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Proposed Marine Farm, Kaikoura Point, Port Underwood: Benthic Survey, July 1999

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prepared for

Port Underwood Mussels Limited
Blenheim

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Introduction

This report presents a biological description of benthic habitats and associated conspicuous macrobenthic communities from an area proposed as a marine farm located along Kaikoura Point, Port Underwood (Figure 1).

The aim of this study was to provide ecological information on the proposed site and to identify features of significant biological value that could potentially be threatened by the establishment of a marine farm.

The "Guideline for Ecological Investigations of Proposed Marine Farm Areas" (DEPARTMENT OF CONSERVATION 1995) was used as a basis for survey design and ecological assessment.

Study area

The location of the proposed site is along the coast between Ocean Bay and Rangitane Bay at the mouth of Port Underwood (Figure 1). The area of the proposed site is 6.374 ha (Figure 2). Position fixes were gained using the ships DGPS. The shoreline of the proposed site is in an exposed position to southerly winds and is dominated by hard bedrock. The terrestrial landscape above the shoreline is composed of very steep cliffs.

Qualifications

I realise that my name is new to most people in the Marlborough Sounds region, so I hope to allay any suspicions of my competency in carrying out the described assessment by listing my qualifications and experience below. I would be more than happy to furnish anyone with a list of referees if they felt the information supplied below was insufficient.

My name is Bernard Brosnan and I am the biological coordinator for the ecological assessment of the present site. I have a number of marine related qualifications and which qualify me to carry out this type of assessment. My tertiary qualifications include;

- an M.Sc. in Marine Science with credit from the university of Otago
- a postgraduate diploma in Marine Science with credit from the university of Otago
- a B.Sc. in Zoology and Psychology from Massey University.

I have spent three years carrying out epibenthic surveys in fiordland and have a great deal of experience in survey design and analysis. I am familiar with many types of survey techniques and community analysis, indeed my Masters thesis was solely based on epibenthic surveys.

I have worked at the National Institute of Environmental and Scientific Research (ESR) as a laboratory analyst in the Marine Biotoxin group. As a result I have become more familiar with the shellfish industry, particularly in the Marlborough Sounds.

I have been a qualified PADI diver for over eleven years, I currently hold a PADI rescue diver qualification. I have also been involved in research diving for over five years both in a leading and assisting role.

I have worked as an assistant or researcher on a number of marine projects such as;

- the national survey for the level of contaminants in the common cockle
- contamination of stormwater entering the coastal environment
- temporal, spatial and seasonal variation in productivity and larvae in the port of Tauranga.

I would be more than happy to furnish you with a copy of my cirriculum vitae or a list of referees if you require further information on my work history.

Currently, I am enrolled in a Postgraduate diploma in Environmental Management at the University of Waikato. I hope to continue on next year and complete a Masters in management.

Methods

Field work was completed on the 3rd July, 1999. The areas of the proposed marine farm and location of shore profiles were identified using the vessels radar and DGPS.

The guidelines for ecological investigations (Department of Conservation 1995) sets out the basic procedures to be followed when doing an ecological assessment. These are explained below.

Investigative survey

The aim of the investigative study was to provide a description of substratum and the distribution and/or abundance of conspicuous species or features of particular ecological interest in, and immediately adjacent to, a proposed marine farm area (Department of Conservation 1995). As per the 'Marine farm guidelines' (Department of Conservation 1995), a number of shore profiles were carried out. This involved conducting a total of three diver transects, one within the proposed marine farm area and two transects in the adjacent areas outside the proposed farm boundary.

Each diver transect began at 250 m from shore and ended at the water mark. Along each transect, marine biologists recorded all conspicuous species present, and the habitat (including bottom sediment and depth). All depths in this report are adjusted to chart datum.

If any conspicuous species were observed above the 'trigger levels' indicated in "the guidelines for ecological investigations of proposed marine farm areas" (Department of Conservation 1995), a more rigorous, quantitative survey was undertaken.

Results

Shore profiles

The shore profiles show the general distribution sediment type and species across the sea bottom.

The depth profile of the northern side of the proposed marine farm (Transect A) is given in Figure 4. The sea floor extends from the shore as large boulders, interspersed with broken shell and fine silt to a depth of around 10 m and to a distance of 70 m from shore. From 70 m to the end of the transect (250 m) the sea floor is mainly composed of fine silt and clays. The topography of the sea floor is rather constant at a distance of 100 m from the shore to the end of the transect averaging a depth of 15 m.

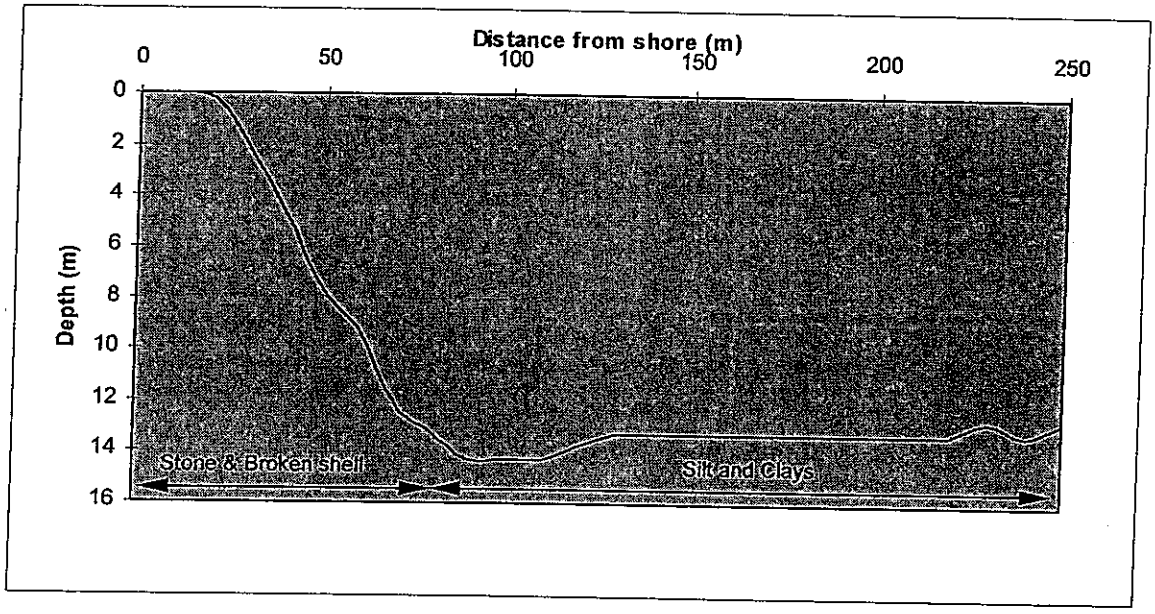

Figure 4. Shore profile of transect A.

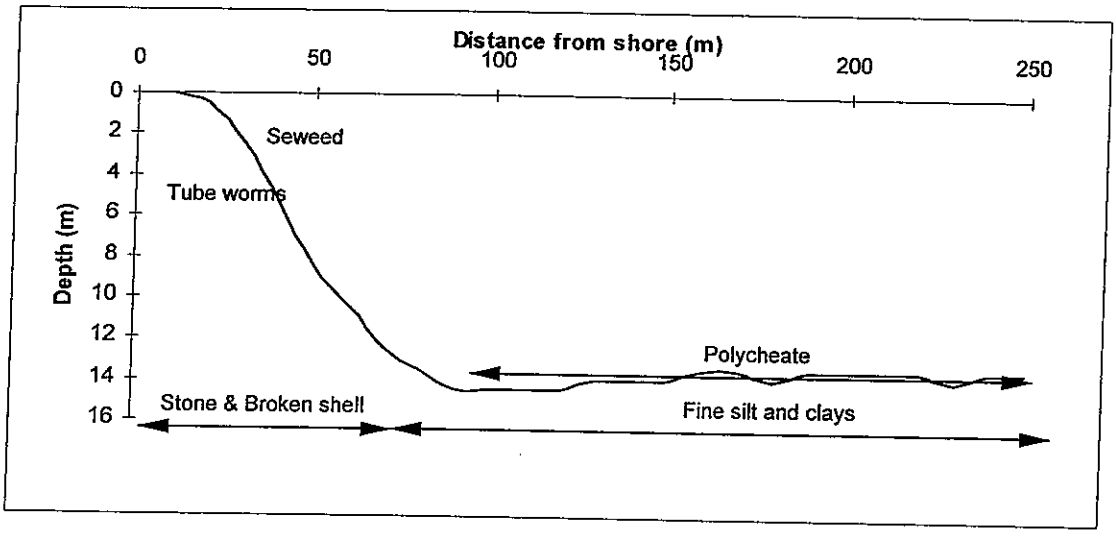

Figure 5. Depth profile of transect B.

Transect B (Figure 5) was carried out in the middle of the proposed marine farm and was very similar to transect A. Stone cobbles and broken shell were the predominant substrate to a depth of around 10 m and a distance of 70 m from the shore. Silt and clays dominate the rest of the sea floor from 70 m to the end of the transect (250 m). The topography is very steep for almost the first 100 m from the shore then it levels out at a depth of around 14 m for the rest of the transect.

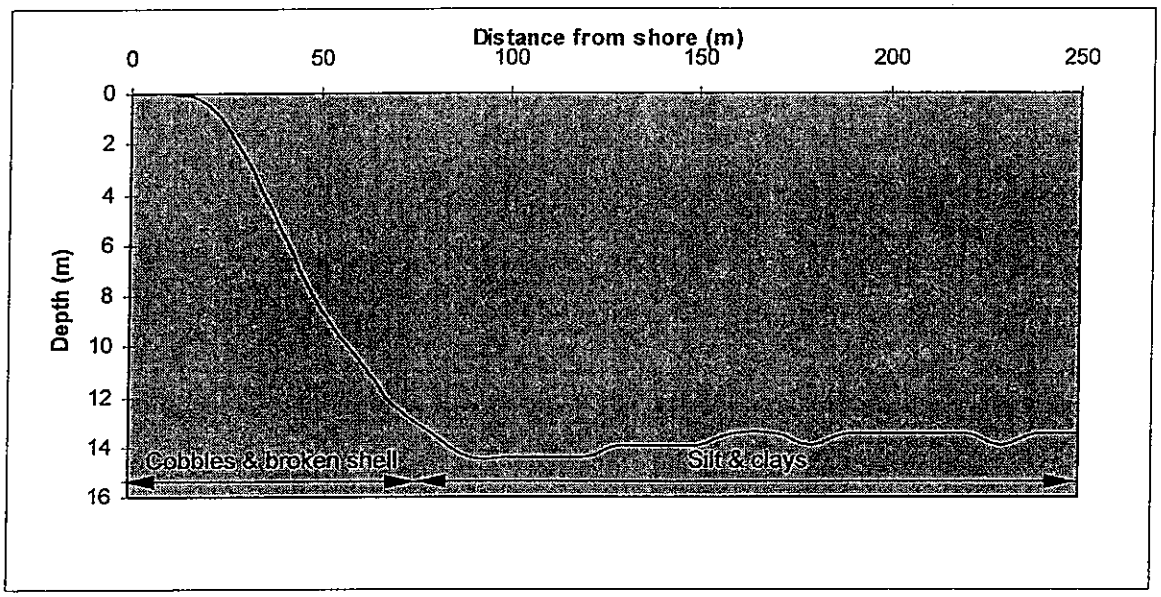

Figure 6. Depth profile of transect C.

Transect C, was undertaken on the south of the proposed mussel farm boundary (Figure 6). Dead shell and stone dominated the substrate to a depth of around 13 m which was about 70 m from the shore. The rest of the transect consisted of silt and clays. The topography was again reasonably steep for the first 100 m and then appeared to level out for the rest of the transect at a depth of 15 m.

All three transects were very similar in topography, depth ranges, and bottom composition. It is intended that the proposed farm will lie exclusively over the silt/clay sediment found at depths greater than 10 m.

The three transects were combined to give a three dimensional image of the sea floor under lying the proposed farm (Figure 7). Although three transects represent a very small sample of depths from around the slope, it is done to show the consistent topography that the proposed farm is to be situated over. The three transects were separated by approximately 100 m.

Conspicuous species

All transects recorded very similar groups of species on each habitat. A total of 26 species was recorded, covering a wide range of animal and plant groups (Table 1). The

most wide spread organism along the transects weas a polychaete tube worm that exists in the fine sediments of the sea floor. These worms build a calcerious tube that stands about 10 cm above the sediment. The apperture of the tube is between 1 and 2 mm wide. The density of these tube worms are reasonably high and are common throughout the fine sediments of Port Underwood. These tube worms were observed only on fine silt substrates.

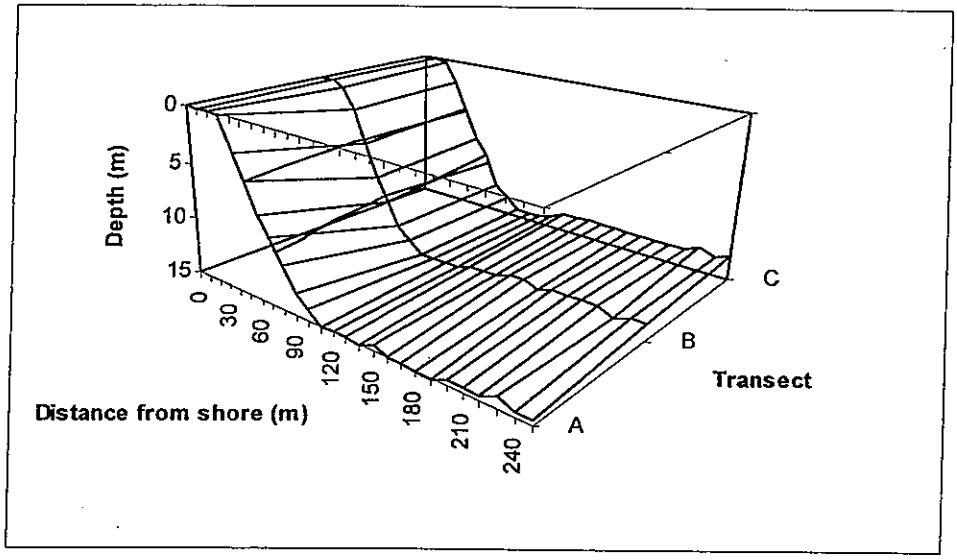

Figure 7. 3-dimensional profile of proposed marine farm

Algae		
		Cystophora retroflexa
	Venus necklace	*Hormosira banksi*
	Sawtoothed comb weed	*Marginariella boryana*
Brachiopoda		
	Bryozoan	*Caberea solida*
Chordata		
	Aplidium	*Fam. Tunicata*
	Saddle squirt	*Cnemidocarpa bicornuata*
	Black aplidium	*Fam. Tunicata*
	White aplidium	*Didemnum candidum*
	Yellow aplidium	*Fam. Tunicata*
Coelenterata		
	Coralline paint	*Lithothamnion*
Echinodermata		
	11 armed starfish	*Coscinasterias muricata*
	Cushion star	*Patiriella regularis*
	Sea egg	*Evechinus chloroticus*
	Sea cucumber	*Stichopus mollis*

	Snake star	*Fam. Ophiuroidea*
Mollusca		
	Common barnacle	*Elminius modestus*
	Baby octopus	*Pctopus maorum*
	Chiton	*Cryptoconchus porosus*
	Green mussel	*Perna canaluculus*
	Scallop	*Pecten novaezelandiae*
	Cats eys	*Turbo smaragdus*
	Sea slugs	*Fam. Opisthobranchia*
Polychaeta		
	Tube worm mounds	*Galeolaria hystrix*
	Polycheate	*Fam. Terebellidae*
	Fine silt tube worms	*Unknown Polychaeta*
	Fan worm	*Branchiomma serratibranchis*

Table 1. List of conspicuous species identified along transects

The habitat that supported the greatest number of species was the stone and cobble substrates which extended to a depth of around 10 m with 24 species. The habitat that supported the least number of species was the silt/clay habitats which dominated the majority of the transects, starting at around 70 m from shore and continuing well beyound the 250 m mark that the present survey started from. It is this habitat that the proposed farm would be cited over.

Horse Mussels (*Atrina zelandica*)
Live horse mussels were observed along transect A at a distance of about 80 m from the shore. However the density of the horse mussel was below the trigger levels stated in the marine farm application guidelines (Doc 1995) so investigation was taken no further. An interesting site was the number horse mussel shells that were observed along the other two transects.

Lampshells
No lampshells (Brachiopoda) were observed on any of the transects.

Hydroids and Bryozoans
No large hydroid species were observed during the present study. One specie of bryozoan was identified along transect C of the current study. It was identified as *Caberea solida*. Only one tuft of the bryozoan was observed and was no bigger than 5 cm tall.

Tube worm mounds (*Galeolaria hystrix*)
Along transects B & C large, dead tube worm mounds were observed at a depth of 5 m and a distance of 50 m from shore. These mounds now have a thick covering of coralline paint (*Lithothamnion*). A transverse dive along this site revealed that all the *Galeolaria hystrix* mounds observed were infact dead. The only living speicimens of *Galeolaria hystrix* were seen growing individually on large boulders or rock.

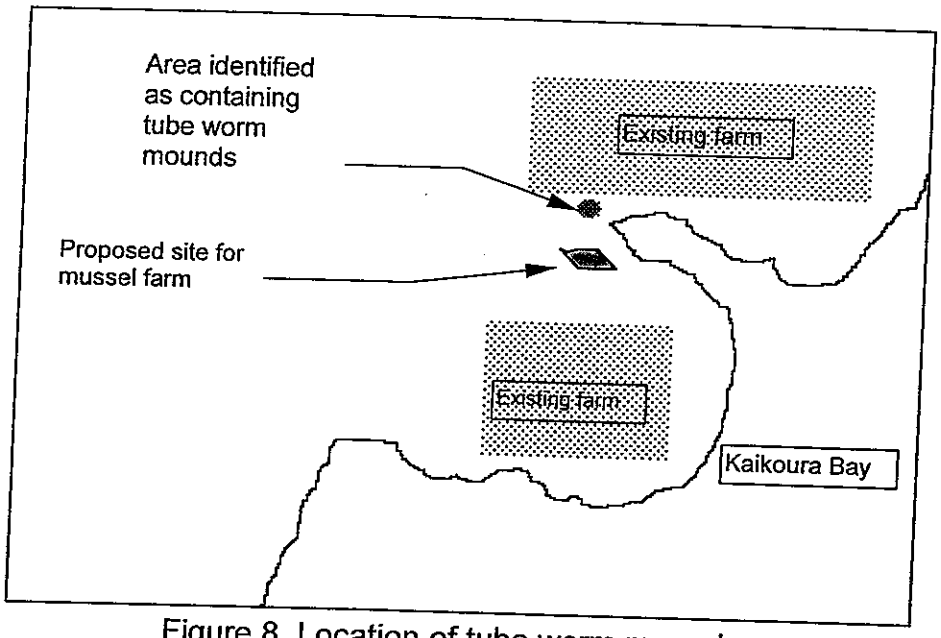

Figure 8. Location of tube worm mounds.

Discussion

The present study identified that the most diverse benthic community exists between 0 and 10 m depth which is inshore of the proposed farm boundary. Horse mussels were detected in low densities, below the trigger levels set by the Department of Comservation (Department of Conservation 1995). The bottom type was dominated by fine silt and clays and only the first 10 m of water appeared to contain rock and cobble as the main substrate type. The topography is reasonably consistent beneath the proposed marine farm and a constant depth (14-15 m).

Potential Impact of a bivalve farm

Impacts of mussel culture on soft bottom substratum have been reported as (Gillespie 1989, Watson 1995, Davidson 1998);

- increased levels of shell and fine sediment particles deposited onto the benthos (due to shell drop off, mussel harvesting, and float and warp cleaning)
- on a mud bottom, the diversity of species living on the surface most often increases (due to shell substratum providing additional habitat), while the diversity of species lining within the sediment most often decreases (due to deposition of finer sediment and chemical changes)
- the anoxic layer moves closer to the surface (due to the deposition of finer sediment and organic material originating from the mussel farm)
- an increase in sulphide and organic material, especially nitrogen which results in a increase in ammonium levels

The study site is located well within Port Underwood and experiences low tidal currents and little wave action. As a result, any possible effects will be localised to areas beneath the farm or a few meters adjacent to it (Gillespie 1989).

TUBE WORM MOUNDS

An area north of the proposed farm has been identified as containing tube worm mounds Figure 8. The transects undertaken in the present study also noted the presence of tube worm mounds at a depth of around 5 m and located a distance of 50 m from the shore. However, all the tube worm mounds observed in this study were dead and broken. Large, boulder sized mounds of *Galeolaria hystrix* lay broken and covered in a thich crust of coralline paint and other epibenthic organisms. Live individuals were observed living on boulders and rocks but as individual or in very low densities.

It is therefore suggested, that to safeguard any remaining tube worm mounds or individual specimens, the inshore boundary could be moved seawards away from the shoreline some distance (<100 m) if felt necessary. Gillespie (1989) has stated that in areas that have low tidal and wave action, such as in Port Underwood, sediment settles out of the water mainly within the farm boundaries or within a few meters of it. It is felt that this, combined with moving the inshore boundary, would mitigate any adverse effects on any tube worm mounds still alive to the north of the proposed site.

The proposed site is situated between two existing marine mussel farms. These mussel farms appear to have been established some time ago. It appears that the natural community has been altered over the years. This is evident from the large number of dead shells of tube worms and horse mussels that were observed along the transects. It is impossible to attribute a cause for this change as terrestrial activities as well as marine activities could have lead to this change.

Visibility was very low during the present study (<1 m) which indicates a high suspended sediment load. The species observed during the present study did not appear to be adversly affected by this sediment. It is likely then that the communities present are able to cope with high sediment loads and low sediment oxygen concentrations which are said to be produced by mussel farms. Indeed, the fine silt sediment of the area beneath the proposed farm is dominated by polycheates which are resistant to low sediment oxygen concentrations (Gillespie 1989) and therefore unlikely to be adversly affected by the granting of the application.

Marine farms have also been noted to increase abundances of animals in and on the seabed around mussel farms (Watson 1995). The mussel farm can provide hard substrata, and an enhanced source of food for natural predators such as starfish, crabs and fish (Watson 1995).

Conclusion

In conclusion, the proposed site is located in an area that is exposed to mild tidal currents and therefore there appears little threat to inshore communities. The

community assemblages that currently exist in the Kaikoura Point vicinity are unlikely to be altered by the addition of a mussel farm. Dead tube worm mounds were observed during the present study but it is suggested that the inshore boundary is moved a greater distance from the shore to safeguard any mounds that may be still alive outside the surveyed area.

References

Davidson, R.J. (1998). Preliminary report on ecological issues related to mussel harvesting activities. *Research, Survey and Monitoring report number 158, Wellington.*

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Gillespie, P.A. (1989). The impact of long-line mussel culture on benthic habitat. *Report prepared for the Coastal and Marine Resources Directorate, Department of Conservation, Wellington.*

Watson, S. (1995). Wilson's Bay marine farm applications: Assessment of environmental effects. *Consultancy report SAN 300, NIWA, Hamilton.*

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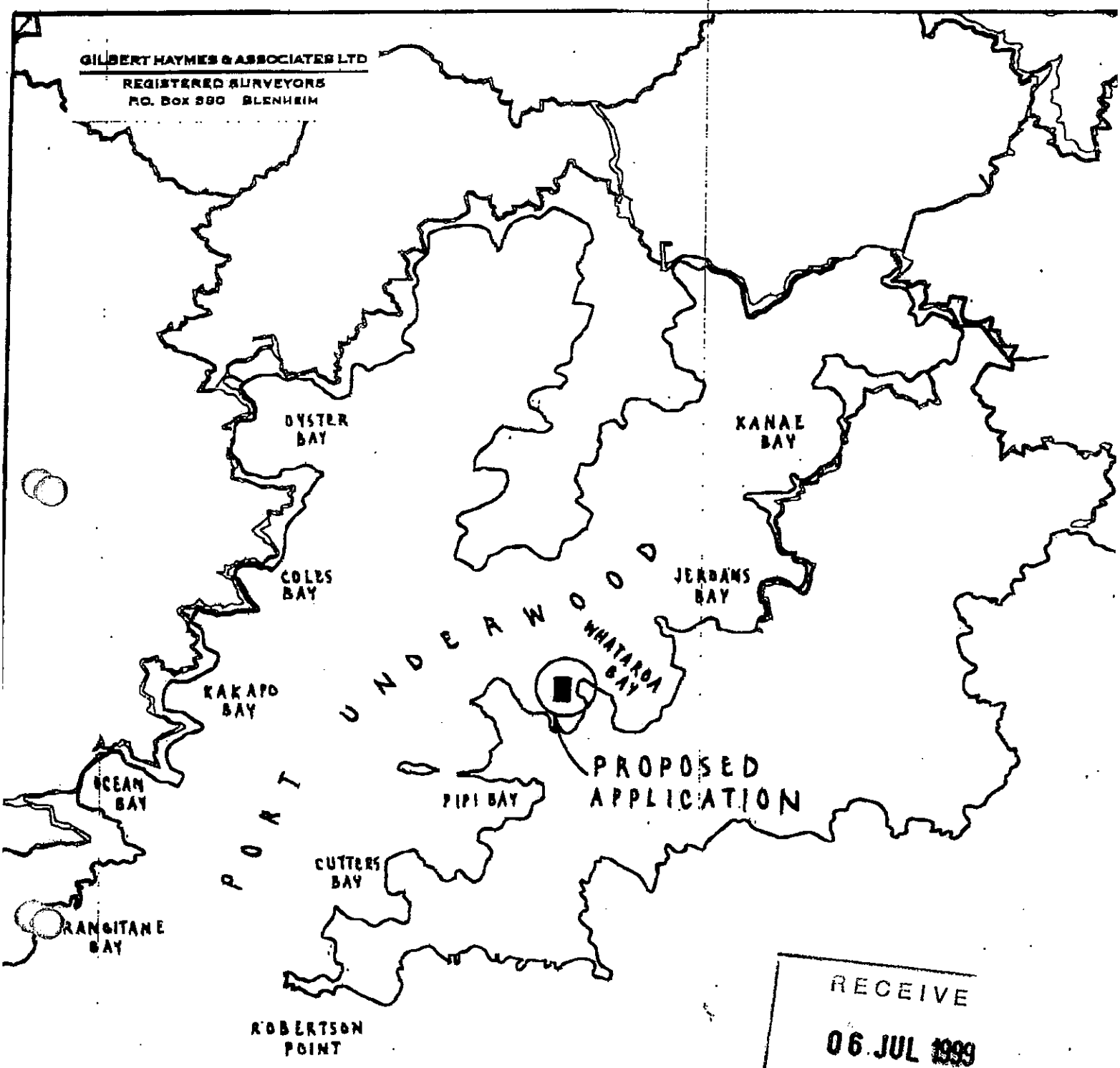

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06 JUL 1999
MARLBOROUGH DISTRICT COUNCIL

LOCATION PLAN

FIGURE 1

Scale 1:250000
0 500 1000 1500 2000 2500 3000 3500 4000 4500 5000 5500 6000m

PLAN OF PROPOSED COASTAL PERMIT
- PORT UNDERWOOD MUSSELS LIMITED -