

**Delaware County Regional Water Quality Control Authority (DELCORA)**

**Meeting with U.S. Office of Information and Regulatory Affairs - August 20, 2025**

**Supporting Documentation**

Date	Document Name	Recipient	Page Count
February 19, 2025	DELCORA Comments on the Proposed Consent Decree with the Delaware Riverkeeper Network in <i>Delaware River Keeper Network et al. v. U.S. EPA et al.</i> , Docket No. 2:24-cv-05308 (E.D. Pa.).	USEPA Office of General Counsel	5
February 20, 2024	DELCORA Comments on EPA's Proposed Water Quality Standards	USEPA Office of Water Docket	25
January 20, 2023	DELCORA Comments on the EPA Water Quality Standards Determination of December 1, 2022	Ms. Radhika Fox USEPA Assistant Administrator	48
	Includes comments submitted to DRBC on the - ○ September 2022 Draft of the Analysis of Attainability: Improving Dissolved Oxygen and Aquatic Life Uses in the Delaware River Estuary Report	Ms. Lisa Garcia USEPA Region 2 Administrator	
	○ September 2022 Draft of the Social and Economic Factors Affecting the Attainment of Aquatic Life Uses in the Delaware River Estuary Report	Mr. Adam Ortiz USEPA Region 3 Administrator	
	○ November 2022 Draft of the Linking Aquatic Life Uses with Dissolved Oxygen Conditions in the Delaware River Estuary Report	Deborah Nagle Director, USEPA Office of Science and Technology	



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February 19, 2025

U.S. Environmental Protection Agency  
Office of General Counsel  
Washington, D.C. 20460

Re: **Docket ID No. EPA-HQ-OGC-2025-0019**

Dear Sir or Madam:

I am writing on behalf of the Delaware County Regional Water Quality Control Authority (“DELCORA”) to request the EPA to withdraw from the proposed consent decree (“PCD”) with the Delaware Riverkeeper Network in *Delaware River Keeper Network et al. v. U.S. EPA et al.*, Docket No. 2:24-cv-05308 (E.D. Pa.).

The PCD does not reflect an arms-length agreement and is neither appropriate nor in the public interest.

The PCD was put together in an astonishingly short period of time which can only be explained as an attempt to preclude the new administration from fully and fairly considering the issues which are implicated. In particular, the proposed June deadline simply does not allow the new administration time to install new EPA leadership and for them to consider the extensive public comments which the prior administration received – and, apparently, did nothing with for more than one year. It appears to us that the PCD’s compliance deadline was set to preclude the new administration from making any changes to the prior administration’s proposed rule. EPA simply would not have time to republish a different rule, take comments, evaluate and respond to those comments and still meet the proposed June 2025 compliance deadline.

As such, the PCD would make the public comment period and the approximately 400 comments received a charade and undermine the public participation goals of the Administrative Procedure Act. This is particularly inappropriate given the enormous impacts the proposed rule would have on millions of public sewer utility ratepayers, especially those on low and fixed incomes.

We are particularly disappointed with the PCD given that the sole basis for EPA taking this rulemaking away from the Delaware River Basin Commission was that its March 2025 rule completion date was too long. Now, after sitting on the public comments for more than a year, until the 2024 federal election was complete, EPA proposes a promulgation date of June 2025 which will prevent any material modification of the proposed rule based upon the extensive public comments. That is simply unfair.

For these and the additional reasons explained below, we urge EPA to withdraw from the consent decree and either adopt final water quality standards after the Trump Administration has had sufficient time to fairly consider and address the public comments or send the water quality standards back to the Delaware River Basin Commission (DRBC).

EPA took the unprecedented step of commandeering the development of water quality standards in the Delaware River from the states of Delaware, New Jersey, and Pennsylvania, through the DRBC, on December 1, 2022. Despite the fact that the DRBC was working to revise its existing water quality standards, EPA, at the urging of Plaintiff Delaware Riverkeeper,<sup>1</sup> unilaterally determined that it must designate fish propagation as a use and set dissolved oxygen criteria to protect that use for the Delaware River from river miles 108.4 to 70.0. EPA's only asserted justification for hijacking the criteria development was that DRBC's extensive and deliberative water quality standard development process was moving too slow.

In December 2023, more than a year after it took over rulemaking from DRBC, EPA proposed revised water quality standards for the relevant portion of the Delaware River. 88 FR 88315 (December 21, 2023). As of the writing of this letter in February 2025, however, EPA has not finalized water quality standards. Instead, in the final weeks of the Biden Administration, EPA agreed to a consent decree to settle a citizen suit attempting to force the promulgation of the proposed standards as soon as possible. According to this proposed consent decree, EPA is required to adopt final water quality standards by June 30, 2025.<sup>2</sup>

EPA's delay in promulgating final standards likely stems from two possible explanations: (1) EPA needed time to consider the complexity of the issues associated with the development of the proposed water quality standards and the public comments received; and/or (2) EPA was waiting until after the 2024 election to issue a final rule. Under either scenario, the proposed consent decree requiring the EPA to promulgate a final rule by June 2025 is inappropriate as it effectively precludes the new presidential administration from making any material changes to the prior administration's proposed rule because there is not time to republish a revised rule. The proposed deadline makes a mockery of the public participation and comment process.

### **The Consent Decree Would Not Give EPA Sufficient Time to Review the Standards**

The new federal administration came into office on January 20, 2025. The following day, the PCD was published in the *Federal Register*. 90 Fed. Reg. 7133 (Jan. 21, 2025). Since then,

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<sup>1</sup> The Riverkeeper asserted as the basis for pressing the Biden EPA to take over the criteria development process from DRBC that it expected to get a better rule from the Biden EPA than from DRBC.

<sup>2</sup> The PCD pretends that EPA will not have to promulgate a final rule if the DRBC (or individual states) develop final water quality standards before June 30, 2025. This assertion is disingenuous as that timing is impossible – especially after EPA took over DRBC's rulemaking two years ago. DRBC, the local authority Congress intended to have primacy to develop water quality standards under the Clean Water Act, is not realistically able to promulgate a final standard on or before June 30, 2025. The PCD's suggestion that DRBC or the states can head off an EPA promulgation is misleading.

President Trump has issued a plethora of executive orders and directives to pause or reverse regulatory decisions and priorities set under the previous presidential administration.

For example, President Trump ordered a regulatory freeze on all new rules until a department or agency head appointed or designated by the President after noon on January 20, 2025, reviews and approves the rule. Similarly, President Trump signed Executive Order 14192 on January 31, 2025 instructing all federal agencies to identify at least 10 existing regulations to repeal before promulgating a new regulation in fiscal year 2025. The same order requires regulations with new incremental costs to offset those costs by eliminating or lowering the costs associated with at least 10 existing regulations. These directives and others indicate the current President's clear intention to thoroughly review regulatory actions in a manner different from the prior Biden administration.

If the EPA under the Biden Administration required over a year to review the issues and comments associated with the proposed Delaware River water quality standards, the EPA under President Trump will need more than five months to review and understand the issues and public comments associated with the proposed water quality standards but also to ensure the rule adheres to the new administration's directives and priorities.

DELCORA's comments on the EPA's proposed water quality standard alone provided substantial and material criticisms of the science supporting the EPA's proposed water quality standards. Among other things, DELCORA emphasized: (1) its concern that EPA ignored compelling fisheries data and technical comments on the presence and survival of sturgeon in the waters of interest; (2) the novel and improperly vetted approach EPA used to assess cohorts of Atlantic sturgeon; (3) the insufficient validation of EPA's cohort model; (4) the insufficient documentation in EPA's Technical Support Document; (5) the absence of an evaluation of WQS issues for sturgeon during the spawning/larval development and overwintering seasons; and (6) other similar comments.

DELCORA likewise informed the EPA of the exorbitant and inequitable costs the proposed water quality standards will impose on the region in general and vulnerable communities and individuals in particular. DELCORA attached an economic and environmental justice analysis it paid outside experts to develop for EPA's consideration. Critically, DELCORA demonstrated to EPA that the costs of its proposed water quality standards would exceed any potential public or environmental benefit by \$24 million annually and hundreds of millions of dollars over the next 30 years. This cost imbalance exists even though EPA badly overstated the possible benefits of the proposed standards.

The EPA under the Trump Administration must have time to appropriately consider the science and cost estimates of the proposed water quality standards to ensure the final standards adhere to President Trump's Executive Orders and other directives. In particular, the EPA will need to consider what additional rules it could repeal and how to offset the exorbitant costs of the standards under Executive Order 14192. Likewise, the EPA must evaluate whether the standards are subject to the regulatory freeze and cost-offsetting provisions.

Finally, EPA will not have sufficient time under the consent decree to republish a revised rule that is not a logical outgrowth of its original proposed rule. As highlighted above, DELCORA and other communities along and dependent on the Delaware River submitted detailed comments that are critical of both the science and social costs and benefits EPA used to develop and justify its proposed rule. If the EPA determines that significant changes to the rule are necessary in response to these comments, as DELCORA believes it should, the PCD would not allow EPA time to republish the rule for additional public comment. The PCD would, thus, impose a limitation on EPA's review of public comments that is incongruous with the Administrative Procedure Act and public participation in the rulemaking process.

For these reasons, the PCD was not negotiated at arms length. It is also highly inappropriate and not in the public interest. EPA should withdraw the PCD to ensure it has a reasonable period of time to review and address public comments or to return the rulemaking to the DRBC by withdrawing the inappropriate "Administrator's Determination" used to hijack DRBC's standards development process.

### **The Consent Decree Would Improperly Limit the New Administration's Policies**

After an unprecedented hijack of DRBC's water quality standards development process on the purported basis that DRBC was taking too long, EPA sat on the standards until after the presidential election – likely due to the significant impacts to the Commonwealth of Pennsylvania. Accordingly, the PCD is an inappropriate attempt by one Presidential administration to tie the hands of the next.

EPA must consider the policies and priorities of the President at the time it promulgates final rules. The PCD was rushed through in the final weeks of President Biden's administration and sets an unrealistic timeline for new agency personnel to review and evaluate the standards according to President Trump's directives and policy priorities. The rapid development of a consent decree at the end of one presidential administration that in effect binds the following President's review of a regulatory action at least raises the spectre that its development was not the product of arm's length negotiation. Any attempt to circumvent the results of the 2024 election through a consent decree that would effectively force through a proposed rule without the adequate review and consideration of the new President is antidemocratic and unacceptable.

It is clear to us that EPA must withdraw the PCD and either adopt final standards after sufficient time has passed for the new Administration to review them (such as December 31, 2025) or return rulemaking authority back to the DRBC and its member state sovereigns – who are most closely associated with the Delaware river and the designated uses surrounding it.

If EPA decides to, instead, seek entry of the PCD, we ask that this comment letter be attached to any motion for entry which the US Department of Justice may submit to the Court.

Thank you for considering our comments. We would welcome the opportunity to discuss these issues with the appropriate EPA and/or DOJ officials.

Sincerely,



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F. Paul Calamita  
Outside Counsel

C: Robert Willert, DELCORA  
Michael DiSantis, DELCORA  
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DELAWARE COUNTY REGIONAL WATER QUALITY CONTROL AUTHORITY  
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February 20, 2024

VIA EMAIL ONLY  
READ RECEIPT REQUESTED

via email: <https://www.regulations.gov/>

U.S. Environmental Protection Agency  
Office of Water Docket  
Mail Code 28221T  
Washington, D.C. 20460

Re: Docket ID No. EPA-HQ-OW-2023-0222

Gentlemen/Ladies:

Please accept the following and attached comments of Delaware County Regional Water Quality Control Authority ("DELCO"), and on behalf of our customers and ratepayers, to EPA's proposal for water quality standards ("WQS") for Dissolved Oxygen (D.O.) in the specified portions of the Delaware River. The following comments in this letter pertain to EPA's Technical Support Document for the Proposed Rule: Water Quality Standards to Protect Aquatic Life in the Delaware River. We refer to and incorporate within our own comments the factual and technical data, explanations, conclusions of the Philadelphia Water Department submitted on the EPA proposal approximately this date ("PWD Technical Comments" or "PWD"):

- Philadelphia Water Department: Technical Comments on the Evidence for Hypoxia as a Stressor on Atlantic Sturgeon in the Delaware River - Submitted on February 20, 2024

DELCO engaged Paul M. Leonard, CFP from Brown and Caldwell, to assist with independent review of the PWD Technical Comments and the preparation of the comments included in this letter. Paul is an American Fisheries Society (AFS) Certified Fisheries Professional with more than 40 years of consulting experience with fisheries and aquatic investigations, instream flow studies, fisheries effects analysis, and the permitting and environmental assessment for large and complex water resource, mining, transportation, linear facilities, and other coastal and riverine infrastructure projects. Paul has provided peer and expert review and evaluation for several projects, including independent evaluations, depositions, and expert testimony. Paul is an Endangered Species Act (ESA) specialist who has engaged in ESA Section 7 and Section 10 informal and formal consultation with lead federal agencies and the U.S. Fish and Wildlife Service and NOAA Fisheries (aka. NFMS) for over 30 projects. He

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provides support and advisory services including federal and state environmental permitting (NPDES, 404, 401), National Environmental Policy Act (NEPA) documentation, species surveys and Endangered Species Act review, archeological and historical investigations, and environmental planning documents.

Portions of our detailed comments are included in the Economic and Environmental Justice Attachment titled “Economic and Environmental Justice Analysis for the Proposed Rule: Water Quality Standards to Protect Aquatic Life in the Delaware River, Comment Report February 16, 2024” and is attached to this letter. DELCORA engaged Raftelis to assist with the preparation of these comments. Raftelis is a leading advisor to the water sector, having served over 1,700 local government and utility clients across the country. In the past year alone, Raftelis’ 170 consultants have worked on over 1,300 projects for over 700 agencies in 47 states.

Raftelis’ principal author was Zachary R. Green. Mr. Green has an interdisciplinary background in water sector economics, physical science, and utility management, in both public and private settings. Zachary is a frequent speaker at local, state, and national conferences, with a current focus on utility financial and organizational assessment advisory services. His areas of focus include cost-of-service and rate studies, benefit-cost analyses, economic assessments, shared service assessments, and affordability research. Zachary holds a Master of Public Administration (Public Financial Management) degree from Maxwell School of Citizenship & Public Affairs at Syracuse University and Master of Professional Studies (Water & Wetland Resource Studies) from SUNY College of Environmental Science & Forestry. He also holds a Bachelor of Science degree in Applied Economics & Management (Environmental & Resource Economics) from Cornell University.

1. We appreciate the work of EPA and its personnel on the protection and enhancement of water quality, and particularly on the complex issues involving aquatic life protection in the affected zones of the Delaware River. However, for the reasons that follow, we believe that the current EPA proposal does not meet the standard set under the Clean Water Act for the adoption of water quality standards by either the states (or DRBC) or by EPA. Accordingly, we ask that EPA withdraw the current proposal and pursue a more accurate and scientifically defensible proposal for WQS.
2. Water quality standards must simply be (1) protective of designated uses and (2) based on a sound scientific rationale. 40 C.F.R. §131.11(a). Because of the manner in which the current proposal was developed it is not clear whether designated uses would be further protected, and if they are it appears to be only because of substantial and cumulative measures of conservatism that are built into the proposal. More importantly here, a sound scientific rationale is missing in light of EPA’s use of (1) an untried, untested and unverified cohort modeling approach to the definition of conditions supportive of the designated use; (2) insufficiencies in EPA’s analysis of fish data and failure to consider substantial parts of an existing data base; (3) failure to do any evaluation of critical water

quality issues for two of the three criteria seasons that EPA itself established as a framework for the proposal; and (4) other matters that we address below.

3. Further, although we recognize the limited nature of economic issues in the derivation of numeric WQS, we have substantial concerns about EPA's economic analysis and its Environmental Justice analysis. The Raftelis reports address and document these concerns in detail. It may be that the short schedule, essentially 12 months, announced by EPA initially and then adhered to for this complex and impactful WQS development effort, did not allow time for a properly evaluative economic or EJ analysis. We believe it would be a mistake to rely on these incomplete analyses.
4. EPA must correct the errors and omissions noted in order to fairly state the economic costs and benefits as well as the impacts on affected environmental justice communities, especially the City of Chester in the DELCORA service area. The proposed rule is arbitrary and capricious in its measurement of costs, benefits, net societal impacts, and burdens that will result. EPA's insufficient and cursory treatment of these issues is more important than it might otherwise be in light of the substantive deficiencies in EPA's development of WQS for Dissolved Oxygen. In any case where the necessary approach to WQS or the necessary stringency of criteria is in question, the necessary investments in public money for wastewater treatment should be more closely examined as to costs, benefits, and impacts on EJ communities.

### **Insufficiencies in EPA's Fish Data Analysis**

5. The PWD Technical Comments address, in addition to other issues, a large amount of Delaware River fisheries data from River segments three, four and five. From EPA's proposal and supporting documents it is apparent that EPA has largely ignored those data in its conclusions about the current state of propagation and growth of the Atlantic Sturgeon, the need for new WQS for D.O, and in its development of such WQS. Without addressing a reason for this choice, EPA has chosen instead a highly technical water quality/fish propagation modeling approach about which we have multiple concerns. The PWD Technical Comments provide, refer to, and analyze very substantial data sets, including more than 5000 recent Delaware River juvenile sturgeon collection records from the Delaware River, which PWD has used to test various hypotheses regarding the effects of hypoxia on the Atlantic Sturgeon. These data have unquestioned (to our knowledge) validity and clear relevance to the matters at issue here. As such, those data have scientific validity and direct applicability to matters of the need for and the necessary nature of D.O. WQS for the Delaware River. A proper evaluation of these matters requires that these data be incorporated into EPA's WQS process.

6. The PWD Technical Comments speak for themselves, and we believe they provide a valuable roadmap for a further EPA effort on proper Delaware River WQS. However, several of the PWD observations and conclusions are particularly compelling, and we believe that a focus on these and PWD's basis for its conclusions should cause EPA to withdraw the current WQS proposal and undertake further WQS work. Those observations and conclusions include the following:
  - a. Atlantic Sturgeon are now propagating and growing in the affected waterway segments under existing water quality conditions. PWD Technical Comments 1 - 4.
  - b. EPA's rulemaking lacks evidence that current D.O. levels adversely affect Atlantic Sturgeon under existing conditions. PWD Summary.
  - c. There is substantial evidence available that current D.O. levels support Atlantic Sturgeon under existing conditions. PWD at 1 - 4, 8.
  - d. Given these factors and the availability of other, proven avenues of D.O. WQS development, there is no need for a cohort modeling approach. PWD generally.
  - e. EPA failed to use a substantial collection of data on juvenile Atlantic Sturgeon in the affected waterway segments. PWD at 1.
  - f. Comparisons with data from the Hudson River watershed support PWD conclusions about the status of and factors affecting Atlantic Sturgeon in the Delaware River. PWD at 9.
7. Based on the existence of these data and PWD's evaluations, we believe that EPA's failure to consider the scientifically valid and fully relevant data in any meaningful way, and its failure to incorporate the data and make proper findings and conclusions thereon, essentially disproves any EPA claim that its proposed WQS are based on a sound scientific rationale. If a state or a site-specific WQS applicant were to propose a WQS and failed to incorporate in its evaluation relevant data of a far lesser volume, EPA would readily reject the proposal on the basis that non-use of such data does not support a finding that a WQS proposal is based on a sound scientific rationale. As a matter of law, no less of a standard applies to EPA here. 40 C.F.R. § 133.22(c).

### **EPA's Cohort Modeling Approach**

8. EPA's use of a cohort model to set water quality standards is a novel application. Although interesting from a technical perspective, we have found no other applications in the literature or through our regulatory contacts of cohort models being used to set site-specific water quality standards. Neither the cohort model concept nor this specific application has been corroborated for this purpose, and the model should not be applied in this regulatory context before full evaluation, validation and refinement. EPA's use of water quality modeling to derive site-specific criteria usually requires a high bar of model calibration and corroboration. EPA is falling far short of making such a demonstration with the application of the

Atlantic Sturgeon cohort model. According to EPA's own *Guidance on the Development, Evaluation, and Application of Environmental Models*,<sup>1</sup> the cohort model should have been subject to the following.

- a. Scientific peer review
- b. Quality assurance project planning
- c. Corroboration
- d. Sensitivity analysis
- e. Uncertainty analysis

In light of the criticality of the WQS at issue, and the substantial economic implications of the application of the Atlantic Sturgeon cohort model, EPA should retract the use of the cohort model until these quality review elements are fully addressed, the model has been corroborated, and the uncertainty of the model results reduced. We also support the comment by Philadelphia Water Department that EPA's fish cohort model has not been published or substantively reviewed by the scientific community and as such cannot properly be used as the basis of new DO criteria. Although we know that peer review is planned, that does not support the use of the model at this time.

9. Elements of quality assurance that appear to be missing from the EPA's Atlantic Sturgeon cohort model development include a Quality Assurance Project Plan for Model Development, Modification, Evaluation and Application; detailed review of assumptions; and sensitivity analysis. Was a QAPP developed for the application of Atlantic Sturgeon Cohort Model and its application to water quality standards for the Delaware River? (<https://www.epa.gov/sites/default/files/2015-06/documents/region1qapptemplate.pdf>). A QAPP should be available for review as part of EPA's process of public and industry review and comment on the proposed rule. Sensitivity analysis should have been undertaken, and should be completed, to better understand the uncertainty and the most important contributing variables for each parameter estimate and key assumptions. EPA's Technical Support Document ("TSD") provides some limited assessment of uncertainty and certain assumptions, but these are qualitative and insufficiently explored and documented to support the application of such a novel approach in a regulatory setting with such significant environmental and economic implications.

#### Potential Propagation of Errors.

10. Possibly of most concern, EPA has not addressed the potential propagation of errors that can occur when multiple, sequential correlative analyses are used to make parameter estimates, that are then used in the Atlantic Sturgeon cohort

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<sup>1</sup> U.S. Environmental Protection Agency (EPA). 2009. *Guidance on the Development, Evaluation, and Application of Environmental Models* (citing Suter 1993).

model which also has its own sources of error or uncertainty. These concerns are amplified by multiple factors including the following.

- a. Mortality model – a regression model based on experimental laboratory studies for shortnose sturgeon. EPA’s TSD did not address how or why the shortnose sturgeon data was directly applicable to Atlantic sturgeon, nor did EPA address the limitations of the experimental laboratory studies. EPA itself stated that the small number of experimental estimates of mortality resulted in wide limits of uncertainty.
- b. Growth model – a bioenergetic modeling approach using six sub-models based on experimental laboratory studies.
- c. Habitat suitability index model – an approach that required several assumptions and quantile general additive models (QGAMS) that also simplify observed data that have considerable variability.

In statistics and modeling, the propagation of uncertainty (or propagation of error) is the effect of variables' uncertainties (or errors) on the uncertainty of a function based cumulatively on them. The documentation provided in EPA’s TSD is insufficient to evaluate each of the sources of error and their potential cumulative error, and as a result the analysis is not sufficiently transparent. Inadequate time was provided for technical and public review of these issues.

Absence of Sufficient Validation.

11. The lack of sufficient validation of the Atlantic Sturgeon Cohort Model is of considerable concern. As described by Kell *et al.* (2021),<sup>2</sup> model validation increases confidence in the outputs of a model, leads to an increase in trust among the public, stake and asset-holders and policymakers (Saltelli *et al.*, 2020),<sup>3</sup> and can identify model limitations that should be addressed in future research. As we state above, the model does not appear to have been adequately validated. As stated in EPA’s own guidance documents, no model should be used unless it has been validated.<sup>4</sup>
12. EPA’s efforts to perform validation were limited and yielded inconsistent results. A demonstration of a moderate significant correlation at one site (e.g., Penn’s Landing) is not a demonstration that the model is accurate. A model that is highly

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<sup>2</sup> Kell, L. T., Sharma, R., Kitakado, T., Winker, H., Mosqueira, I., Cardinale, M., and D. Fu. 2021. Validation of stock assessment methods: is it me or my model talking? ICES Journal of Marine Science. ICES Journal of Marine Science, 78:2244–2255.

<sup>3</sup> Saltelli A., Bammer G., Bruno I., Charters E., Di Fiore M., Didier E., Espeland W. N. et al. 2020. Five Ways to Ensure that Models Serve Society: a Manifesto. Nature, 582: pp. 482–484.

<sup>4</sup> Guidance on the Development, Evaluation, and Application of Environmental Models.

inaccurate could still correlate with the true result; correlation is not accuracy. For this reason, calibration objectives from modeling guidance, including EPA's own guidance, do not focus on correlation, but on various other measures of accuracy and precision. The accuracy of the cohort model as applied by EPA to the Delaware River is unproven and may well be inaccurate. Correlations identified by EPA while possibly helpful for descriptive analysis, have not been demonstrated as accurate.

13. For additional support of our position, we reference PWD's extensive comments on the draft rulemaking, including both the general comments as well as the detailed comments in its *Technical Comments*. PWD compiled and evaluated several lines of evidence for the strength of the association between hypoxia and measures of Atlantic Sturgeon condition and health in the Delaware River and concluded that the evidence for hypoxia being an important stressor to Atlantic Sturgeon in 2009-2022 as evaluated with the best available scientific data and that existing DO levels are supporting Atlantic Sturgeon propagation and growth. PWD also pointed out that EPA's analysis did not include all available commercial and scientific data, and so does not represent the best available science. We concur with many of the technical points made by PWD and we encourage EPA to address them.

The Documentation Provided in the Technical Support Document is Insufficient.

14. The minimal documentation on the cohort model approach in the TSD is not adequate to evaluate each of the sources of error, much less their potential cumulative error. As a result, the analysis is not sufficiently transparent. DELCORA and other commenters requested an extension of the limited comment period on the EPA proposal, in part to allow some evaluation of this and other critical issues. Unfortunately, that request was denied, and inadequate time was provided for technical and public review of the complex issues involved.

EPA's Research-Based Model is Improper for Use for this Purpose.

15. EPA has used a research-based cohort model with considerable potential sources of error and lack of corroboration to propose site-specific WQS for the Delaware River without sufficient opportunity for review by the regulated and scientific communities and without literature support for the use of fish cohort models to address their potential strengths and weaknesses for the proposed application.
16. In its TSD, EPA provided no support from the fisheries literature about the application of cohort models for evaluating environmental conditions for fish early life history. This should be part of any further review or application of the Atlantic Sturgeon Cohort Model before it is applied in a regulatory context.

17. In light of the data and other resources available, it is unclear why EPA would in any event want to rely on complex modeling to propose these WQS. EPA's own Science Advisory Board warned about reliance on mathematical modeling in setting water quality criteria or standards, stating that the results from a deterministic model "may be infinitely precise, although possibly inaccurate."<sup>5</sup> Based on all the concerns we identify, the use of the cohort model is arbitrary and capricious and is not based on a sound scientific rationale.

### **Absence of Evaluation of WQS Issues for the Spawning and Larval Development and Overwintering Seasons**

18. In its rulemaking proposal EPA divides the year into three seasons for sturgeon protection/WQS development purposes – (1) Spawning and Larval Development season (spring); (2) Juvenile Development (July through October); and (3) Overwintering. Juvenile Development is seen as the most critical for the sturgeon, and the conditions and factors during that season are what was modeled to get the proposed 66 percent daily average percent D.O. saturation WQC (also an additional criterion of 74 percent with a larger number of allowable days for an exceedance frequency). We generally agree with this WQS seasonal approach.

19. Having divided the affected Delaware River WQS into three distinct seasons, EPA has an obligation to consider proposed WQS for each season, and the requirement for a sound scientific rationale for any resulting criteria applies. However, EPA appears to have made no attempt to develop criteria specific to the Spawning and Larval Development or Overwintering seasons. Instead, EPA made the simple conclusion that criteria for the most critical season will be protective of the other two seasons. The Spawning and Larval Development and Overwintering seasons criteria were accordingly proposed at the same 66 percent WQS. However, it does not appear that there was any modeling focused on either of those seasons. Instead, EPA simply used the Juvenile Development-based modeling (and results) based on the presumption/conclusion that the same WQS will be protective for the less critical seasons and temperatures. EPA noted:

*[C]onsidering the available evidence, EPA concluded that the percent oxygen saturation threshold that is protective for juveniles experiencing stressful water temperatures during the Juvenile Development season would also be protective for larvae and overwintering juveniles experiencing non-stressful water temperatures. EPA Technical Support Document p. 28 ("TSD").*

With EPA having separated the evaluation into seasons, and with the extensive financial impacts that are involved, EPA has an obligation to do a separate, specific evaluation of WQS necessary for water quality protection in all of the

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<sup>5</sup> An SAB Report: Review of the Biotic Ligand Model of the Acute Toxicity of Metals, EPA-SAB-EPEC-00-006 (Feb. 2000).

seasons. Note EPA's TSD Fig. 2, Seasonal Distributions of Selected Water Quality Parameters, reflecting large instream data sets (2002 – 2022) for USGS monitoring stations in Zones 3 and 4 (the upper zones). If we were dealing with strictly numeric D.O. WQS, compared to a generic EPA WQC of 5.5 mg/l (30-day mean), all of the Overwintering season instream data appear to be substantially above that generic WQC. For the Spawning and Larval Development season much but not all of the data points are above 5.5 mg/l WQC, and the daily median data appear to be at or above 5.5 (also above or very close to EPA's generic WQC 6.0 7-day mean for early life stages, which appears a more appropriate contrast for the Spawning and Larval development season). TSD p. 18. Also from Fig 2, for the percent saturation chart note it appears that all of the data points for one of the stations and nearly all for the other stations are above EPA's proposed 66%, for the Overwintering season. The daily medians are all well above 66%. For the Spawning and Larval Development season not all of the data points are above 66%, but the daily medians all appear to be above that value.

Our conclusions from this are that for the two less-critical seasons the 20-year data set shows that all of the daily median D.O. data are above the 5.5 mg/l EPA generic criterion, and most are well above 5.5. For the EPA-proposed 66 percent of saturation WQS, some of the data points are below the 66 percent point, but all of the daily medians appear to be above 66 percent. If EPA had modeled the two less-critical seasons as it did for the Juvenile Development season, it would have presumably proposed less stringent percent D.O. saturation (or straight concentration) WQS. Less stringent criteria and a showing of more complete instream data better than those criteria for the Spawning and Larval Development and Overwintering seasons may provide benefits for future wasteload allocation calculations and NPDES permit conditions.

## **Costs and Benefits; Environmental Justice**

20. We refer EPA to the detailed Raftelis analyses on Economic Analysis and Environmental Justice aspects of the WQS proposal. Although we recognize the limited nature of economic issues in the derivation of numeric WQS, we have substantial concerns about EPA's analyses. Taken together EPA's Economic and Environmental Justice Reports suffer from a lack of spatial, temporal, and statistical coherence, along with a lack of rigor in following EPA's own affordability guidance. Amazingly, EPA's findings in support of its proposed regulatory action are contradicted by EPA's own data. EPA must correct these errors in order to fairly state the economic costs and benefits as well as the impacts on affected Environmental Justice communities, especially the City of Chester in DELCOA's service area.
21. As a result of the insufficiencies identified in the Raftelis attachments, the proposed rule is arbitrary and capricious in its measurement of costs, benefits,

net societal impacts, and burdens that will result. These issues require further study and explanation to ensure that costs and benefits are properly assessed – especially for the Environmental Justice communities that will be impacted. Finally, as to economics and Environmental Justice, EPA's insufficient and cursory treatment of these issues is more important than it might otherwise be in light of the substantive deficiencies in EPA's development of WQS for D.O. In any case where the necessary approach to WQS or the necessary stringency of criteria is in question, the necessary investments in public money for wastewater treatment should be more closely examined as to costs, benefits, and impacts on EJ communities.

22. As to the specifics of EPA's WQS proposal, the inadequacies in EPA's Economics and Environmental Justice analyses should be seen as highlighting the importance of EPA's choices in its approach to these criteria. EPA's cursory and seemingly rushed Economics and Environmental Justice efforts provide a poor basis for consideration of the positive and negative impacts of the WQS proposal, and that concern is greater in light of the incorporation in the proposal of a number of unproven WQS development concepts.

## **Conclusion and Recommendation**

23. DELCORA has identified a number of serious concerns about EPA's proposal for WQS for D.O. in portions of the Delaware River. Those include issues involving EPA's failure to use existing data that are highly relevant to the matters at hand; the use of an unnecessary and unproven cohort modeling exercise; and the complete absence of evaluation of WQS issues for the Spawning and Larval Development and Overwintering seasons. As to the failure of EPA's proposed rule and the TSD to consider and use the substantial relevant data sets we address above, the proposal ignores relevant information. A sound scientific rationale by definition includes appropriate consideration of information and data that bear directly on the environmental matters at hand. As to each of these issues and insufficiencies, EPA's proposal fails to identify how the proposal is supported by a sound scientific rationale. As such the proposal does not satisfy the legal requirements for the adoption of WQS.
24. Some of the decisions and directional choices made by EPA in the process of the WQS draft development and proposal are further arbitrary and capricious considering their lack of basis or EPA's failure to fully consider more traditional and proven approaches to WQS development. Particularly as to EPA's failure to consider at all the specifics of water quality during the Spawning and Larval Development and Overwintering seasons, after its own decision to consider water quality in three separate seasons, EPA appears to completely ignore its WQS obligations. There is no sound scientific rationale for simply concluding that the proposed D.O. requirements for the more critical Juvenile Development

season are protective for the other two seasons. Such an approach is clearly arbitrary and capricious.

25. EPA's cursory Economics and Environmental Justice efforts provide a poor basis for consideration of the positive and negative impacts of the WQS proposal, and that concern is greater in light of the incorporation in the proposal of a number of unproven WQS development concepts.

Respectfully, in light of the concerns we express, we recommend that EPA withdraw its current D.O. WQS proposal, and then work on a reproposal that addresses those issues and deficiencies. DELCORA and the other affected wastewater treatment service providers are typically always in the process of collection and treatment improvements, including CSO Long Term Control Plans, that, although not directed solely at instream D.O, will continue to bring about incremental improvements in Delaware River D.O. Accordingly, in addition to the substantial benefits that we believe a better considered WQS proposal will bring about, we believe that this valuable process will not improperly delay any necessary D.O. improvements.

Thank you for your consideration of these comments.

Sincerely,



Charles N. Hurst, P.E., BCEE  
Director of Engineering

CNH:bab  
attachment

cc: Catherine Libertz (Libertz.catherine@Epa.gov), EPA Region 3  
Greg Voigt (voigt.gregory@epa.gov), EPA Region 3  
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Robert Willert, DELCORA  
File

**Final Report**

**Economic and Environmental Justice  
Analyses for the Proposed Rule: Water  
Quality Standards to Protect Aquatic Life  
in the Delaware River**

**EPA-HQ-OW-2023-0222-0003\_Econ &  
EPA-HQ-OW-2023-0222-0004\_EJ**

**Comment Report  
Zachary R. Green**

February 16, 2024

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February 9, 2024

Mr. Charles Hurst  
DELCORA  
100 E. 5th Street  
Chester, PA 19013

**Subject: Comment Report Pertaining to the EPA Office of Water Economic and Environmental Justice Analyses for the Proposed Rule: Water Quality Standards to Protect Aquatic Life in the Delaware River**

Dear Mr. Hurst:

At the request of DELCORA, Raftelis prepared this Comments Report in response to two reports from the United States Environmental Protection Agency (“EPA”) Office of Water covering Economic and Environmental Justice Analyses for the Proposed Rule: Water Quality Standards to Protect Aquatic Life in the Delaware River. Specifically, this report documents my review and response to the following reports:

- EPA-HQ-OW-2023-0222-0003\_Econ: Economic Analysis for the Proposed Rule: Water Quality Standards to Protect Aquatic Life in the Delaware River, Published December 2023
- EPA-HQ-OW-2023-0222-0004\_EJ: Environmental Justice Analysis for the Proposed Rule: Water Quality Standards to Protect Aquatic Life in the Delaware River, Published December 2023

This report is a review report detailing comments, which is intended to reflect industry best practices, expertise in economic analysis, and consistency with EPA’s own published guidelines.

Sincerely,



Zachary Green  
Manager, Raftelis

# Table of Contents

- I. Report Purpose and Objectives .....2
- II. Sources of Information .....3
- III. Review of EPA-HQ-OW-2023-0222-0003\_Econ – Economic Analysis for the Proposed Rule: Water Quality Standards to Protect Aquatic Life in the Delaware River.....3
  - General Comments ..... 3
  - Benefits ..... 3
  - Costs..... 4
  - Other Technical Comments ..... 5
  - Net Economic Impacts..... 7
  - Conclusions..... 7
- IV. EPA-HQ-OW-2023-0222-0004\_EJ: Environmental Justice Analysis for the Proposed Rule: Water Quality Standards to Protect Aquatic Life in the Delaware River.....8
  - General Comments ..... 8
  - Environmental Justice ..... 8
  - Affordability Measurement ..... 9
  - Conclusions..... 11

## I. Report Purpose and Objectives

1. Raftelis was retained by DELCORA to provide expert opinions related to new proposed water quality regulations in the Delaware River.
2. Raftelis was asked to review and submit comments in response to the following reports:
  - a. EPA-HQ-OW-2023-0222-0003\_Econ: Economic Analysis for the Proposed Rule: Water Quality Standards to Protect Aquatic Life in the Delaware River, Published December 2023 (“EPA Economic Report”)
  - b. EPA-HQ-OW-2023-0222-0004\_EJ: Environmental Justice Analysis for the Proposed Rule: Water Quality Standards to Protect Aquatic Life in the Delaware River, Published December 2023 (“EPA EJ Report”)
3. The primary author of the EPA reports is the EPA Office of Water.
4. The intended use of this review is to assist the EPA with improvements to the Economic and Environmental Justice reviews to better reflect the realities of impacts within the DELCORA service area and to then result in more sustainable and balanced regulation of water quality in the Delaware River.
5. The purpose of this report is to determine if the opinions and conclusions contained in the EPA economic and environmental justice reports are credible and supportable.
6. EPA’s reports focus on the economic and environmental justice impacts of stricter water quality regulations on the waters of the Delaware River, where DELCORA discharges treated wastewater effluent. A primary assumption of EPA’s reporting is the assessment that dischargers of treated wastewater within the Delaware River specified zones<sup>1</sup> are primary contributors to reduced dissolved oxygen levels that inhibit the ability of an endangered and anadromous local population of Atlantic Sturgeon to propagate in the river.
7. The scope of work of our assignment included thoroughly reviewing and analyzing the EPA Economic and Environmental Justice Reports, including reviewing the information referenced and relied upon by EPA to arrive at their conclusions and opinions; and the completion of independent research concerning the assumptions and development of alternative suggestions that would improve the EPA analyses.

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<sup>1</sup> In these comments ‘specified zones’ indeed refers to the same definition used in EPA’s reports, that is Zone 3, Zone 4, and the upper portion of Zone 5 of the Delaware River. In some cases, comments will refer more narrowly to the stretch of river that DELCORA discharges to (Zone 4), or to DELCORA’s service area more broadly.

## II. Sources of Information

8. In completing our review and rendering Raftelis' opinions regarding the EPA Economic and Environmental Justice Reports, I reviewed and considered various documents and information, including the following:
  - a. EPA, CSO Control Policy Financial Capability Assessment Guidance, Published February 2023, Available at <https://www.epa.gov/system/files/documents/2023-01/cwa-financial-capability-assessment-guidance.pdf>
  - b. AWWA, Developing a New Framework for Household Affordability and Financial Capability Assessment in the Water Sector, Published April 2019, Available at <https://www.awwa.org/Portals/0/AWWA/ETS/Resources/DevelopingNewFrameworkForAffordability.pdf?ver=2020-02-03-090519-813>
  - c. Information and referenced sources pertaining to water utilities as cited in this report.
  - d. Water industry reference sources as cited in this report.
  - e. Other sources and publicly available information as cited in this report.

## III. Review of EPA-HQ-OW-2023-0222-0003\_Econ – Economic Analysis for the Proposed Rule: Water Quality Standards to Protect Aquatic Life in the Delaware River

### General Comments

9. EPA's economic analysis fails because of significant temporal inconsistencies that render the net assessments of benefits and costs as irrelevant for DELCORA's ratepayers and therefore insufficient for policy setting purposes. These issues will be detailed in the sections that follow.
10. EPA's economic analysis fails because of significant geographic inconsistencies that render the net assessments of benefits and costs as irrelevant for DELCORA's ratepayers and therefore insufficient for policy setting purposes. These issues will be detailed in the sections that follow.

### Benefits

11. EPA relies on a single sentence in a single *national* study (Viscusi, 2008, page 10) to establish a 100-mile radius of water quality benefits for a policy that is clearly local in costs, not national. That study worked to quantify willingness to pay, a form of contingent valuation research, for water quality improvements across the country. When reviewing a policy where the costs are to be borne by a given set of localized ratepayers, the comparative benefits used to assess total net economic impacts should be isolated to the benefit that those ratepayers perceive and their own willingness-to-pay (WTP). Before asserting that households in relatively distant geographies, like New York City, desire to pay for or recreate in remediated water quality in the waters off of

industrialized areas of Chester, PA (which is in the DELCORA service area in Zone 4), it should be understood that the costs of the infrastructure will not be borne by most of the population for which EPA has chosen to measure benefits. While recognizing that EPA has a national remit, it should be clear that the geographic inconsistencies with which benefits and costs were measured for the purposes of this economic assessment render the net analysis as meaningless and arbitrary. As the common refrain goes, it is apples and oranges. Even if one accepts the premise that benefit can be measured in a range beyond the DELCORA service area for federal policy setting EPA's analysis fails to address the concept of distance decay within the 100-mile range and instead assumed equal WTP throughout that range, which will overstate benefits. That assumption is being challenged by EPA itself through the 2023 study entitled "Survey to Improve Economic Analysis of Surface Water Quality Changes".<sup>2</sup>

12. "Concentrating on one state should isolate subindex aggregation issues from other concerns with population, income, and heterogeneity in water quality monitoring."<sup>3</sup> The 100-mile radius applied here in EPA's report requires a multi-state aggregation analysis that would not isolate such issues.
13. On page 15 the report states that "EPA deems waters unaffected by the proposed WQS (Water Quality Standard) within the 100-mile buffer around each census block group as viable substitutes." However, research indicates that spatial variability in preferences and competition from viable alternative water bodies can have a significant impact on WTP.<sup>4</sup> The Mid-Atlantic and Northeastern U.S. regions included in the 100-mile buffer are rich with competing water bodies that one could argue are more natural, scenic, and less urbanized settings for non-market benefits to occur whether it be the enjoyment of recreation or wildlife as compared with the specified zones, which again could mean a significant overstatement of benefit in EPA's analysis.
14. EPA uses a population of 14.96 million people in its benefit analysis, note that the combined service areas of the utilities affected by the regulation that would pay for the infrastructure costs is only 3.4 million people. While a broad net social welfare analysis is defensible for federal rulemaking that applies nationally, this rulemaking is narrower and as such the economic analysis should have a consistent and narrower frame focused on where the areas that will bear the costs that proceed from it.

## Costs

15. On page 11 EPA notes that for the purposes of the water quality thresholds it is considering, it assumes Long-Term Control Plan (LTCP) projects that address combined sewer overflows (CSO) in the specified zones will have been completed given their schedules. There are two errors with this assumption. First, the LTCPs will not be completed. Philadelphia Water Department has

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<sup>2</sup> "Economic Analysis of Surface Water Quality Changes. EPA invitation for comments to OMB on survey. Available at: <https://www.aeaweb.org/forum/3459/economic-analysis-surface-quality-changes-invites-comments>. Accessed on February 9, 2024.

<sup>3</sup> Walsh, Patrick, Wheeler, William. "Water Quality Index Aggregation and Cost Benefit Analysis". Published by the National Center for Environmental Economics, July 2012. Available at: [https://www.epa.gov/sites/default/files/2014-12/documents/water\\_quality\\_index\\_aggregation.pdf](https://www.epa.gov/sites/default/files/2014-12/documents/water_quality_index_aggregation.pdf). Accessed on February 9, 2024.

<sup>4</sup> Moore, Chris C. et. al. "Measuring the social benefits of water quality improvements to support regulatory objectives: Progress and future directions", Available at: <https://www.pnas.org/doi/full/10.1073/pnas.2120247120>. Accessed on February 9, 2024.

hundreds of millions of dollars-worth of work yet to perform and DELCORA is still in the process of revising the CSO LTCP for the City of Chester. It is clear that the revised LTCP will cost in excess of \$100 million and it remains to be seen how those costs will be allocated among DELCORA's regional users. Second, even if the CSO LTCPs were completed (which they are far from), it is not clear that costs for those projects have been considered anywhere in the analysis. This is noted here but will also become particularly relevant to the temporal aspects of the environmental justice analysis, which focus on incremental costs of the DO (dissolved oxygen) infrastructure in isolation relative to today's costs, therefore ignoring the very significant CSO LTCP costs.

16. On page 13 EPA notes:

- a. Capital costs were assumed to occur "upfront".
  - Often large capital investments in wastewater infrastructure are financed such that bond proceeds may pay for capital upfront, but debt service costs are paid over time and it is those debt service costs that customers experience economically through the rates they pay, which improves intergenerational equity of long-lived capital assets. If EPA is currently assuming 100% cash funding of this infrastructure, that assumption should be revisited to consider costs under reasonable financing scenarios. In fact, research indicates that about 90% of state and local capital spending is debt financed.<sup>5</sup>
- b. Costs were annualized over 30-years from 2024 to 2053 and then discounted to 2024 dollars using a 3 percent discount rate.
  - EPA should confirm if Kleinfelder also used a 3% inflation assumption in its estimates of future costs. If that analysis was done in today's dollars or a lower inflation rate, then EPA's discounting would not be correct. Further, EPA should clarify what "annualized" costs are based on, which could be equivalent annual cost as typically defined<sup>6</sup>, an average cost across the 30-year period or something different (median, etc.).

## Other Technical Comments

17. Relying on just one year of water quality impact data that is thought to represent typical historical conditions reduces the reliability of EPA's technical and ultimately economic assessments for the development of the water quality standard of interest for two reasons.
- a. While this report is not focused on the technical details of water quality measurement, which is the focus of other experts supporting DELCORA, it should be noted that per page 11 of the report, pollution reduction modeling conducted by EPA relied on a single year of data (2019). However, EPA's own NPDES Permit Writers' Manual notes on page 16 that

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<sup>5</sup> Marlowe, Justin. Municipal Bonds and Infrastructure Development – Past, Present, and Future: An International City/County Management Association (ICMA) and Government Finance Officers Association (GFOA) White Paper. Published August 2015. Available at: <https://issuer2issuer.com/wp/wp-content/uploads/2015/08/Municipal-Bonds-and-Infrastructure-Development.pdf>. Accessed on February 9, 2024.

<sup>6</sup> Investopedia, Equivalent Annual Cost, Available at: <https://www.investopedia.com/terms/e/eac.asp>. Accessed on February 9, 2024.

“...it is recommended that the permit writer establish an average from the past 5 years of facility data.” EPA should follow its own directives and increase the size of the data set used to estimate the infrastructure required to meet its regulations.

- b. A trend of climatic changes that includes both warming and higher intensity precipitation events is now a well-established and observed fact.<sup>7</sup> Given this and the significant impacts that temperature can have on water chemistry, a single historically representative year cannot be relied on to predict how future infrastructure will or will not address pollution. Again, more years of data and to the extent possible as adjusted to reflect current and future temperature, rainfall, and other factors that affect facility costs should be assessed to improve EPA’s cost estimates.
18. In its observational analyses based on just two continuous monitoring stations in Zone 3 and Zone 4 and none in the upper portion of Zone 5 (see top page 12), EPA fails to establish that the stations reflect water quality in the river more broadly. For example, the location of the station could be impacted by sunlight, adjacent soil conditions, channel composition, water speed and depth, bank integrity, riparian zone health and vegetation, avian and terrestrial animal activities and wastes, boat traffic, proximity to discharges of any kind, illegal dumping, or other forms of human activity. In considering the significant economic costs under review, the baseline assessments of water quality should be supported by more robust field science at multiple locations with varying characteristics within each of the specified zones.<sup>8</sup> While we believe additional monitoring is necessary, if EPA disagrees, it must explain how the two monitoring stations are representative of the broader river stretches in which the criteria would apply.
  19. On page 14 EPA notes that BOD (biological oxygen demand), FC (fecal coliform), and TSS (total suspended solids) measurements relied on data at various locations (page 57 notes 8 locations) within the specified zones. While this is more than the paltry two continuous monitoring stations used for other measurement purposes in Zone 3 and 4, these parameters were excluded from the Water Quality Index (WQI) change estimates. The WQI change estimates only considered DO and BOD. The resulting meta-analysis is an amalgamation of inconsistent data sources (two continuous monitoring sources, eight other locations, etc.) that are weaved together for regulatory purposes but do not reflect instream reality. A more consistent and high-quality study of baseline environmental conditions should be conducted before any policy decisions are made about DO, BOD, or any other pollutants.
  20. A rigorous review of impacts should consider not just human activity such as discharging treated wastewater, but also how the integrity of the river itself, or channel design, could be improved to impact water quality. A river that has been artificially constrained for decades can become a poor habitat for fish even in the absence of point-sources of pollution, and as such, restoration of the river with an eye towards physical habitat restoration for species of concern should be considered alongside any incremental and expensive attempts at further point source pollution mitigation

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<sup>7</sup> United Nations Environment Programme (UNEP) Intergovernmental Panel on Climate Change (IPCC), Available at: <https://www.ipcc.ch/report/ar6/wg1/resources/climate-change-in-data/>, Accessed on February 9, 2024.

<sup>8</sup> EPA. Sampling and Consideration of Variability (Temporal and Spatial) For Monitoring of Recreational Waters. Available at: <https://www.epa.gov/sites/default/files/2015-11/documents/sampling-consideration-recreational-waters.pdf>, Accessed on February 9, 2024.

from changes in wastewater treatment infrastructure in what are ultimately industrialized riparian zones that don't promote ideal fish habitat.<sup>9</sup> Similarly, DRBC's determination that WWTP ammonia nitrogen loadings are the leading cause of oxygen depletion in the river should be reviewed and documented more completely to establish the magnitude of each identified contributor. If there are many contributors, the "leading" cause can actually refer to a small percentage of the problem.

21. Table ES-3 details an 8.8% change from baseline in dissolved oxygen and biological oxygen between baseline and 2019 restored scenarios for the upper portion of Zone 5, but EPA noted that there is no continuous monitoring station there. It is unclear how the data was obtained for Zone 5. Please confirm how DRBC obtained the data used by EPA for Zone 5 as well as any differences in approach for Zone 3 and Zone 4 in relation to the continuous monitoring stations that exist there.

## Net Economic Impacts

22. Despite the problems with the measurement of benefits noted above, the quantified benefit of \$112.8 million is ultimately less than the quantified cost of \$137.1 million. Yet, EPA dismisses what is essentially the negative finding of their benefit-cost analysis by suggesting that the quantified non-market benefits when added to unknown and unmeasured market benefits, would surely be higher than the costs. To be clear, the analysis revealed an annual shortfall of \$24.3 million dollars or \$729 million dollars over the 30-year period of analysis and if the benefit assessment had been more local and more sound, that annual and period deficit would only expand. At a minimum, the assumed large market benefits have to be better justified and quantified to establish the magnitude of positive finding that EPA asserts. Even if that is possible, the aforementioned problems of the non-market benefits established in this section would persist.

## Conclusions

23. Measuring WTP for WQI improvements is a technical science that EPA has worked to improve in recent years by increasing metadata sample size and other initiatives. However, in this case, we have demonstrated via literature review that there are a range of flaws with the approach in general as applied to this proposed rulemaking.
24. Despite the flaws in EPA's methodologies - which overstate benefit and potentially understate cost - EPA's benefit-cost analysis resulted in a significant annual negative finding for the specified zones.
25. EPA chose to dismiss that negative finding pursuant to an unsupported assumption that if measured, market benefits would enhance the total benefit when coupled with the estimated non-market benefits, thereby resulting in a positive finding. This unsupported assumption is arbitrary and capricious. EPA's analysis should be improved to better estimate and justify this key assumption if it is to be the underpinning of the cost-benefit evaluation for this rulemaking.

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<sup>9</sup> United States Department of Agriculture, Natural Resources Conservation Service. Part 654 Stream Restoration Design National Engineering Handbook, Chapter 11, Rosgen Geomorphic Channel Design, Available at: <https://directives.sc.egov.usda.gov/17771.wba>, Accessed on February 9, 2024

26. Improvement to EPA's documented non-market benefits and costs must be performed along with completion of the analysis of market benefits.

#### IV. **EPA-HQ-OW-2023-0222-0004\_EJ: Environmental Justice Analysis for the Proposed Rule: Water Quality Standards to Protect Aquatic Life in the Delaware River**

##### **General Comments**

27. The Environmental Justice analysis is based on arbitrary geographies in buffer zones of 5 or 10 miles from the specified zones of the Delaware River.
28. EPA only reviewed affordability for a case study of the City of Philadelphia, and, inexplicably, ignored areas of acute burden such as Chester, PA, which is in DELCORA's service area in specified Zone #4. EPA must evaluate environmental justice and affordability for all of the impacted utility service areas, but at a minimum must perform an evaluation for Chester, PA given its well-known environmental justice burdens.
29. EPA's affordability analysis is incomplete and inconsistent with its own CSO Control Policy Financial Capability Assessment guidance that defines the metrics used here as part of a much broader exercise.

##### **Environmental Justice**

30. Despite using a 100-mile radius to measure benefits in their Economics report, in the Environmental Justice analysis EPA arbitrarily and without explanation proposes to focus on a 5-mile buffer from the specific zones and a 10-mile control as detailed in page 18. Surprisingly, EPA finds environmental justice present in the 5-mile zone but not in the 10-mile zone and then appears to dismiss the finding in the 10-mile zone. Again, as was observed in comments on the Economics report, this is an example of EPA selecting geographies in an arbitrary manner and dismissing findings when it doesn't confirm its own hypothesis. EPA appears committed to the presumptions that its benefit-cost findings will be positive, and that environmental justice will be served by the proposed DO standards even in the face of its own analyses that reject both of those hypotheses.
31. On page 19 EPA notes that it assigned census block groups (CBGs) that straddle the specified zones and comparator geographies entirely to the specified zones. More care should have been taken to analyze those border CBGs to allocate portions of them to the specific zones and to the comparator (similar to what was done in the aggregation of data within the buffer zones using aerial information and weighting per page 21). As completed, it is unclear what the impacts of these border areas assigned to the specified zones might be. Without further analysis this brings into question the accuracy of the environmental justice review comparisons.
32. EPA looks at urban areas and rural areas in its environmental justice review but does not clarify how these are defined or how suburban areas are treated. It is possible that density analyses are

used to group suburban areas into either designation, but this is not specified. Census bureau definitions for urban and rural areas changed after 2020, so it is important for EPA to identify which definition applies in the 5-year data that was used.<sup>10</sup> Aerial imagery and surveys should be reviewed locally to confirm if the census data appear to accurately characterize the density of housing in the geographies under review as development advances, particularly given changes in housing since the Covid-19 pandemic.

33. Beginning on page 23 the Race and Ethnicity descriptions and charts do not appear to offer any statistical basis for their determinations. While it is clear from tools such as EPA EJScreen that areas of Philadelphia and Chester, PA are designated as Environmental Justice areas, it is less clear from the EPA report that in this case the 5, or certainly 10-mile buffer zones, statistically differ from the comparator areas. Statistical margins of error and an establishment of significance must be made to support EPA's asserted findings.
34. On page 32 EPA deems differences between the 5 and 10-mile zones as minor and states that they can draw the same environmental justice conclusions regardless of distance from the specified zones based on their review of the data, however, this conclusion seems to directly contradict the data reviewed in the report. The 10-mile zone findings were lower in difference in more cases than not and again, no statistical analysis is done to determine the validity of findings. Any policy decisions made on the basis of environmental injustice findings in this report would be arbitrary as a result.

## Affordability Measurement

35. EPA leverages one piece of the CSO Control Policy Financial Capability Assessment (FCA) Guidance (Residential Indicator) to measure affordability burden in their report.<sup>11</sup> It is unclear why the broader dossier of information that is required to complete an FCA or that is suggested to locally enhance it (supplemental information) is not included. These include the full financial capability matrix scoring, comprehensive cash flow analyses to analyze actual rate impacts (including CSO LTCP costs) and affordability over time, and alternative supplemental information that might include measurement at different income levels, assessment of housing and other cost of living burdens, a review of the number of households that would be driven into poverty by the new rule, measurement of burdens by race and income level, and more. EPA cannot cherry pick one FCA affordability factor. EPA must provide a full FCA-based analysis of the financial impact of the proposed rule and provide an opportunity for DELCORA to develop a dossier of supplemental information rather than arbitrarily focus on just one factor.
36. On page 22 EPA discusses assessing financial burden based upon median household income. Median income is an unsound level for measuring burden in isolation because it is above the level where households of concern (especially in environmental justice communities) experience burden and because as income inequality has expanded in the country, fewer and fewer households exist

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<sup>10</sup> <https://www.census.gov/newsroom/blogs/random-samplings/2022/12/redefining-urban-areas-following-2020-census.html>

<sup>11</sup> EPA, CSO Control Policy Financial Capability Assessment Guidance, Published February 2023, Available at <https://www.epa.gov/system/files/documents/2023-01/cwa-financial-capability-assessment-guidance.pdf>

at the median. The upper bound of the lowest quintile of income is the more relevant metric for measuring affordability burden because it is above the level at which most welfare benefits are available to households but below the level where basic household needs become affordable. These critiques have been detailed in numerous water sector and academic reports and were most recently comprehensively synthesized in the footnote referenced here.<sup>12</sup>

37. At the bottom of page 32 EPA notes that Philadelphia has the highest cost of compliance among the total of \$137.1 million dollars across all utilities, however, it is unclear if this statement applies just in total or is a per capita determination. This is potentially significant as Philadelphia has a large population to spread costs over compared with other communities and could perhaps have more or less burden than others on a per capita basis. A per capita review would more closely reflect customer rate impacts and would be a better basis for making the decision to isolate the case study to Philadelphia. Regardless, the analysis of distribution of costs and affordability should be completed in all applicable service areas before policy decisions move any further to ensure a more comprehensive understanding of this issue.
38. On page 35 EPA notes that more than one in three households in Philadelphia would experience a high burden from water and wastewater bills if this regulation moves forward. On the same page EPA then dismisses the incremental impacts of policies, including in the established Environmental Justice areas, where a high affordability burden for wastewater has already been established. This defies logic. Using this approach would set a precedent that once a high burden is established, a regulator can consume all of a vulnerable household's income with an array of regulations, while claiming that each new regulation is not contributing to the affordability problem. Once high burden is established, unfunded mandates that create additional ratepayer burden should require identifiable funding support. Isolating funding responsibility to individual service areas is to demand that utilities defy cost-of-service based rate setting in order to address vulnerable communities while a viable approach for doing that is not provided.
39. In citing the Philadelphia TAP program as one approach to mitigate existing or induced high affordability burdens in Section 3.4, EPA acknowledges that TAP is not currently reaching the majority of its intended population despite several years since implementation, and yet EPA suggests that other utilities beyond Philadelphia should adopt the program. This is presented as a mere leap of faith that the program "could" work to solve burdens however, it is not perceived to be a viable solution for DELCORA. If EPA is working to document environmental justice concerns and high affordability burdens while denying that incremental costs contribute to burdens while calling on individual ratepayers to pay for the costs of its policy; then EPA is simply making economic conditions worse for those that they already acknowledge are suffering.
40. On page 41 EPA notes that it is not possible to conduct the environmental justice review in the future due to a lack of demographic data and therefore the analysis is only for the current period. However, EPA's own FCA guidance lays out a methodology for measuring affordability over time. Yet again in those sections of the report that detail measurement of affordability burden,

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<sup>12</sup> AWWA, Developing a New Framework for Household Affordability and Financial Capability Assessment in the Water Sector, Published April 2019, Available at <https://www.awwa.org/Portals/0/AWWA/ETS/Resources/DevelopingNewFrameworkForAffordability.pdf?ver=2020-02-03-090519-813>

only a current analysis is done. Conveniently for the purposes of water quality monitoring, as detailed in the EPA Economic Report, the LTCP CSO infrastructure investments are assumed to have been made. This inconsistency where CSO LTCP costs are in this case excluded, understates the actual costs and burdens that ratepayers will experience and renders the exercise of affordability measurement arbitrary and misleading.

## Conclusions

41. Taken together EPA's Economic and Environmental Justice Reports suffer from a lack of spatial, temporal, and statistical coherence, along with a lack of rigor in following EPA's own affordability guidance. Amazingly, EPA's findings in support of its proposed regulatory action are contradicted by EPA's actual data. EPA must correct these errors in order to fairly state the economic costs and benefits as well as the impacts on affected environmental justice communities, especially the City of Chester in DELCORA's service area. The proposed rule is arbitrary and capricious in its measurement of costs, benefits, net societal impacts, and burdens that will result. These issues require further study and explanation to ensure that costs and benefits are properly assessed – especially for the environmental justice communities that will be impacted.



DELAWARE COUNTY REGIONAL WATER QUALITY CONTROL  
P.O. Box 999 • Chester, PA 19016-0999

January 20, 2023

EMAIL delivery, read receipt requested.

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RE: DELCORA Comments to EPA Water Quality  
Standards Determination of December 1, 2022

Dear Sir/Madam:

I am writing on behalf of Delaware County Regional Water Quality Control Authority (DELCORA) and the 46 municipalities we serve to express some of our concerns about the Environmental Protection Agency's (EPA) Determination concerning its intent to develop and promulgate water quality standards ("WQS") for Dissolved Oxygen for lower portions of the Delaware River estuary. EPA's intervention in the ongoing efforts of the Delaware River Basin Commission (DRBC) and the affected states is in our view unnecessary and counterproductive. Accordingly, we request that EPA reconsider the Determination and either withdraw it or instead suspend its process pending the pursuit and completion of the DRBC process on its current timeline.

On December 2 DELCORA submitted substantial comments on the draft DRBC Analysis of Attainability addressing aquatic life uses and on DRBC's Social and Economic Factors draft. DELCORA comments of December 16 addressed the draft DRBC document on Linking Aquatic Life Uses with DO Conditions in the Delaware River Estuary. Those comments provide additional information on the matters we address herein, and they are attached for EPA's information. Although these comments are considerable, DELCORA is largely supportive of the development of technically defensible WQS to protect aquatic life and support fish propagation in zones 3, 4, and upper 5 of the Delaware River Estuary.

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**EPA Legal Authority.** First, based on the advice of counsel, it is not clear that EPA has the legal authority under the Clean Water Act to impose federal WQS for DO in this instance, where the underlying designated use of aquatic life propagation was historically unattained. It is unclear to what extent the use may be currently attained, but, based on DRBC conclusions and the guarded assertions of interested parties, it is likely that propagation is at best marginal, partial or intermittent, and may be considered, if attained at all, an attained sub-use.

The CWA includes a carefully crafted federalism-based division of WQS responsibilities between EPA and the states, which do not to us clearly authorize EPA promulgation of WQS in this instance. We note that EPA's Determination does not address this issue at all, and merely makes generic references to EPA authority under CWA section 303. In any event, the matter of the aquatic life propagation use in the Delaware River estuary and DO WQS appears to be unfitting for EPA use of its purported CWA legal authority as indicated by the Determination.

**Interference with the DRBC Delaware River Estuary Process.** As you know, DRBC, the states of Pennsylvania, New Jersey and Delaware, the major dischargers, and other interested parties are, and have been for years, involved in a substantial collaborative and transparent technical process addressing designated uses and water quality in the Delaware River estuary. EPA and its Regional Offices have been active participants and supporters of this process.

With the recent publication of DRBC's draft documents addressing uses, potential WQS, attainability including economic and social impacts, and other relevant matters, the DRBC process is at a critical stage. Given DRBC's goal for development of DRBC WQS for DO by early 2025, which are likely to represent a substantial consensus position among the states and many or all of the major participants in the ongoing DRBC process, it is difficult to understand how EPA believes that its intervention, and potential draft DO standards by late 2023, would benefit the larger process of water quality in the estuary.

Our preliminary analysis, and we believe that of some other participants in the DRBC process, of EPA's Determination raises concerns about possible incomplete or incorrect information on which EPA may have relied from the draft DRBC Attainability Analysis. The substantial comments submitted by DELCORA and others address these matters, and we anticipate that a later second draft or final DRBC document will provide more complete and accurate information. Such changes are the natural intended result of a draft document and comment period, and EPA should have anticipated later DRBC changes to some of the included information and conclusions.

In any event, and irrespective of legal authorities, we believe it is highly inappropriate for EPA to intervene in the WQS process of DRBC and the states in the

manner it has done in the Determination. The shorter timeline for WQS proposal anticipated by EPA would seem to be insubstantial compared with the DRBC timeline. More importantly, the DRBC process is more all-encompassing, including the designated use, DO standards, projections and information on social and economic impacts, and initial or preliminary wasteload allocation information for the major dischargers to the estuary. The EPA process would at best address designated uses and WQS. The DRBC process is also far more finely tuned to the needs of the shared waters of the estuary and the states by virtue of the breadth of the process. The pendency of the EPA process will surely divert some of the attention of DRBC, the states and the other process participants from this more advantageous, current strongly-consensus-based approach to water quality in the estuary.

**The Social and Economic Burden on Communities and Rate Payers is a Major Concern.** As DELCORA's comments on the draft DRBC Social and Economic Factors document and the comments of others illustrate, new WQS for DO in the Delaware River estuary have the potential for excessive and unnecessary financial burdens to communities within the region. We recognize the limited role that economics may play in the development of federal WQS. However, the far more tailored DRBC approach is far better suited to address the issues of these impacts; and the more tailored approach should be expected to lead to a more systematic and earlier implementation process, and to a lessened need for extended compliance schedules.

**Conclusion.** It is concerning that, after years of EPA participation in the DRBC Delaware River estuary process, which participation we believe has been active and embraced by the other participants, and with the DRBC process on the verge of final decisions on estuary designated uses and WQS for DO, EPA has unilaterally decided to adopt federal WQS in an abbreviated timeframe propose. EPA's Determination ignores the critical primary role of DRBC set out and approved by Congress in the DRBC Compact, and ignores many years of successful work among DRBC, the states, interested parties and EPA on water quality efforts. Even separate from the point of DRBC authorities and state primacy in WQS development, EPA's determination is a severe turn away from the principles of federalism that underlie the CWA division of authorities as to WQS among EPA and the states.

The parallel EPA WQS development process undertaken and abruptly announced by EPA may ultimately delay both current underway water quality projects, and the larger process of WQS implementation and full achievement of the propagation element of designated uses in the estuary. Accordingly, we request that EPA reconsider the Determination in light of DELCORA's comments herein and in the earlier comment documents to DRBC, and comparable comments that we believe EPA may receive from other affected dischargers. As requested initially, EPA should either withdraw its Determination or suspend its process pending the pursuit and completion of the DRBC process on its current timeline.

Regardless and as noted above, the agency should be made aware of comments submitted to DRBC by DELCORA on several draft documents to be used in the development of WQS. As previously noted, these documents, upon which EPA may have relied upon in its Determination, are *draft* documents and our preliminary analysis raises concerns about possible incorrect and incomplete information. Those comments provide additional information on the matters we address herein, and they are attached for EPA's information. As stated above, DELCORA is supportive of the development of technically defensible WQS to protect aquatic life and support fish propagation in zones 3, 4, and upper 5 of the Delaware River Estuary; however, we believe the development of these WQS should remain with the DRBC leading this process for the Delaware River Estuary.

Thank you for EPA's further consideration of these comments and of its involvement in the efforts of DRBC and all of the affected parties in the matter of water quality in the Delaware River estuary.

Sincerely,



Charles Hurst P.E.  
Director of Engineering

Digitally signed by  
Charles Hurst  
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CNH:mc  
enclosure

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DELAWARE COUNTY REGIONAL WATER QUALITY CONTROL AUTHORITY  
P.O. BOX 999 • CHESTER, PA 19016-0999

December 2, 2022

VIA EMAIL ONLY  
READ RECEIPT REQUESTED

via email: [john.yagecic@drbc.gov](mailto:john.yagecic@drbc.gov)

John Yagecic, P.E.  
Manager, Water Quality Assessment  
Delaware River Basin Commission  
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West Trenton, NJ 08628

Re: Draft (1) Analysis of Attainability: Improving Dissolved Oxygen and Aquatic Life Uses in the Delaware River Estuary; (2) Social and Economic Factors Affecting the Attainment of Aquatic Life Uses in the Delaware River Estuary

Dear Mr. Yagecic:

Please accept the following and attached comments of and on behalf of Delaware County Regional Water Quality Authority ("DELCOA") on the Delaware River Basin Commission ("DRBC") September drafts of the subject Analysis of Attainability and Report on Social and Economic Factors. We believe the draft Analysis of Attainability positively moves forward the process of addressing the full range of aquatic life designated uses in the affected waterways, and the Social and Economic Factors draft should be used as a starting point for the more complete evaluation of these factors. The following is a summary of DELCOA comments at this stage of the DRBC process.

**The Draft Analysis of Attainability.** DELCOA has engaged Brown and Caldwell ("BC") to review all aspects of the draft report entitled "*Analysis of Attainability: Improving Dissolved Oxygen and Aquatic Life Uses in the Delaware River Estuary*". The goal of this review was to provide a technical evaluation of whether the draft models and the attainability analysis were technically defensible and appropriate for the intended scientific and regulatory purposes. This report with associated comments is identified as "Attachment A" and is formally submitted by DELCOA to DRBC. DRBC may also reference the DELCOA/BC report ("Attachment A") for more detailed analyses and rationale to support these comments. Below is the outline list of DELCOA comments generated from the BC report.

John Yagecic, DRBC

Comments to DRBC on Analysis of Attainability and Social and Economic Factors

December 2, 2022

page 2 of 7

1. *The 3-D hydrodynamic model is well constructed and well calibrated for use in the attainability analysis.*
2. *The water quality model is well-calibrated to dissolved oxygen (DO) in the warm weather months, with other limitations that should be either addressed or recognized during application.*
3. *The water quality model is not well calibrated to ammonia in spring conditions. This calibration should be improved, using lower nitrification rates.*
4. *The water quality model has little predictive power for phytoplankton, and so is better applied as a DO sag model rather than as a eutrophication model.*
5. *The model underestimates the 1<sup>st</sup> percentile DO. This bias should be either corrected or directly considered when predicting the degree of non-attainment with DO targets.*
6. *The assumption that SOD and sediment ammonia fluxes would not respond to ammonia reduction is overly conservative. These values should be adjusted downward for model scenarios.*
7. *The manner in which CBOD was calculated for model scenarios is unclear; request for more clarity.*
8. *The environmental conditions of year 2012 are more infrequent than regulatory precedents for critical conditions. The critical condition should represent a 1-in-10 year frequency.*
9. *The HADO approach would result in overprotective DO criteria. The DO goal for the attainability analysis (and future criteria) should be based on the water quality that is suitable for fish propagation. Any higher DO targets should be non-regulatory in nature.*
10. *DRBC should consider the combined use of the DRBC linkage analysis and the Chesapeake Bay DO criteria to set DO targets for the Delaware Bay estuary.*
11. *The attainability analysis does not consider the seasonal succession of life stages. The strictest DO criteria should only apply during the early spawning and larval period.*
12. *The attainability analysis must consider the increased difficulties and decreased efficiencies of nitrification as temperatures decrease.*
13. *The attainability analysis should evaluate science-based DO targets with the appropriate averaging periods.*
14. *DELCORA does not have a significant impact on low DO in the FMA, and so should be categorized as a Class A discharge rather than a Class A' discharge.*
15. *The use of point source design flows in scenarios is very conservative, and points to the need for load-based permit limits and high flow exceptions.*
16. *DRBC and regulated facilities should consider allocations based on ultimate oxygen demand (UOD), which could increase WWTP operational flexibility.*
17. *The modeling and attainability analysis have multiple conservative elements, several of which should be adjusted to avoid an overly conservative evaluation*

As we address in more detail in our attached comments, we conclude that the hydrodynamic model is properly calibrated based on the best available data. The water quality model is well calibrated to DO for the summer months, but we recommend some improvements to ensure that it can properly simulate response of DO to ammonia reduction during the spring fish spawning period. Our review revealed that the modeling and analysis includes various conservative assumptions and elements (Comments Table 4). Although some level of conservatism is appropriate, the collective assumptions would cause the resulting DO goal or implementation to be overprotective. In using the term “overprotective” we do not suggest that any shortcuts should be taken in protecting aquatic life, including the propagation of aquatic life. But, natural water quality is always variable, aquatic life are typically not adversely affected or only temporarily affected by transitory water quality issues, and it is incumbent on all of us to focus on protections of the designated uses rather than on any ideal benchmarks.

Several of our most important comments address the process and goals of the Analysis of Attainability, and address draft conclusions that may bias the later adoption of aquatic life water quality standards, as well as implementation through NPDES permit requirements.

The methodology of the attainability analysis has other, longer-term implications for permitting. DELCORA should be classified as a Class A (rather than Class A') discharge because the attainability analysis clearly demonstrates that DELCORA has very little impact on low DO in the FMA.

The assumption that all point sources discharge at full design flow throughout a dry, low-flow period is unrealistic. Concentration limits resulting from this approach would be excessively conservative (low), and so any resulting limits should be expressed as load limits rather than concentration limits. Some facilities might also merit high-flow exceptions to limits, which would not compromise fish propagation. We also recommend that the partnership explore the benefits of permit limits based on UOD.

#### **The Draft Social and Economic Factors Analysis.**

Like the review of the Analysis of Attainability, DELCORA has engaged Raftelis Financial Consultants, Inc. to review all aspects of draft report entitled “*Social and Economic Factors Affecting the Attainment of Aquatic Life Uses in the Delaware River Estuary*” (Draft Report). The review provides an assessment of whether the evaluation of the social and economic factors affecting the attainment of aquatic life uses is technically defensible and appropriate for the intended scientific and regulatory purposes. This report with associated comments is identified as “Attachment B” and is formally submitted by DELCORA to DRBC. DRBC may also reference the Raftelis report (“Attachment B”) for

more detailed analyses and rationale to support these comments. Below is the outline list of DELCORA comments generated from the Raftelis report.

1. *We approve of applying latitude in developing the methodology for evaluating social and economic factors in the ever-evolving area of customer affordability and community/utility financial capability measurement.*
2. *DRBC did not choose to wholly follow any directly applicable or currently approved federal or state law, legislation, or guideline, nor comprehensive industry best practices in their chosen methodology for conducting the social and economic assessment.*
3. *The Draft Report has selected elements of household affordability methodologies from three primary sources in developing its approach for identifying and measuring any widespread social and economic impacts resulting from costs to be incurred for Tier 1 Utility treatment upgrades required to attain the desired aquatic life uses. There is not however a clear explanation presented in the Draft Report as to why the DRBC selected specific elements while rejecting others from the three sources.*
4. *There is a need for greater clarity on how DRBC is defining the social and economic assessment and whether it is truly focused on household affordability, utility and community financial capability, or something broader and less well defined.*
5. *To the extent that DRBC is focused on household affordability and financial capability, some elements that should at a minimum be added to the Draft Report include measurement of impacts over time, utility-specific cash flow modeling, equity considerations, more exploration of sub-geographic impacts, inflation factors to reflect current dollars, and broader cost of living measures.*
6. *For EPA 2022 one area the Draft Report could be expanded to include so as to provide a more complete evaluation of social and economic factors, would be to include the Lowest Quintile Poverty Indicator scoring exercise, which introduces additional metrics for review as part of the FCA.*
7. *The collective goal of DRBC and its regulated communities should be to collaboratively develop an honest triple bottom line assessment of social and economic factors, not a simplified comparative scoring or ranking that does not reflect the reality experienced by communities, utilities, and households.*
8. *Where available, more current Census data should be considered for incorporation.*
9. *In the second to last paragraph of page 5 DRBC reveals how census tracts that straddle service areas were apportioned to regulated communities. The regulated communities should be granted the opportunity to verify census tracts and populations within their service area based on their own billing data and address matching to census tracts, where possible, to ensure accuracy.*
10. *Local utility specific information on typical consumption by census tract should be analyzed to better estimate consumption per capita and ultimately to calculate more accurate bills by census tract.*

11. *Despite seeking to find data that differentiates household consumption levels based on housing density, on page 9 of the Draft Report it appears the DRBC applies a uniform household size of 2.65 to all households in their analytics. This would particularly penalize large low income households. Data is available on household size from census and should be locally applied.*
12. *Another factor that could potentially be softening burdens in high density low income areas is described on Draft Report page 9, where DRBC notes the application of a 10% wastewater consumptive use rate assumption. Urban households are less likely to irrigate or have other outside water uses and therefore, regulated communities should be permitted to provide variable assumptions for the consumptive use rate where local data is available.*
13. *DELCORA would like to have the opportunity to review all calculations and assumptions required to produce Table 5 on page 10 of the Draft Report. Please provide the data sources, and calculations in Microsoft Excel format with all formulas intact as well as detail on any assumptions required for analysis of \$/gallon (water and wastewater) and \$/household/month (stormwater).*
14. *DRBC's assumptions about consumption per capita relative to community density, likely contradict DRBC analyses conducted in DELCORA's subareas to apportion treatment costs.*
15. *DRBC's treatment of financial capability metrics in the report Appendix and narrative is dismissive of those metrics and their results, and also reflects a narrow interpretation of their applicability.*
16. *In the second to last bullet on page 12 DRBC notes that separate computations that were independently manually produced by another staff member resulted in differences that were then resolved. A fuller description of the cause of those differences should be shared with the regulated communities to understand their nature and demonstrate that communities should get involved in the process and collaboratively share their own evaluations for validation.*
17. *The Costs per Household detailed on page 14 for ammonia at 1.5 mg/L are lower than those calculated by DELCORA (\$1,377.07 vs. \$1,480.00 (or +7%)) in the aforementioned FCA RI analyses developed for EPA and should be reconciled by working with DELCORA staff.*
18. *AWWA 2019 notes that the thresholds it proposed when analyzing bills as percentage of income as well as those included in EPA guidance for cost per household as a percentage of income required further study. As such an over-reliance on such metrics in the Draft Report is limited in its ability to provide a useful social and economic assessment, and a broader dossier of information should be developed.*
19. *On page 18 it would be helpful to understand how the three included PWD alternatives were selected among the 125 noted as possible.*
20. *On page 19 and 20 DRBC describes a sensitivity analysis that was undertaken to assess impacts of use attainability investments to achieve 1.5 mg/L ammonia across*

*a dataset of historical interest rates and loan terms. Was this analysis conducted for attainment of nitrogen 4 mg/L?*

21. *The Monte Carlo simulation detailed in the Draft Report appears to defend assumptions around interest rates and loan payback periods that the regulated communities do not agree with. These assumptions should be changed to better reflect expected financing terms particularly because spreading costs over a longer period reduces the magnitude of debt service payments in any given year and therefore underestimated affordability burdens.*

As to the draft DRBC analysis of Social and Economic Factors, DRBC has employed an arbitrary selection of elements of household affordability analyses from selected primary sources, including unfinalized 2021 and 2022 EPA guidance documents focusing on Combined Sewer Overflow proceedings and remedies. Given this limited basis, the limited focus on household affordability and absence of substantial consideration of broader utility and community financial capabilities, DELCORA recommends that DRBC engage in a broader collaborative approach with its regulated communities that is grounded in industry best practices. This will ensure that a fair, equitable, and impactful social, economic, and environmental assessment is developed.

Unfortunately, the approach taken by the current draft suffers from a number of problems including the relegation of other important economic elements to an Appendix or their exclusion entirely; and the failure noted above to address a broader set of metrics affecting utilities and communities. With respect to the focus on household affordability metrics, the draft suffers from an absence or insufficiency of analysis of economic impacts over time; inflation; equity and sub-geographic disparities, and other issues noted in our attached comments. Particularly as to issues of Environmental Justice our more detailed comments identify numerous ways in which the current abbreviated economic approach fails to adequately consider the affected communities.

In light of these shortcomings the draft analysis effectively limits its use by DRBC, the affected utilities and communities, and anyone who may rely on DRBC's evaluation of social and economic impacts when considering potential changes to the identification of instream designated uses, possible new water quality standards, and an implementation framework. The initial limited economic projections, even though they are in draft, carry the risk of biasing the direction of the larger process going forward. Accordingly, DELCORA recommends that the DRBC process of evaluation of social and economic factors going forward include and be more directly based on consultations with the regulated community as a whole as well as individually with the affected utilities and municipalities.

Finally, we recommend that DRBC's more complete analyses of social and economic factors consider appropriate technical issues that we address in our attached comments on the draft Analysis of Attainability, including but not limited to consideration of

John Yagecic, DRBC  
Comments to DRBC on Analysis of Attainability and Social and Economic Factors  
December 2, 2022  
page 7 of 7

modifications or alternatives to DRBC's initially recommended Analysis of Attainable Scenarios (AA08) and Highest Attainable DO Condition (HADO). Clearly a proper analysis of social and economic impacts is incomplete in the absence of an evaluation of all reasonable alternatives to the underlying water quality issues and projects.

In summary, DELCORA is supportive of the DRBC in its endeavor to successfully develop technically defensible water quality standards to protect aquatic life and support fish propagation in zones 3, 4, and upper 5 of the Delaware River Estuary. The draft Analyses on the subjects of Attainability and Social and Economic Factors are a progressive step to achieving that goal. However, DELCORA respectfully submits these comments because of overarching concerns that the current overconservativeness and technical deficiencies of the AA in combination with an incomplete analysis and oversimplification of social and economic impacts will result in DO criteria that is not only overprotective of fish propagation, but at costs that are presently unrecognized and have the significant potential to place undue burden to our communities. Left unchecked, the compounding issues of overprotective water quality and unrecognized burden will cause unnecessary investment of public funds. This is particularly problematic when there are many competing needs for those precious public funds such as exists today. DELCORA's commitment to environmental responsibility must also be balanced alongside our fiscal responsibilities to ensure fair and equitable service.

As always, DELCORA will provide any needed further information on these comments that may be necessary or helpful.

Sincerely,



Digitally signed by Charles Hurst  
Date: 2023.01.20 15:33:41 -05'00'

Charles Hurst, PE, BCEE  
Director of Engineering

CNH:bab  
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cc: Jim Kern, PE – DELCORA Chairman  
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Irene Fitzgerald – DELCORA  
Robert Willert – DELCORA  
Dick Sedgley – AquaLaw  
Clifton Bell PE, PG – Brown and Caldwell  
Zachary Green – Raftelis Financial Consultants, Inc.  
Mike Hope – Greeley & Hansen (DO Partnership Facilitator)  
File

**Attachment A**

**DELAWARE COUNTY REGIONAL WATER QUALITY CONTROL AUTHORITY**

**Comments on Delaware River Basin Commission**

**Draft Analysis of Attainability:**

**Improving Dissolved Oxygen and Aquatic Life Uses in the Delaware River Estuary**

**December 2, 2022**

## Background

In September, 2022 the Delaware County Regional Water Quality Control Authority (DELCORA) and other Tier 1 Dischargers in the Delaware River Estuary received notification from the Delaware River Basin Commission (DRBC) regarding the issuance of the draft analysis of attainability reports and opportunity for document review and comment. DELCORA and Brown and Caldwell have performed a review of several DRBC reports related to the ongoing aquatic life designated use study for fish propagation in the Delaware River Estuary. The goal of the review was to provide a technical opinion of whether the draft models and the attainability analysis were technically defensible and appropriate for the intended scientific and regulatory purposes. The primary documents reviewed were accessed from the DRBC website ([https://www.nj.gov/drbc/about/advisory/WOAC\\_index.html](https://www.nj.gov/drbc/about/advisory/WOAC_index.html)) in October 2022 and are titled as follows:

- *Modeling Eutrophication Processes in the Delaware River Estuary: Three-Dimensional Hydrodynamics Model* (DRAFT; December 2021) & Appendices A-N (DRBC, 2021)
- *Modeling Eutrophication Processes in the Delaware Estuary: Three-Dimensional Water Quality Model* (DRBC, 2022a)
- *Analysis of Attainability: Improving Dissolved Oxygen and Aquatic Life Uses in the Delaware River Estuary* (DRBC, 2022b)

We also reviewed various other DRBC documents on the website to gain additional background on the attainability analysis. Our major comments are presented below. Note these comments do not include a complete review of the draft report entitled *Linking Aquatic Life Uses with Dissolved Oxygen Conditions in the Delaware River Estuary* (DRBC, 2022c), because that report was only made available late in the review period of the other reports. Our understanding is that DRBC has set a separate review period for the linkage report.

## Section 1: Technical Review of the Models

The following comments pertain to the set up and calibration of the 3-D hydrodynamic and water quality models used for the attainability analysis.

1. *The 3 D hydrodynamic model is well constructed and well calibrated for use in the attainability analysis.*

The selected model code (EFDC) is appropriate. The model grid, boundary conditions, and algorithms appear to be adequate for the intended purpose of simulating hydrodynamic and mass transport in the Delaware River Estuary. We believe the hydrodynamic model was properly calibrated based on the best available data. Several statistical parameters were used to quantify the quality of the calibration. Consistent high correlation coefficients (R square) demonstrate that the conducted calibration of the hydrology and hydraulics parameters is reasonably appropriate. Specifically, acceptable model calibration was achieved for the following:

- The dominant constituents of the M2, M4 and M6 tidal amplitudes throughout the different locations of the Delaware River.
- The water surface elevation and the current velocity which represent the hydrodynamic nature of the mass conservation and momentum of the governing equations.

- Temperature and salinity which are part of the Equation of State and an indicator of the transport of water quality parameters.
- The model-to-data comparisons of the predicted model results against the samples collected by boat reassured positively that the salinity calibration was properly achieved.

The model has the typical model limitations related to the preparation of model inputs and the best available data that could be identified with gaps in the datasets or lack of information on specific parameters. Nevertheless, these limitations seem to be addressed properly with reasonable assumptions.

A potential limitation that was mentioned in the document is the model to data comparisons for the underprediction of the salinity intrusion under wet weather or high flow conditions. This is not expected to be a major drawback for the attainability analysis, which focuses on lower flow conditions. The report documented the testing of the sensitivity of model results result to the vertical grid resolution, but not to the horizontal grid resolution. It is recommended that the authors document the grid dependency test on the horizontal plane, to increase confidence that the chosen grid resolution is appropriate.

2. *The water quality model is well calibrated to dissolved oxygen (DO) in the warm weather months, with other limitations that should be either addressed or recognized during application.*

In the attainability analysis, the water quality model was primarily used to predict DO during the May 1 – October 15 period. Hence, an important topic of review is whether the water quality modeling framework is accurate at predicting how DO during the period would change in response to water quality management scenarios. Our consultants considered this by reviewing the model set up, calibration, and corroboration results.

Based on that review, we conclude that the water quality model includes the major mechanisms that would be expected to control DO in the Delaware River Estuary, including reaeration, oxidation of CBOD, nitrification, sediment oxygen demand (SOD), and phytoplankton growth. The major coefficients controlling the simulation of these factors are within plausible ranges. Allowing the possibility of adjustments to some of these mechanisms (as discussed in comments below), it appears that the model is well calibrated to DO. This conclusion is based on favorable calibration statistics for DO, graphical fits of modeled to observed data, and the fact that the calibrated model performed reasonably well at predicting DO during the 2012 corroboration period. The model predicts the major seasonal patterns and the approximate location of the DO sag. For the summer months, the relative effects of different DO sources and sinks also appear reasonable outside of algal bloom periods. Based on the above, it appears that the model is useful for simulating potential changes in DO from changes in ammonia and CBOD5 loading during the warm weather months.

Notwithstanding the overall favorable DO calibration, we also believe the model has limitations that should either be addressed or should affect the manner of model application. For example, the calibration needs improvement for the spring months, and the model has limitations for accurately predicting the extremes of the DO distribution (e.g, the 1<sup>st</sup> percentile). Model limitations are addressed in separate comments below.

3. *The water quality model is not well calibrated to ammonia in spring conditions. This calibration should be improved, using lower nitrification rates.*

Although the water quality model seems well calibrated to ammonia during the summer months, it significantly underpredicts ammonia during the winter and spring in much of the model domain, apparently due to an overprediction of nitrification in these seasons as seen in Figure 1.

DBRC (2022a) acknowledges this fact and states that it is “perhaps due to a single nitrification rate employed in WASP or/and an inexact representation of temperature effects on nitrification.”

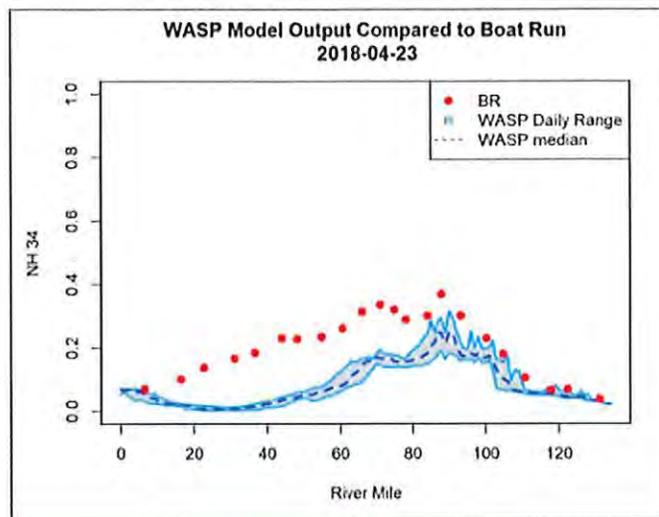


Figure 1 – Example of spring underprediction of ammonia. Source: Appendix F2 of DRBC (2002a).

We assume that the favorable DO calibration to the overall seasonal pattern was partly achieved by underprediction of nitrification and over or underprediction of some other DO source (e.g., phytoplankton) or sink (e.g., SOD). Hence, the current model might not be accurate at predicting how DO would respond to ammonia reductions during the spring months.

Accordingly we strongly recommend that the calibration of ammonia to winter and spring conditions be improved. Although the existing draft attainability analysis focuses on the May – October 15 period, alternative versions of the attainability analysis might distinguish between early spawning periods (including spring months) and later summer months. (See comment 11 for the more discussion of this topic). Hence, the model should be well calibrated to ammonia for a wide range of seasonal conditions. Additional exploration would be required to determine if the colder month ammonia calibration is best achieved by use of a different maximum nitrification rate by season or adjustment of coefficients related to the temperature dependence of nitrification. In addition to temperature effects, higher flows have been observed to “wash out” or otherwise reduce nitrifiers in some coastal waters (e.g., Haas and others, 2021), and so changes in seasonal flow conditions are another possible cause of seasonally dependent nitrification rates.

4. The water quality model has little predictive power for phytoplankton, and so is better applied as a DO sag model rather than as a eutrophication model.

Some of the calibration statistics for phytoplankton (chlorophyll a) are relatively poor. For example, as noted on p. 115 of DRBC (2022a), the Nash Sutcliffe efficiency for phytoplankton was less than zero, indicating that the model has little predictive capability for this variable. Similarly, the model is not capable of reliably predicting larger bloom events. The report describes various investigations that the authors performed to identify the cause of the model's limitation in this regard. The sensitivity analysis indicated that that DO predictions are sensitive to the phytoplankton related coefficients.

We conclude that the low predictive power for phytoplankton does not invalidate use of the model for predicting DO changes in response to CBOD or ammonia load reductions. This is because phytoplankton is not expected to change significantly in response to CBOD5/ammonia reductions, and critical conditions for DO would probably not include high summer blooms events. However, with the limited ability to predict changes in phytoplankton, we do not believe this model should be characterized as a “eutrophication” model. Rather, it is a DO sag model that is calibrated to an average trophic condition. We do not recommend using this model to quantify changes in trophic condition from nutrient reductions (except as part of a gross sensitivity analysis), nor to predict DO in any scenarios in which the phytoplankton was predicted to change significantly from the average observed condition.

5. The model underestimates the 1<sup>st</sup> percentile DO. This bias should be either be corrected or directly considered when predicted the degree of non-attainment with DO targets.

The water quality model was applied to predict various DO metrics including the 1<sup>st</sup> percentile DO. It is unclear that the model framework is capable of accurately predicting this extreme of the temporal distribution of DO. The model calibration statistics presented in DRBC (2022b) do not allow direct evaluation of the model’s capabilities to predict the 1<sup>st</sup> percentile of the data distribution. This is not unusual, because water quality model calibration rarely focuses on the extremes of the distributions. However, Appendix F3 of DRBC (2022b) do allow comparison of the predicted and observed DO frequency distribution, including percentiles as low as 10%. This information would suggest that the overall fit is good, but that model underpredicts the low percentiles of DO within the fish maintenance area (FMA) by 0.4 to 0.9 mg/L (Table 1). Presumably this negative bias extends to the 1<sup>st</sup> percentile as well.

Table 1. Predicted and Observed 10 <sup>th</sup> Percentile DO [Values taken from Appendix F3 of DRBC (2022a)]			
Value	Benjamin Franklin Bridge	Paulsboro	Marcus Hook
DO Observed (mg/L)	6.00	5.92	5.97
DO Predicted (mg/L)	5.51	5.02	5.61
Underprediction (mg/L)	0.49	0.90	0.36

Because of the way that the water quality model is being used in the attainability analysis, it is more important that the model accurately predict low DO values than average or high DO values. We recommend that the model team consider ways to reduce the model’s predictive bias in the lower DO percentiles. To the extent some low bias remains, interpretations of model scenarios should include the explicit acknowledgement that the model underpredicts the 1<sup>st</sup> percentile in the FMA by 0.4 to 0.9 mg/L depending on location. This bias should be considered when interpreting results; the 1<sup>st</sup> percentile DO values that are slightly below a DO target should not necessarily be interpreted as non attainment.

6. The assumption that SOD and sediment ammonia fluxes would not respond to ammonia reduction is overly conservative. These values should be adjusted downward for model scenarios.

The water quality model was developing using observed SOD and nutrient flux values rather than a sediment diagenesis model. Although this approach is acceptable, it is overly conservative to

assume that SOD and sediment ammonia fluxes will remain unchanged despite major reductions in water column ammonia concentrations. This approach would compound the conservativeness of assuming that sediment nutrient fluxes based on August data would be maintained year round. If a sediment diagenesis model had been used with management scenarios, it would presumably predict reductions in SOD and sediment nutrient fluxes caused by lower ammonia in sediment pore water (DiToro, 2001). An accepted practice for models with sediment diagenesis is to run the model under reduced loading conditions until sediment fluxes and SOD reach dynamic equilibrium, and to then use these values as the initial conditions for model scenarios (e.g., Shen and Qin, 2019). In this manner, the model represents the long term benefit of reducing loading on SOD and sediment fluxes.

In the absence of a sediment diagenesis model, we recommend that DRBC make reasonable estimates of how much SOD and sediment ammonia fluxes would decrease in response to ammonia load reductions. The Washington Department of Ecology has developed a relevant spreadsheet based tool (SedFlux) based on the methods of DiToro (2001) and Cerco and Cole (1995). This tool could be used to estimate the approximate SOD and nutrient flux reductions to use in model scenarios.

7. The manner in which CBOD was calculated for model scenarios is unclear; request for more clarity.

We recommend that the water quality modeling and attainability analysis report identify the time period associated with CBOD; e.g., utilize terms such as CBOD5 and CBODU instead of simply CBOD where appropriate. Appendix D of DRBC (2022a) provided details regarding CBODU calculations from DOC, TOC, or CBOD5 for the calibrated model. Assumptions related to the translation between CBODU and CBOD5 or CBOD20 concentrations for model scenarios should also be documented, even if it is to clarify that the same calculations were applied in reverse. Some NPDES permits include implicit assumptions regarding these translations, and so their documentation would facilitate comparison of how model assumptions compare with permit assumptions.

## Section 2: Review of the Attainability Analysis

The following comments pertain to other aspects of the attainability analysis such as the water quality goal, process, and longer term regulatory implications. Most are based on review of the *Analysis of Attainability: Improving Dissolved Oxygen and Aquatic Life Uses in the Delaware River Estuary* (DRBC, 2022a).

8. The environmental conditions of year 2012 are more infrequent than regulatory precedents for critical conditions. The critical condition should represent a 1 in 10 year frequency.

The attainability analysis is based on the year 2012, which DRBC (2022b) states “resulted in the lowest estuary DO condition in more than twelve years”. The box and whisker plots presented in the report as seen in Figure 2 suggest that 2012 was the lowest DO condition in more than 13 years, if 2022 is included. Because only thirteen years are included in those graphs, the actual recurrence interval could be significantly longer.

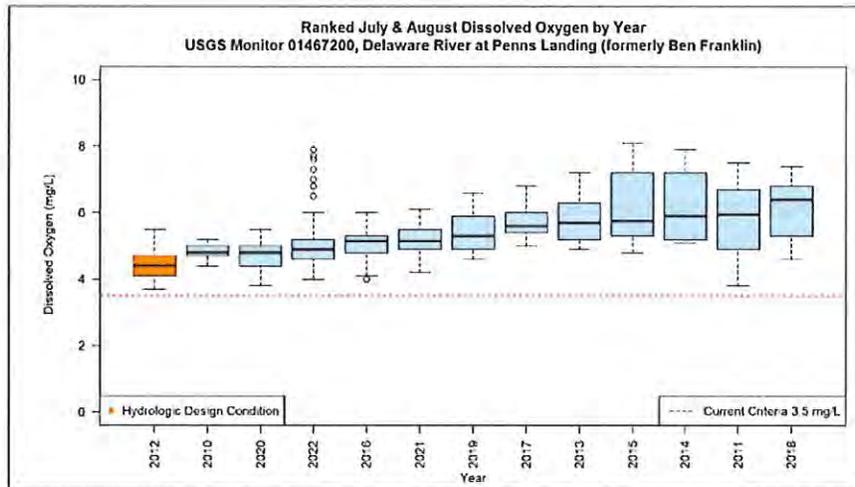


Figure 2 – Dissolved oxygen at Penn’s Landing during July and August from 2010-2012. Source: Figure 2-5 of DRBC (2022b)

A one in thirteen (or more) year frequency is more stringent than regulatory precedents for water quality management and permitting. Water quality criteria for aquatic life protection are usually interpreted as having a one in three year allowable exceedance frequency. As stated by USEPA (1985):

Most aquatic ecosystems can probably recover from most exceedances in about three years. Therefore, it does not seem reasonable to purposely design for stress above that [occurring] more than once every three years on the average.

USEPA's technical support document for NPDES permitting (USEPA, 1991a) specifically references the one in three year period in the context of dynamic water quality modeling for setting wasteload allocations as noted below:

The outputs from dynamic models can be used to base permit limits on probability estimates of receiving water concentrations rather than worst case conditions...the return frequency is usually one event in 3 years...

The one in three year frequency would be most relevant if the attainability sought to quantify individual criteria exceedances, which is not necessarily the case. However, NPDES permits and most TMDLs do not use a critical condition that is less frequent than 1 in 10 years. For example, water quality based permit limits for aquatic life protection are often derived using a 7Q10 or 1Q10 streamflow that occurs every ten years on average. The Chesapeake Bay nutrient and sediment TMDL used a critical condition based on a 1 in 10 year return period, and the associated TMDL document (USEPA, 2010) justified this approach by citing other TMDL precedents, precedents for NPDES permitting, etc.

Based on regulatory precedents, we recommend the use of a critical condition with a 1 in 10 year return interval. Based on the information provided in section 2.4.1 of the attainability analysis report, this would be conditions similar to those of 2022, or 2016 if based on streamflow at Trenton, NJ. If the 2012 period is retained for analysis purposes, the low frequency of this condition should be considered a conservative element, and some level of exceedance of water quality targets should be accepted.

9. The HADO approach would result in overprotective DO criteria. The DO goal for the attainability analysis (and future criteria) should be based on the water quality that is suitable for fish propagation. Any higher DO targets should be non regulatory in nature.

The Clean Water Act (CWA) and associated regulations and guidance are founded upon the attainment of water quality standards, which "...consist of the designated uses of the navigable waters involved and the water quality criteria for such waters based upon such uses." (CWA Section 303l(2)(A)). As stated by USEPA in the *Water Quality Standards Handbook* (USEPA, 1994):

If a [water quality] criterion is exceeded, the water quality may pose a human health or ecological risk, and protective or remedial action may be needed.

Under this definition, water quality criteria are not developed as optimum conditions, a subjective concept of "excellent" water quality, nor the highest water quality that could be attained. Rather, water quality criteria represent "a reasonable and adequate amount of protection" of a use, recognizing that "because aquatic ecosystems can tolerate some stress and occasional adverse effects, protection of all species at all times and places is not deemed necessary." (*Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses*, USEPA (1985)).

Because of the CWA definition of water quality standards, water quality criteria promulgated by the USEPA and states generally represent the base level of water quality needed to support the use. For example, as stated by USEPA (1986) with regard to nationally promulgated freshwater DO criteria:

The average dissolved oxygen concentrations selected are values 0.5 mg/L above the slight production impairment values and represent values between no production impairment and slight production impairment. Each criterion may thus be viewed as an estimate of the threshold concentration below which detrimental effects are expected.

This is a very different approach than setting the criteria at levels considering to be optimum, associated with no effects anywhere or anytime, or that exceed the levels needed to support the use.

By taking the HADO approach in the attainability analysis, DRBC appears to be on a path to setting the water quality criteria higher than needed to support the use. For example, the attainability analysis describes the HADO as:

an *excellent* [emphasis added] DO condition for any estuary...[that] will exceed (i.e., be better than and result in more DO than required by) the criteria established by EPA to protect DO sensitive fish in the Chesapeake Bay...

This approach is not consistent with the CWA framework nor with USEPA guidance on developing water quality criteria, as described above. It is recommended that DRBC derive a water quality criterion that represents a reasonable and adequate level of protection to support fish propagation, and consign any more stringent water quality goals to non regulatory status or antidegradation policies.

10. DRBC should consider the combined use of the DRBC linkage analysis and the Chesapeake Bay DO criteria to set DO targets for the Delaware Bay estuary.

The attainability analysis (DRBC, 2022b) states the following:

The current state of science does not allow us to know in advance exactly what degree of propagation will be associated with a particular DO condition; we can say with certainty that, within a range in which fish are sensitive to DO, more DO is better. Based on a comprehensive assessment of the available literature (DRBC, 2022c), that range appears to be approximately 4.3 mg/L to 7.0 mg/L

The statement above appears to be a basis for the major policy decision to set the water quality goal based on the HADO rather than an objective level need to support fish propagation. Comment 9 above discusses problems with this approach. In addition, we disagree with the conclusion that there is insufficient information to set a science based water quality criteria for fish propagation.

First, it is not necessary to know “exactly what degree of propagation” would be achieved in order to set an appropriate base level water quality criterion. Minimum data requirements for criteria derivation are discussed by USEPA (1994), and are expressed in terms of having acceptable data for the variety of taxa being protected, and thereby providing “a reasonable level of protection...if all except a small fraction of the taxa are protected.” This standard does not require quantification of ecological outcomes in any specific setting. In the case of evaluating fish propagation, the number of relevant species is relatively small, and the criterion is likely to be controlled by a small number of sensitive species such as sturgeon. Hence, information on a large number of taxa is not necessary to meet the minimum threshold of information.

Second, the scientific literature and regulatory precedents do provide the basis for setting criteria for protection of fish propagation. An example is USEPA’s Chesapeake Bay DO criteria (USEPA, 2003) which includes scientifically rigorous DO targets to protect fish propagation in mid Atlantic estuaries. These criteria (Table 2) were based on an extensive literature review and address sensitive mid Atlantic fish at multiple life stages. The criteria were derived to protect the survival and growth of larval and juvenile fish (including sturgeon) both during winter/spring spawning periods and the summer/fall months.

Table 2. Chesapeake Bay DO Criteria for Migratory Fish Spawning and Nursery Use [Adapted from Table 1 of USEPA (2003)]			
Magnitude (mg/L)	Averaging Period	Protection Provided	Temporal Application
6 <sup>a</sup>	7 day mean	Survival/growth of larval/juvenile tidal fresh resident fish; protective of threatened/endangered species.	Feb. 1 May 31
5	None	Survival and growth of larval/juvenile migratory fish; protective of threatened/endangered species.	
5.5 <sup>b</sup> /5	30 day mean	Growth of larval, juvenile and adult fish; protective of threatened/endangered species.	Year round
4	7 day mean	Survival of open water fish larvae.	
3.2	None	Survival of threatened/endangered sturgeon species. <sup>c</sup>	

<sup>a</sup>Applies to tidal habitats with 0 to 0.5 ppt salinity

<sup>b</sup>Applies to tidal habitats with >0.5 ppt salinity

<sup>c</sup>The Chesapeake Bay criteria include the following note: At temperatures considered stressful to shortnose sturgeon (>29°C), dissolved oxygen concentrations above an

instantaneous minimum of 4.3 mg/L will protect survival of this listed sturgeon species.

The Chesapeake Bay and Delaware River Estuary share the same key fish species, overlap in latitude, and are even hydraulically connected. It is unclear why, if USEPA and the Chesapeake Bay Program partner states determined that there was sufficient information to set science based criteria for fish propagation, DRBC would conclude otherwise and instead pursue overprotective, HADO based criteria.

We do not recommend that the Chesapeake Bay be adopted for the Delaware River Estuary in an uncritical fashion. We recommend that they be examined in light of more recent literature and Delaware Bay estuary specific considerations.

11. The attainability analysis does not consider the seasonal succession of life stages. The strictest DO criteria should only apply during the early spawning and larval period.

The attainability analysis defines the “critical propagation season” as May 1 to October 15, and all model scenarios/metrics pertain to this time period. A refined analysis should distinguish between the early spawning/larval period and later months. This is because the strictest DO targets apply to eggs and larval fish of specific species that mature to juveniles by late spring. This is reflected in the Chesapeake Bay criteria, which include different criteria for the early spawning/larval period (February – May) and later months. As stated by USEPA (2003):

The migratory fish spawning and nursery designated use applies from February 1 through May 31. The defined season for applying this use is based on a composite of the full range of spawning and nursery periods of all the target anadromous and semi anadromous species....The February 1 beginning date reflects the initiation of the yellow perch spawning season; the May 31 end date reflects when the eggs and larvae have finished their transition to the juvenile life stage for all the target anadromous and semi anadromous species.

The DO aquatic life linkage report (DRBC, 2022c) identifies a spring season (April 1 – June 30), summer period (July 1 – September 30) and fall season (October 1 – November 20), and includes some evaluation of which life stages of sensitive are present in the Delaware River Estuary within those seasons. As stated in that report:

spawning begins much earlier than May 1, and juvenile development continues past October 15; however, the period from May 1 to June 30 is when DO conditions are especially important for spawning and nursery success, and the period from July 1 to October 15 is when DO conditions are especially important for juvenile development...

The linkage report is still under review. Future comments might pertain to the seasonal definitions and timings of specific life stages. However, we consider it a positive element of that report to recognize the seasonal succession of life stages, and encourage DRBC to consider this directly in the criteria and attainability analysis. We recommend that, after defining DO targets for fish propagation with the appropriate seasons of application, the revised attainability analysis evaluate the metrics in accordance with the appropriate seasons.

12. The attainability analysis must consider the increased difficulties and decreased efficiencies of nitrification as temperatures decrease.

DRBC is proposing stringent NH<sub>3</sub> N effluent limits during the summer season which begins in April and ends in October. To achieve the stringent effluent limit for NH<sub>3</sub> N, the treatment facilities will need to achieve full nitrification. Nitrification is a biological process that unlike a physical or chemical treatment process cannot be started up quickly. Rather, it requires the

gradual growth of nitrifying microorganisms which is highly temperature dependent and are prone to die off with cold spring wet weather. It is for this reason that the State of Maryland, for example, has adopted an approach of establishing progressively decreasing NH<sub>3</sub> N effluent limits during April and May with the final summer season effluent limit going into effect in June. For example, the Oxford Rochdale Sewer district has a monthly average NH<sub>3</sub> N effluent limit in April of 10 mg/L, a monthly average NH<sub>3</sub> N effluent limit in May of 5 mg/L, and a monthly average NH<sub>3</sub> N effluent limit of 2.0 mg/L in June through October. This approach provides a reasonable time for the nitrification process to transition through partial nitrification in April to full nitrification beginning June 1 and continuing through October.

There is of course an unavoidable conflict between the temperature dependency of nitrification and the Spring critical spawning period (section 11 immediately above). However, DELCORA requests that to the extent practicable DRBC utilize this same approach of specifically considering the temperature dependency of nitrification with respect to its proposed summer season NH<sub>3</sub> N effluent limits.

If this a phased down approach or application of limits directly linked to seasonal succession of life stages (comment 11) is ultimately not recommended by DRBC to the commission, it is highly recommended that the Nitrogen Reduction Cost Estimation Study be revised to account for spring temperature variation and the likely costs of wintertime nitrification. As noted above, nitrification is not a process that can be “turned on/off” with the flip of a switch; rather, it takes time, resources, and attention to achieve and maintain. From an operational perspective, achieving a May 1 limit of 1.5 mg/L will likely result in the need to nitrify all year round to ensure compliance with a May ammonia permit limit and to endure unpredictable and inconsistent springtime temperature fluctuations.

13. The attainability analysis should evaluate science based DO targets with the appropriate averaging periods.

The attainability analysis uses various metrics to present scenario results, such as the 1<sup>st</sup> percentile DO, percent time above selected DO concentrations, and the DO relative stress index. However, in accordance with the recommendation of adopting science based DO criteria, we recommend that such criteria (magnitude and averaging period) be the primary metrics utilized in the attainability analysis.

The 1<sup>st</sup> percentile represents an uncommon or highly transitory condition, and so is theoretically useful for evaluating DO criteria that lack explicit averaging periods. In addition, estuarine modeling frameworks are not accurate nor precise enough to reliably predict exceedance rates of less than 1 percent. For example, in developing model based WLAs for the Chesapeake Bay TMDL, USEPA and partners considered predicted non attainment rates of 1% and lower to be equivalent to attainment (USEPA, 2010). See comment #5 for observations and recommendations related to the DRBC water quality model's capabilities for predicting the 1<sup>st</sup> percentile DO.

It is also recommended that the revised attainability analysis consider other DO metrics corresponding to time averaged criteria. Any literature review of DO thresholds (e.g., DRBC, 2022c) should report not just the magnitude but the averaging period associated with effects that were observed or not observed. Criteria should then be expressed and evaluated with magnitude and duration (averaging period) components, as opposed to treating all criteria as “instantaneous minimum” thresholds or evaluating them using the 1<sup>st</sup> percentile DO. For example, the Chesapeake Bay criteria include targets expressed as 7 day and 30 day averages (Table 1). The temporal averaging can actually improve confidence in the model prediction,

because water quality models are generally better at predicting time averaged values than extremes of the distribution or concentrations at specific points in time.

14. DELICORA does not have a significant impact on low DO in the FMA, and so should be categorized as a Class A discharge rather than a Class A' discharge.

The draft attainability analysis places point source discharges into one of the following three classifications: A', A, and B. Discharges in Class A' are proposed to receive more stringent ammonia limits than discharges in Class A, which would in turn receive more stringent ammonia limits than dischargers in Class B. DRBC (2022b) defines these classes as follows:

**Class A':** Discharges that have a major impact on low DO in the FMA. The biggest DO response to effluent ammonia reductions is located within the FMA, the discharge is located within the FMA, and low DO in the FMA is sensitive to the level of ammonia reduction.

**Class A:** Discharges that have a marginal impact on low DO in the FMA. Low DO within the FMA is impacted, but the biggest DO response to effluent ammonia reductions is located outside of the FMA. The discharge is not located within the FMA, and low DO in the FMA is less sensitive to the level of ammonia reduction.

**Class B:** Discharges that do not have a measurable impact on low DO in the FMA.

In the draft attainability analysis, DELICORA is classified as a Class A' discharge. However, DELICORA should be categorized as a Class A discharge because this discharge has a marginal impact on low DO within the FMA, as described further below.

First, the classification of point source discharges should be based *only* on the impact on low DO in the FMA. The impact on low DO is the environmental outcome of consequence. Location within or out of the FMA and loading rate are only consequential to the degree that they affect the impact on low DO in the FMA. Similarly, it would be arbitrary to classify a discharger as Class A' simply on the basis that the load is within the 95% cumulative load, regardless of impact on DO.

Second, the attainability analysis clearly demonstrates that DELICORA has a very small impact and possibly an immeasurable impact on low DO in the FMA. This is partly due to DELICORA's low proportion of the total point source ammonia load (2.6%), but is also strongly related to the location of DELICORA at the downstream end of the FMA, approximately twenty river miles downstream of the DO sag minimum. The screening analysis presented in DRBC (2022b) indicated the following:

- DELICORA's predicted effects on the volume of water with >1 mg/L DO change were *two to six orders of magnitude* lower than any other Class A' discharger, not significant enough to warrant further analysis (Figure 4)
- DELICORA's predicted effects on the percent reduction on the DO relative stress index were less than 1%, not significant enough to warrant further analysis (Figure 4).

**Table 3-2: Screening results for the 19 wastewater discharges with the greatest ammonia load**

Values that warrant further analysis are highlighted with bold text. Discharges with a highlighted value in any column were selected.

Point Source Name	Summer NH34 Load (kg N/day)	% Cumulative NH34 Load	Vol. with ΔDO = 1 mg/L (m <sup>3</sup> )	% Reduction DO RSI in FMA
PWD Southwest WPCP	14354	36.5%	3.16E+08	51.7%
Camden County MUA	5241	49.9%	1.38E+08	36.9%
City of Wilmington WWTP	4807	62.1%	6.98E+07	1.3%
PWD Southeast WPCP	3626	71.4%	7.92E+07	25.2%
PWD Northeast WPCP	3535	80.4%	7.80E+07	20.4%
Gloucester County Utilities Authority	2438	86.6%	4.45E+07	10.6%
Hamilton Twp WPCF	1634	90.7%	5.24E+07	2.6%
DELCORA	1014	93.3%	4.73E+04	0.8%
Lower Bucks County JMA	747.6	95.2%	1.71E+07	1.8%
City of Millville STA	495.4	96.5%	1.95E+06	0.3%
Trenton Sewer Utility	411.2	97.5%	1.10E+07	1.0%
Morrisville BMA	261.8	98.2%	8.68E+06	0.9%

Figure 4 – Excerpt from the attainability analysis, showing that DELCORA was predicted to have insignificant impacts on low DO. Green box added to highlight DELCORA. Source: Table 3 2 DRBC (2022b).

Subsequent model runs confirmed that DELCORA has marginal to immeasurable impacts on low DO in the FMA. Figure 5 shows an excerpt from the attainability analysis, illustrating results of model runs to test the application of 1.5 mg/L ammonia permit limits to different discharges. The relevant information in this figure is the predicted difference in DO between sequential model scenarios 81 and run 85. In run 85, the 1.5 mg/L ammonia limit was applied to three discharges including DELCORA. The results of this run show the combined impact of these three discharges rather than just DELCORA, but this makes the lack impact on low DO even more striking. Specific observations from this analysis are as follows:

- The three discharges including DELCORA would only result in very small (zero to <0.1 mg/L) differences in DO in the DO sag area.
- The three discharges including DELCORA would collectively have a slightly higher impact on (0.2 to 0.3 mg/L) on DO downstream of the DO sag, but only where DO was already not predicted to fall below 5 mg/L. This is not an impact on “low DO” and would not change attainment of science based DO targets for fish propagation.

These results demonstrate that the only location where Class A' level limits on the DELCORA discharge would likely have a measurable effect is where DO would be already recovered from the sag. The attainable analysis definition of a Class A' discharge is one that has “a major impact on low DO” [emphasis added]. Because DELCORA clearly does not meet this definition, it should be classified as an A discharge.

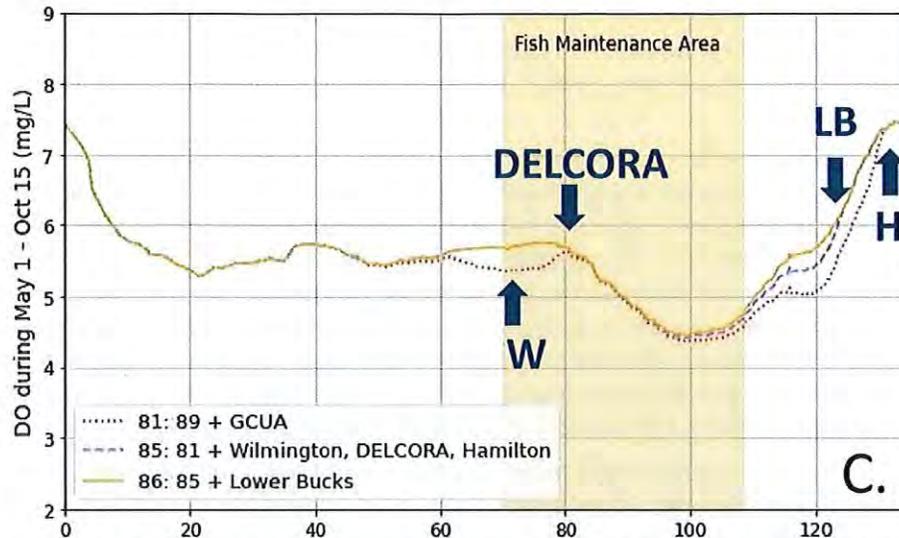


Figure 5 – 3D model results from sequential reductions of effluent NH4 reductions.  
 Source: Figure 3 3 of DRBC (2022b)

Although the classification of DELCORA as a Class A discharge instead of a Class A' discharge results in a higher ammonia limit than the median ammonia used in the model, this proposal to maintain a 5 mg/L ammonia limit is still a considerably noteworthy commitment requiring substantial investment. As DRBC is aware, DELCORA's current capital plan includes the redirection of Eastern Service Area (“ESA”) flow from the PWD Southwest Water Pollution Control Plant (“SWPCP”) to the WRTP by way of an underground tunnel that will also serve as wet weather storage. If the assumed 23 MGD of ESA wastewater currently being treated at the PWD SWPCP discharges at the PWD SWPCP median ammonia concentration of 19 mg/L, it can be calculated that the ESA flow currently contributes an approximate ammonia loading of 3,600 lbs/day to the Delaware River, at a location that also happens to be at the lowest point of the DO sag within the FMA. Upon subsequent redirection to and treatment at the DELCORA WRTP, the same 23 MGD of ESA flow will be discharged at 5 mg/L ammonia concentration, resulting in an additional ammonia loading of approximately 960 lbs/day, which is about a 74% reduction from its currently condition. In addition to this reduction in ammonia loading, ESA NH3 loading discharged at DELCORA results in lessened DO impacts because of the downstream discharge location in the FMA where the DO demonstrates it is consistently greater than 5 mg/L. This project to redirect flow and increase plant treatment capacity is a significant engineering project with a substantial financial commitment and the proposal to meet a limit imposed on class A facilities is considerable.

15. The use of point source design flows in scenarios is very conservative, and points to the need for load based permit limits and high flow exceptions.

The attainability analysis scenario set point source discharges to their full design flows. This is a common approach for WLA permitting and is generally recommended so that WLAs are attainable even at full design flow. However, the assumed combination of *all dischargers* at full

design flow during dry, low flow critical conditions is extremely conservative. In reality, wastewater treatment plants (WWTPs) do not discharge close to their design flows for extended periods. Design flows are set with the anticipation of higher flows during wet weather periods and flows during dry weather periods are usually much lower than full design flows. This is especially true for combined sewer overflow (CSO) communities that make major investments to intentionally direct wet weather flows to WWTPs and thereby reduce CSOs. Although we concur with establishing WLAs based on full design flow, the absence of rationality of the use of design flows under critical dry weather periods merits specific consideration during future NPDES permitting stages.

First, ammonia permit limits should be based on ammonia load rather than effluent ammonia concentration. The attainability analysis demonstrated that ambient DO predictions were insensitive to assumptions regarding effluent flow because (as expected) DO was only predicted to respond to the total load of ammonia discharged. In other words, the estuary only “sees” the total ammonia load and not specific combinations of effluent flow and ammonia concentration. Because WWTPs will *never* be collectively close to design flows under dry weather periods, the imposition of low concentration limits would result in highly overprotective limits. Conversely, loading limits would protect water quality while providing WWTPs with much valued flexibility in the combination of flows and concentrations that would meet those limits.

Second, some communities might merit high flow exceptions to ammonia limits; i.e., relaxation or non application of the limits under specific wet weather conditions. High flow exceptions would not be incompatible with attaining DO targets because such high flow exceptions would typically be brief and only occur under flow conditions that are very different from dry, low condition that serves as the critical condition for DO. High flow exceptions could be especially important to CSO communities that intentionally accept wet weather flows to prevent/reduce bacteria impairments of the Delaware River Estuary. This permitting approach would be compatible with joint pursuit of recreational and fish propagation uses of the estuary.

16. DRBC and regulated facilities should consider allocations based on ultimate oxygen demand (UOD), which could increase WWTP operational flexibility.

Some states such as North Carolina and South Carolina have set permit limits for the ultimate (or total) oxygen demand in lieu of separate limits for CBOD5 and ammonia. UOD based permit limits can provide dischargers with more operational flexibility than separate limits. For example, there might be cooler periods in which a WWTP achieves less nitrification but is able to compensate by achieving lower CBOD5 limits, and thereby maintain compliance with UOD limits.

The attainability analysis focuses on ammonia reduction. Some model scenarios were also performed to explore the sensitivity of DO to CBOD5 and concluded that DO would be relatively insensitive to additional point source CBOD5 reductions. Although lower CBOD5 limits are not warranted, the DRBC water quality model could theoretically be used to identify UOD equivalents of proposed ammonia and CBOD5 limits, and combinations of ammonia and CBOD5 that would meet UOD limits. This information would provide insights into of the operational flexibility that would be afforded by pursuing UOD limits.

17. The modeling and attainability analysis have multiple conservative elements, several of which should be adjusted to avoid an overly conservative evaluation.

Our review revealed that the modeling and attainability analysis includes various conservative assumptions and elements (Table 3). Although some of level of conservatism might be appropriate, the collective assumptions would cause the resulting DO goal or implementation to be overprotective. In using the term “overprotective” we do not suggest that any shortcuts should

be taken in protecting aquatic life, including the propagation of aquatic life. However, natural waters are always subject to fluctuations in DO as well as other water quality measures, and our goal should be to properly and adequately protect the aquatic life designated use, and should not focus on a “more DO is better” (Analysis of Attainability” section 1.3, p. 9) approach. Our individual comments make various recommendation for either amending overly conservative assumptions or considering that conservativeness directly during interpretation.

<b>Table 3. Summary of Conservative Elements of the DRBC Modeling and Attainability Analysis</b>	
<b>Conservative Element</b>	<b>Described in Comment(s)</b>
Underestimation of DO at low percentiles	#5
August benthic nutrient fluxes assumed to occur all year round	#6
No reduction in SOD or sediment nutrient fluxes with reduced ammonia loadings	#6
Critical condition that is less frequent than normally used for permitting and TMDL	#8
DO target based on HADO that likely exceeds protective criteria	#9, #10
Assumption that support of fish propagation requires the strictest DO targets to be met throughout the summer and fall.	#11
No time averaging of DO targets	#13
Assumption that all point sources simultaneously and continuously discharge at design flow throughout critical dry conditions	#15

### **Section 3: Summary**

BC reviewed several DRBC reports related to the ongoing aquatic life designated use study for fish propagation in the Delaware River Estuary. Our goal in conducting this review was to determine if the draft models and the attainability analysis were technically defensible and appropriate for the intended scientific and regulatory purposes. Table 4 provides a summary of the major technical issues that were identified during this review, and the related recommendations.

Table 4. Summary of Key Issues and Recommendations		
Issue	Related Recommendation	Described in Comment(s)
Overestimation of spring nitrification rates	Improve model calibration to ammonia under spring conditions	#3
Underestimation of DO at low percentiles	Improvement of model calibration to low DO percentiles; recognition of bias in model interpretation	#5
Overly conservative assumption that SOD and sediment nutrient fluxes do not respond to external load reductions.	Make reasonable estimates of how much SOD and sediment ammonia fluxes would decrease in response to ammonia load reductions.	#6
The critical condition is more infrequent than regulatory precedents.	Choose a critical condition that represents a 1 in 10 year frequency.	#8
Overly stringent HADO-based DO target	Evaluate attainability of science-based DO targets that are suitable for fish propagation.	#9, #10
Lack of recognition of seasonal life stage progression in the estuary.	The strictest DO targets should only apply during the early spawning and larval period	#11
Increased and decreased efficiencies of nitrification as temperature decreases	Directly consider temperature effects on nitrification during permitting stages and cost estimation	#12
The DO metrics evaluated are not all directly comparable to potential criteria or literature based DO targets.	Base the attainability analysis on science based criteria with the appropriate magnitudes and averaging periods.	#13
DELCORA has little impact on low DO in the FMA, and so was miscategorized as a Class A' discharge.	Categorize DELCORA as a Class A discharge.	#14
The use of point source design flows in scenarios is very conservative	Retain full design flows for WLA determination, but recognize future permitting need for concentration based limits (not load limits) and high flow exceptions.	#15

Our review indicates that the hydrodynamic model is properly calibrated based on the best available data. The water quality model is well calibrated to DO for the summer months, but we recommend some improvements to ensure that it can properly simulate response of DO to ammonia reduction during the spring fish spawning period. The model has little predictive power for phytoplankton, so is better characterized as a DO sag model than a eutrophication model. The modeling and attainability analysis have multiple conservative elements, several of which should be adjusted to avoid an overly conservative evaluation

Several of our most important comments pertain to the process and goals of the Analysis of Attainability. Based on the available information, DRBC's approach to the analysis would result in overly stringent DO criteria. It is recommended to derive science based DO criteria that are suitable for fish propagation, relying on proven and defensible precedents such as the Chesapeake Bay DO criteria and more recent literature. DRBC should then evaluate the attainability of WLAs that would meet the use but are not lower than needed to meet the use.

The methodology of the attainability analysis has other, longer term implications for permitting. DELCORA should be classified as a Class A (rather than Class A') discharge because attainability analysis clearly demonstrates that DELCORA has very little impact on low DO in the FMA. The assumption that all point sources discharge at full design flow throughout a dry, low flow period is unrealistic. Concentration limits resulting from this approach would be excessively conservative (low), and so any resulting limits should be expressed as load limits rather than concentration limits.

Some facilities might also merit high flow exceptions to limits, which would not compromise fish propagation. We also recommend that the stakeholders explore the benefits of permit limits based on UOD.

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**Attachment B**

**DELAWARE COUNTY REGIONAL WATER QUALITY CONTROL AUTHORITY**

**Comments on Delaware River Basin Commission**

**Draft Report:**

**Social and Economic Factors Affecting the Attainment of Aquatic Life Uses in the Delaware River  
Estuary**

**December 2, 2022**

## Background

This document summarizes comments developed by the Delaware County Regional Water Quality Control Authority (DELCORA) and Raftelis Financial Consultants, Inc. upon review of the Delaware River Basin Commission (DRBC) draft report entitled “Social and Economic Factors Affecting the Attainment of Aquatic Life Uses in the Delaware River Estuary” (Draft Report), dated September 2022. The Draft Report outlines an assessment of widespread social and economic impacts that could result from a range of costs to be incurred for Tier 1 Utility (referred to in the Draft Report and here as “regulated communities”) treatment upgrades required to attain desired aquatic life uses.

We applaud DRBC for taking a degree of care in considering both evolving financial capability guidelines from EPA, as well as perspectives put forth by the water sector in their Draft Report. However, we hope to work with DRBC to further refine their reporting with the goal of improving rigor across its social, economic, and environmental dimensions.

## Draft Report Comments

1. We approve of applying latitude in developing the methodology for evaluating social and economic factors in the ever evolving area of customer affordability and community /utility financial capability measurement.
  - a) We acknowledge that DRBC has attempted to leverage approaches from recently proposed methodologies from the United States Environmental Protection Agency (EPA), as well as approaches for measuring household affordability and financial capability put forth by the water sector.
  - b) We suggest that an approach be developed collaboratively by the DRBC and its regulated communities that is grounded in industry best practices to ensure that a fair, equitable, and impactful social, economic, and environmental assessment is executed. We believe that taken together the comments in this report can help inform improvements to the DRBC Draft Report.
2. DRBC did not choose to wholly follow any directly applicable or currently approved federal or state law, legislation, or guideline, nor comprehensive industry best practices in their chosen methodology for conducting the social and economic assessment.

The Draft Report notes that Resolution No. 2017-04 “...directed the Executive Director to initiate DRBC rulemaking to revise the designated aquatic life uses consistent with the results of the studies and the objectives and goals of the federal Clean Water Act.” However, because the DRBC ultimately conducted the analyses in the Draft Report based on pieces of industry methodologies from AWWA 2019, unapproved federal guidelines (EPA 2021 and EPA 2022), and an array of data sources including non-federal data sets (e.g. Van Abs, 2018), this suggests that DRBC does not believe that there is currently a directly and rigidly applicable law, legislation, or set of guidelines for DRBC to follow in conducting the social and economic assessment.

3. The Draft Report has selected elements of household affordability methodologies from three primary sources in developing its approach for identifying and measuring any widespread

social and economic impacts resulting from costs to be incurred for Tier 1 Utility treatment upgrades required to attain the desired aquatic life uses. There is not however a clear explanation presented in the Draft Report as to why the DRBC selected specific elements while rejecting others from the three sources.

It should be noted that:

- a) The selected metrics from two proposed U.S. Environmental Protection Agency (EPA) 1997 Combined Sewer Overflow (CSO) and/or 1995 Economic Guidance for Water Quality Standards Financial Capability Assessment (FCA) guidelines referred to in the Draft Report as “EPA 2021” and “EPA 2022” have not yet been approved by EPA and are subject to change.
  - b) DRBC and DELCORA are not engaging in an EPA CSO Control Policy schedule negotiation (which would otherwise follow EPA’s 1997 Guidance) in this case. They also note that “...a use attainability analysis is typically performed by a state seeking to remove a use, an action not considered by Resolution No. 2017-4...” in the Draft Report. This suggests that the 1995 Economic Guidance for Water Quality Standards, which mirrors the 1997 CSO methodology, would also not officially apply to the social and economic assessments detailed in the Draft Report even if EPA 2021 or EPA 2022 were approved.
  - c) It should be noted that the supporting consultants that worked with DELCORA to author this document are named authors of the other primary source referred to in the Draft Report as “AWWA 2019”.
  - d) Taken together the comments in this report will detail the observed gaps in the Draft Report relative to the cited guidelines and industry best practices.
4. There is a need for greater clarify on how DRBC is defining the social and economic assessment and whether it is truly focused on household affordability, utility and community financial capability, or something broader and less well defined.

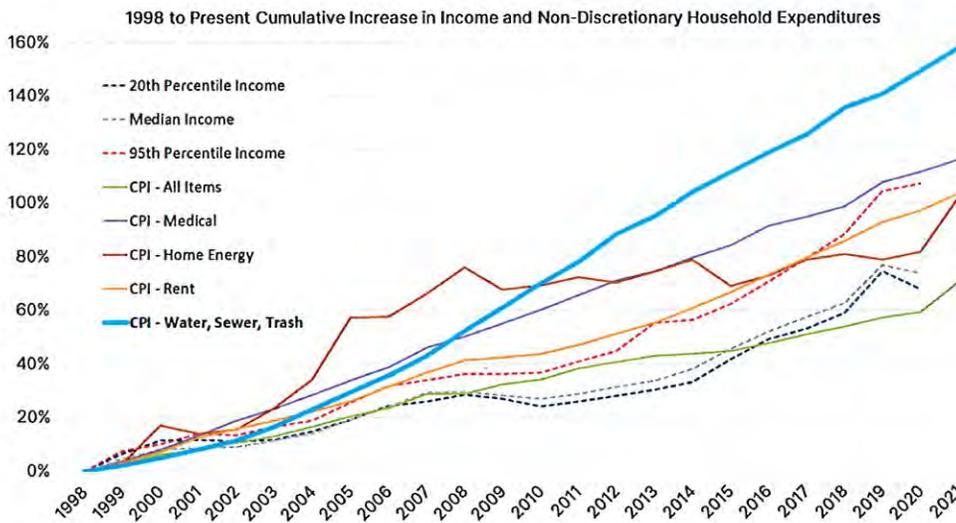
The report has applied selected and modified household affordability measurement approaches from the EPA and industry, many of which were developed as a component of broader FCA methodologies, while relegating other elements of those methodologies to their appendix or excluding them entirely. That is, there is an important distinction between household affordability measurement and utility or community financial capability measurement that the Draft Report does not address. However, in limiting the visibility and applicability of the financial capability metrics, the report appears to prefer to focus on household affordability. It would be helpful for the DRBC to further clarify how they are defining the social and economic assessment and whether it is focused on household affordability or utility and community financial capability. A definition of these two distinct types of measurement can be found in “AWWA 2019”. In the absence of a clear focus on either and without a formal regulatory guidance to follow there are a range of analytics that are used in the industry to measure household affordability and an even broader set of

metrics that should be considered in a less precisely defined social and economic assessment.

5. To the extent that DRBC is focused on household affordability and financial capability, some elements that should at a minimum be added to the Draft Report include measurement of impacts over time, utility-specific cash flow modeling, equity considerations, more exploration of sub-geographic impacts, inflation factors to reflect current dollars, and broader cost of living measures.

a) **Impacts Over Time** – Since the development of the EPA CSO Control Policy and Economic Guidance for Water Quality Standards FCA approach, which occurred primarily from 1995 to 1997, a significant critique of the approach has been that it measures impacts at a single point in time. The Draft Report fails to assess the impacts of the use attainability investments over time. AWWA 2019 did propose an approach that would allow for measurement of FCA throughout the duration of the forecast period<sup>1</sup>, but it was dismissed in the Draft Report in favor of other point-in-time metrics looking only at present-day realities. However, particularly for communities that are moderately or highly burdened at the beginning of the relevant assets lifecycle, it is critical to understand if the investments under review would cause burdens as costs inevitably escalate over time. This is particularly important because water sector costs are escalating faster than other sectors of the economy and faster than household incomes per Figure 1. As a result of these trends water sector costs over time represent an increasingly large share of household budgets and burdens.

**Figure 1: 1998 to Present Utility CPI vs other CPI Components and Incomes<sup>2</sup>**



<sup>1</sup> AWWA 2019 referred to the “forecast period” or the “forecast regulatory horizon under review”. This period is generally understood to tie to any relevant debt financing terms (typically 20+ years) and/or the useful life of the most substantial and relevant assets, which can be longer than 20 years for some assets.

<sup>2</sup> U.S. Bureau of Labor Statistics (CPI) and U.S. Census (Income)

- b) **Cash Flow Modeling** – AWWA 2019 notes that utility level cash flow forecast models that extends out through a relevant forecast period is the best way to measure the realistic burdens of regulatory compliance comprehensively, and accurately, and practically as they will be experienced by utilities and customers. On page 3 of the Draft Report DRBC notes that such modeling was “...determined to be outside the scope of our task.” For costs and programs of this magnitude, it seems appropriate to give the Tier 1 Utilities the opportunity to develop these models to ensure the social and economic assessment is accurate, not just for ‘now’ but for the impact over time. Beyond being recommended in AWWA 2019, cash flow modeling is considered a best practice in the industry for estimating financial realities over time. Per AWWA 2019 “The cash-flow forecast should include projections of annual revenues, utility rates, operation and maintenance expenses, capital needs, debt service requirements, and key fiscal policy measures, such as debt service coverage and projections of fund cash balances.”<sup>3</sup> What AWWA 2019 also recognized and detailed is how such forecasts can easily be integrated with household affordability measurement and financial capability assessment.
- c) **Equity** – Since the publication of AWWA 2019 governments and industry have increased their focus and attention on equity in the water sector in recognition of the disparate environmental and economic impacts of historical racism and injustice. Environmental Justice is one area in the Draft Report and analysis that could and should be given more attention. As DELCORA completed their own sub-geographic analysis of the impacts of compliance with the contemplated DRBC use attainments it became clear that the economic impacts of water investment are beginning to place significant stress on communities of color in their service area. This concern is supported by analytics developed by DELCORA for an EPA FCA wastewater proceeding, where results showed highly burdened census tracts based on the RI were on average 59% minority vs. 17% minority for census tracts with medium or low burden. Disproportionately, the communities that live in highly or very highly burdened census tracts as revealed in DELCORA’s own analyses for EPA or the DRBC Draft Report Figures 5 and 6, as well as Figures D-1 through D-15 are communities of color. To simply push forward with unfunded mandates for use attainability DRBC would be doing further injustice to these communities without due consideration. It is recommended that before decisions are made by DRBC on this matter, further scrutiny of the equity impacts should be incorporated into the analysis. Sensitivity to the economic impacts of policy and funding decisions on minority communities is an increasing focus at local, state, and federal levels of government across the country, and this regional effort should be no exception. As part of EPA 2022 EPA noted that “In addition to completing an economic analysis, consideration of opportunities to mitigate impacts to areas with potential environmental justice concerns is recommended”.<sup>4</sup>
- d) **Sub-Geographic Disparities** – The same DELCORA analytics that highlight the disparate equity impacts of water sector investments on communities of color help to clarify the significant extent to which burden exists in the service area generally. That

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<sup>3</sup> AWWA 2019, Page E-7

<sup>4</sup> <https://www.epa.gov/system/files/documents/2022-03/2022-proposed-fca-presentation.pdf>

is, 44% of households in the DELCORA service area currently live in highly burdened communities based on census tract level analytics.<sup>5</sup> This is a significant portion of the DELCORA service area that should be considered even though the service area level point in time may only show a moderate burden across the entire service area. Increasingly in America income stratification, where more people exist at the far ends of income distributions with fewer in the middle, is a reality. Similarly, sub-geographic analytics suggest that this reality is acute in DELCORA's service area in particular. What the aforementioned map figures in the Draft Report do not, however, reveal is that those census tracts with high burden are also more densely populated than the larger tracts to their west. So despite seeming to represent a smaller subset of communities that are tightly bound against the Delaware River visually, the highly burdened census tracts represent a significant proportion of DELCORA service area households (44%) and population (43%). These realities should be more prominently detailed in the report and incorporated into use attainability investment requirement decisions.

- e) **Inflation** – Draft Report page 4 notes that costs considered in the document are from a 2021 Kleinfelder Report and should be considered budgetary capital cost estimates in 2019 dollars. The Engineering News Record Construction Cost Index for the Philadelphia area from January 2019 to November 2022 estimates that inflation has resulted in a 16% increase in capital costs. If indeed the costs have not been escalated to current dollars this exercise should be undertaken to ensure estimates are as current as possible. With aggressive inflation still occurring in America and these contemplated investments not yet begun, a degree of conservativeness should also likely be added to account for additional time and potential further inflation.
  
- f) **Cost of Living** – There are a range of metrics that measure not only incomes, poverty, utility rates, ratios or scores of these, or other utility or community financial capability metrics, but also look more comprehensively at basic costs of living that vary geographically and that all households must cover to ensure their health and well-being. These include not just water, wastewater, and stormwater costs but also housing costs, insurance and medical costs, childcare costs, clothing, electricity, trash, and other utility costs. Importantly, these assessments can vary tremendously by geography, where for example, often cities are found to have high costs of living despite pockets of very low income populations, while more rural areas may have lower costs of living, but lower incomes as well. One example of such methodologies is an application of the MIT Living Wage, which can be used to determine the number of people that live below a living wage income level to assess economic vulnerability in a community. Another example of such metrics is the Affordability Ratio 20 (AR20), which measures the available income to pay for water bills after covering other essential costs of living at the upper bound of the lowest quintile (20<sup>th</sup> percentile) income level. These approaches are noted in AWWA 2019. Daniel Van Abs, a source that was cited in the Draft Report has conducted subsequent statewide research using similar methodologies that consider essential costs of living in New Jersey. These are just a few examples of how economists may incorporate costs of living beyond the water sector into comprehensive economic assessments in the water

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<sup>5</sup> Based on Residential Indicator (RI) calculations developed by DELCORA and consultants as part of an FCA filing.

sector. DRBC did not consider such essential costs of living in the Draft Report, again failing to employ a best practice approach despite being unbound from any prescribed guidance.

6. For EPA 2022 one area the Draft Report could be expanded to include so as to provide a more complete evaluation of social and economic factors, would be to include the Lowest Quintile Poverty Indicator scoring exercise, which introduces additional metrics for review as part of the FCA.
7. The collective goal of DRBC and its regulated communities should be to collaboratively develop an honest triple bottom line assessment of social and economic factors, not a simplified comparative scoring or ranking that does not reflect the reality experienced by communities, utilities, and households.

On page 4 of the Draft Report, DRBC notes that the body of the report focuses on the Household Affordability Score (AWWA 2019) and the Residential Indicator Score<sup>6</sup> (EPA 2022) because they allow for direct relative comparison of different effluent treatment scenario costs with each other and with the baseline condition before any additional effluent treatment cost is added. DRBC notes that all other metrics are included in the Appendix. While this may have been done because the other metrics do not allow for direct comparisons, unfortunately this positioning portrays a sense of lesser importance and focuses the reader on the two household affordability scores. The result is that other meaningful considerations, such as the financial capability metrics in the Draft Report Appendix (those that go beyond household affordability and look at utility and community considerations) are not elaborated upon in the report. Despite the Appendix, which lacks much narrative around its analytical findings, the Draft Report reads as quite a narrowly framed comparative assessment, particularly when considering the aforementioned absence of utility cash flow forecast modeling over time, community specific equity perspectives, and a broader set of data that look at costs of living.

8. Where available more current Census data should be considered for incorporation.

On page 5 DRBC suggests that 5-year census data through 2020 is the best source as it partially incorporates the impacts of Covid-19, however depending on the resolution of geographic lenses applied for various analytics, it is possible that 1-year 2021 census data may be a sound source for consideration. This should be reviewed as appropriate to ensure data is as current as possible. As we are near the end of 2022 it is possible that 2022

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<sup>6</sup> The FCA guidance relies in part on MHI, which is a poor indicator of economic distress bearing little relationship to poverty or other measures of economic need across households that make up a community. Therefore, the calculated Municipal Preliminary Screener is not focused on the poor or the most economically vulnerable users, and MHI does not capture impacts across diverse populations. Income levels tend not to be clustered around the median but are spread over a wide income range and are concentrated at either end of the income spectrum, making MHI a less meaningful metric. While the 2022 Draft FCA Guidance incorporates the LQRI, the Municipal Preliminary Screener is still used as part of EPA's overall FCA and remains problematic.

census information may become available and should be considered before decisions here are finalized.

9. In the second to last paragraph of page 5 DRBC reveals how census tracts that straddle service areas were apportioned to regulated communities. The regulated communities should be granted the opportunity to verify census tracts and populations within their service area based on their own billing data and address matching to census tracts, where possible, to ensure accuracy.
10. Local utility specific information on typical consumption by census tract should be analyzed to better estimate consumption per capita and ultimately to calculate more accurate bills by census tract.

On page 7 DRBC cites information from New Jersey on consumption per capita for various levels of housing density, with high density area consumption less than half of that of low housing density areas. While this data is perhaps directionally applicable in Pennsylvania the regulated communities should be granted the opportunity to verify based on actual data on local consumption. This is particularly important given that the effect of lower consumption being applied to higher housing density areas may be that some high density urban areas, that can also be low income and have high water burdens, will have reduced bills calculated for them. Local utility specific information on typical consumption by census tract can be analyzed to better estimate usage and ultimately to calculate more accurate bills.

11. Despite seeking to find data that differentiates household consumption levels based on housing density, on page 9 of the Draft Report it appears the DRBC applies a uniform household size of 2.65 to all households in their analytics. This would particularly penalize large low income households. Data is available on household size from census and should be locally applied.
12. Another factor that could potentially be softening burdens in high density low income areas is described on Draft Report page 9, where DRBC notes the application of a 10% wastewater consumptive use rate assumption. Urban households are less likely to irrigate or have other outside water uses and therefore, regulated communities should be permitted to provide variable assumptions for the consumptive use rate where local data is available.
13. DELCORA would like to have the opportunity to review all calculations and assumptions required to produce Table 5 on page 10 of the Draft Report. Please provide the data sources, and calculations in Microsoft Excel format with all formulas intact as well as detail on any assumptions required for analysis of \$/gallon (water and wastewater) and \$/household/month (stormwater).
14. DRBC's assumptions about consumption per capita relative to community density, likely contradict DRBC analyses conducted in DELCORA's subareas to apportion treatment costs.

On page 12 DRBC notes that equivalent households for each subarea in DELCORA were used to estimate the approximate percentage that each subarea contributed to the total service area when working to combine them for treatment cost apportioning. On page 7 DRBC specifically suggests, based on research and data from the State of New Jersey, that high

density areas have less than half the consumption per capita than low density areas. This seems to highlight one area where it would be important to incorporate more detailed, local assumptions so that the analysis wouldn't appear to be uniformly applied thereby apportioning costs 1-1 based on households, especially if the consumption is so dramatically different.

15. DRBC's treatment of financial capability metrics in the report Appendix and narrative is dismissive of those metrics and their results, and also reflects a narrow interpretation of their applicability.

On page 12 DRBC provides what appears to be a rationale for limiting their review of financial capability metrics to the appendix based on the taxing authority of CCMUA<sup>7</sup> and the resultant applicability of certain financial capability metrics. It is true that each utility is distinct and that it is likely the case that a unique set of metrics is most applicable for each utility, but that is not a rationale to entirely limit the use of the set of financial capability metrics. Further, by limiting tax related metrics to assessments of utilities with taxing authorities, DRBC is perhaps not recognizing that community financial capability and the extent of economic vulnerability in a community can, and in fact in some cases must be measured by metrics that do not necessarily focus on utility financials and revenue sources alone. For example, for DELCORA the Net Debt as a Percentage of Full Market Property Value metric scores as Weak and yet there is no discussion of this in the body of the report. Communities with high debt burdens and relatively low property values may be enduring a period of fiscal stress. Taken together escalating water investment needs and tax recovery requirements whether water related or not can lead to severe and widespread social and economic stress that should be considered along with regulatory enforcement in the water sector. Throughout this document we've attempted to demonstrate that there are many social and economic factors that should be measured as part of use attainability investment decision-making. For DELCORA EPA community financial capability metrics that measure as Weak (such as the one noted here from the Appendix) should be an important consideration that is elaborated upon in the body of the DRBC report and considered carefully in subsequent decision-making rather than largely ignored.

16. In the second to last bullet on page 12 DRBC notes that separate computations that were independently manually produced by another staff member resulted in differences that were then resolved. A fuller description of the cause of those differences should be shared with the regulated communities to understand their nature and demonstrate that communities should get involved in the process and collaboratively share their own evaluations for validation.
17. The Costs per Household detailed on page 14 for ammonia at 1.5 mg/L are lower than those calculated by DELCORA (\$1,377.07 vs. \$1,480.00 (or +7%)) in the aforementioned FCA RI analyses developed for EPA and should be reconciled by working with DELCORA staff.
18. AWWA 2019 notes that the thresholds it proposed when analyzing bills as percentage of income as well as those included in EPA guidance for cost per household as a percentage of income required further study. As such an over-reliance on such metrics in the Draft Report

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<sup>7</sup> I believe this is incorrectly referred to as "CCUMA" in the report on phase 12.

is limited in its ability to provide a useful social and economic assessment, and a broader dossier of information should be developed.

Table 7 details the matrix and thresholds from AWWA 2019 for the HBI and PPI metrics. The thresholds for the HBI were noted as estimates by the AWWA 2019 authors based on the percentage of a national lowest quintile bill that a 2% bill at national median household income (MHI) would represent. However, the authors recognized that a better approach to threshold identification would be to study the distribution of bills as a percentage of incomes across a range of communities and to perform research on household burdens to verify those thresholds. This was recommended because the historical rationale for the 2% of MHI threshold is not well understood and more research in this area is needed. Until that research is done, an over-reliance on metrics such as service area level HBI is not recommended and a broader dossier of affordability measurement, sub-geographic reviews, and supplemental information, as discussed, is preferable to ensure robustness.

19. On page 18 it would be helpful to understand how the three included PWD alternatives were selected among the 125 noted as possible.
20. On page 19 and 20 DRBC describes a sensitivity analysis that was undertaken to assess impacts of use attainability investments to achieve 1.5 mg/L ammonia across a dataset of historical interest rates and loan terms. Was this analysis conducted for attainment of Nitrogen 4 mg/L?
21. The Monte Carlo simulation detailed in the Draft Report appears to defend assumptions around interest rates and loan payback periods that the regulated communities do not agree with. These assumptions should be changed to better reflect expected financing terms particularly because spreading costs over a longer period reduces the magnitude of debt service payments in any given year and therefore underestimated affordability burdens.

Rather than conducting the Monte Carlo simulation DRBC should consult with each regulated community to determine expected financing terms given current market realities, which are evolving significantly in some cases from recent history as interest rates increase, regulatory mandates expand, and inflationary cost pressures escalate. Some utility finance departments will not allow financing to be extended beyond certain terms as a policy so applying a flat 30 years is unsound particularly where it reduces the annual cost burden in the face of known realities that the regulated communities have already expressed may be closer to 20 years.



DELAWARE COUNTY REGIONAL WATER QUALITY CONTROL AUTHORITY  
P.O. BOX 999 • CHESTER, PA 19016-0999

December 16, 2022

VIA EMAIL ONLY  
READ RECEIPT REQUESTED

via email: [john.yagecic@drbc.gov](mailto:john.yagecic@drbc.gov)

John Yagecic, P.E.  
Manager, Water Quality Assessment  
Delaware River Basin Commission  
P. O. Box 7360  
25 Cosey Road  
West Trenton, NJ 08628

RE: Draft Report on Linking Aquatic Life Uses with Dissolved Oxygen  
Condition in the Delaware River Estuary

Dear Mr. Yagecic:

Please accept the following and attached comments of DELCORA on the DRBC September draft of the subject Report on Linking Aquatic Life Uses and Dissolved Oxygen. We believe the draft Report substantially and positively contributes to the process of addressing the proper approach to the development of aquatic life water Quality standards for dissolved oxygen in the affected portions of the estuary. This effort and the approach taken in this Report are made far more important and time sensitive by USEPA's December 1 Determination to undertake the development and adoption of federal dissolved oxygen standards; and USEPA's announced very compressed one year schedule for that development emphasizes the importance of the work of DRBC and the states on DO standards for the estuary. The critical changes to the Report we recommend in our attached comments will help in properly directing the path of standards development.

As we did for our earlier comments on the draft DRBC Analysis of Attainability, DELCORA engaged Brown and Caldwell ("BC") to review the subject draft Report. The BC review and report is attached as "Attachment A" and is with this cover letter submitted to DRBC. Although the BC report goes into considerable detail to explain and justify the comments, that report addresses only five (5) principal points with recommendations. The list below includes the heading summaries from the BC report, and is followed by a brief discussion of critical points.

1. The representations of life stage presence/absence by season should be refined to qualify relative abundance and certainty.
2. DELCORA concurs with defining a critical spawning/nursery period for the purposes of identifying DO thresholds.
3. DO thresholds should be expressed and applied with the appropriate averaging periods.
4. The scientific literature and criteria precedents inform the appropriate averaging periods of DO thresholds
5. The concepts of "minimum suitable" and "protective" thresholds should be merged into "minimum protective" thresholds.

Overall, we emphasize that our recommendations are consistent with fundamental precepts of aquatic life water quality standards development, and are in line with standards approaches taken routinely by USEPA and the states. The first two comments, addressing the importance of evaluation of "relative abundance" of early life stages of affected aquatic life and the definition of the specific spawning and nursing periods, are critical to the ability to properly tailor dissolved oxygen standards to the needs of the affected portions of the estuary.

Our third comment notes the absence in the draft Report of information on DO averaging periods. Averaging periods, including duration and return frequency components, are in essentially universal practice and pursuant to USEPA longstanding water quality criteria guidance essential standards components. Comment number three includes a Brown and Caldwell discussion of our specific recommendations for properly addressing DO standards averaging periods.

Related to comment three, comment number four recommends averaging periods and seasons of applicability informed by scientific literature and criteria precedents related to dissolved oxygen standards, such as the Chesapeake Bay DO criteria. And lastly, in comment number five, DELCORA recommends concepts of "minimum suitable" and "protective" thresholds should be merged into "minimum protective" thresholds. Additionally, it is DELCORA position that the "upper limit" DO thresholds of the draft linkage report are not directly relevant to water quality criteria development, and DELCORA would oppose the selection of regulatory DO criteria between the minimum protective values and the upper limit values. As stated in our prior comments, any DO thresholds higher than minimum protective values should only be used for non-regulatory purposes.

John Yagecic, DRBC  
Comments to DRBC on Linking Aquatic Life Uses with DO Condition  
December 2, 2022  
page 3 of 3

As always, DELCORA will provide any needed further information on these comments that may be necessary or helpful.

Sincerely,



Digitally signed by Charles Hurst  
Date: 2023.01.20 15:34:25 -05'00'

Charles Hurst, PE, BCEE  
Director of Engineering

CNH:bab  
attachment

cc: Jim Kern, PE – DELCORA Chairman  
Michael DiSantis – DELCORA  
Irene Fitzgerald – DELCORA  
Robert Willert – DELCORA  
Dick Sedgley – AquaLaw  
Clifton Bell PE, PG – Brown and Caldwell  
Zachary Green – Raffelis Financial Consultants, Inc.  
Mike Hope – Greeley & Hansen (DO Partnership Facilitator)  
File

**DELAWARE COUNTY REGIONAL WATER QUALITY CONTROL AUTHORITY**

**Comments on Delaware River Basin Commission**

**Linking Aquatic Life Uses with Dissolved Oxygen Conditions  
in the Delaware River Estuary (November 2022 Draft)**

**December 16, 2022**

## Background

In September 2022, the Delaware County Regional Water Quality Control Authority (DELCORA) and other Tier 1 Dischargers in the Delaware River Estuary received notification from the Delaware River Basin Commission (DRBC) regarding the issuance of the draft analysis of attainability reports and opportunity for document review and comment. DELCORA provided comments on these reports on December 2, 2022 (DELCORA, 2022). An additional DRBC draft report entitled *Linking Aquatic Life Uses with Dissolved Oxygen Conditions in the Delaware River Estuary* (DRBC, 2022) became available for review in mid-November 2022, with a 30-day comment period extending until mid-December 2022. This document presents DELCORA's comments on that report, which is herein abbreviated as the "linkage report". DELCORA engaged Brown and Caldwell to assist with the preparation of these comments.

In general, DELCORA views the linkage report and underlying analysis as very important elements of the analysis of attainability. We appreciate the efforts that DRBC has taken to identify DO targets for protection of key sensitive species. Our previous comments (DELCORA, 2022) included several recommendations related to the derivation of scientifically defensible dissolved oxygen (DO) targets for fish propagation in the estuary. Those prior recommendations can be summarized as follows:

- The DO goal for the attainability analysis (and future criteria) should be based on the water quality that is suitable for fish propagation. Any higher DO targets should be non-regulatory in nature.
- DRBC should consider the combined use of the DRBC linkage analysis and the Chesapeake Bay DO criteria to set DO targets for the Delaware Bay Estuary.
- The attainability analysis should evaluate science-based DO targets with the appropriate averaging periods and seasons of application.
- The strictest DO criteria should only apply during the early spawning and larval period.

Our comments on the linkage report necessarily overlap with these prior comments. Although the linkage report does not explicitly propose water quality criteria, DELCORA anticipates that it will likely serve as one of the primary bases for the future selection of regulatory criteria. Therefore, it is important that the DO thresholds presented in the linkage report are scientifically defensible and anticipate subsequent regulatory applications. We hope that DRBC finds our comments and recommendations useful in this regard.

## Specific Comments

1. *The representations of life stage presence/absence by season should be refined to qualify relative abundance and certainty.* The linkage report presents conservative estimates of the presence of different life stages of key sensitivity species in the Delaware River Estuary, most notably in Figure 2-1 and accompanying text. The report identifies various data sources for the estimates and states that the word "conservative" in this context means that the presence of a species is more likely to be over- than under-represented. DELCORA believes that the linkage report presents an overly conservative representation of early life stage occurrence in summer because it (1) does not distinguish between high and very low occurrence and (2) does not convey information on the certainty of the occurrence.

Understanding of relative abundance of early life stages is important to DRBC's overall process because future water quality criteria should represent "a reasonable and adequate amount of protection" of a use, recognizing that "because aquatic ecosystems can tolerate some stress and occasional adverse effects, protection of all species at all times and places is not deemed necessary." (*Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses*, USEPA (1985)). A "reasonable and adequate" DO criterion for protection of early life stages would apply to seasons in which these life stages have moderate to high abundance, but not necessarily to seasons in which their presence is extremely low or sporadic. Later in the linkage report, DRBC does present valuable information on the relative abundance of egg and larval stages (e.g., Figure 2-2), and correctly notes "a steep drop-off in the presence of egg and larval life stages after the end of June".

Similarly, uncertainty in the presence/absence of early life stage is also relevant, because the selection of seasonally-protective DO thresholds should give greater weight to more certain information on when certain life stages are present. There is relatively high certainty in spring spawning periods of key sensitive species, borne out by the ECSI ichthyoplankton sampling data. There is considerably more uncertainty in whether the Delaware Bay supports or can reasonably support late spawning periods for species such as the Atlantic sturgeon.

The draft form of Figure 2-1 utilizes color codes for "all life stages present", "juvenile and adults present", and "absent". The recommended revision is to use additional color code(s) to distinguish between "early life stages present - moderate to high" and "early life stages present - low or uncertain". The latter color codes should apply to most of the summer period.

2. DELCORA concurs with defining a critical spawning/nursery period for the purposes of identifying DO thresholds. The draft linkage report provides valid justifications for distinguishing between a spring spawning/nursery period and later period(s) for the growth and development of juveniles and adults (p. 6). This concept is consistent with DELCORA Comment #11 on the attainability analysis submitted earlier in December 2022 which questioned the attainability analysis' definition of May 1 to October 15 as the "critical propagation season", without recognizing the seasonal succession of life stages and potential differences in DO requirements by season. We consider it a positive element of the draft linkage report to define seasons based on the succession of life stages. This distinction should be carried forward throughout the discussion of DO thresholds, because different DO thresholds apply to different life stages and seasons.
3. DO thresholds should be expressed and applied with the appropriate averaging periods. In DELCORA's opinion, the biggest shortcoming of the draft linkage report is the lack of information on the appropriate averaging periods to use with the cited DO thresholds. This also represents the most important opportunity to improve/refine report and maximize its utility for subsequent criteria development steps. Ultimately, regulatory criteria must include magnitude and duration (averaging) components. DO thresholds with the same magnitude but different averaging periods have very different implications for modeling and attainability. As stated in DELCORA'S comments on the attainability analysis:

Any literature review of DO thresholds...should report not just the magnitude but the averaging period associated with effects that were observed or not observed. Criteria should then be expressed and evaluated with magnitude and duration (averaging period) components, as opposed to treating all criteria as "instantaneous minimum" thresholds or evaluating them using the 1st percentile DO.

We recommend that discussion of averaging periods be added to the following part of the draft linkage report:

- Section 2.5 (Identification of Key DO Thresholds): Table 2-1 should include a column that cites the duration components of the experiments or criteria being cited. The associated text of Section 2.5 should consistently cite averaging periods associated with the DO thresholds.
- Section 3: The discussion and graphics of bounding DO thresholds should be revised and refined to include averaging periods and avoid direct comparison of DO levels/thresholds with disparate averaging periods.
- Appendix A: Citations of DO thresholds from sturgeon-related literature should be reviewed and revised to ensure the experiment durations and averaging periods are identified.
- Appendix B: The “suitability illustrations” should be revised to clearly identify the averaging periods of the DO thresholds being plotted. The plotting of the current water quality condition should include 7-day and 30-day averages to allow comparison to the corresponding DO thresholds.

4. The scientific literature and criteria precedents inform the appropriate averaging periods of DO thresholds. This comment builds upon the prior comment to recommend specific averaging periods for the cited DO thresholds. These recommendations are informed by the Chesapeake Bay DO criteria (USEPA, 2003), supporting scientific literature, and other information presented in the linkage report. The recommended averaging periods and seasons of applicability associated with the major thresholds are as follows:

DO Threshold (mg/L)	Protective Basis of Threshold	Appropriate Averaging Period	Season of Applicability
3.2	Survival of sturgeon when temperatures $\leq 26^{\circ}\text{C}$	Not to fall below	Year-round
4.0	Survival of open-water fish larvae	7-day mean	Year-round
4.3	Survival of sturgeon when temperatures $> 26^{\circ}\text{C}$	Not to fall below	Year-round
5.0	Survival and growth of early life stages of fish	Not to fall below	Feb 1- Jun 30
	Growth of early life stages of fish <sup>1</sup>	30-day mean	Year-round
6.0	Survival and growth of early life stages of fish	7-day mean	Feb 1- Jun 30

<sup>1</sup>USEPA (2003) also recommended a 30-day mean of 5.5 mg/L for salinities less than 0.5 ppt.

Note that the averaging period of the 5.0 mg/L threshold would vary by season of application. We also recommend the use of the 3.2 mg/L threshold for sturgeon protection when water temperatures are  $26^{\circ}\text{C}$  or less.

5. The concepts of “minimum suitable” and “protective” thresholds should be merged into “minimum protective” thresholds. As written, the draft linkage report distinguishes between “minimum suitable” and “protective” DO thresholds, with the protective thresholds being higher than the minimum suitable thresholds. However, for the purposes supporting water quality criteria development, the concepts of minimum suitable and protective values are not distinct.

We refer DRBC to DELCORA (2022) Comment #9 on the attainability analysis which presents the definition of water quality criteria in the Clean Water Act framework, focusing in the “reasonable

and adequate amount of protection” of a use and recognizing that “because aquatic ecosystems can tolerate some stress and occasional adverse effects, protection of all species at all times and places is not deemed necessary.” (USEPA, 1985). That comment also discusses USEPA precedents developing for DO criteria as representing “values between no production impairment and slight production impairment...[and] an estimate of the threshold concentration below which detrimental effects are expected” (USEPA, 1986). Under this framework, the minimum suitable values are protective of uses when attained with their appropriate averaging periods. The Delaware River Estuary currently does not fully support a fish propagation use (DRBC, 2015). The definition of minimum protective values will aid the determination of whether such a use is attainable.

Our review of the draft linkage report suggests that DRBC’s distinction between “minimum suitable” and “protective” DO thresholds may have been more related to different averaging periods than different levels of protection. For example, the values selected as minimum suitable thresholds tend to be values below which DO should rarely drop, and the definition of protective values indicated that protectiveness was dependent upon “timing, frequency and duration of exposure”.

As discussed in Comment #3 above, averaging periods are an important component of regulatory criteria that should be explicitly identified. Hence, the first step in addressing this comment would be to identify averaging periods in accordance with Comment #3. The report should then identify the “minimum protective” values (of different averaging periods) for support of fish propagation in different seasons. As also discussed in Comment #4 above, we believe that the Chesapeake Bay criteria essentially serve this purpose and could be directly used as the minimum protective values.

Under this approach, there is no need for the draft linkage report to present intermediate DO thresholds, which would only serve to confuse the selection of protective thresholds. The “upper limit” DO thresholds of the draft linkage report are also not directly relevant to water quality criteria development, and DELCORA would oppose the selection of regulatory DO criteria between the minimum protective values and the upper limit values. As stated in our prior comments, any DO thresholds higher than minimum protective values should only be used for non-regulatory purposes.

## References

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