

APPENDIX C - TOTAL MAXIMUM DAILY LOADS

C1.0 OVERVIEW

A percent reduction based on average yearly loading was used as the primary approach for expressing the sediment TMDLs within this document because there is uncertainty associated with the loads derived from the source assessment, and using the estimated sediment loads alone creates a rigid perception that the loads are absolutely conclusive. However, in this appendix the TMDL is expressed using daily loads to satisfy an additional EPA required TMDL element. Daily loads should not be considered absolutely conclusive and may be refined in the future as part of the adaptive management process. The TMDLs may not be feasible at all locations within the watershed but if the allocations are followed, sediment loads are expected to be reduced to a degree that the sediment targets are met and beneficial uses are no longer impaired. It is not expected that daily loads will drive implementation activities.

C2.0 APPROACH

The preferred approach for calculating daily sediment loads is to use a nearby water quality gage with a long-term dataset for flow and suspended sediment because the relationship between streamflow and suspended sediment can vary geographically. Within the Thompson Project Area, there are two USGS gage stations with continuous discharge datasets but no gage stations with daily suspended sediment measurements. In the absence of paired streamflow and sediment data, daily streamflow can still be a useful surrogate for representing daily sediment loading because sediment loading to streams and concentrations within streams is strongly related to runoff and streamflow, which increases during spring runoff and storm events (solid line in **Figure C-1**). Using the percentage that each mean daily discharge value is of the annual streamflow to calculate daily sediment values for TMDLs results provides percentages that mimic the annual hydrograph (**Figure C-1**).

Using the mean of daily mean discharge values from 57 years of record (1956 - 2013) at the USGS station on the Thompson River near Thompson Falls, MT (12389500), a daily percentage relative to the mean annual discharge was calculated for each day (see **Figure C-1** and **Table C-1**). For each TMDL, the daily load can be calculated by multiplying the percentages in **Table C-1** by the total average annual load associated with the TMDL percent reductions in **Section 5.7** and provided in **Table C-2**. For instance, the total allowable annual sediment load for the Little Thompson River is 1,241 tons. To determine the TMDL for January 1st, 1,241 tons is multiplied by 0.11% which provides a daily load for the Little Thompson River on January 1st of 1.37 tons. To conserve resources, this appendix contains the daily loads for the Little Thompson River as an example (**Table C-2** and **Figure C-2**). Daily loads for all other TMDLs can be calculated by multiplying the percentages in **Table C-1** by the values in **Table C-3**. The daily loads are a composite of the allocations, but as allocations are not feasible on a daily basis, they are not contained within this appendix. If desired, daily allocations may be obtained by applying allocations provided in **Section 5.6** to the daily load.

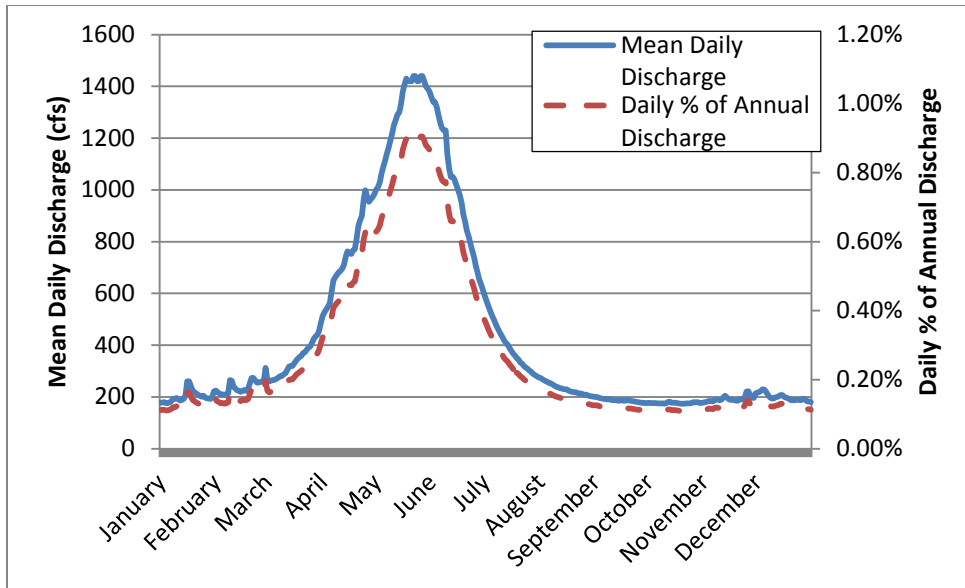


Figure C-1. Mean daily discharge and daily percentage of annual discharge for the Thompson River near Thompson Falls, Montana (#12389500, 1956 – 2013).

Table C-1. USGS Stream Gage 12389500 (Thompson River near Thompson Falls, MT) – Percent of Mean Annual Discharge Based on Mean of Daily Mean Discharge Values for each Day of Record (Calculation Period 1956-04-01 - 2014-03-23)

Day of Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.11%	0.14%	0.17%	0.32%	0.63%	0.86%	0.37%	0.17%	0.13%	0.11%	0.11%	0.14%
2	0.11%	0.14%	0.16%	0.33%	0.64%	0.85%	0.36%	0.17%	0.13%	0.11%	0.11%	0.14%
3	0.11%	0.13%	0.17%	0.34%	0.65%	0.85%	0.35%	0.17%	0.12%	0.11%	0.11%	0.14%
4	0.11%	0.13%	0.17%	0.35%	0.67%	0.84%	0.34%	0.17%	0.12%	0.11%	0.12%	0.14%
5	0.11%	0.13%	0.17%	0.36%	0.69%	0.82%	0.32%	0.16%	0.12%	0.11%	0.12%	0.14%
6	0.11%	0.13%	0.17%	0.38%	0.70%	0.80%	0.31%	0.16%	0.12%	0.11%	0.11%	0.14%
7	0.12%	0.13%	0.17%	0.41%	0.72%	0.78%	0.31%	0.16%	0.12%	0.11%	0.12%	0.13%
8	0.12%	0.13%	0.18%	0.42%	0.73%	0.78%	0.29%	0.16%	0.12%	0.11%	0.12%	0.12%
9	0.12%	0.17%	0.18%	0.42%	0.75%	0.78%	0.29%	0.15%	0.12%	0.11%	0.12%	0.12%
10	0.12%	0.16%	0.18%	0.43%	0.77%	0.72%	0.28%	0.15%	0.12%	0.11%	0.12%	0.12%
11	0.12%	0.15%	0.18%	0.43%	0.79%	0.69%	0.27%	0.15%	0.12%	0.11%	0.12%	0.12%
12	0.12%	0.15%	0.19%	0.44%	0.80%	0.67%	0.26%	0.15%	0.12%	0.11%	0.12%	0.12%
13	0.12%	0.14%	0.20%	0.45%	0.81%	0.67%	0.26%	0.15%	0.12%	0.11%	0.13%	0.13%
14	0.12%	0.14%	0.20%	0.47%	0.82%	0.66%	0.25%	0.15%	0.12%	0.11%	0.12%	0.13%
15	0.13%	0.14%	0.20%	0.48%	0.84%	0.65%	0.24%	0.14%	0.12%	0.11%	0.12%	0.13%
16	0.16%	0.14%	0.21%	0.48%	0.87%	0.64%	0.24%	0.14%	0.12%	0.11%	0.12%	0.13%
17	0.16%	0.14%	0.21%	0.47%	0.89%	0.62%	0.23%	0.14%	0.12%	0.11%	0.12%	0.12%
18	0.15%	0.14%	0.22%	0.48%	0.90%	0.60%	0.23%	0.14%	0.12%	0.11%	0.12%	0.12%
19	0.14%	0.14%	0.22%	0.49%	0.89%	0.58%	0.22%	0.14%	0.12%	0.11%	0.12%	0.12%
20	0.14%	0.16%	0.23%	0.51%	0.90%	0.55%	0.22%	0.14%	0.12%	0.11%	0.12%	0.12%
21	0.13%	0.17%	0.23%	0.54%	0.89%	0.53%	0.21%	0.14%	0.12%	0.11%	0.12%	0.12%
22	0.13%	0.17%	0.23%	0.55%	0.90%	0.52%	0.21%	0.14%	0.12%	0.11%	0.12%	0.12%
23	0.13%	0.17%	0.24%	0.57%	0.90%	0.50%	0.20%	0.14%	0.11%	0.11%	0.12%	0.12%
24	0.13%	0.16%	0.25%	0.61%	0.89%	0.49%	0.20%	0.13%	0.11%	0.11%	0.13%	0.12%
25	0.13%	0.16%	0.25%	0.63%	0.89%	0.47%	0.19%	0.13%	0.11%	0.11%	0.14%	0.12%
26	0.12%	0.16%	0.26%	0.61%	0.91%	0.45%	0.19%	0.13%	0.11%	0.11%	0.14%	0.12%
27	0.12%	0.16%	0.27%	0.60%	0.91%	0.43%	0.19%	0.13%	0.11%	0.11%	0.13%	0.12%
28	0.12%	0.17%	0.27%	0.61%	0.89%	0.41%	0.18%	0.13%	0.11%	0.11%	0.12%	0.12%
29	0.12%	0.20%	0.28%	0.61%	0.88%	0.40%	0.18%	0.13%	0.11%	0.11%	0.12%	0.11%
30	0.13%	--	0.29%	0.62%	0.88%	0.39%	0.18%	0.13%	0.11%	0.11%	0.13%	0.11%
31	0.14%	--	0.31%	--	0.87%	--	0.17%	0.13%	--	0.11%	--	0.11%

Table C-2. Total allowable daily loads (i.e., TMDLs) for the Little Thompson River.

Day of Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.37	1.74	2.11	3.97	7.82	10.67	4.59	2.11	1.61	1.37	1.37	1.74
2	1.37	1.74	1.99	4.10	7.94	10.55	4.47	2.11	1.61	1.37	1.37	1.74
3	1.37	1.61	2.11	4.22	8.07	10.55	4.34	2.11	1.49	1.37	1.37	1.74
4	1.37	1.61	2.11	4.34	8.31	10.42	4.22	2.11	1.49	1.37	1.49	1.74
5	1.37	1.61	2.11	4.47	8.56	10.18	3.97	1.99	1.49	1.37	1.49	1.74
6	1.37	1.61	2.11	4.72	8.69	9.93	3.85	1.99	1.49	1.37	1.37	1.74
7	1.49	1.61	2.11	5.09	8.94	9.68	3.85	1.99	1.49	1.37	1.49	1.61
8	1.49	1.61	2.23	5.21	9.06	9.68	3.60	1.99	1.49	1.37	1.49	1.49
9	1.49	2.11	2.23	5.21	9.31	9.68	3.60	1.86	1.49	1.37	1.49	1.49
10	1.49	1.99	2.23	5.34	9.56	8.94	3.47	1.86	1.49	1.37	1.49	1.49
11	1.49	1.86	2.23	5.34	9.80	8.56	3.35	1.86	1.49	1.37	1.49	1.49
12	1.49	1.86	2.36	5.46	9.93	8.31	3.23	1.86	1.49	1.37	1.49	1.49
13	1.49	1.74	2.48	5.58	10.05	8.31	3.23	1.86	1.49	1.37	1.61	1.61
14	1.49	1.74	2.48	5.83	10.18	8.19	3.10	1.86	1.49	1.37	1.49	1.61
15	1.61	1.74	2.48	5.96	10.42	8.07	2.98	1.74	1.49	1.37	1.49	1.61
16	1.99	1.74	2.61	5.96	10.80	7.94	2.98	1.74	1.49	1.37	1.49	1.61
17	1.99	1.74	2.61	5.83	11.04	7.69	2.85	1.74	1.49	1.37	1.49	1.49
18	1.86	1.74	2.73	5.96	11.17	7.45	2.85	1.74	1.49	1.37	1.49	1.49
19	1.74	1.74	2.73	6.08	11.04	7.20	2.73	1.74	1.49	1.37	1.49	1.49
20	1.74	1.99	2.85	6.33	11.17	6.83	2.73	1.74	1.49	1.37	1.49	1.49
21	1.61	2.11	2.85	6.70	11.04	6.58	2.61	1.74	1.49	1.37	1.49	1.49
22	1.61	2.11	2.85	6.83	11.17	6.45	2.61	1.74	1.49	1.37	1.49	1.49
23	1.61	2.11	2.98	7.07	11.17	6.21	2.48	1.74	1.37	1.37	1.49	1.49
24	1.61	1.99	3.10	7.57	11.04	6.08	2.48	1.61	1.37	1.37	1.61	1.49
25	1.61	1.99	3.10	7.82	11.04	5.83	2.36	1.61	1.37	1.37	1.74	1.49
26	1.49	1.99	3.23	7.57	11.29	5.58	2.36	1.61	1.37	1.37	1.74	1.49
27	1.49	1.99	3.35	7.45	11.29	5.34	2.36	1.61	1.37	1.37	1.61	1.49
28	1.49	2.11	3.35	7.57	11.04	5.09	2.23	1.61	1.37	1.37	1.49	1.49
29	1.49	2.48	3.47	7.57	10.92	4.96	2.23	1.61	1.37	1.37	1.49	1.37
30	1.61	--	3.60	7.69	10.92	4.84	2.23	1.61	1.37	1.37	1.61	1.37
31	1.74	--	3.85	--	10.80	--	2.11	1.61	--	1.37	--	1.37

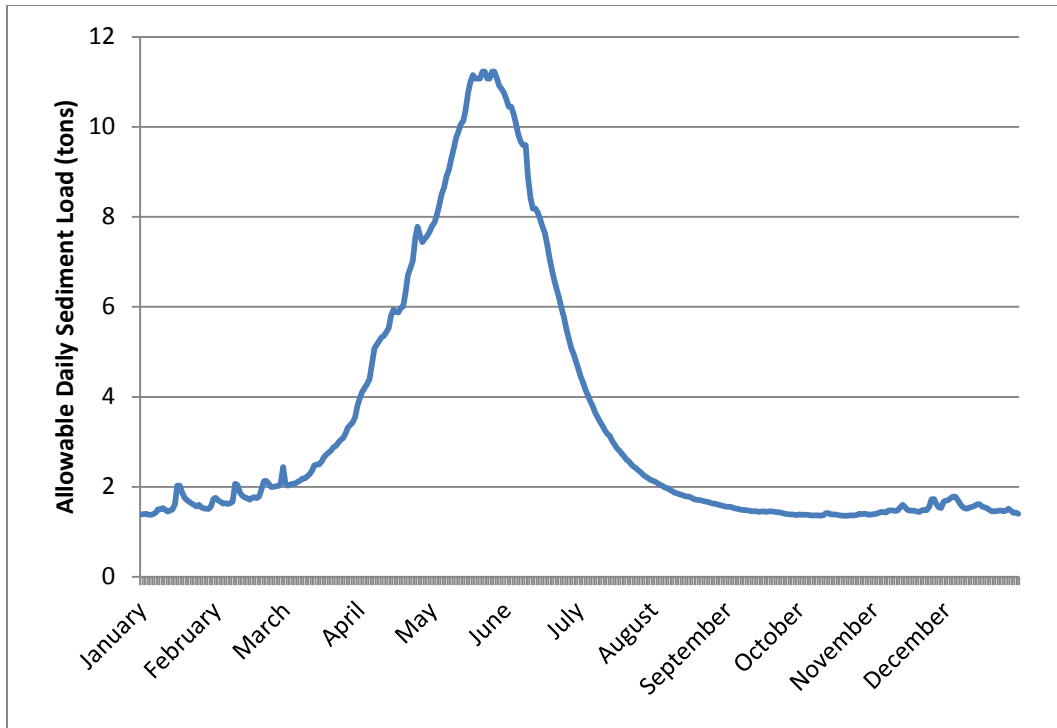


Figure C-2. Total maximum daily load for sediment (tons) for the Little Thompson River.

Table C-3. TMDLs expressed as an average annual load and can be used in conjunction with the values in Table C-1 to compute daily loads.

Stream Segment	Waterbody ID	TMDL Expressed as Average Annual Load (tons/year)
Lazier Creek	MT76N005_060	306
Little Bitterroot River	MT76L002_060	790
Little Thompson River (excluding McGinnis Creek)	MT76N005_040	1,241
Lynch Creek	MT76N003_010	511
McGinnis Creek	MT76N005_070	113
McGregor Creek	MT76N005_030	303
Sullivan Creek	MT76L002_070	71
Swamp Creek	MT76N003_160	593

