State of Oregon
DEQ Department of Environmental Quality

Calculation of Waste Load and Load Allocations for the Willamette Basin Mercury TMDL

Table of Contents

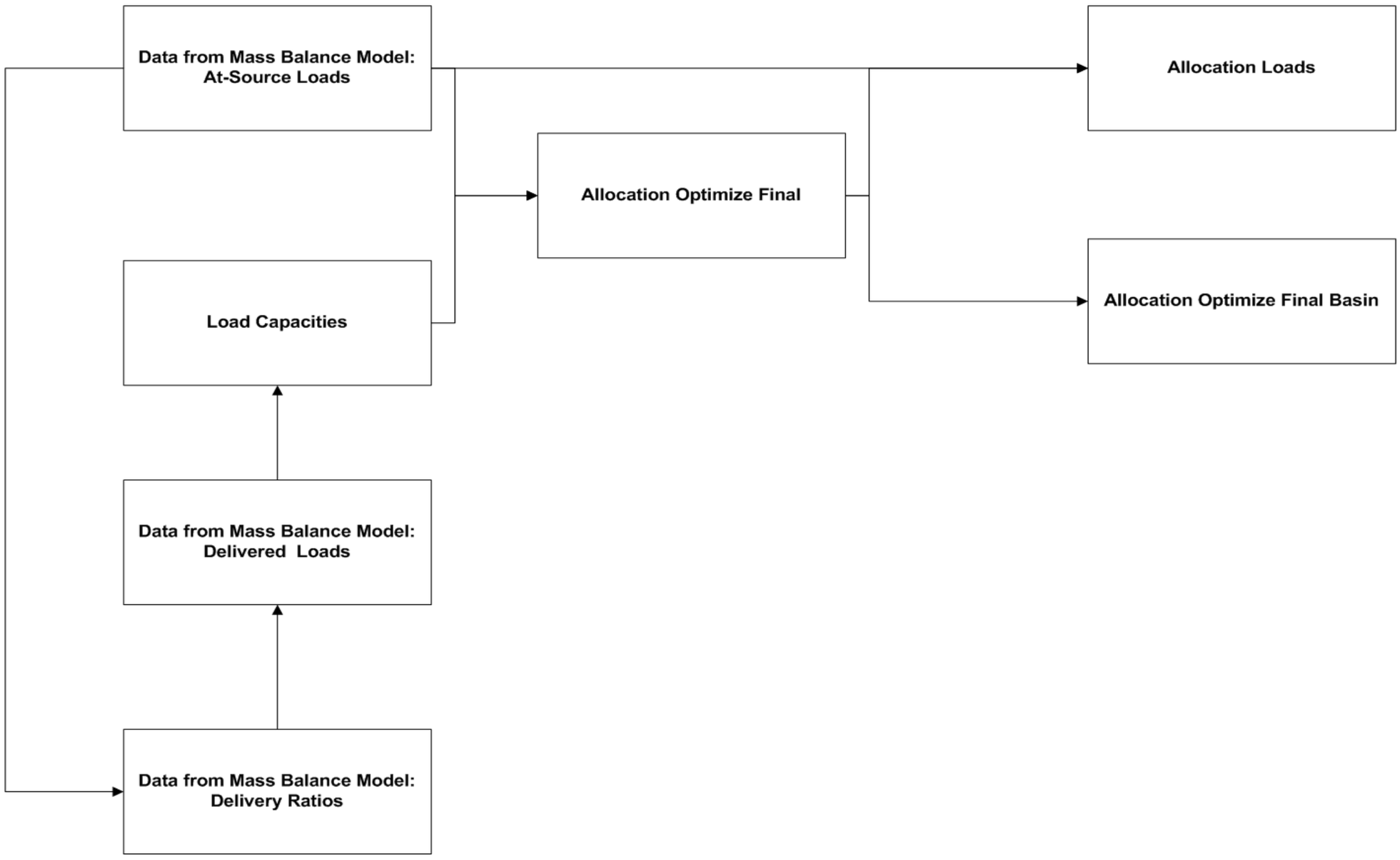
This spreadsheet calculates waste load and load allocations for the Willamette Basin Mercury TMDL.
Note that changes to the workbook structure (e.g., addition of rows) could result in miscalculation.

Sub-Basin Map

Map of sub-basins of Willamette Basin

Flowchart

Shows the general flow of calculations among the individual sheets.



Source Categories

Descriptions of total mercury source categories.

Source Category	Group	Description
Runoff of atmospheric deposition	NPL	total mercury in surface runoff from wet and dry atmospheric deposition to pervious and impervous surfaces.
Atmospheric deposition direct to water	NPL	total mercury from wet and dry atmospheric deposition direct to water surfaces.
Groundwater	NPL	Dissolved total mercury associated with subsurface flows (shallow interflow and resurfacing groundwater).
Sediment	NPL	Particulate-assocatied total mercury from sediment erosion and transport.
MS4	MS4	total mercury associated with stormwater in permitted Phase I & II MS4 areas (cities, counties, & ODOT). Includes total mercury from runoff of atmospheric deposition, dissolved total mercury in shallow subsurface interflow, and particulate-associated total mercury from sediment erosion. Limited to developed low, medium, and high density land in MS4 areas.
Urban DMAs	NPL	total mercury associated with stormwater from urban Designated Management Areas (DMAs). Includes total mercury from runoff of atmospheric deposition, dissolved total mercury in shallow subsurface interflow, and particulate-associated total mercury from sediment erosion. Limited to developed low, medium, and high density land in urban DMA areas.
Mines	NPL	Legacy total mercury from contaminated mine tailings and furnace areas at the Black Butte Mine and the Bohemia Mining District.
POTWs	PSL	total mercury associated with discharges from major POTWs and minor domestic WWTPs that hold NPDES permits.
Industrial dischargers	PSL	total mercury associated with discharges from industrial facilities that hold NPDES permits.

Aggregated Land Use	National Land Cover Database (2011) Categories
Agriculture	Cultivated Crops (land used for production of annual crops or perennial woody crops, e.g., vineyards or orchards)
Forest	Deciduous, Evergreen, and Mixed Forest
Shrub	Shrub/Scrub; predominantly disturbed forest land
Developed	Developed Open, Low, Medium, and High Density
Other	Barren Land, Grassland/Herbaceous, Pasture/Hay, Wetlands, Open Water

Optimized Allocation for Entire Willamette Basin

Optimized percent reductions for entire basin. This sheet is linked to the "Allocation Optimize Final" sheet

	Total	
Total allocation (g/day)	42	
Load for planned reductions (g/day)	42	
Result	Met	0.00

Category	Opt Reduction	Combined with Atm Dep Reduction	Lower Limit	Upper Limit
Runoff of atmospheric deposition (agriculture)	**88%**	99%	0%	88%
Runoff of atmospheric deposition (forest)	**88%**	99%	0%	88%
Runoff of atmospheric deposition (shrub)	**88%**	99%	0%	88%
Runoff of atmospheric deposition (developed)	**88%**	99%	0%	88%
Runoff of atmospheric deposition (other)	**88%**	99%	0%	88%
Atmospheric deposition direct to water	**11%**		0%	11%
Groundwater (agriculture)	**60%**		0%	88%
Groundwater (forest)	**88%**		0%	88%
Groundwater (shrub)	**88%**		0%	88%
Groundwater (developed)	**22%**		0%	88%
Groundwater (other)	**88%**		0%	88%
Sediment (agriculture)	**88%**		0%	88%
Sediment (forest)	**88%**		0%	88%
Sediment (shrub)	**88%**		0%	88%
Sediment (developed)	**88%**		0%	88%
Sediment (other)	**88%**		0%	88%
MS4	**75%**		0%	75%
Urban DMAs	**75%**		0%	75%

Mines	**95%**		90%	95%
POTWs	**10%**		0%	10%
Industrial dischargers	**10%**		0%	10%

Optimized Allocation by HUC08

Optimized percent reductions for by HUC08. The "solver" tool in Excel is used to find the optimum percent reductions given the lower and upper limit constraints. This sheet uses data from the "Load Capacities" and "At-Source Loads" sheets as input.
See link for more information about Microsoft Solver: Link to Microsoft Excel Solver information

Load (kg/yr)																
	17090001	17090002	17090003	17090004	17090005	17090006	17090007	17090008	17090009	17090010	17090011	17090012	Multnomah	Columbia	Total	Check
Total allocation	0.99	1.03	3.02	1.47	0.91	1.61	0.73	1.50	1.30	0.97	1.00	0.29	0.32	0.12	15.25	NA
Load for planned reductions (below)	0.81	0.59	3.45	1.11	0.68	1.11	1.42	1.57	1.31	1.31	0.88	0.57	0.33	0.10	15.25	0.00

Planned Percent Reductions																		
Category	17090001	17090002	17090003	17090004	17090005	17090006	17090007	17090008	17090009	17090010	17090011	17090012	Multnomah	Columbia	Opt Reduction	Combined with Atm Dep Reduction	Lower Limit	Upper Limit
Runoff of atmospheric deposition (agriculture)	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	**88%**	99%	0%	88%
Runoff of atmospheric deposition (forest)	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	**88%**	99%	0%	88%
Runoff of atmospheric deposition (shrub)	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	**88%**	99%	0%	88%
Runoff of atmospheric deposition (developed)	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	**88%**	99%	0%	88%
Runoff of atmospheric deposition (other)	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	**88%**	99%	0%	88%
Atmospheric deposition direct to water	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	**11%**		0%	11%
Groundwater (agriculture)	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	**60%**		0%	88%
Groundwater (forest)	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	**88%**		0%	88%
Groundwater (shrub)	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	**88%**		0%	88%
Groundwater (developed)	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%	**22%**		0%	88%
Groundwater (other)	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	**88%**		0%	88%
Sediment (agriculture)	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	**88%**		0%	88%
Sediment (forest)	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	**88%**		0%	88%
Sediment (shrub)	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	**88%**		0%	88%
Sediment (developed)	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	**88%**		0%	88%
Sediment (other)	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	**88%**		0%	88%
MS4	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	**75%**		0%	75%
Urban DMAs	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	**75%**		0%	75%
Mines	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	**95%**		90%	95%
POTWs	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	**10%**		0%	10%
Industrial dischargers	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	**10%**		0%	10%

Existing At-Source Loads

At-source loads are defined as total mercury loads generated in the HUC. Loads from upstream HUCs are not included and instream processes (e.g., total mercury loads conversion to elemental mercury that escapes to the atmosphere) are not represented. This sheet uses data from the "Allocation Optimize Loads" and "At-Source Loads" sheets as input. Filterable with dynamic HUC8 loads (applicable to the table in kg/yr).

	Load (kg/yr)														
Category	**17090001**	**17090002**	**17090003**	**17090004**	**17090005**	**17090006**	**17090007**	**17090008**	**17090009**	**17090010**	**17090011**	**17090012**	**Multnomah**	**Columbia**	**Total**
Runoff of atmospheric deposition (agriculture)	1.11E-04	4.35E-04	6.79E-03	1.34E-04	5.77E-04	7.34E-04	2.88E-03	2.79E-03	1.65E-03	2.03E-03	3.35E-04	2.86E-05	7.68E-04	8.29E-06	1.93E-02
Runoff of atmospheric deposition (forest)	2.54E-02	2.75E-02	1.23E-02	3.54E-02	2.35E-02	4.15E-02	9.69E-04	3.86E-03	1.16E-02	2.73E-03	2.16E-02	2.35E-04	1.18E-03	1.65E-06	2.08E-01
Runoff of atmospheric deposition (shrub)	6.67E-03	1.00E-02	8.58E-03	8.08E-03	5.56E-03	1.33E-02	4.41E-04	2.38E-03	3.64E-03	1.73E-03	4.90E-03	1.54E-05	6.42E-04	1.24E-06	6.59E-02
Runoff of atmospheric deposition (developed)	1.58E-03	2.20E-03	1.77E-02	1.47E-03	2.01E-03	1.91E-03	1.17E-02	4.24E-03	4.11E-03	8.89E-03	2.75E-03	1.16E-02	1.27E-03	6.90E-03	7.83E-02
Runoff of atmospheric deposition (other)	5.80E-03	3.46E-03	1.65E-02	1.04E-02	4.26E-03	5.80E-03	3.42E-03	3.61E-03	2.20E-03	1.49E-03	1.15E-03	3.65E-04	1.07E-03	1.28E-04	5.97E-02
Atmospheric deposition direct to water	2.23E-01	6.22E-02	3.75E-01	1.03E-01	8.97E-02	8.47E-02	5.18E-01	5.90E-02	5.82E-02	7.49E-02	6.96E-02	1.57E-01	1.54E-02	1.73E-02	1.91E+00
Groundwater (agriculture)	4.20E-03	4.10E-03	1.27E-01	1.17E-02	2.02E-02	2.36E-02	6.83E-02	9.88E-02	8.24E-02	5.52E-02	1.65E-02	1.38E-03	8.77E-03	9.89E-05	5.22E-01
Groundwater (forest)	2.65E-01	5.56E-02	1.01E-01	4.30E-01	1.97E-01	1.37E-01	1.38E-02	6.97E-02	8.49E-02	2.80E-02	2.85E-01	2.93E-03	1.24E-02	5.93E-05	1.68E+00
Groundwater (shrub)	3.98E-02	1.52E-02	4.18E-02	6.00E-02	2.87E-02	3.34E-02	4.04E-03	2.75E-02	2.45E-02	1.31E-02	3.63E-02	8.87E-05	5.41E-03	2.04E-05	3.30E-01
Groundwater (developed)	6.49E-03	8.47E-03	8.94E-02	1.50E-02	9.55E-03	8.26E-03	4.44E-02	3.48E-02	3.15E-02	5.61E-02	1.76E-02	2.56E-02	1.44E-02	1.29E-02	3.74E-01
Groundwater (other)	1.68E-02	1.16E-02	1.28E-01	3.12E-02	2.52E-02	3.52E-02	3.57E-02	4.64E-02	5.56E-02	1.70E-02	1.73E-02	1.73E-03	9.54E-03	6.43E-04	4.32E-01
Sediment (agriculture)	2.08E-03	2.67E-02	3.00E-01	3.63E-03	1.66E-02	2.70E-02	7.39E-02	1.57E-01	6.60E-02	7.32E-02	1.29E-02	6.11E-04	3.13E-02	2.33E-04	7.91E-01
Sediment (forest)	1.26E-01	1.27E-01	6.54E-01	1.47E-01	1.42E-01	3.55E-01	6.07E-02	4.63E-01	4.26E-01	2.26E-01	1.53E-01	1.63E-02	9.95E-02	1.18E-04	3.00E+00
Sediment (shrub)	4.62E-02	8.21E-02	5.50E-01	1.23E-01	5.76E-02	2.42E-01	3.61E-02	3.81E-01	2.25E-01	1.96E-01	7.67E-02	1.14E-03	7.42E-02	8.92E-05	2.09E+00
Sediment (developed)	2.72E-03	8.33E-03	8.94E-02	4.45E-03	5.57E-03	8.50E-03	2.94E-02	4.10E-02	3.19E-02	2.62E-02	1.50E-02	1.86E-02	1.12E-02	1.10E-02	3.03E-01
Sediment (other)	1.56E-02	2.03E-02	2.24E-01	1.56E-02	1.19E-02	4.77E-02	3.39E-02	9.37E-02	7.14E-02	3.08E-02	1.29E-02	1.09E-03	1.69E-02	1.31E-03	5.97E-01
MS4	7.91E-03	1.85E-02	2.99E-01	2.55E-02	2.61E-03	5.71E-03	1.63E-01	4.64E-03	3.12E-02	2.61E-01	5.31E-02	1.14E-01	1.25E-03	4.40E-02	1.03E+00
Urban DMAs	1.03E-03	5.54E-04	2.24E-02	0.00E+00	1.00E-02	1.22E-02	5.60E-02	5.24E-02	4.81E-02	4.34E-04	8.11E-03	0.00E+00	1.83E-02	4.29E-04	2.30E-01
Mines	0.00E+00	7.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.30E-02
POTWs	1.73E-02	4.16E-03	2.04E-01	0.00E+00	2.45E-02	3.10E-02	1.73E-01	2.36E-02	4.13E-02	2.32E-01	7.75E-02	2.15E-01	4.91E-03	0.00E+00	1.05E+00
Industrial dischargers	0.00E+00	2.61E-02	1.85E-01	8.21E-02	5.18E-03	2.33E-04	8.97E-02	2.40E-03	8.60E-03	1.97E-03	0.00E+00	5.96E-03	0.00E+00	0.00E+00	4.07E-01
Total	0.81	0.59	3.45	1.11	0.68	1.11	1.42	1.57	1.31	1.31	0.88	0.57	0.33	0.10	15.25

Load Capacities

Load capacities for target surface water total mercury concentration (0.14 ng/L) to meet a fish tissue concentration of 0.40 mg/kg MeHg in the Northern Pikeminnow. This sheet uses data from the "At-Source Loads" and Delivered Loads" sheets as input.

Surface Water Target Concentration (ng/L)	0.14
Reserve Capacity (%)	1%
Median total mercury Concentration (ng/L)	1.2

At-source Load Capacities

Category	17090001	17090002	17090003	17090004	17090005	17090006	17090007	17090008	17090009	17090010	17090011	17090012	Multnomah	Columbia
Median total mercury Concentration (ng/L, 2002-2017)	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
Percent reduction based on NPM Median Target	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%
Total at-source load (kg/yr)	8.57	8.91	26.16	12.70	7.88	13.97	6.32	12.97	11.22	8.38	8.63	2.49	2.80	1.03
Loading capacity (kg/yr)	1.00	1.04	3.05	1.48	0.92	1.63	0.74	1.51	1.31	0.98	1.01	0.29	0.33	0.12
Loading capacity (g/d)	2.74	2.85	8.36	4.06	2.52	4.46	2.02	4.14	3.58	2.68	2.76	0.80	0.90	0.33
Reserve Capacity (kg/yr)	0.010	0.010	0.031	0.015	0.009	0.016	0.007	0.015	0.013	0.010	0.010	0.003	0.003	0.001
Remaining Load Capacity (kg/yr)	0.99	1.03	3.02	1.47	0.91	1.61	0.73	1.50	1.30	0.97	1.00	0.29	0.32	0.119

Delivered Load Capacities

Category	17090001	17090002	17090003	17090004	17090005	17090006	17090007	17090008	17090009	17090010	17090011	17090012	Multnomah	Columbia
Percent reduction based on NPM Median Target	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%	88%
Total delivered load (kg/yr)	2.23	4.83	35.79	9.39	15.16	9.26	76.59	10.70	9.78	6.31	7.34	83.81	2.59	0.96
Loading capacity (kg/yr)	0.26	0.56	4.18	1.10	1.77	1.08	8.94	1.25	1.14	0.74	0.86	9.78	0.30	0.11
Loading capacity (g/d)	0.71	1.54	11.43	3.00	4.84	2.96	24.46	3.42	3.12	2.02	2.34	26.77	0.83	0.31
Reserve Capacity (kg/yr)	0.003	0.01	0.04	0.01	0.02	0.01	0.09	0.01	0.01	0.01	0.01	0.10	0.00	0.00
Remaining Load Capacity (kg/yr)	0.26	0.56	4.13	1.08	1.75	1.07	8.85	1.24	1.13	0.73	0.85	9.68	0.30	0.11

Existing At-Source Loads

At-source loads are defined as total mercury loads generated in the HUC. Loads from upstream HUCs are not included and instream processes (e.g., total mercury conversion to elemental mercury that escapes to the atmosphere) are not represented.
Top table is in kg/yr and bottom table is in g/day. Filterable with dynamic HUC8 loads (applicable to the table in kg/yr).

	Load (kg/yr)															Load (g/day)
Category	**1.7E+07**	**1.7E+07**	**1.7E+07**	**1.7E+07**	**1.7E+07**	**1.7E+07**	**1.7E+07**	**1.7E+07**	**1.7E+07**	**1.7E+07**	**1.7E+07**	**1.7E+07**	**Multnomah**	**Columbia**	**Total**	
Runoff of atmospheric deposition (agriculture)	0.01	0.04	0.68	0.01	0.06	0.07	0.29	0.28	0.17	0.20	0.03	0.00	0.08	0.00	1.93	5.3
Runoff of atmospheric deposition (forest)	2.54	2.75	1.23	3.54	2.35	4.15	0.10	0.39	1.16	0.27	2.16	0.02	0.12	0.00	20.78	56.9
Runoff of atmospheric deposition (shrub)	0.67	1.00	0.86	0.81	0.56	1.33	0.04	0.24	0.36	0.17	0.49	0.00	0.06	0.00	6.59	18.1
Runoff of atmospheric deposition (developed)	0.16	0.22	1.77	0.15	0.20	0.19	1.17	0.42	0.41	0.89	0.27	1.16	0.13	0.69	7.83	21.4
Runoff of atmospheric deposition (other)	0.58	0.35	1.65	1.04	0.43	0.58	0.34	0.36	0.22	0.15	0.11	0.04	0.11	0.01	5.97	16.3
Atmospheric deposition direct to water	0.25	0.07	0.42	0.12	0.10	0.10	0.58	0.07	0.07	0.08	0.08	0.18	0.02	0.02	2.14	5.9
Groundwater (agriculture)	0.01	0.01	0.32	0.03	0.05	0.06	0.17	0.25	0.21	0.14	0.04	0.00	0.02	0.00	1.31	3.6
Groundwater (forest)	2.21	0.46	0.84	3.59	1.65	1.14	0.11	0.58	0.71	0.23	2.38	0.02	0.10	0.00	14.03	38.4
Groundwater (shrub)	0.33	0.13	0.35	0.50	0.24	0.28	0.03	0.23	0.20	0.11	0.30	0.00	0.05	0.00	2.75	7.5
Groundwater (developed)	0.01	0.01	0.11	0.02	0.01	0.01	0.06	0.04	0.04	0.07	0.02	0.03	0.02	0.02	0.48	1.3
Groundwater (other)	0.14	0.10	1.06	0.26	0.21	0.29	0.30	0.39	0.46	0.14	0.14	0.01	0.08	0.01	3.60	9.8
Sediment (agriculture)	0.02	0.22	2.50	0.03	0.14	0.22	0.62	1.31	0.55	0.61	0.11	0.01	0.26	0.00	6.60	18.1
Sediment (forest)	1.05	1.06	5.45	1.23	1.18	2.95	0.51	3.86	3.55	1.88	1.28	0.14	0.83	0.00	24.96	68.3
Sediment (shrub)	0.38	0.68	4.59	1.02	0.48	2.01	0.30	3.18	1.87	1.64	0.64	0.01	0.62	0.00	17.42	47.7
Sediment (developed)	0.02	0.07	0.74	0.04	0.05	0.07	0.25	0.34	0.27	0.22	0.13	0.16	0.09	0.09	2.53	6.9
Sediment (other)	0.13	0.17	1.87	0.13	0.10	0.40	0.28	0.78	0.59	0.26	0.11	0.01	0.14	0.01	4.98	13.6
MS4	0.03	0.07	1.20	0.10	0.01	0.02	0.65	0.02	0.12	1.04	0.21	0.46	0.00	0.18	4.13	11.3
Urban DMAs	0.00	0.00	0.09	0.00	0.04	0.05	0.22	0.21	0.19	0.00	0.03	0.00	0.07	0.00	0.92	2.5
Mines	0.00	1.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.46	4
POTWs	0.02	0.00	0.23	0.00	0.03	0.03	0.19	0.03	0.05	0.26	0.09	0.24	0.01	0.00	1.17	3.2
Industrial dischargers	0.00	0.03	0.21	0.09	0.01	0.00	0.10	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.45	1.2
Total	8.57	8.91	26.16	12.70	7.88	13.97	6.32	12.97	11.22	8.38	8.63	2.49	2.80	1.03	132.03	361.3

Existing Delivered Loads

Delivered loads are defined as total mercury loads delivered to the specified HUC outlet. Loads from upstream HUCs are included and instream processes are represented.
For example, loads listed for 17090001 (Middle Fork Willamette) are representative of loads delivered to the outlet of 17090001.
The "Total" column includes loads delivered to the Columbia River from the Willamette River Basin (i.e., the sum of loads delivered to the Lower Willamette (17090012), Multnomah Channel, and Columbia Slough).
Top table is in kg/yr and bottom table is in g/day. Filterable with dynamic HUC8 loads (applicable to the table in kg/yr).

	Load (kg/yr)														
Category	**17090001**	**17090002**	**17090003**	**17090004**	**17090005**	**17090006**	**17090007**	**17090008**	**17090009**	**17090010**	**17090011**	**17090012**	**Multnomah**	**Columbia**	**Total**
Runoff of atmospheric deposition (agriculture)	0.01	0.03	0.62	0.01	0.12	0.07	1.43	0.24	0.14	0.15	0.03	1.42	0.07	0.00	1.49
Runoff of atmospheric deposition (forest)	0.60	1.28	4.60	2.27	3.93	2.29	9.12	0.32	1.08	0.20	1.72	10.54	0.11	0.00	10.65
Runoff of atmospheric deposition (shrub)	0.14	0.51	1.76	0.60	1.16	0.76	3.24	0.19	0.34	0.13	0.40	3.53	0.06	0.00	3.59
Runoff of atmospheric deposition (developed)	0.08	0.16	1.80	0.12	0.32	0.16	4.33	0.35	0.36	0.70	0.29	5.60	0.12	0.64	6.36
Runoff of atmospheric deposition (other)	0.18	0.23	2.49	0.89	0.71	0.45	3.69	0.30	0.19	0.11	0.10	3.71	0.10	0.01	3.82
Atmospheric deposition direct to water	0.08	0.04	0.56	0.09	0.17	0.08	1.35	0.06	0.06	0.07	0.07	1.54	0.02	0.02	1.58
Groundwater (agriculture)	0.01	0.01	0.31	0.03	0.10	0.06	1.00	0.21	0.18	0.10	0.04	1.01	0.02	0.00	1.03
Groundwater (forest)	0.51	0.24	3.35	2.29	1.69	0.57	5.77	0.47	0.64	0.17	1.88	7.44	0.10	0.00	7.54
Groundwater (shrub)	0.06	0.07	0.73	0.38	0.33	0.16	1.39	0.19	0.18	0.08	0.24	1.59	0.04	0.00	1.63
Groundwater (developed)	0.00	0.01	0.12	0.02	0.02	0.01	0.30	0.04	0.03	0.06	0.02	0.34	0.02	0.02	0.38
Groundwater (other)	0.04	0.07	1.18	0.23	0.42	0.26	2.47	0.32	0.40	0.11	0.13	2.54	0.07	0.01	2.62
Sediment (agriculture)	0.01	0.12	2.23	0.03	0.34	0.21	4.78	1.11	0.47	0.45	0.10	4.74	0.24	0.00	4.99
Sediment (forest)	0.29	0.55	6.06	1.13	3.15	2.10	15.98	3.18	3.06	1.39	1.20	16.79	0.77	0.00	17.56
Sediment (shrub)	0.14	0.40	5.00	0.97	1.98	1.57	11.64	2.59	1.60	1.20	0.60	11.88	0.57	0.00	12.46
Sediment (developed)	0.01	0.06	0.70	0.04	0.11	0.06	1.59	0.28	0.23	0.17	0.13	1.82	0.09	0.09	1.99
Sediment (other)	0.06	0.14	1.80	0.12	0.44	0.36	3.52	0.65	0.50	0.19	0.10	3.53	0.13	0.01	3.67
MS4	0.02	0.06	1.19	0.10	0.03	0.02	2.62	0.02	0.11	0.83	0.17	3.15	0.00	0.16	3.32
Urban DMAs	0.00	0.00	0.08	0.00	0.08	0.05	0.68	0.17	0.16	0.00	0.03	0.69	0.07	0.00	0.75
Mines	0.00	0.82	0.72	0.00	0.00	0.00	0.63	0.00	0.00	0.00	0.00	0.61	0.00	0.00	0.61
POTWs	0.01	0.00	0.22	0.00	0.06	0.03	0.68	0.02	0.04	0.21	0.08	0.98	0.01	0.00	0.98
Industrial dischargers	0.00	0.02	0.28	0.09	0.01	0.00	0.35	0.00	0.01	0.00	0.00	0.35	0.00	0.00	0.35
Total	2.23	4.83	35.79	9.39	15.16	9.26	76.59	10.70	9.78	6.31	7.34	83.81	2.59	0.96	87.36

Delivery Ratios to HUC Outlet

Delivery ratios to HUC outlets based on loading from all upstream HUCs. This sheet uses data from the "Delivered Loads" sheet as input.

At-Source Loads - Including all upstream HUC	Load (kg/yr)													
Category	**17090001**	**17090002**	**17090003**	**17090004**	**17090005**	**17090006**	**17090007**	**17090008**	**17090009**	**17090010**	**17090011**	**17090012**	**Multnomah**	**Columbia**
PSL	0.019	0.034	0.576	0.091	0.068	0.035	1.459	0.029	0.055	0.260	0.086	2.957	0.005	0.000
Permitted MS4s	0.032	0.074	1.405	0.102	0.033	0.023	3.509	0.019	0.125	1.044	0.213	7.034	0.005	0.176
NPL	8.520	8.802	54.37	12.509	21.744	13.909	156.257	12.920	11.041	7.071	8.332	317.259	2.793	0.854

Delivered Load	Load (kg/yr)													
Category	**17090001**	**17090002**	**17090003**	**17090004**	**17090005**	**17090006**	**17090007**	**17090008**	**17090009**	**17090010**	**17090011**	**17090012**	**Multnomah**	**Columbia**
PSL	0.007	0.021	0.493	0.087	0.063	0.033	1.038	0.024	0.046	0.207	0.083	1.326	0.005	0.000
Permitted MS4s	0.022	0.058	1.195	0.097	0.030	0.021	2.619	0.015	0.108	0.827	0.171	3.148	0.005	0.164
NPL	2.196	4.754	34.105	9.202	15.065	9.210	72.932	10.666	9.622	5.277	7.084	79.331	2.581	0.797

Delivery Ratios	Load (kg/yr)													
All Categories	**17090001**	**17090002**	**17090003**	**17090004**	**17090005**	**17090006**	**17090007**	**17090008**	**17090009**	**17090010**	**17090011**	**17090012**	**Multnomah**	**Columbia**
Delivered/At-source	0.26	0.54	0.64	0.74	0.69	0.66	0.48	0.83	0.87	0.75	0.85	0.26	0.92	0.93