資料-5 事業事前計画表（基本設計時）

１．案件名
セーシェル国　漁業施設及び機材整備計画
２．要請の背景（協力の必要性・位置づけ）
(1) セーシェル国（以下「セ」国）は、インド洋南西部に位置する大小 115 の島々からなる島嶼国で、豊富な漁業資源を有している。水産セクターは、ツナ缶詰や魚介類の輸出、マグロ漁業に係る入漁料、転載料、漁港利用料等による外貨獲得により、観光業偏重の経済構造の改善に貢献している。我が国の無償資金協力等を通じて、主要漁港の整備を推進した結果、漁船の増加、漁船の大型化が促進され、水産関連輸出金額は飛躍的に向上した。「セ」国は、水産業を国家経済発展のための最重要産業として位置づけ、2005 年に水産政策を策定し、持続性かつ責任ある水産開発を推進している。 (2) ビクトリア漁港は中・小規模漁業の中心となっており、1997 年に実施された我が国の水産無償資金協力によって、岸壁や荷捌き場等が整備された。その後、利用漁船数の増加により岸壁が非常に混雑し、水揚げ効率の悪化による漁獲物の鮮度低下や漁船係留の安全性が損なわれている。一方、ベル・オンブレ地区はビクトリア漁港に次ぐ第二の漁港で、「セ」国政府により漁港の拡張整備が実施中である。しかし、製氷施設が未整備なため、主要漁船はビクトリア漁港で水揚げ・係留しており、ビクトリア漁港の混雑を助長している。 (3) 「セ」国政府は、新産業地区であるプロビデンス地区への漁港施設の整備及び第二の水揚げ地であるベル・オンブレ漁港への製氷施設の整備により、両地区の小規模漁業を振興するとともにビクトリア漁港の混雑解消を図るため、本プロジェクト実施に必要な無償資金協力を我が国に要請してきた。
３．プロジェクト全体計画概要
(1) プロジェクト全体計画の目標（裨益対象の範囲及び規模） 1) 目標 ①ビクトリア漁港において港内混雑が解消される。 ②プロビデンス地区及びベル・オンブレ漁港における小規模漁業が振興される。 2) 裨益対象の範囲及び規模 ①裨益対象の範囲：ビクトリア漁港、プロビデンス地区及びベル・オンブレ漁港関連産業従事者 ②裨益対象の規模：直接：漁業者約 500 人及び関連産業従事者数百人 間接：「セ」国国民約 84,000 人（2002 年） (2)プロジェクト全体計画の成果 1) プロビデンス地区に岸壁が整備される。 2) プロビデンス地区に管理棟、荷捌き場、製氷機棟、漁具倉庫棟が整備される。 3) ベル・オンブレ地区に製氷機棟が整備される。 4) プロビデンス地区に氷運搬用機材が調達される。 5) ベル・オンブレ地区に氷運搬用機材が調達される。 6) プロビデンス地区に水産加工施設が建設される。 7) プロビデンス地区に水産加工業者が誘致される。 8) ベル・オンブレ漁港に漁具ロッカー、燃料給油所等が整備される。

9) 漁港施設が適切に管理・運営される。
10) 氷運搬用機材が適切に管理・利用される。

(3) プロジェクト全体計画の主要活動

1) プロジェクト運営のための人員（プロビデンス漁港管理委員会、プロビデンス漁港運営維持管理要員、ベル・オンブレ地区施設管理要員）を配置する。
2) プロビデンス地区に岸壁、管理棟、荷捌き場、製氷機棟、漁具倉庫棟を整備する。
3) ベル・オンブレ地区に製氷機棟を整備する。
4) プロビデンス地区に氷運搬用機材を調達する。
5) ベル・オンブレ地区に氷運搬用機材を調達する。
6) 「セ」国は、上記施設・機材を使用して活動を実施する。

(4) 投入（インプット）

1) 日本側=プロビデンス地区漁港施設及び機材、ベル・オンブレ地区製氷施設及び機材：
無償資金協力 11.39 億円
2) 相手国側：
①必要な人員：プロビデンス地区 18 人、ベル・オンブレ地区 2 人
②建設資機材：工事用仮設ヤードの確保
③相手国負担事項（電気・水道・電話の引き込み、下水管の接続、アクセス道路整備、フェンス建設、燃料タンクを含む燃料給油所）：0.62 億円
④施設／機材の運営・維持管理に係る経費：運営維持管理費（年間）約 0.57 億円

(5) 実施体制

実施機関：セーシェル漁業公社
主管官庁：「セ」国環境天然資源省

４．無償資金協力案件の内容

(1) サイト

「セ」国マヘ島プロビデンス地区及びベル・オンブレ地区

(2) 概要

1) プロビデンス地区において漁港施設の建設及び氷運搬用機材の調達
2) ベル・オンブレ地区において製氷施設の建設及び氷運搬用機材の調達

(3) 相手国負担事項

1) 工事用仮設ヤードの確保
2) 計画サイトの木の伐採、スクラップ・ゴミ等の撤去
3) 建設残土の投棄場所の確保

(4) 概算事業費

概算事業費　12.01 億円（日本側負担 11.39 億円、「セ」国側負担 0.62 億円）

(5) 工期

詳細設計・入札期間を含め約 24.5 ヶ月（予定）

(6) 貧困、ジェンダー、環境及び社会面の配慮

環境面の配慮として、岸壁建設時に水質汚濁防止膜を設置し、環境保全に留意して工事を施工する。

５．外部要因リスク（プロジェクト全体計画の目標の達成に関するもの）

想定を越える(設計対象波を上回る異常波浪や地震による津波)災害がないこと。

６．過去の類似案件からの教訓の活用

特になし。

７．プロジェクト全体計画の事後評価に係る提案

(1) プロジェクト全体計画の目標達成を示す成果指標

成果指標	プロジェクト実施前	プロジェクト完了後
1)ビクトリア漁港の 1 日当り漁船係留隻数の減少	58 隻	40 隻
2)プロビデンス漁港の水揚げ量	0 トン	273 トン/年
3)ベル・オンブレ漁港の水揚げ量	302 トン/年(2004 年)	447 トン/年
4)プロビデンス漁港の利用漁船隻数の増加	0 隻	24 隻
5)ベル・オンブレ漁港の利用漁船隻数の増加	9 隻	21 隻
6)プロビデンス漁港の製氷量	0 トン	10 ﾄﾝ/日
7)ベル・オンブレ漁港の製氷量	0 トン	6 ﾄﾝ/日
8)プロビデンス漁港の水産加工会社数	2 社	増加する

(2) その他成果指標

特になし。

(3) 評価のタイミング

① 2009 年以降（全協力対象施設供用開始後）

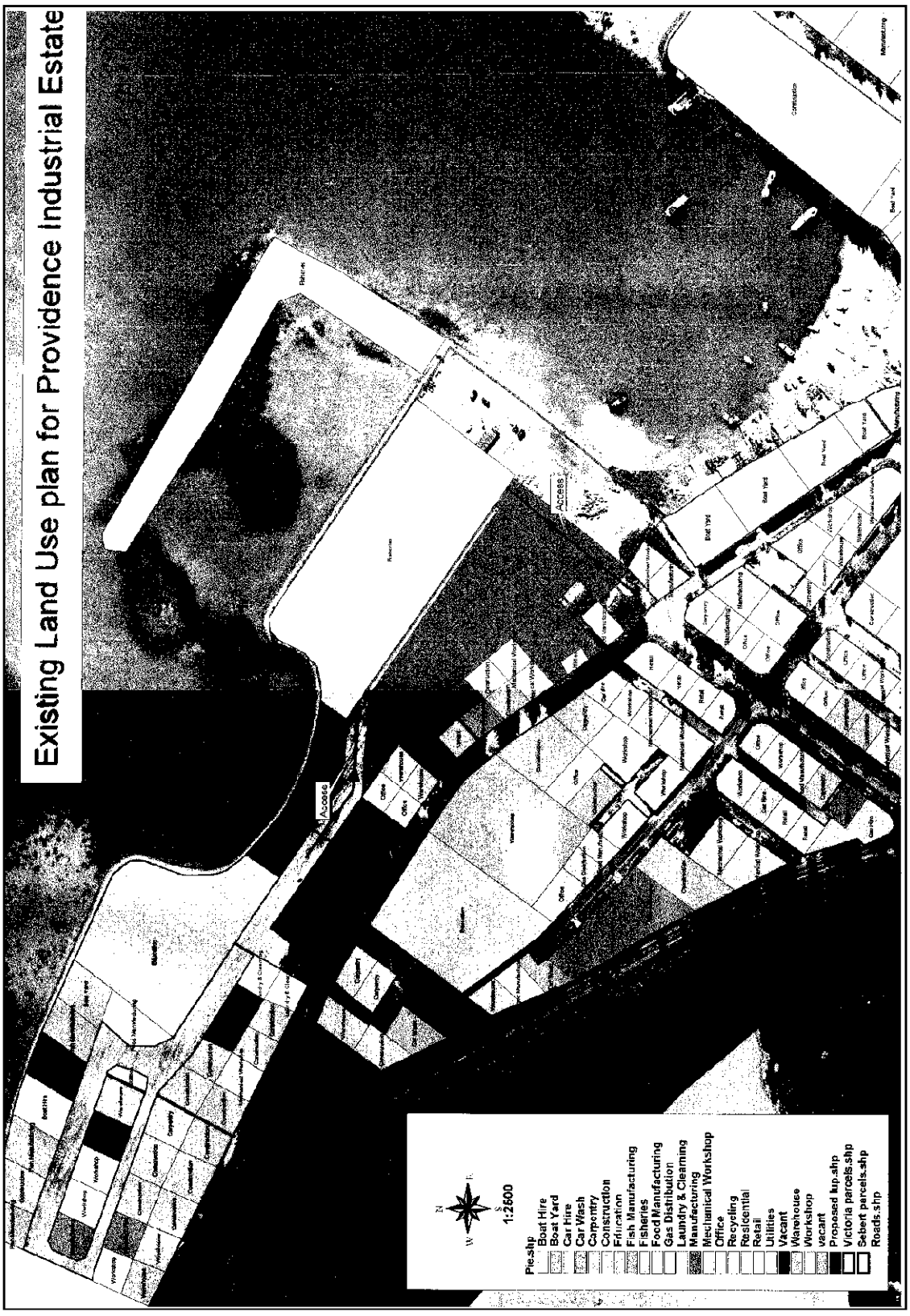
収集資料リスト

調査名　セーシェル国漁業施設及び機材整備計画基本設計調

番号	名称	形態	ｵﾘｼﾞﾅﾙ・ｺﾋﾟｰ	発行機関	発行年
1	Technical Report Seychelles Artisanal fisheries Statistics, 2004	電子データ	コピー	SEYCHELLES FISHING AUTHORITY	2004
2	PREPARATION OF A LONG TERM PLAN ASSESSMENT OF THE NEEDS OF THE FISHERIES SECTOR IN SEYCHELLES Main final report	電子データ	コピー	SEYCHELLES FISHING AUTHORITY	2004
3	潮位に関する記録（1977-2005）	電子データ	コピー	METEOROLOGICAL OFFICE	
4	天候に関する記録（1972-2005）	電子データ	コピー	METEOROLOGICAL OFFICE	
5	プロビデンス地区深浅測量データ（2002年10月,2003年1月）	電子データ	コピー	MINISTRY OF LAND USE & HABITANT	
6	土地利用計画図（プロビデンス・ベルオンブレ）	図書	コピー	MINISTRY OF LAND USE & HABITANT	
7	Planning applications form	図書	コピー	MINISTRY OF LAND USE & HABITANT	
8	SEYCHELLES' COMMERCIAL LEGISLATION Vol.1Second Edition	図書	コピー	MINISTRY OF FINANCE AND COMMUNICATINS	1996
9	Trades Tax (Amendment) Regulations	図書	コピー		2005
１０	Agriculture and Fisheries (Incentives) ACT	図書	コピー		2005
１１	Goods and Service Tax Regulations	図書	コピー		2003
１２	Environment Protection (Impact Assessment) Regulations	図書	コピー		1996
１３	Port and Harbour Dues Regulations	図書	コピー		2002
１４					
１５					
１６					

資料-7 その他の資料・情報

資料 7-1 プロビデンス産業地区（ゾーン 6）の土地利用計画図



資料 7-2 プロビデンス漁港の施設利用計画及び行動計画

(1) 施設利用計画

THE PROJECT FOR CONSTRUCTION OF PORT INFRASTRUCTURE, FACILITIES AND SUPPLY OF EQUIPMENT IN THE REPUBLIC OF SEYCHELLES.

UTILIZATION PLAN FOR FISHERY FACILITIES IN NEW PROVIDENCE AND BEL OMBRE FISHING PORT.

1. Background

In 2003 the Government of the Republic of Seychelles made a request for the Grant Aid for the Project for Construction of Port Infrastructure, Facilities and Supply of Equipment in Seychelles to the Government of Japan. Japan International Co-operation Agency (JICA), has been entrusted by the government of Japan to examine the viability of the Project and have hence sent a study team to conduct a Basic Design Study of the project proposal.

JICA sent to Seychelles a Basic Design Study Team, headed by Mr. Katsuji Miyata, Office of Technical Co-ordination and Examination, Grant Aid Management Department. The team stayed in Seychelles between 8 January and 5th February 2006 where field surveys were conducted, discussions held with relevant government officials and stakeholders. Both sides agreed on the main items of the request and further works is envisaged to prepare the Basic Design Study report

The objective of the project is to ensure safe navigation and reduce congestion in the Victoria artisanal fishing port, improve freshness and quality of fish by developing a fishing port and other facilities in the Providence and Bel Ombre area. This is in line with the government's objective of increasing investment in the fisheries sector as manifested by the inactment of the Fisheries Incentives Act 2005.

2. Components of the project.

The project will comprise of the following infrastructure and facilities;

2.1 Providence

- Quay 100 - 125 m, - 2.5 m deep + fish handling shed, navigational aids and mooring bouys
- Bunkering lay-by 15 – 20 m, (Fuel station 15,000 l diesel, 5,000 l benzene)1
- Ice Plant 2 x 5 mt/day
- Blast Freezer and Storage Room with back-up generator, receiving area and plastic bins (Forklift, 1 x 1 ton unit)

1 Fuel station and tanks to be provided by the Seychelles Government.

- Administration Office, approx. 15 – 20 persons. (See Annex 1)
- Storage Facilities (fishermen's locker) 24 units
- Boat Repair Yard and/or 15 ton Mobile Crane

2.2 Bel Ombre

- Ice Making Machine, 2 unit 2.5 mt/day
- Forklift 1 ton x 1 unit

3. Utilization Plan.

As part of the discussion during the Basic Design Study, a concrete plan for the utilization of the quay and fishery facilities at Providence and Bel Ombre will have to be confirmed by the Seychelles side. The utilization plan will look firstly at the costs and benefits to the people affected by the project, the management of the facilities, maintenance and other miscellaneous issues and how the Seychelles Fishing Authority will encourage its utilization

3.1 Costs.

Firstly, with the realization of the project it is not anticipated to be significant costs associated with the transfer or relocation of fishing vessels to the new facility. In the initial stages boat owners may incur additional costs if they have to land in Victoria and then move to Providence for berthing. Once processing facilities have been set up in the area, no major costs are being foreseen, as fishing vessels based at Providence will have no need to come to Victoria. The possibility however remains with fishing vessels (34) that have contracts with Oceana Fisheries Co. Ltd. since they are oblige to sell their catch to that company.

3.2 Benefits

The benefits that the project will bring about will far outweigh the costs associated.

- In the first instance the project will help ease congestion in the Victoria artisanal port, thus ensuring safer navigation and less damages to fishing vessels as well as to allow for better planning in the provision of services, (fuel, ice).

- With the proposed facilities, it will allow for more efficient/faster operational and logistical undertakings by boat-owners and skippers. With additional facilities for producing ice and for fuelling, fishing vessels will spent less time in port which will lead to increase days fishing and hence increased income.

- There are a number of repair facilities in the Providence Industrial Estate (PIE), and hence it will be more convenient and less costly for vessels owners when they have to undertake repair on their fishing vessels.

- The new facilities in the PIE and Bel Ombre will act as a catalyst for decentralization of the sector away from Victoria. It will provide a base for other activities to be undertaken and encourage investment in the sector. It is anticipated that other processing plants will be set up in the area given that there has been a number of requests for land in the PIE for such development. The proximity to the airport is another feature that makes it more interesting for processing and exporting companies to be based in the area.

- It has been observed in the past couple of years that a number of the owners of smaller fishing vessels, (mini-mahe, extended mini-mahe, super sea dogs,) are installing iceboxes on their vessels. Should this trend continue there would be added pressure on the present ice-making facilities. The planned ice making facilities will hence help to meet the anticipated increase in ice.

- The setting up of a blast freezing and storage facility will help in the better usage of landed catch that would have to either be discarded or wasted during periods of glut.

- Year after year there are requests for the government to undertake reef-clearing operations in the districts, (which can be very costly) to ensure safe navigation in the passes. Should fishing vessels in areas close to Providence and Bel Ombre relocate to these areas, there will be less need for these operations, thereby reducing costs and reduce environmental degradation

4. Operation, Management and Maintenance of the facilities.

A prerequisite of Japanese Grant Aid is that the Government of Seychelles undertakes to provide the necessary resources (financial, human) for the proper operation, management and maintenance of the facilities provided under the project. In this light therefore, the Seychelles Fishing Authority, as implementing agency of the project and the government's arm responsible for all fisheries matters will ensure that enough budgetary allocation and personnel is assigned over the years to ensure proper operation, management and maintenance of the facilities and equipment.

A Providence Port Management Committee that will include amongst others, SFA, Seychelles Ports Authority and related government agencies, Fishing Boat Owners Association, Fish Mongers and Processors based in the Providence area as well as other stakeholders. The committee will also be responsible for the organization of the opening ceremony of the fishing port and the promotion for optimal use of the facilities.

To ensure the optimal utilization of the facilities at both, Providence and Bel Ombre, the Seychelles Fishing Authority, together with other government agencies, (PUC, Land Transport etc.) to ensure all necessary amenities are put in place prior to any allocation of land in the area. Careful screening of project proposals for processing activities in the area and speedy approval process will be guaranteed.

5. Utilization

5.1 Quay and Fish Handling Shed

The quay will be used principally for unloading fish, loading of provision prior to fishing trips and also for berthing purposes. It is anticipated, in the first instance that vessels not having contract with Oceana Fisheries may move to the Providence area and there is also the potential that vessels owners residing in the Bel Ombre and North Mahe area, whose vessels are based in Victoria to move their vessels in Bel Ombre.

At present there are about 113 vessels based in Victoria. It is estimated that about 19 vessels would move to Bel Ombre and another 34 vessels are on contract with Oceana Fisheries. There are at present some vessels that after selling their catch in Victoria moved to La Digue during the week-end for berthing and then comes back to Victoria for provision before there next trip. There is the possibility that these vessels could move to the Providence area for berthing which will entails less cost on fuel. It is anticipated that the majority of the 67 vessels left would eventually relocate to the Providence fishing port. It is not anticipated however that all these vessels will move to Providence in the first instance given the logistic of their fishing and trading operations.

Nonetheless, once processing plants are set up in the PIE, more fishing vessels are expected to permanently move at PIE. It should also be noted that at present there are two sea-cucumber processing plants in the PIE and this should also attract a number of vessels, (15 to 20) doing sea cucumber fishing to relocate there.

The fish-handling shed to be provided under the project is to ensure that fish are not unloaded under direct sunlight thereby maintaining its good quality and sanitary conditions.

Personnel will be recruited to ensure proper use of the facilities and orderly berthing. Regular checks for siltation will be undertaken and dredging carried when the need arises.

5.2 Bunkering Lay-by.

This facility will after the completion of the fuel station will be used for bunkering of fishing vessels. A 15,000 liters diesel and 5,000 liters benzene capacity fuel station will be provided in the PIE. This will not necessitate fishing vessels to travel to Victoria for refueling. Moreover boat owners in the vicinity will spend less on transportation in that they will not have to travel to the Victoria Station to purchase fuel. The SFA station at present has a capacity of 13,000 liters of diesel which normally last for one week. Additional bunkering services will mean less time spent queuing for fuel and hence longer fishing trips.

SFA will provide for fuel attendants to man the station.

5.3 Administration Office.

This facility will be used by SFA personnel to ensure proper management of the activities in the port area and to ensure security. The office will need to cater for a personnel of between 15 to 20. Maintenance of the facility will be the responsibility of SFA.

5.4 Ice Plants.

2 units x 5 mt/day ice plant is being considered for the Providence and 2 units x 2.5 mt/day plant for Bel Ombre. These two plants will ensure that there is adequate ice for fishermen when they start their fishing trip. Additional plants will allow for better planning for ice provision and will also complement the supply and reduce pressure on the Victoria facilities. Again additional supply of ice will mean less time spent queuing and hence longer fishing trips. The plants operations will be complemented by two forklifts to allow for easy transportation of ice bags from the plants to fishing vessels. The possibility of having an ice shooter for the Providence facility should also be explored. Such a facility will allow for easy and faster loading of ice.

Competent personnel will be recruited to operate and mange the ice plants whilst experienced engineers will be recruited and trained to oversee the proper maintenance of the plants.

5.5 Blast Freezer, Storage Facility and Plastic Containers

A 1 to 2 ton per day blast freezer and 30t storage facility are being planned under the project. These will be used to blast freeze fish or bait, which can then be stored in the cold room. This will ensure that in period of excess supply, fish are not wasted as well as guarantee that bait can be stored and made available in periods of shortages. Transportation of bait and fish will be facilitated by the forklift, whilst the plastic containers will be used for proper and orderly storage of the products.

SFA undertakes to recruit qualified personnel to see to the appropriate operation and maintenance.

5.6 Boat Repair Yard and Mobile Crane.

These facilities will be used for repair purposes. The boat repair yard/slipway will be essential if fishing vessels do not need to be put of land for repairs or cleaning. The mobile crane, though dedicated to the Providence area could also be used in other fishing bases when the need arises.

Both facilities will be maintained by SFA.

5.7 Fishermen's Stores.

24 units of 2m x 2.5 m stores are being envisaged under the project, which will be used by individual fishermen for storing of engines, spares fishing gears etc. This will ensure the fishermen properties are stored in a safe place. These stores may be fitted with electricity outlets should there be a need. A minimal fee may be charged for use of the facility.

The private sector will be encouraged to provide other ancillary services such as shops for provision (food), snacks shops and take-aways, restaurant and bar facilities etc. These are purely commercial operations and not in line with SFA's mandate.

6. Conclusion

It became evident during the stakeholders meeting that there was strong support for the project where even additional facilities, (polystyrene box molding plant, ice shooter) where requested. With the number of fishing vessels that can potentially move in the two areas, one can expect that the facilities will be used to the maximum. However it will the responsibility of the Government of Seychelles through the Seychelles Fishing Authority to ensure the most efficient use of the facilities as well as their proper operation, management and maintenance.

Annex 1.

Details for the Administration Building

- Staff toilets 2
- Tea Room (1)
- Meeting Room
- Store
- Offices for:

			Salary Band SR
•	Port Manager	1	4900 - 5400
•	Administrator	1	3900 – 4400
•	Pier Master	1	2000 – 2500
•	Field Workers	2	2000 – 2500
•	Fisheries Technicians	2	2900 – 3400
•	Enforcement Officer	2	2900 – 3400
•	Security	1 (2)	2000 – 2500
•	Cleaner/ Tea Lady	1	2000 – 2500
•	Slipway Manager	1	2900 – 3400

Ice Plant/Cold Storage Building

•	Maintenance Manager	1	4900 – 5400
•	Ice Plant Operator	1	2000 – 2500
•	Blast Freezer/Cold Store Operator	1	2000 – 2500
•	Forklift Driver	1	2000 – 2500
•	Fuel Pump Operator	1	2500 - 2900

(2) **プロビデンス漁港の施設利用に関する行動計画**

THE PROJECT FOR CONSTRUCTION OF PORT INFRASTRUCTURE, FACILITIES AND SUPPLY OF EQUIPMENT IN THE REPUBLIC OF SEYCHELLES.

ACTION PLAN FOR FISHERY FACILITIES IN NEW PROVIDENCE AND BEL OMBRE FISHING PORT.

1. Background

In 2003 the Government of the Republic of Seychelles made a request for the Grant Aid for the Project for Construction of Port Infrastructure, Facilities and Supply of Equipment in Seychelles to the Government of Japan. Japan International Co-operation Agency (JICA), has been entrusted by the government of Japan to examine the viability of the Project and have hence sent a study team to conduct a Basic Design Study of the project proposal.

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The objective of the project is to ensure safe navigation and reduce congestion in the Victoria artisanal fishing port, improve freshness and quality of fish by developing a fishing port and other facilities in the Providence and Bel Ombre area.

2. Components of the project.

The project will comprise of the following infrastructure and facilities;

2.1 Providence

- Quay 100 - 125 m, - 2.5 m deep n + fish handling shed, navigational aids and mooring bouys
- Bunkering lay-by 15 – 20 m, (Fuel station 15,000 l diesel, 5,000 l benzene)2
- Ice Plant 2 x 5 mt/day
- Blast Freezer and Storage Room with back-up generator, receiving area and plastic bins (Forklift, 1 x 1 ton unit)

2 Fuel station and tanks to be provided by the Seychelles Government.

- Administration Office, approx. 15 – 20 persons. (See Annex 1)
- Storage Facilities (fishermen's locker) 24 units
- Boat Repair Yard and/or 15 ton Mobile Crane

2.2 Bel Ombre

- Ice Making Machine, 2 unit 2.5 mt/day
- Forklift 1 ton x 1 unit

3. Action Plan.

As part of the discussions which ensued during the Basic Design Study, the Seychelles sides were instructed to submit an Action Plan for the two facilities starting from the completion of the works and after official opening. The Action Plan will look at the staff recruitment and financial resources for the proper management and maintenance of the facilities, security, promotion/awareness programmes and probable time schedule.

3.1 Staffs

Before completion of the facilities, The Seychelles Fishing Authority shall ensure that the required staff have been recruited and where appropriate given the appropriate training. In the initial stage a minimum of 16 personnel will be required. The SFA will negotiate with the relevant Ministry/Departments for additional budgetary allocation to cover for the increased salaries and miscellaneous expenditures.

3.2 Budget

The Seychelles Fishing Authority shall undertake to secure the required budgetary allocation to ensure the proper management and maintenance of the facilities. Negotiations will be undertaken with relevant Ministry/Department prior to completion of the works.

3.3 Utilities

The Seychelles Fishing Authority will with the collaboration of other agencies ensure that the necessary utilities and services prior to completion of the works. These include amongst others, electricity lines, water, telephones lines, sewage pipes and access roads to both project sites. The Seychelles Fishing Authority will also have to ensure that proper fencing is erected around that project areas and that gates are also installed to ensure security. Security system for the area will be well in place before completion of the construction works.

3.4 Providence Fishing Port Management Committee.

The Seychelles Fishing Authority is envisaging forming a management committee to ensure optimal use of the

facilities and the proper management. Mobilization for the committee will begin just after the Exchange of Notes between the Government of Japan and the Seychelles Government. The committee will be comprised of officials from the Seychelles Fishing Authority, Seychelles Ports Authority and related government agencies, Fishing Boat Owners Association, Fish Mongers and Processors based in the Providence area as well as other stakeholders. The committee will also be responsible for the organization of the opening ceremony of the fishing port.

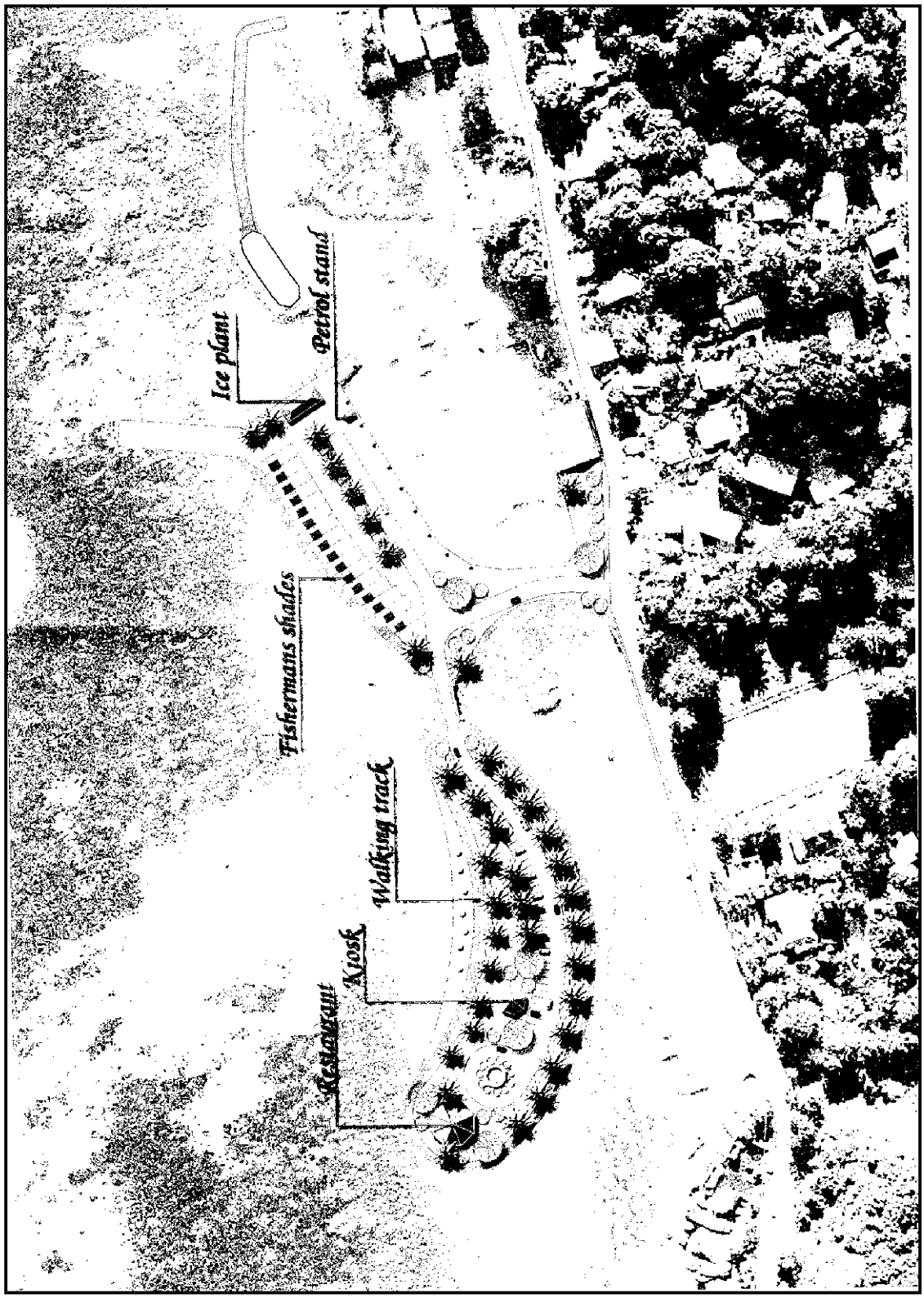
The Management Committee will also be engaged in the active promotion of the facilities especially for processing activities and other ancillary services such as shops for provision of food and gears, take-aways, snack shops, telephones etc. Opening promotion which will include discount prices on a number of services and the possibility of providing promotional tokens to fishermen, boat-owners etc.. Promotion would be done with the help of the media, Fishermen and Fishing boat owners associations and other NGO's.

Prior to the opening of the fishing port the Seychelles Fishing Authority in consultation with the Management Committee will decide on the beneficiaries for the fishermen's stores and arrange to hand over the keys to the respective fishermen.

4 **Time Schedule**.

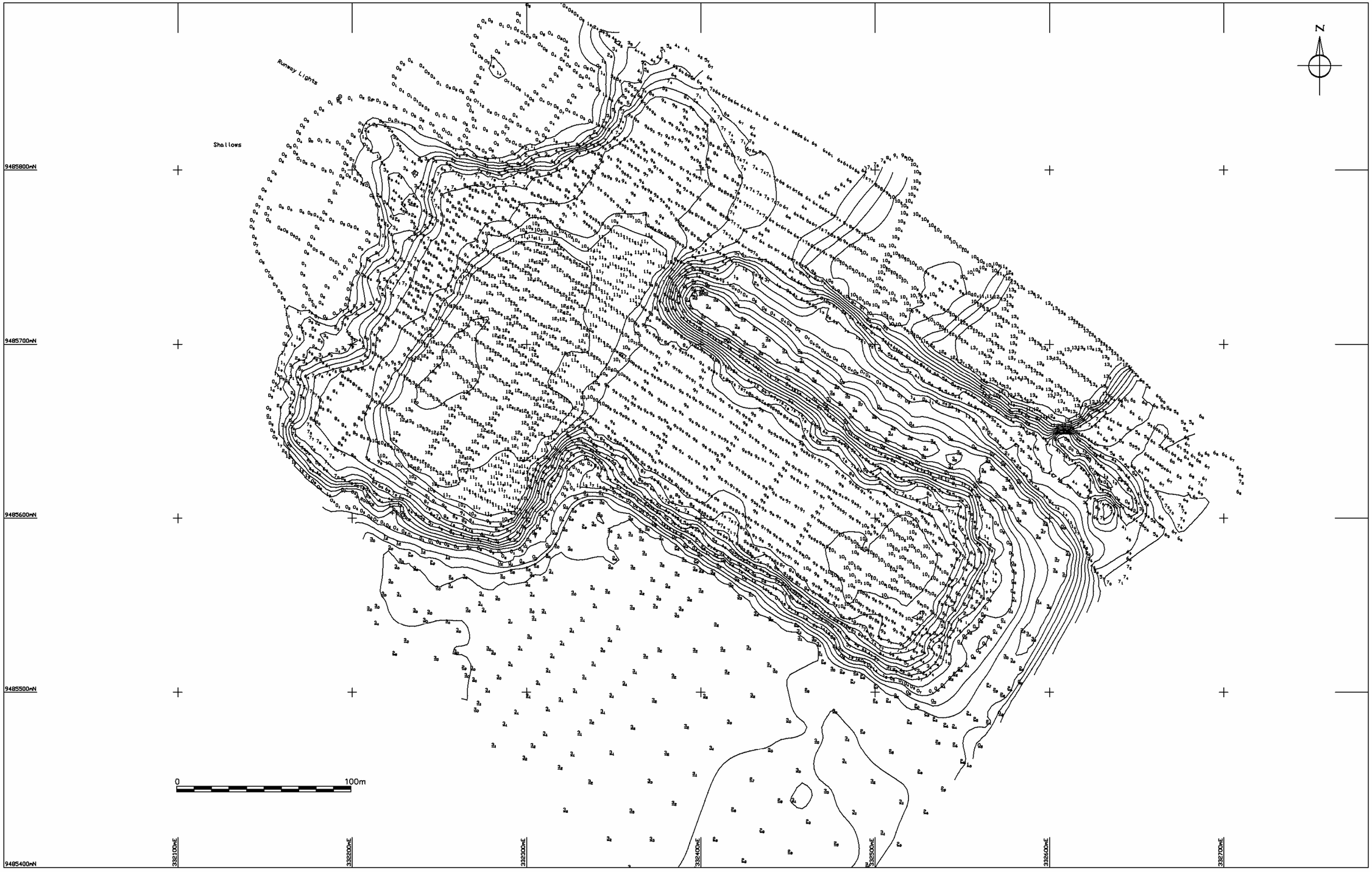
Milestones		MONTHS										
		-6	-5	-4	-3	COMPLETION	-2	-1	OPENING	1	2	3	4
1	Staff Recruitment												
2	Negotiate Budget												
3	Install Utilities, Services & Fuel Tanks												
4	Fencing, Gates & Security												
5	Establishment of Management Committee												
	Management Committee Meeting												
6	Provision of Ancillary Services												
7	Promotion Campaign												
8	Distribution of Gear Store												
9	Setting Up security System												
10	Support for Transportation												
11	Opening Promotion												

資料 7-3 ベル・オンブレ漁港開発計画（マスタープラン）の計画平面図



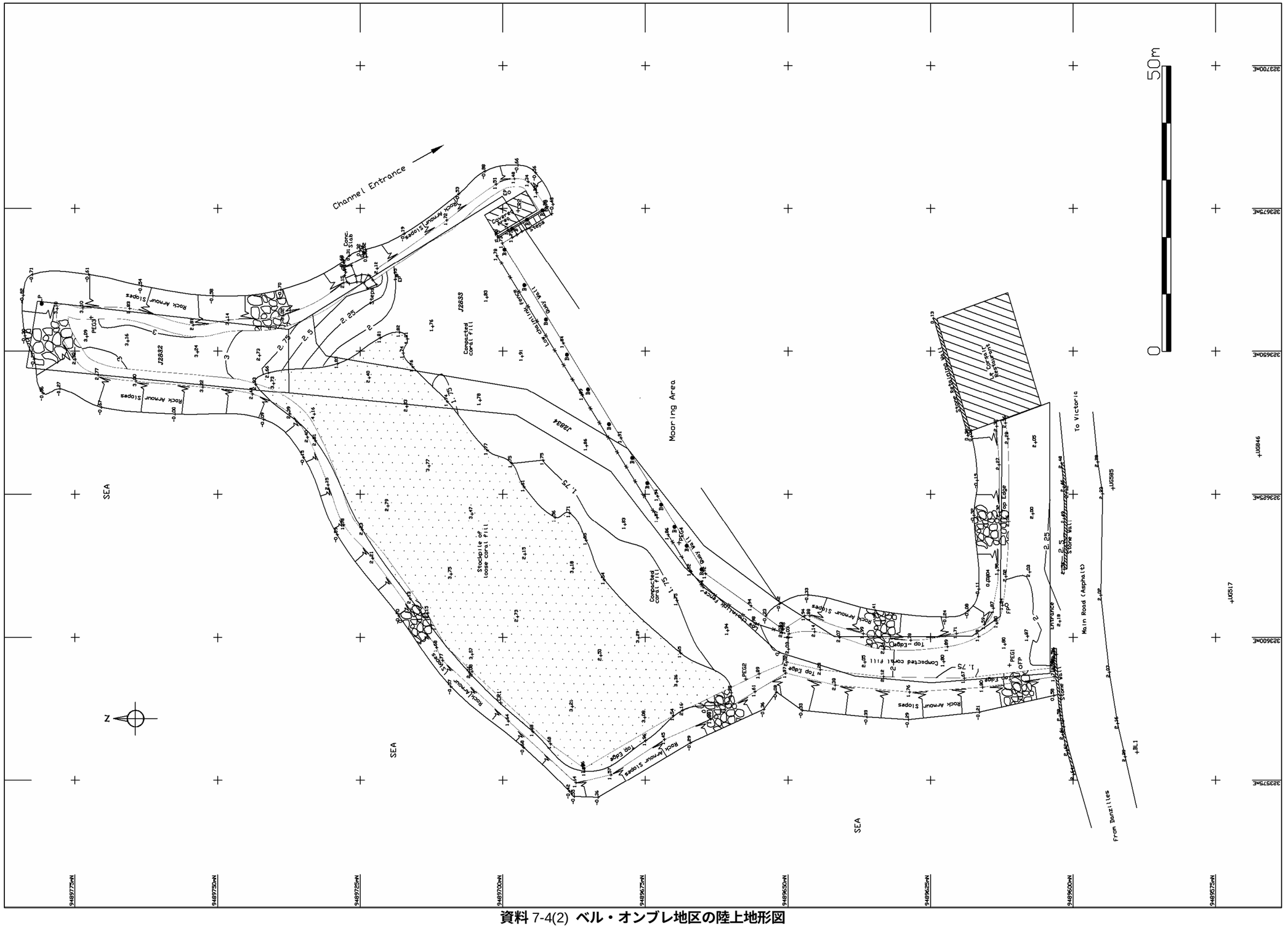
資料 7-4 **プロビデンス地区及びベル・オンブレ地区の測量図**

(1) **プロビデンス地区の陸上地形・海底地形図**



資料 7-4(1) **プロビデンス地区の陸上地形・海底地形図**

(2) **ベル・オンブレ地区の陸上地形図**



資料 7-4(2) **ベル・オンブレ地区の陸上地形図**

資料 7-5-1 環境影響に関する書簡（2005 年 9 月 7 日）

Republic of Seychelles
Ministry of Environment & Natural Resources

The Principal Secretary (Environment)

7th September 2005

Mr. Rondolph Payet
Managing Director
Seychelles Fishing Authority
New Port
Victoria

Dear Mr. Payet

RE: PROPOSED CONSTRUCTION OF FISHING FACILITIES ON ZONE 6 PROVIDENCE INDUSTRIAL ESTATE

With reference to your queries about the Environment Impact of the above stated project, please note that the Ministry of Environment has no objection in principal to the project.

Zone 6 is not in a protected or sensitive area, and is located on a reclaim piece of land. This site has already been earmarked for industrial development and the necessary survey was done prior to the reclamation to confirm that the site can be used for this particular purpose.

The Ministry would therefore have no objection to approving this project which is expected to have negligible impact on the environment of the area.

Yours Sincerely,

Didier Dogley
Ag. PRINCIPAL SECRETARY

c.c. DG (PCEI)

SEYCHELLES -9 SEP 2005

Botanical Gardens, Mont Fleuri, P.O Box 445, Victoria, Mahé, Seychelles
Tel: (248) 670512 – Fax (248) 610638 – E mail: ps@env.gov.sc

MINISTRY OF ENVIRONMENT & NATURAL RESOURCES
POLLUTION CONTROL AND ENVIRONMENT IMPACTS DIVISION
Botanical Gardens, Mont Fleuri, P.O. Box 445, Republic of Seychelles
Telephone: (248) 670 500, Telefax: (248) 610 648 E-mail Address: eapc@seychelles.net

Please address all correspondence to the Principal Secretary

Your Ref:	
Our Ref:	**MENR/PCEI/EIA/EA/297/06**
Enquiries To:	**Joseph Rath**
Telephone:	**670 500**
Telephone Ext:	**569**
Date:	**17th March 2006**

Rondolph Payet
Managing Director
Seychelles Fishing Authority
P. O. Box 1269
New Port
Victoria

Dear Sir,

RE: **Terms of Reference for proposed fishing port at Providence Industrial Estate for Seychelles Fishing Authority submitted under planning application with reference numbers DC/160/06 – EA/297/06**

Reference is made to the submission of the outline planning application regarding the above.

The Ministry of Environment & Natural Resources has no objection in principle to the proposal. However, we reserve our final comments regarding the issuance of Environmental Authorization upon the submission of a Class II Environmental Impact Assessment (EIA) report for the project.

Please find attached a copy of the Terms of Reference for the study.

Yours faithfully,

Joseph Rath
Director - EIA
For: DIRECTOR GENERAL (PCEI)

c.c. Secretary – Town and Country Planning Authority - MLUH

TERMS OF REFERENCE FOR THE PREPARATION OF AN

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) STATEMENT UNDER THE ENVIRONMENT PROTECTION (IMPACT ASSESSMENT) REGULATIONS, 1996

PROPOSED PROVIDENCE FISHING PORT PROJECT

POLLUTION CONTROL AND ENVIRONMENTAL IMPACTS DIVISION
ENVIRONMENTAL IMPACT ASSESSMENT SECTION
BOTANICAL GARDENS
P. O. BOX 445
VICTORIA

Terms of Reference for the preparation of a Class II Environmental Impact Assessment (EIA) Statement for a Fishing Port

APPLICANT: Government of Seychelles – Seychelles Fishing Authority

PROPOSED DEVELOPMENT: Fishing Port

LOCATION: Mahe (Providence)

Pursuant to Schedule 1, Regulation 3(1) (b) of the Environment Protection (Impact Assessment) Regulations, 1996, Schedule 1, a fishing port development is a prescribed project. Under Section 15(1) of the Environment Protection Act, 1994 the preparation of an Environmental Impact Assessment (EIA) statement is required when an application is made to the Authority for Environmental Authorization.

In preparing the EIA statement, it is the applicant's responsibility to address the impacts of the proposal to the degree necessary to enable the Authority to be informed of all relevant impacts of the proposal. The level and nature of investigations should be relative to the likely extent and scale of the impacts. It is suggested that the applicant/consultant contact the relevant referral agencies to clarify the nature and level of investigations.

The EIA produced to accompany the application is to address the issues set out below and should generally follow the format as suggested in this document.

Description of the Proposal

1. Introduction - Identify the development project to be assessed. Describe the rationale for the development and its objectives.

2. Background Information – Briefly describe the major components of the proposed project, the implementing agencies, a brief history of the project and its current status.

3. Study Area - Specify the boundaries of the study area for the assessment as well as any adjacent or remote areas that should be considered with respect to the project (e.g. dredged material disposal site/s).

4. Description of the Proposed Project - Provide a full description of the relevant parts of the project, using maps at appropriate scales where necessary. This is to include: quality and volume of sediments to be excavated in each area to be dredged; type of dredging equipment to be used and the manner of deployment including handling, transportation, and disposal of dredged material, sediment containment, settling and turbidity control measures; alternative dredging methods considered; project schedule; and life span.

Legislative and Regulatory Considerations

Describe the pertinent legislation, regulations and standards, and environmental policies that are relevant and applicable to the proposed project, and identify the appropriate authority jurisdictions that will specifically apply to the project.

Description of Environment and Assessment of Potential Impacts

Description of the Environment - Assemble, evaluate and present baseline data on the relevant environmental characteristics of the study area (and disposal sites), including the following:

- Environmental statistics for the last 5 years
Environmental statistics of sea water quality, air quality, noise and disposal of wastes

- Significant features in terms of environmental preservation
Existence of significant features of landscape, archaeological/historical significance, fauna and flora

- Natural conditions
Meteorological conditions in Mahe. Observatory locations, items measured, specifications of observation equipment, lists of periodical publications about meteorological statistics on general climatic characteristics like rainfall, temperature, relative humidity and atmospheric pressure for the last decade.

- Sea conditions
Tide, tidal current and wave records in Providence

- Siltation
Sediment data observed in the coastal area, specifications for dredging, dredging works and record and volume of dredging in Providence with particular reference to the project site.

- Ground conditions
Soil conditions and sea bed conditions

- Bathymetric survey
Bathymetric conditions of the project site

Characterize the extent and quality of the available data, indicating significant information deficiencies and any uncertainties associated with the prediction of impacts.

Determine the Potential Impacts of the Proposed Project

Identify impacts related to any dredging, spoil disposal and possible land filling. Distinguish between significant impacts that are positive and negative, direct and indirect, and short and long term. Identify impacts that are cumulative, unavoidable or irreversible. Special attention will be paid to:

- Effects of the project (dredging and spoil disposal) on water quality and existing coastal ecosystems and resources.

- Effects of storm water drainage from proposed spoil disposal sites, including potential for off-site flooding.

- Effects of dredging on the coastal stability of adjacent shorelines,
- Effects of the project on maritime, boating and road traffic,
- Effects of the project on ambient noise levels, and
- Effects of the project on any historical resources.

Mitigation and Management of Negative Impacts

Identify possible measures to prevent or reduce significant negative impacts to acceptable levels with particular attention paid to dredge spoil disposal and dispersal/sedimentation control, as well as measures to minimize disruption to existing port and yacht club operations.

Development of a Monitoring Plan

Identify the critical issues requiring monitoring to ensure compliance to mitigation measures and present impact management and monitoring plan for any dredging/disposal operations.

Report

The environmental impact assessment report should be concise and focus on significant environmental issues. It will contain the findings, conclusions and recommended actions supported by summaries of the data collected and citations for any references used in interpreting those data

Upon completion of the environmental impact assessment statement, three (3) hard copies and a digital copy on CD ROM (preferably in Acrobat PDF format) of the report are to be submitted to the Authority – Pollution Control and Environmental Impacts Division, as part of any application.

MINISTRY OF ENVIRONMENT & NATURAL RESOURCES
POLLUTION CONTROL & ENVIRONMENTAL IMPACTS DIVISION
Botanical Gardens, Mont Fleuri, P.O. Box 445, Republic of Seychelles
Telephone: (248) 670500, Telefax: (248) 610648 E-mail Address: eia@env.gov.sc

Please address all correspondence to the Principal Secretary

Your Ref:	
Our Ref:	**MENR/PCEI /EIA/Detailed Class2/Providence Fishing Port – EA/297/06**
Enquiries To:	**Joseph Rath**
Telephone:	**670 500**
Telephone Ext:	**568**
Date:	**29th September 2006**

Mr. Rondolph Payet
Managing Director
Seychelles Fishing Authority
New Port
P. O. Box 1269
Victoria

Dear Sir,

RE: Notice of Acceptance for the Environmental Impact Assessment (EIA) Report for the proposed fishing port at Providence, Mahe

Reference is made to the EIA report regarding the above project proposal that was submitted to the Authority for our consideration for the issuance of Environmental Authorization.

Following internal review at the Department of Environment, we hereby accept the EIA report as submitted.

It was of the general acceptance that the quality of the report submitted was satisfactory. The report was found to adhere to the Terms of Reference submitted for the Impact Assessment and the level of details provided was of appropriate depth to allow the Authority to make a thorough assessment of the proposal.

As such we are pleased to inform you that Environmental Authorization is hereby granted for the project with the following conditions which should be strictly adhered to prior and during the implementation of the project.

- Environmental Authorization is being issued in accordance with mitigating measures as per the EIA report.
- All waste water should be channeled for treatment in the Victoria Sewage Treatment plant.
- There must be no direct discharge of untreated wastewater and sewage into the sea.
- No open fire should be lit on site without a valid burning permit from the National Parks & Forestry Section of the Ministry of Environment & Natural Resources.
- Should there be a need to fell/lop any species of trees permission and professional advice should be sought from the National Parks & Forestry Sections of the Ministry of Environment and Natural Resources.

- All plastics, rubber, glassware, synthetic or any other inorganic waste, construction debris, demolition waste should not be dumped into sea and wet land but should be sorted out at source prior to disposal at appropriate site.
- Onus is on the developer to minimize nuisance by reasons of noise, smell, dirt, dust and fumes to any adjoining properties.
- Public access to adjoining properties and plots must not be severed or obstructed.
- Filter cloth should be used in the rock armoring to minimize wash out of sediments.
- Appropriate measures should be taken to minimize the risk of erosion from earthworks.
- Adequate mitigative measures should be taken on site to prevent sediments wash down.
- Adequate storm/surface water drainage facilities should be provided so as not to affect neighboring properties.
- Drain, culvert, bridge and cross drain should be well maintained at all times.
- Access road should be hard surfaced immediately after earthworks.
- Public access to adjoining properties/plots should not be severed or obstructed.
- All monitoring exercises as stipulated by the EIA report are to be undertaken in close liaison with the Environmental Impact Assessment Section of the Ministry of Environment and Natural Resources and copies of results obtained have to be communicated to the same Ministry.
- Any other project that the promoter entails to introduce for the development which is not stipulated by this EIA Report will be subject to a separate application for authorization.
- At this juncture the Ministry of Environment and Natural Resources would like to inform the corporation that heavy fines will be imposed on them for non-compliance to directives from our ministry for works undertaken contrary to agreements between our two parties and works carried out without the necessary approvals from this Authority. As such it is in the interest of the proponent to ensure that all the necessary approvals are sought well in advance for any works or undertaking that they wish to implement as part of the project.
- The Ministry of Environment & Natural Resources reserves the right to impose further conditions in addition to the ones imposed by the authorization if during the operational phase of the development: we conclude that the proposal is generating any other adverse environmental impacts not foreseen by this appraisal.

Should you have any queries regarding the conditions set above please do not hesitate to contact the undersigned for clarification.

Yours faithfully,

Joseph Rath
DIRECTOR (EIA)
For: DIRECTOR GENERAL (PCEI)

c.c. Principal Secretary – MLUH; Attention: Secretary - TCPA

Seychelles

資料 7-5-4 ベル・オンブレ漁港整備に関する環境許可（2006 年 9 月 29 日）

DC/903/06 1392/06

Application No. ...../ EA .....

ENVIRONMENT PROTECTION ACT. 1994
(ACT 9 of 1994)
ENVIRONMENT PROTECTION (IMPACT ASSESSMENT) REGULATIONS, 1996

NOTICE OF ENVIRONMENTAL AUTHORISATION FOR DEVELOPMENT

To SEYCHELLES FISHING AUTHORITY

of P. O. BOX 449 - VICTORIA

The Ministry of Environment **HEREBY GRANTS** Environmental Authorisation for the following development proposed by you in your application dated the 29th day of SEPT 20 06

namely: PROPOSED ICE MAKING PLANT

situated at BELOMBRE

in accordance with the plans submitted therewith with the following specific conditions:

1. Soakaway pit should be located at least 5metres from the boundary.
2. Soakaway pit should be located at least 15metres from the sea.
3. Adequately sized septic tank and soakaway pit should be provided.
4. Adequate mitigative measures should be taken on site to prevent sediments wash down.
5. All earthworks to be done during the dry spell.
6. Adequate storm/surface water drainage facilities should be provided so as not to affect neigbouring properties.
7. Proper guttering and down pipe should be provided to appropriately drain roof water without affecting nearby properties.
8. There must be no direct discharge of wastewater into the sea.
9. Public access to adjoining properties/plots should not be severed or obstructed.
10. All plastics, rubber, glass, synthetic and other inorganic waste, construction and demolition waste should not be dumped into the nearby sea but should be sorted out at source and appropriately disposed at the designated waste disposal site.
11. Onus is on the developer to minimize nuisance by reasons of noise, smell, dirt, dust and fumes to any adjoining properties.
12. No open fire should be lit on site without a valid burning permit from the National Parks & Forestry Section of the Ministry of Environment & Natural Resources.
13. Roof colour of the proposed building should be green/grayish colour to match with existing surrounding natural environment.
14. The Ministry of Environment & Natural Resources reserves the right to impose further conditions in addition to the ones imposed by the authorization if during the operational phase of the development: we conclude that the proposal is generating any other adverse environmental impacts not foreseen by this appraisal.

Dated this 29th day of SEPTEMBER 20 06 (Signed) .....
Administrator

cc: Secretary - Town & Country Planning Authority

Notes:

The development hereby authorised shall be carried out and completed in every respect in accordance with the detailed plans and particulars.

IMPORTANT This authorisation does not purport to convey any approval or consent required under any written law other than the Environment Protection (Impact Assessment) Regulations, 1996 of the Environment Protection Act, 1994

資料 7-6 ステークホルダーミーティング議事録

(1) 第 1 回議事録（2006 年 1 月 11 日）

PROJECT FOR CONSTRUCTION OF PORT INFRASTRUCTURE AND SUPPLY OF EQUIPMENT
ECOH Corporation/SFA

Minutes of Stakeholder Meeting held Wednesday 11th January 2006 in SFA Conference Room

Present: The list of participants is attached.

1. Mr. Rondolph Payet, MD SFA, welcomed everyone and thanked them for making time to attend this very important meeting. This was followed by introductions of everyone around the table. The objective of the meeting was then explained and background to the project provided.

2. The participants were then invited to share their views/opinions regarding the project proposal with the delegation present.

3. The following summarises the responses of the stakeholders present:

Bel Ombre Project
There was general consensus that the Ice Plant for Bel Ombre is a necessity as there is huge demand for ice that cannot be met by present suppliers. This would also cut down on transport costs for fishermen of the northern region who would normally have to travel 6km to Victoria and are not always guaranteed a constant supply of ice upon getting there. It would also ensure that the ice purchased would be promptly loaded into their vessels.

Port Development at Zone 6, Providence
There was very strong support for the new proposed development by most present. Both present disadvantages and benefits of the new development were discussed. These are summarized below:

Congestion – all agreed that the congested nature of Port Victoria is a real impediment to present operations and hampers any future development. The move to decentralize was welcomed by all and was even described as 'overdue'.

Supply of Ice – the main issues raised were irregular supplies/shortages of ice, queues and long delays.

Bait – there is a lack of cold storage for bait, which is both seasonal and dependent on foreign vessels, and can lead to delays in supply of up to 3 months. This leads to setbacks in operations as well as wastage of resources that are often dumped e.g. mackerel. There were insufficient plastic scows to store fish.

Mooring/parking – there is very limited space and boats often have to find alternative areas to offload their fish and moor their boats.

Increasing Competitiveness – there is an urgent need for increased competitiveness in this sector for services to be improved. Zone 6 will provide the opportunity for young entrepreneurs to venture into this industry, especially in processing, and the export trade.

New facilities - Zone 6 will provide an opportunity to modernize the industry as well as providing a boost to new ventures, with ample space for cold storage, refueling, offloading wharves, and hopefully a new fish moulding plant as the current company cannot meet demand.

Strategic location - Zone 6 is ideally suited for access to ancillary/support services as most workshops and spare parts outlets are now situated there. It is close to the main town and airport for potential/future exports. One boat owner mentioned that some 12 vessels are presently harbouring nearby despite quay facilities not being provided yet .

Enhancement of the semi-industrial fishery – the new facilities are seen as a boost to the development of the longline industry; this was supported by those present.

4. Issues raised

Boatowners - who owns the land? SFA
- would the land be leased to future entrepreneurs – yes

Processor – would Japanese Government provide ALL the facilities discussed? What about funding? It was explained that it was a Grant Aid, the 6th one in fact.

MD SFA – raised concern expressed by Japanese Government about potential underutilization of the facilities on Zone 6 once in place. There was unanimous reiteration that the facilities were necessary and would be fully utilized.

ECOH delegation - What about transport costs from Providence to Victoria where main market is found? The response was that 5km to town was not an issue as many fishermen travel from all parts of the island to sell their fish on the market that is most lucrative to them, even if they are only district markets.

5. Recommendations

Zone 6 Development, Providence

- A 10 (or 20) Tonne Ice Plant needs to be considered in order to meet increasing demand for ice.
- It was also recommended that the SFA manage the new Ice Plant .
- An 'ice shooter' should be considered to improve efficiency, freshness and cut back losses on provision of ice to vessels.
- A fish moulding plant is a necessity.
- There is a request for more plastic scows to store fish.

Bel Ombre Port

- The capacity of the Ice Plant for may need to be increased. To be discussed further.

6. Conclusion

The meeting was very well attended and saw the participation of 18 representatives from the industry.

The proposal was positively supported by all present.

13/01/06
CM

Stakeholder meeting held Wednesday 11th January 2006

Objective : To gauge stakeholder feedack re: the need for Zone 6 Port Development

Attendees	Status/organisation	Contact
Albert Napier	Seafarers Association	770 711
Beatty Hoarau	Fishing Boat Owners' Asssociation	511 559
Benny Michel	B/O/Fishing Master	525 001
Danny Loizeau	Boat owner	247 885
Elvis Hoareau	Fisherman	
Emiliano Isnard	skipper	517 794
George Michel	B/O	511 747
Gilbert Rassool	Boat Owner	513 513
James Lesperance	B/O	713888
Joe Tirant	Oceana Fisheries	224 712
Joel Nageon	Fisheries Policy Unit	513118
Keith Andre	B/O/skipper	710 800
Paul Morin	Morin Group	711707
Philip Hoareau	Fishing Master	512834
Ralph Simeon	Fishing Master	516954
Teddy Songoire	B/O	
Timothe Morin	B/O	711200
Travis Jensen	Sea Harvest	224880
Rondolph Payet	SFA	
Clifford Toussaint	SFA	
Collleen Morel	SFA	
Hitoshi Takemoto	ECOH Delegation	
Masao Tobari	ECOH Delegation	
Takeyoshi Hanada	ECOH Delegation	

(2) **第 2 回議事録（2006 年 1 月 30 日）**

Minutes of meeting held with fishermen on Monday 30th January 2006 at 9.00 a.m. in the SFA Canteen.

The purpose of the meeting was to provide to them a brief of the new facilities to be built at Zone 6 Providence.

Fishermen was briefed about the impending project and its contents; Quay, ice plant, store, slipway, cold store etc. All present felt there was serious congestion in Port Victoria and consequently this often lead to (1) waste of time; (2) fishing boats getting damaged.

They feel the new facilities should take into consideration the provision of the ice plant, cold storage, stores, slipway and other related services. They were also of the opinion that a good level of security of the area should as well be maintained. They claimed at times they have to wait up to 1 week before they could have ice thus wasting useful fishing times.

Fishermen present were unanimous that should such facilities exist at Zone 6, they will have an option to use same instead of Victoria. The economical cost involved will be very marginal.

Finally, a member present expressed on behalf of his colleagues present, how appreciative they were to the project and thank the Japanese taxpayers for past and new fisheries project financed by the Japanese.

C. Toussaint
03/02/06

Attendance List of Second Stake Holder Meeting at SFA on 30 January 2006

NAME	BOAT NAME	TITLE
Dona Hoareau	Valiant SZ 35	Boat owner/skipper
Patrick Hoareau	SZ 260	Skipper
Leon Dubignon	SZ 460	Skipper
Thesier Hoareau	SZ 451	Boat owner
Marcel Barbier	SZ 329	Fisherman
Marco Lalande	SZ 678	Boat owner/skipper
Robert Azemia	SZ 452	Skipper
Brian Auguste	SZ 329	Fisherman
Charles Dubignon	SZ 86	Skipper/fisherman
George Camille	SZ 55	Fisherman
Leon Cecile	SZ 3	Fisherman
Marcel Volcere	SZ 45	Fisherman
Marshall Hoareau	SZ 25	Boat owner/skipper
Anthony Estrade	SZ 114	Fsherman
Bernard Reginald	SZ 180	Skipper
Winsley Jean	SZ 249	Skipper
Christophe Ernesta	SZ 113	Skipper/owner

資料 7-7 プロビデンス地区既存防波堤の設計波の検討

1．既存防波堤設計波の検討

1-1 風

「セ」国の位置するインド洋西部の平均風の分布（気象庁のデータベースより）を図 1 に示す。インド洋の南緯 10 度以南では貿易風の影響が大きく、平均風速が 5m/sec 程度となっているが、「セ」国付近は比較的穏やかである。

一方、「セ」国における風配図と通年の風向風速の頻度分布を同資料より求めたものが図 2 及び表 1 である。これによれば、通年では貿易風の影響と思われる風向 SE 及び SSE の発生頻度が高く、この 2 方向で全体の 40%以上を占めている。また、風向分布は季節的な変動が大きく、4 月から 10 月にかけての雨期には SE～SSE の出現率が特に高くなっている。これに対し、11 月から 3 月にかけての乾期には WNW 及び SE 方向の頻度が高くなっている。通年における風速 5.0m/sec、7.5m/sec、10.0m/sec 以上となる出現率はそれぞれ 47.8%、17.5%、1.7%となっている。

一方、図 3 及び表 2 は、現地観測風をもとに、風配図及び風向風速階級頻度表を示したものである。

両者を比較すると、風向は、16 方位ベースで 1 方位程度のずれはあるものの、通年及び季節別の出現特性は一致している。一方、現地観測結果の場合、通年における風速 5.0m/sec、7.5m/sec、10.0m/sec 以上となる出現率は、それぞれ 34.3%、7.4%、0.5%となっており、気象庁データベースの風資料に比べると強風の出現率は若干少なくなっている。現地の風資料は陸上で観測されたものであり、陸地や建造物の影響で、風速は海上での風より小さくなっていることを考慮すると、気象庁データベースの風資料は現地での風（海上風）の出現特性を良く再現しているものといえる。

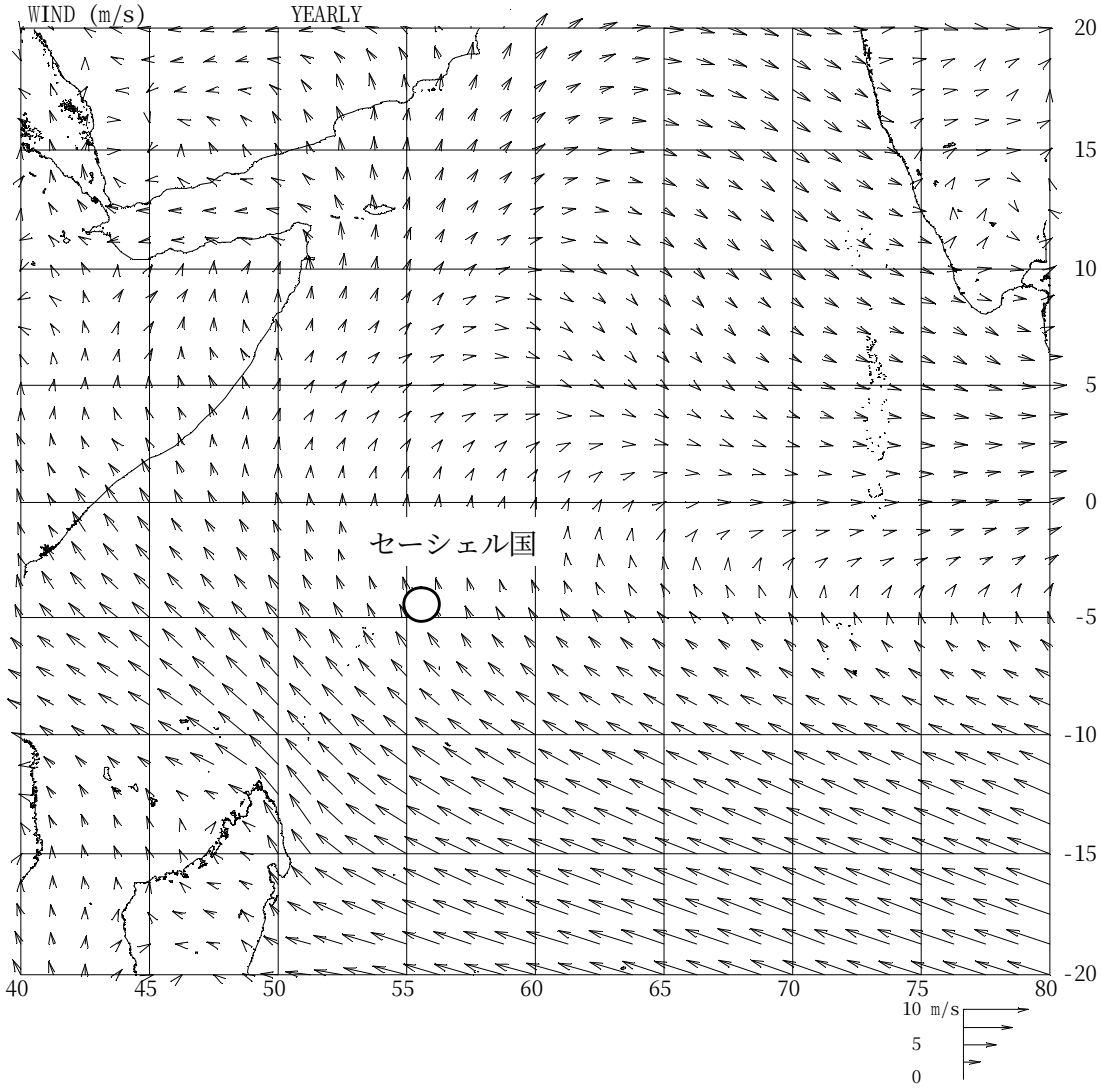
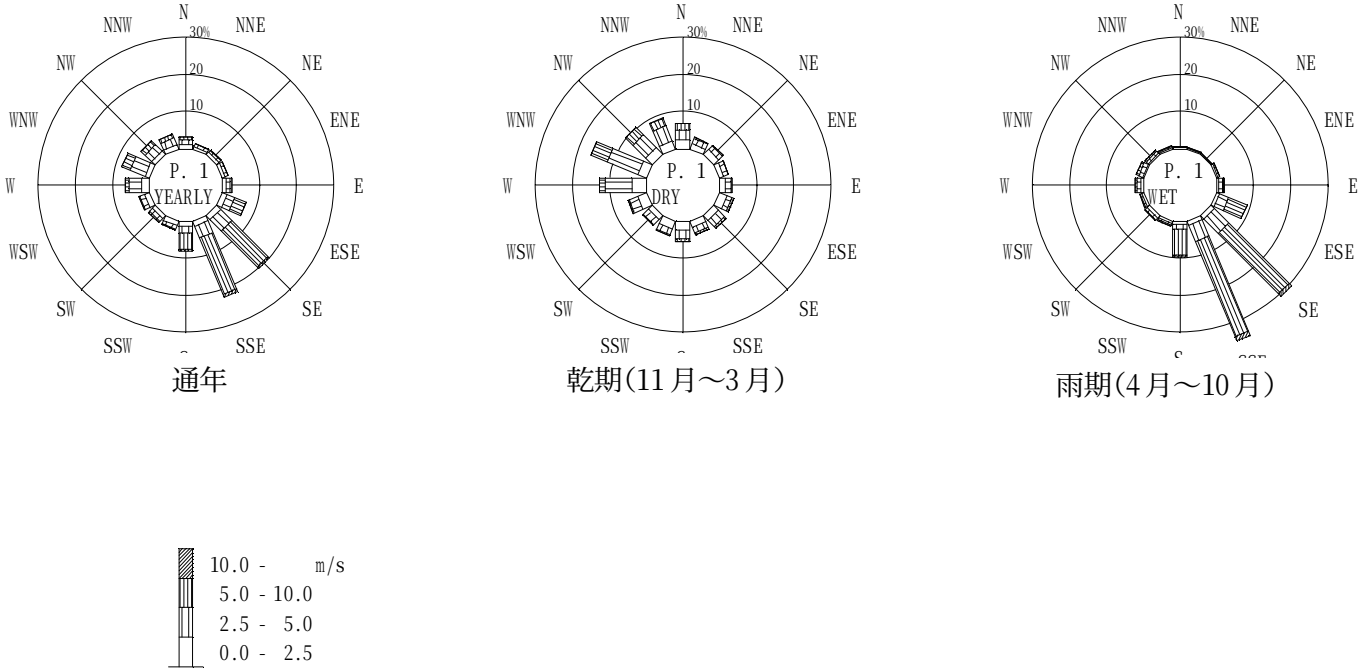
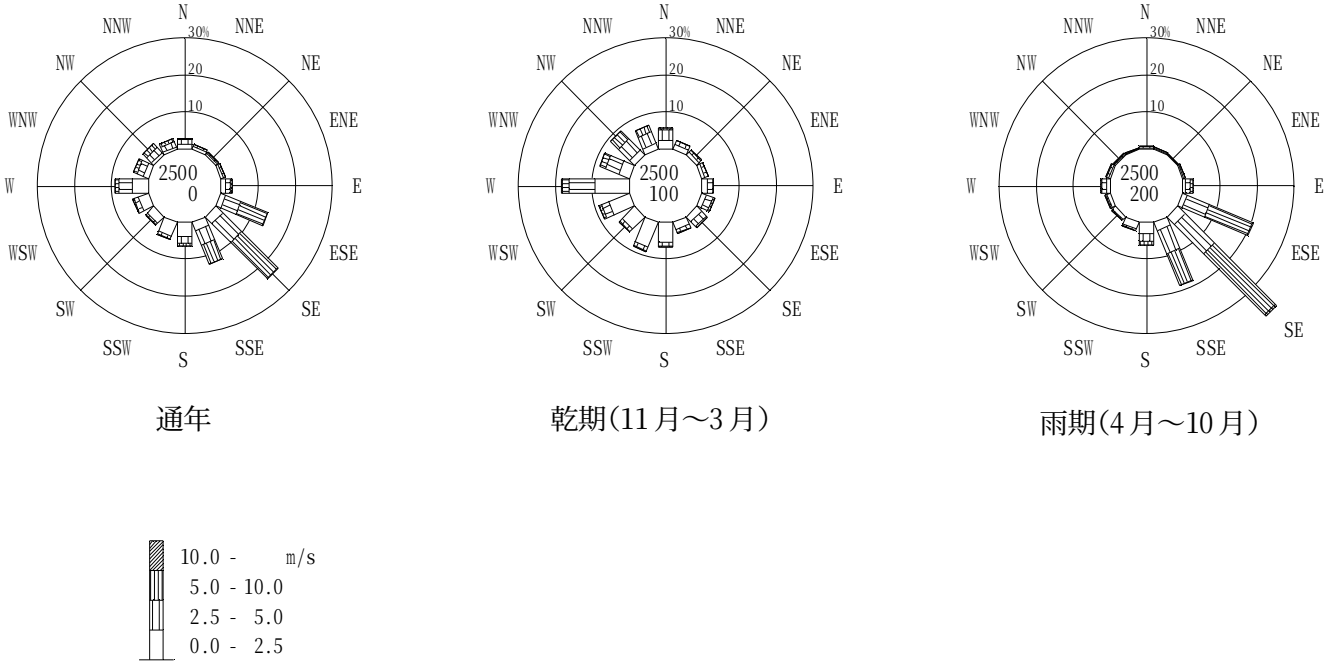


図１ 西インド洋の平均風分布（気象庁資料）



通年　　乾期(11 月～3 月)　　雨期(4 月～10 月)

図 2 セーシルの風配図（気象庁資料、2001 年 3 月～2004 年 2 月、4 回／日）



通年　　乾期(11 月～3 月)　　雨期(4 月～10 月)

図 3 セーシェルの風配図（現地観測値、1996～2005 年、通年、24 回／日）

表 1 セーシェルの通年の風向・風速頻度表

（気象庁資料、2001 年 3 月～2004 年 2 月、通年、4 回／日）

Direction / U(m/s)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW		Total
0.0 - 0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.1 - 2.5	48	30	38	37	50	63	64	59	60	54	44	62	87	54	52	51	2	855
	1.09	0.68	0.87	0.84	1.14	1.44	1.46	1.35	1.37	1.23	1.00	1.41	1.98	1.23	1.19	1.16	0.05	19.50
2.5 - 5.0	59	34	33	36	51	97	184	151	82	45	54	59	159	189	113	90	0	1436
	1.35	0.78	0.75	0.82	1.16	2.21	4.20	3.44	1.87	1.03	1.23	1.35	3.63	4.31	2.58	2.05	0.00	32.76
5.0 - 7.5	28	8	4	1	12	114	376	395	123	11	11	10	39	95	58	41	0	1326
	0.64	0.18	0.09	0.02	0.27	2.60	8.58	9.01	2.81	0.25	0.25	0.23	0.89	2.17	1.32	0.94	0.00	30.25
7.5 - 10.0	4	0	0	0	0	34	228	331	67	2	0	1	3	11	5	4	0	690
	0.09	0.00	0.00	0.00	0.00	0.78	5.20	7.55	1.53	0.05	0.00	0.02	0.07	0.25	0.11	0.09	0.00	15.74
10.0 - 12.5	0	0	0	0	1	0	23	33	16	0	0	0	0	0	1	2	0	76
	0.00	0.00	0.00	0.00	0.02	0.00	0.52	0.75	0.36	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.00	1.73
12.5 - 15.0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
15.0 - 17.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17.5 - 20.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20.0 - 22.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22.5 - 25.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25.0 - 27.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27.5 - 30.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30.0 - 100.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	139	72	75	74	114	308	876	969	348	112	109	132	288	349	229	188	2	4384
	3.2	1.6	1.7	1.7	2.6	7.0	20.0	22.1	7.9	2.6	2.5	3.0	6.6	8.0	5.2	4.3	0.0	100.0

Upper : Number of contents
Lower : Percentage of occurrence

表 2 セーシェルの通年の風向・風速頻度表（現地観測値、1996～2005 年、通年、24 回／日）

WIND DIRECTION	U.K.	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
WIND SPEED(M/S)																		
CALM	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	1 .0	0 .0	0 .0	1 .0
0.0 - 2.5	20 .2	71 .8	56 .6	43 .5	31 .4	66 .8	77 .9	119 1.4	182 2.1	283 3.2	295 3.4	151 1.7	168 1.9	339 3.9	110 1.3	48 .5	61 .7	2120 24.2
2.5 - 5.0	20 .2	165 1.9	72 .8	38 .4	50 .6	100 1.1	235 2.7	596 6.8	492 5.6	224 2.6	85 1.0	62 .7	86 1.0	344 3.9	168 1.9	152 1.7	222 2.5	3111 35.5
5.0 - 7.5	9 .1	53 .6	12 .1	6 .1	3 .0	37 .4	297 3.4	1359 15.5	614 7.0	101 1.2	22 .3	14 .2	38 .4	102 1.2	69 .8	68 .8	73 .8	2877 32.8
7.5 - 10.0	1 .0	0 .0	1 .0	1 .0	0 .0	5 .1	52 .6	352 4.0	162 1.8	23 .3	1 .0	4 .0	2 .0	15 .2	5 .1	7 .1	3 .0	634 7.2
10.0 - 15.0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	11 .1	10 .1	1 .0	0 .0	0 .0	1 .0	0 .0	1 .0	0 .0	0 .0	24 .3
15.0 - 20.0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0
20.0 - 25.0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0
25.0 - 30.0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0
30.0 -	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0
TOTAL	50 .6	289 3.3	141 1.6	88 1.0	84 1.0	208 2.4	661 7.5	2437 27.8	1460 16.7	632 7.2	403 4.6	231 2.6	295 3.4	800 9.1	354 4.0	275 3.1	359 4.1	8767 100.0

1-2 波浪

(1) 通常時波浪

表 3 は、西インド洋の風の平面データ（気象庁提供）から、「1 点スペクトル法」を用いて、「セ」国沖における通常時の波浪を沖波条件で推算したものである。

「1 点スペクトル法」は、風波及びうねりの発生・発達・伝搬において波浪の不規則性を考慮しながら、推算対象地点を 1 点にすることで計算プログラムを簡略化した波浪推算手法であり、1 年間以上の長期間に亘る波浪の推算を行うことができる。風の平面分布の時系列データを用いることにより、対象地点に来襲する波浪の諸元（波高、周期、波向）の時系列が出力されるため、当該海域における通常時波浪の特性（波浪の頻度表）が得られる。表 3 は、この推算手法を用いて、「セ」国沖の波浪を推算し、波浪の頻度表を求めたものである。

これによれば、波向は風の出現率と対応しており、E～S 波の出現率が全体の 80%程度を占めている。波高は最大で 5m程度である。また周期は 3～10 秒程度まで幅広く分布しているが、6～8 秒のものが卓越している。

計画対象地点は、Ｅ～SE 方向に開けており、この方向からの波浪は直接入射する。

(2) 異常時波浪

南インド洋では西進するサイクロンの影響を受ける。ただし、サイクロンが発生し進行するのは、ほぼ南緯 10°以南に限られており、「セ」国付近ではその影響は比較的少ない。図 4 は、1945 年～2003 年に発生したサイクロンの内、「セ」国に高波をもたらしたと考えられるサイクロンの経路を図化したものである。この内、83 年 9 月に来襲したサイクロン 8307（仮称：83 年の 7 号サイクロンの意味）と 8908 について「1 点スペクトル法」を用いて「セ」国に来襲した波浪を沖波条件で推算した。

サイクロンによる波浪推算では、通常時波浪の場合とは異なり、サイクロン周辺の風がその諸元（中心気圧、サイクロンの半径、経路）により計算で求めることができるので、より精度の高い推算が可能である。上述したサイクロンの経路と波浪推算結果を図 5 に示す。

これによれば、最大波高はそれぞれ 5.7m及び 5.6mであり、周期は 10～12 秒である。また波向は SE～SW 方向である。

波高については、通常時の波浪推算結果での最大値は 5m程度であるが、上記した最大規模のサイクロンによる波浪推算結果を勘案して、沖波波高を 6mと設定した。また、構造物の設計においては長周期のものが危険側となるため、サイクロンによる波浪推算結果や通常時波浪の推算結果等から、現地における周期の最大値と考えられる 12 秒を対象とした。波向については、現地における主波向は S 方向であるが、対象地点付近の地形状況から、波向が E 方向になる程の波浪の影響が大きくなるため、構造物前面の設計波の算定においては、影響が最も大きくなると考えられる波向 ESE を対象に変形計算を行うものとした。

沖波設計波の諸元をまとめると以下のおりとなる。

沖波設計波諸元

波高（Ho）	6.0m
周期（To）	12.0sec
波向	ESE～SW（変形計算では波向 ESE を対象とする）

表 3 波向別波高階級別頻度表（セーシェル沖、通年、2001 年 3 月～2004 年 2 月）

WAVE DIRECTION	U.K.	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
WAVE HEIGHT(M)																		
CALM	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0
0.00 - 0.50	0 .0	676 2.6	450 1.7	48 .2	45 .2	65 .2	330 1.3	1090 4.1	638 2.4	68 .3	9 .0	0 .0	0 .0	0 .0	0 .0	0 .0	22 .1	3441 13.1
0.50 - 1.00	0 .0	1004 3.8	728 2.8	40 .2	85 .3	16 .1	1088 4.1	2080 7.9	699 2.7	354 1.3	35 .1	0 .0	0 .0	27 .1	107 .4	91 .3	92 .3	6446 24.5
1.00 - 1.50	0 .0	774 2.9	254 1.0	14 .1	0 .0	1 .0	635 2.4	1771 6.7	719 2.7	320 1.2	25 .1	0 .0	17 .1	0 .0	75 .3	52 .2	85 .3	4742 18.0
1.50 - 2.00	0 .0	127 .5	3 .0	0 .0	0 .0	0 .0	799 3.0	2000 7.6	584 2.2	282 1.1	2 .0	0 .0	0 .0	17 .1	6 .0	42 .2	43 .2	3905 14.8
2.00 - 2.50	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	669 2.5	1583 6.0	661 2.5	237 .9	15 .1	0 .0	0 .0	5 .0	0 .0	3 .0	27 .1	3200 12.2
2.50 - 3.00	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	328 1.2	1363 5.2	647 2.5	213 .8	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	2551 9.7
3.00 - 3.50	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	90 .3	822 3.1	321 1.2	127 .5	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	1360 5.2
3.50 - 4.00	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	5 .0	253 1.0	183 .7	91 .3	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	532 2.0
4.00 - 5.00	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	27 .1	48 .2	45 .2	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	120 .5
5.00 - 6.00	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0
6.00 - 7.00	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0
7.00 -	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0
TOTAL	0 .0	2581 9.8	1435 5.5	102 .4	130 .5	82 .3	3944 15.0	10989 41.8	4500 17.1	1737 6.6	86 .3	0 .0	17 .1	49 .2	188 .7	188 .7	269 1.0	26297 100.0

表 4 波高、周期階級別頻度表（セーシェル沖、通年、2001 年 3 月～2004 年 2 月）

YEAR 2500 MONTH 0 KESOK 7

WAVE PERIOD(S)	CALM	0- 1	1- 2	2- 3	3- 4	4- 5	5- 6	6- 7	7- 8	8- 9	9-10	10-11	11-12	12-13	13-14	14-15	15-	TOTAL
WAVE HEIGHT(M)																		
CALM	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0
0.00 - 0.50	0 .0	0 .0	16 .1	151 .6	783 3.0	517 2.0	569 2.2	431 1.6	417 1.6	437 1.7	115 .4	5 .0	0 .0	0 .0	0 .0	0 .0	0 .0	3441 13.1
0.50 - 1.00	0 .0	0 .0	0 .0	0 .0	962 3.7	1725 6.6	1147 4.4	906 3.4	629 2.4	765 2.9	219 .8	80 .3	13 .0	0 .0	0 .0	0 .0	0 .0	6446 24.5
1.00 - 1.50	0 .0	0 .0	0 .0	0 .0	0 .0	461 1.8	1872 7.1	999 3.8	649 2.5	458 1.7	261 1.0	40 .2	2 .0	0 .0	0 .0	0 .0	0 .0	4742 18.0
1.50 - 2.00	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	977 3.7	1804 6.9	683 2.6	215 .8	145 .6	60 .2	20 .1	1 .0	0 .0	0 .0	0 .0	3905 14.8
2.00 - 2.50	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	6 .0	1550 5.9	1326 5.0	234 .9	68 .3	16 .1	0 .0	0 .0	0 .0	0 .0	0 .0	3200 12.2
2.50 - 3.00	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	181 .7	1780 6.8	543 2.1	33 .1	14 .1	0 .0	0 .0	0 .0	0 .0	0 .0	2551 9.7
3.00 - 3.50	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	557 2.1	782 3.0	21 .1	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	1360 5.2
3.50 - 4.00	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	15 .1	416 1.6	101 .4	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	532 2.0
4.00 - 5.00	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	96 .4	24 .1	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	120 .5
5.00 - 6.00	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0
6.00 - 7.00	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0
7.00 -	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0	0 .0
TOTAL	0 .0	0 .0	16 .1	151 .6	1745 6.6	2703 10.3	4571 17.4	5871 22.3	6056 23.0	3946 15.0	987 3.8	215 .8	35 .1	1 .0	0 .0	0 .0	0 .0	26297 100.0

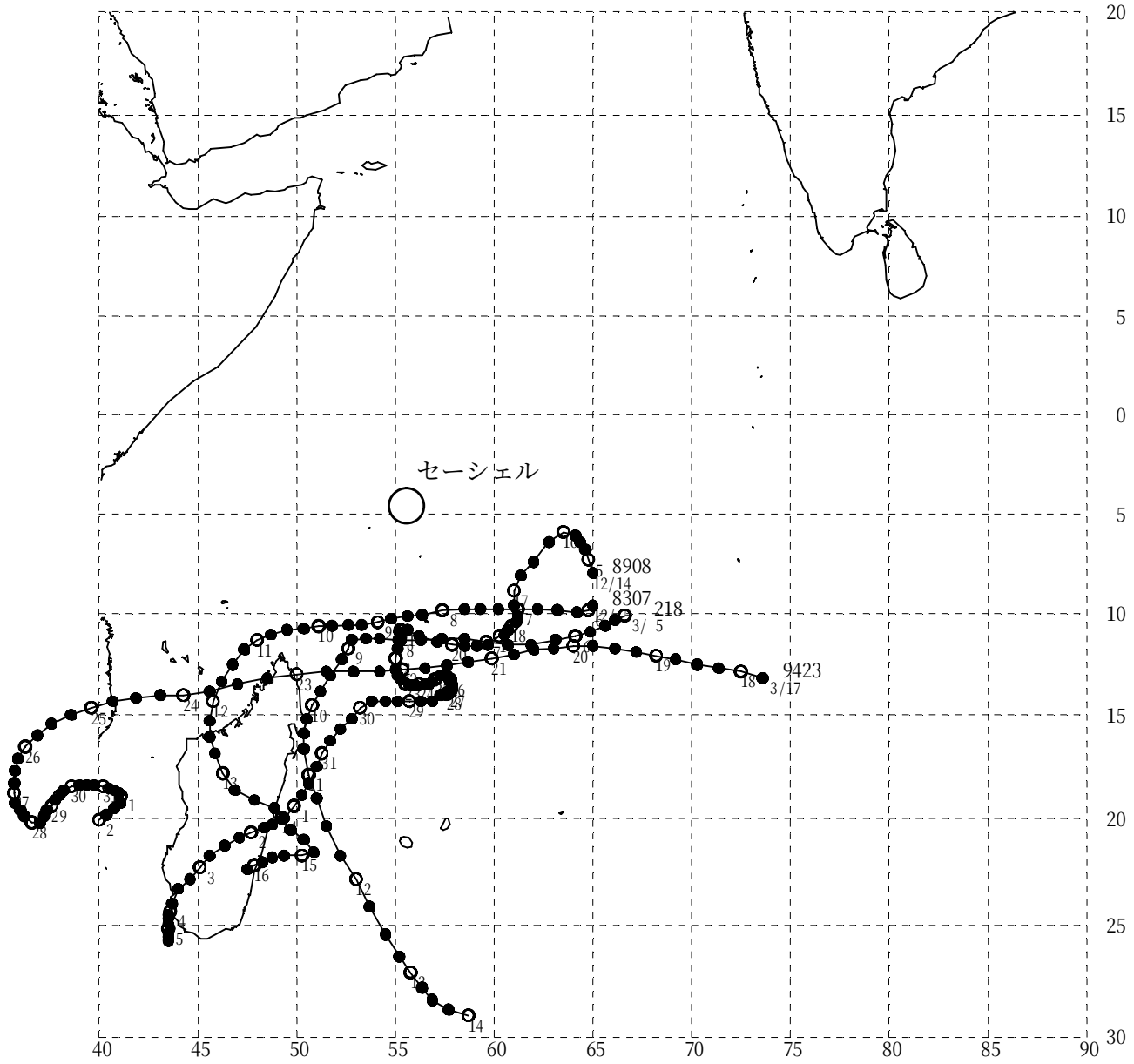
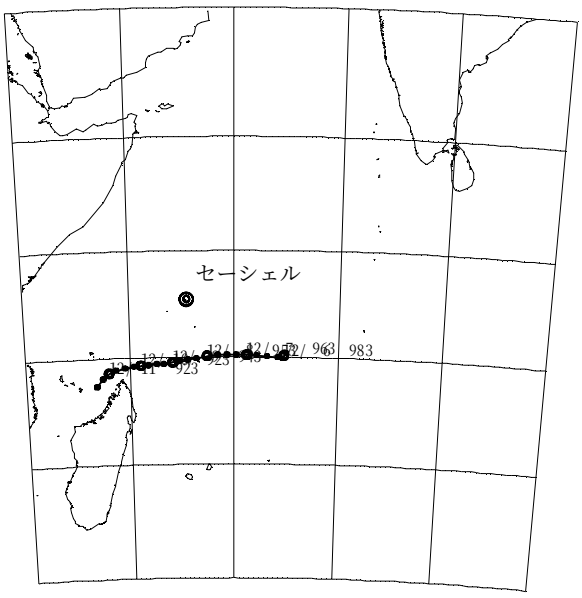
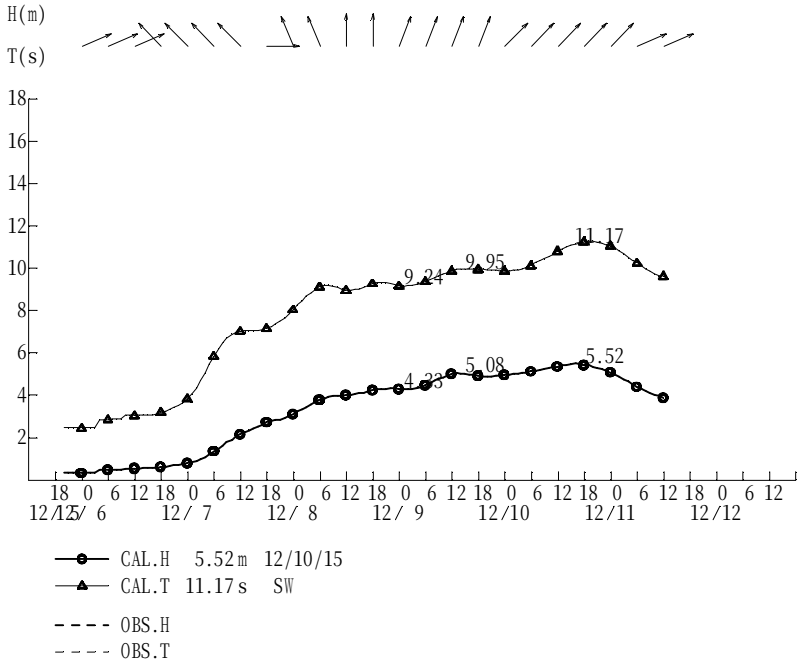


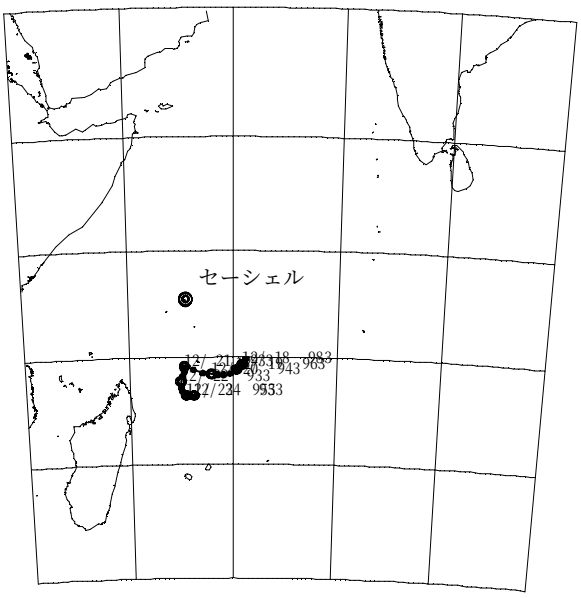
図 4 サイクロン経路図（1945 年～2003 年）

サイクロン 8307





サイクロン 8908



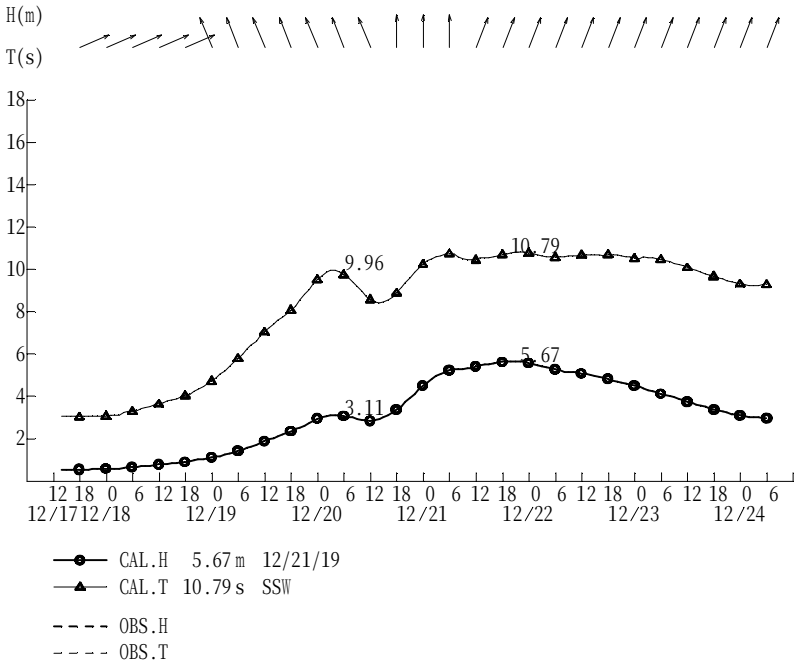


図 5 サイクロン経路と波浪推算結果（サイクロン 8307、8908）

2-2 設計波の算定

(1) 浅海域における波浪変形計算

上記の波浪に対し、浅海域における波浪変形計算を実施し、構造物前面の波浪を求めた。計算方法は、不規則波による波浪変形計算手法として、現在最も一般的といわれている、エネルギー平衡方程式を解く方法を用いた。

計算範囲は図 6 に示すとおり、東西、南北ともに約 25㎞ の領域とした。格子間隔は何れも 500m である。計算は領域の沖側境界で前述した設計波の条件を与え、これが海底地形の変化に伴って変形するのを順次計算していくものである。計算結果から、各格子点上における波高比、屈折係数、波向が出力される。計算結果を図 7～8 に示す。

計算結果から、構造物前面の波浪諸元を求めたものが表 5 である。既存防波堤前面の入射波高は 2.64mとなる。また、入射波向は N53.2°E となる。

表 5 波浪諸元（既存防波堤設置位置）

沖波諸元		屈折係数	入射波	
波高（Ho）	6.0m	0.44	入射波高（Ho’）	2.64m
周期（T）	12.0sec		周期	12.0sec
波向	ESE		入射波向	N53.2°E

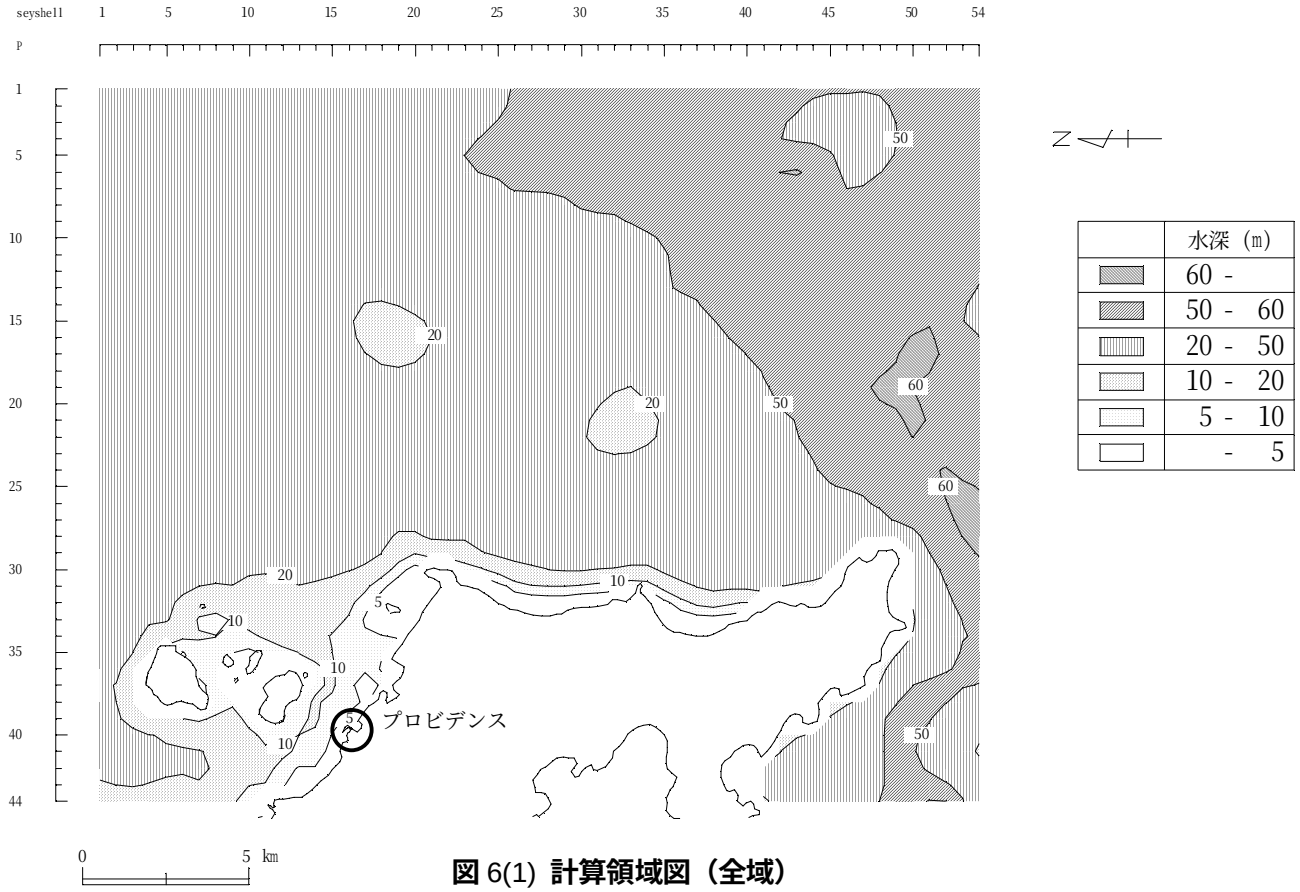


図 6(1) 計算領域図（全域）

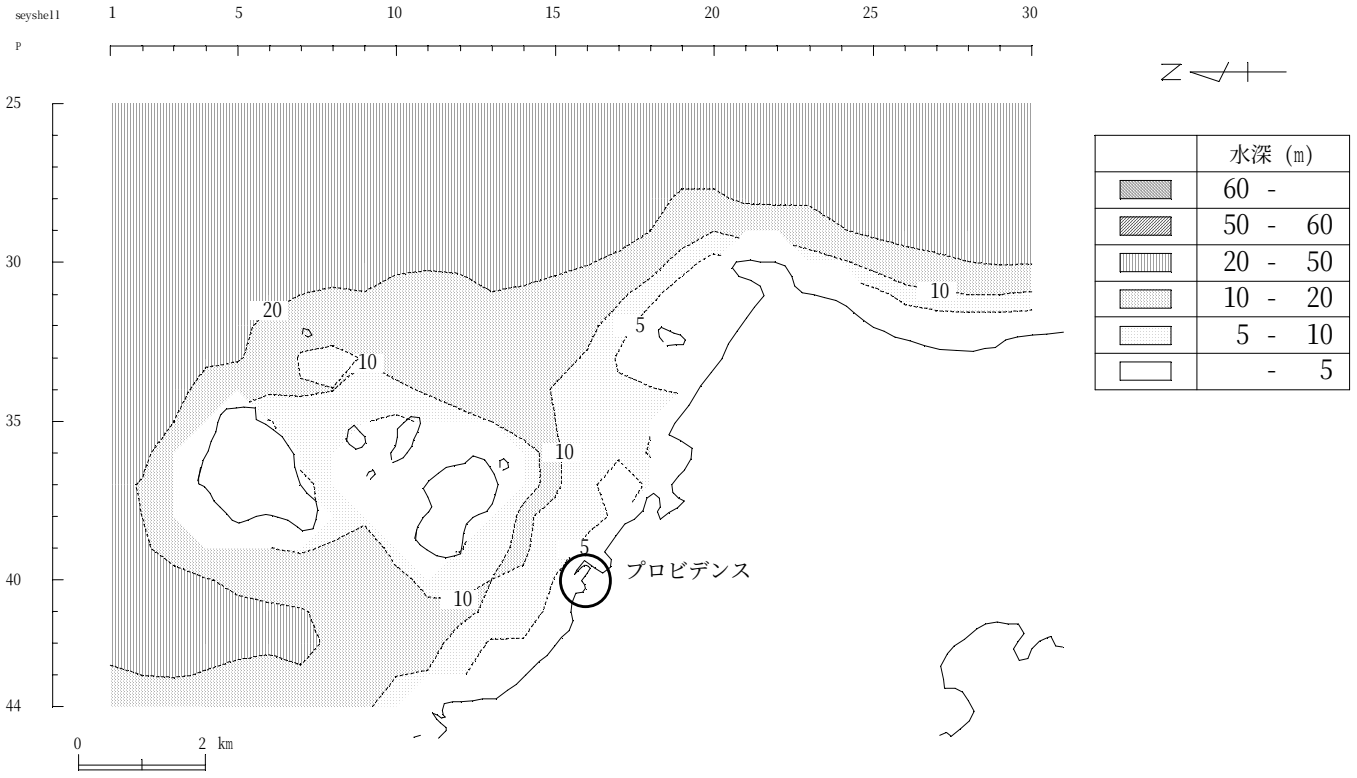
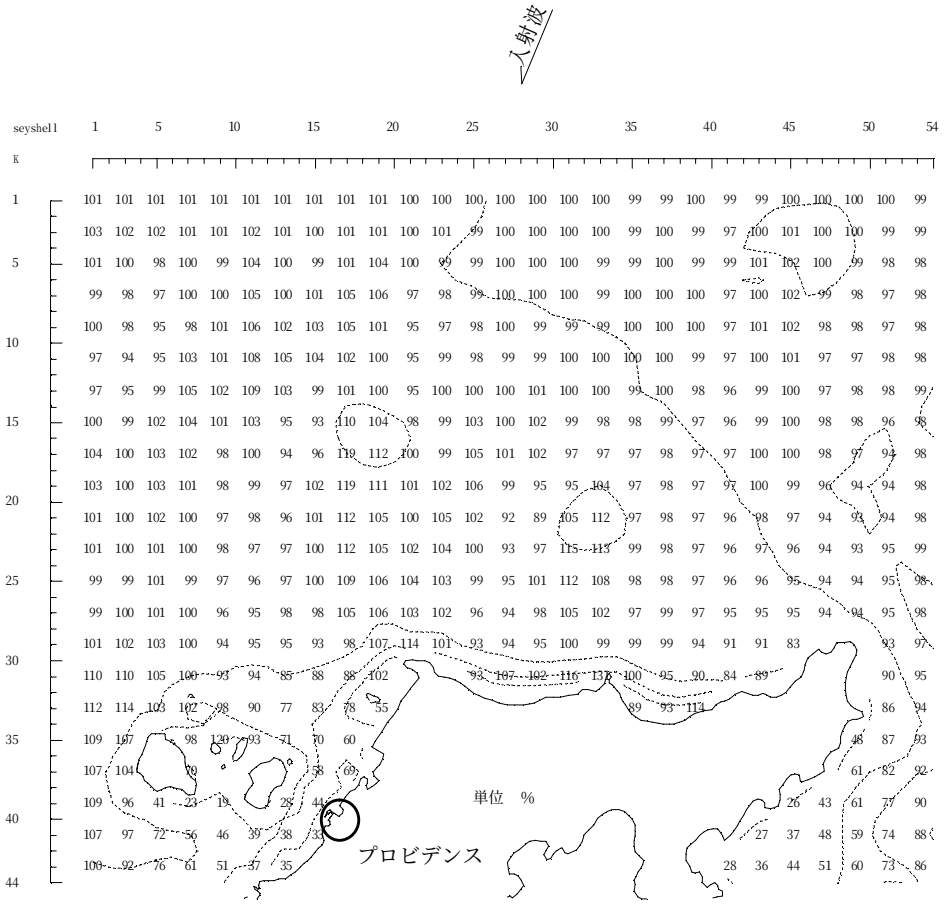
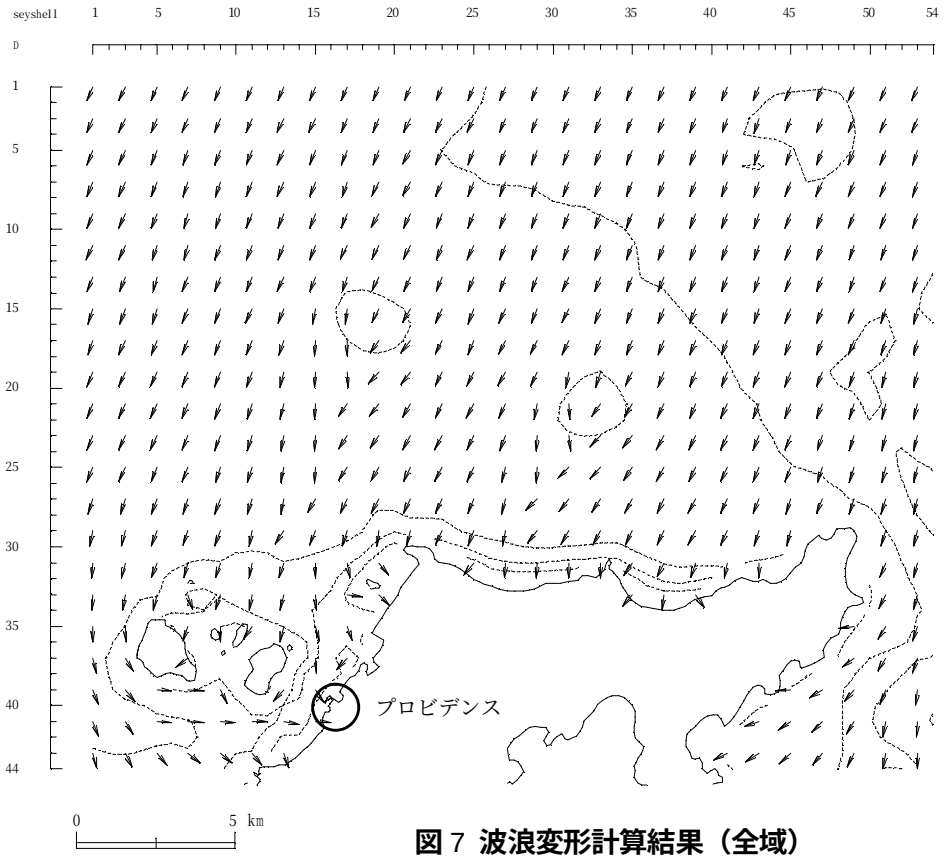


図 6(2) 計算領域図（拡大図）



屈折係数

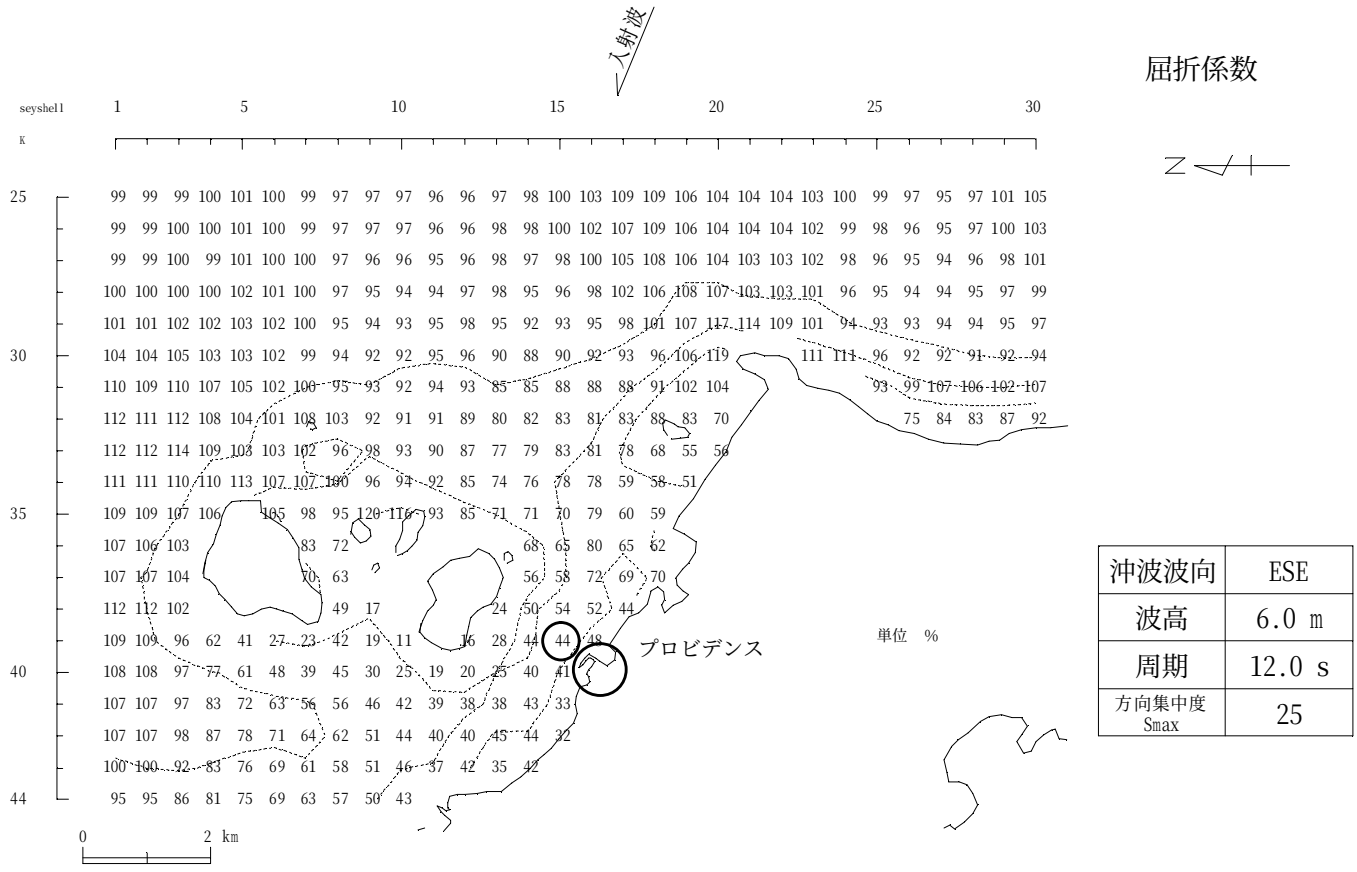
沖波波向	ESE
波高	6.0 m
周期	12.0 s
方向集中度 Smax	25



波向

沖波波向	ESE
波高	6.0 m
周期	12.0 s
方向集中度 Smax	25

図 7 波浪変形計算結果（全域）



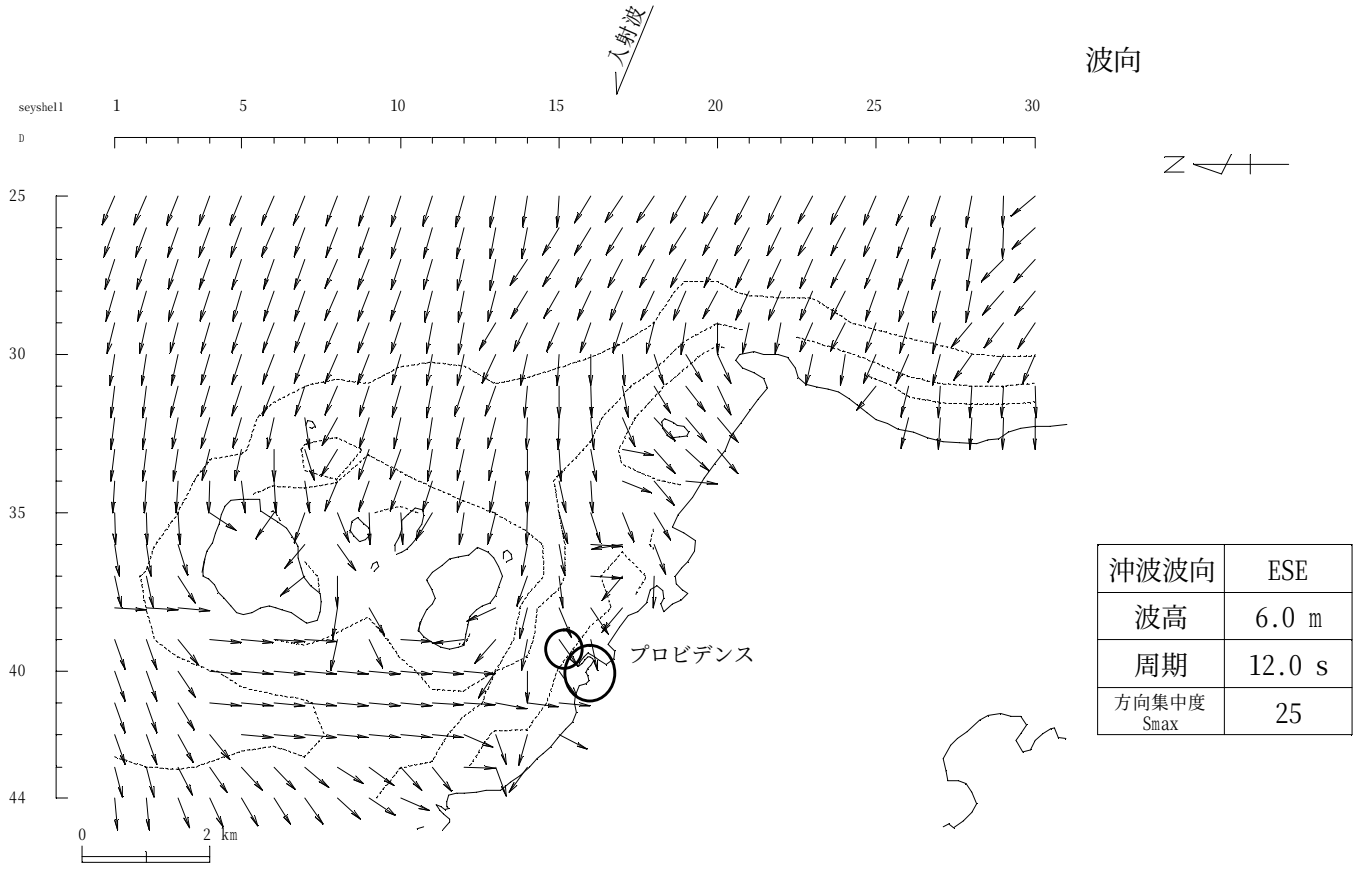


図 8 波浪変形計算結果（拡大図）

(2) 既存防波堤前面の設計波

表 5 に示す入射波高 2.64m に対して、水深による波高変化（図 9 参照）を考慮し、プロビデンスの既存防波堤前面における設計波高は以下のとおりである。

水深 h：　　9.0m+1.45m(潮位)＝10.45m
換算沖波波高 Ho’：　　2.64m
沖波波長 Lo　　：　　1.56 x To^2＝224.6m
海底勾配：1:30
Ho’/Lo：　　2.64/224.6＝0.012
h/Ho’：　　10.45/2.64＝3.96

図 9 より、H/Ho’＝1.08　したがって、設計波高 H＝2.85m（有義波）

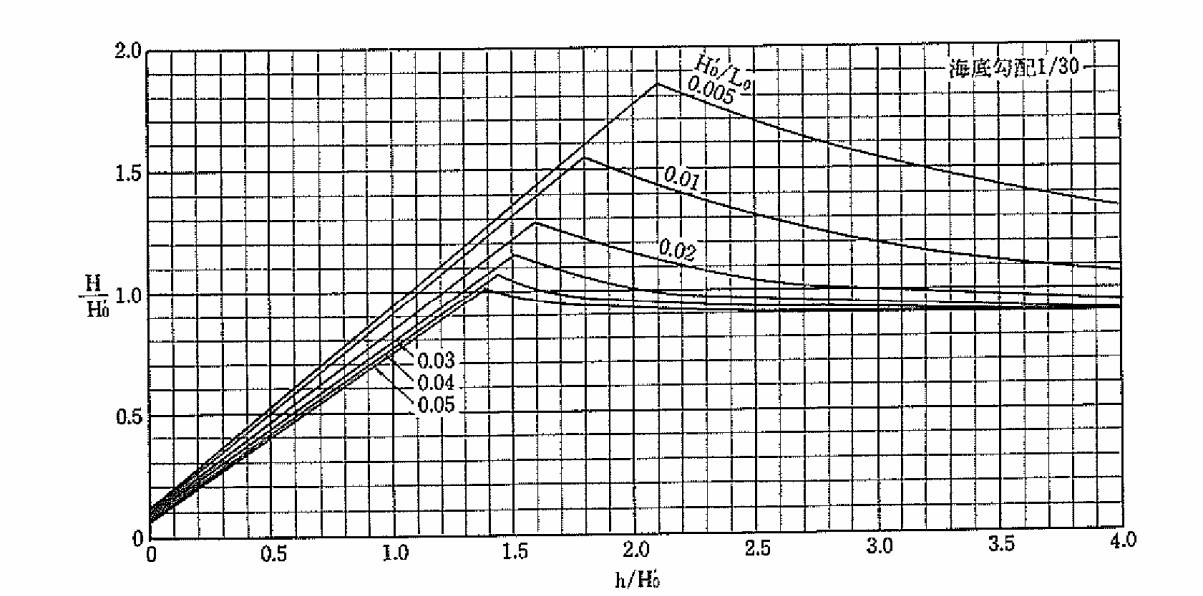


図 9 水深による波高変化