Appendix 19

Load Reductions

The Watershed Treatment Model (WTM) was first released in 2001 as version 3.0 by the Center for Watershed Protection through funding by the United States Environmental Protection Agency (EPA). Since its original release an updated version has been made available and is called version 3.1. It is the WTM Version 3.1 that was used to find both the expected pollutant loads for each sampling site based on land use alone and the expected load reductions for each HUC 14-digit watershed located in the study area. Version 3.1 of the WTM can be found on the Stormwater Center's website at: http://www.stormwatercenter.net/monitoring%20and%20assessment/watershed_treatment_model.htm.

To calculate the load reductions expected through the implementation of various best management practices (BMPs) in the sub-watersheds the current land use distributions were first entered into the "Primary Sources" worksheet. Other information included on the "Primary Sources" sheet were the planning horizon of 20 years and the stream length which varied in the three watersheds. The impervious area percentages were also changed to reflect a more realistic value. Those changed included medium density and high density urban to 65% and 75%, respectively. The impervious area percentage for the rural land use category was listed at 3% to reflect the land use that was included in the category. Table 1 shows the area in acres used for each land use category for the three 14-digit watersheds along with the impervious percentages used.

The next input worksheet in the WTM Version 3.1 was a "Secondary Sources" worksheet that had no input on any of the watersheds except that "Method 1" was used for channel erosion calculations. This method used an annual sediment loading rate and a bank erosion rate, both of which were default settings in the model.

An outline of the existing management practices was included in the third worksheet of the workbook. The only existing practice included the use of what was currently identified as wetlands being considered riparian buffer areas due to the fact that they were in poor shape and therefore could not act as a proper wetlands corridor.

The next worksheet to have input data was the "Future Management Practices" which outlined a number of different programs. The practices included for incorporation into the plan were a lawn care program and a pet waste program both being promoted via the newspaper. An erosion and sediment control program was also considered to be put in place that would regulate 80 percent of the building permits. Along with the 80 percent of permits regulated a factor of 0.7 was used as the compliance discount and 0.6 for the installation/maintenance discount. The use of street sweeping in the communities within the watershed was also assumed to be happening on a monthly basis. The technique discount was considered to be 0.5 due to on-street parking and a lack of training for street sweepers in most communities.

	Primary Sources Land use	Area (acres)	Impervious Percentage
E-W Split Watershed 07120003030050	Medium Density Urban	4007.5	65
	High Density Urban	1746.4	75
	Roadway	234.1	100
	Forest	1650.5	0
	Rural	1617.5	3
	Open Water	364.7	0
	Active Construction	54.9	2
LC & DR Watershed 04040001040020	Medium Density Urban	5038	65
	High Density Urban	1719.8	75
	Roadway	246.7	100
	Forest	2640.6	0
	Rural	2592.9	3
	Open Water	248.6	0
	Active Construction	49.5	2
WC & BD Watershed 04040001040030	Medium Density Urban	3015.2	65
	High Density Urban	1630.7	75
	Roadway	412	100
	Forest	2921.8	0
	Rural	4318.5	3
	Open Water	119.2	2
	Active Construction	102.2	0

Table 1: "Primary sources" land use areas and percentages.

Other future management practices being considered for implementation in the watershed management plan included a variety of structural BMP's. Table 2 list the structural BMPs implemented in each 14-dgit watershed. The last future management practice used was a septic system education program. The media used to spread the message was considered to be the newspaper with a factor or 0.3.

	BMP Type	Acreage
E-W Split Watershed	Infiltration Strip	17
	Wet Pond	200
	Dry Extended Detention Pond	100
	Wetlands	1857
LC & DR Watershed	Infiltration Strip	21
	Wet Pond	200
	Dry Extended Detention Pond	151
	Wetlands	970
WC & BD Watershed	Infiltration Strip	54
	Wet Pond	200
	Dry Extended Detention Pond	256
	Wetlands	1954
COMBINED	Infiltration Strip	92
	Wet Pond	600
	Dry Extended Detention Pond	506
	Wetlands	4780

Table 2: BMP acreage for 14-digit watersheds.

Based on the structural BMPs implemented in each 14-digit watershed the future land use changed. For the E-W split watershed the future land use only changed in regards to areas becoming wetlands and therefore being classified as forest. For the remaining two watersheds an area of development was considered to take place in the southern portion of Porter County. This development was considered to be medium density urban and therefore not only was land converted to wetlands but land was also converted to residential. Table 3 shows the future land use acreage for each HUC 14-digit watershed.

	Future Land use	Area (acres)
E-W Split Watershed 07120003030050	Medium Density Urban	4007.5
	High Density Urban	1746.4
	Roadway	234.1
	Forest	2731.9
	Rural	570.1
	Open Water	364.7
	Active Construction	21.2
LC & DR Watershed 04040001040020	Medium Density Urban	5620.3
	High Density Urban	1719.8
	Roadway	246.7
	Forest	3219.2
	Rural	1446.7
	Open Water	248.6
	Active Construction	34.9
WC & BD Watershed 04040001040030	Medium Density Urban	4981.6
	High Density Urban	1630.7
	Roadway	412
	Forest	4431.6
	Rural	927.4
	Open Water	119.2
	Active Construction	17.1

Table 3: Future land use based on Future BMPs and Porter County Development.

Based on the input listed above the WTM Version 3.1 produced a "Summary Sheet" that contained a table showing the total, storm, and non-storm loads for Total Nitrogen, Total Phosphorus, Total Suspended Solids and Bacteria (Fecal) for existing practices and land use as well as that resulting from future practices being implemented. Table 4 shows the pollutant loads that were found using the WTM. A reduction line was added to each table to show the percentage reduction resulting from the future management practices implemented.

Summary of All Loads			TN lb/year	TP lb/year	TSS lb/year	Bacteria billion/year
07120003030050	Existing	Total	77981.91476	9705.439401	4837800	2914706.201
		Storm	67530.37976	9084.384401	4748591.5	2914706.201
		Non-Storm	10451.535	621.055	89208.5	0
	With Future Practices	Total	63455.42237	7361.817466	744691.9419	1750534.83
		Storm	55941.22165	6799.509151	655483.4419	1750534.83
		Non-Storm	7514.200714	562.3083143	89208.5	0
	Reduction	Total	14526.49239	2343.621935	4093108.058	1164171.372
		Percentage	18.63%	24.15%	84.61%	39.94%
04040001040020	Existing	Total	92725.31373	11734.39655	6268050	3387752.015
		Storm	80278.81373	10907.15155	6177182	3387752.015
		Non-Storm	12446.5	827.245	90868	0
	With Future Practices	Total	81186.87367	10107.42633	1915031.232	2517449.232
		Storm	72243.10359	9350.235932	1824163.232	2517449.232
		Non-Storm	8943.770088	757.1904018	90868	0
	Reduction	Total	11538.44006	1626.970215	4353018.768	870302.783
		Percentage	12.44%	13.86%	69.45%	25.69%
04040001040030	Existing	Total	80958.98496	10490.05076	6259800	2600590.923
		Storm	65848.42496	9348.25776	6168921	2600590.923
		Non-Storm	15110.56	1141.793	90879	0
	With Future Practices	Total	66306.45792	7947.396173	707266.3968	1179873.779
		Storm	53532.37408	6852.332697	616387.3968	1179873.779
		Non-Storm	12774.08384	1095.063477	90879	0
	Reduction	Total	14652.52704	2542.654586	5552533.603	1420717.144
		Percentage	18.10%	24.24%	88.70%	54.63%
Combined	Existing	Total	251666.2134	31929.88671	17365650	8903049.138
		Storm	213657.6184	29339.79371	17094694.5	8903049.138
		Non-Storm	38008.595	2590.093	270955.5	0
	With Future Practices	Total	210948.754	25416.63997	3366989.57	5447857.84
		Storm	181716.6993	23002.07778	3096034.07	5447857.84
		Non-Storm	29232.05464	2414.562193	270955.5	0
	Reduction	Total	40717.45949	6513.246737	13998660.43	3455191.298
		Percentage	16.18%	20.40%	80.61%	38.81%

Table 4: Pollutant loads for existing and future practices found using the WTM Version 3.1.

One drawback of the WTM being used to find load reductions is the fact that they use fecal bacteria in lieu of *E.coli* bacteria. There is a direct correlation between the two bacteria forms and according to the TMDL prepared for the Little Calumet River *E.coli* is typically 80% of the value that fecal bacteria is found to be. With this direct correlation knowledge the percentage reduction found over the entire study area, 38.81%, was used to reduce the *E.coli* concentrations found at each of the 42 sampling locations tested again. The result of this reduction is shown in Table 5.

Sampling Location	E.coli (cfu/100ml)			
	Dry Weather (7/24/2007)		Dry Weather (10/30/2007)	
	Sampling Results	38.81% Reduction	Sampling Results	38.81%Reduction
1		0	225	138
2	1804	1104	341	209
3	448	274	190	116
4	25	15	218	133
5	396	242	174	106
6	94	58	52	32
7	2	1	3	2
8	3	2	5	3
9	1	1	32	20
10	228	140	15	9
11	207	127	144	88
12	108	66	15	9
13	56	34	1	1
14	353	216	20	12
15	270	165	46	28
16	692	423	75	46
17	119	73	78	48
18	345	211	58	35
19	1	1	428	262
20	88	54	113	69
21	51	31	79	48
22	111	68	7	4
23	374	229	40	24
24	505	309	77	47
25	275	168	48	29
26	68	42	16	10
27	937	573	445	272
28	375	229	260	159
29	158	97	5	3
30	168	103	18	11
31	5	3	72	44
32	72	44	102	62
33	50	31	8	5
34	71	43	19	12
35	129	79	27	17
36	51	31	2	1
37	4	2	92	56
38	3	2	79	48
39	36	22	67	41
40	9	6	2	1
41	86	53	44	27
42	913	559	586	359

Table 5: Sampling locations dry weather *E.coli* loads resulting from percentage load reduction.