

SECTION 7: CALCULATING LOAD REDUCTIONS

Based on the aforementioned potential BMPs to implement within the Elkhart River Watershed, load reduction calculations were estimated for both sediment and nutrients. Sediment loading estimates used measures in terms of Total Suspended Solids (TSS), and nutrient loading estimates used measures in terms of total nitrogen and total phosphorus. The critical areas shown on Figure 34 were identified by the Steering Committee as having existing sediment, *E. coli* and nutrient loading problems. Total loads of sediment, nutrients and *E. coli*, and nutrients were modeled for each critical area using PLOAD and Spreadsheet Tool for Estimating Load Reductions (STEPL) frameworks. PLOAD is a simplified, GIS-based model to calculate pollutant loads for watersheds. Pollution load reductions were estimated for sediment and nutrients. Load reduction calculations were not applied for *E. coli*, as its practice is not technically sound or readily applied in the industry. Table 50 depicts the limited load reductions available for modeling pollutant load reductions by BMP's for *E. coli*. The Elkhart River WMP will only present pollutant load reductions for sediment and nutrients.

Resulting loads were established for each critical area in units of pounds for nutrients, tons for sediment and coliform units for bacteria. For each critical area, the total load per year and the total load per acre per year are provided (Exhibits 29 through 32). Table 51 shows current loads and target loads for each of the critical areas.

Goals established by the Steering Committee have targets as concentrations identified in units of mg/L. In order to convert total loads into mg/L, the total annual flow volume from each critical area was calculated. For the presentation of this report, runoff volume calculations were applied to each critical area based on average annual precipitation, soils, and landcover (Tables 1, 2, and 13; Appendix A). The calculated runoff volumes for each critical area were calibrated using data from three nearby United States Geologic Survey stream gages.

Based on the results of the pollution load modeling of existing conditions, calculations were then made to project what load per year of sediment, total nitrogen, and total phosphorus would exist in the year 2027 if all of the target concentration goals were achieved. A linear transgression was used to denote what loading targets would be needed to achieve five and ten year goals based on the Steering Committee's approach for implementing pollutant load reductions in a consistently linear fashion over time.

Tables 52 through 54 portray the pollutant load reductions and BMP costs to achieve the reductions for each critical area over time. The reductions were calculated by applying all of the 21 BMPs selected by the Steering Committee to three primary landcover types (urban, pastureland, and cropland) in proportions appropriate to the corresponding proportions of landcover in each critical area. An average BMP reduction value was derived from ten BMPs for Urban areas. Eleven BMPs were used to create the average reductions for both cropland and pasture land. Drainage areas were assumed for necessary BMPs, as site specific values could not be measured. Cost estimates of BMPs needed to be implemented within each of the critical areas in order to accomplish the five, ten, and twenty year goals were determined using the lowest cost BMPs for each landcover; \$400/acre for urban, \$20/acre for pasture, and \$10/acre for cropland. The costs and reductions were also calculated assuming that many of the applied BMPs benefit an upland drainage area. Cost estimates are valued in current 2008 pricing, and do not have a multiplier to reflect inflation over time. This decision was made so that the costs provided

by this plan can be interpreted accurately in the future without having to calculate off of inaccurate inflation rate projections.

Margin of Safety (MOS) corrections were applied to values of nutrient load reduction estimates, so that practical cost estimates to accomplish these goals could be forecast. There was no MOS applied to the modeling values of TSS loading estimates.

Table 51. Current and Target Loads for Each Critical Area

Critical Area	Name	Acreage	Current Nitrogen Load lbs/year	Target Nitrogen Load lbs/year	Current Phosphorus Load lbs/year	Target Phosphorus Load lbs/year	Current TSS Load tons/year	Target TSS Load tons/year
1	Turkey Creek	3,684	28,079	22,555	2,080	1,587	1,688	311
2	Upper Yellow Creek	15,941	159,621	148,942	11,494	10,477	4,232	2,054
3	Lower Yellow Creek	5,920	53,668	49,276	4,354	3,466	2,827	680
4	Upper Rock Run Creek	13,665	131,100	127,759	9,799	8,987	4,959	1,762
5	Horn Ditch	11,099	112,925	102,435	8,416	7,206	4,440	1,413
6	Papakeechee Subwatershed & LARE Study	2,957	16,235	15,206	1,171	1,070	1,157	210
7	Knapp Lake Chain & LARE Study	10,167	103,816	87,437	7,078	6,151	3,622	1,206
8	Stony Creek	13,014	135,767	119,925	9,562	8,436	4,964	1,654
9	Elkhart Urban	8,779	72,030	61,808	6,140	4,348	3,570	853
10	Goshen Urban	20,925	196,916	167,336	15,412	11,771	5,257	2,308
11	Ligonier Urban	18,412	196,655	165,469	13,471	11,640	4,933	2,282
12	Nappanee Urban	9,742	105,525	88,954	7,660	6,257	3,993	1,227
13	Kendallville Urban	18,077	169,504	145,086	12,381	10,206	4,083	2,001
14	Syracuse Urban & LARE Study	17,537	152,863	130,971	10,916	9,213	4,997	1,806
15	Millersburg Urban	12,506	128,495	114,124	9,114	8,028	4,594	1,574
16	Albion Urban & LARE Study	16,970	159,576	143,278	11,296	10,079	3,625	1,976
17	Rome City Urban	19,692	172,293	152,793	12,152	10,748	4,623	2,107
18	Milford Urban	14,459	157,822	132,045	10,712	9,289	3,741	1,821
19	Jones Lake & surrounding area within Noble County	5,885	46,228	39,443	3,356	2,775	1,187	544
20	Upper Reaches of S. Branch Elkhart River (N. of 100 North)	15,422	136,315	123,406	9,634	8,681	3,865	1,702
21	Solomon Creek Upper Watershed & LARE Study	15,156	168,085	141,058	11,247	9,923	3,626	1,946
22	Solomon Creek Lower Watershed & LARE Study	8,524	94,426	78,107	6,362	5,494	1,852	1,077
24	Golf Courses	11,321	100,281	86,758	7,151	6,103	3,592	1,197
25	LaGrange County Lakes & LARE Studies	7,596	62,458	49,756	4,427	3,500	1,487	686

Table 52. Five Year Loading Objectives to be Achieved by 2012

Critical Area	Acreage	Nitrogen							Phosphorus							Total Suspended Sediment						
		Total Nitrogen Load	Reduction to Meet Objective*	BMPs Required to meet Nitrogen Goals (acres)					Total Phosphorus Load	Reduction to Meet Objective*	BMPs Required to meet Phosphorus Goals (acres)					TSS Load	Reduction to Meet Objective	BMPs Required to meet TSS Goals (acres)				
		lbs/year	lbs/year	Urban	Cropland	Pasture	Total Acres	Total Cost	Lbs/year	lbs/year	Urban	Cropland	Pasture	Total Acres	Total Cost	tons/year	tons/year	Urban	Cropland	Pasture	Total Acres	Total Cost
1	3,684	28,079	1,381	9	235	82	325	\$7,401	2,080	123	3	86	30	119	\$2,704	1,688	344	24	659	229	913	\$20,781
2	15,941	159,621	2,670	2	440	238	680	\$9,777	11,494	254	1	186	101	288	\$4,134	4,232	544	5	1,376	745	2,125	\$30,553
3	5,920	53,668	1,098	59	126	115	300	\$27,097	4,354	222	59	126	115	300	\$27,097	2,827	537	490	1,048	962	2,500	\$225,812
4	13,665	131,100	835	1	116	98	215	\$3,494	9,799	203	1	138	117	256	\$4,164	4,959	799	16	2,027	1,707	3,750	\$60,938
5	11,099	112,925	2,622	35	421	218	675	\$22,646	8,416	303	18	218	113	350	\$11,742	4,440	757	161	1,935	1,003	3,100	\$104,003
6	2,957	16,235	257	1	47	10	58	\$985	1,171	25	0	18	4	23	\$385	1,157	237	8	471	96	575	\$9,850
7	10,167	103,816	4,095	5	841	129	975	\$13,174	7,078	232	1	189	29	219	\$2,956	3,622	604	11	1,617	248	1,875	\$25,334
8	13,014	135,767	3,961	16	719	253	988	\$18,598	9,562	282	21	964	339	1,325	\$24,954	4,964	828	51	2,311	813	3,175	\$59,796
9	8,779	72,030	2,556	385	244	209	838	\$160,709	6,140	448	357	225	193	775	\$148,715	3,570	679	2,128	1,345	1,152	4,625	\$887,495
10	20,925	196,916	7,395	699	1,059	468	2,225	\$299,384	15,412	910	408	618	273	1,300	\$174,921	5,257	737	1,374	2,081	920	4,375	\$588,677
11	18,412	196,655	7,797	104	1,629	242	1,975	\$62,841	13,471	458	24	381	57	463	\$14,716	4,933	663	132	2,061	307	2,500	\$79,546
12	9,742	105,525	4,143	55	866	129	1,050	\$33,409	7,660	351	19	295	44	358	\$11,375	3,993	691	139	2,165	322	2,625	\$83,523
13	18,077	169,504	6,105	161	1,088	313	1,563	\$81,718	12,381	544	61	409	118	588	\$30,726	4,083	521	194	1,306	376	1,875	\$98,062
14	17,537	152,863	5,473	192	961	221	1,375	\$90,955	10,916	426	70	350	81	500	\$33,074	4,997	798	472	2,360	543	3,375	\$223,253
15	12,506	128,495	3,593	78	688	172	938	\$41,339	9,114	272	25	220	55	300	\$13,229	4,594	755	259	2,294	573	3,125	\$137,797
16	16,970	159,576	4,074	17	718	278	1,013	\$19,680	11,296	304	6	239	93	338	\$6,560	3,625	412	28	1,152	445	1,625	\$31,585
17	19,692	172,293	4,875	39	911	288	1,238	\$30,465	12,152	351	13	294	93	400	\$9,847	4,623	629	83	1,932	611	2,625	\$64,624
18	14,459	157,822	6,444	50	1,278	322	1,650	\$39,114	10,712	356	11	291	73	375	\$8,889	3,741	480	60	1,550	390	2,000	\$47,410
19	5,885	46,228	1,696	2	301	99	403	\$5,902	3,356	145	1	108	35	144	\$2,108	1,187	161	3	375	123	500	\$7,331
20	15,422	136,315	3,227	3	611	199	813	\$11,428	9,634	238	1	190	62	253	\$3,551	3,865	541	9	1,587	516	2,113	\$29,712
21	15,156	168,085	6,757	10	1,471	175	1,656	\$22,406	11,247	331	2	278	33	313	\$4,227	3,626	420	9	1,277	152	1,438	\$19,446
22	8,524	94,426	4,080	3	861	103	968	\$11,977	6,362	217	1	175	21	196	\$2,429	1,852	194	2	512	61	575	\$7,118
24	11,321	100,281	3,381	28	627	189	844	\$21,244	7,151	262	9	204	62	275	\$6,924	3,592	599	73	1,625	490	2,188	\$55,077
25	7,596	62,458	3,175	89	604	104	798	\$43,773	4,427	232	26	175	30	231	\$12,693	1,487	200	74	501	86	661	\$36,295
							23,558	\$1,079,516						9,685	\$562,124						54,236	\$2,934,020

* Margin of Safety (MOS) was applied in calculating these values.

Table 53. Ten Year Loading Objectives to be Achieved by 2017

Critical Area	Acreage	Nitrogen							Phosphorus							Total Suspended Sediment						
		Total Nitrogen Load	Reduction to Meet Objective*	BMPs Required to meet Nitrogen Goals (acres)					Total Phosphorus Load	Reduction to Meet Objective*	BMPs Required to meet Phosphorus Goals (acres)					TSS Load	Reduction to Meet Objective	BMPs Required to meet TSS Goals (acres)				
		lbs/year	lbs/year	Urban	Cropland	Pasture	Total Acres	Total Cost	lbs/year	lbs/year	Urban	Cropland	Pasture	Total Acres	Total Cost	tons/year	tons/year	Urban	Cropland	Pasture	Total Acres	Total Cost
1	3,684	28,079	2,762	17	469	163	650	\$14,803	2,080	246	6	172	60	238	\$5,409	1,688	688	48	1,318	459	1,825	\$41,561
2	15,941	159,621	5,340	3	880	477	1,360	\$19,554	11,494	508	1	372	202	575	\$8,267	4,232	1,089	10	2,751	1,489	4,250	\$61,107
3	5,920	53,668	2,196	118	251	231	600	\$54,195	4,354	444	118	251	231	600	\$54,195	2,827	1,074	980	2,095	1,924	5,000	\$451,624
4	13,665	131,100	1,671	2	232	196	430	\$6,988	9,799	406	2	277	233	513	\$8,328	4,959	1,599	33	4,053	3,414	7,500	\$121,875
5	11,099	112,925	5,245	70	843	437	1,350	\$45,292	8,416	605	36	437	227	700	\$23,485	4,440	1,513	323	3,870	2,007	6,200	\$208,006
6	2,957	16,235	515	2	94	19	115	\$1,970	1,171	51	1	37	7	45	\$771	1,157	474	16	943	191	1,150	\$19,700
7	10,167	103,816	8,189	11	1,681	258	1,950	\$26,348	7,078	463	2	377	58	438	\$5,911	3,622	1,208	21	3,234	495	3,750	\$50,668
8	13,014	135,767	7,921	32	1,437	506	1,975	\$37,196	9,562	563	43	1,929	679	2,650	\$49,909	4,964	1,655	102	4,621	1,627	6,350	\$119,592
9	8,779	72,030	5,111	771	487	417	1,675	\$321,417	6,140	896	713	451	386	1,550	\$297,431	3,570	1,359	4,255	2,691	2,304	9,250	\$1,774,991
10	20,925	196,916	14,790	1,397	2,117	936	4,450	\$598,769	15,412	1,820	816	1,237	547	2,600	\$349,842	5,257	1,475	2,747	4,163	1,840	8,750	\$1,177,354
11	18,412	196,655	15,593	209	3,257	484	3,950	\$125,682	13,471	915	49	763	113	925	\$29,432	4,933	1,325	264	4,123	613	5,000	\$159,091
12	9,742	105,525	8,286	111	1,732	257	2,100	\$66,818	7,660	701	38	590	88	715	\$22,750	3,993	1,383	277	4,329	644	5,250	\$167,046
13	18,077	169,504	12,209	323	2,176	626	3,125	\$163,437	12,381	1,088	121	818	235	1,175	\$61,452	4,083	1,041	387	2,611	752	3,750	\$196,124
14	17,537	152,863	10,946	385	1,923	443	2,750	\$181,910	10,916	852	140	699	161	1,000	\$66,149	4,997	1,595	944	4,719	1,087	6,750	\$446,505
15	12,506	128,495	7,185	155	1,376	344	1,875	\$82,678	9,114	543	50	440	110	600	\$26,457	4,594	1,510	517	4,588	1,145	6,250	\$275,595
16	16,970	159,576	8,149	35	1,435	555	2,025	\$39,359	11,296	609	12	478	185	675	\$13,120	3,625	824	56	2,303	891	3,250	\$63,169
17	19,692	172,293	9,750	78	1,821	576	2,475	\$60,931	12,152	702	25	589	186	800	\$19,695	4,623	1,258	165	3,863	1,222	5,250	\$129,247
18	14,459	157,822	12,889	99	2,557	644	3,300	\$78,227	10,712	712	23	581	146	750	\$17,779	3,741	960	121	3,099	780	4,000	\$94,821
19	5,885	46,228	3,393	5	603	197	805	\$11,803	3,356	291	2	215	71	288	\$4,216	1,187	322	6	749	245	1,000	\$14,663
20	15,422	136,315	6,454	7	1,221	397	1,625	\$22,856	9,634	476	2	379	123	505	\$7,103	3,865	1,081	18	3,175	1,033	4,225	\$59,424
21	15,156	168,085	13,513	21	2,942	350	3,313	\$44,811	11,247	662	4	555	66	625	\$8,455	3,626	840	18	2,553	304	2,875	\$38,893
22	8,524	94,426	8,160	7	1,723	206	1,935	\$23,954	6,362	434	1	349	42	393	\$4,859	1,852	387	4	1,024	122	1,150	\$14,236
24	11,321	100,281	6,762	56	1,254	378	1,688	\$42,488	7,151	524	18	409	123	550	\$13,848	3,592	1,198	145	3,251	979	4,375	\$110,155
25	7,596	62,458	6,351	178	1,209	208	1,595	\$87,546	4,427	464	52	351	60	463	\$25,386	1,487	400	148	1,002	172	1,323	\$72,589
							47,115	\$2,159,033						19,370	\$1,124,247						108,473	\$5,868,040

* Margin of Safety (MOS) was applied in calculating these values.

Table 54. Twenty Year Objectives to be Achieved by 2027

Critical Area	Acreage	Nitrogen							Phosphorus							Total Suspended Sediment										
		Total Nitrogen Load	Reduction to Meet Objective*	BMPs Required to meet Nitrogen Goals (acres)					Total Phosphorus Load	Reduction to Meet Objective*	BMPs Required to meet Phosphorus Goals (acres)					TSS Load	Reduction to Meet Objective	BMPs Required to meet TSS Goals (acres)								
		lbs/year	lbs/year	Urban	Cropland	Pasture	Total Acres	Total Cost	Lbs/year	lbs/year	Urban	Cropland	Pasture	Total Acres	Total Cost	tons/year	tons/year	Urban	Cropland	Pasture	Total Acres	Total Cost				
1	3,684	28,079	5,523.8	34	939	327	1,300	\$29,605	2,080	493	12	343	119	475	\$10,817	1,688	1,377	96	2,636	918	3,650	\$83,123				
2	15,941	159,621	10,679.2	6	1,761	953	2,720	\$39,108	11,494	1,017	3	744	403	1,150	\$16,535	4,232	2,177	19	5,502	2,979	8,500	\$122,213				
3	5,920	53,668	4,392.4	235	503	462	1,200	\$108,390	4,354	888	235	503	462	1,200	\$108,390	2,827	2,147	1,961	4,191	3,848	10,000	\$903,249				
4	13,665	131,100	3,341.8	4	465	391	860	\$13,975	9,799	812	4	554	467	1,025	\$16,656	4,959	3,197	65	8,107	6,828	15,000	\$243,750				
5	11,099	112,925	10,490.0	141	1,685	874	2,700	\$90,583	8,416	1,210	73	874	453	1,400	\$46,969	4,440	3,027	646	7,740	4,014	12,400	\$416,012				
6	2,957	16,235	1,029.3	3	189	38	230	\$3,940	1,171	101	1	74	15	90	\$1,542	1,157	947	32	1,885	383	2,300	\$39,401				
7	10,167	103,816	16,378.5	22	3,363	515	3,900	\$52,695	7,078	927	5	754	116	875	\$11,823	3,622	2,416	42	6,467	991	7,500	\$101,337				
8	13,014	135,767	15,842.0	64	2,875	1,012	3,950	\$74,392	9,562	1,126	85	3,857	1,358	5,300	\$99,817	4,964	3,310	204	9,243	3,253	12,700	\$239,185				
9	8,779	72,030	10,222.1	1,541	975	834	3,350	\$642,835	6,140	1,793	1,426	902	772	3,100	\$594,862	3,570	2,717	8,510	5,382	4,608	18,500	\$3,549,982				
10	20,925	196,916	29,580.6	2,794	4,234	1,871	8,900	\$1,197,537	15,412	3,641	1,633	2,474	1,093	5,200	\$699,685	5,257	2,949	5,495	8,326	3,679	17,500	\$2,354,708				
11	18,412	196,655	31,186.5	417	6,514	969	7,900	\$251,364	13,471	1,831	98	1,525	227	1,850	\$58,864	4,933	2,651	528	8,246	1,226	10,000	\$318,183				
12	9,742	105,525	16,571.1	222	3,463	515	4,200	\$133,637	7,660	1,403	76	1,179	175	1,430	\$45,500	3,993	2,766	554	8,658	1,287	10,500	\$334,092				
13	18,077	169,504	24,418.1	646	4,352	1,253	6,250	\$326,873	12,381	2,175	243	1,636	471	2,350	\$122,904	4,083	2,082	775	5,222	1,503	7,500	\$392,248				
14	17,537	152,863	21,892.1	769	3,845	886	5,500	\$363,819	10,916	1,703	280	1,398	322	2,000	\$132,298	4,997	3,191	1,888	9,439	2,174	13,500	\$893,011				
15	12,506	128,495	14,370.3	310	2,753	687	3,750	\$165,357	9,114	1,086	99	881	220	1,200	\$52,914	4,594	3,020	1,034	9,175	2,291	12,500	\$551,189				
16	16,970	159,576	16,297.5	70	2,870	1,110	4,050	\$78,719	11,296	1,217	23	957	370	1,350	\$26,240	3,625	1,648	112	4,607	1,782	6,500	\$126,339				
17	19,692	172,293	19,499.8	156	3,642	1,152	4,950	\$121,862	12,152	1,404	50	1,177	372	1,600	\$39,390	4,623	2,516	331	7,726	2,443	10,500	\$258,494				
18	14,459	157,822	25,777.2	199	5,113	1,288	6,600	\$156,455	10,712	1,423	45	1,162	293	1,500	\$35,558	3,741	1,920	241	6,198	1,561	8,000	\$189,642				
19	5,885	46,228	6,785.8	9	1,206	395	1,610	\$23,607	3,356	582	3	431	141	575	\$8,431	1,187	643	11	1,498	491	2,000	\$29,325				
20	15,422	136,315	12,908.9	14	2,442	794	3,250	\$45,711	9,634	953	4	759	247	1,010	\$14,206	3,865	2,162	35	6,350	2,065	8,450	\$118,849				
21	15,156	168,085	27,026.6	42	5,883	700	6,625	\$89,623	11,247	1,325	8	1,110	132	1,250	\$16,910	3,626	1,681	36	5,106	607	5,750	\$77,786				
22	8,524	94,426	16,319.4	13	3,445	412	3,870	\$47,908	6,362	868	3	699	84	785	\$9,718	1,852	775	8	2,048	245	2,300	\$28,472				
24	11,321	100,281	13,523.2	112	2,508	755	3,375	\$84,977	7,151	1,048	36	817	246	1,100	\$27,696	3,592	2,396	290	6,502	1,958	8,750	\$220,310				
25	7,596	62,458	12,701.9	356	2,418	416	3,190	\$175,093	4,427	927	103	701	121	925	\$50,771	1,487	801	296	2,005	345	2,645	\$145,179				
							94,230	\$4,318,065								38,740	\$2,248,495								216,945	\$11,736,079

* Margin of Safety (MOS) was applied in calculating these values.