Water Quality Trading in NPDES Permits
Internal Management Directive

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State of Oregon
Department of
Environmental
Quality

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Disclaimer

The recommendations contained in this internal management directive should not be construed as requirements of rule or statute. It is not meant to limit potential trades but rather to define concepts, explain eligibility, and describe specific trading scenarios that DEQ anticipates and generally supports. The reader should note that all specific trading proposals will be evaluated on a case-by-case basis; however, proposals that are consistent with this internal management directive should be approved with minimal oversight by DEQ staff.

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Water Quality Trading in NPDES Permits Internal Management Directive

1. Introduction

1.1 Focus of the IMD

Purpose

The purpose of this internal management directive (IMD) is to provide DEQ staff with a consistent framework for evaluating water quality trades implemented through the National Pollutant Discharge Elimination System (NPDES) permit program. DEQ supports and encourages water quality trading in NPDES permits as well as the development of trading in other water quality programs provided trading activities do not result in adverse ecological consequences, address the source or sources of the problem, and do not circumvent minimum federal and state treatment requirements.

This IMD replaces all previous guidance. As DEQ gains more experience with water quality trading issues, the IMD will be modified or new guidance developed as necessary.

Basis for the IMD

This IMD is based on water quality trading policies developed by the Environmental Protection Agency (EPA) and DEQ experiences in Oregon. EPA's 2003 *Water Quality Trading Policy*, 2004 *Water Quality Trading Assessment Handbook*, 2007 *Water Quality Trading Toolkit for Permit Writers*, and other EPA trading guidance may be viewed at: http://www.epa.gov/owow/watershed/trading.htm.

Developed for NPDES permits

This IMD is to be used by DEQ staff primarily to review and guide water quality trades conducted to comply with total maximum daily load (TMDL) wasteload allocations or other requirements in NPDES permits, such as mass load limitations. The IMD is focused on NPDES permittees because DEQ expects the majority of trading activity to be driven by the need to comply with permit requirements. The IMD may also be used as a framework for trading in other situations (e.g., trading for 303(d) listed parameters pre-TMDL or parameters that are not listed as impaired).

Potential use in 401 certifications for hydropower and fill/removal

This IMD may be useful to DEQ staff involved with re-certification of a hydroelectric project and development of watershed approaches to comply with water quality standards. However, it is not intended to provide explicit direction on these types of projects because of legal issues typically associated with hydroelectric projects (e.g., ongoing settlement discussions) and differences between NPDES permit program and Federal Energy Regulatory Commission regulations. This IMD may also be useful to DEQ staff involved with 401 certifications of fill/removal projects; however, DEQ has not yet explored the opportunities for trading within this program.

Issues for further consideration

DEQ's internal Water Quality Trading Workgroup (see Appendix F for DEQ member list) reviewed many issues associated with water quality trading in Oregon for development of this IMD, but not all of them could be included because the workgroup believes they need further consideration as experience is gained from the implementation of this IMD. These issues are listed in Appendix G.

1.2 Water quality trading background

What is water quality trading?

Water quality trading is an innovative approach to achieve water quality goals more efficiently than traditional methods. In the context of the NPDES permit program, water quality trading allows a permittee that discharges wastewater to a stream or river to meet its regulatory obligations by:

- Taking action to create or restore wetlands, floodplains, aquatic habitat, or other instream conditions to reduce the impact of pollutants in their discharge.
- Obtaining equivalent or larger pollutant reductions from another permittee or non-permitted entity.
- Trading discharge loads between multiple outfalls at a single facility.

Note: Water quality trading cannot be used by a permittee to meet existing federal treatment technology requirements unless authorized by CFR. See *Federal treatment technology requirements*, p. 7 for more information.

Legal authority

The Clean Water Act provides authority for EPA, states, and tribes to develop a variety of programs and activities to control pollution, such as water trading. DEQ is using its authority under state law to incorporate provisions for water quality trading through NPDES permits, TMDLs, or watershed plans. These provisions may also be supplemented by or incorporate private contracts between sources or third-party contracts where the third party provides an

indemnification or certification function. In addition, Oregon Revised Statute (ORS) 468B.555 directs DEQ to develop and implement a pollutant reduction trading program as a means of achieving water quality objectives and standards in Oregon in a manner that complies with state and federal water quality regulations and promotes economic efficiency.

Why was water quality trading developed?

Water quality trading programs have been developed throughout the U.S. to address situations with the following characteristics:

- *A driver exists to motivate NPDES permittees to seek pollutant reductions, usually a TMDL or more stringent water quality-based requirement in an NPDES permit.*

- *Pollutants in a water body come from different sources and regulations to control these sources vary.*
  For example, NPDES permits are required by the Clean Water Act for "point source" discharges of wastewater to waters of the U.S. (primarily surface waters), but are not required for many agricultural, urban, and forestry activities (also known as "nonpoint source" activities) that may also contribute pollutants to surface waters. Since regulatory mandates for nonpoint sources are often insufficient to achieve desired results in a water body, a water quality trading program that allows these nonpoint sources to generate credits for sale to NPDES permittees can provide an economic incentive for nonpoint sources to implement new or additional practices to reduce their pollutant load.

- *There are different costs for pollutant sources to remove or reduce the pollutant of concern in a water body.*
  For example, an NPDES permittee may be better equipped or funded to improve its treatment capabilities than another permittee located nearby or additional wastewater treatment for an NPDES permittee may be more expensive to install and operate than a stream restoration project that would achieve the same or greater benefit. A water quality trading program that allows NPDES permittees to use alternative compliance strategies can provide for equivalent or greater pollutant reductions and ancillary benefits to improve watershed health at lower costs.

- *Different pollutant removal or reduction strategies may have ancillary benefits or negative impacts.*
  For example, the cooling of Oregon NPDES permitted wastewater discharges will not result in significant improvement to stream conditions in many areas of Oregon because the discharges are a small part of the overall problem. (Stream warming typically results from a combination of factors, including lack of streamside vegetation to provide for shading, withdrawal or alteration of instream flows, stream channel modifications, and warm wastewater discharges.) However, if wastewater cooling is

required, the operation of cooling technologies (e.g., coolers, chillers) would have negative impacts by significantly increasing greenhouse gas emissions as a result of their power consumption and increased costs for their installation and operation. Alternatively, allowing an NPDES permittee to participate in a water quality trading program where it can mitigate the impacts of its warm discharge with stream restoration efforts can provide for equivalent or greater pollutant reductions and ancillary benefits (e.g., wildlife habitat, floodplain restoration) that are better overall for the environment.

Trading objectives

Consistent with *EPA Water Quality Trading Policy (Jan 2003)*, DEQ encourages water quality trading when it does not result in adverse ecological consequences and supports one or more of the following objectives:

- Achieves early reductions and progress towards water quality standards pending development of TMDLs for impaired waters.
- Reduces the cost of implementing TMDLs through greater efficiency and flexible approaches.
- Establishes economic incentives for voluntary pollutant reductions from point and nonpoint sources within a watershed.
- Reduces the cost of compliance with water quality-based requirements.
- Offsets new or increased discharges resulting from growth in order to maintain levels of water quality that support all designated uses.
- Achieves greater environmental benefits than those under existing regulatory programs. EPA supports the creation of water quality trading credits in ways that achieve ancillary environmental benefits beyond the required reductions in specific pollutant loads, such as the creation and restoration of wetlands, floodplains and wildlife and/or waterfowl habitat.
- Secures long-term improvements in water quality through the purchase and retirement of credits by any entity.
- Combines ecological services to achieve multiple environmental and economic benefits, such as wetland restoration or the implementation of management practices that improve water quality and habitat.

1.3 Examples

Trading in Oregon

DEQ's experience identifying and pursuing water quality trading suggests that trading in Oregon is most likely to occur as a cost-effective, custom solution to a compliance issue or area wide problem; however, trading may also offer opportunities to prevent problems before they occur by compensating for new or increased discharges of pollutants. In Oregon, DEQ has authorized the following water quality trading programs in NPDES permits:

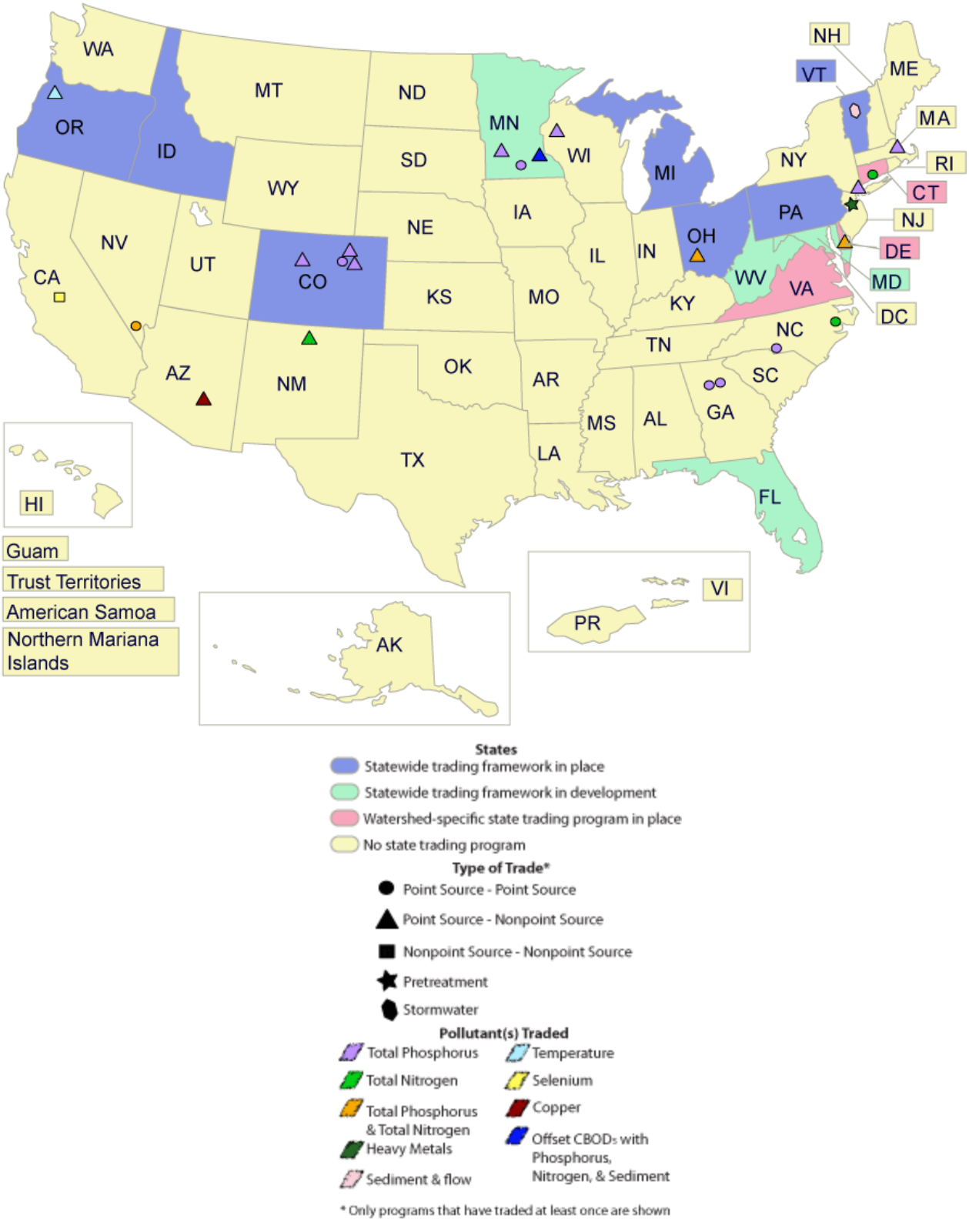
- *Clean Water Services NPDES permit #101141-101144* (http://www.deq.state.or.us/wq/wqpermit/cwspermit.htm)
  To comply with its temperature wasteload allocation from the Tualatin Basin TMDL, Clean Water Services is allowed to purchase temperature credits from nonpoint sources that restore riparian vegetation to increase stream shading, augment instream flows to increase base flows, and trade biochemical oxygen demand (BOD) and ammonia discharge loads between its two treatment plants.

- *Port of St. Helens Port Westward Industrial Site NPDES* Permit #102650
  The Port of St. Helens is allowed to implement riparian vegetation restoration projects to mitigate for heat load effluent limits that were developed to implement the temperature standard for the Columbia River.

Trading activities nationwide

Across the U.S., a variety of successful trading models exist, ranging from single-party/single transaction projects to multi-party/multi-transaction programs. See Figure 1-1 below. Some of these efforts focus on a single pollutant, while others focus on two or more. The following parameters are currently represented among existing or planned programs: ammonia, biological oxygen demand, dissolved oxygen, mercury (pretreatment trading for indirect dischargers), nitrogen, phosphorus, sediment, selenium, and temperature.

Figure 1-1: EPA Identified Water Quality Trading Programs
(http://www.epa.gov/owow/watershed/trading/tradingmap.html, Sept. 12, 2008)
For clarity, figure should be printed in color.



2. Minimum provisions for water quality trading

2.1 Basic requirements

Consistency with existing regulation

Water quality trades and trading programs must be consistent with the Clean Water Act (CWA), Code of Federal Regulation (CFR), Oregon Revised Statutes, Oregon Administrative Rules (OAR), and all other applicable regulations.

Federal treatment technology requirements

Water quality trading cannot be used by a permittee to meet existing federal treatment technology requirements unless authorized by CFR. These federal requirements include EPA secondary treatment standards for publicly-owned treatment works (POTWs) and EPA technology-based effluent limitation guidelines (ELGs) for certain industries. In some cases, trading may be authorized by an ELG. For example, the ELG at 40 CFR §420.03 for the Iron and Steel point source category contain a regulatory mechanism to allow for intra-plant trading of pollutants between outfalls at any single steel mill.

Implementation through enforceable mechanisms

DEQ will authorize water quality trading activities that are conducted to meet regulatory requirements through an enforceable mechanism to ensure accountability for such trades. These mechanisms may include, but are not limited to, a DEQ permit, order, or license.

Mechanisms for determining and ensuring compliance are essential for all trades and trading programs and include a combination of record keeping, monitoring, and reporting requirements. Failure to comply with the monitoring and reporting requirements related to a water quality trading program authorized in an NPDES permit is subject to the enforcement provisions in OAR, CWA, and 40 CFR.

New source or new discharger

If a trade is to be implemented through an NPDES permit for a new source or new discharger and the discharge will cause or contribute to the violation of water quality standards, 40 CFR §122.4(i) requires the following:

> *No permit may be issued to a new source or a new discharger, if the discharge from its construction or operation will cause or contribute to the violation of water quality standards. The owner or operator of a new source or new discharger proposing to discharge into a water segment*

which does not meet applicable water quality standards or is not expected to meet those standards even after the application of the effluent limitations required by sections 301(b)(1)(A) and 301(b)(1)(B) of CWA, and for which the State or interstate agency has performed a pollutants load allocation for the pollutant to be discharged must demonstrate, before the close of the public comment period, that:

(1) There are sufficient remaining pollutant load allocations to allow for the discharge; and

(2) The existing dischargers into that segment are subject to compliance schedules designed to bring the segment into compliance with applicable water quality standards. The Director may waive the submission of information by the new source or new discharger required by paragraph (i) of this section if the Director determines that the Director already has adequate information to evaluate the request.

EPA interprets 40 CFR 122.4(i) to allow for a new source or new discharger to compensate for its entire increased load through trading. (*EPA Water Quality Trading Toolkit for Permit Writers, 2007)*

Public participation

DEQ supports public participation throughout the development of water quality trading programs because stakeholder involvement is necessary for program effectiveness and credibility. In the interest of keeping stakeholders informed about trading in Oregon, DEQ maintains a website (http://www.deq.state.or.us/wq/trading/trading.htm) with designated contacts, current trading policy, and information on trading activities in Oregon.

In addition, public participation is a required element of the NPDES permit program. OAR 340-045-0027 requires that NPDES permit proposals include public notice of the proposal, a minimum 35-day public comment period, and opportunity for public hearing. Public notice on an individual trade is not required, however, if the NPDES permit contains authorization and provisions for acceptable trades and the public was given notice and an opportunity for comment and public hearing at the time permit issuance was proposed.

Public access to information

Information on individual trades, trading programs, trading results, and compliance and inspections reports for specific permittees are available for public review from DEQ upon request.

EPA oversight

Pursuant to the CWA, EPA retains oversight authority of CWA programs implemented by DEQ, including water quality trading. DEQ also coordinates with EPA throughout development of trading programs to ensure consistency with the CWA.

2.2 Compliance with antidegradation policy and anti-backsliding provisions

Anti-degradation policy

40 CFR §131.12 establishes requirements for states to implement a statewide antidegradation policy that, at a minimum, maintains and protects the level of water quality necessary to support beneficial uses. Oregon's antidegradation policy is found in OAR 340-041-0004 and generally prohibits the lowering of existing water quality. The Environmental Quality Commission or DEQ may approve a lowering of water quality in a water body that currently meets all water quality standards (i.e., high quality water) if a demonstration is made that 1) all water quality standards will be met and beneficial uses protected, 2) no other reasonable alternative exists, and 3) the lowering of water quality is necessary for social and economic benefits that outweigh the environmental costs. For more information, see the DEQ *Antidegradation Policy Implementation IMD* at http://www.deq.state.or.us/wq/pubs/imds/antideg.pdf.

Consistent with EPA policy, DEQ believes that no lowering of water quality occurs in the case of new or increased discharge when, as a result of a water quality trade or trading program, there is no net increase of the pollutant being discharged into the water body and the trade(s) do not result in any localized impairments. In addition, an activity conducted to generate credits for trading (e.g., riparian restoration for shading) that is consistent with this IMD will not increase the overall load of pollutants being discharged nor impair beneficial uses; therefore, a lowering of water quality will not occur as a result of such an activity. As a result, the state antidegradation policy is upheld and an in-depth antidegradation review would not typically be required when trading is proposed in an NPDES permit.

Note: As discussed previously, water quality trading cannot be used to meet existing federal treatment technology requirements unless authorized by CFR.

Anti-backsliding

As used in the IMD, anti-backsliding refers to the requirements of CWA §402(o) and 40 CFR §122.44(l) that generally prohibit the renewal, reissuance, or modification of an existing NPDES permit that contains effluent limitations, permit conditions, or standards that are less stringent than those established in the previous permit. The CWA and CFR also establish exceptions to the anti-backsliding prohibitions.

Consistent with EPA policy, DEQ does not view water quality trading to meet a water quality-based effluent limitation as a less stringent effluent limitation provided the permittee is still responsible for the same level of pollutant reduction. Trading offers the discharger an additional means of achieving its limitation and, therefore, is not subject to the anti-backsliding prohibitions.

Note: As discussed previously, water quality trading cannot be used to meet existing federal treatment technology requirements unless authorized by CFR.

2.3 Locations where trading may occur

Geographic scope

Water quality trading is intended to provide opportunities for efficiently achieving and maintaining water quality standards within watersheds, as opposed to cleaning up one watershed at the expense of another. Trading may be allowed across a wide geographic area if the water body to be addressed drains a large area (e.g., the Willamette River) or across a smaller area if the water body is itself small (e.g., an individual stream segment). Generally, the geographic scope of a trading program should be large enough to encompass the universe of sources that contribute to the specific water quality problem that is to be addressed through trading.

High quality waters

High quality waters (HQW) are water bodies that have water quality that meets or is better than all applicable state water quality criteria. [OAR 340-041-0006(41) and 340-041-0026(1)(a)(A)(iii)]

Existing NPDES permittees and nonpoint sources in high quality waters (water bodies that already meet or exceed water quality standards) may use trading to maintain or further improve high quality waters. Trading may also be used to compensate for new or increased discharges of pollutants provided it is consistent with this IMD.

Water quality limited: pre-TMDL

As defined in OAR 340-041-0006(30), *water quality limited waters* are those water bodies that a) do not meet the water quality standards during the entire year or defined season even after implementation of standard technology, b) only meet water quality standards through the use of higher than standard technology, or c) insufficient information exists to determine if water quality standards are being met.

Trading in *pre-TMDL water quality limited waters* for a parameter that is not on the DEQ 303(d) list as impaired would proceed as described in the above section for high quality waters. Trading for a parameter that needs a TMDL may be challenging because it is often difficult to determine the total allowable loading of a pollutant to a receiving water body without the analysis inherent in the TMDL process. DEQ may consider pre-TMDL trading for a 303(d) listed parameter provided the following conditions are met:

1. The existing sources involved conduct an analysis of current pollutant loadings to establish a target or loading cap below current conditions that represents progress in the attainment of water quality standards. This analysis and resulting target or loading cap would be subject to a public notice and review process as well as DEQ review and approval. Such an analysis would likely not be necessary for an existing NPDES permittee to offset its current discharge or a nonpoint source to begin improvements in a basin in anticipation of a TMDL.

2. Trades occur to make progress toward or meet the target or cap, which would result in an overall net reduction of the pollutant load evaluated across the participating sources.

3. The proposed trade achieves direct environmental benefit relevant to the conditions for which the water body is impaired and does not cause or contribute to further impairments of the water body.

For discharges to impaired waters pre-TMDL, trading need not trigger the anti-backsliding provision of CWA §402(o) or the limitations under CWA §303(d)(4) even where the effect of the permit authorizing trading is to allow a greater actual discharge from the facility itself (because of the purchase of credits) than the previous permit issued to the trading point source. Allowing a facility to meet an established WQBEL through trading does not necessarily constitute a *less stringent* effluent limitation as specified in CWA §402(o) if the facility is still responsible for the same level of pollutant reduction. In that case, trading merely offers the discharger an additional means of achieving that limitation and must not result in a net increase in the pollutant discharged to the water body or in a localized impairment. Similarly, allowing a facility to meet a WQBEL through trading does not necessarily constitute a *revised* effluent limit under CWA §303(d)(4)(A) if a facility is still responsible for the same level of pollution reduction. All WQBELs, including those that are subject to CWA §402(o), must meet the requirements of CWA §301(b)(1)(C), which requires that the limitations be set at levels necessary to achieve water quality standards and localized impairments be avoided. (*EPA Water Quality Trading Toolkit for Permit Writers*, Aug 2007)

Once a TMDL is issued, trading agreements made prior to the TMDL that are inconsistent with TMDL requirements will have to be modified. DEQ encourages parties interested in pre-TMDL trading to contact DEQ early in the process to ensure that future revisions to trading agreements as a result of the TMDL do not create disincentives for early action.

Water quality limited: post-TMDL

Trades and trading programs in impaired waters for which a TMDL has been issued by DEQ need to be consistent with the assumptions and requirements upon which the TMDL is established and this IMD. DEQ may include specific trading provisions in the TMDL itself, NPDES permits, watershed plans, or the continuing statewide water quality planning process. TMDLs provide a useful framework for developing trades and evaluating the impact of trading activities.

DEQ does not support any trading activity that would delay implementation of a TMDL or would, over time, cause the combined NPDES permit and nonpoint source loadings to exceed the total loading capacity established by a TMDL.

2.4 Pollutants and parameters that may be traded

DEQ supports and encourages trading for temperature and oxygen demanding substances, which include BOD, ammonia, nutrients, sediment, and total suspended solids. This list is not meant to be exhaustive, but rather reflects where current interests have been expressed. For more information, see the following sections.

Temperature

Temperature trades are supported in Oregon's temperature standard, OAR 340-041-0028, which acknowledges that steam temperatures are influenced by a variety of conditions such as stream shade, channel morphology, groundwater inflows, and stream velocity, volume and flow. As stated in OAR, the temperature standard was developed to encourage restoration and protection of critical aquatic habitat and recognizes that some of Oregon's waters will, in their natural condition, not provide optimal thermal conditions at all places and times that salmonid use occurs. Consistent with the temperature standard, the following are different types of trades that may be developed for temperature.

1. *Temperature trades involving shade*
   DEQ supports trading projects that will result in increased riparian shade in situations where stream temperature problems are partially or wholly due to inadequate riparian shade. The protocols for establishing the value of such trades are described in Appendix A. DEQ has authorized a trading program that includes trades involving shade in the Clean Water Services NPDES permit (see http://www.deq.state.or.us/wq/wqpermit/cwspermit.htm).

2. *Temperature trades involving flow augmentation*
   DEQ supports trades that will result in higher instream flows when this will result in lower temperatures. Trades involving flow augmentation should be evaluated for their potential to contribute to water quality violations in other time periods, as well as for their potential to harm fish. For example, a flow augmentation plan involving pulsed flows from a reservoir could result in fish stranding, which may not be desirable even if the plan were to contribute to improved temperatures. DEQ has authorized a trading program involving flow augmentation consistent with this policy in the Clean Water Services NPDES permit (see http://www.deq.state.or.us/wq/wqpermit/cwspermit.htm). For more information, see Appendix B.

3. *Temperature trades involving improved habitat*
   Streams with elevated temperatures frequently exhibit a loss of cold water refugia and cooling features (e.g., gravel bars) as a result of floodplain

loss and other degraded stream conditions. DEQ recognizes that increasing cold water refugia and improving stream condition can provide benefits to salmonids and other aquatic life to a greater degree than efforts designed to reduce wastewater temperatures. As a result, DEQ supports trading projects that will create areas of improved habitat and localized cooling provided there is adequate modeling or other appropriate demonstrations of their value.

These types of habitat projects may include but are not limited to floodplain restoration, side channel creation, stream restoration, and wetland enhancement or restoration. DEQ is currently evaluating the feasibility of developing protocols to establish the value of these types of projects. The following is a preliminary list of potential approaches to develop temperature credits:

- Correlation of positive changes in salmonid fish capacity and abundance to improved temperatures necessary to support fish life cycles.
- Correlation of increases in floodplain processes (e.g., gravel movement, wetland restoration, floodplain restoration) to historic conditions when instream temperatures were cooler.
- Measurement of lower instream temperatures from hyporheic zones or other cold water refugia.

Until the protocols are developed, DEQ will evaluate proposals for trades involving improved habitat on a case-by-case basis.

Oxygen-demanding parameters

DEQ supports cross-pollutant trading for oxygen-related pollutants, such as biochemical oxygen demand (BOD), carbonaceous BOD, nitrogenous BOD, and ammonia can be used as an indirect measure of NBOD, where adequate information exists to evaluate their impacts on water quality. Trading for ammonia would only be allowed when it can be demonstrated that toxicity from such trades would not occur.

Examples of cross-pollutant trading to offset a downstream biochemical oxygen demand or to improve depressed in-stream dissolved oxygen levels include the following:

- Reducing upstream nutrient levels
- Reducing upstream contribution of oxygen demanding sediments
- Flow augmentation to increase instream flows

Where the interdependency of pollutants is not quantifiable, cross-pollutant trading would only be allowable in situations where ecological benefits are clear.

DEQ has authorized a trading program involving BOD and ammonia that is consistent with this policy in the Clean Water Services NPDES permit (see

http://www.deq.state.or.us/wq/wqpermit/cwspermit.htm); Appendix C contains more information on this type of trade.

Nutrients

DEQ supports trades involving nutrients where adequate information exists to establish and correlate impacts on water quality. DEQ anticipates that the U.S. Department of Agriculture (USDA) National Resource Conservation Services (NRCS) Nutrient Trading Tool will provide a foundation for nutrient trading once the tool is expanded to Oregon. Prior to the tool's availability and evaluation of applicability for nutrient trading in Oregon, Appendix D provides an acceptable methodology for quantifying the pollutant reductions associated with such trades.

Sediment and suspended solids

DEQ is also considering sediment and suspended solids as possible pollutants to include in trading to address sedimentation, dissolved oxygen, nutrient, and mass load limitation issues; however, they are not discussed in detail in this IMD because they have not been fully evaluated. DEQ did develop a correlation between fencing and resulting total suspended sediment and nutrient reductions (see Appendix D), but it has yet to be used. As a result, these types of trades will be evaluated on a case-by-case basis.

2.5 Pollutants not being considered at this time

EPA priority pollutants and Oregon priority persistent pollutants

DEQ recognizes that trading programs may provide incentives for reducing the presence of EPA priority pollutants (Appendix A to 40 CFR Part 423) and Oregon priority persistent pollutants (Senate Bill 737 list) in the environment beyond what can be achieved through current regulation. DEQ also recognizes that there are unique ecological risks and analytic challenges associated with such pollutants; therefore, no trades involving these pollutants are under consideration at this time. DEQ will address this issue when water quality rules or EPA provide more substantive direction and guidance on these types of trades.

Bacteria

DEQ does not anticipate trades involving bacteria. Bacteria such as fecal coliform and *E. coli* are surrogates for disease-causing organisms that could threaten public health. For this reason, DEQ does not consider it reasonable to encourage trades involving bacteria.

2.6 Addressing uncertainty: trading ratios, margins of safety, and monitoring for surrogates

Overview

Uncertainties in trading activities are predominantly associated with the challenges of accurately assessing and monitoring nonpoint source credit generation activities (e.g., riparian shade restoration, livestock fencing, cold water refugia) and their resulting pollutant load reductions. DEQ has identified several different approaches for dealing with the uncertainties that may be encountered in different trading proposals: trading ratios, margins of safety, and monitoring of surrogates. Each approach along with its appropriate application is discussed below.

The method or methods selected to address uncertainties need to fit the circumstances of the trading proposal. DEQ will also consider alternatives to the approaches discussed below if a demonstration can be made that the elements of the proposed trade or watershed trading program are sufficiently conservative to account for uncertainties.

Trading ratios

Trading ratios may be used to compensate for the amount of time necessary for the impact of a trade to take effect. For example, DEQ typically uses a trading ratio of 2:1 to compensate for the time it takes for riparian restoration projects to provide effective shade and to account for the variability inherent in such projects. In general, the practical application of this ratio means that a permittee would need to plant two miles of stream buffer to generate the equivalent of one mile of temperature credit. See *Trading ratio*, p. A-6, in Appendix A: Protocols for Temperature Trading – Riparian Shade Restoration.

In addition, EPA also identifies the following types of ratios that DEQ may choose to develop for future TMDLs or different trading scenarios (excerpt from *EPA Water Quality Trading Toolkit for Permit Writers (2007)*, http://www.epa.gov/owow/watershed/trading/WQTToolkit.html):

- *Delivery or location ratios* are calculated as part of the overall trading ratio for a particular pair of sources to account for pollutant attenuation because of the fate and transport characteristics of a pollutant, the unique characteristics of the watershed (e.g., hydrology, vegetation), distance, and time. This type of ratio accounts for the fact that a pound of a pollutant discharged upstream will not arrive as a pound of a pollutant at a given point downstream.

- *Equivalency ratios* adjust for trading different forms of the same pollutant. One pollutant can exist in different forms. While two sources may discharge the same pollutant, the composition of their discharges

may differ with respect to the forms of the pollutant. Pollutants from different sources can be traded if they have the same effect on the water body of concern or if their effects can be related by some factor.

- *Retirement ratios* can be applied if a goal of the trading program is to accelerate achievement of water quality standards. These ratios *retire* a percentage of all credits generated, and these credits cannot be sold. Therefore, the overall loading to the water body is reduced with each trade that yields net water quality improvement. This form of ratio can be particularly useful in impaired water bodies for which a TMDL has not yet been developed because the exact reductions required of individual sources to achieve water quality standards might not yet be known.

Margins of safety

Margins of safety are an appropriate means for dealing with negative circumstances that have a reasonable likelihood of occurring. For example, DEQ could require greater planting densities or wider buffer widths in riparian shade restoration projects to compensate for low survival rates or high rates of channel migration. DEQ could also require that a permittee use conservative estimates and assumptions if modeling is necessary to determine the impact of a proposed trade.

Monitoring of surrogates

To determine units of trade, DEQ may use surrogate parameters in place of water quality criteria that are inherently variable or difficult to monitor. When a surrogate is allowed, DEQ may also require monitoring to establish the accuracy of the surrogate in representing the parameter for trading purposes as well as its effectiveness at achieving the water quality goal. Regardless of whether a surrogate is used, DEQ will continue to monitor ambient conditions for a TMDL pollutant to assess the overall impact of TMDL implementation by nonpoint sources and NPDES permittees.

For example, instream temperatures vary throughout the day and seasonally as well as spatially in the water column. These temperatures are also influenced by different factors, such as weather, lack of streamside vegetation for shading, instream flow withdrawals, dams, stream channel modifications, and warm wastewater discharges. In these situations, the instream temperature reduction from an individual riparian shade restoration project can be difficult to quantify, especially when other temperature impacts continue. As a result, DEQ has elected to require that permittees monitor plant survival of a riparian shade restoration project rather than instream temperatures and, later as such projects mature, DEQ may elect to require effective shade in lieu of stream temperature. (See Appendix A for more information on riparian shade restoration projects.) DEQ will continue to monitor ambient instream temperatures to assess the overall impact of TMDL implementation by nonpoint sources and NPDES permittees.

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3. Mechanics of water quality credit trading

3.1 Baselines

What is a baseline?

Prior to engaging in water quality trading, DEQ must develop a *baseline* to determine the quantity of a pollutant or *credit* that NPDES permittees or nonpoint sources may *buy* or *sell*. The baselines for trading are permit limits for NPDES permittees or required management practices for nonpoint sources that apply in the absence of trading. These baselines will vary depending on the sources involved and the specific circumstances under which trading will occur.

NPDES permit baselines

NPDES permittee as a seller

The baseline for an NPDES permittee as a seller is its most stringent effluent limitation. A permittee may generate credits for sale when it reduces its discharge below its baseline.

NPDES permittee as a buyer

An NPDES permittee must meet a minimum control level at the point of discharge that represents its federal technology-based effluent limit (TBEL). TBELs are derived from EPA secondary treatment standards for publicly-owned treatment works (POTWs) and EPA effluent limit guidelines (ELGs) for industries. An NPDES permittee cannot buy or generate credits to meet its TBEL; it would only be able to buy credits to meet permit effluent limits that are water-quality-based and more stringent than the TBEL. After a permittee meets its minimum control level through its treatment requirements, it can buy or generate credits to meet its WQBEL or baseline, which is often derived from a TMDL wasteload allocation.

It is important to note that the secondary treatment requirements for POTWs and many ELGS for industries do not include minimum control levels for temperature. In these situations, the temperature wasteload allocations developed through the TMDL process serve as the baseline because there are no minimum technology requirements for temperature.

Baseline for high quality or pre-TMDL water quality limited waters

For trades that occur where water quality fully supports designated uses or in water quality limited waters (i.e., impaired waters) prior to a TMDL being established, the baseline for NPDES permittees would be established by the applicable water quality-based effluent limitation, quantified performance requirement, or management practice derived from water quality standards.

The baseline for nonpoint sources would be the pollutant load level associated with existing land uses and management practices that comply with existing state or local regulations. It may be challenging to quantify the baseline for a particular nonpoint source due to the variability associated in management practices; however, DEQ would compensate for this difficulty by developing appropriate trading ratios and/or margins of safety. The overall targets for improving water quality limited waters that do not yet have TMDLs will be determined using the process outlined in section 2.3, *Water quality limited: pre-TMDL*, p. 11.

Baseline for Post-TMDL/ Revisited TMDL waters

Once a TMDL is issued by DEQ, the applicable wasteload allocation for an NPDES permittee would serve as its baseline for engaging in trading. Individual wasteloads may also be aggregated to serve as a baseline for multiple permittees.

Provisions of the *TMDL Implementation Plans* for designated management agencies would be the baseline for nonpoint sources. Baselines may also change when a TMDL is revisited.

3.2 Credit definition and use

Definition of a credit

A credit is the unit of trade that represents the amount (e.g., mass, kilocalorie) of pollutant reduced over a specified time period (e.g., day, month, year) by a particular action (e.g., riparian shade restoration).

How are credits generated?

Credits for a particular pollutant may be generated by either nonpoint source activities (e.g., riparian shade restoration) or NPDES permittees (e.g., NPDES permittee shares its wasteload allocation with another permittee). Credit can only be given for actions that are not currently required by existing regulation or are above and beyond the minimum regulatory requirement.

For example, if there is a state requirement to minimize activity within a 25 foot buffer next to a stream, temperature credit could be given for areas within that buffer that are actively planted and maintained to provide for stream shading. In most cases, planting and maintaining the area would allow for quicker and more successful riparian shade restoration than would occur if the area were allowed to recover without intervention.

Start date for credit generation

For trades taking place within a TMDL framework, DEQ will give credit for actions started after the initial TMDL is issued by DEQ. For trades taking place in pre-TMDL water quality limited waters, credit generation would start after the targets are developed by the process described in *Water quality limited: pre-TMDL*, section 2.3, p. 11, and approved by DEQ.

Effective start date for use of credits

Credits can be used when the action taken to generate the credit is in effect. For temperature credits generated by restoring riparian shade, credits become effective once the vegetation is planted. DEQ will typically require extra planting to compensate for the time it will take for shade to establish. See section 2.6, p. 16, for a discussion on compensating for uncertainties associated with trading activities involving nonpoint sources and Appendix A for an explanation of how credits may be generated from riparian shade restoration projects.

Disposition of unused credits

A permittee may sell, give away, or retire nonpoint source credits (e.g., riparian restoration temperature credits) that are not needed to comply with its permit requirements or upon closure of the permitted facility. Credits from wasteload allocations that are shared by NPDES permittees may be managed as conditioned in the applicable permits.

3.3 Location of credit generation activities

Service area

Credits need to be generated in areas that will benefit the beneficial use(s) being impacted; such areas are referred to as *service areas.* For additional information on appropriate service areas, permit writers and TMDL staff are directed to EPA's *Water Quality Trading Toolkit for Permit Writers (2007)*.

For trading conducted to comply with a TMDL, the service area is typically the area covered by the TMDL. DEQ may further refine or broaden the service area to address specific impairments identified during the TMDL process provided there is adequate justification to do so.

In pre-TMDL basins, DEQ will establish service areas on a case-by-case basis. Permit writers and other DEQ staff contacted about trading proposals need to consult with the DEQ regional or statewide trading coordinator (see Appendix F for current staff assignments) prior to establishing service areas or approving trades. The trading coordinator will assist DEQ staff in reviewing proposed trades or trading programs with assistance from the DEQ regional basin coordinator and appropriate DEQ TMDL modeler.

Priorities within service areas

DEQ may also encourage or direct trades and trading programs to address priorities within a service area, such as the protection of existing quality areas, improvement of degraded areas, and/or restoration by filling in gaps to provide continuity.

DEQ encourages cooperation with existing watershed efforts that have set or are developing priorities. There are many groups actively working in Oregon on priority issues (e.g., local watershed councils, Oregon Watershed Enhancement Board, The Nature Conservancy, The Willamette Partnership). The Nature Conservancy's synthesis map is an example of a collaborative effort that defines areas within the Willamette Valley that are high priorities for restoration due to rare and endangered species or habitat type. Additionally, the *Willamette River Basin Planning Atlas: Trajectories of Environmental and Ecological Change* (D. Hulse, S. Gregory, and J. Baker, 2002) is a valuable resource for prioritizing restoration strategies in the Willamette basin. Other examples include state recovery plans that have been approved by the Services (National Oceanic and Atmospheric Administration Fisheries and U.S. Fish and Wildlife Services) for threatened or endangered species listed under the Endangered Species Act.

DEQ guidelines

General DEQ guidelines for determining service areas and priorities within these areas are detailed in the appendices by type of trading activity. Service areas and priorities may also be detailed within a TMDL, NPDES permit, or permit evaluation report (fact sheet).

3.4 Credit quantification and duration

Quantifying credits

DEQ has developed general approaches for quantifying credits associated with trades involving temperature and oxygen demanding substances such as biochemical oxygen demand (BOD), ammonia, and nutrients. These are described in the appendices as follows:

- Appendix A: Protocols for Temperature Trading – Riparian Shade Restoration
- Appendix B: Protocols for Temperature Trading – Flow Augmentation
- Appendix C: Protocols for Inter and Intraplant BOD and Ammonia Trading
- Appendix D: Protocols for Nutrient Trading

The list of appendices is in no way exhaustive. For other types of trades under consideration that are not addressed by the appendices, DEQ will work with interested parties in developing additional protocols for such trades.

Duration of credits

Credits will be effective for as long as they are maintained.

3.5 Acceptable trading scenarios

Overview

The following examples are provided to illustrate the range of situations that could develop in Oregon. DEQ may elect to consider other scenarios as well. The most appropriate scenario for a given situation will depend on a number of factors including but not limited to: pollutant(s) to be traded, size and hydrodynamics of the trading service area, number and type of sources involved, pre-existing regulatory framework, and stakeholder preferences.

Intraplant and intramunicipal trading

Intraplant trading is the simplest scenario where trading occurs between different outfalls within a facility or plant that involves the generation and use of credits between multiple outfalls that discharge to the same receiving water.

Similar to intraplant trading, intramunicipal trading allows a municipality to manage its multiple discharges as a system. The difference is that intramunicipal trading involves trading among multiple facilities owned by a single municipality that traditionally would be covered under separate individual NPDES permits. The Clean Water Services (CWS) NPDES permit contains an example of this type of trade. The permit allows CWS to trade BOD and ammonia between its two treatment plants that discharge to the Tualatin River.

Single "buyer"

In the *single buyer* scenario a permitted facility may buy or obtain credits from one or more NPDES permittees or nonpoint sources. An example of this type of trade is the temperature trade DEQ authorized in the CWS NPDES permit. Under this permit, CWS is allowed to offset its excess thermal load via riparian shading and flow augmentation. The "single buyer" model also includes situations in which a single permittee with multiple outfalls discharging to the same watershed is allowed to trade credits between outfalls. The CWS arrangement could also be viewed as a multi-party closed market system since multiple treatment plants are involved in the trade; however, CWS is really a single buyer of credits in the basin.

Multi-party closed market

With a *multi-party closed market* scenario there are multiple parties involved in purchasing and selling credits but trading is restricted to sources specifically named in permits and trading documents authorizing the trading program. This model usually involves a specific group of NPDES permittees, such as a group of municipal wastewater treatment plants subject to a TMDL. In a closed market, the permittees covered by the program trade between one another and are in compliance so long as loadings remain below their combined wasteload allocations. Participants may buy and sell credits on the closed market or make decisions about additional treatment options that do not actually require the exchange of credits or monies. DEQ will establish the acceptable trading provisions for the participants based on the model used to develop the TMDL or a similar approach. Permittees wishing to generate such credits may develop sample scenarios in advance of implementing such trades to simplify accounting once trading has been authorized in their individual NPDES permits or a watershed NPDES permit.

Examples

Connecticut's Long Island Sound program for nitrogen is being implemented under an NPDES general permit that covers 79 publicly owned treatment works that are allowed to trade between themselves. North Carolina's Neuse River program for nitrogen also covers 20 dischargers under an NPDES general permit that allows permittees to trade with one another, but they may also purchase wetland restoration credits under certain situations. Colorado's Cherry Creek program for phosphorus allows permittee to permittee as well as permittee to nonpoint trading options. Information on these trading programs may be found at: http://www.epa.gov/owow/watershed/trading/tradingmap.html.

Multi-party open-market

These programs are similar to the multi-party closed-market programs except that participation is not restricted to sources identified in trading documents authorizing the program. Eligibility may be established by other factors, such as location within the trading area, need for credits, and ability to create credits relative to applicable trading baselines. Such trades may be implemented through the use of a credit exchange. The credit exchange is maintained by a separate entity which may be a state agency, a conservation district, a private entity, or other organization.

Examples

The Willamette Partnership's credit registry for the Willamette basin is an example of a multi-party open market system. For more information, visit: www.willamettepartnership.org.

Additional information

EPA's *Water Quality Trading Toolkit for Permit Writers* and *Water Quality Trading Assessment Handbook* provide detailed information on trading scenarios and can be found at: http://www.epa.gov/owow/watershed/trading.htm.

3.6 Use of a credit registry

Overview

Where there are multiple permittees wishing to trade in a particular basin, DEQ supports and encourages the use of a common registry to record and track trades. Services provided by a registry can include tracking the generation, verification, maintenance, purchase, ownership, and reporting of credits available within a marketplace. A registry with these characteristics would allow permittees to easily purchase available credits as well as provide documentation to comply with permit requirements. A registry also provides the transparency needed for markets to gain trust and traction throughout the community. For example, the Willamette Partnership has developed a registry that may be used by permittees in the Willamette basin. For more information, visit: www.willamettepartnership.org.

Basic elements of a credit registry

DEQ currently has no authority to approve or regulate credit registries; therefore, the permittee should ensure that the registry they choose to work with is legitimate and has been reviewed by DEQ or that DEQ has participated in its development. At a minimum the registry should operate consistent with the guidance found in this IMD.

Permittee signature on registry reports

DEQ inspectors may accept reports generated by a credit registry provided they are signed and certified by the permittee as required by 40 CFR §122.22.

Permittee responsible for permit compliance

The use of a credit registry to purchase credits does not reduce the responsibility of an NPDES permittee to comply with the terms of its permit. If the use of credits from a registry or other third party acting as a consolidator of credits does not result in permit compliance (e.g., the quantity or quality is improperly calculated or otherwise misrepresented by the registry or third party), the permittee will need to respond accordingly to maintain compliance with its permit. The permittee will not be held responsible for improper or negligent actions on the part of the credit registry provided it was not complicit in these actions.

4. Incorporating trades into NPDES permits

4.1 DEQ review of trades

Process for review

The permit writer must review and approve proposed trading activities that are conducted to comply with CWA requirements to ensure they are consistent with this IMD and implemented through an enforceable mechanism (i.e., DEQ order, permit, or license). The permit writer may conduct the review as part of the permit issuance process (new or renewal) or during the permit cycle as a permit modification.

The permit writer is also directed to contact the DEQ regional or statewide trading coordinator (see Appendix F for current staff assignments) prior to approving the proposal. The trading coordinator will assist the permit writer in reviewing proposed trades or trading programs with assistance from the DEQ regional basin coordinator and appropriate DEQ TMDL modeler. DEQ's Water Quality Trading Workgroup (see Appendix F) is also available to consult on trading proposals that raise issues that cannot be resolved with reference to this IMD.

Note: DEQ does not expect the two previously approved trading programs in the Clean Water Services and Port of St. Helens' NPDES permits to be inconsistent with this IMD. Permit writers assigned to these permits need to contact the DEQ regional or statewide trading coordinator should issues arise during the permit renewal process.

Information needed in proposals

To determine if trades or trading programs are consistent with this IMD, DEQ staff should expect the following information to be submitted:

1. The proposed trading activities that will generate credits and how the credits will be used.

2. A list of proposed or potential trading partners and their experience in conducting the proposed credit generation activities. If the trading partners are not experienced, an explanation of how they will be trained. Also, copies of contracts or agreements if they are being used to execute the trades and/or maintain credits.

3. Quantification of the proposed trades. Trades within watersheds for pollutants that have TMDLs need to be consistent with the TMDL. DEQ anticipates that most trades will happen within the context of an approved TMDL, though the existence of a TMDL is not a necessary pre-condition

for trading. DEQ also recognizes that credits generated by nonpoint sources may be challenging to quantify and trading ratios and/or margins of safety may need to be adjusted accordingly.

4. Identification of ancillary benefits beyond the required reductions in specific pollutant loads, if any. Such benefits may include but are not limited to the creation and restoration of wetlands, floodplains, wildlife habitat, or cost-effectiveness.

5. Reasonable assurances that the proposed action(s) will be implemented by the trading partners. For NPDES permittees, permit requirements provide such assurances. For nonpoint sources, examples of reasonable assurance include but are not limited to: performance bonds, memoranda of agreement, and third party contracts.

DEQ's Water Quality Trading Workgroup is available to assist permit writers in evaluating trades (see Appendix F).

4.2 Permit development

Permit development

DEQ permit writers are directed to be flexible in working with permittees and stakeholders to develop permit conditions and compliance plans that are suitable for the permittee's specific situation.

Overview of permit conditions

To allow trading in NPDES permits, the permit writer must include permit conditions to describe the following:

1. Acceptable types of trades, including:
   a. Area where trades may occur
   b. General methodology for credit calculation
   c. Measures (e.g., trading ratios, aggressive planting plans) being taken to address uncertainties in the methodology if they exist
   d. Conditions pertaining to the duration of credits and applicability for future permit cycles

2. Minimum requirements for written trading agreements (e.g., contractual agreements) if credits are to be purchased or obtained from a third party.

3. Recordkeeping, monitoring, and reporting requirements to ensure that credits are valid.

4. If necessary, alternate permit limits or conditions that establish the baseline for trading if it occurs. See section 3.1, *What is a baseline?*, p. 18, for more information.

5. Requirements for submittal of the permittee's proposed credit trading program if such a proposal was not submitted as part of the permit action (e.g., with the permit renewal application). The proposal will be subject to public review and comment and DEQ approval. At a minimum, the permittee's proposal should:
   a. Describe the planned credit trading activities, including the quantity of credits to be generated by these activities, methodology utilized to calculate the quantity of credits, and specific units of credits generated.
   b. Target areas that are in need of improvement. The permittee should focus on areas that have greater potential for overall ecological benefit.
   c. Include interim goals by which the success of the program will be measured. For example, tree planting goals for each year. These goals are not subject to enforcement action by the Department.

   Upon DEQ approval, the credit trading program proposal would be incorporated into the permit by reference and the permittee's trading activities would be allowed. (Note: If the NPDES permit contains authorization for trading and the public was given notice and an opportunity for comment and public hearing of such authorization at the time permit issuance was proposed, public notice of individual trades is not required.)

6. Any additional information or requirements necessary to regulate trading activities. For example, provisions that reflect the nature of the trading activity for permit compliance determination purposes may be needed. These could include permit conditions that specify how an exceedance of an aggregate loading cap will be enforced when multiple permittees share such a cap (i.e., individual vs. group liability) or requirements or alternative compliance mechanism that apply when credits are unavailable to demonstrate permit compliance.

Note: The permit should be developed with conditions that are sufficient to address a variety of situations such that the permit will not require modification each time circumstances change; however, the permit writer must also recognize that in some cases permit modification may be necessary to address particular issues (e.g., addition of a compliance schedule).

Flexible permit conditions

The permit writer needs to be aware that in some situations trading may be one of several options a permittee may use to comply with an effluent limit or wasteload allocation. For example, a permittee may choose to land irrigate a portion of its wastewater to comply with its temperature wasteload allocation rather than restore the riparian shade originally proposed in its trading plan. As a result, permit conditions need to appropriately reflect the nature of the permittee's trading proposal and provide flexibility when trading is not necessary to comply with an effluent limit or wasteload allocation.

Aggregating wasteload allocations

When allowing permittees to share an aggregated wasteload allocation either in a watershed permit or in the individual permit of the parties that are sharing the load, an aggregate limit should be developed for the group and individual limits should also be detailed for each permittee in the group. This approach is intended to provide assurance to the permittees meeting their requirements that they will not be held responsible in the event one or more of the other permittees are responsible for discharging above the aggregate limit.

Example conditions

An example of NPDES permit conditions necessary to authorize trading may be found in Appendix E.

4.3 Consistency with standard methods

DEQ will continue to use methods and procedures (e.g., sampling/testing protocols, monitoring frequencies) pertaining to NPDES permits that are specified by federal or state regulations, where applicable, for measuring compliance for permittees that engage in trading. This approach is required by the NPDES permit program and provides clear and consistent standards for measuring compliance as well as ensures that appropriate enforcement action can be taken against permit violations if they occur.

4.4 Documentation in permit evaluation report (fact sheet)

Permit evaluation reports (fact sheets) need to contain the following:

1. Information on the proposed trade or trading programs, including:
   - Identification of the credit generation activity or activities.
   - List of potential or proposed trading partners (a general description of

potential trading partners is sufficient if specifics are not yet available due to the nature of the program).
- Quantification methodology of proposed trades, including measures (e.g., trading ratios) being taken to address uncertainties in the methodology if they exist.
- Anticipated ancillary environmental benefits if any.

2. Description of permit conditions related to trading, including monitoring and reporting requirements.

3. Discussion on compliance with the state antidegradation policy and NPDES anti-backsliding provisions.

4.5 Permit compliance and enforcement

Monitoring compliance

Permits authorizing trading must contain monitoring and reporting requirements documenting trading activities and results of trading activities. DEQ permit writers are directed to review this information at least once a year or on the schedule assigned by their managers. DEQ regional and statewide trading coordinators will be available to assist the permit writer during trading program reviews.

Enforcement of noncompliance

Enforcement of noncompliance with permit conditions will be conducted in accordance with OAR 340-012 and DEQ enforcement guidelines. Extreme weather conditions or other circumstances beyond the control of the permittee will be handled in a manner consistent with DEQ enforcement guidelines. Appendix E contains example permit monitoring and reporting requirements authorizing trades to meet temperature wasteload allocations.

Permittee accountability

The permittee is responsible for complying with its permit conditions. If the permittee's anticipated credits, either self-generated or purchased, are not available to comply with permit conditions the permittee will need to respond appropriately. This response may include acquiring other available credits, taking appropriate operational actions to maintain compliance (e.g., the permittee may reduce its discharge by increasing land irrigation), or other action (e.g., permit modification).

Use of credit registry or third party

The use of a registry or third party to purchase or generate credits does not reduce the responsibility of an NPDES permittee to comply with the terms of its permit. If the use of credits from a registry or other third party acting as a consolidator of credits does not result in permit compliance (e.g., the quantity or quality is improperly calculated or otherwise misrepresented by the registry or third party), the permittee will need to respond accordingly to maintain compliance with its permit (e.g., purchase additional credits, make operational changes, request permit modification). The permittee will not be held responsible for improper or negligent actions on the part of the credit registry or third party provided it was not complicit in these actions.

Appendix A: Protocols for Temperature Trading – Riparian Shade Restoration

Table of Contents

Protocols for Temperature Trading: Riparian Shade Restoration

1. Acceptable locations for credit generation

Service areas for TMDL parameter

The term *service area* describes the area within which credit generation activities may occur. For permittees that are interested in using credits to comply with a temperature wasteload allocation from a TMDL, the permit writer may allow credit generation from riparian shade restoration projects in the following service areas:

- ***Option 1: TMDL Document***
  If provided in the TMDL document, the allowable service area that is specifically described for an NPDES permittee or permittees as acceptable for trading activities.

- ***Option 2: Above the Point of Maximum Impact (POMI)***
  The point of maximum impact or POMI is the location in a water body where the cumulative impact of upstream sources is most severe or most critical. The point of maximum impact may vary seasonally as well as spatially. In addition, some water bodies may have more than one POMI, depending on the unique spatial and temporal thermal profiles of the water body and sources of warming (e.g., nonpoint and point source POMIs).

  If the TMDL document does not describe an allowable service area, then it will generally be: 1) located above the POMI that is attributed to contributions from NPDES permitted discharges (i.e., the point source POMI), and 2) include water bodies, either upstream or downstream of the permittee's discharge outfall, that provide habitat for the particular fish species addressed by the temperature TMDL in question.

  The focus of the service area above the point source POMI is to encourage credit generation activities that will directly benefit areas impacted by the permittee, which provides for the nexus that is necessary to allow NPDES permittees to use riparian shade restoration credits to comply with their temperature wasteload allocations.

  The service area may also include additional areas as follows:

  a. Justification can be made to allow projects in areas where the applicable fish use exists but is not properly indicated on the DEQ temperature criteria fish use designation maps.

b. Water bodies that are hydrologically connected (e.g., alcoves, wetlands) to the same water body for which the TMDL was established may also be included.

- ***Option 3: Demonstration of Decreased Temperatures***
  Riparian shading projects in areas outside of the TMDL may be allowed by DEQ if the party proposing the project can demonstrate (e.g., with field monitoring) or model decreased temperatures in the service areas or at the point of maximum impact.

- ***Option 4: Other Justifiable Area***
  Any other area provided there are legal and factual justifications for doing so. For example, a permittee could propose to conduct restoration in an area that historically provided habitat for the applicable fish species but is not indicated on the DEQ temperature criteria fish use designation maps. The permit writer should consult the DEQ regional or statewide trading coordinator for assistance (see Appendix F for current staff assignments).

Generally, the options described above will result in credit generation activities that, at a minimum, occur within the same USGS level three (3) hydrological unit code (HUC), commonly referred to as the "basin." See Table A-1 below for Oregon basins identified as level three (3) hydrological units. In the interest of maintaining a reasonable pool of potential projects for sources located at the upstream end of a 3rd level HUC, projects located in the 4th field HUC immediately upstream of the source may also be considered. This is most likely to apply to sources located on rivers such as the Columbia and Snake Rivers which cross basins.

Table A-1: Level Three (3) Hydrologic Unit Codes in Oregon

Basin Name	Code
Black Rock Desert	160402
Deschutes	170703
John Day	170702
Klamath	180102
Lower Columbia	170800
Lower Snake	170601
Middle Columbia	170701
Middle Snake/Boise	170501
Middle Snake/Powder	170502
North Lahontan	180800
Northern California Coastal	180101
Northern Oregon Coastal	171002
Oregon Closed Basins	171200

Basin Name	Code
Southern Oregon Coastal	171003
Upper Sacramento	180200
Washington Coastal	171001
Willamette	170900

Priorities

To ensure that shading projects are effective and to avoid widely disconnected projects with no discernible net impact on either temperature or the ecosystem, trading programs should conduct projects in areas that have one or more of the following characteristics:

- Streams in subwatersheds with low riparian forest fragmentation. For example, 60% or more of the stream riparian area has existing natural riparian cover.
- Streams in subwatersheds with a high percentage of land management that provides a high level of protection to riparian areas. For example, areas with significant conservation easements, high levels of Conservation Reserve Enhancement Program (CREP) or Conservation Reserve Program (CRP) enrollment, or federal, state, or private ownerships with highly protective management plans.
- Streams with high opportunity. For example, a single project or set of contiguous projects that will result in five miles of stream with a continuous.

Developing priorities

Consistent with the framework of the applicable TMDL, DEQ staff will work in cooperation with existing watershed efforts that have set priorities or are developing priorities to determine where trades may be located.

2. Methodology for credit quantification

Basis of methodology

Since trades involving riparian shade are expected to result in improved habitat for aquatic and wildlife species, DEQ allows credit for such projects to be based on the amount of solar radiation they are projected to block rather than on the thermal benefit they produce at the TMDL point of maximum impact. The value of the credit will depend on the amount of stream surface that is shaded.

Credit calculation

The following equation may be used to calculate a temperature credit load from riparian shade projects for a specific reach of stream. This calculation should be done approximately every 50 meters (~165 feet) along the stream reach within each project.

Available Credits = (*Stream Surface Area*) x (*Increase in Effective Shade*) x (*Daily Insolation Rate*) / *Trading Ratio*

Where,

- *Stream Surface Area* = (*Average Stream Width*) x (*Stream Length*)
- *Increase in Effective Shade* = (*Estimated Effective Shade After Planting*) – (*Effective Shade Before planting*)
  - ✓ *Estimated Effective Shade After Planting* may be calculated with DEQ's Shade-a-lator model (http://www.deq.state.or.us/wq/TMDLs/tools.htm).
  - ✓ *Effective Shade Before Planting* may also be calculated with Shade-a-lator or measured with a solar pathfinder.

  Note: DEQ may approve alternate methods with adequate justification.
- *Daily Insolation (in*cident *so*lar rad*iation*) *Rate* = The amount of solar radiation energy received on a given surface area for a particular day. See discussion below.
- *Trading Ratio* = See *Trading ratio* discussion below.

Daily insolation (incident solar radiation) rate

The amount of solar radiation that is blocked from vegetation (i.e., value of temperature credits) will vary throughout the year because the amount of solar radiation received on a given surface area varies in time. In a market setting, buyers and sellers may wish to estimate temperature credits from a riparian shade restoration project using a fixed date for the solar radiation rate to keep the process simple and work with a common currency. However, the calculation of temperature credits to demonstrate compliance with a temperature wasteload allocation in an NPDES permit have to accurately reflect the specific time period during which the compliance demonstration is being made (typically, this will be during spring, late summer, and early fall).

If a temperature wasteload allocation is a daily limit in an NPDES permit, the permit writer must ensure that the calculation for temperature credits is sufficient to demonstrate compliance with a daily limit. Either of the following methods to determine the correct calendar date(s) to be used in Shade-a-lator for the daily solar radiation rate is acceptable:

1. *Simple method*
   To simplify credit calculation, the calendar date chosen should correspond to the calendar date within the same month that represents the most conservative (or smallest) potential solar radiation rate during the general

period when the permittee needs temperature credits to meet its wasteload allocation.

For example, if the permittee is likely to need temperature credits to comply with its wasteload allocation during October, October 31 should be used. Alternatively, if the permittee needs temperature credits during April, April 1 should be used. This conservative approach is recommended to ensure that sufficient temperature credits are generated to prevent the permittee from exceeding its wasteload allocation.

2. *Specific solar radiation rate(s)*
   Using this method, the calendar date chosen may be made on a daily or weekly basis using the applicable daily solar radiation rate corresponding to the day or week the permittee uses the temperature credits to comply with its daily wasteload allocation. While this approach may need more calculations, it would likely result in more temperature credits for late summer and fall because it is less conservative than option #1 above.

   For example, if the permittee uses temperature credits for August 15, 16, and 17 to meet its wasteload allocation, the solar radiation rates for August 15, 16, and 17 may be used in Shade-a-lator to calculate the available temperature credits for each of these days or August 17 may be used to represent the three days. These solar radiation rates are higher than the rate for August 30 (the rate that would result from option #1 above) and result in a greater amount of temperature credits available for each day.

The permit writer may consider alternatives to the approaches described above when a temperature wasteload allocation is expressed differently than a daily permit limit (e.g., weekly, monthly, yearly) provided consideration is made to reflect when the temperature credits are needed for compliance purposes. The permit writer may also consider alternatives when a TMDL allows for a different methodology.

Trading ratio

Generally, the default trading ratio for riparian shading projects is 2:1 unless a different value is specified for trading in the TMDL. This means that for every unit of excess heat load (e.g., kilocalorie/day) that an NPDES permittee wishes to offset via shade planting, two (2) units of solar radiation load must be blocked by that planting. This ratio provides a way to account for the time it takes for shade to establish.

The permit writer may revise the trading ratio if there is adequate justification (i.e., modeling, field studies, or other DEQ-approved method) to do so and after consultation with the regional or statewide trading coordinator. For example, a lower ratio may be considered if the project proposal also preserves existing riparian shade upstream of the project location to increase

	the effectiveness of the downstream riparian shade restoration project. A lower ratio may also be considered for projects with multiple elements, such as floodplain restoration or creation of cold water refugia, provided additional improvement of stream temperature or fish habitat would occur above what would be expected with traditional shading projects. Alternatively, higher trading ratios for future projects may be considered if current projects do not provide the anticipated benefits.
Credit calculation tools	DEQ's Shade-a-lator model v6.2 may be used to calculate effective shade. Shade-a-lator is a solar routing model developed by DEQ that calculates the potential and received solar radiation flux at the stream surface and provides effective shade output data. It is part of the Heat Source v6 computer model used by DEQ to simulate stream thermodynamics and hydrology. Shade-a-lator v6.2 is available on the DEQ website at http://www.deq.state.or.us/wq/trading/trading.htm. DEQ may also approve alternate methods with adequate justification
Margin of safety	To ensure that riparian shade restoration projects are successful, written planting plans, ecologically appropriate planting goals, and recordkeeping, and reporting requirements are required as discussed in sections 3 and 4 below.
Credit effective date	*General effective date* For trades taking place within a TMDL framework, DEQ will give credit for actions started after the initial TMDL is issued by DEQ. For trades taking place in 303(d) impaired waters, credit generation would start after the baseline condition is developed by the process described in *Water quality limited: pre-TMDL*, p. 11, and approved by DEQ. *Specific project effective date* Credits for specific riparian shade restoration projects may be used for compliance with a permittee's temperature wasteload allocation as soon as the planting has been accomplished according to the permittee's planting plan.
Credit duration	Credits will remain in effect for as long as the project area is maintained for shade generation.

3. Requirement for planting plan and goals

Written planting plan

To ensure that temperature credits are of good quality and ecologically appropriate, a written planting plan is needed. The requirement for a plan is to be included as a permit condition. At a minimum, this plan should include the following:

1. Schedule and timeline for planting.
2. Site preparation protocols.
3. Description of planting goals (discussed below).
4. Integrated pest management plan that includes measures to control non-native and invasive species and damage from wildlife.
5. Monitoring and maintenance practices for ensuring plant survival on a schedule appropriate to the type and location of habitat being planted.
6. Monitoring practices to document project success. Monitoring should occur at least once a year during the first 5 years of planting and may be allowed on a more relaxed schedule once the plantings are established.
7. Recordkeeping requirements to document project success, including pre- and post-implementation photo documentation.

The permit writer may allow a permittee to use plans developed by another entity (e.g., watershed council) and develop general planting plans provided they are ecologically appropriate rather than require a planting plan for each project. Acceptable photo documentation practices may be found in *OWEB Guide to Photo Point Monitoring* (Oregon Watershed Enhancement Board, Revised July 2007) http://www.oregon.gov/OWEB/docs/pubs/PhotoPoint_Monitoring_Doc_July2007.pdf.

Ecologically appropriate planting goals

Plantings for a shade restoration project need to be ecologically appropriate for the site and ideally based on a local reference site to ensure that the project is successful. DEQ recognizes that there are planting designs (e.g., poplar plantings) that may provide shade more quickly than ecologically appropriate plans; however, planting plans that reflect the local ecology will provide greater benefits over long term, such as wildlife habitat for native species.

DEQ permit writers are not expected to be riparian restoration specialists; however, they need to ensure that the following minimum elements are included in planting goals and recognize that the specific requirements or goals will vary depending on the project conditions. See *DEQ review of planting goals*, p. A-9, below, for additional direction.

1. *Minimum species diversity*
   Species diversity goals will help to ensure a project's sustainability over the long term. For an example, the Willamette Partnership is considering the following guidelines for a shade restoration site in the Willamette

basin: at least five woody species, no single species representing more than 50% of the woody plants, trees should account for at least 20% of the total stems per acre target, and shrubs should account for at least 20% of the total stems per acres target.

2. *Minimum plant density*
   Plant density (stems per acre) goals that are based on habitat type. Ideally, there will be a nearby reference site for a specific habitat type to draw from to develop tree stem density and shrub stem density goals. For example, in the Tualatin basin, Clean Water Services has a goal of 2,000 and 2,600 woody stems per acre to provide for quick cover.

3. *Maximum allowable level of non-native and invasive species*
   Goals to control of non-native and invasive species are integral to project success. For example, the Long Tom Watershed Council goal is for no more than 5% black berry or Scotch Broom and Clean Water Services' goal in the Tualatin basin is no more than 20 percent non-native cover.

4. *Plant materials from seed sources appropriate for the location*
   Proper plant materials are necessary to ensure that plantings will survive under local conditions over the long term. For example, in the Willamette basin, plant materials should be from Willamette valley seed sources below 1500 ft.

Timeframe for planting goals

The permit writer is to ensure that planting goals developed by a permittee or permittee's representative will allow the permit writer to assess project performance on an annual basis and over the long term. The planting goals discussed above that are developed by the permittee need to be accompanied by appropriate timeframes to indicate when success with the goals will be measured. DEQ expects that five years will be appropriate, but will consider alternative timeframes.

Examples of acceptable annual goals could include meeting timelines for planting or plant survival rates expected in the short term. Over the long term, the permit writer needs to focus on the general success with the planting goals discussed above and the actual establishment of shade.

DEQ review of planting goals

Goals developed in collaboration with local watershed councils, USDA Natural Resource Conservation Service (NRCS), local soil and water conservation districts, or other established groups are acceptable to DEQ. Permit writers are also directed to allow riparian restoration projects that are developed to meet other objectives (e.g., erosion control, increase wildlife habitat) in addition to shading. Additional benefits from shading projects should be encouraged but are not required.

Additionally, the permit writer is to recognize that planting program goals may need to be revised to reflect better information as it becomes available on preferred planting materials and maintenance needs for different habitat types. Planting program goals are not to be incorporated into permit requirements as compliance schedules due to the inherent variability experienced in planting projects (e.g., drought conditions, flooding, pest infestations). However, the permit writer and inspector need to be aware of whether the permittee's goals are necessary to comply with its effluent limit or wasteload allocation. If the goals are necessary, the permit writer should request revised planting goals from the permittee to ensure that it is still on schedule to meet its effluent limit or wasteload allocation.

Additional resources

There are many available resources that can provide specific planting recommendations and maintenance protocols for different locations throughout Oregon. These include but are not limited to local watershed councils (www.oregon.gov/OWEB/WSHEDS/), local governments, local nonprofit organizations [e.g., The Willamette Partnership, The Freshwater Trust, and the Oregon Watershed Enhancement Board (www.oregon.gov/OWEB/)].

4. Recordkeeping and reporting

Overview

The following are minimum guidelines for the permit writer on recordkeeping and reporting requirements to include in an NPDES permit to allow for trading. The permit writer may alter these requirements consistent with his or her best professional judgment of what is needed to determine a permittee's performance and compliance.

Recordkeeping

To ensure that credit calculations are accurate and credits are not being used more than once, the permit writer needs to ensure that the following recordkeeping is available to DEQ upon request for each project site.

1. Project description
    a. Project name
    b. Street address
    c. Land ownership information
    d. General description of the project, including a description with latitudes and longitudes delineating the project boundary and, if applicable, the georeferenced GIS shapefile of the project boundary
    e. Name and contact information of party or parties responsible for conducting the planting and monitoring (e.g., a third party)

2. If applicable, trading agreements or contracts if purchasing credits
3. Average baseline riparian buffer width
4. Average anticipated riparian buffer width
5. Minimum, average, and maximum stream wetted width
6. Total stream length
7. Stream wetted surface area
8. Total daily baseline solar loading before restoration
9. Total daily anticipated solar loading after restoration
10. Written planting plan
11. Results of site visit results, including photo documentation

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Reporting

Monthly

40 CFR §122.44(i) requires that an NPDES permit contain monitoring and reporting provisions that are sufficient to assure compliance with permit limitations and at frequency dependent on the nature and effect of the discharge. As a result, if the permittee's temperature wasteload allocation is included in the permit as a daily or monthly limit, reporting on this parameter would typically occur on the permittee's discharge monitoring report (or other DEQ-approved form) that is submitted to DEQ on a monthly basis. The amount and source (project name) of credits being used to comply with the permit's temperature limit should also be provided at this time. If credits are required to comply with a permit limit (e.g., the permittee *must* restore 30 miles of riparian shade), the permit writer may develop an alternative schedule (e.g., yearly may be sufficient).

Annual

To assess whether a permittee is in compliance with its trading provisions, the permit writer should require, at a minimum, that the following be reported to DEQ on an annual basis:

1. Summary descriptions of trades, including:
   a. Whether credits were generated by permittee's activities or purchased by the permittee; and
   b. How credits were used (e.g., applied towards compliance with waste discharge limitations, sold to another permittee).
2. A progress update relative to the interim goals defined for the trading program (e.g., status of plantings).

Appendix B: Protocols for Temperature Trading – Flow Augmentation

Table of Contents

Protocols for Temperature Trading: Flow Augmentation

1. Acceptable locations for credit generation

Service area DEQ supports flow augmentation trades consistent with the service area protocol in Appendix A. DEQ does not anticipate establishing specific priorities for these types of trades.

2. Methodology for credit quantification

Credit calculation Modeling used to develop the temperature TMDL is the preferred method to develop empirical equations that relate instream flow to temperature. These equations can then be used to determine how much thermal credit can be given for a particular level of flow augmentation.

Trading ratio Trading ratios will be considered on a case-by-case basis.

Margin of safety When allowing credit for flow augmentation, the permit writer may elect to propose a margin of safety to account for uncertainty in flow availability or the impact of such projects.

Credit duration The credit will be in effect for as long as the flow augmentation remains in place.

3. Recordkeeping and reporting

Recordkeeping To ensure that credit calculations are accurate, at a minimum the permit writer needs to require that the following recordkeeping is conducted by the permittee and made available to DEQ upon request for each flow augmentation project:

1. Project description, including location and information on the party or parties involved with the flow augmentation.
2. If applicable, trading agreements or contracts for the flow augmentation project

3. Amount of flow or flow rights purchased, leased, or gifted
4. Amount of cooling achieved
5. Baseline information used to calculate cooling
6. Equations used in credit calculations

Reporting

Monthly

40 CFR §122.44(i) requires that an NPDES permit contain monitoring and reporting provisions that are sufficient to assure compliance with permit limitations and at frequency dependent on the nature and effect of the discharge. As a result, if the permittee's temperature wasteload allocation is included in the permit as a daily or monthly limit, reporting on this parameter would typically occur on the permittee's discharge monitoring report (or other DEQ-approved form) that is submitted to DEQ on a monthly basis. The amount and source (project name) of credits being used to comply with the permit's temperature limit should also be provided at this time. If credits are required to comply with a permit limit, the permit writer may develop an alternative schedule (e.g., yearly may be sufficient).

Annual

At a minimum, the permit writer needs to require that the permittee submit an annual report with the following information:

1. Summary of the trades.
2. Overview of the permittee's compliance status with the applicable parameters that were traded.
3. Any necessary changes that should be made to the modeling assumptions should the permittee become aware of them as a result of monitoring data or more information obtained over the past year.

4. Additional resources

Oregon Water Trust

The Oregon Water Trust, a program of the Freshwater Trust, may be able to assist in developing flow augmentation projects through their efforts and expertise with purchases and leases of long-term water rights to restore surface waters. Visit their website at http://www.thefreshwatertrust.org/programs/oregon-water-trust or call (503) 222-9091.

State water law

For an introduction to Oregon water law, the following may be helpful:

- Oregon Water Resources Department (OWRD) publication *Water Rights in Oregon: An Introduction to Oregon's Water Law (March 2008)* (http://www.wrd.state.or.us/OWRD/PUBS/aquabook.shtml)
- Oregon Revised Statute 537 *Appropriation of Water Generally*, ORS 537.348 authorizes the purchase, lease, or gift of water rights for instream uses (http://www.leg.state.or.us/ors/537.html)

Appendix C: Protocols for Inter and Intraplant BOD and Ammonia Trading

Table of Contents

Protocols for Inter and Intraplant BOD and Ammonia Trading

1. Acceptable locations for credit generation

Service area

Under an inter or intra-plant biochemical oxygen demand (BOD) or ammonia trading scheme, sources may be allowed to shift loads of oxygen-demanding substances between treatment plants as well as within a particular treatment plant. These treatment plants need to discharge to the same water body and be able to demonstrate a relationship between their discharges and resulting impacts to the water body. DEQ does not anticipate establishing specific priority areas for these types of trades.

2. Methodology for credit quantification

Credit calculation

BOD or ammonia trading between plants cannot result in water quality standards violations. As a result, permittees that are interested in trading BOD or ammonia or both will need to conduct modeling to determine allowable daily and weekly mass loads under a variety of conditions. These conditions should include at a minimum:

- Instream flow
- Instream dissolved oxygen levels
- Month of the year
- River temperature

The modeling should also be used to determine the point of maximum impact to water quality and how this may vary over time.

Trading ratio

Trading ratios have not been established at this time; they will be considered on a case-by-case basis.

Margin of safety

When allowing credit for BOD or ammonia trading, the permit writer may elect to propose a margin of safety to account for uncertainty in flow availability or the impact of such projects.

Credit duration

The credit will remain in effect for as long as the trading occurs.

3. Recordkeeping and reporting

Recordkeeping

To ensure that credit calculations are accurate, the permittee must maintain records detailing the test results and calculations performed. Generally, the permit writer will not need to add an additional permit condition to maintain these records because they are required to be maintained by a permit's "general" conditions.

Reporting

Monthly

40 CFR §122.44(i) requires that an NPDES permit contain monitoring and reporting provisions that are sufficient to assure compliance with permit limitations and at frequency dependent on the nature and effect of the discharge. As a result, if the permittee's BOD and/or ammonia limit is included in the permit as a daily or monthly limit, reporting on this parameter would typically occur on the permittee's discharge monitoring report (or other DEQ-approved form) that is submitted to DEQ on a monthly basis. The amount and source of credits being used to comply with the BOD and/or ammonia limit(s) should also be provided at this time. If credits are required to comply with a permit limit, the permit writer may develop an alternative schedule (e.g., yearly may be sufficient).

Annual

At a minimum, the permit writer needs to require that the permittee submit an annual report with the following information:

1. Summary of the trades.
2. Overview of the permittee's compliance status with the applicable parameters that were traded.
3. Any necessary changes that should be made to the modeling assumptions should the permittee become aware of them as a result of monitoring data or more information obtained over the past year.

Appendix D: Protocols for Nutrient Trading

Note: *The methodology for credit quantification is excerpted from the "Resource Guide to Watershed-Based Trading" developed for DEQ in October 2000 (available upon request). DEQ has not developed a nutrient trading program to date. Interested permittees and permit writers should contact the DEQ statewide or regional trading coordinator (see* Appendix F *for current staff assignments) with specifics to work through implementing a nutrient trade. DEQ will likely use the Natural Resources Conservation Service (NRCS) web-based nitrogen credit trading tool to facilitate water quality trading for nitrogen once the tool is ready for use in Oregon.*

Table of Contents

Protocols for Nutrient Trading

1. Acceptable locations for credit generation

Service area

The service area would be those areas addressed by the TMDL. At this time, DEQ has not developed priorities areas for these types of trades and will consider the issue on a case-by-case basis.

2. Methodology for credit quantification

Background

Nonpoint sources wishing to generate nutrient credits for trade may do so via the adoption of BMPs. Three examples of BMPs are discussed here. They are:

- Grassy swales
- Vegetative buffers
- Livestock exclusion (Fencing)

Grassy swales are channels shaped or graded to have a gentle slope and covered with a dense growth of vegetation. They provide a stable conveyance and encourage runoff to infiltrate into the soil, thus reducing pollutants and decreasing runoff velocity. They are typically used in urban settings around residential and industrial developments, as highway medians, and in agricultural settings.

A vegetative buffer is a strip of vegetation separating a water body from a land use that could act as a nonpoint source of pollution. Vegetated buffers prevent the direct flow of runoff into surface waters. They improve overall bank stability, decrease erosion, and decrease nutrient pollutant loadings. When runoff flows into a buffer, pollutants settle out, adsorb to the soil, and are taken up by vegetation or infiltrate into the ground.

Vegetated buffers typically contain a heterogeneous mix of cover, including herbaceous and woody species. They are typically used in agricultural, recreational, logging, and open space settings.

The appropriate vegetative makeup of the buffer will vary across the state and by ecosystem type. Staff from the local DEQ, ODFW or SWCD office can provide suggestions as to the type of vegetation and species that are best suited to the site. However, in general, a multi-storied forest of native species is recommended. A wider buffer will increase contact time between runoff and vegetation, and likely increase its effectiveness.

Livestock exclusion involves putting up a barrier, typically a fence, to exclude livestock from riparian areas and allow recovery of riparian vegetation. This can result in securing the banks, lowering stream velocity, trapping suspended sediment, decreasing erosion, and decreasing temperature. In addition, this practice also eliminates direct pollutant loadings from manure deposition in the stream. This BMP is typically used in agricultural settings.

The BMPs listed above reduce the loading of multiple pollutants. Therefore, you may receive credits for more than one pollutant when you implement one BMP. The types of credits available for each BMP are listed in Table D-1 below.

Table D-1: Available Credits by BMP

Type of BMP	Total Phosphorus (TP)	Total Nitrogen (TN)
Grassy Swale	**X**	**X**
Vegetative Buffers	**X**	**X**
Fencing	**X**	**X**

Note: The trading ratios, factors and coefficients listed in this appendix should be used for nutrient trading; however, if other values can be justified, they can be used subject to review and approval by DEQ.

Trading ratio

The following trading ratios should be used.

Table D-2: Ratios for the Three Eligible BMPs

Eligible BMP	Suggested Ratio
Grassy Swales	2.5
Planting Riparian Buffer Vegetation	2.5
Fencing of Stream Riparian Areas	2.8

Credit calculation: Grassy swales

The grassy swales calculations are the simplest and most straightforward of the three BMPs. A simple pollutant load model is used to estimate the baseline load, and an effectiveness factor is applied to determine the reduction achieved.

Data Requirements

You'll need to collect two key pieces of data for grassy swales calculations:

- Your land use areas tributary to the stream, in acres
- Average annual precipitation at your location, in inches (For average annual precipitation for your location, contact your local county extension office, your local newspaper, or visit the Oregon Climate Service website: http://ocs.oce.orst.edu.)

Calculations

There are four steps to calculating the pollutant reductions from using grassy swales as a BMP:

1) Calculate the annual amount of precipitation that produces runoff:

Runoff-producing precipitation = average annual precipitation x factor from Figure D-1

Find your location on Figure D-1 at the end of this appendix and use the percentage from that figure to reduce your average annual precipitation.

2) Calculate the average annual storm runoff for each land use:

Storm runoff = 3,630 x runoff-producing precipitation x runoff coefficient x land use area

Runoff coefficients can be found in Table D-5 at the end of this appendix. The value 3,630 allows you to convert inches-acres to cubic feet. The resulting storm runoff value is in units of cubic feet per year.

3) Calculate the baseline pollutant load for each pollutant-land use combination:

Baseline pollutant load = 0.00006245 x storm runoff x pollutant concentration

Storm runoff was calculated in Step 2 and pollutant concentrations are given in Table D-6. The value 0.00006245 allows you to convert ft^3-mg/L to pounds. The resulting load value is in pounds per year for each pollutant.

4) Calculate the pollutant load removed by this BMP:

Pollutant load removed = Baseline pollutant load x effectiveness factor

The baseline pollutant load was calculated in Step 3. The effectiveness factors for this BMP are given in Table D-3 below.

Table D-3: Percent Effectiveness of Grassy Swales BMP

Parameter	Total Phosphorus (TP)	Total Nitrogen (TN)
Effectiveness, %	20	35

Credit calculation: Vegetative buffers

The calculations for vegetative buffers are similar to those used for grassy swales.

Data Requirements

You'll need the following data for vegetative buffers calculations:

- Your land use areas tributary to the stream, in acres
- Average annual precipitation at your location, in inches

Calculations

As in the grassy swales calculations, there are four steps to calculating your credit for using vegetative buffers as a BMP.

1) Calculate the amount of annual precipitation that produces runoff:

Runoff-producing precipitation = average annual precipitation x factor from Figure D-1

Find your location on Figure D-1 at the end of this appendix and use the percentage from that figure to reduce your average annual precipitation.

2) Calculate the average annual storm runoff:

Storm runoff = 3,630 x runoff-producing precipitation x runoff coefficient x land use area

Runoff coefficients can be found in Figure D-1 at the end of this appendix. The value 3,630 allows you to convert inches-acres to cubic feet. The resulting storm runoff value is in units of cubic feet per year.

3) Calculate the baseline pollutant load for each pollutant-land use combination:

Baseline pollutant load = 0.00006245 x storm runoff x pollutant concentration

Storm runoff was calculated in Step 2 and pollutant concentrations are given in Table D-6 at the end of this appendix. The value 0.00006245 allows you to convert ft^3-mg/L to pounds. The resulting load value is in pounds per year for each pollutant.

4) Calculate the pollutant load removed by this BMP:

Pollutant load removed = Baseline pollutant load x effectiveness factor

The baseline pollutant load was calculated in Step 3 and effectiveness factors can be found in Table D-4 below.

Table D-4: Percent Effectiveness of Vegetative Buffers BMP

	Parameters	
Setting	**Total Phosphorus (TP)**	**Total Nitrogen (TN)**
Urban	40	40
Agriculture	75	70

Credit calculation: Fencing

Data Requirements

You'll need to collect data for fencing calculations. The first set of data is similar to the data requirements for the previous two BMPs:

- Your land use areas tributary to the stream, in acres
- Average annual precipitation at your location, in inches

To calculate pollution reduction for this BMP (specific to excluding cattle), you'll need to collect information about your animals and soil:

- Number of head of cattle
- Average weight per animal in pounds
- Average bulk density of the soil in the riparian zone in pounds per cubic foot (you may obtain a soil test, or assume a value of 87.4 lbs per cubic foot)

Calculations

As in the previous two BMP credit calculations, there are multiple steps to calculating your credits if you select fencing as your BMP. The first four steps are related to TSS pollution reductions that occur as vegetation is restored along the riparian corridor. Those reductions are added to the reductions calculated in Steps 6 through 10, which are related to pollution reductions directly resulting from excluding livestock from the stream.

1) Calculate the amount of annual precipitation that produces runoff:

Runoff-producing precipitation = average annual precipitation x factor from Figure D-1.

Find your location on Figure D-1 at the end of this appendix and use the percentage from that figure to reduce your average annual precipitation.

2) Calculate the estimated average annual storm runoff:

Storm runoff = 3,630 x runoff-producing precipitation x runoff coefficient x land use area

Runoff coefficients can be found in Table D-5 at the end of this appendix. The value 3,630 allows you to convert inches-acres to cubic feet. The resulting storm runoff value is in units of cubic feet per year.

3) Calculate the baseline TSS load:

Baseline pollutant load = 0.00006245 x storm runoff x TSS concentration

Storm runoff was calculated in Step 2 and TSS concentrations are given in Table D-6 at the end of this appendix. The value 0.00006245 allows you to convert cubic feet to pounds. The resulting load value is in pounds per year.

4) Calculate the TSS load removed by this BMP:

Pollutant load removed = Baseline pollutant load x effectiveness factor

The baseline TSS load was calculated in Step 3. The effectiveness factor for TSS for this BMP is 60%.

5) Calculate the annual pollutant deposited by livestock manure for TN, TP and bacteria:

Annual pollutant deposition = head x avg weight x pollutant deposition rate x 365 days/yr

Pollutant deposition rates are found in Table D-7 at the end of this appendix.

6) Calculate the baseline pollutant load from livestock manure that is delivered to the stream:

This step assumes certain values for a) the percent of pollutant that is delivered to the stream from each zone, and b) the percent of time livestock spend in each zone. You should use your own values for these percentages if you have more accurate data. Repeat this step for each TP and TN.

From the riparian zone:

Baseline pollutant load = pollutant deposition x 100% delivery x 28% time distribution

From the near-upland zone (within ¼ mile of the stream):

Baseline pollutant load = pollutant deposition x 20% delivery x 36% time distribution

From the far-upland zone (beyond ¼ mile of the stream):

Baseline pollutant load = pollutant deposition x 10% delivery x 36% time distribution

The pollutant deposition values were calculated in Step 5. The resulting baseline pollutant load values are in pounds/year. Approximately half of the nitrogen will be lost to the atmosphere through ammonia volatilization, so apply a 50% field loss factor to your estimates of TN pollutant load.

7) Calculate the reduction in pollutant load from livestock manure:
Repeat Step 6, but assume a 0% time distribution for the riparian zone (reducing the load from that zone to zero), and a 50% time distribution for each of the upland zones. The difference in pollutant load between Step 6 and Step 7 equals the reduction in pollutant load from livestock manure. Repeat this step for TP and TN.

8) Calculate the baseline TSS pollutant load from sediment caused by livestock:
This calculation assumes that 60% of the soil entering the creek will become TSS. It also assumes that the livestock spend 28% of the time in the riparian zone (0.60 x 0.28 = 0.168). If you have more accurate data, you should recalculate this factor.

Baseline TSS load = head x 1ft3/animal/day x 0.168 x 87.4 lbs/ft3 x 365 days/yr

The resulting TSS load is in pounds per year. The potential reduction in this pollutant is equal to the baseline value.

9) Calculate the baseline TP pollutant load from sediment caused by livestock:

Baseline TP load = baseline TSS load x 0.4

The baseline TSS load was calculated in Step 8. 40% of the TSS load is assumed to be phosphorus attached to the soil particles. The resulting TP load is in pounds per year. The potential reduction in this pollutant is equal to the baseline value.

10) Total all the potential pollutant reductions:
Add each of the TN and TP reduction values calculated in Steps 7 and 9 to get the total pollutant reduction from this BMP.

Credit duration The credit will be in effect for as long as the management practice is kept in place.

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3. Recordkeeping and reporting

Recordkeeping To ensure that credit calculations are accurate, at a minimum the permit writer needs to require that the following recordkeeping is conducted by the permittee and made available to DEQ upon request:

1. Project description, including location and information on the party or parties involved with the trade.

2. If applicable, trading agreements or contracts for the bmp implementation and maintenance.
3. Amount of credits calculated.
4. Baseline information used to calculate credits.
5. Equations used in credit calculations.

Reporting

Monthly

40 CFR §122.44(i) requires that an NPDES permit contain monitoring and reporting provisions that are sufficient to assure compliance with permit limitations and at frequency dependent on the nature and effect of the discharge. As a result, if the permittee's nutrient limit is included in the permit as a daily or monthly limit, reporting on this parameter would typically occur on the permittee's discharge monitoring report (or other DEQ-approved form) that is submitted to DEQ on a monthly basis. The amount and source of credits being used to comply with the nutrient limit(s) should also be provided at this time. If credits are required to comply with a permit limit, the permit writer may develop an alternative schedule (e.g., yearly may be sufficient).

Annual

For point source to nonpoint source trades, at a minimum, the permit writer needs to include the following annual reporting requirement in a permit to assess whether a permittee is in compliance with the permit trading provisions:

1. Summary descriptions of trades, including whether credits were:
   a. Generated by activities conducted by the permittee or purchased by the permittee; and
   b. How the credits were used (e.g., applied towards compliance with waste discharge limitations, retired, sold to another permittee).
2. A progress update relative to the interim goals defined for the trading program.

Table D-5: Runoff Coefficients By Land Use

Land Use	Runoff Coefficient
Urban	0.59
Logging	0.22
Agriculture	0.25
Industrial	0.68
Open Space	0.14

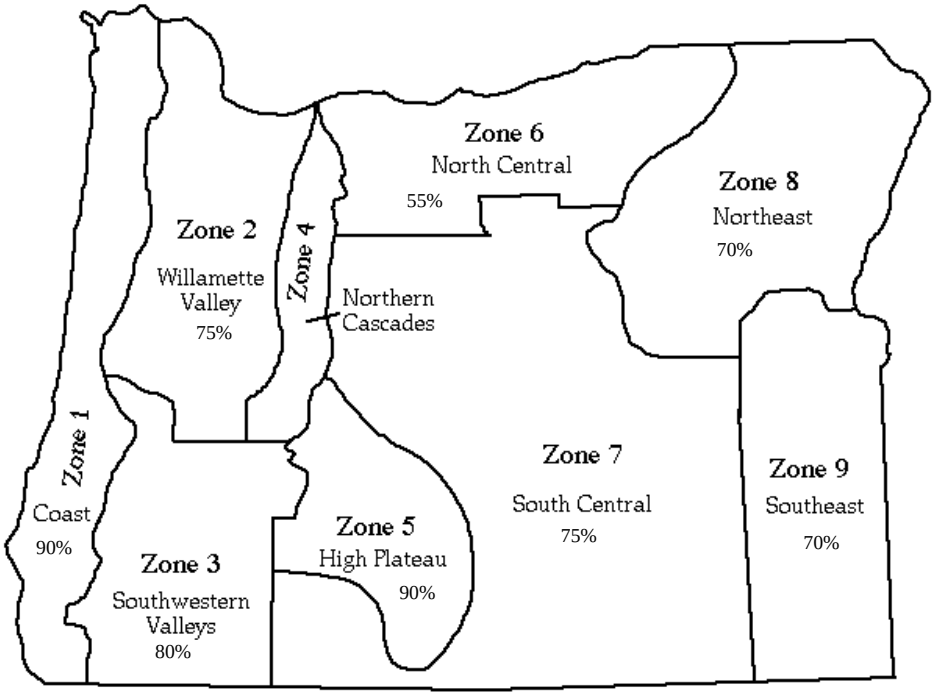
Table D-6: Pollutant Concentrations Typical for Indicated Land Use

Land Use	TSS, mg/L	TP, mg/L	TN, mg/L
Urban	64.00	1.000	6.500
Logging/post clear-cut	38.00	0.015	0.034
Agriculture (Crops)	8.93	0.210	2.620
Agriculture (Grazing)	3.90	0.480	4.200
Industrial	102.00	0.380	1.530
Open Space	58.00	0.160	0.690

Table D-7: Pollutant Deposition Rates for Beef Waste

Component	Units	Feeder, yearling 750 to 1,100 lb High Forage Diet	450 to 750 lb	Cow
N	lb/day/1000#	0.31*	0.30*	0.33*
P	lb/day/1000#	0.11*	0.10*	0.12*
* Include the units for pollution deposition rates when computing the annual pollutant deposition (e.g. 0.33 lb/day) 1000 lb				

Figure D-1: Percent of Annual Precipitation that Contributes to Runoff



Appendix E: Example NPDES Permit Conditions for Temperature Trading

The following draft language is the product of a cooperative effort between DEQ, the Willamette Partnership, and several NPDES permittees in the Willamette basin to address elevated stream temperatures in the basin. This draft provides a useful framework for developing NPDES permit conditions for a trading program; however, it was completed prior to the 2009 revision of the DEQ Water Quality Trading IMD. As a result, there are several areas of the draft that need to be expanded; these include:

- For riparian shade restoration projects, the delineation of the service area where projects may occur.
- Planting and maintenance protocols and goals for riparian shade restoration projects (e.g., ecologically appropriate plantings).
- Additional recordkeeping and reporting requirements for riparian shade restoration projects.
- Other conditions to address credit duration and maintenance, outline requirements or alternative compliance mechanism that apply when credits are unavailable to demonstrate permit compliance, allow other types of trades (e.g., BOD, ammonia, nutrients), etc.

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1. Water Quality Credit Trading in {*insert basin or water body*}
   a. Authorization of Thermal Load Credit Trading
      i. The permittee is authorized to utilize water quality credit trading to assist in compliance with thermal load permit requirements as follows:
      ii. The permittee's credit trading activities may not cause a net increase of thermal load or impair instream beneficial uses. In addition, the credit trading activities must be designed to reduce or offset thermal loads, improve instream temperatures, and/or improve or restore conditions for {*insert; e.g., salmonids*} in the {*insert basin or water body*} (see condition 1.f below).
      iii. The permittee must develop and implement a credit trading program that meets the requirements in conditions 1.c to 1.h below.

   b. Authorization of Additional Parameters
      i. The permittee may request authorization from the Department to utilize water quality credit trading for parameters other than thermal load. This request must be consistent with the requirements in conditions 1.c to 1.e, 1.g, and 1.h below.

   c. Public Review and Department Approval of Permittee's Credit Trading Program
      i. The permittee must submit its proposal for a credit trading program to the Department for review and approval.
      ii. The Department will provide an opportunity for a 30-day public review and comment period on the proposed credit trading program prior to approving or denying the proposal.
      iii. The permittee must submit any program amendment that changes the scope or direction of the program to the Department for public review and Department approval as described in (ii) above. Department approval and public review is not required for individual trading agreements provided the agreements are consistent with the overall scope of the credit trading program.

d. Credit Trading Program Components
At a minimum, the permittee's program proposal must:
   i. Describe the planned credit trading activities, including the quantity of credits to be generated by these activities, methodology utilized to calculate the quantity of credits, and specific units of credits generated.
   ii. Target areas that are in need of improvement. The permittee should focus on areas that have greater potential for overall ecological benefit.
   iii. Include interim goals by which the success of the program will be measured. For example, tree planting goals for each year. These goals are not subject to enforcement action by the Department.

e. General Provisions for Credit Trading
   i. Obtaining credits.
      (1) The permittee may obtain credits through contractual trading agreements with land or water conservation organizations, government agencies, private parties, or marketplace exchanges, or through activities performed by the permittee itself.
      (2) Trading agreements must be developed according to condition 1.g below and made available to the Department within 30 days of request.
   ii. Selling credits. The permittee may sell credits to a third party if the credits are not needed to comply with waste discharge limitations in Schedule A.
   iii. Validity of credits. Credits are valid if the following requirements are met:
      (1) Credits must be generated from activities that are not already required by statute or rule.
      (2) Credits must be generated prior to or during the period they are applied to the permittee's waste discharge limitations in Schedule A except as provided in condition 1.f.iv below.
      (3) Assurances exist to ensure that credits are generated and will be maintained.
      (4) Maintenance plans are developed for the life of the credits.
      (5) Monitoring plans are developed and implemented for the activities generating credits to ensure that these activities are functioning as intended.
      (6) See condition 1.f below for additional requirements for thermal load credits.
   iv. Use of credit. The permittee may use credits to comply with its waste discharge limitations in Schedule A for as long as the pollution control, best management practice, or other environmental improvement project is functioning as expected.

f. Provisions for Generating Thermal Load Credits
   i. Thermal load credits may be generated from the following activities including but not limited to:
      (1) Riparian area shading
      (2) Receiving stream flow augmentation
      (3) Recycling of wastewater effluent through reuse
      (4) Application of cooling technology
      (5) Other activities related to improving or restoring instream temperatures or conditions for salmonids (e.g., fish habitat improvements, floodplain restoration, wetland restoration).
   ii. Credits must be from activities implemented after the {*insert date*} adoption date of the {*insert basin or water body*} TMDL.
   iii. Credits for reducing thermal load must be generated in the area of the {insert basin} upstream of the "Point of Maximum Impact" defined in the {*insert basin or water body*} *TMDL* ({*insert date*}).

iv. Credits for reducing thermal load with riparian shading via tree planting may be generated at the time trees are planted and may be used for a maximum of 20 years provided a long-term maintenance plan exists and is implemented.

g. Trading Agreements
   i. The permittee must ensure that trading agreements are written agreements that are signed and dated by authorized representatives of the buyer and seller. At a minimum the agreements must include the following:
      (1) Name of party(ies) involved with the generation and use of credits and their responsibilities (e.g., seller, buyer).
      (2) Location map of the project area used to generate the water quality credits.
      (3) Description of activities that will generate the credits. For riparian shade restoration plans, plant selection and planting densities appropriate for site-specific soil conditions must be included. For flow augmentation plans, source and period of augmentation water must be included.
      (4) Quantity of credits to be generated including a summary of the methodology utilized to calculate the quantity of credits and specific units of credits generated (e.g., the Shade-a-lator model developed by DEQ was used to calculate credits from shade restoration activities).
      (5) Long-term financial plan for implementation and maintenance of credits.
      (6) Maintenance plan that includes a schedule and specific activities for the life of the credit.
      (7) Monitoring plan to ensure that the activities generating the credits are functioning as intended.
      (8) Consequences for failure to fulfill negotiated terms.
   ii. A breach of a trading agreement by either party is not a violation of this permit. If the credits expected from the breached agreement are necessary to maintain compliance with its waste discharge limitation in Schedule A, the permittee must update and submit its credit trading program to the Department within 60 days of the breach. The permittee must explain in its updated credit trading program how it will compensate for the loss of credits.

h. Annual Credit Trading Program Report
   The permittee must submit to the Department by {*insert month, day*} an annual report summarizing the results of its credit trading activities for the previous calendar year. At a minimum, the report must include:
   i. Summary descriptions of trades, including whether credits were:
      (1) Generated by activities conducted by the permittee or purchased by the permittee; and
      (2) How the credits were used (e.g., applied towards compliance with waste discharge limitations, sold to another permittee).
   ii. A progress update relative to the interim goals defined for the trading program.

Appendix F: DEQ Water Quality Trading Workgroup

In recognition of the fact that trading is an evolving area for DEQ, the DEQ Water Quality Program Management Team (PMT) formed an internal Water Quality Trading Workgroup in April 2008. The group was tasked with developing trading policies and procedures as well as a consistent message regarding trading for the benefit of DEQ staff as well as external stakeholders. Members of the group currently include:

- Sonja Biorn-Hansen, Water Quality Division, DEQ (Statewide trading coordinator)
- Doug Drake, Northwest Region, DEQ
- Ranei Nomura, Western Region, DEQ (Western Region trading coordinator)
- Ryan Michie, Water Quality Division, DEQ
- Mike Wolf, Western Region, DEQ
- Pamela Wright, Western Region, DEQ

Former members included:

- Jane Bacchieri, Water Quality Division, DEQ
- Pete Dalke, Northwest Region, DEQ

Appendix G: Issues for Further Consideration

Many aspects and issues involved with water quality trading in Oregon were reviewed by the Water Quality Trading Workgroup. Some specific issues are listed below for future consideration as experience is gained from the implementation of this IMD. These topics are placeholders for future discussions and are listed in no particular order:

- *Toxics trading.* Some permittees have expressed interest in a program to allow the trading of "toxic" pollutants. The revised IMD does not address the trading of priority pollutants and persistent bioaccumulative toxics (see section 2.4, *Pollutants and parameters that may be traded*, p.13 of the IMD). DEQ felt considerable additional information and broader representation is needed for any discussion of a water quality trading program that would include these substances (e.g., mercury).

- *Buffer widths.* The IMD does not specify minimum or maximum riparian buffer widths for credit generating projects. At this time, DEQ relies on other institutional controls (e.g. the Oregon Forest Practices Act, the Conservation Reserve Enhancement Program, local riparian ordinances, conservation easements) to address adequate buffer width in combination with riparian shade projects. There may also be stakeholder interest in DEQ developing incentives for increasing buffer widths and exceeding effective shade targets. As ecosystem markets develop, DEQ may also need to clarify whether there is a need for larger buffer widths beyond the minimum regulatory requirements to provide effective shade or whether specific buffer widths are needed to qualify for other credits, e.g., carbon credits.

- *Trading ratios.* Trading ratios are used to account for uncertainty, compensate for the amount of time necessary for the beneficial impact of a trade to take effect, or compensate for the distance between the generation of a credit and the point of maximum impact as defined in a TMDL. The trading ratio currently developed for riparian shade restoration is a uniform 2:1 (see *Trading ratio*, p. 6 in Appendix A: Protocols for Temperature Trading – Riparian Shade Restoration). Because the ratio is uniform, it is not being used as an incentive mechanism to direct the location or type of credit generating projects (i.e., the location of individual shade restoration projects does not change the trading ratio). DEQ may adjust this trading ratio in the future for future projects if current projects do not providing the anticipated benefits.

- *Priority areas for riparian shade restoration.* There has been much discussion around whether DEQ should require that a *majority* (greater than 50%) of the kilocalorie credits used by a permittee be generated along a DEQ-approved priority stream reach. DEQ decided not to include this requirement at this time because it makes it more difficult for permittees to start their trading activities (i.e., no analysis has been conducted to determine if actual opportunities are available in these areas). However, such a requirement may be added to a specific TMDL or developed in the future if shade projects in a particular watershed are not providing the anticipated benefits.

- *Federal lands and dams.* The revised IMD assumes that a majority of trades will take place between NPDES permittees and private landowners. As a result, the IMD does not directly address trades involving lands managed or owned by the U.S. Forest Service, Bureau of Land Management, or other federally-owned or managed lands. However, DEQ acknowledges that excluding government-owned land from consideration for trading may eliminate the best opportunities for achieving environmental gain in a basin, especially in areas where there are fewer funds available to these agencies to address legacy activities. If this turns out to be the case, future discussion will be needed to address trades on lands owned by governmental entities.

- *Private and public dams.* The IMD does address flow augmentation; however, it does not provide detailed guidance for dam projects and trades associated with such projects because they are managed differently than NPDES-related trades due to different regulatory drivers and wide-ranging environmental impacts. Further discussion on requirements for these types of projects is needed.

- *Agricultural lands and water quality management plans.* Oregon Senate Bill 1010 and related management plans for agricultural lands do not require the active restoration of riparian areas. Water quality trading is intended to encourage and potentially reward active restoration and the associated incremental environmental gains that will occur in a shorter time when compared to passive management activities in riparian areas. Future discussion will be needed if the IMD does not effectively encourage active restoration.

- *Temperature trades involving improved habitat.* The potential for these trades is discussed in Section 2.4, *Temperature*, p. 15, of the IMD. At present, DEQ anticipates developing protocols for these trades on a case-by-case basis. DEQ anticipates receiving more information from current research that will better allow establishing the protocols for these types of trades. Further discussion is needed to develop protocols to quantify the water quality and environmental benefits of improved habitat projects into tradable units, determine the appropriate scale and scope of habitat improvement projects for the trading program, and monitor effectiveness of such trades.

- *Trades involving sediment or suspended solids.* The potential for these trades is discussed briefly in Section 2.4, *Sediment and suspended solids*, p. 17, of the IMD. DEQ is considering sediment or suspended solids as possible pollutants to include in trading to address sedimentation and/or dissolved oxygen issues. Further discussion and consideration is needed to develop protocols for these types of trades.

- *Trading in high quality waters or pre-TMDL 303(d) impaired waters.* The potential for trading in high quality waters and pre-TMDL 303(d) impaired waters is briefly discussed in Section 2.3, *Locations where trading may occur*, p. 10, of the IMD. Further discussion and consideration is needed to develop protocols for trading in these situations.