



DEPARTMENT OF
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State of Washington

Industrial Stormwater Discharges to Impaired Water Bodies

Options for Numeric Effluent Limitations

Report to the Legislature



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Industrial Stormwater Discharges to Impaired Waterbodies

Options for Numeric Effluent Limitations

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Abstract/Executive Summary

The federal Clean Water Act requires that all states restore their waters to be “fishable and swimmable.” The Clean Water Act established a process to identify and clean up polluted (impaired) waters. All states are required to prepare a “303(d)” list of impaired waterbodies.

This report is submitted to fulfill RCW 90.48.555(7)(b), the Washington State Water Pollution Control Act, which requires the Department of Ecology to report to the legislature how numeric effluent limitations for industrial stormwater discharges will be implemented by May 1, 2009.

The report provides two options for deriving appropriate water quality based numeric effluent limitations for dischargers to water bodies listed as impaired according to the Clean Water Act. Option 1 involves setting *generic limits* based on generalized information; Option 2 involves *site-specific limits* based on the characteristics of the site and receiving waterbody. Depending on the assumptions used to identify which facilities are subject to numeric effluent limitations, the number of affected facilities (and workload) is significantly different. Therefore, Ecology’s preferred option is different, depending on the underlying assumptions used.

Ecology recommends the assumption that numeric effluent limits should only apply to facilities that could contribute to further impairment of the 303(d)-listed waterbody they discharge to. This would significantly reduce the number of facilities requiring limits, and allow Ecology to derive numeric effluent limitations using *site-specific information*. Limits based upon site-specific information would typically result in more appropriate discharge limitations to protect water quality.

The report identifies the approximate number of dischargers to impaired water bodies under Ecology’s proposed 2008 303(d) list of impaired waterbodies. Where possible, an assessment of anticipated rates of compliance is provided.

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Industrial Stormwater Discharges to Impaired Waterbodies on the Washington State 303(d) List

Options for Establishing Numeric Effluent Limitations

Background

Clean Water Act and the 303(d) List

The federal Clean Water Act, adopted in 1972, requires that all states restore their waters to be “fishable and swimmable”. The Clean Water Act established a process to identify and clean up polluted waters. Every two years, all states are required to prepare a list of water bodies that do not meet water quality standards. This list is called the *303(d) list* because the process is described in Section 303(d) of the Clean Water Act.

Waters placed on the 303(d) list require the preparation of Total Maximum Daily Loads (TMDLs), a key tool in the work to clean up polluted waters. TMDLs identify the maximum amount of a pollutant to be allowed to be released into a waterbody so as not to impair uses of the water, and allocate that amount among various sources. In addition, even before a TMDL is completed, the inclusion of a water body on the 303(d) list can reduce the amount of pollutants allowed to be released under permits issued by Ecology.

Ecology’s assessment of which waters to place on the 303(d) list is guided by federal laws, state water quality standards, and the Policy on the Washington State Water Quality Assessment (PDF). In the previous 303(d) lists, the primary water quality problems in our state’s waters were temperature and fecal coliform bacteria. Both are generally associated with nonpoint source pollution – that is, pollution which comes from many diffuse sources, not just from the end of a pipe.

Temperature is significant for the health of aquatic life. Salmon, especially, and other fish need cooler temperatures to survive and spawn. High temperatures can occur due to the discharge of hot water from power plants and industrial sources or, more often, from loss of vegetation along streams that used to shade the water and from new land uses (buildings and pavement) from which rainfall picks up heat before it runs off into the stream.

Fecal coliform bacteria are significant for human health as an indicator of the presence of disease-carrying organisms. It commonly comes from livestock, pet waste and failing septic tanks.

Other water quality problems which lead to 303(d) listings in Washington State include:

- Toxic substances from industrial and other sources, which can collect in sediments on the bed of the water or in the tissues of aquatic life.

- Erosion from roads, construction, and agriculture, which increases sediment in streams that can cloud the water and cover aquatic habitat.
- Too much organic waste decaying in the water, which can lower the levels of dissolved oxygen that fish and other aquatic creatures need to survive.
- Excessive nutrients, such as phosphorus and nitrogen, are the primary problem in Washington's lakes. Sources include irrigated agriculture, gardening practices, and urban and suburban property development. The nutrients cause algae and other aquatic plants to grow in lakes, which deprive aquatic life of vital oxygen. Algae can also make lakes unusable for recreation.

Washington State Water Pollution Control Act: RCW 90.48

RCW 90.48.555 requires the Department of Ecology (Ecology) to develop appropriately derived water quality based numeric limits for discharges regulated by the Industrial Stormwater General Permit (ISWGP) to 303(d)-listed waters under the Federal Clean Water Act (33 U.S.C. SEC. 1313 (d)).

Specifically, RCW 90.48.555(7) states:

(a) The department shall modify the industrial storm water general permit to require compliance by May 1, 2009, with appropriately derived numeric water quality-based effluent limitations for existing discharges to water bodies listed as impaired according to 33 U.S.C. Sec. 1313(d) (Sec. 303(d) of the federal clean water act, 33 U.S.C. Sec. 1251 et seq.).

(b) No later than September 1, 2008, the department shall report to the appropriate committees of the legislature specifying how the numeric effluent limitation in (a) of this subsection would be implemented. The report shall identify the number of dischargers to impaired water bodies and provide an assessment of anticipated compliance with the numeric effluent limitation established by (a) of this subsection. (RCW 90.48.555(7))

Ecology is submitting this report to fulfill the requirements of RCW 90.48.555(7)(b).

Timing of Report In Relation To Other Regulatory Processes

At the time of this report, Ecology is actively working with an external stakeholder advisory committee to develop a new ISWGP that will be issued in 2009, and remain in effect for the next 5 years.

In addition, the current 303(d) list of impaired waterbodies is about to be replaced. The proposed 2008 303(d)-list is currently being reviewed by EPA, and it may be approved within the next month. *For purposes of this report, Ecology used the proposed 2008 303(d) list. However, EPA's review could change the types and locations of 303(d)-listed waterbodies that trigger numeric effluent limits for industrial stormwater dischargers, i.e., some 303(d) water bodies could be added, and others could be removed. In particular, it is likely that as many as 200 sediment quality listings will be removed from the final list, based on EPA's review.*

Water Quality Program Funding Inadequate to Meet Statutory Requirements

Inadequate funding and staff resources have prevented the Department of Ecology Water Quality Program from meeting the statutory deadlines in RCW 90.48.555(7). The statute requires Ecology to modify the industrial stormwater general permit by May 1, 2009 to require compliance with numeric effluent limitations. Inadequate funding (permit fees) has caused a reduction in program staff and, as a result, the May 1, 2009 deadline will not be met. Ecology expects to issue the next version of the industrial stormwater general permit in September 2009, which will include the effluent limitations required by RCW 90.48.555(7)(a).

The same shortfall in funding and staffing levels has contributed to the Water Quality Program's failure to submit *this* report the legislature by September 1, 2008 (RCW 90.48.555(7)(b) – the report is being submitted approximately 4 months late.

How Big Is The Problem of Impaired Waterbodies?

Ecology's assessment of which waters to place on the 303(d) list is guided by federal laws, state water quality standards, and the Policy on the Washington State Water Quality Assessment (PDF). Waterbodies placed on the 303(d) list generally fall into four categories, based on the type of sampling used to demonstrate impairment (pollution):

- Chemical sampling indicating *pollution directly in the waterbody*, or water column;
- Sediment sampling, indicating *contaminated sediment*, at the bottom of a waterbody;
- Fish surveys, indicating that the waterbody has *fish with contaminated tissue*; and
- Bioassessment, or *biological surveys* of aquatic invertebrate communities.

Impairment Based on Sampling in the Water Column

Most waterbodies on the state's 303(d) list were assessed based upon water quality data that shows violations of the numeric state water quality criteria (Surface Water Quality Standards WAC 173-201(A)). These pollutant parameters are measured directly in the water column, and include:

- Bacteria
- Dissolved Oxygen
- pH
- Total Phosphorus in Lakes
- Temperature
- Total Dissolved Gas
- Toxic Substances (Metals, Pesticides, Ammonia, etc.)
- Turbidity

Over 1,100 facilities are currently covered under the Industrial Stormwater General Permit. Based on a review of the proposed 2008 303(d) list, approximately 172 of these facilities discharge to a 303(d)-listed waterbody that was listed based on documented violations of the state's numeric water quality criteria (WAC 173-201(A)).

- Most of these facilities (100+) discharge to waterbodies impaired due to high temperature, high bacteria, and low dissolved oxygen.
- Approximately 37 facilities discharge to waterbodies impaired due to high pH.

- Approximately 6 facilities discharge to waterbodies impaired due to toxic substances, including ammonia, copper, zinc, mercury, and pentachlorophenol.
- Approximately 2 facilities discharge to waterbodies impaired due to excessive total phosphorus.

Impairment Based on Contaminated Sediment

The proposed 2008 303(d) list contains approximately 411 locations where freshwater or marine waterbodies contain contaminated sediments. At the time of this report, EPA is reviewing the proposed list and has indicated that as many as half of these locations will be removed from the final 2008 303(d) list. Therefore, Ecology is not able to provide a reliable estimate of the number of facilities discharging to waterbodies impaired due to contaminated sediment. As a point of reference, approximately 63 facilities covered under the current Industrial Stormwater General Permit discharge to sediment contaminated waterbodies on the 2004 303(d) list. The 2004 303(d) list will be superseded when EPA approves the 2008 303(d) list.

Impairment Based on Contaminated Fish Tissue

Based on a review of the proposed 2008 303(d) list, approximately 22 facilities covered under the Industrial Stormwater General Permit discharge to a 303(d)-listed waterbody that was listed based on data showing elevated levels of pollutants in fish tissue. These pollutants include organic compounds such as Polychlorinated biphenyls (PCBs), alpha-BHC, DDT and Dieldrin.

Impairment Based on Bioassessment

Based on a review of the proposed 2008 303(d) list, approximately 8 facilities covered under the Industrial Stormwater General Permit discharge to a waterbody that was placed on the 303(d) listed due to bioassessment. Bioassessment is a survey of benthic invertebrates in the waterbody. Benthic invertebrates are organisms that live on the bottom of a water body (or in the sediment) and have no backbone. The abundance, diversity and species composition of benthic invertebrates can be used as indicators of changing environmental conditions. Waterbody impairments based on bioassessment are typically attributed to:

- Physical alterations to the waterbody (e.g., streambed gravel smothered with fine sediment), or
- Pollution in the waterbody (e.g., toxic chemicals, low dissolved oxygen, etc).

Options for Establishing Numeric Effluent Limitations

Ecology has evaluated two options for establishing water quality based numeric effluent limitations under the Industrial Stormwater General Permit. These options are described below:

Option 1: Use General Information to Derive Limits

Under *Option 1*, Ecology would establish “generic” water quality based numeric effluent limits using regional or statewide assumptions of the discharge and receiving water characteristics.

This is in contrast to how Ecology would derive water quality based numeric effluent limitations for individual discharge permits, with procedures to account for site-specific information, such as:

- Potential dilution (how discharge mixes into receiving waterbody),
- Ratio of dissolved metals to total metals (dissolved metals may be toxic to organisms) ,
- Background concentration of the pollutants being discharged,
- Hardness (dissolved calcium and magnesium - affects toxicity of metals), and
- pH (acidity or alkalinity).

This site-specific analysis may require the discharger to collect and submit water quality data from the discharge and receiving waterbody, which can add considerable time and cost to the process.

If deriving limits for hundreds of facilities around the state, it would not be feasible for Ecology to conduct site-specific analysis to develop different numeric limits for each site. The overall workload would be unmanageable under current funding and staffing levels. Under *Option 1*, Ecology would derive effluent limits using statewide assumptions of discharge characteristics, receiving water characteristics, and applicable water quality standards.

Option 2: Use Site-specific Information to Derive Limits

Under *Option 2*, Ecology would establish site-specific water quality based numeric effluent limits using site-specific information about the discharge and receiving water characteristics. The methodology would be similar to how effluent limits in individual waste discharge permits are derived.

Ecology’s Permit Writers Manual includes a process for establishing water quality-based effluent limits for individual wastewater dischargers. Ecology’s process is based upon the process developed by the United States Environmental Protection Agency (EPA) for deriving water quality-based numeric effluent limitations.

The Impact of Basic Assumptions on Ecology’s Preferred Option

The ability of Ecology to implement Option 1 (generic limits) and Option 2 (site-specific limits) is dependent on the set of assumptions used to determine which industrial facilities require limits. The following section describes the how different sets of assumptions about the “pollutants of concern” have a significant effect the number of facilities that require effluent limitations. The number of affected facilities has workload implications that directly influence Ecology’s preferred option.

Assumption A: Limits Applied to All Facilities Discharging to 303(d) Waterbodies

If limits are required for all 200+ facilities discharging to waterbodies on the 303(d) list, *regardless of the type of 303(d) listing*, it would be necessary to implement *Option 1*, and make generalized assumptions about discharge and receiving water characteristics, resulting in limits that are generic (rather than site-specific). It would be very time consuming and costly to implement *Option 2* and derive site-specific limits for hundreds of facilities using the

methodology used for individual waste discharge permits (receiving water studies, engineering reports, etc.).

- ***Under “Assumption A” Ecology prefers Option 1: Derive limits based on generalized information***

Assumption A/Option 1: Number of Affected Facilities and Expected Compliance Rates

Under Assumption A/Option 1, limits would be required for all facilities discharging to waterbodies on the 303(d) list, *regardless of the type of 303(d) listing.*

Table 1 provides an assessment of the number of facilities subject to limits under Assumption A (limits for all 303(d) discharges) using Option 1: generic limits based on generalized information and the applicable water quality standards (WAC 173-201A and National Toxics Rule). Expected compliance rates are provided where possible, based upon a review of aggregate DMR data submitted by industrial facilities under the previous permit cycle.

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Listed Parameter/ Parameter Monitored	Approximate Number of Facilities Subject to Limits	Water Quality Based Numeric Effluent Limitation	Expected Compliance Rates
4,4'-DDD	2	1.1 µg/L	unknown
Alpha-BHC	2	0.0039µg/L	unknown
Bioassessment	8	TBD	unknown
Chlorinated Pesticide	4	TBD	unknown
Copper/Copper	1	11.9 ug/L	33.99%
DDT	7	1.1 µg/L	unknown
Dissolved Oxygen	85	BOD5 11 mg/L	TBD
Mercury/Mercury	1	2.1 µg/L	100%
pH/pH	37	6.0 – 9.0 s.u.	87.11%
Fecal Coliform Bacteria	100	14 colonies/100 ml	TBD
High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAH)	11	TBD Per <i>National Toxics Rule</i>	unknown
PCB	21	0.014 µg/L	unknown
Temperature	32	TBD per <i>WAC 1730-201A</i>	unknown
Total Phosphorus/ Total Phosphorus	2	10 µg/L	99.05%
Total Ammonia/ Total Ammonia	1	10 µg/L	98.09%
Sediment Quality	TBD	30 mg/L TSS ¹	61.58%
Pentachlorophenol	1	9 µg/L	No Data; estimate 100%
Zinc/Zinc	1	109 ug/L	51.13%

Table 1. Assessment of facilities discharging to 303(d) water bodies subject to numeric effluent limitations, and expected compliance rates.

¹For discharges to waterbodies impaired for sediment quality, Ecology is proposing a 30 mg/L Total Suspended Solids (TSS) limit, as a surrogate for the specific chemical compound causing contamination.

Assumption B: Apply Limits Only To Facilities That May Cause or Contribute To Water Quality Impairment

If Ecology were to use the basic assumption that numeric effluent limits only apply to facilities discharging to impaired waterbodies that were “listed” due to pollutants that are typically present in industrial stormwater discharges, a more site-specific approach could be used to derive numeric effluent limitations.

Under this assumption, limits would not be required for the discharges to the following types of 303(d)-listed waterbodies:

- *Temperature.* Numeric effluent limits would not apply to waterbodies listed for temperature. The rationale is that temperature is a “seasonal” water quality problem, and considering weather patterns in Washington State, stormwater discharges typically do not occur during the late summer months when temperature impaired waterbodies are relatively warm and more susceptible to thermal loading (discharges of heated water).
- *Fecal Coliform.* Numeric effluent limits would not apply to waterbodies listed for fecal coliform bacteria, unless the industrial facility is determined by Ecology to be a source fecal coliform bacteria to the receiving water (e.g., compost facilities, facilities with guard dogs, etc.). This determination would be based upon information collected on the permit application form and/or facility-specific information collected by Ecology.
- *Low Dissolved Oxygen.* Numeric effluent limits would not apply to waterbodies listed for low dissolved oxygen (D.O.). Low D.O. impairments are seasonal (summer) problems, while stormwater discharges in Washington commonly occur from November through April. Low D.O. impairments are typically attributed to:
 - Heavy loading of nutrients (e.g., nitrogen or phosphorus) that cause excessive algae and plant growth, the decay of which depletes oxygen levels in the summer-time (eutrophication), or
 - Excessive discharges of wastewater or other substances with a high biochemical oxygen demand, expressed as BOD₅ - a test to see how fast biological organisms use up oxygen in a waterbody. These kinds of pollutants have a “far field” effect – which means the demand for oxygen doesn’t occur directly where the effluent or runoff water is discharged; it occurs somewhere downstream where decomposition finally occurs. This can make it difficult to show a direct relationship between the discharge of oxygen demanding substance and a low D.O. problem without site-specific water quality modeling.
- *Fish Tissue/Bioassessment.* Numeric effluent limits would not apply to waterbodies 303(d)-listed due contaminated fish tissue (e.g., PCBs, DDT, etc.) or bioassessment (surveys of benthic invertebrate communities). It would be extremely difficult to show a direct relationship between stormwater discharges and impairments due to contaminated fish tissue or bioassessment.

If limits are not imposed on facilities that discharge to waterbodies impaired due to factors other than stormwater (and not likely to be further degraded by stormwater), the number of affected

facilities would drop significantly and it would be more practical for Ecology to implement *Option 2* and derive appropriate limits based on site-specific information.

- ***Under “Assumption B” Ecology prefers Option 2: Derive limits based on site-specific information.***

Assumption B/Option 2: Number of Affected Facilities and Expected Compliance Rates

As described above, discharges to waterbodies listed for temperature, and low dissolved oxygen, would not trigger a numeric effluent limitation. Discharges to waterbodies impaired for fecal coliform bacteria would only be required if the industrial facility is a potential source of bacteria (e.g., compost facilities, facilities with guard dogs, etc.). In addition, 303(d) listings related to contaminated fish tissue (e.g., PCBs, DDT, etc.) or bioassessment (surveys of benthic invertebrate communities), would not trigger numeric effluent limitations. However, 303(d) listings for all other pollutant parameters would result in numeric effluent limitations.

Table 2 provides an assessment of the number of facilities subject to limits under Assumption B/Option 2. Several of these limits would require site-specific information to calculate the applicable discharge concentration. Where possible, the approximate numeric effluent limitation is provided. The expected compliance rates for copper, TSS, pentachlorophenol, and zinc are unknown at this time; for other parameters, expected compliance rates are based upon a review of aggregate discharge monitoring report (DMR) data from the last permit cycle.

Listed Parameter/ Parameter Monitored	Approximate Number of Facilities Subject to Limits	Water Quality Based Numeric Effluent Limitation	Expected Compliance Rates
Copper	1	Site-specific ⁴	unknown
Mercury	1	2.1 ug/L	100%
pH	37	6.0 – 9.0 s.u.	87%
Fecal Coliform Bacteria	TBD	TBD	TBD
Total Phosphorus	2	10 µg/L	99%
Total Ammonia	1	10 µg/L	98%
Sediment Quality	TBD ¹	TSS 30 mg/L ²	unknown
Pentachlorophenol	1	Site-specific ³	unknown
Zinc	1	Site-specific ⁴	unknown

Table 2. Assessment of facilities discharging to 303(d) water bodies subject to numeric effluent limitations, and expected compliance rates.

¹EPA is currently reviewing Ecology’s proposed sediment quality listings, and is expected to remove approximately 200 sediment listings from the final 303(d) list. Therefore, it is not possible to predict the number of facilities that may be subject to limits at this time.

²It would be difficult to calculate an appropriately derived limit for the chemical parameter causing sediment contamination (e.g., DDT, PCB, etc.). Therefore, Ecology is proposing a 30 mg/L Total Suspended Solids (TSS) limit as a surrogate for the specific chemical compound causing contamination.

³ pH dependant limit based on: ($\leq e^{[1.005(\text{pH}) - 4.830]}$) based on Surface Water Quality Standards (WAC 173-201A)

⁴ Hardness dependant limit based on Surface Water Quality Standards (WAC 173-201A)

Conclusion

This report summarizes two options to meet the requirements of RCW 90.48.555(7)(a): Option 1 involves setting generic limits based on generalized information; Option 2 involves site-specific limits based on the characteristics of the site and receiving waterbody. Depending on the assumptions used to identify which facilities are subject to numeric effluent limitations, Ecology's preferred option is different.

Ecology recommends using *Assumption B* – in which numeric effluent limits only apply to facilities discharging to impaired waterbodies that were “listed” due to pollutants that are typically present in industrial stormwater discharges at concentrations that could cause further impairment of the waterbody. This would allow Ecology to derive numeric effluent limitations using *Option 2 – site-specific information*. This will result in limitations that are based upon the facilities discharge characteristics and receiving waterbody characteristics.

If *Assumption A* is used – in which numeric effluent limits would apply to *all* facilities discharging to 303(d) listed waters (even those not discharging pollutants that contribute to impairment), Ecology would recommend *Option 1 – generic limits*, based on generalized information and assumptions about “typical” discharge and receiving water characteristics.

Ecology will continue to work with the external advisory committee on the development of the limits that will be included in the draft permit which is expected to be released for public comment in May 2009. Following the public comment period, Ecology will prepare a response to comments and make appropriate changes, and issue the final permit in September 2009.

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