ALASKA POLLUTANT DISCHARGE ELIMINATION SYSTEM

PERMIT FACT SHEET – FINAL

Individual Permit: AK0055921 – Oil Search (Alaska), LLC
Seawater Treatment Plant

DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Wastewater Discharge Authorization Program

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Anchorage, AK 99501

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Issuance of an Alaska Pollutant Discharge Elimination System (APDES) permit to:

OIL SEARCH (ALASKA), LLC

For wastewater discharges from:

Oil Search (Alaska), LLC, Seawater Treatment Plant
Oliktok Point
Simpson Lagoon, Beaufort Sea

The Alaska Department of Environmental Conservation (Department or DEC) is issuing APDES Individual Permit AK0055921 – Oil Search (Alaska), LLC, Seawater Treatment Plant (Permit). The Permit authorizes and sets conditions on the discharge of pollutants from this facility to waters of the United States. In order to ensure protection of water quality and human health, the Permit places limits on the types and amounts of pollutants that can be discharged from the facility and outlines best management practices (BMPs) to which the facility must adhere.

This fact sheet explains the nature of potential discharges from the Oil Search (Alaska), LLC (OSA) Seawater Treatment Plant (STP or facility) and the development of the Permit including:

- information on public comment, public hearing, and appeal procedures,
- a listing of effluent limitations and other conditions,
- technical material supporting the conditions in the permit, and
- proposed monitoring requirements in the Permit.

Appeals Process

The Department has both an informal review process and a formal administrative appeal process for final APDES permit decisions. An informal review request must be delivered within 20 days after receiving the Department's decision to the Director of the Division of Water at the following address:

Director, Division of Water
Alaska Department of Environmental Conservation
555 Cordova Street, 3rd Floor
Anchorage AK, 99501

Interested persons can review 18 AAC 15.185 for the procedures and substantive requirements regarding a request for an informal DEC review. See http://dec.alaska.gov/commish/review-guidance/informal-reviews for information regarding informal reviews of DEC decisions.

An adjudicatory hearing request must be delivered to the Commissioner of the Department within 30 days of the permit decision or a decision issued under the informal review process. An adjudicatory hearing will be conducted by an administrative law judge in the Office of Administrative Hearings within the Department of Administration. A written request for an adjudicatory hearing shall be delivered to the Commissioner at the following address:

Commissioner
Alaska Department of Environmental Conservation
P.O. Box 111800
Juneau AK, 99811-1800

Interested persons can review 18 AAC 15.200 for the procedures and substantive requirements regarding a request for an adjudicatory hearing. See http://.dec.alaska.gov/commish/review-guidance/informal-reviews for information regarding appeals of DEC decisions.

Documents are Available

The permit, fact sheet, application, and related documents can be obtained by visiting or contacting DEC between 8:00 a.m. and 4:30 p.m. Monday through Friday at the addresses below. The permit, fact sheet, application, and other information are located on the Department's Wastewater Discharge Authorization Program website: http://dec.alaska.gov/water/wastewater/.

Alaska Department of Environmental Conservation
Division of Water
Wastewater Discharge Authorization Program
555 Cordova Street
Anchorage, AK 99501
(907) 269-6285

Alaska Department of Environmental Conservation
Division of Water
Wastewater Discharge Authorization Program
410 Willoughby Avenue
Juneau, AK 99801
(907) 465-5180

TABLE OF CONTENTS

1.0 INTRODUCTION 1
1.1 Applicant 1
1.2 Authority 1
2.0 BACKGROUND 2
2.1 Project Description 2
2.2 Facility Information 2
2.3 Requested Discharges and Discharge Characteristics 4
3.0 RECEIVING WATERBODY 5
3.1 Water Quality Standards 5
3.2 Water Quality Status of Receiving Water 6
3.3 Mixing Zone Analysis 6
4.0 EFFLUENT LIMITS AND MONITORING REQUIREMENTS 11
4.1 Basis for Permit Effluent Limits 11
4.2 Technology Based Effluent Limits 12
4.3 Water Quality Based Effluent Limits 12
4.4 Effluent Limits and Monitoring Requirements 13
5.0 ANTIBACKSLIDING 17
6.0 ANTIDEGRADATION 18
6.1 Receiving Water Status, Tier Determination, and Analysis Requirements 18
6.2 Tier 1 Analysis of Existing Use Protection 18
6.3 Tier 2 Analysis for Lowering Water Quality 19
7.0 OTHER PERMIT CONDITIONS 25
7.1 Standard Conditions 25
7.2 Quality Assurance Project Plan 25
7.3 Best Management Practices Plan 25
8.0 OTHER LEGAL REQUIREMENTS 26
8.1 Endangered Species Act 26
8.2 Essential Fish Habitat 27
8.3 Ocean Discharge Criteria Evaluation 27
8.4 Permit Expiration 27
9.0 REFERENCES 28

TABLE OF TABLES

Table 1. Outfall 001 Strainer Backwash Limits and Monitoring Requirements 13

TABLE OF APPENDICIES

APPENDIX A. FIGURES A-1
APPENDIX B. EFFLUENT LIMITATIONS B-1
APPENDIX C. REASONABLE POTENTIAL DETERMINATION C-1
APPENDIX D. MIXING ZONE ANALYSIS CHECKLIST D-1

TABLE OF FIGURES

Figure 1: Vicinity Map Location of OSA STP and Outfall 001 ..... A-1
Figure 2: Treatment Plant Simplified Process Flow Diagram A-2

1.0 INTRODUCTION

On July 22, 2021, the Alaska Department of Environmental Conservation (DEC or Department) received an application from Oil Search (Alaska), LLC (OSA) for issuance of Alaska Pollutant Discharge Elimination System (APDES) Individual Permit AK0055921 – Oil Search (Alaska), LLC, Seawater Treatment Plant (Permit). Information contained in this fact sheet is based on information in the application and supplemental information provided by OSA upon request by DEC. The Permit authorizes discharges to Simpson Lagoon, Beaufort Sea from the OSA Seawater Treatment Plant (STP or facility), located on the North Slope on Oliktok Point, Beaufort Sea (See Appendix A – Figures).

1.1 Applicant

This fact sheet provides information on the APDES permit for the following entity:

Name of Facility:	Oil Search (Alaska), LLC, Seawater Treatment Plant
APDES Permit Number:	AK0055921
Facility Location:	Oliktok Point, Simpson Lagoon, Beaufort Sea
Mailing Address:	Oil Search (Alaska), LLC P.O. Box 240927 Anchorage, Alaska 99524
Facility Contact:	Mr. Kollin Fencil

The Permit authorizes the following discharges:

Outfall	Description	Receiving Water	Latitude	Longitude
001	Strainer/Filter Backwash	Simpson Lagoon	70.512369	-149.855606

See Appendix A, Figure 1 for the location of the outfall relative to the STP.

1.2 Authority

The APDES Program regulates the discharge of wastewater to waters of the United States (U.S.). Transfer of authority to administer the National Pollutant Discharge Elimination System (NPDES) Program to Alaska from the Environmental Protection Agency (EPA) occurred in four phases with oil and gas facilities transferring as part of Phase IV on October 31, 2012. The state NPDES program is known as the APDES Program and is administered by DEC. Accordingly, DEC is the permitting authority for regulating the discharges associated with the Permit. This is the first issuance of the Permit.

Section 301(a) of the Clean Water Act (CWA) and Alaska Administrative Code (AAC) 18 AAC 83.015 provide that the discharge of pollutants to water of the U.S. is unlawful except in accordance with an APDES permit. A violation of a condition contained in the permit constitutes a violation of the CWA and subjects the permittee of the facility with the permitted discharge to the penalties specified in Alaska Statutes (AS) 46.03.760 and AS 46.03.761.

2.0 BACKGROUND

2.1 Project Description

OSA proposes to construct a STP at Oliktok Point, including a make-up water (waterflood) pipeline, to support development of the Pikka Unit. The STP will be located on a gravel pad adjacent to the mainland shoreline at Oliktok Point at the western end of Simpson Lagoon and the eastern side of Harrison Bay in the Beaufort Sea. The STP will also be co-located next to another existing STP at Oliktok Point operated by ConocoPhillips Alaska Inc. (see Appendix A – Figure 1).

Pikka Unit reservoirs require a supply of "make-up" water to conduct waterflood to optimize pressure in the reservoirs for enhanced oil recovery. Construction of the STP will provide a reliable and predictable supply of make-up water quantity and quality for improved hydrocarbon extraction efficiency from the Pikka Unit reservoirs. The STP will strain, filter, heat, bio-treat, and de-aerate seawater drawn from four intake bays located on the face of the OSA sheet pile dock facility for waterflood and other industrial uses.

2.2 Facility Information

The STP will discharge wastewater streams from one outfall: Outfall 001 - Strainer/Filter Backwash. The discharge line for Outfall 001 is a 0.3556-meter outer diameter (0.2997-meter inner diameter) line buried 1.22 meters deep and oriented in the north (0° true) direction. The outfall line, once constructed, is anticipated to terminate 140.2 meters offshore with a single port diffuser. Outfall 001 is oriented perpendicular to prevailing currents and the shoreline at a depth of approximately 2.44 meters below sea surface (See Appendix A, Figure 1). Prior to constructing the facility and outfall, OSA must submit engineering plans to DEC for approval to construct.

2.2.1 Outfall 001 – Strainer/Filter Backwash Description

The removal of suspended sediment and microbes in seawater must be performed prior to waterflood injection to prevent clogging of pore spaces in the formations. The straining and filtration processes ultimately prevent the possibility of particulate matter blocking pore spaces in formations that could restrict the flow of oil in a producing well. Waterflood is typically produced by using direct sand filtration and hypochlorite to prevent biofouling filters, vessels, and pipes. However, the OSA STP will use membrane ultrafiltration (UF) and nanofiltration (NF) to remove a greater percentage of sediment and microbes to be commensurate with the unique requirements of the oil producing formations.

Seawater is brought into the OSA STP through four intake bays located on the face of the OSA STP sheet pile dock and is subject to screening to prevent debris, marine life, and other materials from entering the intake. Each of the intake bays was designed with a maximum intake velocity of approximately 15.25 centimeters per second to reduce impingement mortality and entrainment for all life stages of fish and shellfish. Each intake bay also includes a sodium hypochlorite injection point, to prevent bacteria growth on downstream strainers and membranes. Each intake bay consists of a bar screen, a traveling screen, and seawater feed pumps. Sodium hypochlorite is injected into the seawater intake upstream of the feed pumps. Debris from this initial screening process is diverted to a bin for removal to an upland site.

The seawater then passes through twenty-four crossflow filters to remove the bulk of the silt, sand, and detritus from the seawater. Seawater is further treated with two self-backwashing strainers (coarse filters) to remove silt, sand, and detritus greater than (>) 250 microns from the

seawater. Backwash from the crossflow filters and strainers is routed to the outfall tank for discharge through Outfall 001 after commingling with other filter backwash.

After the self-backwashing strainers, the seawater is heated to 15.5 °C using heat exchangers to reduce the viscosity of the seawater and optimize the treatment process. A portion of this heated water is recycled through the intake bays to prevent freezing.

A second set of self-backwashing strainers (fine filters) further filters seawater to remove particles > 50 microns with the reject water going to the outfall tank. A small portion of the filtrate, approximately 0.2 million gallons per day (mgd) is treated by reverse osmosis for use in the membrane clean-in-place (CIP) processes. The remaining filtrate from the fine filters is treated further using seven UF membrane units that remove silt and clays > 0.1 micron. Strainer and membrane backwash is routed to the outfall tank for discharge through Outfall 001.

The seawater is then injected with an inhibitor to prevent scale formation and sodium bisulfate to remove chlorine prior to being treated in four sulfate removal unit (SRU) membranes. Approximately 25% of this flow (2.1 mgd) is recycled through the heat exchangers and ultimately discharged through Outfall 001. The permeate from the SRU membranes is processed further for waterflood without any other waste streams being discharged. Although the SRU membranes are soaked with a biocide once per week, this solution is diverted to a dedicated holding tank and then pumped into the make-up water pipeline to the Pikka Unit or trucked for disposal. This process configuration intentionally prevents toxic chemicals from being discharged to Simpson Lagoon through Outfall 001. However, other CIP wastewater from upstream membranes are intermittently discharged but only after neutralization of the cleaning chemicals.

All membranes utilized in the OSA STP require periodic cleaning, which involves soaking the membranes in a weak acid or caustic solution before routing the membrane backwash solution to a neutralization tank for pH adjustment. After the pH is adjusted to ≥ 6.0 and ≤ 9.0 pH, the neutralization tank solution is routed to the outfall tank for discharge through Outfall 001.

The filter membranes also undergo a chemically enhanced backwash (CEB) with a weak alkali solution once per day and a weak acid solution once per week. The membrane backwash solution is neutralized in a tank to adjustment the pH to ≥ 6.0 and ≤ 9.0 pH. After neutralization the solution goes to the outfall tank for discharge through Outfall 001.

Most of the flow entering the outfall tank is dechlorinated seawater from the SRU membranes (2.1 mgd) containing scale inhibitor, after being recycled from the SRU membranes through the heat exchangers. The outfall tank also receives 0.1 mgd of processed seawater from the cross-filter effluent and screen backwash, and 0.4 mgd of backwash from the filter membranes. Effluent (0.01 mgd) from the neutralization tank is periodically sent to the outfall tank once pH has been adjusted to ≥ 6.0 and ≤ 9.0 pH. The total residual chlorine (TRC) concentration in the water entering the outfall tank is monitored and, if necessary, sodium bisulfite is added to neutralize residual chlorine in the outfall tank before discharge to Outfall 001. pH is also monitored continuously on the outfall line and OSA can adjust the pH of water as needed.

The OSA STP process flow design capacity balances the operation of the sequential pumping system with wastewater elevations in the outfall tank to yield a near constant, steady-state rate of effluent discharge via the outfall of approximately 3.5 mgd. The maximum expected discharge from the facility is 5.0 mgd based on the maximum continuous seawater intake capacity of the facility.

After the sediment and microbial removal steps that result in a discharge to Outfall 001, clarified seawater is treated further to produce waterflood appropriate for injection by undergoing additional membrane filtration and adding treatment chemicals including biocide, scale inhibitor, corrosion inhibitor, and oxygen scavenger. The de-aerating process uses membrane de-aerating units to remove oxygen to reduce corrosion in the pipelines and drill site distribution system. Although not intended for routine operations, oxygen scavenger may be used on an as-needed basis. To prevent bacterial growth, biocide will be injected at the plant outlet to the make-up water pipeline, which could otherwise produce hydrogen sulfide and clog pore spaces in the oil-producing formations. A corrosion inhibitor and scale inhibitor may also be injected into the waterflood as needed. Although these chemicals will be used in the waterflood treatment process, they will not be discharged through the STP outfall without prior written authorization from the Department (see Appendix A, Figure 2).

As described in the application, it may be necessary to periodically drain back the waterflood pipeline to the outfall tank for pipeline maintenance and emergency shut-ins, resulting in a discharge of water from the pipeline to Outfall 001. In these cases, a discharge of drain back water from the pipeline without chemicals would pose limited risk to the environment, allowing for an expedited approval to discharge. If drain back of the pipeline is required during an emergency (i.e., drain back water includes chemicals), the approval to discharge may be contingent on submittal of information or data demonstrating there would be no adverse environmental impacts. The permittee must submit information necessary for the Department to provide written approval prior to conducting conditional discharge.

2.3 Requested Discharges and Discharge Characteristics

2.3.1 Strainer/Filter Backwash (Outfall 001)

During the effective period of the Permit, the permittee requests authorization to discharge pollutants associated with seawater treatment at the STP located at Oliktok Point in the Beaufort Sea. The application submitted by OSA identifies those discharges and pollutants resulting from facility processes, waste streams, and operations that are requested to be authorized in the Permit. OSA has requested to discharge wastewater associated with the strainer/filter backwash.

Strainer/filter backwash includes water from backwashing the strainers/filters and neutralized water from the CIP tanks from periodic chemical cleaning of the membranes. The initial parameters of interest are flow, temperature, chlorine, pH, salinity, turbidity, and chronic whole effluent toxicity (WET).

2.3.2 Wastewater Characteristics and Applicable Water Quality Criteria

Sodium bisulfite is used to dechlorinate the backwash prior to being discharged in Outfall 001 – Strainer/Filter Backwash. Seawater will be heated year-round to enhance oxygen removal by decreasing the solubility of oxygen in the water and to prevent freezing. The CEB and CIP processes use acids and bases that must be neutralized prior to discharge. There is also potential for low levels of chronic WET. However, based on the toxicity estimates in safety data sheets (SDSs) and assessment of mass balance in the processes, chronic WET is not expected to be significant, less than 10 chronic toxicity units (TU_c), as temperature is anticipated to be the driving parameter in the chronic mixing zone. Whereas, TRC is anticipated to be the driving parameter for the acute mixing zone but, like chronic WET, is not the driving parameter for the chronic mixing zone. Accordingly, TRC from injection of hypochlorite and temperature are

primary pollutants of concern (POCs) during normal operations for the acute and chronic mixing zones, respectively.

Note that the marine water quality criteria for temperature is based on a 1 °C increase over the ambient receiving water temperature. To provide a direct comparison with marine water quality criteria, DEC is using the temperature differential (ΔT) to represent the POC, which is the effluent temperature minus the simultaneous receiving water ambient temperature. Only positive ΔT values are considered because negative values do not result in lowering of water quality of the receiving water based on the established marine temperature water quality criteria. For TRC, the applicable aquatic life criteria for acute is 13 micrograms per liter (µg/L) and the chronic is 7.5 µg/L.

Because this is a first issuance of the permit for a facility that has not been constructed, there is no data available for characterization. Therefore, the applicant considered data from other similar STPs as well as mass balance around the STP process design. The application included estimates of the effluent temperature in degrees Celsius (°C) based on estimated heat transfer and mass balance. For TRC, the applicant considered data from similar STPs that used chlorination/dechlorination processes. Lastly, the flow is based on throughput through the most limiting process units as well as projected volumes of waterflood needed for field operations. The applicant estimates an average monthly flow of 3.5 mgd and a daily maximum of 5.0 mgd to be discharged through Outfall 001. A maximum ΔT of 19.6 °C based on heat transfer and mass balance assumptions was presented along with a maximum TRC concentration of 150 µg/L based on review of data from similar STPs operating immediately after startup and before process optimization. The Department determined that the estimate for TRC appears appropriate. However, in the absence of temperature data the Department determined that the maximum expected ΔT should be based on situations where the system may be shut-in for a period and restarted with the wastewater temperature equilibrated to room temperature instead of based on continuous operation. DEC has observed similar data from other STPs and views this as a conservative estimate until operational data becomes available. Therefore, DEC assumes the maximum effluent temperature is 20 °C and the ambient low temperature during winter, under-ice-cover is -1.7 °C, resulting in a maximum ΔT of 21.7 °C. DEC can reconsider these initial assumptions during the next reissuance of the permit using actual data from an operating facility.

3.0 RECEIVING WATERBODY

3.1 Water Quality Standards

Section 301(b)(1)(C) of the CWA requires the development of limitations in permits necessary to meet water quality standards by July 1, 1997. Per 18 AAC 83.435, APDES permits must include conditions to meet 18 AAC 70 – Alaska Water Quality Standards (WQS). The WQS are composed of waterbody use classifications, numeric and/or narrative water quality criteria, and the state Antidegradation Policy. The use classification system designates the beneficial uses that each waterbody is expected to achieve. The numeric and/or narrative water quality criteria are the criteria deemed necessary by the state to support the beneficial use classification of each waterbody. The Antidegradation Policy ensures that the beneficial uses and existing water quality are maintained.

Waterbodies in Alaska are designated for all uses unless the water has been reclassified under 18 AAC 70.230 as listed under 18 AAC 70.230(e). Some waterbodies in Alaska can also have site–

specific water quality criterion per 18 AAC 70.235, such as those listed in 18 AAC 70.236(b). The Department has determined that there has been no reclassification nor has site-specific water quality criteria been established at the location of the discharge from the permitted facility into Simpson Lagoon. Accordingly, the Department has determined that all marine use classes must be protected. These marine use classes include: water supply; water recreation; growth and propagation of fish, shellfish, other aquatic life, and wildlife; and harvesting for consumption of raw mollusks or other raw aquatic life.

3.2 Water Quality Status of Receiving Water

Any part of a waterbody for which the water quality does not or is not expected to meet applicable WQS is defined as a "water quality limited segment" and placed on the state's impaired waterbody list. For an impaired waterbody, Section 303(d) of the CWA requires states to develop a Total Maximum Daily Load (TMDL) management plan for the waterbody. The TMDL documents the amount of a pollutant a waterbody can assimilate without violating WQS and allocates that load to known point sources and nonpoint sources.

Beaufort Sea is classified as Tier 2 waterbody on *Alaska's Final 2020 Integrated Water Quality Monitoring and Assessment Report, May 17, 2021 (2020 Integrated Report*). The Beaufort Sea is not listed as an impaired waterbody nor is the subject waterbody listed as a CWA 303(d) waterbody requiring a TMDL. Accordingly, no TMDL has been developed for the subject waterbody.

3.3 Mixing Zone Analysis

Per 18 AAC 70.240, as amended through August 14, 2006, the Department may authorize mixing zone(s) in an APDES permit. Determination of mixing zones requires an evaluation of critical characteristics of the receiving water, effluent discharges and other pertinent factors, combined with use of an approved mixing zone modeling program such as the Cornell Mixing Zone Model Expert System model program (CORMIX) or Visual Plumes (VP). DEC and OSA discussed which model is more applicable and/or appropriate and agreed that CORMIX would be used for the modeling.

3.3.1 Mixing Zone Model Results Submitted by OSA

OSA submitted a revised mixing zone application on October 6, 2021 requesting a 208 meter (m) long by 166 m wide chronic mixing zone for Outfall 001 and a 76 m long by 23 m wide acute mixing zone for Outfall 001. The mixing zones in the application were sized using CORMIX for modeling effluent temperatures and TRC concentrations in representative summer and winter conditions in the receiving water. DEC made modifications to the recommended mixing zones during the evaluation process.

The ambient receiving water data obtained from past sampling for the Kuparuk STP facility was determined appropriate for use in all mixing zone modeling for the Permit. These data were used in OSA estimates of discharge salinity based on project filter concentrates being 1.2 to 1.8 times greater than the ambient intake water. Because the effluent density is dependent on the intake water, it is expected to vary by season but should always result in an effluent density greater than ambient even when intake water temperature is increased during treatment. To account for unknown seasonal variations, the Department conducted a verification and sensitivity analysis on the effects of the effluent and receiving water density on the mixing zone size.

3.3.2 Mixing Zone Model Confirmation and Modifications by DEC

The mixing zones for Outfall 001 were modeled using the maximum expected effluent concentration (MEC) of TRC (150 μg/L) for the acute mixing zone and the maximum expected ΔT (21.7° C) for the chronic mixing zone. Evaluating temperature as the difference between effluent temperature and ambient temperature as paired data sets eliminates the need for seasonal mixing zones when critical effluent and receiving water conditions are modeled concurrently. Instead of evaluating seasonal receiving water temperatures separately, DEC has evaluated paired data sets that account for seasonal differences in temperature (i.e., ΔT) for Outfall 001.

The velocity exiting the 0.3-meter port for Outfall 001 is 3.1 m/s. Due to a shallow water depth, low ambient current speeds under ice cover, and a high effluent exit velocity the chronic water quality criteria are met in the farfield and acute water quality criteria are met in the nearfield.

For the acute mixing zone, the controlling conditions are the low current condition for width and the high current condition for length. The acute water quality criteria are met in the nearfield, prior to the plume fully turning to travel with the prevailing currents. This leads to assigning the width based on low current conditions representing spread of the plume on the seafloor plus the distance the plume has traveled from the outfall perpendicular to the prevailing currents and the length based on the high current because the spreading on the seafloor is less pronounced.

For the chronic mixing zone, the controlling condition for both the width and length is the high current condition due to the port configuration and high effluent velocity. The high effluent velocity results in the plume traveling perpendicular to the currents before turning and moving with the currents, resulting in limited spreading under the low current condition due to water quality criteria being met in the nearfield. This leads to assigning both the length and width based on high current conditions.

3.3.2.1 Density Sensitivity Analysis

The density was determined to have minimal effect on the length of the plume or the location where the plume turns in the direction of the ambient current. However, the width of the plume projected by CORMIX was observed to increase as the density increases due to a thinner plume and greater spreading on the seafloor.

Due to uncertainties associated with the startup of the STP, a range of flow scenarios from the STP were analyzed. CORMIX generally produced smaller mixing zones associated with lower flows. However, below 1.5 m/s the discharge conditions become unstable in CORMIX and the current velocity becomes more dominant over discharge velocity. Hence, the CORMIX model was found to be very sensitive to variations in current velocity at low effluent flow conditions, particularly at the low current speeds that were modeled for the winter under-ice flow. As shown by Roberts et al. (2011), CORMIX was found to underestimate dilutions by a factor of two for zero and low flow conditions when compared to either the VP model or dye study results conducted under low flow and low current conditions. Due to this limitation in CORMIX, DEC recommends the outfall design be based on high flow scenarios to help prevent impacts due to effluent spreading and entrainment at low effluent flow and low current conditions.

For the acute mixing zone, the width is not expected to vary by more than three meters between the average and the highest estimated density or by more than two meters between the average and the lowest estimated density. For the chronic mixing zone, the width is not expected to vary by more than 20 meters between the average and the highest estimated density and 32 meters between the

average and the lowest estimated density. Based on available treatment information it is expected that the actual density will be closer to the lower estimated density. Taking that into consideration, and because mixing zone dimensions become smaller as the effluent density decreases, the Department concluded that the average estimated effluent density is appropriate for the mixing zone analysis until the model can be refined using operational data collected during the first term of the Permit.

3.3.3 Mixing Zone Modelling Summary

In summary, the Department used the CORMIX to remodel the mixing zone based upon the following:

- The mixing zones were modeled using maximum effluent concentrations for TRC and ΔT, water quality criteria, and critical receiving water conditions as discussed above.
- The critical ambient conditions for the chronic mixing zone are represented by under ice, unstratified conditions and the 90th percentile current at 0.1 m/s.
- The critical ambient conditions for the acute mixing zone are represented by under ice, unstratified conditions with the greatest width occurring at the 10th percentile current of 0.03 m/s and the greatest length occurring at the 90th percentile current at 0.1 m/s.
- Temperature was the POC requiring the most dilution for chronic conditions. Evaluating temperature as the difference between the effluent temperature (ΔT) and that of the ambient receiving water at the time of discharge was found to be a better comparison of the data to the numeric limit of no increase above 1° C above the ambient temperature.

Appendix D, Mixing Zone Analysis Checklist, outlines criteria per mixing zone regulations that must be considered when the Department reviews an application for mixing zones. These criteria include the size of the mixing zone, treatment technology, and existing uses of the waterbody, human consumption, spawning areas, human health, aquatic life, and endangered species. The following summarizes the Department's regulatory mixing zone analysis:

3.3.4 Size

A chronic mixing zone has been authorized for temperature, TRC, pH, WET, and salinity. An acute mixing zone has been authorized for TRC.

For the chronic mixing zone, the critical receiving water conditions are represented by under ice, initially unstratified conditions and the 90th percentile current of 0.1 m/s for length and width. This modified approach resulted in authorization of a rectangular chronic mixing zone with an authorized dilution factor of 21.5 extending from the seafloor to the top of the unfrozen water column that is 410 m long (205 m in each prevailing current direction) by 120 m wide centered on the single-port outfall. The length is perpendicular to the discharge orientation and parallel with the prevailing currents.

For the acute mixing zone for Outfall 001, the MEC for TRC was used and the critical receiving water conditions were the same as with the chronic mixing zone except the 90th percentile current speed, 0.1 m/s, was used to determine the length of the mixing zone and the 10th percentile current for the width. Based on these modeled conditions, the Department is authorizing a rectangular acute mixing zone extending from the seafloor to the top of the unfrozen column that is 20 m long (10 m in each prevailing current direction) by 30 m wide centered on the discharge port similar to the chronic mixing zone. The authorized acute dilution factor is 11.5 for Outfall 001.

Discussion on Sizing

In accordance with 18 AAC 70.240(k), the Department determined that the size of the mixing zones or the wastewater discharge is appropriate and are as small as practicable. The sizes of the mixing zones are a small fraction of the area, or width of the Beaufort Sea. Including the addition of the OSA mixing zone, the cumulative linear length of all mixing zones intersected on any given cross section of the Beaufort Sea does not exceed 10 percent of the total length of that cross section. The total horizontal area allocated to all mixing zones in the Beaufort Sea does not exceed 10 percent of the surface area.

Per 18 AAC 70.240(d)(7), acute mixing zones must be sized so there will be no reasonable expectation of lethality to passing organisms in the mixing zone. The drifting organism travel time and acute mixing zone dimensions were similar, though slightly smaller, for open water and initially stratified conditions.

Applicable water quality criteria representing the most stringent use classification are met at the boundary of the chronic mixing zone. Given the low concentrations of pollutants, rapid dispersion of the discharge plume, and the absence of sensitive aquatic resources within the vicinity, the mixing zones are determined to be protective of aquatic life.

3.3.5 Technology

Per 18 AAC 70.240(c)(1) as amended through August 14, 2006, before authorizing a mixing zone the Department is required to determine if "an effluent or substance will be treated to remove, reduce, and disperse pollutants, using methods found by the Department to be the most effective and technologically and economically feasible, consistent with the highest statutory regulatory treatment requirements." Applicable "highest statutory and regulatory requirements" are defined by three parts in 18 AAC 70.240(c)(1)(A), (B), and (C), which are:

- Any federal technology based effluent limits (TBELs) identified in 40 CFR 125.3 and 40 CFR 122.29, as amended through August 15, 1997, adopted by reference at 18 AAC 83.010;
- Minimum treatment standards in 18 AAC 72.050; and
- Any treatment requirement imposed under another state law that is more stringent than the requirement of this chapter.

The first part of the definition includes all applicable federal technology-based Effluent Limitation Guidelines (ELGs) that may be adopted by reference at 18 AAC 83.010(g)(3) or TBELs developed using case-by-case Best Professional Judgment (BPJ). There are no ELGs that apply to the Permit. The Permit includes a TBEL for pH developed using case-by-case BPJ. The Department determines that the first part of the definition has been met.

The second part of the definition per 18 AAC 72.050 refers to the minimum treatment requirements for domestic wastewater. The application of 18 AAC 72.050 is not pertinent to the Permit as the discharge does not include domestic wastewater sources. Accordingly, the second part of the definition has been met.

The third part of the definition includes any treatment required by state law that is more stringent than 18 AAC 70. Other regulations beyond 18 AAC 70 that may apply to this permitting action include 18 AAC 83, 18 AAC 72 and 18 AAC 15. The Permit is consistent with 18 AAC 83 and neither the regulations in 18 AAC 15, 18 AAC 72, nor another state legal requirement that the Department is aware of impose more stringent treatment requirements than 18 AAC 70. Therefore, the third and final part of the definition has also been met.

3.3.6 Existing Use

Per 18 AAC 70.240(c)(2), the mixing zone has been appropriately sized to fully protect the existing uses of the Beaufort Sea. Water quality criteria are developed to ensure protection of all existing uses. Specifically, the mixing zones were sized to avoid impacts to nearby intake structures used as industrial water supply. Hence, the chronic mixing zone has been appropriately sized to ensure water quality criteria will be met at, and beyond, the boundary of the mixing zone and that regulatory mixing zone size requirements have been met. Accordingly, the mixing zones result in protection of the existing uses of the waterbody as a whole.

3.3.7 Human Consumption

Per 18 AAC 70.240(d)(6), the pollutants discharged cannot produce objectionable color, taste, or odor in aquatic resources harvested for human consumption; nor can the discharge preclude, or limit established processing activities or commercial, sport, personal use, or subsistence fish and shellfish harvesting per 18 AAC(c)(4)(C). The mixing zone is not at a location where aquatic resources are harvested or that could result in precluding or limiting established processing activities or commercial, sport, personal use, or subsistence fish and shellfish harvesting. In addition, there is no indication that the pollutants discharged could produce objectionable color, taste, or odor in aquatic resources harvested for human consumption if such resources exist at the location of the mixing zone. The mixing zone is located near a dock that requires periodic screeding or dredging that is inconsistent with resource harvesting; the lack of known aquatic resources at this location suggests this location has not been traditionally used for harvesting aquatic resources for human consumption (see Section 3.3.9).

3.3.8 Spawning Areas

Per 18 AAC 70.240(e)(1) and (2), a mixing zone will not be authorized in lakes, streams, rivers, or other flowing freshwaters in spawning area of any of the five species of Pacific salmon found in the state or be allowed to adversely affect the present and future capability of an area to support spawning of these species. Per 18 AAC 70.240(f), a mixing zone will not be authorized in a spawning area for the following resident fish: Arctic Grayling; northern pike; lake trout; brook trout; sheefish; burbot; landlocked coho salmon, chinook salmon, or sockeye salmon; anadromous or resident rainbow trout, Arctic char, Dolly Varden, whitefish, or cutthroat trout. The permit does not authorize the discharge of effluent to open waters of a freshwater lake, river, or other flowing freshwater. Therefore, there are no associated discharges to anadromous fish spawning areas or the resident freshwater fish listed in the regulation.

3.3.9 Human Health

Per 18 AAC 70.240(d)(1), the mixing zones must not result in pollutants discharged at levels that will bioaccumulate, bioconcentrate, or persist above natural levels in sediments, water, or biota, or at levels that otherwise will create a public health hazard through encroachment on a water supply or contact recreation uses. The Department has reviewed available data provided by the applicant and has determined there are no bioaccumulating or bioconcentrating parameters associated with the discharges. Per 18 AAC 70.240(d)(1), available evidence must reasonably demonstrate that the pollutants discharged in an authorized mixing zone will not bioaccumulate. Based on the application, none of the discharges are expected to contain bioaccumulative chemicals.

Per 18 AAC 70.240(d)(2) pollutants discharged must not present an unacceptable risk to human health from carcinogenic, mutagenic, teratogenic, or other effects as determined using a risk assessment method approved by the Department and consistent with 18 AAC 70.025, which indicates the lifetime

incremental cancer risk level is 1 in 100,000 for exposed individuals. There are no cancer-causing pollutants being discharged at concentrations that present unacceptable risks.

Given the characteristics of the effluent discharged through Outfall 001, there is no indication that the discharge includes pollutants that could bioaccumulate, bioconcentrate, or persist above natural levels in sediments, the receiving water, or biota. The Department determines that the discharges are protective of human health.

3.3.10 Aquatic Life and Wildlife

Per 18 AAC 70.240(c)(4)(A), (D), and (E), pollutants for which the mixing zones will be authorized will not result in an acute or chronic toxic effect in the water column, sediments, or biota outside the boundaries of the mixing zone; a reduction in fish or shellfish population levels; or in permanent or irreparable displacement of indigenous organisms. In addition, the mixing zone must not result in undesirable or nuisance aquatic life per 18 AAC 70.240(d)(5).

Because all criteria are met at the respective acute and chronic mixing zone boundaries, toxic effects in the water column, sediments, or biota will not occur outside these boundaries; existing water quality criteria are protective from these occurrences. In addition, there are no anticipated displacement of indigenous species nor promotion of undesirable or nuisance aquatic life.

Membrane filtration increases the density of the effluent, resulting in a high density, negatively buoyant plume that will spread on the seafloor. The facility maintenance will require screeding and dredging in the area, which will have similar effects as those naturally occurring due to sea ice on benthic organisms in the plume vicinity. Therefore, impacts to benthic organisms are not expected.

Based on the characteristics of the effluent in Outfall 001 and size of the acute mixing zone for TRC in Outfall 001, there is no anticipation of lethality to drifting organisms (see Section 3.3.1). Nor do the effluent characteristics indicate there will be undesirable nuisance aquatic life effects or displacement, or reduction, of existing aquatic life outside the mixing zones. The Department therefore concludes aquatic life and wildlife will be maintained and protected.

3.3.11 Endangered Species

Per 18 AAC 70.240(c)(4)(F), the mixing zone will not cause an adverse effect on threatened or endangered species. Based on the information regarding endangered species in the area of the discharges and the size of the mixing zones, authorized mixing zones are not likely to adversely affect threatened or endangered species. Based on limited time that endangered species may migrate through this area, the discharge is not likely to cause adverse effects on threatened or endangered species. Species that have some potential to be in the vicinity of the STP's Outfall 001 and are listed under the Endangered Species Act (ESA) are discussed in Section 8.1.

4.0 EFFLUENT LIMITS AND MONITORING REQUIREMENTS

4.1 Basis for Permit Effluent Limits

Per 18 AAC 83.015, the Department prohibits the discharge of pollutants to waters of the U.S. unless the permittee has first obtained a permit issued by the APDES Program that meet the purposes of AS 46.03 and is in accordance with the CWA Section 402. Per these statutory and regulatory provisions, the Permit includes effluent limits that require the discharger to (1) meet standards reflecting levels of

technological capability, (2) comply with 18 AAC 70 –WQS, and (3) comply with other state requirements that may be more stringent.

The CWA requires that the limits for a particular pollutant be the more stringent of either TBELs or water quality based effluent limits (WQBELs). TBELs are either set via EPA-rule makings in the form of ELGs that correspond to the level of treatment that is achievable using available technology, or through the development of TBELs using case-by-case BPJ. In establishing permit limits, DEC first determines which, if any, ELGs must be incorporated into the Permit and whether other TBELs using case-by-case BPJ should be adopted. DEC then evaluates the effluent characteristics to determine if the discharge could result in, or contribute to, instream excursions above the water quality criteria in the receiving water beyond the boundary of the authorized mixing zones. If instream excursions could occur, WQBELs must be included in the Permit.

The Permit includes numeric WQBELs for temperature, TRC, and flow for Outfall 001, as well as a case-by-case BPJ TBEL for pH (see Appendix B for additional details). In addition, the permit contains monitoring requirements for WET and BMP's for chemical optimization and avoiding chemicals in emergency discharges of waterflood from pipeline drain-back.

4.2 Technology Based Effluent Limits

As discussed in Section 4.1 and detailed in Appendix B, TBELs are either established using case-by-case BPJ or set via EPA rule makings in the form of ELGs, adopted by reference in 18 AAC 83, that correspond to the level of treatment achievable in selected industries using available treatment technology. There are no established ELGs applicable to the discharges authorized by the Permit. However, TBELs for pH have been developed for existing STP facilities located on the North Slope and discharging to the Beaufort Sea. These facilities are substantially similar in nature, particularly regarding pH control. DEC has previously evaluated effluent characteristics and available treatment technologies for pH at STP facilities and has concluded that the TBEL limitation of 6.0 – 9.0 Standard Units (su) at all times is appropriate and is implementing this case-by-case BPJ TBEL in the Permit. Because the TBEL for pH exceeds water quality criteria, it has been included in the authorized chronic mixing zone for Outfall 001.

4.3 Water Quality Based Effluent Limits

CWA Section 301(b)(1) requires the establishment of limits in permits necessary to meet WQS by July 1, 1977. All discharges to water of the U.S. must comply with WQS, including the Antidegradation Policy. Per 18 AAC 83.435(a)(1), APDES permits must include conditions to meet any applicable requirement in addition to, or more stringent than, TBELs (e.g., WQBELs) that "achieve WQSs established under CWA Section 303, including State narrative criteria for water quality." The following sections discuss the WQBELs meeting 18 AAC 83.435 requirements as detailed in Appendix B.

4.3.1 Strainer/Filter Backwash (Outfall 001)

The Department has determined, based on available evidence, there is reasonable potential for the discharge of strainer/filter backwash to exceed numeric water quality criteria for temperature, pH, and TRC at the point of discharge. However, based on characterization of the effluent discussed in Section 2.2.1, only temperature and TRC are evaluated in the RPA for limit derivation purposes as the driving parameters for the chronic and/or acute mixing zones, respectively.

4.3.1.1 Reasonable Potential Analysis (Outfall 001)

As the driving parameters for the acute and chronic mixing zones, the Department determined there is reasonable potential for TRC and ΔT to result, or contribute to, an instream excursion of water quality criteria at the respective mixing zone boundaries. In Appendix B, the Department developed the following WQBELs for ΔT and TRC.

4.3.1.2 WQBEL Derivation (Outfall 001)

The following summarize the derivation of WQBEL's (see Appendix B for calculations):

TRC: The WQBEL derivation resulted in a maximum daily limit (MDL) of 150.0 µg/L and an average monthly limit (AML) of 75.0 µg/L. However, because the minimum reporting level for TRC is 100 µg/L, the AML is also set to 100 µg/L.

ΔT: The WQBEL derivation resulted in an MDL of 35°C for ΔT.

pH: The WQBEL based on WQS is more stringent for pH than the BPJ TBEL, requiring the pH be no less than 6.5 and no greater than 8.5 su ($6.5 \leq pH \leq 8.5$) at all time. However, due to the use of both acid and bases in the membrane CIP systems, DEC is using BPJ to impose less stringent pH limits to help ensure the facility maintains compliance while allowing for dilution in the chronic mixing zone while applying the end of the pipe TBEL of between 6 and 9 su ($6.0 < pH < 9.0$). Hence, the water quality criteria for pH can be exceeded within the mixing zone but not beyond the TBEL for pH (See Section B.2.4.2). Therefore, the Department is including the case-by-case TBEL in the permit consistent with limits in other similar permits for STPs. The pH is expected to meet water quality criteria in close proximity to the outfall due to the high buffering capacity of marine waters.

4.4 Effluent Limits and Monitoring Requirements

Per AS 46.03.110(d), the Department may specify in a permit the terms and conditions under which waste material may be disposed. The following sections provide the effluent limits and monitoring requirements for each outfall.

4.4.1 Outfall 001 Strainer Backwash

The Permit requires the limitation and monitoring requirements as per Table 2.

Table 1. Outfall 001 Strainer Backwash Limits and Monitoring Requirements

Parameter	Effluent Limits			Monitoring Requirements	
	Units	MDL	AML	Frequency	Type
Flow	mgd	Report	5.0	Continuous	Meter
pH [4.4.1.1]	su	$6.0 < pH < 9.0$		1/Week	Meter or Grab
Temperature Differential (ΔT) [4.4.1.2]	° C	35.0	N/A	Daily	Meter or Grab
TRC [4.4.1.3]	µg/L	150.0	100.0	Daily	Meter or Grab
Chronic WET [4.4.2]	TU_c	Report		Quarterly [4.4.1.4]	Composite
Note: Table notes refer to the Permit Sections below this table.					

4.4.1.1 pH Conditions

The pH must be no less than 6.0 and no greater than 9.0 per 40 CFR 401.17 - pH Effluent Limitations Under Continuous Monitoring. The permittee must report the monthly maximum and monthly minimum pH on the discharge monitoring report (DMR).

4.4.1.2 ΔT Conditions

Temperature differential is the effluent temperature minus the receiving water temperature. The permittee shall monitor the receiving water intake simultaneously with the effluent to demonstrate compliance with the temperature limit. In addition to submitting monthly DMRs, the permittee must record the maximum daily ΔT for the month on the DMR and submit the daily data electronically with the next application for reissuance.

Temperature monitoring is only applicable when there is a discharge occurring. Hence, the permittee is not required to monitor and report ΔT if there is no discharge occurring.

4.4.1.3 TRC Conditions

The AML is set at the compliance level for TRC at 100 μg/L. However, because the facility proposes to use continuous inline TRC monitoring equipment calibrated to detect down to 20 μg/L the following rules for reporting and averaging apply. If equipment modifications result in different calibrations, the new detectable value may be used instead of 20 μg/L as long as the compliance level of 100 μg/L is achieved.

For reporting on DMRs, if the monitoring equipment reports values that are less than the original laboratory calibration value, then the permittee reports < [original equipment calibration value in μg/L] on the DMR. If the equipment reports between the original equipment calibration value in μg/L and 100 μg/L, the permittee reports < 100 μg/L on the DMR. If the equipment records 100 μg/L or greater, the permittee reports the actual value on the DMR.

For averaging purposes, if the equipment records a value that is less than the original equipment calibration value in μg/L, the permittee uses zero for averaging. If the equipment records a value between the original equipment calibration value in μg/L and 100 μg/L, the permittee uses the original equipment calibration value in μg/L for averaging. Lastly, if the equipment reports 100 μg/L or greater, the permittee uses the actual value for averaging.

4.4.1.4 Chemical Inventory

The permittee must development and implement a chemical-dosing matrix to optimize the use of cleaning chemicals and scale inhibitors as a BMP specific to discharge 001 (see Section 7.3.1). In addition, the permittee must maintain a precise chemical inventory of all constituents added to the discharge and submit a report including the general time, dose, and frequency of each chemical additive used and actually discharged. The inventory shall include all chemical additives used for all cleaning operations that result in a discharge through Outfall 001 or that are recycled within the treatment system, ultimately resulting in a discharge to Outfall 001. The permittee must submit these inventory records to DEC annually by January 31 of each year.

The annual inventory must include the following three components:

1) type of each chemical (product name) that is injected into the seawater and/or used for cleaning or maintaining the membrane systems,
2) estimated concentrations listed in item 1), and
3) estimated volume of chemically treated discharges from each cleaning operation and all chemically treated discharges from the SRU membrane, including when chemically treated water from the SRU membrane is recycled within the treatment system or when biocide is used and drained to the biocide holding tank.

Prior to using new or substantially different chemicals the permittee must submit a request for written Department approval.

4.4.2 Chronic WET Monitoring

Chronic WET monitoring applies to the strainer/filter backwash discharge through Outfall 001. As required by the Permit, chronic WET testing of one vertebrate and one invertebrate species listed below must be conducted quarterly. Sampling frequency can be reduced from quarterly to semi-annually, if after the first three full years of testing, twelve quarterly WET tests, indicate that chronic toxicity is not greater than 10 TU_c. If subsequent annual tests indicate chronic WET is greater than 10 TU_c, then DEC may require the permittee to revert back to a quarterly frequency depending on the need for adequate and representative data for future reasonable potential Analyses (RPA).

Chronic WET monitoring must be conducted in accordance with the following:

The Permit specifies chronic WET test screening to identify the most sensitive of the invertebrate species listed below for toxicity testing for a minimum of the first three WET tests in the Permit cycle or for a minimum of three tests if any new chemical is used in the STP. Upon identification of the most sensitive test species, the permittee may submit a written request to eliminate the less sensitive species in subsequent WET analysis for DEC approval. DEC can also approve written requests to substitute the less sensitive species during periods when the more sensitive species is unavailable. The permittee shall not make any changes to the selection of test species or dilution series without prior written DEC approval.

Vertebrate (survival and growth): *Atherinops affinis* (topsmelt minnow). In the event the topsmelt is not available, *Menidia beryllina* (Inland Silverside) may be used as a substitute. Each WET report shall document the species used in testing. The permittee shall document the use of substitute species in the DMR for the testing.

Invertebrate: For larval development tests, the permittee must use bivalve species *Crassostrea gigas* (Pacific Oyster) or *Mytilus spp*. (mussel) and *Americamysis bahia* (formally *Mysidopsis bahia*, mysid shrimp) for survival and growth. Due to seasonal variability, testing may be performed during reliable spawning periods (e.g., December through February for mussels and June through August for oysters).

A series of at least five dilutions and a control must be tested. The recommended initial dilution series is 6.25, 12.5, 25, 50, and 75% (or maximum hypersaline dilution per test method) and a control dilution water control (0% effluent). DEC may require subsequent tests to use modified dilution series that increases the likelihood of observing the 25% effect concentration (EC_{25}) endpoint and provides a more accurate estimate of chronic toxicity. Similarly, the permittee may request written approval form DEC to modify the dilution series based on previous test results.

For the bivalve and primary marine fish species, the presence of chronic toxicity must be estimated as specified Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to West Coast Marine and Estuarine Organisms (EPA/600/R-95/136). For the shrimp and alternate marine fish species Menidia beryllina, USEPA Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms, Third Edition (EPA-821-R-02-014) or the most recently updated version must be used.

Both the no observed effect concentration (NOEC) and 25% inhibition concentration (IC_{25}), must be provided in the full WET report. The chronic toxicity results reported on the DMR must use $TU_c = 100/IC_{25}$, $100/EC_{25}$ or 100/NOEC. If the endpoint is estimated to be above the highest

dilution, the permittee must indicate this on the DMR by reporting a less than value for TU_c based on the highest dilution. The Department may compare the reported TU_c based on the IC_{25} or EC_{25} with one based on the NOEC during evaluation of data during the next Permit reissuance. Although acute WET monitoring is not required, the permittee must estimate acute toxicity based on observations of total mortality recorded for chronic tests and include this information in the full WET report.

The logistics of shipping WET samples to the lower 48 can be challenging as poor weather delays or missed connections during shipping can result in violation of the standard 36-hour hold time. If extenuating circumstances occur, WET samples hold times can exceed 36 hours but must not exceed 72 hours. The permittee must document the conditions that resulted in the need for the holding time to exceed 36 hours and any potential effect the extended hold time could have on the test results.

4.4.3 Electronic Discharge Monitoring Reports

4.4.3.1 E-Reporting Rule, Phase I

The permittee must submit a DMR for each month by the 28th day of the following month. DMRs shall be electronically through NetDMR per Phase I of the E-Reporting Rule (40 CFR 127) upon the effective date of the Permit. For access to the NetDMR Portal, go to https://cdxnodengn.epa.gov/oeca-netdmr-web/action/login. DMRs submitted in compliance with the E-Reporting Rule are not required to be submitted as described in Permit Appendix A – Standard Conditions unless requested or approved by the Department. DEC has established an e-Reporting Information website at https://dec.alaska.gov/water/compliance/electronic-reporting-rule/ which contains general information about this new reporting format. Training modules and webinars for NetDMR can be found at https://netdmr.zendesk.com/home.

4.4.3.2 E-Reporting Rule, Phase II

Phase II of the E-Reporting Rule Permittees will integrate electronic reporting for all other reports required by the Permit (e.g., Annual Reports and Certifications) and implementation is expected to begin sometime in the future. Permittees should monitor DEC's E-Reporting website (https://dec.alaska.gov/water/compliance/electronic-reporting-rule/) for updates on Phase II of the E-Reporting Rule and will be notified when they must begin submitting all other reports electronically. Until such time, other reports required by the Permit may be submitted in accordance with Permit Appendix A – Standard Conditions.

4.4.3.3 Rollout of New DEC Database and Portal

DEC is currently developing a new database with a permittee portal that may affect reporting under the Permit. This database/portal may be an added enhancement for NetDMR or be a complete substitute. DEC will communicate with permittees as necessary during the rollout of this new database/portal.

4.4.4 Additional Effluent Monitoring

DEC may require additional monitoring of effluent or receiving water for facility or site-specific purposes, including, but not limited to data to support applications, demonstration of water quality protection, obtaining data to evaluate ambient water quality, evaluating causes of elevated concentrations of parameters in the effluent, and conducting chronic WET monitoring or toxicity

identification and reduction evaluations. If additional monitoring is required, DEC will provide the permittee or applicant the request in writing.

The permittee has the option of taking more frequent samples than required under the Permit, or DEC may request this additional information. These additional samples can be used for averaging if they are conducted using the Department approved test methods (generally found in 18 AAC 70 and 40 CFR 136 [adopted by reference in 18 AAC 83.010], and if the method detection limits are less than the effluent limitations and are sufficiently sensitive. All data collected during the Permit term must be provided to the Department with the next application for reissuance. This information is necessary to adequately characterize the effluent and conduct an RPA. When data is being collected to characterize effluent or receiving water, a sufficiently sensitive method must be used that allows comparison of results with applicable water quality criteria. A method approved under 40 CFR 136 is sufficiently sensitive when:

1) The method minimum level (ML) is at or below the level of the applicable water quality criterion for the measured parameter, or
2) The method ML is above the applicable water quality criterion, but the amount of the pollutant or pollutant parameter in the discharge is high enough that the method detects and quantifies the level of the pollutant or pollutant parameter in the discharge (e.g., not applicable to effluent or receiving water monitored for characterization), or
3) The method has the lowest ML of the analytical methods approved under 40 CFR 136 for the measured pollutant or pollutant parameter (e.g., the receiving water concentration or the criteria for a given pollutant or pollutant parameter is at or near the method with the lowest ML).

5.0 ANTIBACKSLIDING

Per 18 AAC 83.480, “effluent limitations, standards, or conditions must be at least as stringent as the final effluent limitations, standards, or conditions in the previous permit.” Per 18 AAC 83.480(c), a permit may not be reissued “to contain an effluent limitation that is less stringent than required by effluent guidelines in effect at the time the permit is renewed or reissued.”

Effluent limitations may be relaxed as allowed under 18 AAC 83.480, CWA §402(o) and CWA §303(d)(4). 18 AAC 83.480(b) allows relaxed limitations in renewed, reissued, or modified permits when there have been material and substantial alterations or additions to the permitted facility that justify the relaxation, or, if the Department determines that technical mistakes were made.

CWA §303(d)(4)(A) states that, for waterbodies where the water quality does not meet applicable WQS, effluent limitations may be revised under two conditions, the revised effluent limitation must ensure the attainment of the WQS (based on the waterbody TMDL or the waste load allocation) or the designated use which is not being attained is removed in accordance with the WQS regulations.

CWA §303(d)(4)(B) states that, for waterbodies where the water quality meets or exceeds the level necessary to support the waterbody's designated uses, WQBELs may be revised as long as the revision is consistent with the state's Antidegradation Policy. Even if the requirements of CWA §303(d)(4) or 18 AAC 83.480(b) are satisfied, 18 AAC 83.480(c) prohibits relaxed limits that would result in violations of WQS or ELGs.

State regulation 18 AAC 83.480(b) only applies to effluent limitations established on the basis of CWA Section 402(a)(1)(B), and modification of such limitations based on effluent guidelines that were issued under CWA Section 304(b). Accordingly, 18 AAC 83.480(b) applies to the relaxation previously

established case-by-case TBELs developed using BPJ. To determine if backsliding is allowable under 18 AAC 83.480(b), the regulation provides five regulatory criteria (18 AAC 83.480[b][1-5]) that must be evaluated and satisfied.

This is the first issuance of the Permit. Therefore, an anti-backsliding analysis is not required.

6.0 ANTIDEGRADATION

Antidegradation is implicit in CWA Section 101(a) goals, explicitly referenced in CWA Section 303(d)(4)(B), and implemented through 40 CFR 131.12. Section 303(d)(4) of the CWA states that, for waterbodies where the water quality meets or exceeds the level necessary to support the waterbody's designated uses, WQBELs may be revised as long as the revision is consistent with the State Antidegradation Policy and Implementation Methods. Alaska's current Antidegradation Policy and Implementation Methods are presented in 18 AAC 70.015 Antidegradation Policy (Policy) and in 18 AAC 70.016 Antidegradation Implementation Methods for Discharges Authorized Under the Federal CWA (Implementation Methods). For these state regulations to apply under the CWA, they must be previously approved by EPA per CWA Section 303(c)(3). The Policy and Implementation Methods have been amended through April 6, 2018; are consistent with the CWA and 40 CFR 131.12; and were approved by EPA on July 26, 2018.

This section of the fact sheet analyzes and provides rationale for the Department decision to issue the Permit with respect to the Antidegradation Policy.

6.1 Receiving Water Status, Tier Determination, and Analysis Requirements

Per the Implementation Methods, the Department determines a Tier 1 or Tier 2 classification and protection level on a parameter-by-parameter basis for the waterbody. The Implementation Methods also describe a Tier 3 protection level applying to designated waters, although at this time no Tier 3 waters have been designated in Alaska.

The marine waters of the Beaufort Sea, covered under the Permit, are not listed as impaired (Categories 4 or 5) in the *2020 Integrated Report*. Therefore, no parameters have been identified where only the Tier 1 protection level applies. Accordingly, this antidegradation analysis applies the Tier 2 protection level on a parameter-by-parameter basis consistent with 18 AAC 70.016(c)(1) and 18 AAC 70.015(a)(2), that states if the quality of water exceeds levels necessary to support propagation of fish, shellfish, wildlife, and recreation in and on the water, that quality must be maintained and protected, unless the Department authorizes a reduction in water quality. Prior to authorizing a reduction of water quality, the Department must first analyze and confirm the findings under 18 AAC 70.015(a)(2)(A-D) are met. Because Tier 1 protection applies to all waters of the U.S. in the state, the analysis must be conducted with implementation procedures in 18 AAC 70.016(b)(5)(A-C) for Tier 1 protection. For Tier 2 protection, the analysis must also comply with 18 AAC 70.016(c)(7)(A-F). These analyses and associated finding are summarized below.

6.2 Tier 1 Analysis of Existing Use Protection

The summary below presents the Department's analyses and findings for the Tier 1 analysis of existing use protections per 18 AAC 70.016(b)(5) finding that:

(A) existing uses and the water quality necessary for protection of existing uses have been identified based on available evidence, including water quality and use related data, information submitted by the applicant, and water quality and use related data and information received during public comment;

The Department has reviewed water quality data, environmental monitoring studies, and information on existing uses within the coverage area. The Department finds the information reviewed as sufficient and credible to identify existing uses and water quality necessary for Tier 1 protection.

(B) existing uses will be maintained and protected; and

Per 18 AAC 70.020 and 18 AAC 70.050, marine waters are protected for all uses. Therefore, the most stringent water quality criteria found in 18 AAC 70.020 and in *the Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances, 2008 (Toxicity Manual*) apply and were evaluated to ensure existing uses and the water quality necessary for protection of existing uses of the receiving waterbody are fully maintained and protected. Water quality criteria are developed to be protective of existing uses. The discharges authorized under the Permit are controlled or limited to either meet criteria at the point of discharge, or at the boundary of the acute and chronic mixing zones, if applicable. DEC has authorized an acute and chronic mixing zone per Section 4. Given water quality criteria is met at the boundary of the acute and chronic mixing zones for all parameters, the existing uses of the waterbody as a whole are being maintained and protected.

(C) the discharge will not cause water quality to be lowered further where the department finds that the parameter already exceeds applicable criteria in 18 AAC 70.020(b), 18 AAC 70.030, or 18 AAC 70.236(b).

As discussed in (B), the Permit has been developed to ensure discharges shall not cause or contribute to an instream excursion of water quality criteria. As previously stated, the marine waters of the Beaufort Sea covered under the Permit are not listed as impaired. Therefore, no parameters were identified as already exceeding the applicable criteria in 18 AAC 70.020(b) or 18 AAC 70.030.

The Department concludes the terms and conditions of the Permit will be adequate to fully protect and maintain the existing uses of the water and that the Tier 1 findings required under 18 AAC 70.016(b)(5) are met.

6.3 Tier 2 Analysis for Lowering Water Quality

6.3.1 Scope of Tier 2 Analysis

Per 18 AAC 70.016(c)(2), an antidegradation analysis is only required for those waterbodies needing Tier 2 protection and which have any new or existing discharges that are being expanded based on permitted increases in loading, concentration, or other changes in effluent characteristics that could result in comparative lower water quality or pose new adverse environmental impacts. Per 18 AAC 70.016(c)(2)(A), the analysis will only be conducted for the portion of the discharge that represents a new discharge or an increase from the existing authorized discharge. Additionally, per 18 AAC 70.016(c)(3), DEC is not required to conduct an antidegradation analysis for a discharge that is not new or not expanding.

Per 18 AAC 70.990(75), “new or expanded” with respect to discharges means discharges that are regulated for the first time or discharges that are expanded such that they could result in an increase in pollutant load or concentration or other changes in discharge characteristics that could lower water quality or have other adverse environmental impacts.

Because AK0055921 is a new permit, all discharges under the Permit are considered new discharges and must have a Tier 2 Analysis.

6.3.2 Tier 2 Analysis

The Policy in 18 AAC 70.015(a)(2) states that if the quality of water exceeds levels necessary to support propagation of fish, shellfish, wildlife, and recreation in and on the water (i.e., Tier 2 waters), that quality must be maintained and protected. The Department may allow a reduction of water quality only after finding that the most practicable and effective pollution prevention, control, and treatment methods are being used such that lowering of water quality is necessary. Upon making this determination, the specific requirements of the Policy noted in 18 AAC 70.015(a)(2)(A)-(D) must be met. The Department's findings are presented below.

6.3.2.1 Tier 2 Alternatives Analysis

OSA provided an alternatives analysis to support the STP application and this antidegradation analysis. Per 18 AAC 70.016(c)(4)(C-F), the applicant must submit a description and analysis of a range of practicable alternatives that have the potential to prevent or lessen the degradation associated with the expanded discharge. The analysis must identify the water quality environmental impacts and relative costs for each practicable alternative. OSA submitted their analysis on July 22, 2021. DEC has reviewed this submittal and has determined it is sufficient and credible for Department review.

The alternatives analysis provided per 18 AAC 70.016 (4)(C) - (F) demonstrates that:

(i) a lowering of water quality under 18 AAC 70.015(a)(2)(A) is necessary; when one or more practicable alternatives that would prevent or lessen the degradation associated with the proposed discharge are identified, the department will select one of the alternatives for implementation; and

Seawater Treatment Alternatives

Strainer/filter backwash is generated during the treatment of seawater for waterflood injection. OSA considered direct sand filtration as an alternative process for seawater filtration. Using a sand filtration system would cost approximately $40 to $50 million to install and would still require membrane filtration, estimated to cost $30 to $37 million, to achieve the water quality needed for waterflood that can be obtained by the proposed system. The overall cost of including sand filtration is estimated to be $70 to $87 million, in comparison to $30 to $37 million for the proposed membrane filtration system.

The addition of sand filtration would not lessen the degradation associated with the proposed discharge. Additional equipment and chemicals for coagulation/flocculation would be needed to reduce suspended solids below the capabilities of sand filtration. This means some of these chemicals would likely be present in the effluent, resulting in increased WET in the discharge without attaining the required quality of the waterflood.

Sand filtration would also require a 1,800 square foot footprint compared to 1,380 square feet for the UF membranes and increase energy requirements. Because this alternative would not prevent or lessen the degradation associated with the proposed discharge or lessen the cross-media environmental impacts, the Department has determined UF membranes alone provide the most practicable and effective method of pollution control and treatment, with a minimal reduction of water quality under 18 AAC 70.015(a)(2)(A).

Effluent Cooling Alternatives

The ΔT between the water leaving the OSA STP and the receiving waterbody is the main POC in the effluent. During the seawater treatment process, heat is added the seawater year-round to enhance oxygen removal and to prevent freezing. As an alternative to the proposed design, OSA considered cooling towners to aid in further cooling effluent prior to discharge and reduce the ΔT. Cooling towers were determined to be technically infeasible on a year-round basis because the cooling water would freeze during winter.

Fin fans were also considered to cool the water but would also likely freeze during the winter and result in burst tubes. Fin fans with a glycol water mixture and heat exchanges would be less prone to freezing, but more costly. In addition, the inclusion of glycol poses another source of pollution that would not be present otherwise.

The infrastructure necessary for cooling towers with fin fans would also increase the proposed OSA STP site footprint. Each of these cooling technologies results in more energy emissions to power pumps and/or fans and there would be accompanying cross-media environmental impacts from higher energy consumption and the associated increased quantities of greenhouse gas emissions.

Consequently, effluent cooling is not considered a practicable alternative for the OSA STP because the potential for freezing in winter is not eliminated and due to logistical challenges considering the overall project purpose.

Considering the level of treatment provided, and the ability of the discharge to meet chronic and acute water quality standards at the boundary authorized mixing zones, the Department has determined that the proposed seawater treatment system provides the most practicable and effective method of pollution control and treatment, with a minimal reduction of water quality under 18 AAC 70.015(a)(2)(A).

Site Location Alternatives

Alternatives considered by OSA included alternative site locations at Oliktok Long Range Radar Site and near Oooguruk. The site location did not affect the level of degradation associated with the proposed discharge. However, the proposed location at Oliktok Point had the least accompanying cross-media environmental impacts during construction.

Most Effective and Practicable Treatment Alternative

The most effective and practicable treatment alternative for the OSA STP is intake water screening, straining, and UF followed by NF. Although UF and NF membranes require CIP cleanings and soaking in acid/bases, these waste streams will be neutralized. Similarly, the use of hypochlorite injection followed by dechlorination result in neutralizing chemicals prior to discharge. These processes are the most effective and practicable alternatives when considering the limited lowering of water quality that may result in the vicinity of the discharge as discussed in the following section.

(ii) the methods of pollution prevention, control, and treatment applied to all waste and other substances to be discharged are found by the department to be the most effective and practicable.

For Outfall 001, water used to backwash filters is dosed with hypochlorite to prevent biofouling of the filter media. Heat added to the treatment process to enhance removal of particulates in the filtration process is controlled using heat exchangers and is not anticipated to exceed effluent limits. The chlorinated backwash water is mixed with reject water from the pre-filter strainers and

dechlorinated using sodium bisulfite prior to discharge. Based on similar facilities and monitoring for TRC in the outfall tank, it is expected that the dechlorination system will effectively remove chlorine to below the permitted effluent limits. The development and implementation of BMPs provides another level of control over the use of potentially toxic chemicals.

For Outfall 001, a BMP Plan is required to be developed and implemented to achieve the following two primary objectives:

1. The number and quantity of pollutants and the toxicity of effluent generated, discharged, or potentially discharged at the facility shall be minimized by the permittee to the extent feasible by managing each potential waste stream in the most appropriate manner.
2. Under the BMP Plan, any Standard Operating Procedures (SOPs) must be included in the Plan to ensure proper operation and maintenance of the STP.

Through the BMP Plan, the cleaning chemicals are to be selected based on their low toxicity and the concentrations used to be optimized. This source control will be verified via chronic WET monitoring. Based on the SDSs provided for the cleaning chemicals, a chronic toxicity no greater than 10 TU_c is anticipated in the discharge.

DEC has determined the most reasonable and effective pollution prevention, control, and treatment is being used.

6.3.2.2 Accommodation of Important Social or Economic Develop in the Vicinity

18 AAC 70.015 (a)(2)(A). Allowing lower water quality is necessary to accommodate important economic or social development in the area where the water is located.

Based on the evaluation required per 18 AAC 70.015(a)(2)(D) below, the Department has determined that the most reasonable and effective pollution prevention, control, and treatment methods are being used and that the localized lowering of water quality is necessary.

The Alaska Oil and Gas Association (AOGA) 2020 Final Report - AOGA Economic Impact Study (2020 AOGA Final Report) indicates that the petroleum industry is the top employer in the North Slope Borough (NSB) generating a total of 1,637 direct, support, or indirect jobs with wages paid totaling $96 million in 2018 for Alaska residents. In addition, the oil and gas industry paid $376.7 million in property taxes to the NSB in 2018 contributing 95% of total NSB tax revenues. The 2017 Active Oil and Gas Lease Inventory by the Alaska Department of Natural Resources, Oil and Gas Division states that oil and gas leases sales involving North Slope and Beaufort Sea acreage made by the state totaled approximately 2.71 million acres as of August 4, 2021. The 2014 Annual Report by the Alaska Department of Natural Resources, Oil and Gas Division states that since 1964, oil and gas leases sales involving North Slope and Beaufort Sea acreage, representing a total of 5.5 million acres have been made by the state.

The 2020 AOGA Final Report also indicates that OSA acquired the Nanushuk field in the Pikka Unit (51% ownership) and is expected to produce approximately 120,000 barrels of oil per day. The waterflood operation is of critical importance to OSA and the state for providing the injection of treated seawater into aging oil reservoirs to enhance oil recovery from production wells. Construction of the STP and make-up water pipeline will support the Pikka Project, which is anticipated to generate billions of dollars through state and local taxes, royalty revenues, fees, employment opportunities, and community investment contributions, which would benefit the City of Nuiqsut, NSB, State of Alaska, and Alaska Native Corporations. Construction of the STP and

pipeline could create up to approximately 350 jobs on the North Slope at the peak of construction and an additional six to seven full-time jobs for operation of the STP.

The Department finds that the requirements of this part of the Antidegradation analysis have been met.

6.3.2.3 Reducing Water Quality Will Not Violate Applicable Criteria

18 AAC 70.015 (a)(2)(B). Except as allowed under this subsection, reducing water quality will not violate the applicable criteria of 18 AAC 70.020 or 18 AAC 70.235 or the whole effluent toxicity limit in 18 AAC 70.030.

The Department evaluated the applicable criteria in 18 AAC 70.020 while establishing permit limits and conditions. An acute mixing zone has been authorized for TRC at Outfall 001, and in addition, a chronic mixing zone has been authorized for TRC, pH, and temperature. The size of the authorized mixing zones were developed to ensure water criteria will be met at, and beyond, their boundaries and that the waterbody has a whole would be protected. There are no site-specific criteria addressed by the Permit so 18 AAC 70.235 does not warrant further consideration. In addition, WET testing in the Permit for Outfall 001 consists of monitoring only so WET limits associated with 18 AAC 70.030 also do not warrant further consideration. Therefore, DEC concludes that the finding is met.

6.3.2.4 Tier 1 Protection of Existing Uses

18 AAC 70.015(a)(2)(C). The resulting water quality will be adequate to fully protect existing uses of the water.

Water quality criteria are established such that, if the criteria are met, the uses of the waterbody will be protected. DEC developed and incorporated narrative and numeric permit limitations at the point of discharge based on meeting the most stringent water quality criteria applicable to all uses of the waterbody at the boundaries of the mixing zones. As discussed in part (B) of the preceding Tier 1 analysis, marine waters are protected for all uses and all water quality criteria developed to protect these uses are met at the boundary of the chronic mixing zone for produced water. The chronic mixing zone has been sized to ensure there is no overlap with nearby mixing zones and industrial water supply intakes. Because criteria are being met at the boundaries of the mixing zones, mixing zones have been sized to avoid overlap with existing uses, and these criteria protect the uses of the waterbody, DEC concludes that the resulting water quality will fully protect the existing uses of the waterbody as a whole and the finding is met.

6.3.2.5 All Wastes and Other Substances Discharged Will be Treated and Controlled

18 AAC 70.015(a)(2)(D). All wastes and other substances discharged will be treated and controlled to achieve (i) for new and existing point sources, the highest statutory and regulatory requirements; and (ii) for nonpoint sources, all cost-effective and reasonable best management practices.

The applicable "highest statutory and regulatory treatment requirements" are defined in18 AAC 70.015(d). The definition includes the four components noted below:

(1) Any federal technology-based effluent limitation identified in 40 CFR 122.29 and 125.3, revised as of July 1, 2017 and adopted by reference in 18 AAC 83.010;

There are no applicable federal ELGs for seawater treatment facilities. However, a TBEL has been established for pH using case-by-case BPJ for Outfall 001 per Section 4.X in conjunction with BMPs discussed previously.

(2) Any minimum treatment standards identified in 18 AAC 72.050;

The second part of the definition is in reference to domestic wastewater and is inapplicable to STP discharges as discussed previously in Section 3.3.2.

(3) Any treatment requirements imposed under another state law that is more stringent than a requirement of this chapter; and

The third part of the definition includes any treatment required by state law that is more stringent than 18 AAC 70. Other regulations beyond 18 AAC 70 that may apply to this permitting action include 18 AAC 83 and 18 AAC 15. The Permit is consistent with 18 AAC 83 and neither the regulations in 18 AAC 15, or other state legal requirement(s) the Department is aware of, impose more stringent treatment requirements than 18 AAC 70.

DEC has concluded that this criterion has been met through the implementation of BMPs to control sources of pollution to ensure discharges are treated to the highest statutory and regulatory requirements.

(4) Any water quality-based effluent limitations established in accordance with 33 U.S.C. 1311(b)(1)(C) (Clean Water Act, sec. 301(b)(1)(C)).

Alaska water quality criteria are presented in 18 AAC 70.020 and the *Water Quality Criteria for Toxics and Other Deleterious Substances* amended through December 12, 2008. Except for pH, WQBELs have been established to be more stringent than applicable TBELs per the *Reasonable Potential Analysis and Effluent Limits Development Guide*, June 30, 2014 (*RPA/WQBEL Guidance*), which complies with 18 AAC 83.435 and CWA 301(b)(1)(C). Although the state WQS are more stringent, the TBEL for pH is anticipated to be met within a few feet after discharging to the chronic mixing zone (see Sections 2.2.1 and 4.3.1).

The Permit imposes WQBELs for flow (AML of 5.0 MGD), ΔT (MDL of 35˚C), and TRC (MDL of 150.0 µg/L and AML of 100.0 µg/L). During development of these WQBELs, DEC used ambient data for temperature from monitoring records from other point source discharges within the area of coverage. For TRC, no ambient concentrations of TRC are assumed due to the natural high chlorine demand in marine waters.

Per 18 AAC 70.016(c)(7)(C), DEC must consider other point sources and state-regulated non-point sources discharging to the waterbody that could impact water quality and if there are any outstanding compliance issues with point source permits or BMPs for non-point sources. In this fourth finding, DEC identifies all the discharges in the Permit and discharges from the following permitted point source that has limits for temperature, TRC, pH, or WET:

- AK0043354 – ConocoPhillips Alaska, Inc., Kuparuk Seawater Treatment Plant

In review of AK0043354, DEC found no outstanding compliance issues that affect the antidegradation analysis. Although the Kuparuk STP is adjacent to the OSA STP, their respective mixing zones do not overlap. Hence, cumulative impacts are not anticipated because water quality criteria is met at the boundary of each mixing zone.

For state-regulated non-point sources, DEC considered contaminated sites in the vicinity of the OSA STP and reviewed the DEC contaminated sites database on August 26, 2021. The database showed several sites where cleanup is considered complete by the Department and no active contaminated were in the vicinity of the OSA STP.

Therefore, DEC concludes that the fourth finding is met.

6.3.3 Tier 2 Finding

Per the aggregate findings in Sections 6.3.1 through 6.3.2.5, DEC determines that the applicant has submitted sufficient evidence for the Department to authorize lowering of water quality associated with the discharges from the OSA STP.

7.0 OTHER PERMIT CONDITIONS

7.1 Standard Conditions

Appendix A of the Permit contains standard regulatory language that must be included in all APDES permits. These requirements are based on the regulations and cannot be challenged in the context of an individual APDES permit action. The standard regulatory language covers requirements such as monitoring, recording, reporting requirements, compliance responsibilities, and other general requirements.

7.2 Quality Assurance Project Plan

The permittee is required to develop procedures to ensure that the monitoring data submitted are accurate and to explain data anomalies if they occur. The permittee is required to update the Quality Assurance Project Plan (QAPP) within 90 days of the effective date of the final Permit. Additionally, the permittee must submit a letter to the Department within 90 days of the effective date of the Permit stating that the plan has been implemented within the required time frame. The QAPP shall consist of SOPs the permittee must follow for collecting (e.g., composite sampling for chronic WET), handling, storing and shipping samples; laboratory analysis; and data reporting. The plan shall be retained on site and made available to the Department upon request.

7.3 Best Management Practices Plan

A BMP Plan is a collection of pollution control methods and housekeeping measures which are intended to minimize or prevent the generation and the potential release of pollutants from a facility to the waters of the U.S. through normal operations and ancillary activities. Per CWA Section 402(a)(1), development and implementation of BMPs may be included as a condition in APDES permits. CWA 402(a)(1) authorizes DEC to include miscellaneous requirements that are deemed necessary to carry out the provision of the CWA in permits on a case-by-case basis. The BMP Plan must be developed to control, or abate, the discharge of pollutants in accordance with 18 AAC 83.475. A BMP Plan must include certain generic BMPs as well as specific BMPs for controlling pollutants (see Section 7.3.1).

Within 90 days of the effective date of the Permit, the permittee must develop and implement the BMP Plan to address activities at the facility and submit written certification of the review, revision and implementation to DEC.

In each subsequent year of the Permit, the permittee must establish a committee to review and revise the BMP Plan as necessary to address any modifications or changes to operational practices at the terminal and to continue to meet the objectives and specific requirements of the Permit. The permittee must submit written certification to DEC that the BMP Plan review committee has reviewed the BMP Plan, and modified if necessary, by January 31st of each year the Permit remains in effect.

7.3.1 Specific BMPs

In addition to the generic BMPs listed in Permit Section 3.2.4.1, DEC requires that the BMP Plan include specific BMPs as follows:

7.3.1.1 Chemical Optimization

A specific BMP (e.g., a chemical-dosing matrix) to optimize the use of cleaning chemicals in the treatment system that will be discharged through Outfall 001, including chemically treated water that is recycled through the treatment system. See also Section 4.4.1.4 – Chemical Inventory.

7.3.1.2 Waterflood Pipeline Drain Back

The permittee must develop a specific BMP for preventing treatment chemicals in waterflood that could be drained back to the outfall tank to facilitate pipeline maintenance and repairs. In order to discharge drain back water, the permittee is required to contact DEC to discuss the specific characteristics of the drain-back water and options to evacuate the pipeline in compliance with the permit and/or regulations. If there are no chemicals in the waterflood as a result of successful implementation of the BMP, then the approval will be expedited. If emergency situations prevent drain back without waterflood chemicals, the permittee may be required to conduct chronic WET testing on the waterflood to demonstrate that the discharge will not exceed 21.5 TU_c. This information ensures the discharge will not impart chronic toxicity to aquatic organisms, expressed as 1.0 TU_c, at the boundary of the chronic mixing zone in accordance with 18 AAC 70.030.

8.0 OTHER LEGAL REQUIREMENTS

8.1 Endangered Species Act

The ESA requires federal agencies to consult with the National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (FWS) if their actions could beneficially or adversely affect any threatened or endangered species. As a state agency, DEC is not required to consult with these federal agencies regarding permitting actions. However, the Department voluntarily requested this information from these services on July 27, 2021 to inform permit development. The Department received a threatened and endangered species list from NMFS on August 2, 2021 for threatened and endangered species under their jurisdiction. The Department did not receive a response from FWS and therefore reviewed the FWS Information, Planning, and Conservation (IPaC) tool for habitat ranges for FWS managed species.

Based on information provided by NMFS and the IPaC tool, the following may occur in the Beaufort Sea at the vicinity of one of the discharges: Steller's Eider (*Polysticta stelleri*), Spectacled Eider (*Somateria fischeri*), Polar Bear (*Ursus maritimus*), Bowhead Whale (*Balaena mysticus*), Bearded Seal (*Erginathuse barbatus nauticus*), and Ringed Seal (*Phoca hispida hispida*).

8.2 Essential Fish Habitat

Essential fish habitat (EFH) includes the waters and substrate (sediments, etc.) necessary for fish from commercially-fished species to spawn, breed, feed, or grow to maturity. The Magnuson-Stevens Fishery Conservation and Management Act (January 21, 1999) requires federal agencies to consult with NOAA when a proposed discharge has the potential to adversely affect (reduce quality and/or quantity of) EFH. Although DEC, as a state agency, is not required to consult with these federal agencies regarding permitting activities, the Department voluntarily requested this information July 27, 2021 from these services to inform permit development.

The Department did not receive a response and therefore inspected the NMFS interactive map of EFH and found the area in the vicinity of the discharges is EFH for Arctic Cod (*Arctogadus glacialis*) and Arctic snow crab *(Chionoecetes opilio).*

No other North Pacific marine fish species were listed on the NMFS interactive website as having EFH in the general area of the discharges.

8.3 Ocean Discharge Criteria Evaluation

CWA Section 403(a), Ocean Discharge Criteria, prohibits the issuance of a permit under CWA Section 402 for a discharge into the territorial sea, the water of the contiguous zone, or the oceans except in compliance with Section 403. Permits for discharges seaward of the baseline on the territorial seas must comply with the requirements of Section 403, which include development of an Ocean Discharge Criteria Evaluation (ODCE).

The Permit requires compliance with Alaska WQS. Consistent with 40 CFR 125.122(b), adopted by reference at 18 AAC 83.010(C)(8), discharges in compliance with Alaska WQS shall be presumed not to cause unreasonable degradation of the marine environment. EPA made the connection between the similar protections provided by ODCE requirements and WQS when promulgating ocean discharge criteria rules in 1980, as stated, “the similarity between the objectives and requirements of [state WQS] and those of CWA Section 403 warrants a presumption that discharges in compliance with these [standards] also satisfy CWA Section 403” (Ocean Discharge Criteria, 45 Federal Register 65943). As such, given the Permit requires compliance with Alaska WQS, unreasonable degradation to the marine environment is not expected and further analysis under 40 CFR 125.122 is not warranted for this permitting action.

8.4 Permit Expiration

The permit will expire five years from the effective date of the permit.

9.0 REFERENCES

1. 18 AAC 70. *Water Quality Standards,* as amended through June 26, 2003.
2. *18 AAC 70. Water Quality Standards,* as amended through July 1, 2008.
3. *18 AAC 70. Water Quality Standards,* as amended through April 8, 2012.
4. *18 AAC 70. Water Quality Standards,* as amended through February 19, 2016.
5. *18 AAC 70. Water Quality Standards,* as amended through April 6, 2018
6. *18 AAC 70. Water Quality Standards,* as amended through March 5, 2020
7. *18 AAC 72. Wastewater Disposal,* as amended through December 23, 2009.
8. *18 AAC 83. Alaska Pollutant Discharge Elimination System Program.* As amended Through October 23, 2008.
9. DEC 2008. *Alaska Water Quality Criteria Manual for Toxics and Other Deleterious Organic and Inorganic Substances,* as amended through December 12, 2008.
10. DEC 2014. *Alaska Pollutant Discharge Elimination System Permits Reasonable Potential Analysis and Effluent Limits Development Guide,* June 30, 2014.
11. DEC 2020. *Alaska's Final 2020 Integrated Water Quality Monitoring and Assessment Report*, May 17, 2021.
12. DEC and University of Alaska Fairbanks Institute of Marine Science 2016. *Offshore Oil/Gas Wastewater Study: 2014 Assessment of Simpson Lagoon.* June 2016.
13. Alaska Department of Natural Resources – Division of Oil and Gas, *Annual Report*, 2014.
14. Alaska Department of Natural Resources – Division of Oil and Gas, North Slope Borough and Beaufort Sea Oil and Gas Lease Inventory, August 4, 2021.
15. Alaska Oil and Gas Association. *Economic Impact Report – The Role of the Oil and Gas Industry in Alaska's Economy*, January 2020.
16. EPA 1991. *Technical Support Document for Water Quality-based Toxics Control. Office of Water, EPA-505-2-90-001, PB91-127415.* Washington D.C., March 1991.
17. EPA 1992d. U.S. EPA, Region 10. *Region 10 Guidance: Best Management Practices Plans in NPDES Permits.* Prepared by Water Division, Wastewater Management and Enforcement Branch, Seattle, WA. June 1992.
18. EPA 1995. *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to West Coast Marine and Estuarine Organisms, First Edition.* Office of Research and Development, EPA-600 R 95 136, Cincinnati, Ohio, August 1995.
19. EPA 1996a. *EPA Guidance on Application of Mixing Zone Policies in EPA-Issued NPDES Permits.* Robert Perciasepe, Assistant Administrator, Office of Water. August 6, 1996.
20. EPA 1996b. *Interim Guidance for Performance-Based Reduction of NPDES Monitoring Frequencies.* Office of Water, EPA-833-B-96-001, Washington D.C., April 1996.
21. EPA 2002. 19. *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms, Third Edition.* Office of Water, EPA-821 R 02 014, Washington, D.C., October 2002.

22. EPA 2010. *Permit Writers' Guide to Water Quality-based Permitting for Toxic Substances*. EPA 883 K 10 001005. Office of Water. Washington, D.C., July 1987.

23. National Oceanic and Atmospheric Administration, 2017 *EFH Mapper. N.p.,n.d.* Web July 28, 2021.

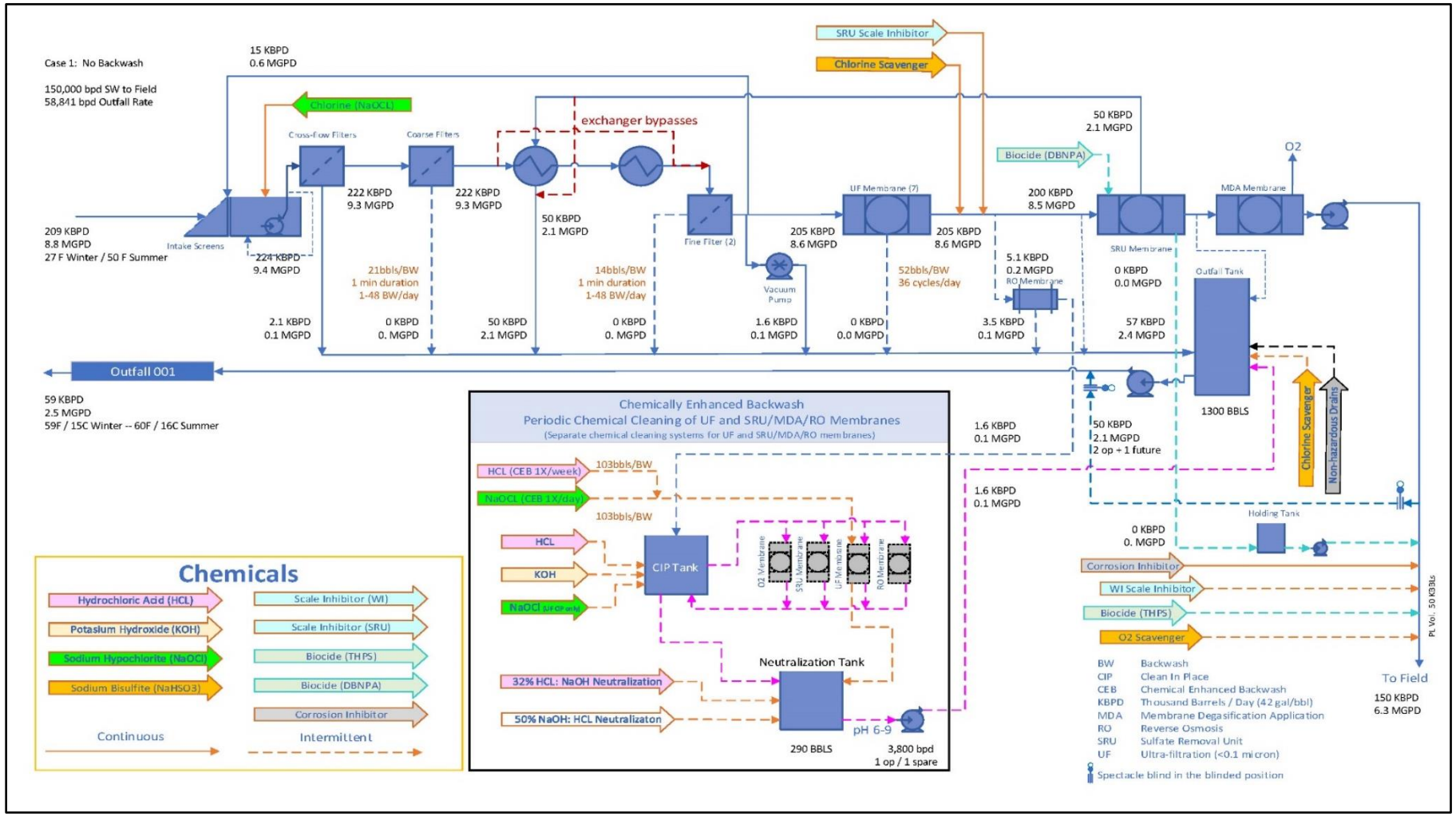
24. National Oceanic and Atmospheric Administration, 2017 *MMPA Mapper. N.p.,n.d.* Web July 28, 2021.

25. Roberts, P.J.W., X. Tian, and Y. Jung, 2011. Physical Model Study of an Alternating Diffuser for Thermal Discharge. Journal of Hydraulic Engineering. September 2011.

APPENDIX A. FIGURES

Figure 1: Vicinity Map Location of OSA STP and Outfall 001

Figure 2: Treatment Plant Simplified Process Flow Diagram



APPENDIX B. EFFLUENT LIMITATIONS

The Alaska Department of Environmental Conservation (Department or DEC) prohibits the discharge of pollutants to waters of the United States per Alaska Administrative Code (AAC) 18 AAC 83.015 unless first obtaining a permit issued by the Alaska Pollutant Discharge Elimination System (APDES) Program that meets the purposes of Alaska Statutes (AS) 46.03 and is in accordance with Clean Water Act (CWA) Section 402. Per these statutory and regulatory requirements, individual permit AK0055921– Oil Search (Alaska), LLC, Seawater Treatment Plant (Permit) includes effluent limitations that require the discharger to (1) meet standards reflecting levels of technological capability, (2) comply with 18 AAC 70 – Alaska Water Quality Standards (WQS), (3) and comply with other state requirements that may be more stringent. The CWA requires that the limits for a particular parameter be the more stringent of either technology-based effluent limits (TBEL) or water quality-based effluent limits (WQBEL). TBELs are set via rule makings by the Environmental Protection Agency (EPA) in the form of Effluent Limitation Guidelines (ELGs) that correspond to the level of treatment that is achievable using available technology. In situations where ELGs have not been developed or have not considered specific discharges or pollutants, a regulatory agency can develop TBELs using best professional judgment (BPJ) on a case-by-case basis. A WQBEL is designed to ensure that WQS codified in 18 AAC 70 are maintained and the waterbody as a whole is protected. WQBELs may be more stringent than TBELs. In cases where both TBELs and WQBELs have been generated, the more stringent of the two limits will be selected as the final permit limit.

B.1 TECHNOLOGY BASED EFFLUENT LIMITS

EPA has not established national ELGs for seawater treatment facilities for waterflood production. However, the Department is adopting a TBEL developed using case-by-case BPJ for pH. The Permit requires pH to be within 6.0 standard units (su) to 9.0 su.

B.2 WATER QUALITY BASED EFFLUENT LIMITS

B.2.1 Statutory and Regulatory Basis

Per 18 AAC 83.435(a), an APDES permit must include conditions (e.g., WQBELs) in addition to, or more stringent than established TBELs as necessary to protect WQS. When evaluating if WQBELs are needed in addition to TBELs, the permitting authority conducts a reasonable potential analysis (RPA) based on pertinent pollutants of concern (POCs). Pertinent POCs are those that the Department considers as having the potential to exceed water quality criteria at the point of discharge or at the boundary of a mixing zone, if authorized. If a mixing zone is authorized, the Department may consider the dilution available in the receiving water in the analysis. Per 18 AAC 83.435(c), DEC must also use procedures that account for effluent variability (e.g., maximum expected effluent concentrations [MEC] and coefficient of variation), existing controls on point sources (e.g., treatment systems), and nonpoint sources of pollution (e.g., ambient receiving water concentrations). The Department developed and implemented a *Reasonable Potential Analysis and Effluent Limits Development Guide, June 30, 2014 (RPA/WQBEL Guidance)* and associated spreadsheet tool that were used in development of the WQBELs in the Permit.

B.2.2 Reasonable Potential Analysis

The RPA procedures use statistical methods to estimate MECs or, in the case of temperature in this permit, maximum expected temperature difference between effluent and the ambient receiving water (MEΔT). The Permit is a first-time issuance and therefore there is no available data to conduct the RPA and OSA therefore estimated the MECs based on similar facilities. Due to potential unknown variations in the effluent concentrations associated with starting a new facility a multiplier of 1.5 was applied to TRC to estimate the MECs. For temperature a worst-case scenario was assumed during plant shut down where the water in the

outfall tank could warm to room temperature (20 °C) while discharging under ice cover (-1.7 °C), resulting in a MEΔT of 21.7°.

Using a mass balance approach, the RPA projects the concentration, or temperature, at the boundary of a mixing zone if authorized. Because DEC has authorized acute and chronic mixing zones, the mass balance procedure evaluates if the effluent causes, or contributes to, an instream excursion above water quality criteria at the boundary of either the acute or the chronic mixing zone. Based on the anticipated MEC's summarized in OSA's application package, the Department has determined temperature has a reasonable potential to exceed chronic marine criteria at the boundary of the chronic mixing zone and TRC at the boundary of the acute mixing zone for Outfall 001. Accordingly, WQBELs for temperature (ΔT) and total residual chlorine (TRC) are established per 18 AAC 83.435 to be consistent with the calculated available wasteload allocation (WLA) and are stringent enough to ensure compliance with WQS. No other parameters were determined to have reasonable potential.

B.2.3 Wasteload Allocations

In the context of this section, a wasteload allocation (WLA) is the concentration of a pollutant that can be discharged to the receiving water and comply with the acute (a) or chronic (c) water quality criteria ($WQC_{a,c}$), accounting for ambient concentrations and authorized acute or chronic dilution factors ($DF_{a,c}$) in the mixing zones, if applicable. For TRC, no ambient concentrations of TRC are assumed due to the natural chlorine demand in marine waters. The WLA for TRC is calculated by rearranging Equation C-3a in Appendix C and substituting WQC for receiving water concentration and WLA for the maximum expected concentration. The resulting mass balance equation is:

$$WLA_{TRC} = DF_{a,c} \times WQC_{a,c}$$

Per the derivation of Equation C-3b in Appendix C, ΔT is the limited parameter and internally accounts for ambient temperatures of the receiving water. This requires the chronic WQC for temperature to be 1 °C and the WLA equation for temperature simplifies to:

$$WLA_{\Delta T} = DF_c \times 1$$

B.2.4 WQBELs for Outfall 001

Per Section B.2.2, the effluent characteristics for Outfall 001 demonstrated reasonable potential for ΔT at the boundary of the chronic mixing zone and TRC at the boundary of the acute mixing zone. Therefore, Outfall 001 requires limits for ΔT and TRC as described in Sections B.2.4.1 and B.2.4.2, respectively.

B.2.4.1 *Temperature Difference (ΔT)*

The maximum daily limit (MDL) and average monthly limit (AML), if applicable, for ΔT are based on MEΔT equaling 21.7 degrees Celsius (°C), a default coefficient of variation (CV) of 0.6, and an assumed four samples per month. The WLA is used to determine whether the acute long-term average (LTA_a) or the chronic long-term average (LTA_c) is the most stringent for developing the WQBELs. For ΔT, LTA_c is the most limiting and is used in the derivation because the LTA_a is not applicable given there is no acute criteria for temperature in the WQS. Consistent with other existing STP permits, DEC is establishing an MDL but not an AML. The resulting MDL is 35 °C. The following steps were conducted for calculation of the MDL per Part 5.4 (Permit Limit Derivation) of the EPA Technical Support Document and the DEC *RPA/WQBEL Guidance.*

- **Determine $\boldsymbol{LTA_s}$**: the LTAs are calculated as follows:

$$LTA_{chronic} = WLA * [\exp(0.5\hat{\sigma}_4^2 - Z_{99}\hat{\sigma}_4)], where\ \sigma_4^2 = \ln(CV^2/4 + 1)$$

$$WLA = 21.5\ °C, CV = 0.6, Z_{99} = 2.326, \sigma_4 = 0.2936\ and\ \sigma_4^2 = 0.0862$$

$$\boldsymbol{LTA_{chronic}} = 11.34°C$$

- **Calculate the $\boldsymbol{MDL}$**:

$$MDL = LTA_c\ [\exp(Z_{99}\sigma - 0.5\sigma^2)], where\ \sigma^2 = \ln(CV^2 + 1)$$

$$CV = 0.6, Z_{99} = 2.326, \sigma = 0.5545, and\ \sigma^2 = 0.3075$$

$$\boldsymbol{MDL = 35.32°C}$$

$$\boldsymbol{Round\ down\ to\ 35.0\ °C}$$

B.2.4.2 *Total Residual Chlorine*

The RPA revealed that only TRC has reasonable potential to exceed water quality criteria at the boundary of the acute mixing zone requiring development of WQBELs. The TRC MDL and AML are based on the MEC concentration equaling 150 micrograms per liter (µg/L), a default CV of 0.6, and an assumed four samples per month. The resulting MDL is 150.0 µg/L and AML is 75.0 µg/L. However, because the minimum reporting level for TRC is 100 µg/L, the AML is also set to 100 µg/L. The following steps were conducted for calculation of the MDL and AML per Section 5.4 (Permit Limit Derivation) of the EPA Technical Support Document and DEC's *RPA/WQBEL Guidance*.

- **Determine $\boldsymbol{LTA_s}$**: the LTAs are calculated as follows:

$$LTA_a = WLA * [\exp(0.5\sigma^2 - Z_{99}\sigma)], where\ \sigma^2 = \ln(CV^2 + 1)$$

$$WLAa = 149.5\ \frac{\mu g}{L}, CV = 0.6, Z_{99} = 2.326, \sigma = 0.5545\ and\ \sigma^2 = 0.3075$$

$$\boldsymbol{LTA_a} = 48.0\ \mu g/L$$

$$LTA_c = WLA * [\exp(0.5\sigma_4^2 - Z_{99}\sigma_4)], where\ \sigma_4^2 = \ln(CV^2/4 + 1)$$

$$WLA = 161.25\ \mu g/L, CV = 0.6, Z_{99} = 2.326, \sigma_4 = 0.2936\ , and\ \sigma_4^2 = 0.0862$$

$$\boldsymbol{LTA_c} = 85.05\ \mu g/L$$

- $\boldsymbol{Determine\ the\ most\ limiting\ (lowest) LTA}$

$$\boldsymbol{LTA_a}\ is\ the\ most\ limiting = 48.00\ \mu g/L$$

- **Calculate the MDL and AML**

$$\boldsymbol{MDL = LTA_a}[exp(Z_{99}\sigma - 0.5\sigma^2)], where\ \sigma^2 = ln(CV^2 + 1)$$

$$CV = 0.6, Z_{99} = 2.326, \sigma = 0.5545\ and\ \sigma^2 = 0.3075$$

$$\boldsymbol{MDL = 149.49\ \mu g/L}$$

$$\boldsymbol{Round\ up\ to\ 150.0\ \frac{\mu g}{L}}$$

$$AML = LTA_a\ [\exp(Z_{95}\sigma_4 - 0.5\sigma_4^2)], where\ \sigma_4^2 = \ln\ (CV^2/4 + 1)]$$

$$CV = 0.6, Z_{95} = 1.645, \sigma_4 = 0.2936, and\ \sigma_4^2 = 0.0862$$

$$\boldsymbol{AML = 74.52\ \mu g/L}$$

$$\boldsymbol{Round\ to\ 75.0\ \mu g/L}$$

Although the calculated WQBEL results in an AML of 75.0 µg/L, the limit is adjusted to the minimum reporting level for TRC, 100 µg/L, as discussed above.

APPENDIX C. REASONABLE POTENTIAL DETERMINATION

The Alaska Department of Environmental Conservation (Department or DEC) determined if the permitted discharge has reasonable potential (RP) to cause or contribute to a violation of Alaska Water Quality Standards (WQS) in accordance with the Environmental Protection Agency (EPA) *Technical Support Document for Water Quality-Based Toxics Control, 1991 (Technical Support Document)* and the *DEC Reasonable Potential Analysis and Effluent Limits Development Guide, June 30, 2014 (RPA/WQBEL Guidance)*

The Department determines RP by comparing the maximum projected receiving water concentration at the boundary of the acute or chronic mixing zone boundary to the water quality criteria for each pollutant of concern (POC). RP to exceed exists if the projected receiving waterbody concentration at the boundary of the respective mixing zone exceeds the applicable criteria for the POC and a water quality-based effluent limit (WQBEL) must be included in the permit per 18 AAC 83.435. By procedure, DEC does not authorize more dilution than that required to meet water quality criteria for the POC(s) requiring the most dilution in the mixing zone (driving parameters). Hence, the driving parameters for mixing zones will have RP and, subsequently, a WQBEL.

This Appendix discusses how the maximum projected receiving waterbody concentrations were determined for these discharges to marine waters and summarizes the calculations. To illustrate the procedures, calculations for TRC and temperature for Outfall 001 are shown in Sections C.3 and C.4 respectively.

C.1 MASS BALANCE

Normally, for a discharge of a parameter at the MEC into a marine receiving environment with a known ambient water concentration (AWC), the projected RWC is determined using a steady state model represented by the following mass balance equation:

$$(V_{MEC} + V_{AWC})RWC = V_{MEC} * MEC + V_{AWC} * AWC \qquad \text{(Equation C-1)}$$

where,

RWC = Receiving waterbody concentration downstream of the effluent discharge.

MEC = Maximum projected effluent concentration (or MEΔT)

AWC = Ambient waterbody concentration, taken as the 85th percentile of data or 15 percent of the chronic criteria if no ambient data is available.

V_{MEC} = Volume of the maximum expected effluent discharged into the control volume.

V_{AWC} = Volume of the ambient receiving water in the control volume.

Definition:

Dilution Factor (DF), $DF = \frac{V_{MEC}+V_{AWC}}{V_M}$ (Equation C-2)

Upon separating variables in Equation C-1 and substituting Equation C-2 yields:

$$DF = \frac{(MEC - AWC)}{(RWC - AWC)} \qquad \text{(Equation C-3a)}$$

The preceding equation provides the dilution factor achieved at the boundary of the mixing zone if based on the MEC. To determine the dilution factor required to meet water quality criteria at the boundary, the water quality criteria (WQC) is substituted for RWC in Equation C-3a. However, for temperature Equation C-3a is not directly applicable in the same manner because the marine water quality criteria for temperature is in reference to the instantaneous ambient receiving water temperature; the increase above ambient cannot be more than 1 °C (i.e., WQC = AWC +1). By making substitutions and using the descriptor "ΔT" for temperature instead of "C" for concentration, Equation C-3a can be rewritten to:

$$DF = \frac{(ME\Delta T - AWT)}{[(AWT + 1) - AWT]}$$

Simplifying…

$$DF = ME\Delta T \qquad \text{(Equation C-3b)}$$

Where:

$$ME\Delta T = \text{Maximum Effluent Temperature} - \text{Ambient Receiving Water Temperature}$$

Rearranging Equation C-3a to solve for RWC yields:

$$RWC = \frac{(MEC - AWC)}{DF} + AWC \qquad \text{(Equation C-4a)}$$

In the case of temperature, Equation C-4 simplifies to the following equation:

$$RWC = \frac{ME\Delta T}{DF} + 1 \qquad \text{(Equation C-4b)}$$

In order to determine the MEC, a modified equation from the *RPA/WQBEL Guidance* was used due to the lack of data that is required to develop a reasonable potential multiplier (RPM). A variability factor (VF) that is not based on data was used in place of the RPM and the maximum predicted concentration (MPC) was used in place of the maximum observed concentration (MOC). The MEC for total residual chlorine (TRC) is determined by multiplying the MPC by a safety VF to derive the MEC:

$$\text{MEC}=(\text{VF})*(\text{MPC}) \qquad \text{(Equation C-5a)}$$

Or for Temperature Differential: $\text{ME}\Delta\text{T}=(\text{VF})*(\text{MP}\Delta\text{T})$ (Equation C-5b)

C.2 MAXIMUM PROJECTED EFFLUENT CONCENTRATION

To calculate the MEC (or MEΔT) per the *RPA/WQBEL Guidance*, the Department uses modified procedures from the *Technical Support Document* Section 3.3, however these procedures do not apply to new facilities with no effluent data. In order to determine the MEC, OSA assessed similar STP facilities and the anticipated values based on the treatment system design. Based on this assessment, OSA predicted that MEΔT could reach 18.3 degrees Celsius (°C) and TRC could be expected in concentrations up to 100 micrograms per liter (µg/L). Due to potential variations in the effluent concentrations associated with starting a new facility a multiplier of 1.5 was applied to TRC to estimate the MECs. For temperature a worst-case scenario was assumed during plant shut down where the water in the outfall tank could warm to room temperature (approximately 20 °C) while discharging under ice cover (-1.7 °C), resulting in a MEΔT of 21.7°. Because the DEC used very conservative assumptions on the effluent temperature, a VF = 1 was used.

C.3 RPA CALCULATIONS FOR TOTAL RESIDUAL CHLORINE – OUTFALL 001

The mixing zone analysis identified TRC as the driving parameter for the acute mixing zone. The Department authorizes an acute mixing zone with a DF of 11.5 and a chronic mixing zone with a DF of 21.5. The following calculations demonstrates TRC has reasonable potential to exceed, or contribute to an exceedance, at the boundary of the acute mixing zone.

Using Equation C-5a for MEC:

$$MEC = \left(1.5 * 100\frac{\mu g}{L}\right) = 150\ \mu g/L\ (maximum\ projected\ effluent\ concentration).$$

$$AWC = 0$$

$$For\ DF_{acute} = 11.5$$

$$RWC_{acute} = \frac{150\ \mu g/L - 0\ \mu g/L}{11.5} + 0\ \mu g/L = 13.04\ \mu g/L$$

$$For\ DF_{chronic} = 21.5$$

$$RWC_{chronic} = \frac{150\ \mu g/L - 0\ \mu g/L}{21.5} + 0\frac{\mu g}{L} = 6.98\ \mu g/L$$

The RWC at the boundary of the chronic mixing zone is less than the water quality criteria of 7.5 µg/L so there is no chronic reasonable potential. However, the RWC for TRC at the boundary of the acute mixing zone is above the acute water quality criteria of 13 µg/L. Therefore, TRC must have a WQBEL in the Permit based on an instream excursion projected at the boundary of the acute mixing zone.

C.4 RPA CALCULATIONS FOR TEMPERATURE DIFFERENTIAL (ΔT) OUTFALL 001

The mixing zone analysis identified ΔT as the driving parameter for the chronic mixing zone resulting in the Department authorizing a chronic mixing zone with DF of 21.5. The following calculations demonstrate that ΔT has reasonable potential to cause, or contribute to, an instream excursion above temperature criteria at the boundary of the chronic mixing. Note that there is no acute temperature criteria and because the temperature differential is being evaluated, the applicable chronic criteria at the boundary of the chronic mixing zone is 1 degree Celsius (°C).

Using Equation C-5b for MEΔT:

$$ME\Delta T = (1.0)(21.7\ °C) = 21.7°C\ (maximum\ projected\ effluent\ concentration),$$

$$For\ DF_{chronic} = 21.5$$

$$RWC_{chronic} = \frac{21.7\ °C}{21.5} = 1.01\ °C$$

Because the RWC for ΔT at the boundary of the chronic mixing zone is more than 1°C above ambient, the Permit must have a WQBEL for ΔT for Outfall 001.

APPENDIX D. MIXING ZONE ANALYSIS CHECKLIST

Mixing Zone Authorization Checklist

based on Alaska Water Quality Standards (2006)

The purpose of the Mixing Zone Checklist is to guide the permit writer through the mixing zone regulatory requirements to determine if all the mixing zone criteria presented in the Alaska Administrative Code (AAC) at 18 AAC 70.240 through 18 AAC 70.270 are satisfied, as well as provide justification to authorize a mixing zone in an Alaska Pollution Discharge Elimination System permit. In order to authorize a mixing zone, all criteria must be met. The permit writer must document all conclusions in the permit Fact Sheet. However, if the permit writer determines that one criterion cannot be met, then a mixing zone is prohibited, and the permit writer need not include in the Fact Sheet the conclusions for when other criteria were met.

Criteria	Description	Resources	Regulation	Mixing Zone Approved Y/N
Size	Is the mixing zone as small as practicable? - Applicant collects and submits water quality ambient data for the discharge and receiving waterbody (e.g. flow and flushing rates).	Yes •Technical Support Document for Water Quality Based Toxics Control •Water Quality Standards Handbook • DEC's RPA Guidance • EPA Permit Writers' Manual Fact Sheet Sections 3.3.1	18 AAC 70.240 (k)	Y
Technology	Were the most effective technological and economical methods used to disperse, treat, remove, and reduce pollutants? **If yes**, describe methods used in Fact Sheet Mixing Zone Analysis. Attach additional documents if necessary.	Yes Fact Sheet Section 3.3.2	18 AAC 70.240 (c)(1)	Y

Low Flow Design	**For river, streams, and other flowing fresh waters.** - Determine low flow calculations or documentation for the applicable parameters. Justify in Fact Sheet.	N/A – Marine Discharge	18 AAC 70.240(l)	
Existing use	Does the mixing zone…			
	(1) partially or completely eliminate an existing use of the waterbody outside the mixing zone? **If yes, mixing zone prohibited.**	No Fact Sheet Section 3.3.3	18 AAC 70.240(c)(2)	Y
	(2) impair overall biological integrity of the waterbody? **If yes, mixing zone prohibited.**	No Fact Sheet Sections 3.3.5, 3.3.7, and 3.3.9	18 AAC 70.240(c)(3)	Y
	(3) provide for adequate flushing of the waterbody to ensure full protection of uses of the waterbody outside the proposed mixing zone? **If no, then mixing zone prohibited.**	Yes Fact Sheet Section 3.3.4	18 AAC 70.240(b)(1)	Y
	(4) cause an environmental effect or damage to the ecosystem that the Department considers to be so adverse that a mixing zone is not appropriate? **If yes, then mixing zone prohibited.**	No Fact Sheet Sections 3.3.4, 3.3.5, 3.3.7, 3.3.8, and 8.2	18 AAC 70.240(m)	Y
Human consumption	Does the mixing zone…			
	(1) produce objectionable color, taste, or odor in aquatic resources harvested for human consumption? **If yes, mixing zone may be reduced in size or prohibited.**	No Fact Sheet Section 3.3.4	18 AAC 70.240(d)(6)	Y
	(2) preclude or limit established processing activities of commercial, sport, personal use, or subsistence shellfish harvesting?	No Fact Sheet Section 3.3.4	18 AAC 70.240(c)(4)(C)	Y

	If yes, mixing zone may be reduced in size or prohibited.			
Spawning Areas	Does the mixing zone…			
	(1) discharge in a spawning area for anadromous fish or Arctic grayling, northern pike, rainbow trout, lake trout, brook trout, cutthroat trout, whitefish, sheefish, Arctic char (Dolly Varden), burbot, and landlocked coho, king, and sockeye salmon? **If yes, mixing zone prohibited.**	No Fact Sheet Section 3.3.5	18 AAC 70.240 (e) and (f)	Y
Human Health	Does the mixing zone…			
	(1) contain bioaccumulating, bioconcentrating, or persistent chemical above natural or significantly adverse levels? **If yes, mixing zone prohibited.**	No Fact Sheet Section 3.3.6	18 AAC 70.240 (d)(1)	Y
	(2) contain chemicals expected to cause carcinogenic, mutagenic, tetragenic, or otherwise harmful effects to human health? **If yes, mixing zone prohibited.**	No Fact Sheet Section 3.3.6	18 AAC 70.240 (d)(2)	Y
	(3) Create a public health hazard through encroachment on water supply or through contact recreation? **If yes, mixing zone prohibited.**	No Fact Sheet Section 3.3.5	18 AAC 70.240(c)(4)(B)	Y
	(4) meet human health and aquatic life quality criteria at the boundary of the mixing zone? **If no, mixing zone prohibited.**	Yes Fact Sheet Sections 3.3.6 and 3.3.7	18 AAC 70.240 (c)(4)(A)	Y
	(5) occur in a location where the Department determines that a public health hazard reasonably could be expected? **If yes, mixing zone prohibited.**	No Fact Sheet Section 3.3.4 and 3.3.6	18 AAC 70.240(c)(4)(B)	Y