# Recommended
## Mean Benthic Chlorophyll-a Biomass Target Recommendation for use in the AQUATOX Modeling and TMDL

| Parameter | Use | Rationale | TMDL Development vs. Implementation |
|---|---|---|---|
| **Magnitude** | | | |
| Mean benthic Chl-a biomass ≤ 150 mg/m$^2$ | AQUATOX | This target was supported by the LBWC and scientific literature largely affirms that aquatic life and/or recreation impairment begins somewhere in the benthic algal biomass range of 100 to 250 mg/m$^2$ (see DEQ's January 3, 2013 presentation to TAC). Montana DEQ identified 150 mg/m$^2$ as the benthic algal biomass that supports recreation beneficial uses. | TMDL Development - AQUATOX will help to identify current and predicted periphyton-TP relationships in the LBR needed to meet the mean biomass target. The modeled mean TP-periphyton values will help develop TP allocations in the TMDL. |
| | TMDL | | TMDL Implementation - Periphyton monitoring will help determine the mean biomass chl-a values relative to the target. |
| **Location** | | | |
| Mean biomass target (≤ 150 mg/m$^2$) will apply within individual AQUATOX segments on the mainstem LBR | AQUATOX | The current AQUATOX modeling effort identifies13 discrete LBR segments. Spatially limiting the mean biomass target analyses to individual AQUATOX segments will help ensure that each AQUATOX segment is appropriately compared to the mean target. | TMDL Development – Mean benthic chlorophyll-a values from one AQUATOX segment will not be averaged with another AQUATOX segment to meet the ≤ 150 mg/m$^2$ mean target, and the corresponding TP values. |
| Mean biomass target (≤ 150 mg/m$^2$) will apply within individual AUs on the mainstem LBR | TMDL | The TMDL addresses 2 impaired and 3 non-impaired AUs on the mainstem LBR. Spatially limiting the benthic mean biomass target analyses to individual AUs will help ensure that each AU is appropriately compared to the mean target. | TMDL Implementation - Mean benthic chlorophyll-a values from one AU will not be averaged with another AU to meet the ≤ 150 mg/m$^2$ mean target. Periphyton monitoring will help determine the mean biomass chl-a values in each AU relative to the target. |
| **Frequency** | | | |
| The mean biomass target (≤ 150 mg/m2) will apply on a monthly (or seasonal) basis | AQUATOX | Confining the mean benthic chlorophyll-a biomass analyses to monthly (or seasonal) periods will be biologically meaningful and applicable to current and future NPDES permits. | TMDL Development - Mean benthic chlorophyll-a values from one month (or season) would not be averaged with another to meet the ≤ 150 mg/m$^2$ target. Modeled mean TP-periphyton values will help identify TP allocations in the TMDL. |
| | TMDL | | TMDL Implementation - The TMDL TP allocations based on monthly (or seasonal) values will help ensure consistency among current and future NPDES permits in developing limits based on monthly (or seasonal) averages. |
| **Duration** | | | |
| The mean biomass target (≤ 150 mg/m2) will be evaluated year-round | AQUATOX | Conducting the mean benthic chlorophyll-a biomass analyses over the entire year will help identify when mean target exceedances are likely and should be addressed. | TMDL Development – The AQUATOX analyses will help to identify and refine the appropriate periphyton target and subsequent TP allocation periods (especially during periods when existing periphyton data is sparse) to be included in the TMDL. |
| | TMDL | Results of the AQUATOX modeling will help identify periods when the mean biomass target will likely be exceeded and identified in the TMDL. | TMDL Implementation - Monitoring will help to determine whether the TP allocations are helping to meet the mean biomass target and will help verify the appropriateness of the target periods. |

Troy Smith **Provisional – For discussion purposes only** September 6, 2013

## Recommended
## Maximum Benthic Chlorophyll-a Biomass Target Recommendation for use in the TMDL

| Parameter | Use | Rationale | Implementation |
|---|---|---|---|
| **Magnitude** | | | |
| Maximum benthic Chl-a biomass ≤ 200 mg/m$^2$ | TMDL | The maximum target is supported by scientific literature and is consistent with nutrient criteria approaches in Montana, Minnesota, and Colorado*. It will help ensure that spatial "hot spots" do not result while still meeting the mean biomass target objective. | TMDL Implementation - Monitoring maximum chl-a biomass will help determine compliance with preventing periphyton "hot spots" in the river (e.g. chlorophyll-a values of 290 and 10 could be averaged to meet the mean target, but would still exceed the maximum target). |
| **Location** | | | |
| The maximum benthic Chl-a biomass target (≤ 200 mg/m$^2$) will apply to all sampling locations of the mainstem LBR | TMDL | Working to meet the maximum target at all sampling locations on the mainstem LBR will help to ensure "hot spots" do not result, spatially on the LBR. | TMDL Implementation - All chl-a biomass sampling locations will be analyzed independently (e.g. no average among sites). All sampling and analysis would be conducted under USGS or another scientifically-defensible and approved protocol. |
| **Frequency** | | | |
| The maximum benthic Chl-a biomass target (≤ 200 mg/m$^2$) will apply to all sampling periods with an allowable exceedance frequency of 1 in 5 years | TMDL | Working to meet the maximum target during all sample periods will help to ensure "hot spots" do not result, temporally on the LBR. The allowable exceedance period is consistent with Montana, Minnesota, and Colorado* approaches. | TMDL Implementation - All chl-a biomass sampling periods will be analyzed independently (e.g. no average among sample periods). All sampling and analysis would be conducted under USGS or another scientifically-defensible and approved protocol. |
| **Duration** | | | |
| The maximum benthic Chl-a biomass target (≤ 200 mg/m$^2$) will apply year-round. | TMDL | Working to meet the maximum target during all sample periods will help to ensure "hot spots" do not result on the LBR. | TMDL Implementation - Chl-a biomass sampling periods can occur and be analyzed during any time of the year. All sampling and analysis would be conducted under USGS or another scientifically-defensible and approved protocol. |

*Montana: "100 mg/m$^2$ (summer mean) and 150 mg/m$^2$ (peak) chlorophyll a at any site, for the entire Clark Fork River area of the VNRP;" *Clark Fork River Voluntary Nutrient Reduction Program* (1998). Tri-State Implementation Council.

150 mg Chl a/m$^2$ season maximum, July – September 30 (Northern Rockies, Canadian Rockies, Middle Rockies, Idaho Batholith) with 20% recommended allowable exceedance rate. *Montana's Level III Ecoregion Nutrient Criteria* (2008). Montana DEQ; *Updating Numeric Nutrient Standards for Wadeable Streams in Montana* (2012). Presentation by Watson, V. and M. Suplee.

Minnesota: "Rivers shall have an algal biomass not to exceed 150 mg Chl *a* m$^2$ to avoid nuisance algal biomasses that interfere with important aquatic recreation designated uses…For assessment purposes, sampling should occur during the algal growing season of June through September and no more than one year in ten should exceed 150 mg Chl *a* m$^2$." *Minnesota Nutrient Criteria Development for Rivers*. 2013. Minnesota Pollution Control Agency.

Colorado: "The Commission adopted a value of 150 mg chlorophyll *a* / m2 for the abundance of benthic periphyton (attached algae) for protection of the recreational use in rivers and streams…The allowable exceedance frequency is set at once in five years, as a matter of policy, based on the historical use of a five year data period for evaluation in the context of the 303(d) list." *The Basic Standards and Methodologies for Surface Water 5 CCR 1002-31 (2012).* Colorado Department of Public Health and Environment

# Overview of Montana's Draft Numeric Nutrient Criteria and their Implementation

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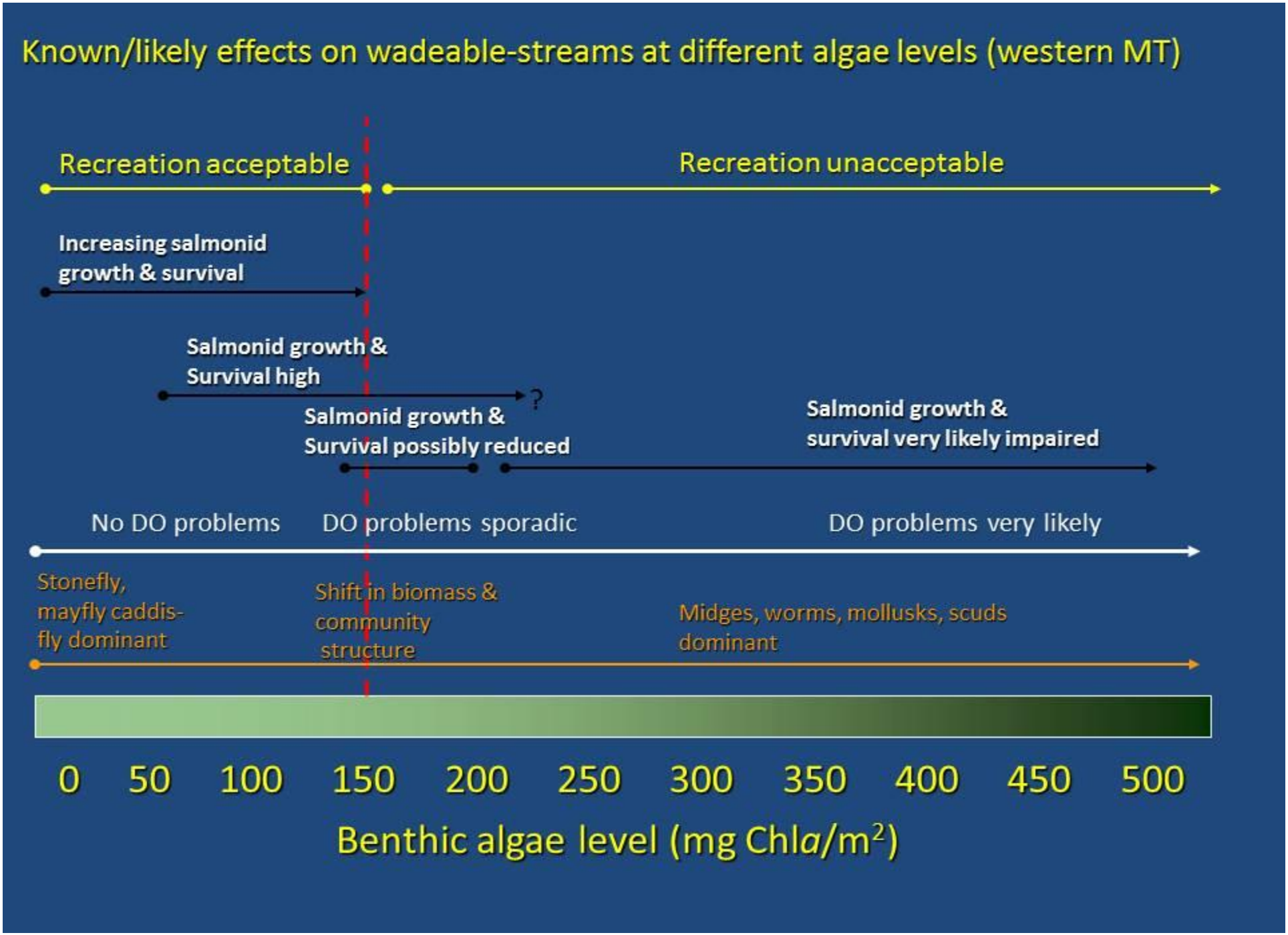
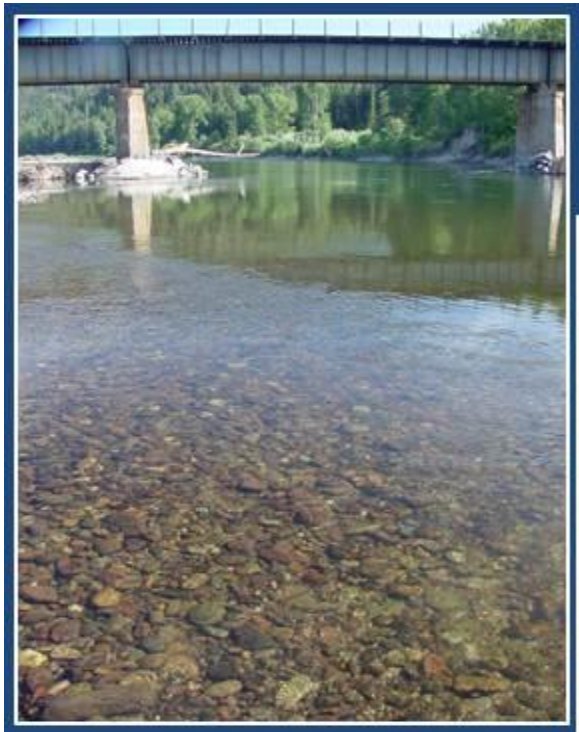
MT Dept. of Environmental Quality

Board of Environmental Review Meeting
Helena, MT
July 26, 2013


Known/likely effects on wadeable-streams at different algae levels (western MT)
Recreation acceptable
Recreation unacceptable
Increasing salmonid growth & survival
Salmonid growth & Survival high
?
Salmonid growth & Survival possibly reduced
Salmonid growth & survival very likely impaired
No DO problems
DO problems sporadic
DO problems very likely
Stonefly, mayfly caddis-fly dominant
Shift in biomass & community structure
Midges, worms, mollusks, scuds dominant
0 50 100 150 200 250 300 350 400 450 500
Benthic algae level (mg Chla/m2)

Attached algae growth commonly quantified as chlorophyll *a* per square meter of stream bottom



40 mg Chl*a*/m$^2$

120 mg Chl*a*/m$^2$

300 mg Chl*a*/m$^2$