

Sediment Quality Assessment of Puget Sound's Hood Canal Region, 2004

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Sediment Quality In Hood Canal

- * Highest sediment quality was measured in shallow sediments in the entrance sill and along the eastern shoreline of central Hood Canal.
- * The majority of sediments in central and southern Hood Canal were moderately degraded.
- * Sediments in the deep, south-central Dabob Bay stations were of intermediate/ degraded quality.
- * No sediments were of degraded quality.
- * A high percentage of stations with only impaired benthos and no chemical contamination or toxicity may have been affected by low dissolved oxygen levels.

PSAMP Sediment Monitoring in Hood Canal in 2004

A sediment quality survey was conducted in Hood Canal in 2004 by the Washington State Department of Ecology (Ecology) as part of the Puget Sound Assessment and Monitoring Program (PSAMP).

The goal of this survey was to evaluate the quality of sediments throughout the Hood Canal monitoring region.

This region includes the length of Hood Canal and Port Gamble, Port Ludlow, and Dabob Bay (Figure 1). Sediment samples were collected at 30 randomly selected locations throughout the 295 km² study area.

The upper layers of each sample were analyzed to determine (1) the concentrations of potentially toxic chemicals, (2) degree of response in a laboratory test of toxicity, and (3) measures of health of the sediment-dwelling invertebrates (*benthos*) living in each location.

These three elements, commonly referred to as the Sediment Quality Triad, are combined as Ecology's Sediment Quality Triad Index (SQTI) to determine geographic patterns and spatial extent of sediment quality degradation in the Hood Canal study area.

Ecology compared these 2004 results with similar Hood Canal data collected in 1999 to determine changes over time.

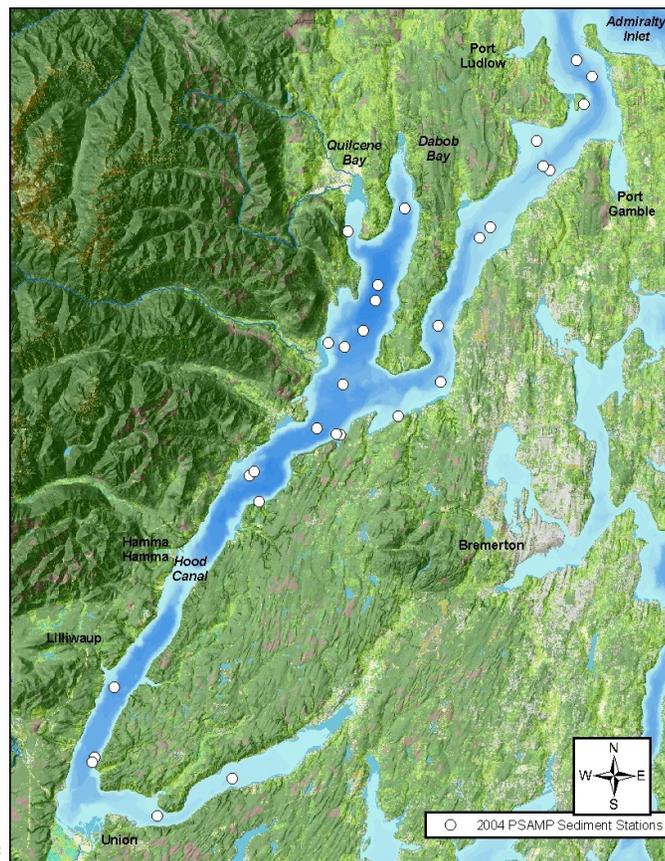


Figure 1. Locations of the 30 sampling stations for the 2004 PSAMP Sediment Component Hood Canal monitoring region.

None of the samples were classified as chemically contaminated.

17% of the samples and 18% of the study area were toxic.

Benthic invertebrate communities were adversely affected in 77% of the Hood Canal stations.



Sediment sampling in Hood Canal - C.M. Eaton

Chemical Contamination

Laboratory analyses were performed for over 120 chemicals and sediment properties.

None of the chemical concentrations in the 30 samples were higher than individual Washington State Sediment Quality Standard (SQS) or

Cleanup Screening Level (CSL) values. Therefore, the incidence and spatial extent of chemical contamination relative to the State standards was zero for the Hood Canal region.

Patterns of concentrations of mixtures of some

chemicals were slightly higher in the south-central Dabob Bay stations than elsewhere. These concentrations tended to decrease slightly toward the entrance to Hood Canal at Admiralty Inlet.

Toxicity

Sediment toxicity was determined in laboratory tests by examining the effect of sediment porewater on fertilization success of gametes from the Pacific purple sea urchin.

Five of the 30 Hood Canal samples (17%) had a toxic response.

The estimate of the spatial extent of toxicity was 52 km², equivalent to 18% of the survey area.

The toxicity data showed a distinct spatial pattern, with toxicity highest at the deepest stations in south-central Dabob Bay and generally diminishing away from this location.

Benthic Community Composition

Composition, diversity, and abundance of the benthic community at the 30 sampled stations changed noticeably both along the length of the canal and with station depth.

Many of the stations on the relatively shallow entrance sill and along the eastern shoreline of central Hood Canal had the highest abundance, diversity, and number of dominant species.

Near the canal entrance, the relatively stress-tolerant species of annelids were less abundant, whereas some of the more stress-sensitive amphipods, molluscs, and

echinoderms were relatively abundant.

In contrast, the benthos at many of the deepest stations in south-central Dabob Bay and in central Hood Canal near the confluence with Dabob Bay were dominated by stress-tolerant annelids. Arthropods and echinoderms were rare or absent at these stations.

Abundance, diversity, and dominance often were lowest in these locations.

Most of the stations in central and southern Hood Canal also had relatively low taxa richness, and were dominated by annelids and bivalves.

The benthos were classified as unaffected at four stations in the entrance of Hood Canal and at three stations along the eastern shoreline of central Hood Canal.

These stations had coarse sediments, low organic carbon content, and relatively high dissolved oxygen levels.

Benthic invertebrate communities were considered to be adversely affected at 23 of the 30 (77%) of the stations. These stations occurred throughout Hood Canal from the entrance to southern Hood Canal, and in Dabob Bay.

Sediment Quality Triad Index (SQTI)

The SQTI combines the chemical contamination, toxicity, and benthic invertebrate data into a 4-level scale from high to degraded sediment quality. The SQTI station designations in Hood Canal in 2004 are displayed in Figure 2.

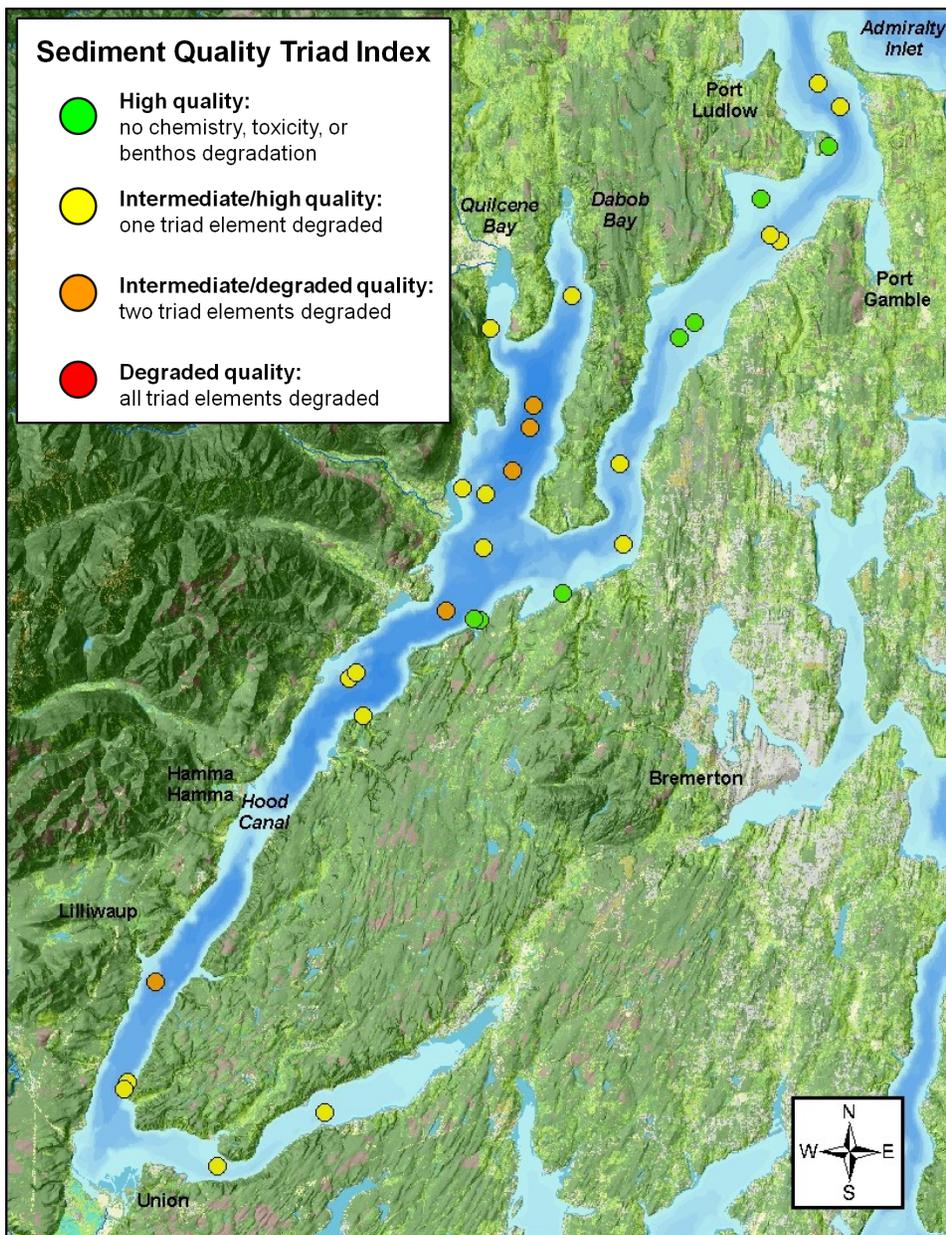
Among the 30 stations, 7 were classified as high quality, 18 as intermediate/high quality, 5 as intermediate/degraded, and none as degraded. These stations

represented 65, 178, 52, and 0 km² of the region's sediments, respectively, equivalent to 22%, 60%, 18%, and 0%, respectively, of the total Hood Canal survey area (Table 1).

Overall, the sediments in the deep, south-central Dabob Bay stations were most degraded (Figure 2). They were highly toxic in the laboratory tests of porewaters and supported impaired benthic

communities often dominated by species that are known to tolerate hypoxia and/or chemical contamination.

Sediments in central and southern Hood Canal also were moderately degraded. Sediments at the shallow stations in the entrance sill and along the eastern shoreline of central Hood Canal were the least degraded.



A high percentage of stations with impaired benthos and no chemical contamination or toxicity may have been affected by low dissolved oxygen, a common occurrence in Hood Canal.

Figure 2. Spatial patterns in sediment quality based on the Sediment Quality Triad Index in the 2004 PSAMP Sediment Component Hood Canal regional survey.

**This paper is a
summary of the report:**

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[www.ecy.wa.gov/
biblio/1003005.html](http://www.ecy.wa.gov/biblio/1003005.html)



General information
and all data generated
for this report can be
accessed from Ecology's
Marine Sediment
Monitoring website:
[www.ecy.wa.gov/
programs/eap/psamp/
index.htm](http://www.ecy.wa.gov/programs/eap/psamp/index.htm)

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Comparisons between years and among Puget Sound Sediment Monitoring Regions

Based on the weight-of-evidence of chemistry, toxicity, and benthos data compiled as the Sediment Quality Triad Index (Table 1), the percentage of the Hood Canal region with high quality sediments decreased somewhat from 1999 to 2004. During this same time, the area classified as intermediate in quality increased considerably. However, because of the lack of chemical contamination, the area classified as degraded was zero in both 1999 and 2004.

In comparison to Puget Sound-wide sediment quality data collected from 1997-2003, Hood Canal in 2004 had much lower incidence and spatial extent of high quality sediments, much higher incidence and spatial extent of intermediate sediments, and a somewhat lower amount of degraded sediments.

Sediment Quality Triad Index Category	Incidence		Spatial extent	
	Number of stations	(%) of stations	km ²	(%) of study area
Hood Canal 2004	30	(100.0)	294.8	(100.0)
High	7	(23.3)	64.6	(21.9)
Intermediate/high	18	(60.0)	178.1	(60.4)
Intermediate/degraded	5	(16.7)	52.1	(17.7)
Degraded	0	(0.0)	0.0	(0.0)
Hood Canal 1999	21	(100.0)	316.4	(100.0)
High	7	(33.3)	111.2	(35.1)
Intermediate/high	10	(47.6)	165.1	(52.2)
Intermediate/degraded	4	(19.1)	40.1	(12.7)
Degraded	0	(0.0)	0.0	(0.0)
Puget Sound 1997-2003	381	(100.0)	2388.6	(100.0)
High	241	(63.3)	2006.8	(84.0)
Intermediate/high	89	(23.4)	332.9	(13.9)
Intermediate/degraded	36	(9.4)	44.8	(1.9)
Degraded	15	(3.9)	4.1	(0.2)

Table 1. Comparisons in estimated incidence and spatial extent of categories of relative sediment quality based on the Sediment Quality Triad for Hood Canal and Puget Sound-wide.

Management Recommendations

Recommendations for future MSMT activities based on this 2004 Hood Canal study include:

- * Continue to provide *status and trends* and *effectiveness monitoring* information for Hood Canal to the Puget Sound Partnership and others for adaptive management strategies.

- * Continue to cooperate with scientists and managers from the Hood Canal Dissolved Oxygen Program to provide the latest information on sediment quality in Hood Canal and its relationship to low dissolved oxygen in water and sediments.

- * Develop multi-metric benthic indices for Puget Sound, and reexamine the SQTl.

- * Use standardized sampling and analysis methods among years to ensure comparability of past and future data.

Details are provided in the full report (see sidebar on this page).