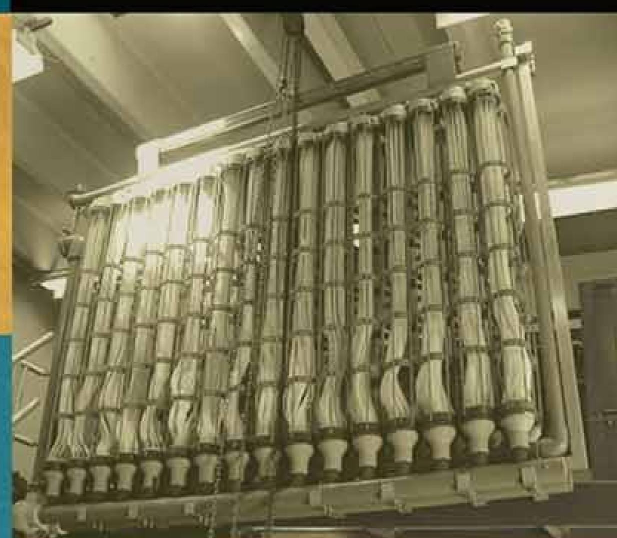
WESTCAS 2009 Fall Conference

National Nutrient Standards



David L. Clark

HDR Engineering

dclark@hdrinc.com

October 29, 2009

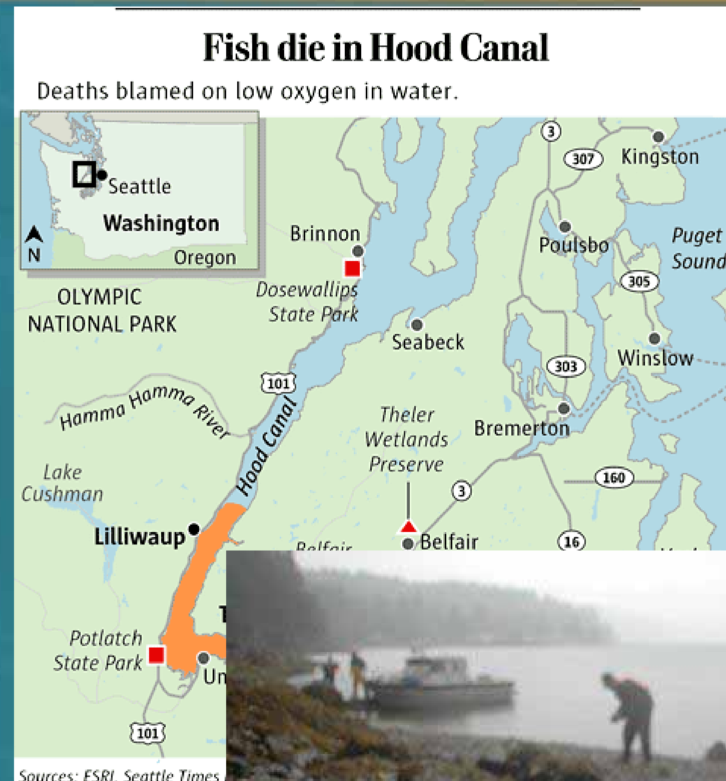
HDR

National Nutrient Standards

- **Water Quality Protection**
  - **Regulatory Initiatives**
  - **Numeric Nutrient Standards**
- **Wastewater Treatment Technology**
  - **Limit of Technology**
  - **Sustainability**
- **Nutrient Discharge Permitting**

Water Quality Protection

Lake Spokane, WA
Washington Department of Ecology

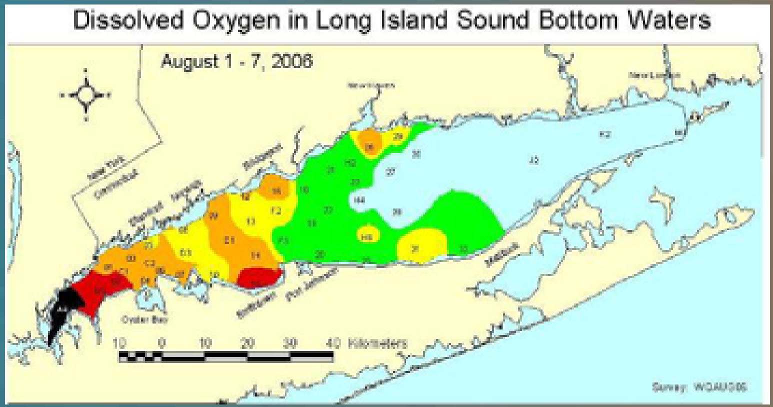


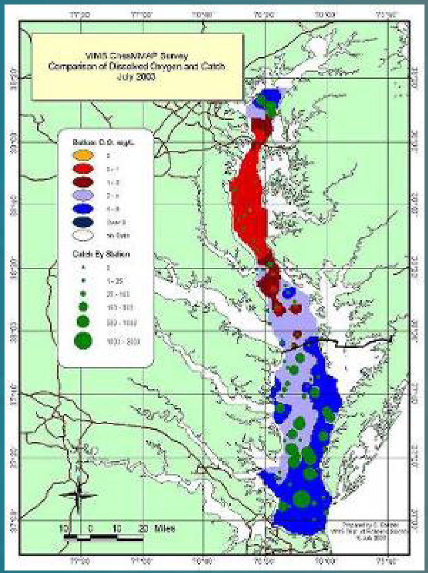
Puget Sound, WA
Seattle Times, 2006

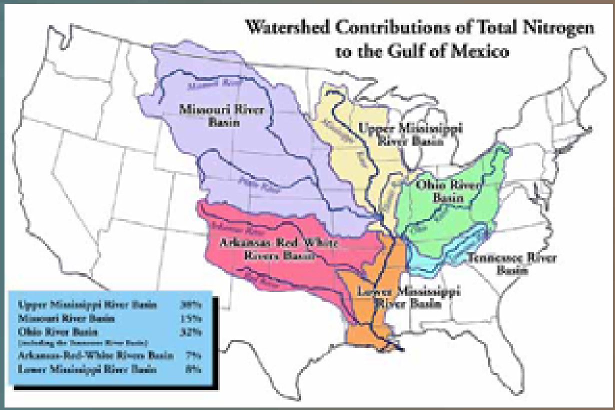
National Water Quality Priorities

Ben Grumbles, Former EPA Assistant Administrator for Water

- Chesapeake Bay
  - 150,000 New Residents per Year
- Gulf of Mexico
  - Large dead zone
  - Importance of Phosphorus
- Long Island Sound
  - Below DO in Half of Sound
  - Water quality trading program implemented
- Puget Sound
  - Priority No. 1: Better handle on nutrient and bacteria loadings from Septic Systems







EPA's National Nutrient Strategy

- **Ben Grumbles May 25, 2007 Memorandum to States**
  - ***"Numeric standards reduce States' time and effort to establish TMDLs and permits to control nutrient levels"***
- **EPA Assistance to States**
  - **Assistance in Adopting Numeric Criteria**
  - **Science-based Criteria for Estuaries, Wetlands, and Large Rivers**
  - **Communicate the Dangers of Nutrient Pollution and the Merits of Numeric Nutrient Criteria to States, Nutrient Sources, and the General Public**

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAY 25 2007

OFFICE OF WATER

MEMORANDUM

SUBJECT: Nutrient Pollution and Numeric Water Quality Standards

FROM: Benjamin H. Grumbles
Assistant Administrator

TO: Directors, State Water Programs
Directors, Great Water Body Programs
Directors, Authorized Tribal Water Quality Standards Programs
State and Interstate Water Pollution Control Administrators

This memo provides a national update on the development of numeric nutrient water quality standards and describes EPA's commitment to accelerating the pace for progress. EPA published its June 1998 national nutrient criteria strategy and some States and Territories have made notable progress in establishing numeric nutrient standards - most recently in connection with the Chesapeake Bay and Tennessee streams. However, overall progress has been uneven over the past nine years. Now is the time for EPA and its partners to take bold steps, relying on a combination of science, innovation and collaboration.

Why Action is Needed

High nitrogen and phosphorus loadings, or nutrient pollution, result in harmful algal blooms, reduced spawning grounds and nursery habitats, fish kills, oxygen-starved hypoxic or "dead" zones, and public health concerns related to impaired drinking water sources and increased exposure to toxic microbes such as cyanobacteria. Nutrient problems can exhibit themselves locally or much further downstream leading to degraded estuaries, lakes and reservoirs, and to hypoxic zones where fish and aquatic life can no longer survive.

Nutrient pollution is widespread. The most widely known examples of significant nutrient impacts include the Gulf of Mexico and the Chesapeake Bay. For these two areas alone, there are 35 States that contribute the nutrient loadings. There are also known impacts in over 80 estuaries/bays, and thousands of rivers, streams, and lakes. The significance of this impact has led EPA, States, and the public to come together to place an unprecedented priority on public partnerships, collaboration, better science, and improved tools to reduce nutrient pollution.

Virtually every State and Territory is impacted by nutrient-related degradation of our waterways. All but one State and two Territories have Clean Water Act Section 303(d) listed

Internet Address (URL) • http://www.epa.gov
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Ben Grumbles, Assistant EPA Administrator, May 25, 2007

NRDC Petition on Secondary Treatment Standards

- November 27, 2007 NRDC Petition for Rulemaking
  - EPA Has Unreasonably Delayed Publishing Information on Secondary Treatment to Remove Excess Nutrients
  - Nutrient Control is Properly Included within “Secondary Treatment”

- ***NRDC States:***
  - ***TP 0.3 mg/l and TN 3 mg/l Currently Attainable***
  - ***TP 1 mg/l and TN 8.0 mg/l Attainable Only Using Biological Processes***
  - ***EPA Must Assess Whether This Constitutes “Secondary Treatment”***

NRDC

NATURAL RESOURCES DEFENSE COUNCIL

November 27, 2007

Stephen L. Johnson
Administrator
U.S. Environmental Protection Agency
Ariel Rios Building
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460

Dear Administrator Johnson,

Enclosed please find a petition, along with attachments, seeking overdue and needed improvements to the Environmental Protection Agency's secondary treatment requirements for wastewater treatment plants.

This petition is filed on behalf of the following groups, many of which are membership organizations that are collectively supported by millions of individuals: the Natural Resources Defense Council, the Environmental Law and Policy Center of the Midwest, the Sierra Club, the Waterkeeper Alliance, the Missouri Coalition for the Environment, Midwest Environmental Advocates, the Prairie Rivers Network, the Iowa Environmental Council, the Minnesota Center for Environmental Advocacy, American Rivers, and the Gulf Restoration Network.

We would welcome the opportunity to discuss the materials presented in this petition with you and your staff.

Should you have any questions about the enclosed materials, please do not hesitate to contact me at (202) 289-2361.

Sincerely,

Jon P. Devine, Jr.
Senior Attorney
Clean Water Project
Natural Resources Defense Council

cc (without attachments):
Benjamin Grumbles, Assistant Administrator for Water (Mail Code 4101M)
Roger R. Martella, Jr., General Counsel (Mail Code 2310A)
James A. Hanlon, Director, Office of Wastewater Management (Mail Code 4201M)

www.nrdc.org
1200 New York Avenue, NW, Suite 400
Washington, DC 20005
TEL 202 289-6868 FAX 202 289-1060

NEW YORK • LOS ANGELES • SAN FRANCISCO

Peter S. Silva, EPA Assistant Administrator for Water

- **May 12, 2009 Senate Hearing**
  - ***"….we now see additional challenges have arisen in the areas of <u>non point source pollution</u> and in new <u>emerging pollutants</u> of concern."***
  - ***"…we need to carefully consider how to ensure that our water, wastewater, and stormwater infrastructure can be financed and <u>managed sustainably</u>."***

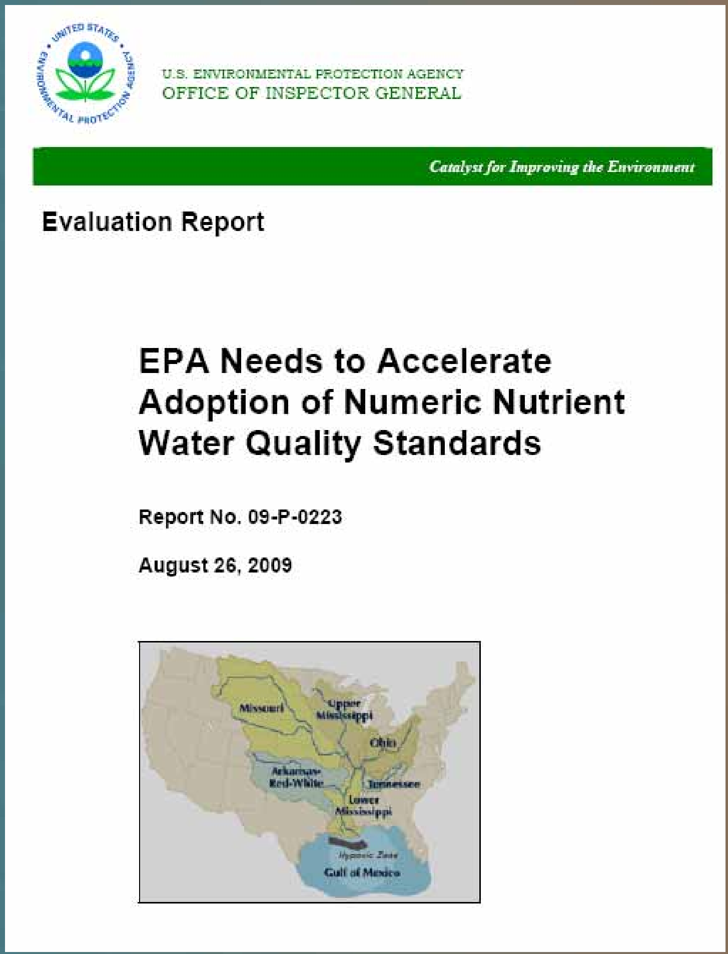
WEFTEC 2008 Government Affairs Session 77 Clean Water Policy 2008

- ***Ephraim King, EPA OST predicts we're coming to perfect storm on nutrients:***
  - *Increasing litigation*
  - *Population growth*
  - *Climate change with less rain and higher nutrient concentrations*
  - *Biofuels to support growth*
  - *Vastly expanded urbanization*

- ***EPA Water Program Nutrient Tools***
  - *Narrative standards*
  - *TMDLs*
  - *BMPs*
  - *Economic incentives*
  - *Technology Based standards (treatment technology limits)*
  - *Partnerships*
  - *Numeric Nutrient standards*
  - ***How can all of these be put together?***

EPA Office of Inspector General Report

- ***"EPA's current approach is not working"***
- ***Recommendations***
  - Select significant waters of national value
  - EPA set numeric nutrient standards
    - Mississippi River and Gulf of Mexico highlighted
  - Establish EPA and State accountability
  - Establish metrics to gauge progress by States
  - EPA regions validate water quality standards action tracking application annually


U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF INSPECTOR GENERAL

Catalyst for Improving the Environment

Evaluation Report

EPA Needs to Accelerate Adoption of Numeric Nutrient Water Quality Standards

Report No. 09-P-0223

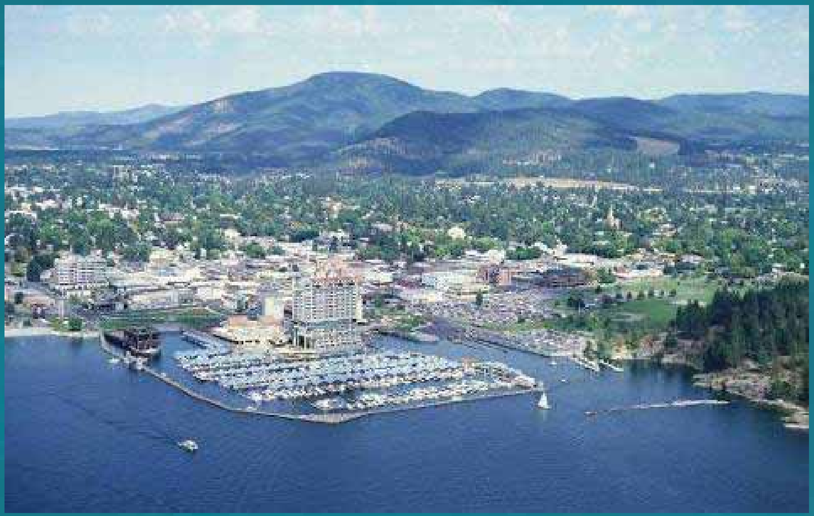
August 26, 2009

Urgent Call to Action: Report of the State-EPA Nutrient Innovations Task Group, August 2009

States and EPA recognize that eutrophication and nutrient overloading are significant environmental problems, not just for aquatic resources but also from a drinking water standpoint. In the past, we have been successful in some areas, but not in others. We agree to meet to develop a strategy to change the way we act to improve ways to reduce or eliminate nutrient releases.

- **Top 5 Most Promising Tools Recommended by Work Groups**
  - **Detergent Phosphate Ban**
  - **Nonpoint Source Regulation**
  - **Federally Required State WQS Numeric Nutrient Water Quality Criteria**
  - **Update Secondary Nutrient Treatment Requirements**
  - **Green Labeling**

Numeric Nutrient Standards



Lake Coeur d'Alene, ID

Spokane River, WA

Lake Spokane, WA

Lake Spokane, WA

Evolving Nutrient Limits and Numerical Standards

- Narrative Standards for Nutrient Enrichment
  - Nuisance Algae Growth
- Evolving Numerical Standards for Nutrients
  - EPA Eco-Region Data
- EPA's National Numeric Nutrient Criteria for Receiving Waters
  - Emphasis on Controlling "Nitrogen and Phosphorus Pollution"

Coeur d'Alene Lake and Spokane River, ID

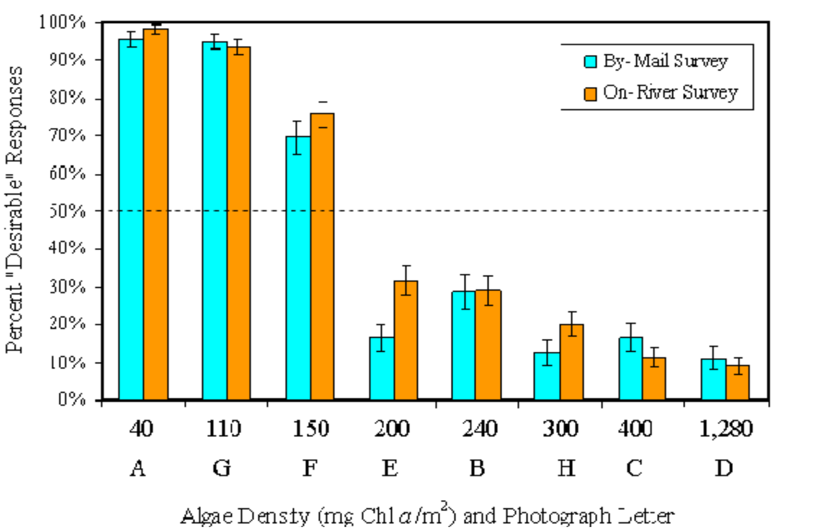
Coeur d'Alene ID Treatment Plant

Nutrient Target Setting Challenges

- Identifying the Threshold of Harm to Beneficial Uses
  - Stressor Response, Change Point Analysis
    - Numeric Nutrient Criteria
    - Macroinvertebrate Indices
    - Fisheries
  - Recreation/public Perception
- Translation of Standards or TMDLs to NPDES Effluent Discharge Permits

F 150 mg/m^2 Chl$\underline{a}$

D 1,250 mg/m^2 Chl$\underline{a}$



Scientific and Technical Basis for Montana's Numeric Nutrient Criteria

Summary of Ecoregion Values for Rivers and Streams

Ecoregion	TN (mg/L)	TP (mg/L)
I: Willamette and Central Valley	0.66	0.055
II: Western Forested Mountains	0.12	0.010
III: Xeric West	0.38	0.022
IV: Great Plains Grass and Shrublands	0.56	0.023
V: South Central Cultivated Great Plains	0.88	0.067
VI: Corn Belt and Northern Great Plains	2.18	0.076
VII: Mostly Glaciated Dairy Region	0.54	0.033
VIII: Nutrient-Poor, Largely Glaciated Upper Midwest and Northeast	0.38	0.010
IX: Southeastern Temperature Forested Plains and Hills	0.69	0.037
X: Texas-Louisiana Coastal and Mississippi Alluvial Plains	0.57	0.060
XI: The Central and Eastern Forested Uplands	0.31	0.010
XII: Southeastern Coastal Plain	0.90	0.040
XIII: Southern Florida Coastal Plain	1.14	0.015
XIV: Eastern Coastal Plain	0.71	0.031

In-stream target concentrations are low in all ecoregions

Aggregate Level III Ecoregion – Xeric West III

Rivers and Streams in Nutrient Ecogreion III (25th percentile)	
Nutrient Parameter	Aggregate Nutrient Ecoregion III Reference Conditions
Total Phosphorus (mg/L)	0.02188
Total Nitrogen (mg/L)	0.38
Chlorophyll a (ug/L)	1.78
Turbidity (NTU)	2.34

Lakes and Reservoirs in Nutrient Ecogreion III (25th percentile)	
Nutrient Parameter	Aggregate Nutrient Ecoregion III Reference Conditions
Total Phosphorus (mg/L)	0.017
Total Nitrogen (mg/L)	0.40
Chlorophyll a (ug/L)	3.4
Turbidity (NTU)	2.7

- Northern and Southern Arizona

Aggregate Level III Ecoregion – Western Forested Mountains II

Rivers and Streams in Nutrient Ecogreion II (25th percentile)	
Nutrient Parameter	Aggregate Nutrient Ecoregion II Reference Conditions
Total Phosphorus (mg/L)	0.010
Total Nitrogen (mg/L)	0.12
Chlorophyll a (ug/L)	1.08
Turbidity (NTU)	1.3

Lakes and Reservoirs in Nutrient Ecogreion II (25th percentile)	
Nutrient Parameter	Aggregate Nutrient Ecoregion II Reference Conditions
Total Phosphorus (mg/L)	0.0088
Total Nitrogen (mg/L)	0.1
Chlorophyll a (ug/L)	1.9
Turbidity (NTU)	4.5

- Central Arizona

Status of States & Territories Numeric Nutrient Standards (EPA, 2008)

Rivers and Streams		
Stage	**Number**	**States**
Has approved criteria for all parameters	5	TN, HI, AS, GU, CN
Has approved criteria for N, P, or Chlorophyll	4	DC, FL, OK*, NV
Engaged in developing criteria for all parameters and waters	6	MA, ME, VT, KY, MI, WI
Collecting data for all parameters or waters	34	CT, NH, RI, NJ, NY, PR, DE, MD, PA, VA, AL, FL, GA, MS, NC, SC, IL, IN, MN, OH, AR, LA, OK, NM, TX, IA, KS, MO, NE, CO, MT, UT, AZ, CA
Just starting criteria process	8	WV, ND, SD, WY, AK, ID, OR, WA

*OK: scenic rivers only, Updated May 14, 2007

Wastewater Treatment Technology

Healdsburg, CA Membrane Bioreactor

Yakima River, WA

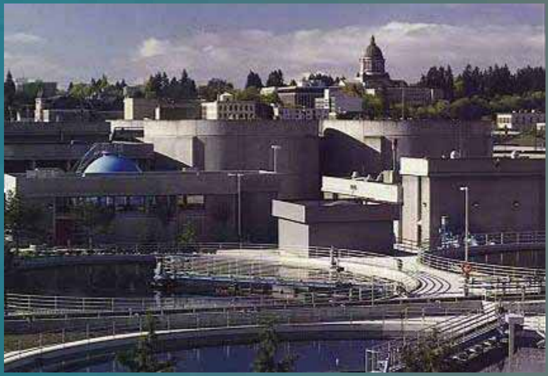
Concrete, WA MBR Effluent

Numeric Nutrient Criteria and Limits of Wastewater Treatment Technology

Parameter	Typical Municipal Raw Wastewater, mg/l	Secondary Effluent (No Nutrient Removal), mg/l	Typical Advanced Treatment Nutrient Removal (BNR), mg/l	Enhanced Nutrient Removal (ENR), mg/l	Limits of Treatment Technology, mg/l	*Typical In-Stream Nutrient Criteria, mg/l*
Total Phosphorus	4 to 8	4 to 6	1	0.25 to 0.50	0.05 to 0.07	*0.020 to 0.050*
Total Nitrogen	25 to 35	20 to 30	10	4 to 6	3 to 4	*0.3 to 0.600*

Las Vegas, NV (TP 0.170 mg/l)

Clean Water Services, OR (TP 0.100 mg/l)



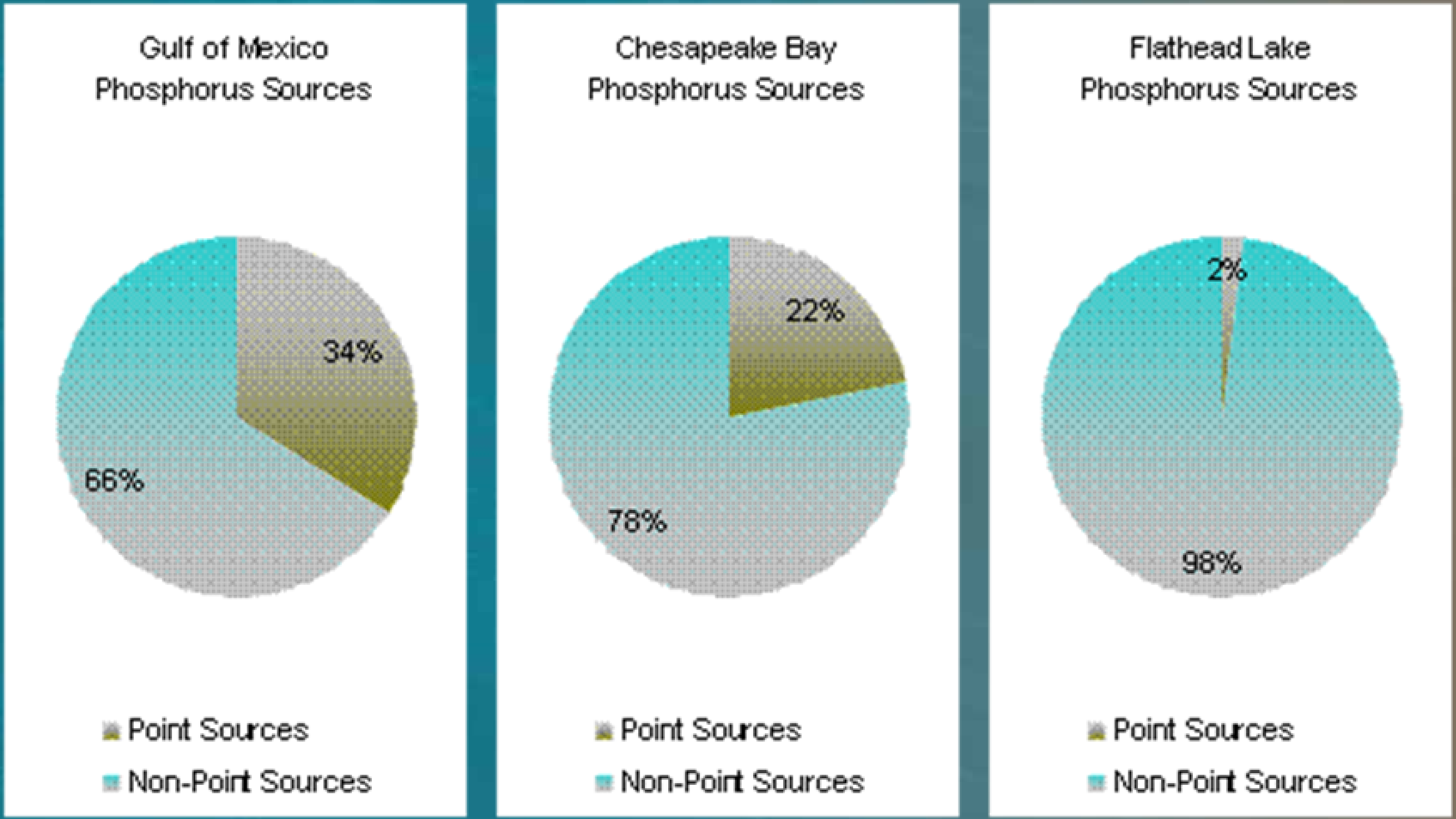
Lacy, Olympia, Tumwater Thurston Co (LOTT), WA (TIN 2 mg/l)

Coeur d'Alene, ID (TP 0.050 mg/l)

Discharger Issues with Numeric Nutrient Standards

- In-Stream Numeric Nutrient Standards Based on Natural Conditions Are Very Low
  - *Translation to Discharge Permits*
  - *Lower Than Treatment Technologies Are Capable of Achieving If Applied "End-of-Pipe"*
- Wastewater Utilities Rely on Surface Waters for Effluent Management
- Over-Regulation of Point Sources May Have Unintended Consequences
- Reduction in Point Sources Alone Will Not Protect Water Quality

Nonpoint Sources Dominate Many Watersheds



Phosphorus Loading Summaries for Gulf of Mexico, Chesapeake Bay, and Flathead Lake

Interpretation/Implementation of Numeric Nutrient Standards

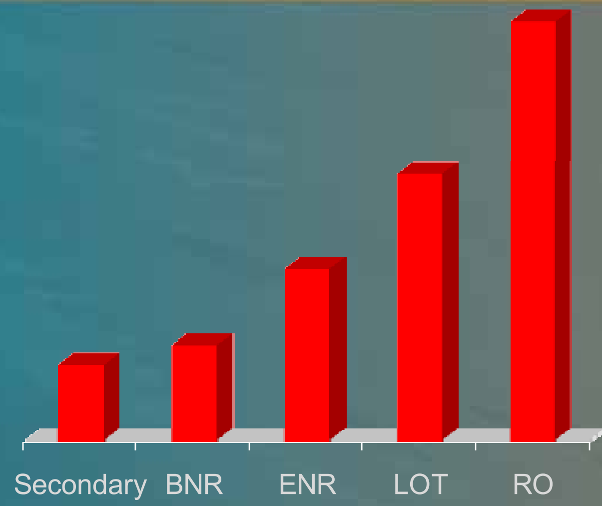
- ***Will Water Quality Variances be Required?***
  1. Dams or other hydrologic modifications
  2. Natural, ephemeral intermittent low-flow
  3. Natural physical conditions preclude attainment of aquatic life uses
  4. Human-caused conditions or pollutant sources that cannot be remedied or would cause more environmental damage to correct than to leave in place
  5. Substantial and widespread economic and social impact

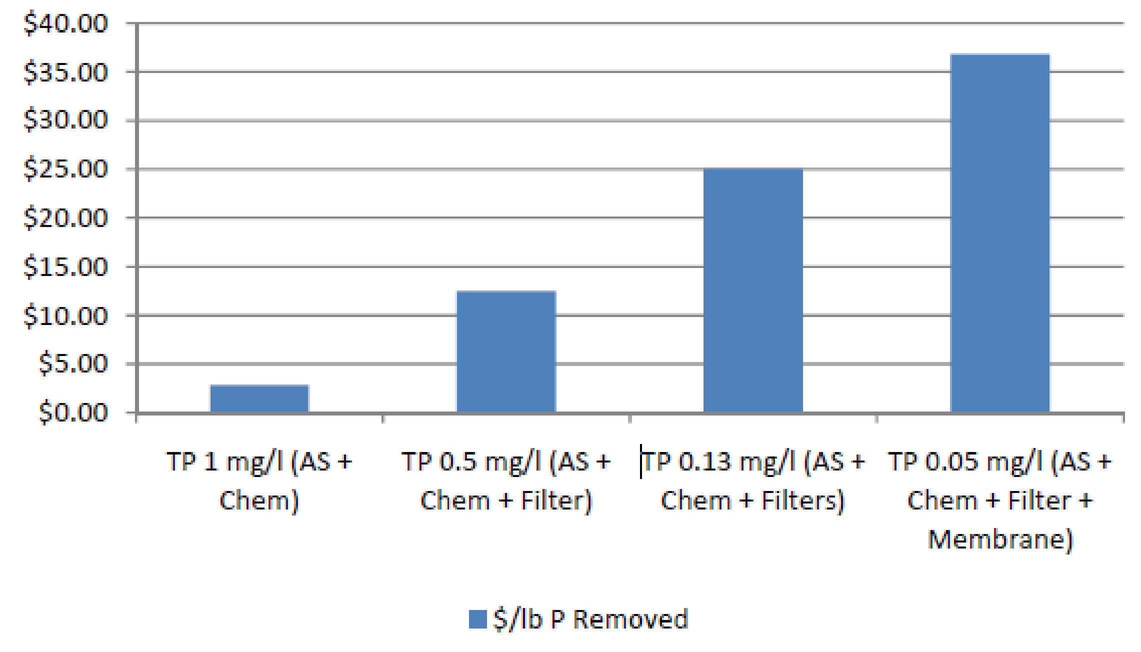
- **Montana Approach**
  - Senate Bill 95 Temporary Water Quality Standards
    - Economic Hardship
      - Substantial and Widespread
      - Selected 1% Median Household Income
    - Limits of Technology
  - Rulemaking for Numeric Nutrient Standards

2% Median Household Income in Kansas

Treatment Costs Escalate Substantially as It Approaches Technology Limits

- **Secondary treatment**
- **Biological nutrient removal (BNR)**
- **Enhanced nutrient removal (ENR)**
- **Limit of treatment technology (LOT)**
- **Reverse osmosis (RO)**





Adapted from Jiang et al. 2005

Balance and Sustainability

Yellowstone River, MT

Billings, MT Treatment Plant

Balance and Sustainability to Protect Water Quality

- ***As Much as We Like Wastewater Treatment…***
  - ***… Advanced Treatment Increases:***
    - **Capital and Operating Costs**
    - **Energy Use**
    - **Chemical Use**
    - **Atmospheric Emissions**
  - **May Not Always Benefit Water Quality**

Comparison of Point and Nonpoint Source Nutrient Control Performance

Approach	Nutrient Removal Performance	Cost Effectiveness
Point Source	80% to 90%	$0.50 to $50+ $/lb
Advanced Treatment		
Nonpoint Source	15% to 80%	$0.50 to $300+ $/lb
Best Management Practices[1]		

[1]Conservation Tillage, Grass Buffers, Detention Basins, Wetlands

Sustainability Comparison of Point and Nonpoint Source Nutrient Controls

Approach	Electrical Power	Chemical Use	Greenhouse Gas	Additional Watershed Enhancements
Point Source Advanced Treatment	+50% to + 250% over Secondary Treatment	Alum, Ferric, Methanol, other carbon sources	+120% over Secondary Treatment	None
Nonpoint Source Best Management Practices[1]	None	None	Sequesters Carbon	Enhanced Habitat, Aesthetics, Sediment Reduction

[1]Conservation Tillage, Grass Buffers, Detention Basins, Wetlands

Conditions Required for Potential Water Quality Offsets or Trading

- "Driver" for Pollutant Reductions
  - TMDL
  - NPDES Permit
    - Permit Limits Conducive to Trading
- Sources with Significantly Different Costs for Control
- Pollutant Reduction Not So Large That All Sources Must Reduce as Much as Possible
  - Need a Surplus of Reductions To Trade
- Willing Stakeholders and Agencies
- Loading Analysis
  - Point Sources Defined
  - Need to Quantify Nonpoint Source Loadings

Conventional Tillage

Conservation Tillage

Sidestream Nutrient Recovery

- **Phosphorus Removal Applications**
  - **Anaerobic Digestion**
  - **Dewatering**
- **Struvite (MAP) Reactor**
  - **Recycles Nutrients as Fertilizer**
  - **Reduces Solids Stream Recycle Impact**
  - **Reduces Chemical Use**
  - **Potential Greenhouse Gas Credit**
    - **~6 to 8 tons CO_2 Equivalent per Ton of Struvite**

Clean Water Services of Washington County, OR Durham Plant

Ostara's Green Crystal Green® Fertilizer Product

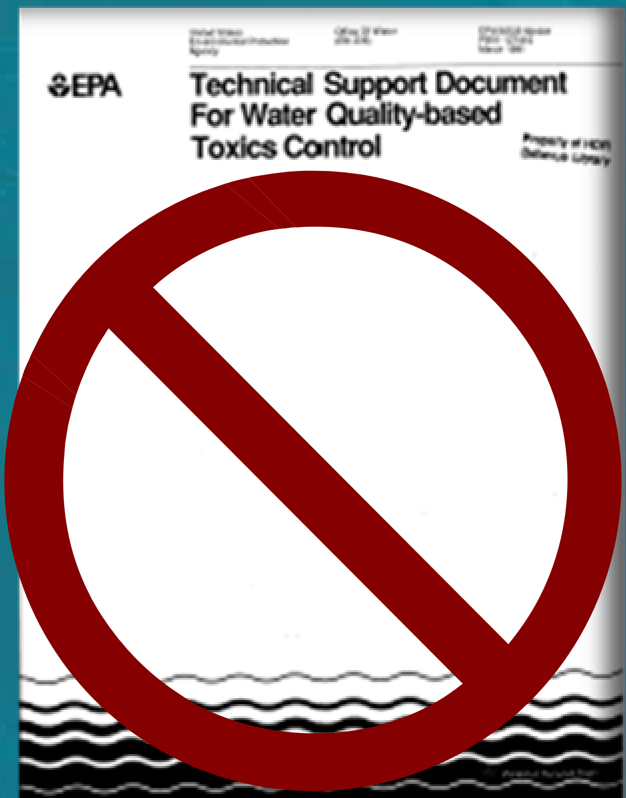
Effluent Nutrient Discharge Permitting Issues

WERF Nutrient Challenge

Gilbert, AZ :Riparian Preserve

Silverton Oregon Gardens

Appropriate Discharge Permit Guidance for Nutrients



Over-specifying effluent discharge permit limits will not provide significant additional water quality protection

- **Translation water quality criteria to NPDES to permit limits**
  - **Critical interpretation of water quality Issues**
    - **Pre-formulated permit guidance from EPA and States often focused on toxics**
  - **Appropriate averaging periods**
  - **Variability In low nutrient plant performance**

Nutrients Differ From Toxics

Nutrients

- **No Immediate Impact**
  - **Aside from Ammonia**
- **Watershed Scale Impacts**
  - **Nutrient Enrichment Leads to Aquatic Growth**
- **Algal Response Over Longer Periods**
  - **Longer Averaging Period Appropriate for Nutrients**
  - **Seasonal or Annual Averages Appropriate**
- **Treatment Technology**
  - **Variability at Low Levels in the Best Technologies**

Toxics

- **Acute and Chronic Impacts on Aquatic Life**
  - **Chlorine, Metals, Organics**
- **Near-field (mixing zone) and Far-field (watershed) Impacts**
- **Long Term Response**
  - **Average Limits**
- **Short Term Response**
  - **Maximum Limits Required**
- **Treatment Technology**
  - **Available Technology to Prevent Excursions**

Effluent Requirements Below Limit of Technology

- **Ruidoso, NM**
  - **Total Nitrogen**
    - **1 mg/L 30 Day Average**
    - **1.5 mg/L Daily Max**
  - **Total Phosphorus**
    - **0.1 mg/L 30 Day Average**
    - **0.15 mg/L Daily Max**

REGION 6
1445 ROSS AVENUE
DALLAS, TEXAS 75202-2733

NPDES Permit No NM0029165

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Clean Water Act, as amended, (33 U.S.C. 1251 et. seq; the "Act"),

City of Ruidoso Downs and Village of Ruidoso WWTP
313 Cree Meadows Drive
Ruidoso, NM 88345

Post-Construction Effluent Limits – 2.6 MGD Design Flow – OUTFALL 001 Continued

EFFLUENT CHARACTERISTICS		DISCHARGE LIMITATIONS					MONITORING REQUIREMENTS	
		lbs/day, unless noted		mg/l, unless noted				
POLLUTANT	STORET CODE	30-DAY AVG	7-DAY AVG	30-DAY AVG	7-DAY AVG	DAILY MAX	MEASUREMENT FREQUENCY	SAMPLE TYPE
Flow	50050	Report MGD	Report MGD	***	***	***	Continuous	Totalizing Meter
Biochemical Oxygen Demand, 5-day	00310	651	976	30	45	N/A	1/Week	6-Hr Composite
Total Suspended Solids	00530	651	976	30	45	N/A	1/Week	6-Hr Composite
E. coli Bacteria (*1)	51040	N/A	N/A	126 (*2)	N/A	410 (*2)	1/Week	Grab
Cyanide (WAD) (*4)	00718	Report	N/A	Report	N/A	Report	Once/Quarter	24-Hr Composite
Total Nitrogen ,Ti <13°C (*5, *6, *7)	00600	<195.2	N/A	<9	N/A	< 9 (*8)	Once/2 weeks	24-Hr Composite
Total Nitrogen, Ti ≥ 13°C (*5, *6, *7)	00600	<130.1	N/A	<6	N/A	< 6 (*9)	Once/2 weeks	24-Hr Composite
Total Nitrogen (*5, *15)	00600	21.7	N/A	1	N/A	1.5	Once/Month	24-Hr Composite
Total Phosphorus (*10)	00665	2.2	N/A	0.1	N/A	0.15	Once/Month	24-Hr Composite
Total Thallium (*11)	01059	0.37	N/A	10.87 ug/l	N/A	16.30 ug/l	Once/Month	24-Hr Composite
TRC (*12)	50060	N/A	N/A	N/A	M/A	19 ug/l	Daily	Grab

NPDES Permit No. NM0029165, September 2007

Phosphorus Requirements Below the Limit of Treatment Technology

- **Spokane River D.O. Dissolved Oxygen Total Maximum Daily Load (TMDL)**
  - **CBOD 4.2 mg/L**
  - **Ammonia Nitrogen 0.21 mg/L**
  - **Total Phosphorus 0.036 to 0.042 mg/L**
    - **Best Treatment Technology Capable of TP ~0.050 mg/L**

Point Source Discharge	2027 Projected Flow Rates (MGD)[1]	NH3		TP		$CBOD_5$[2]	
		mg/L	lbs/day (WLA)	mg/L	lbs/day (WLA)	mg/L	lbs/day (WLA)
Liberty Lake	1.5	variable[3]	variable[3]	0.036	0.45	3.6	45.1
Kaiser4	15.4	0.07	9.0	0.025	3.21	3.6	462.7
Inland Empire Paper Company	4.1	0.71	24.29	0.036	1.23	3.6	123.2
City of Spokane	50.8	variable[3]	variable[3]	0.042	17.81	4.2	1780.6
Spokane County (new plant)	8	variable[3]	variable[3]	0.042	2.80	4.2	280.4
Stormwater[5]	2.36	0.05	0.98	0.310	6.1	3.0	59.1
CSO	0.12	1.0	1.0	0.95	0.95	30.0	30.0

Revised TMDL Spokane River Wasteload Allocation, Washington Department of Ecology, September 2009

Nonpoint Source Reduction to Off-set Point Source Loading
Eliminate 15,000 On-site Septic Systems
Water Quality Off-set WAC 173-201A-450

NPDES Permitting Regulations

- **40 CFR 122.45(d) requires that all permit limits be expressed as average monthly limits and average weekly limits for publicly owned treatment works (POTWs) and as both average monthly limits and maximum daily limits for all others, unless *"impracticable."***

Maximum monthly, weekly, and daily limits likely to be exceeded by even the best designed and operated low nutrient treatment facilities

Effluent N and P concentration is highly variable for even the best designed and operated low nutrient treatment facilities

Individual permit writers in every nutrient limited watershed must interpret these NPDES regulations and the definition of "impracticable" with limited guidance

Chesapeake Bay Annual Limits

- **Annual Permit Limits for Nitrogen and Phosphorus for Permits Designed to Protect Chesapeake Bay**
  - ***"…permit limits expressed as an annual limit are appropriate and that it is reasonable in this case to conclude that it is <u>"impracticable"</u> to express permit effluent limits as daily maximum, weekly average, or monthly average effluent limitations."***

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAR 3 2004

OFFICE OF WATER

<u>MEMORANDUM</u>

SUBJECT: **Annual Permit Limits for Nitrogen and Phosphorus for Permits Designed to Protect Chesapeake Bay and its tidal tributaries from Excess Nutrient Loading under the National Pollutant Discharge Elimination System**

FROM: James A. Hanlon, Director
Office of Wastewater Management

TO: Jon Capacasa, Director
Water Permits Division, EPA Region

Rebecca Hanmer, Director
Chesapeake Bay Program Office

This memo responds to your proposal to use National Pollutant Discharge Elimination System (NPDES) permit effluent limits for nitrogen and phosphorus expressed as an annual limit in lieu of daily maximum, weekly average, or monthly average effluent limitations, for the protection of Chesapeake Bay and its tidal tributaries from excess nutrient loading. Based on the information provided by your staff and for the reasons and under the circumstances outlined herein, I concur that permit limits expressed as an annual limit are appropriate and that it is reasonable in this case to conclude that it is "impracticable" to express permit effluent limitations as daily maximum, weekly average, or monthly average effluent limitations. This memo describes the scientific and policy rationales that support this approach.

EPA Region 3 has developed recommended water quality criteria for certain parameters designed to protect water quality in Chesapeake Bay and its tidal tributaries.[1] The main cause of water quality impairment for these parameters in the main stem of the Bay is loading of nutrients, specifically nitrogen and phosphorus, from point and nonpoint sources throughout the entire Chesapeake Bay watershed. The States are in the

[1] See EPA's <u>Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity and Chlorophyll for the Chesapeake Bay and Its Tidal Tributaries, April 2003</u>. "Chesapeake Bay and its tidal tributaries" is the portion of the Chesapeake Bay watershed subject to the ebb and flow of ocean tides. This area encompasses all of the mainstem Bay and the area north and east to the fall line. The fall line is a physical barrier on the Bay's larger tributaries marked by waterfalls and rapids.

Internet Address (URL) • http://www.epa.gov

Jim Hanlon, Office of Wastewater Management, March 3, 2004

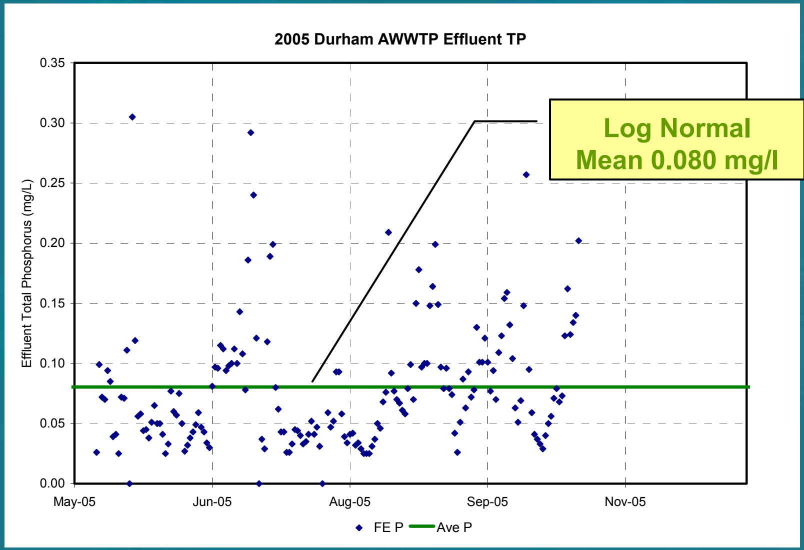
Variety of Permit Structures Nationally

- **Concentration Only, Mass Only, Both**
  - **Seasonal Limits**
  - **Mean or Median**
  - **Shared Capacity**

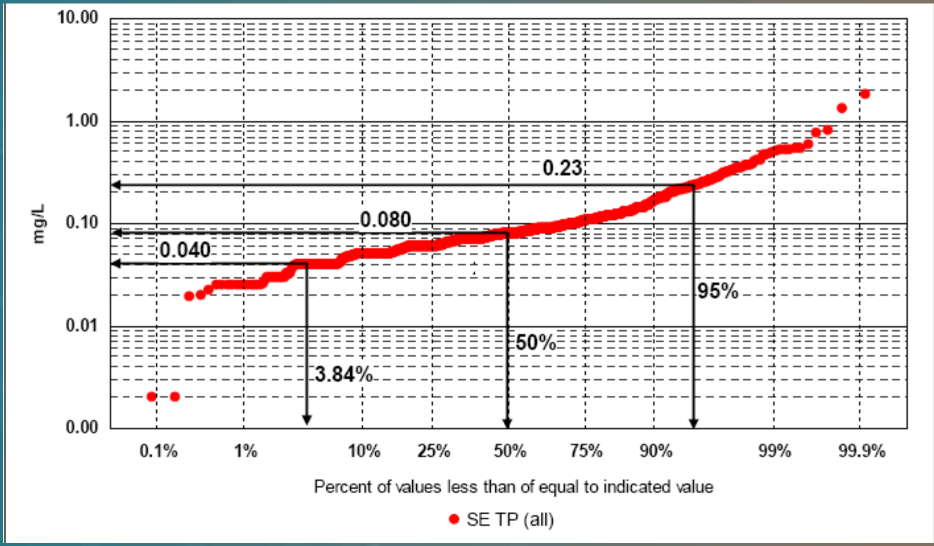
Location	Total Phosphorus Limits	Comments
Clean Water Services of Washington County, OR	0.100 mg/l	Monthly Median, May 1 to Oct 31 Watershed Permit
Las Vegas, Clark County, Henderson, NV	334 lbs/day (130/174/30 lbs/day)	Mar 1 to Oct 31 Cooperative Agreement to Share for Flexibility
Alexandria, VA	0.18 mg/l and 37 kg/day 0.27 mg/l and 55 kg/day	Monthly Average Weekly Average

Discharge Permits that Make Sense for Nutrients

- **Performance Achieved by a Technology Under Specific Conditions and Expressed in Statistical Terms**
  - **Lowest Technology Can Achieve**
  - **Full Scale Plant Performance**



Daily Effluent Phosphorus Concentration, Clean Water Services, OR Durham Plan, 2005



Probability Scale Plot of Effluent Phosphorus Data Showing 3.84th, 50th, and 95th Percentiles

Recommendations for Consideration

Puget Sound Mud Monster

Spokane River, WA Treatment Technology Workshop

Wastewater Utilities

Capabilities

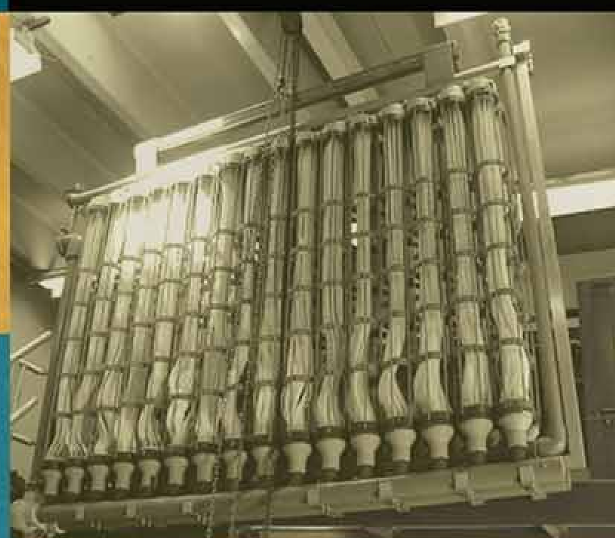
- Effective Technologies for Nutrient Removal
- Predictable Nutrient Removal Performance
- Continuing Innovation
- Sustainable Designs

Needs

- Predictable Future for Facilities Planning
  - 20 Year Capital Improvement Programs
- Balanced Regulatory Framework
- Practical Consideration of Limit of Treatment Technology
- NPDES Compliance Schedules Spanning Multiple 5-Year Cycles

WESTCAS 2009 Fall Conference

National Nutrient Standards



David L. Clark

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October 29, 2009

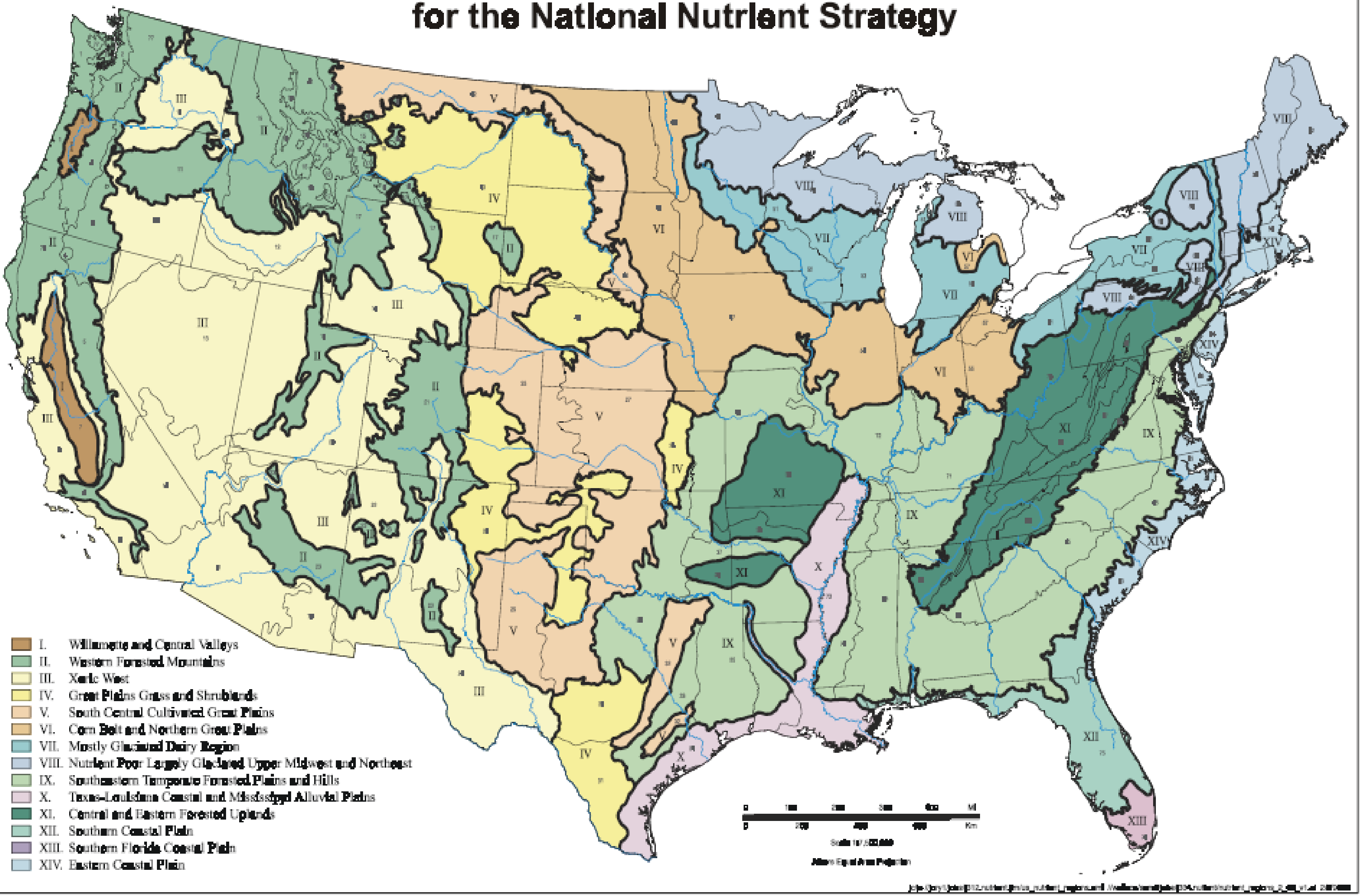
HDR

Regulatory Challenges

- ***Unfortunately…***
  - Current Regulations Present Challenges in Practice
    - Disproportionate Regulation of Point Sources
    - No Specific Process to Balance Broader Considerations
- **Clean Water Act**

- ***Good News!***
  - No Prohibition on Sustainable Design
  - Convergence of Technologies
  - Watershed Opportunities
    - Locally Balanced Decisions
    - Voluntary Nonpoint Source Reduction

Draft Aggregations of Level III Ecoregions for the National Nutrient Strategy



Aggregate Level III Ecoregion -- South Central Cultivated Great Plains V

Rivers and Stream in Nutrient Ecoregion V (25th percentile)

Nutrient Parameter	Aggregate Nutrient Ecoregion V Reference Conditions
Total Phosphorus (mg/L)	0.067
Total Nitrogen (mg/L)	0.88
Chlorophyll a (ug/L)	3
Turbidity (FTU)	7.83

Lakes and Reservoirs in Nutrient Ecoregion V (25th percentile)

Nutrient Parameter	Aggregate Nutrient Ecoregion V Reference Conditions
Total Phosphorus (mg/L)	0.033
Total Nitrogen (mg/L)	0.56
Chlorophyll a (ug/L)	2.3
Turbidity (FTU)	1.3

- **Northeastern Colorado (including Fort Collins, Boulder and Denver)**

Aggregate Level III Ecoregion -- Great Plains Grass and Shrublands IV

Rivers and Stream in Nutrient Ecoregion IV (25th percentile)

Nutrient Parameter	Aggregate Nutrient Ecoregion IV Reference Conditions
Total Phosphorus (mg/L)	0.023
Total Nitrogen (mg/L)	0.56
Chlorophyll a (ug/L)	2.4
Turbidity (FTU)	4.21

Lakes and Reservoirs in Nutrient Ecoregion IV (25th percentile)

Nutrient Parameter	Aggregate Nutrient Ecoregion IV Reference Conditions
Total Phosphorus (mg/L)	0.020
Total Nitrogen (mg/L)	0.44
Chlorophyll a (ug/L)	2
Turbidity (FTU)	2

- Southeastern Colorado (including Colorado Springs)

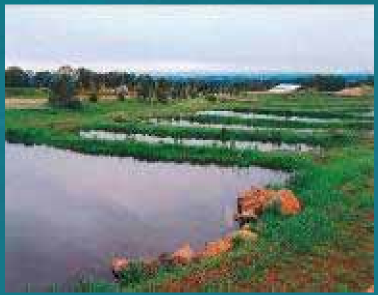
New USDA Office of Ecosystem Services and Markets

- **Conservation and Land Management Environmental Services Board**
  - **Assess Environmental Benefits**
  - **Promote Markets for Ecosystem Services**
    - **Carbon Trading**

Secretary of Agriculture, Tom Vilsack, speaks at a Conservation Reserve Enhancement Program (CREP), April 24, 2009

Convergence of Technologies

- Reclaimed Water Reuse
  - Effluent Filtration for Low Phosphorus
  - Standards for Reclaimed Water
  - Recycles Nutrients
- New Options for Effluent Management
  - Appropriate Discharge Permit Structure
    - Avoid Disincentives
- Microconstituents, EDCs, PPCPs
  - Existing Treatment Technologies Effective on Many Compounds
  - Not All Processes Equal!
  - Activated Sludge
    - Potential for large removals
      - Enhanced by Longer SRT
  - MBR or Membrane filtration
    - Enhanced solids removal



Endocrine Disrupting Compounds and Implications for Wastewater Treatment. WERF 04-WEM-6. 2005

Removal of Endocrine Disrupting Compounds In Water Reclamation Processes. WERF 01-HHE-20T. 2006.

H.R. 2454 American Clean Energy and Security Act of 2009 Passes House

- **Cap and Trade Program**
  - **Greenhouse Gas Reduction**
    - **17% from 2005 levels by 2020**
    - **83% by 2050**
- **Limiting Emissions from Industry**
  - ***Agriculture excluded from the cap***
- **Tighter Standards on New Coal-fired Power Plants**
- **Electric Utilities**
  - **12% from renewable sources**
  - **8% energy-efficiency savings**
- **Offset Projects**
  - **Tree Planting and Forest Protection**
- **Rebates and Credits to Low-income Households**

City of Las Vegas, NV Las Vegas Wash

Table I.3

Constituent	City of Las Vegas IWLA	Clark County Sanitation District IWLA	City of Henderson IWLA	ΣWLA
Total Phosphorus as P	130 lb/day	174 lb/day	30 lb/day	334 lb/day, Note: This WLA only applies March 1 - October 31; no limit applies the rest of the year.
Total Ammonia as N	379 lb/day	502 lb/day	89 lb/day	970 lb/day, Note: This WLA only applies April 1 - September 30; no limit applies the rest of the year.

I.A.2. **Waste Load Allocation (WLA)** The Permittee is authorized to discharge the waste loads listed in Table I.3. for Total Phosphorus as P and Total Ammonia as N, to the Las Vegas Wash. The WLA applies to the combined loading from Outfalls 001 and 002. This permit condition constitutes a cooperative agreement between the City of Las Vegas, Clark County Sanitation District, and City of Henderson (hereinafter dischargers) to allow discharge flexibility. Each facility has an **Individual Waste Load Allocation (IWLA)** and there is a **Sum of Waste Load Allocations (ΣWLA)** defined below for the three facilities. Treatment facilities which are used to attain a waste load allocation are not required to be operated when not needed to meet that allocation.

a. The Permittee shall be considered in compliance if **either**:

i. The Permittee does not exceed the **IWLA** listed below or the **IWLA** in effect due to transfers, **or**

ii. The **Sum of the Waste Load Allocations (ΣWLA)** listed below is not exceeded.

- **Mass Only**
- **Seasonal**
- **Shared Wasteload Allocation**

Definition of Reasonable Economic Hardship Thresholds

- **Federal Reference Points**
  - **“Substantial”**
  - **“Widespread”**
- **EPA Recommendations**
  - **“Substantial”**
    - **“Municipal Preliminary Screener”**
      - **Mean Total Pollution Control Cost per Household/Median Household Income**
    - **MPS < 1% Cost Bearable**
    - **MPS 1% to 2% Midrange Impact**
    - **MPS > 2% Unreasonable Cost**
  - **“Widespread”**

"Municipal Preliminary Screener" 1% to 2% Midrange Impact

City	Monthly Rate, $/Mo	Median 2004 Household Income, $/Yr	2% Median Income, $/Mo	Increase Over Existing Rates, %
Branson	$17.20	$31,919	$53	209%
Independence	$22.30	$42,351	$71	217%
Jefferson	$17.82	$47,715	$80	346%
Ozark	$31.22	$43,231	$72	131%
Springfield	$14.57	$36,887	$61	322%

- Example Threshold for Economic Hardship @ 2% of Median Household Income
  - *Little Comfort That "Substantial" and "Widespread" Economic Thresholds Reflect Expectations for Reasonable Wastewater Rates*