

# Protection of Downstream Water Quality Standards Through TMDLs: Wisconsin River TMDL Example

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**2023 NATIONAL TRAINING WORKSHOP ON  
WATER QUALITY DATA, ASSESSMENT, AND PLANS**

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National Conservation Training Center  
Shepherdstown, West Virginia  
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# Wisconsin Statewide Phosphorus Criteria

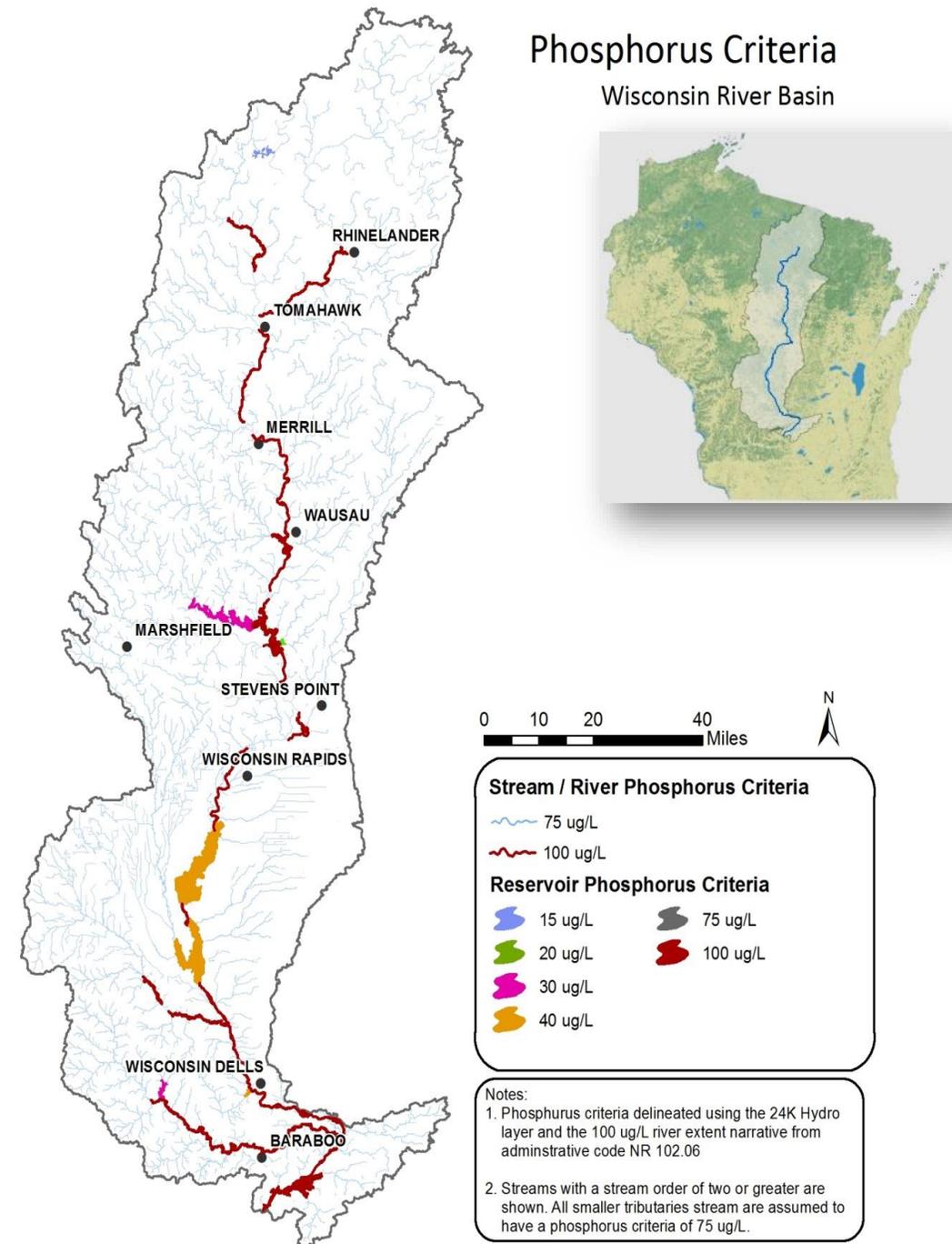
				
<b>Rivers</b> 100 µg/L	<b>Streams</b> <sup>1</sup> 75 µg/L	<b>Reservoirs</b> <ul style="list-style-type: none"><li>• Not Stratified = 40 µg/L</li><li>• Stratified = 30 µg/L</li></ul>	<b>Inland Lakes</b> <sup>2</sup> Ranges from 15-30 µg/L	<b>Great Lakes</b> <ul style="list-style-type: none"><li>• Lake Michigan = 7 µg/L</li><li>• Lake Superior = 5 µg/L</li></ul>

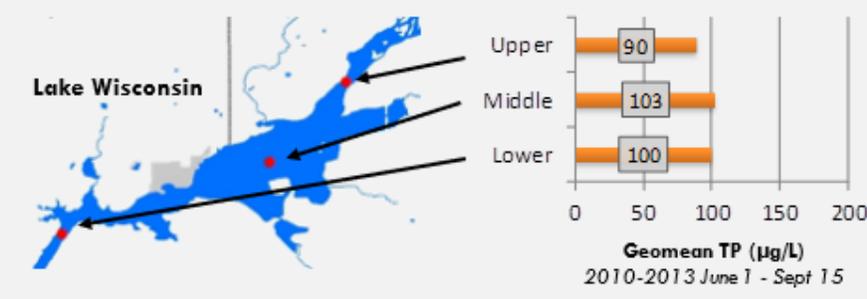
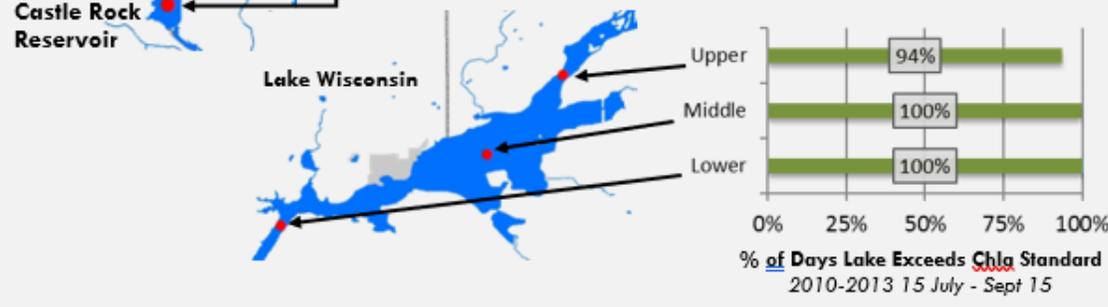
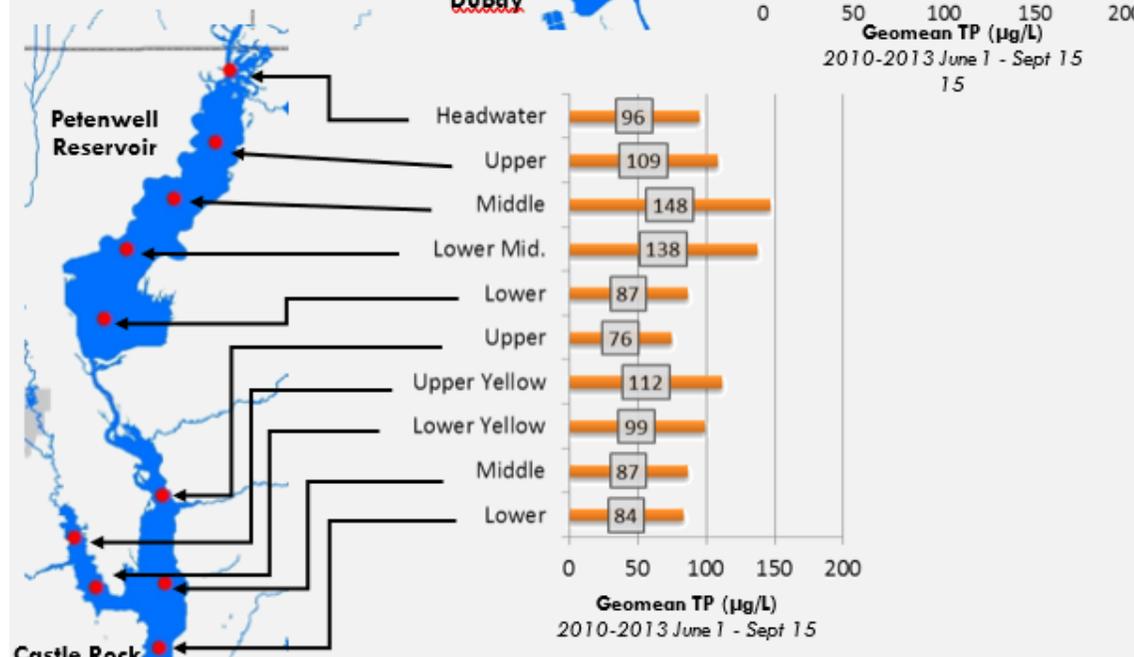
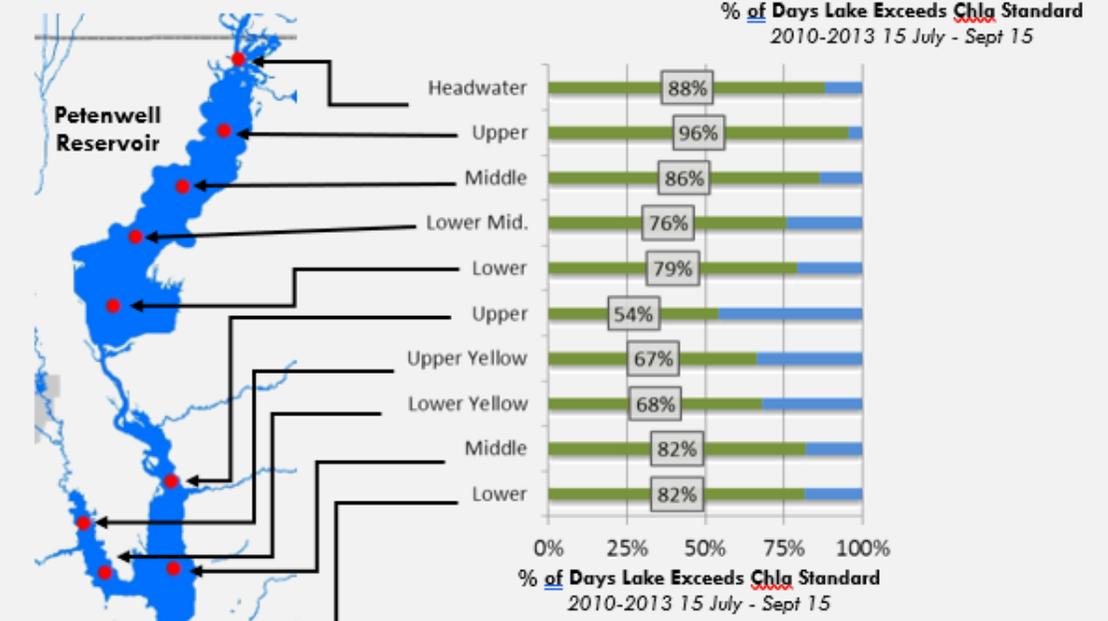
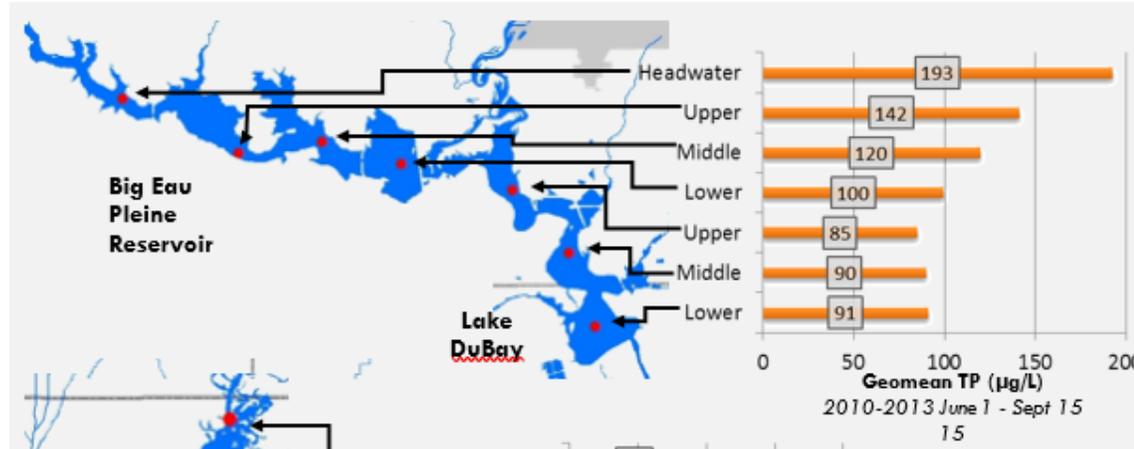
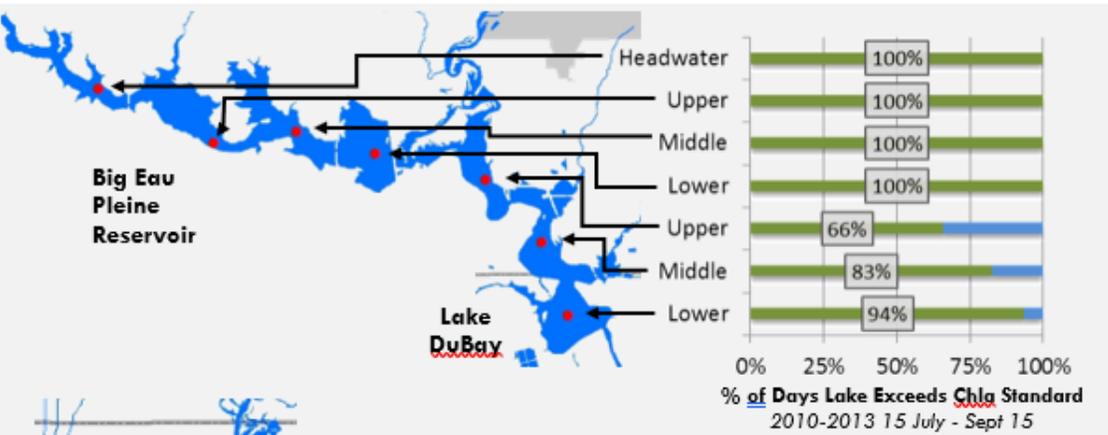
<sup>1</sup>All unidirectional flowing waters not in NR 102.06(3)(a). Excludes Ephemeral Streams.

<sup>2</sup>Excludes wetlands and lakes less than 5 acres

# Wisconsin River Basin TMDL for Total Phosphorus

- TMDL allocations driven by local water quality and downstream reservoirs.
  - Big Eau Pleine Reservoir: 6,348 acres
  - Lake Du Bay: 4,649 acres
  - Petenwell: 23,173 acres
  - Castle Rock: 12,981 acres
  - Lake Wisconsin: 7,197 acres
- Monitoring and modeling supported development of site-specific criteria for Castle Rock, Petenwell, and Lake Wisconsin.

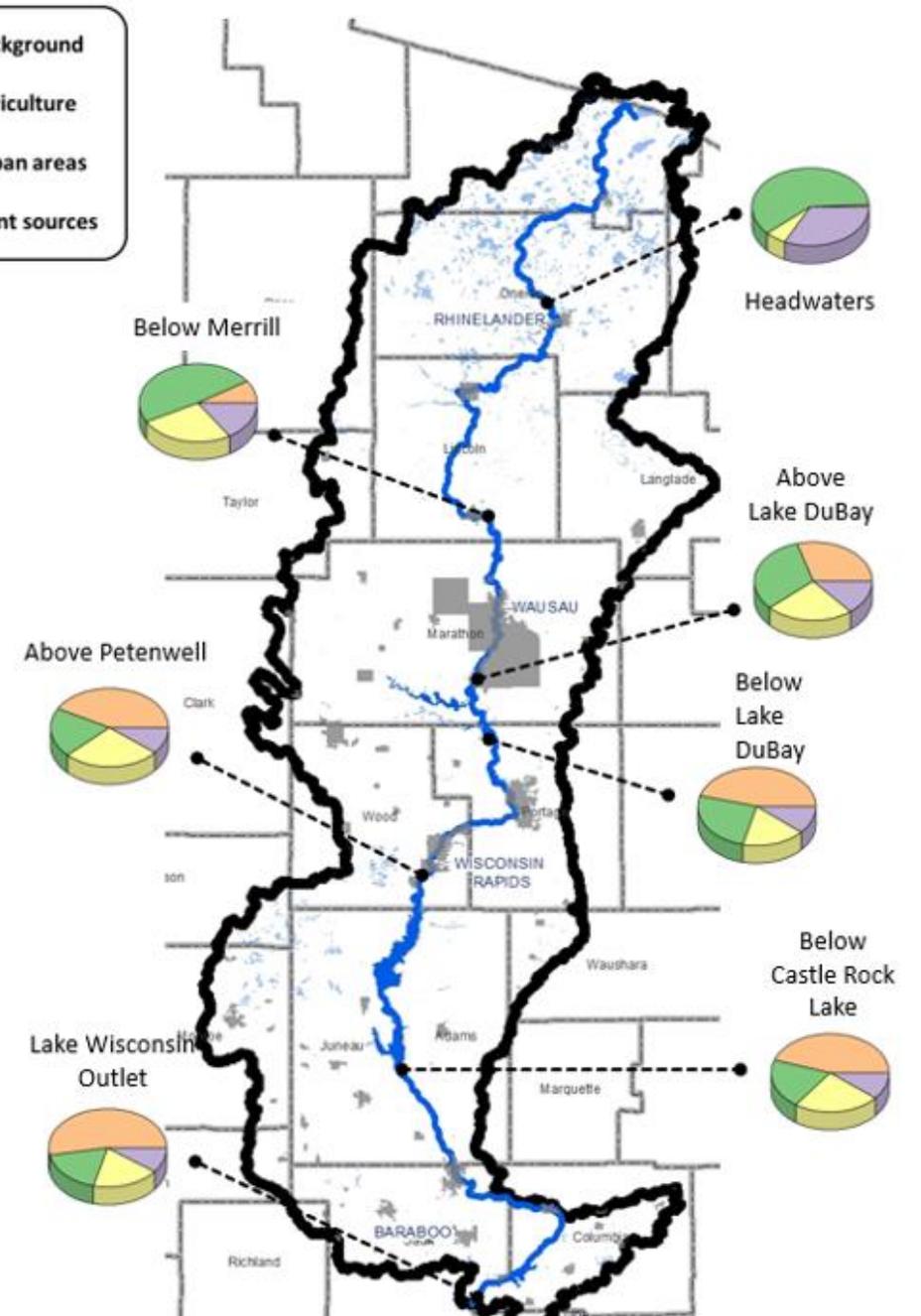
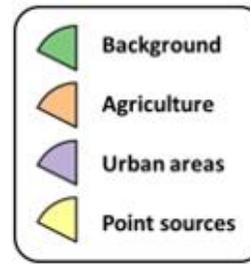




# Allocation Process:

$$\text{TMDL} = \sum \text{WLA} + \sum \text{LA} + \text{MOS} + \text{RC}$$

1. Determining baseline loadings from all sources
2. Determining the reductions needed to meet local water quality criteria
3. Determining the reserve capacity allocation
4. Determining the reductions needed to meet downstream reservoir criteria
5. Checking the point source concentrations and adjusting, if needed

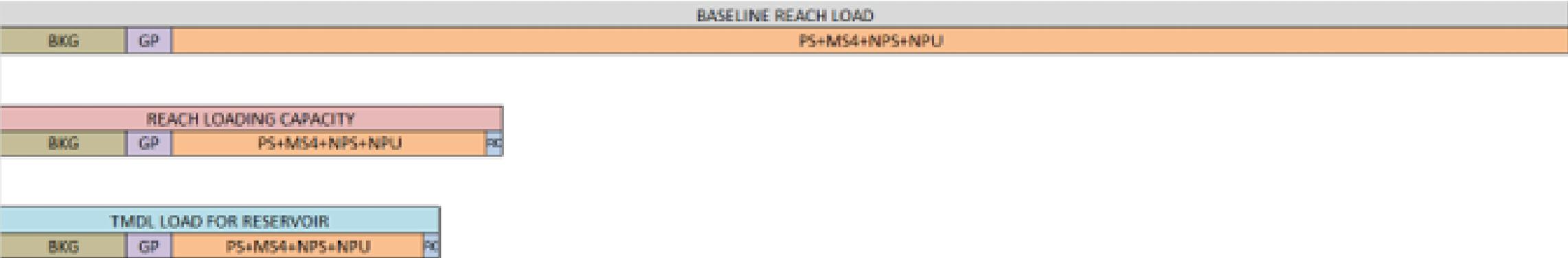


# Allocation Process: $TMDL = \sum WLA + \sum LA + MOS + RC$

Three allocation cases were utilized:

## Case 1: Reach baseline load above reach allowable load

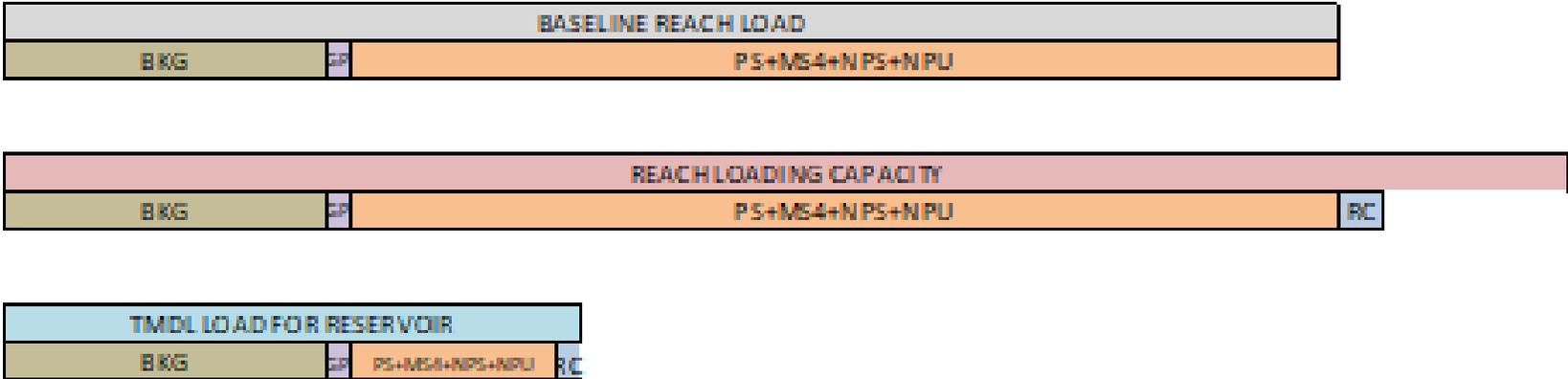
Using the reach allowable load, the background and general permit loads are first subtracted. The reserve capacity is set to 5% of the remaining controllable load. If a downstream reservoir requires additional reductions, the reserve capacity and the remaining source loads are reduced proportionally by the necessary amount resulting in the reserve capacity remaining 5% of the final controllable load.



# Allocation Process: $TMDL = \sum WLA + \sum LA + MOS + RC$

## Case 2: Reach baseline load below reach allowable load (Protection TMDL)

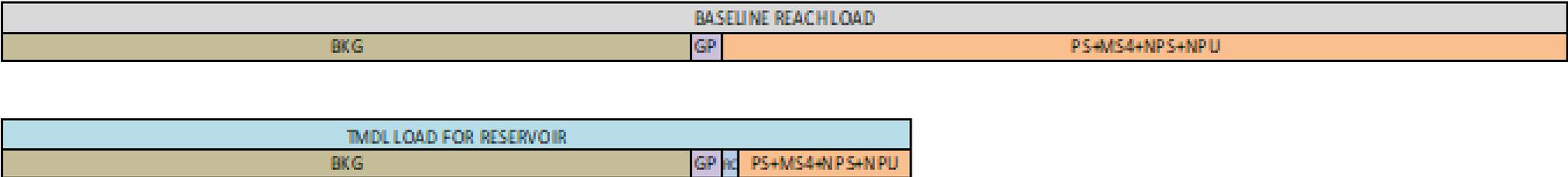
Since the baseline reach load is less than the reach allowable load, no load reductions are required to meet local water quality criteria. The reserve capacity is set to 5% of the reach controllable load (point source, MS4, NPS, NPU, & RC) and added to the baseline reach load. If a downstream reservoir requires reductions, the reserve capacity and the remaining source loads are reduced proportionally by the necessary amount resulting in the reserve capacity remaining 5% of the final controllable load.



# Allocation Process: $TMDL = \sum WLA + \sum LA + MOS + RC$

## Case 3: Reach contains reservoir

Reductions from the baseline reach load for subbasins containing reservoirs are made to the controllable load as necessary. The reserve capacity is then set at 5% of the reduced controllable load and subtracted from the remaining controllable load.



# Results: Summary for WQT and AM (Appendix O)

Estimate the “Adaptive Management Target” for each subbasin which is the in-stream concentration for each subbasin that results from meeting the overall assimilative capacity for the subbasin, contributory subbasins, and water quality criteria of the downstream reservoirs.

The “Adaptive Management Target” allows the AM compliance point to be applied at the bottom of the facility’s subbasin, rather than having to demonstrate compliance at the downstream reservoir.

Table O-2. Allocations and Reach Phosphorus Targets by Permitted Point Source Based on Proposed Site-Specific Phosphorus Criteria.

Facility Name	Permit Number	TMDL Reach	P Wasteload Allocation SSC (lbs./year)	Local Wasteload Allocation SSC (lbs./year)	Max Downstream Credits (lbs./year)	Downstream Reservoir	Adaptive Management Target (mg/L)
ABBOTSFORD WASTEWATER TREATMENT FACILITY	0023141	323	160	162	2	Big Eau Plaine	0.074
ABBYLAND FOODS INC ABBOTSFORD PLANT	0057436	323	198	201	3	Big Eau Plaine	0.074
ADAMS WASTEWATER TREATMENT FACILITY	0023159	202	486	1,328	842	Lake Wisconsin	0.021
ANTIGO CITY OF	0022144	216	1,874	4,121	2,247	Lake Wisconsin	0.036
ARPIN WASTEWATER TREATMENT FACILITY	0031267	314	42	42	0	-	0.075
ATHENS WASTEWATER TREATMENT FACILITY	0022365	215	209	304	95	Lake Wisconsin	0.045
AUBURINDALE WASTEWATER TREATMENT FACILITY	0022411	211	112	112	0	-	0.075
BARABOO WASTEWATER TREATMENT FACILITY	0020605	179	2,487	6,793	4,306	Lake Wisconsin	0.073
BELLEVUE SHERRY SANITARY DISTRICT WASTE	0031050	207	91	95	54	Lake Wisconsin	0.050

## Site-Specific Criteria

Monitoring data for Petenwell, Castle Rock, and Lake Wisconsin indicated that an SSC would be appropriate. Currently, reservoirs average a concentration over 100 µg/L.

Reservoir	Existing TP Criterion (µg/L)	Recommended Site-Specific TP Criterion (µg/L)
Petenwell Flowage	40	53
Castle Rock Flowage	40	55
Lake Wisconsin	100	47

Calculated to support recreational use by preventing excessive algae (Chlorophyll *a* shall not exceed 20 µg/L more than 30% of days during July 15 – Sept 15)

# Two sets of allocations: Current Criteria and Recommended Site-Specific Criteria

- Appendix J – Allocations based on Current Criteria

Table J-1. Annual Total Phosphorus Allocations by Reach for Current Criteria.

Reach	Loading Capacity (lbs./year)	Reserve Capacity (lbs./year)	Load Allocation (lbs./year)	Background (lbs./year)	Agricultural Nonpoint (lbs./year)	Non-Permitted Urban (lbs./year)	Wasteload Allocation (lbs./year)	General Permits (lbs./year)	Permitted MS4 (lbs./year)	Individual WW Permits (lbs./year)
1	5,618	241	5,208	626	2,896	1,686	169	169	0	0
2	4,096	179	3,896	486	3,230	180	20	20	0	0
3	2,487	98	2,351	489	1,485	378	38	38	0	0
4	2,424	111	2,160	168	1,711	281	153	28	0	125
5	3,398	157	2,732	209	1,980	543	509	54	455	0
6	5,641	216	5,382	1,273	3,885	224	43	43	0	0
7	3,766	144	3,584	849	2,639	95	39	39	0	0
8	1,804	75	1,696	278	1,282	136	33	33	0	0

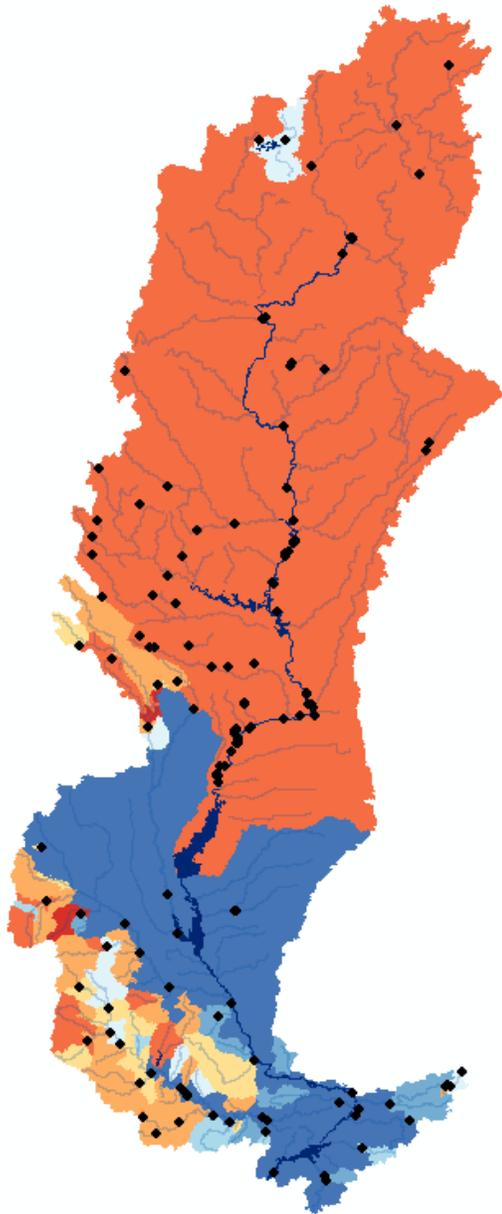
- Appendix K – Allocations based on Recommended SSC

Table K-1. Annual Total Phosphorus Allocations by Reach for Proposed Site-Specific Criteria.

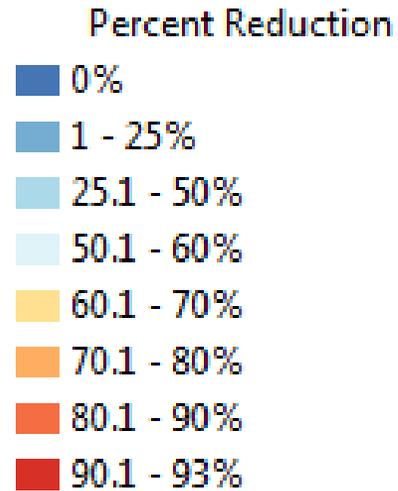
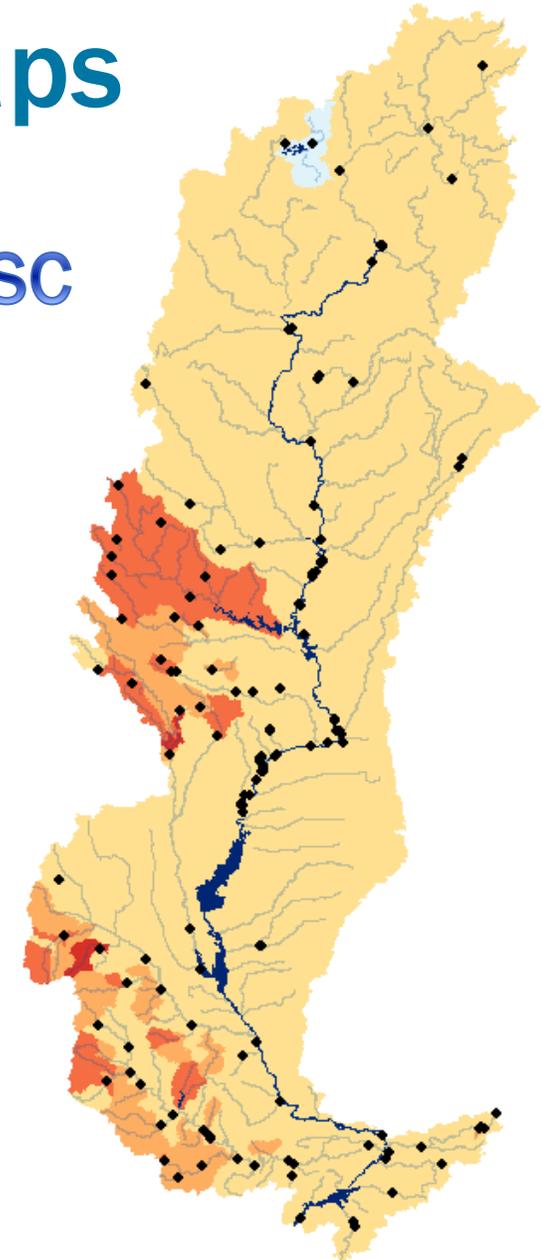
Reach	Loading Capacity (lbs./year)	Reserve Capacity (lbs./year)	Load Allocation (lbs./year)	Background (lbs./year)	Agricultural Nonpoint (lbs./year)	Non-Permitted Urban (lbs./year)	Wasteload Allocation (lbs./year)	General Permits (lbs./year)	Permitted MS4 (lbs./year)	Individual WW Permits (lbs./year)
1	2,561	88	2,304	626	1,060	617	169	169	0	0
2	2,000	75	1,904	486	1,344	75	20	20	0	0
3	1,245	36	1,171	489	544	138	38	38	0	0
4	1,012	41	897	168	626	103	74	28	0	46
5	1,411	57	1,133	209	725	199	221	54	167	0
6	4,331	151	4,138	1,273	2,709	156	43	43	0	0

# Percent Reduction Maps

Current  
Criteria



SSC



Outfalls





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