Appendix 6. Pollutant Load Estimates and Reductions

Quantifiable amounts of pollutant loads delivered to water bodies within the watershed were modeled to determine overall loading rates. Pollutant load reductions can be calculated based on BMPs installed to reduce targeted pollutants.

The Spreadsheet Tool for Estimating Pollutant Load (STEPL) uses 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). It computes watershed surface runoff, nutrient loads, including nitrogen, phosphorus, biological oxygen demand, and sediment delivery based on various land uses and practices. Annual nutrient loading is calculated based on 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 is calculated based on the Universal Soil Loss Equation (USLE) and sediment delivery ratio. The sediment and pollutant load reductions that result from the implementation of BMPs are computed using the known BMP efficiencies (http://it.tetratech-ffx.com/steplweb/).

Knowledge of environmental data ensures a more precise model with better empirical data. Input Data Server, a map interface, was used to generate input data for the model at the HUC 12 or sub-watershed level. Watershed-level data used: county data, weather station, land use distribution, agricultural animal populations and number of months manure applied, septic system information, irrigated acreage, stream banks and gullies. Watershed specific data was input based on measurements acquired through specific watershed analysis. STEPL automatically applies a default urban land use distribution to identify the types of land uses. Loadings were calculated for the following sub watersheds and total watershed loading was also determined.

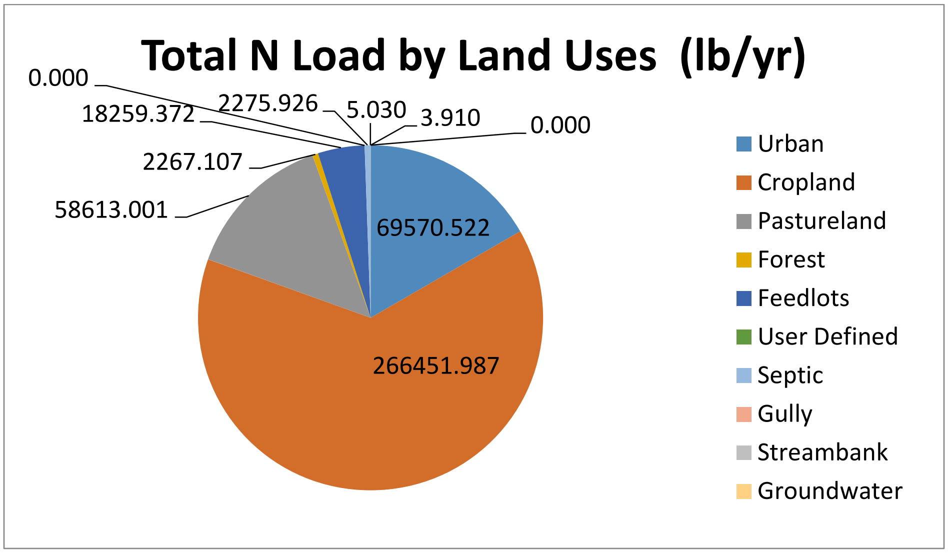
Subwatershed	**HUC 12 Name**
W1	Goose Lake Drain – Portage River
W2	Butternut Creek – Bear Creek
W3	Indian Lake – Portage River
W4	Headwaters Portage River
W5	Portage Creek
W6	Gourdneck Creek

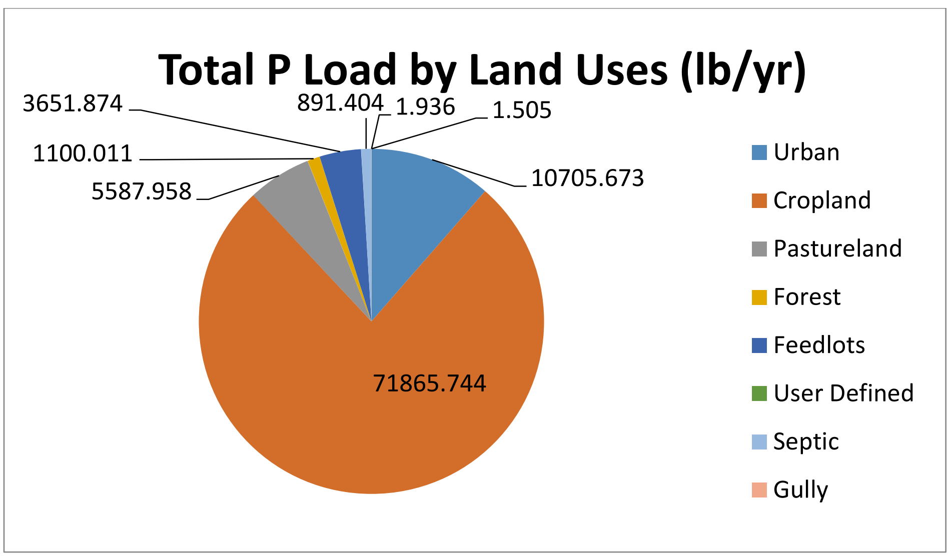
Loading estimates were generated based upon specific inputs to each sub-watershed. A base estimate per sub-watershed was determined:

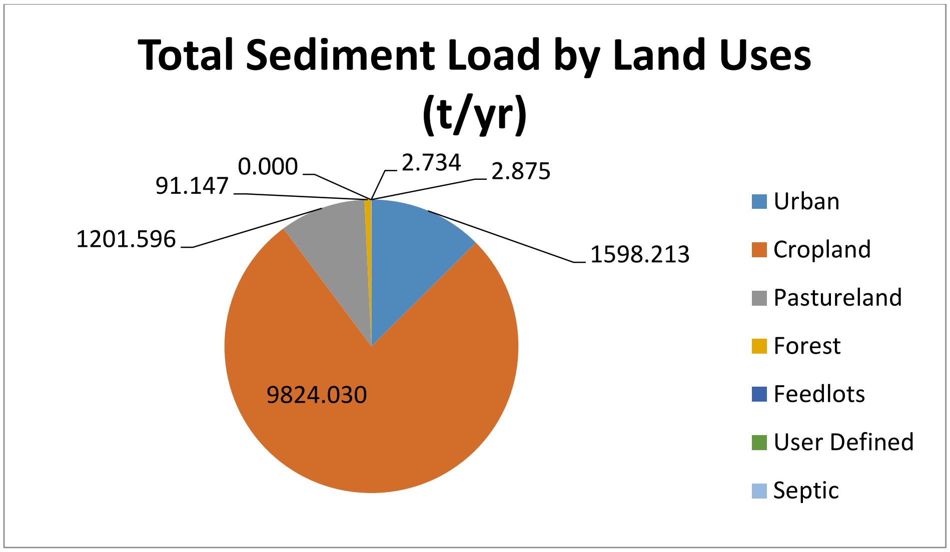
1. Total load by subwatershed(s)

Watershed	N Load (no BMP)	P Load (no BMP)	BOD Load (no BMP)	Sediment Load (no BMP)
	lb/year	lb/year	lb/year	t/year
W1	193629.8	46764.5	360829.0	7098.7
W2	68443.5	15943.9	132524.7	2820.4
W3	125461.7	29408.0	241494.0	4694.9
W4	136407.0	32043.1	258975.3	5036.0
W5	91961.0	21144.2	189452.3	3555.1
W6	97223.7	21321.4	228561.8	3356.9
Total	713126.6	166625.1	1411837.0	26561.9

The following charts depict the loads per land use:







BMPs were applied to known agricultural impairments and agricultural land uses. A combination of cover crops, filter strips, and reduced tillage systems were used. Streambanks and gullies received a bmp restoration with efficiencies of 95%. Urban BMPs were not applied as inventory was directed to agricultural impairments and natural verse unnatural stream degradation.

STEPL worksheets require data entry on specific physical characteristics of the watershed and probable best management practices (BMPs) which can be applied. Some data are constants based on geographic location, soil types, and other factors. Other sets of data can be varied. Particular attention was given to the "affective area" of any BMP. Affective area refers to the total acreage to which a selected BMP practice applies. Since the watershed is mostly in agricultural use, no BMP practice could be retroactively and/or successfully applied to the entire watershed. Therefore, a percentage was applied to each land use type to find the affective area. (Example: Wetlands in the watershed equal 8,797 acres. If BMPs could be applied to affect 10% of the wetland space, the "affective area" would be 88 acres with numbers rounded to the nearest whole.) Because of the uncertainty of the effectiveness of various BMPs on load reduction, the percentage of affective area was adjusted to reflect a 25% rate.

As explained in Chapter 11.4, because of the uncertainty of the effectiveness of various BMPs on load reduction, the percentage of affective area was adjusted to reflect a 25% rate.

BMP	N (lbs/yr)	P (lbs/yr)	BOD (lbs/yr)	Sediment (tons/yr)
Cover Crop	0.3	0.25	ND	0.35
Filter strip	0.7	0.75	ND	0.65
Reduced Tillage Systems	0.55	0.45	ND	0.75
Combined BMPs-Calculated	0.517	0.483	ND	0.583

The following section depicts loading with 25% BMP application:

Watershed	N Load (with BMP)	P Load (with BMP)	BOD (with BMP)	Sediment Load (with BMP)	%N Reduction	%P Reduction	%BOD Reduction	%Sed Reduction
	lb/year	lb/year	lb/year	t/year	%	%	%	%
W1	105516.5	25205.0	336259.2	3210.8	45.5	46.1	6.8	54.9
W2	40303.5	8928.4	123080.2	1344.7	41.1	44.0	7.1	52.3
W3	72438.8	16347.8	225646.4	2215.0	42.3	44.4	6.6	52.8
W4	78056.1	17696.0	241847.0	2359.8	42.8	44.8	6.6	53.1
W5	55824.4	12182.3	177904.0	1750.6	39.3	42.4	6.1	50.8
W6	65307.3	13446.5	218857.3	1840.6	32.8	36.9	4.2	45.2
Total	417446.6	93806.0	1323594.1	12721.4	41.5	43.7	6.2	52.1

With agricultural BMPs and stream bank and gully erosion BMPs nitrogen loading in the watershed was reduced by 41.5%, 43.7% reduction in phosphorus, and 52.1% reduction in sediment.

According to the inputs, STEPL modeling results determined that Goose Lake Drain (0506) sub watershed contributes the highest amounts of nitrogen, phosphorus, and sediment. The Headwaters Portage River (0501) contributes the second most. Indian Lake – Portage River (0505) contributes the third most. Gourdneck Creek (0502) contributes the fourth most. Portage Creek (0503) contributes the fifth most and Butternut Creek – Bear Creek contributes the lowest amounts.