
Study Report

Comprehensive Survey of the Aquatic Community in the Area of Georgia-Pacific's Outfall 001

Prepared for
Georgia-Pacific Toledo LLC

December 2010

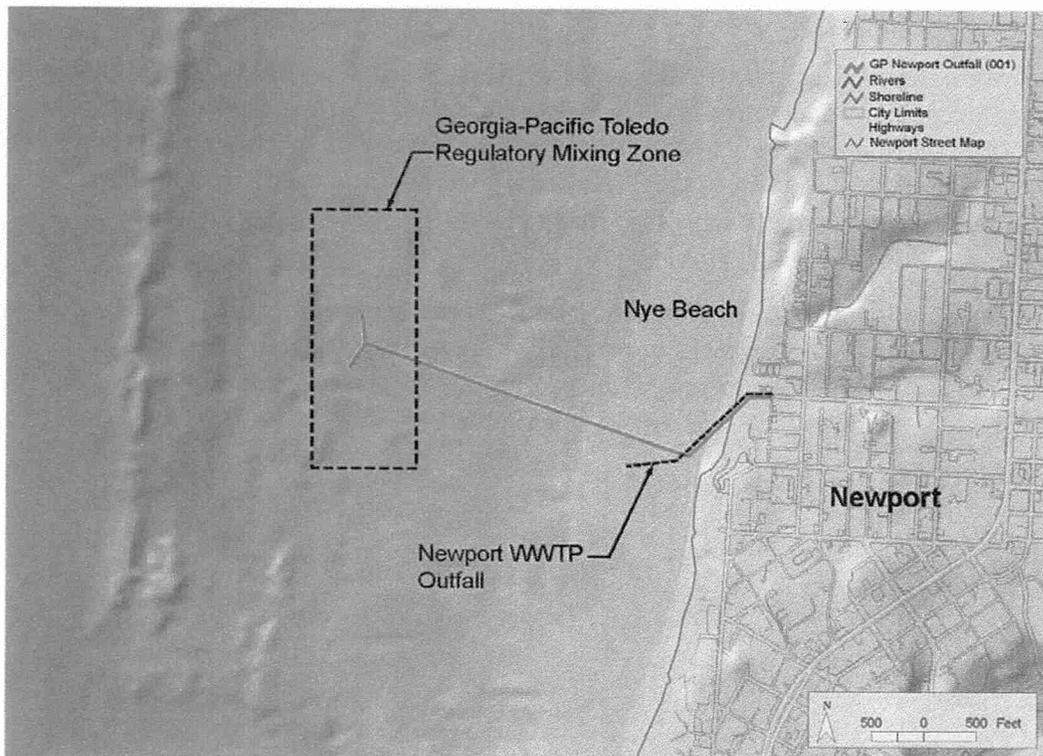
Prepared by
CH2MHILL
2300 NW Walnut Blvd
Corvallis, Oregon 97330

Executive Summary

Background

Georgia-Pacific Toledo LLC (Georgia-Pacific) operates an unbleached Kraft, semi-chemical and secondary fiber pulp and paper mill in Toledo, Oregon. The facility discharges treated wastewater through an ocean outfall (Outfall 001) approximately 4,000 feet offshore of Nye Beach in Newport, Oregon. Outfall 001 is authorized by National Pollutant Discharge Elimination System (NPDES) Permit No. 101409, issued by the Oregon Department of Environmental Quality (DEQ). The NPDES permit defines the zone of initial dilution (ZID) and Regulatory Mixing Zone (RMZ) for Outfall 001 (Figure ES-1). The ZID and the RMZ boundaries are the distances from the diffuser where the discharge must meet acute and chronic water quality criteria for the protection of aquatic organisms, respectively. Outfall 001 terminates with a Y-shaped multiport diffuser that is located at a depth of 32 feet below mean lower low water in a sandy region surrounded on the south, west, and north by shallow siltstone and mudstone reefs. The City of Newport wastewater outfall is located in the shallow near-shore area off Nye Beach and inshore of Outfall 001.

FIGURE ES-1
Georgia-Pacific Outfall 001 and Diffuser and Regulatory Mixing Zone Boundary
GP-Toledo Aquatic Community Survey



Project Basis

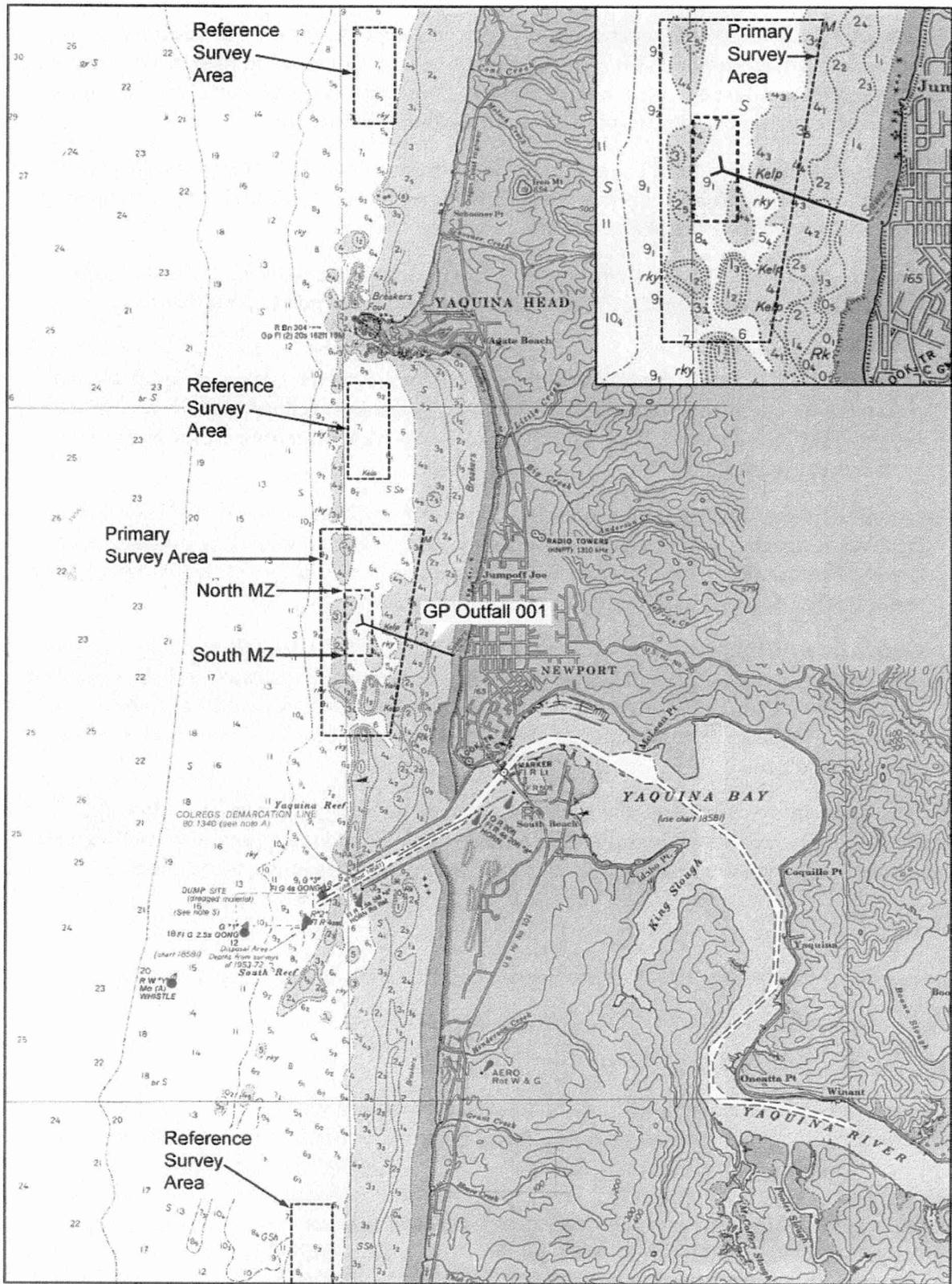
Georgia-Pacific's NPDES permit specifies that a comprehensive survey of the aquatic community in the area around the mill's outfall diffuser and MZ be conducted after study plan review and approval by DEQ. This Aquatic Survey was designed to characterize the physical, chemical, and biological characteristics of the area near Outfall 001 (within the defined mixing zone and surrounding areas to the north and south), and at three reference areas with similar physical sediment characteristics, but distant from the effluent discharge of Outfall 001. This Aquatic Survey is being conducted during two oceanographic periods in 2010 – one prior to the upwelling period (April-May) and one after the summer upwelling period (September-October). Data collected during the spring of 2010 are analyzed in this report.

The project study area consists of the nearshore region of the Pacific Ocean along the Oregon coast from 2 miles north of Yaquina Head to approximately 3 miles south of the Yaquina Bay entrance jetties (Figure ES-2). Figure ES-2 shows the overall project study area and identifies the Nye Beach Offshore Area (which includes the MZ Region, South Mixing Zone [SMZ] Region, North Mixing Zone [NMZ] Region), South Beach Reference [SBR] Region, South Yaquina Reference [SYR] Region, and North Yaquina Reference [NYR] Region. The conditions at the Outfall 001 diffuser are coastal ocean conditions that are dominated by tidally driven currents and wave-induced mixing. Coastal winds are also a key input to the ambient conditions. During summer, strong and persistent northwesterly winds generate large-scale coastal water transport to the south that causes upwelling of deep waters into the nearshore coastal region. This study was designed to collect field measurements before (spring) and after (fall) the summer upwelling period.

In accordance with the NPDES permit, Georgia-Pacific developed a study plan in 2009 that described the approach and suggested methods to collect data to represent the benthic community and physical and chemical conditions in the Outfall 001 mixing zone (MZ), immediately outside the MZ, and at several reference sites during two distinct oceanographic seasons (fall and spring). The Study Plan was approved by DEQ in August 2009.

Prior to the start of field studies, and in accordance with the approved Study Plan, Georgia-Pacific submitted the *Quality Assurance Project Plan for the Aquatic Survey of Outfall 001* (QAPP) to DEQ in March 2010 for review, and the final QAPP was approved by DEQ on April 21, 2010. Field survey activities occurred during the period May 5 – June 1, 2010.

FIGURE ES-2
Georgia-Pacific Aquatic Survey Study Areas and Regulatory Mixing Zone Boundary
GP-Toledo Aquatic Community Survey



395023.B1.22_ES092009001SEA_Fig2-1_MarineHabitatSurveyAreas_Sep2010.ar

Objectives

The objectives of this Aquatic Survey include the following:

- Obtain data to define the seabed bathymetry and general marine habitat conditions (using multibeam sonar) within the Outfall 001 MZ, from areas immediately outside the MZ, and from reference sites. Use these environmental maps to compare study sites and to summarize the physical habitat similarities and differences.
- Obtain data that represent the sediment physical and chemical conditions, as well as seasonal benthic infauna community data from within the Outfall 001 MZ, from areas immediately outside the MZ, and from reference areas.
- Analyze the benthic infauna community data to determine whether the community within the MZ is different from the communities outside the MZ and from reference sites.
- Use the results of the seabed sediment samples for a screening-level comparison with the sediment chemical criteria in the Sediment Evaluation Framework for the Pacific Northwest (USACE et. al, 2009) and those in the NOAA Screening Quick Reference Tables (Buchman, 2008).
- Obtain data that represent the receiving water characteristics within the Outfall 001 MZ, from areas immediately outside the MZ, and from reference sites. Use the results of water column samples to compare with the chemical criteria for the protection of aquatic organisms as defined in the Oregon water quality standards.
- Obtain data that represent the effluent characteristics of Outfall 001 and City of Newport wastewater, as well as the creek runoff quality of Nye Creek during the field sampling period. Evaluate and compare the results of effluent and creek runoff samples to determine whether any potential exists for these sources to affect the near-shore water quality conditions.

To meet these study objectives, the project team selected and implemented sampling methods that provide representative and reliable samples of water, sediment, and aquatic organisms, and applied rigorous field and laboratory methods and quality control.

Study Results

The results of the Spring 2010 Aquatic Survey of Outfall 001 are summarized below by survey topic.

Marine Habitat Survey

The Marine Habitat Survey used remote-sensing technology (multibeam sonar) to map the bathymetry and acoustic backscattering strength (seabed sediment characteristics) of the Nye Beach Offshore Area (which included the MZ, SMZ, and NMZ Regions and three reference sites: SBR, SYR, and NYR). The environmental maps that were generated from the survey were used to define the six study regions and to summarize the similarities and differences associated with the physical habitat. Three different types of figures have been

developed from the multibeam survey data for each survey area: depth contour plot, 3-dimensional bathymetry chart, and backscatter chart that show two distinct types of seafloor substrates.

- The survey of the Nye Beach Offshore Area included the MZ Region, and areas north and south of the MZ captured complex seabed features and bathymetry. There are extensive siltstone and mudstone reef outcroppings in this area, particularly to the north, south, and west of Outfall 001 and the MZ. These shallow siltstone reefs and mudstone reefs are ancient geological features.
- The areas encompassed by the Outfall 001 MZ consist primarily of unconsolidated sands, with siltstone and mudstone outcrops. These outcroppings are especially prominent at 1,800 to 2,000 feet offshore of the Outfall 001 diffuser and 2,000 to 2,500 feet south of the diffuser site. The Outfall 001 diffuser is located in a relatively flat area consisting mostly of unconsolidated sediments (sands). The relatively shallow depth of the siltstone and mudstone reefs, located west of the Outfall 001 diffuser, causes large incoming waves to break over the reefs, leading to wave-induced erosion and sediment movements on the landward side.
- The geomorphology of the seabed in the SBR Region is very similar to that of the Nye Beach Offshore Area. This reference location consists of linear features of sandstone and mudstone outcrops that match the alignment and features recorded off Nye Beach. The SBR Region shows areas of unconsolidated sediments (sand) deposited between the prominent reef outcrop areas.
- The SYR Region is located approximately 1.5 nautical miles north of the MZ Region and 0.5 mile south of Yaquina Head. Nearly all of this survey area is gently sloping, and the depth contours bend slightly and follow a more northwest orientation as they begin to approach Yaquina Head. The southwest corner of the SYR Region exhibits a relatively large area of exposed sandstone and mudstone reef.
- The NYR Region is located approximately 2 nautical miles north of Yaquina Head. This reference area consists primarily of unconsolidated sediments (well sorted fine sands). Exposure to waves and wave-induced currents would be expected to result in greater seasonal sediment movements in this region.
- The marine habitat survey was completed first to provide detailed physical maps of the study areas to be sampled, and these new charts were used in the field to guide the location of the sediment and benthic infauna sampling sites. Once sampling sites were selected for each region, then the same sites were visited for water quality sampling.

Sediment Quality Survey

Marine surface sediment composite samples were collected from 18 sampling stations that were located with three sampling sites in each of six separate regions: Mixing Zone (MZ), South Mixing Zone (SMZ), North Mixing Zone (NMZ), South Beach Reference (SBR), South Yaquina Reference (SYR), and the North Yaquina Reference (NYR). Sediment sampling was conducted at the same time as benthic infauna sampling, but samples were collected from separate grab samples. Unconsolidated sediments (marine sands) were sampled (avoiding

siltstone and mudstone outcrops) since these sediments contain benthic infauna organisms and deposited materials.

- Sediment samples from the MZ Region were 97 percent fine sands, with low organic content at all sites. Organic content was measured as total volatile solids and as total organic carbon. Sediment concentrations of metals, cyanide, and phenolics in the MZ sites were well below the sediment screening criteria (sediment chemical criteria in the Sediment Evaluation Framework for the Pacific Northwest, USACE, et. al, May 2009; and NOAA Screening Quick Reference Tables, Buchman, 2008).
- Sediment samples from the NMZ and SMZ Regions were 94 to 98 percent fine sands, with low organic content at all sites. Sediment concentrations of metals, cyanide, and phenolics in these regions were well below the sediment screening criteria.
- The *Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment* (DEQ, 2007) includes proposed background sediment chemical levels for marine sediments in Oregon. All sediment concentrations in the MZ, NMZ and SMZ samples were below these proposed background levels.
- Sediment samples from the SBR Region were 94 to 95 percent fine sands, with low organic content at all sites. Sediment concentrations of chromium, lead, nickel, mercury, selenium, tin, and zinc were higher in SBR than in the MZ, SMZ, and NMZ sediments. The location of the SBR Region approximately 2 miles south of the Yaquina Bay entrance may account for these higher levels of metals in surface sediments. Sediment concentrations of metals, cyanide, and phenolics in this region were all well below the sediment screening criteria.
- Sediment samples from the SYR and NYR Regions were 94 to 98 percent fine sands, with low organic content at all sites. One site (NYR-1) consisted of 11 percent medium sands and 86 percent fine sands. Sediment concentrations of metals, cyanide, and phenolics in these regions were well below the sediment screening criteria.
- Marine sediments collected within the MZ Region had chemical concentrations equal to or less than those reported for the three reference regions and the SMZ and NMZ regions. Sediment physical characteristics in the MZ Region were more similar to those in SBR than to sediments in the SYR and NYR Region. There is no indication of any effect of the Outfall 001 discharge on the marine sediments in the MZ Region.

Benthic Infauna Community Survey

The Benthic Infauna Community Survey was designed to collect replicate surface sediment samples from the Outfall 001 MZ, near the MZ, and from three reference areas to allow direct comparisons of the communities of organisms dwelling in the sediments. Benthic infauna sampling was conducted concurrently with sediment chemistry sampling, but from separate grab samples.

- A total of 5,206 organisms were collected and 58 taxonomic classifications (primarily species) were identified from the 90 benthic infauna samples. A total of 790 individual organisms were identified within the MZ sites, 641 in the NMZ Region, and 675 in the SMZ Region. There were 922 individual organisms identified within the SYR Region;

1,027 within the SBR Region; and 1,151 within the NYR Region. A total of 28 taxonomic classifications were identified within the MZ, 34 in the NMZ, and 27 in the SMZ. At the reference sites, there were 35, 28, and 36 taxonomic classifications within the samples collected in the SYR, SBR, and NYR Regions, respectively.

- Statistical analysis of benthic infauna organism abundances indicated that five regions are statistically similar in abundance (NMZ, SMZ, SBR, MZ, and SYR) and that the NYR and SYR Regions are similar.
- Benthic infauna community evenness index and a diversity index were calculated to represent the condition of the benthic infauna communities in the study area. The median species diversities for the NMZ, MZ, SBR, and NYR were within range of each other, and the SMZ and SYR were essentially outside the other four regions.
- Statistical analysis of benthic infauna community diversity (based on 15 replicates for each region) shows that four regions are statistically similar in diversity: SMZ, SBR, MZ, and NMZ. Additional grouping by diversity includes the NYR, MZ, SBR, and NMZ Regions, and then the SYR and NYR Regions.
- These analyses of the benthic infauna community data show trends that the SBR, SMZ, MZ, and NMZ regions are grouped as similar (sometimes including NYR), while the SYR and NYR Regions are grouped as similar. These results demonstrate that the benthic infauna community within the Outfall 001 MZ is not different from the communities outside the MZ or at the reference sites. The benthic community results from the fall sampling event will be used to distinguish site-specific trends from seasonal trends in the benthic community.

Effluent and Creek Runoff Survey

Effluent and creek runoff that discharge into the near-shore waters off Nye Beach were sampled during the Offshore Marine Water Survey. Composite samples of the Georgia-Pacific Toledo Mill effluent, City of Newport effluent, and Nye Creek runoff were collected during the day of offshore marine water sampling in the MZ Region and on the following day.

- Outfall 001 effluent total phenolics, color, turbidity, TSS, and 5-day biochemical oxygen demand (BOD₅) were consistent between sampling days and with other routine effluent monitoring for the Toledo Mill. Resin and fatty acids were measured in low concentrations, and most resin and fatty acid compounds were not detected in these effluent samples.
- Outfall 001 effluent total recoverable metals and cyanide concentrations were all below the acute and chronic water quality criteria for the protection of aquatic life with the exceptions of copper (above acute and chronic criteria) and lead (only above chronic criteria). Effluent ammonia concentrations were also greater than acute and chronic criteria. These effluent concentrations are for samples collected at the Georgia-Pacific Toledo Mill, prior to discharge through the marine outfall diffuser. The minimum dilution factors for the marine outfall diffuser are defined in the Georgia-Pacific NPDES Permit for Outfall 001 as 52 at the ZID and 175 at the MZ boundary. After the Outfall 001 effluent is mixed with the seawater (application of these dilution factors), then ammonia,

copper, and lead are reduced to concentrations that are much less than the acute and chronic criteria for the protection of aquatic organisms.

- The Newport effluent ammonia had a wide range between sampling days. Effluent turbidity, TSS, BOD₅, and total phenolics were consistent between sampling days. Two resin and fatty acids were measured in low concentrations (estimated values), and most resin and fatty acid compounds were not detected in the effluent sample.
- Newport effluent total recoverable metals were all below the acute and chronic water quality criteria for the protection of aquatic life. Effluent ammonia on May 25 was above acute and chronic criteria levels. Effluent free cyanide concentrations were measured at two times greater than the Georgia-Pacific effluent concentrations; these were slightly above the acute and chronic water quality criteria for the protection of aquatic life. Newport effluent is discharged through a shallow outfall off Nye Beach and inshore of the Outfall 001 MZ.
- Nye Creek runoff was estimated at 10 to 15 gpm on May 24 and at 30 to 60 gpm on May 25, when there was steady rainfall. The Nye Creek samples measured ammonia, color, TSS, and turbidity. BOD₅ and total phenolics were not detected. Nye Creek total recoverable metals and free cyanide values were below the acute and chronic water quality criteria for the protection of aquatic life, with the exception of copper in the second-day sample. The ammonia concentration in Nye Creek on May 25 exceeded the chronic water quality criteria for the protection of aquatic life in marine waters.

Marine Water Quality Survey

Water column data were collected at the six regions on two separate days: on May 24 at MZ, NMZ, SMZ, and SYR before sea conditions in the study area degraded to hazardous, and on June 1 at SBR and NYR. Persistent south-southwest winds and rough seas after May 24 delayed the completion of sampling at the last two regions. On June 1, the remaining sampling was completed at the NYR and SBR Regions.

- The MZ stations were sampled during flood tide on May 24; two of the three stations were sampled in the visible Outfall 001 discharge plume during flood tide. A pycnocline (density layer) was observed at stations MZ-1 and MZ-3 (in plume) at depths of approximately 6 to 7 meters. At these stations, the mid-depth water samples were collected below the pycnocline depth.
- The water column profile measurements show that the pH of 8.0 at all MZ stations is nearly linear from surface to bottom, dissolved oxygen ranged from 10.0 to 9.0 milligrams per liter (mg/L) from surface to bottom, and turbidity did show a slight increase below the pycnocline, which may indicate the presence of the discharge plume and may also indicate the re-suspension of sediments as a result of tidal and wave-induced bottom currents. The water column measurements for photosynthetically active radiation or PAR (representing solar light transmittance) in the MZ provide a possible correlation with the presence of the Georgia-Pacific plume at the water surface during flood tide.
- There were no detected phenolics, resin and fatty acid compounds, or ammonia in the MZ seawater samples. Other nutrients were detected, but only at levels equivalent to the

values at the reference sites. Seawater concentrations of TSS were roughly equivalent at all regions except for the SBR Region, where higher values were measured. These higher TSS values in the SBR stations may be attributable to the proximity to the discharge of Yaquina Bay. Seawater concentrations of color were roughly equivalent at all regions except the MZ during flood tide. There are no marine water quality criteria for TSS and color in the Oregon water quality standards.

- Seawater total recoverable metals and cyanide concentrations in the MZ samples were well below the acute and chronic water quality criteria for the protection of aquatic life.
- For the SMZ Region, a weak pycnocline was observed at stations SMZ-1 and SMZ-2 at depths of about 6 to 8 meters, during the flood tide. The density profile for SMZ-2 exhibits the strongest density gradient within the SMZ Region, occurring between depths of 7 and 8 meters.
- Comparison of the PAR measurements at the NMZ and SMZ Regions showed that those at the NMZ Region during ebb tide were generally higher than those measured at the SMZ Region during flood tide (especially in the near-surface waters). This result is presumably a function of the measurements having been taken later in the day (for example, 0900 - 1000 hours at the SMZ Region, compared with 1200 - 1300 hours at the NMZ Region).
- There were no detected phenolics or ammonia in the NMZ and SMZ seawater samples. Color values were uniform (3 to 7 color units [CU]) across all sampling sites and depths. TSS values were elevated only in the surface sample at NMZ-1 and NMZ-2, and in the bottom sample at NMZ-2. These TSS results do not correlate with color values at these sites and are believed to be from suspended materials from tidal and wave-induced bottom currents. Sea conditions during sampling at the NMZ Region were 2- to 3-foot seas with 5 to 7-foot swells.
- Seawater total recoverable metals and free cyanide concentrations in the NMZ and SMZ samples were well below the acute and chronic water quality criteria for the protection of aquatic life.
- Water quality profiles at all the reference regions – NYR, SYR, and SBR – demonstrate a well mixed water column. At the SBR Region, a pycnocline was observed at all stations (SBR-1, SBR-2, and SBR-3) at depths between approximately 4 and 6 meters. At the NYR and SYR Regions, no distinct pycnoclines were observed to occur at any of the stations occupied.
- The three sets of reference seawater sample showed no detected phenolics or ammonia, similarly to the MZ seawater samples. Color values were uniform and low (2 to 6 CU) across all sampling sites and depths. TSS values were elevated only in the bottom samples at SBR-2 and SYR-3.

- In reviewing seawater metals results for all regions, seawater concentrations of cadmium and silver were two orders of magnitude below the marine chronic criteria, and arsenic values were more than one order of magnitude below the marine chronic criteria. The marine chronic criterion is more stringent (lower) than the acute criterion. Seawater concentrations of chromium and copper were roughly equal at all regions, and copper was four times lower than the marine acute and chronic criteria (there are no acute and chronic seawater criteria for total chromium). Seawater concentration of mercury were near or below the detection limit at the MZ, NMZ, SYR, and NYR Regions, and measurable at the SMZ and SBR Regions. These measured seawater mercury values were more than an order of magnitude less than the marine chronic criteria. Seawater concentrations of nickel, lead, and selenium were roughly equal at all regions except for lead and selenium levels in the MZ Region, where higher values were measured, but these values were still well below the marine acute and chronic criteria. Seawater concentrations of zinc and free cyanide were equal at all regions except for higher free cyanide values in the MZ Region. The free cyanide levels measured in the MZ Region were still three times lower than the marine chronic criteria.
- Seawater metals concentration within the MZ region were at least one order of magnitude lower than the marine chronic criteria levels.

Overview

Data collected during in the spring 2010 period are analyzed in this report; based on these results, no changes are recommended for the fall 2010 study period. The Marine Habitat Survey completed during spring 2010 provided detailed physical relief, and sediment-type maps and will not be repeated in the fall.

This Aquatic Survey applies a tiered assessment study approach, as defined in *Clean Water Action Plan: Coastal Research and Monitoring Strategy* (U.S Environmental Protection Agency's [EPA], 2000a). The tiered approach applies different levels (or tiers) of sampling and chemical analyses to evaluate a site's potential media contamination and/or biological impairment. This Aquatic Survey is a Tier 1 study to develop survey information, based on standardized methods, to identify potential chemical contamination of environmental media and/or impairment of established biological communities. Only if contamination or impairment were demonstrated, compared with reference sites, would Tier 2 studies be developed. The results of the spring sampling event indicate that Tier 2 studies are not warranted, and this will be reevaluated with the results of the fall sampling.