# **Tables**

		Page
1	Monthly rainfall totals	29
2	Total monthly rainfall in SMC during 2000	31
3	Monthly precipitation totals for St. Peter and SMC in 2000	31
4	Total monthly rainfall in SMC during 2001	32
5	Monthly precipitation totals for St. Peter and SMC in 2001	32
6	Land use and land cover	33
7	Percent of sub-shed by RUSLE erosion categories	44
8	Acres within 300 feet of waterway by soil loss category	44
9	Slope classes	47
10	Sub-watersheds and slope classes	47
11	Wetland characteristics	47
12	Feedlot statistics	51
13	Potential phosphorus contribution from livestock	52
14	Reporting units and methods	66
15	Interquartile range of pollutant concentrations by ecoregion	73
16	Tillage transect survey results	80
17	Total suspended solids	93
18	Nitrate nitrogen	94
19	Total phosphorus	95
20	Ortho-phosphorus	96
21	Fecal coliform bacteria	97
22	2000 and 2001 flow stats	102
23	2000 flow weighted mean concentrations	110
24	2001 flow weighted mean concentrations	110
25	2002 flow weighted mean concentrations	110
26	2000 Yield	110
27	2001 Yield	110
28	2002 Yield	110
29	Average FWMC for 2000 and 2001	111
30	Average Yield for 2000 and 2001	111
31	Tillage transect survey results and analysis	124
32	Phosphorus contributions from septics	139
33	Nitrogen mass balance for SMC	142
34	Nitrate losses from 1987-1994	149
35	Economic analysis of nitrogen rates	171
36	SMC implementation plan –cash expenditures	184
37	SMC implementation plan-in kind contributions	185

# **Figures**

1Water surface elevation252Average annual precipitation rates263Average annual precipitation rates, St. Peter264TSS and storm hydrograph895Nitrate-nitrogen vs. time916Total phosphorus vs. time927TSS concentrations vs. time938Nitrate concentrations vs. time949Total phosphorus concentrations vs. time9610Ortho-phosphorus concentrations vs. time9611Fecal coliform levels9712Fecal coliform levels with upper limit reference9813Early summer SMC hydrograph10014Mid-summer SMC hydrograph10115Late summer SMC hydrograph10116Site 1 hydrograph10317Site 2 hydrograph10418Site 3 hydrograph10519Average daily flows at each site vs. time10620Percent of pollutant load by month for 2000 and 200111321TSS vs. monitoring year11623Total phosphorus vs. monitoring year11624Ortho-phosphorus vs. monitoring year11625TSS yield comparison11726TSS vs. transparency12127Priority areas as identified by RUSLE modeling13833Sediment sources in SMC14034Phosphorus sources in SMC14735Nitrate nitrogen sources in SMC147<			Page
3Average annual precipitation rates, St. Peter264TSS and storm hydrograph895Nitrate-nitrogen vs. time916Total phosphorus vs. time927TSS concentrations vs. time938Nitrate concentrations vs. time949Total phosphorus concentrations vs. time9610Ortho-phosphorus concentrations vs. time9611Fecal coliform levels9712Fecal coliform levels with upper limit reference9813Early summer SMC hydrograph10014Mid-summer SMC hydrograph10115Late summer SMC hydrograph10116Site 1 hydrograph10317Site 2 hydrograph10418Site 3 hydrograph10519Average daily flows at each site vs. time10620Percent of pollutant load by month for 2000 and 200111321TSS vs. monitoring year11623Total phosphorus vs. monitoring year11624Ortho-phosphorus vs. monitoring year11625TSS yield comparison11726TSS vs. transparency12121Priority areas as identified by RUSLE modeling13833Sediment sources in SMC14734Phosphorus sources in SMC14735Vield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms<			
4TSS and storm hydrograph895Nitrate-nitrogen vs. time916Total phosphorus vs. time927TSS concentrations vs. time938Nitrate concentrations vs. time949Total phosphorus concentrations vs. time949Total phosphorus concentrations vs. time9611Fecal coliform levels9712Fecal coliform levels with upper limit reference983Early summer SMC hydrograph10014Mid-summer SMC hydrograph10115Late summer SMC hydrograph10317Site 2 hydrograph10318Site 3 hydrograph10418Site 3 hydrograph10519Average daily flows at each site vs. time10620Percent of pollutant load by month for 2000 and 200111321TSS vs. monitoring year11423Total phosphorus vs. monitoring year11624Ortho-phosphorus vs. monitoring year11625TSS yield comparison11826Total phosphorus normalized yield for 200011827Total phosphorus normalized yield for 200011828Total phosphorus sources in SMC13934Phosphorus sources in SMC14735Sediment sources in SMC14736Nitragen mass balance14647Seign of nitrogen sources in SMC14738Yield vs. concentration155		• • •	
5Nitrate-nitrogen vs. time916Total phosphorus vs. time927TSS concentrations vs. time938Nitrate concentrations vs. time949Total phosphorus concentrations vs. time9510Ortho-phosphorus concentrations vs. time9611Fecal coliform levels9712Fecal coliform levels with upper limit reference9813Early summer SMC hydrograph10114Mid-summer SMC hydrograph10115Late summer SMC hydrograph10317Site 2 hydrograph10418Site 3 hydrograph10519Average daily flows at each site vs. time10620Percent of pollutant load by month for 2000 and 200111321TSS vs. monitoring year11422Nitrate vs. monitoring year11523Total phosphorus vs. monitoring year11624Ortho-phosphorus vs. monitoring year11725TSS yield comparison11726TSS vs. transparency12127Total phosphorus normalized yield for 200011828Total phosphorus for 200011929Normalized yield for nitrate nitrogen for 200011821TSS vs. transparency12122Priority areas as identified by RUSLE modeling13833Sediment sources in SMC14034Phosphorus sources in SMC14735Yield vs. concentration1			
6Total phosphorus vs. time927TSS concentrations vs. time938Nitrate concentrations vs. time949Total phosphorus concentrations vs. time9611Fecal coliform levels9712Fecal coliform levels with upper limit reference9813Early summer SMC hydrograph10014Mid-summer SMC hydrograph10115Late summer SMC hydrograph10116Site 1 hydrograph10317Site 2 hydrograph10518Site 3 hydrograph10519Average daily flows at each site vs. time10610Percent of pollutant load by month for 2000 and 200111321TSS vs. monitoring year11422Nitrate vs. monitoring year11523Total phosphorus vs. monitoring year11624Ortho-phosphorus vs. monitoring year11725Syled comparison11726TSS vold comparison11827Total phosphorus normalized yield for 200011828Total phosphorus for 200011929Normalized yield for nitrate nitrogen for 200011821Priority areas as identified by RUSLE modeling13833Sediment sources in SMC14034Phosphorus sources in SMC14735Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Far			
7TSS concentrations vs. time938Nitrate concentrations vs. time949Total phosphorus concentrations vs. time9510Ortho-phosphorus concentrations vs. time9611Fecal coliform levels9712Fecal coliform levels with upper limit reference9813Early summer SMC hydrograph10014Mid-summer SMC hydrograph10115Late summer SMC hydrograph10116Site 1 hydrograph10317Site 2 hydrograph10418Site 3 hydrograph10519Average daily flows at each site vs. time10620Percent of pollutant load by month for 2000 and 200111321TSS vs. monitoring year11523Total phosphorus vs. monitoring year11625TSS yield comparison11726TSS concentration comparison11827Total phosphorus normalized yield for 200011828Total phosphorus for 200011930No <sub>3</sub> -N comparison12031TSS vs. transparency12132Priority areas as identified by RUSLE modeling13833Sediment sources in SMC14035Nitrogen mass balance14636Estimated nitrogen sources in SMC14737Estimated nitrogen losses in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms158	5	0	
8Nitrate concentrations vs. time949Total phosphorus concentrations vs. time9510Ortho-phosphorus concentrations vs. time9611Fecal coliform levels9712Fecal coliform levels with upper limit reference9813Early summer SMC hydrograph10014Mid-summer SMC hydrograph10115Late summer SMC hydrograph10316Site 1 hydrograph10317Site 2 hydrograph10418Site 3 hydrograph10519Average daily flows at each site vs. time10620Percent of pollutant load by month for 2000 and 200111321TSS vs. monitoring year11523Total phosphorus vs. monitoring year11624Ortho-phosphorus vs. monitoring year11625TSS yield comparison11726TSS concentration comparison11827Total phosphorus for 200011930No <sub>3</sub> -N comparison12031TSS vs. transparency12132Priority areas as identified by RUSLE modeling13833Sediment sources in SMC14034Phosphorus sources in SMC14735Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen losses in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms158 <t< td=""><td></td><td></td><td></td></t<>			
9Total phosphorus concentrations vs. time9510Ortho-phosphorus concentrations vs. time9611Fecal coliform levels9712Fecal coliform levels with upper limit reference9813Early summer SMC hydrograph10014Mid-summer SMC hydrograph10115Late summer SMC hydrograph10317Site 2 hydrograph10418Site 3 hydrograph10519Average daily flows at each site vs. time10620Percent of pollutant load by month for 2000 and 200111321TSS vs. monitoring year11422Nitrate vs. monitoring year11523Total phosphorus vs. monitoring year11624Ortho-phosphorus vs. monitoring year11625TSS yield comparison11726TSS concentration comparison11827Total phosphorus for 200011930No <sub>3</sub> -N comparison12031TSS vs. transparency12132Priority areas as identified by RUSLE modeling13833Sediment sources in SMC14034Phosphorus sources in SMC14035Nitragen mass balance14636Estimated nitrogen losses in SMC14737Estimated nitrogen losses in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms15830Design of nitrogen rate strips at Red Top Farms	7	TSS concentrations vs. time	93
10Ortho-phosphorus concentrations vs. time9611Fecal coliform levels9712Fecal coliform levels with upper limit reference9813Early summer SMC hydrograph10014Mid-summer SMC hydrograph10115Late summer SMC hydrograph10316Site 1 hydrograph10317Site 2 hydrograph10418Site 3 hydrograph10519Average daily flows at each site vs. time10620Percent of pollutant load by month for 2000 and 200111321TSS vs. monitoring year11422Nitrate vs. monitoring year11523Total phosphorus vs. monitoring year11624Ortho-phosphorus vs. monitoring year11625TSS yield comparison11726TSS vold for 200011827Total phosphorus normalized yield for 200011828Total phosphorus for 200011929Normalized yield for nitrate nitrogen for 200011920No <sub>3</sub> -N comparison12031TSS vs. transparency12132Priority areas as identified by RUSLE modeling13833Sediment sources in SMC14034Phosphorus sources in SMC14735Yield vs. concentration15539Nitrate reductions at Red Top Farms15839Nitrate reductions at Red Top Farms15831Design of nitrogen rate strips at Red Top Farm	8	Nitrate concentrations vs. time	94
11Fecal coliform levels9712Fecal coliform levels with upper limit reference9813Early summer SMC hydrograph10014Mid-summer SMC hydrograph10115Late summer SMC hydrograph10116Site 1 hydrograph10317Site 2 hydrograph10418Site 3 hydrograph10519Average daily flows at each site vs. time10620Percent of pollutant load by month for 2000 and 200111321TSS vs. monitoring year11523Total phosphorus vs. monitoring year11524Ortho-phosphorus vs. monitoring year11625TSS yield comparison11726TSS concentration comparison11827Total phosphorus for 200011928Total phosphorus for 200011929Nora-N comparison12031TSS vs. transparency12121Priority areas as identified by RUSLE modeling13833Sediment sources in SMC14035Nitrogen mass balance14636Estimated nitrogen sources in SMC14737Field vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms15841Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172	9	Total phosphorus concentrations vs. time	95
12Fecal coliform levels with upper limit reference9813Early summer SMC hydrograph10014Mid-summer SMC hydrograph10115Late summer SMC hydrograph10116Site 1 hydrograph10317Site 2 hydrograph10418Site 3 hydrograph10519Average daily flows at each site vs. time10620Percent of pollutant load by month for 2000 and 200111321TSS vs. monitoring year11422Nitrate vs. monitoring year11523Total phosphorus vs. monitoring year11624Ortho-phosphorus vs. monitoring year11625TSS yield comparison11826TSS concentration comparison11827Total phosphorus for 200011928Total phosphorus for 200011929Normalized yield for nitrate nitrogen for 200011920Nos-N comparison12031TSS vs. transparency12132Priority areas as identified by RUSLE modeling13833Sediment sources in SMC14034Phosphorus sources in SMC14735Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17041Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172	10	Ortho-phosphorus concentrations vs. time	96
13Early summer SMC hydrograph10014Mid-summer SMC hydrograph10115Late summer SMC hydrograph10116Site 1 hydrograph10317Site 2 hydrograph10418Site 3 hydrograph10519Average daily flows at each site vs. time10620Percent of pollutant load by month for 2000 and 200111321TSS vs. monitoring year11422Nitrate vs. monitoring year11523Total phosphorus vs. monitoring year11625TSS yield comparison11726TSS concentration comparison11827Total phosphorus for 200011929Normalized yield for nitrate nitrogen for 200011920No <sub>3</sub> -N comparison12021TSS vs. transparency12122Priority areas as identified by RUSLE modeling13833Sediment sources in SMC14034Phosphorus sources in SMC14735Nitrogen mass balance14636Estimated nitrogen sources in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17041Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172	11	Fecal coliform levels	97
14Mid-summer SMC hydrograph10115Late summer SMC hydrograph10116Site 1 hydrograph10317Site 2 hydrograph10418Site 3 hydrograph10519Average daily flows at each site vs. time10620Percent of pollutant load by month for 2000 and 200111321TSS vs. monitoring year11422Nitrate vs. monitoring year11523Total phosphorus vs. monitoring year11624Ortho-phosphorus vs. monitoring year11625TSS yield comparison11726TSS concentration comparison11827Total phosphorus for 200011928Total phosphorus for 200011929Normalized yield for nitrate nitrogen for 200011930No <sub>3</sub> -N comparison12031TSS vs. transparency12132Priority areas as identified by RUSLE modeling13833Sediment sources in SMC14034Phosphorus sources in SMC14735Nitrogen mass balance14636Estimated nitrogen losses in SMC14736Tield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17041Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172	12	Fecal coliform levels with upper limit reference	98
15Late summer SMC hydrograph10116Site 1 hydrograph10317Site 2 hydrograph10418Site 3 hydrograph10519Average daily flows at each site vs. time10620Percent of pollutant load by month for 2000 and 200111321TSS vs. monitoring year11422Nitrate vs. monitoring year11523Total phosphorus vs. monitoring year11624Ortho-phosphorus vs. monitoring year11625TSS yield comparison11726TSS concentration comparison11827Total phosphorus for 200011928Total phosphorus for 200011929Normalized yield for nitrate nitrogen for 200011930No <sub>3</sub> -N comparison12031TSS vs. transparency12132Priority areas as identified by RUSLE modeling13833Sediment sources in SMC14034Phosphorus sources in SMC14735Nitrogen mass balance14636Estimated nitrogen losses in SMC14737Estimated nitrogen losses in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17041Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172	13	Early summer SMC hydrograph	100
16Site 1 hydrograph10317Site 2 hydrograph10418Site 3 hydrograph10519Average daily flows at each site vs. time10620Percent of pollutant load by month for 2000 and 200111321TSS vs. monitoring year11422Nitrate vs. monitoring year11523Total phosphorus vs. monitoring year11625TSS yield comparison11726TSS concentration comparison11827Total phosphorus normalized yield for 200011928Total phosphorus for 200011929Normalized yield for nitrate nitrogen for 200011930No <sub>3</sub> -N comparison12031TSS vs. transparency12132Priority areas as identified by RUSLE modeling13833Sediment sources in SMC14034Phosphorus sources in SMC14735Nitrogen mass balance14636Estimated nitrogen losses in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17041Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172	14	Mid-summer SMC hydrograph	101
17Site 2 hydrograph10418Site 3 hydrograph10519Average daily flows at each site vs. time10620Percent of pollutant load by month for 2000 and 200111321TSS vs. monitoring year11422Nitrate vs. monitoring year11523Total phosphorus vs. monitoring year11625TSS yield comparison11726TSS concentration comparison11827Total phosphorus normalized yield for 200011928Total phosphorus for 200011929Normalized yield for nitrate nitrogen for 200011930No <sub>3</sub> -N comparison12031TSS vs. transparency12132Priority areas as identified by RUSLE modeling13833Sediment sources in SMC14034Phosphorus sources in SMC14735Nitrogen mass balance14636Estimated nitrogen losses in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17041Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172	15	Late summer SMC hydrograph	101
18Site 3 hydrograph10519Average daily flows at each site vs. time10620Percent of pollutant load by month for 2000 and 200111321TSS vs. monitoring year11422Nitrate vs. monitoring year11523Total phosphorus vs. monitoring year11524Ortho-phosphorus vs. monitoring year11625TSS yield comparison11726TSS concentration comparison11827Total phosphorus normalized yield for 200011828Total phosphorus for 200011929Normalized yield for nitrate nitrogen for 200011930No <sub>3</sub> -N comparison12031TSS vs. transparency12132Priority areas as identified by RUSLE modeling13833Sediment sources in SMC14035Nitrogen mass balance14636Estimated nitrogen losses in SMC14737Estimated nitrogen losses in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17041Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172	16	Site 1 hydrograph	103
19Average daily flows at each site vs. time10620Percent of pollutant load by month for 2000 and 200111321TSS vs. monitoring year11422Nitrate vs. monitoring year11523Total phosphorus vs. monitoring year11524Ortho-phosphorus vs. monitoring year11625TSS yield comparison11726TSS concentration comparison11827Total phosphorus normalized yield for 200011828Total phosphorus for 200011929Normalized yield for nitrate nitrogen for 200011930No <sub>3</sub> -N comparison12031TSS vs. transparency12132Priority areas as identified by RUSLE modeling13833Sediment sources in SMC14035Nitrogen mass balance14636Estimated nitrogen sources in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17041Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172	17	Site 2 hydrograph	104
20Percent of pollutant load by month for 2000 and 200111321TSS vs. monitoring year11422Nitrate vs. monitoring year11523Total phosphorus vs. monitoring year11524Ortho-phosphorus vs. monitoring year11625TSS yield comparison11726TSS concentration comparison11827Total phosphorus normalized yield for 200011928Total phosphorus for 200011929Normalized yield for nitrate nitrogen for 200011930No <sub>3</sub> -N comparison12031TSS vs. transparency12132Priority areas as identified by RUSLE modeling13833Sediment sources in SMC14035Nitrogen mass balance14636Estimated nitrogen losses in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17142Profitability vs. nitrogen rate172	18	Site 3 hydrograph	105
21TSS vs. monitoring year11422Nitrate vs. monitoring year11523Total phosphorus vs. monitoring year11624Ortho-phosphorus vs. monitoring year11625TSS yield comparison11726TSS concentration comparison11827Total phosphorus normalized yield for 200011828Total phosphorus for 200011929Normalized yield for nitrate nitrogen for 200011930No <sub>3</sub> -N comparison12031TSS vs. transparency12132Priority areas as identified by RUSLE modeling13833Sediment sources in SMC14035Nitrogen mass balance14636Estimated nitrogen losses in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17041Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172	19	Average daily flows at each site vs. time	106
21TSS vs. monitoring year11422Nitrate vs. monitoring year11523Total phosphorus vs. monitoring year11524Ortho-phosphorus vs. monitoring year11625TSS yield comparison11726TSS concentration comparison11827Total phosphorus normalized yield for 200011828Total phosphorus for 200011929Normalized yield for nitrate nitrogen for 200011930No <sub>3</sub> -N comparison12031TSS vs. transparency12132Priority areas as identified by RUSLE modeling13833Sediment sources in SMC14035Nitrogen mass balance14636Estimated nitrogen losses in SMC14737Estimated nitrogen losses in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17142Profitability vs. nitrogen rate172	20	Percent of pollutant load by month for 2000 and 2001	113
22Nitrate vs. monitoring year11523Total phosphorus vs. monitoring year11624Ortho-phosphorus vs. monitoring year11625TSS yield comparison11726TSS concentration comparison11827Total phosphorus normalized yield for 200011828Total phosphorus for 200011929Normalized yield for nitrate nitrogen for 200011930No <sub>3</sub> -N comparison12031TSS vs. transparency12132Priority areas as identified by RUSLE modeling13833Sediment sources in SMC14035Nitrogen mass balance14636Estimated nitrogen losses in SMC14737Estimated nitrogen losses in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17142Profitability vs. nitrogen rate172	21		114
24Ortho-phosphorus vs. monitoring year11625TSS yield comparison11726TSS concentration comparison11827Total phosphorus normalized yield for 200011828Total phosphorus for 200011929Normalized yield for nitrate nitrogen for 200011930No <sub>3</sub> -N comparison12031TSS vs. transparency12132Priority areas as identified by RUSLE modeling13833Sediment sources in SMC14035Nitrogen mass balance14636Estimated nitrogen losses in SMC14737Estimated nitrogen losses in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17142Profitability vs. nitrogen rate172	22	Nitrate vs. monitoring year	115
24Ortho-phosphorus vs. monitoring year11625TSS yield comparison11726TSS concentration comparison11827Total phosphorus normalized yield for 200011828Total phosphorus for 200011929Normalized yield for nitrate nitrogen for 200011930No <sub>3</sub> -N comparison12031TSS vs. transparency12132Priority areas as identified by RUSLE modeling13833Sediment sources in SMC14035Nitrogen mass balance14636Estimated nitrogen losses in SMC14737Estimated nitrogen losses in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17142Profitability vs. nitrogen rate172	23		115
25TSS yield comparison11726TSS concentration comparison11827Total phosphorus normalized yield for 200011828Total phosphorus for 200011929Normalized yield for nitrate nitrogen for 200011930No <sub>3</sub> -N comparison12031TSS vs. transparency12132Priority areas as identified by RUSLE modeling13833Sediment sources in SMC14035Nitrogen mass balance14636Estimated nitrogen losses in SMC14737Estimated nitrogen losses in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17041Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172	24	Ortho-phosphorus vs. monitoring year	116
27Total phosphorus normalized yield for 200011828Total phosphorus for 200011929Normalized yield for nitrate nitrogen for 200011930No <sub>3</sub> -N comparison12031TSS vs. transparency12132Priority areas as identified by RUSLE modeling13833Sediment sources in SMC13934Phosphorus sources in SMC14035Nitrogen mass balance14636Estimated nitrogen sources in SMC14737Estimated nitrogen losses in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17041Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172	25		117
27Total phosphorus normalized yield for 200011828Total phosphorus for 200011929Normalized yield for nitrate nitrogen for 200011930No <sub>3</sub> -N comparison12031TSS vs. transparency12132Priority areas as identified by RUSLE modeling13833Sediment sources in SMC13934Phosphorus sources in SMC14035Nitrogen mass balance14636Estimated nitrogen sources in SMC14737Estimated nitrogen losses in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17041Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172	26	TSS concentration comparison	118
28Total phosphorus for 200011929Normalized yield for nitrate nitrogen for 200011930No <sub>3</sub> -N comparison12031TSS vs. transparency12132Priority areas as identified by RUSLE modeling13833Sediment sources in SMC13934Phosphorus sources in SMC14035Nitrogen mass balance14636Estimated nitrogen sources in SMC14737Estimated nitrogen losses in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17041Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172	27	•	118
29Normalized yield for nitrate nitrogen for 200011930No <sub>3</sub> -N comparison12031TSS vs. transparency12132Priority areas as identified by RUSLE modeling13833Sediment sources in SMC13934Phosphorus sources in SMC14035Nitrogen mass balance14636Estimated nitrogen sources in SMC14737Estimated nitrogen losses in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17041Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172	28		119
30No <sub>3</sub> -N comparison12031TSS vs. transparency12132Priority areas as identified by RUSLE modeling13833Sediment sources in SMC13934Phosphorus sources in SMC14035Nitrogen mass balance14636Estimated nitrogen sources in SMC14737Estimated nitrogen losses in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17041Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172	29	1 1	119
31TSS vs. transparency12132Priority areas as identified by RUSLE modeling13833Sediment sources in SMC13934Phosphorus sources in SMC14035Nitrogen mass balance14636Estimated nitrogen sources in SMC14737Estimated nitrogen losses in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17041Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172	30		120
32Priority areas as identified by RUSLE modeling13833Sediment sources in SMC13934Phosphorus sources in SMC14035Nitrogen mass balance14636Estimated nitrogen sources in SMC14737Estimated nitrogen losses in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17041Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172	31	-	121
33Sediment sources in SMC13934Phosphorus sources in SMC14035Nitrogen mass balance14636Estimated nitrogen sources in SMC14737Estimated nitrogen losses in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17041Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172	32		138
35Nitrogen mass balance14636Estimated nitrogen sources in SMC14737Estimated nitrogen losses in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17041Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172	33		139
35Nitrogen mass balance14636Estimated nitrogen sources in SMC14737Estimated nitrogen losses in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17041Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172	34	Phosphorus sources in SMC	140
36Estimated nitrogen sources in SMC14737Estimated nitrogen losses in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17041Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172	35	-	146
37Estimated nitrogen losses in SMC14738Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17041Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172			147
38Yield vs. concentration15539Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17041Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172			147
39Nitrate reductions at Red Top Farms15840Design of nitrogen rate strips at Red Top Farms17041Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172	38	•	155
40Design of nitrogen rate strips at Red Top Farms17041Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172		Nitrate reductions at Red Top Farms	
41Average corn yields for different nitrogen rates17142Profitability vs. nitrogen rate172		•	
42 Profitability vs. nitrogen rate 172			

# Figures

		<b>Page</b>
44	Proposed Seven Mile Creek budget	188
45	Proposed BMP budget for Seven Mile Creek Project	188

## <u>Maps</u>

_		Page
1	SMC Watershed	3
2	Middle Minnesota Major Watershed	4
3	SMC Watershed with monitoring sites	9
4	SMC Watershed and wellhead protection area	19
5	Elevation map of SMC Watershed	22
6	Slope map of SMC Watershed	23
7	Monthly precipitation totals	30
8	1990 land use	34
9	Presettlement vegetation	35
10	Soil survey	38
11	Expected average corn yields	39
12	Expected average soybean yields	40
13	Land capability	41
14	Soil organic matter	42
15	Prime farmland	43
16	Soil erosion potential	45
17	Soil erosion potential adjacent to water bodies	46
18	Wetlands	48
19	Potentially restorable wetlands	49
20	Feedlots	53
21	Parcels with known spreading acres	54
22	Proposed location of Northern Plains Dairy	57
23	Potentially failing septics	59
24	Residential locations	61
25	Minnesota ecoregions	73
26	TSS FLUX flow weighted mean concentrations	108
27	Nitrate-Nitrogen flow weighted mean concentrations	108
28	Total phosphorus flow weighted mean concentrations	109
29	Ortho-phosphorus flow weighted mean concentrations	109
30	Tillage transect survey points and routes	125
31	Tillage transect survey results	125
32	2001 Watershed Inventories	128
33	Total Maximum Daily Loads	152
34	Middle Minnesota Major Watershed	153
35	Potential nitrogen remediation sites	177

# <u>Photos</u>

		Page
1	Seven Mile Creek near the mouth with MN River	18
2	Spring runoff conditions	28
3	Snowmelt conditions at site 2	28
4	Monitoring station at site 2	29
5	Monitoring site 1	74
6	Monitoring site 2	75
7	Monitoring site 3	76
8	Spring snowmelt at Seven Mile Creek Park	99
9	Spring snowmelt, site 1	100
10	Stream flow at site 1	107
11	Bank erosion soil samples	127
12	Stream bank erosion site	127
13	Rock inlet	181