STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION

JANET T. MILLS
GOVERNOR

GERALD D. REID
COMMISSIONER

MEMORANDUM

TO: Board of Environmental Protection

FROM: Gerald D. Reid, Commissioner
Kevin Martin, Compliance & Procedures Specialist, Office of the Commissioner
Gregg Wood, Director, Division of Water Quality Management

RE: Nordic Aquafarms, Inc. – Application for a Maine Pollutant Discharge Elimination System (MEPDES) Permit

DATE: May 20 & 21, 2020 Board Meeting – Deliberative Session

Introduction. Nordic AquaFarms Inc. (Nordic or applicant) submitted an application to the Maine Department of Environmental Protection (Department) on October 19, 2018, seeking coverage for a proposed discharge of treated waste water under a combination Maine Pollutant Discharge Elimination System (MEPDES) permit/Maine Waste Discharge License (WDL). The Department determined the application to be complete for processing on November 9, 2018. Nordic is seeking a permit/license to discharge a monthly average flow of 7.7 million gallons per day (MGD) of treated process waste water to Belfast Bay. The applicant is proposing to convey any sanitary waste water generated at the proposed facility to the City of Belfast's waste water treatment facility that is permitted by the Department via MEPDES permit #ME0101532/WDL #W000569.

Nordic is proposing to rear and process up to 33,000 metric tons of Atlantic salmon in a recirculating aquaculture system (RAS) located in the City of Belfast. The applicant is proposing to treat the waste water generated at the facility in an advanced biological treatment system via drum filtration, aerobic moving bed bio-reactors (MBBR), chemical precipitation, micro-filtration in membrane bio-reactors (MBR), sludge dewatering and ultraviolet disinfection prior to discharge. The proposal is to discharge the treated waste water via an outfall pipe measuring 36 inches in diameter with a multi-port diffuser discharging at 11.5 meters below mean low water approximately 3,600 feet off of the shoreline.

Statutory and Regulatory References.

- Pollution Control Law, 38 M.R.S. §§ 411 through 424-B, 451;
- Water Classification Program, 38 M.R.S. §§ 464 through 470;
- Department regulations adopted pursuant to the above laws, including Chapters 520-525, 530, 579, 582, 584 and 587.

Licensing criteria evaluation by subject

1. **Temperature**

- Licensing criteria - No discharge of pollutants shall cause the monthly mean of the daily maximum ambient temperatures in any tidal body of water, as measured outside the mixing zone, to be raised more than 4 degrees Fahrenheit nor more than 1.5 degrees Fahrenheit from June 1 to September 1.

- The applicant is proposing to discharge at 15°C (59.0°F) to 18°C (64.4°F) on a year round basis.

- **Based on Department staff's review and analysis to date, the proposed dischasrge, if permitted would fall below, and thus meet the non-summer licensing criteria as the temperature difference (∆T) is 3.0°F < 4°F.**

- **Based on Department staff's review and analysis to date, the proposed dischasrge, if permitted would fall below, and thus meet the summer licensing criteria as the temperature difference (∆T) 1.4°F < 1.5°F.**

See Attachment A of this memorandum for a more in-depth discussion on temperature.

2. **Dilution**

- Licensing criteria - For discharges to the ocean, dilution must be calculated as near-field or initial dilution, or that dilution available as the effluent plume rises from the point of discharge to its trapping level, at mean low water level and slack tide for the acute exposure analysis, and at mean tide for the chronic exposure analysis using appropriate models determined by the Department such as MERGE, CORMIX or another predictive model. There are no established licensing criteria for determining far-field dilution. Therefore, far-field dilution factors are determined based on a best professional judgment.

- The applicant has modeled the proposed discharge and determined the near-field acute dilution factor is 10:1, the near-field chronic dilution factor is 15:1 and the far-field dilution factor is 300:1.

The Department staff has reviewed the applicant's modeling efforts and believes the proposed near-field and far-field dilution factors for the proposed discharge are based on a sound scientific rationale and if the discharge is permitted, would meet the licensing criteria established in Maine law, §451 and 06-096 CMR Chapter 530.

See Attachment B of this memorandum for a more in-depth discussion on dilution.

3. **Biochemical oxygen demand (BOD_5) and total suspended solids (TSS)**

- Licensing criteria - The dissolved oxygen content of Class SB waters may not be less than 85% of saturation. The discharge is subject to effluent limitations that require application of the best practicable treatment (BPT). The Department has determined BPT to be 30 mg/L as a monthly average and 50 mg/L as a daily maximum. The Department shall issue a license for the discharge of pollutants only if it finds that the discharge either by itself or in combination with other dischargers will not lower the classified body of water below such classification.

- At optimal efficiencies of the waste water treatment facility, the permittee is proposing to discharge BOD and TSS at concentrations of 6 mg/L respectively. This represents a 99% removal rate of BOD and TSS.

- **Based on its review and analysis to date, the Department staff believes BPT based limitations for BOD_5 and TSS of 30 mg/L as a monthly average and 50 mg/L as a daily maximum would meet the dissolved oxygen licensing criteria of 85% saturation and the anti-degradation provision in that the discharge, if permitted, will not cause or contribute to failure of the receiving water to meet the standards of its assigned classification.**

See Attachment C of this memorandum for a more in-depth discussion on BOD_5 and TSS.

4. **Effluent limitations and ambient water quality monitoring**

- Licensing criteria **-** Department rules establish procedures and criteria for setting technology-based effluent limitations in waste discharge licenses. Included are general provisions regarding establishing effluent limits, test procedures, units of measurement, and categories of pollutants. If the technology based limitations are not stringent enough to meet the classification standards assigned to the waterbody, more stringent limitations referred to as water quality based limitations are required.

- The applicant is proposing to accept both BPT and water quality based limitations as well as monitoring the effluent for flow, BOD, TSS, total kjeldahl nitrogen (TKN), nitrate + nitrite nitrogen, total nitrogen, total ammonia, total phosphorus and pH at frequencies ranging from 1/Week to 3/Week. In addition, the applicant is proposing to conduct annual ambient water quality monitoring at five sampling site in Belfast Bay and conduct a dye study to better define the mixing characteristics of the proposed discharge with the receiving water.

- **Based on its review and analysis to date, the Department staff believes that the establishment of BPT and water quality based limitations where appropriate, routine effluent monitoring and ambient water quality monitoring would meet the licensing criteria if the project is permitted.**

See Attachment D of this memorandum for a more in-depth discussion on effluent limitations and monitoring requirements.

5. **Total nitrogen**

Licensing criteria - The discharge is subject to effluent limitations that require application of the best practicable treatment. The Department will issue a license for the discharge of pollutants only if it finds that the discharge either by itself or in combination with other dischargers will not lower the classified body of water below such classification. In applying the statutory antidegradation standards and based upon its historical practice and best professional experience and judgment and its nonbinding Waste Discharge Program Guidance dated June 13, 2001, Department staff will generally consider new or increased discharge that consume 20% or more of the remaining assimilative capacity for dissolved oxygen or other water quality parameter, to be a lowering of the water quality. The Department utilizes two total nitrogen (TN) threshold values to address aquatic life use of Maine's marine waters:

- 0.45 mg/L for protection of dissolved oxygen, when eelgrass has not been historically mapped within close proximity to the discharge in question.

- 0.32 mg/L for protection of eelgrass, when historically mapped as present within close proximity to the discharge in question; and

- At optimal efficiencies of the waste water treatment facility, the applicant is proposing to discharge total nitrogen at a concentration of 23 mg/L. This represents a 99% removal rate of total nitrogen.

- **For the protection of <u>dissolved oxygen</u> as the environmental response indicator, based on Department staff review and analysis to date, the proposed discharge concentration of 23 mg/L would not meet the default antidegradation licensing criteria threshold of 12 mg/L at full flow if permitted. This is because a proposed discharge value of 23 mg/L would consume 38% of the remaining assimilative capacity of the receiving water.**

- **For the protection of <u>eelgrass</u> as the environmental response indicator, based on Department staff review and analysis to date, the proposed discharge concentration of 23 mg/L would not meet the default antidegradation licensing criteria threshold of 14 mg/L at full flow. This is because a proposed discharge value of 23 mg/L would consume 33% of the remaining assimilative capacity of the receiving water.**

- **Based on the default <u>antidegradation</u> licensing criteria and Department staff review and analysis to date, the limiting discharge threshold is 12 mg/L. This 12 mg/L threshold would result in the consumption of no more than 20% of the remaining assimilative capacity of the receiving water. According to the state's antidegradation policy, and based upon the Department staff's historical practice and best professional experience and judgment, consuming more than 20% of the remaining assimilative capacity of the receiving water is considered a lowering of water quality and the applicant would only be able to meet the standard if it established and the Department made the findings required by Maine law, 38 M.R.S. §464(4)(F)(5).**

See Attachment E of this memorandum for a more in-depth discussion on total nitrogen.

Attachment A

Temperature

Applicable temperature licensing criteria

06-096 CMR Chapter 582, *Regulations Relating to Temperature* states in part:

> SUMMARY: These rules provide safeguards for fresh and salt water fauna in lakes and rivers of the state, by establishing instream limits on temperature resulting from thermal discharges.
>
> and
>
> Sub-§5, *Tidal Water Thermal Discharges states* – "No discharge of pollutants shall cause the monthly mean of the daily maximum ambient temperatures in any tidal body of water, as measured outside the mixing zone, to be raised more than 4 degrees Fahrenheit nor more than 1.5 degrees Fahrenheit from June 1 to September 1. In no event shall any discharge cause the temperature of any tidal waters to exceed 85 degrees Fahrenheit at any point outside a mixing zone established by the Board."

Department Review and Analysis of Temperature

Department staff have reviewed and analyzed the applicant's proposal from the standpoint of applicable temperature criteria and note the following:

Considering a worst-case scenario for the applicant's proposed discharge at the full flow of 7.7 MGD contemplated by the application as follows:

Using the highest discharge temperature 18°C (64.4°F). (The temperature of 18°C is the highest discharge temperature identified by the applicant in its application.)

Using the mean of the daily maximum ambient temperature – non summer 1.3°C (34.3°F), in the month of March. (Ambient temperatures are coldest in the month of March.)

Using the mean daily maximum ambient temperature - summer 10°C (50.0°F) in the month of June. (Ambient temperatures are warmest in the month of June.)

Given:

Acute near-field dilution factor 10:1 to be conservative ⇒ 9 parts ambient, 1 part effluent. An acute near-field dilution factor is most appropriate for this analysis as temperature impacts to the environment are greatest shortly after being discharged to the environment.

Effluent flow = 7.7 MGD (from the application)

Receiving water volume= 69.3 MG (calculated from the acute near-field dilution factor of 10:1)

Non-Summer (September 2 – May 31)

Ambient 34.3° F (1.3 °C)
Daily max effluent temperature of 64.4 °F (18° C)

Find the change in temperature (ΔT):

$$\frac{(64.4°F)(7.7\ MGD) + (34.3°F)(69.3\ MGD)}{77\ MGD} = 37.3°F$$

37.3°F -34.3°F = **3.0°F < 4°F** **Based on Department's staff review and analysis to date, this worst-case scenario for non-summer would be below, and thus meet the non-summer licensing criteria if permitted.**

Summer (June 1 – September 1)

Ambient 50.0 °F (10° C)
Daily max effluent temperature of 64.4 °F (18° C)

Find the change in temperature (ΔT):

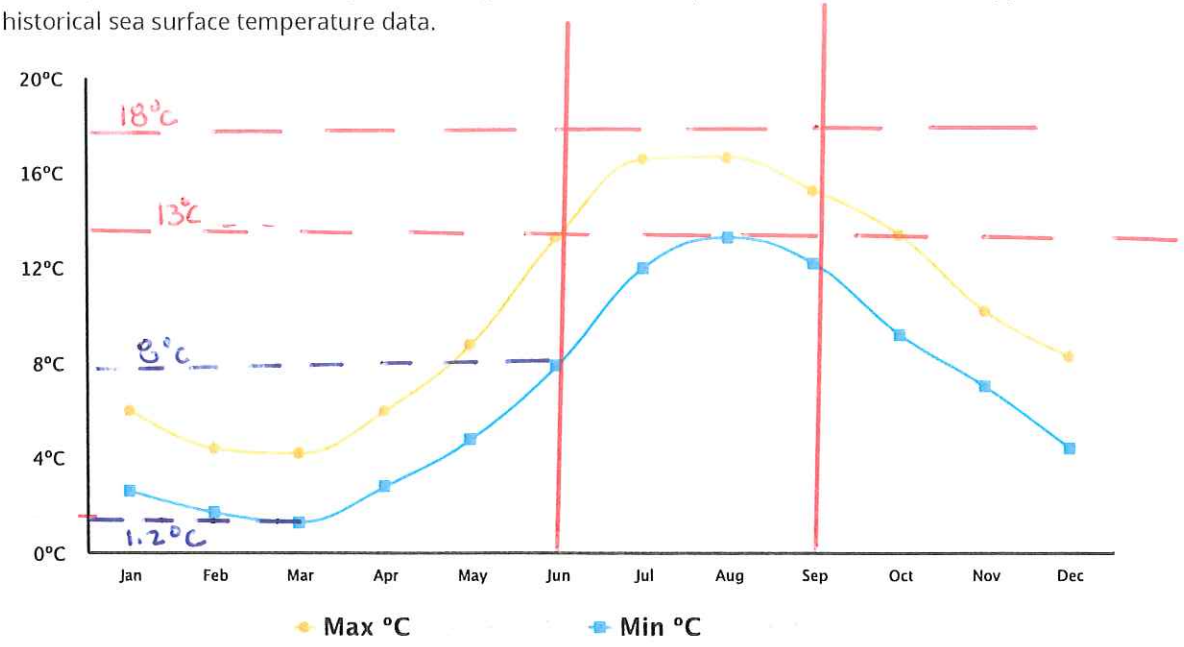
$$\frac{(64.4°F)(7.7\ MGD) + (50.0°F)(69.3\ MGD)}{77\ MGD} = 51.4°F$$

51.4°F -50.0°F = **1.4°F < 1.5°F** **Based on Department's staff review and analysis to date, this worst-case scenario for summer would be below, and thus meet the summer licensing criteria if permitted.**

ANON. 2020a. *Belfast Sea Temperatures* [Online]. 2020. Available: https://www.seatemperature.org/north-america/united-states/belfast.htm [Accessed 9th January 2020].

Monthly average max / min water temperatures

The graph below shows the range of monthly Belfast water temperature derived from many years of historical sea surface temperature data.



Attachment B

Dilution Factors

Applicable dilution licensing criteria

Maine law, 38 M.R.S. §451 *Enforcement generally* states in part:

> After adoption of any classification by the Legislature for surface waters or tidal flats or sections thereof, it is unlawful for any person, firm, corporation, municipality, association, partnership, quasi-municipal body, state agency or other legal entity to dispose of any pollutants, either alone or in conjunction with another or others, in such manner as will, after reasonable opportunity for dilution, diffusion or mixture with the receiving waters or heat transfer to the atmosphere, lower the quality of those waters below the minimum requirements of such classifications, or where mixing zones have been established by the department, so lower the quality of those waters outside such zones, notwithstanding any exemptions or licenses which may have been granted or issued under sections 413 to 414-B.
>
> The department may establish a mixing zone for any discharge at the time of application for a waste discharge license. The department shall attach a description of the mixing zone as a condition of a license issued for that discharge. After opportunity for a hearing in accordance with section 345-A, the department may establish by order a mixing zone with respect to any discharge for which a license has been issued pursuant to section 414 or for which an exemption has been granted by virtue of section 413, subsection 2.
>
> The purpose of a mixing zone is to allow a reasonable opportunity for dilution, diffusion or mixture of pollutants with the receiving waters before the receiving waters below or surrounding a discharge will be tested for classification violations. In determining the extent of any mixing zone to be established under this section, the department may require from the applicant testimony concerning the nature and rate of the discharge; the nature and rate of existing discharges to the waterway; the size of the waterway and the rate of flow therein; any relevant seasonal, climatic, tidal and natural variations in such size, flow, nature and rate; the uses of the waterways in the vicinity of the discharge, and such other and further evidence as in the department's judgment will enable it to establish a reasonable mixing zone for such discharge. An order establishing a mixing zone may provide that the extent thereof varies in order to take into account seasonal, climatic, tidal and natural variations in the size and flow of, and the nature and rate of, discharges to the waterway.

> Where no mixing zones have been established by the department, it is unlawful for any person, corporation, municipality or other legal entity to dispose of any pollutants, either alone or in conjunction with another or others, into any classified surface waters, tidal flats or sections thereof, in such manner as will, after reasonable opportunity for dilution, diffusion, mixture or heat transfer to the atmosphere, lower the quality of any significant segment of those waters, tidal flats or sections thereof, affected by such discharge, below the minimum requirements of such classification, and notwithstanding any licenses which may have been granted or issued under sections 413 to 414-B.

06-096 CMR Chapter 530 – *Surface Water Toxics Control Program,* §4(A) (calculation of dilution factors) states in part as §4(A)(2)(a):

> For discharges to the ocean, dilution must be calculated as near-field or initial dilution, or that dilution available as the effluent plume rises from the point of discharge to its trapping level, at mean low water level and slack tide for the acute exposure analysis, and at mean tide for the chronic exposure analysis using appropriate models determined by the Department such as MERGE, CORMIX or another predictive model.

Modeling for Near-field and Far-field Dilution

The United States Environmental Protection Agency (USEPA) supports the use of the CORMIX model for calculating near-field dilution factors. Page 76 of the *USEPA Technical Support For Water Quality Based Toxics Control, March 1991*, states in part

> "The first model, CORMIX may be the most useful to regulators since it is an expert system that guides the user in selecting an appropriate modeling strategy for rivers or estuaries."

and:

> "CORMIX is a series of software elements for the analysis of a submerged buoyant or nonbuoyant discharge containing conventional or toxic pollutants and entering into stratified or unstratified watercourses, with emphasis on the geometry and dilution characteristics of the initial mixing zone."

Near-Field Dilution

Near-field dilution factors are applicable to pollutants that have the potential for an immediate adverse effect on the flora or fauna of a marine ecosystem. For example, marine organisms react to elevated levels of toxic pollutant such as total metals with hours or days of being exposed. Therefore, estimating acute and chronic dilution factors with a steady state model such as the CORMIX model is supported by Department rules and USEPA technical support documents.

In a letter dated August 14, 2019, to the Department, the applicant indicated it had utilized the CORMIX model to determine the near-field dilution factors for the proposed discharge from the Nordic facility. The input parameters included, but were not limited to, a full flow rate of 7.7 MGD that would be discharged via an outfall pipe measuring 36 inches in diameter with a multi-port diffuser discharging at 11.5 meters below mean low water approximately 3,600 feet off of the shoreline. The applicant calculated worst case near-field dilution factors of 10:1 (acute) and 15:1 (chronic).

Far field dilution

Far-field dilution factors are applicable to pollutants that have the potential for a more subtle and or systemic types of effects on the flora or fauna of a marine ecosystem, and or pollutants that exert their influence on broader time scales. For example, biochemical oxygen demand (BOD_5) decays over time and takes five days to exert its implied influence on ambient dissolved oxygen. Eutrophication associated with excessive nitrogen loadings happens on significantly broader spatial and time scales in this type of marine system, due in large part to the very dynamic nature of the bay.

Unlike the CORMIX model that is supported by Department rules and USEPA technical support documents for estimating near-field acute and chronic dilution factors, there currently are no rules or statutes that establish methodologies to model far-field dilution. Therefore, modeling personnel must use best professional judgment to select modeling tools that are most appropriate for a particular receiving water and discharge characteristics.

Maine law 38 M.R.S. §451 provides some guidance regarding dilution factors that may be considered by the Department: “In determining the extent of any mixing zone to be established under this section, the department may require from the applicant testimony concerning the nature and rate of the discharge; the nature and rate of existing discharges to the waterway; the size of the waterway and the rate of flow therein; any relevant seasonal, climatic, tidal and natural variations in such size, flow, nature and rate; the uses of the waterways in the vicinity of the discharge, and such other and further evidence as in the department's judgment will enable it to establish a reasonable mixing zone for such discharge.”

In this proceeding, the applicant utilized a hydrodynamic model referred to as the ADvanced CIRculation (ADCIRC) model to estimate the far-field dilution factors for the proposed discharge to Belfast Bay. The ADCIRC model was originally developed for coastal flood hazard studies in the larger Penobscot Bay and has many of the dynamic physical attributes of the bay already built into the model. The applicant evaluated a particle tracking output from the model to evaluate the far field dilution factor in close proximity to the proposed discharge over 4 tide cycles (two days) and determined that a far-field dilution factor for

assessing impacts to dissolved oxygen is 300:1. For potential impacts to the closest eelgrass bed located 4 kilometers (2.5 miles) to the southwest of the proposed discharge along the southern shore of Northport as mapped by the Department (see Department sampling station PB02 on the attached aerial photograph entitled *Fig.1: Belfast Bay and Penobscot Bay)*, the dilution factor of 1,000:1 was based on the Department's best professional judgment.

Department staff's review and analysis of the applicant's modeling to date

The Department staff has reviewed the applicant's modeling efforts and believes that the proposed near-field and far-field dilution factors utilized for the proposed discharge are based on a sound scientific rationale and would, if the discharge is permitted, meet the dilution licensing criteria established in Maine law, §451 and 06-096 CMR Chapter 530.

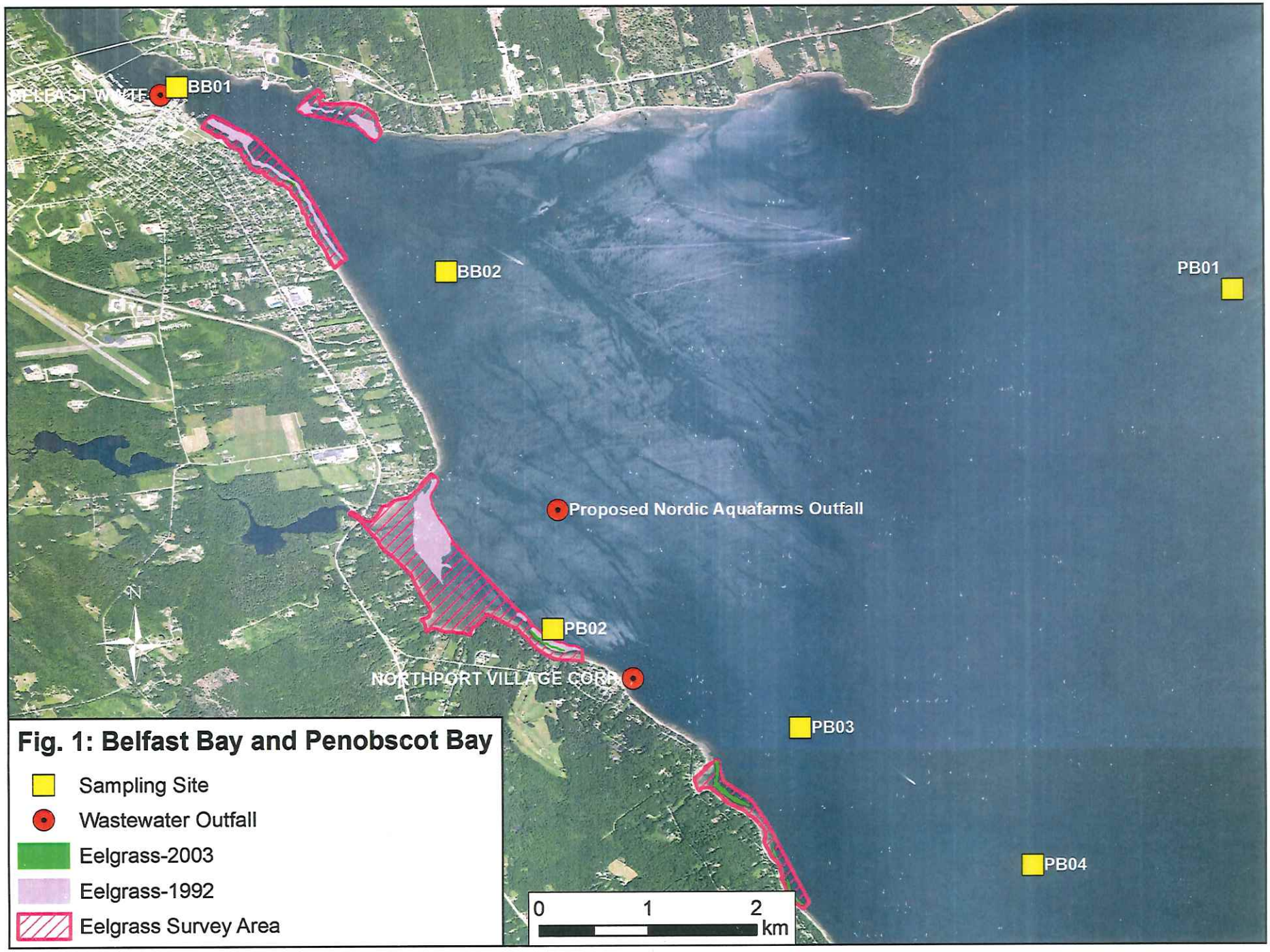


Fig. 1: Belfast Bay and Penobscot Bay

- Sampling Site
- Wastewater Outfall
- Eelgrass-2003
- Eelgrass-1992
- Eelgrass Survey Area

Attachment C

Biochemical Oxygen Demand (BOD_5) & Total Suspended Solids (TSS)

Applicable BOD and TSS Licensing criteria

Maine law 38 M.R.S.§469, *Classifications of estuarine and marine waters*, states that all estuarine and marine waters lying within the boundaries of coastal counties of the State of Maine and that are not otherwise classified are Class SB waters.

Maine law 38 M.R.S. §465-B, *Standards for classification of estuarine and marine waters*, states in part "2. Class SB waters. Class SB waters shall be the 2nd highest classification." Subsection 465-B(2)(b) further states in part; "The dissolved oxygen content of Class SB waters may not be less than 85% of saturation." Subsection 465-B(2)(C) further state in part; "Discharges to Class SB waters may not cause adverse impact to estuarine and marine life in that the receiving waters must be of sufficient quality to support all estuarine and marine species indigenous to the receiving water without detrimental changes in the resident biological community."

Maine law 38 M.R.S. §464 *Classification of Maine Waters,* states in part as follows*:*

> 38 M.R.S. §464 (F)(3): "The department may only issue a discharge license pursuant to section 414-A or approve water quality certification pursuant to the Federal Water Pollution Control Act, Section 401, Public Law 92-500, as amended, if the standards of classification of the water body and the requirements of this paragraph are met. The department may issue a discharge license or approve water quality certification for a project affecting a water body in which the standards of classification are not met if the project does not cause or contribute to the failure of the water body to meet the standards of classification."
>
> 38 M.R.S. §464 (C): "Where natural conditions, including, but not limited to, marshes, bogs and abnormal concentrations of wildlife cause the dissolved oxygen or other water quality criteria to fall below the minimum standards specified in sections 465, 465-A and 465-B, those waters shall not be considered to be failing to attain their classification because of those natural conditions."

Maine law 38 M.R.S. §414-A(1)(D), *Conditions of licenses,* states in part (emphasis added):

> "The discharge will be subject to effluent limitations that require application of the best practicable treatment. "Effluent limitations" means any restriction or prohibition including, but not limited to, effluent limitations, standards of performance for new sources, toxic effluent standards and other discharge criteria regulating rates, quantities and concentrations of physical, chemical, biological and other constituents that are discharged directly or indirectly into waters of the State. "Best practicable treatment" means the methods of reduction, treatment, control and handling of pollutants, including process methods, and the application of best conventional pollutant control technology or best available technology economically achievable, for a category or class of discharge sources that the department determines are best calculated to protect and improve the quality of the receiving water and that are

consistent with the requirements of the Federal Water Pollution Control Act, as amended, and published in 40 Code of Federal Regulations. If no applicable standards exist for a specific activity or discharge, the department must establish limits on a case-by-case basis using best professional judgment, after consultation with the applicant and other interested parties of record. In determining best practicable treatment for each category or class, the department shall consider the existing state of technology, the effectiveness of the available alternatives for control of the type of discharge and the economic feasibility of such alternatives."

Department Staff Discussion

BOD_5 is a measurement of dissolved oxygen that is used by aerobic microorganisms when decomposing organic matter in water. Elevated BOD discharged into a receiving water can cause the ambient dissolved oxygen to be depleted. TSS are solids in water that can be trapped by a filter. Elevated levels of TSS can settle to the bottom of receiving water and impact the resident biological community.

Currently there are no state or federally promulgated best practicable treatment (BPT) numeric standards for BOD_5 and TSS for land based recirculating aquaculture system (RAS) facilities. In 2002, the United States Environmental Protection Agency (USEPA) promulgated standards for RAS facilities based on narrative best management practices (BMPs) controls but opted not to establish numerical standards for BOD_5 and TSS. However, the Department has in other instances been more stringent than the federally promulgated standards and has established numeric limitations for both parameters. The Department has issued MEPDES permits for other RAS facilities establishing monthly average and daily maximum concentration limits of 30 mg/L and 50 mg/L respectively, for BOD_5 and TSS based on Department best professional judgment (BPJ) of BPT for RAS facilities. These limits were based on BPT recommendations included in USEPA's 2002 proposed draft National Effluent Guidelines for TSS for re-circulated fish hatchery wastewater receiving a secondary level of treatment and the Department's long-standing view of the relationship with and significance of BOD_5. For the proposed discharge from the proposed Nordic facility, mass limits would be calculated based on the monthly average flow limit of 7.7 MGD, the applicable concentration limit used by the Department based on BPJ and a conversion factor of 8.34 lbs/gal for water.

The limits would be calculated as follows:

Monthly average: (7.7 MGD)(30 mg/L)(8.34 lbs/gal) = 1,926 lbs/day

Daily maximum: (7.7 MGD)(50 mg/L)(8.34 lbs/gal) = 3,211 lbs/day

The Department staff has modeled the impact of the BPT discharge levels calculated above for BOD_5 and TSS on the ambient dissolved oxygen and believe that, based on its review and analysis to date, the proposed discharge, if permitted, would not have a discernable influence on ambient dissolved oxygen. The proposed discharge of BOD_5 at 30 mg/L has the potential to increase ambient BOD_5 concentrations by up to 0.1 mg/L, based on a far-field dilution factor of 300:1 (30 mg/L/300 = 0.1 mg/L). BOD is exerted at an approximate rate of 20% per day, which would suggest a relative influence on dissolved oxygen of approximately 0.02 mg/L (0.1 mg/L/5 = 0.02 mg/L). This degree of influence is significantly less than what could be measured within a reliable degree of accuracy. Dissolved oxygen monitoring instrumentation is only accurate to with plus or minus 0.1 mg/L.

According to data collected by the applicant and included in their MEPDES permit application and data collected by the Department in the summer of 2019, there are areas of naturally occurring dissolved oxygen levels that do not attain the Class SB 85% saturation standard. The discharge pipe as proposed would, if permitted, discharge at approximately 11.5 meters below the mean low water mark and would be fitted with a multiport diffuser designed to enhance mixing with the receiving water. The discharge would tend to be buoyant due to the fresh water component of the discharge. The pycnocline is the area of separation between two different densities of water due to changes in salinity and temperature gradients. Areas above the pycnocline tend to be better mixed due to wave action and water below the pycnocline tend to be hydraulically isolated due to greater density. The Department's water quality modelling engineer and marine biologist have assessed this situation and based on their review and analysis to date, believe the impact to the naturally occurring area of dissolved oxygen saturation levels of less than 85% is not measurable given the buoyance of the proposed discharge.

It is noted Nordic's application for a MEPDES permit indicates that if the maximum efficiencies of the proposed waste water treatment facility are realized, the proposed discharge concentration of BOD_5 and TSS may be as low 6 mg/L, representing a 99% removal rate for both parameters.

Based on Department staff's review and analysis to date, the establishment of BPT based limitations for BOD_5 and TSS would, if permitted, meet the dissolved oxygen standard licensing criteria of 85% saturation and the anti-degradation provision in that the discharge would not cause or contribute to failure of the receiving water to meet the standards of its assigned classification.

Attachment D

Effluent Monitoring and Ambient Water Quality Monitoring

Applicable licensing criteria

06-096 Chapter 525, *Effluent Guidelines and Standards* states in part:

.

> SUMMARY: "This rule establishes procedures and criteria for setting technology-based effluent limitations in waste discharge licenses. Included are general provisions regarding establishing effluent limits, test procedures, units of measurement, and categories of pollutants."

If the technology-based limitations in Chapter 525 are not stringent enough to meet the classification standards assigned to the waterbody, more stringent limitations referred to as water quality based limitations are required.

Maine law 38 M.R.S. §414-A. *Conditions of licenses,* states in part:

"1. Generally. The Department shall issue a license for the discharge of pollutants only if it finds that:

A. The discharge either by itself or in combination with other dischargers will not lower the classified body of water below such classification."

Department Staff Discussion of Effluent Monitoring

With the exception of testing requirements for whole effluent toxicity testing (WET), analytical chemistry and priority pollutants, specified in 06-096 CMR, Chapter 530*, Surface Waters Toxics Control Program*, there currently are no statutes or rules that dictate the monitoring frequencies for parameters that are specifically regulated in a MEPDES permit. Monitoring frequencies are determined based on use of best professional judgment, considering effluent characteristics, ambient water quality conditions, whether the permit limitations are technology or water quality based, and if there is a reasonable potential for the discharge to exceed applicable water quality standards. The monitoring frequencies can range from 1/Day to 1/Year.

In general, each permitted facility is assigned a Department compliance inspector that is responsible for oversight of permitted facilities. Compliance inspectors conduct a minimum of one comprehensive facility compliance inspection annually. MEPDES permits establish numeric limitations and or routine monitoring requirements for pollutants of concern and parameters that are required to be limited by state or federal laws and rules/regulations. Permittees are required to electronically submit the results of the monitoring required by the permit to the Department

compliance inspector at a frequency of 1/Month. The monthly reports are referred to as Discharge Monitoring Reports (DMRs). The Department's compliance staff review the DMRs for accuracy, completeness and compliance with the terms and conditions of the discharge permit. All DMR data are entered into United States Environmental Protection Agency (USEPA) compliance tracking system referred to as the Integrated Compliance Information System (ICIS) which is accessible by the public. Reported non-compliance for all permittees is discussed each month by a committee of Department personnel including permitting, compliance and enforcement staff, to determine the most appropriate course of action to bring the facility back into compliance with the permit. Chronic or significant non-compliance may result in a formal enforcement action by the Department.

Though the state of Maine has been authorized to administer the delegated MEPDES program in Maine since January 12, 2001, the USEPA has oversight of the MEPDES program and may take action on issues relating to permitting, compliance or enforcement actions if it disagrees with the state's action or lack thereof, to administer the requirements of the Clean Water Act.

Department Staff Discussion of Ambient Water Quality Monitoring

Ambient water quality monitoring is sometimes required in MEPDES permits to verify the assumptions made in modelling decisions or to obtain a more robust data set of ambient water quality conditions. Nordic hired a contractor to conduct ambient water quality sampling at four sampling sites on two days in August 2018 and one day in September of 2018. Samples were collected from two proposed intake stations on August 23-24, 2018, and from two proposed discharge stations on September 7, 2018, along with an additional water sample collected on September 7, 2018, from a location on the Little River below the reservoir dam. In-situ water column profile measurements with a data sonde were collected for temperature, turbidity, pH, depth, dissolved oxygen (mg/L and % saturation) salinity and specific conductance. Water samples were collected and sent to a certified laboratory and were analyzed for total suspended solids (TSS), ammonia as nitrogen, nitrate/nitrite nitrogen, total nitrogen, TKN nitrogen, total phosphorus, chemical oxygen demand (COD) and biochemical oxygen demand (BOD). It is noted the sampling events were conducted shortly after rainfall events resulting in the total nitrogen data being influenced by storm water runoff.

With the exception of the Little River Reservoir sampling station, the four sampling stations are within approximately 0.3 miles apart from one another. See the attached aerial photograph entitled *Figure 1. Sampling stations map*, by Normandeau Associates Inc. and attached to this document.

The Department conducted four sampling events (approximately every three weeks) between June and September 2019 (on alternating ebb and flood tides) at six sampling locations in Belfast Bay and Penobscot Bay ranging from 1.2 miles to 4.3 miles apart to get a larger view of ambient water quality conditions of the bays. The Department collected data via sondes and water quality samples for all the same parameters as Normandeau Associates did in 2018. See the location of the Department's sampling sites in the attached aerial photograph entitled, *Fig 1: Belfast Bay and Penobscot Bay*.

For the Nordic facility proposal, there was no objection from any party at the Board of Environmental Protection (BEP) hearings held from February 11–14, 2020, as to the idea of gathering additional ambient water quality data prior to any discharge from the proposed facility given the limited data sets collected to date. Ambient water quality monitoring before and after a proposed new discharge goes on-line is common in the issuance of MEPDES permits. If a permit were to be granted, ongoing monitoring would enable the Department, permittee and interested parties to better understand the dynamics of the receiving water and verify (or refute) assumptions made in modeling efforts and verify that the proposed discharge will not cause or contribute to a violation of the standards assigned to its classification.

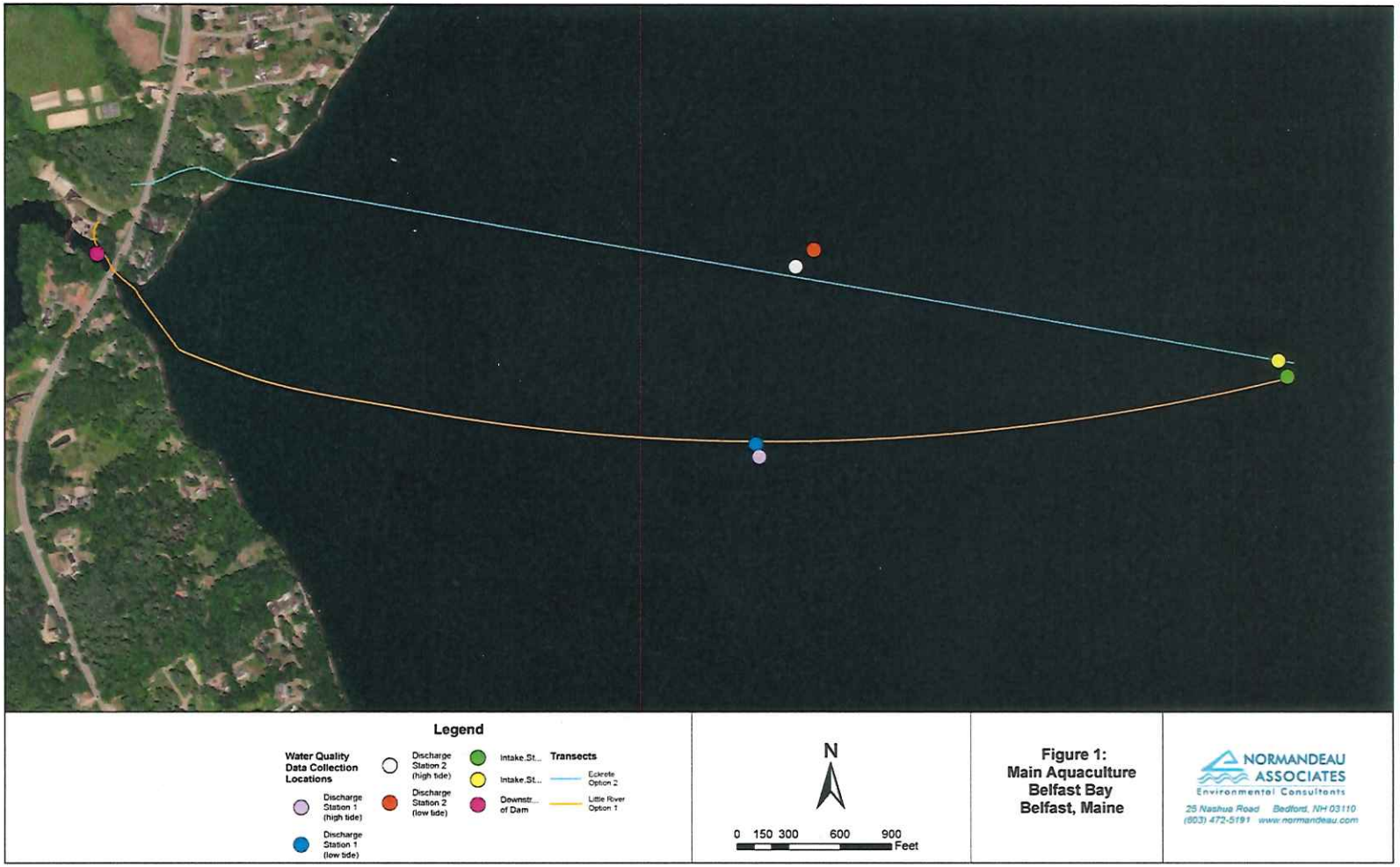


Figure 1. Sampling stations map

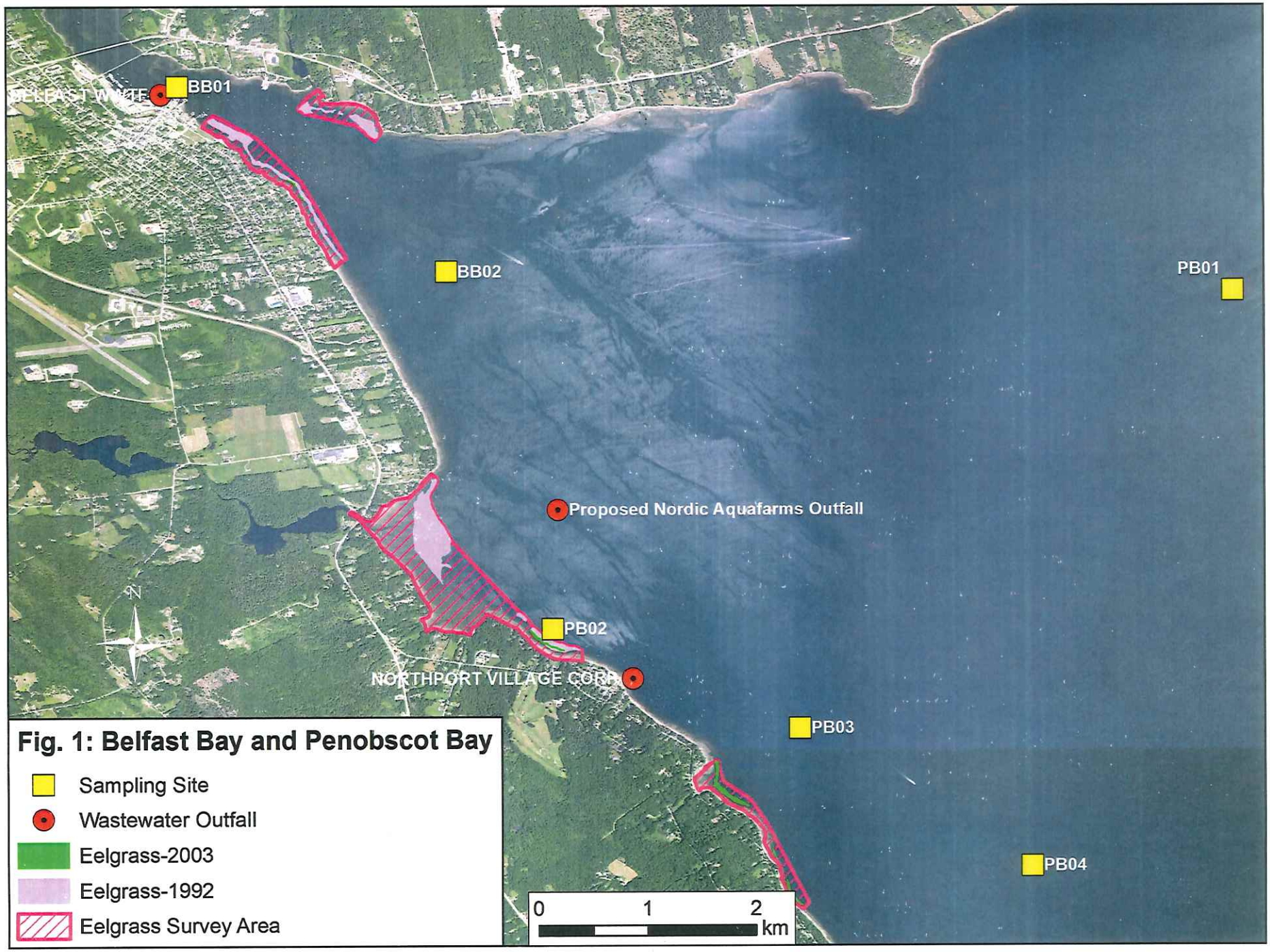


Fig. 1: Belfast Bay and Penobscot Bay

- Sampling Site
- Wastewater Outfall
- Eelgrass-2003
- Eelgrass-1992
- Eelgrass Survey Area

Attachment E

Total Nitrogen

Applicable nitrogen licensing criteria

Maine law 38 M.R.S. §464. *Classification of Maine Waters,* states in part as follows:

"4. General provisions. The classification system for surface waters established by this article shall be subject to the following provisions." 38, M.R.S. §464(4)(F) further states in part: "F. The antidegradation policy of the State is governed by the following provisions."

38 M.R.S. §464(4)(F)(3) states:

> "3. The department may only issue a discharge license pursuant to section 414-A or approve water quality certification pursuant to the Federal Water Pollution Control Act, Section 401, Public Law 92-500, as amended, if the standards of classification of the water body and the requirements of this paragraph are met. The department may issue a discharge license or approve water quality certification for a project affecting a water body in which the standards of classification are not met if the project does not cause or contribute to the failure of the water body to meet the standards of classification."

38 M.R.S. §464(f)(5) states:

> "5. The department may only issue a discharge license pursuant to section 414-A or approve water quality certification pursuant to the United States Clean Water Act, Section 401, Public Law 92-500, as amended, which would result in lowering the existing quality of any water body after making a finding, following opportunity for public participation, that the action is necessary to achieve important economic or social benefits to the State and when the action is in conformance with subparagraph (3). That finding must be made following procedures established by rule of the board."

Maine law 38 M.R.S. §414-A. *Conditions of licenses,* states in part as follows:

"1. Generally. The Department shall issue a license for a discharge of pollutants only if it finds that:" 38 M.R.S. §414-A(D) states (emphasis added):

> "D. The discharge will be subject to effluent limitations that require application of the best practicable treatment. "Effluent limitations" means any restriction or prohibition including, but not limited to, effluent limitations, standards of performance for new sources, toxic effluent standards and other discharge criteria regulating rates, quantities and concentrations of physical, chemical, biological and other constituents that are discharged directly or indirectly into waters of the State. "Best practicable treatment" means the methods of reduction, treatment, control and handling of pollutants, including process methods, and the

application of best conventional pollutant control technology or best available technology economically achievable, for a category or class of discharge sources that the department determines are best calculated to protect and improve the quality of the receiving water and that are consistent with the requirements of the Federal Water Pollution Control Act, as amended, and published in 40 Code of Federal Regulations. If no applicable standards exist for a specific activity or discharge, the department must establish limits on a case-by-case basis using best professional judgment, after consultation with the applicant and other interested parties of record. In determining best practicable treatment for each category or class, the department shall consider the existing state of technology, the effectiveness of the available alternatives for control of the type of discharge and the economic feasibility of such alternatives."

Department Staff Discussion of Total Nitrogen

Nitrogen is generally the limiting nutrient for primary productivity in marine waters. Discharges of excess quantities of immediately bioavailable nitrogen can cause algal blooms in the receiving waters, which can lead to negative impacts to dissolved oxygen levels. Immediately bioavailable nitrogen typically consists of dissolved inorganic forms, including nitrate (NO_3^-), nitrite (NO_2^-), and ammonium (NH_4^+). Total kjeldahl nitrogen (TKN) is the sum of organic nitrogen, ammonia (NH_3), and ammonium (NH_4^+). To calculate Total Nitrogen (TN), the concentrations of nitrate and nitrite are determined and added to TKN. With the exception of ammonia, nitrogen is not acutely toxic; thus, at this time, the Department considers a far-field dilution model to be most appropriate when evaluating the more systemic types of influences associated with nitrogen in the marine environment.

Currently there are no state or federally promulgated best practicable treatment (BPT) standards for land-based recirculating aquaculture system (RAS) facilities and the State of Maine has not promulgated numeric ambient water quality criteria for total nitrogen. Since 2015, on a case-by-case basis, Maine DEP staff have been completing reasonable potential analyses (RP) upon renewal of wastewater discharge licenses for those facilities that discharge nitrogen directly to marine waters of the state. To date, the Department's RP assessments have generally utilized two total nitrogen (TN) threshold values to address aquatic life use of Maine's marine waters that the Department staff believe are appropriate here:

- 0.32 mg/L for protection of eelgrass, when historically mapped as present within close proximity to the discharge in question; and

- 0.45 mg/L for protection of dissolved oxygen, when eelgrass has not been historically mapped within close proximity to the discharge in question.

Maine DEP's definition of "close proximity" has been eelgrass located approximately 0.5 km from the wastewater outfall, or as informed by best professional judgement (BPJ) based on known eelgrass resources. The TN threshold value currently used in Maine's marine wastewater permits for protection of eelgrass was a concentration used regionally by United States Environmental Protection Agency (USEPA) permitting staff. The USEPA decision to use 0.32 mg/L was due to its numerical midpoint between 0.34 mg/L, a concentration deemed protective of eelgrass by the Massachusetts Estuary Project, and 0.30 mg/L, an average concentration from the lower Piscataqua River where Maine DEP observed epiphytic growth on eelgrass that resulted in a 2012 impaired waters listing due to eelgrass loss. The TN threshold value used for dissolved oxygen originates from a New Hampshire Department of Environmental Services (NH DES) guidance document for the Great Bay estuary (NH DES 2009), and was utilized in an EPA-issued wastewater discharge license in the Taunton River estuary in Massachusetts (EPA 2015).

Despite historically mapped eelgrass (1992 and 2003) beds as close to the proposed discharge as 0.5 kilometers (0.3 miles), based on a 2019 summer Department survey, the nearest eelgrass to the proposed discharge is currently approximately 4 kilometers (2.5 miles) to the southwest along the southerly shore of Northport. Given the absence of mapped eelgrass in close proximity to the proposed discharge and the moderately high light attenuation occurring in the water column as measured at nearby eelgrass habitat based on suspended solids and dissolved organic matter, the Department is utilizing a critical nitrogen threshold value of 0.45 mg/L and a far-field dilution factor of 300:1 to evaluate the impact of the proposed discharge on dissolved oxygen in the vicinity of the proposed discharge location. For the closest eelgrass bed, the Department is utilizing a critical nitrogen threshold value of 0.32 mg/L and a dilution factor of 1000:1 to evaluate the impact on the eelgrass bed. Both environment response indicators are being evaluated for total nitrogen given the geographic differences in the dilution factors associated with each environmental response indicator. The Department staff utilizes a weight of evidence approach to determine attainment of water quality standards and places a greater weight on ambient water chemistry and biological data, including dissolved oxygen, pH, and chlorophyll *a* to determine whether the discharge, if permitted, will cause or contribute to violations of water quality.

Department Staff Discussion of Antidegradation

The State of Maine's antidegradation policy states that water quality that exceeds the minimum applicable standards will be managed by the Department for the environmental, economic and social benefit of the State. *See* 38 M.R.S. §§414-A(1)(C), 464(4)(F)(5). Where a new or increased discharge is proposed, the Department will determine whether the discharge will result in a lowering of existing water quality. For purposes of evaluating and applying the statutory antidegradation standard, the Department staff generally considers the following case-by-case basis consistent with its historical practice and best experience and judgment as reflected in its nonbinding Waste Discharge Program Guidance dated June 13, 2001:

- "New discharge" means a discharge that does not now exist or that is not currently licensed.

- "Increased discharge" means a discharge that would add one or more new pollutants to an existing effluent, increase existing levels of pollutants in an effluent, or cause an effluent to exceed one or more of its current licensed discharge flow or effluent limits, after the application of applicable best practicable treatment technology, as defined at 38 MRSA § 414-A(1)(D), or new source performance standards to the discharge.

- "Existing water quality" means the water quality that would exist under critical water quality conditions. Critical water quality conditions include, but are not limited to, conditions of low flow, high water temperature, maximum loading from point source and non-point source discharges, and conditions of acute and chronic effluent toxicity.

In making a determination as to whether a new or increased discharge will result in a lowering of existing water quality pursuant to the statutory standard, the Department staff generally considers the following case-by-case basis consistent with its historical practice and best experience and judgment as reflected in its nonbinding Waste Discharge Program Guidance dated June 13, 2001:

- The predicted change in ambient water quality, concentrations of chemical pollutants, or mass loading of pollutants under critical water quality conditions.

- The predicted consumption of the remaining assimilative capacity of the receiving water. The remaining assimilative capacity is the increment of existing water quality above the minimum standards of the assigned classification under critical water quality conditions.

- The predicted change in the ability of the receiving water to support aquatic life and to meet applicable aquatic life and habitat criteria.

- The possible additive or synergistic effects of the discharge in combination with other existing discharges.

- The cumulative lowering over time of water quality resulting from the proposed discharge in combination with previously approved discharges.

Based on the above considerations, the Department staff generally makes a case-by-case determination as to whether a new or increased discharge will result in a lowering of existing water quality. However, where the new or increased discharge will consume 20% or more of the remaining assimilative capacity for dissolved oxygen or other water quality parameter, the resulting lowering of water quality will generally be considered by Department staff to be lowered based upon the Department staff's historical practice and best experience and judgment.

Where the Department determines that a new or increased discharge will result in a lowering of existing water quality, the Department will then determine whether the lowering of water quality is necessary to achieve important economic or social benefits to the State. *See* 38 M.R.S. §§414-A(1)(C), 464(4)(F)(5). In making this determination pursuant to the statutory standard, the Department staff generally considers the following on a case-by-case basis consistent with its historical practice and best experience and judgment as reflected in its nonbinding Waste Discharge Program Guidance dated June 13, 2001:

- Whether the lowering of water quality is necessary to accommodate new or increased commercial activity or industrial production while providing that (1) the discharge consistently complies with applicable effluent limitations requiring application of best practicable treatment or new source performance standards and (2) any existing treatment facility is appropriate and is optimally maintained.

- The economic and social benefits that would result from the lowering of water quality. These benefits may include, but are not limited to, increases in employment, increases in local or regional income or purchasing power, increases in the community tax base, correction of an environmental or public health problem or nuisance situation (e.g., removal of overboard discharges or failing or substandard septic systems) and improved community stability. In the case of a lowering of water quality due to community growth, benefits may include an assessment of the economic and social consequences that would result if the new or increased discharge and the resulting lowering of water quality were not approved.

- The technical availability, economic feasibility, and environmental effectiveness of alternatives that could reduce or eliminate the lowering of water quality. Alternatives may include, but are not limited to, alternative discharge locations, non-discharging alternatives, alternative methods of production, improved process controls, waste water minimization technologies, improved waste water treatment facility operation and maintenance, alternative waste water treatment methodologies, and advanced treatment beyond applicable technology requirements.

<u>Department Staff Discussion of the Remaining Assimilative Capacity</u>

Between June and September of 2019, the Department staff conducted four ambient water quality monitoring events at six sites in Belfast Bay and Penobscot Bay to determine ambient concentrations of total nitrogen in addition to many other parameters. See the attached map for the location of the sampling sites. To establish "existing water quality" for the purposes of evaluating the impact of nitrogen being discharged from the proposed Nordic facility, the Department staff considered averaged data from sampling sites BB02 and PB03 to be most representative of existing water quality conditions at the proposed outfall location. The Department staff has taken an arithmetic mean of the surface total nitrogen values obtained in 2019 and calculated and utilized a background concentration of 0.25 mg/L as representative of Belfast Bay. Therefore, the total nitrogen discharge threshold that will not consume more than 20% of the remaining assimilative capacity can be calculated as follows:

Department Staff Analysis of Dissolved Oxygen as the Environmental Response Indicator

Given:

Critical water quality threshold - 0.45 mg/L
Background concentration – 0.25 mg/l
Applicant's proposed discharge concentration of total nitrogen – 23 mg/L
Far field factor: 300:1 (calculated by the applicant)

Find: Proposed effluent limitation

0.45 mg/L – 0.25 mg/L = 0.20 mg/l (remaining assimilative capacity)

(0.20 mg/L) (0.2) = 0.040 mg/L (20% of the remaining assimilative capacity)

(300)(0.040 mg/L) = 12 mg/L

(7.7 MGD)(8.34 lbs/gal)(12 mg/L) = 770 lbs/day. (This is the figure that Department staff believes, based upon its review and analysis to date, is the limit that would avoid the need to make supported findings pursuant to 38 M.R.S. §464(4)(F)(5).

Based on the Department staff's review and analysis to date, the proposed discharge concentration of 23 mg/L would not meet the default antidegradation licensing criteria threshold of 12 mg/L at full flow. This is because, in the Department staff's view based on its review and analysis to date, the proposed discharge value of 23 mg/L would consume 38% of the remaining assimilative capacity of the receiving water. According to the state's antidegradation policy, and the staff's historical practice and best professional experience and judgment, this would be considered a lowering of water quality and the applicant would only be able to meet the standard if it established and the Department made the findings required by 38 M.R.S. §464(4)(F)(5).

Department Staff Analysis of Eelgrass as the Environmental Response Indicator

Given:

Critical water quality threshold - 0.32 mg/L
Background concentration – 0.25 mg/l
Applicant's proposed discharge concentration – 23 mg/L
Dilution factor: 1,000:1 (at location of the Northport eelgrass bed, DEP station PB02)

Find: Proposed effluent limitation

0.32 mg/L – 0.25 mg/L = 0.07 mg/l (remaining assimilative capacity)

(0.07 mg/L) (0.2) = 0.014 mg/L (20% of the remaining assimilative capacity)

(1,000)(0.014 mg/L) = 14 mg/L

(7.7 MGD)(8.34 lbs/gal)(14 mg/L) = 899 lbs/day. (This is the figure that Department staff believes, based upon its review and analysis to date, is the limit that would avoid the need to make supported findings pursuant to 38 M.R.S. §464(4)(F)(5).

Based on the Department staff's review and analysis to date, the proposed discharge concentration of 23 mg/L would not meet the default antidegradation licensing criteria threshold of 14 mg/L at full flow. This is because, in the Department staff's view based on its review and analysis to date, the proposed discharge value of 23 mg/L would consume 33% of the remaining assimilative capacity of the receiving water. . According to the state's antidegradation policy, and the staff's historical practice and best professional experience and judgment, this would be considered a lowering of water quality and the applicant would only be able to meet the standard if it established and the Department made the findings required by 38 M.R.S. §464(4)(F)(5).

Therefore, if a permit were to be granted, and absent supported findings contemplated by 38 M.R.S. §464(4)(F)(5), the most stringent discharge concentration that would protect both dissolved oxygen and eelgrass as the environmental response indicators would be 12 mg/L based on the dissolved oxygen analysis at a full flow of 7.7 MGD.