LOWER HARDISTY CREEK

BIOLOGICAL SURVEY

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Concern has been expressed as to the possible impact of leachate, from a discontinued bark pile on the St. Regis mill site, on the quality of Hardisty Creek. The problem appears to have persisted over a five or six year period but up until this time chemical analysis has not documented the significance of any impact. In attempting to clarify the situation a biological survey of the creek was undertaken. Benthic invertebrate samples were obtained from locations above and below the bark pile to quantify the magnitude of instream changes. The sites selected are illustrated in figure 1 and a brief description of the sampled sites follows.

Site 1 - 4,500 meters from mouth located downstream of forestry road culvert (approx. 50 meters). This was an apparently undisturbed site, the forest canopy was dense and stream bed heterogeneity high with normal amounts of allochthonous material. Stream width 2 meters; maximum depth 30 cms.

Site 2 - 2,000 meters from mouth and upstream of any discharges however this site is in an urban setting with extensive clearing. There was evidence of heavy scouring and bank erosion, little allochthonous material was present in the stream bed. Stream width 2 meters, maximum depth 25 cms.

Site 3 - 1,800 meters from mouth, 70 meters downstream of storm sewer discharge. Stream bed was not visible due to dense growth of attached algae. Stream width 1.5 meters, maximum depth 30 cms.

Site 4 - 1,200 meters from mouth, in the vicinity of bark pile, downstream of apparent entry of leachate material. Heavy orange-brown discoloration on substrate visible, little growth of epiphytic community visible, but large amounts of organic material present. Stream width 1.5 meters, maximum depth 25 cms.

Site 5 - 200 meters from mouth, surrounding area appeared to be natural vegetation with a good forest canopy and considerable allochthonous material was present in the stream. No discoloration was visible on stream bed and the site appeared to be unperturbed. Stream width 2 meters, maximum depth 35 cms.

Five replicate samples were taken at each site using a modified cylinder sampler. Samples were returned to the laboratory for sorting and identification after preservation. Because of the nature of some of the sampling units these were subsampled quantitatively, detailed results are attached. As data are available for only the one sampling occasion it was felt more suitable to contain data analysis to the lower taxonomic groups thus avoiding interpretation problems resulting from life history variations. Furthermore all data was transformed prior to analysis with a natural logarithm transformation as they showed a non-normal distribution.

Summarized results for the four dominant groups are shown in figure 2, and indicate considerable changes in the community structure over the study reach. These changes are indicative of major habitat variation over a relatively small stream reach. This is confirmed by a one way ANOVA on the taxonomic groups and total numbers sampled showing the sites to represent different populations (Table 1).

Based on the known history of the stream and the results available here it seems that the effects of three phenomena may be observed that are determining the distribution and abundance of the benthic fauna. The first effect observed is the result of the heavy scouring observed at control site 2. It is likely that this had two effects first physical removal of the animals, second removal of a main food source viz. allocthonous material. The fact that the stream is located in an urban setting in a heavily eroded stream bed at site 2 probably reduces the inputs of material to the stream and also reduces the rate of recovery. The main effect of this impact has been a reduction in the number of larger detritivores, the mayflies, and a generally lower production in the stream.

The second impact in the stream is observed at site 3, that is the discharge from the storm sewer. It was apparent from observation at the site that there was a large nutrient input from the storm sewer. This was clear from the heavy development of attached algal growth at the sewer outlet and in the stream below the entry of the sewer discharge. The effect of this on the stream community is clear from the data. There is a large increase in the numbers of chironomids (300%) and also a recovery in the numbers of mayflies (ephemeroptera) to site 1 levels (Table 1). In a sense this may be considered a recovery in that there is an increase in the food supply. However the large amount of organic material could result in low winter dissolved oxygen levels.

The third impact is observed at sites 4 and 5. These two sites do appear to show the greatest effect. The most obvious is the three orders of magnitude change in the oligochaete population to more than 3000 per sample at site 4. Similarly there is a significant increase in the number of chironomids compared to site 1 and a decline in the number of ephemeroptera compared with both sites 1 and 3. In order to distinguish the differences between the storm sewer discharge and the bark pile leachate sites 4 and 5 were compared with both sites 1 and 3. It seems that the difference in the oligochaete and ephemeroptera populations is in fact a result of stream modification from the leachate, and whilst chironomid numbers are higher at sites 4 and 5 compared with site 3 this difference does not appear significant. Physically the in stream changes at site 4 are apparent, a heavy orange-brown discoloration of the substrate and a shift from the green algal growth at site 3 to other epiphytes and decomposing organic material. It is clear that at site 4 the stream is severly stressed showing the effects of high organic loadings. Whether the decrease in the ephemeroptera populations represents an additional toxic response can only be speculated upon, however it is of interest that at both sites 4 and 5 the ephemeroptera community was significantly depressed. Finally at site 5 although the streams environs and the stream itself appeared to have recovered physically the impact can still be observed in the biological community. Oligochaetes and chironomids are still significantly more abundant than at the sites upstream and the ephemeroptera conversely remain depressed.

In summary Hardisty Creek shows a considerable variation in biological quality over a relatively short reach. There are three responses observed which in order of severity appear to be:

1) seepage from the bark pile-which has a physical impact on the appearance of the stream and in terms of the community response shows an organic loading stress and a possible toxic component.

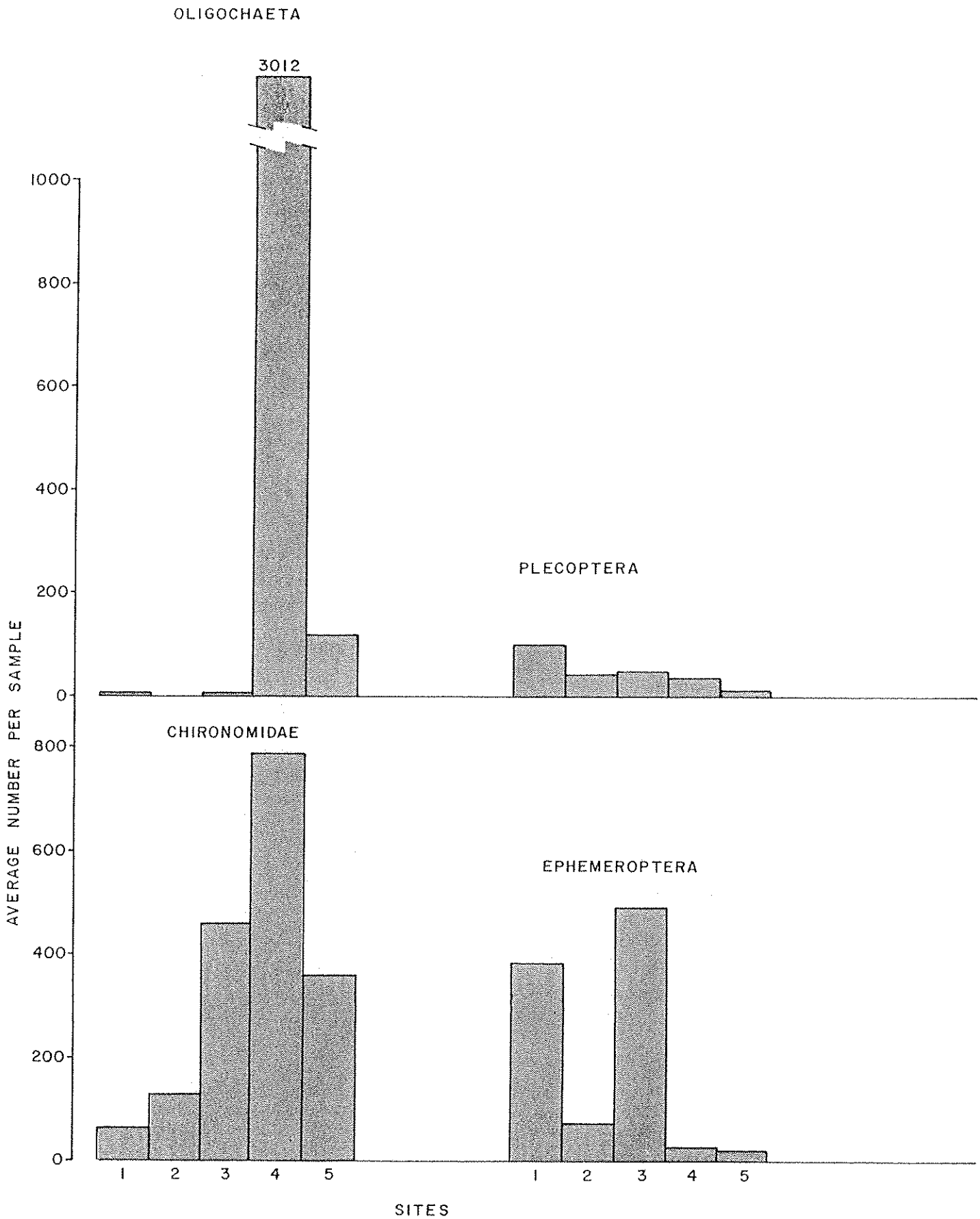
2) discharge from the storm sewer-which in terms of community response demonstrates the effects of organic loading.

3) the effects of physical disturbances from scouring and bad erosion.

TABLE 1

Results of 1-way ANOVA, values of F and significance ($P<0.05$) for impacts on Hardisty Creek

Sites Tested	1,2,3,4,5	1,2	1,2,3,	1,3	1,4,5	3,4,5,
Phenomena	represent some population	effect of scouring	scouring & sewer	sewer	bark pile	sewer & bark pile
Oligochaete F	29.03	2.18	0.95	0.04	24.19	21.60
sig.	+	-	-	-	+	+
Chironomiue F	6.67	0.27	19.37	26.90	9.78	0.01
sig.	+	-	+	+	+	-
Ephemeroptera F	12.50	7.12	2.13	0.05	40.97	42.91
sig.	+	+	-	-	+	+
Plecoptera F	3.16	0.64	0.04	0.30	3.20	1.97
sig.	+	-	-	-	-	-
Total Numbers F	5.08					
sig.	+					



NUMBERS OF INVERTEBRATES SAMPLED FROM HARDISTY CREEK LOCATIONS

FIGURE 2

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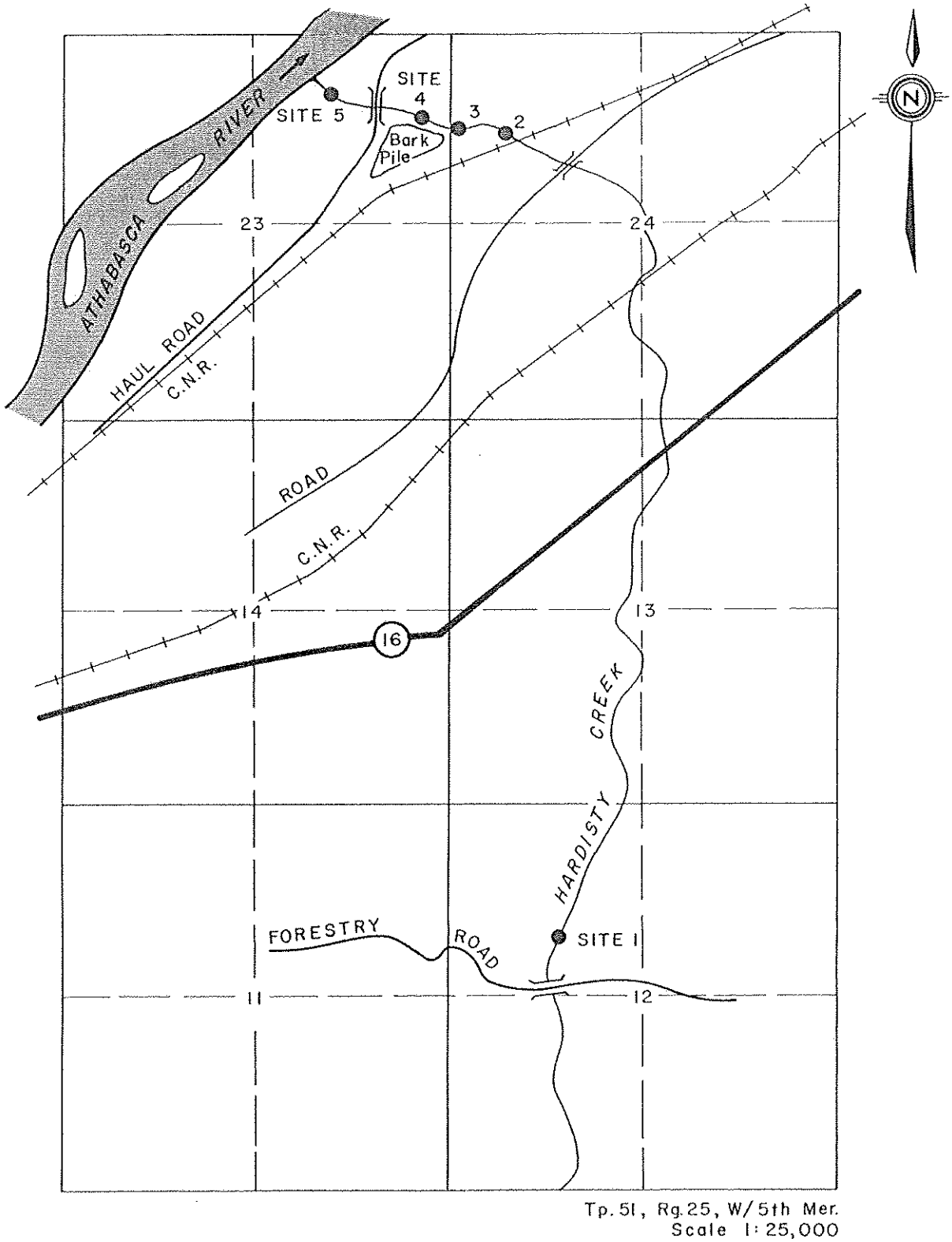

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Scale 1:25,000

LOCATION OF SAMPLING SITES ON HARDISTY CK.

FIGURE 1

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