BEST MANAGEMENT PRACTICE (BMP) LIST FOR THE LOWER BOISE RIVER POLLUTION TRADING PROGRAM

THE LOWER BOISE RIVER POLLUTION TRADING PROJECT

This Pollution Trading project has been established and supported by many agencies and local interests to assist the point and nonpoint phosphorus sources in reducing their phosphorus loads and implementation costs in meeting a Total Maximum Daily Load (TMDL) at the mouth of the Boise River near Parma, Idaho. A "trading market" should enable point and nonpoint sources reductions to be achieved at lesser costs.

The trading that occurs between point and nonpoint sources will be due largely to high point source reduction costs. The point sources that cannot immediately meet their permitted discharges would be permitted to discharge in excess of their permit as long as there is an equal reduction at another point or nonpoint source location. In-stream water quality problems due to discharges in excess of what is permitted will not be allowed under this trading program. Water quality improvements are still to be achieved, regardless of the activity within the trading program.

DOCUMENT PURPOSE

Selected nonpoint source BMPs can be used to offset a point source's discharge, in which are described here. The procedure for generating credits, as well as other trading program requirements, are described as well. This document will be updated periodically and new BMPs added to the list of those currently eligible for trading.

CALCULATED AND MEASURED PHOSPHORUS CREDITS

To offset a given amount of phosphorus at one location from a point source, there must be an equal and beneficial reduction from another point or nonpoint source location. The term "credit" has been established to represent that equalized portion of phosphorus considered in the trading market. The reduction is calculated or measured in pounds of phosphorus, determined by one of two methods. These reductions are then converted to credits for trading purposes.

To estimate what a BMP's capability is in reducing phosphorus losses, local sampling data is needed in order to make that estimate. Where there is adequate data for a specific BMP's reduction capability, a calculation can be made with fair certainty of it actually occurring. Where data is limited, "measuring" for phosphorus removal is necessary. For this trading program, participants will use either the calculated or measured approach to generate credits. The calculated approach will utilize exiting data to estimate an average reduction for a particular BMP, with a slight discount in its effectiveness due to potential uncertainty in the data and other management factors. For measured credits, grab samples will be taken during the BMP's operation to quantify the actual reductions. An inflow and outflow condition will be necessary to sample a BMP.

GENERAL BEST MANAGEMENT PRACTICE (BMP) REQUIREMENTS FOR THE POLLUTION TRADING PROJECT

Agricultural landowners participating in the pollution trading program are highly encouraged to develop a conservation plan with one of two Soil Conservation Districts (SCD). The Ada Soil Conservation District resides at 132 SW 5th Ave., Meridian, ID 83642 (208-888-1890 x3) along with the Natural Resource Conservation Service (NRCS), the Soil Conservation Commission (SCC), and the Farm Services Agency (FSA). Ada county participants will utilize this office for technical and trading program assistance. For Canyon county participants, the Canyon Soil Conservation District is located at 2208 E. Chicago St. Caldwell, ID 83605 (208-454-8684), which also includes NRCS, SCC, and FSA.

The conservation plans are cooperatively developed among the landowner, NRCS and the SCC. These conservation plans are developed to address existing natural resource concerns as well as meeting the landowner's objectives. Through the conservation planning process, BMP installation and other planned activities are evaluated to ensure that they do not have significant negative impacts on natural resources and other landowners.

The BMPs typically used to address water quality concerns are listed in the Agricultural Pollution Abatement Plan (APAP), which is kept at the SCC. BMPs originate in the USDA-NRCS National Handbook of Conservation Practices (NHCP, 2000), which can be found in either of the SCD offices.

Upon installation, after being incorporated into this document, it is to be certified as installed according to NRCS and this document's criteria, as well as meet any applicable local, state, and federal laws and regulations. Upon certification and at the start of BMP operation, credit generation can begin. Most agricultural BMPs within the Lower Boise River watershed will provide reductions primarily within the irrigation season as designed and operated. All BMPs are to function according to the appropriate criteria throughout their operating period.

All BMPs are to be inspected after installation or application, prior to their seasonal period operation. Some BMPs will require a greater number of inspections as outlined in the monitoring section.

CURRENT ELIGIBLE BMPS FOR TRADING

The program eligible BMPs are listed in Table 1, which are also discussed in Carter 2002. The NRCS practice code and typical lifespan are included here.

Table 1. BMPs Currently Eligible for Trading.

BMP	NRCS Code[1]	Lifespan
Sediment basins	350	20 years
Filter strips	393	1 season
Underground outlet	620	20 years
Straw in furrows	484	1 season
Crop sequencing	328, 329	1 season
Polyacrylamide	450	1 irrigation
Sprinkler Irrigation	442	15 years
Microirrigation	441	10 years
Tailwater Recovery	447	15 years
Surge Irrigation	430HH	15 years
Nutrient Management	590	1 year
Constructed Wetland	656	15 years

[1] Refer to http://id.nrcs.usda.gov/practices.htm Additional components for the BMP may incorporate other practice codes.

BMP EFFICIENCY AND UNCERTAINTY DISCOUNTS

Listed in Table 2 are the effectiveness and uncertainty discounts for the currently eligible types, field, farm, and watershed scale. The sediment basin is categorized into 3 types, which, are due to differences in the size of treatment area and duration of flow in the basins.

Nutrient management does not have a phosphorus reduction efficiency due to numerous complexities. This practice is, however, a necessary long-term practice that will benefit water quality if applied properly. Though this practice does not have an efficiency associated with it, it is a valuable BMP for this trading program and will be marketable in relation to other applied BMPs. If nutrient management is applied in addition to other eligible BMPs, the uncertainty factor for those other BMPs will reduced by 50%, thereby, increasing their market value.

Table 2: BMP Effectiveness and Uncertainty Discounts

BMP	Effectiveness	Uncertainty[1]
Polyacrylamide	95%	10%
Filter Strip	55%	15%
Sprinkler	100%	10%
Microirrigation	100%	2%
Tailwater Recovery	100%	5%
Mulching	90%	20%
Crop sequencing	90%	10%
Sediment Basin Field scale	80%	10%
Sediment Basin (farm scale)	75%	10%
Sediment Basin (watershed scale)	65%[4]	15%[4]
Underground Outlet	85% (65%)[2]	15% (25%)[2]
Surge Irrigation	50%	5%
Nutrient Management	NA[3]	NA[3]
Constructed Wetland (farm scale)	90%	5%
Constructed Wetland (watershed scale)	NA[4]	NA[4]

(1) This is to be subtracted from the efficiency.
(2) This BMP's effectiveness drops after 2 years.
(3) Data unavailable for efficiency estimate. If applied with other eligible BMPs, their uncertainty discounts will be reduced by 50%.
(4) Not recommended for calculated credit.

BMP MONITORING: EVALUATION AND MEASUREMENT REQUIREMENTS

To ensure that a BMP is operating properly and actually reducing phosphorus losses, an evaluation is necessary. An evaluation will consist of at least 1 annual field inspection to ensure proper application and operation. Table 3 provides the minimum inspections needed for each BMP, and provides a minimal level of measurement requirements, though not applicable to all BMPs.

Some BMPs do not allow for true "inflow-outflow" comparisons utilizing flow and nutrient measurements, therefore it is not recommended for measurement. Also, a measurable BMP's inflow conditions only represent the instantaneous condition, not reflective of the 1996 baseline condition. In essence, these instantaneous measurements would provide a pretreatment load different than that of the baseline average load, misrepresenting the average 1996 loads. Therefore, no measurements will be allowed for field-scale BMPs to generate credits.

Watershed-scale BMPs, such as the sediment basin and constructed wetlands, where they are not easily calculated, will be measured to generate credits. The schedule for measurements will be set within the buyer-seller contracts for specific watershed-scale BMPs.

Table 3. BMP Evaluation Requirements

BMP	Evaluation
Sediment basin - field scale	before & middle of all irrigations
Sediment basin - farm scale	before & middle of all irrigations
Sediment basin - watershed scale	before & middle of season of use
Filter strips	before & middle of all irrigations
Underground outlet	before & middle of all irrigations
Straw in furrows	before & middle of all irrigations
Crop sequencing	before & middle of all irrigations
Polyacrylamide	evaluate 2 irrigations & review application records
Sprinkler Irrigation,	evaluate 1 irrigation
Microirrigation	evaluate 1 irrigation
Tailwater Recovery	before irrigations & evaluate 1 irrigation
Surge Irrigation	evaluate 1 irrigation
Nutrient Management	evaluate records annually
Constructed wetland	before & middle of season of use

CREDIT PRODUCTION METHOD

Calculated Credits

To calculate a total phosphorus credit, a reduction estimate is determined prior to the sale of the credits, utilizing BMP effectiveness data and other applicable factors.

In the case of calculated credits, specifically to a cropland field, the phosphorus losses in 1996 (TMDL baseline) must be estimated. The Surface Irrigation Soil Loss (SISL) tool is currently the most accurate and simple method available for the program area to estimate soil losses from surface irrigated croplands. SISL losses are then converted to phosphorus losses by multiplying tons soil loss by 2, which provides pounds of phosphorus. Typically, there is on average, 2 pounds of phosphorus loss per ton of soil loss within the program area. This tool is described in USDA-NRCS Agronomy Technical Note No. 32.

There is a great amount of variability in soil and phosphorus loss from one year to the next because of crop rotations, as the SISL shows when used according to its design. This variability would cause a great deal of fluctuation from year-to-year in credits generated from one field. This fluctuation may is not greatly desired in a trading program. Also, because there does not exist data for all fields within the program area for 1996, the crop specific SISL estimate cannot be derived for a number of fields.

An average subwatershed Base Soil Loss (BSL), a necessary factor in SISL, has been determined for each the major Lower Boise River subwatersheds (Table 4). Numerous field crop records from 1996 were evaluated to establish baseline 1996 soil losses with SISL. By utilizing the average subwatershed BSL, crop rotations will have no effect on credit calculation because the pretreatment load of 1996 will not change. A change in credits will only be due to switching from one BMP to another.

Where the SISL-BSL represents seasonal sediment losses, monthly losses may be estimated utilizing numerous irrigation records, which can be used to provide an average number of irrigations per month. Another critical factor to be considered in determining an average sediment and phosphorus loss on a monthly basis, is the percent soil loss of total per irrigation. The first three irrigations typically produce the majority of the annual sediment loss, whereas, with each additional irrigation, less erosion takes place due to increasing soil stability and some crop foliage protection where it lies within the furrow later in the growing season.

Table 4. SISL BSL (tons/ac/yr soil loss[1]) per Subwatershed

Slope of field	<1%		1-1.9%		2-2.9%		>3%	
Drain/Field length	660	1320	660	1320	660	1320	660	1320
Eagle Drain	2.0	1.6	7.3	5.8	15.5	12.4	25.2	20.2
Thurman Drain[2]	NA	NA	NA	NA	NA	NA	NA	NA
Fifteenmile	1.6	1.3	5.8	4.6	12.5	10.0	21.0	16.8
Mill Slough	2.0	1.6	7.3	5.8	15.5	12.4	25.2	20.2
Willow Creek	1.9	1.5	6.8	5.5	14.7	11.7	24.0	19.2
Mason Slough	2.0	1.6	7.3	5.8	15.5	12.4	25.2	20.2
Mason Creek	1.7	1.4	6.4	5.1	14.1	11.2	23.7	18.9
East Hartley	2.0	1.6	7.3	5.8	15.7	12.5	25.6	20.5
West Hartley	2.0	1.6	7.3	5.8	15.7	12.5	25.6	20.5
Indian Creek	1.9	1.5	6.9	5.5	14.9	11.9	24.7	19.8
Conway Gulch	2.0	1.6	7.3	5.8	15.7	12.5	25.6	20.5
Dixie Drain	1.7	1.4	6.4	5.1	13.9	11.1	23.0	18.4
Boise River	2.0	1.6	7.3	5.8	15.5	12.4	25.2	20.2

(1) Multiple BSL by 2 to obtain pounds of phosphorus
(2) Thurman drain currently does not have any cropland fields within it drainage area.

Based on numerous irrigation records and local input, average number of irrigations per crop type per month was established, then one average for all crops per month. The average number of irrigations per month is shown in Table 5.

Table 5. Average Number of Irrigations per month, based on a 181-day irrigation season.

Month	Irrigations	Days/month
April	0.4	15
May	1.2	31
June	2.4	30
July	3.0	31
August	1.9	30
September	0.5	31
October	0.2	15
Total	9.5	181

The average number of irrigations per month was not rounded to the whole number because it would exclude any irrigation that does occur in April and October. The irrigation season is assumed to start on start on April 15 and end October 15, providing a 181 irrigation day season.

Based on numerous runoff studies on surface irrigated cropland, percent soil loss per irrigation was determined. These percent losses per irrigation were then lined up with the average 9-10 irrigations per season to estimate average percent loss per irrigation (Figure 1).

Figure 1. Average Percent Soil Loss per Irrigation per Total Season Loss

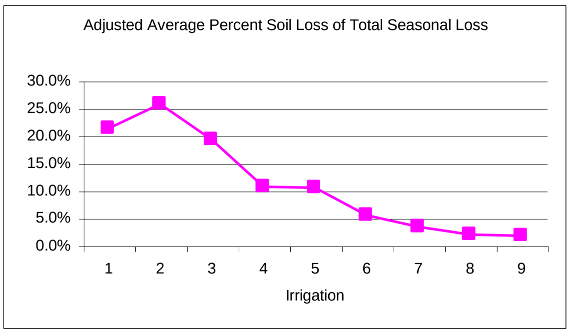

Table 6 shows the percent loss per month, which was derived from the average irrigations per month (Table 5) and percent loss per the 9-10 irrigations per season (Figure 1).

Table 6. Percent Soil Loss per Month

Month	Percent Loss
April	8.5%
May	28.1%
June	39.9%
July	19.4%
August	3.6%
September	0.4%
October	0.1%

Recent water quality samples taken throughout the Lower Boise River tributaries reflect similar loss characteristics, where the months of May, June, and July show the largest in-stream sediment loads. Once the seasonal SISL losses are determined, which represents the pretreatment load, a monthly estimate can be estimated with the values from Table 6.

<u>River Location Ratios</u>

Upon establishing a monthly or irrigation season phosphorus reductions, with a BMP applied, pounds reduced are to be converted into "Parma Pounds" or credits. The current adopted method utilizes a simple mathematical calculation to convert pounds into credits. The amount of phosphorus retained by a BMP on a field within a subwatershed does equal the amount of phosphorus reduced at the mouth of the drainage. There are River Location Ratios (DEQ, 2000) that attempt to account for the river's phosphorus transmission losses and are set at the various locations within the river system, primarily at the mouths of the major tributaries, as shown in Table 7. Those river adjacent lands that impact the river directly will receive the next downstream tributary river location ratio.

Table 7. River Location Ratios

Subwatershed	River Location Ratio
Eagle Drain	0.63
Thurman Drain	0.51
Fifteenmile Creek	0.75
Mill Slough	0.75
Willow Creek	0.75
Mason Slough	0.75
Mason Creek	0.75
East Hartley Gulch(1)	0.80
West Hartley Gulch(1)	0.80
Indian Creek	0.89
Conway Gulch	0.95
Dixie Drain	0.96

(1) East & West Hartley Gulch merge before confluence at Boise River

<u>Site Location Factors</u>

Transmission losses may occur between the point where the reduction takes place and the subwatershed's channel due to wastewater being water reuse and natural sediment-phosphorus relationships. Canals may intercept wastewater runoff from fields, which may or mat not impact the drainage in which the field is located. The greater the travel distance and the chance of reuse, the less likely the total phosphorus amount lost at the field will reach the channel. Site Location Factors are developed to account for some of this transmission loss, shown in Table 8.

Table 8. Site Location Factors

Land runoff flows into a canal, likely to be reused by downstream canal users	0.6
Land runoff does not flow directly to a drain, but through or around other fields prior to entering a drain	0.8
Land runoff flows directly to a drain or stream through a culvert or ditch	1.0

Drainage Delivery ratios

Drainage Delivery Ratios were also developed to account for the phosphorus transmission losses in the subwatershed's main channels. Recent water quality samples collected from within some of these subwatersheds do show however, upstream to downstream, an increase in phosphorus concentrations. This increase in phosphorus concentration is likely due to increasing surface and ground water flows and phosphorus loads from increasing numbers of sources. Due to no available research data or locally developed transmission models, a simple linear calculation is made that represents this potential loss, which is:

(100 - distance in miles to mouth of the drain from the project's point of discharge on the drain)/100.

A measurement, in miles, is made from the mouth of the channel on the river to the point where the wastewater enters the channel. This measurement is to be made with the use of computer based Geographic Information Software (GIS).

Example Credit Calculation

The following is an example of the current method of calculating credits:

Given: 30 acre surface irrigated field to be converted to a sprinkler system, capable of eliminating all sedimentation loss (100% removal) but with a 10% uncertainty factor (subtracted from BMP efficiency). Average annual SISL load is determined to be 7.3 tons/acre (219 total) soil loss per irrigation season. Total annual phosphorus loss is calculated to be 438 pounds (219 x 2 lbs/t). Assuming a 78% TMDL reduction requirement from all sources, 342 lbs is to be removed first, prior to trading and calculating credits. A total of 394 lbs is to be reduced by the sprinkler system (0.9 x 438). The Site Location Factor is 0.8, because there is potential but reuse, but not through a canal. The distance from the river to the entry point at the channel is 2.5 miles, which gives a 0.975 Drainage Delivery Ratio. The River Location Ratio is 0.75.

Credits (Parma Pounds) =
438 lbs P
x 0.90 (1.0 effective - 0.10 uncertainty)
-342 lbs P (438 lbs P x TMDL 0.78)
x 0.8 site location factor
x 0.975 drainage delivery ratio
x 0.75 river location ratio =
30 credits (Parma Pounds) for sale for one irrigation season.

By month:	*April*	*2.6*
	May	*8.4*
	June	*12.0*
	July	*5.8*
	August	*1.1*
	September	*0.1*
	October	*0.0*

INCLUSION OF NEW OR EXISTING PHOSPHORUS CONSERVATION MEASURES TO THE BMP LIST

There may be other conservation measures not specifically characterized within the NHCP or APAP that can reduce phosphorus losses from agricultural lands or treat wastewater. These conservation measures can be added to this list at any time, once they have been reviewed and approved by the BMP technical Committee potentially undergo a public review process to fulfill the trading program requirements.

Proposed conservation measures to be considered for the purpose of establishing credits not contained within this list are to be forwarded to the Idaho Soil Conservation Commission, BMP Technical Committee, Pollution Trading, P. O. Box 790, Boise, Idaho 83701 at (208) 332-8650.

REFERENCES

Carter, D. L. 2002. Proposed Best Management Practice (BMP) list and application criteria for the Lower Boise River Pollution Trading Demonstration Project, Unpublished report.

Idaho Department of Environmental Quality (DEQ). 6/7/2000. Lower Boise River pollution trading demonstration project, summary of participant recommendations for a trading framework. Unpublished document.

USDA - Natural Resources Conservation Service. 2000. Agronomy technical note 32, rev. 2. Predicting irrigation induced soil loss on surface irrigation cropland. Unpublished document. – USDA-NRCS, Boise Idaho.