

APPENDIX F

SEDIMENT TOTAL MAXIMUM DAILY LOADS

Overview

A percent reduction approach was used for the TMDLs within this document because there is uncertainty associated with the loads derived from the source assessment, and using the estimated sediment loads creates a rigid perception that the loads are absolutely conclusive. However, because daily loads are a required product of TMDL development and percent reductions are most relevant at an annual scale, loads within this appendix are expressed as daily loads. 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.

Approach

The average annual sediment loads determined from source assessments were used along with historical flow and suspended sediment data from the Big Hole River to determine average daily sediment loads for all water bodies in the Upper Big Hole TPA. A sediment rating curve was developed using daily flow and suspended solids load data collected from 1960 through 1964 at the USGS gage on the Big Hole River near Melrose, MT (Station 6025500) (**Figure F-1**).

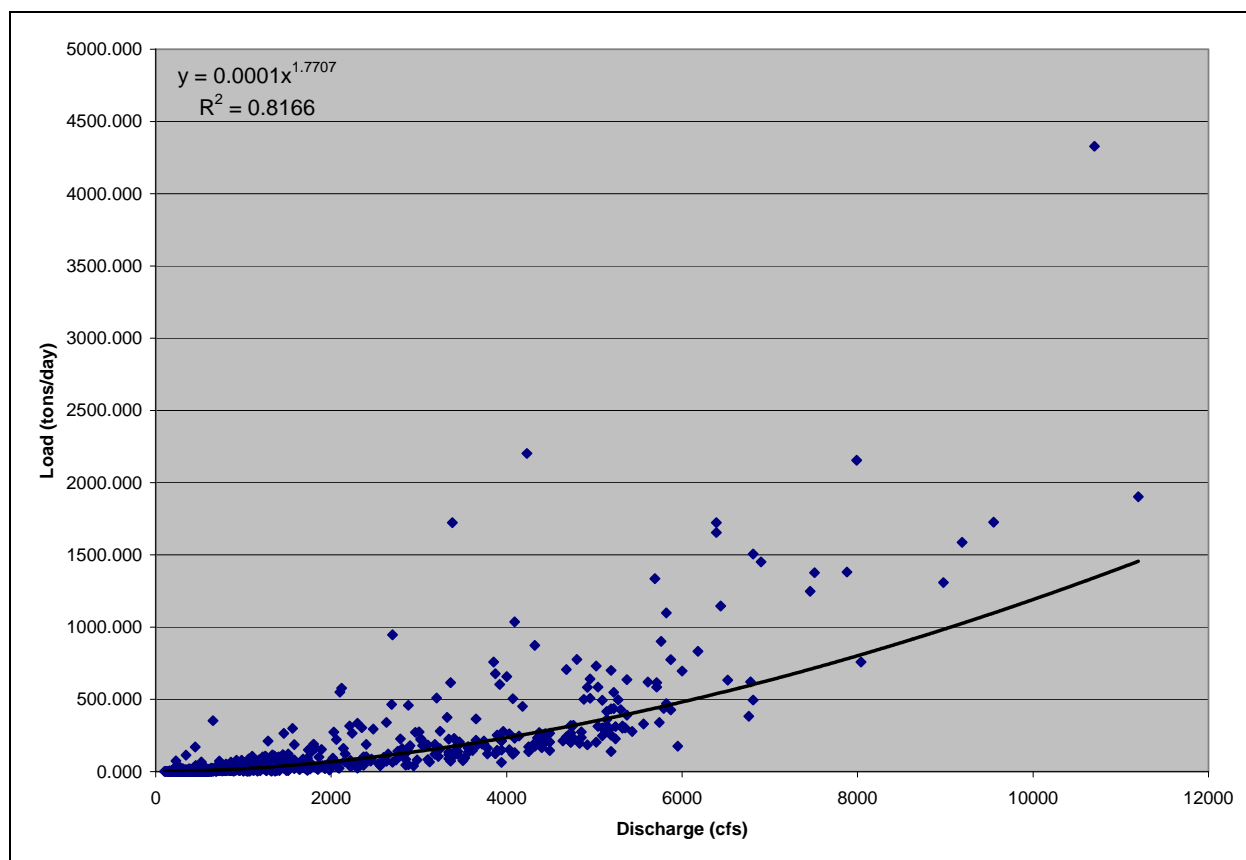


Figure F-1. Sediment Rating Curve for the Big Hole River

The daily mean discharge based on 84 years of record (1923-2007) at the USGS gage was then plugged into the equation for the sediment rating curve to get a daily suspended sediment load. The suspended sediment load is only a fraction of the total load from the source assessment, but provides an approximation of the relationship between sediment and flow in the Big Hole River. Based on the sum of the calculated daily sediment loads, a daily percentage relative to the annual suspended sediment load was calculated for each day. The daily percentages were then applied to the total average annual loads associated with the TMDL calculated from the annual percent reduction in sediment load from **Section 8.3.11** to determine the average daily load. To conserve resources, this appendix contains daily loads for the North Fork of the Big Hole River as an example. As discussed in **Section 8.3.11**, the TMDL for the North Fork of the Big Hole River is a 20 percent reduction in the total average annual sediment load, which is roughly equivalent to an allowed average annual sediment load of 22,914 tons/year. The daily percentages discussed above were then multiplied by the annual load of 22,914 tons to get a daily expression of the North Fork of the Big Hole River TMDL (**Table F-1**). Although the relationship between sediment and flow is likely different within the 303(d) listed tributaries in the Upper and North Fork Big Hole Watersheds than in the Big Hole River, it was used to determine average daily loads because it is the best available data and TMDL implementation activities will not be driven by the daily loads. 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 8.0** to the daily load. Daily loads for all other TMDLs may be derived by using the daily percentages in **Table F-1**, and the

TMDLs expressed as an average annual load, which are discussed in **Section 8.0** and also provided in **Table F-2**.

Table F-1. Daily TMDL for the North Fork of the Big Hole River.

Month	Day	Daily % of annual load	North Fork Big Hole River TMDL (tons/day)	Month	Day	Daily % of annual load	North Fork Big Hole River TMDL (tons/day)
Jan	1	0.02%	4.8	Feb	17	0.02%	4.8
Jan	2	0.02%	4.8	Feb	18	0.02%	4.9
Jan	3	0.02%	4.8	Feb	19	0.02%	4.9
Jan	4	0.02%	4.8	Feb	20	0.02%	5.0
Jan	5	0.02%	4.7	Feb	21	0.02%	5.0
Jan	6	0.02%	4.6	Feb	22	0.02%	5.1
Jan	7	0.02%	4.6	Feb	23	0.02%	5.1
Jan	8	0.02%	4.8	Feb	24	0.02%	5.1
Jan	9	0.02%	4.7	Feb	25	0.02%	5.1
Jan	10	0.02%	4.7	Feb	26	0.02%	5.3
Jan	11	0.02%	4.6	Feb	27	0.02%	5.3
Jan	12	0.02%	4.7	Feb	28	0.02%	5.3
Jan	13	0.02%	4.7	Feb	29	0.02%	5.1
Jan	14	0.02%	4.8	Mar	1	0.02%	5.3
Jan	15	0.02%	4.7	Mar	2	0.02%	5.2
Jan	16	0.02%	4.7	Mar	3	0.02%	5.2
Jan	17	0.02%	4.6	Mar	4	0.02%	5.3
Jan	18	0.02%	4.5	Mar	5	0.02%	5.2
Jan	19	0.02%	4.5	Mar	6	0.02%	5.4
Jan	20	0.02%	4.5	Mar	7	0.02%	5.6
Jan	21	0.02%	4.5	Mar	8	0.02%	5.7
Jan	22	0.02%	4.5	Mar	9	0.03%	5.8
Jan	23	0.02%	4.5	Mar	10	0.03%	6.0
Jan	24	0.02%	4.5	Mar	11	0.03%	6.2
Jan	25	0.02%	4.5	Mar	12	0.03%	6.5
Jan	26	0.02%	4.5	Mar	13	0.03%	6.7
Jan	27	0.02%	4.5	Mar	14	0.03%	6.9
Jan	28	0.02%	4.5	Mar	15	0.03%	7.0
Jan	29	0.02%	4.4	Mar	16	0.03%	7.5
Jan	30	0.02%	4.5	Mar	17	0.04%	8.1
Jan	31	0.02%	4.6	Mar	18	0.04%	8.3

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Month	Day	Daily % of annual load	North Fork Big Hole River TMDL (tons/day)	Month	Day	Daily % of annual load	North Fork Big Hole River TMDL (tons/day)
Feb	1	0.02%	4.7	Mar	19	0.04%	8.5
Feb	2	0.02%	4.8	Mar	20	0.04%	8.7
Feb	3	0.02%	4.7	Mar	21	0.04%	9.0
Feb	4	0.02%	4.6	Mar	22	0.04%	9.4
Feb	5	0.02%	4.6	Mar	23	0.04%	9.9
Feb	6	0.02%	4.8	Mar	24	0.04%	10.2
Feb	7	0.02%	4.9	Mar	25	0.05%	10.6
Feb	8	0.02%	5.0	Mar	26	0.05%	11.0
Feb	9	0.02%	5.0	Mar	27	0.05%	11.7
Feb	10	0.02%	5.0	Mar	28	0.06%	13.8
Feb	11	0.02%	4.9	Mar	29	0.07%	15.7
Feb	12	0.02%	4.9	Mar	30	0.07%	16.2
Feb	13	0.02%	4.7	Mar	31	0.07%	16.8
Feb	14	0.02%	4.7	Apr	1	0.08%	17.7
Feb	15	0.02%	4.7	Apr	2	0.08%	18.8
Feb	16	0.02%	4.8	Apr	3	0.08%	19.1
Apr	4	0.09%	21.3	May	21	1.36%	311.2
Apr	5	0.10%	24.0	May	22	1.44%	329.1
Apr	6	0.12%	26.8	May	23	1.46%	335.2
Apr	7	0.13%	30.2	May	24	1.50%	342.9
Apr	8	0.15%	34.1	May	25	1.52%	349.1
Apr	9	0.17%	38.7	May	26	1.58%	363.2
Apr	10	0.18%	41.8	May	27	1.67%	382.3
Apr	11	0.20%	45.5	May	28	1.70%	390.5
Apr	12	0.22%	49.5	May	29	1.78%	406.9
Apr	13	0.23%	52.8	May	30	1.84%	422.0
Apr	14	0.25%	57.7	May	31	1.87%	428.7
Apr	15	0.28%	63.5	Jun	1	1.87%	428.7
Apr	16	0.30%	68.0	Jun	2	1.88%	430.4
Apr	17	0.31%	71.8	Jun	3	1.88%	430.4
Apr	18	0.35%	79.8	Jun	4	1.95%	447.6
Apr	19	0.35%	80.7	Jun	5	1.95%	447.6
Apr	20	0.36%	83.1	Jun	6	2.00%	458.0
Apr	21	0.38%	86.5	Jun	7	2.04%	466.8
Apr	22	0.38%	86.5	Jun	8	2.04%	466.8
Apr	23	0.40%	91.6	Jun	9	2.03%	465.0
Apr	24	0.43%	97.8	Jun	10	1.96%	449.3
Apr	25	0.45%	103.2	Jun	11	1.89%	432.1
Apr	26	0.45%	104.1	Jun	12	1.78%	406.9
Apr	27	0.44%	100.5	Jun	13	1.73%	395.4
Apr	28	0.43%	99.6	Jun	14	1.65%	377.5
Apr	29	0.45%	103.2	Jun	15	1.56%	356.9
Apr	30	0.47%	106.9	Jun	16	1.50%	344.4

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Month	Day	Daily % of annual load	North Fork Big Hole River TMDL (tons/day)	Month	Day	Daily % of annual load	North Fork Big Hole River TMDL (tons/day)
May	1	0.50%	114.4	Jun	17	1.48%	338.3
May	2	0.51%	116.3	Jun	18	1.43%	327.6
May	3	0.52%	119.3	Jun	19	1.37%	314.1
May	4	0.55%	126.1	Jun	20	1.27%	290.8
May	5	0.58%	132.2	Jun	21	1.21%	278.0
May	6	0.60%	137.3	Jun	22	1.15%	262.7
May	7	0.62%	142.5	Jun	23	1.06%	242.5
May	8	0.67%	154.3	Jun	24	0.97%	221.7
May	9	0.73%	166.5	Jun	25	0.89%	202.9
May	10	0.76%	174.4	Jun	26	0.82%	187.3
May	11	0.79%	180.2	Jun	27	0.77%	175.6
May	12	0.80%	183.7	Jun	28	0.72%	165.4
May	13	0.83%	190.8	Jun	29	0.66%	151.1
May	14	0.89%	202.9	Jun	30	0.62%	141.5
May	15	0.93%	214.1	Jul	1	0.56%	128.1
May	16	1.01%	230.7	Jul	2	0.52%	118.3
May	17	1.08%	247.8	Jul	3	0.47%	107.8
May	18	1.15%	262.7	Jul	4	0.43%	99.6
May	19	1.18%	271.0	Jul	5	0.41%	93.4
May	20	1.26%	289.4	Jul	6	0.37%	84.0
Jul	7	0.33%	75.8	Aug	22	0.02%	5.4
Jul	8	0.31%	71.1	Aug	23	0.02%	5.4
Jul	9	0.29%	67.2	Aug	24	0.02%	5.6
Jul	10	0.28%	63.5	Aug	25	0.02%	5.5
Jul	11	0.26%	59.8	Aug	26	0.02%	5.4
Jul	12	0.25%	57.7	Aug	27	0.02%	5.2
Jul	13	0.23%	52.1	Aug	28	0.02%	5.0
Jul	14	0.21%	47.5	Aug	29	0.02%	4.8
Jul	15	0.19%	42.4	Aug	30	0.02%	4.6
Jul	16	0.17%	38.1	Aug	31	0.02%	4.6
Jul	17	0.15%	34.7	Sep	1	0.02%	4.5
Jul	18	0.14%	32.4	Sep	2	0.02%	4.4
Jul	19	0.13%	30.2	Sep	3	0.02%	4.4
Jul	20	0.13%	29.3	Sep	4	0.02%	4.3
Jul	21	0.12%	27.5	Sep	5	0.02%	4.2
Jul	22	0.11%	25.9	Sep	6	0.02%	4.2
Jul	23	0.10%	24.0	Sep	7	0.02%	4.2
Jul	24	0.10%	21.8	Sep	8	0.02%	4.3
Jul	25	0.09%	20.1	Sep	9	0.02%	4.6
Jul	26	0.08%	19.0	Sep	10	0.02%	4.5
Jul	27	0.08%	18.0	Sep	11	0.02%	4.5
Jul	28	0.07%	16.9	Sep	12	0.02%	4.6
Jul	29	0.07%	16.0	Sep	13	0.02%	4.7
Jul	30	0.07%	15.5	Sep	14	0.02%	4.7
Jul	31	0.07%	15.5	Sep	15	0.02%	4.7

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Month	Day	Daily % of annual load	North Fork Big Hole River TMDL (tons/day)	Month	Day	Daily % of annual load	North Fork Big Hole River TMDL (tons/day)
Aug	1	0.06%	14.8	Sep	16	0.02%	4.7
Aug	2	0.06%	13.9	Sep	17	0.02%	4.8
Aug	3	0.06%	13.3	Sep	18	0.02%	5.0
Aug	4	0.05%	12.6	Sep	19	0.02%	5.2
Aug	5	0.05%	11.8	Sep	20	0.02%	5.6
Aug	6	0.05%	11.0	Sep	21	0.03%	5.8
Aug	7	0.04%	10.2	Sep	22	0.03%	5.9
Aug	8	0.04%	9.3	Sep	23	0.03%	5.9
Aug	9	0.04%	8.6	Sep	24	0.03%	6.0
Aug	10	0.04%	8.1	Sep	25	0.03%	5.9
Aug	11	0.03%	7.7	Sep	26	0.03%	6.0
Aug	12	0.03%	7.5	Sep	27	0.03%	6.1
Aug	13	0.03%	7.2	Sep	28	0.03%	6.2
Aug	14	0.03%	6.9	Sep	29	0.03%	6.5
Aug	15	0.03%	6.7	Sep	30	0.03%	6.6
Aug	16	0.03%	6.5	Oct	1	0.03%	6.8
Aug	17	0.03%	6.2	Oct	2	0.03%	6.8
Aug	18	0.03%	5.9	Oct	3	0.03%	7.0
Aug	19	0.02%	5.7	Oct	4	0.03%	7.2
Aug	20	0.02%	5.5	Oct	5	0.03%	7.3
Aug	21	0.02%	5.4	Oct	6	0.03%	7.4
Oct	7	0.03%	7.5	Nov	22	0.03%	7.4
Oct	8	0.03%	7.6	Nov	23	0.03%	7.1
Oct	9	0.03%	7.6	Nov	24	0.03%	7.2
Oct	10	0.03%	7.8	Nov	25	0.03%	7.7
Oct	11	0.03%	7.9	Nov	26	0.03%	7.6
Oct	12	0.04%	8.1	Nov	27	0.03%	7.2
Oct	13	0.04%	8.2	Nov	28	0.03%	6.9
Oct	14	0.04%	8.4	Nov	29	0.03%	6.9
Oct	15	0.04%	8.6	Nov	30	0.03%	6.7
Oct	16	0.04%	8.9	Dec	1	0.03%	6.9
Oct	17	0.04%	8.9	Dec	2	0.03%	7.2
Oct	18	0.04%	8.9	Dec	3	0.03%	7.1
Oct	19	0.04%	8.8	Dec	4	0.03%	7.0
Oct	20	0.04%	8.8	Dec	5	0.03%	6.5
Oct	21	0.04%	9.0	Dec	6	0.03%	6.2
Oct	22	0.04%	9.3	Dec	7	0.03%	6.0
Oct	23	0.04%	9.5	Dec	8	0.02%	5.7
Oct	24	0.04%	9.6	Dec	9	0.03%	5.8
Oct	25	0.04%	9.5	Dec	10	0.03%	5.9
Oct	26	0.04%	9.7	Dec	11	0.03%	6.0
Oct	27	0.04%	9.8	Dec	12	0.03%	6.0
Oct	28	0.04%	9.7	Dec	13	0.03%	5.8
Oct	29	0.04%	9.6	Dec	14	0.03%	5.7
Oct	30	0.04%	9.5	Dec	15	0.03%	5.7
Oct	31	0.04%	9.5	Dec	16	0.02%	5.6

Table F-1. Daily TMDL for the North Fork of the Big Hole River.

Month	Day	Daily % of annual load	North Fork Big Hole River TMDL (tons/day)	Month	Day	Daily % of annual load	North Fork Big Hole River TMDL (tons/day)
Nov	1	0.04%	9.5	Dec	17	0.02%	5.5
Nov	2	0.04%	9.4	Dec	18	0.02%	5.2
Nov	3	0.04%	9.5	Dec	19	0.02%	5.1
Nov	4	0.04%	9.8	Dec	20	0.02%	5.1
Nov	5	0.04%	9.7	Dec	21	0.02%	5.2
Nov	6	0.04%	9.8	Dec	22	0.02%	5.2
Nov	7	0.04%	9.8	Dec	23	0.02%	5.4
Nov	8	0.04%	9.9	Dec	24	0.02%	5.4
Nov	9	0.04%	9.9	Dec	25	0.02%	5.2
Nov	10	0.04%	9.5	Dec	26	0.02%	5.1
Nov	11	0.04%	9.3	Dec	27	0.02%	5.3
Nov	12	0.04%	9.2	Dec	28	0.02%	5.2
Nov	13	0.04%	9.0	Dec	29	0.02%	4.9
Nov	14	0.04%	8.9	Dec	30	0.02%	4.9
Nov	15	0.04%	8.9	Dec	31	0.02%	4.9
Nov	16	0.04%	8.5				
Nov	17	0.04%	8.6				
Nov	18	0.04%	8.6				
Nov	19	0.04%	8.3				
Nov	20	0.03%	7.7				
Nov	21	0.03%	7.6				

Table F-2. Average Annual Sediment Loads

Stream Segment	Water Body #	TMDL expressed as average annual load (tons/year)
Big Hole River , above Pintlar Creek	MT41D001-030	97,963
North Fork Big Hole River , headwaters to mouth (Big Hole River)	MT41D004-010	22,914
Mussigbrod Creek , headwaters to mouth (North Fork Big Hole River)	MT41D004-020	1,835
Johnson Creek , headwaters to mouth (North Fork Big Hole River)	MT41D004-030	1,994
Tie Creek , headwaters to mouth (North Fork Big Hole River)	MT41D004-060	1,452
Trail Creek , Headwaters to Joseph Creek	MT41D004-070	1,612
Trail Creek , Joseph Creek to mouth (North Fork Big Hole River)	MT41D004-080	4,748
Joseph Creek , headwaters to mouth (Trail Creek-North Fork Big Hole River)	MT41D004-090	802
Ruby Creek , headwaters to mouth (North Fork Big Hole River)	MT41D004-100	4,312
Swamp Creek , headwaters to mouth (Big Hole River)	MT41D004-110	4,252
Rock Creek , headwaters to mouth (Big Hole River)	MT41D004-120	4,888
Miner Creek , headwaters to mouth (Big Hole River)	MT41D004-140	3,069
Governor Creek , headwaters to mouth (Big Hole River-South of Jackson)	MT41D004-150	15,131
Pine Creek , headwaters to mouth (Andrus Creek-Governor Creek)	MT41D004-160	519
Fox Creek , headwaters to mouth (Governor Creek)	MT41D004-170	1,628
Steel Creek , headwaters to mouth (Big Hole River)	MT41D004-190	5,333
Francis Creek , headwaters to mouth (Steel Creek) T3S R15W	MT41D004-200	1,755
McVey Creek , headwaters to mouth (Big Hole River) T1S R15W	MT41D004-210	1,210
Doolittle Creek , tributary to the Big Hole River T1S, R14W	MT41D004-220	956