Proceedings of the 8th Annual British Columbia Mine Reclamation Symposium in Victoria, BC, 1984.
The Technical and Research Committee on Reclamation

LAND AND MARINE WASTE DUMPS

by Ron Hillis and Ian Horne

Laura has discussed the colonization by benthic organisms of tailings deposited on the floor of Rupert Inlet. I will now carry on up through the subtidal, intertidal and foreshore zones.

One area where tailings have been deposited in the intertidal zone is at Hankin Point. This is due to tidally manifested upwelling from the deeper zones of the inlet. The mean sedimentation rate from 1977 to 1983 has ranged from 200 to 400 g/m^2 /day. This is contrasted to less than 15 g/m^2/day in other locations in the system.

In spite of the high sediment loads, the flora and fauna around Hankin Point continue to live and reproduce. The following slides were all taken by divers at Hankin Point between March and December 1983. The deep water clam, Humilaria kennerleyi, lives in the tailings. This specimen was found at 15 metres below the surface. Many species of fish live around Hankin Point. This flatfish blends in well with the tailings. A Northern Ronquill is seen swimming over the tailings. A Buffalo Sculpin hides among the rocks. The unique looking colony, known as the Sea Pen, Ptilosarcus gurneyi, is also found growing in the tailings. Numerous other organisms such as: the Vermillion Star, Mediaster aequalis, Burrowing Sea Anemones, Pachycerianthus fimbriatus, Burrowing Sea Cucumber, Cucumaria miniata and the Slime Worm Theleaus crispas are found in large numbers.

On rocks, or any other substrate above the inlet floor, such as our suspended sediment tripod and collection cup, many other organisms thrive. The Leather Star, Dermisterias imbricata, has climbed up the tripod looking for a meal. The hydroids have settled and are growing on the collection cup. These nudibranchs are seen feeding on the hydroids.

Moving up into the intertidal or litoral zone, tailings settle out onto the rocky outcroppings. Yet, the green algae, Ulva, a Leather Star, a Bat Star, Patiria miniata and brown algaes are seen. The rocks are covered with hydroids, as well as sediment.

The beach, in this limited area around Hankin Point, representing less than 1% of the Rupert Inlet shoreline, has been transformed from a pebble cobble environment to one of sand. The pins you see sticking out of the sediment allow us to monitor the accumulation of tailings. Eel grass, Zostera marina, a marine relative of land plants, does grow on the sediment. Shifting and rapid deposition of sediment, rather than sediment sterility or toxicity, affect its survival. This overview of the beach shows the cobbles in the upper zone with a thick deposit of tailings in the lower zone.

Another area impacted by sediment upwelling at Hanking Point is Quatsino Narrows. The current through the Narrows is too swift to permit a large amount of sediment deposit, but this area is frequently dusted with fine particles of tailings. It has been observed by local divers that Quatsino Narrows compares and in some areas exceeds the diversity and growth of organisms found in pristine high current systems such as Stubbs Island in Johnstone Straight and Browing Pass in Queen Charlotte Sound.

In Quatsino Narrows, there is a large scallop bed, the exact location is our secret, where scallops are larger than your outstretched hand. They would be more than 20 years old. This specimen is covered with tunicates. Another favorite of shellfish lovers, the abalone, is well represented in Quatsino Narrows. Here a nudibranch appears to be dancing with a sea pen. Actually, he is about to graze on it. Giant barnacles continually sweep the passing waters for food.

Knowing a good spot when they see it, hydroids cover the barnacle shell and they too trap food passing by. The monster of the deep is a giant Wolf Eel. Its head is larger than mine and its overall length is probably 2.5-3 metres. The divers tried to entice it out of its den with a free meal of sea urchin, but it would only stick its head out.

Deepwater, subtidal and intertidal colonization of tailings deposited in the marine setting is one aspect of reclamation at Island Copper. The other is our marine and land dumps.

The major waste rock dumping zone is a marine landfill presently extending 3700 metres along the north shore of Rupert Inlet and extending up to 1000 metres out from the original shoreline. Over 80% of waste rock ends up on this dump.

In a government report, issued in 1980, Mike Waldechuck and Ron Buchanan made several recommendations to help reduce environmental impact at Island Copper. They recommended that the total length of the disturbed foreshore be kept to a minimum and on cessation of dumping, be recontoured to a colonizable slope of 10° through the intertidal zone.

A site at the westernmost end of the marine landfill was chosen for reclamation. This included the western end of the dump, Narrow Island and the Emergency Tailings Pond Dyke. The Emergency Tailings Pond Dyke was built between the marine outfall and Narrow Island to create an impoundment. The dyke was originally designed to be 20 metres wide. This did not provide enough material for recontouring, so an additional 200,000 tons of waste rock was placed in early 1982. The portion of the site to the east of Narrow Island did not require any additional material and was recontoured using our own production dozers. The procedure entailed cutting the dump face back and then sloping it to a 10° grade. To recontour the intertidal zone, times were carefully chosen to coincide with extreme low tides. This resulted in a colonizable slope of 10°, extending to and below the zero tidal mark. Once recontouring was complete, tills gleaned from a stripping operation at the north end of the pit were dumped and spread on the foreshore zone. Approximately 30 centimetres of tills were applied over the waste rock. A total of 167 dozer hours were required to construct, contour and spread materials on the site.

The beach reclamation site now extends from the marine outfall, east to Narrow Island. A portion of the island's natural shoreline remains undisturbed. Then, the beach continues to the western end of the landfill. The total length of the recontoured shoreline is 450 metres, which represents about 12% of the existing beach dump shoreline.

The beach site was seeded in April 1982, with the first growth coming on in June. In February 1983, the entire site was refertilized, and by July, was covered with lush green growth. Also during February 1983, Red Alder seedlings Alunus rubra, were transplanted onto the site. Also, some Scotch Broom and Huckleberry bushes were planted. These plants were all taken from areas around Port Hardy. Our resident deer population spends many hours sleeping in the grasses. They also graze on the grasses, legumes and plants.

The intertidal zone was left to natural recolonization by marine organisms. The green a l goes, Ulva and Enteromorpha were the first to settle, followed by barnacles of the genus Balanus. Washing by wave and tide action sorted material such that only the larger stable rocks provided a secure substrate on which to grow. In 1983, the first set of Fucus, a common brown algae was seen among the green algaes. By September 1983, the algae cover had become significant and the beach was providing habitat for intertidal shore crabs, Hemigrapsus nudus, and amphipod sand fleas. A number of commercial crab fishermen, who fish the Rupert-Holberg Inlet system now put their traps along the beach. These traps are pulled and reset repeatedly.

A further concern, with respect to the beach dump, was the loss of salmon fry habitat. So, as part of a larger program attempting to estimate fry populations in the

Rupert-Holberg systems, a sampling site was established on the reclamation beach. From February to July 1983, nine surveys were conducted. During the peak period, from April 15 through June 15, up to 600 fry of three species (Chum, Pink and Chinook) were caught in a single cast of the net. This result was a median value for the other twelve sampling sites. The fry were counted and released.

These results are highly encouraging and bode well for further reclamation work of this kind on our beach dump.

Turning our attention inland, which to us on the coast means 100 metres or so, I would like to show you our successes on the other side of the Emergency Tailings Pond Dyke. No tailings have been dumped into the pond for many years. The water quality in the pond is similar to other freshwater systems in the area and where above the water level, the tailings have packed down to form a hard sandy substrate. Today the western end of the pond is thick with bullrushes and with each passing year, more and more are growing. Recently, we have seen water lilies growing in the pond.

Our Emergency Tailings Pond now supports a year round population of ducks and provides a wintering ground for a dozen or more Canada Geese and eight Trumpeter Swans.

Efficient and lasting land reclamation depends on the materials available. During I960, the upper east wall of the pit was pushed back to its final limit. During the stripping and grubbing operations in this area, a decision was made to stockpile 3.4 million tons of glacial tills. This was calculated to be the amount of material necessary to cover the final area of our marine and land dumps with 30 centimeters of tills. Overburden materials from all areas of the pit have now been used to create a stockpile on top of our marine landfil. The stockpile occupies about 3 hectares and rises 20 metres above the dump level. Another till stockpile is located on the North Dump. To date, the total amount of stockpiled tills on both dumps exceeds 4 million tons. Soils and till removal is continuing on the west and north west areas of the pit, further adding to our available reserves. The swamp seen in the foreground of the slide provided typic mesisol for reclaiming the low level dump behind. This brings me to the summit of my talk and the hilltops referred to in the title of this presentation.

During the summer of 1980, a project was undertaken to recontour an old till stockpile (seen in the background of this 1979 slide). Production dozers were first used to recontour the slopes. Yet, on each of several attempts, the dozers became mired in soft material and had to be towed out. A D-6 wide-track Swamp Cat was then hired to do the job. This machine literally floated over the material. It took six weeks to recontour the dump and the resulting smooth slopes rose gently to the crest. Once recontouring was complete, topsoil, seen on top of the dump, was spread part way down the slope. The old tree stumps and logs, stockpiled with the topsoil were spread as well - creating another dimension to natural reclamation of our slopes. The slopes were seeded in 1981. This slide, taken in July 1983, shows the development of the whole area. Notice how the alders in the foreground have grown since 1981.

The southern facing outslopes, adjacent to the recontoured till dump, were composed of waste rock. These slopes were recontoured by our production dozers and subsequently spread with topsoils stored on top of the dump. These slopes were seeded in 1981 at a rate of I IO kg/ha of seed and 450 kg/ha of fertilizer. The seed mixture had included 40% creeping Red Fescue, 25% Rye grasses and 25% legumes. Results have been so good with this mixture, that it has been our staple every since. Our fertilizer mix has been 27-18-9 for spring planting, and 13-16-10 for fall planting.

Several tree planting projects have been conducted since I960. 750 Red Alders and 6000 Lodge Pole Pines (Pinus contorta) were planted in various areas of the North Dump in the spring of 1980. This was followed in February 1981, by 10,000 Red Alder

seedlings transplanted all over the North Dump. The alders planted in 1980 and 1981 have really taken off, growing up to 3 metres in height. The pine trees were slow in starting, particularly compared to adjacent alders. However, in 1983, many showed a half metre of new top growth.

With few exceptions, our reclamation sites do not receive any maintenance. Once seeded, fertilized and planted, they are on their own. In many areas planted before 1981, the grasses are less prominent, while the legumes, particularly alfalfa, dominate. This development reduces total ground cover, but makes way for natural reforestation of Western Hemlock, Douglas Fir and Western Red Cedar. The Island Copper plant site was aerially seeded and fertilized in 1971. For comparison, I have included this slide from I 972 - compared to 1983.

Finally, some new projects at Island Copper have included site preparation along the crest of the south wall of the pit. This was done in conjunction with a program to dewater the south wall. A packed till cap was covered with soil and planted, making an impermeable barrier to surface water. This area has been nicknamed "Hogan's Fairway" after our Pit Superintendent. Being the only flat and level piece of ground we've reclaimed, many of our employees have expressed an interest in harvesting it for hay.

Our current project is to recontour the north side of the North dump slopes (seen in the foreground of this slide). This will be the largest program undertaken to date. It began in late 1983, by placing a toe lift around the western end and will continue eastward over 1600 metres the length of the dump. The western end has been recontoured in such a manner as to blend in with the natural topography. It was covered with soils from an adjacent swamp and will be planted in the spring. The remainder of the project will continue through 1984.

Several times I have referred to the local deer population in my talk, so now, here she is. Then as night passes to a new day, I leave you with this snow, a rare occurence in Port Hardy.