Clean Water Act Section 319 Load Reduction Estimations

Darcy Sharp – DEQ State Office Technical Services

Southwest Idaho Basin Advisory Group Meeting

January 28, 2015 DEQ Boise Regional Office

Legal Basis for Reporting Load Reduction Estimations

* Clean Water Act § 319
  * CWA § § 319[h][11] and 319 [m][1]—annual report
  * CWA § § 319[h][10]—EPA authority to request data
* Government Performance and Results Act
  * EPA Strategic Plan
    * National Water Program Guidance
      * Performance Activity Measures

Clean Water Act § § 319 [h][11] & 319 [m][1]

* Requires each state to make an annual report of progress toward controlling nonpoint sources
* Report reductions in nonpoint source pollutant loading

2013 Performance and Progress Report

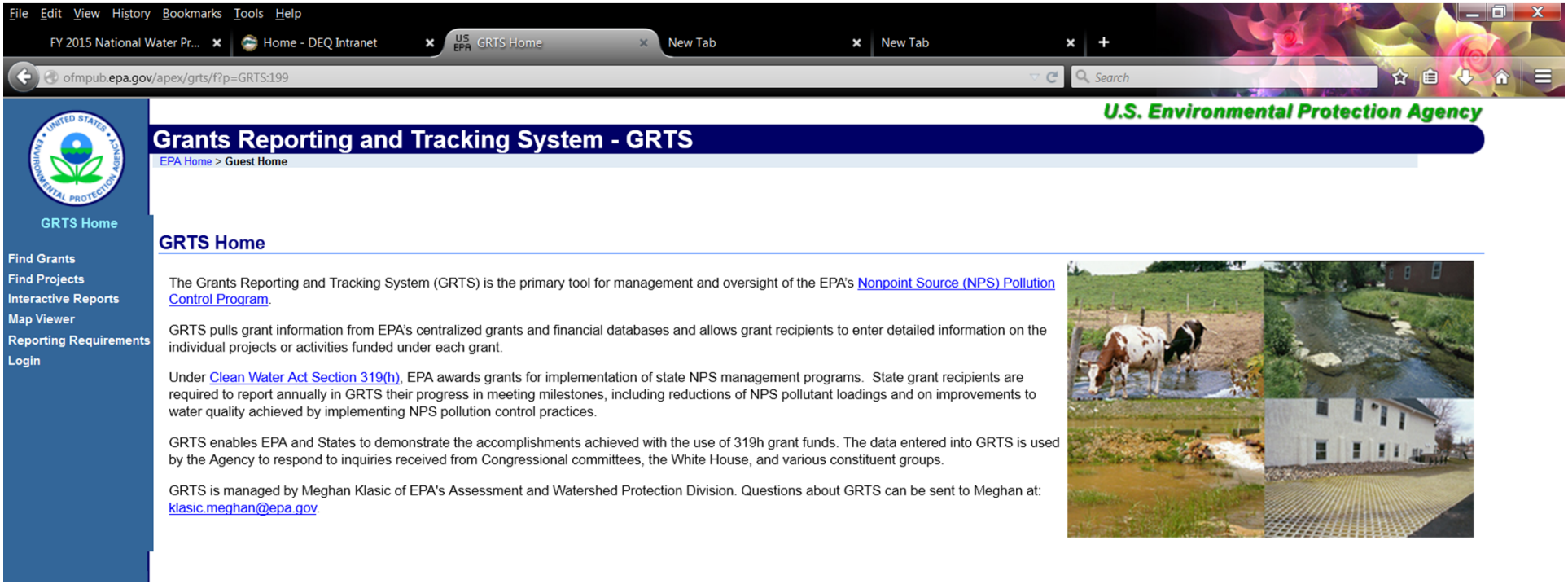
State of Idaho Nonpoint Source Management Program

State of Idaho
Department of Environmental Quality

March 2014

Clean Water Act § § 319 [h][10]

* Authorizes EPA to request information, data, and reports to determine a state's continuing eligibility to receive § 319 grants

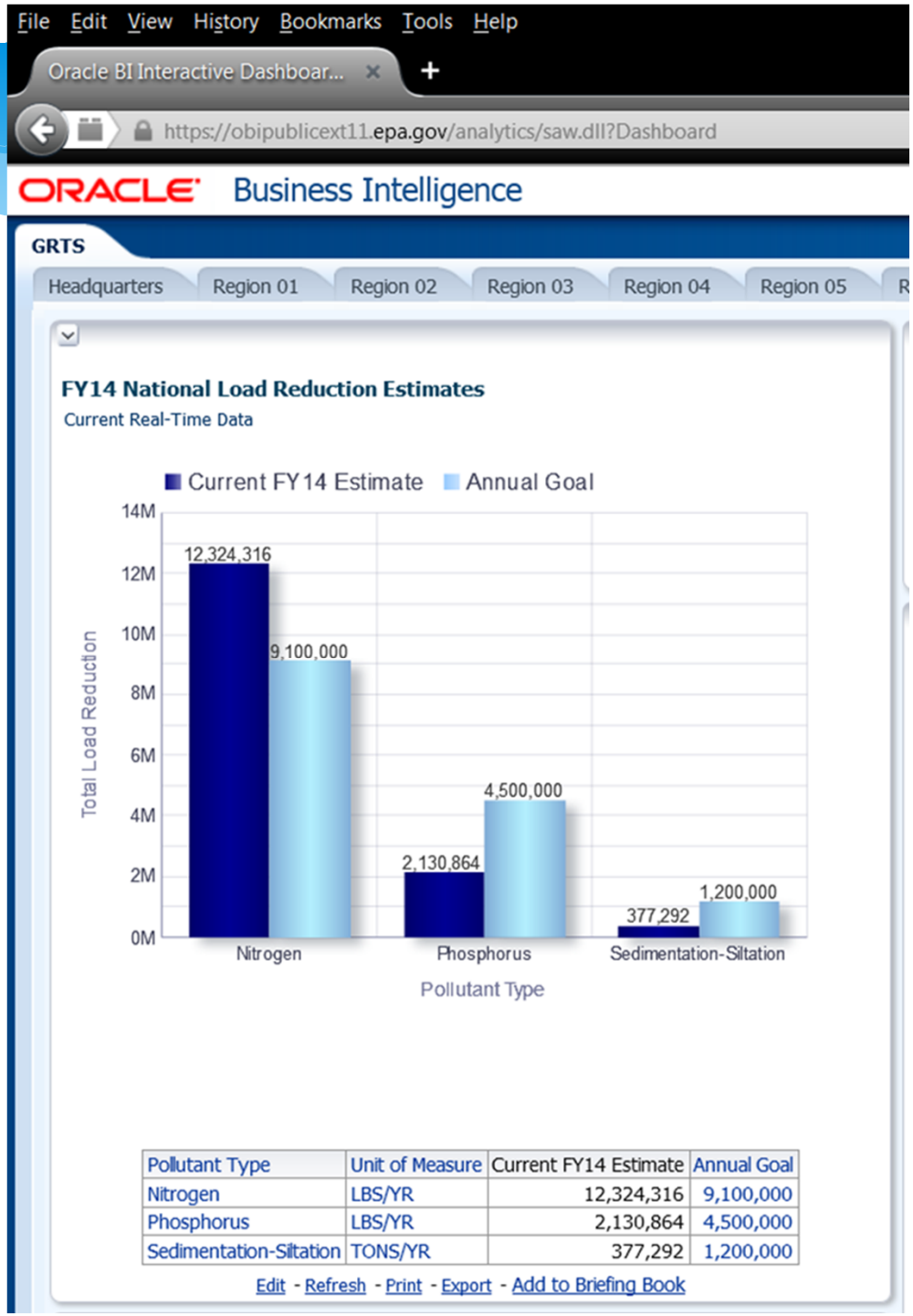


Government Performance and Results Act

- Requires federal programs to develop strategic plans with performance goals and program evaluations and make them publicly available
- EPA's ***Strategic Plan*** fulfills this requirement
  - Identifies nonpoint source pollution, primarily nitrogen, phosphorus, and sediment, as the largest remaining impediment to improving water quality
  - EPA's ***National Water Program Guidance*** identifies target load reductions in nitrogen, phosphorus, and sediment for each fiscal year

FY 14 National Load Reduction Estimates

Current Real-Time Data as of 1/27/2015



Why estimate load reductions?

* Accountability and continued § 319 funding
* Share accomplishments
* Measure water quality improvements—WQ-10 "success stories"

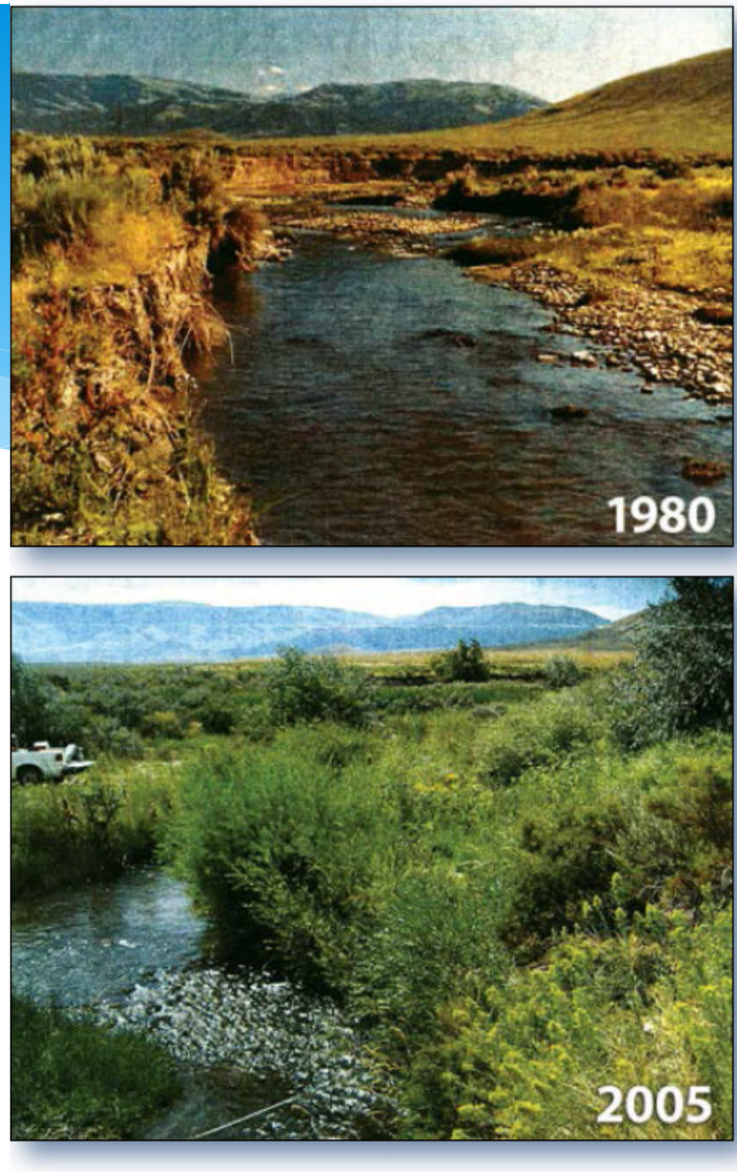


Figure 2. Raft River at the Narrows, before (top) and after (bottom) BLM installed exclosures to limit livestock access to the river.

EPA-Recommended Tools for Estimating Load Reductions

Welcome to STEPL and Region 5 Model

Spreadsheet Tool for Estimating Pollutant Load (STEPL) employs simple algorithms to calculate nutrient and sediment loads from different land uses and the load reductions that would result from the implementation of various best management practices (BMPs). STEPL provides a user-friendly Visual Basic (VB) interface to create a customized spreadsheet-based model in Microsoft (MS) Excel. It computes watershed surface runoff; nutrient loads, including nitrogen, phosphorus, and 5-day biological oxygen demand (BOD5); and sediment delivery based on various land uses and management practices. For each watershed, the annual nutrient loading is calculated based on the runoff volume and the pollutant concentrations in the runoff water as influenced by factors such as the land use distribution and management practices. The annual sediment load (sheet and rill erosion only) is calculated based on the Universal Soil Loss Equation (USLE) and the sediment delivery ratio. The sediment and pollutant load reductions that result from the implementation of BMPs are computed using the known BMP efficiencies.

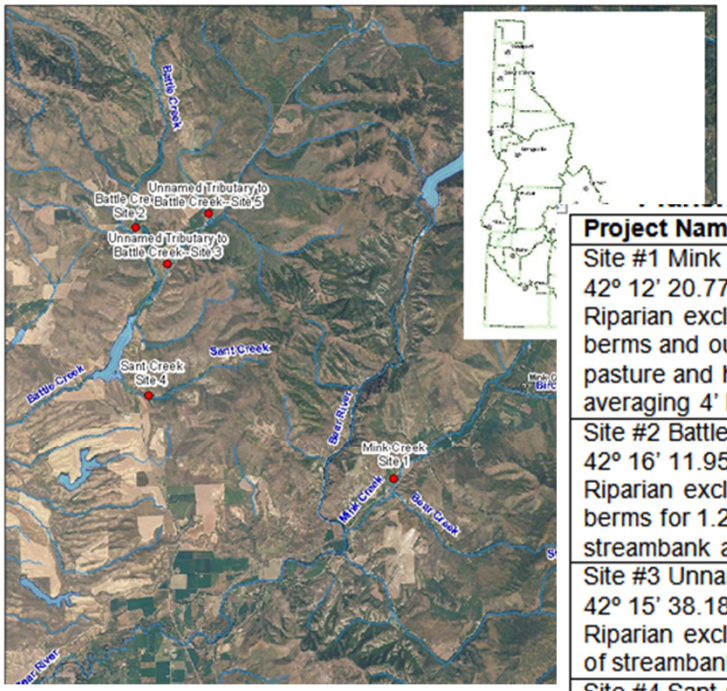
Region 5 Model is an Excel workbook that provides a gross estimate of sediment and nutrient load reductions from the implementation of agricultural and urban BMPs. The algorithms for non-urban BMPs are based on the "Pollutants controlled: Calculation and documentation for Section 319 watersheds training manual" (Michigan Department of Environmental Quality, June 1999). The algorithms for urban BMPs are based on the data and calculations developed by Illinois EPA. Region 5 Model does not estimate pollutant load reductions for dissolved constituents.

STEPL
Spreadsheet tool for estimating pollutant loads

* Easy to use Excel spreadsheets
* Calculates sediment and nutrient loads
  * Calculates runoff volume and pollutant concentration determined by land use
  * Sediment load from sheet and rill erosion
  * According to best management practice (BMP) implemented
    * Known BMP efficiencies
    * Specific to land use

Bear River Animal Feeding Operation Projects S296
Load Reduction Estimations

The Franklin Soil and Water Conservation District is planning six projects for installation and implementation of Best Management Practices (BMPs) in Franklin County, Idaho. Figure 1 shows the vicinity of the projects funded in part from the 319 program of Idaho Department of Environmental Quality (DEQ). Conservation planning efforts are concentrating on Animal Feeding Operations (AFOs) adjacent to wetlands and perennial streams in the Middle Bear River watershed.



Project Name, Location and Parameters	Calculation Method	Load Reduction
Site #1 Mink Creek 42° 12' 20.77" N 111° 45' 41.80" W Riparian exclusion by fencing and off-site watering; berms and outlet for 11.7-acre AFO with 225 sheep; pasture and hayland planting. 3920' of streambank averaging 4' high.	STEPL modeling, Direct volume calculation	Sediment =663 tons Phosphorus =1091 lbs Nitrogen=2396 lbs
Site #2 Battle Creek 42° 16' 11.95" N 111° 50' 43.72" W Riparian exclusion by fencing and off-site watering; berms for 1.2-acre AFO with 200 cows. 440' of streambank averaging 1.5' high.	STEPL modeling, Direct volume calculation	Sediment =28 tons Phosphorus =309 lbs Nitrogen=1270 lbs
Site #3 Unnamed tributary to Battle Creek 42° 15' 38.18" N 111° 50' 6.72" W Riparian exclusion; pasture and hayland planting. 1230' of streambank averaging 2.25' high.	Direct volume calculation	Sediment =117 tons Phosphorus =187 lbs Nitrogen=373 lbs
Site #4 Sant Creek 42° 13' 41.43" N 111° 50' 32.71" W Riparian exclusion by off-site watering; berms for 4.5-acre AFO with 60 cows. 3200' of streambank averaging 2.5' high.	STEPL modeling, Direct volume calculation	Sediment =337 tons Phosphorus =673 lbs Nitrogen=1669 lbs
Site #5 Unnamed tributary to Battle Creek 42° 16' 22.84" N 111° 49' 15.71" W Riparian exclusion by fencing and off-site watering; berms for 0.6-acre AFO with 40 cows.1060' of streambank averaging 1' high	STEPL modeling, Direct volume calculation	Sediment = 44 tons Phosphorus =160 lbs Nitrogen=534 lbs
Site #6 Upper Worm Creek 42° 9' 46.99" N 111° 41' 6.39" W Riparian exclusion by off-site watering	Direct volume calculation	Sediment = 6 tons Phosphorus =10 lbs Nitrogen=20 lbs
Total Load Reduction Estimations		**Sediment = 1195 tons** Phosphorus =2430 lbs Nitrogen=6262 lbs

STEPL Input Sheet: Values in RED are required input. Change worksheets by clicking on tabs at the bottom. You entered 6 subwatershed(s).

This sheet is composed of eight input tables. The first four tables require users to change initial values. The next four tables (initially hidden) contain default values users may choose to change.

Step 1: Select the state and county where your watersheds are located. Select a nearby weather station. This will automatically specify values for rainfall parameters in Table 1 and USLE param

Step 2: (a) Enter land use areas in acres in Table 1; (b) enter total number of agricultural animals by type and number of months per year that manure is applied to croplands in Table 2; (c) enter values for septic system parameters in Table 3; and (d) if desired, modify USLE parameters associated with the selected county in Table 4.

Step 3: You may stop here and proceed to the BMPs sheet. If you have more detailed information on your watersheds, click the Yes button in row 10 to display optional input tables.

Step 4: (a) Specify the representative Soil Hydrologic Group (SHG) and soil nutrient concentrations in Table 5; (b) modify the curve number table by landuse and SHG in Table 6; (c) modify the nutrient concentrations (mg/L) in runoff in Table 7; and (d) specify the detailed land use distribution in the urban area in Table 8.

Step 5: Select BMPs in BMPs sheet. **Step 6**: View the estimates of loads and load reductions in Total Load and Graphs sheets.

Show optional input tables? Yes No ☑ **Treat all the subwatersheds as parts of a single watershed** ☐ **Groundwater load calculation**

State	County	Weather Station (for rain correction factors)
Idaho	Franklin	ID POCATELLO WSO AP

1. Input watershed land use area (ac) and precipitation (in)

									Rain correction factors 0.592	0.189	
Watershed	Urban	Cropland	Pastureland	Forest	User Defined	Feedlots	Feedlot Percent Paved	Total	Annual Rainfall	Rain Days	Avg. Rain/Event
Site 1--Mink Creek	0	0	0	0	0	11.7	0-24%	11.7	22.79	94.1	0.759
Site 2--Battle Creek	0	0	0	0	0	1.2	0-24%	1.2	22.79	94.1	0.759
Site 3--Trib Battle	0	0	0	0	0	0	0-24%	0	22.79	94.1	0.759
Site 4--Sant Creek	0	0	0	0	0	4.5	0-24%	4.5	22.79	94.1	0.759
Site 5 Trib to Battle	0	0	0	0	0	0.6	0-24%	0.6	22.79	94.1	0.759
Upper Worm	0	0	0	0	0	0	0-24%	0	22.79	94.1	0.759

2. Input agricultural animals

Watershed	Beef Cattle	Dairy Cattle	Swine (Hog)	Sheep	Horse	Chicken	Turkey	Duck	# of months manure applied
W1	0	0	0	225	0	0	0	0	0
W2	200	0	0	0	0	0	0	0	0
W3	0	0	0	0	0	0	0	0	0
W4	60	0	0	0	0	0	0	0	0
W5	40	0	0	0	0	0	0	0	0
W6	0	0	0	0	0	0	0	0	0
Total	300	0	0	225	0	0	0	0	

5. BMPs and efficiencies for different pollutants on FEEDLOTS, ND=No Data

Watershed	Feedlots					
	N	P	BOD	Sediment	BMPs	%Area BMP Applied
W1	0.8	0.9	ND	ND	Waste Mgmt System	100
W2	0.8	0.9	ND	ND	Waste Mgmt System	100
W3	ND	0.825	ND	ND	0 No BMP	100
W4	0.8	0.9	ND	ND	Waste Mgmt System	100
W5	0.8	0.9	ND	ND	Waste Mgmt System	100
W6	0	0	0	0	0 No BMP	100

1. Total load by subwatershed(s)

Watershed	N Load (no BMP)	P Load (no BMP)	BOD Load (no BMP)	Sediment Load (no BMP)	N Reduction	P Reduction	BOD Reduction	Sediment Reduction
	lb/year	lb/year	lb/year	t/year	lb/year	lb/year	lb/year	t/year
W1	342.9	33.2	276.5	0.0	274.3	29.9	0.0	0.0
W2	1474.6	294.9	1966.2	0.0	1179.7	265.4	0.0	0.0
W3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W4	737.3	147.5	983.1	0.0	589.9	132.7	0.0	0.0
W5	491.5	98.3	655.4	0.0	393.2	88.5	0.0	0.0
W6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	3046.4	573.9	3881.2	0.0	2437.1	516.5	0.0	0.0

BMP efficiencies in current version

Landuse	*BMP & Efficiency*	*N*	*P*	*BOD*	*Sediment*
Cropland					
Cropland	0 No BMP	0	0	0	0
Cropland	Combined BMPs-Calculated	0	0	0	0
Cropland	Contour Farming	0.485	0.55	ND	0.405
Cropland	Diversion	0.1	0.3	ND	0.35
Cropland	Filter strip	0.7	0.75	ND	0.65
Cropland	Reduced Tillage Systems	0.55	0.45	ND	0.75
Cropland	Streambank stabilization and fencing	0.75	0.75	ND	0.75
Cropland	Terrace	0.2	0.7	ND	0.85
Pastureland					
Pastureland	0 No BMP	0	0	0	0
Pastureland	Combined BMPs-Calculated	0	0	0	0
Pastureland	User	0.7	0.75	0	0.65

Planned updates

- Cropland
  - Nutrient Management
  - Conservation Cover
  - Cropland Protection (crop rotation, cover crops)
  - Cover Crops
  - Critical Area Planting
  - Field Border
  - Riparian Buffer
  - Water and Sediment Control Basin
  - Wetland Creation/Restoration
  - Drainage water management
  - Land retirement/conversion (Cropland to Forest/Wetland/Grass)

- Pasture
  - Alternative Water Supply
  - Streambank stabilization and fencing
  - Streambank protection w/o fencing
  - Livestock Exclusion Fencing
  - Grazing Land Management (rotational grazing with fenced areas)
  - Pasture and Hayland Planting (also called Forage Planting)
  - Prescribed Grazing
  - Tree/Shrub Establishment
  - Critical Area Planting
  - Heavy Use Area Protection
  - Use Exclusion

Other Tools for Estimating Load Reductions

DEQ Tools for Estimating Load Reductions

Direct Volume Calculation

Sediment Erosion Rate = **Eroding Area** × **Soil Density** × **Lateral Recession Rate** × **Conversion Factor**

$$\frac{ton}{year} = \frac{ft^2}{ft^3} \times lbs \times \frac{ft}{year} \times \frac{1\ ton}{2000\ lbs}$$

Direct Volume Calculation References

Pollutants Controlled
Calculation and Documentation
for
Section 319 Watersheds
Training Manual

Revised June 1999

Michigan Department of Environmental Quality
Surface Water Quality Division
Nonpoint Source Unit
P.O. Box 30273
Lansing, Michigan 48909
http:\\www.deq.state.mi.us

Bulk Density

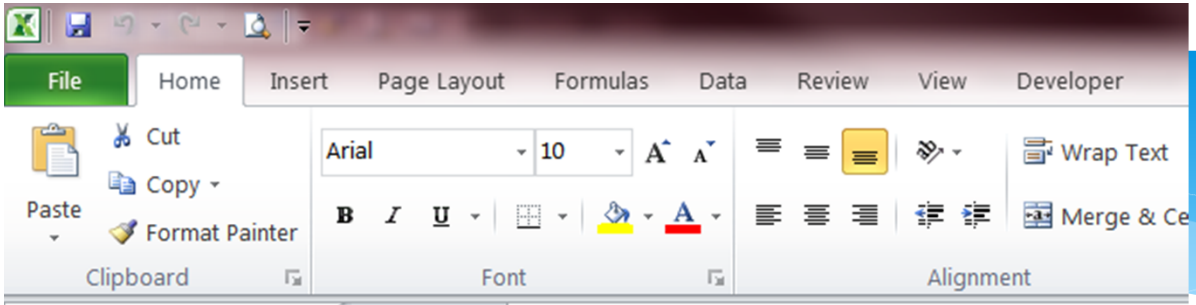
Soil Texture	Bulk Density (tons/ft^3)	Bulk Density (lbs/ft^3)
Sand, loamy sand	0.055	110
Sandy loam	0.0525	105
Fine sandy loam	0.05	100
Loams, sandy clay loams, sandy clay	0.045	90
Silt loam	0.0425	85
Silty clay loam, silty clay	0.04	80
Clay loam	0.0375	75
Clay	0.035	70
Organic	0.011	22

(Michigan DEQ 1999)

Lateral Recession Rate of Streambanks

Lateral Recession Rate (ft/yr)	Category	Description
0.01-0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang. No exposed tree roots.
0.06-0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang.
0.3-0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen trees and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross-section becomes more U-shaped as opposed to V-shaped.
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-shaped and streamcourse or gully may be meandering.

(Michigan DEQ 1999)



A7 =((B4*B5*0.5*B6)/2000)-((B4*1*0.01*B6)/2000)

	A	B	C	D	E
1					
2		**S280--American River**			
3					
4	Eroding Streambank length	300	Soil Texture		
5	Eroding height	5	Correction Factor		
6	Bulk Density	85			
7	31.7	tons sediment			
8	50.8	lbs phosphorus			
9	101.6	lbs nitrogen			
10					
11					
12		**S280--Red River**			
13	**Direct Volume Calculation**				
14	Eroding Streambank length	7920	Soil Texture	Silt Loam	
15	Eroding height	2.5	Correction Factor	1	
16	Bulk Density	85	STEPL output		
17	417.4	tons sediment	1098		
18	667.8	lbs phosphorus	1512.0		
19	1335.6	lbs nitrogen	4264.0		
20					
21					
22					
23					
24	1515.4	1547.1	Tons Sediment		
25	2179.8	2230.6	Pounds Phosphorus	1.1153052	
26	5599.6	5701.2	Pounds Nitrogen	2.8506104	
27					

Lateral Recession Rate of Streambanks

Lateral Recession Rate (ft/yr)	Category	Description
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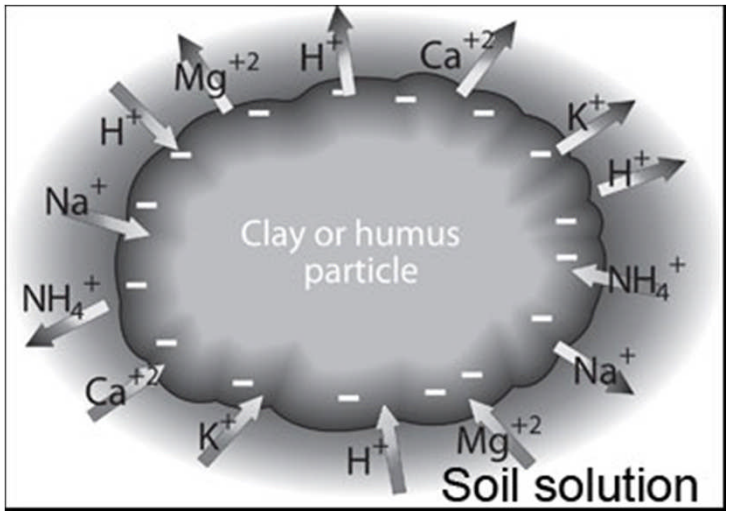
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and changes in cultural features as above. Massive slips or washouts common. Channel cross-section is U-shaped and streamcourse or gully may be meandering.

(Michigan DEQ 1999)

Direct Volume Calculation References—Nutrients Adsorbed to Sediment

* Some nutrients are adsorbed to sediment particles
  * 1.6 pounds phosphorus per ton of sediment per acre per year
  * 3.2 pounds nitrogen per ton of sediment per acre per year



http://extension.missouri.edu/p/mg4

AGNPS: A nonpoint-source pollution model for evaluating agricultural watersheds

R. A. Young, C. A. Onstad, D. D. Bosch, and W. P. Anderson

ABSTRACT: A computer model to analyze nonpoint-source pollution and to prioritize potential water quality problems in rural areas is described. The event-based model uses geographic cells of data units at resolutions of 0.4 to 16 ha to represent upland and channel conditions. Within the framework of the cells, runoff characteristics and transport processes of sediment, nutrients, and chemical oxygen demand are simulated for each cell and routed to the outlet. This permits the flow at any point in the watershed to be examined. Upland sources contributing to a potential problem can be identified and prioritized where remedial measures could be initiated to improve water quality most efficiently.

Further Tools for Estimating Load Reductions

* Monitoring Data—best to monitor discharge and water quality data pre-and post-project implementation
* Scientific Literature—studies in similar watersheds
* Apply to:
  * Irrigation management
    * Automated head gates
    * Conversion from furrow to sprinkler irrigation

Weiser Irrigation Automated Head Gate Project
Galloway Canal, Monroe, Jenkins, and Warm Springs Creeks
Load Reduction Estimations

The Weiser River Soil Conservation District is proposing installation of automated head gates on three creeks and one canal, seeking funding from the 319 program of the Idaho Department of Environmental Quality (DEQ). The headgates will reduce return flows of nonused irrigation waters.

Reduction of irrigation return flows will reduce sediment and nutrient loading to the Weiser River via Monroe Creek, and the Snake River via Jenkins Creek, Warm Springs Creek, and the Galloway Canal. Monitoring discharge regime pre- and post-project implementation will be the only way to truly gage effectiveness of pollutant reductions. Assuming the sediment and nutrient loads remain constant, the pollutant reduction will depend on reduction of return flows from the three creeks and Galloway Canal. Increased irrigation efficiency will vary depending on the water year, but a similar project in South Dakota has shown an 84% improvement in water delivery efficiency over the operation before the automated check gate (Belle Fourche River Watershed Partnership 2007). The following calculations use a conservative assumption of 50% improved efficiency in water delivery results. For instance, whereas the Galloway Canal averages 10 cfs for April 1 through October 31, the total load calculated on a 5 cfs discharge would be the load reduction for 50% improved water delivery efficiency.

Similar project in the literature

Water quality data

Galloway Canal Load Reduction Calculations

Water quality sampling conducted in the Galloway Canal (ISDA 2001) determined the pollutant load carried during the water year—averaging 10 cfs—from April through October:

- Total Suspended Sediment (TSS) averages 17508 pounds per day
- Total Phosphorus (TP) averages 89 pounds per day
- Nitrate + Nitrite (TN) averages 153 pounds per day

50% of this load would equal:

- TSS = 8754 pounds per day
- TP = 45 pounds per day
- TN = 77 pounds per day

There are 214 days from April 1 through October 31 for a total load reduction of:

- TSS = 937 tons per year
- TP = 4.8 tons per year
- TN = 8.2 tons per year

for Galloway Canal.

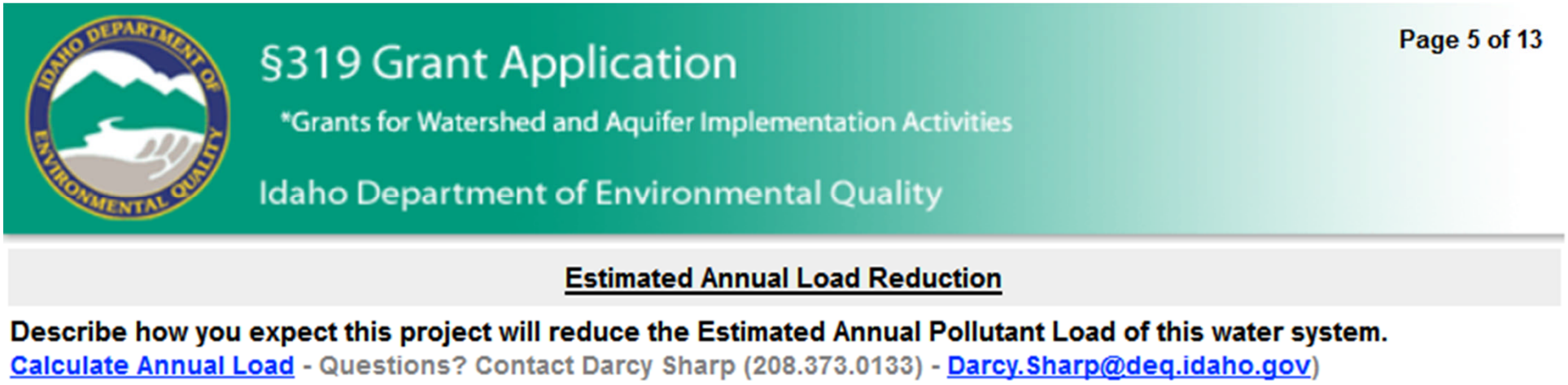
Irrigation Conversion Furrow to Sprinkler

* 2007 Twin Falls region study where soil loss due to furrow irrigation averaged 5.23 tons/acre/year (Bjorneberg 2007).
  * However, soil loss was widely variable depending on
    * Volume and velocity of incoming water
    * Field slope
    * Soil types
    * Management practices
* USDA Agricultural Research Center in Kimberly, ID uses 7 tons/acre/year for surface irrigation-induced soil loss (SISL)
* State Agronomists consider that conversion to sprinkler irrigation will reduce erosion to near zero
* I use 5 tons/acre/year as the average sediment load reduction for irrigation conversion

Bjorneberg, D.L., E.T. Westermann, N.O. Nelson. 2007. Sprinkler and surface irrigation effects on return flow water quality and quantity. USDA ARS Kimberly, ID: 7 p.

My Involvement

- 2004—contracted with the State Office program to be a resource for § 319 grant recipients to calculate load reductions
- 2005 and 2006—presented load reduction workshops at the annual water quality monitoring conference
- Ongoing annual budget to be a resource for these calculations
  - grant application process
  - final closeout reports



§319 Grant Application

*Grants for Watershed and Aquifer Implementation Activities

Idaho Department of Environmental Quality

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Estimated Annual Load Reduction

Describe how you expect this project will reduce the Estimated Annual Pollutant Load of this water system.

Calculate Annual Load - Questions? Contact Darcy Sharp (208.373.0133) - Darcy.Sharp@deq.idaho.gov)

Successful Relationships

Conservation District Case Study

* 11/6/2014 Request for modeling assistance—what type of information would I need?
* 12/23/2014 Submitted details for projects including forest road rocking, meadow restoration with riparian plantings, livestock exclusion fencing, and replacement of undersized culverts that cause downstream bank erosion
* 12/24/2014 I sent them a short report documenting the data sources and assumptions I used to calculate load reductions
* 1/8/2015 Manager of one of the nine streambank projects requested changing streambank erosion from moderate to slight
* 1/14/2015 Manager of the road rocking projects re-ran my FSWEPP model runs, editing one parameter to more closely fit what was on the ground, plus identifying a conversion error I had made
* 1/15/2015 Final modeling report

Darcy D. Sharp, Technical Services
Idaho Department of Environmental Quality
1410 N. Hilton, Boise, ID, 83706
(208)373-0133, fax (208) 373-0143

Latah Soil and Water Conservation District
Subgrant S396 Load Reduction Estimations

This document provides the load reduction estimations for nine watershed improvement projects in northern Idaho implemented by the Latah Soil and Water Conservation District.

STEPL, the "Spreadsheet tool for estimating pollutant load" developed by TetraTech (2003) for EPA, evaluates the nutrient loads from different land uses, giving the load reductions that would result from the implementation of various best management practices. This tool was used to calculate estimated load reductions for acreage of riparian plantings.

For the projects improving road surfaces, the FSWEPP model (1999) simulated the upgrade from native soils to gravel.

For projects that result in streambank stabilization, a sediment load reduction will result from the volume of previously-eroding streambank material that would have been potentially delivered annually during high streamflow or runoff episodes. Potential sediment delivery will return to a natural background condition once the streambanks have become re-established. The direct volume calculation (DEQ 2013) is an applicable method for estimating the sediment load reduction for streambank stabilization. This method evaluates percentage of erosive streambank, develops lateral recession rates based on local data or literature values, and provides the quantity of sediment delivered by the percent erosive streambanks in tons per year. Eroding volume is calculated by the equation:

$$E = [A_R * R_{LR} * \Delta_B]/2000 \text{ lbs/ton}$$

where:
E = bank erosion over sampled stream reach (tons/year/sample reach)
A_R = eroding area (ft^2)
R_{LR} = lateral recession rate (ft/yr)
Δ_B = bulk density of bank material (lbs/ft^3)

Nutrients adsorb to silt particles in sediment at an approximate ratio of 1.6 pounds per ton for phosphorus and 3.2 pounds per ton for nitrogen, according to the Section 319 Watersheds Training Manual (Michigan DEQ 1999). Therefore, sediment load reduction also reduces the nutrients.

Load reductions estimations for Latah Soil and Water Conservation District installation and implementation of BMPs are summarized in Table 1.

Darcy D. Sharp, Technical Services
Idaho Department of Environmental Quality
1410 N. Hilton, Boise, ID, 83706
(208)373-0133, fax (208) 373-0143

Table 1. Sediment and nutrient load reductions from implementation projects.

Project Name, Contract Number, Location and Parameters	Calculation/Estimation Method	Load Reduction
Big Bear Creek – Tourmaline Habitat Phase I 46.807614/ -116.614217 Streambank restoration—0.16 miles severe erosion; 9.8 acres riparian plantings	Direct volume calculation STEPL	Sediment =140 tons Nitrogen =433 lbs Phosphorus=184 lbs
Big Bear Creek – Levin Livestock Exclusion fencing and Riparian plantings 46.785681/-116.604518 Streambank restoration—0.34 miles severe erosion; 4.3 acres riparian plantings	Direct volume calculation STEPL	Sediment = 145 tons Nitrogen =459 lbs Phosphorus=221 lbs
Big Bear Creek – Elliot 46.790311/-116.664267 Streambank restoration—1.08 miles slight erosion; 4.24 acres riparian plantings	Direct volume calculation STEPL	Sediment = 317 tons Nitrogen =1019 lbs Phosphorus= 496 lbs
Big Bear Creek – Deer Creek Road Culvert 46.8363153/-116.624804 Culvert replacement to repair 170 feet severe erosion; 0.15 affected acres	Direct volume calculation STEPL	Sediment =36 tons Nitrogen =114 lbs Phosphorus=57 lbs
Boulder Creek – Park Ranch Riparian Plantings 46.730740/ -116.444157 Streambank restoration—0.19 miles moderate erosion; 1.03 acres riparian plantings	Direct volume calculation STEPL	Sediment =151 tons Nitrogen =457 lbs Phosphorus=222 lbs
E. Fork Potlatch River – Jackson Creek Road Rocking and Culvert Replacement 46.84739/-116.327996 Road rocking 400 meters and ditch relief culverts	FSWEPP	Sediment =11 tons Nitrogen = 45 lbs Phosphorus= 22 lbs
E. Fork Potlatch River – Corduroy Channel Stabilization 46.862202/-116.289929 Streambank restoration—600 feet severe erosion; 2 acres riparian plantings	Direct volume calculation STEPL	Sediment =92 tons Nitrogen =296 lbs Phosphorus=142 lbs
E. Fork Potlatch River – Bob's Creek Road Rocking and Culvert Replacement 46.889725/-116.323553 Road rocking 1.87 miles and cross ditch culverts	FSWEPP	Sediment =309 tons Nitrogen = 989 lbs Phosphorus= 494 lbs
E. Fork Potlatch River – Mallory Creek Road Rocking 46.876569/-116.267267 Road rocking 2 miles	FSWEPP	Sediment =508 tons Nitrogen = 1626 lbs Phosphorus= 813 lbs
Total Load Reduction Estimations		**Sediment = 1712 tons Nitrogen = 5450 lbs Phosphorus= 2651 lbs**

Darcy D. Sharp, Technical Services
Idaho Department of Environmental Quality
1410 N. Hilton, Boise, ID, 83706
(208)373-0133, fax (208) 373-0143

References

DEQ. 2013. *Standard operating procedure for streambank erosion inventory to measure instream sediment load in wadeable streams.* Boise, ID: Idaho Department of Environmental Quality. 32 p.

FS WEPP. USDA Forest Service. 1999. Forest Service interfaces for the Water Erosion Prediction Project computer model (FS WEPP). Rocky Mountain Research Station and San Diman Technology and Development Center. (Web Page). Accessed March 10, 2009. URL: <http://forest.moscowfsl.wsu.edu/fswepp/>.

Michigan DEQ. 1999. *Section 319 watersheds: training manual.* Surface water quality division. Nonpoint source unit. Lansing, MI: 59 p.

Tetra Tech, Inc. 2003. Spreadsheet tool for the estimation of pollutant load (STEPL) User's guide. For US Environmental Protection Agency. Fairfax, VA. 41 p.

Data Accuracy

* Document my data sources, assumptions and tools
* Grant recipient checks my report for accuracy
* Data entered into the GRTS with backup documentation