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OCEAN DISPOSAL ACTIVITIES SUMMARY

1993

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Report No. 97 - 01

Regional Program Report by:

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ABSTRACT

Environment Canada's administration of the Canadian Environmental Protection Act (CEPA) Part VI, regarding ocean disposal of wastes, is summarized in this report. Disposal activities from January 01, 1993 to December 31, 1993 in the Pacific and Yukon Region are specifically documented. The sites in this region are used primarily for disposal of dredge and excavation spoils. Activities at these sites from 1975 to 1992 have been compiled in a series of reports by Ward and Sullivan (1980), Sullivan (1987) and Kim and Sullivan (1993). This report is a continuation of this series and includes information on 17 disposal sites that were active in the Pacific and Yukon Region in 1993. Data are presented for monitoring done at six of these sites.

RÉSUMÉ

Ce rapport concerne les activités d'Environnement Canada en matière d'application de la partie VI de la Loi canadienne sur la protection de l'environnement (LCPA) (dépôts de déchets en mer). Il traite plus spécifiquement d'activités de dépôts qui ont eu lieu du 1^{er} janvier au 31 décembre 1993 dans certains sites de la région du Pacifique de du Yukon. Les sites de cette région servent principalement du dépôt des matériaux de dragage et d'excavation. Les activités de dépôt pour la période comprise entre 1975 et 1992 ont été compilées dans une série de rapports préparés par Ward et Sullivan (1980), Sullivan (1987) et Kim et Sullivan (1993). Ce rapport s'inscrit dans cette série et contient de l'information sur les activités de 17 sites de dépôt dans la région du Pacifique et du Yukon au cours de l'année 1993. Les données fournies concernent les contrôles effectués dans six de ces sites.

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1.0 INTRODUCTION

Environment Canada has administered the requirements for ocean disposal of wastes since 1975 under authority of the Ocean Dumping Control Act (ODCA). In 1988 this legislation was replaced by the Canadian Environmental Protection Act (CEPA), Part VI. Material destined for ocean disposal requires a permit issued by Environment Canada. To ensure compliance with the conditions of the permit, inspections are routinely conducted by Environment Canada, Enforcement and Emergencies Division.

Within Canada, ocean disposal sites are divided into four geographical regions: Atlantic, Prairie and Northern, Quebec, and Pacific and Yukon (Figure 1 shows the Pacific and Yukon Region). This report describes all the activities conducted in 1993 by the Ocean Disposal Control Program in the Pacific and Yukon Region. There are thirty-five designated sites in the Region concerned primarily with dredge and excavation spoils. In 1993 fourteen disposal sites were used and six were monitored (Table 1).

2.0 ADMINISTRATION

2.1 APPLICATION AND REVIEW PROCESS

Under the authority of CEPA, Part VI, material destined for ocean disposal or loaded for the purpose of ocean disposal requires an Ocean Disposal Permit. Applications are reviewed by Environment Canada with advice from the Regional Ocean Disposal Advisory Committee (RODAC). This committee has representation from Environment Canada, the Department of Fisheries and Oceans, and the British Columbia Ministry of Environment, Lands and Parks. Information on the application process can be obtained from Environment Canada, Pacific and Yukon Region, 224 West Esplanade, North Vancouver, B.C., V7M 3H7. Figure 2 shows the complete permitting process.

As part of the Green Plan Initiative, amendments to Ocean Disposal Regulations are being made. Phase I, including the revision of application fees and forms has been completed. A new application form was created and the information requirements to be supplied by the applicant have been increased. The new application form was introduced on October 01, 1993 with the application fee increased to \$2 500 to reflect the actual cost of permit review.

The applicant must inform the public with a Notice of Intent published in a local newspaper. Public concerns and comments are addressed to Environment Canada throughout the permit review process. Under the Environmental Assessment Review Process (EARP) Guidelines Order Section 15, in effect in 1993, Environment Canada posted notices to issue Ocean Disposal Permits on the Ocean Disposal Notice Board at

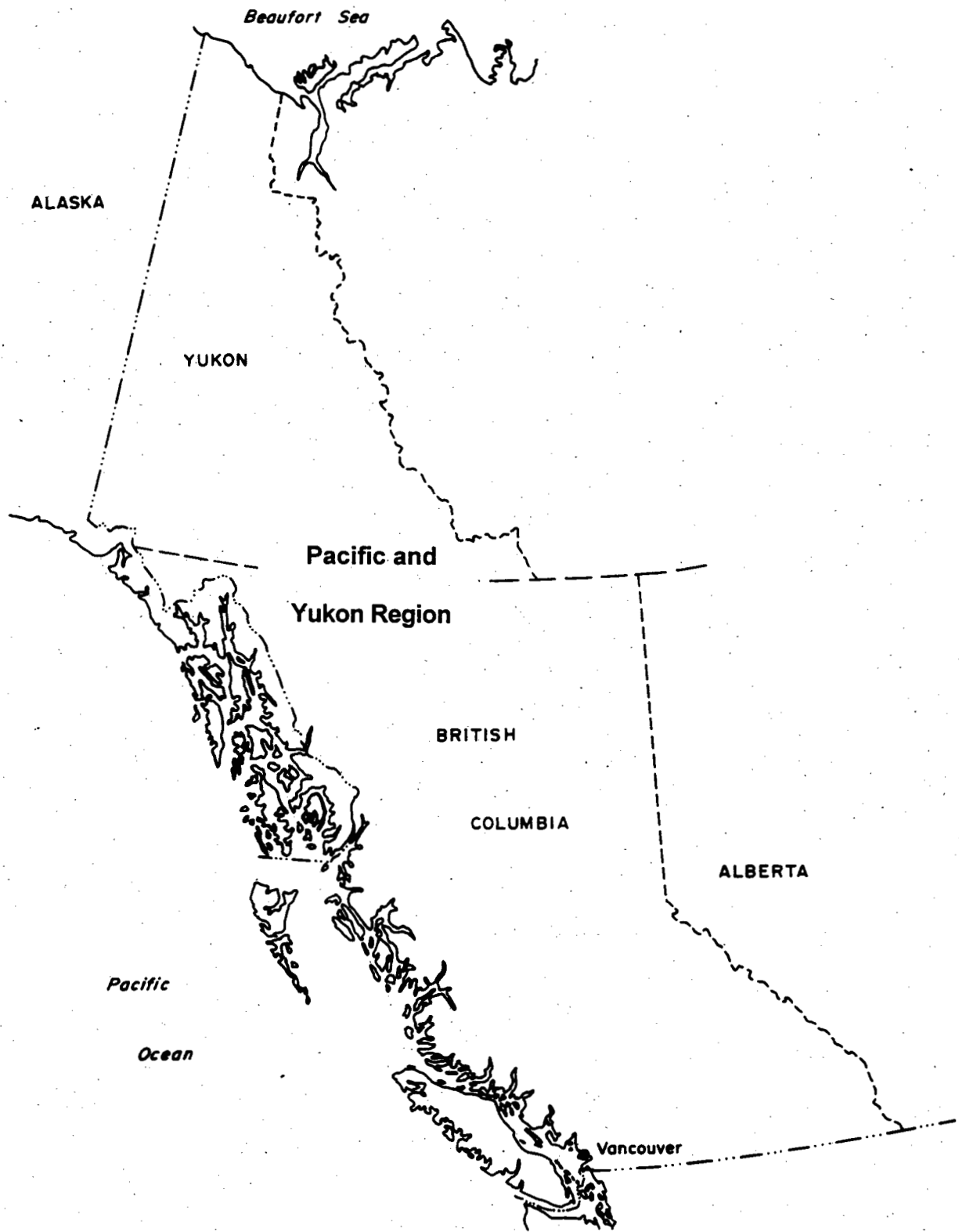


Figure 1. Location map.

Table 1. Active ocean disposal sites.

Number	Disposal Site	Co-ordinates		Volume Disposed in 1993
* 1	Point Grey	49°15.40'N	123°22.10'W	598,264 m ³
9	Sand Heads	49°06.00'N	123°19.50'W	55,428 m ³
14	Victoria	48°22.30'N	123°21.80'W	305 tonnes
* 32	Porlier Pass	49°00.20'N	123°29.80'W	11,000 m ³
* 40	Five Finger Island	49°15.20'N	123°54.60'W	1,500 m ³
48	Comox	49°41.70'N	124°44.50'W	7,500 m ³
49	Malaspina Strait	49°45.00'N	124°27.00'W	22,850 m ³
* 64	Thornbrough Channel	49°31.00'N	123°28.20'W	0 m ³
* 65	Watts Point	49°38.50'N	123°14.00'W	0 m ³
114	Thormanby Island	49°27.50'N	124°05.50'W	300 m ³
116	Cape Mudge	49°57.70'N	125°05.00'W	6,500 m ³
119	Johnstone Strait - Hickey Point	50°27.80'N	126°04.80'W	2,500 m ³
120	Johnstone Strait - Hanson Island	50°33.50'N	126°48.00'W	3,000 m ³
140	Queen Charlotte Strait	50°46.40'N	127°22.60'W	12,000 m ³
* 146	Kunechin Point	49°37.52'N	123°48.45'W	0 m ³
152	PWC 3	49°06.40'N	123°07.90'W	20,717 m ³
154	PWC 5	49°09.40'N	122°59.70'W	12,500 m ³
TOTAL				754,059 m³ + 305 tonnes

* Monitoring surveys were conducted at these sites in 1993.



RODAC Agencies

DOE -	Toxic Chemicals
DOE -	Pollution Abatement Div
DFO -	Science and Research
DFO -	Habitat Management
BCE -	Contaminated Sites and Toxicology

Legend

EC	Environment Canada
RODAC	Regional Ocean Disposal Advisory Committee
BCE	BC Ministry of Environment, Lands and Parks
DFO	Department of Fisheries and Oceans
EARP	Environmental Assessment Review Process

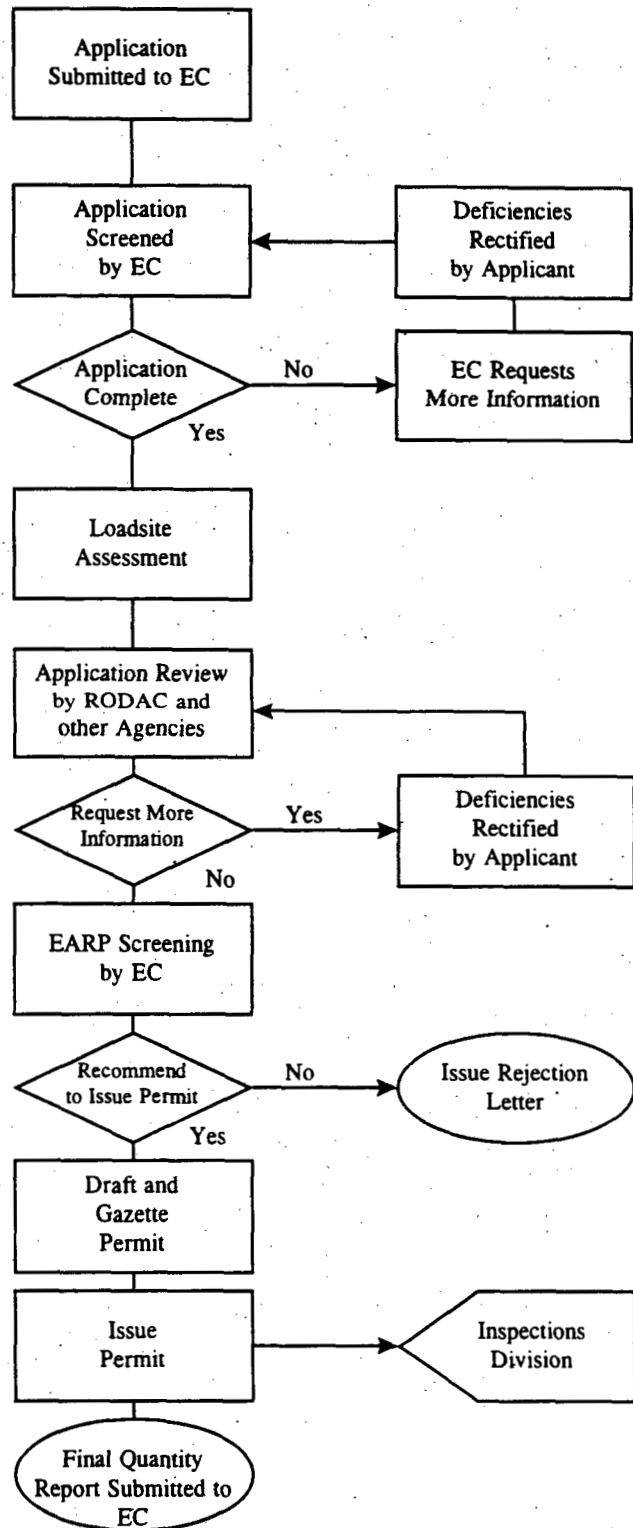


Figure 2. Ocean disposal permitting process.

224 West Esplanade, North Vancouver, B.C., and on the Electronic Bulletin Board System. All applications are now screened under the Canadian Environmental Assessment Act (CEAA).

Following the initial review of the application by Environment Canada, inspection of the site may be required. The applicant may also be asked to provide pre-load sampling data. Following the application review process, only the material which has been rigorously tested and found to meet the Interim Contaminant Testing Guidelines for Ocean Disposal, Pacific and Yukon Region, (ICTG) (Appendix I), is approved for ocean disposal. All Ocean Disposal permits and amendments must be published in the Canada Gazette before they are issued. After a permit has been gazetted, a one week time period is reserved for public comments before a permit becomes effective. Permits are valid for a one year period.

Maintenance dredging activities involving less than 4 000 cubic metres of dredged material, or excavation projects involving clean native till may be undertaken under the terms and conditions of a general ocean disposal permit. New dredging projects or maintenance activities involving volumes in excess of 4 000 cubic metres require a site specific permit.

2.2 OCEAN DISPOSAL RESTRICTIONS

Under Schedule III, Parts I and II, certain substances are prohibited or restricted from ocean disposal. In addition, the ICTG further outlines the criteria for polynuclear aromatic hydrocarbons, polychlorinated biphenyls, chlorophenols and dioxins/furans (Appendix I).

The following substances listed in Part I are generally prohibited when present at concentrations in excess of those specified below unless, in the opinion of the Minister, the substance will be rapidly rendered harmless (RRH) by physical, chemical or biological processes of the sea at the specified disposal site. If such is the case, disposal may be approved under the provisions of Section 71(3)(a) CEPA Part VI. Biological tests must show that the material can be disposed of at sea without causing acute or chronic effects on marine organisms or human health.

a) Organohalogen compounds:

- | | |
|---|---------------|
| • Chlorophenols (PCP and TCP) | 1.0 µg/g |
| • Polychlorinated biphenyls (PCB) | 0.1 µg/g |
| • Polynuclear aromatic hydrocarbons (PAH) | *2.5 µg/g |
| • Dioxin (2,3,7,8 TCDD) | *quantifiable |

*ICTG rejection limit.

- b) mercury and mercury compounds in a solid phase of a waste (0.75 µg/g), and in the liquid phase of a waste (1.5 µg/g);
- c) cadmium and cadmium compounds in a solid phase of a waste (0.6 µg/g), and in a liquid phase of waste (3.0 µg/g);
- d) persistent plastics and other persistent synthetic materials (4% by volume), in a suitably comminuted form;
- e) crude oil and its wastes, refined petroleum products, petroleum distillate residues and any mixtures containing any of those substances (any quantity that yields more than 10.0 µg/g of n-hexane soluble substances);
- f) high-level radioactive wastes or other high-level radioactive matter that may be prescribed;
- g) substances in whatever form produced for biological and chemical warfare.

Under Part II, the following substances are restricted when present in significant amounts:

- a) arsenic and its compounds;
- b) lead and its compounds;
- c) copper and its compounds;
- d) zinc and its compounds;
- e) organosilicon and its compounds;
- f) cyanides;
- g) fluorides;
- h) pesticides and their by-products not included in the List of Prohibited Substances in Part I;
- i) beryllium and its compounds;
- j) chromium and its compounds;
- k) nickel and its compounds;
- l) vanadium and its compounds;
- m) containers and scrap metal;
- n) radioactive wastes or other radioactive matter not included in the List of Prohibited Substances in Part I;
- o) substances that by reason of their bulk would interfere with fishing;
- p) substances that, though of a non-toxic nature, may become harmful due to the quantities in which they are dumped, or that are liable to seriously reduce amenities.

In dredged material, lead concentrations of 0.05 percent or more by weight (500 µg/g) are considered significant. Arsenic, copper, zinc, beryllium, chromium, nickel and vanadium are considered present in significant amounts at concentrations of 0.1% (1 000 µg/g). Pacific RODAC considers these levels as general guidelines only and may impose more stringent limits in specific situations.

In order to protect fisheries resources, spawning areas, and juvenile and adult migratory areas, the Department of Fisheries and Oceans (DFO) requires that dredging and/or ocean disposal activities be conducted within time frames specified by district Habitat Management Units. Proponents are directed to contact the appropriate DFO units prior to commencing any projects for timing restrictions relevant to the area of proposed activities. For example, Fraser River dredging guidelines for operations within navigation channels specify periods when clamshell or suction dredging is allowed. Dredging outside navigation channels is reviewed on a site-specific basis.

2.3 COMPLIANCE AND ENFORCEMENT

Environment Canada, Pacific and Yukon Region, conducts pre-load inspections to confirm sampling program design and collects samples as required. Enforcement of the terms and conditions of permits issued under CEPA, Part VI is the responsibility of the Inspections Section, Enforcement and Emergencies Branch. CEPA inspectors routinely conduct compliance and surveillance inspections of dredging/loading and disposal operations. Vessel Traffic Management Centers monitor disposal sites to ensure disposal activities occur at the authorized locations. Any contravention of permit conditions are dealt with under authority of CEPA, Part VI or Section 36 (3) of the Fisheries Act.

3.0 ENVIRONMENTAL ASSESSMENT

Routine monitoring of ocean disposal sites is carried out by Environment Canada to ascertain physical, biological and chemical effects of disposal operations. This is essential to the management of the environmental impact of large-scale ocean disposal on Canada's coastline. National compendia of monitoring at ocean disposal sites since 1991 are published and available at the annual meetings of the London Convention. It is recognized that data from representative sites will help in planning future monitoring studies.

The ICTG were developed in consultation with RODAC. These guidelines address the environmental impact of ocean disposal on marine sediments. Minimum sampling and analytical requirements for dredged and excavated material are outlined. Rejection/screening limits are given for the following parameters: cadmium, mercury, arsenic, copper, zinc, beryllium, chromium, nickel, vanadium, lead, chlorophenols, PCBs,

total PAH, and dioxins/furans. A general guide for the collection and preparation of sediments for physico-chemical characterization and biological assessment is included.

Under Phase II of the Green Plan initiative, environmental assessment procedures are being revised. The regulated substance list will be reviewed and effects of ocean disposal on the marine environment assessed. Three biological testing protocols, Amphipod Acute Toxicity, Echinoid Fertilization Assay and Bacterial Photoluminescence were completed in 1992. Polychaete Growth and Bioaccumulation protocols are in preparation. These are currently used for sediment assessment. Biological monitoring guidelines and technical guidance on physical monitoring documents are also to be drafted for use in the program.

4.0 OCEAN DISPOSAL ACTIVITIES

Records of ocean disposal activities in the Pacific and Yukon Region can be found in Ward and Sullivan (1980), Sullivan (1987), and Kim and Sullivan (1993).

4.1 NUMBER OF PERMITS

In 1993, 27 ocean disposal permit applications were received in the Pacific and Yukon Region. Twenty-five permits were issued (Table 2) and the remaining two permits were under technical review at the end of the year. Twenty-one permits issued were for dredged material, three for excavated material and one for the disposal of contaminated sugar.

Table 2. Number of permits issued in the Pacific and Yukon Region - 1987 to 1993.

Permit Type	1987	1988	1989	1990	1991	1992	1993	Total
Dredge	33	41	28	25	23	20	21	191
Excavation	2	5	5	4	4	5	3	28
Vessel	0	0	1	0	2	2	0	5
Others	2	2	2	2	1	0	1	10
Total	37	48	36	31	30	27	25	234

Under general permits for dredged and excavated materials, ninety-two projects were assessed and approved in 1993. Information on specific permits and approvals at each disposal site can be found in Ocean Disposal Site Summaries (Appendix II).

4.2 VOLUME OF MATERIAL OCEAN DISPOSED

A total of approximately 750 000 cubic metres of material was disposed of at ocean disposal sites in the Pacific and Yukon Region in 1993 (Table 1). Point Grey and Sand Heads disposal sites received more than 80% of all materials. Dredging and excavation projects accounted almost equally for most of this volume and a very small quantity was from contaminated sugar disposal (Figure 3). The annual volume of material disposed in this Region varies with the yearly fluctuations in Fraser River sediment deposition rates.

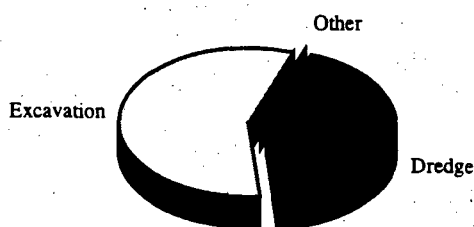


Figure 3. Type of materials ocean disposed (%) - 1993.

4.3 MONITORING

In 1993, sediments were collected from five disposal sites (Point Grey, Porlier Pass, Five Finger Island, Thornbrough Channel, and Watts Point). Analyses were done for trace metals, PAH (except at Point Grey), total organic carbon and particle size distribution. Results are reported in Section 5.0 of this report.

Sediment toxicity tests are conducted to determine and monitor toxic effects (if any) of sediments in the receiving environment. A 10-day test for measuring the acute lethality of sediment, using the marine infaunal amphipod *Eohaustorius washingtonianus*, was conducted using samples from 17 stations in the Point Grey study area. To test the impact of ocean disposal on the benthic community, benthic infauna analyses were also conducted for the Point Grey Disposal Site. Thirty-eight samples were analyzed from 11 stations in the Point Grey study area for species richness and total abundance (Sullivan *et al.*, in prep.).

H.M.C.S. Chaudiere, a decommissioned destroyer, was sunk in Sechart Inlet in December 1992 (Kim and Sullivan, 1993). In February 1993, water samples were collected near the vessel and analyzed for trace metals, oil and grease, and asbestos fibres. The results were comparable to values from a near-by reference site. Video recordings show marine algal growth over most of the outer hull of the vessel (Ellis, 1993).

In September 1993, another monitoring study was undertaken by Environment Canada. Due to concerns expressed by First Nations Band Council members in Sechelt regarding the perceived potential for shellfish contamination, a baseline sanitary water quality investigation was also conducted. Data indicate that the vessel has had no apparent impact on the marine environment. There has been no elevation in the concentration of any of the water quality parameters measured (Kim, 1994).

In 1993, the Vancouver Port Corporation, on behalf of Pacific Coast Terminals (PCT), applied for an ocean disposal permit under the rapidly rendered harmless provision of CEPA. The chemical analysis indicated that the sediments from the dredge site exceeded the limits for cadmium. Bioassays were conducted on the sediments. Based on interim guidelines and pass/fail criteria determined by Environment Canada, the sediments were approved for open ocean disposal.

5.0 ACTIVE DISPOSAL SITE INFORMATION

5.1 POINT GREY

Disposal Site:	Point Grey
Number:	1
Co-ordinates:	49°15.40'N; 123°22.10'W
Depth:	210 metres
Total Quantity Disposed Since 1976:	6 156 582 cubic metres

Comments

The Department of Fisheries and Oceans request that, subject to approval by the appropriate Habitat Management Unit, Vancouver Harbour and the Fraser River Dredging Guidelines be applied to any dredging projects.

Loadsite Information

Clean native till excavated from approved sites in the Lower Mainland formed the largest portion of the material disposed of at this site in 1993. Public Works and Government Services Canada disposed of over 84 145 cubic metres of material resulting from this year's Fraser River channel maintenance.

Other large projects included annual maintenance dredging at S & R Sawmills which required dredging and disposal of 34 427 cubic metres of material. The remaining material originated from various forest related industry sites on the Fraser River.

Monitoring Information

Monitoring was conducted in June 1993, to examine how ocean disposal activities are impacting the disposal site and the surrounding area, and also to field test the Interim Monitoring Guidelines for Ocean Disposal. The monitoring study consisted of trace metal and particle size analyses, biological testing, benthic infauna and physical characterization of the disposal site. Sediment chemistry and particle size analyses are presented in Table 3. Survey results indicate that all chemical parameters are within the screening criteria specified in the ICTG. Biological testing showed that sediments did not elicit a toxic response from *E. washingtonianus* or *L. pictus*. The results of the benthic infauna study indicated no significant difference in the total abundance or species richness between the disposal site and the reference site, with the exception of two stations where the total abundance was greater at the disposal site. Summary information on the disposal site is contained in Sullivan *et al.* (in prep).

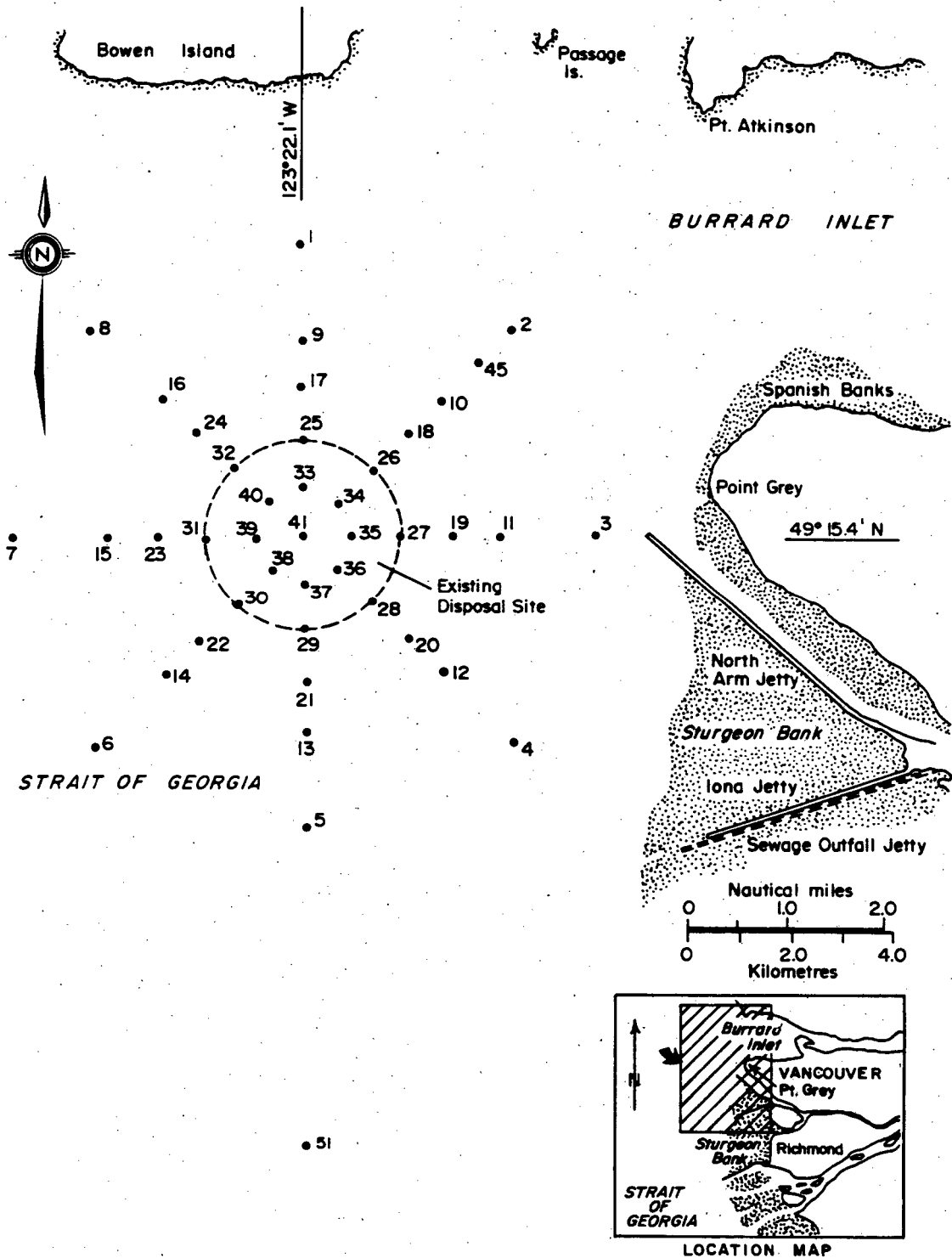


Figure 4. Point Grey ocean disposal site and sediment stations.

Table 3. Point Grey sediment chemistry and particle size - June 1993 survey.

Station	Sediment Chemistry						Particle Size (%)		
	Cd ¹ µg/g	Cu µg/g	Hg µg/g	Pb µg/g	Zn µg/g	TOC %	Gravel > 2mm	Sand 0.0625 - 2 mm	Silt and Clay < 0.0625mm
1	0.36	45.5	0.111	16	132	1.00	0.0	4.1	95.9
2	0.05	51.4	0.105	18	136	0.98	0.0	2.7	97.3
3	0.05	28.3	0.061	9	82	0.56	0.0	53.3	46.7
4	0.07	42.7	0.104	17	138	0.99	0.0	1.1	98.9
5	0.13	39.3	0.100	14	143	1.12	0.0	0.6	99.4
6	0.26	39.1	0.098	15	142	1.11	0.0	0.7	99.3
7	0.06	44.9	0.107	18	145	1.06	0.0	1.8	98.2
8	0.05	53.9	0.119	21	142	0.90	0.0	1.8	98.2
9	0.06	37.2	0.090	15	129	1.23	0.0	9.8	90.2
10	0.05	45.0	0.101	18	128	1.25	0.0	6.5	93.5
11	0.10	42.3	0.105	16	120	1.10	0.0	1.5	98.5
12	0.03	39.6	0.098	15	140	1.16	0.0	0.8	99.2
13	0.05	39.1	0.100	15	122	1.07	0.0	1.3	98.7
14	0.02	39.3	0.105	17	131	1.23	0.0	0.8	99.2
15	0.03	42.6	0.111	19	132	1.14	0.0	4.7	95.3
16	0.10	51.5	0.134	20	154	1.31	0.0	4.4	95.6
17	0.07	36.8	0.101	15	145	1.22	0.0	16.7	83.3
18	0.07	36.9	0.090	14	113	0.83	0.1	14.9	85.0
19	0.07	37.5	0.109	14	122	1.29	0.0	6.1	93.9
20	0.02	39.0	0.091	15	122	1.16	0.0	4.1	95.9
21	0.05	39.6	0.097	14	127	1.41	0.0	3.4	96.6
22	0.02	40.4	0.101	17	128	1.23	0.0	2.1	97.9
23	0.06	45.8	0.107	24	132	1.24	0.0	12.0	88.0
24	0.06	46.0	0.117	19	143	1.18	0.0	8.1	91.9
25	0.08	31.7	0.076	13	121	1.36	0.2	38.9	61.0
26	0.02	21.2	0.035	6	60	0.28	3.0	68.6	28.4
27	0.05	23.7	0.049	8	79	0.60	14.2	43.5	42.4
28	0.05	39.4	0.049	15	143	1.21	0.0	4.1	95.9
29	0.06	36.8	0.049	14	122	1.21	0.3	15.2	84.5
30	0.03	33.8	0.088	14	106	1.38	3.3	15.9	80.8
31	0.06	39.9	0.148	17	124	1.64	0.6	16.2	79.9
32	0.07	38.5	0.099	21	131	2.58	0.0	20.1	79.9
34	0.04	20.7	0.045	7	65	0.43	11.6	58.3	30.1
35	0.10	24.6	0.053	8	88	0.76	2.4	42.2	55.4
36	0.06	30.3	0.068	13	110	1.26	1.4	37.2	60.7
37	0.04	34.0	0.097	13	110	1.47	0.0	27.3	72.7
38	0.07	33.0	0.080	14	111	3.42	3.6	31.2	65.2
39	0.03	35.9	0.093	20	107	1.69	0.3	18.2	81.5
40	0.09	31.5	0.065	11	105	1.55	5.1	42.5	52.4
41	0.10	32.0	0.056	11	118	0.83	3.1	55.6	41.3
Reference	0.07	35.1	0.105	11	117	0.77	0.0	7.4	92.6

Mean values are reported for stations 1-8, 25, 27, 29, 31, 34, 36, 40 and Reference; N = 3.

¹ Trace metal analyses are expressed as total metals.

5.2 SAND HEADS

Disposal Site:	Sand Heads
Number:	9
Co-ordinates:	49°06.00'N; 123°19.50'W
Depth:	70 metres
Total Quantity Disposed Since 1976:	7 173 593 cubic metres

Comments

For specific dredging timing restrictions contact the Department of Fisheries and Oceans' Habitat Management Unit in New Westminster.

The Fraser River Dredging Guidelines, developed by the Department of Fisheries and Oceans, apply to all projects. Clamshell dredging may be conducted throughout the year, subject to site specific approval. Suction dredges must operate at five metres depth at low tide from March 1st to June 1st. In even-numbered years the use of suction dredges is prohibited from around April 15th to May 15th, during the downstream migration of pink salmon.

Loadsite Information

Only clean sand, silt and gravel are approved for disposal at the Sand Heads site. The majority of material disposed of at this site originated from Fraser River channel maintenance projects conducted by Public Works and Government Services Canada.

5.3 VICTORIA

Disposal Site:	Victoria
Number:	14
Co-ordinates:	48°22.30'N; 123°21.80'W
Depth:	90 metres
Total Quantity Disposed Since 1976:	299 624 cubic metres + 305 tonnes

Comments

For dredging timing restrictions contact the Department of Fisheries and Oceans' Habitat Management Unit in Nanaimo.

Loadsite Information

In 1993, a permit was issued to Anchor Shipping Ltd. for the disposal of 305 tonnes of raw sugar which had been inadvertently contaminated by salt water. The permit required that the material be continuously discharged while the towing vessel was underway within the disposal site boundary.

Monitoring Information

A benthic sediment chemistry monitoring survey will be conducted in 1994.

5.4 PORLIER PASS

Disposal Site:	Porlier Pass
Number:	32
Co-ordinates:	49°00.20'N; 123°29.80'W
Depth:	200 metres
Total Quantity Disposed Since 1976:	130 935 cubic metres

Comments

For dredging timing restrictions contact the Department of Fisheries and Oceans' Habitat Management Unit in Nanaimo.

Loadsite Information

In 1993, dredging projects in Chemainus and Ladysmith required the disposal of 11 000 cubic metres of woodwaste from forest industry operations.

Monitoring Information

A benthic sediment chemistry survey was conducted in November 1993. At each station (Figure 5) a single grab was collected using a Smith McIntyre grab sampler; at Station 5 five replicate grabs were collected. Each grab was analyzed for trace metals, PAH, TOC and particle size distribution (Table 4). The analyses indicate no obvious impacts associated with ocean disposal activities at the Porlier Pass site.

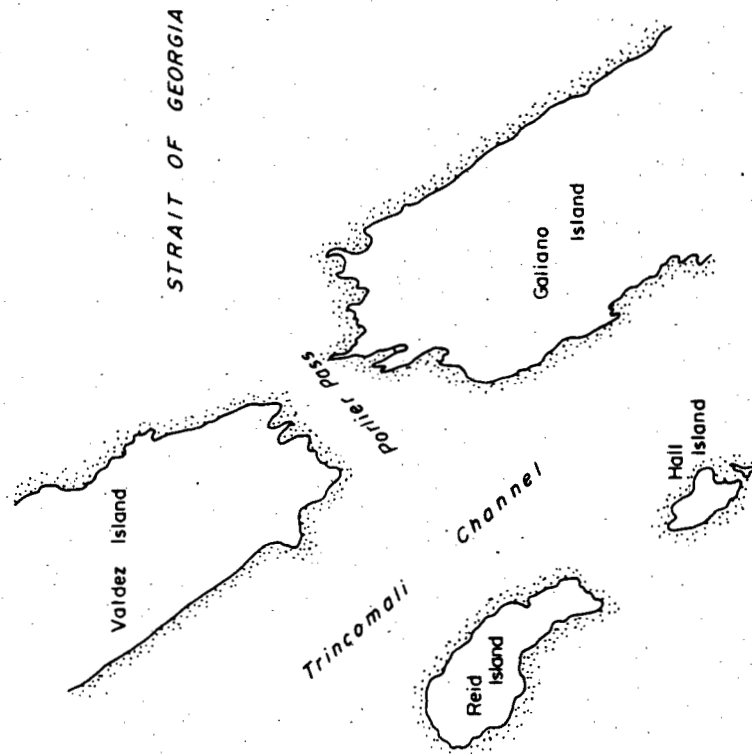
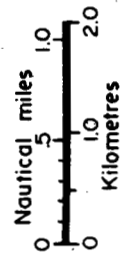
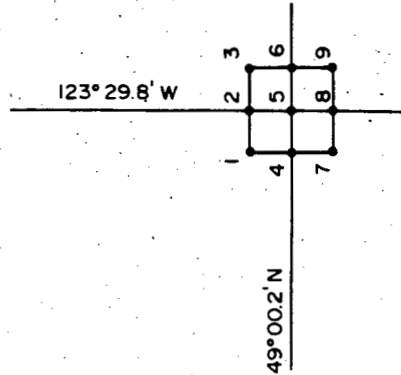
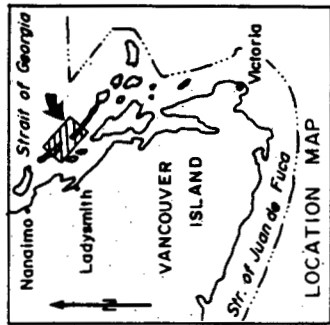


Figure 5. Porlier Pass ocean disposal site and sediment stations.

Table 4. Porlier Pass sediment chemistry and particle size - November 1993 survey.

Station	Sediment Chemistry							Particle Size		
	Cd ² µg/g	Cu µg/g	Hg µg/g	Pb µg/g	Zn µg/g	TPAH µg/g	TOC %	Gravel > 2mm	Sand 0.0625 - 2 mm	Silt and Clay < 0.0625mm
1	0.10	39.3	0.093	10	128	0.48	1.57	3.6	7.7	88.7
2	0.10	40.0	0.095	10	126	0.41	1.75	3.2	10.0	86.8
3	0.10	38.8	0.102	10	127	0.63	1.83	2.7	11.1	86.2
4	0.10	38.9	0.101	10	128	0.54	2.89	8.8	8.6	82.6
5	0.10	38.6	0.099	10	119	0.51	1.61	4.0	11.4	84.6
	0.10	40.0	0.110	10	124	0.46	1.10	0.2	15.0	84.8
	0.09	42.4	0.110	10	124	0.45	1.61	0.9	11.8	87.3
	0.08	46.4	0.090	10	116	0.43	1.39	4.0	9.0	87.0
	<u>0.10</u>	<u>72.9</u>	<u>0.095</u>	<u>10</u>	<u>202</u>	<u>0.46</u>	<u>1.47</u>	<u>2.4</u>	<u>8.7</u>	<u>88.9</u>
	0.09 ± .01	48.1 ± 12.7	0.101 ± .01	10	137 ± 33	0.46 ± .03	1.44 ± .19	2.3 ± 1.6	11.2 ± 2.3	86.5 ± 1.6
6	0.10	42.2	0.099	10	129	0.51	1.78	0.8	10.2	89.0
7	0.10	39.4	0.100	17	132	0.44	1.12	0.0	6.5	93.5
8	0.10	39.6	0.086	10	118	0.49	1.29	2.5	11.1	86.4
9	0.10	39.9	0.083	10	124	0.59	1.06	0.1	5.6	94.3

² Trace metal results are expressed as total metals.

5.5 FIVE FINGER ISLAND

Disposal Site:	Five Finger Island
Number:	40
Co-ordinates:	49°15.20'N; 123°54.60'W
Depth:	280 metres
Total Quantity Disposed Since 1976:	191 012 cubic metres

Comments

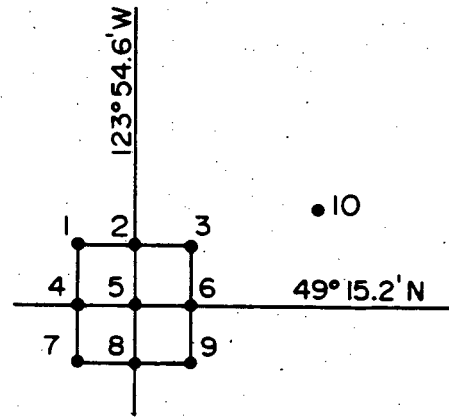
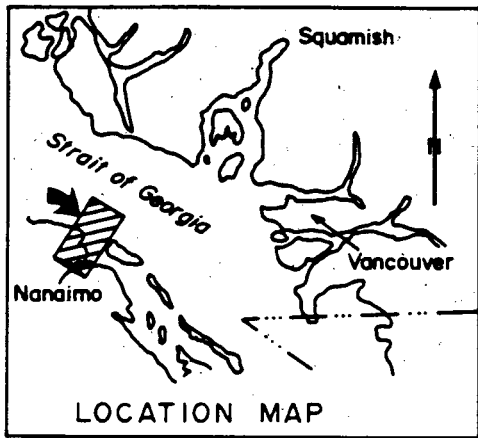
For dredging and disposal timing restrictions contact the Department of Fisheries and Oceans' Habitat Management Unit in Nanaimo.

Loadsite Information

Approved dredge material from forest related industries formed the largest part of the material disposed of at this site in 1993. The annual maintenance dredging at the Doman's site at Duke Point required dredging and disposal of 1 500 cubic metres of material.

Monitoring Information

A benthic sediment chemistry survey was conducted in November 1993. At each station (Figure 6) a single grab was collected using a Smith McIntyre grab sampler; at Station 5 five replicate grabs were collected. Each grab was analyzed for trace metals, PAH, TOC and particle size distribution (Table 5). The analyses indicate no obvious impacts associated with ocean disposal activities at the Five Finger Island site.



STRAIT OF GEORGIA

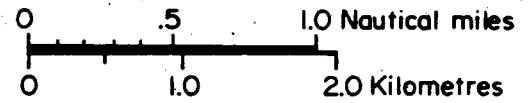
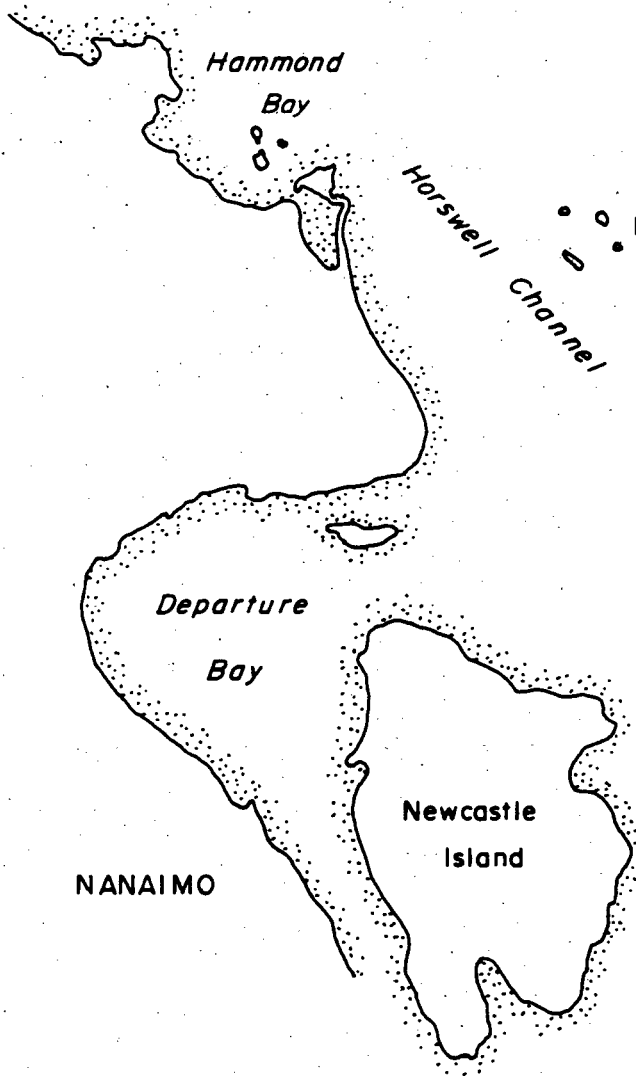


Figure 6. Five Finger Island ocean disposal site and sediment stations.

Table 5. Five Finger Island sediment chemistry and particle size - November 1993 survey.

Station	Sediment Chemistry							Particle Size		
	Cd ³ µg/g	Cu µg/g	Hg µg/g	Pb µg/g	Zn µg/g	TPAH µg/g	TOC %	Gravel > 2mm	Sand 0.0625 - 2 mm	Silt and Clay < 0.0625mm
1	0.27	53.4	0.161	25	176	1.30	1.93	0.0	9.2	90.8
2	0.34	52.8	0.164	22	194	1.29	2.19	0.0	10.5	89.5
3	0.29	52.0	0.152	24	174	1.62	2.78	1.9	12.2	85.9
4	0.32	51.6	0.163	20	159	1.87	2.93	28.3	4.5	67.2
5	0.29	46.9	0.135	24	147	3.45	4.72	4.5	67.1	58.4
	0.30	52.4	0.163	22	178	1.34	2.68	0.9	12.3	86.8
	0.24	44.7	0.134	25	156	3.10	4.39	0.1	26.9	73.0
	0.20	47.7	0.175	23	164	1.85	6.58	4.2	13.4	82.4
	0.26	51.6	0.140	18	170	2.27	3.55	0.0	9.1	90.9
	0.26 ± .04	48.7 ± 2.4	0.149 ± .02	22 ± 2	163 ± 11	2.40 ± .78	4.38 ± 1.31	1.9 ± 2.0	19.8 ± 10.6	78.3 ± 11.6
6	0.28	53.4	0.147	23	165	1.92	3.10	0.0	11.6	88.4
7	0.27	54.4	0.171	21	166	2.71	3.80	0.0	19.7	80.3
8	0.20	37.9	0.127	17	160	3.05	4.56	2.0	32.4	65.6
9	0.31	43.1	0.148	10	141	4.73	4.36	0.0	36.4	63.6

³ Trace metal analyses are presented as total metals.

5.6 COMOX

Disposal Site:	Comox
Number:	48
Co-ordinates:	49°41.70'N; 124°44.50'W
Depth:	190 metres
Total Quantity Disposed Since 1976:	12 117 cubic metres

Comments

For specific dredging and disposal timing restrictions contact the Department of Fisheries and Oceans' Habitat Management Unit in Nanaimo.

Loadsite Information

Public Works and Government Services Canada dredged 7 500 cubic metres of material from the Courtenay River as part of a channel maintenance project. This was disposed of at the Comox Disposal Site.

5.7 MALASPINA STRAIT

Disposal Site:	Malaspina Strait
Number:	49
Co-ordinates:	49°45.00'N; 124°27.00'W
Depth:	320 metres
Total Quantity Disposed Since 1976:	342 699 cubic metres

Comments

For specific dredging and disposal timing restrictions contact the Department of Fisheries and Oceans' Habitat Management Unit in Nanaimo.

Loadsite Information

In 1993, 17 850 cubic metres of woodwaste from annual maintenance dredging at MacMillan Bloedel in Powell River, and dredging spoils from Lang Creek and Phillips Arm were disposed of at the Malaspina Strait site.

Monitoring Information

A monitoring survey consisting of sediment chemistry, biological testing, benthic infauna and Remotely Operated Vehicle (ROV) work will be undertaken in 1994.

5.8 THORNBROUGH CHANNEL

Disposal Site:	Thornbrough Channel
Number:	64
Co-ordinates:	49°31.00'N; 123°28.30'W
Depth:	220 metres
Total Quantity Disposed Since 1976:	55 361 cubic metres

Comments

The Thornbrough Channel Ocean Disposal Site has not been used since 1989.

Monitoring Information

Monitoring was conducted in November 1993 to test if selected contaminants of concern are in sediments in the vicinity of the disposal site (Figure 7). Trace metals, PAH, TOC and particle size analyses were conducted (Table 6). The results indicate that all chemical parameters of concern are well within the criteria specified in the ICTG.

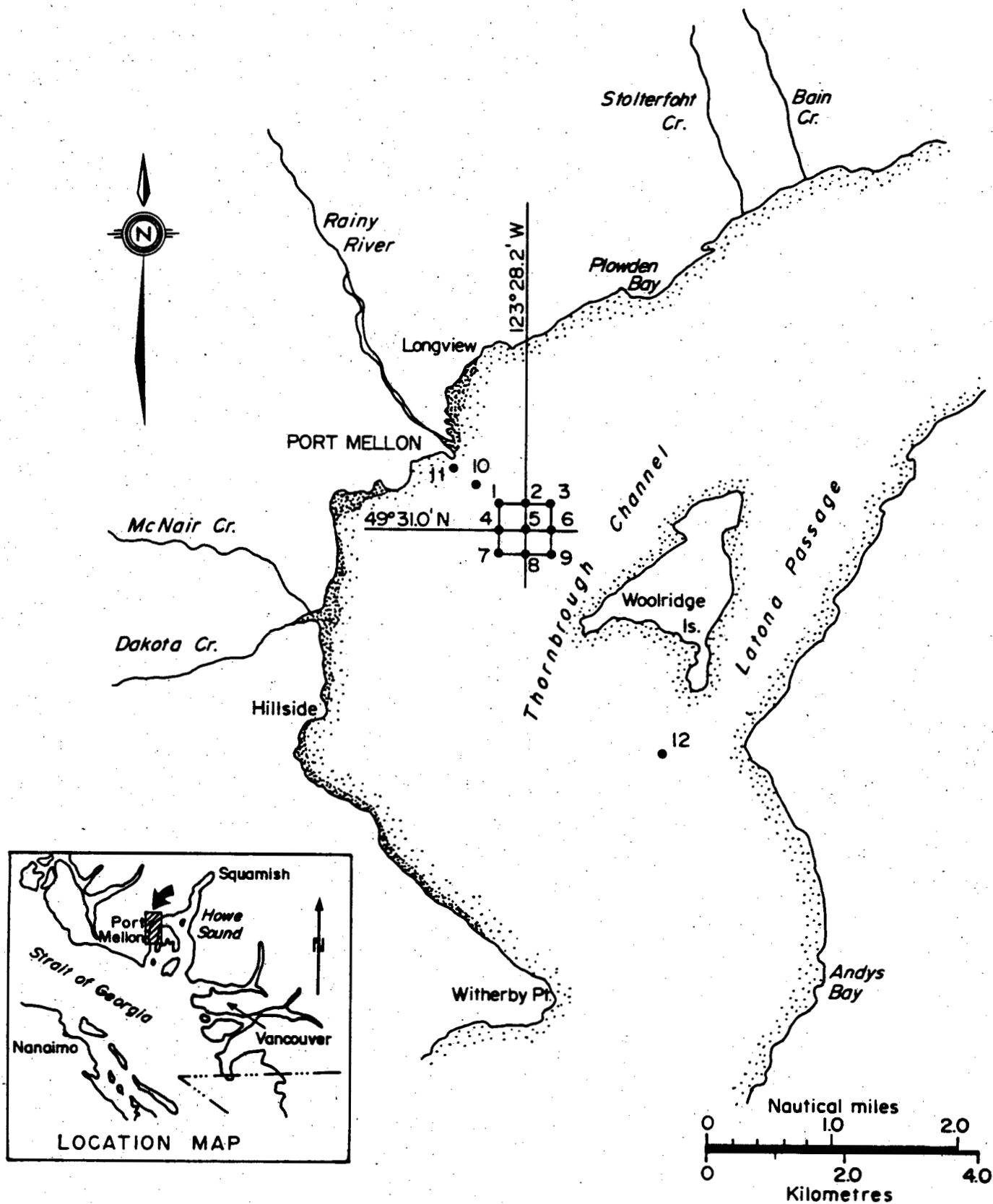


Figure 7. Thornbrough Channel ocean disposal site and sediment stations.

Table 6. Thornbrough Channel sediment chemistry and particle size - November 1993 survey.

Station	Sediment Chemistry							Particle Size		
	Cd ⁴ µg/g	Cu µg/g	Hg µg/g	Pb µg/g	Zn µg/g	TPAH µg/g	TOC %	Gravel > 2mm	Sand 0.0625 - 2 mm	Silt and Clay < 0.0625mm
1	0.10	42.7	0.084	9	80	2.04	2.21	0.0	72.5	27.5
2	0.25	49.8	0.113	10	112	0.93	2.95	28.6	34.8	36.6
3	0.46	71.6	0.158	21	150	2.04	3.53	0.8	25.3	73.9
4	0.38	64.5	0.135	20	132	1.76	4.91	7.7	43.1	49.2
5	0.27	57.5	0.122	20	117	1.63	3.88	24.4	38.0	37.6
	0.31	70.2	0.168	23	144	1.55	3.87	21.4	43.4	35.2
	0.32	70.9	0.166	21	165	2.10	4.61	9.1	55.3	35.6
	0.41	80.4	0.212	20	168	2.41	3.88	0.0	47.1	52.9
	<u>0.35</u>	<u>73.7</u>	<u>0.194</u>	<u>23</u>	<u>161</u>	<u>1.1</u>	<u>3.54</u>	<u>0.0</u>	<u>52.7</u>	<u>47.3</u>
	0.33 ± .05	70.5 ± 7.5	0.172 ± .03	21 ± 1.4	151 ± 19	1.76 ± .46	3.96 ± 0.35	11.0 ± 10.3	47.3 ± 6.2	41.7 ± 7.1
6	0.31	70.9	0.177	19	141	2.09	4.41	10.0	38.1	51.9
7	0.28	76.5	0.199	21	155	1.51	3.24	7.5	29.6	62.9
8	0.23	85.2	0.236	28	166	1.82	3.24	0.0	15.4	84.6
9	0.38	90.9	0.262	22	185	2.03	3.55	0.0	13.5	86.5

⁴ Trace metal analyses are presented as total metals.

5.9 WATTS POINT

Disposal Site:	Watts Point
Number:	65
Co-ordinates:	49°38.50'N; 123°14.00'W
Depth:	230 metres
Total Quantity Disposed Since 1976:	468 516 cubic metres

Comments

The Watts Point Ocean Disposal Site was last used in 1992.

For specific dredging and disposal timing restrictions contact the Department of Fisheries and Oceans' Habitat Management Unit in Steveston.

Monitoring Information

A benthic sediment chemistry survey was conducted in November 1993. At each station (Figure 8) a single grab was collected using a Smith McIntyre grab sampler; at Station 5 five replicate grabs were collected. Each grab was analyzed for trace metals, PAH, TOC and particle size distribution (Table 7). The analyses indicate no obvious impacts associated with ocean disposal activities at Watts Point.

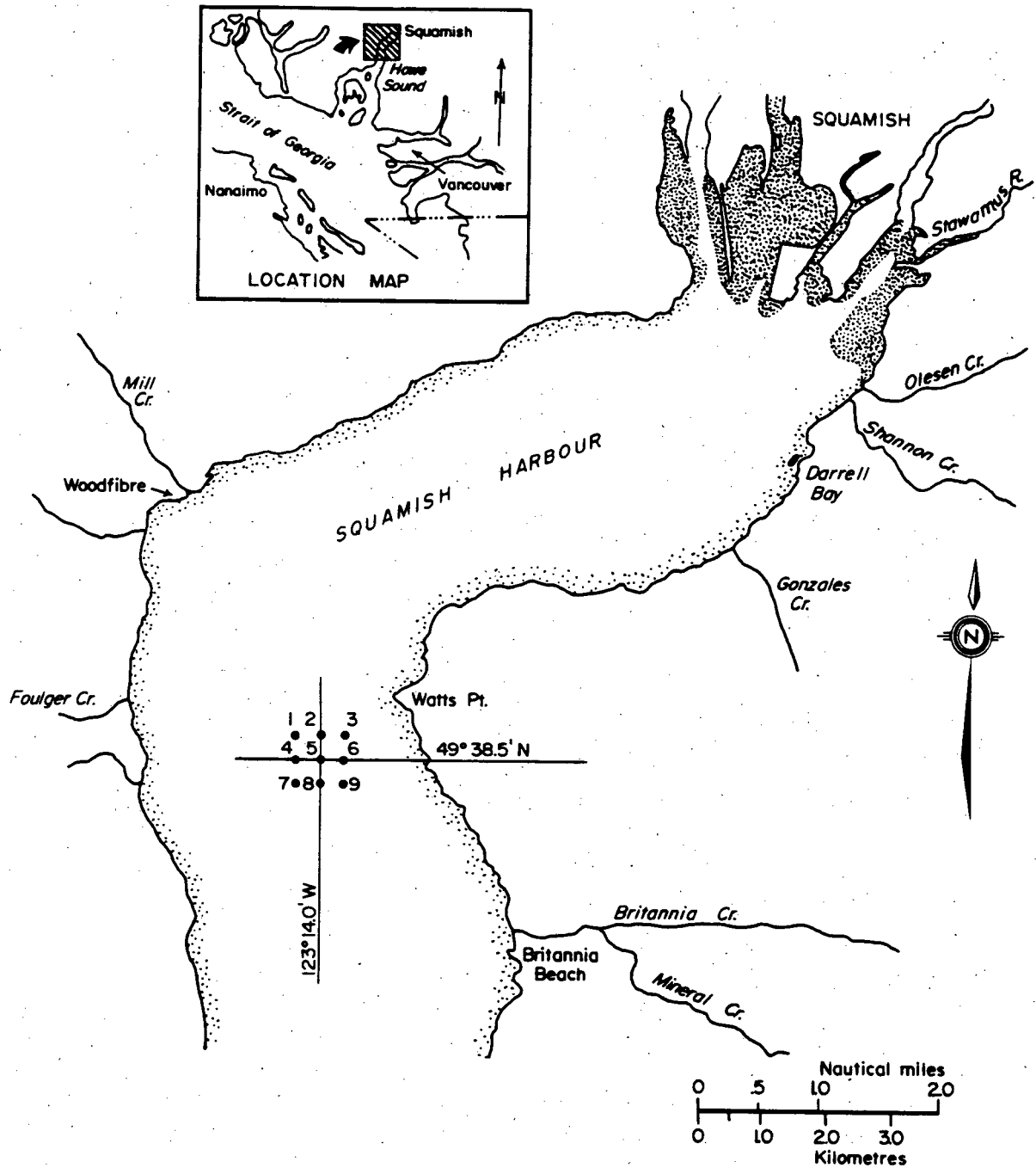


Figure 8. Watts Point ocean disposal site and sediment stations.

Table 7. Watts Point sediment chemistry and particle size - November 1993 survey.

Station	Sediment Chemistry							Particle Size			
	Cd ⁵ µg/g	Cu µg/g	Hg µg/g	Pb µg/g	Zn µg/g	TPAH µg/g	TOC %	Gravel > 2mm	Sand 0.0625 - 2 mm	Silt and Clay < 0.0625mm	
1	0.08	66.4	0.049	8	102	0.11	0.63	0.0	1.3	98.7	
2	0.08	69.7	0.049	8	102	0.17	0.36	0.4	13.9	85.7	
3	0.05	76.0	0.052	8	104	0.16	0.66	0.1	2.3	97.6	
4	0.06	66.5	0.053	9	110	0.17	0.64	0.0	6.9	93.1	
5	0.07	64.2	0.052	8	101	0.17	0.60	1.8	28.5	69.7	
	0.08	49.7	0.034	8	88	0.17	1.11	6.2	43.2	50.6	
	0.03	57.4	0.049	8	91	0.17	0.74	5.8	37.8	56.4	
	0.07	62.9	0.047	8	99	0.18	1.03	2.3	31.9	65.8	
	0.07	61.4	0.049	8	101	0.17	0.44	0.4	12.4	87.2	
	0.06 ± .02	59.1 ± 5.2	0.046 ± .01	8	96 ± 6	0.17 ± .01	0.78 ± .25	3.3 ± 2.3	30.8 ± 10.5	65.9 ± 12.6	
6	0.03	57.6	0.031	8	91	0.18	0.93	0.0	3.0	97.0	
7	0.05	58.1	0.063	8	99	0.2	5.35	0.7	5.7	93.6	
8	0.04	61.2	0.049	8	104	0.14	0.86	0.0	1.6	98.4	
9	0.09	70.0	0.045	8	102	0.14	0.59	0.0	1.2	98.8	

⁵ Trace metal analyses are presented as total metals.

5.10 THORMANBY ISLAND

Disposal Site:	Thormanby Island
Number:	114
Co-ordinates:	49°27.50'N; 124°04.50'W
Depth:	384 metres
Total Quantity Disposed Since 1976:	5 700 cubic metres

Comments

For specific dredging and disposal timing restrictions contact the Department of Fisheries and Oceans' Habitat Management Unit in Nanaimo.

The Department of Fisheries and Oceans have concerns regarding the impact on oyster and clam beds and shellfish habitat at the loadsites. A commercial hake fishery exists in the vicinity of the disposal site and salmon fry, larval cod and shrimp are abundant in the area from April to September.

Loadsite Information

In 1993, 300 cubic metres of clean sand and silt from Vaucroft Harbour was disposed of at the Thormanby Island Ocean Disposal Site.

5.11 CAPE MUDGE

Disposal Site:	Cape Mudge
Number:	116
Co-ordinates:	49°57.70'N; 125°05.00'W
Depth:	200 metres
Total Quantity Disposed Since 1976:	130 953 cubic metres

Comments

For specific dredging and disposal timing restrictions contact the Department of Fisheries and Oceans' Habitat Management Unit in Nanaimo.

To protect salmon stocks and to minimize disruption of the local sport fishery, the Department of Fisheries and Oceans generally prohibits dredging/loading activities in the Campbell River area from December 1st to March 15th each year. Ling cod utilize the bottom areas close to the disposal site.

Loadsite Information

In 1993, 6 500 cubic metres of material from forest industries in Menzies Bay were disposed of at the disposal site.

Monitoring Information

Monitoring survey consisting of sediment chemistry, biological testing, benthic infauna, and ROV study will be done in 1994.

5.12 JOHNSTONE STRAIT - HICKEY POINT

Disposal Site:	Johnstone Strait - Hickey Point
Number:	119
Co-ordinates:	50°27.80'N; 126°04.80'W
Depth:	270 metres
Total Quantity Disposed Since 1976:	139 688 cubic metres + 40 tonnes

Comments

For specific dredging and disposal timing restrictions contact the Department of Fisheries and Oceans' Habitat Management Unit in Nanaimo.

Loadsite Information

In 1993, a total of 2 500 cubic metres of dredged material from MacMillan Bloedel's Eve River and Kelsey Bay operations were ocean disposed of at this site.

Monitoring Information

A benthic sediment chemistry study will be undertaken in June 1994.

5.13 JOHNSTONE STRAIT - HANSON ISLAND

Disposal Site:	Johnstone Strait - Hanson Island
Number:	120
Co-ordinates:	50°33.50'N; 126°48.00'W
Depth:	350 metres
Total Quantity Disposed Since 1976:	156 056 cubic metres

Comments

For specific dredging and disposal timing restrictions contact the Department of Fisheries and Oceans' Habitat Management Unit in Nanaimo.

Loadsite Information

In 1993, annual dredging requirements at Canadian Forest Products in Beaver Cove and MacMillan Bloedel and Western Forest Products in Port McNeil resulted in the disposal of 3 000 cubic metres of material at this site.

Monitoring Information

A benthic sediment chemistry study will be undertaken in June 1994.

5.14 QUEEN CHARLOTTE STRAIT

Disposal Site:	Queen Charlotte Strait
Number:	140
Co-ordinates:	50°46.40'N; 127°22.60'W
Depth:	390 metres
Total Quantity Disposed Since 1976:	20 613 cubic metres

Comments

For dredging and disposal timing restrictions contact the Department of Fisheries and Oceans' Habitat Management Unit in Nanaimo.

Loadsite Information

In 1993, a total of 12 000 cubic metres of dredged material resulting from the construction of the Port Hardy Seaplane Base in Hardy Bay was disposed of at this site.

5.15 KUNECHIN POINT, SECHELT INLET

Disposal Site:	Kunechin Point, Sechelt Inlet
Number:	146
Co-ordinates:	49°37.52'N; 123°48.45'W
Depth:	27 metres
Material Disposed:	H.M.C.S. Chaudiere

Comments

As reported in Kim and Sullivan (1993), the H.M.C.S. Chaudiere, a decommissioned destroyer, was sunk in Sechelt Inlet in December 1992 by the Artificial Reef Society of B.C.

H.M.C.S. Chaudiere - Monitoring

In February 1993, water samples were collected and analyzed for trace metals, oil and grease, and asbestos fibers (Ellis 1993). The results indicate that values between the vessel and the reference site are similar to each other as well as to the background levels for Sechelt Inlet. Video recordings show marine algal growth over the majority of the vessel.

In September 1993, a follow-up monitoring study was undertaken by Environment Canada. Due to concerns expressed by First Nations Band Council members in Sechelt regarding the perceived potential for shellfish contamination, a baseline sanitary water quality investigation was also conducted. Data indicate that the vessel has had no apparent impact on the marine environment. There has been no elevation in the concentration of any of the water quality parameters measured (Kim 1994).

5.16 PWC 3

Disposal Site:	PWC 3
Number:	152
Co-ordinates:	49°06.40'N; 123°07.90'W
Depth:	13 metres
Total Quantity Disposed Since 1976:	212 962 cubic metres

Comments

For dredging and disposal timing restrictions contact the Department of Fisheries and Oceans' Habitat Management Unit in New Westminster.

Loadsite Information

PWC 3 is exclusively used by Public Works and Government Services Canada for channel maintenance projects in the Fraser River. In 1993, 20 717 cubic metres of material was disposed of at the PWC 3 disposal site. All suction dredging activities must be conducted within the Fraser River Dredging Guidelines.

5.17 PWC 5

Disposal Site:	PWC 5
Number:	154
Co-ordinates:	49°09.40'N; 122°59.70'W
Depth:	10 metres
Total Quantity Disposed Since 1976:	1 222 797 cubic metres

Comments

For specific dredging and disposal timing restrictions contact the Department of Fisheries and Oceans' Habitat Management Unit in New Westminster.

Loadsite Information

PWC 5 is exclusively used by Public Works Canada. In 1993, 14 500 cubic metres of Fraser River sand from St. Mungo Bend was disposed of at PWC 5. The Fraser River Dredging Guidelines apply. Clamshell dredging may operate year round subject to site specific approval.

6.0 REFERENCES

- Ellis, David L.S. 1993. H.M.C.S. Chaudiere monitoring survey results. Environment Canada, Waste Management Division, Conservation and Protection, Pacific and Yukon Region. Regional Data Report: 93-01.
- Kim, K. 1994. H.M.C.S. Chaudiere monitoring survey results. Environment Canada, Waste Management Division, Pollution Abatement Division, Environmental Protection Branch, Pacific and Yukon Region. Regional Data Report: 94-01.
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- Sullivan, D. 1987. Compilation and assessment of research, monitoring and dumping information for active dumpsites on the British Columbia and Yukon coasts from 1979 to 1987. Environment Canada, Conservation and Protection, Pacific and Yukon Region. Manuscript Report: 87-02.
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- Ward, A.B. and D.L. Sullivan. 1980. A review of existing and historical ocean dumpsites in the Pacific Region. Environment Canada, Environmental Protection Service, Pacific Region. Regional Program Report: 80-5.

APPENDICES

APPENDIX I

Interim Contaminant Testing Guidelines For Ocean Disposal Pacific And Yukon Region (1997 March)

INTERIM CONTAMINANT TESTING GUIDELINES FOR OCEAN DISPOSAL PACIFIC AND YUKON REGION (1997 MARCH)

In response to growing concern over the biological implications of contaminants in marine sediments along the Canadian coastline, Environment Canada (EC), Pacific and Yukon Region (P&Y), in consultation with the Regional Ocean Disposal Advisory Committee (RODAC), has developed the following guidelines for sampling, analysis and reporting associated with proposed ocean disposal activities.

Under Schedule III, Part III of the Canadian Environmental Protection Act (CEPA), EC (P&Y) must consider the availability of practical alternative disposal options. To satisfy this requirement the applicant must provide a written record of the decision-making process used in selecting ocean disposal as the alternative of choice for disposal of materials. Disposal at sea is only permitted for materials where it is the environmentally preferable and practical alternative.

To assess the potential for environmental impacts of Ocean Disposal, EC (P&Y) will require chemical analyses to be performed on any material where there is a lack of chemical data, or a reason to believe that contaminants such as selected trace metals or organics are present. The minimum number of samples and the analyses required is specified in the following tables; the number of samples and the analyses required may be increased by EC (P&Y) in some instances. A proposed sampling program should be developed by the applicant, based on information provided in the following tables, and submitted to EC (P&Y) for approval prior to commencement of loading/ocean disposal activities.

Materials found to contain substances of concern at or higher than the regulated or guideline concentrations identified in the following tables may be considered for ocean disposal under section 71(3) of CEPA if they pass a series of biological tests. A tiered assessment approach using biological testing is used for this determination. The procedures for these tests are described in the document entitled "Interim Guidance for Application of Rapidly Rendered Harmless (RRH) and Trace Contaminants"; which is available upon request from EC (P&Y). Ocean disposal options such as capping, containment, and side-casting, suggested by an applicant, will be considered by EC (P&Y), but their acceptance will be conditional on compliance with RRH protocols.

SAMPLING AND ANALYSIS REQUIREMENTS

The following pages identify the minimum sampling and analytical requirements for dredged and excavated materials based on the size of the project, as well as rejection/screening limits currently used by EC (P&Y). Sampling requirements will be tailored on a site specific basis at the discretion of EC (P&Y), and analysis of other parameters may be requested when EC (P&Y) has reason to believe that other contaminants are present.

MINIMUM REQUIREMENTS FOR DREDGED MATERIALS

SAMPLING REQUIREMENTS

All samples are analysed for minimum requirements.

Project Quantity (m ³)	Permit Type	Minimum # of Samples	Type of Sampling
0 - 4,000	General *	3 (1) **	<ul style="list-style-type: none"> • surface sampling prior to loading
0 - 10,000	Site-Specific	3 (1)	<ul style="list-style-type: none"> • surface sampling prior to loading
10,000 - 30,000	Site-Specific	3 (1) 3 (1) or 6 (2)	<ul style="list-style-type: none"> • surface sampling prior to loading • sampling to depth prior to loading • surface sampling prior to loading • may require additional sampling during dredging
30,000 - 60,000	Site-Specific	4 (2) 4 (2)	<ul style="list-style-type: none"> • surface sampling prior to loading • sampling to depth prior to loading
> 60,000	Site-Specific	<ul style="list-style-type: none"> • sampling requirements to be determined on a project specific basis 	

* General Permits are multi-loadsite permits issued to applicants, and are specific to disposal from maintenance dredging projects of less than 4000 cubic metres.

** The brackets indicate the number of *composite* samples to be analysed initially for dioxins/furans, if requested by EC (P&Y).

MINIMUM ANALYSIS REQUIREMENTS

	Parameter	Limit of Detection
Trace Metals	Mercury (Hg)	0.2 µg/g
	Cadmium (Cd)	0.2 µg/g
Organics	TPAH	0.1 µg/g
Other	TOC	
	Particle Size	

For PAH, the analytical methodology and quality assurance protocol must conform to that outlined in the 'Interim Quality Assurance Guidelines for Determination of Polynuclear Aromatic Hydrocarbons in Marine Sediments for Ocean Disposal', a copy of which is available from EC (P&Y).

Should the site history reveal cause for environmental concern, an increased number of samples and/or analysis of other metals and/or organics may be requested. Additional parameters may include the following:

	Parameter	Limit of Detection
Trace Metals	Copper (Cu)	10 µg/g
	Zinc (Zn)	10 µg/g
	Arsenic (As)	10 µg/g
	Chromium (Cr)	10 µg/g
	Nickel (Ni)	10 µg/g
	Lead (Pb)	10 µg/g
Organics	PCB	0.05 µg/g
	PCP	0.05 µg/g
	Dioxins/furans	10 pg/g for T ₄ CDD

The analysis results are to be reported on a dry weight basis with detection limits less than or equal to those stated above. The precision of the test method should be indicated by reporting analyses on five replicate sub-samples on 10% of the trace metal samples, and two replicate sub-samples on 20% of the organics samples, with a minimum of one replicated sample. Sub-sampling should be done following homogenizing but prior to digestion of the sample and the replicates should not be run consecutively. The accuracy of the test method should be indicated by reporting the results of certified reference materials analysed at the same time as the test samples.

For dioxin/furan, the analytical methodology and quality assurance protocol must conform to that outlined in the 'Internal Quality Assurance Requirements for Analysis of Dioxins in Environmental Samples', a copy of which is available from EC (P&Y).

MINIMUM REQUIREMENTS FOR EXCAVATION MATERIALS*

* "General" Permits for excavation spoils are restricted to the loading and ocean disposal of *undisturbed, native material*. For other excavated materials, a site specific permit will be required.

SAMPLING REQUIREMENTS

Project Quantity (m ³)	Minimum Number of Samples	Type of Sampling
0 - 10,000	3	• composite of surface native material to one metre depth
10,000 - 30,000	6	• composite of surface native material to one metre depth
30,000 - 60,000	8	• composite of surface native material to one metre depth
> 60,000	sampling requirements to be determined on a project specific basis	

MINIMUM ANALYSIS REQUIREMENTS

	Parameter	Limit of Detection
Trace Metals	Mercury (Hg)	0.2 µg/g
	Cadmium (Cd)	0.2 µg/g
	Lead (Pb)	10 µg/g
	Copper (Cu)	10 µg/g
	Zinc (Zn)	10 µg/g
	Arsenic (As)	10 µg/g
	Chromium (Cr)	10 µg/g
	Nickel (Ni)	10 µg/g
Organics	TPAH	0.1 µg/g
Other	TOC	
	Particle Size	

Should the site history reveal cause for environmental concern, an increased number of samples and/or analysis of other metals and/or organics may be requested.

The analysis results are to be reported as stipulated under Table 1. Minimum requirements for dredged materials.

REJECTION/SCREENING LIMITS

Parameter	Rejection/Screening Limit ($\mu\text{g/g}$ dry weight)
Cadmium	0.6 $\mu\text{g/g}$
Mercury	0.75 $\mu\text{g/g}$
Arsenic	* 0.1 % or more by weight or 1000 $\mu\text{g/g}$
Copper Zinc	
Beryllium	
Chromium	
Nickel	
Vanadium	
Lead	
Chlorophenols (PCP) (penta and tetra isomers)	1.0 $\mu\text{g/g}$
Polychlorinated biphenyls (PCB)	0.1 $\mu\text{g/g}$
PAH (total)	2.5 $\mu\text{g/g}$
Dioxin/Furan	"quantifiable" 2,3,7,8 TCDD

* These levels are defined as "significant amounts" as agreed to by Canada as a signatory to the London Convention (LC); if exceeded, special care measures are required for disposal. *EC (P&Y) considers these levels as general guidelines only and may impose more stringent limits.*

STEPS REQUIRED FOR COLLECTING SAMPLES AND SUBMITTING ANALYTICAL DATA

Prepare the following information:

- 1) a location map for the dredge/excavation site with the the street address of the proposed excavation or dredge site,
- 2) a site map showing the proposed excavation or dredge site relative to known landmarks and/or streets,
- 3) a list of any known possible contaminant input sources in the vicinity of the proposed works,
- 4) a written record of the decision making process used in selecting ocean disposal as the preferred materials disposal option, explaining why other disposal methods are not being used,
- 5) a site use history for the site from which the material destined for ocean disposal will originate, and
- 6) a proposed sampling plan of the site showing the proposed sampling locations, and a list of proposed analyses. The proposed sampling plan should be developed based on information presented in this document. Assistance in designing a sampling program can be provided by Environment Canada (EC), Pacific and Yukon Region (P&Y). *The sampling program must be approved prior to taking the samples.*

The information identified above should be sent to EC (P&Y). If the project does not qualify for completion under the terms and conditions of a "General" permit, this information should be submitted with a completed Ocean Disposal Application form. For information on how to apply, please contact EC (P&Y).

If the project qualifies for completion under a "General" Ocean Disposal Permit, this information must be submitted to EC (P&Y) with a covering letter describing the proposed activities in detail, and the proposed schedule for the work. Upon completion of the sampling and analyses program, the test data, together with all QA/QC data as identified in the foregoing information, must be sent to EC (P&Y).

No work may proceed under a "General" Permit until written approval for the specific site has been received from EC (P&Y), and a copy of the approval letter is posted at the work site.

For further information on this document, or any other matter relating to Ocean Disposal, please contact the following:

Dixie Sullivan	(604) 666-2730
Duane Brothers	(604) 666-0724
Cathy Schnider	(604) 666-2685

GENERAL GUIDE TO SOIL AND SEDIMENT SAMPLE COLLECTION

Containers for the samples should be obtained from the laboratory contracted to conduct the required analyses. Avoid unnecessary contact with clean glassware and utensils. A clean stainless steel or teflon spoon or scoop is ideal for transferring samples. Handle containers by the outsides only. Do not touch the inside of the jar, or teflon (or foil) liners, and use spoons or scoops by the handles only. When removing a foil or teflon liner and lid from a jar, remove as one piece and put down on a piece of foil or other clean surface while filling the jar.

If using a grab sampler, remove the water from the surface of the grab, taking care not to disturb the contents if possible. Use the clean scoop to remove a portion of the sediment from the middle of the sampler down to the depth of the material caught in the grab. The material in the sample jar should be representative of the material to be loaded for ocean disposal.

Alternatively, the sample may be taken by removing the lid, holding the jar by the sides and scooping the sample from the sediment without the use of other utensils. The threads of the jar may then be wiped with a paper towel before replacing the lid. Do not fill the jar more than about 3/4 full, allowing plenty of room for mixing/stirring, and expansion during freezing.

When the sample is in the jar, replace the teflon/foil liner and lid, and label the jar with project identification, the sampling site number, and the date.

To clean the sampling spoon or grab in-between samples, wipe with a paper towel to remove any solids, then rinse with water. Clean the tray in this manner as required.

If three samples are required for analysis, three small jars of sediment should be taken for *each* sampling station, for a total of nine jars. The three jars per sample will be composited by the analytical lab by taking equal aliquots of sample from each jar for a single analysis of most parameters of concern. The samples may be further composited for other testing as required but would otherwise be maintained as discrete samples.

Keep the samples in a refrigerator or on ice for short term storage (1-2 days); freeze the sample as soon as possible or store over dry ice for long term storage. The laboratory responsible for the analyses should be asked to freeze the samples after removal of sufficient material to complete the required analyses. These samples should remain frozen until the permit, or approval under a general permit, has been issued by EC (P&Y).

APPENDIX II

Ocean Disposal Site Summaries

Disposal Site History Report

For Disposal Activities Between 1/1/93 and 12/31/93

Disposal Site Point Grey
 Number 1
 Latitude 49°15.40
 Longitude 123°22.10
 Depth (m) 210

Permit Type	Permit	Loadsite	Dump Start Date	Quantity	
Dredge	3045	FRNA-MB-NW	04-Apr-93	1510 m3	
	3047	FR-ACORN-PRIMEX	10-Jan-93	700 m3	
		FRNA-WEST COAST CELLUFIBRE	31-Jan-93	1500 m3	
		FR-NORVIK LUMBER	12-Mar-93	1500 m3	
		FR-ACORN-PRIMEX	14-Mar-93	1000 m3	
		FR-MACKENZIE MILLS	02-Apr-93	750 m3	
		FRNA-WEST COAST CELLUFIBRE	04-Apr-93	750 m3	
		FRNA-EBURNE	16-Apr-93	100 m3	
		FRNA-VAN SAWMILL	25-Apr-93	1500 m3	
		FRNA-EBURNE	09-May-93	3000 m3	
		3048	FR-MAINTENANCE	15-Feb-93	1000 m3
	3050	HOWE SD-THORNBROUGH	23-Feb-93	3000 m3	
		FR-MILL & TIMBER	27-Feb-93	4000 m3	
		FR-DOMANS-NW	06-Mar-93	3000 m3	
		VAN HBR-FALSE CREEK	10-Mar-93	1500 m3	
		FR-COLUMBIA BITULITHIC	15-Mar-93	350 m3	
		FRNA-MAINLAND SAWMILL	20-Mar-93	3000 m3	
		FRNA-TERMINAL SAWMILL	27-Mar-93	1500 m3	
		FRNA-WESTERN WHITEWOOD	06-Apr-93	1500 m3	
		FR-COLUMBIA BITULITHIC	14-Apr-93	50 m3	
		FR-CONAG-MITCHELL ISLAND	14-Apr-93	700 m3	
	3056	FRNA-RICHMOND PLYWOOD	01-May-93	3000 m3	
		FR-BC PACKERS	16-Mar-93	1000 m3	
		3062	FR-MAINTENANCE	03-Nov-93	26400 m3
		3064	VAN HBR-VANCOUVER SHIPYARD	30-Jan-93	17403 m3
		3078	FR-ACORN-PRIMEX	19-Jun-93	1000 m3
			FRNA-WEST COAST CELLUFIBRE	07-Aug-93	2000 m3
			FRNA-LAFARGE-KENT ST	10-Aug-93	800 m3
			FR-MACKENZIE MILLS	14-Aug-93	1000 m3
			FR-ACORN-PRIMEX	21-Aug-93	1000 m3
FRNA-EBURNE			24-Sep-93	1000 m3	
FRNA-VAN SAWMILL	09-Oct-93		2500 m3		
FRNA-WEST COAST CELLUFIBRE	08-Nov-93		4000 m3		
FR-DOMANS-NW	12-Nov-93		3000 m3		
FR-ACORN-PRIMEX	20-Nov-93		1000 m3		
3079	FRNA-WEST COAST CELLUFIBRE	19-Dec-93	1000 m3		
	FR-S&R SAWMILLS	04-Nov-93	34428 m3		

Disposal Site History Report

For Disposal Activities Between 1/1/93 and 12/31/93

Dredge	3080	FR-MILL & TIMBER	16-Jul-93	3500 m3	
		FR-MILL & TIMBER	15-Oct-93	3000 m3	
	3082	FRNA-MB-NW	25-Aug-93	3700 m3	
	3084	FRNA-CANADIAN WHITE PINE	16-Jul-93	4000 m3	
		LOWER MAINLAND-BEL	25-Jul-93	2000 m3	
		FRNA-WESTERN WHITEWOOD	21-Sep-93	700 m3	
		FRNA-MAINLAND SAWMILL	25-Sep-93	3000 m3	
		FRNA-RICHMOND PLYWOOD	08-Oct-93	2000 m3	
		FR-DOMANS-NW	13-Nov-93	3000 m3	
		LOWER MAINLAND-BEL	24-Nov-93	1500 m3	
		FRNA-WESTERN WHITEWOOD	27-Nov-93	350 m3	
		FRNA-CANADIAN WHITE PINE	21-Dec-93	700 m3	
		FRNA-AERO TRADING	29-Dec-93	2700 m3	
	3087	FR-CIPA LUMBER	22-Sep-93	7050 m3	
	3088	VAN HBR-NOVA LUMBER	27-Jul-93	1500 m3	
		VAN HBR-NOVA LUMBER	05-Nov-93	500 m3	
	3089	VAN HBR-FLAVELLE CEDAR	30-Aug-93	9500 m3	
				Total Dredge Quantity:	181141 m3
	Excavation	3042	LOWER MAINLAND-MILLER	29-Jan-93	40000 m3
3052		LOWER MAINLAND-BEL	28-Feb-93	20299 m3	
		LOWER MAINLAND-BEL	31-Mar-93	49361 m3	
		LOWER MAINLAND-BEL	30-Apr-93	35847 m3	
		LOWER MAINLAND-BEL	31-May-93	23166 m3	
		LOWER MAINLAND-BEL	30-Jun-93	17596 m3	
3058		LOWER MAINLAND-MILLER	25-Mar-93	75000 m3	
		LOWER MAINLAND-MILLER	27-May-93	8000 m3	
		LOWER MAINLAND-MILLER	25-Jun-93	3000 m3	
		LOWER MAINLAND-MILLER	14-Jul-93	14000 m3	
3085		LOWER MAINLAND-BEL	30-Jul-93	23361 m3	
		LOWER MAINLAND-BEL	30-Aug-93	17082 m3	
		LOWER MAINLAND-BEL	30-Sep-93	14716 m3	
		LOWER MAINLAND-BEL	31-Oct-93	8541 m3	
		LOWER MAINLAND-BEL	30-Nov-93	14365 m3	
3091		LOWER MAINLAND-BEL	31-Dec-93	16867 m3	
		LOWER MAINLAND-MILLER	31-Jul-93	3952 m3	
		LOWER MAINLAND-MILLER	31-Aug-93	12600 m3	
		LOWER MAINLAND-MILLER	30-Sep-93	487 m3	
		LOWER MAINLAND-MILLER	31-Oct-93	3427 m3	
	LOWER MAINLAND-MILLER	30-Nov-93	8287 m3		
		LOWER MAINLAND-MILLER	31-Dec-93	7169 m3	
			Total Excavation Quantity:	417123 m3	
			Total Disposal Site Quantity:	598264 m3	

Disposal Site History Report

For Disposal Activities Between 1/1/93 and 12/31/93

Disposal Site Sand Heads
Number 9
Latitude 49°06.00
Longitude 123°19.50
Depth (m) 70

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3048	FR-MAINTENANCE	19-Feb-93	12500 m3
		FR-MAINTENANCE	21-Apr-93	27000 m3
	3084	FR-GENSTAR-TILBURY ISLAND	04-Oct-93	4000 m3
	3090	FR-MCIVOR'S LANDING	15-Dec-93	2500 m3
	3094	FR-GULF SITE	31-Oct-93	9428 m3
Total Dredge Quantity:				55428 m3
Total Disposal Site Quantity:				55428 m3

Disposal Site History Report

For Disposal Activities Between 1/1/93 and 12/31/93

Disposal Site Victoria
Number 14
Latitude 48°22.30
Longitude 123°21.80
Depth (m) 90

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Others	3081	VAN HBR-BC SUGAR	26-Apr-93	305 metric tons
Total Others Quantity:				<u>305 metric tons</u>
Total Disposal Site Quantity:				<u><u>305 metric tons</u></u>

Disposal Site History Report

For Disposal Activities Between 1/1/93 and 12/31/93

Disposal Site Porlier Pass
Number 32
Latitude 49°00.20
Longitude 123°29.80
Depth (m) 200

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3068	VAN IS-LADYSMITH-CPFP-MILL	27-Jun-93	3500 m3
		VAN IS-LADYSMITH-CPFP-DRYSOR	01-Jul-93	1500 m3
		VAN IS-CHEMAINUS-SAWMILL	23-Jul-93	2000 m3
		VAN IS-CHEMAINUS-DRYSORT	11-Aug-93	1000 m3
		VAN IS-LADYSMITH-DOMANS	15-Aug-93	2000 m3
		VAN IS-LADYSMITH-CPFP-MILL	06-Sep-93	1000 m3
		Total Dredge Quantity:		<u>11000 m3</u>
		Total Disposal Site Quantity:		<u>11000 m3</u>

Disposal Site History Report

For Disposal Activities Between 1/1/93 and 12/31/93

Disposal Site Five Finger Island
Number 40
Latitude 49°15.20
Longitude 123°54.60
Depth (m) 280

Permit Type	Permit	Loadsite.	Dump Start Date	Quantity
Dredge	3068	VAN IS-DOMANS-DUKE PT	04-Jul-93	1500 m ³
Total Dredge Quantity:				<u>1500 m³</u>
Total Disposal Site Quantity:				<u>1500 m³</u>

Disposal Site History Report

For Disposal Activities Between 1/1/93 and 12/31/93

Disposal Site Comox (Cape Lazo)
Number 48
Lattitude 49°41.70
Longitude 124°44.50
Depth (m) 190

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3073	VAN IS-COURTENAY RIVER	31-Jul-93	7500 m3
Total Dredge Quantity:				<u>7500 m3</u>
Total Disposal Site Quantity:				<u>7500 m3</u>

Disposal Site History Report

For Disposal Activities Between 1/1/93 and 12/31/93

Disposal Site Malaspina Strait
Number 49
Latitude 49°45.00
Longitude 124°27.00
Depth (m) 320

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3046	POWELL RIVER	22-May-93	3000 m3
	3069	LANG CREEK	16-Feb-93	4000 m3
		PHILLIPS ARM	31-May-93	1000 m3
	3077	POWELL RIVER	30-Sep-93	12250 m3
		POWELL RIVER	03-Oct-93	2600 m3
Total Dredge Quantity:				<u>22850 m3</u>
Total Disposal Site Quantity:				<u><u>22850 m3</u></u>

Disposal Site History Report

For Disposal Activities Between 1/1/93 and 12/31/93

Disposal Site Thormanby Island
Number 114
Lattitude 49°27.50
Longitude 124°04.50
Depth (m) 384

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3074	THORMANBY ISLAND	16-Jan-93	300 m3
Total Dredge Quantity:				<u>300 m3</u>
Total Disposal Site Quantity:				<u><u>300 m3</u></u>

Disposal Site History Report

For Disposal Activities Between 1/1/93 and 12/31/93

Disposal Site Cape Mudge
Number 116
Lattitude 49°57.70
Longitude 125°05.00
Depth (m) 200

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3069	VAN IS-MENZIES BAY-MB-DRY SO	07-Mar-93	3500 m3
		VAN IS-MENZIES BAY-MB-WET SO	13-Mar-93	3000 m3
		Total Dredge Quantity:		<u>6500 m3</u>
		Total Disposal Site Quantity:		<u>6500 m3</u>

Disposal Site History Report

For Disposal Activities Between 1/1/93 and 12/31/93

Disposal Site Johnstone Strait-Hickey Point
Number 119
Latitude 50°27.80
Longitude 126°04.80
Depth (m) 270

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3070	VAN IS-EVE RIVER	22-Jan-93	1000 m3
		VAN IS-KELSEY BAY-MB	25-Jan-93	1500 m3
			Total Dredge Quantity:	2500 m3
			Total Disposal Site Quantity:	2500 m3

Disposal Site History Report

For Disposal Activities Between 1/1/93 and 12/31/93

Disposal Site Johnstone Strait-Hanson Island
Number 120
Latitude 50°33.50
Longitude 126°48.00
Depth (m) 350

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3070	VAN IS-BEAVER COVE-CANFOR	14-Jan-93	1000 m3
		VAN IS-PORT MCNEILL-WESTERN	16-Jan-93	500 m3
		VAN IS-PORT MCNEILL-MB	20-Jan-93	1500 m3
		Total Dredge Quantity:		<u>3000 m3</u>
		Total Disposal Site Quantity:		<u><u>3000 m3</u></u>

Disposal Site History Report

For Disposal Activities Between 1/1/93 and 12/31/93

Disposal Site Queen Charlotte Strait
Number 140
Lattitude 50°46.40
Longitude 127°22.60
Depth (m) 390

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3055	VAN IS-HARDY BAY-SEA PLANES	07-Jan-93	12000 m3
Total Dredge Quantity:				<u>12000 m3</u>
Total Disposal Site Quantity:				<u>12000 m3</u>

Disposal Site History Report

For Disposal Activities Between 1/1/93 and 12/31/93

Disposal Site PWC 3
Number 152
Latitude 49°06.40
Longitude 123°07.90
Depth (m) 13

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3062	FR-MAINTENANCE	03-Aug-93	20717 m3
Total Dredge Quantity:				<u>20717 m3</u>
Total Disposal Site Quantity:				<u><u>20717 m3</u></u>

Disposal Site History Report

For Disposal Activities Between 1/1/93 and 12/31/93

Disposal Site PWC 5
Number 154
Latitude 49°09.40
Longitude 122°59.70
Depth (m) 10

Permit Type	Permit	Loadsite	Dump Start Date	Quantity
Dredge	3048	FR-MAINTENANCE	15-Feb-93	6000 m3
		FR-MAINTENANCE	07-Apr-93	8500 m3
			Total Dredge Quantity:	<u>14500 m3</u>
			Total Disposal Site Quantity:	<u><u>14500 m3</u></u>