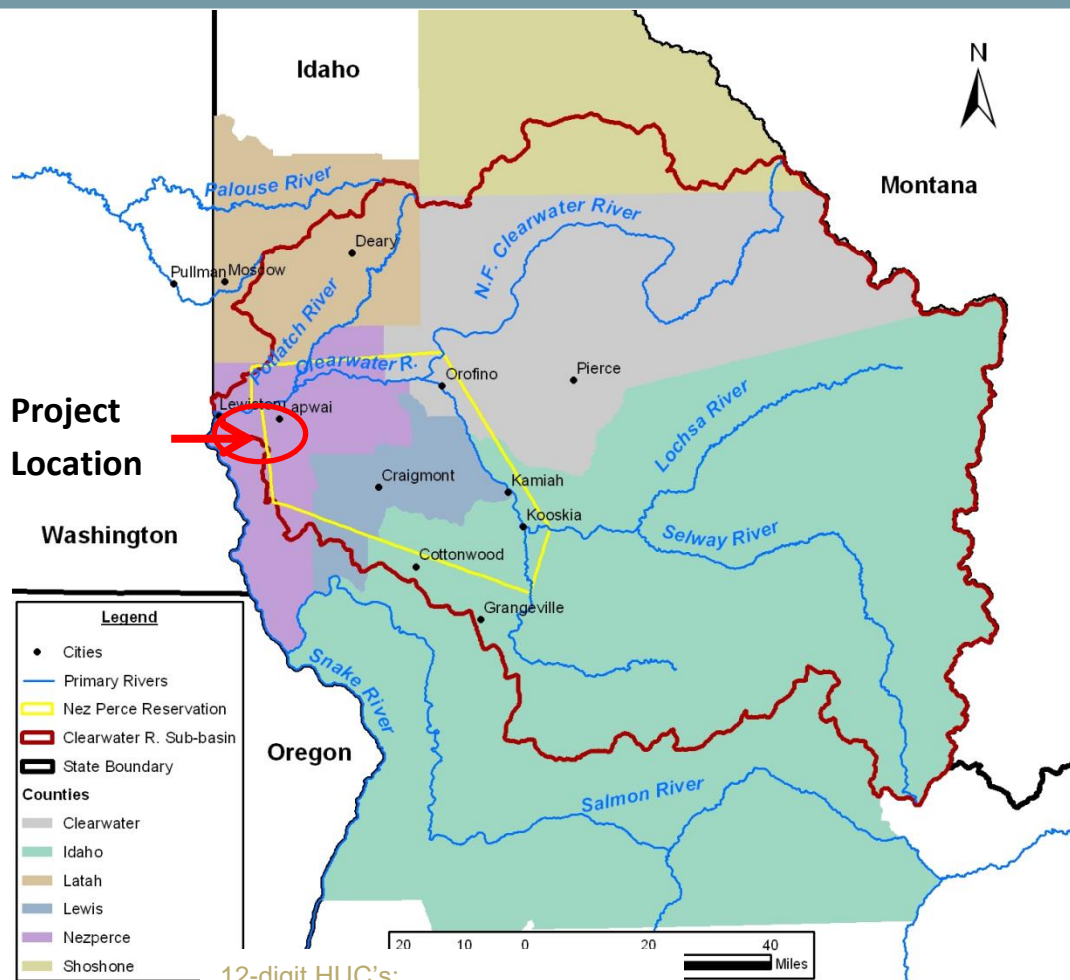


# Tammany Creek Watershed Assessment Report

## Appendix 3 – QSWAT Surface Erosion Estimates



12-digit HUC's:  
170601030306 (Tammany Creek),  
1706010305 (Ten Mile Canyon),  
170603061307 (Lindsay Creek),  
1706013061308 (Hidden Canyon),  
170603061308 (unnamed tributary)

Nez Perce Soil and Water  
Conservation District

Tammany Creek  
Watershed Assessment Report  
Appendix 3 – QSWAT Surface Erosion Estimates

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## **1. QSWAT3 Model**

Sediment yield and nutrient loads to Tammany Creek were computed with the Soil & Water Assessment Tool (SWAT)<sup>1</sup> implemented in QGIS<sup>2</sup>. The version used was QSWAT3 (1.1.1). SWAT is a hydrologic response unit (HRU) model that can assess runoff rates, sediment yield, and nutrient loads for point loads and non-point loads. It has features for agricultural watersheds including crop, soil and tillage databases, and simulation timing based on plant growth and heat units. It also has an internal weather generator which can be adapted to different climate scenarios.

Earlier versions of the SWAT model have been used in other NPSWC projects to estimate sediment yield. The

USDA Conservation Effects Assessment Project (CEAP) used APEX and SWAT to model erosion for the Pacific Northwest basin (CEAP, 2014).

There are numerous parameters that must be specified to setup and run a SWAT model. Crop and tillage parameters are difficult to specify for the Palouse region based on existing information. It is often advisable to calibrate SWAT models with measured water quality data. The sediment and nutrient loads summarized below should be considered very preliminary.

### **1.1 SWAT Model Parameters**

The QSWAT model requires information about climate, soil type, surface cover type, crop growth, tillage, slope lengths, and slope gradients.

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<sup>1</sup> <https://swat.tamu.edu/>

<sup>2</sup> <https://www.qgis.org/en/site/>

### ***Climate Data***

A climate file was developed internally by QSWAT for the NWQI project area with information from nearby climate stations.

### ***Soil Data***

Soil data for the QSWAT subbasins were obtained from the linked SSURGO database and appears to correspond to the soil data discussed in Section 2.4. of the main report.

### ***Slope Gradient and Length***

Hydrologic subbasin boundaries, slope gradients, and channel flow paths were determined by the QGIS and QSWAT terrain analysis of the 2016 LiDAR elevation data.

### ***Land Cover and Tillage***

Land cover classes were determined by the QSWAT program from the 2021 Cropland Data Layer (CDL). The SWAT

land cover and crop codes corresponding to the CDL are listed in Table 1. The SWAT land cover or crop parameters were obtained from the default database. No changes were made to the default parameters.

### ***Subbasins***

The subbasin threshold parameter in the QGIS interface was adjusted to obtain the 35 subbasins in the Tammany Creek watershed shown in Figure 1.

## ***1.2 Sediment Yield***

The 100-year average surface erosion rates for the subbasins are summarized in Table 2. Subbasin average erosion rates for conservation till winter wheat ranged from 0.29 to 1.46 U.S. tons per acre per year ( $\text{ton ac}^{-1} \text{yr}^{-1}$ ) and averaged 1.46  $\text{ton ac}^{-1} \text{yr}^{-1}$ . Monthly average sediment yields for the watershed are summarized in Table 3. Most of the sediment load (91 percent) is

generated December through February, and about half of the annual sediment load is runoffs in January.

### ***1.3 Nutrient Loads***

The SWAT program models nutrient in crops and soils, and estimates nitrogen and phosphorus loads in surface runoff and groundwater. Annual average (100 years) nitrate load in surface runoff from the entire watershed is 0.217 pounds per acre per year ( $\text{lb} \cdot \text{ac}^{-1} \cdot \text{yr}^{-1}$ ) and in lateral flow is  $0.346 \text{ lb} \cdot \text{ac}^{-1} \cdot \text{yr}^{-1}$ . Nitrate yield to groundwater is estimated to be  $0.014 \text{ lb} \cdot \text{ac}^{-1} \cdot \text{yr}^{-1}$ . Soluble phosphorus in surface runoff is estimated to be  $0.007 \text{ lb} \cdot \text{ac}^{-1} \cdot \text{yr}^{-1}$  and carried by sediment is  $0.792 \text{ lb} \cdot \text{ac}^{-1} \cdot \text{yr}^{-1}$ . Subbasin nutrient loads are summarized in Table 4.

NWQI Project Area CDL-SWAT Land Cover Codes		
CDL ID	Class Name	SWAT Code
0	Background	WWHT
1	Corn	CORN
6	Sunflower	SUNF
21	Barley	BARL
23	Spring Wheat	SWHT
24	Winter Wheat	WWHT
28	Oats	OATS
31	Canola	CANP
35	Mustard	LENT
36	Alfalfa	ALFA
37	Other Hay/Non Alfalfa	HAY
42	Dry Beans	LENT
43	Potatoes	POTA
51	Chick Peas	PEAS
52	Lentils	LENT
53	Peas	FPEA
58	Clover/Wildflowers	ALFA
59	Sod/Grass Seed	BLUG
61	Fallow/Idle Cropland	WWHT
66	Cherries	ORCD
68	Apples	APPL
69	Grapes	WWHT
111	Open Water	WATR
121	Developed/Open Space	PAST
122	Developed/Low Intensity	URLD
123	Developed/Med Intensity	URMD
124	Developed/High Intensity	URHD
131	Barren	PAST
141	Deciduous Forest	FRSD
142	Evergreen Forest	FRSE
143	Mixed Forest	FRSE
152	Shrubland	RNGB
176	Grassland/Pasture	PAST
190	Woody Wetlands	WETF
195	Herbaceous Wetlands	WETN
205	Triticale	WWHT

**Table 1. SWAT land cover and crop codes for the Cropland Data Layer (CDL).**

Tammany Creek QSWAT Erosion Analysis		
Subbasin	Area ac	Sediment Yield ton/ac/yr
1	1,717.7	2.81
2	354.5	1.79
3	64.8	0.80
4	153.4	0.97
5	88.2	0.94
6	273.5	1.14
7	157.5	1.21
8	101.3	2.21
9	615.0	0.65
10	339.6	1.46
11	38.3	0.65
12	837.7	1.47
13	3,265.7	1.15
14	47.1	0.61
15	123.6	0.87
16	989.9	2.36
17	733.4	1.67
18	614.6	0.98
19	434.1	1.66
20	478.3	1.51
21	1,026.7	0.60
22	558.5	0.76
23	327.8	2.29
24	345.4	1.14
25	389.4	0.92
26	551.2	1.14
27	595.0	1.05
28	2,313.9	1.35
29	25.9	0.29
30	1,428.9	3.03
31	774.6	1.90
32	512.4	1.30
33	332.6	0.90
34	1,019.1	0.55
35	727.7	0.50
Watershed	22,357	1.46

**Table 2. QSWAT estimates of subbasin sediment yield.**

Tammany Creek QSWAT Erosion Analysis		
Month	Sediment Yield ton/ac	Percent of Annual
1	0.74	51.1%
2	0.36	24.5%
3	0.04	2.8%
4	0.03	2.1%
5	0.03	2.1%
6	0.00	0.3%
7	0.00	0.0%
8	0.00	0.0%
9	0.00	0.0%
10	0.00	0.0%
11	0.02	1.5%
12	0.23	15.6%
Annual	1.46	100.0%

**Table 3. Monthly average QSWAT estimates of watershed sediment yield.**

Lewiston-Nez Perce County NWQI Watershed Analysis – Tammany Creek

Tammany Creek QSWAT Subbasin Nutrient Loads							
Subbasin	Area ac	Sediment Yield ton ac <sup>-1</sup> yr <sup>-1</sup>	Nitrate Surface Runoff lb ac <sup>-1</sup> yr <sup>-1</sup>	Nitrate Lateral Flow lb ac <sup>-1</sup> yr <sup>-1</sup>	Nitrate Groundwater lb ac <sup>-1</sup> yr <sup>-1</sup>	Phosphorus Soluable lb ac <sup>-1</sup> yr <sup>-1</sup>	Phosphorus Sediment lb ac <sup>-1</sup> yr <sup>-1</sup>
1	1,717.7	2.82	0.038	0.126	0.000	0.003	0.811
2	354.5	1.79	0.098	0.434	0.000	0.003	0.722
3	64.8	0.80	0.105	0.609	0.000	0.004	0.525
4	153.4	0.96	0.137	0.340	0.000	0.004	0.608
5	88.2	0.94	0.004	0.077	0.000	0.002	0.448
6	273.5	1.15	0.046	0.017	0.000	0.004	0.533
7	157.5	1.21	0.046	0.018	0.000	0.004	0.546
8	101.3	2.20	0.047	0.011	0.000	0.005	0.864
9	615.0	0.65	0.103	0.091	0.000	0.004	0.367
10	339.6	1.46	0.393	0.481	0.036	0.011	0.935
11	38.3	0.65	0.262	0.272	0.039	0.011	0.594
12	837.7	1.47	0.355	0.429	0.040	0.009	0.884
13	3,265.7	1.15	0.141	0.111	0.000	0.005	0.654
14	47.1	0.61	0.302	0.269	0.057	0.012	0.492
15	123.6	0.87	0.115	0.253	0.000	0.004	0.550
16	989.9	2.36	0.162	0.220	0.000	0.006	0.981
17	733.4	1.67	0.734	0.211	0.021	0.014	1.204
18	614.6	0.98	0.154	0.417	0.000	0.004	0.583
19	434.1	1.66	0.416	0.650	0.038	0.010	0.999
20	478.3	1.51	0.120	0.387	0.000	0.004	0.732
21	1,026.7	0.60	0.131	0.120	0.000	0.004	0.375
22	558.5	0.76	0.223	0.109	0.000	0.006	0.606
23	327.8	2.30	0.211	0.486	0.000	0.005	1.094
24	345.4	1.14	0.178	0.374	0.000	0.005	0.721
25	389.4	0.92	0.037	0.326	0.000	0.003	0.441
26	551.2	1.14	0.186	0.242	0.000	0.005	0.718
27	595.0	1.05	0.402	0.233	0.055	0.010	0.749
28	2,313.9	1.35	0.439	0.450	0.037	0.012	1.061
29	25.9	0.29	0.236	0.165	0.061	0.012	0.402
30	1,428.9	3.04	0.183	1.143	0.023	0.006	1.335
31	774.6	1.90	0.206	1.148	0.038	0.007	1.075
32	512.4	1.30	0.234	0.751	0.052	0.009	0.940
33	332.6	0.90	0.320	0.480	0.053	0.010	0.749
34	1,019.1	0.55	0.155	0.132	0.000	0.005	0.457
35	727.7	0.50	0.142	0.084	0.000	0.004	0.424
Watershed	22,357	1.47	0.217	0.346	0.014	0.007	0.792

**Table 4. Estimated nutrients loads for the Tammany Creek QSWAT subbasins.**

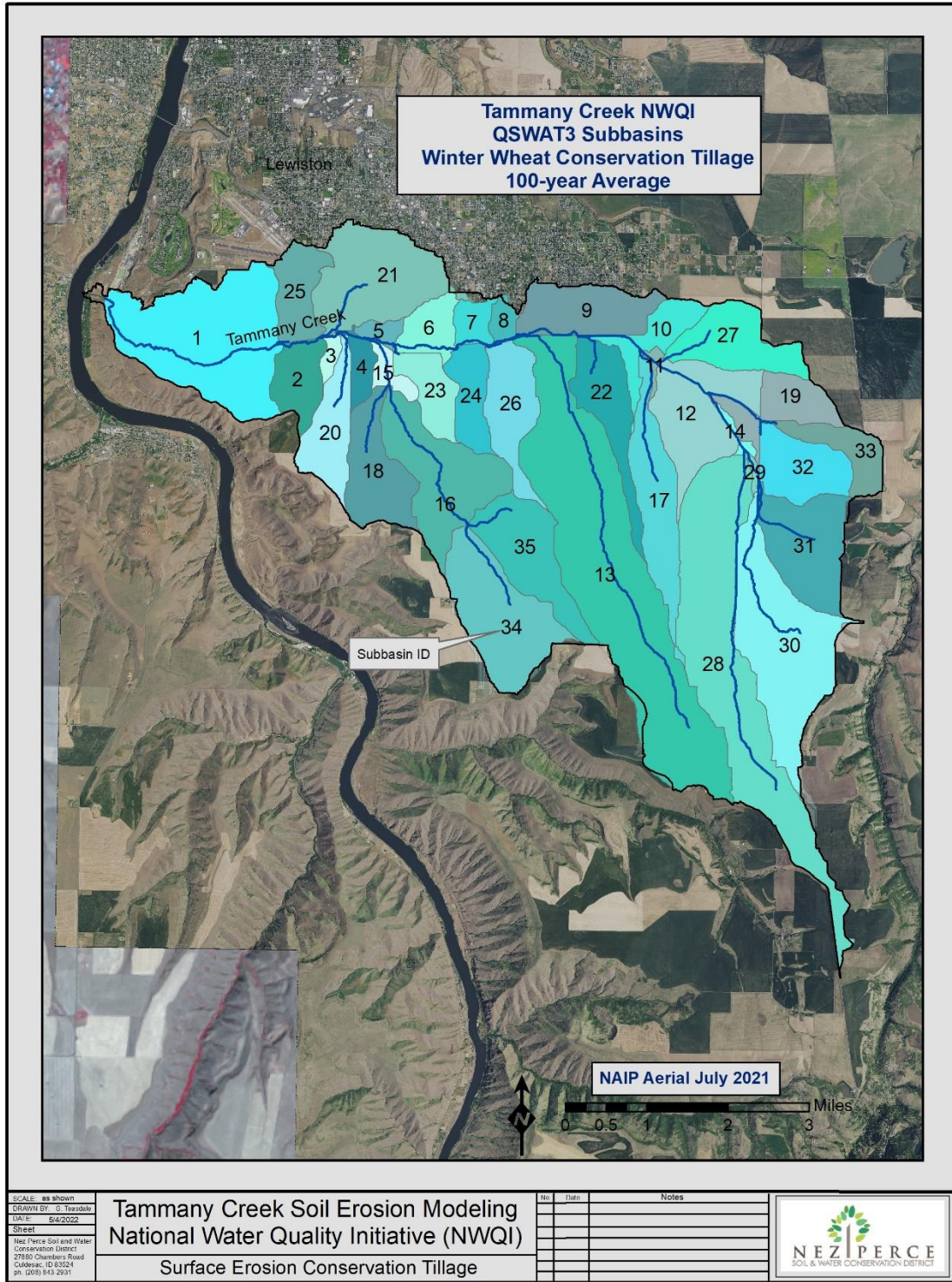


Figure 1. Tammany Creek QSWAT3 subbasins.