Applying the EPA's Economic Analysis Tools to a WQS Variance for Ammonia for Small Lagoon Communities

Office of Water

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1. Overview

In 2022, the EPA released the *Lagoon Wastewater Treatment Action Plan* (hereafter referred as "Lagoon Action Plan") with the goal to "improve public health and clean waterway protections for small, rural, and tribal communities that rely on lagoon wastewater treatment systems through equitable, accessible, and coordinated technical and financial assistance." [1] Lagoon wastewater treatment systems are earthen ponds that treat wastewater using biological processes.[2]

The Lagoon Action Plan estimates that as of 2022, "there are over 4,500 discharging lagoon wastewater systems in the United States that do not rely on more advanced supplemental technology."[3] Communities with lagoon wastewater treatment systems are also often smaller, usually with populations under 5,000 and more typically under 3,000 persons. Such communities may also be economically disadvantaged.

As states, territories, and authorized Tribes[4] continue to use sound science to adopt new or more stringent water quality criteria to protect their waters' designated uses, lagoon communities may find it difficult to meet Clean Water Act (CWA) Section 402 National Pollutant Discharge Elimination System (NPDES) permit requirements[5] based on water quality standards (WQS) for certain pollutants. Specifically, the costs to install new or additional pollutant control technologies to meet these requirements could cause substantial and widespread economic and social impacts to the affected lagoon communities. One pollutant that has been particularly challenging for lagoon communities is ammonia.

States and authorized Tribes may adopt WQS variances, consistent with 40 CFR 131.14, when and where the designated use and associated criterion are shown to be unattainable for a period of time and incremental water quality progress can be made to reduce ammonia loadings to receiving waterbodies. A WQS variance (as defined in 40 CFR 131.3(o)) is "a time-limited designated use and criterion for a specific pollutant(s) or water quality parameter(s) that reflect the highest attainable condition during the term of the WQS variance." A lagoon community may be interested in a WQS

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[1] U.S. Environmental Protection Agency. 2022. Lagoon Wastewater Treatment Action Plan: Supporting Small, Rural and Tribal Communities. (EPA-832-B2-2022). https://www.epa.gov/system/files/documents/2022-10/Lagoon%20Action_Plan_FINAL.pdf. (pg. 4).

[2] For the purposes of this document, "lagoon wastewater treatment system" also includes systems that are "lagoon dominate" or "lagoon dominated".

[3] U.S. Environmental Protection Agency. 2022. Lagoon Wastewater Treatment Action Plan: Supporting Small, Rural and Tribal Communities. (EPA-832-B2-2022). https://www.epa.gov/system/files/documents/2022-10/Lagoon%20Action_Plan_FINAL.pdf. (pg. 6).

[4] Hereafter referred to as ''states and authorized Tribes.'' ''State'' in the CWA and this document refers to a state, the District of Columbia, the Commonwealth of Puerto Rico, the U.S. Virgin Islands, Guam, American Samoa, and the Commonwealth of the Northern Mariana Islands. ''Authorized Tribes'' refers to those federally recognized Indian Tribes with authority to administer a CWA WQS program.

[5] NPDES permits are developed on a case-by-case basis in accordance with the CWA and implementing regulations. Compliance with those permits is a separate case-specific matter under the applicable CWA authorities. Any statements in this document about meeting NPDES permit limits are only for informational and illustrative purposes.

variance when they are unable to comply with their ammonia water quality-based effluent limit (WQBEL) in a NPDES permit, and neither technological nor financial assistance is available to remedy the noncompliance issue.

The EPA anticipates that many states, authorized Tribes and lagoon communities may be interested in pursuing a WQS variance for ammonia based on a demonstration that "[c]ontrols more stringent than those required by sections 301(b) and 306 of the [CWA] would result in substantial and widespread economic and social impact" ((40 CFR 131.10(g)(6) or "Factor 6").[6] It is important to note that this evaluation is not a cost-benefit analysis. A Factor 6 evaluation only determines if meeting water quality standards would cause substantial and widespread economic and social impact in a specific circumstance. However, lagoon communities considering a WQS variance may also lack the resources and capacity to conduct the economic analysis themselves to determine if implementing such controls would result in "substantial and widespread economic and social impact." In such instances, states and authorized Tribes may conduct the economic analysis and develop the WQS variances for the lagoon wastewater treatment systems[7] within their jurisdictions. Given the large numbers of such systems in some jurisdictions, however, the number of economic analyses may require a significant commitment of resources and staff time for some states and authorized Tribes.

In support of the specific needs of these communities, states, and authorized Tribes, the EPA committed under Action Item 4 of the Lagoon Action Plan to develop lagoon wastewater treatment system cost and performance regulatory support tools.[8] The EPA has developed two tools that states, authorized Tribes, and lagoon communities may utilize when conducting the economic impact analysis for ammonia-specific WQS variances:

1. The Small Lagoon Community Economic Streamlining Tool, or "SLCES Tool"; and
2. The Individual Lagoon Tool, or "ILT".

Both tools provide user-friendly ways for a state, authorized Tribe, or community to follow the EPA's economic guidance for publicly owned lagoon wastewater treatment systems to evaluate whether a WQS variance for ammonia is justified based on Factor 6. Consistent with the EPA's economic guidance, both tools result in an assessment of whether a substantial economic and social impact is likely, unlikely, or unclear when implementing the pollutant control technology options included in the tools. The SLCES Tool streamlines the information collection process for conducting the economic impact analysis, whereas the ILT enables a user to conduct the economic impact analysis using community-specific

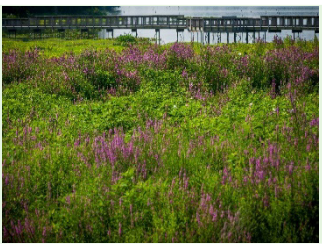
[6] 40 CFR 131.14(b)(2)(i)(A) provides seven factors that a state or authorized Tribe can use to demonstrate the need for a WQS variance.

[7] U.S. Environmental Protection Agency. 2022. The Universe of Lagoons: An analysis of state and tribal wastewater treatment systems and socioeconomic, environmental justice, and compliance patterns in small, rural communities in the United States. (EPA-823-R-22-001). https://www.epa.gov/system/files/documents/2022-06/universe-lagoons-report-2022.pdf

[8] U.S. Environmental Protection Agency. 2022. Lagoon Wastewater Treatment Action Plan: Supporting Small, Rural and Tribal Communities. (EPA-832-B2-2022). https://www.epa.gov/system/files/documents/2022-10/Lagoon%20Action_Plan_FINAL.pdf and https://www.epa.gov/small-and-rural-wastewater-systems/lagoon-wastewater-treatment-systems.

information. The ILT may be particularly useful where using the SLCES Tool may not accurately reflect community conditions.

This document describes:



1. How and when it might be appropriate for a community, state or authorized Tribe to use the SLCES Tool and ILT; and
2. How a state or authorized Tribe can use the information from either or both tools to develop a WQS variance for ammonia for publicly-owned lagoon systems based on Factor 6, consistent with 40 CFR 131.14.

2. Water Quality Standards (WQS) Variances

A WQS variance (as defined in 40 CRF 131.3(o)) is "a time-limited designated use and criterion for a specific pollutant(s) or water quality parameter(s) that reflect the highest attainable condition during the term of the WQS variance." The EPA's WQS regulation at 40 CFR 131.14 establishes a framework for the adoption of WQS variances. States and authorized Tribes may choose to utilize WQS variances to require incremental improvements in water quality while allowing time for advances in treatment technologies, control practices, or other changes in circumstances, that may, in some cases, lead to eventual attainment of the designated use and criterion.

All WQS variances are WQS; therefore, to be effective for CWA purposes, they must be adopted[9] and submitted to the EPA for review and approval under CWA Section 303(c).[10] WQS variances must meet the requirements of 40 CFR Part 131, including 40 CFR 131.14, and the public participation requirements specified in 40 CFR 131.20(b).

For additional information on WQS variances, please refer to the EPA's WQS variances website.[11] This website includes the WQS Variance Building Tool,[12] which is designed to help states and authorized Tribes evaluate whether a WQS variance is appropriate and if so, to navigate the requirements at 40 CFR 131.14.

[9] A WQS must be a legally binding provision adopted or established pursuant to state or tribal law. CWA Section 303(a)-(c) uses the terms "adopt," "law," "regulations," and "promulgate" when referring to WQS and the EPA's regulation (40 CFR 131.3(i)) specifies that WQS are "provisions of state or federal law." The EPA considers documents incorporated by reference into state or tribal law to be legally binding provisions adopted or established pursuant to state or tribal law. Please see Chapters 1 and 7 of the EPA's WQS Handbook for a discussion on the EPA's authority and duty to review and approve or disapprove new or revised WQS.

[10] CWA Section 303(c)(2)-(3) and 40 CFR 131.21(c).

[11] https://www.epa.gov/wqs-tech/water-quality-standards-variances

[12] https://www.epa.gov/wqs-tech/water-quality-standards-variance-building-tool

3. The EPA'S Economic Guidance for WQS Decisions

The EPA's economic guidance for WQS decisions is found in two main documents*: Interim Economic Guidance for Water Quality Standards: Workbook* (hereinafter referred to as "1995 Interim Economic Guidance") (EPA-823-B-95-002, March 1995) and *Clean Water Act Financial Capability Assessment Guidance* (herein after referred to as "FCA Guidance") (EPA-800-B-24-001, March 2024). The 1995 Interim Economic Guidance provides guidance to public and private sector dischargers on the information that a state or authorized Tribe should consider when determining whether the cost of implementing pollutant reduction options to meet permit requirements derived from the designated use and criterion "would cause substantial and widespread economic and social impact" to the affected community and/or discharger. The FCA Guidance supplements the public sector sections of the 1995 Interim Economic Guidance with additional indicators and analyses for low-income residents, an Expanded Economic Impact Matrix, and recommendations to consider when making WQS decisions. This section includes a broad overview of the EPA's economic guidance. Please refer to the EPA's *Economic Guidance for Water Quality Standards* website for a full discussion of the EPA's recommendations. It is important to note that a Factor 6 evaluation is not a cost/benefit analysis. A Factor 6 evaluation only determines if the pollutant control technology needed to meet WQS would cause substantial and widespread economic and social impacts in a specific circumstance.

To meet the requirements of Factor 6, the socioeconomic impact of additional pollutant controls must be both substantial and widespread. The EPA recommends first performing an analysis to determine if the cost of additional pollutant controls would result in a substantial impact. If the analysis suggests the cost would have a substantial impact, then the state or authorized Tribe should perform a separate analysis to determine if the substantial impact would be widespread.

For public-sector dischargers (e.g., publicly owned wastewater treatment facilities in the context of this document), a "substantial impact" refers to the economic impact on the community, taking into consideration socioeconomic conditions, if the discharger were required to implement additional pollutant controls necessary to comply with WQS based on the applicable designated use and criterion (e.g., aquatic life use and ammonia criteria). The EPA's FCA Guidance recommends determining substantial impacts in four steps:

1. **Determine the Initial Economic Impact as described in the EPA's 1995 Interim Economic Guidance.** The Initial Economic Impact is evaluated using two tests – the Municipal Preliminary Screener and the Secondary Test. The Municipal Preliminary Screener evaluates the impact the cost of additional pollutant controls would have on a household and thus "screens" for situations where additional analyses may not be warranted. The Secondary Test further evaluates the potential for a substantial impact by examining indicators related to the community's financial health and results in a Secondary Score. The Municipal Preliminary Screener and Secondary Score are then combined to determine the Initial Economic Impact.

2. **Calculate a Lowest Quintile Poverty Indicator (LQPI) Score.** In addition to determining the Initial Economic Impact, the FCA Guidance recommends evaluating a set of six socioeconomic statistics from the United States Census Bureau to assess the severity and prevalence of poverty in a community's service area and incorporate that information into the assessment of economic impacts.

3. **Perform a Financial Alternatives Analysis.** The FCA Guidance recommends investigating a variety of potential funding sources and alternative financial mechanisms that could minimize financial impacts to low-income households so that they can also benefit from infrastructure investments and improved water quality. See section 5.1 of this document for information on the availability of technical assistance for small communities that may lack the resources to be able to fully evaluate funding and financing alternatives when making WQS decisions.

4. **Combine the analysis recommended in the 1995 Interim Economic Guidance with the additional analyses recommended in the FCA Guidance.** The FCA Guidance recommends combining the analytical results from the 1995 Interim Economic Guidance (described under Step 1) with the additional analytical results recommended in the FCA Guidance (described under Step 2) using an Expanded Economic Impact Matrix. The FCA Guidance also describes how the Financial Alternatives Analysis (described under Step 3) may modify the outcome from the Expanded Economic Impact Matrix.

Finally, the FCA Guidance provides recommendations on how to interpret the combined analytical results to determine if additional pollution controls necessary to meet WQS would result in a substantial economic and social impact to a public sector discharger.

In addition to the determining whether the impact is "substantial," a demonstration based on Factor 6 requires a determination of whether the impact is "widespread." "Widespread impacts" refer to how a substantial impact could affect the community or surrounding area. The 1995 Interim Economic Guidance recommends evaluating potential changes to various socioeconomic indicators of a community to determine if a substantial impact is likely to also be widespread. For example, a decrease in household income, decrease in commercial development, lower property values, or an increase in unemployment could negatively affect the ways in which people in a community live, work, play, relate to one another, and organize their activities.

4. The EPA's Economic Tools for Small Communities with Lagoon Systems

The Small Lagoon Community Economic Streamlining Tool (SLCES Tool) and Individual Lagoon Tool (ILT) are two tools that states, authorized Tribes, and communities may use when conducting an economic impact analysis for ammonia-specific WQS variances for public sector lagoons, pursuant to Factor 6. The tools follow the recommendations for public sector facilities in the 1995 Interim Economic Guidance and FCA Guidance. For information on conducting an economic analysis for private sector wastewater treatment systems, see the EPA's 1995 Interim Economic Guidance.

4.1 Methodology to Develop the SLCES Tool and the ILT

To develop these tools, the EPA evaluated cost and performance information for pollutant control technologies that could treat or remove ammonia in lagoon wastewater treatment systems with design flows equal to or less than 2 million gallons per day (MGD). The EPA chose 2 MGD because the EPA's Lagoon Universe Dataset[13] on lagoon wastewater treatment systems in the United States specified that 97.8% of lagoon facilities, for which data were collected and design flows were known, had a design flow less than or equal to 2 MGD. In particular, the EPA evaluated two broad categories of technologies: technologies that could replace the lagoon treatment system with an activated sludge-based system and in-lagoon treatment technologies that could be installed within the existing lagoon to improve ammonia removal performance or could be added on to the existing lagoon to remove additional ammonia from the effluent. When selecting the pollutant control technologies to include in these tools from this broad universe of lagoon treatment system technologies, the EPA considered the following principles:

1. The technology's cost and performance should be able to be modeled at the national level.
2. Tools should include the lowest cost technologies available that are likely to meet the target ammonia criterion in most circumstances.
3. Tools should also include any lower-cost ammonia removal technologies, even if not likely to meet the target ammonia criteria in most circumstances, because they could inform identification of the WQS variance highest attainable condition.

Limiting the technologies to only those where the cost and performance could be modeled at the national level eliminated many pollutant control technologies because the EPA found limited data for assessing the cost and performance of many in-lagoon treatment technologies for ammonia. Deriving nationally relevant cost and performance estimates from these limited data was further complicated by variability in local cost and performance estimates due to site-specific factors. As a result, the EPA decided to develop these tools using known pollutant control technologies for which cost and performance could currently be modeled at the national level.[14] These were technologies whose cost

[13] U.S. Environmental Protection Agency. (July 2022). Lagoon Inventory Dataset. https://www.epa.gov/small-and-rural-wastewater-systems/lagoon-wastewater-treatment-systems#dataset

[14] For information on the cost and performance estimation approach used for the ILT and SLCES Tools see the U.S. Environmental Protection Agency's *Cost and Performance Estimation Approaches for the Individual Lagoon Tool and the Small Lagoon Community Economic Streamlining Tool. 2024.* 820-B-24-003. https://www.epa.gov/system/files/documents/2025-04/cost-and-performance-estimation-approaches-for-slces-and-ilt.pdf

and performance could be modeled without inputting site-specific information (other than the state in which the lagoon is located). At the same time, per Action Item #3 in the EPA's Lagoon Wastewater Treatment Action Plan, the EPA anticipates completing two research projects in late 2025 and late 2026 to gather additional cost and performance information for lagoon treatment technologies for ammonia and nutrients.

The FCA guidance recommends that states and authorized Tribes identify the lowest cost pollutant reduction option that allows the entity to meet water quality standards. Therefore, to streamline the analysis when using these tools, the EPA included the lowest cost pollutant control technologies likely to meet a target ammonia criterion from the suite of currently available technologies for which cost and performance could be modeled at the national level. Identifying a target ammonia criterion was critical to developing tools useful for these small communities. States and authorized Tribes have the discretion to establish numeric water quality criteria based on (1) CWA Section 304(a) national recommended water quality criteria,[15] (2) CWA section 304(a) national recommended water quality criteria modified to reflect site-specific conditions, or (3) other scientifically defensible methods.[16] However, the EPA needed to make an assumption about the stringency of the target ammonia criterion in order to identify the lowest cost pollutant control technology options that could meet that target criterion. Thus, the EPA assumed the target ammonia criterion is commensurate with EPA's 2013 CWA section 304(a) recommended ammonia criteria.[17] While the EPA made this assumption for the purposes of developing these two tools, nothing in this document, the SLCES Tool, or the ILT, dictates how states and authorized Tribes are to develop water quality criteria for ammonia.

The EPA identified the following three pollutant control technologies as meeting the three principles identified:

1) **Oxidation ditch activated sludge system**
2) **Sequencing batch reactor (SBR)**

} **Options to fully replace a lagoon treatment system with an activated sludge-based system**

3) **Addition of floating lagoon covers to existing aerated lagoon system** } **In-lagoon treatment technology**

[15] To provide guidance to states and authorized Tribes, the EPA publishes, and from time to time revises, national recommended criteria for water quality under CWA Section 304(a) that accurately reflect the latest scientific knowledge. The EPA's national CWA 304(a) criteria recommendations do not impose legally binding requirements. They do not substitute for the CWA or EPA regulations, and they are not regulations themselves.

[16] 40 CFR 131.11(b)(1)

[17] The 2013 304(a) recommended ammonia criteria superseded the EPA's previously recommended freshwater ammonia criteria from 1999 and reflect new data on sensitive freshwater mussels and snails.

An oxidation ditch is "a modified activated sludge biological treatment process that utilizes long solids retention times (SRTs) to remove biodegradable organics".[18] A sequencing batch reactor (SBR) is an activated sludge system whereby wastewater is added to a "batch" reactor, treated, and then discharged.[19] Floating covers (i.e., modular insulated covers) can be added to reduce heat loss from lagoons, thereby maintaining wastewater temperatures that are sufficient to support nitrification for a greater proportion of the year.

The EPA estimated that, depending on influent temperature, the oxidation ditch and sequencing batch reactor pollutant control technologies could result in an effluent ammonia concentration between 0.29 mg/L and 1.42 mg/L. Although this level of performance may not be sufficient to meet the target ammonia criterion in some site-specific situations (e.g., in very high pH receiving waters), these pollutant control technologies would meet such a criterion in most situations. The EPA did not include higher performing pollutant control technologies (such as more advanced mechanical plants) because their level of performance would not be needed to meet the target ammonia criterion in most circumstances, making it unlikely that they would be the lowest cost pollution reduction option.

Based on nationally relevant performance data, the EPA also estimated that floating lagoon covers would result in an effluent ammonia concentration between 4 mg/L and 20 mg/L when used in an aerated lagoon wastewater treatment system. Aerated lagoons are mechanically aerated and can be either partially or completely mixed,[20] whereas facultative lagoons are earthen ponds approximately four to eight feet deep that are not mechanically mixed or aerated.[21] Although installing floating lagoon covers on aerated lagoons is not likely to meet the target ammonia criterion in many situations, floating covers may meet the target ammonia criterion in some situations such as those lagoons discharging to waterbodies with high flow rates relative to the effluent flow rate. The EPA was unable to identify nationally relevant performance data on the addition of floating covers to a facultative lagoon.

Due to the streamlined nature of the SLCES Tool, it only evaluates an oxidation ditch activated sludge system. Because the oxidation ditch activated sludge system cost model always results in a lower cost compared to the SBR cost model, the EPA used the oxidation ditch activated sludge system as the default pollutant control technology for the SLCES Tool.

The ILT, on the other hand, evaluates all three technologies. Therefore, where installing a sequencing batch reactor (SBR) system, or adding floating lagoon covers to an existing aerated lagoon system, would be more appropriate, states and authorized Tribes should consider using the ILT.

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[18] U.S. Environmental Protection Agency. (2000). Wastewater Technology Fact Sheet: Oxidation Ditches (EPA 832-F-00-013). https://www3.epa.gov/npdes/pubs/oxidation_ditch.pdf.

[19] U.S. Environmental Protection Agency. (1999). Wastewater Technology Fact Sheet: Sequencing Batch Reactors (EPA 932-F-99-073). https://www3.epa.gov/npdes/pubs/sbr_new.pdf

[20] U.S. Environmental Protection Agency. (2002). Wastewater Technology Fact Sheet: Aerated, Partial Mix Lagoons (EPA 832-F-02-008). https://www3.epa.gov/npdes/pubs/apartlag.pdf.

[21] U.S. Environmental Protection Agency. (2002). Wastewater Technology Fact Sheet: Facultative Lagoons (EPA 832-F-02-014). https://www3.epa.gov/npdes/pubs/faclagon.pdf.

The EPA's selection of these technologies is for the purposes of using these voluntary tools to support small communities with limited resources and site-specific information when pursuing a WQS variance for ammonia. The EPA notes that this does not limit the scope of pollutant control technologies a discharger can consider utilizing to meet its NPDES permit requirements. The EPA used CapdetWorks[22] to develop the cost estimates in the SLCES tool and ILT. However, where the state, authorized Tribe or community has the resources and information to determine more precise cost estimates for a particular project, the EPA recommends using those site-specific cost estimates along with the Public Sector spreadsheet tools accompanying the EPA's economic guidance documents, to determine whether a WQS variance can be justified based on Factor 6.

4.2 Overview of the SLCES Tool and the ILT

4.2.1 Small Lagoon Community Economic Streamlining (SLCES) Tool

The SLCES Tool provides a streamlined process states and authorized Tribes can use to evaluate the economic and social impacts of installing an oxidation ditch activated sludge system.

The SLCES Tool automatically retrieves data from the U.S. Census Bureau (https://data.census.gov), hereafter referred to as "Census", for the economic impact analysis recommended in the EPA's 1995 Interim Economic Guidance and FCA Guidance. The SLCES Tool streamlines the analysis by first calculating the Municipal Preliminary Screener using the median household income for each community, that is automatically retrieved from the Census. The SLCES Tool then predicts Secondary Scores using a statistical model[23] based on the MHI and unemployment rate data automatically downloaded from the Census for each community, rather than having the user enter municipal (i.e., community specific) financial information for each community. The SLCES Tool then calculates a lowest quintile poverty indicator (LQPI) score for each community based on data also automatically retrieved from the Census. The SLCES Tool combines the analytical results for the Secondary Scores and the LQPI using the Expanded Economic Impact Matrix. Thus, the SLCES tool provides for a streamlined economic evaluation using one set of data inputs that is automatically downloaded from the Census.

A key feature of the SLCES Tool is that it predicts Secondary Scores for the communities being evaluated using a statistical model based on Census information; therefore, users do not have to collect and input municipal economic data for each individual community. However, the statistical model may not fully capture the unique economic and social circumstances of every community. Where the SLCES Tool may

[22] CapdetWorks is a software tool for preliminary design and cost estimation for wastewater treatment plant construction project alternatives. These costs generally are prepared based on limited site-specific information and used for purposes such as planning, project screening at more developed stages, alternative scheme analysis, confirmation of economic and/or technical feasibility, and preliminary budget approval. The accuracy of such cost estimates is generally in the range of -30 percent to +50 percent. See AACEI International Recommended Practice No. 18R-97 (2020): https://web.aacei.org/docs/default-source/rps/18r-97.pdf?sfvrsn=a5d0dab5_20.

[23] U.S. Environmental Protection Agency. 2024. Technical Support Document: Statistical Model for Predicting the Outcome of the Secondary Test in the Small Lagoon Community Economic Streamlining Tool. 820-B-24-002. https://www.epa.gov/system/files/documents/2024-08/slces-tool-tsd-statistical-model-to-predict-secondary-test-outcomes-8.2024.pdf

not accurately capture a community's economic and social conditions, the state or authorized Tribe may use the ILT to help account for the community's unique circumstances. See section 4.2.2.

The SLCES Tool may be most useful when:

1. Performing the economic analysis recommended in the EPA's 1995 Interim Economic Guidance and FCA Guidance on an individual lagoon-by-lagoon basis would be cumbersome; or
2. The data for more than two Secondary Score indicators specified in the EPA's 1995 Interim Economic Guidance (i.e., data other than the median household income (MHI) and unemployment values, which can be obtained from the Census in the absence of local information) are not available or are impractical to obtain.

More information on the SLCES Tool, including additional detail on the Tool's assumptions and limitations, is provided in the SLCES Tool User Manual.[24]

4.2.2 Individual Lagoon Tool (ILT)

The Individual Lagoon Tool (ILT) allows users to perform a detailed analysis for a particular lagoon community using community-specific information. A key feature of the ILT is that it allows the user to compare the cost, performance, and potential economic and social impacts of implementing any of the three pollutant control technologies – the two activated sludge-based technologies and the addition of floating lagoon covers (to an existing aerated lagoon system only). The ILT can also incorporate the effects of certain community-specific circumstances into the cost analysis for an individual lagoon, such as accounting for any grant funding that a community has been able to obtain to offset the cost of the treatment.

Similar to the SLCES Tool, the ILT automatically retrieves Census data used for the economic analyses recommended in the EPA's 1995 Interim Economic Guidance and FCA Guidance. However, for the Secondary Score analysis, where the SLCES Tool relies on a statistical model using the MHI and unemployment rate, the ILT provides the ability for a user to enter community specific (or municipal) financial data not available from the Census (e.g., overall net debt, property tax collection rate) that are then combined with certain Census data to calculate the Secondary Score. The ILT output shows where the community falls on the Initial Economic Impact Matrix for each pollutant control technology. The ILT then calculates a LQPI score based on data automatically retrieved from the Census and combines the analytical results using the Expanded Economic Impact Matrix.

[24] U.S. Environmental Protection Agency. 2024. *SLCES Tool User Manual*. 820-B-24-004. https://www.epa.gov/system/files/documents/2025-04/slces-tool-user-manual.pdf

The ILT may be most useful when:

1. The state, authorized Tribe, or community is interested in performing the economic analysis for one or more individual lagoon communities using community-specific information, including in situations where the SLCES Tool indicates it is unclear whether there will be a substantial economic and social impact; or
2. The state, authorized Tribe, or community believes the SLCES Tool is not correctly identifying the economic and social impacts expected for one or more lagoon communities where additional economic information is available (e.g., for debt or financial management) that cannot be entered into the SLCES Tool; and/or
    - For example, in a situation where a community has an above-average MHI and a below-average unemployment rate, but also has a lot of existing debt and very limited ability to raise capital via increased property taxes, the ILT may show that the community's Secondary Score is weaker than the estimate produced by the SLCES Tool statistical model.
3. The state, authorized Tribe, or community wishes to estimate costs and the potential economic and social impact on one or more lagoon communities when adding floating covers to an existing aerated lagoon or replacing the lagoon with an SBR system in addition to the oxidation ditch activated sludge system.

More information on the ILT, including an overview of how to use the Tool and guidance for each data entry field, is integrated into the Tool.

5. Constructing a WQS Variance Using the SLCES Tool or ILT

5.1 Using the SLCES Tool and the ILT to Determine if the Cost of Installing Pollutant Control Technology Would Result in Substantial Impact

Consistent with the EPA's economic guidance, discussed in Section 3 of this document, to meet the requirements of Factor 6 when adopting a WQS variance for ammonia, the cost of installing additional pollutant controls to treat or reduce ammonia must be both substantial and widespread. This section discusses how the SLCES Tool and the ILT can be used to determine whether there are "substantial" economic and social impacts, while section 5.2 discusses whether there are "widespread" economic and social impacts to the community. Example results from both the SLCES Tool and ILT are shown in Table 1 and Table 2, respectively.

Table 1 shows example SLCES Tool results for the economic impact analysis of several fictitious lagoon communities. In this example, the "Final Result" column identifies whether installing an oxidation ditch activated sludge system would:

1. Likely cause a substantial economic and social impact on the community;
2. Not likely cause a substantial economic and social impact on the community; or
3. It is unclear whether installing an oxidation ditch activated sludge system would cause a substantial economic and social impact on the community.

Table 1: *Example SLCES Tool Economic Impact Analysis Results*

ID	Facility Name	Final Result
US00123	ORANGE, CITY OF	Substantial Impact
US00124	ZUCCHINI, VILLAGE OF	Substantial Impact
US00125	PEPPER, VILLAGE OF	Impact Unclear
US00126	TOMATO, VILLAGE OF	Impact Unclear
US00127	CARROT, VILLAGE OF	Not Likely to be Substantial
US00128	APPLE, CITY OF	Substantial Impact
US00129	GRAPEFRUIT, CITY OF	Substantial Impact
US00130	POTATO, VILLAGE OF	Substantial Impact
US00131	MELON, CITY OF	Impact Unclear
US00132	RICE SANITARY DISTRICT	Substantial Impact

Table 2 shows example ILT economic impact results for one fictitious small community with an aerated lagoon system. This example economic impact results table combines the Municipal Preliminary Screener and the Secondary Score to generate an intermediate analytical result ("Initial Economic Impact") which can be Substantial, Unclear or Not Substantial. This Initial Economic Impact is then combined with the LQPI Score to generate the Expanded Economic Impact result. The "Expanded Economic Impact" row in this example shows whether installing a SBR system, an oxidation ditch activated sludge system, or floating covers would cause a substantial economic and social impact on the community.

Table 2*: Example ILT Outputs: Economic Impact*

Summary of Tool Outputs: Economic Impact

This table combines the Municipal Preliminary Screener and the Secondary Test score as recommended in EPA's 1995 Economic Guidance for Water Quality Standards to determine the Initial Economic Impact, which can be *substantial, unclear,* or *not substantial*. This Initial Economic Impact is then combined with the results of the LQPI Score to generate the Expanded Economic Impact result below. This table also reports the estimated ammonia concentrations in winter and summer for each pollutant control technology. The estimated total annual cost to the community includes existing pollution control costs combined with each pollutant control technology's estimated cost.

	Oxidation Ditch	Sequencing Batch Reactors	Floating Covers
Ammonia conc in winter (mg/l)	1.29	1.29	20
Ammonia conc in summer (mg/l)	0.67	0.67	4
Total annual cost	$1,056,813	$1,480,786	$244,452
% Community MHI (MPS value)	2.61% (large economic impact)	3.66% (large economic impact)	0.604% (little economic impact)
Secondary Test Score	2.33 (midrange economy)	2.33 (midrange economy)	2.33 (midrange economy)
Initial Economic Impact	substantial impact	substantial impact	impact not likely to be substantial
LQPI Score	2.00 (medium impact)	2.00 (medium impact)	2.00 (medium impact)
Expanded Economic Impact	substantial impact	substantial impact	impact not likely to be substantial

In addition to the Expanded Economic Analysis, as described in Section 3 of this document, the FCA Guidance recommends performing a Financial Alternatives Analysis (in Section III.d.3) to seek ways to minimize financial impacts to low-income households. Appendix C in the FCA Guidance provides a checklist and example worksheet[25] to guide an entity when performing and documenting a Financial Alternatives Analysis. Although a Financial Alternatives Analysis may be performed after determining the results of the economic analysis, the state, authorized Tribe, or community may find it advantageous to perform the Financial Alternatives Analysis beforehand so that any estimated savings associated with any identified feasible financial alternative (see the FCA Guidance for further discussion on identifying feasible financial alternatives) are immediately incorporated into the cost component of the economic analysis rather than performing the analysis again after the cost estimate is revised.

Where the Financial Alternatives Analysis provides additional information regarding the ability to mitigate costs for specific communities, the state, authorized Tribe, or community should update the appropriate ILT inputs to reflect the financial alternatives identified. Where it is not possible to do so, the user should consider the results of the ILT and the Financial Alternatives Analysis together to evaluate whether economic and social impacts are or are not substantial as recommended in the FCA Guidance. Note that the ILT explicitly asks the user whether they performed a Financial Alternatives Analysis. If the user indicates that they did perform a Financial Alternatives Analysis, the ILT output shows the economic impact results consistent with the Expanded Economic Impact matrix. If the user indicates they did not perform a Financial Alternatives Analysis, the ILT output shows results that are one impact category more conservative than the results from the Expanded Economic Impact matrix, as recommended in Section III.d.5 of the FCA Guidance.

In contrast to the ILT, the SLCES Tool does not explicitly ask the user whether they performed a Financial Alternatives Analysis. To streamline the economic analysis, the SLCES tool assumes a Financial Alternatives Analysis was performed for all communities analyzed and displays the Expanded Economic Impact Matrix results under that assumption. If a Financial Alternatives Analysis is not completed, the state or authorized Tribe should adjust the results of the Expanded Economic Impact Matrix, as recommended by Section III.d.5 of the FCA Guidance.

As stated in the FCA Guidance, the EPA recognizes that not all small communities have the resources to be able to fully evaluate funding and financing alternatives when making WQS decisions. If there are resource concerns, the community could request technical assistance by completing the Water Technical Assistance (WaterTA) Intake Form. Such technical assistance can include support in conducting a Financial Alternatives Analysis, reviewing a completed Financial Alternatives Analysis, or more specific requests such as completing Clean Water State Revolving Fund applications, identifying funding options, assisting with rate design and analysis, and helping with asset management planning. Additionally, to help identify what kind of assistance might be appropriate for a community, the EPA and

[25] U.S. Environmental Protection Agency. 2023. Clean Water Act Financial Capability Assessment Guidance. Appendix C: Financial Alternatives Analysis Checklist and Example Worksheet. EPA-800-B-21-001. United States Environmental Protection Agency, Office of Water. Washington, DC. February 2023.

its partners have developed many tools and resources[26] to help small communities with planning, designing, constructing, and maintaining wastewater infrastructure. The EPA and other organizations also provide funding[27] to improve water and wastewater systems in small and rural communities.

5.2 Determining Whether Substantial Economic and Social Impacts are Widespread

For many public wastewater treatment facilities, the cost of additional pollutant controls is passed on directly to households and businesses through increases in wastewater treatment rates. Although low-income segments of a community would disproportionally experience substantial adverse economic impacts, a significant community-wide increase in wastewater treatment rates would likely have broad adverse impacts on the economic wellbeing throughout the community. Therefore, if a state or authorized Tribe can demonstrate that the additional cost to a public sector discharger to install pollutant controls for ammonia would be funded by a large proportion of households and businesses in the community, it is reasonable to conclude that such a substantial economic impact to the community would also be widespread. Where this is the situation, a state or authorized Tribe should provide this rationale as part of the supporting documentation for its WQS variance submission.

5.3 Identifying the Highest Attainable Condition and term of the WQS Variance

5.3.1 Identifying the Highest Attainable Condition (HAC)

Where a state or authorized Tribe can demonstrate the need for a discharger-specific WQS variance for ammonia, the EPA's regulation at 40 CFR 131.14 requires the state or authorized Tribe to identify the highest attainable condition (HAC) for the water body or waterbody segment, as a quantifiable expression that is one of the following options:[28]

1. The highest attainable interim criterion; or
2. The interim effluent condition that reflects the greatest pollutant reduction achievable; or
3. If no additional feasible pollutant control technology can be identified, the interim criterion or interim effluent condition that reflects the greatest pollutant reduction achievable with the pollutant control technologies installed at the time the state or authorized Tribe adopts the WQS variance, and the adoption and implementation of a pollutant minimization program (PMP).

If there *is* a feasible pollutant control technology that can be identified (i.e., the cost will not cause substantial and widespread economic and social impact) to treat or remove ammonia but not to the extent needed to meet the applicable criterion, the state or authorized Tribe could express the HAC as

[26] https://www.epa.gov/small-and-rural-wastewater-systems/tools-training-and-technical-assistance-small-and-rural

[27] https://www.epa.gov/small-and-rural-wastewater-systems/funding-sources-small-and-rural-wastewater-systems

[28] 40 CFR 131.14(b)(1)(ii)(A)

option 1 or 2 (HAC1 or HAC2).[29] In this case, the "highest attainable interim criterion" or "interim effluent condition representing the greatest pollutant reduction achievable", respectively, would be the condition that is expected to be achieved by the end of the WQS variance term, once the pollutant control technology is installed and operational. The EPA encourages states and authorized Tribes to investigate whether any communities with similar environmental characteristics have piloted such technologies that may provide useful locally applicable information that could be used to inform the HAC for ammonia.

Where the SLCES Tool indicates that installing an oxidation ditch activated sludge system, or the ILT indicates that installing each of the three pollutant control technologies, would likely result in substantial and widespread economic and social impact, it would be reasonable for a state or authorized Tribe to determine that "no additional feasible pollutant control technology can be identified", per 40 CFR 131.14(b)(1)(ii)(A)(3). In such a case, the state or authorized Tribe could express the HAC as HAC3. However, to be consistent with the EPA's WQS regulation, such an HAC must be identified "…using the greatest pollutant reduction achievable with *optimization of currently installed pollutant control technologies and adoption and implementation of a Pollutant Minimization Program (PMP).*"[30] [emphasis added] The supporting documentation that the state or authorized Tribe would submit to the EPA showing that "no additional feasible pollutant control technology can be identified" could include, for example, any community financial documentation used for the inputs to the SLCES Tool or ILT, as well as the outputs from those tools showing that implementing the pollutant control technologies included in the tool used would cause substantial and widespread economic and social impact.

Where expressing the HAC as HAC3, the WQS variance must include the adoption and implementation of a pollutant minimization program (PMP).[31] In the context of WQS variances, a PMP is "a structured set of activities to improve processes and pollutant controls that will prevent and reduce pollutant loadings."[32] In addition to activities to prevent and reduce ammonia loadings to the receiving water, the state or authorized Tribe should consider including monitoring and evaluation requirements, including regular evaluations of whether new information is available about add-on or in-lagoon treatment technologies for ammonia to ensure that the PMP continues to facilitate water quality improvements in the receiving water during the term of the WQS variance.

For more information about lagoon wastewater treatment systems, including tools, training and technical assistance for small and rural wastewater systems, visit the EPA's Lagoon Wastewater Treatment Systems website: https://www.epa.gov/small-and-rural-wastewater-systems/lagoon-wastewater-treatment-systems.

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[29] As discussed in section 4.1, the addition of floating covers to aerated lagoons is not likely to meet the target ammonia criterion in many situations. In such cases, where the ILT output shows that adding covers does not result in a substantial impact, adding lagoon covers could be considered a feasible pollutant control technology for purposes of identifying the HAC.

[30] *Water Quality Standards Regulatory Revisions*, 80 Fed. Reg. 51037 (August 21, 2015).

[31] 40 CFR 131.14(b)(1)(ii)(A)(3)

[32] 40 CFR 131.3(p)

5.3.2 Determining the Term of the WQS Variance

The EPA's regulation at 40 CFR 131.14(b)(1)(iv) specifies that the term of a WQS variance "must only be as long as necessary to achieve the highest attainable condition…," and must be justified by providing supporting documentation.[33] Additionally, WQS variances longer than five years must be reevaluated at least once every five years.[34]

The EPA stated in the preamble to its final rule establishing 40 CFR 131.14 "There can be instances where a state or authorized tribe has information to determine that the underlying designated use and criterion cannot be attained for a particular period of time, but does not have sufficient information to identify the highest attainable condition that would be achieved in that same period of time. In such cases, EPA anticipates that a state or authorized tribe will adopt a shorter WQS variance reflecting the highest attainable condition that is supported by the available information, including the pollutant control activities identified in the WQS submission. States and authorized tribes could then determine the appropriate mechanism to continue making progress towards the underlying designated use and criterion, which may include adoption of subsequent WQS variances as more data are gathered and additional pollutant control activities are identified."[35]

While some potential ammonia reduction strategies for lagoons are currently known, the issue of ammonia treatment in lagoons is an active field of study. As discussed earlier, under Action Item #3 of the Lagoon Action Plan, the EPA is actively gathering additional data over the next few years on performance and cost of potential technologies that lagoon communities could implement to achieve greater removal of ammonia and nutrients. Because the knowledge about ammonia control technologies in lagoons is evolving, pollutant control technologies that cannot currently be identified may become better defined during the term of a WQS variance. Thus, the EPA recommends states and authorized Tribes using these tools for ammonia WQS variances consider adopting a shorter term, such as 5 years, so that the state or authorized Tribe can account for any advances in pollutant control technologies when considering the appropriate mechanism to continue making water quality progress based on the newly available information (e.g., subsequent WQS variance). States and authorized Tribes should work closely with their EPA regional WQS contacts so they can be informed as soon as possible when the EPA has identified additional options for lagoon ammonia removal.

6.0 Conclusion

The SLCES Tool, the SLCES user guide, the ILT, and this document are intended to assist states, authorized Tribes and communities in conducting the economic impact analysis when they are interested in considering WQS variances for ammonia based on Factor 6 for small communities with

[33] 40 CFR 131.14(b)(2)(ii)

[34] 40 CFR 131.14(b)(1)(v)

[35] Water Quality Standards Regulatory Revisions. 80 Fed. Reg. 51038 (August 21, 2015)

lagoon wastewater treatment systems.[36] A WQS variance could be well-suited to provide these communities the time they need to make incremental water quality improvements with respect to ammonia when and where the designated use and associated ammonia criterion are shown to be unattainable for a period of time and there is uncertainty as to what may be ultimately attainable in the waterbody at the time the WQS variance is adopted.

While the EPA selected specific pollutant control technologies to include in the SLCES Tool and ILT for the reasons laid out in this document, those selections do not limit the scope of pollutant control technologies that a state or authorized Tribe could assess when considering a WQS variance for ammonia for a small community with a lagoon wastewater treatment system in their jurisdiction. A state or authorized Tribe may find it beneficial to collect additional wastewater technology cost and performance information on other pollutant control technologies because cost and performance information can be case-specific and dependent on existing infrastructure, permit limits, climate, land ownership, or state or Tribal lagoon maintenance guidelines which may not be captured by the SLCES Tool or ILT. In addition, a discharger may be willing to serve as a pilot for certain technologies. Considering additional pollutant control technologies may be particularly useful if the state or authorized Tribe has:

- Access to operators with knowledge on how to optimize poorly functioning lagoon systems;
- The ability to determine if other communities within the jurisdiction have commissioned a contractor to find similar information that might be applicable to other communities;
- The funding and expertise to research the performance and cost information of currently available technologies that would be applicable to the lagoon(s) in question;
- Experience with the implementation and use of proprietary technology; and/or
- The opportunity to conduct independent studies of emerging technology.

However, the EPA recognizes that many of these same small communities may face similar challenges meeting their CWA requirements for other pollutants. Thus, the EPA is working with its partners to evaluate additional ways it can support small community lagoon systems. For more information and resources to support small and rural communities in developing affordable solutions to aging or inadequate wastewater treatment systems, or to the lack of access to basic wastewater services, visit: https://www.epa.gov/small-and-rural-wastewater-systems and https://www.epa.gov/small-and-rural-wastewater-systems/lagoon-wastewater-treatment-systems

[36] For more information see the EPA's website: https://www.epa.gov/wqs-tech/ammonia-wqs-variance-tools-small-communities-lagoon-wastewater-treatment-systems