



HOWE SOUND PULP AND PAPER ENVIRONMENTAL EFFECTS MONITORING CYCLE SIX

FINAL

Prepared for:

HOWE SOUND PULP AND PAPER
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MARCH 2013

HS1625.2



EXECUTIVE SUMMARY

The Environmental Effects Monitoring (EEM) Cycle Six program for Howe Sound Pulp and Paper (HSPP) ran between April 2010 and April 2013, and included sublethal toxicological testing of mill effluent, benthic invertebrate community survey with a supporting sediment quality assessment, and a dioxin/furan monitoring survey of sediment, crab and finfish in support of the EEM fish tissue survey.

Sublethal toxicity testing was undertaken six times from 2010 to 2012 at the Howe Sound pulpmill. There were observed effects of mill effluent on echinoderm fertilization at a mean effluent concentration of 12.3% (IC25) and effects on *Champia parvula* reproduction at a mean effluent concentration of 1.0% (IC25). Based on a 1% effluent concentration zone of 2,000 m from the diffuser, maximum potential zones of sublethal effect from the effluent discharge point were 162 m for invertebrate fertilization, and 1,995 m for algal reproduction.

In March 2012, sediments, crabs, and finfish (spiny dogfish) were collected from various historical sites in Howe Sound for organochlorine analyses. Concentrations of dioxins and furans in sediments near the mill were within the lower end of the historical range. Concentrations of dioxins and furans in hepatopancreas tissue of Dungeness crab collected from three (C14, C19a, and C28, throughout Howe Sound) of the eight sampling sites exceeded the Health Canada consumption criteria (24.4 pg/g), while levels at the remaining five sites were below the criteria. The total TEQ concentration in dogfish liver was 11.5 times greater than the Health Canada criteria (30.0 pg/g liver). An exceedance was not observed in dogfish muscle tissue. Based on data collected in Cycle Six and similar to previous years, concentrations of dioxins and furans appear to be exhibiting a decreasing trend in sediment near the diffuser, and in Dungeness crab and dogfish captured in Howe Sound.

The benthic invertebrate survey, conducted in March 2012, used a gradient design including twelve stations located in Howe Sound. Absolute distance from the diffuser and carbon/nitrogen (C/N) ratio in sediment were used as exposure gradients to compare benthic community metrics and sediment quality among stations.

Benthic invertebrate community densities and the Bray-Curtis dissimilarity index exhibited clear spatial trends along the distance exposure gradient. Density generally decreased with increasing distance from the diffuser and exposed communities located further from the diffuser were more similar to reference communities. However, only the difference in the Bray-Curtis index exceeded the critical effects criteria. Taxa richness, evenness, and diversity did not show any significant spatial trends with the exposure gradient.

Sediments to the south of the diffuser exhibited some organic enrichment but an improvement in oxygen conditions compared to Cycle Three. Sediment at stations to the north of the diffuser exhibited a decrease in organic content, with exception of station HSB8A, and exhibited a better oxidative state compared to Cycle Three. Possible sources of nutrient enrichment included log booming activities, particularly to the south of the diffuser, and the degrading historical fibre mat near the pulpmill, which is still present in some areas, particularly to the north of the diffuser.

Based on trends across EEM cycles, it is evident that conditions in Howe Sound with respect to sediment quality and benthic invertebrate communities continue to improve. Sources of nutrient enrichment, which likely contributed to the higher densities and TOC and TN concentrations at near-field stations included the degrading historical fibre mat to the north of the pulpmill and log booming activities to the south, rather than current effluent conditions.