Salmonid Restoration Federation

Attachment to SRF Appeal

The certified local coastal program (LCP) is the 2022 Humboldt Bay Area Plan (HBAP). The HBAP largely adopts Coastal Act Provisions in its Development Policies, and sections of the Coastal Act are reiterated within the document. The subsections of the HBAP utilize the same numbers as the Coastal Act and are identified within HBAP sections described below.

HBAP Section 3.14 Industrial, Development Policies

Subsection 30250(a)

The HBAP's modified 30250(a) states that development "will not have significant adverse effects, either individually or cumulatively, on coastal resources." Pathogens known to occur in farmed Atlantic salmon are not receiving adequate testing and the intake water will receive more disease treatment than the outfall water. If a deleterious salmonid virus (known to occur in farmed Atlantic salmon) escapes the Project, local runs of wild native salmon could be impacted and run failure could result. The Salmonid Restoration Federation (SRF) has partnered with other parties to restore salmonid habitat on the North Coast. Loss of wild salmonid runs will have a significant effect on coastal resources.

Subsection 13142.5 (a)

Subsection 13142.5 Coastal Marine Environment (a) reiterates the Coastal Act provision that waste water discharges shall be treated to protect present and future beneficial uses, giving highest priority to wetlands, estuaries, and other biologically sensitive sites.

There are three outstanding issues with the Project's effluent affecting biologically sensitive species and ecosystems respectively. First is the lack of targeted ozone treatment to adequately treat the effluent to kill viruses that proliferate in Atlantic salmon farms and that are known to harm or kill wild native salmonids. Second is that the proposed sewage treatment design has not been proven to be protective of receiving waters. Third is that effluent dispersal into Humboldt Bay has not been fully analyzed or addressed in the environmental documents, and impacts to the estuarine ecosystem were not given full consideration.

Wastewater leaving the Project will not be as fully treated as the river and estuary water entering the Project (*i.e.*, incoming water will be filtered, UV treated, and ozone treated; outgoing water will only be filtered and UV treated). Lack of ozone treatment of the wastewater and factory floor effluent, combined with the lack of testing Project effluent or fish processing waste for the diseases known to be associated with Atlantic salmon farms, will put in place untried technologies without the practical safety provisions necessary to protect California's wild, native salmonids.

It is unproven that UV-C sterilization will fully treat the 12.5 MGD of effluent leaving the Project. The potential for viruses being present in Project effluent would have significant adverse effects to Coho salmon, Chinook salmon, and steelhead. Viruses attached to the 408 pounds-per-day of suspended solids in the effluent stream, would be capable of surviving the proposed UV treatment of the effluent. The fish processing portion of Project effluent would contain a massive viral load if any of the viruses known to be associated with Atlantic salmon farming have an outbreak in the rearing tanks. This is a serious threat to our native, wild salmon.

Once a salmonid virus enters a wild population, the threat to individual fish goes beyond direct mortality. Ability to swim and forage is typically compromised in infected salmonids, rendering them weak and vulnerable to predation. One or more viral pathogens in wild salmonid populations are implicated in high mortality during outmigration (Furey *et al.* 2021, Jeffries *et al.* 2014, Hinch *et al.* 2012). Other pathogens such as bacteria, fungi, protozoa, myxozoan microparasites, and sea lice compound the physiological stress from viral loads and increase the threat of mortality (Lovell *et al.* 2010). Salmonid viruses that affect internal organs compromise infected salmonids during upmigration (returning to natal streams to spawn). In instances when viral exposure and viral loading does not result in direct mortality to the fish, indirect harm, injury, and mortality are likely to occur when infected wild salmonids experience increased predation, decreased mobility and visual acuity, and lack of energy required for successful migration. (Furey *et al.* 2021, Hinch *et al.* 2012, Jeffries *et al.* 2014, Miller *et al.* 2017). Added stress from viral infection causes salmonids to either not start their up migration to natal streams, or not survive the natural physiological stresses of upmigration. Salmon compromised by viral load are referred to as "dead fish swimming" (Hinch *et al.* 2012).

During fish processing, bodily fluids containing a viral load will be the most difficult to contain and prevent from spreading into wild salmonid populations. Industrial cleansers used for protecting human health during fish processing can be damaging to biofilters, and could compromise the effectiveness of the Project's sewage treatment system to remove sewage solids. Viruses posing the highest risk to wild salmonids are as follows:

> **Infectious Pancreatic Necrosis Virus (IPN)** is a disease first found in 1951 in farmed Atlantic salmon in Canada. It causes fluid in the abdomen (ascites) and sudden mortality. Other symptoms are: swollen eyes, darkening of the skin, anorexia, spiral swimming, fecal casts trailing from the vent, pancreatic necrosis, catarrhal exudate in the intestine, and hemorrhages in the visceral organs. IPN is an acute and highly contagious disease in juvenile salmonids. It causes mortality rates up to 70% in farmed salmon, with freshwater-stage mortality up to 100% (Evensen and Santi 2008).

As well as being found in Atlantic salmon, IPN is also found in farmed rainbow trout (*O. mykiss*). This virulent disease has spread to fish farms in North America, Europe, Chile, Japan, Korea, Taiwan, Iran, Turkey, China, Kenya, and Australia (Dopazo 2020). There has been a push to develop a vaccine for IPN, but it would not be possible to vaccinate all of the wild salmonid species from the Mad River, Eel River, Humboldt Bay, Elk River, Salmon Creek, Freshwater Creek, or Jacoby Creek once wild fish have been exposed to the virus. Because adult and juvenile salmonids will be migrating through the Project's effluent plume, their risk of mortality is high if this virus were to escape the Project. If IPN were introduced by the Project, it could have a significant adverse impact on the Mad River fish hatchery.

Infectious Salmon Anemia Virus, also known as Hemorrhagic Kidney Syndrome, Infectious Salmon Anemia (ISA) is a highly contagious disease associated with farmed Atlantic salmon. First reported in fish farms in Norway in 1984, ISA has since spread to fish farms in Scotland, the Faroe Islands, Chile, northeastern Canada and northeastern U.S. (Maine). Symptoms include: lethargy, anemia, leukopenia, bloated abdomen (ascites), protruding eyes, darkened skin, enlarged spleen, liver necrosis, swollen and discolored kidneys, localized bleeding from skin lesions (USDA *et al.* 2011, USDA 2020), and increased mortality of approximately 5 to 90 percent (Dannevig *et al.* 2008). Rainbow trout may also develop heart lesions.

Infectious Salmon Anemia virus can also be transmitted to Pacific herring (Nylund *et al.* 2002), allowing for spread of the disease to wild salmonids through foraging. Pacific herring can also act as a disease reservoir. Humboldt Bay and its surrounding waters are known to support large populations of Pacific herring.

Salmonid Alphavirus (SAV) causes pancreas disease (PD) in farmed Atlantic salmon and sleeping disease (SD) in farmed rainbow trout. It is found in salmonid farms in Norway, Scotland, England, Ireland, France, Germany Spain, U.S. (Washington), and Italy. Infections of SAV have high mortality rates. Six strains of SAV have been identified (Deperasińska *et al.* 2018). Symptoms include: cessation of feeding, lethargy, muscle damage, fluid in the abdomen, atrophy of red skeletal muscle, pancreatic necrosis, cardiac myopathy, difficulty swimming and staying upright, failure to grow, failure to gain weight, and death. Survivors appear thin and unthrifty, and they can become vectors. SAV was found to have up to 27 percent mortality in net pens in Washington state, but no studies on mortality have been conducted on wild salmonids. Sleeping disease in wild steelhead would make them extremely vulnerable to predation. If SAV escapes the Project, it could have a significant impact on steelhead returns to the Mad River Fish Hatchery.

Piscine Orthoreovirus and Novel Piscine Reoviruses is also known as Atlantic salmon reovirus and novel reovirus. Piscine Orthoreovirus (PRV) symptoms include, but are not limited to: heart and skeletal inflammation (HSMI), inflammatory lesions of the heart and skeletal muscle, burst cells (in Chinook), jaundice, anemia, anorexia, lethargy, inflammation, kidney and liver damage (degenerative/ necrotic lesions of the liver/kidney), and fluid in the abdomen (ascites). There are now three strains of PRV, with both PRV-1 and PRV-3 each having two sub-types with additional mutations.

PRV's expression of HSMI was first characterized in 2010 in farmed Atlantic salmon (Palacios 2010). PRV and HSMI have been found in farmed: Atlantic salmon (Palacios 2010, Kibenge *et al.* 2017), coho salmon (Takano *et al.* 2016, Kibenge *et al.* 2017), Chinook salmon, and rainbow trout (Olsen *et al.* 2015). PRV and HSMI are associated with high morbidity and mortality. PRV and HSMI are now also found in wild coho and Chinook salmon in Canada (Kibenge *et al.* 2017).

PRV and its variants are found in farmed salmonids in Norway, Denmark, Germany, United Kingdom, France, Canada, Japan, Chile, Italy, and the U.S. (Washington, Oregon, and Maine). Kibenge *et al.* (2017) estimated PRV prevalence in the source farmed Atlantic salmon population at 95% or greater. They found escaped, farmed Atlantic salmon had a PRV prevalence close to

100% in Washington State and British Columbia following a large containment failure at a farm in northern Puget Sound. Mordecai *et al*. (2021) found that infection of wild Chinook salmon with PRV-1 infection was closely tied to farm proximity.

First found in farmed Atlantic salmon in 1999 (Kongtorp *et al.* 2004) and later implicated as being associated with HSMI (Palacios 2010), PRV was first described in farmed *O. mykiss* in Norway in 2013; however, symptoms similar to PRV have been described as early as 1977 (Vendramin *et al.* 2019).

Although PRV is ubiquitous in farmed salmon, some argue that symptoms and mortality are less than previously reported (Polinski *et al.* 2019). Emerging studies (Løvell *et al.* 2010, Mordecai *et al.* 2020) have shown that co-occurrences with other viruses and pathogens may drive the expression of symptoms and mortality. PRV is often co-associated with other viruses (Løvell *et al.* 2010, Mordecai *et al.* 2021).

Polinski *et al.* (2019) found that different populations of farmed Atlantic salmon had different responses to PRV, but PRV variants were not isolated in the study. Also, the fish with HSMI in other studies were already sick; whereas PRV-positive but asymptomatic fish in Polinski *et al.* (2019) may have had earlier disease progression than other studies, therefore not yet showing signs of HSMI.

In their study of PRV-3, Sørenson *et al.* (2020) found that the variant had its highest prevalence in grow-out facilities (71.7%) and, in Denmark, disease outbreaks of PRV-3 were only observed in RAS facilities. Considering that the Project is a grow-out RAS facility, the risk of viral loading after disease introduction is very high.

PRV has variable outcomes for farmed salmonids, depending on the PRV strain and the affected species. Stress is thought to be causative when going from a PRV infection to full-on HSMI. There are no studies of heart, liver, or kidney effects to wild salmonids during upmigration to natal streams, but the stress of upmigration would put a phenomenal amount of physiological strain on individual salmonids with PRV. Individuals that avoid predation in their outmigration and marine phases would be the “dead fish swimming” described by Hinch *et al.* (2012) —e.g., not able to complete their full life-history cycle, upmigrate, or reproduce. If PRV escapes the Project, it could have a significant adverse effect on the Mad River Fish Hatchery.

Novel Fish Totivirus is co-associated with PRV and is implicated in Cardiomyopathy Syndrome (CMS), which is a spontaneous heart attack that occurs in farmed fish prior to harvest (Løvell *et al.* 2010). CMS was first reported in Norwegian farmed salmon in 1988 (Amin and Trasti 1988). Totiviruses are typically associated with fungi. Co-association of the novel fish totivirus and PRV is thought to significantly increase salmonid mortality.

Infectious Hematopoietic Necrosis Virus is one of the earlier diseases associated with fish farming and hatcheries. Now known as Infectious Hematopoietic Necrosis Virus (IHNV), earlier names being Oregon Sockeye Salmon Disease, Columbia River Sockeye Disease, Sacramento River Chinook Disease. Juvenile salmonids are more severely affected by IHNV than adults, but those that do survive the disease become vectors by shedding the virus through feces and mucus. IHNV is known to affect Atlantic salmon, sockeye and Chinook salmon, and *O.mykiss*. It is found in continental Europe, Alaska, Japan, Canada, Central California, Oregon, and Washington State.

IHNV causes lethargy, occasional frenzied swimming, darkened skin, abdomen swollen with ascitic fluid, protruding eyes, and hemorrhaging at the mouth, anus, and base of the fins. The cumulative mortality rates on fish farms can reach 90-95%. Occasional disease outbreaks have been reported in wild salmon.

PCR (polymerase chain reaction) testing is available for PRV, SAV, and IHNV. Weekly PCR testing of fish processing waste and Project effluent is needed to ensure early detection and that these deadly viruses do not proliferate at the Project. As PCR testing becomes commercially available for other Atlantic salmon diseases, they should be added to the weekly viral screening at the Project.

Subsection 13142.5 (d)

The HBAP states: "Independent baseline studies of the existing marine system should be conducted in the area that could be affected by a new or expanded industrial facility using seawater in advance of the carrying out of the development." Contemporary baseline monitoring of the Sacramento River for salmonid pathogens (Mauduit *et al.* 2022) has demonstrated that the technology exists and is a useful tool in establishing a pathogen-burden baseline in local, wild salmonid populations in California. However, Nordic Aquafarms has strenuously rejected such monitoring in favor of biannual veterinary visits to the Project.

With worldwide proliferation of deadly viruses (*e.g.*, PRV, SAV, and IHNV) known to occur in Atlantic salmon farms, a fair assessment and baseline of salmon-farm pathogens is required in order to conform with subsection 13142.5. The baseline monitoring of the Sacramento River, done by Mauduit *et al*. (2022) is an excellent example of using modern investigative techniques to establish a pathogen baseline. Salmonid critical habitat that is likely to interface with Project effluent is the mouths of Mad River, Eel River, Humboldt Bay, Elk River, Salmon Creek, Freshwater Creek, and Jacoby Creek. Salmonids directly exposed to the effluent outfall when migrating past or feeding near the Project's outfall pipe are likely to disperse pathogens into spawning areas when they migrate upstream. A baseline for each of these rivers and streams, as well as Klamath River and Redwood Creek, is needed in order to track the progression of disease known to be associated with farmed Atlantic salmon.

HBAP Section 3.30 Natural Resources Protection Policies and Standards

Subsection 30240

The HBAP directs that: "Environmentally sensitive habitat areas shall be protected against any significant disruption of habitat values, and only uses dependent on such resources shall be allowed within such areas." The Project is not protective of environmentally sensitive marine habitat, such as essential fish habitat and ESA critical habitat, and is not protective of salmonids dependent upon the environmentally sensitive habitats specifically identified in the HBAP. Release of effluent into the migratory path for green sturgeon, coho salmon, Chinook salmon and steelhead trout will cause disruption of migratory behavior. Exposure of salmonids to viruses associated with farmed Atlantic salmon could cause disruption of wild salmonid populations and potential run failure. Loss of important commercial, recreational, and valued native fishes should be considered a significant disruption.

Subsection 8--Coastal Streams, Riparian Vegetation and Marine Resources

Protection of marine resources has a high level of emphasis in the HBAP: "Marine resources shall be maintained, enhanced, and, where feasible, restored. Special protection shall be given to areas and species of special biological or economic significance. Use of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes."

As discussed earlier, the risk of run decimation from Atlantic farmed salmon diseases continues due to lack of monitoring, timely response, mitigation, and remediation. Loss of salmon and steelhead runs in the Mad River, Eel River, Redwood Creek, Klamath River and tributaries to Humboldt Bay would have a profound impact on long-term commercial, recreational, scientific, and educational purposes of Humboldt Bay and the coastal marine area.

Subsection 30231

The HBAP requires protection of biological productivity and coastal waters. It includes direction to minimize adverse effects of waste water discharges and entrainment. Without ozone treatment of Project effluent and without viral monitoring, timely response, mitigation, and remediation for diseases found in Atlantic salmon, the Project will affect the biological productivity and the habitat quality of Humboldt Bay, coastal streams, and the Mad and Eel Rivers. When PRV, SAV, IHNV, and other deadly diseases escape the Project, the biological productivity of coastal waters, streams, wetlands, and estuaries will not be able to maintain optimum populations of wild salmon.

Nordic Aquafarms has strenuously opposed weekly PCR testing for PRV, SAV, and IHNV—claiming that all PCR positives in the effluent would be false positives, or non-pathogenic. PCR testing is an inexpensive and effective methodology for screening for viral diseases. Positive PCR tests would be an indication that virus has infected the facility and closer inspection for Atlantic salmon diseases is warranted. PCR testing is an important tool for disease control, planning, initial response, mitigation, and remediation.

Full ozone treatment of effluent and vigorous disease monitoring could minimize adverse effects of waste water discharges on wild native salmonids. In addition, technology exists to further remove ammonia and nitrogenous waste from effluent. Without these measures, biological productivity and habitat quality in Humboldt Bay and coastal streams will be compromised.

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