ensures that water can attain designated uses
- Reserve capacity may be included to account for new or expanded discharges

TMDL = ∑WLA + ∑LA + Margin of Safety
(also may include Reserve Capacity)

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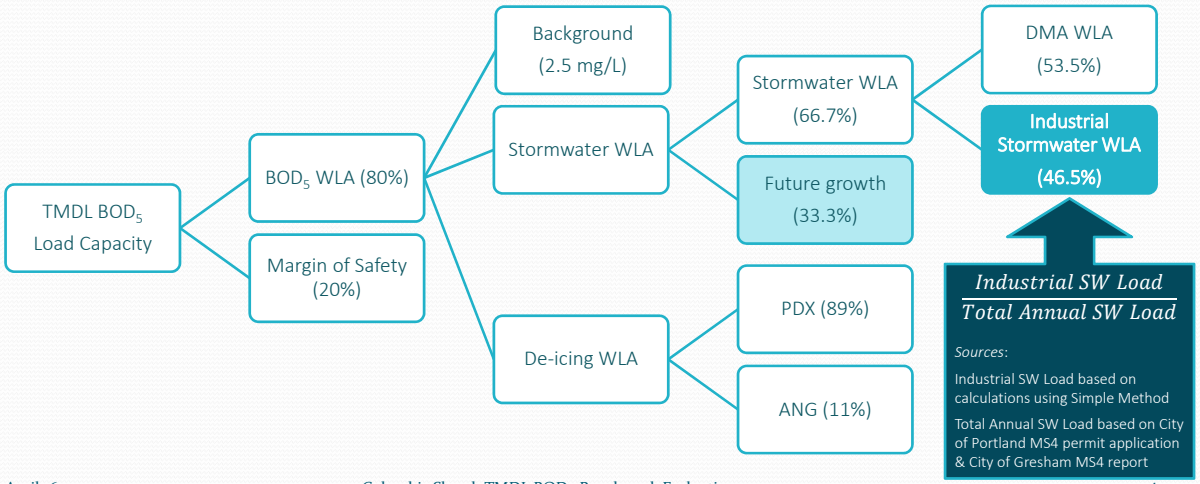
BOD_5 TMDL to Address Dissolved Oxygen



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1200-COLS Permit BOD_5 Benchmark

- Based on allocation modeling: "…to meet the urban storm water allocation, the average storm water concentration should be about 8 mg/L BOD_5."
- Permit Fact Sheet
  - Average 8 mg/L BOD_5 target – distribution varies by land use
  - Analyses to calculate land use-specific benchmark values
    - Average land use-specific concentrations
    - Land use areas
    - Weighted mean concentration
    - Apply reduction ratios to normalize
- **1200-COLS Benchmark for Industrial Stormwater is 33 mg/L BOD_5**

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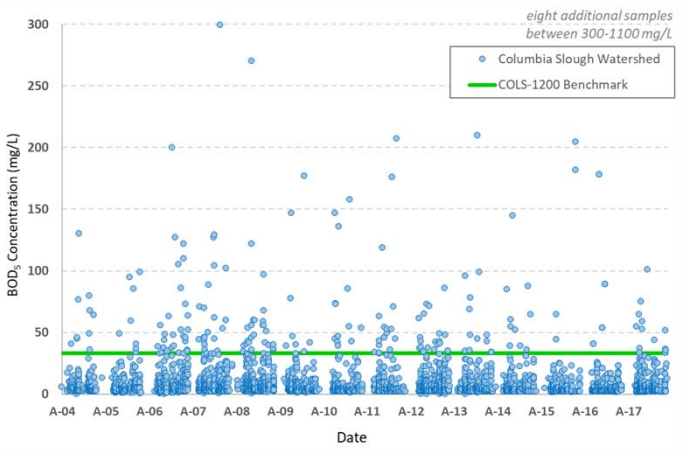
Data Analyses: Industrial Facility BOD_5 Data

Summary Statistics	Columbia Slough Watershed
Number of samples	5,312
Maximum	1,110
Mean	8.9
No. of exceedances	217
Percent exceedance	4%
Standard Deviation	29.9
Coefficient of Variation (CV)	3.3

Summary by Permit Registrant	Columbia Slough Watershed
Number of Permit Registrants	115
Number of Samples	5,312
Percent of Registrants Exceeding Benchmark (*based on average concentration*)	4%



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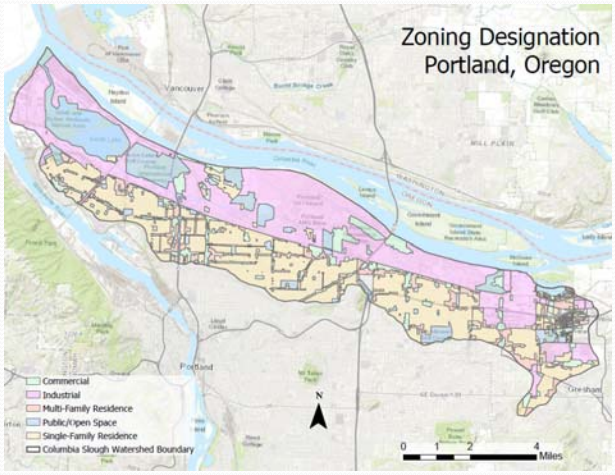
GIS Data: Columbia Slough Watershed

Zoning Classification	Zoned Area (acres)
Commercial	2,535
Industrial	12,179
Multi-Family Residence	2,228
Public/Open Space	4,924
Single-Family Residence	10,470
Total	**32,336**



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Stepwise Benchmark Analysis

- Follows process described in 1200-COLS fact sheet
  - Maintains attainment of **average 8 mg/L BOD_5 target**
  - Updated with more recent data, where pertinent
    - Industrial land use current BOD_5 concentration = 33 mg/L
      - previously 68 mg/L; recent data demonstrate significant reduction in average concentration
    - Updated all land use areas
      - Incorporated into calculation of weighted mean concentration
    - Other values in calculations remained unchanged
      - non-industrial land use concentrations
      - reduction ratio from light industrial concentrations
      - runoff coefficients
      - rainfall estimate

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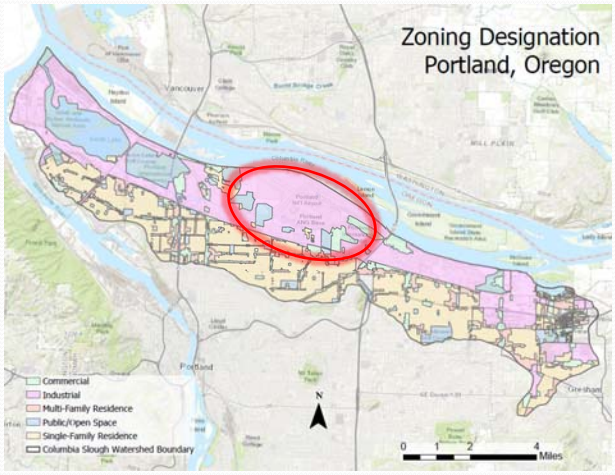
GIS Data: Columbia Slough Watershed

Zoning Classification	Zoned Area (acres)
Commercial	2,535
Industrial	3,816
Multi-Family Residence	2,228
Public/Open Space	4,924
Single-Family Residence	10,470
Total	**23,973**



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Stepwise Benchmark Analysis

Land Use	Zoned Area (acres)	Runoff coefficient	Rainfall (in/yr)	Current BOD Concentration (mg/L)	Numerator (Area*Runoff Coefficient* Concentration*Rainfall)	Denominator (Area*Runoff Coefficient* Rainfall)
Single-Family Residence	10,470	0.37	34.3	11	1,461,622	132,875
Multi-Family Residence	2,228	0.59	34.3	11	495,968	45,088
Industrial	3,816	0.68	34.3	33	2,937,145	89,004
Commercial	2,535	0.82	34.3	17	1,212,090	71,299
Public/Open Spaces	4,924	0.14	34.3	2	47,290	23,645
Total	23,973			*17 mg/L*	*Weighted mean concentration*	

- Beginning with **17 mg/L** weighted mean concentration
  - Applied 50% loss from monitored value to loads to Columbia Slough to target
    - 8 mg/L → 16 mg/L
  - **1.0625** Reduction from weighted mean to target (17 mg/L : 16 mg/L)

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Stepwise Benchmark Analysis

Land Use	Current Concentration (mg/L)	Reduction	Reduction Ratio	Benchmark (mg/L) (Current – [reduction*ratio])
Single-Family Residence	11	1.0625	1	10
Multi-Family Residence	11	1.0625	1	10
Industrial	33	1.0625	8	24
Commercial	17	1.0625	3	14
Public/Open Spaces	2	1.0625	0	2

- Industrial area benchmark concentration calculated as **24 mg/L** based on updated data

Benchmark Verification

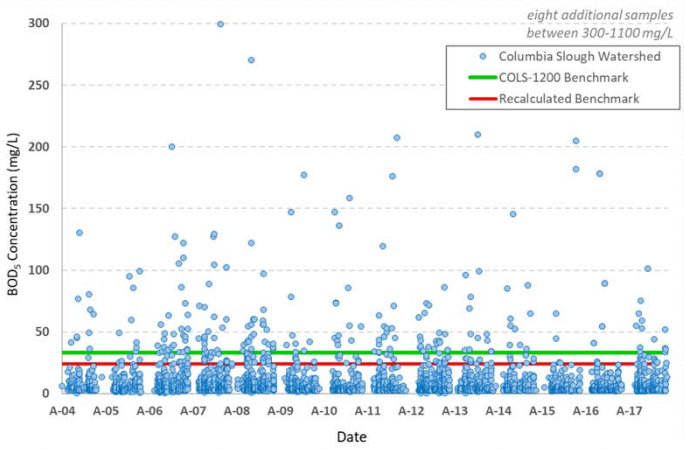
Condition	Area (acres)	Pollutant Concentration (mg/L)	Pollutant Load (kg/day)	Summary
Load from Industrial Area and Benchmark from 1200-COLS Fact Sheet	2,702	33	587	Assumed to be industrial load to meet TMDL; used for comparison with new loads
Load from New Area and Benchmark from 1200-COLS Fact Sheet	3,816	33	830	141% of load
Load from New Area and Benchmark	**3,816**	**24**	**603**	**103% of load calculated with 1200-COLS fact sheet information (within reserve capacity)**

- Summary: Using non-airport industrial land use area, loading with new benchmark is 103% of those calculated with values from 1200-COLS fact sheet
  - Within the 150% future growth reserve

New Benchmark: Comparison with Industrial Facility BOD_5 Data

Summary Statistics	Columbia Slough Watershed
Number of samples	5,312
Maximum	1,110
Mean	8.9
No. of exceedances	~~217~~ 336
Percent exceedance	~~4%~~ 6%
Standard Deviation	29.9
Coefficient of Variation (CV)	3.3

Summary by Permit Registrant	Columbia Slough Watershed
Number of Permit Registrants	115
Number of Samples	5,312
Percent of Registrants Exceeding NEW Benchmark (*based on average concentration*)	~~4%~~ 7%



Benchmark Analysis: Sensitivity to Industrial Current Concentration

Condition	Current Concentration (mg/L)	Benchmark (mg/L)	Comparison to Industrial Load to Meet TMDL
Current benchmark	**33**	**24**	**103% (uses a portion of reserve capacity)**
Current concentration used in 1998 TMDL	68	37	158% (exceeds reserve capacity)
2004-2018 average concentration	8.9	9	39%
2004-2018 average concentration + 1 Standard Deviation	38.8	27	116% (uses a portion of reserve capacity)
2014-2018 average concentration	6.8	7	30%
2014-2018 average concentration + 1 Standard Deviation	20.5	17	73%

Oregon 1200-Z Benchmarks Comparison with EPA's 2020 Proposed MSGP

Oregon DEQ Advisory Committee Meeting

April 16, 2020

1

Objectives of the Review

- Previously, Oregon adopted EPA benchmarks without fully evaluating appropriateness with applicable WQS
- Review EPA's 2020 Proposed Multi-Sector General Permit (MSGP) to determine basis for benchmarks
- Review EPA's 2020 Proposed MSGP and Oregon's water quality standards and 1200-Z Permit to evaluate appropriateness of benchmarks
- Review EPA's 2020 Proposed MSGP and Oregon's 1200-Z Permit to evaluate consistency of monitoring frequencies

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Overview of Findings

- Basis for EPA's 2020 Proposed MSGP Benchmark Concentrations
  - Many of the MSGP benchmark values remain unchanged from the 2015 MSGP, with the following exceptions
    - Iron and magnesium benchmarks removed
    - Chromium (III) and (VI) benchmarks added
  - EPA's MSGP establishes benchmarks for metals for saltwater and freshwater receiving waters (most freshwater benchmarks are hardness-dependent; therefore, a certain value is not established in the MSGP)
  - Benchmarks for most metals, ammonia, and aluminum are based on EPA's National Recommended WQC
  - Cadmium benchmark is based on EPA's 2016 Aquatic Life Ambient WQC
  - BOD_5 and pH benchmarks are based on secondary treatment standards (40 CFR 133)
  - COD is based on a factor of 4 times BOD_5 (source: North Carolina benchmark)
  - TSS and Nitrate and Nitrite Nitrogen benchmarks are based on the National Urban Runoff Program median concentration

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Overview of Findings

- Consistencies between permits: Benchmark Concentrations
  - Aluminum, Ammonia, BOD_5, COD, Nitrate plus Nitrite Nitrogen, Phosphorus, Turbidity, Antimony, Arsenic (freshwater), Beryllium, Cyanide (freshwater), Mercury (freshwater), Selenium (freshwater)
  - Antimony benchmark is 640 µg/L (0.64 mg/L)
    - Oregon's freshwater WQC = 9,000 µg/L (Acute) and 1,600 µg/L (Chronic)

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Overview of Findings

- Oregon's 1200-Z Permit establishes a single benchmark concentration; EPA's proposed MSGP establishes saltwater and freshwater benchmarks
  - Planning to implement saltwater/freshwater benchmarks in future 1200-Z Permit
- Oregon's 1200-Z Permit **lacks** sector-specific benchmark concentrations whereas they are established in EPA's 2020 Proposed MSGP, as follows:
  - TSS (EPA: 100 mg/L)
    - Addressed via state-wide benchmarks in Oregon

Columbia River	Columbia Slough	Portland Harbor	Regional
100 mg/L	30 mg/L	30 mg/L	100 mg/L

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Overview of Findings

- Oregon's 1200-Z Permit **lacks** sector-specific benchmark concentrations whereas they are established in EPA's 2020 Proposed MSGP, as follows:
  - Chromium (III), Chromium (VI)
    - EPA's benchmark concentrations for these metals are based on EPA's National Recommended WQC
      - Oregon lacks saltwater Chromium (III) criteria (EPA: 570 µg/L)
      - Oregon's freshwater Chromium (III) is hardness dependent (EPA: 570 µg/L)
      - Oregon's saltwater Chromium (VI) is 1,100 µg/L (EPA: 110 µg/L)

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Overview of Findings

- Oregon's 1200-Z Permit **lacks** sector-specific benchmark concentrations whereas they are established in EPA's 2020 Proposed MSGP, as follows:
  - Copper, Lead, and Zinc
    - EPA's benchmark concentrations for these metals are based on EPA's National Recommended WQC
      - Freshwater criteria are hardness dependent
      - Saltwater criteria: Copper: 4.8 ug/L; Lead: 210 ug/L; Zinc: 90 ug/L (all consistent with OR WQC)
    - Addressed via State-wide benchmarks
      - Oregon's freshwater Copper based on BLM (currently tech-based)
      - Lead and Zinc are hardness dependent

Parameter	Units	Columbia River	Columbia Slough	Portland Harbor	Regional
Total Copper	mg/L	0.020	0.020	0.020	0.020
Total Lead	mg/L	0.040	0.060	0.040	0.015
Total Zinc	mg/L	0.12	0.24	0.12	0.12

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Overview of Findings

- EPA's 2020 Proposed MSGP **lacks** sector-specific benchmark for **Iron**, whereas Oregon's 1200-Z Permit includes a benchmark concentration based on Oregon's freshwater chronic WQC
  - EPA's 2020 Proposed MSGP Fact Sheet indicates Iron benchmark was removed from permit
- Differences between EPA's 2020 Proposed MSGP and Oregon's 1200-Z **benchmark concentrations**
  - Nickel (sector G): EPA's saltwater benchmark = 74 µg/L, 1200-Z: 500 µg/L (OR WQC: 74 µg/L)
  - Silver (sector G): EPA's saltwater benchmark = 1.9 µg/L, 1200-Z: 0.5 µg/L (OR WQC: 1.9 µg/L)
  - Cadmium (sector K): EPA's freshwater benchmark (hardness dependent) and saltwater benchmark of 33 ug/L, 1200-Z: 1 µg/L
    - Oregon's Cadmium saltwater WQC = 40 µg/L (acute)
- Consistencies between EPA's 2020 Proposed MSGP benchmark concentrations and Oregon's **WQS**
  - EPA's Proposed MSGP includes a benchmark for metals, for saltwater receiving waters
    - Saltwater benchmarks for Copper, Arsenic, Lead, Nickel, Silver, Zinc match Oregon's acute saltwater WQC

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Overview of Findings

- Consistencies between permits: Benchmark Monitoring
  - Oregon's 1200-Z Permit contains 59 sector-specific monitoring requirements; 47 of which match those in EPA's 2020 Proposed MSGP (state-wide and I, P, and R sectors will be added in the renewal)
  - Monitoring frequencies match (i.e., four times per year)
- Inconsistencies:
  - EPA's 2020 Proposed MSGP includes monitoring for TSS and heavy metals, such as copper, lead, and zinc, in multiple sub-sectors, whereas the 1200-Z Permit addresses these via state-wide benchmarks (copper is inconsistent with criteria)
  - OR's 1200-Z Permit includes monitoring requirements for iron in multiple sub-sectors, while EPA's MSGP does not require iron monitoring in any sub-sectors.
  - Several sub-sectors within Sectors A, C, D, E, F, I, J, L, O, P, R, and Y that contain monitoring requirements in EPA's 2020 Proposed MSGP lack monitoring requirements in the 1200-Z Permit. (many of these are addressed via state-wide benchmark monitoring)

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Recommendations

- Establish freshwater and saltwater benchmark concentrations
  - Define saltwater for the purpose of benchmark monitoring
    - Currently planned for Oregon's 1200-Z Permit
- Discuss basis for antimony benchmark concentration, as it does not align with Oregon's WQC
- Consider revising benchmark concentrations for nickel and silver consistent with EPA's 2020 Proposed MSGP and Oregon's WQS
- Consider establishing benchmarks for metals (e.g., cadmium, chromium (III) and (VI)) consistent with Oregon's WQS

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Oregon 1200-Z Evaluating Surrogate Monitoring for Impairing Pollutants

Oregon DEQ Advisory Committee Meeting

April 16, 2020

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Objectives of the Review

- Identify Oregon's Category 5 303(d) List pollutants
- Review EPA's 2020 Proposed MSGP, available state-issued MSGPs, and conducted a literature review to identify existing requirements for monitoring surrogate pollutants
- Evaluate appropriateness of use of monitoring for surrogate pollutants for impairing pollutants
- Oregon still accessing the potential use of surrogates in the 1200-Z Permit renewal

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Overview of Findings

- Surrogate monitoring is used to:
  - Gain information on pollutant parameters when monitoring for the actual pollutant may not be possible
  - When surrogate monitoring is more cost effective in providing the desired information
  - When surrogate monitoring provides more useful information than the actual pollutant of concern

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Overview of Findings

- In addition to the 1200-Z, reviewed the following permits:
  - EPA's 2020 Proposed MSGP
  - Rhode Island's 2019 MSGP
  - Minnesota's 2015 MSGP
  - California's 2015 MSGP
  - Montana
  - New York
  - Connecticut
  - Utah
  - Wyoming

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Overview of Findings

- Example of Literature Reviews
  - *Estimating Metal Concentrations with Regression Analysis and Water-Quality Surrogates at Nine Sites on the Animas And San Juan Rivers, Colorado, New Mexico, and Utah*, USGS, 2018
  - *Use of Water Quality Surrogates to Estimate Total Phosphorus Concentrations in Iowa Rivers*, Journal of Hydrology: Regional Studies, Keith E. Schilling, et al, 2017
  - Predicting Total Dissolved Gas (TDG) for the Mid-Columbia River System, Environmental Sciences Division, Oak Ridge National Laboratory and U.S. Dept of Interior, Bureau of Reclamation, Boualem Hadjerious, et al, undated (after 2011)
  - Guidelines and Procedures for Computing Time-Series Suspended-Sediment Concentrations and Loads from In-Stream Turbidity-Senor and Streamflow Data, USGS, Patrick P. Rassmussen, et al, 2009, Revised 2011
  - Code of Federal Regulations, Title 40, Section 136.3

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Overview of Findings

Possible Surrogate Pollutants for Certain Impairing Pollutants of Concern in Oregon

List of Impairing Pollutants of Concern - Oregon	***Possible Corresponding Surrogate Pollutant***	***Reference***
Aquatic Weeds and Algae	Phosphorus and Nitrogen	Oregon 1200-Z PER (2011)
	Chlorophyll-a	HAR 11-54
Biological Criteria	Total suspended solids (TSS)	EPA Region 5 (Minnesota MSGP)
Chlorophyll-a	Phosphorus, Total (as P) for nutrient eutrophication	EPA Region 5 (Minnesota MSGP) and HAR 11-54
Dissolved Oxygen	BOD, Carbonaceous 5-Day (@20 Deg C) ($CBOD_5$), and/or COD (Chemical Oxygen Demand)	EPA Region 5 (Minnesota MSGP)
	BOD_5	Oregon 1200-Z PER (2011)
Fecal Coliform	*E. coli*	Oregon 1200-Z PER (2011)
Polynuclear Aromatic Hydrocarbons (PAHs)	COD	EPA 2020 Proposed MSGP
Sedimentation and Turbidity	TSS	EPA 2020 Proposed MSGP and EPA Region 1 (Rhode Island MSGP)
Organic pollutants	COD	EPA 2020 Proposed MSGP
Nutrient Eutrophication Biological Indicators	Phosphorus, Total (as P)	EPA Region 5 (Minnesota MSGP)
Turbidity	TSS	EPA Region 5 (Minnesota MSGP) and Oregon 1200-Z PER (2011)
Petroleum Hydrocarbons	Oil and Grease	EPA Region 9 (California)
Acidic and Alkaline Pollutants	pH	EPA Region 9 (California)

This slide lists impairing pollutants for which surrogate pollutants were identified in permits reviewed (i.e., the Category 5 303(d) List includes 26 pollutants)

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Overview of Findings – Current Monitoring

- Oregon's 1200-Z (Impairing Pollutant: Surrogate):
  - Aquatic Weeds/Algae: Phosphorus and Nitrogen
  - Dissolved Oxygen: BOD_5
  - Fecal Coliform: *E. coli*
  - Turbidity, Suspended Solids, or Sediment: TSS
- EPA's 2020 Proposed MSGP:
  - Turbidity, Suspended Solids, or Sediment: TSS
  - Organic Pollutants: COD
  - Polynuclear Aromatic Hydrocarbons (PAHs): COD

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Overview of Findings – Current Monitoring

- California, Rhode Island:
  - Turbidity, Suspended Solids, or Sediment: TSS
  - Petroleum Hydrocarbons: Oil and Grease
  - Acidic and Alkaline Pollutants: pH
- Minnesota:
  - Dissolved Oxygen: Carbonaceous BOD_5 and COD
  - Turbidity: TSS
  - Fish, Macroinvertebrate, and Plant Biota: TSS
  - Chloropyll-a, Nutrient Eutrophication and Biological Indicators: Total Phosphorus

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Conclusions

- Monitor specific impairing pollutants to determine compliance with numeric WQS
  - Actual data for impairing pollutant provides direct measurement of water quality impairment
- Surrogate monitoring is useful when a reliable correlation between the surrogate parameter and the actual parameter exists
  - TSS and turbidity data submitted by 1200-Z enrollees illustrates weak correlation
    - Both OR and WA have statements in technical documents indicating poor correlation without site-specific analysis
- Surrogate parameters may be appropriate when they provide useful data
  - When BOD/COD data will be utilized by the permitting authority in TMDL development or evaluating impacts on DO concentrations in the receiving water
  - When evaluating nutrient contributions to eutrophication
  - When the pollutant of concern is a subset of the surrogate
    - Hydrocarbons and oil/grease
    - E. coli/fecal coliform

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Oregon 1200-Z Monitoring Recommendations for New Applicants for Category 5 303(d)-Listed Pollutants

Oregon DEQ Advisory Committee Meeting

April 16, 2020

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Objectives of the Review

- Review EPA's 2020 Proposed Multi-Sector General Permit (MSGP) and state-issued MSGPs to identify existing monitoring requirements for Category 5 303(d)-listed pollutants, specific to new applicants
- Consider possible corrective actions that are implemented when an exceedance is triggered based on results of monitoring for impairing pollutants
- Offer recommendations for monitoring requirements for Category 5 303(d)-listed pollutants, specific to new applicants

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Overview of Findings and Recommendations

- Permit Coverage and Eligibility Criteria
  - 1200-Z criteria are consistent with EPA's 2020 Proposed MSGP and state-issued MSGPs reviewed
    - Prevent all exposure to stormwater of the pollutant(s) for which the waterbody is impaired, and retain documentation of procedures taken to prevent exposure onsite with your SWPPP
    - Provide technical information to support claim that the pollutant(s) for which the waterbody is impaired is not present at facility, and retain such documentation with your SWPPP
    - Provide either data or other technical documentation, to support a conclusion that the discharge is expected to meet applicable water quality standards and retain such information with your SWPPP
  - *Recommendation:* Require registrants to submit supporting documentation certified by a P.E. to demonstrate discharge expected to meet applicable WQS

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Overview of Findings and Recommendations

- Pollutants Monitored
  - 1200-Z and certain other state-issued MSGPs require monitoring for **all** impairing pollutants
  - EPA's 2020 Proposed MSGP requires dischargers to compare lists of industrial pollutants and **sector-specific benchmark** monitoring pollutants to the list of impairing pollutants and monitor **only** for pollutants that appear on both lists
    - *California, New York, Minnesota*
  - *Recommendation:* Require monitoring only for those pollutants that are both causing impairments and associated with the industrial activity and/or applicable benchmarks
    - Could develop additional pollutants of concern by industrial category for this purpose, even if no benchmarks exist

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Overview of Findings and Recommendations

- Monitoring Frequency for *New Applicants prior to Coverage*
  - All existing data for which the water-body is impaired
  - If discharge data does not exist, provide estimates of pollutant concentrations for which the water-body is impaired
  - *Provide technical information or other documentation to support estimates for pollutant concentrations, or that the pollutants of concern are not present at the site*
  - *Provide technical information or other documentation to support a conclusion that the discharge is expected to meet applicable water quality standards at the point of discharge or achieve consistency with an approved TMDL (may or may not include P.E. certification)*

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Overview of Findings and Recommendations

- Monitoring Frequency for ***New Applicants following Coverage***
  - Assign impairment monitoring if they are impaired for one of the eight major pollutants of concern
    - Same monitoring requirements as existing facilities
  - Assuming no contribution for facilities where the impairment pollutant is NOT a pollutant of concern
    - Based on technical documentation and estimates with application (may include certification from a P.E.)
      - If identified, not eligible for coverage
  - Assuming existing pollutant control measure for sector-specific and state-wide benchmarks will bring registrants into compliance with WQC if they are exceeding for other pollutants

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Overview of Findings and Recommendations

- Accelerated Monitoring
  - 1200-Z permit includes corrective actions in response to exceedances of reference concentrations (WQC), but lacks specific increased monitoring frequency requirements
    - *Recommendation:* Require a specific increased monitoring frequency upon exceedance of a corrective action trigger (e.g., semi-annual to quarterly; quarterly to bi-quarterly) until routine compliance is demonstrated (e.g., four consecutive samples)
- Monitoring Discontinuation
  - 1200-Z permit allows for monitoring waiver if geometric mean of four consecutive samples is equal to or less than the applicable reference concentration
    - *Recommendation*: Require monitoring for extended period (e.g., 2 years) to determine appropriateness of discontinuing monitoring

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Questions?

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Oregon 1200-Z Water Quality-Based Effluent Limitations

Oregon DEQ Advisory Committee Meeting

April 16, 2020

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Presentation Outline

- Objective of the Analysis
- Overview of WQBELs
  - Water quality criteria
  - Purpose of WQBELs
- Application of WQBELs for Stormwater
  - Observed practices and rationale
- Recommendations

2

Overview of WQBELs

	Technology-based Effluent Limitations (TBELs)	Water Quality-based Effluent Limitations (WQBELs)
Goal or Policy:	▪ Zero Discharge of Pollutants	▪ Fishable and Swimmable Waters ▪ No Toxics in Toxic Amounts
Standards:	▪ Technology	▪ Water Quality
NPDES Regulations:	▪ 40 CFR 122.44(a), (e) ▪ 40 CFR 125.3	▪ 40 CFR 122.44(d)

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Overview of WQBELs

- Determining the need for WQBELs

  Required when a Registrant causes, has the reasonable potential to cause, or contributes to an exceedance of water quality criteria, an effluent limitation protective of water quality must be implemented.
  - If a Registrant is discharging to an impaired waterbody, they are typically considered to have the reasonable potential to contribute to an exceedance of water quality criteria.
- WQBELs can be numeric or narrative
  - Most often narrative in MSGPs
  - Very few numeric WQBELs in MSGPs

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Overview of WQBELs

- Water Quality Criteria
  - Establishes levels (e.g., concentration) of pollutants that are protective of beneficial uses
  - Often expressed as:
    - Numeric Criteria
    - Narrative Criteria (in some cases, can convert to numeric)
  - Numeric Criteria typically include specified:
    - **Duration** – time period of exposure
    - **Magnitude** - concentration
    - **Frequency** – how often exposed to a concentration for the duration of concern

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Overview of WQBELs

- Toxics Criteria Duration
  - Acute (typically a 1-hr exposure duration)
  - Chronic (typically a 4-day exposure duration)
  - Human Health Duration
    - Typically a very long exposure period (~70 years)
- Complex durations for bacteria/pathogens

No.	Pollutant	CAS Number	Human Health Criterion	Freshwater (µg/L)		Saltwater (µg/L)	
				Acute Criterion (CMC)	Chronic Criterion (CCC)	Acute Criterion (CMC)	Chronic Criterion (CCC)
23	Heptachlor	76448	y	0.52 [A]	0.0038 [A]	0.053 [A]	0.0036 [A]
[A] See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.							
24	Heptachlor Epoxide	1024573	y	0.52 [A]	0.0038 [A]	0.053 [A]	0.0036 [A]
[A] See expanded endnote A at bottom of Table 30 for alternate frequency and duration of this criterion.							
25	*Iron (total)*	7439896	n	--	1000	--	--
26	Lead	7439921	n	*See* **C , F**	*See* **C , F**	210 [C]	8.1 [C]
[C] Criterion is expressed in terms of "dissolved" concentrations in the water column. [F] The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. To calculate the criterion, use formula under expanded endnote F at bottom of Table 30.							

- Due to the limited duration of discharges, consideration of criteria is typically limited to acute

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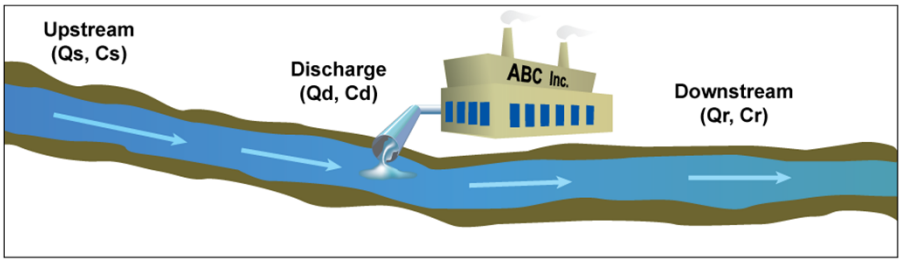
Typical Procedures for Calculating WQBELs



WLA* = the maximum allowable pollutant concentration in the effluent from ABC Inc. that, after accounting for available dilution under critical conditions, will meet an applicable water quality criterion

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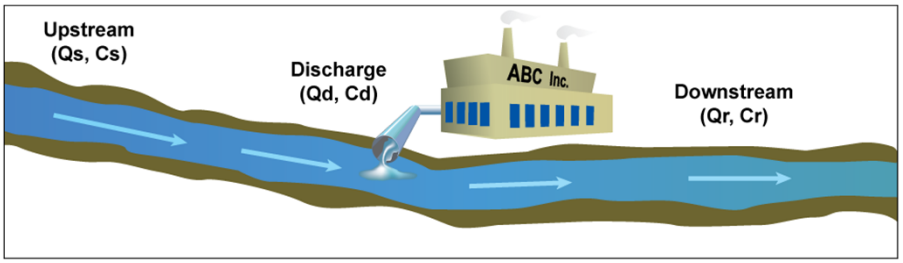
Typical Procedures for Calculating WQBELs



Mass-Balance Equation: $Q_sC_s + Q_dC_d = Q_rC_r$

$$C_d = \frac{C_r(Q_d + Q_s) - C_sQ_s}{Q_d}$$

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Typical Procedures for Calculating WQBELs

- Dilution used for benchmarks is not appropriate for WQBELs
  - Must be protective of water quality criteria
  - Dilution of 5:1 was based on numerous assumptions and lack the necessary rigor for development of limits
    - **Selection of Regions:** Only three regions (Rogue Valley, Willamette Valley and Eastern Oregon) in the State were evaluated for rainfall intensity
    - **Limited Streamflow Data:**
      - Only three years of streamflow data was used in the analysis
    - **Achievability:**
      - 80% facilities can achieve 5:1 or more dilution, while 20% of the facilities had estimated dilution less than 5:1
- WQBELs will be applicable when no assimilative capacity in the receiving water exists [303(d) list waterbodies]
- Must assume zero dilution for the development of WQBELs

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Typical Procedures for Calculating WQBELs

WLAs	Typical WQBELs
Derived from water quality criteria through TMDLs, watershed analyses, or facility-specific analyses	Derived from applicable WLAs
Often have the same duration as criteria (e.g., 1-hour average, 4-day average)	Regulations [§ 122.45(d)] require that, for continuous discharges, all effluent limitations shall, *unless impracticable*, be stated as • MDLs and AMLs for non-POTWs • AWLs and AMLs for POTWs

- The expression of limits for stormwater discharges as AMLs is typically found to be impracticable

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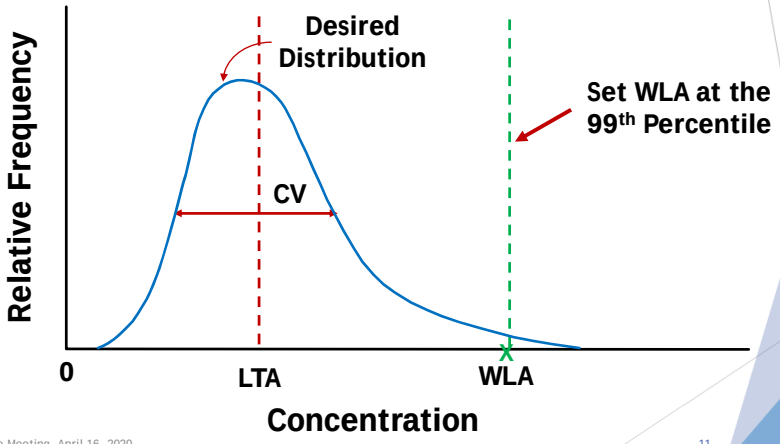
Typical Procedures for Calculating WQBELs



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Typical Procedures for Calculating WQBELs

Sector	Copper mg/L	Lead mg/L	Zinc mg/L	TSS mg/L
Sector A: Timber Products	2.8	4.6	8.4	3.1
Sector AA: Fabricated Metal Products	3.7	3.2	3.5	2.9
Sector AB: Transportation Equipment, Industrial or Commercial Machinery	4.5	2.7	13.9	2.8
Sector AC: Electronic, Electrical, Photographic and Optical Goods	2.1	2.3	1.7	2.4
Sector B: Paper and Allied Products	1.9	20.0	2.4	2.3
Sector C: Chemicals and Allied Products Manufacturing and Refining	3.1	2.7	10.3	2.5
Sector D: Petroleum Refining and Related Industries	2.5	3.0	1.6	2.6
Sector E: Glass, Clay, Cement, Concrete, and Gypsum Products	7.5	10.5	2.9	3.0
Sector F: Primary Metals	2.2	3.3	1.5	5.4
Sector K: Hazardous Waste Treatment, Storage, or Disposal Facilities	24.5	4.1	23.9	3.7
Sector M: Motor Vehicle Parts, Used	1.4	2.7	1.6	2.1
Sector N: Scrap and Waste Materials	2.9	3.8	2.8	2.6
Sector O: Steam Electric Generating Facilities	0.9	1.2	1.0	1.3
Sector P: Land Transportation and Warehousing	41.5	2.6	2.1	3.0
Sector Q: Water Transportation	6.7	3.6	11.0	3.0
Sector R: Ship and Boat Building and Repairing Yards	1.9	2.0	1.4	2.2
Sector S: Air Transportation Facilities	6.6	2.7	4.3	4.0
Sector T: Treatment Works	1.6	2.4	1.7	3.5
Sector U: Food and Kindred Products	4.4	3.3	2.8	16.8
Sector Unassigned	42.0	3.3	2.4	3.2
Sector W: Furniture and Fixtures	2.0	1.8	1.7	3.7
Sector Y: Rubber, Miscellaneous Plastic Products, and Miscellaneous Manufacturing Industries	2.3	11.9	1.7	2.7

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Typical Procedures for Calculating WQBELs

- Use the lognormal distribution to calculate the MDL and AML
  - Considers:
    - Numerous LTAs (i.e., acute, chronic, human health, etc.)
    - Effluent variability
    - WLA as "not to exceed"
    - Based on percentiles of projected distributions at a specified confidence interval
      - E.g., 99th the MDL and 95th for AML
- Appropriate for stormwater discharges?
  - Accounts for durations much longer than reasonable to assume for stormwater discharges
  - Assumes continual discharge
  - Typically involves discharges with significantly less variability
  - Develops a monthly average
- Better to simply apply the WLA for acute criteria as the limit
  - Protective and correlates better to duration of discharge

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Typical Procedures for Calculating WQBELs

- Address other criteria…. No standardized method, but similar considerations
  - Limits must consider duration and magnitude of criteria
  - Limits must be protective of water quality criteria under all likely discharge scenarios
    - Not reasonable to consider dilution under this specific scenario
    - Receiving water characteristics often must be considered
  - Unlike benchmarks, WQBELs require additional technical rigor and be protective of water quality criteria at all times
    - Permit as a shield
    - Narrative requirements retain enforceability where additional permit requirements are not protective

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Summary of Findings

- Permits Reviewed
  - U.S. EPA Proposed 2020 MSGP
  - 22 State Permits
    - Alaska
    - Arizona
    - Arkansas
    - California
    - Connecticut
    - Georgia
    - Hawaii
    - Illinois
    - Kansas
    - Kentucky
    - Maine
    - Maryland
    - Minnesota
    - Montana
    - Nebraska
    - New York
    - Ohio
    - Texas
    - Utah
    - Vermont
    - Virginia
    - Washington

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Summary of Findings

- Vast majority of states assume compliance with technology-based effluent limitations, best management practices, and other permit conditions will result in achieving compliance with water quality standards
  - Do not include numeric WQBELs
- Most permits require additional pollutant control measures if water quality standards are identified as being exceeded
- If water quality standards can not be achieved through pollution control, an individual NPDES permit may be necessary

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Summary of Findings

- Numeric WQBELs identified in the following
  - U.S. EPA Proposed 2020 MSGP
    - Fond du Lac Reservation (2 x ambient concentrations)
      - Ammonia, arsenic, chromium, total phosphorus, TSS, and zinc
    - Idaho
      - pH (based on range in WQS)
      - Arsenic and zinc (based on acute criteria)
  - States (not including pH)
    - Washington
      - Turbidity, pH, TSS, phosphorus, ammonia, copper, lead, mercury, zinc, and pentachlorophenol
    - Hawaii
      - BOD, COD, TSS, Total Nitrogen, N+N, pH, and toxics

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Observed Methodology

- U.S. EPA Proposed 2020 MSGP
  - Fond du Lac Reservation (2 x ambient concentrations)
    - Ammonia, arsenic, chromium, total phosphorus, TSS, and zinc
  - Idaho
    - pH (based on range in WQS)
    - Arsenic and zinc (based on acute criteria)

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Observed Methodology

- Washington
  - Details on methodology aren't clearly specified in the fact sheet
  - pH: direct application of standards (6.5 – 8.5 s.u., with consideration of buffering)
    - Allows up to 0.5 s.u. on the minimum and maximum range depending on impairment
  - Copper, lead, mercury, zinc, ammonia, and pentachlorophenol: daily maximum, based on acute criteria
    - Site-specific based on receiving water characteristics
  - TSS: Best professional judgement – 30 mg/L
    - Assume stormwater discharges with less than 30 mg/L will not cause or contribute to a violation of sediment management standards
  - Turbidity: ??? 25 NTU
  - Phosphorus: ??? Site-specific

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Observed Methodology

- Hawaii
  - BOD, COD, TSS, Total Nitrogen, N+N
    - Instantaneous maximums based on "not to exceed more than 10 percent of the time" criteria
  - pH
    - Instantaneous limit from direct application of criteria as limit
  - Toxics
    - Direct application of acute toxicity standard (does not specify duration)
  - Hawaii is planning to remove numeric limits in future MSGPs

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Proposed Methods - Metals (Cadmium, Copper, Iron, Lead, and Zinc)

- Water quality criteria defined in Table 30 of OAR 340-041-8033
- Includes acute and chronic aquatic life, and human health criteria
- Criteria for the following pollutants are formula driven and would be site-specific based on hardness or other characteristics of the receiving water:
  - Cadmium (hardness)
  - Copper (BLM)
  - Lead (hardness)
  - Zinc (hardness)
- Iron does not have acute criteria. Recommend iron be controlled by narrative permit conditions. EPA's 2020 MSGP is proposing to remove iron benchmark due to a lack of evidence of acute effects.
- Directly apply acute criteria for metals as a 1-hr average, do not establish numeric limit for iron

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Proposed Methods - Metals (Cadmium, Copper, Iron, Lead, and Zinc)

- Metals criteria are often formula driven and require characteristics of the receiving water to develop a protective concentration
- How to define receiving water characteristics?
  - Site-specific
  - Basin-wide
  - State-wide
- Total vs Dissolved
  - Regulations require implementation of limits in total recoverable

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Proposed Methods - Bacteria

- Water quality criteria defined in OAR 340-041-0009
  - E. coli (fresh water limits specified in regs)
    - Monthly geomean of 126 organisms/100mL
    - SSM of 406 organisms/100 mL
  - Enterococcus (coastal limits specified in regs)
    - Monthly geomean of 35 organisms/100 mL
    - Not more than 10 percent of samples in a month exceed 130 organisms/100 mL
  - Fecal (shellfish, no limits specified in regs)
    - Median of 14 organisms/100 mL
    - Not more than 10 percent of samples in a 90-day period may exceed 43 organisms/100 mL

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Proposed Methods - Bacteria

- Complex water quality criteria not easily implemented into a general permit and appropriate for stormwater
  - Geometric means
  - Not to exceed 10 percent of the time
- Numeric limits would need to be based on type and beneficial uses of receiving water
- Sampling frequency and discharge frequency impact ability to implement criteria as meaningful numeric limits
  - Recommended to have five samples to calculate geometric mean
  - Unknown/inconsistent discharge frequencies
  - Compliance with numeric limits greater than geomean or percent exceedances still may not be protective of the receiving water

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Proposed Methods - Bacteria

- E. coli (fresh water limits specified in regs)
  - Monthly geomean of 126 organisms/100mL [Not practicable]
  - SSM of 406 organisms/100 mL [Can be directly applied]
- Enterococcus (coastal limits specified in regs)
  - Monthly geomean of 35 organisms/100 mL [Not practicable]
  - Not more than 10 percent of samples in a month exceed 130 organisms/100 mL [Not practicable]
- Fecal (shellfish, no limits specified in regs)
  - Median of 14 organisms/100 mL [Can be established as a long-term average]
  - Not more than 10 percent of samples in a 90-day period may exceed 43 organisms/100 mL [Not practicable]

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Proposed Methods - Sedimentation or Turbidity

Turbidity

- Water quality criteria for turbidity defined in OAR 340-041-0036
- No more than 10 percent cumulative increase in natural stream turbidites may be allowed, as measured relative to a control point immediately upstream of the turbidity causing activity.
  - Site-specific – based on "natural stream turbidity"
- Require defined "natural stream turbidity" via receiving water monitoring
  - Control point upstream of the discharge
- Limit may be established as a percent increase to upstream value
  - When to monitor?
- Could assume a representative and conservative natural turbidity based on available data
  - Basin
  - State

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Proposed Methods - Sedimentation or Turbidity

Sedimentation/Total Suspended Solids

- No defined water quality standard for sedimentation
  - Currently addressed through application of state narrative criteria
  - Sediment TMDLs reference turbidity standard
  - TSS may be correlated to turbidity, but will be site specific and require an evaluation of local relationships between the variables
  - If a site-specific correlation is determined, TSS may be applied as a surrogate for turbidity and/or sediment
  - Default of 30 mg/L has been assumed by Washington based on BPJ
  - Not practical

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Proposed Methods - Sedimentation or Turbidity

- Example TSS Targets developed for TMDL to achieve a turbidity of 30 NTU

Table A6-1: Umatilla Basin Loading Capacities

Watershed target concentrations/loading capacities	
Watershed	TSS Target (mg/L) @ 30 NTU Turbidity
Upper Umatilla River	76
Meacham Creek	60
Squaw/Buckaroo	99
Pendleton	80*
Wildhorse	86
Tutuilla	70
McKay	72
Birch	110
Butter	110
Gulches and Canyons	80*
Stage Gulch	80*
Sand Hollow	80*
Cold Springs	80*
Lower Umatilla River	77

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Proposed Methods - pH

- Water quality criteria defined in OAR 340-041-0021 and -0101 through -0350
  - Marine waters: 7.0 – 8.5
  - Estuarine and fresh waters are basin specific
    - pH ranges vary between basins, examples:
      - Main Stem Snake River Basin: 7.0 – 9.0
      - Deschutes Basin: 6.5 – 8.5 (exception: Cascade Lake: 6.5 – 8.5)
      - Goose and Summer Lakes Basin: 7.5 – 9.5 (exception: Goose Lake: 7.5 – 9.5)
      - Grande Ronde Basin: 6.5 – 9.0
- pH standards are often applied directly as instantaneous limits

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Questions?

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