Mixing Zone Analysis (October 2026)

In accordance with 18 AAC 70.240, the Department may authorize a mixing zone in a permit. A chronic mixing zone is sized to protect the ecology of the waterbody as a whole and an acute mixing zone is sized to prevent lethality to passing organisms.

The Department (DEC) received the Silver Bay Seafoods – Kodiak West Facility final ammonia mixing zone modeling and application on October 28, 2026.

Mixing zones were modeled using the PLUMES2.0 dilution model. PLUMES is a widely used and broadly accepted modeling tool for accurate and reliable point source mixing analysis. PLUMES predicts the distance at which a modeled parameter meets water quality criteria as well as the corresponding dilution at that point.

Inputs to PLUMES included the maximum expected effluent concentration, water quality criteria, receiving water characteristics (such as water depth and density) at the outfall, and outfall and diffuser specifications (such as port size, direction, and number).

In the analysis, ammonia required the most dilution of the parameters that demonstrated reasonable potential to exceed water quality criteria. The chronic mixing zone for this discharge is therefore driven by ammonia, has a dilution of 32:1, and is defined as a rectangular area 25 feet wide by 12 feet long, with width perpendicular to prevailing current direction and length parallel to it. Water quality criteria for ammonia may be exceeded within the authorized chronic mixing zone.

There is a smaller, initial, acute mixing zone for ammonia surrounding the outfall and contained within the larger chronic mixing zone. The acute mixing zone for this discharge has a dilution of 5:1 and is defined as a rectangular area 8 feet wide by 4 feet long, with width perpendicular to prevailing current direction and length parallel to it.

According to EPA's Technical Support Document for Water Quality-based Toxics Control, lethality to passing organisms is not expected if an organism passing through the plume along the path of maximum exposure is not exposed to concentrations exceeding the acute criteria when averaged over a one-hour time period. Furthermore, the travel time of an organism drifting through the acute mixing zone must be less than 15 minutes if a one-hour exposure is not to exceed the acute criterion. The travel time of an organism drifting through the acute mixing zone was determined to be less than one minute; therefore, there will be no lethality to organisms passing through the acute mixing zone.

There are several regulatory criteria that must be met for the Department to authorize a mixing zone. These criteria include the size of the mixing zone, treatment technology, existing uses of the waterbody, human consumption, spawning areas, human health, aquatic life, and endangered species.

The following summarizes this analysis:

Size

In accordance with 18 AAC 70.240, a mixing zone must be as small as practicable. 18 AAC 70.240(b)(2) requires the Department to consider the characteristics of the effluent after treatment of the wastewater. DEC reviewed the Silver Bay Seafoods – Kodiak West Facility's effluent monitoring data from 2022 through 2026 to determine which parameters had reasonable potential to exceed water quality criteria and then which parameter required the most dilution to meet water quality criteria for the chronic and acute mixing zones. Ammonia required the most dilution to meet chronic and acute aquatic life water quality criteria; therefore, ammonia was modeled in PLUMES to determine the smallest practicable chronic and acute mixing zones.

Table 1 summarizes the basic PLUMES inputs that were used to model the chronic and acute mixing zones.

Table 1 – PLUMES Model Inputs

Parameter Modeled	Maximum Expected Concentration	Ambient Concentration	Chronic Water Quality Criterion	Acute Water Quality Criterion
Ammonia	9.6 mg/L	0.16 mg/L	0.31 mg/L	2.06 mg/L
Outfall and Receiving Waterbody Characteristics				
Outfall Type	Submerged Single Outfall			
Outfall Length	400 feet			
Port Diameter	10 inches			
Depth at Discharge	49 feet			
Ambient Velocity	0.15 meters per second (m/s) 10^{th} percentile current			
	0.57 m/s 90^{th} percentile current			
Effluent Characteristics				
Flow Rate	0.90 mgd and 1.85 mgd			

Technology

In accordance with 18 AAC 70.240(c)(1), the most effective technological and economical methods should be used to disperse, treat, remove, and reduce pollutants. The Silver Bay Seafoods – Kodiak West Facility's wastewater is treated by 0.8 mm rotary screens. The treatment methods incorporated at the facility are commonly employed and accepted for treatment of similar discharges in populated Alaskan areas.

Existing Use

In accordance with 18 AAC 70.240(c)(2) and (3) and 18 AAC 70.240(c)(4)(B) and (C), the mixing zones have been appropriately sized to fully protect the existing uses of Saint Paul Harbor. Saint Paul Harbor's existing uses and biological integrity have been maintained and protected under the terms of the previous authorization and shall continue to be maintained and protected under the terms of the modified authorization. Water quality criteria are developed to specifically protect the uses of the waterbody as a whole. Because water quality criteria for pollutants that demonstrated reasonable potential to exceed water quality criteria will be met prior to or at the boundary of the mixing zones, designated and existing uses in Saint Paul Harbor that are beyond the boundary of the mixing zones will be maintained and protected.

Human Consumption

In accordance with the conditions of the permit, and in accordance with 18 AAC 70.240(d)(6), the pollutants discharged cannot produce an objectionable color, taste, or odor in aquatic resources harvested for human consumption. There is no indication that the pollutants discharged have produced objectionable color, taste, or odor in aquatic resources harvested for human consumption.

Spawning Areas

In accordance with 18 AAC 70.240(f), a mixing zone is not authorized in fresh water spawning areas for Arctic grayling; northern pike; lake trout; brook trout; sheefish; burbot; salmon; or anadromous or resident rainbow trout, Arctic char, Dolly Varden, whitefish, or cutthroat trout. The proposed discharge is to marine waters.

Human Health

In accordance with 18 AAC 70.240(d)(1), the mixing zones must not contain bioaccumulating, bioconcentrating, or persistent chemicals above natural or significantly adverse levels. 18 AAC 70.240(d)(2) states that the mixing zones must not present an unacceptable risk to human health from carcinogenic, mutagenic, teratogenic, or other effects as determined using risk assessment methods approved by DEC and consistent with 18 AAC 70.025. An analysis of the effluent data that was included with the Silver Bay Seafoods – Kodiak West Facility's mixing zone application, DMRs, and the results of the RPA conducted on pollutants of concern indicated that the level of treatment at the facility is protective of human health. The effluent data was used in conjunction with applicable water quality criteria, which serve the purpose of protecting human and aquatic life, to size the mixing zones to ensure all water quality criteria are met in the waterbody at the boundary of the

mixing zones.

Aquatic Life and Wildlife

In accordance with 18 AAC 70.240, the mixing zones authorized in the authorization shall be protective of aquatic life and wildlife. The mixing zones do not form a barrier to migratory fish species or fish passage nor will they result in a reduction of fish population levels. A toxic effect will not occur in the water column, sediments, or biota outside the boundaries of the mixing zones. PLUMES modeling conducted for this discharge to Saint Paul Harbor incorporated the most stringent water quality criteria for protection of the growth and propagation of fish, shellfish, other aquatic life, and wildlife. All water quality criteria will be met at the boundary of the authorized mixing zones.

Endangered Species

In accordance with 18 AAC 70.240(c)(4)(F), the mixing zones will not cause an adverse effect on threatened or endangered species. Review of applicable endangered species mapping and databases, and information received from the National Marine Fisheries Service (NMFS) and the United States Fish and Wildlife Service (USFWS) in communications with DEC, identified that endangered short-tailed albatross, Steller sea lions, humpback whales, North Pacific right whales, and fin whales as well as threatened Steller's eiders and northern sea otters and nesting seabird colonies are present in Saint Paul Harbor. DEC determined that with consideration of the nature of the discharge, mixing zone sizing, and ambient critical conditions these species would not be significantly affected by discharge from the Silver Bay Seafoods – Kodiak West Facility.

DEC will provide a copy of the authorization to NMFS and USFWS when it is public noticed. Any comments received from the agencies regarding endangered species will be considered prior to issuance of the authorization.