18 July 2022

Mr. Allan Ota
Oceanographer
Water Division (WTR-2-4)
U.S. EPA Region 9
75 Hawthorne Street
San Francisco, CA 94105

Subject: Application for Ocean Dumping Special Permit for Starkist Samoa Co., American Samoa

Dear Mr. Ota,

A research ocean dumping permit (OD2020-01 Research) was issued to Starkist Samoa Co. ("Starkist") in May 2020. The Regional Administrator of United States Environmental Protection Agency (USEPA) Region 9 determined that disposal of fish processing liquid wastes off American Samoa met USEPA's ocean dumping criteria at 40 C.F.R. Parts 227 and 228. The 18-month effective date for ocean dumping began April 6, 2021, and ends October 6, 2022.

Ocean disposal of fish processing liquid wastes was EPA-approved and in use in 2012 and for many years earlier. Starkist has demonstrated through the current 18-month Research Permit that ocean disposal of Starkist's fish processing wastes has no discernable effects on the water quality of the ocean in or near the dump site. This has been demonstrated through high-strength wastewater (HSW) storage tank and receiving water analytical results and through bioassay testing and dilution modeling. Analytical results for the HSW storage tank show no exceedances to the Permitted Maximum Concentrations during the reporting period except for pH which was analyzed for root cause and successfully corrected. Analytical results for HSW storage tank samples collected during the Research Permit are generally consistent with liquid fish processing waste that was previously permitted for ocean dumping.

Furthermore, receiving water results show that the median concentration data at the leading edge of the dump site are generally comparable to background ocean conditions for all six parameters and three depths monitored at the dump site. Based on dilution modeling using bioassay results, the estimated edge of disposal zone waste concentration is lower than the limiting permissible concentration (LPC), indicating that toxicity would not be observed at this boundary under the conditions assumed in this model. These data suggest that sufficient dilution of the fish waste is occurring.

Accordingly, given no discernable effects on ocean water quality have been observed with ocean disposal, pursuant to Section 102 of the Marine Protection, Research, and Sanctuaries Act (MPRSA) of 1972 (33 U.S.C. 1412), Starkist submits this application for an ocean dumping special permit for a three year duration in accordance with the requirements presented in CFR §221.1, and this document is organized pursuant to requirements set forth in CFR §221.1. Supporting materials to this application are provided as attachments.

(a) Name and address of applicant:

Starkist Samoa Co., PO Box 368, Pago Pago, American Samoa 96799

(b) Name of the person or firm transporting the material for dumping, the name of the person(s) or firm(s) producing or processing all materials to be transported for dumping, and the name or other identification, and usual location, of the conveyance to be used in the transportation and dumping of the material to be dumped, including information on the transporting vessel's communications and navigation equipment

Name of Producer: Starkist Samoa Co.

Name of Transporter: Aquatic Blue Environmental, PO Box 1861, Pago Pago, American Samoa, 96799.

Under the current research permit (OD2020-01 Research), Aquatic Blue Environmental has been the transporter. Starkist proposes to continue to contract with Aquatic Blue Environmental to operate an ocean dumping vessel.

The transporting vessel, *Miss Lilly*, received its Certificate of Documentation from the United States Department of Homeland Security, United States Coast Guard (USCG). The *Miss Lilly* also received a certification of vessel stability/seaworthiness and International Load Line Certificate from the USCG. Attachment 1 includes these certificates, specifications including the vessel's tank holding plan, liquid capacity, and piping plan as well as list of replacement parts for the vessel.

Aquatic Blue's vessel Master Captain has experience captaining vessels performing open ocean operations and is a highly skilled vessel mechanic, proficient in fixing electrical systems, navigation systems, and issues with engines. The captain is certified in operating vessels in both open ocean and near-shore conditions. Aquatic Blue's Chief Engineer for the Starkist ocean dumping vessel is an experienced mechanic, including experience with managing crew members and designing, maintaining, and monitoring pump systems.

Transporter Vessel Communications and Navigation Equipment: The transporting vessel, *Miss Lilly*, is equipped with a Global Positioning System (GPS) receiver enabled with the Wide Area Augmentation System (WAAS) for horizontal position accuracy of +/-10 feet. The GPS receiver provides speed, course, and the time and date information received from the satellite signals. The tracking unit is fitted with calibrated current sensors on up to two pumps to detect changes in pump amperage, signifying use, and is fitted with a flow meter to measure and record the flow rate at the point of discharge. The vessel is equipped with two VHF marine radios, radar, and one Single Sideband marine radio.

Starkist proposes to continue to contract with Advanced Dredging & Industrial Solutions (ADISS, Inc.) to provide a vessel tracking and e-logging system to comply with the vessel monitoring requirements set forth by USEPA Region 9 for approval to dispose of fish waste within the USEPA-designated American Samoa offshore disposal site. ADISS is currently providing vessel tracking and e-logging system support. ADISS specializes in monitoring dredging projects and has provided tracking services to commercial dredging companies since 1997. About 800 monitoring projects have been completed, documenting more than 250,000 loads of dredged material to offshore and upland placement sites.

To comply with the vessel monitoring requirements, ADISS configured and wired a "Black Box" data logger on the *Miss Lilly* to receive and record vessel position, pump status, and discharge flow rate information. The data logger is housed in a watertight enclosure along with a back-up battery, power supply, Wi-Fi network adaptor, and amber alert LED. Back-up equipment and supplies are stored on the vessel at all times. The system is powered by 110VAC supplied by the vessel.

Flow meter data will continue to be interrogated by the logger software to confirm that discharge flow rates are within the stipulated seasonally and speed based permissible discharge rates. If the allowable discharge rate is exceeded, the system provides a visual alert by flashing the amber alert LED until the rate falls below the threshold limits. Control of the flow rate is discussed in Section g.

The data logger is programmed to acquire position and sample the sensors at two different intervals. While inside a pre-determined geo-fence surrounding the designated disposal area, the system logs data at a 14-second rate. While outside the geo-fence and away from the disposal area, the system logs at a 5-minute rate. The "Black Box" logging system on the vessel is designed to store and report the following data points at the designated intervals:

- GMT Date/Time (converted to Local when imported)
- Latitude/Longitude
- Speed
- Course
- System Voltage
- Pump Amperage
- Flow Rate in gallons/minute (when discharging)

The position and sensor data will continue to be logged and stored in the onboard data logging system. When possible, the logged data are transmitted to a Fish Waste Disposal (FWD) website (created and operated by ADISS for Starkist) via a connection between the onboard Wi-Fi system and the island cellular data network (subject to communications connectivity with the mainland). This connection has been reliable between the vessel and the island-based cellular data network during ocean dumping trips. However, as a backup to this connection in the event of an outage, the transfer of data to the FWD website is expected to occur as the vessel returns to Pago Pago Harbor (the Harbor) and the vessel's Wi-Fi returns to within coverage of the island cellular data network system. In addition to the "Black Box" data logger, the vessel is also equipped with an e-Logging laptop/netbook that ADISS has trained the vessel crew to operate. This laptop/netbook provides the vessel crew with a software interface to enter and submit their daily trip logs.

In addition to the "Black Box" data logger, the vessel Captain/crew will continue to maintain the laptop/netbook and enter trip-specific details not recorded by the data logger including:

- Onshore loading start/end times
- Volume loaded (in gallons)
- Wind direction and speed (including every 30 minutes during discharge)
- Dump site center conditions (coordinates, wind direction, and observed surface water direction)
- Current direction (at center/beginning of discharge, end of discharge)
- Discharge pattern
- Direction of discharge plume (end of discharge)
- Presence of plume
- Time and position of any floating material
- Unusual occurrences
- Deviations from normal disposal pattern (with rationale for the deviation)

The data logging software is capable of interfacing with the incoming GPS data to auto-populate several form fields to simplify data entry (i.e., discharge rate, total run time, average speed during discharge). The vessel Wi-Fi network will continue to transmit the required vessel trip logs from the laptop/netbook to the FWD website via the same data connection as outlined above.

As a backup to the data upload system when Wi-Fi network coverage is not available, the software will continue to be programmed to save and store logged and vessel data to a flash drive when inserted into the netbook/laptop. Once saved to the flash drive, the captain/crew member can download and email the daily data files directly to the ADISS server when they return to the island, subject to accessible data connections between the island communication and the mainland. Once received by ADISS, the files undergo a data validation Quality Assurance (QA) process. Upon completion of the QA process, the data are made available on the FWD website for biweekly viewing by authorized external parties. The FWD website will continue to operate continuously in support of vessel operations and will be monitored and supported by ADISS's team of Information Technology (IT) specialists.

The FWD website will continue to host aerial and map views that show shorelines, as well as the designated EPA disposal site boundary. The website also includes other features, including the ability to display cursor coordinates and distance measurements from viewer selected map locations. Additionally, the website provides access to the "trip plots" biweekly that display the vessels geographical data (i.e., vessel navigational plot showing its course during discharge) and sensor status relative to the permitted disposal site. These data will continue to clearly show where disposal operations have occurred by showing position and corresponding pump and flow status. Attachment 1 includes the ADISS vessel compliance monitoring certification and confirmation of vessel operator instructions for disposal operations reporting protocol, ADISS's certification that the designated disposal vessel is properly instrumented to record the measurements as specified in Research Permit Section 4.4.1, ADISS compliance documentation, GPS Antenna Quality Assurance (QA) Checks, Velocity Dye Test Results, and the ADISS Monitoring System User Manual.

During implementation of the Research Permit, Starkist made the following updates to the ADISS system:

- The Research Permit (Section 2.3.5) allows for discharges associated with periodic tank maintenance, including the flushing of the disposal tank to remove solids that have settled on the bottom of the tank. This discharge is considered de minimus and would not be included in the per-trip maximum volume allowance. The ADISS Trip Log was updated to include when the trip is considered a Tank Cleaning Trip.
- Supplementary to the above addition to the Trip Log, the ADISS logging software was updated to incorporate the "Flushing Lines" task. The vessel Captain indicates when the Flushing Lines task is initiated and is displayed in the Trip Log. This option can be activated at any time during an active voyage. Both the Trip Plot and Trip Report illustrate when the vessel has performed flushing of the lines.
- Since April 2021, ADISS modified its GPS and data logger software to compare vessel speeds collected every two seconds to a 10-second running average (i.e., for every two seconds, the ADISS system data logger software calculates and averages speed based on the most recent ten seconds) as allowed by the permit. The software initially was set to make a direct comparison of vessel speed

for every two seconds to the permit limit; however, due to the factor of error with the GPS, this set up resulted in several "false" alarms.

- The ADISS system generates "email" alerts regarding any apparent discharges outside the ocean disposal site and/or when the seasonal maximum speed is exceeded. The alert notifications provided in the ADISS system indicate the type of alert; time and date of notification; and latitude/longitude, speed, course, pump amperage, flow rate, and maximum flow discharge rate at the time of notification. Each notification includes an option for the vessel Captain to determine whether the alert was considered "Valid" or "Invalid" with comments describing each alert.

(c) Adequate physical and chemical description of material to be dumped, including results of tests necessary to apply the Criteria, and the number, size, and physical configuration of any containers to be dumped:

The three (3) waste streams intended for ocean dumping are fish processing waste from (1) the dissolved air flotation (DAF) sludge, (2) press liquor/water from the fishmeal sump, and (3) pre-cooker wastewater, as authorized in 40 CFR 228.15(m)(1)(vi). Since the issuance of the Research Permit, there have been no modifications at the facility that would affect the content or characteristics of the fish processing waste.

Starkist submitted documents in August 2019 to USEPA Region 9 associated with testing and other matters related to the disposal of liquid fish processing waste as part of the application process for the Research Permit. The application package included results for sampling of the three wastewater streams on five separate days between June 20 and 27, 2019. During the sampling period, 24-hour composite samples were collected from each source, which were then composited to generate one combined ocean disposal composite sample for each sample day. To demonstrate that the combined liquid fish processing waste data collected in 2019 were compatible with historical combined waste stream conditions, the 2019 dataset was compared to historical datasets for Permitted Maximum Concentrations (PMCs), including data from November 2018, and historical ocean disposal data from the 2010 ocean disposal program (i.e., during the term of the 1998 Special Permit). Through that comparison, the samples of the combined ocean disposal liquid fish processing waste collected in June 2019 were shown to be generally consistent with liquid fish processing waste that was previously permitted for ocean dumping. When average concentrations for parameters analyzed in previous years were compared against the average concentration data collected in 2019, the concentrations were generally lower or within the historical average concentrations (Table 1).

As per the Research Permit (Section 3), physical and chemical characterization of the High Strength Waste (HSW) storage tank contents is required monthly. Samples are collected from the HSW tank transfer line while filling the vessel tanks at 10-minute intervals and composited together to produce one sample for analysis. Sampling protocols followed the Ocean Disposal Waste Characterization Sampling and Analysis Plan (SAP) dated February 2021. Analytical results for samples collected during the Research Permit are presented in Table 2.[1] Analytical results were compared to the Research Permit PMCs[2] for the HSW tank (Section 2.4, Table 2). Results for the 12 months of sampling show no exceedances to the PMCs, with the exception of pH for April through July 2021 (Table 2).

Analytical results from April through July 2021 reported pH results of 7.9, 7.4, 7.2, and 7.4, respectively, compared to the PMC pH range of 6.2 to 7.1. The pH range was slightly exceeded for these four months. As a result of these exceedances, Starkist carried out pH tests in each of the three sources of HSW influent (i.e., DAF sludge, precooker water, and presswater as described below in Section h) and identified higher pH contributions in the presswater. Since the July 2021 sample was collected, Starkist staff re-evaluated the quantities of nitric acid and caustic soda used in the process that results in the presswater and adjusted the usage to better balance the pH leaving the equipment while continuing to be within the ranges recommended by the equipment manufacturer. These actions have successfully reduced the pH of the presswater (aka Fish Processing Liquid Wastes), as reported in the August 2021 through March 2022 results (Table 2).

Results from the Research Permit were compared to the 2019 dataset, data from November 2018, and historical ocean disposal data from the 2010 ocean disposal program (i.e., during the term of the 1998 Special Permit) (Table 1). The comparison demonstrates that the samples collected during the Research Permit are generally consistent with liquid fish processing waste that was previously permitted for ocean dumping. When average concentrations for parameters analyzed in previous years were compared against the average concentration data collected during the Research Permit, the concentrations were generally lower or within the historical average concentrations (Table 1).

Confirmatory Suspended-Phase Acute Toxicity Bioassay and Dilution Model Calculations. In accordance with the Research Permit (Section 3.3.5), Starkist performed the two required sets of confirmatory suspended-phase acute toxicity bioassay tests and dilution model calculations on fish processing liquid waste. The first toxicity tests were performed during the third quarter of the 2021 ocean dumping program (October through December 2021) and the second round of toxicity testing was performed during the second quarter of the 2022 ocean dumping program (April through June 2022).

Toxicity testing was conducted in accordance with the final Ocean Disposal Waster Characterization Sampling and Analysis Plan (SAP) dated February 2021 and other specifications listed in the permit. In accordance with the SAP, Starkist conducted sampling from the transfer line as the fish waste is transferred from the HSW tank to the disposal vessel’s holding tanks. For both sampling events, samples were shipped to Enthalpy Analytical, San Diego, CA. Based on previous bioassay results and historical dilutions and discussions with USEPA in July 2019, the final dilutions established for all three species are concentrations

[1] For purposes of this application, Starkist is presenting the analytical results for samples collected every month beginning in April 2021, when ocean dumping was initiated, through March 2022 (12 months). Starkist continues to sample and analyze monthly samples from the HSW tank; however, laboratory data collected in April and May 2022 has not been validated; therefore, is not presented in this application.

[2] The PMCs for the HSW tank were calculated based on an analysis of data over a 4-year period to be determined from the permittee's previous ocean dumping permits.

of 2.0, 1.0, 0.5. 0.25, 0.125, 0.06, 0.03, and 0.015% waste as a volume dilution in seawater with salinity equal to that of the receiving water.

The first sample collected for toxicity testing was on November 6, 2021. Toxicity tests were conducted between November 12 to 17, 2022. Results for the first bioassay tests were received from Enthalpy Analytical on February 2, 2022. The Data Summary Report and associated laboratory report were submitted to USEPA Region 9 on February 18, 2022, and are also provided in Attachment 2.

The second sample collected for toxicity testing was on April 9, 2022. Toxicity tests were conducted between November 9 to 13, 2021. Results for the second bioassay tests were received from Enthalpy Analytical on May 9, 2022. The Data Summary Report and associated laboratory report were submitted to USEPA Region 9 on June 20, 2022, and are also provided in Attachment 3.

For both rounds of toxicity tests, bioassay results indicate that no adverse effects are expected to be observed at the edge of the disposal zone under the conditions assumed in the model. Results of the bioassay testing from the combined fish waste collected in November 2021 and April 2022 show improved lowest acutely toxic concentrations compared to the wastewater that was previously tested and permitted for ocean disposal (Table 3).

Pursuant to the requirements of the Permit, Starkist updated the 1997 dilution model (CH2M Hill & gdc 1997) by applying up-to-date ambient ocean current data. This update also revised the vessel parameters to reflect the current ocean dumping vessel configuration. Attachment 4 presents the results of the Updated Dilution Modeling Analysis that documents the dilution model calculations of fish processing liquid wastes within the designated disposal site.

For both rounds of toxicity testing, the limiting permissible concentration (LPC) was calculated in accordance with 40 CFR Section 227.27 (a) where the LPC is the concentration of waste in the receiving water that does not exceed an acute toxicity threshold of 0.01 of the lowest acutely toxic concentration (i.e., the EC50 or LC50 of the sensitive marine organisms tested). The LPC was then compared to estimated waste sample concentrations at the edge of the disposal zone, based on the updated dilution modeling summarized in the Updated Dilution Modeling Analysis Memorandum (Attachment 4).

The LPC was calculated using the lowest EC/LC50 result of 0.028% and 0.0337% for the purple sea urchin samples for first and second round toxicity test, respectively, and applying the 0.01 factor (40 CFR 227.27), resulting in an LPC of 0.00028% and 0.000337% sample (i.e., or 1% of the lowest EC50 measured in bioassay tests, Table 3).

Results of the two rounds of suspended-phase acute toxicity bioassay tests conclude that there is no reason to believe that there would be any observable toxicity at the edge of the disposal zone under the current characteristics of the fish waste and conditions assumed in the updated model.

Monitoring of Receiving Water. In accordance with the Research Permit, receiving water quality sampling is completed once per month during active dumping. For this application, Starkist submits monthly receiving water data from April (implementation of ocean dumping) through March 2022, for a total of 12 sampling events.[3] The receiving water quality program was executed in accordance with the final Receiving Water Quality SAP – Fish Liquid Waste Offshore Disposal dated December 2021 (Aquatic Blue Environmental 2021). During each monitoring cruise, the disposal plume from the disposal vessel was sampled by taking discrete water samples from five stations and three depths (1, 3, and 10 meters [m] below the water surface [bws]). Sampling stations were located at the starting position (Control Sample and Station 1), 0.25 nautical miles (nmi) down current (Station 2), 0.5 nmi down current (Station 3), 1.0 nmi down current (Station 4), and at the leading edge of the plume, but within the plume (Station 5).

For each sampling event, a total of 18 samples were collected and shipped to Eurofins Calscience, LLC (Eurofins), Garden Grove, CA. As per the SAP, Eurofins analyzed each sample for ammonia, hexane-extractable material (HEM) oil & grease, total phosphorous, total nitrogen, total suspended solids (TSS), and total volatile suspended solids (TVSS). Total nitrogen is calculated using the analytical results of nitrate-nitrite (as N), and total Kjeldahl nitrogen also performed by Eurofins.

As required by the Research Permit (Section 5.2) that Starkist submitted in March 2022 to USEPA Region 9, the Dump Site Monitoring Annual Report documenting receiving water quality monitoring activities conducted during Ocean Dumping activities in American Samoa. The Annual Report presented data collected from April through December 2021, for a total of nine sampling events (Attachment 4). Results show that the median concentrations data at the leading edge of the dump site are generally comparable to background ocean conditions for all six parameters and three depths monitored at the dump site. Results show that there is little to no variability between the stations monitored. These data suggest that sufficient dilution of the fish waste is occurring.

Since the Dump Site Monitoring Annual Report was submitted to USEPA Region 9 in March 2022, the receiving water monitoring results were updated to include data from January, February, and March 2022. Table 4 presents the analytical results of the receiving water samples collected between April 2021 and March 2022 for each of the three depths at each station for all parameters and their corresponding minimum, maximum, median, and standard deviation concentrations.

For data interpretation and discussion purposes, the Method Detection Limit (MDL), defined as the minimum measured concentration of a substance that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results, was used as the concentration for all non-detect results. In some instances, the MDL concentration reported as non-detect varied between sample dates and sample depths for a given parameter analyzed. To calculate the median for a specific parameter and sample depth, the highest MDL concentration reported was used. For all six parameters monitored at the dump site, the median concentration data at Station 5, which represents the leading edge of the dump site, are generally comparable to the Control Station (background) for all three depths. This suggests very little to no variability between these stations, and sufficient dilution of the fish waste at the leading edge of the plume is occurring compared to background concentrations.

---

[3] Starkist continues to collect monthly receiving water data in compliance with the Research Permit. At the time of this application submittal analytical data from April 2021 through March 2022 had been validated and submitted to USEPA in the form of Quarterly Reports.

In accordance with the Research Permit Section 5.4.2, the qualifications of the on-site Principal Investigator in charge of the field monitoring operation at the dump site is to be submitted for US EPA approval. Attachment 1 includes the resume for the Principal Investigator, Matthew J. Neal – Element Environmental, LLC, Aiea, Hawaii (subcontractor to Aquatic Blue Environmental).

(d) Quantity of material to be dumped:

Up to four hundred thousand (400,000) U.S. gallons per trip, which is consistent with the combined fish waste volumes historically permitted from the two canneries. Authorization to dispose up to 400,000 gallons per trip would be an increase over the 300,000 gallons per trip allowed by the Research Permit. This requested increase is discussed below in item (e).

(e) Proposed dates and times of disposal:

The fish processing waste is generated whenever the Starkist facility is in operation. Starkist requests 400,000 gallons per day to allow operational flexibility in the facility's ocean dumping schedule. Additionally, there may be a need for accumulation of wastes and daily dumping up to 400,000 gallons in the event of unplanned downtime of the vessel or other emergency condition (i.e., severe weather).

The vessel, *Miss Lilly*, has a current aggregate tank capacity of 300,000 gallons. The *Miss Lilly* can be retrofitted to include additional tanks on the clear deck space. Tanks up to 100,000 gallons could be added to the vessel to transport and dump 400,000 gallons per disposal trip.

Consistent with the dumping schedule executed under the current Research Permit, Starkist anticipates filling the vessel with fish waste on an as-needed basis from the HSW storage tank. The vessel tanks are filled over a period of a few days. On average, during the Research Permit period, Starkist carries out two dumping trips per week. Typically, the vessel tanks are not filled to full capacity to prevent overflow and optimize the maintenance of tanks. Maintaining additional capacity in the tanks is to allow for emergency situations such as those mentioned above.

(f) Proposed dump site, and in the event such proposed dump site is not a dump site designated in this subchapter H, detailed physical, chemical and biological information relating to the proposed dump site and sufficient to support its designation as a site according to the procedures of part 228 of this subchapter H:

The proposed dump site is the approved USEPA-designated site in the Pacific Ocean confined to a circular area with a 1.5 nautical mile radius, centered at 14° 24.00' South latitude by 170° 38.30 West longitude.

(g) Proposed method of releasing the material at the dump site and means by which the disposal rate can be controlled and modified as required:

The proposed method of releasing the fish processing waste at the dump site is through the current pump/pipe system connecting the vessel's six holding tanks to a single discharge port at the stern of the vessel. The disposal rate during dumping is controlled by a manifold system with valves that allows the vessel crew to manually release the fish waste from the holding tanks at a controlled rate. [4] The flowrate of the discharge is then measured at a point closer to the discharge port (i.e., after the manifold). This approach to disposal allows for vessel stability to be maintained during discharge. See Section (c) above for more details on the vessel instruments monitoring and reporting of disposal rates.

(h) Identification of the specific process or activity giving rise to the production of the material;

The fish processing waste is produced from the tuna canning process at the Starkist facility. The DAF sludge originates from the DAF treatment system, which is a physical/chemical separation process to remove suspended material from the combined wastewater streams generated in the production facility. This treatment is achieved by dissolving air in a wastewater stream and combining it with the DAF influent under pressure, then releasing the air at atmospheric pressure in the flotation tank. The DAF influent is treated with aluminum sulfate (alum) and anionic polymer to improve solids separation. Solids and oil and grease particles adhere to the dissolved air, and these materials float to the surface of the DAF where they are removed from the surface as DAF float. DAF bottoms are materials that are unable to float due to their relative weight and sink to the bottom of the DAF for collection and removal via the DAF bottoms' pump system. DAF float and DAF bottoms comprise the DAF sludge discussed in this permit application.

Wastewater from the pre-cookers is generated from condensed steam used to cook the fish and from the release of liquids as the fish is cooked. Vegetable broth is added to some of the fish before entering the pre-cookers and a portion of the broth drains from the fish during the cooking process, accumulating in the pre-cooker wastewater. The pre-cooker area wastewater is currently collected in the pre-cooker sump. Prior to the implementation of ocean dumping, wastewater from the pre-cooker sump was pumped to the fishmeal area for treatment via the steam-fed evaporator (SFE). Since the implementation of the ocean dumping program in April 2021, Starkist ocean disposes of all the pre-cooker wastewater and discontinued treatment via the SFE.

Presswater (also referred to as press liquor or stickwater) generated from the fishmeal process was historically discharged into the fishmeal sump, along with other wastewater side streams generated in the fishmeal process, and the contents of the fishmeal sump were ocean disposed. In November 2017, Starkist installed a waste heat-fed evaporator (WFE) for the removal of solids from the stickwater into a concentrate for beneficial re-use into fishmeal product. The condensate portion of the stickwater from the WFE continues to be discharged into the fishmeal sump, along with the precooker wastewater side streams historically generated in the fishmeal process area. The combined wastewater stream, including the WFE condensate and wastewater sources collecting in the fishmeal sump, have been ocean disposed.

---

[4] The valve system is manual with crew opening and closing valves as needed. To maintain stability, the crew releases fish waste from two tanks simultaneously, the tanks on opposite sides of the vessel (port and starboard). The level of each tank is measured with sounding tape and/or a float switch system that displays the tank level. Each tank has a low- and high-level alarm system. Additionally, the vessel is equipped with multiple inclinometers to determine and maintain stability.

(i) Description of the manner in which the type of material proposed to be dumped has been previously disposed of by or on behalf of the person(s) or firm(s) producing such material:

The fish waste material has been ocean dumped at the USEPA-designated dump site (See Section f above) on the permit effective date of April 6, 2021, under Starkist's existing MPRSA Ocean Dumping Permit (OD 2020-01 Research). Starkist proposes to continue to dump the fish waste in the same manner as previously permitted under OD2020-01 Research.

(j) A statement of the need for the proposed dumping and an evaluation of short- and long-term alternative means of disposal, treatment or recycle of the material. Means of disposal shall include without limitation, landfill, well injection, incineration, spread of material over open ground; biological, chemical or physical treatment; recovery and recycle of material within the plant or at other plants which may use the material, and storage. The statement shall also include an analysis of the availability and environmental impact of such alternatives:

Starkist historically dumped fish processing waste based on the need demonstrated in the 1989 Environmental Impact Statement (EIS) (USEPA 1989).

The EIS considered three alternatives for fish waste dumping: No Action, land-based dumping, and ocean-based dumping. Each alternative included a set of options that were evaluated to select the approach with the lowest potential for human health and ecological impacts.

"No Action" alternatives included dumping without a permit, dumping on land, discontinued use of DAF equipment, and discontinuing operations in American Samoa. The "No Action" alternatives were considered to either cause violations with local and federal regulations or deprive American Samoa of its major industry. Land-based alternatives included ponding, landfilling, or percolation of saline cannery waste. For the land-based alternatives, the EIS concluded that "the cumulative effect of these attempts to carry out land dumping have illustrated well the fact that land dumping on island territories is not a feasible alternative to management of fish processing wastes."

Based on the issues associated with land-based dumping, ocean dumping was the most viable and protective alternative. Three ocean-based alternatives were evaluated: a shallow water site; the original permitted site; and a deep-water site. The deep-water alternative was selected because this site offered the most protection against possible surface slicks approaching shores, there was minimal possibility that the plume would encroach on environmentally sensitive areas at this site, and it provided a larger mixing zone and dilution zone. It was deemed safe for disposal for larger quantities of waste.

Since no new land-based disposal options are available and the status of the previously reviewed options have not changed since 1989, the findings of the EIS continue to reflect the viable option of offshore ocean disposal of fish processing waste.

Starkist and Van Camp Seafood began ocean dumping of fish wastes off the south coast of Tutuila Island, American Samoa, in December of 1980 (Permit Number: OD 79-01/02 Special). Research Permits were subsequently issued on February 26, 1987 (OD 86-01); September 2, 1987 (OD-87-01); March 4, 1988 (OD 88-01); and September 12, 1988 (OD 88-02). In 1990, the disposal site was moved further offshore into deeper water. Special Permits were issued in 1990 (OD 90-01) and 1993 (OD 93-01). Starkist discontinued ocean dumping in 2012. Between 2012 and 2017, the previously ocean dumped fish wastes from Starkist were pre-treated by a high-strength wastewater treatment system before being combined with the remaining wastewater streams. The combined wastewater stream was then treated by a DAF system and discharged to an outfall diffuser in the Harbor via the Joint Cannery Outfall (JCO).

Starkist upgraded the wastewater treatment systems, beginning in 2017 through early 2018, and 2020. The upgrades completed in 2017 and 2018 significantly reduced loading rates to the on-site wastewater treatment system (WWTS) as a result of the upgrades for Total Suspended Solids, Total Phosphorus, Total Nitrogen, Ammonia, and Oil and Grease, in part by recovering material within the fishmeal operations from the evaporators. However, through ongoing optimization efforts, a portion of the concentrate generated by the evaporators could not be recovered through the fishmeal dryers and required landfill disposal. Starkist's desire to reduce the overall nutrient loading to the Harbor and discontinue landfilling of concentrate from the plant, led to the pursuit of the current ocean dumping research permit issued in 2020. The existing WWTS was upgraded in 2020 during ocean dumping research permit discussions. The upgrades included additional pumping capacity, flow control, new and automated chemical dosing equipment, and a larger tube flocculator for chemical addition to the wastewater stream for improved coagulation and flocculation of solids prior to removal by the DAF. The DAF upgrades and ocean disposal of high strength wastewater streams were used in combination by the facility to come into compliance with the facility NPDES permit limits to treat up to the permit limit of 2.9 million gallons per day (MGD) of wastewater.

Starkist began ocean dumping of high strength wastewater on April 6, 2021 to improve the wastewater quality discharged to the joint cannery outfall (JCO) in Pago Pago Harbor (Harbor). Prior to ocean dumping, the high strength wastewater streams were comingled with other wastewater generated at the Facility and treated through the on-site WWTS and discharged to the Harbor.

Since ocean dumping was implemented in April 2021, Starkist wastewater effluent quality discharged to the JCO has significantly improved. The wastewater quality data for all NPDES permit analytes collected one year prior to as well as one year after the commencement of ocean dumping is summarized in Table 5. The wastewater data are presented in Table 5 with the NPDES permit limits for each analyte for comparison to the permit. A negative difference in the table indicates that pollutant loading in the effluent decreased after ocean dumping was implemented. Upon implementation of ocean dumping, the effluent wastewater quality has improved for nearly all of the wastewater quality parameters in the effluent. The average monthly discharge of total nitrogen has decreased 41%, total phosphorus has decreased 53%, and total suspended solids have decreased 50%. In addition, the maximum temperature has decreased due to the removal of heated wastewater sources from the precooker and fishmeal areas. Other parameters including biochemical oxygen demand and oil & grease also decreased while the ammonia impact ratio increased slightly. Overall, the diversion of high strength wastewater to ocean dumping instead of treatment via the on-site WWTS and discharge to the JCO has successfully improved wastewater effluent quality discharged from the Facility for the average monthly limits.

If ocean dumping were discontinued, the anticipated costs and other constraints involved with attempting to meet the NPDES effluent limits presents a serious challenge to the viability of the Facility. In particular, capital costs for treatment system upgrades, combined with limited Facility footprint and operational complexity in a remote setting would severely restrict the Facility's ability to successfully upgrade the existing treatment system to meet the NPDES permit limits. The Facility footprint is constrained by the orientation of the site relative to the mountains, the highway, and the Harbor leaving very little viable land for an advanced treatment system sized for 2.9 MGD. To the extent a treatment system can even be designed and constructed given the very limited space available at the Facility, the operation of a complex treatment system in a remote location with limited local operation and maintenance resources increases the risk of future non-compliance. Contracting skilled off-island treatment operators may be possible but at a significant premium, while the local mechanical, electrical, and instrumentation and control staff are less skilled than in other parts of the United States, requiring emergency off-island support in the event of equipment failure. The risk to effluent wastewater compliance associated with operational complexity are significant.

(k) An assessment of the anticipated environmental impact of the proposed dumping, including without limitation, the relative duration of the effect of the proposed dumping on the marine environment, navigation, living and non-living marine resource exploitation, scientific study, recreation and other uses of the ocean.

The environmental impact of the continued dumping in American Samoa was demonstrated in the EIS conducted by USEPA. With input from federal and local agencies and the public, USEPA designated the current deep-water dumping site. As noted above in Section j, the designation was based on the determination that ocean dumping of fish waste was the preferred alternative over other alternatives proposed for disposing of fish waste. The EIS determined that "no cumulative effects of ocean dumping are expected under presently permitted quantities of dumping. The currents and winds effectively dissipate the wastes, and none are measurable after four hours, nor are they visible on the morning following the previous day's disposal to indicate a buildup of wastes. The assimilative capacity of the open ocean is enormous. There should be no buildup of any pollutants under existing disposal practices."

In compliance with EPA's ocean dumping criteria at 40 CFR Parts 227 and 228 and pursuant to MPRSA §102, Starkist collected monthly data at the dump site (receiving waters and vessel operations) and the onshore HSW storage tank to document the impact to the ocean dumping operation. In compliance with Special Conditions outlined in the research permit (OD2020-01 Research), Starkist routinely (i.e., every three months during the permit period) provided USEPA with Ocean Disposal Site Monitoring Reports (April / May / June, July / August / September, and October / November / December 2021 and January / February / March 2022) during current ocean dumping activities. These reports included ocean dumping vessel operations information, dump site monitoring data, and fish waste processing data, including analytical results. Starkist also completed two sets of confirmatory suspended phase acute toxicity bioassay tests and dilution model calculations on fish processing liquid waste during the permit term. The two Bioassay Reports, submitted to USEPA in February and June 2022, documented the sampling and bioassay analysis methods and results for Starkist's high-strength fish waste. In March 2022, Starkist submitted to USEPA a Dump Site Monitoring Annual Report documenting receiving water quality monitoring activities conducted during ocean dumping activities. The Annual Report presents data collected from April (when ocean dumping activities began) through December 2021, for a total of nine sampling events. Based on Starkist's demonstration of compliance with permit conditions submitted to USEPA in these reports, there have been no discernable permanent effects on the water quality of the ocean in or near the dump site. Starkist proposes to continue to dispose of fish waste from the same waste streams currently permitted.

As described in Section c (above and in Tables 1 through 3 and Attachments 2 through 4), current analytical and biological toxicity data collected as part of the Research Permit show consistent results with historical data from the same permitted combined waste streams. Based on dilution levels reported at the designated ocean dumping site, the fish processing wastes are not expected to cause significant short- or long-term impacts to oceanic water quality, marine ecosystems, or human health.

Closing

Starkist has demonstrated through the Research Permit that there have been no discernable effects on the water quality of the ocean in or near the dump site. This has been demonstrated through HSW storage tank and receiving water analytical results and through bioassay testing and dilution modeling. Analytical results for the HSW storage tank show no exceedances to the PMCs during the reporting period except for pH which was analyzed for root cause and successfully corrected. Analytical results for HSW storage tank samples collected during the Research Permit are generally consistent with liquid fish processing waste that was previously permitted for ocean dumping.

Receiving water results show that the median concentration data at the leading edge of the dump site are generally comparable to background ocean conditions for all six parameters and three depths monitored at the dump site. Based on dilution modeling using bioassay results, the estimated edge of disposal zone waste concentration is lower than the LPC, indicating that toxicity would not be observed at this boundary under the conditions assumed in this model. These data suggest that sufficient dilution of the fish waste is occurring.

We appreciate USEPA's prompt review of the Ocean Dumping permit application information summarized in this letter. Should you have any questions about this submission, please feel free to contact me at 684.622.2002.

Sincerely,

Injoo Ha
Deputy General Manager/Acting General Manager Starkist Samoa Co.

Copies to: Ms. Elizabeth Sablad and Ms. Sara Goldsmith – USEPA
Ms. Ellen Blake – USEPA
Director Fa'amao Asalele – ASEPA
Faafoie Palepua, Edmund Kim, and Emmanuel Bernal – Starkist Samoa Co.
Earl Moynihan, Scott Meece, and Sanghyun Lee – StarKist Co.
Suzanne Gabriele, Keith Kroeger, and Jeremy Chesher – Geosyntec Consultants
Scott Dismukes, Esq. and Dave Rockman, Esq. – Eckert Seamans

Literature Cited:

CH2M Hill & gdc. 1997. Revised Report for Joint Cannery Ocean Dumping Studies in American Samoa.

U.S. Environmental Protection agency (USEPA). 1989. Final Environmental Impact Statement for the Designation of an Ocean Disposal Site off Tutuila Island, American Samoa for Fish Processing Wastes. February.

Application Supporting Tables:

Table 1: Research Permit (OD2020-01) and 2018/2019 Combined Ocean Disposal Wastewater Quality Comparison to Historical Ocean Dumping Data

Table 2: Research Permit High Strength Waste Storage Tank Comparison to OD2020-01 Permit Limits

Table 3: Bioassay Test Results with Comparison to 1994/1995 Samples

Table 4: Receiving Water Analytical Results/Statistical Analysis (Min, Max, Median and Std Dev) for Each Parameter

Table 5: Starkist Wastewater Effluent Quality: Pre- and Post-Ocean Dumping 2020 through 2022

Application Supporting Attachments:

Attachment 1: Aquatic Blue Vessel Specifications and Certifications, M/v *Miss Lilly* and ADISS System Replacement Part Inventory, ADISS Vessel Compliance Monitoring Certification, and Qualifications of the On-site Principal Investigator in Charge of the Field Monitoring

Attachment 2: Starkist Samoa Co. OD2020-01 Research – Special Conditions 3.3 Reporting. Section 3.3.5 Suspended Phase Acute Toxicity Bioassay Tests and Dilution Model Calculations. February 2022.

Attachment 3: Starkist Samoa Co. OD2020-01 Research – Special Conditions 3.3 Reporting. Section 3.3.5 Suspended Phase Acute Toxicity Bioassay Tests and Dilution Model Calculations. June 2022.

Attachment 4: Starkist Samoa Co. OD2020-01 Research – Special Conditions 3.3 Reporting. Section 3.3.5 Updated Dilution Modeling Analysis. February 2022.

Attachment 5: Starkist Samoa Co. OD2020-01 Research – Special Conditions 5 Dump Site Monitoring. Section 5.2 Monitoring Reports. March 2022.

Table 1: Research Permit (OD2020-01) and 2018/2019 Combined Ocean Disposal Wastewater Quality Comparison to Historical Ocean Dumping Data

Parameter	Units	April 2021 to March 2022 Research Permit (OD2020-01) Average	April 2021 to March 2022 Research Permit (OD2020-01) Maximum	June 2019 Sampling Event Average	June 2019 Sampling Event Maximum	November 2018 Sampling Event Average	November 2018 Sampling Event Maximum	2010 Ocean Disposal Data Average	2010 Ocean Disposal Data Maximum
Ammonia (as N)	mg/L	3,032	4,100	2,100	2,400	1,140	1,579	3,765	5,100
5-Day Biological Oxygen Demand	mg/L	26,453	56,950	-	-	-	-	-	-
Oil and Grease (HEM)	mg/L	1,865	3,490	2,706	7,090	4,407	8,615	4,787	5,530
Nitrogen, Total	mg/L	3,978	6,400	3,960	4,200	3,284	4,184	4,549	5,100
Phosphorus, Total	mg/L	307	590	684	980	506	638	705	850
Total Solids	mg/L	28,717	58,400	29,000	35,000	29,645	36,471	38,071	48,136
Total Volatile Solids	mg/L	14,000	8,900	16,800	21,000	18,161	26,070	21,437	35,367
pH	std. units	6.7	7.9*	-	-	-	-	-	-
Density	g/mL	1.0	1.01	-	-	-	-	-	-

Notes:
HEM - hexane extractable method
mg/L - milligrams per liter
N - nitrogen
2010 Ocean Disposal data is taken from 12 ocean disposal wastewater samples collected once per month in 2010
November 2018 sampling data is from November 6 – 16
June 2019 sampling data is from June 20, 21, 25, 26, and 27
Research Permit data was collected once per month April 2021 through March 2022.
 - No Data Available.

Table 2. Research Permit High Strength Waste Storage Tank Comparison to OD2020-01 Permit Limits

Month & Year	Total Solids (mg/L)	Total Volatile Solids (mg/L)	5-Day Biological Oxygen Demand (mg/L)	Oil and Grease (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)	Ammonia (mg/L)	pH (pH units)	Density (g/mL)
OD2020-01 Permit Limits	101,800	84,100	129,390	62,940	1,750	10,980	11,810	6.2 to 7.1	0.97 to 1.03
4/2021	35,000	20,000	19,465	1,860	590	6,400	4,100	7.9*	1.00
5/2021	19,000	8,800	23,616	467	470	4,300	3,100	7.4*	1.00
6/2021	19,000	11,000	14,943	3,330	325	2,850	2,430	7.2*	1.01
7/2021	16,800	8,140	16,861	1,420	335	2,550	2,450	7.4*	1.00
8/2021	22,400	15,000	19,519	3,490	459	4,360	3,120	6.9	0.99
9/2021	19,000	8,900	20,885	3,200	360	3,400	2,900	6.3	1.00
10/2021	47,000	34,000	56,950	970	560	4,100	3,800	6.5	1.00
11/2021	23,000	14,000	17,043	2,650	45	3,700	3,200	6.8	1.00
12/2021	27,000	16,000	22,296	1,310	43	3,800	2,400	7.0	1.00
1/2022	58,400	17,900	39,443	774	51	4,380	3,280	6.6	1.01
2/2022	34,000	21,000	46,050	1,890	47	3,900	2,900	6.8	1.00
3/2022	24,000	14,000	20,363	1,020	400	4,000	2,700	6.9	1.00
Average	28,717	15,728	26,453	1,865	307	3,978	3,032	7	1
Standard Deviation	12,813	7,172	13,437	1,060	208	956	529	0.24	0.01

Note:

An asterisk(*) next to the liquid waste concentration indicates that an exceedance of the permit limit has occurred

Table 3. Bioassay Test Results with Comparison to 1994/1995 Samples

Test	Endpoint	2022	2021	2019 Samples		1994/95 Samples		
		Apr-22	11/2021	7/29/2019	7/5/2019	2/1994	10/1994	6/1995
Fish[1] 96 hr Survival Test	NOEC	0.25	0.25	NT	1.0	0.2	0.25	0.25
	LC50	0.352	0.654	NT	1.41	0.27	0.35	0.396
Mysid Shrimp 96 hr Survival Test	NOEC	0.5	0.25	NT	0.25	0.05	0.5	0.5
	LC50	0.559	0.409	NT	0.49	0.12	1.16	1.16
Sea Urchin 72 hr Embryo Development Test	NOEC	0.0075	<0.015	0.016	<0.06	NC	NC	NC
	EC50	0.0337	0.028	0.062	0.04	<0.08	--[2]	--[2]
	LC50	0.113	0.0589	>2.0	NC	>1.2	--[2]	--[2]
Lowest Acutely Toxic (EC50/LC50)		0.0337	0.028	0.062	0.04	<0.08	0.1	0.25

Notes:

[1] Sand dab (*Citharichthys stigmaeus*) were tested in 1994/95 and inland silverside (*Menidia beryllina*) tested in 2019 and 2021

[2] Sea Urchin not tested in 10/1994 and 6/1995 with concurrence from U.S. EPA.

Median sublethal concentrations were defined as IC50 (median inhibitory concentrations) in 1994/95 and median effective concentrations (EC50) in 2019 and 2021; however, effects measured and procedures followed were the same.

Acronyms

LOEC = lowest observable effect concentration
NOEC = no observable effect concentration
NC = Not Calculated
NT = Not Tested. Mussel species not tested in 2019 or 2021

Table 4 - Receiving Water Analytical Results/Statistical Analysis (Min, Max, Median and Std Dev) for Each Parameter

	Location	Control						Station 1						Station 2					
	Depth (meters)	1		3		10		1		3		10		1		3		10	
Parameters	Dates	Conc. (mg/L)						Conc. (mg/L)						Conc. (mg/L)					
Ammonia	4/17/2021	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U
	5/21/2021	0.259	UJ	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U
	6/13/2021	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U
	7/2/2021	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U
	8/6/2021	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U
	9/10/2021	0.259	UJ	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U
	10/1/2021	0.528	U	0.528	U	0.528	U	0.528	U	0.528	U	0.528	U	0.528	U	0.528	U	0.528	U
	11/5/2021	0.528	U	0.528	U	0.528	U	0.528	U	0.528	U	0.528	U	0.528	U	0.528	U	0.528	U
	12/3/2021	0.0911	U	0.0911	U	0.0911	U	0.0911	U	0.0911	U	0.0911	U	0.0911	U	0.0911	U	0.0911	U
	1/7/2022	0.0911	UJ	0.0911	U	0.0911	U	0.0911	U	0.0911	U	0.0911	U	0.0911	U	0.0911	U	0.0911	U
	2/4/2022	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	R	0.1	U
	3/18/2022	0.211	R	0.211	R	0.211	R	0.211	R	0.211	R	0.211	R	0.211	R	0.211	R	0.211	R
	Min	0.0911		0.0911		0.0911		0.0911		0.0911		0.0911		0.0911		0.0911		0.0911	
	Max	0.528		0.528		0.528		0.528		0.528		0.528		0.528		0.528		0.528	
	Median	0.259		0.259		0.259		0.259		0.259		0.259		0.259		0.259		0.259	
	Std. Dev.	0.144		0.144		0.144		0.144		0.144		0.144		0.144		0.144		0.144	
HEM Oil and Grease	4/17/2021	0.497	U	0.484	U	0.477	U	0.56	U	0.509	U	0.481	U	0.539	U	0.538	U	0.505	U
	5/21/2021	0.497	U	0.484	U	0.477	U	0.56	U	0.509	U	0.481	U	0.539	U	0.538	U	0.505	U
	6/13/2021	0.499	U	0.532	U	0.504	U	0.499	U	0.516	U	0.512	U	0.531	U	0.509	U	0.496	U
	7/2/2021	0.524	U	0.476	U	0.478	U	0.48	U	0.479	U	0.534	U	0.571	U	0.536	U	0.513	U
	8/6/2021	0.515	U	0.614	U	0.546	U	0.488	U	0.51	U	0.474	U	0.493	U	0.518	U	0.492	U
	9/10/2021	0.491	U	0.499	U	0.49	U	0.686	J	0.477	U	0.746	J	0.85	J	0.661	J	0.543	U
	10/1/2021	0.479	U	0.484	U	0.475	U	0.508	U	0.777	J	0.488	U	0.479	U	0.485	U	0.475	U
	11/5/2021	0.509	U	0.652	J	0.481	U	0.485	U	0.478	U	0.494	U	0.482	U	1		0.483	U
	12/3/2021	0.563	U	0.529	U	0.494	U	0.479	U	0.482	U	0.481	U	0.476	U	0.48	U	0.476	U
	1/7/2022	0.484	U	0.494	U	0.492	U	0.476	U	0.537	U	0.652	J	0.511	U	0.493	U	0.476	U
	2/4/2022	3.4		0.494	U	0.476	U	0.492	U	0.489	U	0.475	U	0.478	U	0.523	U	0.473	U
	3/18/2022	0.559	R	0.594	R	0.611	R	0.631	J	0.533	R	0.522	R	0.505	R	0.51	R	0.502	R
	Min	0.479		0.476		0.475		0.476		0.477		0.474		0.476		0.48		0.473	
	Max	3.4		0.652		0.611		0.686		0.777		0.746		0.85		1		0.543	
	Median	0.559		0.4965		0.611		0.4955		0.509		0.491		0.508		0.5205		0.543	
	Std. Dev.	0.835		0.059		0.040		0.068		0.082		0.084		0.103		0.144		0.021	
HEM-SGT Oil and Grease	4/17/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5/21/2021	0.779	U	0.759	U	0.748	U	0.877	U	0.798	U	0.755	U	0.845	U	0.844	U	0.791	U
	6/13/2021	0.783	U	0.834	U	0.79	U	0.783	U	0.81	U	0.803	U	0.832	U	0.798	U	0.778	U
	7/2/2021	0.822	U	0.746	U	0.75	U	0.753	U	0.751	U	0.838	U	0.896	U	0.84	U	0.804	U
	8/6/2021	0.807	U	0.819	U	0.857	U	0.765	U	0.8	U	0.743	U	0.772	U	0.812	U	0.771	U
	9/10/2021	0.769	U	0.782	U	0.768	U	0.784	U	0.748	U	0.746	U	0.755	U	0.755	U	0.852	U
	10/1/2021	0.75	U	0.759	U	0.744	U	0.796	U	0.777	U	0.765	U	0.75	U	0.76	U	0.745	U
	11/5/2021	0.798	U	0.746	U	0.754	U	0.76	U	0.749	U	0.774	U	0.755	U	0.802	U	0.757	U
	12/3/2021	0.882	U	0.83	U	0.775	U	0.75	U	0.756	U	0.755	U	0.746	U	0.752	U	0.747	U
	1/7/2022	0.758	U	0.774	U	0.771	U	0.747	U	0.842	U	0.746	U	0.802	U	0.772	U	0.747	U
	2/4/2022	1.65		0.774	U	0.746	U	0.771	U	0.766	U	0.745	U	0.75	U	0.821	U	0.742	U
	3/18/2022	0.876	R	0.931	R	0.958	R	0.841	R	0.835	R	0.818	R	0.792	R	0.799	R	0.787	R
	Min	0.75		0.746		0.744		0.75		0.748		0.743		0.746		0.752		0.745	
	Max	0.882		0.834		0.857		0.877		0.81		0.838		0.896		0.844		0.852	
	Median	0.7905		0.7705		0.761		0.774		0.7665		0.76		0.7635		0.8		0.7745	
	Std. Dev.	0.040		0.038		0.037		0.041		0.026		0.033		0.056		0.037		0.035	

	Location	Station 3						Station 4						Station 5					
	Depth (meters)	1		3		10		1		3		10		1		3		10	
Parameters	Dates	Conc. (mg/L)						Conc. (mg/L)						Conc. (mg/L)					
Ammonia	4/17/2021	0.259	U	0.259	UJ	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U
	5/21/2021	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U
	6/13/2021	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U
	7/2/2021	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U
	8/6/2021	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U
	9/10/2021	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U	0.259	U
	10/1/2021	0.528	U	0.528	U	0.528	U	0.528	U	0.528	U	0.528	U	0.528	U	0.528	U	0.528	U
	11/5/2021	0.528	U	0.528	U	0.528	U	0.528	U	0.528	U	0.528	U	0.528	U	0.528	U	0.528	U
	12/3/2021	0.0911	U	0.0911	U	0.0911	U	0.0911	U	0.0911	U	0.0911	U	0.0911	U	0.0911	U	0.0911	U
	1/7/2022	0.0911	U	0.0911	U	0.0911	U	0.0911	U	0.0911	U	0.0911	U	0.0911	U	0.0911	U	0.0911	U
	2/4/2022	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
	3/18/2022	0.211	R	0.211	R	0.211	R	0.211	R	0.211	R	0.211	R	0.211	R	0.211	R	0.211	R
	Min	0.0911		0.0911		0.0911		0.0911		0.0911		0.0911		0.0911		0.0911		0.0911	
	Max	0.528		0.528		0.528		0.528		0.528		0.528		0.528		0.528		0.528	
	Median	0.259		0.259		0.259		0.259		0.259		0.259		0.259		0.259		0.259	
	Std. Dev.	0.144		0.144		0.144		0.144		0.144		0.144		0.144		0.144		0.144	
HEM Oil and Grease	4/17/2021	0.515	U	0.497	U	0.508	U	0.509	U	0.478	U	0.493	U	0.511	U	0.481	U	0.52	U
	5/21/2021	0.515	U	0.497	U	0.508	U	0.509	U	0.478	U	0.493	U	0.511	U	0.481	U	0.52	U
	6/13/2021	11.4		0.505	U	0.485	U	0.485	U	0.482	U	0.515	U	0.506	U	0.512	U	0.511	U
	7/2/2021	0.498	U	0.496	U	0.503	U	0.505	U	0.553	U	0.524	U	0.572	J	0.569	J	0.48	U
	8/6/2021	0.498	U	0.494	U	0.505	U	0.476	U	0.524	U	0.491	U	0.501	U	0.487	U	0.504	U
	9/10/2021	0.521	U	0.953		0.592	J	0.662	J	0.485	U	0.935		5.05		5.3		6.32	
	10/1/2021	0.483	U	0.513	U	0.474	U	0.506	U	0.504	U	0.492	U	0.485	U	0.473	U	0.505	U
	11/5/2021	0.478	U	0.487	U	0.474	U	0.49	U	0.701	J	0.492	U	0.495	U	0.486	U	0.501	U
	12/3/2021	0.474	U	0.481	U	0.477	U	0.474	U	0.481	U	0.485	U	0.475	U	0.48	U	0.473	U
	1/7/2022	0.495	U	0.492	U	0.486	U	0.507	U	0.478	U	0.491	U	0.488	U	0.552	U	0.491	U
	2/4/2022	0.491	U	0.494	U	0.475	U	0.488	U	0.504	U	0.473	U	0.486	U	0.499	U	0.484	U
	3/18/2022	0.527	R	0.502	R	0.592	J	0.503	R	1.12	J-	0.537	R	0.501	R	0.506	R	0.526	R
	Min	0.474		0.481		0.474		0.474		0.478		0.473		0.475		0.473		0.473	
	Max	11.4		0.953		0.592		0.662		1.12		0.935		5.05		5.3		6.32	
	Median	0.498		0.4965		0.4945		0.504		0.4945		0.4925		0.501		0.493		0.5045	
	Std. Dev.	3.147		0.132		0.042		0.050		0.186		0.127		1.313		1.385		1.680	
HEM-SGT Oil and Grease	4/17/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5/21/2021	0.807	U	0.779	U	0.797	U	0.798	U	0.75	U	0.772	U	0.801	U	0.753	U	0.815	U
	6/13/2021	0.763	U	0.791	U	0.76	U	0.76	U	0.756	U	0.807	U	0.794	U	0.802	U	0.802	U
	7/2/2021	0.78	U	0.778	U	0.789	U	0.792	U	0.867	U	0.821	U	0.763	U	0.758	U	0.753	U
	8/6/2021	0.781	U	0.774	U	0.791	U	0.746	U	0.822	U	0.77	U	0.785	U	0.764	U	0.79	U
	9/10/2021	0.817	U	0.763	U	0.789	U	0.756	U	0.76	U	0.748	U	0.99		0.848	J	1.04	
	10/1/2021	0.757	U	0.804	U	0.743	U	0.794	U	0.79	U	0.771	U	0.76	U	0.741	U	0.791	U
	11/5/2021	0.749	U	0.763	U	0.743	U	0.768	U	0.802	U	0.771	U	0.776	U	0.761	U	0.785	U
	12/3/2021	0.743	U	0.753	U	0.748	U	0.743	U	0.754	U	0.76	U	0.744	U	0.752	U	0.741	U
	1/7/2022	0.776	U	0.771	U	0.762	U	0.794	U	0.75	U	0.77	U	0.766	U	0.865	U	0.77	U
	2/4/2022	0.77	U	0.775	U	0.744	U	0.766	U	0.791	U	0.741	U	0.762	U	0.783	U	0.758	U
	3/18/2022	0.826	R	0.787	R	0.79	R	0.788	R	0.812	R	0.841	R	0.786	R	0.794	R	0.825	R
	Min	0.743		0.753		0.743		0.743		0.75		0.748		0.744		0.741		0.741	
	Max	0.817		0.804		0.797		0.798		0.867		0.821		0.99		0.848		1.04	
	Median	0.7715		0.776		0.7745		0.764		0.775		0.771		0.7805		0.7595		0.7905	
	Std. Dev.	0.027		0.016		0.024		0.022		0.041		0.024		0.078		0.035		0.094	

	Location	Control						Station 1						Station 2						Station 3						Station 4						Station 5					
	Depth (meters)	**1**		**3**		**10**		**1**		**3**		**10**		**1**		**3**		**10**		**1**		**3**		**10**		**1**		**3**		**10**		**1**		**3**		**10**	
Parameters	**Dates**	**Conc. (mg/L)**						**Conc. (mg/L)**						**Conc. (mg/L)**						**Conc. (mg/L)**						**Conc. (mg/L)**						**Conc. (mg/L)**					
Phosphorus	4/17/2021	0.00766	J	0.0049	U	0.0049	U	0.0049	U	0.0049	U	0.0049	U	0.0049	U	0.0049	U	0.0173	J	0.0049	U	0.0049	U	0.0049	U	0.0049	U	0.0049	U	0.0049	U	0.0049	U	0.0049	U	0.0049	U
	5/21/2021	0.0057	J	0.00503	J	0.00596	J	0.0062	J	0.00564	J	0.00521	J	0.00879	J	0.00566	J	0.00719	J	0.00548	J	0.00908	J	0.0049	U	0.00515	J	0.00499	J	0.00524	J	0.00524	J	0.0049	U	0.00512	J
	6/13/2021	0.00604	J	0.0049	U	0.0049	U	0.0049	U	0.0049	U	0.0049	U	0.0049	U	0.0049	U	0.0049	U	0.0049	U	0.0049	U	0.0049	U	0.0049	U	0.0049	U	0.0049	U	0.0049	U	0.0049	U	0.0049	U
	7/2/2021	0.00785	J	0.00768	J	0.00729	J	0.0129	J	0.00722	J	0.00803	J	0.0109	J	0.00643	J	0.00813	J	0.00883	J	0.0101	J	0.00828	J	0.00755	J	0.00743	J	0.00818	J	0.00796	J	0.00845	J	0.00819	J
	8/6/2021	0.0049		0.0049	U	0.0049		0.0049		0.0049		0.015		0.0049		0.0049		0.0049		0.0049		0.00658		0.00656		0.00624		0.0058		0.0049		0.00496		0.00495		0.00494	
	9/10/2021	0.0049	U	0.00629	J	0.00534	J	0.00541	J	0.0049	U	0.00505	J	0.0049	U	0.0049	U	0.0049	U	0.0049	U	0.0049	U	0.00677	J	0.0069	J	0.00651	J	0.00614	J	0.00622	J	0.00648	J	0.00695	J
	10/1/2021	0.0101	J	0.00852	J	0.0089	J	0.00831	J	0.0082	J	0.00791	J	0.00746	J	0.00931	J	0.0088	J	0.00919	J	0.00884	J	0.00905	J	0.00855	J	0.00922	J	0.0116	J	0.00787	J	0.00743	J	0.00769	J
	11/5/2021	0.00638	J	0.00808	J	0.00698	J	0.0063	J	0.00663	J	0.00704	J	0.00608	J	0.00639	J	0.00593	J	0.011	J	0.00632	J	0.00742	J	0.006	J	0.00583	J	0.00605	J	0.00617	J	0.00738	J	0.00537	J
	12/3/2021	0.00923	J	0.0152	J	0.00846	J	0.0104	J	0.017	J	0.00701	J	0.00691	J	0.00729	J	0.00724	J	0.00718	J	0.00818	J	0.00812	J	0.0085	J	0.00732	J	0.00795	J	0.00829	J	0.0079	J	0.00782	J
	1/7/2022	0.016	U	0.016	U	0.016	U	0.016	U	0.016	U	0.016	U	0.016	U	0.016	U	0.016	U	0.016	U	0.016	U	0.016	U	0.016	U	0.016	U	0.016	U	0.016	U	0.016	U	0.016	U
	2/4/2022	0.016	U	0.016	U	0.016	U	0.016	U	0.016	U	0.0167	J	0.019	J	0.016	U	0.016	U	0.016	U	0.016	U	0.016	U	0.016	U	0.016	U	0.0167	J	0.016	U	0.016	U	0.016	U
	3/18/2022	0.00624	J	0.00566	J	0.00602	J	0.00617	J	0.00584	J	0.00564	J	0.00547	J	0.00516	J	0.0056	J	0.00589	J	0.00556	J	0.00524	J	0.00558	J	0.00623	J	0.00545	J	0.00513	J	0.00522	J	0.00508	J
	Min	0.0049		0.0049		0.0049		0.0049		0.0049		0.0049		0.0049		0.0049		0.0049		0.0049		0.0049		0.0049		0.0049		0.0049		0.0049		0.0049		0.0049		0.0049	
	Max	0.016		0.016		0.016		0.016		0.017		0.0167		0.019		0.016		0.0173		0.016		0.016		0.016		0.016		0.016		0.0167		0.016		0.016		0.016	
	Median	0.00702		0.006985		0.0065		0.00625		0.006235		0.007025		0.006495		0.006025		0.007215		0.006535		0.00738		0.007095		0.00657		0.00637		0.006095		0.006195		0.00693		0.00616	
	Std. Dev.	0.004		0.004		0.004		0.004		0.005		0.004		0.005		0.004		0.005		0.004		0.004		0.004		0.004		0.004		0.004		0.004		0.004		0.004	
Nitrate-Nitrite	4/17/2021	0.0292	R	0.0292	R	0.0292	R	0.0292	R	0.0292	R	0.0292	R	0.0292	R	0.0292	R	0.0292	R	0.0292	R	0.0292	R	0.0292	R	0.0292	R	0.0292	R	0.0292	R	0.0292	R	0.0292	R	0.0292	R
	5/21/2021	0.0586	J	0.0325	J	0.0965	J	0.237		0.177		0.0292	U	0.041	J	0.0488	J	0.0292	U	0.0355	J	0.0387	J	0.0292	U	0.0292	U	0.0292	U	0.0292	U	0.0292	U	0.0292	U	0.0292	U
	6/13/2021	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U
	7/2/2021	0.26		0.181		0.111		0.0891	J	0.123		0.0955	J	0.123		0.0903	J	0.115		0.0688	J	0.0975	J	0.0871	J	0.106		0.0692	J	0.0867	J	0.0653	J	0.0746	J	0.042	J
	8/6/2021	0.131		0.136	U	0.135		0.142		0.119		0.139		0.142		0.128		0.129		0.119		0.104		0.116		0.144		0.124		0.17		0.121		0.175		0.149	
	9/10/2021	0.0196	J	0.0172	U	0.0172	U	0.0219	J	0.0172	U	0.0208	J	0.0208	J	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0196	J	0.0326	J	0.0184	J	0.0172	U	0.0184	J	0.0208	J
	10/1/2021	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U
	11/5/2021	0.036	J	0.0317	J	0.0192	J	0.0287	J	0.0372	J	0.0254	J	0.0249	J	0.0172	U	0.0217	J	0.0304	J	0.0316	J	0.0273	J	0.0282	J	0.0499	J	0.0443	J	0.0178	J	0.103		0.038	J
	12/3/2021	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0201	J	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U
	1/7/2022	0.0172	U	0.0172	U	0.0172	U	0.0335	J	0.0172	U	0.0172	U	0.024	J	0.0248	J	0.0173	J	0.0332	J	0.0279	J	0.0323	J	0.0245	J	0.0204	J	0.0172	U	0.0172	U	0.0172	U	0.0172	U
	2/4/2022	0.0172	U	0.0172	U	0.0172	U	0.0191	J	0.0196	J	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U	0.0172	U
	3/18/2022	0.087	J	0.0709	J	0.0723	J	0.0687	J	0.078	J	0.0679	J	0.0769	J	0.078	J	0.0723	J	0.075	J	0.0796	J	0.0835	J	0.0757	J	0.0832	J	0.0838	J	0.0758	J	0.0698	J	0.0649	J
	Min	0.0172		0.0172		0.0172		0.0172		0.0172		0.0172		0.0172		0.0172		0.0172		0.0172		0.0172		0.0172		0.0172		0.0172		0.0172		0.0172		0.0172		0.0172	
	Max	0.26		0.181		0.135		0.237		0.177		0.139		0.142		0.128		0.129		0.119		0.104		0.116		0.144		0.124		0.17		0.121		0.175		0.149	
	Median	0.0244		0.0232		0.0182		0.02895		0.02465		0.0231		0.02445		0.021		0.0195		0.0298		0.02855		0.02825		0.02635		0.0292		0.0238		0.0175		0.0238		0.025	
	Std. Dev.	0.073		0.054		0.044		0.068		0.055		0.039		0.044		0.037		0.041		0.032		0.033		0.034		0.042		0.034		0.047		0.033		0.049		0.038	
TKN	4/17/2021	1.08		1.3		0.784		0.28	U	3.16		0.896		2.24		0.784		1.61		0.658		1.93		0.476	J	0.35	J	0.406	J	0.28	U	0.658		0.28	U	0.378	J
	5/21/2021	0.392	J	1.04		0.504		0.448	J	0.7		0.7		0.294	J	0.784		0.504		0.532		0.644		0.49	J	0.42	J	0.392	J	0.322	J	0.434	J	0.322	J	0.434	J
	6/13/2021	1.16		0.588		0.49	J	0.406	J	0.686		0.504		0.322	J	0.336	J	1.08		0.742		0.448	J	0.798		0.658		0.546		1.19		0.63		0.84		0.91	
	7/2/2021	0.7		0.784		0.56		1.04		0.588		0.602		0.84		1.48		0.938		1.6		0.448	J	0.784		0.952		0.84		1.02		1.05		1.19		0.756	
	8/6/2021	1.06		0.28	U	1.23		1.29		0.882		1.48		1.08		1.01		1.18		1.09		1.69		0.686		1.34		0.952		0.672		1.06		1.078		0.938	
	9/10/2021	0.406	J	0.434	J	0.742		0.35	J	0.28	U	0.336	J	4.44		0.28	J	0.308	J	0.28	U	1.26		0.28	U	0.448	J	0.28	J	0.28	U	0.35	J	0.322	J	0.406	J
	10/1/2021	0.378	J	0.532		0.616		0.392	J	0.616		0.476	J	0.42	J	0.98		0.434	J	0.364	J	0.672		0.756		0.406	J	0.35	J	0.322	J	0.378	J	0.336	J	0.462	J
	11/5/2021	0.351	U	0.462	J	0.351	U	0.351	U	0.462	J	0.392	J	0.756	J	0.351	U	0.351	U	0.351	U	0.351	U	0.351	U	0.351	U	0.56	J	0.462	J	0.476	J	0.672	J	0.546	J
	12/3/2021	0.434	J	0.351	U	0.616	J	0.42	J	0.378	J	0.42	J	0.462	J	0.434	J	0.504	J	0.351	U	0.476	J	0.546	J	0.351	U	0.476	J	0.504	J	0.351	U	0.364	J	0.63	J
	1/7/2022	0.404		0.184	J	0.404		0.1	U	0.1	U	0.1	U	0.274		0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.272		0.618		0.175	J	0.106	J	0.118	J	0.171	J
	2/4/2022	0.107	J-	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.104	J	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
	3/18/2022	0.364	J	0.63	J	0.742	J	0.504	J	0.392	J	0.588	J	0.546	J	0.476	J	0.462	J	0.434	J	0.63	J	0.476	J	0.518	J	0.644	J	0.714	J	0.504	J	0.518	J	0.546	J
	Min	0.107		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1	
	Max	1.16		1.3		1.23		1.29		3.16		1.48		4.44		1.48		1.61		1.6		1.93		0.798		1.34		0.952		1.19		1.06		1.19		0.938	
	Median	0.405		0.497		0.588		0.399		0.525		0.49		0.504		0.455		0.483		0.399		0.553		0.483		0.413		0.511		0.392		0.455		0.35		0.504	
	Std. Dev.	0.345		0.348		0.277		0.350		0.812		0.371		1.228		0.419		0.467		0.431		0.590		0.245		0.334		0.235		0.337		0.307		0.359		0.259	

	Location	Control						Station 1						Station 2						Station 3						Station 4						Station 5					
	Depth (meters)	1		3		10		1		3		10		1		3		10		1		3		10		1		3		10		1		3		10	
Parameters	Dates	Conc. (mg/L)						Conc. (mg/L)						Conc. (mg/L)						Conc. (mg/L)						Conc. (mg/L)						Conc. (mg/L)					
Total Nitrogen	4/17/2021	1.08		1.3		0.784		0.28	U	3.16		0.896		2.24		0.784		1.61		0.658		1.93		0.476	J	0.35	J	0.406	J	0.28	U	0.658		0.28	U	0.378	J
	5/21/2021	0.451	J	1.07		0.601		0.685		0.877		0.7		0.335	J	0.833		0.504		0.568		0.683		0.49	J	0.42	J	0.392	J	0.322	J	0.434	J	0.322	J	0.434	J
	6/13/2021	1.16		0.588		0.49	J	0.406	J	0.686		0.504		0.322	J	0.336	J	1.08		0.742		0.448	J	0.798		0.658		0.546		1.19		0.63		0.84		0.91	
	7/2/2021	0.96		0.965		0.671		1.13		0.711		0.698		0.963		1.57		1.05		1.67		0.546		0.871		1.06		0.909		1.11		1.12		1.26		0.798	
	8/6/2021	1.19		0.28	U	1.37		1.43		1		1.62		1.22		1.14		1.31		1.21		1.79		0.802		1.48		1.08		0.842		1.18		1.11		1.47	
	9/10/2021	0.426	J	0.434	J	0.742		0.372	J	0.28	U	0.357	J	4.46		0.28	J	0.308	J	0.28	U	1.26		0.28	U	0.468	J	0.313	J	0.28	U	0.35	J	0.34	J	0.427	J
	10/1/2021	0.378	J	0.532		0.616		0.392	J	0.616		0.476	J	0.42	J	0.98		0.434	J	0.364	J	0.672		0.756		0.406	J	0.35	J	0.322	J	0.378	J	0.336	J	0.462	J
	11/5/2021	0.28	U	0.494	J	0.28	U	0.28	U	0.499	J	0.417	J	0.781		0.28	U	0.28	U	0.28	U	0.28	U	0.28	U	0.28	U	0.61		0.506		0.494	J	0.775		0.584	
	12/3/2021	0.434	J	0.28	U	0.616		0.42	J	0.398	J	0.42	J	0.462	J	0.434	J	0.504		0.28	U	0.476	J	0.546		0.28	U	0.476	J	0.504		0.28	U	0.364	J	0.63	
	1/7/2022	0.404	J	0.28	U	0.404	J	0.28	U	0.28	U	0.28	U	0.298	J	0.28	U	0.28	U	0.28	U	0.28	U	0.28	U	0.297	J	0.638		0.28	U	0.28	U	0.28	U	0.28	U
	2/4/2022	3900		0.28	U	0.28	U	0.28	U	0.28	U	0.28	U	0.28	U	0.28	U	0.28	U	0.28	U	0.28	U	0.28	U	0.28	U	0.28	U	0.28	U	0.28	U	0.28	U	0.28	U
	3/18/2022	0.451	J	0.701	J-	0.814	J-	0.573	J-	0.47	J	0.656	J-	0.623	J-	0.554	J-	0.534	J-	0.509	J-	0.71	J-	0.56	J-	0.594	J-	0.727	J-	0.798	J-	0.58	J-	0.588	J-	0.611	J-
	Min	0.28		0.28		0.28		0.28		0.28		0.28		0.28		0.28		0.28		0.28		0.28		0.28		0.28		0.28		0.28		0.28		0.28		0.28	
	Max	3900		1.3		1.37		1.43		3.16		1.62		4.46		1.57		1.61		1.67		1.93		0.871		1.48		1.08		1.19		1.18		1.26		1.47	
	Median	0.451		0.513		0.616		0.399		0.5575		0.49		0.5425		0.494		0.504		0.4365		0.609		0.518		0.413		0.511		0.413		0.464		0.352		0.523	
	Std. Dev.	1125.644		0.345		0.292		0.371		0.788		0.370		1.216		0.421		0.459		0.439		0.573		0.227		0.370		0.247		0.340		0.308		0.350		0.334	
TSS	4/17/2021	4.2		3.6		2.8		3.8		2.8		3.2		3.5		3		4.5		3.3		4.95		4.1		4.4		4.1		3.5		3.6		1.2		4	
	5/21/2021	3.2		5.3		4.1		4.7		3.9		3.8		3.9		6.2		3.7		4.9		3.7		2.8		4.5		3.5		4.8		4.8		3.7		3.9	
	6/13/2021	6.2		6.5		7.6		5.6		5.2		6.1		6.2		5.1		5.3		7.7		7.4		7.1		7.5		5.8		0.9	J	5.1		6.2		5.8	
	7/2/2021	4		3.9		2.5		1		4.2		2.11		4.7		4.1		5.2		4.4		3.6		3.9		4		3.7		4.2		5.4		4.6		6	
	8/6/2021	4.7		5.2	U	4.8		3.8		5.2		2.8		4		4.1		4.7		4.6		3.8		4.3		3.3		4.7		3.9		4.8		3.4		4.8	
	9/10/2021	4.1		4.2		3.3		4.7		3.7		4.8		3.6		3.9		4.5		4.6		4.2		4.3		4.3		5		5.8		3.7		4		4	
	10/1/2021	4.7		4.4		5.7		3.5		4.2		4.4		4.4		4.2		5.3		4.1		4.4		2.8		2.2		4.6		4.6		2.6		4.3		4.2	
	11/5/2021	3.6		4.5		6.2		3.9		4		4.8		4.9		4.3		4.5		7.4		4.2		3.7		4.8		4.8		4.1		4		4		4.2	
	12/3/2021	4.7		3.8		4.6		3.61		4.4		4.4		4.9		1.5		3.7		5.8		4.9		5.7		5.8		4.3		3.4		5.3		4.4		4.5	
	1/7/2022	32.6		29.2		33.5		53		29.5		30.2		31.2		29.5		29		33.7		29		29.7		32.4		30.6		36.7		35.5		31.3		40.7	
	2/4/2022	2		0.829	U	0.829	U	0.9	J	1.1		1.8		0.829	U	2.5		5.8		1.5		0.829	U	1.4		0.829	U	1.4		2.4		0.829	U	1.2		2.3	
	3/18/2022	1.3	J-	0.829	R	0.829	R	0.829	R	0.829	R	0.829	R	0.829	R	0.829	R	0.9	J	0.829	R	0.829	R	22.5	J-	1.5	J-	1.5	J-	23.3	J-	0.829	R	1	J-	1	J-
	Min	1.3		0.829		0.829		0.829		0.829		0.829		0.829		0.829		0.9		0.829		0.829		1.4		0.829		1.4		0.9		0.829		1		1	
	Max	32.6		29.2		33.5		53		29.5		30.2		31.2		29.5		29		33.7		29		29.7		32.4		30.6		36.7		35.5		31.3		40.7	
	Median	4.15		4.3		4.35		3.8		4.1		4.1		4.2		4.1		4.6		4.6		4.2		4.2		4.35		4.45		4.15		4.4		4		4.2	
	Std. Dev.	8.390		7.484		8.777		14.433		7.607		7.836		8.065		7.619		7.221		8.676		7.457		8.850		8.421		7.807		10.676		9.309		8.191		10.662	
TVSS	4/17/2021	1.4		1.3		1.1		1.1		1.6		1	U	1.4		1.2		1.6		1.5		3.74		1.3		1		1.4		1.2		2.5		1	U	1.3	
	5/21/2021	-		1.8		1.4		1.8		1.5		1.2	U	1		2.1		1.1		1.5		1		1.3		1.5		1.4		1.5		1.4		1.3	U	1.4	
	6/13/2021	2.1		1.7		2.7		1.3		2.2		1.7		1.7		1.7		2		2.2		2.3		2.1		2.2		1.7		1	U	1.8		2.1		2.4	
	7/2/2021	1.1		1	U	1.3		1	U	1.5		1.26		2.6		1.3		1.5		1.2		2.1		1.5		1.7		1.6		1.4		1.8		1.9		1.9	
	8/6/2021	1.9		1.9	U	1.5		1.5		2.3		1.5		1.2		1.8		1.8		2.1		1.9		1.4		1.4		2.2		1.4		2		1.5		2.1	
	9/10/2021	1.7		1.5		1		1		1.3		1.3		1.3		1.1		1	U	1.6		1		1.4		1.9		1.5		2.3		1.3		1.6		1.5	
	10/1/2021	1.4		1.5		1.7		1.3		1.5		1.7		1.3		1.5		1.8		1.6		1.7		1	U	1.3		1.6		1.5		1	U	1.4		1.6	
	11/5/2021	1.3		1.9		2.4		1.6		1.6		1.5		1.1		1.1		1.7		2.9		1.1		1.5		1.3		1.6		1.4		1.1		1	U	1.7	
	12/3/2021	2.1		1.7		1.2		1.65		1	U	1.1		2		1.5		1	U	2.4		1.4		1.5		1.8		1.7		1	U	1.7		1.4		1.7	
	1/7/2022	8.9		6.6		9.4		8.7		6.3		8.2		7		7.6		6.6		8.8		7.9		7.7		9.2		6.6		9.6		8.9		7.2		10.1	
	2/4/2022	1.6		1	U	1	U	1.5		1.2		1.4		1		2		2.6		1.3		1	U	1.1		1	U	1.8		1.9		1		1.2		1.8	
	3/18/2022	1.3	J	1.18	R	1.18	R	1.18	R	1.18	R	1.18	R	1.18	R	1.18	R	1.18	R	1.18	R	1.18	R	5.8	J-	1.5	J	1.4	J	6.3	J-	1.18	R	1.18	R	1.18	R
	Min	1.1		1		1		1		1		1		1		1.1		1		1.18		1		1		1		1.4		1		1		1		1.18	
	Max	8.9		6.6		9.4		8.7		6.3		8.2		7		7.6		6.6		8.8		7.9		7.7		9.2		6.6		9.6		8.9		7.2		10.1	
	Median	1.6		1.6		1.35		1.4		1.5		1.35		1.3		1.5		1.65		1.6		1.55		1.45		1.5		1.6		1.45		1.55		1.4		1.7	
	Std. Dev.	2.229		1.507		2.344		2.135		1.428		1.990		1.673		1.794		1.525		2.097		1.964		2.135		2.248		1.453		2.647		2.177		1.702		2.452	

Notes

U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit. Upon application of the U qualifier to a reported result, the definition changes to “not detected at or above the reported result".

UJ = The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

J- = The analyte was positively identified; however, the associated numerical value is likely to be lower than the concentration of the analyte in the sample due to negative bias of associated QC or calibration data or attributable to matrix interference.

R = The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

Acronyms

HEM - hexane extractable material

TVSS - Total Volatile Suspended Solids

TSS - Total Suspended Solids

TKN - Total Kjeldahl Nitrogen

SGT - Silica Gel Treated

Table 5 - Starkist Wastewater Effluent Quality: Pre- and Post-Ocean Dumping 2020 through 2022

Parameter	Units	Period 1: April 6, 2020 to April 5, 2021		Period 2: April 6, 2021 to April 23, 2022		Difference Between Periods 1 and 2		NPDES Permit AS0000019 Limits	
		Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily	Average Monthly	Maximum Daily
Flow rate	MGD	1.72	2.96	1.33	1.95	-23%	-34%	-	2.9
Max Temperature	°F	85	95	81	90	-5%	-5%	90	95
Total Suspended Solids	lbs/day	1,462	4,313	733	1,962	-50%	-55%	4,016	10,101
5-Day Biochemical Oxygen Demand	lbs/day	6,424	9,989	4,332	7,443	-33%	-25%	Monitoring and Reporting Only	
Ammonia Impact Ratio	-	0.023	0.06	0.025	0.07	10%	12%	1.0	1.0
Total Nitrogen	lbs/day	1,356	2,522	798	2,570	-41%	2%	1,600	2,795
Total Phosphorus	lbs/day	76	247	36	325	-53%	32%	240	480
Oil & Grease (HEM)	lbs/day	340	534	234	555	-31%	4%	1,022	2,556
pH Low[1]	std. units	6.7		6.7		0%		6.5	
pH High[1]	std. units	6.9		6.9		0%		8.6	

Notes:

[1] Average daily pH limits are provided, pH is to be maintained within the range of 6.5 to 8.6 at all times.
°F - degrees Fahrenheit
HEM - hexane extractable material
MGD - million gallons per day
lbs/day - pounds per day
% - percent