Wild Rice Advisory Committee July 14, 2015
MPCA Duluth Regional Office
Meeting Summary and Flip Chart Notes

Advisory Committee Attendees: Peter Lee, Len Anderson, Paula Maccabee, Jennifer Engstrom, Anne Nelson, Nancy Schuldt, Kurt Anderson, Rachel Walker, Joe Mayasich, David Smiga, Rob Beranek, Katherine Hoffman, Ann Geisen, Robin Richards, David Hatchett

Others in person and on phone: Bethel Anderson, Craig Pagel, Peder Larson, Jane Reyer, Bill LaTady, Leah Foushee, Mike Hansel, Katharine Marko, Chrissy Bartovich, Jaime Johnson

MPCA: Shannon Lotthammer, Katrina Kessler, Edward Swain, Pat Engelking, Phil Monson, David Bael

Meeting summary:

Shannon Lotthammer opened the meeting with introductions and ground rules. She said MPCA would be presenting a follow-up presentation comparing the use of NOEC vs. EC_{10} and would also be completing the MPCA presentation from the May meeting. She requested that only clarifying questions be asked during the presentation and then that there would be advisory committee comments following each of the MPCA presentations. Advisory Committee comments were recorded on flip charts. (Note that the Flip Chart notes follow on the next page.)

After all the advisory committee members had commented on the MPCA presentation, Katrina Kessler had a brief discussion of next steps. She presented a rulemaking timeline (also attached) and talked specifically about the timing of the Initial Request for Comments. The Initial Request for Comments is a required part of the rulemaking record that marks the beginning part of the administrative record. Unlike other rulemakings, the wild rice-sulfate rulemaking has had several years of research and discussion prior to the official start of rulemaking. Katrina commented that the MPCA would likely point interested parties to the MPCA's web pages that document the background on this issue when it issues the Request for Comments.

Katrina also mentioned implementation questions and results from additional MPCA analyses as potential topics for the next advisory committee meeting. The next advisory committee meeting will likely be held sometime in late September or early fall.

Flip Chart notes from Wild Rice Standards Study Advisory Committee
July 14, 2015 Duluth, MN

EC_{10}/NOEC/LOEC--Feedback and questions from Advisory Committee members on Ed Swain's presentation comparing use of NOEC/LOEC vs. use of EC_{10}

- Concern that approach focuses on extirpation rather than reduction/diminishment in rice density. Peer review panel advice on this –review
- Is there an example of NOEC or EC_x that is based on literature vs. experimental data?
- Why not EC_{20}? It seems that there is overlap between control and EC_{10}.
- What is EC_{10} detecting? Statistical significance of what is being measured/detected.
- Don't see that there is a question of choosing EC_{10} vs. E_{20}. EC_{20} is not acceptable given WR impacts and Scientific Advisory Board advice.
- Clarification of why – look at MPCA precedent of acetochlor criterion
- Pull in references that looked at population level ecological risk assessments
  DeForest, Adams, & Chapman (2008, in Integrated Environmental Assessment & Management)
- 7050.0217 – how this relates to EC_x approach.
- Also see 7050.0218
- Look at approach taken to selenium work in West Virginia
- Effects of mining permits on Wild Rice
- Clarify point/intent for "3 lakes" graph
- Report protective concentration—calculated vs. measured vs. WR density
- Clarify slide 42 [Slide 42 is a map of CPSC values from the survey field sites].

Feedback on MPCA presentation (slides 29-46)

- Concerned about interaction between WR presence (beneficial use) and EC_x – interaction of sulfate and other limiting factors for wild rice
- How do rivers fit into SEM approach – any differences?
- Would be useful to see a chart comparing EC_x approaches
- How to address other variables in the equation, or demonstrate independence? Also seasonal variability /factors.
- Sensitivity of plant vs. phenology—dormancy, seed state, etc.
- Slides 41 and 45—spend time understanding how MPCA will translate results into permit limits, distance and duration—concern about false positives [slide 41 is CPSC values on plot of Iron vs Organic Carbon; slide 45 is Modeled porewater sulfide compared to observed]
- Suggestion that winter sampling may be useful
- Would be beneficial to have/discuss experimental data on effects of high sulfate and iron on growth and propagation.
- Are there data to support statement that iron-sulfide precipitate does not appear to be impacting WR?
- Do high SO_4, high Fe result in eutrophication effects?
- How many samples, over what area and # of years will be required to estimate protective sulfate #? Concerned about shifting the burden of proof.
- What will be the requirement of permit holders to be in compliance with the permit?
- Slides 31 and 36 - % on y-axes convert by arc-sine?
- Calculated Protective Sulfate Concentration (CPSC) –Protective ties to EC_{10}. Consider looking at the model using the EC_{10} from the hydroponics (299 micrograms/liter, when using the mean initial concentration) – compare
- Slide 44 – Quotient-based risk assessment example. Still interested in more information on what the hash marks on top and bottom mean. Need to label and explain.

- Concerned that we not lose sight of fact that we're dealing with a natural system. Variability is reflective of that. Trying to fit natural system in an equation—are we going to be protective, and can an equation accurately represent that?
- Glad MPCA is re-looking at density assumption.
- Not sure SEM assumption of steady state is a valid assumption. Preliminary sediment core analysis suggests iron may be being depleted in come high-sulfate loading systems. Sensitivity analysis?
- Addressing/accounting for variability vs. practicality in implementation.
- Agree with examination of other factors
- Practicalities of sampling are very key. Stratigraphy within sediment cores.
- Transition from data analysis to regulatory system
- Would like a clearer understanding of the mechanism of sulfate/sulfide impact. How actually affecting WR?
- Slide 45 – Struggle with ability to draw any conclusions from that graph. Focus on purpose and/or acknowledge challenges in the relationship.
- Do we have data showing (to show) if porewater sulfide decreases to 165 did we see wild rice become present? Also inter-year variability
- Echo concern about assumption of steady state, and how often monitoring might be needed.
- Also how standard would be calculated – all WR waters, as permits come up, etc.?
- Think 10 mg/L is needed and reasonable, perhaps 30 mg/L for some streams depending on the conditions.
- Look again/further at histograms
- Tradeoffs/challenges to manage: flexibility – variability – certainty

Steve Nyhus
July 14, 2015 1:54 PM

Good afternoon Shannon,

Following up on another participant's comment, I would also appreciate some more explanation as to why the MPCA is proposing to go with EC10 rather than EC20. If EC10 is designed to protect species of special concern, I do not see any indication that wild rice has ever been identified by the MDNR as fitting into that category. Any concentration lower than EC20 would seem be indistinguishable from control.

Thank you.

David Smiga
July 15, 2015 11:14 AM

(1) Can you cite to any examples of EC10 being used in the past three years?
(2) Can Ed provide graphs using EC20 & EC 50?
(3) Is MPCA proposing new regulations to have wild rice a " rare and endangered species?"
(4) Have you reviewed any articles that has NOT accepted EC10?

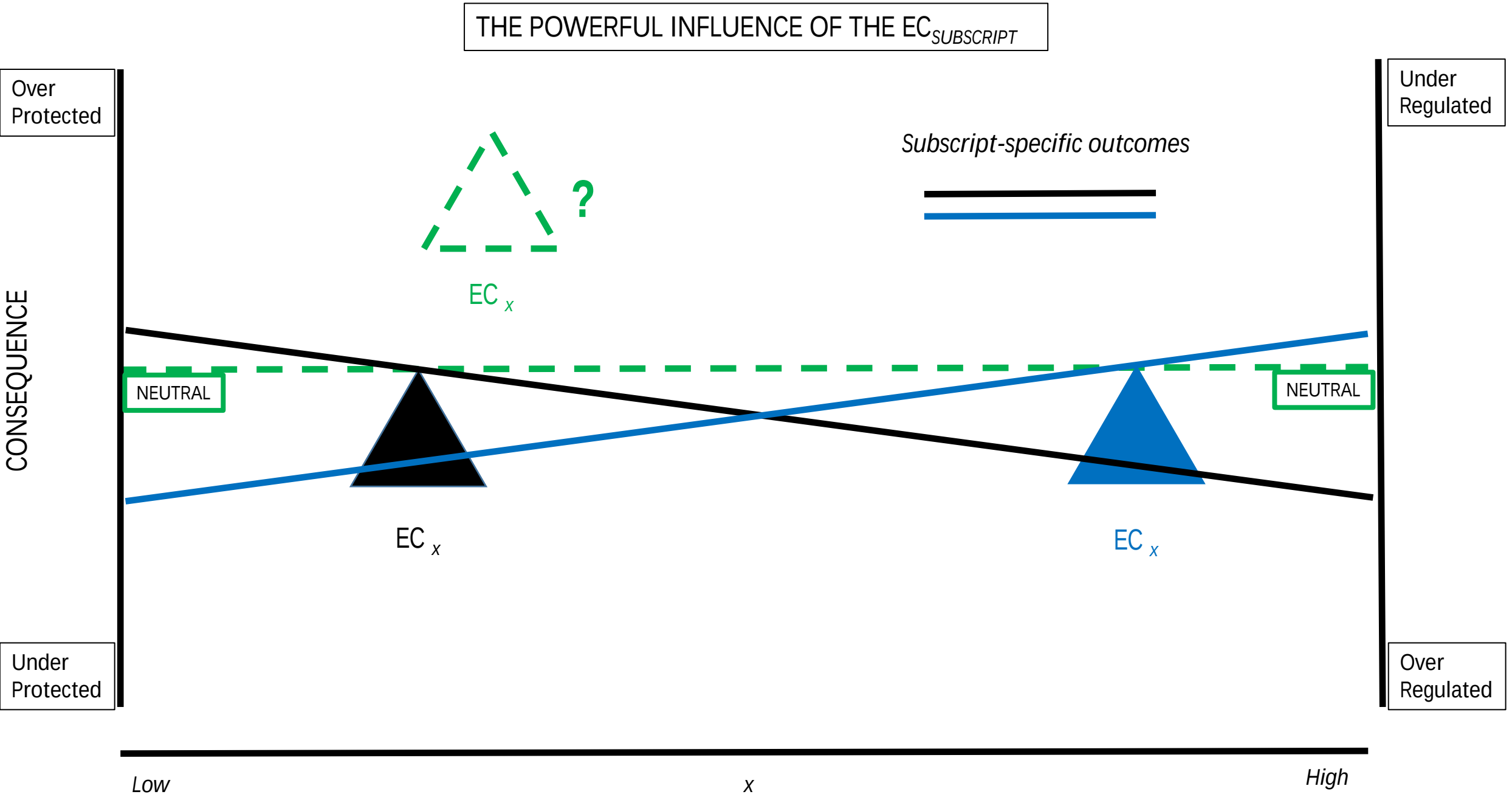
Joe Mayasich
July 15, 2015 11:26 AM

It was indeed (in my opinion). I thank you for facilitating effectively.

I have given the EC subscript level more thought because it is now, and will continue to be, very influential. I was not much good at geometry, but I have applied it crudely to try to get an important point across with the attached slide. As I had indicated yesterday, I fully agree that the EC approach (vs. NOEC, LOEC) is correct; however, I did not come away yesterday with adequate technical/quantitative reassurance that 10 is the appropriate subscript. If the use of 10 will be MPCA policy, as alluded to at the meeting, then that (policy) becomes debatable outside of scientific disciplines; does it not?

Lastly, I'd like to follow-up with more discussion on transforming (via arcsine) the percentages before the binary logistic regressions are performed. The raw data are "discrete" not "continuous" because waters are scored and tallied according to rice presence or absence; not measured on a scale and recorded. The percentages are calculated from the presence/absence count data; are they not? Therefore, pre-analysis arcsine transformation of the percentages should be seriously considered unless the assumptions of the binary logistic regression can be met without performing such a transformation.

Please share all or portions of this communication as you deem appropriate. I hope that my input is helpful.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Leonard Anderson
July 16, 2015 7:38 PM

I completely understand why the sulfate polluters of the state would lobby the MPCA to use EC 20 or even EC 50 as opposed to EC 10 or EC 5. However, the unbiased peer reviewers of the wild rice sulfate research suggest a more protective approach. As a hand harvester and waterfowl-er since 1954, I have an opinion too. I support EC 5 as being truly protective of wild rice. We need to remember the advice of the peer reviewers. In Sect 3.1 of the Summary Report of the Peer Review Meeting we read, "Reviewers agreed that it would be useful for the hydroponics study to consider wild rice populations dynamics when determining effects concentrations. Two reviewers commented that the MPCA's use of EC 20 and EC 50 is not necessarily protective of wild rice. Compounded annually, the effects of EC 20 exposure levels could be anticipated to cause a dramatic decline in wild rice populations over several years." We don't need any more "dramatic declines" in wild rice populations.
Thank you. Len Anderson

Paula Maccabee
July 20, 2015 10:22 PM

Attached, please find a letter and compilation from the *Summary Report of the Meeting to Peer Review MPCA's Draft Analysis of the Wild Rice Sulfate Standard Study.*

This cover letter and Peer Review panel excerpts reflect the perspectives of a number of Advisory Committee members and stakeholders concerned about the preservation of wild rice.

Minnesota Wild Rice Advisory Committee Members & Citizens Concerned about Protection of Natural Stands of Wild Rice

July 20, 2015

Dear Members of the Wild Rice Advisory Committee, Agency Staff, Stakeholders,

The undersigned individuals and organizations believe that several of the issues now being questioned in the Wild Rice Advisory Committee, including but not limited to the EC10 issue, have been discussed at length in the scientific Peer Review process that culminated in a report dated September 25, 2014.

Attached, please find a compilation from the *Summary Report to Peer Review MPCA[1]s Draft Analysis of the Wild Rice Sulfate Standard Study*, including relevant statements from the individual reviewers with specific expertise. We believe that the independent perspectives of these scientific peer reviewers should be given considerable weight as various issues are resolved.

Sincerely yours,

Len Anderson, Advisory Committee, Biologist & Hand Harvester of Wild Rice
Sara Barsel, Advisory Committee, PhD Scientist & Citizen Participant
Lea Foushea, North American Water Office
Kathryn Hoffman, Advisory Committee, Minnesota Center for Environmental Advocacy
Kristin Larsen, Friends of the Cloquet Valley State Forest
Paula Maccabee, Advisory Committee, WaterLegacy
Howard Markus, PhD, Save our Sky Blue Waters
Anne Nelson, Advisory Committee, Hand Harvester of Wild Rice
Nancy Schuldt, Advisory Committee, Fond du Lac Band of Lake Superior Chippewa
Robert Shimek, Advisory Committee, Hand Harvester of Wild Rice
White Earth Land Recovery Project

Enclosure

Summary Report of the
Meeting to Peer Review MPCA's
Draft Analysis of the Wild Rice Sulfate Standard Study
September 25, 2014 (Verbatim Excerpts)

EC20 is Insufficient to Protect Wild Rice

Reviewer Conclusions and Recommendations

"The use of EC20 as the no-effect concentration is not considered protective of wild rice. In order to compare the results of this study to other published research, the panel recommends that a more conservative threshold, such as EC10 or EC05, with appropriate uncertainty factors, including confidence intervals, be calculated using a nonlinear regression approach that accounts for the sigmoidal (i.e., logistic) nature of the experimental response data." (p. 4, first page of Reviewer Conclusions and Recommendations)

Summary of Reviewer Discussions

"Reviewers discussed whether EC20 is an appropriate level to use and what methods are appropriate to calculate effect concentrations.

- One reviewer asked if there are accepted conventions when selecting effect concentrations. Another reviewer responded that toxicology researchers typically accept effects on 5 percent of the population. The relevant question is "What do you want to protect?"
- A reviewer noted that both the endpoint and ecological relevance are important considerations in determining effect concentrations, because there will be a range of sensitivities depending on what endpoint is measured. It is also unclear in this case whether the NOEC speaks to the variability in the test. Researchers typically conduct at least six concentration exposures to determine an accurate NOEC. EC05, which would protect 95 percent of the population, has been used in lieu of a NOEC in Canada. Before setting an effect concentration, researchers need to know the statistical power of the test and what changes can be detected. Another reviewer expressed concern that the Analysis seems to assume that EC20 is equivalent to NOEC, though an effect on 20 percent of the population seems high.
- A reviewer had different thoughts about how to determine the effect concentrations. In combination with other datasets in the Analysis, researchers could conduct a population analysis with life table transition data and then model the wild rice population to look at the sensitivity of the population to different life stages. If population viability is highly sensitive to his life stage, it makes sense to adjust from EC20 to a more protective level, such as EC10. Researchers would need to determine the consequence of 10 or 20 percent mortality on the likelihood of extinction of a population over a long period, such as 50 years." (pp. 14-15)

"One reviewer presented ten concerns he had with the Synthesis: 1. Toxic effects above EC20 need to be modified. MPCA should be careful not to imply there is a NOEC at EC20." (p. 32)

Responses to Charge Questions from Dr. Gertie H.P. Arts
"I do not agree with deriving an EC20 as a value where no effects are to be expected. It is more appropriate to derive an EC10." (p. F-4)

Responses to Charge Questions by Dr. Donald M. Axelrad
"I do not accept the argument that the hydroponics study EC20 is a no effects concentration for sulfide to wild rice; consider using an EC5 or EC10. The decision re which EC to use should be based on science and should be a number that allows for sustainability of wild rice cover – if that is MPCA's desired outcome for protection of wild rice." (p. F-11)

"Answering question number three as posed, regression analysis is appropriate for the hydroponics data. However I question if an EC20 value should be used as a no-effects concentration; instead consider EC5 or EC10." (p. F-12)

Responses to Charge Questions by Dr. Patrick L. Brezonik
"Regression analysis is an appropriate way to analyze the seedling growth data to identify effect levels, and fitting experimental data to a logistic equation is the standard way to calculate EC50 and other EC values. I wonder why EC20 was chosen as an effect level and not EC10, or even EC05. At EC20, 20% of the population is affected, which seems high in terms of protecting wild rice stands. . . . It is difficult to estimate what level of exposure to sulfide would be protective of wild rice populations based solely on the results of short-term bioassays like the hydroponic studies, but it seems to this reviewer that a level affecting 20% of the population (i.e., EC20) is not protective. EC05 would be a more reasonable target level, although again one still has the problem that growth of seedlings is not necessarily the most sensitive life stage of wild rice plants. A weight-of-evidence approach that includes results from all phases of the study—short-term bioassays, long-term, whole life-stage studies (the mesocosms), and field observations—should be used to derive such a value." (p. F-20)

Responses to Charge Questions by Dr. Susan Galatowitsch
"EC20 and EC50 are not adequately protective of wild rice—20% or 50% mortality/impairment should be considered a significant adverse impact to a wild rice population. EC5 or EC10 is, therefore, more appropriate." (p. F-44)

There were ***no*** individual reviewers that endorsed an EC20 level as adequately protective of wild rice.

Threshold for Sulfide Toxicity to Wild Rice Shows Effects at 75 µg

Reviewer Conclusions and Recommendations
"The field study data (Figure 17 in the Analysis) support a working hypothesis of 75 µg sulfide/L in sediment porewater as a threshold for significant toxic effects, although this needs to be confirmed. Preliminary statistical analysis by the panel shows that the

threshold level may be as low as 20-50 µg/L. Overall, the panel concurred that the MPCA data support the preliminary finding of a threshold of < 75 µg/L, more so than the proposed level of 300 µg/L." (p. 7)

Summary of Reviewer Discussions
"During this discussion, all reviewers expressed concern that 300 µg/L sulfide may not be protective of wild rice. . . One reviewer noted that Figure 17 in the Analysis clearly shows a wild rice response starting at 75 µg/L sulfide and sublethal effects starting as low as 30 µg/L." (p. 23)

"One reviewer presented ten concerns he had with the Synthesis: 2.The statement in the Synthesis that the responses of wild rice from the field survey and mesocosm study are consistent with hydroponic study is misleading at best. The field survey results show effects starting at 75 µg/L sulfide." (p. 32)

Responses to Charge Questions by Dr. Donald M. Axelrad
"Importantly, the field study suggests lower no-effects sulfide concentrations than those derived from the hydroponics study. The field study suggests that sulfide above 75 µg/L in porewater is problematic, and one panelists further analysis of the field data, indicated that levels above 20-50 µg/L could result in toxic effects. It appears that the field study may be better suited from which to derive a no-effects concentration for sulfide for protection of wild rice." (F-12)

Responses to Charge Questions by Dr. Curtis D. Pollman
The MPCA histogram analysis of the Field Survey data indicates a change in slope occurring around 60 to 75 mg/L. I believe the histogram assessment is a useful analysis for showing the underlying, overall response in the field survey data, although it is arguably more an assessment of the upper limit of response because it ignores declines in percent cover that may be occurring at lower sulfide levels, but not sufficient to drive percent cover below the 5% threshold. (F-58)

Conceptual "Synthesis" Predicting Sulfide from Sulfate and Iron Goes too Far

Reviewer Conclusions and Recommendations
"Although the conceptual model described in the Synthesis is qualitatively correct, the current Synthesis goes too far in implying that sulfide concentrations in sediment can be predicted accurately by the multiple quantile regression model based on sulfate concentrations in the overlying water and acid-extractable iron in sediments." (p. 9)

Summary of Reviewer Discussions
"It would be useful to have an experiment that examines whether iron would mitigate the ecological effects on wild rice of added sulfide levels. Additionally, current models do not account for the effects from oxygenated rhizospheres and iron plaques on root systems. MPCA needs to understand the mechanism of toxicity better before claiming to understand how iron mitigates sulfide stress. A reviewer responded that there is a substantial amount of literature about interactions between sulfate, sulfide, and iron. Another reviewer noted that these studies are on perennials, and wetland annuals have not

been studied in any detail. For a regulatory standard it would be inappropriate to extrapolate from other species." (p. 28)

"Another reviewer was surprised by the lack of discussion of effects on wild rice plants. If MPCA is going to make site-specific standards based on iron and sulfate concentrations and compare these conditions with the hydroponics study to determine a NOEC, the sulfate concentration determined will not be protective." (p. 32)

"The conceptual model seems qualitatively correct, but it presents an overly optimistic impression about our ability to predict whether toxic sulfide levels will occur in a given wild rice stand from the sulfate concentrations in surface water and acid-extractable iron in sediment." (p. 33)

Responses to Charge Questions from Dr. Gertie H.P. Arts

"As the analysis of the field data survey is based on correlations, those correlations can be used for hypothesis generation. Subsequently, causal relationships need to be tested experimentally." (p. F-5)

"In general, I support the synthesis performed by MPCA. Appropriate study components have been chosen. However, as stated before, I suggest to use the field study for hypothesis generation. These hypotheses can be tested in an experimental setting, e.g., in mesocosms. (p. F-9)

Responses to Charge Questions by Dr. Patrick L. Brezonik

"Figures 15 and 16 could be interpreted as evidence for iron limitation of wild rice growth, and this bears further analysis of the data and literature on wild rice and possibly additional studies. In addition, the important linkage between elevated sulfate levels and phosphorus internal cycling processes in lakes needs further investigation. Elevated sulfate levels could lead to less control of phosphorus levels in sediments by iron, which could exacerbate eutrophication problems—leading to more frequent and more intense algal blooms and a decline in water clarity. Such changes in water quality characteristics could have detrimental impacts on wild rice growth and abundance." (p. F-25)

"The concluding paragraph goes too far in implying that the MQRA model can accurately predict concentrations of sulfide in sediment porewaters. If for no other reason than the uncertainties in the kinetics of solid-phase FeS formation, the statement at the beginning of the paragraph is not realistic. The conceptual model in the Synthesis seems qualitatively correct, but a schematic figure would be useful. In my view, the section and especially its last paragraph presents an overly optimistic picture of our state of knowledge regarding: (a) the quantitative effects of sulfate and sulfide on wild rice and (b) our ability to predict accurately whether toxic sulfide levels will occur in a wild rice stand from knowledge of sulfate levels in the surface water and the acid-extractable iron content of the sediment. I think the Synthesis needs substantial rethinking and rewriting. (p. F-27)