

GERALDTON PORT EXPANSION

NOTICE OF INTENT

HALPERN GLICK MAUNSELL PTY LTD

SEPTEMBER 1989

TABLE OF CONTENTS

	Page No.
1. SUMMARY	1
1.1 Introduction	1
1.2 Alternatives Considered	1
1.3 Existing Environment	2
1.4 Environmental Impacts	3
1.5 Management and Monitoring	3
1.6 Conclusions	4
2. INTRODUCTION	5
2.1 Proponent	5
2.2 Project in Brief	5
2.3 Background and Objectives	6
2.4 Relevant Statutory Requirements	7
2.5 Purpose	7
3. NEED FOR THE DEVELOPMENT	9
3.1 Justification	9
3.1.1 Fishing Industries	9
3.1.2 Cargo Handling and Storage	10
3.1.3 Module Construction	11
3.1.4 Dredging	12
3.2 Development Costs	12
3.3 Future Developments	12
4. EVALUATION OF ALTERNATIVES	13
4.1 Alternatives	13
4.2 The Do Nothing Option	13
4.3 Current Proposal and Evaluation	14
5. DESCRIPTION OF PROPOSAL	15
5.1 General Development Concept	15
5.1.1 Stage 1	15
5.1.2 Stage 2	16
5.2 Turbidity	16
5.2.1 Dredging Activities	17
5.2.2 Bund Wall and Sand Trap Extension	17
5.2.3 Reclamation Site	17

TABLE OF CONTENTS (continued)

	Page No.	
5.3	Associated Works	17
5.4	Proposed Land Use	18
5.5	Access	18
5.6	Drainage of Reclaimed Area	18
5.7	Sewerage	19
5.8	The Construction Period	19
5.9	Operations and Management	20
5.10	Employment	20
6.	EXISTING ENVIRONMENT	21
6.1	Introduction	21
6.2	Physical Environment	21
	6.2.1 Geology and Geomorphology	21
	6.2.2 Wind Climate	22
	6.2.3 Wave Climate	22
	6.2.4 Tides and Sea Level Fluctuations	22
	6.2.5 Coastal Processes	23
	6.2.6 Water Quality	24
6.3	Biological Environment	25
6.4	Human Environment	27
	6.4.1 Existing Adjacent Land Use	27
	6.4.2 Existing Boat Use Patterns	27
	6.4.3 Road and Rail Systems	28
	6.4.4 Regional Landscape	28
	6.4.5 Other Uses - Aboriginal	28
7.	ENVIRONMENTAL IMPACTS	29
7.1	Introduction	29
7.2	Impact on Physical Environment	29
	7.2.1 Coastal Processes	29
	7.2.2 Turbidity	30
	7.2.3 Drainage	32
	7.2.4 Water Quality	32
	7.2.5 Noise and Dust	32
	7.2.6 Landscape	33
7.3	Impacts on Biological Environment	33
	7.3.1 Loss of Marine Flora and Fauna	33
	7.3.2 Turbidity	34
	7.3.3 Disturbance due to Dredging	34
7.4	Impact on Human Environment	34
	7.4.1 Beneficial Impacts	34
	7.4.2 Noise and Dust	35
	7.4.3 Traffic	35
	7.4.4 Access within Harbour	35
7.5	Synthesis	35

TABLE OF CONTENTS (continued)

	Page No.
8. ENVIRONMENTAL MANAGEMENT	37
8.1 Introduction and Objectives	37
8.2 Management of Construction Phase	37
8.2.1 Turbidity	37
8.2.2 Noise and Dust	38
8.2.3 Access within Harbour	38
8.3 Management of Post-Construction Phase	38
8.3.1 Shoreline Stability	38
8.3.2 Water Quality	38
8.3.3 Maintenance Dredging	39
8.4 Contingencies	39
8.5 Management Responsibilities	39
9. SUMMARY OF COMMITMENTS	40
10. CONCLUSIONS	41
REFERENCES	42
APPENDICES	
Appendix I	EPA Guidelines for Notice of Intent
Appendix II	Water Quality Study
Appendix III	Aboriginal Sites, Point Moore, Geraldton Letter from the Western Australian Museum

LIST OF FIGURES

		Following Page No.
1.	Location Plan	5
2.	Level of Cargo Handled at Port of Geraldton 1978-89	10
3.	Level of Exports of Various Commodities through Port of Geraldton 1978-89	10
4.	Extent of Dredging and Reclamation	15
5.	Proposed Land Use	18
6.	Drainage of Reclaimed Land and Relocation of Effluent Outfall	18-
7.	Relationship between Geology, Geomorphology and Swell-Wave Patterns at Geraldton	22
8.	Sampling Sites of Biological Survey at Port of Geraldton	25

1. SUMMARY

1. SUMMARY

1.1 INTRODUCTION

The Geraldton Port Authority (GPA), being the proponent, proposes to expand the inner harbour facilities at the Port of Geraldton, Geraldton, Western Australia. The proposal is to be carried out in two stages and involves:

- (a) reclamation of approximately 5ha of land within the existing fishing boat harbour between No. 5 Berth, the south pens and the outer breakwater
- (b) breaching of the outer breakwater and dredging a channel to create a new entrance to the fishing boat harbour
- (c) extension of the existing sand trap on the northern side of the main breakwater so as to provide protection for fishing vessels navigating the new entrance.

In addition maintenance dredging is required within both the main and fishing boat harbours. The dredged material from these operations would be utilised as spoil for the proposed expansion.

The history of the Port of Geraldton has been one of continued development. Trade has expanded and shipping and economic factors now dictate the need to accommodate the demand for land within and adjacent to the harbour. The aim of the proponent in proposing this development is to meet the current increased demand for land within the existing harbour.

1.2 ALTERNATIVES CONSIDERED

The current expansion of harbour facilities at the Port of Geraldton has been proposed by the GPA as the only viable option of the alternatives that exist. The primary objective of the project is to cater for the demand for port land adjacent to existing harbour facilities. With this in mind, there are a limited number of alternatives.

Existing vacant land both within the port complex and outside its boundaries provide alternative options for the development of land. However, these locations are not considered viable as they would not provide waterfront access as is required by the proposed industries and land usage.

Relocation and construction of a new fishing boat harbour has also been considered. The very high cost of such a development is considered prohibitive given the likely return on capital investment. Relocation of the harbour would also involve alienation of related fishing and service industries. Consequently this option is considered counter productive and not viable.

The preferred option to reclaim land within the existing fishing boat harbour has numerous benefits. Primarily, it would allow for maximum waterfront access as required by the proposed new industries and land usage. The proposed option is the only alternative which would utilise the dredged spoil from maintenance dredging within the harbour. This spoil would otherwise require to be disposed of at some other suitable location creating additional costs.

In addition the \$2 million total cost of the proposed project, which includes the cost of maintenance dredging, is the most cost effective alternative. It provides cheap waterfront land by utilising spoil from maintenance dredging and takes advantage of the existing infrastructure within the port complex.

Consequently, the proponent considers the proposed project as the most viable option in terms of meeting the current demands of the Port of Geraldton.

1.3 EXISTING ENVIRONMENT

The current proposal to expand the inner harbour facilities of the Port of Geraldton has the potential to impact upon an environment which has already been significantly altered. Both the physical and biological characteristics of the inner harbour have been modified in relation to Champion Bay as a whole. As the majority of the development would occur within the existing harbour, its impact would be minimised.

The Port of Geraldton is located on the northern side of Point Moore Peninsula. This promontory is an accretionary sand body which has developed between a limestone ridge to the east and the Point Moore reefs to the west as a result of the prevailing coastal processes. Its northern and southern shores are characterised by sandy beaches while the adjacent mainland beaches are comprised of both sandy and rocky shorelines.

A net northwards longshore transport of sand is the dominant coastal process occurring along the coastline of the entire Geraldton region. This process has however been interrupted by the construction of breakwaters, sand traps and channels associated with the Port. Consequently sand accumulates adjacent to these structures and beaches directly north of the Port undergo erosion.

Extension of the existing sand trap and construction of the new fishing boat harbour entrance will be the only construction activities outside the main breakwater.

These activities shall be confined to the already altered habitats of the sand halo surrounding the breakwaters. Only limited disturbance would occur to the healthy seagrass meadow which covers the sandy seabed of Champion Bay.

1.4 ENVIRONMENTAL IMPACTS

The potential environmental impacts of the proposed port expansion vary in their significance according to the degree of alteration within the existing environment. Both the physical and biological environments of the inner harbour and immediate surrounds have been modified extensively as a consequence of, and subsequent to, the construction of the existing port facilities. The following environmental impacts have been identified:

A temporary interruption of longshore sediment movement would result from the extension of the northern sand trap. However, no significant increase in the size of the "shadow" zone behind the Port complex is expected, and consequently no additional erosion along the northern beaches is anticipated.

The loss of seagrass and benthic fauna resulting from dredging and reclamation. Losses caused by dredging are not considered significant as recolonisation would be expected to occur. Permanent loss due to reclamation and burial would occur within the harbour and at the sand trap extension site. Since the harbour and area surrounding the existing sand trap are already substantially degraded the very small area of seagrass loss (<1% of the total seagrass meadow of Champion Bay) will not be significant.

Short term increases in water turbidity during the construction phase of the project. These are not expected to cause any long term impacts on the physical and biological environments.

No significant alteration to water quality of the harbour is anticipated as a result of the proposed port expansion. The drainage system which is designed to prevent pollutants from entering harbour waters and the improved flushing characteristics of the Port would ensure there is no build-up of pollutants.

Other impacts associated with noise, dust and traffic are not expected to exceed levels already present during peak operation times for the Port such as train movements and grain cartage.

1.5 MANAGEMENT AND MONITORING

The operations and management of the Port of Geraldton is the responsibility of the Geraldton Port Authority. Consequently it would supervise and co-ordinate all activities of the current proposal including management commitments.

Once complete, the Authority would undertake to manage and monitor the development in order to minimise:

- turbidity
- dust
- any decrease in water quality
- effects of construction on shoreline erosion

A summary of commitments made by the proponent to minimise the environmental impact of the development is given in Section 9 of this document.

1.6 CONCLUSION

In proposing the expansion of inner harbour facilities at the Port of Geraldton the proponent aims to meet the demand for waterfront land within the existing port complex. In doing so, the proponent would utilise dredge spoil from necessary maintenance dredging as landfill for the proposed reclamation.

The GPA considers this proposal essential in order to ensure the continued logistic and economic viability of the Port and its many associated industries. Upon completion, the development shall meet the current demands for expansion of fishing related industries, cargo storage and handling facilities. In conjunction, the Port would be in a position to allow platform module construction and deployment from within the port complex.

Several potential impacts to the natural environment as a result of the proposed development have been identified. These include:

- temporary and permanent loss of seagrass and benthic fauna due to dredging and reclamation activities
- short term increases in water turbidity during construction phase of the project associated with dredging and reclamation of land
- temporary interruption of longshore sediment movement resulting from extension of the northern sand trap.

Due to the temporary nature of these impacts and the degraded state of the existing environment within and adjacent to the harbour, they are not considered significant. Nevertheless, the proponent undertakes to minimise any potential impact by using suitable construction techniques. In addition, the proponent undertakes to implement management and monitoring programmes designed to minimise impacts and detect changes in the environment.

2. INTRODUCTION

2. INTRODUCTION

2.1 PROPONENT

The proponent of the proposed harbour expansion at the Port of Geraldton is the Geraldton Port Authority (GPA). The Authority has been the controlling body for all port activities at Geraldton since 1969, when it took over from the Department of Marine and Harbours.

The aim of the proponent in proposing this project is to meet the increased demand for land within the existing harbour so as to ensure the continued operating and economic viability of the Port.

Figure 1 shows the location of Geraldton and details of the proposed reclamation.

2.2 PROJECT IN BRIEF

The proposed project involves:

- reclamation of approximately 5ha of land between No. 5 Berth, the south pens and the outer breakwater
- breaching the outer breakwater and dredging a channel to create a new entrance to the fishing boat harbour
- extension of existing sand trap on the northern side of the outer breakwater.

In addition, both the main and fishing boat harbours require maintenance dredging. The dredged material from these operations would be utilised as spoil for the proposed reclamation.

The project is to be carried out in two stages:

Stage 1:

Stage 1 is to be commenced as soon as Environmental Protection Authority (EPA) approval is received. It involves reclaiming approximately 2.2ha of land between No. 5 Berth, the shoreline and the south pens. Test dredging for the new fishing boat harbour entrance channel would occur immediately west of the existing northern sand trap. The spoil produced by this dredging, some 25,000m³, would provide landfill for the proposed reclamation. In addition, 100,000m³ of spoil would be created by maintenance dredging of the fishing boat harbour. It is intended that this material be utilised as landfill for reclamation purposes.

It is planned that land created by the Stage 1 reclamation would be developed for lease for fishing industry activities, cargo storage, container handling and storage, and car park facilities. At this early stage the types of industries, their location and the services they require are not known. It is expected that the industries established would be of a very similar nature to those already existing around the fishing boat harbour in its present configuration. It is understood that if any of the proposed industries pose a potential impact on the existing social or natural environment then that industry would be referred to the EPA.

Stage 2:

Stage 2 involves the reclamation of approximately 2.8ha of land between No. 5 Berth, the outer seawall, and the reclaimed area of Stage 1. Prior to the completion of this reclamation, a new entrance to the fishing boat harbour is to be created by breaching the outer seawall and completing the dredging of the new channel. It is intended that this dredged material (75,000m³) will be used for reclamation purposes. Dredging required within the main harbour should produce 200,000m³ of spoil. This material can also be utilised as landfill for the proposed reclamation.

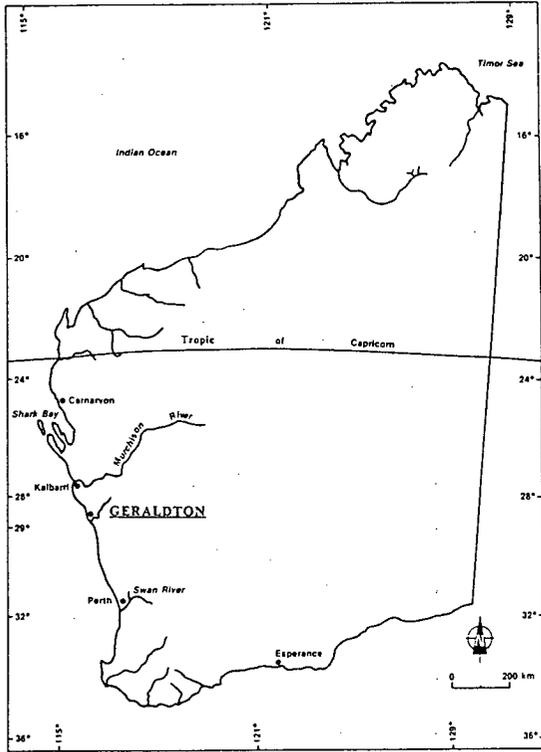
Extension of the existing sand trap is designed to ensure that the new channel does not silt up. It should also provide the required protection for fishing vessels navigating this entrance.

The timing of Stage 2 is dependent upon future land requirements for the construction of modules for Woodside Petroleum's North West Shelf Gas Project Goodwyn Platform. If these contracts are not gained then the reclamation of Stage 2 will not proceed in the immediate future. It should be noted that the GPA must be in a position to guarantee the availability of the Stage 2 land in order to secure the module construction contracts. It is for this reason that the GPA is seeking approval to proceed with Stage 2.

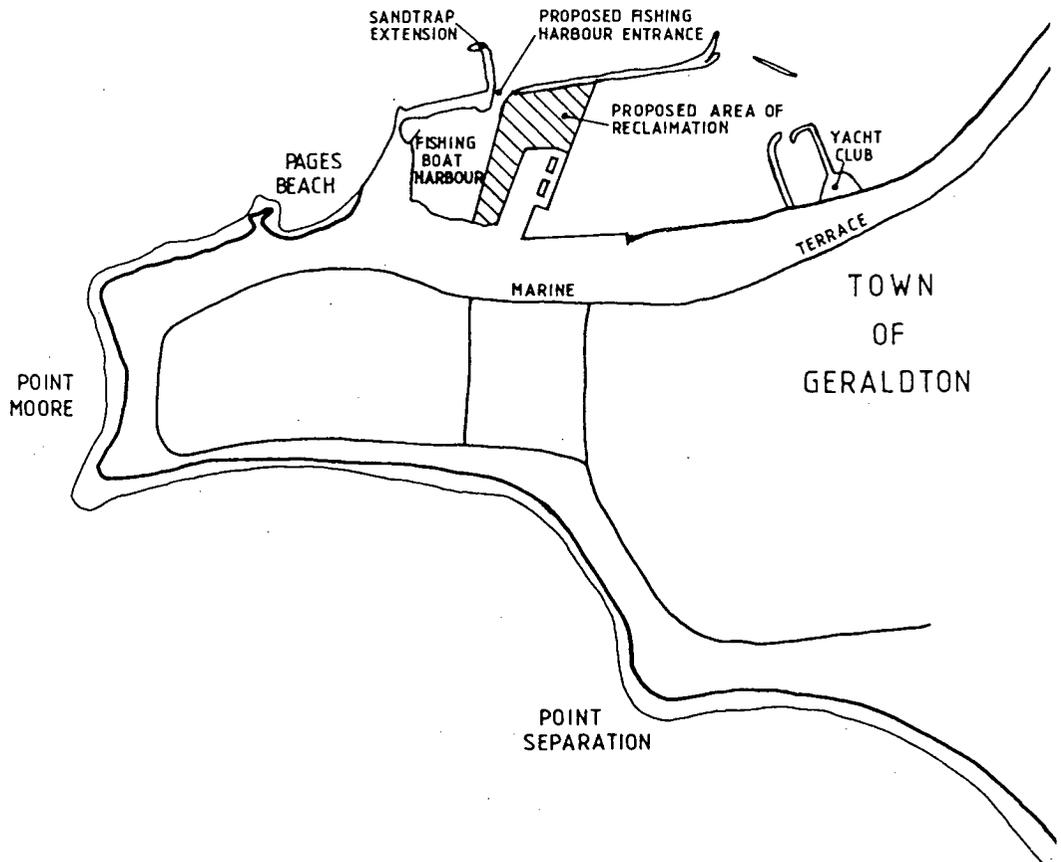
2.3 BACKGROUND AND OBJECTIVES

The Port of Geraldton has a history based on development. This has occurred due to increasing trade and has dictated the need to expand the facilities within the harbour. The history of the Port is detailed below.

The first shipment from the Port of Geraldton involved lead from the Northampton area and coincided with the survey of the townsite in 1849. In 1874, a railway line was built from the mine to the Port and the first town jetty was built. A further jetty was built in 1883 in anticipation of expanded trade from new railway connections to the Murchison and Midlands districts.



CHAMPION BAY



Halpern
Glick
Maunsell



LOCATION PLAN

FIGURE 1

By the 1920s further development of regional agriculture and consequent trade indicated the need to construct a protected harbour. By 1926, a 670m breakwater had been completed and this was eventually connected to land in the 1930s. In addition, the first reinforced concrete berth in Western Australia with a length of 411m was opened in 1931. Bulk wheat storage and loading facilities were installed in 1934 and a grain terminal with a capacity of 60,000 tonnes, owned and operated by Co-operative Bulk Handling Ltd, was opened in 1964. This was extended with a 90,000 tonne annexe in 1968 and a further 240,000 tonne storage capacity is now available.

In 1963, No. 3 Berth was extended by 41m to accommodate larger ships and a fishing boat harbour was constructed. Development of an iron ore mine by Western Mining Corporation at Koolanooka, 190km east of Geraldton, led to construction of a further berth completed in 1966. Closure of this mine and cessation of exports in 1975 coincided with the development of exports of mineral sands from the Eneabba area.

By 1974, deterioration of the original berths completed in 1931 and the need to accommodate larger vessels led to a decision by the GPA to construct a further berth, No. 5 Berth, which was completed in 1979. This can accommodate vessels with a displacement of up to 27,000 tonnes. The development involved the dredging of 200,000m³ of material which was used to reclaim an area of 4ha behind the berth.

Coincident with these improvements to berthing and cargo handling facilities, dredging of the entrance channel and harbour basin continued between 1962 and 1978 to establish an overall maximum draft of 9.3m.

Between 1982 and 1986 the reclaimed land behind No. 5 Berth was used for the construction of platform modules and sea anchors for the North West Shelf Gas Project.

The history of the Port of Geraldton has therefore been one of continuing development as trade expands and shipping and economic factors dictate a need to accommodate the increasing demand for land within and adjacent to the harbour. The object of the present proposal is to cater for this increasing demand and ensure the continuing viability of the Port for the benefit of the people of Geraldton and Western Australia. This Notice of Intent (NoI) addresses the environmental implications of the proposal.

2.4 RELEVANT STATUTORY REQUIREMENTS

The proposal is subject to environmental impact assessment by the Environmental Protection Authority (EPA) which has called for this Notice of Intent (NoI) under its Act.

The Port of Geraldton is located within Crown Reserves No. 20606 and No. 25300 and is subject to the Town of Geraldton District Town Planning Scheme (Clarke Gazzard, 1972). This reserve is vested in the GPA and is zoned "Harbour Works". Consequently, no rezoning is required.

In formulating this proposal the GPA has held initial discussions with government departments, local government, port users, and the general public. Responses to the proposal indicate that there are no unfavourable feelings towards the project.

2.5 PURPOSE

The purpose of this NoI is to fully describe and justify the proposed project and identify the likely environmental impacts thereof. This would allow the EPA to appraise the project and make recommendations with regard to the potential environmental impacts. The environmental management procedures to be employed are also discussed.

Following submission of a Letter of Referral to the EPA on 8 May 1989, guidelines for this Notice of Intent were issued (Appendix - 1). The decision to assess the proposal at Notice of Intent level was largely due to the majority of work taking place within the existing harbour thereby restricting the impact on the environment. In addition the proponent has conducted an extensive publicity campaign during the preparation of the proposal. This has involved:

briefings with government departments, local government, port users, and the general public

press statements and media coverage in Geraldton Guardian, ABC News, 6GE News, and ABC Talk-back

classified advertisement in Geraldton Guardian seeking public comment.

3. NEED FOR THE DEVELOPMENT

3. NEED FOR THE DEVELOPMENT

3.1 JUSTIFICATION

The Port of Geraldton is the region's main port with respect to both cargo and the region's fishing industry. It ranks fifth in the State after Fremantle, Dampier, Port Hedland and Bunbury. Existing demands and the potential for future growth has resulted in the development of the present proposal in order to ensure the Port's continued future viability.

The need for the development is considered by the GPA to be fourfold:

- (1) Increased demand for land to expand fisheries related industries.
- (2) Increased demand for land for the storage and handling of cargo.
- (3) To place Geraldton in a position where all companies tendering for the Goodwyn Gas Platform module construction can nominate, if they so desire, the Port as their preferred construction site.
- (4) Maintenance dredging is required within both the fishing boat harbour and the main harbour.

3.1.1 Fishing Industries

Discussions between the GPA and fishing industries associated with the large fishing fleet based at the Port of Geraldton have indicated their requirements for additional port land. This is in direct response to the growth in shore-based infrastructure associated with the fishing industry. Some of the immediate requirements concern:

- additional hardstanding for storing fishing vessels
- construction of facilities for the processing of rock lobsters
- construction of trawlers and workboats
- expansion of workshops to accommodate an aluminium fabrication plant.

The need to meet these demands is highlighted by the following extract from the Geraldton Regional Plan, 1989:

"Geraldton is the most significant fishing centre in WA. The total value of the fishing catch was estimated at \$57 million in 1985-86, with employment of 1700 people and 449 licensed fishing boats operating out of Geraldton and Dongara. Around 4000 tonnes of crayfish were taken in 1985-86 and processed at four processing factories in Geraldton. The area has potential for high quality table fish and is likely to expand in future years."

Despite a buoyant world market, because of the need to avoid over-fishing by the careful management of the resource, fishing activity is likely to remain stable or at most only marginally increase. This will create continued demand for boat mooring, boat building and servicing facilities along the coast. Boat building is an important local industry resulting in 20-30 boats being built each year."

At the time of writing the GPA was unable to give a detailed description of the industries which will be established on the reclaimed land. However, the GPA has decided that a crayfish processing factory would not be suitable given its associated effluent disposal problem. The GPA has been approached with regard to the availability of land by several firms and people. These include:

- Keans Refrigeration & Airconditioning
- Cliff Johns
- Westate Morgan
- C & R Marine
- Horrie & Steve's Slipway
- DY Engineering
- Vince Basile
- Geraldton Fishermen's Co-operative Ltd
- Planet Fisheries Pty Ltd
- A & ME Masiello
- Tyfe Pty Ltd
- John Miliauskas
- FA Taranto
- Latitude Fisheries Pty Ltd
- Golden West Fisheries
- P Burton

The expansions considered in this proposal would ensure that the Port of Geraldton continues to serve the most important fishing industry in the State.

3.1.2 Cargo Handling and Storage

The capacity of the Port of Geraldton to handle and store both general cargo and containerised cargo has reached a point where expansion is required. The level of cargo handled by the Port over the period 1978/88 shows a steady increase (Figures 2 and 3). This trend is expected to continue and even increase further due mainly to increased mining activities in the Geraldton region.

Increases are expected in the handling and storage of bulk cargo including:

- talc shipments
- copper concentrates
- mineral sands
- petroleum products
- fertilisers.

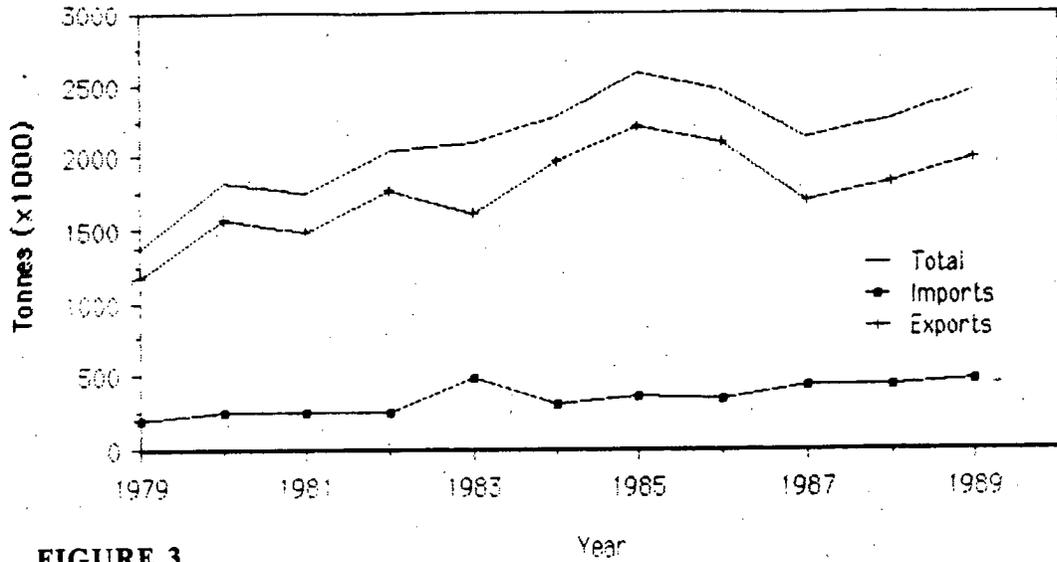


FIGURE 3
LEVEL OF CARGO HANDLED AT PORT OF GERALDTON 1978-89

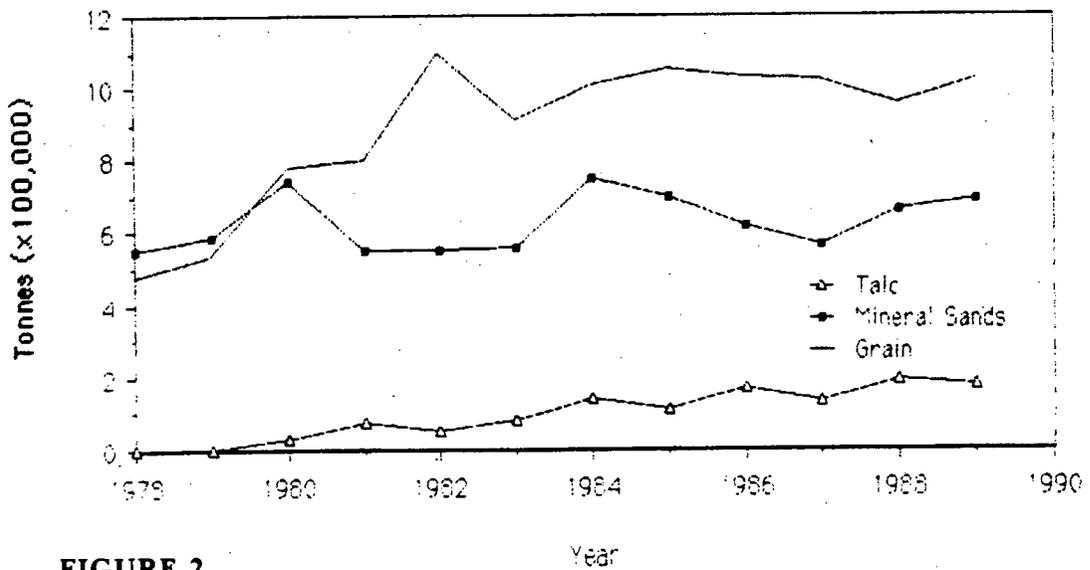


FIGURE 2
LEVEL OF EXPORTS OF VARIOUS COMMODITIES
THROUGH PORT OF GERALDTON 1978-89

General containerised cargo traffic is expected to increase considerably within the immediate future.

In addition, possible new trades involving the handling and storage of both general cargo and containers include:

- one off shipments (power stations, jaw crusher and steam shovel dredger for Associated Minerals Consolidated and Cooljarloo),
- servicing of the iron ore industry and Woodside project,
- export of marble, granite and other stone,
- import of timber,
- export from non-bleaching pulp mill utilising wheat stubble,
- chemicals for industrial processing (most would be in containers), and,
- further offshore drilling and production platform module construction.

Mining and processing activities in the Geraldton region are expected to increase dramatically within the near future. The commissioning of the Golden Grove Mine, expansion of the AMC synthetic rutile plant, and the potential for discovery of new mineral sands deposits will generate additional cargo for the Port of Geraldton.

This proposal would alleviate the immediate demand for land associated with the handling and storage of cargo and containers. It would also allow for the expected increase in relation to cargo associated with future mining projects.

3.1.3 Module Construction

Stage 2 of this proposal addresses the possible future demand for the construction of modules associated with Woodside Petroleum's Goodwyn Platform on the North West Shelf.

Considerable interest has been expressed by five companies tendering for the \$1.3 billion Goodwyn Project to construct the modules at Geraldton. However, all agreed that port facilities would require expansion. A site within the existing port is obviously preferred as all new modules would require transport by sea to the North West Shelf. A failure to provide a construction site could mean the loss of a significant economic benefit to industries and the people of Geraldton.

After module construction is completed it is proposed that the land be used for container storage, cargo storage, and as a location for the GPA maintenance depot which is temporarily located at Fisherman's Wharf.

3.1.4 Dredging

Dredging is currently required within both the fishing boat and main harbours. This work is part of the GPA's ongoing management of the Port and partly to allow access through the new entrance.

The present water depth in the fishing boat harbour adjacent to the north pens varies from 1-3m. It is proposed that dredging to a uniform depth of 3m would achieve uninterrupted access and manoeuvrability to larger boats in the fishing boat harbour.

The inner harbour depth varies from 2m near the breakwater to 9m at the existing turning basin. Dredging would enlarge the turning basin by deepening the shallower areas to a depth of 9m. This would allow larger ships improved access to the berthing facilities of the main harbour.

3.2 DEVELOPMENT COSTS

The estimated overall cost for the entire project is expected to be approximately \$1.5-2 million. This can be broken down as follows:

Stage 1:	Dredging	\$300,000
	Reclamation	\$100,000
Stage 2:	Dredging	\$800,000
	Reclamation	\$300,000
	Extension of sand trap	\$200,000

3.3 FUTURE DEVELOPMENTS

The proposal described in this document is aimed at maintaining the position of the Port of Geraldton by satisfying the immediate demand for land from fishing, cargo handling and construction industries. Future developments including the establishment of industries on reclaimed land and the construction of a new deepwater port will be assessed at the appropriate time by the EPA.

At the time of writing a feasibility study on the siting of a deepwater port was released to the public. Point Moore was recommended as the site for the deepwater port. This is outside and to the west of the existing port operations. The deepwater port proposal is designed to meet the future long-term requirements of the Port of Geraldton in contrast to the current proposal which is designed to meet a small but immediate demand for additional harbour facilities.

4. EVALUATION OF ALTERNATIVES

4. EVALUATION OF ALTERNATIVES

4.1 ALTERNATIVES

The current expansion of harbour facilities at the Port of Geraldton has been proposed by the GPA as the only viable option of the possible alternatives that exist. The primary objective of the project is to cater for the demand for port land adjacent to existing harbour facilities. With this in mind, there are a limited number of alternatives. These include:

- develop existing vacant land within the port complex,
- develop vacant land outside the port complex,
- relocate the fishing boat harbour to Separation Point, and
- the present proposal involving reclamation within the existing harbour.

Currently there is only a limited amount of land within the harbour complex which is not already occupied by one of the many port related industries. The unoccupied land that does exist is located in the south-west corner adjacent to Marine Terrace. This land, however, is of insufficient area to allow for the development of the proposed industries, storage and handling facilities, construction site, and car park. Furthermore, the land is not adjacent to the waterfront and would therefore not provide the required access to vessels or provide for a module loadout bay.

Vacant land outside the port complex could also be developed. Land could be available on the southern side of Point Moore, adjacent to Willcock Drive. This option however presents similar, if not greater, problems to those of developing vacant land within the port complex in that access to the waterfront will not exist. Also, this land would require rezoning as it is currently zoned as parklands and recreation.

Relocation of the fishing boat harbour to Point Separation was first suggested in a report by Maunsell & Partners (1986). This proposal would allow for development of new reclaimed land in addition to adjacent vacant land and thus provide good waterfront access. The very high cost of such a development is, however, considered prohibitive given the likely return on capital investment. Relocation of the harbour would also involve alienation of related fishing and service industries.

4.2 THE DO NOTHING OPTION

This option would mean that the increasing demand for land would continue to a point where constraints on the logistical and economic viability of the Port and the many related industries will occur. The loss of income and potential employment opportunities would be considerable given the significance of these industries to the City of Geraldton and the region as a whole. Consequently this option is regarded as counter productive by not meeting the current demands.

4.3 CURRENT PROPOSAL AND EVALUATION

The current proposal to reclaim land within the existing fishing boat harbour has numerous benefits over the other options discussed above. Primarily, it will allow for maximum waterfront access as required by the proposed new industries and land usage. The proposed option is the only alternative which would utilise the dredged spoil from maintenance dredging within the harbour. As this option is within the existing port complex, no rezoning is required.

The reclaimed area would also allow for the possible future development of an additional berth within the main harbour. No other options allow for this development.

The cost of the proposed project, an estimated \$2million, is the most cost effective alternative which meets the present demands for port land. This is highlighted by the fact that this cost also includes the cost of maintenance dredging.

In addition this proposal is restricted to the already significantly modified areas of the harbour and surrounding breakwaters. The impact on the physical and biological environment is therefore considered to be much less than that for relocating the harbour.

5. DESCRIPTION OF PROPOSAL

5. DESCRIPTION OF PROPOSAL

5.1 GENERAL DEVELOPMENT CONCEPT

The proposed expansion of inner harbour facilities is primarily designed to meet the increasing demand for land within the port complex.

The proposed project involves utilising dredged sediments from maintenance dredging of the harbour to reclaim approximately 5ha of land within the fishing boat harbour. A new entrance and associated channel to the fishing boat harbour will be created by breaching the outer breakwater. Protection of the channel would be provided by extending the existing sand trap north of the outer breakwater.

The demand for land originates from three distinct groups of port users. Namely, for use by the fishing industry and its associated support industries, for cargo storage by larger shipping companies, and by construction industries for the construction of platform modules for the oil/gas industry.

The demand for land is immediate with the exception of the module construction facilities which may be required by about April 1990. Accordingly the project is proposed to be staged in two phases.

5.1.1 Stage 1

The first work to be undertaken involves dredging operations within the fishing boat harbour. The area to be dredged is located directly south of the main breakwater and is approximately 220m x 120m in size covering an area of some 2.64ha (Figure 4). Dredging would increase the water depth from 1-3m to 3.5m thus allowing unrestricted movement of larger vessels within the fishing boat harbour together with improving access to the northern pens. This dredging would supply 100,000m³ of material.

Test dredging for the proposed new entrance channel would also be undertaken as part of Stage 1. It is planned that this work will occur immediately east of the existing sand trap adjacent to the live lobster storage facilities and covers an area of approximately 0.6ha. About 5,000m³ of spoil would be produced from this test dredging.

All of the dredged material would be used to reclaim approximately 2.2ha of land between No. 5 Berth, the shoreline and the southern pens. The reclaimed land would be level with that of No. 5 Berth and protected by a granite bund wall along its western and northern perimeters.

Details of the bund wall construction are outlined in Section 5.2.2. The existing bund wall along the eastern side of the reclaimed land adjacent to No. 5 Berth would be removed once dredging is complete. This rock material would then be incorporated into the new bund wall.

CHAMPION
BAY



STAGE 2
MAINTENANCE
DREDGING TO
SAND TRAP

STAGE 2
EXTEND SAND
TRAP

STAGE 2
COMPLETE
DREDGING
OF NEW F.B.H.
CHANNEL

STAGE 1
TEST DREDGING
NEW F.B.H.
CHANNEL

BREAKWATER
TO BE REMOVED

STAGE 2
MAINTENANCE DREDGING - 200,000 m³

STAGE 2
RECLAMATION -
APPROX. 275,000 m³

STAGE 1
MAINTENANCE DREDGING -
100,000 m³

STAGE 1
RECLAMATION
APPROX. 125,000 m³

BERTH 5

BERTHS 1-4

Marine

Terrace



EXTENT OF DREDGING AND RECLAMATION

FIGURE 4

5.1.2 Stage 2

Stage 2 is proposed to involve dredging within the main harbour directly south of the outer breakwater, over an area of approximately 6.84ha (Figure 4). Dredging would increase the main harbour depth by up to 7m allowing improved access to berthing facilities at No. 5 Berth.

It is proposed that dredging would also be undertaken directly north of the test dredge site of Stage 1 in order to provide a new entrance channel to the fishing boat harbour. This channel would be dredged to a depth of 4m.

Approximately 200,000m³ of material would be dredged from the main harbour and some 75,000m³ from the new entrance channel. All of this would be used to reclaim approximately 2.8ha of land between No. 5 Berth, the outer breakwater and the reclaimed area of Stage 1. It is planned that any shortfall in fill material for Stage 2 will be overcome by dredging a small area of accumulated sediment at the sand trap outside and adjacent to the northeastern extension of the main breakwater.

The reclaimed land would be level with that of No. 5 Berth and the land reclaimed in Stage 1. It is proposed that a bund wall of similar construction to that of Stage 1 will be constructed along the western and eastern sides to provide protection.

A new entrance to the fishing boat harbour would be created by removing a portion of the outer breakwater directly east of the existing sand trap. The removed rock material would be used for bund wall construction.

Stage 2 of the proposal also involves extending the existing sand trap adjacent to the live lobster storage facilities located on the outer breakwater. This structure would be extended by 100m along its present orientation and then at right angles in an east/south-east direction for 50m. Construction would use granite boulders. The sand trap would be designed to ensure that the new fishing boat harbour entrance channel does not silt up in conjunction with providing the required protection for fishing vessels navigating the entrance.

5.2 TURBIDITY

A temporary increase in the amount of suspended sediment within the water column would be caused by dredging and reclamation work associated with the expansion of port facilities. This would extend for about one month for Stage 1 of the proposal and four months for Stage 2 of the proposal. Activities which would increase turbidity include dredging, dumping of rock for bund walls and sand trap construction, and by the deposition of landfill material for reclamation.

5.2.1 Dredging Activities

It is proposed that all dredging is to be carried out by a Kingfisher cutter-suction type dredge which mechanically breaks up any limestone on the seabed. The resulting debris and unconsolidated sediments are then sucked away from the cut site and transported by a pipe system to the reclamation area. The degree of disturbance to the seabed and resulting turbidity is thereby kept to a minimum and is in fact less than the turbidity caused by deep draft vessels manoeuvring within the harbour.

As this type of dredge has to be secured to the seabed by a series of anchors, operations would be limited to relatively calm conditions.

5.2.2 Bund Wall Construction and Sand Trap Extension

The bund walls and sand trap extension are proposed to be constructed out of granite quarried from the local Readymix and/or Pioneer quarries with the Westrail and Department of Marine & Harbours quarries being alternative suppliers. The new quarry providing limestone for the Foreshore Marina Project would also be considered if the cost of granite is too excessive. This rock material consisting of boulders up to a maximum mass of approximately 3 tonnes will be transported to the site and dumped into place by trucks.

5.2.3 Reclamation Site

A turbidity plume would result from the discharge of dredged material at the reclamation site. In order to contain the extent of and minimise the impact of this plume, the bund wall would be constructed well in advance of reclamation. Further details are given in Section 7.2.2.

5.3 ASSOCIATED WORKS

Works to be carried out in association with those described in Section 5.1 but not requiring detailed description for the purposes of this Notice of Intent are:

The maintenance and possible reconstruction of the northern pens. This would require the relocation of the lobster processing effluent outfall to the western end of the main breakwater (see Figure 6). Relocation would be the responsibility of the GPA. However, responsibility of the discharge is that of the Geraldton Water Authority.

Provision for a module layout bay north of No. 5 Berth.

Construction of workshops and sheds on reclaimed land.

Possible future construction of berthing facilities alongside eastern bund of Stage 2 reclaimed land.

At present no schedule exists for the commencement of this work.

5.4 PROPOSED LAND USE

As a consequence of the general demands for land as outlined in Section 3, there are several proposed land uses for the reclaimed areas of Stages 1 and 2. The distribution of these are illustrated in Figure 5 and listed below:

extension of marine lift services and additional hardstanding for storing of fishing vessels

fishing industry related workshops catering for boat construction and aluminium fabrication, service and maintenance industries, and retail outlets

car parking facilities to cater for the projected increase in port usage

bulk and general cargo storage facilities

container storage and handling depot

platform module construction and other port purposes

area reserved for future fishing industry requirements such as live rock lobster storage facilities

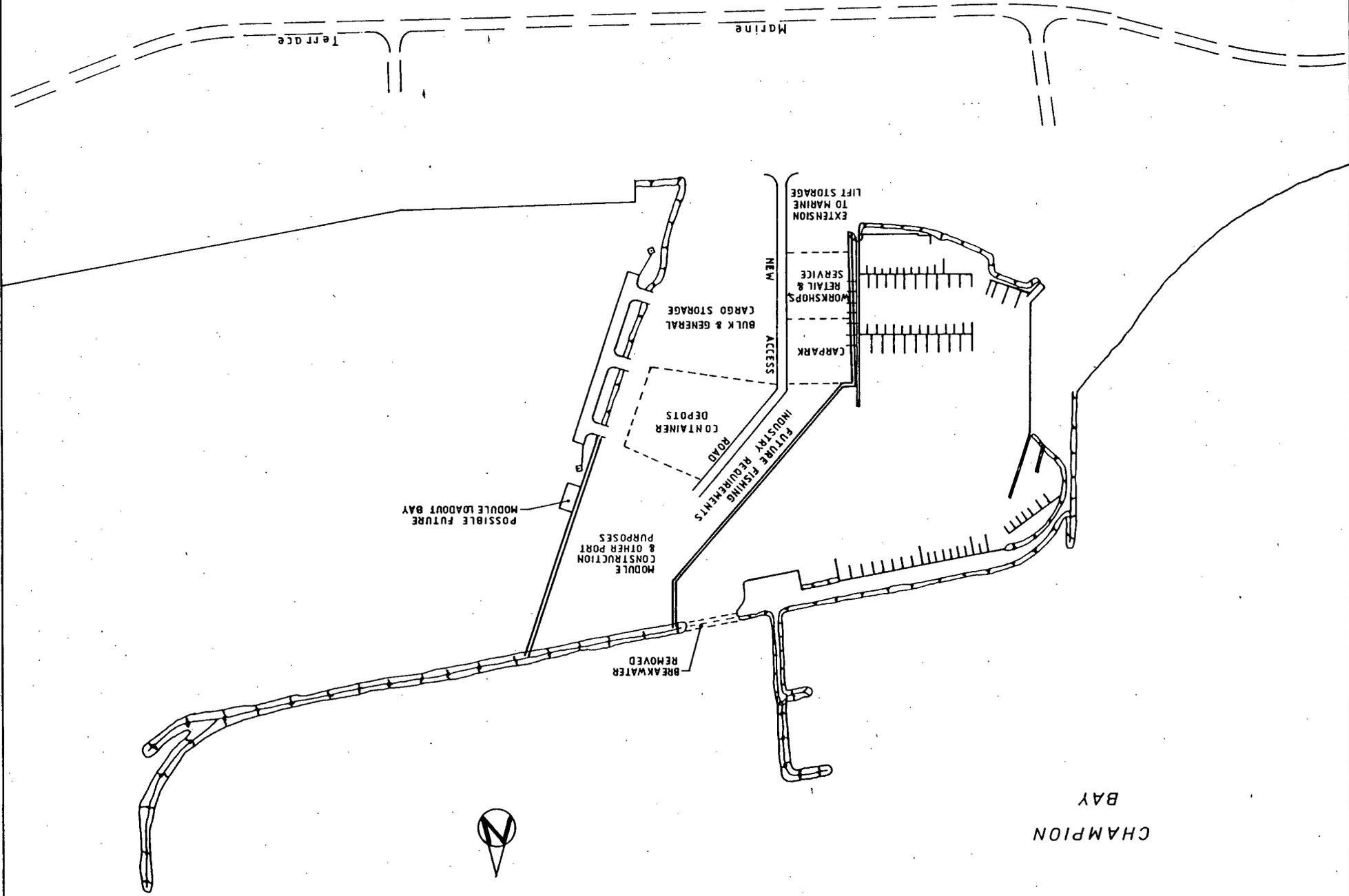
Consistent with GPA policy, the proposed industrial land usage of the reclaimed area would be on the basis of tenants gaining leasehold rather than freehold title to property. A detailed description of the industries to be established is not available at this stage.

5.5 ACCESS

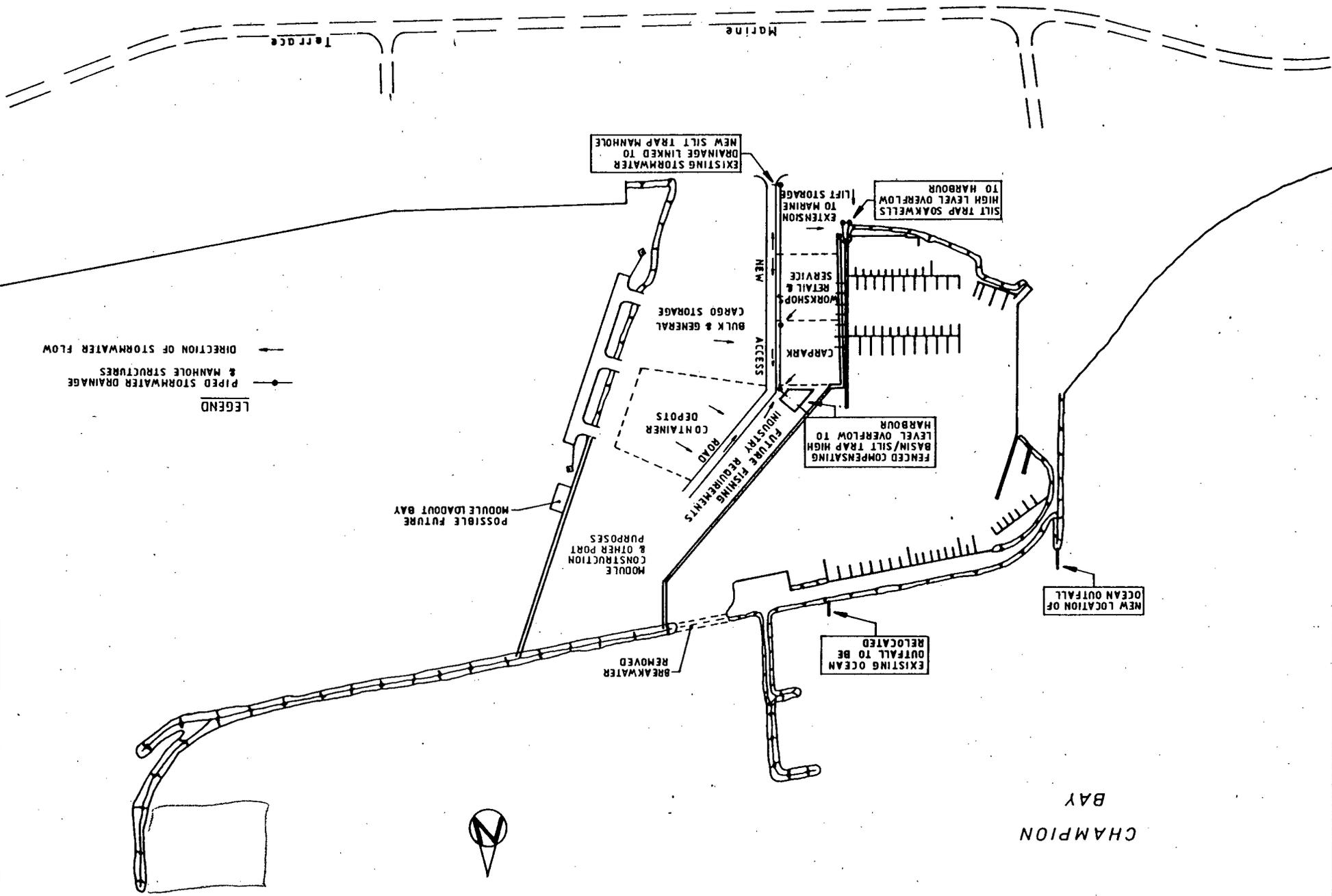
Present access to the Port is via the three main entrances off Marine Terrace. An internal network of roads then provides access to the various wharfs, berths and industrial facilities of the Port complex. It is proposed that a new access road along the proposed reclaimed land would be located centrally and extend towards the proposed module construction site. Access to individual workshops and associated facilities would depend on their exact location and distribution within the defined area. This would be formulated once leasing arrangements have been finalised.

5.6 DRAINAGE OF RECLAIMED AREA

The proposed reclaimed land has been designed to ensure that all stormwater run-off is directed to a piped stormwater drainage system. This drain would be located centrally along the new access road with a manhole and silt trap at either end (see Figure 6). The drainage system has been designed to eliminate the possibility of pollutants from fishing vessels, car park areas, and industries entering the harbour. These pollutants include hydrocarbon spills, antifouling paint scrapings and metal concentrates. This would also ensure a reduction in the turbidity of stormwater effluent and that there is no deterioration in water quality within the fishing boat harbour.



PROPOSED LAND USE



DRAINAGE OF RECLAIMED LAND AND
RELOCATION OF EFFLUENT OUTFALL

FIGURE 6

At the northern end of the drain, a fenced compensating basin with a high level overflow into the harbour would be constructed. At the southern end, the new drainage system would be connected to the existing drain along the fishing boat harbour bund wall. This would allow stormwater from the existing berthing areas to flow through the new drain and silt traps to the new compensating basin.

Stormwater from the proposed extension to the marine lift and hardstanding areas will be directed to a separate drain and silt trap. This drain would have a soak well and high level overflow into the south-eastern corner of the fishing boat harbour.

5.7 SEWERAGE

Presently the port area is not serviced by deep sewers and there are no plans to do so in the immediate future. As a result all toilets in the port area are serviced by septic systems. It is proposed that all toilets established in the reclaimed area will use similar septic systems. These have been approved by the Water Authority of Western Australia and consist of twin septic tanks and a 15m leach drain.

The disposal of effluents from industries into septic tanks is not established practice because of the high volume or noxious character of the effluents. Industries established on the reclaimed land would not be permitted to dispose of effluents by septic systems. It should be noted that crayfish processing industries which have the potential to generate significant amounts of effluent would not be permitted on the reclaimed land.

5.8 THE CONSTRUCTION PERIOD

The project is to be staged as outlined in Section 5.1 with the following timing being proposed:

Stage 1:

Stage 1 would be commenced as soon as EPA approval is received.

Dredging and breaching of the breakwater is expected to take 4-6 weeks.

Reclamation and bunding is expected to take 4-6 weeks.

Stage 2:

The commencement date for Stage 2 is dependent upon the granting of construction contracts for the Goodwyn Platform modules. It is estimated that this will be by about April 1990.

Once land requirements are finalised and a commencement date set, dredging is expected to take 4 months.

Reclamation and bunding is expected to take 8 months.

Dredging, reclamation and bunding periods would overlap so that the total construction time for Stage 2 is expected to be about 10 months.

5.9 OPERATIONS AND MANAGEMENT

The operations of the Port of Geraldton are managed by the GPA through the vesting of Crown Reserves No. 20606 and No. 25300 for the purpose of harbour works. Consequently the responsibility of the Authority would be to supervise and co-ordinate all activities of the current proposal including:

development and construction of all facilities

leasing of reclaimed land

the implementation of the environmental management and monitoring programme outlined in Section 8 of this Notice of Intent

day to day management of the reclaimed land.

5.10 EMPLOYMENT

During the construction period of the project, it is expected that dredging, cartage, reclamation and supervision personnel will number approximately 10.

Once complete, the newly established industries would employ an as yet unquantified number of people in conjunction with providing a stimulus for growth in all harbour and fishing related industries. The long term employment and economic benefits of the project can only be viewed as being positive.

6. EXISTING ENVIRONMENT

6. EXISTING ENVIRONMENT

6.1 INTRODUCTION

The current proposal to expand the inner harbour facilities of the Port of Geraldton deals with an environment which has already been significantly altered. Both the physical and biological characteristics of the inner harbour have been modified in relation to Champion Bay. As the majority of the proposed development would occur within the existing harbour, it is anticipated that minimal impact on the environment outside the port area would occur. This section of the report presents details of the existing environment of the harbour, Champion Bay and the surrounding areas of Point Moore Peninsula.

6.2 PHYSICAL ENVIRONMENT

6.2.1 Geology and Geomorphology

The Port of Geraldton is located on the northern side of Point Moore Peninsula. This sandy promontory is an accretionary body which has developed during the Holocene (<10,000 years ago) as a result of prevailing coastal processes.

The Geraldton coast is dominated by the Coastal Limestone (Saint-Smith, 1912). This unit represents Pleistocene (10,000-2mil. yrs ago) dune sequences which now form a series of north/south trending ridges separated by parallel depressions along the coast of South West Western Australia. During the Holocene this landscape was partially drowned as a result of rising sea levels after the last glacial period (Searle and Woods, 1986).

In the Geraldton area the partially drowned limestone is expressed as two ridges, one which underlies the western suburbs of the City of Geraldton and another eroded ridge which forms the offshore reef system comprising the Point Moore Reefs. Separating these two ridges is the Champion Bay-Port Grey depression (Kerr, 1984; Woods, 1988).

Erosion of the Coastal Limestone and secretion of carbonate by animals and plants has produced sediments throughout the Holocene. Subsequent transportation of this sediment is controlled by the interaction of the complex bathymetry of the inundated landscape with the prevailing swell. Refraction and diffraction of incoming swells around, over and through the Point Moore reefs produces a zone of wave convergence behind the reefs. This point forms the focus for deposition and consequently gradual accretion throughout the Holocene has occurred.

Continued accumulation of sediment and subsequent stabilisation by dune vegetation has led to the development of the peninsula which now extends from the eastern Pleistocene limestone ridge out to the Point Moore reefs themselves. Consequently the original inter-ridge depression has been separated into two discreet marine basins; Champion Bay and Port Grey.

6.3 BIOLOGICAL ENVIRONMENT

The majority of the current proposal is confined to within the existing harbour facilities at the Port of Geraldton. Extension of the existing sand trap and construction of the new fishing boat harbour entrance will be the only construction activities outside the main breakwater. Consequently these will impinge on the surrounding environment of Champion Bay and as such it is appropriate to describe the existing environment of the Bay.

Woods (1988) identified three major habitats of the Champion Bay region of which two are relevant to this proposal:

- (a) Sandy seabed colonised by a dense continuous meadow of seagrass, the dominant genera being *Amphibolos* and strap-like *Posidonia*.
- (b) The water column which is inhabited by phytoplankton, zooplankton and various fish species.

Within the existing harbour both these habitats have been significantly altered as a result of previous dredging, reclamation and breakwater construction in addition to continued shipping activities.

A recent study of the Champion Bay and harbour environments was conducted to determine the species composition of seagrass flora, associated epiphytic algae and invertebrate fauna (Masini, 1988). The characteristics of seafloor sediments were also determined in conjunction with water depth and clarity.

Investigations were carried out at various sites throughout the bay and harbour as illustrated in Figure 8.

Site 2 (Masini, 1988) represents an area unlikely to have been affected by any existing coastal structures and is located approximately 1km offshore in 6.3m of water near the centre of Champion Bay. The site consists of dense seagrass meadow on a thin veneer of sediment overlying limestone reef. In places the limestone reef protrudes between 0.2m and 1m above the surrounding seagrass meadow. Within the seagrass meadow are stands of *P. sinuosa* and equivalent areas of mixed *A. antarctica* and *A. griffithii* in a 3:2 ratio. Underlying these canopy species is an almost continuous layer of *S. isoetifolium*. *H. australis* is found occasionally in association with *S. isoetifolium* in small sand patches (<1m diameter). The genera *Dictyopteris*, *Zonaria*, *Laurencia*, *Heterosiphonia*, *Chondria*, *Soliera* and *Champia* characterises the well developed epiphyte community on *A. griffithii*, with *Laurencia* sp. and *Hypnea* sp. growing on *A. antarctica*.

The reef scattered amongst the seagrass is typical of most limestone reefs in the area with *Vidalia spiralis*, *Padina* sp., *Caulerpa simpliciuscula* and encrusting coralline algae dominating the flora. Small amounts of sponge are also associated with the algae and the western rock lobster, *Panulirus cygnus*, is evident under many of the ledges within the reef.

Water clarity is very good with the bottom being visible from the surface and a photic depth of >12.6m.

Site 5 is located 150m seaward of the main harbour breakwater in 5m of water. It represents an area which may have originally been affected by the construction of the breakwater and has subsequently undergone revegetation. The site consists of a dense meadow of the seagrass *P. sinuosa*. *S. isoetifolium* and *A. griffithii* occurs in small sandier patches within the *P. sinuosa* meadow with a small amount of *Caulerpa cactoides*. Towards the breakwater the meadow becomes dominated by *A. griffithii* with small amounts of *A. antarctica* (<20%). Approaching the breakwater the water column becomes increasingly more turbid with fine particulate matter, and the seagrass meadow thins out leaving only *H. australis*.

Site 6 is located approximately 30m seaward of the main breakwater in 4m of water. It represents a sand halo fringing the breakwater in an area which has been permanently altered. No live seagrass is present at the site. The sediment is covered with algal and seagrass detritus between 0.02 and 0.2m thick, which in some spots is being covered by sediment, indicating sediment movement along the breakwater. The water clarity is quite poor due principally to suspended organic and inorganic particulate material.

Two sites were studied within the harbour. Site 7 in 2.4m of water is located at the entrance to the fishing boat harbour while Site 8, in approximately 4m depth, is located inshore of the main breakwater within the main harbour.

Site 7 has *P. sinuosa* growing in small clumps, approximately 0.3m diameter in size covering some 30% of the bottom. The seagrass is not very luxuriant, being covered with small filamentous epiphytes and coated with a thin layer of trapped sediment. The blue manna crab *Portunus pelagicus* is evident in the sediment at this location.

Site 8 was bare of any macroscopic plant or animal material.

In summary the majority of the proposed development is located within the already significantly altered environment of the existing harbour. Extension of the existing sand trap, construction of a new fishing boat harbour entrance and the associated dredging activities will be confined largely to the already altered habitats of the sand halo surrounding the breakwaters. Disturbance to the healthy seagrass meadow which covers the sandy seabed will be limited. Less than 1% of the seagrass meadow of Champion Bay will be affected.

6.4 HUMAN ENVIRONMENT

6.4.1 Existing Adjacent Land Use

As the current proposal for expansion is to take place within the existing harbour, the immediate adjacent land use comprises industries related both directly and indirectly with the Port. These include:

- . port berthing facilities
- . onshore fishing boat storage and maintenance facilities
- . fishing support industries
- . pleasure craft marina
- . railway
- . mineral sands storage sheds
- . talc stockpiles
- . building industries
- . grain storage sheds and open storage areas
- . fuel storage facilities.

Additional surrounding land uses consist of general residential areas to the south-east, and tourist, residential and caravan park facilities to the west at Point Moore. Pages Beach immediately west of the harbour is a popular recreational area providing shelter and limited carpark facilities. Other beaches of the Point Moore peninsula are also used for various recreational activities.

6.4.2 Existing Boat Use Patterns

The seas adjacent to the Geraldton coast and around the Abrolhos Islands form the major rock lobster fishing grounds in Australia. As a consequence, a large fishing fleet in excess of 350 vessels is based at Geraldton with the majority utilising the fishing boat harbour. Peak vessel movements occur during the rock lobster season, November 15 to June 30, however general fishing activities continue throughout the year.

There were approximately 1,400 boat owners in the Geraldton town in 1985 and a total of about 2,400 in the region from Lancelin to Shark Bay (Riedel & Byrne, 1985). This represents 18% of the total number of households in the town and compares with 14.7% for Perth. During the peak season, approximately 72% of boat owners use their boats virtually every day or at least weekly, compared to the State average of about 60%.

Recreational fishing and general use represents 65% of boating with water skiing and scuba diving accounting for a further 20%.

The GPA marina consisting of 76 pens is currently the only mooring facility dedicated to pleasure craft. Swing moorings within the main harbour and the occasional vacant berth at the fishing boat harbour are also utilised. A marina and tourist development currently being constructed north of the Port of Geraldton on the site of the old railway marshalling yards will provide modern pen facilities for 200-250 pleasure craft upon completion.

6.4.3 Road and Rail Systems

The Port of Geraldton is bordered to the south by Marine Terrace, Francis Street to the east, and by Fisherman's Wharf Road to the west. Vehicular access to the harbour is provided by Port Way which leads from Brand Highway to Marine Terrace. All roads north of Marine Terrace are within the Port grounds and serve as access roads only. The main harbour entrance is off Marine Terrace.

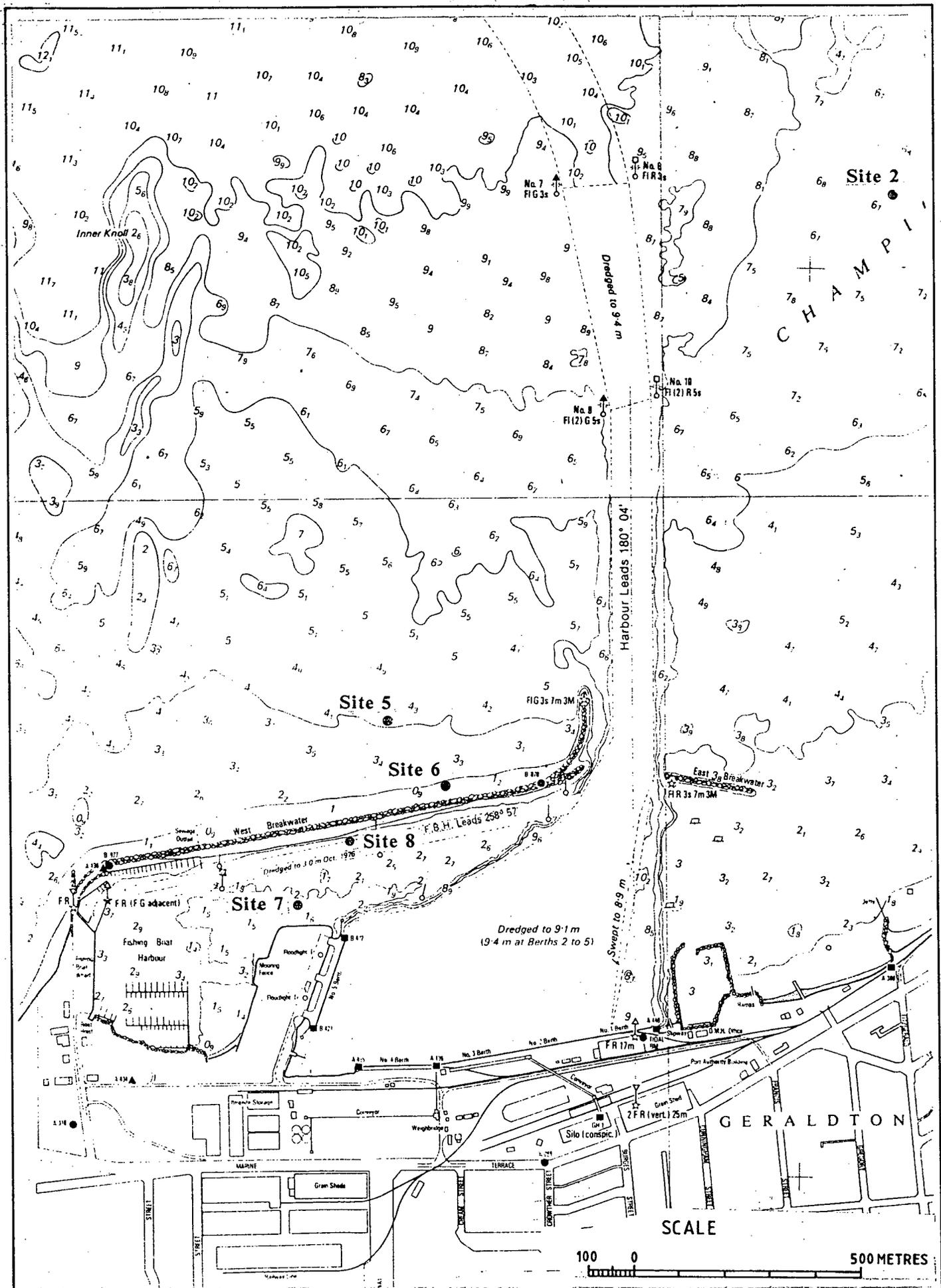
After completion of the foreshore redevelopment and relocation of the marshalling yards, a single railway line will remain to service the Port. This line branches at several locations to access the various industries located within the Port.

6.4.4 Regional Landscape

The natural landscape of the entire Point Moore peninsula on which the Port of Geraldton is located has been significantly altered since the late 1800s. Originally the peninsula would have consisted of a vegetated beach ridge sequence and a series of dunes. The construction of port facilities, roads and railways together with urban, commercial and industrial development has consequently changed this landscape permanently.

6.4.5 Other Uses - Aboriginal

There are no known Aboriginal sites listed in the vicinity of the Port of Geraldton. Any other archaeologically significant sites would have been significantly altered if not totally destroyed by the construction of the Port and its associated roads, railway and buildings. A letter from the Western Australian Museum is listed in Appendix III.



**Halpern
Glick
Maunsell**



**SAMPLING SITES OF BIOLOGICAL SURVEY
AT PORT OF GERALDTON (after Masini, 1988)**

FIGURE 8

7. ENVIRONMENTAL IMPACTS

7. ENVIRONMENTAL IMPACTS

7.1 INTRODUCTION

The potential environmental impacts of the proposed port expansion vary in their significance according to the degree of alteration already evident within the existing environment and their importance to the region's environment as a whole. Both the physical and biological environments of the inner harbour and immediate surrounds have been modified extensively as a consequence of, and subsequent to, the construction of the existing port facilities. The present condition of these environments is outlined in Section 6 of this report.

As the majority of activity associated with land reclamation is confined within the existing harbour, the impact would be minimal. Extension of the existing sand trap and construction of the new fishing boat harbour entrance would have minimal impact on the surrounding environment.

The impact of future industries to be established on the reclaimed land cannot be determined at this stage as their nature is not known. It is planned that they will be of a similar nature to those already existing around the fishing boat harbour. If a proposed industry poses a potential impact to the environment it is understood that it will be referred to the EPA.

This section identifies all the anticipated environmental impacts of the proposed reclamation activities and their relative significance. It also provides a basis for the management and monitoring programmes outlined in Section 8 which are designed to ensure that these impacts are minimised.

7.2 IMPACT ON PHYSICAL ENVIRONMENT

The physical environment of Point Moore peninsula has undergone continued modification since the first port facilities were constructed some 60 years ago. The proposed expansion of port facilities is expected to cause various impacts within and in addition to the already altered area. These would be both long term and short term in nature and may include impacts involving:

- . coastal processes
- . turbidity
- . drainage
- . water quality
- . noise and dust
- . landscape.

7.2.1 Coastal Processes

The dominant coastal process with respect to the current proposal is the longshore transport of sand along the Geraldton coastline. As detailed in Section 6.2.5, sand is transported in both a northerly and southerly direction however due to the prevailing wind and wave conditions being from the south to south-west, the nett transport is in a northerly direction.

It is estimated that of the 15,000-20,000m³ of sediment that arrives at Point Moore annually, approximately 5,000-6,000m³ passes around the Point and continues northwards (DMH, 1988). The existing port facilities and offshore sand traps have however interrupted this northwards transport and caused an accumulation of sand at Pages Beach against the main breakwater, at the northern sand trap, and at the north-east limit of the main breakwater. Accumulation continues until the trap is full and sand is directed offshore. The sand then becomes available for transport in an onshore and northerly direction, however a significant amount is caught by sand traps adjacent to the navigation channels north of the harbour.

Consequently beaches directly north of the Port are in a "shadow" zone with no longshore input of sand occurring. This lack of sand replenishment has caused these beaches to erode up to a point just north of the old railway marshalling yards and a rock wall has had to be built to stabilise the foreshore against further erosion (Kerr, 1984).

The proposed extension of the existing northern sand trap would cause a temporary cessation in the sand being directed offshore as sand accumulates to fill the larger trap. Once this is complete however, sand will once again bypass around the trap and continue to be available for transport.

It is anticipated that there would be no significant increase in the size of the "shadow" zone behind the Port. This assumption is based on the fact that the existing main breakwater to the north-east would remain the main contributor to the majority of the shadow as it extends into Champion Bay a similar distance to the final length of the proposed new sand trap extension. Consequently, increased deterioration of the coast adjacent to the City of Geraldton is not likely due to the advanced state of erosion that already exists in that area. Furthermore, the eastern limestone ridge is exposed north of the railway yard rock wall and the sediment supply to this section of shoreline is already low. Beach sands are stabilised by the underlying limestone so that any increase in erosion would not cause a significant impact.

The shoreline stability of Pages Beach and any other areas west of the main breakwater are not expected to change as the proposed port expansion would not result in alterations to coastal processes in this area.

7.2.2 Turbidity

An impact to the physical environment is expected to occur in the form of increased water turbidity as a result of dredging and land reclamation activities. Activities likely to lead to increased turbidity include:

- dredging of the seabed
- dumping of rock material for bund wall and sand trap construction
- discharge of landfill material for reclamation.

Construction details are outlined in Sections 5.1 and 5.2.

(a) Dredging of the Seabed

The increase in water turbidity caused by dredging activities is anticipated to be minimal and only occur during the construction phase. By using a cutter-suction type dredge, the dredged material is drawn directly in and away from the cut site with minimal disturbance of the seabed. The turbidity created would in fact be less than that produced on occasions by deep draft vessels manoeuvring within the harbour. It should also be noted that maintenance dredging has been carried out in the past and is again required at present.

Dredging operations require calm seas. Such conditions would minimise the development of a turbid plume.

(b) Bund Wall and Sand Trap Construction

Turbidity increases associated with the dumping of rocks generally do not constitute a serious environmental problem. The impact shall be of a short term nature, occurring only during the construction phase of the project. In addition, the plume generated by bund wall construction would be contained mostly within the existing harbour and thus reducing its impact along the coast. The plume generated by rock dumping associated with extension of the sand trap is not expected to be significant as short term increases in turbidity resulting from storms are a common occurrence in the near coastal zone.

(c) Landfill Discharge

The potential exists for a turbidity plume to be generated by the discharge of landfill material for reclamation purposes. The extent of this plume would however be contained by the bund walls surrounding the Stage 1 and Stage 2 reclamation areas.

In the Stage 1 reclamation the discharge outlet would be located as far away from the bund wall opening as possible, allowing a greater time for the sediment to settle before entering the harbour and thus reducing the extent of the turbidity plume. In Stage 2 bund walls would extend around the entire reclamation area. This would allow discharge into the area to pond with water escaping down through the soils. This would considerably lower the amount of fines which would be released into harbour waters.

7.2.3 Drainage

The drainage system for the reclaimed area has been designed to direct all stormwater run-off through silt/oil traps to soakage basins via drains. This would eliminate any pollutants associated with fishing vessels and carpark areas from entering the harbour (Figure 6). Consequently no adverse environmental impact is expected to the water quality of the harbour.

7.2.4 Water Quality

The results of a recent study on water quality within and around the Port of Geraldton showed that waters within the harbour are of similar quality to that of Champion Bay (Geraldton Water Authority 1989). These waters conform to EPA quality criteria relating to direct contact recreation (Section 6.2.6). It is expected that water quality within the harbour would not be reduced as a result of this proposal as no new pollutants would enter the harbour and flushing would be maintained, if not improved, as a result of the new port configuration.

It is considered that the especially designed drainage system will prevent any pollutants associated with industries and fishing vessels from entering the harbour via stormwater run-off (Section 5.6). In addition there would be no direct effluent discharge into either the fishing harbour or the Port itself.

The new fishing boat harbour entrance would allow for a better exchange of water between the harbour and Champion Bay than currently exists. This is because the entrance would be aligned approximately parallel to the dominant wind direction, thereby creating wind induced currents. Also water would have less distance to travel to reach Champion Bay than currently exists. Consequently if any pollutants were to be present in the harbour they would be quickly diluted by the introduction of good quality water from Champion Bay.

7.2.5 Noise and Dust

A limited amount of noise and dust would be generated during the construction phase of the development. The main source of this noise and dust would be from trucks carting and dumping rock material to the harbour site. The levels generated however are expected to be less or similar to that produced by normal port operations such as train movements, stockpiling of mineral sands and carting and stockpiling of grain. Consequently no significant impact is expected.

7.2.6 Landscape

Development of the reclaimed land would produce a landscape compatible with the existing Port environs. Although leasing arrangements have not been finalised, it is likely that buildings, sheds and boat storage facilities would be of a similar type already surrounding the reclaimed area. Consequently the landscape aesthetics of Port Moore would not be altered.

7.3 IMPACTS ON BIOLOGICAL ENVIRONMENT

The biological environments of the inner harbour and the immediate surroundings of Champion Bay have already undergone significant alteration as a result of the existing port facilities. Detailed descriptions of these environments are given in Section 6.3.

It is anticipated that both long term and short term impacts to the biological environment would result from the current proposal. These include:

- permanent loss of marine flora and fauna in reclamation and sand trap extension areas
- temporary increased turbidity during dredging and reclamation
- disturbance of benthic flora and fauna communities due to dredging activities.

7.3.1 Loss of Marine Flora and Fauna

A permanent loss of the existing marine flora and fauna would occur as a result of the reclamation of land within the main harbour. This loss is not considered significant as the biological environment of the inner harbour is in an already degraded condition as a result of the existing port facilities (Masini, 1988).

Extension of the northern sand trap would result in a permanent loss of seagrass and associated flora and fauna. This would occur due to burial by rock and sand. The burial by sand will result as the sand trap fills with sediment and begins to bypass. This loss is not considered significant since the existing sand trap and outer breakwater are surrounded by an already degraded zone consisting of a 75m wide sand halo. This halo however would be dislocated to the end of the new sand trap. The area of dense seagrass meadow affected represents less than 1% of the total seagrass area of Champion Bay and the impact is therefore considered to be minimal.

7.3.2 Turbidity

Most marine organisms in the near coastal zone are able to tolerate substantial increases in turbidity and redistribution of sand on the seabed as these are natural phenomena associated with storm and current-induced water motion. Turbid plumes generated during similar constructions to the present proposal have not caused a permanent impact on the biological environment.

7.3.3 Disturbance Due to Dredging

The proposed dredging would impact on the biological communities of the dredge sites. The majority of dredging would occur in areas already significantly altered by either previous dredging activities or by the accumulation of sediment adjacent to sand traps and breakwaters. - Thus the impact on the biological communities of Champion Bay as a whole would be minimal. The removal of flora and fauna in the port area is considered to be of a short term nature only as recolonisation by new communities is expected (Hirsch et al, 1978).

7.4 IMPACT ON THE HUMAN ENVIRONMENT

7.4.1 Beneficial Impacts

Apart from the direct benefits of providing more land for the purposes described in Sections 3 and 5, other beneficial aspects include provision of car park facilities, increased recreation potential, and improved employment opportunities.

The car park proposed for the reclaimed area of Stage 1 would provide a central location within the port complex from which the new facilities as well as the existing fishing, construction and storage industries can be accessed. The operational aspects of the Port will consequently be improved.

Extension of the northern sand trap would provide increased recreational fishing opportunities at greater depths within Champion Bay, and thus add to the many recreational activities already practised at Point Moore and the surrounding waters.

The proposed port expansion would create significant employment opportunities during both the construction and operational phases of the project. In addition, the potential economic stimulus to associated industries in the Geraldton region is expected to be considerable.

7.4.2 Noise and Dust

No significant impact in the human environment is anticipated to occur as a result of the limited increase in noise and dust associated with the construction phase of the project. As detailed in Section 7.2.5, the noise and dust levels would be less or similar to those generated by normal port operations such as train movements, stockpiling of mineral sands, and carting and stockpiling of grain. However, all efforts would be made to minimise any impact.

7.4.3 Traffic

The existing road system to the Port is designed to cater for large volumes of traffic servicing the harbour during peak times such as grain cartage during harvest. Any increase in traffic associated with the port expansion would therefore be easily absorbed by the existing road system and not produce any significant adverse impact on the human environment.

7.4.4 Access within Harbour

The Port of Geraldton frequently experiences heavy shipping movements during peak periods such as the lobster fishing season. Grain export during the harvest season also contributes to increased shipping movements. The potential exists for the dredging operations within the harbours to cause a disruption to these movements. However, through careful management of the dredge location and the positioning of spoil disposal lines, this problem would be minimised so as to allow continued access to all port facilities.

7.5 SYNTHESIS

In summary, the proposed expansion of harbour facilities at the Port of Geraldton would result in a variety of impacts to the physical and biological environments. The relative significance of these impacts is considered to be minor, given the degraded nature of the natural environment within the harbour.

A temporary interruption of longshore sediment movement would result from the extension of the sand trap. However, it has been demonstrated that no significant increase in the size of the "shadow" zone behind the port complex is expected, and consequently no additional erosion along the northern beaches is anticipated.

The loss of seagrass resulting from dredging and reclamation would cause both short and long term impacts to the biological environment. Losses caused by dredging are not considered significant as recolonisation is expected to occur. Permanent loss due to reclamation and burial would occur within the harbour and at the sand trap extension site. Since the harbour and area surrounding the existing sand trap are already substantially degraded the very small area of seagrass loss would not be significant.

Short term increases in water turbidity during the construction phase of the project are not expected to cause any long term impacts on the physical and biological environments. Most marine organisms can tolerate similar events which occur naturally within the nearshore zone.

No significant alteration to water quality of the harbour is anticipated as a result of the proposed port expansion. The drainage system and flushing characteristics would ensure there is no build-up of pollutants.

8. ENVIRONMENTAL MANAGEMENT

8.1 INTRODUCTION AND OBJECTIVES

A number of potential environmental impacts have been identified. However, due to their temporary nature and the degraded state of the environment within the harbour they are not considered significant. Nevertheless the proponent undertakes to minimise these impacts by using suitable construction methods during the reclamation process. The proponent also undertakes to implement management and monitoring programmes designed to minimise impacts and detect changes in the environment. In this way the GPA can further refine the management techniques employed.

During construction the major management issues are:

- . turbidity
- . noise and dust
- . access within the harbour.

Management issues once construction is complete include:

- . shoreline stability
- . water quality
- . maintenance dredging.

8.2 MANAGEMENT OF CONSTRUCTION PHASE

8.2.1 Turbidity

As described in Sections 5.2 and 7.2.2, increased turbidity would result from dredging and land reclamation activities. The turbidity temporarily created by dredging would be reduced considerably by using a Kingfisher cutter-suction type dredge which removes dredged material away from the cut site rapidly.

Increased turbidity generated by the discharge of dredged material would be managed by enclosing the reclamation area with bund walls well in advance of discharge commencing. In addition the discharge outlet would be located as far away from the overflow outlet as possible. This would allow for the maximum amount of suspended sediment to settle out before the overflow enters the surrounding harbour environment.

Turbidity generated during Stage 2 of the reclamation would be minimised with respect to time by using a larger dredge than that proposed in Stage 1. This would limit the period of increased turbidity and thus the potential impact on seagrasses to four months.

The bund wall of Stage 2 would be extended all the way to the breakwater. This would allow the ponding of discharge into the bunded area and the slow release of waters back into port waters via filtration through bund walls and reclaimed soil. This would result in the turbidity generated to be minimised as most fines would be trapped within the reclaimed area.

8. ENVIRONMENTAL MANAGEMENT

8.2.2 Noise and Dust

It is not anticipated that any noise or dust generated during the construction phase of the project would exceed levels already evident in the area. If in the unlikely event levels are sufficiently high to cause complaints then the appropriate action shall be taken immediately to rectify the situation. This action would depend on the nature of the problem but may include altering the particular methods employed or spraying the surface with a stabilising medium.

8.2.3 Access within Harbour

As it is of prime importance that shipping movements are not disrupted by the various dredging and reclamation activities, access to all existing facilities shall be maintained during the port expansion project. Location of the dredge and associated pipelines would be managed such that continued access to the fishing boat harbour and to the berths within the main harbour would be provided. This would be carried out after consultation with port users along the lines of normal practice during other similar dredging programmes.

8.3 MANAGEMENT OF POST-CONSTRUCTION PHASE

8.3.1 Shoreline Stability

No significant increase in the size of the "shadow" zone behind the port complex is expected as a result of proposed construction activities and consequently no additional erosion along the northern beaches is anticipated. The Department of Marine and Harbours (DMH) has undertaken to monitor the beaches on either side of the Geraldton Foreshore Development Marina in order to identify any unforeseen shoreline instability as a result of that project. The GPA would remain in communication with the DMH with regard to the results of this monitoring programme and if necessary, take appropriate management actions in conjunction with the DMH.

8.3.2 Water Quality

Water quality in both the fishing boat and main harbours is not expected to be significantly altered as a result of the current port expansion proposals. This is primarily a consequence of flushing characteristics together with other features designed to limit the entry of pollutants into the harbour. Stormwater runoff from factories and hardstanding areas which may contain hydrocarbons, nutrients and heavy metals will be directed through drains to silt traps.

It is the GPA's intention to maintain the quality of water that currently exists within the fishing boat harbour. Currently these waters satisfy the criteria for direct contact recreation (Geraldton Water Authority 1989). In line with the GPA's general approach of maintaining this high level of water quality, discharge of litter, effluents, sewerage and hydrocarbons into the harbour will be prohibited.

8.3.3 Maintenance Dredging

Maintenance dredging of the harbour and its associated channels and sand traps is part of the GPA's ongoing management programme designed to ensure continued access to ships navigating these waters. It is not anticipated however that this would be required for some time once the proposed development is completed.

8.4 CONTINGENCIES

The management and monitoring programme detailed in this document has been designed to address foreseeable contingencies. Established contingency plans such as those for oil spills would be updated to take into account the new port configurations. The GPA is equipped to deal with fuel spills, fires, and the impact of storms. The GPA also carries public liability insurance, however, individuals are responsible for their own property and craft. In the event that the stabilising structures fail, the proponent will undertake to address these problems.

8.5 MANAGEMENT RESPONSIBILITY

Control of the Port of Geraldton is the sole responsibility of the GPA which undertakes all operational, administrative and managerial aspects of the Port on a day-to-day basis. This responsibility would also apply to the proposed development and is not expected to change for the life expectancy of the project.

9. SUMMARY OF COMMITMENTS

9. SUMMARY OF COMMITMENTS

The GPA is responsible for all activities with regard to the Port of Geraldton, including the present proposal. As such the Authority makes the following commitments:

The GPA commits to managing the increase turbidity generated by dredging by enclosing the reclamation area with bund walls well in advance of discharge of material to the area. In addition the discharge outlet will be located as far away from the overflow outlet as possible to allow the maximum amount of suspended sediment to settle out before discharge to the harbour. Dredging of Stage 1 will be limited to one month while dredging for Stage 2 will be limited to four months so as to minimise the period over which turbidity will be generated. Management of turbidity will be performed to the satisfaction of the EPA.

The GPA commits to managing the reclamation activities in such a way as to minimise the generation of noise and dust. In the unlikely event that complaints are received the GPA commits to taking appropriate action to rectify the problem. This action will be performed to the satisfaction of the EPA.

The GPA commits to locating the dredge and associated pipelines such that continued access to the fishing boat harbour and to the berths within the main harbour will be provided. This will be carried out after consultation with port users along the lines of normal practice during other similar dredging programmes.

The Department of Marine and Harbours has undertaken to monitor the beaches on either side of the Geraldton Foreshore Development Marina in order to identify any unforeseen shoreline instability as a result of that project. The GPA commits to remaining in communication with the DMH with regard to the results of this monitoring programme and if necessary, take appropriate management actions in conjunction with the DMH.

The GPA commits to managing stormwater runoff from factories and hardstanding surfaces within the reclaimed area so that spills of chemicals, and other potential pollutants at the Port are directed into drains and captured in silt traps. The design of the drainage system will be to the satisfaction of the EPA.

The GPA commits to not allowing crayfish processing industries to establish on the reclaimed land of Stages 1 and 2. This is mainly because of effluent disposal problems associated with this type of industry.

The GPA commits to carrying out management and monitoring programmes designed to detect and address foreseeable contingencies associated with the reclamation works. This includes monitoring of heavy metals in soils to be dredged, modification of contingency programmes in the event of hydrocarbon spillage and fire and the repair of any stabilising structures associated with the works should they fail. These management and monitoring programmes shall be performed to the satisfaction of the EPA.

10. CONCLUSIONS

10. CONCLUSIONS

In proposing the expansion of inner harbour facilities at the Port of Geraldton the proponent, the Geraldton Port Authority, aims to meet the demand for waterfront land within the existing port complex. In doing so, the proponent would utilise dredge spoil from necessary dredging as landfill for the proposed reclamation.

The GPA considers this proposal essential in order to ensure the continued logistic and economic viability of the Port and its many associated industries. Upon completion, the development would meet the current demands for expansion of fishing related industries, and cargo storage and handling facilities. In conjunction, the Port would be in a position to allow platform module construction and deployment from within the port complex.

Several potential impacts to the natural environment as a result of the proposed development have been identified. These include:

- . temporary and permanent loss of seagrass due to dredging and reclamation activities
- . short term increases in water turbidity during construction phase of the project
- . temporary interruption of longshore sediment movement resulting from extension of the northern sand trap.

Due to the temporary nature of these impacts and the degraded state of the existing environment within and adjacent to the harbour, they are not considered significant. Nevertheless, the proponent undertakes to minimise any potential impact by using suitable construction techniques. In addition, the proponent undertakes to implement management and monitoring programmes designed to minimise impacts and detect changes in the environment.

Overall the project would have minimal impact on the natural environment. Those that do occur would be far outweighed by the logistic and economic benefits to the Port of Geraldton, the people of Geraldton and its regions, and the State of Western Australia as a whole.

Point Moore can therefore be regarded as a Holocene accretionary sandy promontory abutting the eastern Pleistocene limestone ridge and protruding out into the Indian Ocean more so than the surrounding coastline. Its northern and southern shores are characterised by sandy beaches while the adjacent mainland beaches comprise a thin veneer of Holocene sediment overlying the Pleistocene limestone basement. Where this veneer is absent and the limestone exposed, the coast is rocky.

The relationship between geology, geomorphology and swell patterns is illustrated in Figure 7.

6.2.2 Wind Climate

The prevailing winds at Geraldton are dominated by the local sea and land breeze system. Characteristically, winds from the south to south-west dominate year round in the afternoons at strengths often up to 30 knots. Light to moderate southerly to easterly winds prevail in the mornings during summer while winter mornings are dominated by light to moderate north-easterlies.

Summer tropical cyclones migrate southwards from equatorial latitudes bringing gale force winds from a variety of directions.

6.2.3 Wave Climate

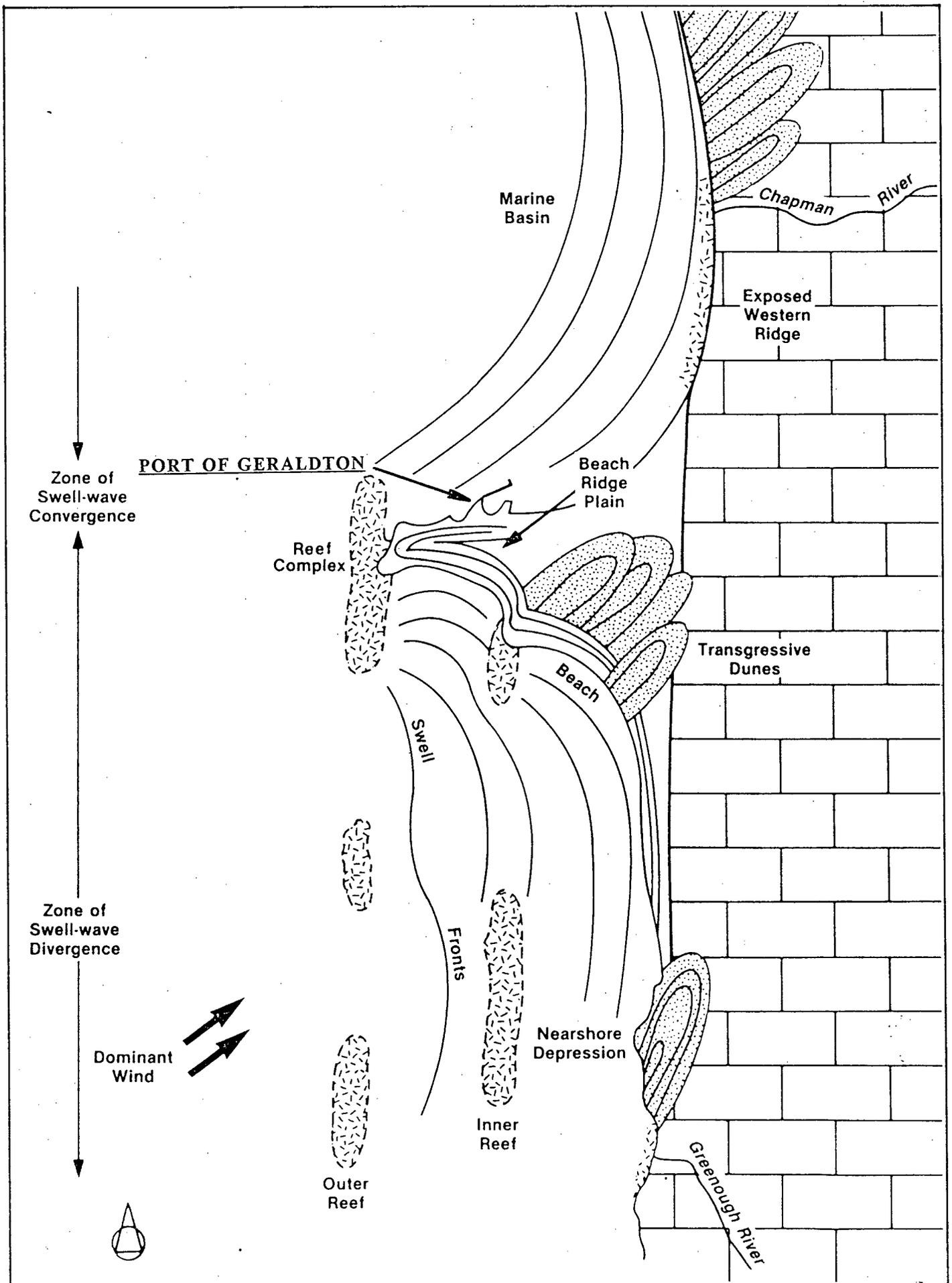
The wave climate experienced at Geraldton is similar to that which prevails along the entire southern half of the west coast of Western Australia.

Wave buoys deployed in Champion Bay and wave observations from ships confirm that the area is affected by long period oceanic swells from the south-west to west, short period wind waves generated by south to south-westerly winds, and storm swells arriving from a variety of directions (DMH, 1988).

Refraction around, diffraction through and breaking of waves over the Point Moore reef system, together with bottom friction causes significant wave attenuation along the coast in Champion Bay and Port Grey.

6.2.4 Tides and Sea Level Fluctuations

Fluctuations in sea level at Geraldton are affected by astronomical, meteorological and oceanographic factors. The astronomical tide is predominantly diurnal with a maximum range of 1.3m. The Australian National Tide Tables for 1988 give the following relevant tidal levels for Geraldton:



Halpern
Glick
Maunsell



RELATIONSHIP BETWEEN GEOLOGY, GEOMORPHOLOGY AND SWELL-WAVE PATTERNS AT GERALDTON (from Kerr, 1984)

FIGURE 7

Highest astronomical tide	+ 1.5m CD (chart datum)
Mean High High Water (MHHW)	+ 1.1m CD
Mean Sea Level (MSL)	+ 0.8m CD
Mean Low Low Water (MLLW)	+ 0.6m CD
Lowest Astronomical Tide	+ 0.2M CD

During winter months, meteorological and oceanographic forces associated with storm activity causes water level rises of 0.3 to 0.5m above the expected astronomical tide. On a 1 in 100 year occurrence a maximum water level 1m above the MHHW astronomical tide level is predicted. This would result in a total water level at Geraldton 2.5m above Chart Datum.

Water level fluctuations within the Port would be similar to those experienced in Champion Bay.

6.2.5 Coastal Processes

The coastal landforms of the Geraldton area are a direct result of coastal processes driven by the prevailing wind and waves. Kerr (1984) identified the following processes:

- swell-induced erosion of outer reefs and subsequent onshore transport of erosion products to the coast
- wave-induced longshore transport of suspended sediment in the surf zone
- inland aeolian (wind-driven) transport of fine sand.

Of these, the dominant process with respect to the current proposal is the longshore transport of sand along the coastline. During periods of prevailing south to south-west wind and wave conditions, sediment is transported in a northerly direction. Wind and waves from the north producing a southerly drift are less frequent and consequently the net transport of sand along the coast is in a northerly direction.

As discussed in Section 6.2.1 and illustrated in Figure 7, the Point Moore area acts as a trap to sand migrating up and down the coast. Continued accumulation of deposited sediment in a zone of wave convergence behind the Point Moore reef system has led to the development of a beach ridge plain forming the peninsula. Accretion of the Point is still occurring with an estimated 15,000-20,000m³ of sediment arriving from the south annually (Woods, 1988). Of this, a significant amount (5,000-6,000m³/yr) passes around the Point and continues northwards (DMH, 1988).

Evidence for southerly transport of sediment can be found in the form of an accumulation of sand on the northern side of the town jetty. The small volume of sand indicates southerly transport is not significant.

Construction of port facilities on the northern flanks of Point Moore has caused an interruption to the northwards transport of sediment. The main breakwater and offshore sand traps act to trap the sand at Pages Beach, the northern sand trap and at the north-eastern limit of the main breakwater. Consequently, beaches directly north of the Port are denied sand and erosion occurs. Evidence for this can be seen along the Town Centre coast where seawalls have had to be constructed to protect the railway marshalling yards from erosion. Sunset Beach approximately 8km north of the Port is also eroding (Kerr, 1984). This has been attributed, in part, to the harbour facilities.

Transfer of sediment across the bottom of Champion Bay does not appear to be significant. This is largely due to the dense cover of seagrass and the relatively deep and calm waters of the Bay. A study of aerial photography indicates an accumulation of sediment around the position of an old jetty forming a "scar" on the seabed. This scar has persisted even though the jetty has long since gone, and indicates limited sediment transport along the seafloor. This may be partially due however to this feature being in the "shadow" of the Port of Geraldton.

A proposal for foreshore redevelopment involving construction of a 250 pen recreational boat harbour has recently been approved for this site.

6.2.6 Water Quality

Results from a water sampling survey (Geraldton Water Authority, 1989) indicate that waters within the fishing boat and main harbours are of similar quality to that of Champion Bay (see Appendix II).

The survey was carried out to determine if outfall from an effluent pipe located outside the main breakwater was adversely affecting the water quality in the area of discharge. In addition waters within the fishing harbour and the main harbour were sampled.

It was concluded that the only results to exceed the EPA criteria were right at the discharge point, within the mixing zone. This is to be expected because of the very shallow water at this location".

It is assumed that the criteria referred to is that of Beneficial Use No. 1 for Direct Contact Recreation (Department of Conservation & Environment, 1981) as beaches within the area of sampling are used for bathing.

REFERENCES

REFERENCES

- Clarke Gazzard Planners Pty Ltd, 1972. Town of Geraldton District Town Planning Scheme No. 1.
- Department of Conservation and Environment, 1981. Water Quality Criteria for Marine and Estuarine Waters of Western Australia. Report of the Working Group established by the Environmental Protection Authority. Bulletin No. 103, Department of Conservation and Environment, WA.
- Department of Marine and Harbours, Western Australia, 1988. Geraldton Foreshore Redevelopment, Coastal Engineering Studies. Report No. DMH4/88.
- Geraldton Region Plan, 1989. State Planning Commission, Perth, WA.
- Geraldton Water Authority, 1989. Geraldton Sewerage - Ocean Outfall Sampling Report No. M318. Report to Pollution Control - Division, Environmental Protection Authority.
- Hirsch ND, Di Salvo LH, Peddicord R, 1978. Effects of Dredging- and Disposal of Aquatic Organisms. Technical Report DS-78-5, Noval Biosciences Laboratory, University of California.
- Kerr MG, 1984. Draft Coastal Management Plan - Town of Geraldton. Department of Conservation and Environment, Perth, WA, Bull. 185.
- Masini RJ, 1988. Assessment of Potential Impacts of the Champion Bay Marina Development on Adjacent Benthic Communities. For the Department of Marine and Harbours. Centre for Water Research, University of Western Australia. Appendix No. 3 in Notice of Intent for Geraldton Foreshore Redevelopment. Department of Marine and Harbours, Western Australia, May 1988.
- Maunsell & Partners Pty Ltd, 1986. Integrated Planning for the Port of Geraldton, Phase 1. Report to the Geraldton Port Authority.
- Riedel & Byrne Consulting Engineers Pty Ltd, 1985. Geraldton Recreational Boating Study. Report for the Geraldton Mid-West Regional Development Advisory Committee.
- Saint-Smith EC, 1912. A Geological Reconnaissance of a Portion of the South-West Division of Western Australia. Western Australian Geol. Survey Bull. 46.
- Searle DJ and Woods PJ, 1986. Detailed Documentation of a Holocene Sea Level Record in the Perth Region, South-Western Australia. Quaternary Research 26, 299-308.
- Woods PJ, 1988. Notice of Intent for Geraldton Foreshore Redevelopment. Report for Department of Marine and Harbours, Western Australia. Vol. I and II.

APPENDICES

APPENDIX I

**EPA GUIDELINES
FOR NOTICE OF INTENT**



ENVIRONMENTAL PROTECTION AUTHORITY

1 MOUNT STREET, PERTH, WESTERN AUSTRALIA 6000

Telephone (09) 222 7000

The Manager
Maunsell and Partners Pty Ltd
PO Box 7190, Cloisters Square
PERTH WA 6000

Your Ref: 11/86
Our Ref: Ms E Bunbury
Enquiries:

Attention: Mr Scott Bird

Dear Sir/Madam

PORT OF GERALDTON - EXPANSION OF CONSTRUCTION FACILITIES

Following our letter to you of 25 May, 1989, please find enclosed the Authority's guidelines for the preparation of the Notice of Intent (NOI) on the above proposal.

For further information regarding the preparation of the NOI, please contact Ms Bunbury direct on 222 7036.

Yours faithfully

BP Kennedy

B P Kennedy
A/DIRECTOR
EVALUATION DIVISION

29 May 1989

0150EBPOR:dc

Enc

GERALDTON INNER HARBOUR EXPANSION PROPOSAL
GUIDELINES FOR THE NOTICE OF INTENT

1. **SUMMARY**

The Notice of Intent (NOI) should contain a brief summary of:

- salient features of the proposal;
- alternatives considered;
- description of receiving environment and analysis of potential impacts and their significance;
- environmental monitoring, management and safeguards, and commitments thereto; and
- conclusions.

2. **INTRODUCTION**

The NOI should include:

- identification of proponent and responsible authorities;
- background and objectives of the proposal including development concepts;
- brief details, and timing of the proposal;
- relevant statutory requirements and approvals; and
- purpose and structure of the NOI.

3. **NEED FOR THE DEVELOPMENT**

The NOI should provide a discussion of the justification for the project and project costs (in the broad sense) and benefits at local and regional levels. For example the following items should be covered:

- the proposed development should be considered within the context of local and regional requirements;
- benefits to the community of the project; and
- how this proposal fits into any overview or regional plan for future development. Include discussion of proposed future stages.

4. **EVALUATION OF ALTERNATIVES**

The evaluation of alternatives is an important part of a NOI. A discussion of alternative options should be given. A comparison of these in the context of the stated objectives should be included as well as costs and benefits at both construction and long term stages. In this way, the rationale for not choosing certain alternatives should be clear as well as the basis for choosing the preferred option.

The following provide examples of alternatives and their potential impacts for consideration:

- various development options or scales of development; and
- various special arrangements of uses based on environmental consequences.

5. DESCRIPTION OF PROPOSAL.

This should include:

- general concepts;
- extent of dredging, both within harbour, and outside for test dredging of the proposed new fishing boat harbour channel;
- disposal of dredged material;
- extent of reclamation;
- bund wall construction and protection;
- proposed land uses on reclaimed area;
- associated works;
- turbidity created by dredging both during dredging and during discharge of material;
- access;
- other works including infrastructure sources;
- drainage of reclaimed area;
- the construction period;
 - . operations; and
 - . employment.

6. EXISTING ENVIRONMENT

The NOI should provide an overall description of the environment and an appraisal of physical and ecological systems likely to be affected by it.

It should then concentrate on the significant aspects of the environment likely to be impacted by the development (ie in particular the processes sustaining the system). Only the processes, habitats, resources and potential resources which could be influenced should be defined.

Wherever possible in the discussion of physical and biological processes that are essential determinants in the maintenance of habitats and resources, models or diagrams should illustrate and synthesise the interactions between the processes.

This discussion should relate to the dredge and reclamation areas and include:

- physical:
 - . soils;
 - . geology;
 - . hydrology;
 - . sediment movement; and
 - . existing wastewater management and drainage at adjacent industrial area.
- biological:
 - . flora; and
 - . fauna.
- human environment:
 - . road systems and traffic;
 - . land tenure and zoning;
 - . existing adjacent land use;
 - . existing boat use patterns;
 - . regional landscape; and
 - . other human uses.

7. ENVIRONMENTAL IMPACTS

This is the most important part of the NOI and the result should show the overall effect on the total ecosystem and social surroundings of the location during and after construction.

The objective of this section is to synthesise all information and predict potential impacts upon the environment in the short and long term, including beneficial impacts and the impacts of alternatives. This should include an assessment of the resilience of the systems identified in Part 6 to natural and man-induced pressures.

Impacts should be quantified where possible. Criteria for making assessments of their significance should be outlined. In some areas there will be advantage in discussing construction and operation impacts separately.

It will be necessary to determine impacts on individual components of the environment before a final overall synthesis of potential impacts is made.

This section should include but not be limited by consideration of the following:

- Shipping Facilities/Dredging Impacts:
 - . dredging and spoil disposal.
- Spoil Disposal:
 - . general;
 - . disposal sites;
 - . site selection and impacts; and
 - . spoil contaminants (if applicable).
- Foreshore Areas:
 - . boating/car parks.
- Economic:
 - . employment during construction; and
 - . recreation potential in reclaimed area.

Construction and long term impacts on existing adjacent community ie noise, increased traffic.

Access.

Landscape Aesthetics.

Future Maintenance Dredging.

Wastewater disposal.

The final synthesis should include an assessment of the significance and timing of the various potential impacts identified.

8. ENVIRONMENTAL MANAGEMENT

An environmental management programme should be described on the basis of (and cross-referenced to) the synthesis of potential environmental impacts described in 7.

The purpose of the management programme is to demonstrate the manner in which potential environmental impacts can be ameliorated.

Authorities responsible for management should be clearly identified as should management administration, costs and funding including long term financial contingency. Reference should be made to environmental standards expected.

Elements of monitoring and the environmental management programme should include the impacts identified in 7. Emphasis should be placed on the manner in which monitoring results will lead, where appropriate, to amendments to the management programme.

Environmental safeguards should be described.

Procedures for reporting the results of monitoring and management to appropriate authorities should be given.

- Sediment movement and water quality, including both inner harbour and reclaimed area;
- management of reclaimed area; and
- management and control of land uses and harbour on reclaimed area.

9. SUMMARY OF COMMITMENTS BY PROPONENT

Commitments should be made to implement the environmental management programme.

10. CONCLUSION

An assessment of the environmental acceptability of the project in terms of its overall environmental impact and in the context of the proposed management programme should be given.

11. REFERENCES

All references used in the NOI should be listed.

12. APPENDICIES

- . GLOSSARY - definitions of technical terms, abbreviations should be included.
- . NOI GUIDELINES - A copy of these Guidelines should be included in the document.
- . Ancillary or lengthy information related to discussion in the text of the Report.

APPENDIX II

WATER QUALITY STUDY

DIRECTOR, POLLUTION CONTROL DIVISION
ENVIRONMENTAL PROTECTION AUTHORITY

Enclosed is a copy of the results of sampling carried out in the vicinity of the ocean outfall for the Geraldton Wastewater Scheme.

This outfall originally discharged septic tank effluent from the main business district to the ocean. With the diversion of the main pumping station to the inland treatment works in 1986, the only properties connected to this outfall now are seven crayfish processing factories which operate on a seasonal basis.

The results of this sampling indicate that the only valves outside the criteria set down in Bulletin 103 are those directly above the discharge, ie. within the mixing zone.

REGIONAL MANAGER, MID WEST

M318

GERALDTON OCEAN SAMPLING

1 DATE

Tuesday, November 29 1988.

2 WEATHER CONDITIONS

Fine and warm with very light south easterly winds of approximately 1 knot during the duration of the sampling programme. A slow moving upper trough was located off the Gascoyne coast while a ridge of high pressure was located across waters south of WA and into the Bight.

Ocean conditions were very calm with a very low swell. Tidal movement was 0.4m with a low tide at 0822 hours (0.6m) and high tide at 2324 hours (1.0m).

3 GRID

Total grid sampled.

4 SAMPLING

Samples were collected as follows -

- 29 offshore
- 24 shore
- 2 drogue
- 1 effluent (bulk sample collected between 1300 and 1630 hours).

The first offshore sample was taken at 1305 hours (D1) and the last offshore sample (D2) was taken at 1510 hours. The first shore sample was taken at 1305 hours (51) and the last shore sample (52) was taken at 1651 hours. No problems were experienced with either the sampling or surveying.

5 DROGUE DRIFT

Ocean current movement in the vicinity of the end of the outfall was monitored with a drogue. The drogue drift rate was 0.01m/sec in a southerly direction towards the shore. However, due to the shallow water in the vicinity of the outlet, the drogue may have grounded during its drift. (fo/ro 21)

6 EFFLUENT

The wastewater discharged from the outlet is from a seafood processing (lobster) factory ~~but also may possibly contain some domestic sewage.~~ Discharge from the outlet only occurs during the lobster processing season which commences about mid November each year. The effluent is grey/brown in

.... /

colour, turbid with some sediment and has a sulphide/fishy odour. Nutrient and BOD concentrations were higher than sewage effluents except for phosphorus which was approximately 50% lower than sewage effluent. Heavy metal concentrations were all similar to concentrations found in sewage effluent except zinc, copper and arsenic which were 3 to 4 fold higher. Faecal coliform concentrations were similar to raw sewage. During routine sampling of the effluent, the pH ranged from 5.8 to 8.3.

7 RESULTS

Sample results are on folios 24 - 28. A copy of the results was sent directly to the Regional Operations Engineer in Geraldton by the Scientific Services Branch.

The outlet discharges at the shoreline and a slick was clearly visible extending approximately 800m in a north westerly direction by 1500 hours. Discharge from the outlet commenced at 1300 hours resulting in the ocean in the general vicinity of the outlet becoming discoloured (white/grey) and very turbid. Strong sulphide/fishy odours were evident for approximately 50 - 100m down-wind of the outlet.

A low dissolved oxygen concentration was recorded at sample point 22 which is located adjacent to the outlet. High ammonia, phosphorus and faecal coliform levels were also recorded at sample point 22.

Dissolved oxygen ammonia, phosphorus and faecal coliform concentrations at sample points located 200m from the outlet were within the respective criteria.

8 DISPERSION PLUMES (Folios 29 - 33)

8.1 The faecal coliform plume was confined to the general vicinity of the outlet (> 150/100mL). A maximum faecal coliform level of > 100 000/100mL was recorded near the outlet (sample point 22). Sample points located 200m from the outlet recorded zero faecal coliform concentrations.

8.2 The ammonia plume (> 600 µg/L) was confined to the general immediate area of the outlet. The maximum ammonia concentration in the plume was 11 000 µg/L (sample point 22). Ammonia levels fell to near background levels at sample points located 200m from the outlet. Slightly elevated levels of ammonia were recorded east of the processing factory (harbour).

8.3 The nitrate/nitrite levels in the general area of the outlet were low and typical of natural inshore water concentrations. *However nitrate/nitrite concentrations increased*

...../

(40 µg/L) approximately 400m north of the outlet and the plume extended into the harbour. Isolated plumes were located 800m west of the outlet possibly due to a local point source of pollution.

8.4 The reactive phosphorus plume was confined to the immediate vicinity of the outlet and extended approximately 100m north, east and west of the outlet. The maximum phosphorus concentration recorded in the plume was 400 µg/L (sample point 22).

8.5 The effluent dilution plume (< 1000 dilutions) was contained within the immediate area of the outlet. A minimum dilution of 12 was recorded in the immediate vicinity of the outlet (sample point 22). At sample points located 200m from the outlet dilutions were > 1000.

9 DISCUSSION

9.1 Due to the fluctuating flow patterns at the outlet, sampling times are critical to ensure representative plume results. Once flow commences sufficient time must be allowed to elapse to ensure generation of the outlet plume.

9.2 Results of the initial outlet sampling indicate further sample points should be added to the existing grid to define the outlet pollution plume.


B SPEIGHT

March 9 1989

:CYD

HW-M-061

GERALTON SEWERAGE
OCEAN CUTFALL

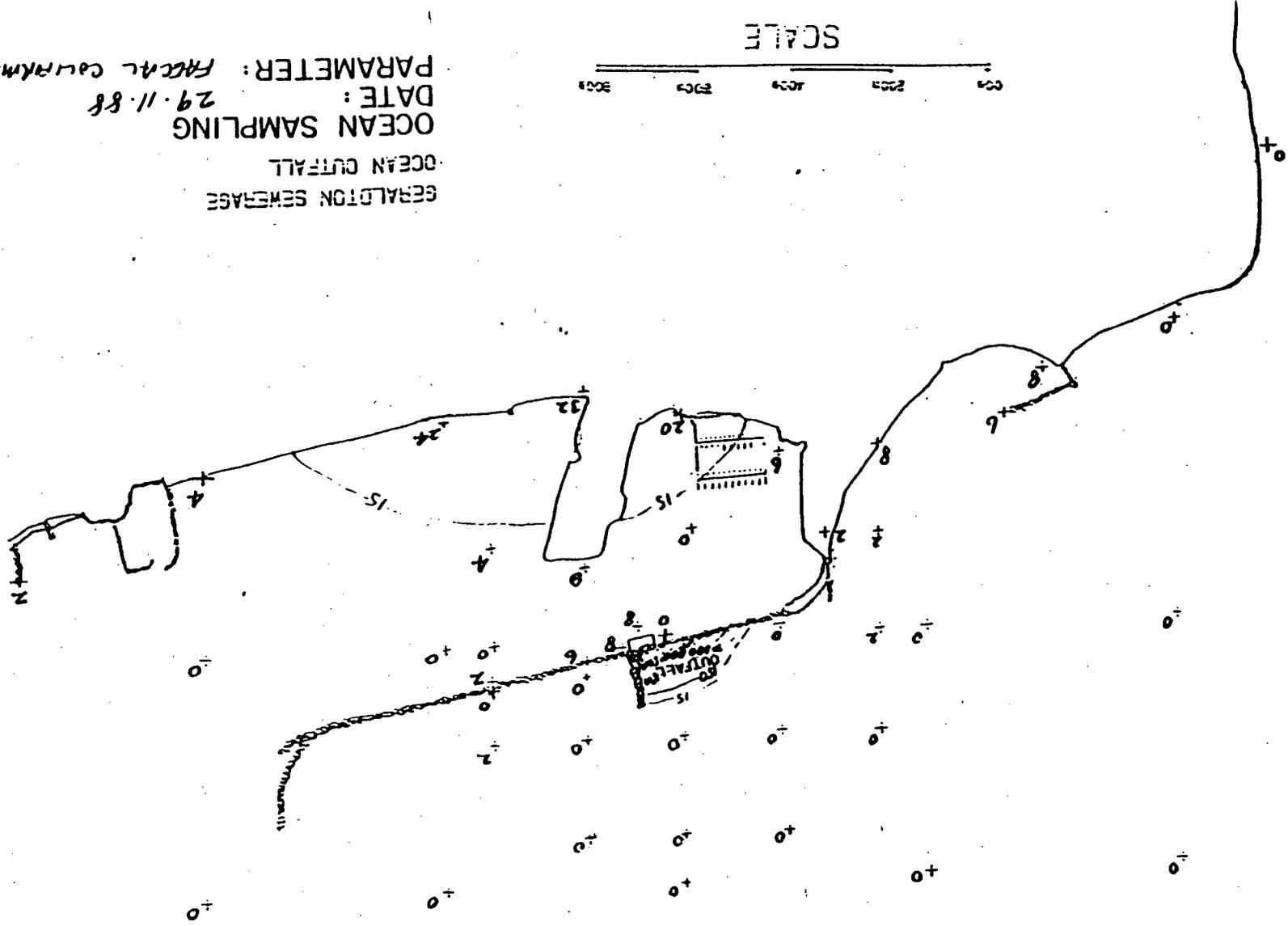
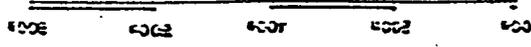
OCEAN SAMPLING

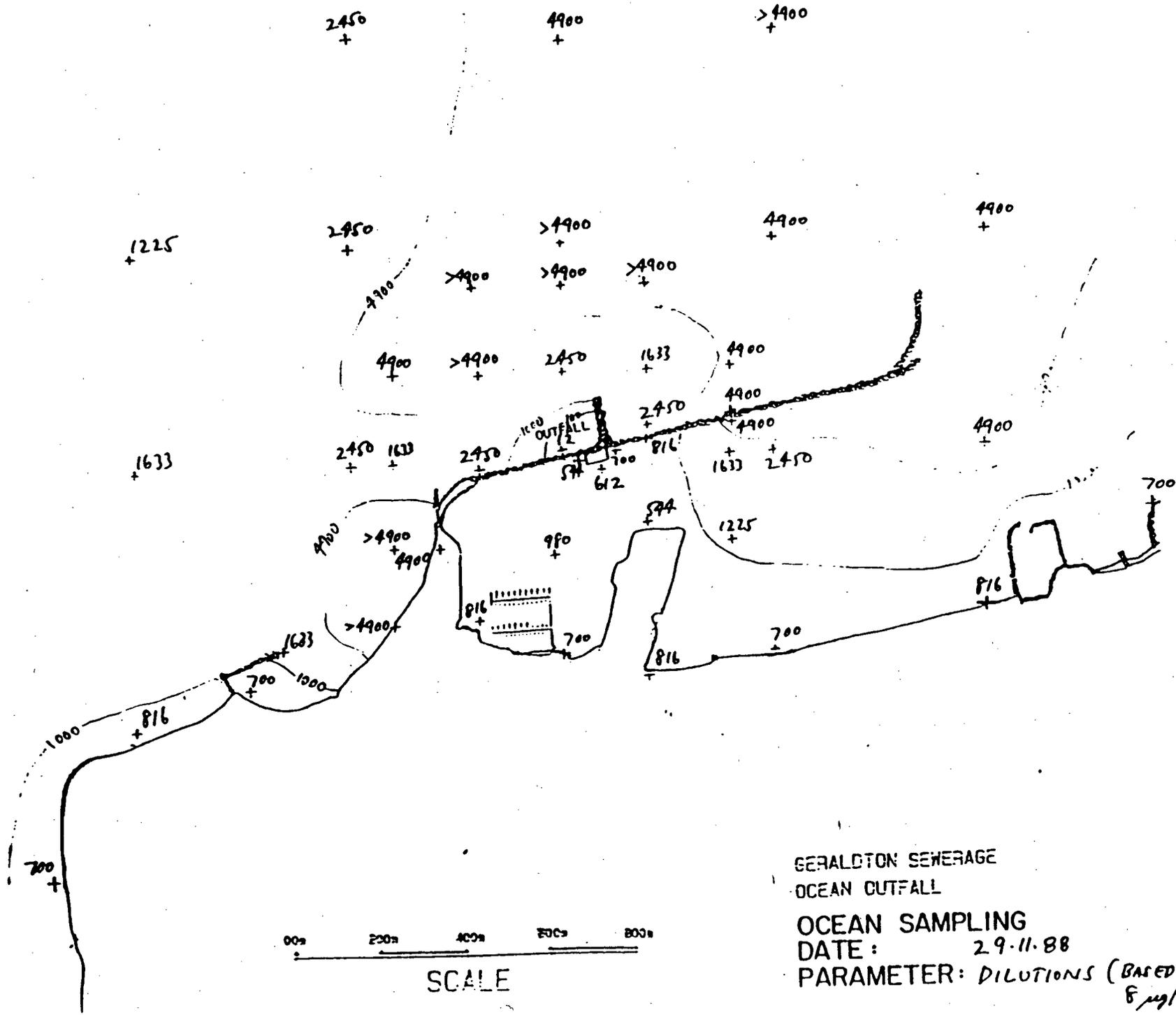
DATE: 29.11.88

PARAMETER: FAEAL COLIFORMS (No/100 mL)

SCALE

SCALE

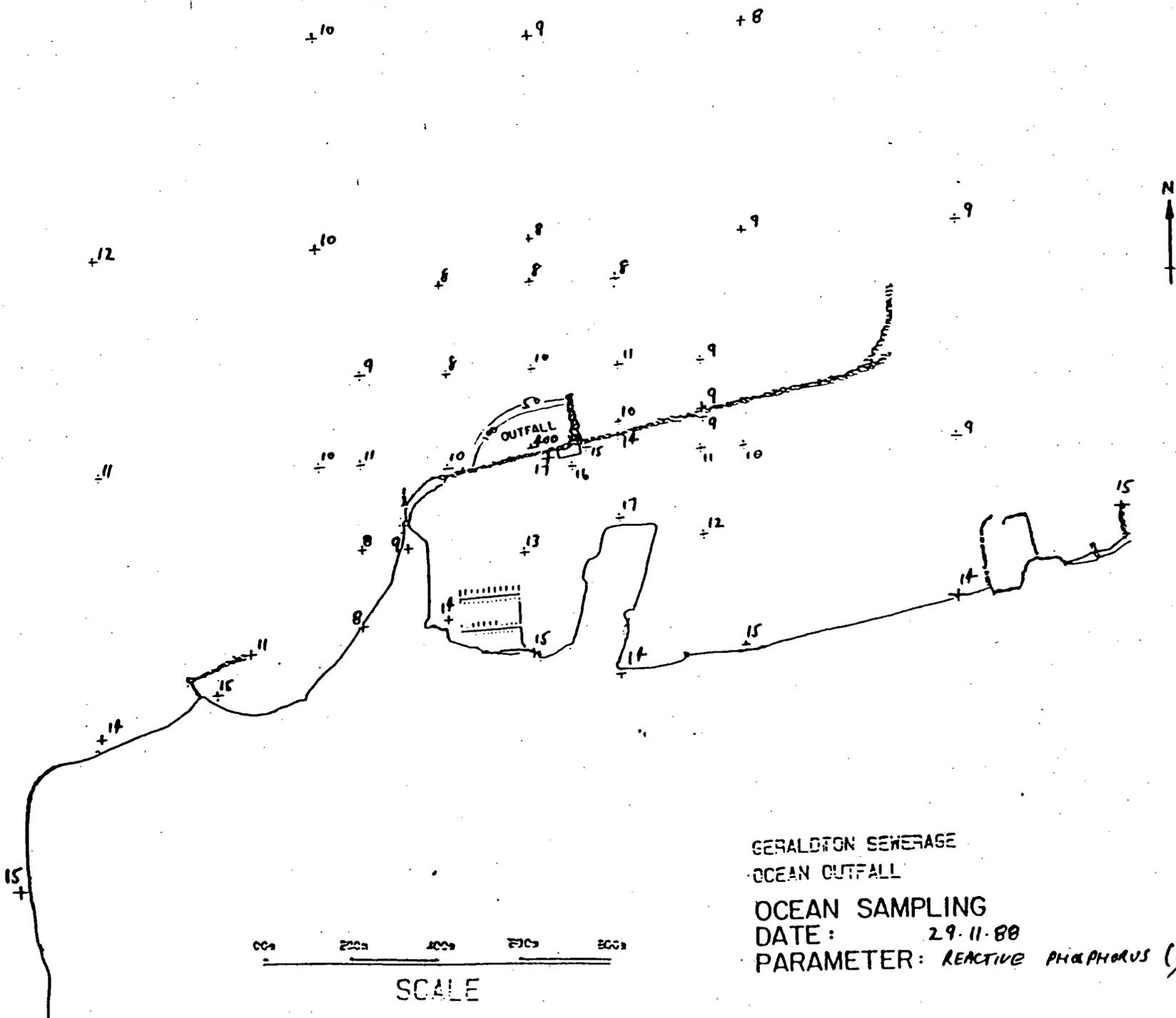




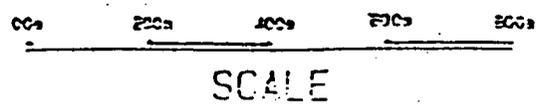
GERALTON SEWERAGE
OCEAN OUTFALL

OCEAN SAMPLING
DATE: 29-11-88

PARAMETER: DILUTIONS (BASED ON FRP; BACKGD.
8 µg/L)



GERALDTON SEWERAGE
 OCEAN OUTFALL
 OCEAN SAMPLING
 DATE: 29.11.88
 PARAMETER: REACTIVE PHOSPHORUS (µg/L)



APPENDIX III

**ABORIGINAL SITES, POINT MOORE, GERALDTON
LETTER FROM THE WESTERN AUSTRALIAN MUSEUM**



Francis Street Perth
Western Australia 6000
Telephone (09) 328 4411
Facsimile (09) 328 8686

Date: 6 July 1989

Your Ref:

Our Ref: 77232
RR:CS

Mr E. Sjerp,
Halpern Glick & Maunsell,
1 Ord Street,
West Perth,
W.A. 6005.

Dear Mr Sjerp,

ABORIGINAL SITES, POINT MOORE, GERALDTON

I have examined our records and there are no Aboriginal sites recorded on Point Moore. Although the port area has been extensively built up it is possible that sites which have not yet been recorded may exist on the coastal side of Wilcock Drive west of the Fisherman's Wharf.

All Aboriginal sites are covered by the provisions of the *Aboriginal Heritage Act 1972-80* regardless if they are known to this Department or not. Section 17 of the Act makes it an offence to excavate, destroy, damage, conceal or in any way alter an Aboriginal site without written permission from the Minister for Aboriginal Affairs.

If your clients have any development proposed for those areas west of the wharf it would be in their interests to engage a consultant archaeologist to examine the area. This would ensure that if sites exist they can be located and recorded to ensure that the provisions of the Act can be met.

If I can assist in any other way please contact me.

Yours sincerely,

Robert Reynolds
Research Officer
DEPARTMENT OF ABORIGINAL SITES