CHAPTER 8 CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

The basic infrastructure facilities that have been developed pursuant to the Noro Township Development Plan, which is intended to develop Noro into the central city of Western Province, are nearing completion. This program has produced a deep-water wharf, power station, roads, water supply and sewer facilities, and residential land development. With the completion of the above program, the next stage will be to build the area's industrial base by further development of the fishing industry as the core industry. This industry is already playing a major role in regional diversification through increasing Noro's permanent population, and is making a sizable contribution to the overall national economy.

The facilities required to accomplish this objective include oil storage tanks, cold storage facilities, the Community Center, and a small harbor workboat.

With respect to the oil storage tanks, in order to supply fuel in stable quantities and at stable prices to Noro-based fishing vessels, the power plant, general vessels, and towns and villages in the Noro vicinity, it has become clear that there is a requirement for oil storage tanks of 6,000 kl capacity in total.

The cold storage is deemed to be appropriate in terms of facilitating selective storage, primarily of high-value yellowfin, and achieving an increase in value added. It has been concluded that there is a requirement for an inside temperature of -25°C and a storing capacity of 500 tons. Considering the area for a future fishing vessel repair facility, including a slipway, the length of the landing wharf serving this cold storage has been expanded to 100 m.

The Community Center is positioned as an educational, cultural, and welfare facility for residents of Noro and the surrounding areas as well as fishermen using Noro as a base. For these purposes, there is a

requirement for a multi-function facility to include a clinic, training area, public meeting areas, and a dormitory.

The harbor workboat is to serve both as a pilot vessel and as a general workboat, as required by Noro's new status as an international port. It has been calculated that this boat should have an output of 130 ps and a total length of about 11 m.

In choosing the Plan site for the shore facilities, including the cold storage facilities, as a result of discussions with officials of the Solomon Islands Government, it was decided to avoid the waters in the front of the power station and the areas that are reserved for a future research laboratory to be built by the Ministry of Natural Resources, and to select instead an adjoining area to the south of this property. With regard to the remaining facilities, it was confirmed that there are no problems concerning the locations shown in the Noro Township Development Plan.

The functions of the various facilities are quite varied and they are to be managed by a number of different organizations. However, in connection with the operation of the oil storage facility and the shore facilities, including the cold storage, which can levy charges on their customers, there is every prospect that the facilities can be run on a self-sustaining basis, without causing financial problems for the management organization. In the case of the Community Center, however, annual operating costs are estimated at about $29,000, which will have to be budgeted by the Western Province Government.

If the Plan facilities are built, the skipjack and tuna industry of the Solomon Islands will be strengthened and equipped to make an ever greater contribution to the national economy. And, based on the public nature of the facilities, it can be expected that Noro will contribute to the development of the fishing industry on both a national and regional level. For if an industrial base is established at Noro with fisheries as the core industry, the necessary infrastructure for urban development will be largely in place, thereby completing the Noro Township

Development Plan, which forms an integral part of the overall National Development Plan. Accordingly, it is deemed appropriate that the Government of Japan provide grant-aid for this Plan.

8.2 Recommendations

Prior to the Plan's implementation, the responsible organization of the Solomon Islands Government will be the Coordinating Committee for Noro Fisheries Infrastructure Development, which is chaired by the Permanent Secretary, Ministry for Economic Planning.

At the implementation stage, assuming normal procedures are followed in the Solomon Islands Government, responsibility for each facility would be given to the future operating agency for that facility. However, since this Plan incorporates facilities with very different objectives and functions, implementing responsibility would be divided among three organizations. Thus, until the Project passes through the implementation phase and moves on to completion, we feel that it is vital that the above Committee continue to function so as to provide a structure for coordinating the various Plan facilities with the Noro Township Development Plan, the governing plan for this Project. In the interest, therefore, of effective implementation, it is strongly recommended that the Committee remain in place until the Plan facilities are completed.

APPENDIX

I. Minutes of Discussions

I-1 Field Survey

I-2 Draft Report Explanation

II. Team Members

III. Survey Itinerary

IV. Discussants

V. Annex

1 Pipe Diameter Calculation

2 Refrigeration Load

3 Munda Monthly Maximum Wind

4 Munda Monthly Total Rainfall and Raindays

5 Munda Monthly Average Maximum and Minimum Temperature

6 Munda Monthly Average Humidity

7 Hourly Tidal Observation

8 Curves for Harmonic Constants

9 Curves for Sub-current Speed

10 Elliptical Chart for Tidal Current

11 Depth Chart

12 Boring Log

13 Expected Training Programme

14 ATC Training Programme for 1989

VI. Photograph

I Minutes of Discussions

I-1 Field Survey

MINUTES OF DISCUSSIONS
ON
NORO FISHERIES INFRASTRUCTURE DEVELOPMENT PROJECT
IN
SOLOMON ISLANDS

In response to the request of the Government of Solomon Islands, the Government of Japan decided to conduct a basic design study on Noro Infrastructure Development Project and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Solomon Islands the Study Team headed by Mr. Shiro Ebisawa, Director, Office for the Overseas Fisheries Cooperation, Oceanic Fisheries Department, Fisheries Agency, Ministry of Agriculture Forestry and Fisheries, from November 6th to November 29th 1988.

The Team had a series of discussions on the Project with the officials concerned of the Government of Solomon Islands headed by Mr S. Danitofea, Permanent Secretary, Ministry of Natural Resources and Mr M. Sibisopere, Permanent Secretary, Ministry of Economic Planning and conducted a field survey in Noro.

As a result of the study, both parties agreed to recommend to their respective Governments that the major points of understanding reached between them, attached herewith, should be examined towards the realization of the Project.

November 16, 1988

海老沢志朗
.....
Shiro Ebisawa
Team Leader
Basic Design Study Team
JICA

.....
S.Danitofea
Permanent Secretary
Ministry of Natural Resources

.....
M.B. Sibisopere
Permanent Secretary
Ministry of Economic Planning

S.E.

Attachment

1. Objective of the Project

The objective of the Project is to enhance Noro township development which is being undertaken in line with the decentralization policy of the Government by providing infrastructure facilities required for the industrial development including fisheries industry which is playing a vital role in the national economy.

2. Executing Agency

The Noro Fisheries Infrastructure Development Project Coordination Committee which comprises the Ministry of Economic Planning, Ministry of Natural Resources, Ministry of Finance, Ministry of Transport, Works and Utilities, Solomon Islands Ports Authority and Western Province, under the chairmanship of the Permanent Secretary, Ministry of Economic Planning, is responsible for the administration and implementation as well as the management of the Project. The organizations undertaking the operation and maintenance of the facilities has been set up as shown in Annex I.

3. Request of Solomon Islands Government

The contents of the Project required by the Government of Solomon Islands are listed in Annex I. The Team will convey the request of the Solomon Islands Government to the Japanese Government that the latter will take the necessary measures to cooperate by providing the items listed in Annex I within the scope of the Japan's Grant Aid Program.

4. Project Site

The site of the Project is located at Noro, Island of New Georgia, Western Province as shown in Annex II.

5. Undertaking of the Government of Solomon Islands

The Government of Solomon Islands will take the necessary measures listed in Annex III on condition that the Grant Aid of the Government of Japan would be extended to the Project.

6. Understanding of Japan's Grant Aid System

The Solomon Islands side has understood Japan's Grant Aid System explained by the Team which includes a principle of use of a Japanese consulting firm and a Japanese firm for the construction.

7. Utilization of Local Solomon Islands Resources

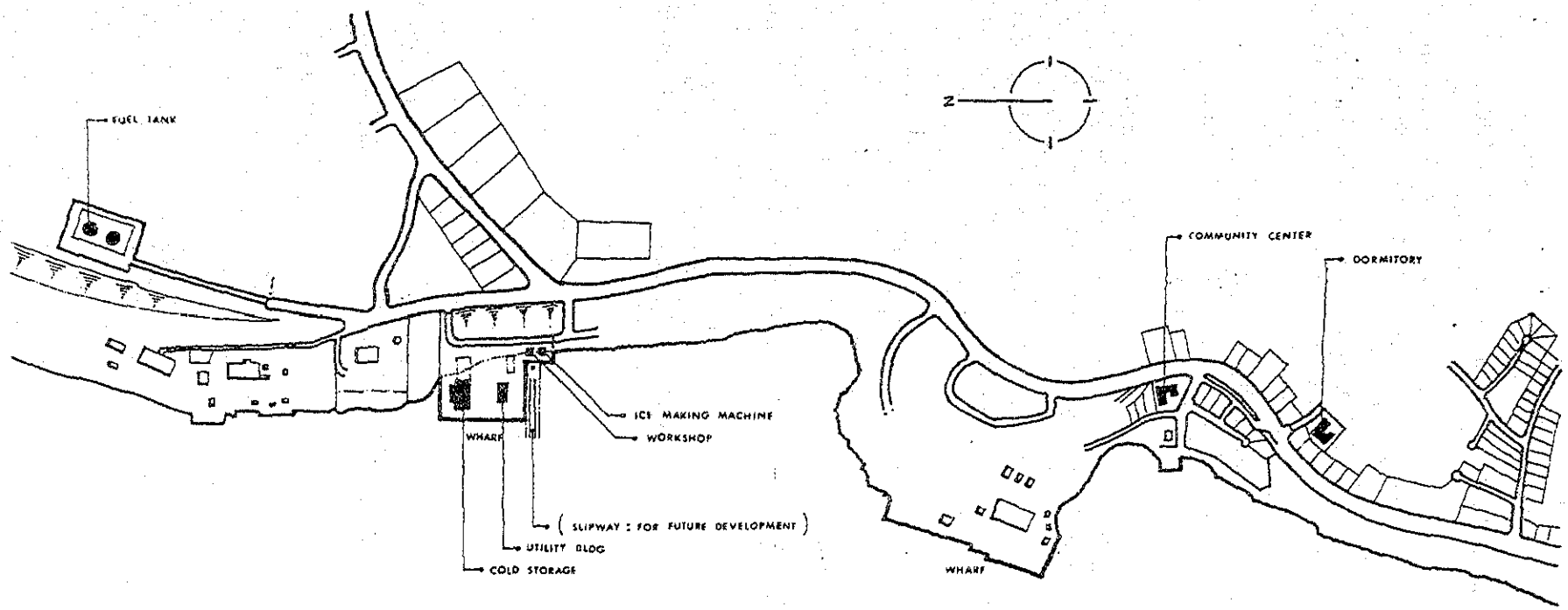
In considering the implementation of the Project the Japanese firms will endeavour to utilize Solomon Islands labour and other local resources to the extent possible.

ANNEX I

ITEMS REQUESTED BY THE GOVERNMENT OF SOLOMON ISLANDS AND INTENDED ORGANIZATION FOR OPERATION AND MAINTENANCE

Item	Main Components	Operating/Maintenance Organization
1. Fuel Oil Tank	Oil storage tanks, piping for discharging to fishing boats, power station and cargo boats.	Ministry of Natural Resources and/or The Investment Corporation of Solomon Islands
2. Cold Storage Facilities	Blast freezers, cold storage rooms, forklifts, pallets, scale and utility building and a wharf.	Ministry of Natural Resources and/or Solomon Islands Ports Authority
3. Small Port Workboat	General purpose harbour utility boat.	Solomon Islands Ports Authority
4. Community Centre	Clinic, meeting and training rooms, dormitory for trainees and visiting lecturers.	Western Province Government
5. Ice Making Machine	Small block ice making machine.	Solomon Islands Ports Authority
6. Workshop	Workshop for training outboard engine repair.	Solomon Islands Ports Authority

ANNEX II



HATHORN SOUND

PROJECT SITE

S.E.

ANNEX III

UNDERTAKING OF THE GOVERNMENT OF SOLOMON ISLANDS

1. To undertake the administrative coordination necessary for ensuring support of the concerned authorities involved in the Project implementation.

2. To secure cleared land necessary for constructing the facilities.

3. To provide facilities for the distribution of electricity, water supply, sewerage and other incidental facilities to the sites of the facility construction.

4. To ensure prompt unloading and custom clearance at the port of disembarkation in Solomon Islands and to secure that the Japanese nationals shall not be subject to any custom duties, internal taxes and other fiscal levies imposed in Solomon Islands, with respect to the supply of materials and services under the verified contracts.

5. To accord Japanese Nationals whose services may be required in connection with the supply of products and the services under the verified contracts such facilities as may be necessary for their entry into Solomon Islands and stay therein for the performance of their work.

6. To ensure proper and effective maintenance and use of the facilities provided under the grant.

7. To bear, or secure other funds for, all the expenses other than those to be borne by the grant including operation and maintenance budget for the facilities.

MINUTES OF DISCUSSIONS

ON

NORO FISHERIES INFRASTRUCTURE DEVELOPMENT PROJECT

IN

SOLOMON ISLANDS

In response to the request of the Government of the Solomon Islands for the Noro Fisheries Infrastructure Development Project (hereinafter referred to as "the Project"), the Government of Japan decided to conduct a basic design study on the project and entrusted the study to the Japan International Cooperation Agency (JICA). A Basic Design Study Team headed by Mr. Shiro Ebisawa, Director, Office for the Overseas Fisheries Cooperation, Oceanic Fisheries Dept., Fisheries Agency, Ministry of Agriculture, Forestry and Fisheries, was sent by JICA to Solomon Islands from November 6 to November 29, 1988.

As a result of the study, JICA prepared a Draft Report and dispatched a team headed by Dr. Shigeru Shimura , Fisheries Development Specialist, Institute for International Cooperation, JICA, to explain and discuss it with the relevant authorities of the Government of Solomon Islands from February 12 to February 24, 1989. The parties had a series of discussions on the Project and agreed to recommend to their respective Governments that the major points of understanding reached between them, attached herewith, should be examined towards the realization of the Project.

Honiara, February 21, 1989

Dr. Shigeru SHIMURA
Team Leader,
Basic Design Study Team
JICA

Mr. Milton SIBISOPERE
Permanent Secretary
Ministry of Economic Planning
Solomon Islands Government

Attachment

1. The Solomon Islands side was satisfied with the Draft Report in principle and agreed with the team to the contents explained in the Appendix.

2. The Solomon Islands side understood Japan's grant aid system and confirmed that the necessary measures will be taken by the Solomon Islands side as shown in the Annex-III of the Minutes of Discussion on the Project signed on November 16, 1988, on the condition that the grant aid by the Government of Japan would be extended to the Project.

3. The Solomon Islands side stated that necessary budget will be provided for the Project to ensure the effective operation and maintenance of the Project constructed under the grant aid by the Government of Japan.

4. The Final Report (10 copies in English) will be submitted to the Solomon Islands side by end April, 1989.

Appendix

SOLOMON ISLANDS GOVERNMENT
MINISTRY OF NATURAL RESOURCES

NORO FISHERIES INFRASTRUCTURE DEVELOPMENT PROJECT

OPERATION STRUCTURE FOR FUEL STORAGE FACILITIES

The Solomon Islands Government (hereafter called "SIG") has confirmed that SIG will implement the following procedures for establishing the operational structure for the fuel storage facilities:

I. SIG will accept the fuel storage depot and associated facilities and operate them as a wholly owned SIG project.

II. SIG will implement this project under the mechanism of a wholly owned subsidiary of the Investment Corporation of the Solomon Islands (ICSI), (Subject to approval by the Board of ICSI).

III. SIG will implement the operation of this facility through a subcontractor which will be arranged through a tendering process.

IV. The responsibility of SIG, through the SIG owned subsidiary, will include, but not be limited to, the following:

i) To organise and implement the original and subsequent tenders for the operation and maintenance of the facilities on an ongoing basis;

ii) To ensure that the tendering process and subsequent contract between SIG and the company selected to be the sub-contractor guarantees an impartial and fair competition between tendering companies;

iii) To set and collect an appropriate level of tariff through the mechanism of a throughput fee (or a suitable alternative) from the operating company which will guarantee that depreciation, maintenance and replacement costs are recovered in an appropriate manner;

iv) To ensure that the operation of the facilities is carried out in such a way as to guarantee that the benefits of the facilities will be in the interest of the public welfare;

v) To ensure that the contract shall include a penalty clause for breach of the terms and conditions of the contract and that SIG shall have the right to terminate the contract in the event that these conditions are violated;

vi) To monitor the operation and maintenance of the facilities to ensure that they meet agreed safety standards;

vii) To monitor the prices of fuel with the assistance of the Prices Advisory Committee; and,

viii) To ensure that the operating subcontractor carries out appropriate training and education of Solomon Islands Nationals in the operation and maintenance of the facilities.

V. The responsibility of the subcontractor will be to assume and carry out the operation and maintenance of the facilities in accordance with the conditions set out above.

Appendix II Team Members

(1) Field Survey Team

Mr. Shiro EBISAWA	Team Leader	Director, Office for Overseas Fishery Cooperation, Oceanic Fisheries Dept. Fisheries Agency, Min. of Agriculture, Forestry and Fisheries
Mr. Shigeki FUJITA	Fisheries Development	Fisheries Insurance Div., Fisheries Administration Dept., Fisheries Agency, Min. of Agriculture, Forestry and Fisheries
Mr. Hidemitsu SAKURAI	Project Coodination	2nd Basid Design Study Div., Grant Aid Planning and Survey Dept., Japan International Cooperation Agency (JICA)
Mr. Naohiko NAKAJIMA	Fisheries Planning	Fisheries Engineering Co., Ltd.
Mr. Kunihiro WATANABE	Civil Engineer	Fisheries Engineering Co., Ltd.
Mr. Taizo KANEKO	Architect	Fisheries Engineering Co., Ltd.
Mr. Taizo HARA	Refrigeration	Fisheries Engineering Co., Ltd.
Mr. Kanji YOSHIMI	Fishing Vessel	Fisheries Engineering Co., Ltd.
Mr. Mitsuo IGARASHI	Environmental Survey	Fisheries Engineering Co., Ltd.
Mr. Michio TORII	Cost Estimation	Fisheries Engineering Co., Ltd.

(2) Draft Report Explanation Team

Dr. Shigeru SHIMURA	Team Leader	Fisheries Development Specialist Institute for International Cooperation Japan International Cooperation Agency (JICA)
Mr. Junichi FUJITA	Fisheries Development	Deputy Director, Office for the Overseas Fishery Cooperation, Oceanic Fisheries Dept., Fisheries Agency, Min. of Agriculture, Forestry and Fisheries
Mr. Naohiko NAKAJIMA	Fisheries Planning	Fisheries Engineering Co., Ltd.
Mr. Taizo KANEKO	Architect	Fisheries Engineering Co., Ltd.
Mr. Takeshi HARA	Refrigeration	Fisheries Engineering Co., Ltd.

III. Survey Itinerary

(1) Field Survey

DAY	DATE	DESCRIPTION		
1	Nov. 6 (Sun)	Lv. Narita QF-080		
2	Nov. 7 (Mon)	Ar. Brisbane, Lv. Brisbane QF-701, Ar. Honiara Visit to Embassy of Japan Courtesy call to and discussion with the Secretary, Min. of Economic Planning		
3	Nov. 8 (Tue)	Mr. Ebisawa, Mr. Fujita, Mr. Sakurai, Mr. Nakajima, Mr. Kaneko, Mr. Hara, Mr. Yoshimi, Mr. Torii: Joint meeting on the Project with the persons in charge of Min. of Economic Planning, Min. of Natural Resources and Solomon Islands Ports Authority		Mr. Watanabe, Mr. Igarashi Lv. Honiara Ar. Noro
4	Nov. 9 (Wed)	Discussion with Under Secretary, Min. of Transport, Works and Utilities. Discussion with Noro Township Project Coordinator, Min. of Transport, Works and Utilities. Lv. Honiara, Ar. Noro		Preparation and set up of bservation station
5	Nov. 10 (Thu)	Site reconnaissance Survey for the Project relating facilities and Noro Township Infrastructure		Start to obeserve environmental condition
6	Nov. 11 (Fri)	Mr. Ebisawa, Mr. Sakurai, Mr. Nakajima, Mr. Kaneko: Lv. Noro, Ar. Gizo Discussion with Provincial Secretary, Western Province	Mr. Fujita, Mr. Hara, Mr. Yoshimi: Visit to relating facilities	Mr. Watanabe, Mr. Igarashi, Mr. Torii: Preparation for field survey Survey for depth measurement
7	Nov. 12 (Sat)	Lv. Gizo, Ar. Noro	Survey for Noro infrastructure	Set up of the observation flags Survey for depth measurement
8	Nov. 13 (Sun)	Discussion within the team Preparing draft of minutes		
9	Nov. 14 (Mon)	Lv. Noro, Ar. Honiara		Survey for depth measurement

10	Nov. 15 (Tue)	Discussion with Noro Fishries Infrastructure Development Coordination Comittee			Site Survey
11	Nov. 16 (Wed)	Presentation of a draft of Minutes of Discussions Conclusion of the Minutes of Discussions Visit to Embassy of Japan			Site survey
12	Nov. 17 (Thu)	Mr. Ebisawa, Mr. Fujita, Mr. Sakurai, Mr. Hara, Mr. Yoshimi: Lv. Honiara QF-700 Ar. Sydney	Mr. Nakajima, Mr. Kaneko: Visit to Min. of Agriculture	Mr. Watanabe: Lv. Noro Ar. Honiara	Mr. Igarashi, Mr. Torii: Site survey
13	Nov. 18 (Fri)	Mr. Ebisawa, Mr. Fujita, Mr. Sakurai, Mr. Hara, Mr. Yoshimi: Lv. Sydney JL772 Ar. Narita	Mr. Nakajima, Mr. Kaneko, Mr. Watanabe: Visit to SIEA, MTWU Additional data collection		Mr. Igarashi, Mr. Torii: Survey for depth measurement
14	Nov. 19 (Sat)	Mr. Nakajima, Mr. Kaneko, Mr. Watanabe: Survey for construction condition			Mr. Igarashi, Mr. Torii Site survey
15	Nov. 20 (Sun)	Lv. Honiara, Ar. Noro Discussion within the team			Reduction of survey data
16	Nov. 21 (Mon)	Commencement of soil investigation and boring Discussion with the members of J.O.C.V.			Observation for tidal current
17	Nov. 22 (Tue)	Topographic survey			Observation for tidal current
18	Nov. 23 (Wed)	Mr. Watanabe, Mr. Kaneko, Mr. Torii: Lv. Noro, Ar. Honiara Courtesy call to Embassy of Japan			Mr. Nakajima, Mr. Igarashi: Visit to the Project relating facilities
19	Nov. 24 (Thu)	Lv. Honiara QF-700 Ar. Sydney			Reconnaisance for construction site

20	Nov. 25 (Fri)	Lv. Sydney JL-772 Ar. Narita	Reduction of survey data
21	Nov. 26 (Sat)		Mr. Nakajima, Mr. Igarashi Removal the observation station Lv. Noro, Ar. Honiara
22	Nov. 27 (Sun)		Reduction of survey data
23	Nov. 28 (Mon)	Mr. Nakajima, Mr. Igarahi Courtesy call to Embassy of Japan Discussion with the Project relating organizations Lv. Honiara QF-700 Ar. Sydney	
24	Nov. 29 (Tue)	Lv. Sydney JL-772 Ar. Narita	

(2) Draft Report Explanation

1	Feb. 12 (Sun)	Lv. Narita QF-080	
2	Feb. 13 (Mon)	Ar. Brisbane, Lv. Brisbane QF-701, Ar. Honiara Courtesy call to and discusstion with the Secretary, Min. of Economic Planning Visit to Embassy of Japan	
3	Feb. 14 (Tue)	Explanation of the draft report to Min. of Economic Planning, Min. of Natural Resources, Central Bank of Solomon Islands and other related organizations	
4	Feb. 15 (Wed)	Dr. Shimura, Mr. Fujita, Mr. Nakajima: Lv. Honiara PX-083 Ar. Port Moresby	Mr. Kaneko, Mr. Hara: Visit to Japanese Embassy for discussion
5	Feb. 16 (Thu)	Visits to Embassy of Japan and JICA Office for explanation of the Project	First Joint Meeting with Noro Fisheries Infrastructure Development Coordination Committee
6	Feb. 17 (Fri)	Lv. Port Moresby PX-084 Ar. Honiara	Additional data collection
		Discussion with Provincial Secretary, Western Province	
7	Feb. 18 (Sat)	Discussion within the Team	
8	Feb. 19 (Sun)	Reduction of data Preparing a draft minutes of discussions	
9	Feb. 20 (Mon)	Second Joint Meeting with Noro Fisheries Infrastructure Development Coordination Committee	Mr. Hara: Lv. Honiara QF-700 Ar. Sydney
10	Feb. 21 (Tue)	Third Joint Meeting with Noro Fisheries Infrastructure Development Coordination Committee Presentation of a draft Minutes of Discussions Signature of the Minutes of Discussions	Lv. Sydney JL-772 Ar. Narita
11	Feb. 22 (Wed)	Discussion within the Team Reduction of data	
12	Feb. 23 (Thu)	Lv. Honiara QF-700 Ar. Sydney	
13	Feb. 24 (Fri)	Lv. Sydney JL-772 Ar. Narita	

Appendix IV Discussants

(1) Field Survey

NAME	TITLE AND/OR ORGANIZATION
M. B. SIBISOPERE	Permanent Secretary Min. of Economic Planning
David ABBOTT	Project Economist Min. of Economic Planning
C. I. MACKAY	Under Secretary (Works) Min. of Transport, Works and Utilities
Ajmal I. HUSSAIN	Noro Project Coordinator Min. of Transport, Works and Utilities
James VAUKEI	General Manager Solomon Islands Ports Authority
T. BISMIRE	Chief Engineer Solomon Islands Ports Authority
Stephen DANITOFEA	Permanent Secretary Min. of Natural Resources
Sylvester DIKE	Principal Fisheries Officer (Research and Management) Min. of Natural Resources
Richard HAIST	UNDP Chief Technical Adviser (Energy) Min. of Natural Resources
Seth GUKUNA	Petroleum Supply Coordinator Min. of Natural Resources
Tabuo K. BOBAI	Provincial Secretary Western Province
Masashi IKENO	Charge d'Affaires a.i. of Japan in Solomon Islands

(2) Draft Report Explanation

NAME	TITLE AND/OR ORGANIZATION
M. B. SIBISOPERE	Permanent Secretary Min. of Economic Planning
David ABBOTT	Project Economist Min. of Economic Planning
C. I. MACKAY	Under Secretary (Works) Min. of Transport, Works and Utilities
Ajmal I. HUSSAIN	Noro Project Coordinator Min. of Transport, Works and Utilities
N. J. CONSTANTINE	Secretary Solomon Islands Ports Authority
J. KWALEMANU	Harbour Master Solomon Islands Ports Authority
T. BISMIRE	Chief Engineer Solomon Islands Ports Authority
Stephen DANITOFEA	Permanent Secretary Min. of Natural Resources
Albert WATA	Chief Fisheries Officer Min. of Natural Resources
Richard HAIST	UNDP Chief Technical Adviser (Energy) Min. of Natural Resources
Seth GUKUNA	Petroleum Supply Coordinator Min. of Natural Resources
Silverio WALEKA	Under Secretary Min. of Finance
Tabuo K. BOBAI	Provincial Secretary Western Province
Eric MASON	General Manager Investment Corporation of Solomon Islands
A. V. HUGHES	Governor Central Bank of Solomon Islands
Donald KUDA	Chief Physical Planner Min. of Agriculture and Lands
Hilary REFETA	Health Planning Officer Min. of Health and Medical Services

H. K. PAIA	Director Administrative Training Center Min. of Public Services
John BLOM	Adviser Administrative Training Center Min. of Public Services
Masashi IKENO	Charge d'Affaires a.i. of Japan in Solomon Islands
Masaaki NAKAMURA	Coordinator JOCV, Solomon Islands
Chusaku NOMURA	Ambassador Embassy of Japan Papua New Guinea
Osamu TAKASAWA	First Secretary Embassy of Japan Papua New Guinea
Toshio OKAZAKI	Resident Representative Papua New Guinea Office, JICA

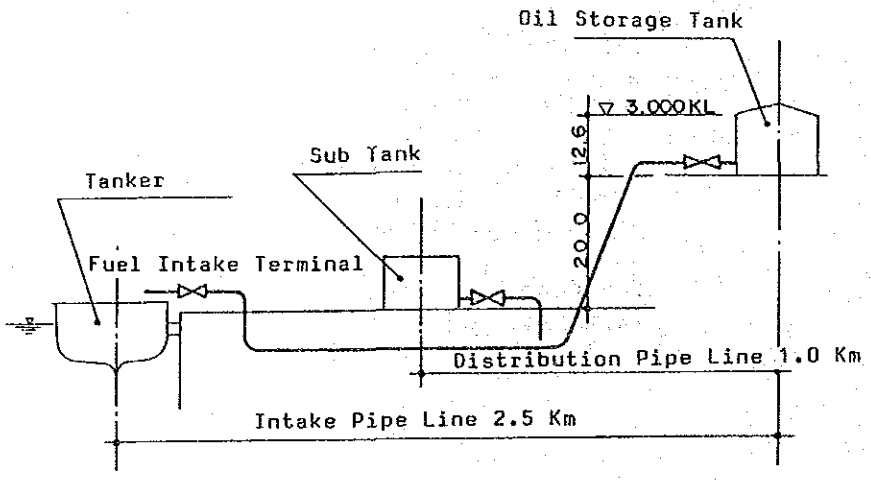
Appendix V-1 Pipe Diameter Calculation

1. Conditions

1.1 Fuel oil

Grade:	Marine diesel oil
Characteristics:	At the minimum design temperature of 18°C;
	Kinematic viscosity 15.0 cst
	Specific gravity 0.82

1.2 Delivery route



1.3 Delivery condition

(1) From an oil tanker to the storage tank:
by prime pump of the tanker having capacities of 1,400 kpa

(2) From the storage tank to distribution points:
by static pressure of liquid in the tank

2. Pipe Friction Loss and Required Pump Pressure

2.1 Pipe friction loss

Friction loss of the pipe has been determined on the basis of the following formula.

$$hf = \lambda \cdot \frac{I}{d} \cdot \frac{V^2}{2g}$$

Where,

hf : Pipe friction resistance

λ : Coefficient of skin friction
Determined by pipe wall roughness ε/d

l : Equivalent pipe length (m)

Actual length x 1.2, considering valves and bends.

d : Pipe diameter (m)

v : Flow velocity (m/sec)

g : Gravitational acceleration 9.8 (m/sec^2)

$Re = vd/\nu$

ν : Kinematic viscosity (m^2/sec) = 10^6cst

2.2 Required Pump Pressure

Required head $H = h_o + h_f + h_p$ (m)

where

h_o : Actual head (= 32.6m)

h_p : Pump suction head (= 5.0m)

Required pressure $p = H$ (kg/m^2)

where

γ : Specific weight Kgf/m^3

3. Delivery Volume Calculation

3.1 Oil delivery from a tanker to the storage tank

$\gamma = 820\ kgf/m^3$

$\nu = 15.0 \times 10^{-6} m^2/sec$

l = 2,500 (actual length) x 1.2 = 3,000m

Selecting the delivery volume G = 250 t/hr or 3,000 t/12hr, 4,500 t/18hr,
the oil delivery operation will be completed within 24 hours.

Calculation results

Dia.	Flow rate	Re	λ	hp	H	P	
	m/sec	$x10^4$		m	m	$x10^4 kg/m^2$	kPa
8B	2.72	3.62	0.0235	134	172	14.1	1380
10B	1.75	2.89	0.025	47.4	85.1	7.0	690

If the tanker pump pressure is less than 1,000 kPa, a pipe diameter of 10B is required. Since 1,400 kPa pump pressure is expected, we have concluded that the required oil delivery operation can be made with 8B pipe.

3.2 Natural flow from the storage tank to the service tank

$H' = 20m$ (Minimum difference of liquid level between the storage tank and the service tank)

$l = 1000 \times 1.2 = 1,200m$

With 6B pipe	With 8B pipe
$v = 1.28$ m/sec	$v = 1.55$ m/sec
$Re = 1.29 \times 10^4$	$Re = 2.07 \times 10^4$
$\lambda = 0.030$	$\lambda = 0.027$
$hp = 19.9m = 20m$	$hp = 19.9m = 20m$
Delivery Volume =67t/hr	Delivery Volume =142t/hr

As we have assumed that the filling time of a 400 kl service tank should be less than 8 hours (normal working hours), the required discharge volume becomes 400 kl / 8 hrs = 50 kl/hr.

Thus, the required volume can be delivered with a pipe of 6B diameter.

Appendix V-2 Refrigeration Load

1. Cold Storage Room

1.1 Conditions

a) Building size 26m x 16m x 5mH (V = 2080 m^3) x 2 rooms

b) Storage capacity 250 tons x 2 rooms

c) Room temperature tr = -25°C

d) Out-door temperature to = 33°C (Relative Humidity 80%)

e) Product temperature on entry ti = -15°C

f) Insulation Ceiling, Exterior wall: ribbed panel 150 mm thick
Floor: styro-foam 150 mm thick

Following load calculation is made for one room.

1.2 Transmission Load

(1) Ceiling

Horizontal solar radiation intensity $I = 900\ kcal/m^2.h$

Solar radiation absorptivity $\alpha = 0.7$

Out-side heat transfer rate $\alpha o = 20\ kcal/m^2.h.^oC$

Under the above conditions, we get the sol-air temperature te as follows.

$$te = to + \alpha . I/\alpha o$$
$$= 33 + 0.7 \times 900/20$$
$$= 64.5^oC$$

Inside heat transfer rate $\alpha i = 8\ kcal/m^2.h.^oC$

Heat conductivity of the insulation $X = 0.03\ kcal/m.h.^oC$

Insulation thickness $l = 0.15\ m$

The overall heat transfer rate U is calculated as follows.

$$\frac{1}{U} = \frac{1}{\alpha i} + \frac{1}{X} + \frac{1}{\alpha o}$$

$$= \frac{1}{8} + \frac{0.15}{0.03} + \frac{1}{20}$$

$$U = 0.193\ kcal/m^2.h.C$$

As the heat transfer area F = 26m x 16m = 416 m^2, we obtain the heat gain from the ceiling Qp1 as follows.

$$Qp1 = K.F.(te - tr)$$

$$= 0.193 \times 416 \times (64.5 + 25)$$

$$= 7,186 \text{ kcal/h}$$

(2) Exterior wall

Because of high solar direction in Solomon Islands, we neglect the influence of solar radiation to the vertical walls. The length facing to open air Lo = 26m + 16m x 2 = 58 m, and the length facing to processing & machine room Lm = 26 m. Assuming that temperatures of the processing room and machine room tm are both 30°C, we have the transmitting heat Qp2 from the walls as follows.

$$QP2 = K \times (Lo \times H) \times (to - tr) + K(Lm \times H) \times (tm - tr)$$
$$= 0.193\ (58 \times 5) \times (33 + 25) + 0.193\ (26 \times 5) \times (30 + 25)$$
$$= 4,626 \text{ kcal/h}$$

where H : Wall height (= 5m)

(3) Floor

The construction of the floor is as follows.

Material	Thickness (m)	Heat conductivity (kcal/m2.h.°C)
1. Upper concrete	0.15	1.3
2. Styro-foam	0.15	0.03
3. Base concrete	0.20	1.3

We specify crashed stone layer under the base concrete, through which ventilating pipes will be arranged. Assuming that ventilating air temperature tv = 5°C, and heat transfer rate of the floor surface Xi = 8 kcal/m^2.h.°C, the overall heat transfer rate U becomes as follows.

$$\frac{I}{U} = \frac{I}{\alpha i} + \frac{l1}{\lambda 1} + \frac{l2}{\lambda 2} + \frac{l3}{\lambda 2}$$

$$\frac{I}{U} = \frac{I}{8} + \frac{0.1}{1.3} + \frac{0.15}{0.03} + \frac{0.2}{1.3}$$

$$U = 0.187 \text{ kcal/m}^2.\text{h.}^\circ\text{C}$$

The transmitting heat from the floor Qp3 is therefore

$$Qp3 = K.F.(Tr - tr)$$
$$= 0.187 \times (26 \times 16) \times (5 + 25)$$
$$= 2,334 \text{ kcal/h}$$

Thus, the total heat gain QP arrives at

$$Qp = Qp1 + Qp2 + Qp3$$
$$= 7,186 + 4,626 + 2,334$$
$$= 14,146 \text{ kcal/h}$$

1.3 Infiltration Air Load

We assume that air exchange rate between indoor and outdoor air is twice a day.

o enthalpy of infiltration air ho = 23.7 kcal/kg (33°C DB, 80% RH)

o enthalpy of refrigerated air hr = -6.0 kcal/kg (-25°C DB)

o specific volume of refrigerated air ν = 0.709 m^3/kg

The heat gain by infiltration Qv is therefore

$$Qv = V \times 2 \times \frac{1}{\nu} \times (ho - hr)/24$$

$$= 2080 \times 2 \times \frac{1}{0.709} (23.7 + 6)/24$$

$$= 7,261 \text{ kcal/h}$$

where V : total air volume in the cold storage room (= 2,080 m^3)

1.4 Product load

Assuming that the amount of products taken into the warehouse is 5% of full storage capacity per day, product temperature on entry ti is -15°C, and specific heat of the product Cp = 0.4 kcal/kg.°C, we obtain heat gain by cooling products Qpr as follows.

$$Qpr = 250 \text{ tons} \times 1,000 \text{ kgs/ton} \times 0.05 \times (ti - tr) \times Cp/24$$

$$Qpr = 250 \times 1,000 \times 0.05 \times (-15 + 25) \times 0.4/24$$
$$= 2,083 \text{ kcal/h}$$

1.5 Internal Load

(1) lights 100W x 15 pcs x 0.86 kcal/w.h x 3h/24h = 161 kcal/h

(2) fans 1.5 kw x 2 units x 860 kcal/kw.h = 2,580 "

(3) workers 2 persons x 300 kcal/h.persons x 3h/24h = 75 "

(4) forklifts 5 kw x 2 x 860 kcal/kw.h = 1,075 "

(5) floor mounted heater 0.5 kw x 860 kcal/kw.h x 8h/24h = 143 "

The sum of above heat generation Qi is therefore;

Qi = 4,034 kcal/h

1.6 Total Refrigeration Load

Taking 10% safety factor into account, the total cooling load Q comes to:

Q = (QP + Qv + Qpr + Qi) x 1.1
= (14,146 + 7,261 + 2,083 + 4,034) x 1.1
= 30,276
= 30,300 kcal/h

2. Quick Freezer

2.1 Conditions

a) Room size : 7.5m x 4m x 5mH (V = 150m^3) x 2 rooms
b) product mass to be frozen : 3 tons x 2 freezing units
c) Freezing time: 18 hours
d) Final temperature of the product tt = -25°C
e) Initial temperature of the product ti = 10°C
f) Room temperature tr = -35°C
g) Freezing temperature tf = -2°C
h) Latent heat of fusion L = 57 kcal/kg
i) Specific heat above freezing Cpl = 0.82 kcal/kg.^{o}C
below freezing Cps = 0.4 "

Following calculation is made for one room.

2.2 Transmission Load

(1) Ceiling

With similar manner as in the case of cold storage room, we have estimated transmitting heat Qp1 as follows.

Qp1 = K.F.(te - tr)
= 0.193 x (7.5 x 4) x (64.5 + 35)
= 576 kcal/h

(2) Walls (processing room & machine room side)

Temperature in processing room and machine room tm is assumed to be 30°C, and heat transfer area F = 7.5m x 5m x 2 = 75 m^2, transmitting heat from the walls is therefore;

Qp2 = K.F.(tm - tr)
= 0.193 x 75 x (30 + 35)
= 941 kcal/h

(3) Walls (cold storage room side)

Heat transfer area F = 4m x 5m = 20 m^2, and warehouse room temperature tr' = -25°C, we obtain transmitting heat Qp3 as follows.

$$Qp3 = K.F.(tr' - tr)$$
$$= 0.193 \times 20 \times (-25 + 35)$$
$$= 39 \text{ kcal/h}$$

(4) Floor

As similar manner to cold storage room, we have

$$Qp4 = K.F.(tv - tr)$$
$$= 0.187 \times (7.5 \times 4) \times (5 + 35)$$
$$= 224 \text{ kcal/h}$$

Thus, total transmitting heat Qp is as follows.

$$Qp = Qp1 + Qp2 + Qp3 + Qp4$$
$$= 1,780 \text{ kcal/h}$$

2.3 Product Load

(1) Prior to freezing

$$Qf1 = 3,000 \text{ kg} \times (ti - tf) \times Cpl/18$$
$$= 3,000 \times (10 + 2) \times 0.82/18$$
$$= 1,640 \text{ kcal/h}$$

(2) Freezing latent heat

$$Qf2 = 3,000 \text{ kg} \times L/18$$
$$= 3,000 \times 57/18$$
$$= 9,500 \text{ kcal/h}$$

(3) After freezing

$$Qf3 = 3,000 \text{ kg} \times (tf - tt) \times Cps/18$$
$$= 3,000 \times (-2 + 25) \times 0.46/18$$
$$= 1,763 \text{ kcal/h}$$

Total product load Qp is threfore;

$$Qf = Qf1 + Qf2 + Qf3$$
$$= 12,903 \text{ kcal/h}$$

2.4 Internal Load

There are three 2.2 kw fans. These fans generate heat as shown below.

$$Qa = 2.2 \text{ kw} \times 3 \times 860 \text{ kcal/kw.h}$$
$$= 5,680 \text{ kcal/h}$$

2.5 Total Refrigeration Load

Allowing 10% safety factor, the total cooling load Q becomes as follows.

$$
\begin{aligned}
Q &= (Qp + Qf + Qa) \times 1.1 \\
&= (1,780 + 12,903 + 5,680) \times 1.1 \\
&= 22,400 \text{ kcal/h}
\end{aligned}
$$

V-3 MUNDA MONTHLY MAXIMUM WIND (KTS)

1968-1987

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1968	W/45	W/20	SE/10	SW/25	SE/07	SE/12	SE/16	SE/20	SE/12	SE/13	SE/16	W/14
1969	NW/30	NW/15	WNW/09	N/A	W/17	SE/17	SE/12	SE/14	SE/13	E/10	SE/12	W/12
1970	W/18	W/12	SE/10	SE/15	SE/10	SE/14	SW/15	S/10	S/14	S/10	NE/10	W/14
1971	W/14	W/10	W/14	ESE/10	SE/10	SW/10	NE/10	SE/12	E/14	NE/12	NW/12	W/18
1972	NW/25	SW/14	WSW/13	NE/12	SE/18	W/30	SE/16	SE/14	WSW/17	WSW/13	SE/11	W/18
1973	W/12	SW/16	WSW/14	S/10	SE/10	S/13	SE/12	SE/12	SE/10	SE/12	NW/10	NW/18
1974	W/14	W/24	SW/16	NW/40	SE/08	SE/09	SE/12	SSW/12	SE/14	NNE/08	SW/16	WSW/10
1975	WSW/16	N/08	W/12	SE/10	NE/10	SW/18	SE/14	ESE/14	ESE/14	NE/16	WSW/22	NE/12
1976	NW/24	W/26	SW/12	SW/12	SE/08	SE/08	W/15	SW/16	SSW/10	E/09	NNE/06	SW/12
1977	W/25	NNE/12	SE/22	SW/30	SE/08	SSE/08	SE/10	SSW/20	SE/14	SE/15	NE/12	W/12
1978	SW/25	W/25	SE/06	WSW/18	NNE/09	SE/08	SE/20	E/20	SE/22	SE/12	SE/10	SW/25
1979	SW/24	N/08	SW/15	WSW/14	SE/08	S/10	SE/20	SE/15	SE/12	E/08	SE/18	SW/14
1980	W/10	SW/12	W/14	SW/10	E/08	SE/15	SE/15	E/15	E/12	SE/14	SE/18	W/12
1981	NE/15	SW/16	SW/20	E/06	E/07	E/09	SE/15	E/10	SE/20	N/10	SW/12	SW/25
1982	W/12	SW/14	W/10	WSW/36	ESE/14	S/14	S/28	S/14	E/14	SSW/18	SE/13	N/07
1983	SW/13	SW/15	SE/12	E/10	NW/10	ESE/15	SE/15	ESE/13	E/12	E/08	SW/10	N/A
1984	NW/10	N/12	SW/13	NW/10	SE/09	ESE/10	SE/14	S/12	SE/12	ESE/16	N/15	SSE/18
1985	W/30	WSW/35	W/30	N/07	NW/08	SE/08	E/08	E/12	ENE/08	E/10	W/08	W/10
1986	SSW/20	N/A	N/08	WSW/15	SW/25	SE/07	E/15	ESE/12	E/12	ESE/09	S/08	SW/20
1987	NE/08	W/18	W/08	E/10	ESE/12	ESE/12	E/10	SE/15	E/12	ESE/18	E/14	W/20

V-4 MUNDA MONTHLY TOTAL RAINFALL(MM) AND RAINDAYS

1968-1987

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1968	515.3	487.8	261.5	256.8	199.5	288.3	249.0	173.5	252.5	185.3	274.3	272.5	3416.3
	25	25	24	17	17	18	26	16	17	20	22	22	249
1969	478.3	562.3	123.8	222.8	179.0	172.3	339.8	455.0	385.3	217.5	151.5	458.3	3745.9
	25	25	19	26	18	19	24	27	24	21	17	25	270
1970	284.8	331.5	365.3	361.0	250.8	136.5	254.0	299.5	243.8	248.8	165.8	396.8	3338.6
	23	16	24	18	21	19	21	20	19	21	22	21	245
1971	374.3	121.5	426.0	283.0	248.0	131.3	316.0	194.3	190.8	199.5	162.2	526.0	3172.9
	21	15	24	23	22	14	19	23	21	20	16	29	247
1972	670.0	172.8	527.5	419.0	500.3	218.3	388.0	192.8	402.0	158.8	166.3	84.0	3899.8
	24	15	25	21	26	18	27	14	12	11	13	15	221
1973	277.5	429.3	317.8	331.3	145.3	211.3	268.3	236.0	298.0	205.8	200.8	271.2	3192.6
	20	21	22	23	21	21	23	23	21	23	16	21	255
1974	124.8	316.6	261.2	249.0	197.3	294.0	192.2	261.3	164.6	247.2	241.6	182.8	2732.6
	14	23	21	18	16	24	24	19	21	25	24	15	244
1975	412.8	308.6	501.4	295.6	211.0	131.1	173.3	267.0	291.8	261.2	369.2	401.8	3624.8
	26	23	25	22	25	18	24	26	20	19	27	26	283
1976	644.6	534.6	305.2	583.7	340.0	169.4	357.6	337.4	80.2	210.0	181.0	331.4	4075.1
	24	25	23	21	22	21	26	21	10	19	16	23	251
1977	885.2	271.7	463.2	309.4	285.8	205.7	406.4	420.7	295.6	208.8	82.3	143.6	3978.4
	24	21	20	24	20	23	19	26	25	21	11	13	247
1978	212.8	597.0	158.0	232.0	329.0	229.0	139.8	495.2	241.4	86.4	319.2	320.2	3360.0
	20	22	21	20	24	18	21	26	22	9	20	17	240
1979	729.2	452.0	432.0	235.6	240.4	262.2	358.4	183.8	226.8	239.6	351.4	180.8	3892.2
	20	22	25	25	19	18	15	16	15	21	18	15	229
1980	381.4	543.0	383.8	72.2	312.8	243.6	349.0	340.4	738.2	135.4	282.8	340.6	4123.2
	23	22	26	16	23	23	27	24	22	16	23	21	266
1981	352.6	618.6	129.2	213.6	113.8	247.8	543.6	107.6	298.8	201.6	180.4	450.8	3449.4
	28	25	12	18	19	24	27	18	26	23	19	22	261
1982	266.6	296.7	297.2	630.4	264.8	212.8	650.5	241.2	66.9	509.4	81.8	164.8	3683.1
	22	24	24	20	21	18	21	20	11	18	11	16	226
1983	371.5	407.0	199.9	194.2	280.4	257.0	164.6	86.0	362.2	240.7	331.0	258.8	3153.3
	20	22	17	19	22	22	20	17	19	25	26	23	252
1984	136.0	184.0	342.4	209.6	221.2	312.2	231.6	153.4	224.4	279.7	242.2	306.2	2842.9
	23	21	20	22	29	25	25	17	20	26	19	21	268
1985	346.4	291.6	902.0	214.6	198.8	96.6	172.2	467.8	115.8	195.2	143.2	172.6	3316.8
	24	19	22	23	21	19	23	26	23	20	17	22	259
1986	333.1	269.6	222.4	433.2	219.4	180.2	203.0	124.4	231.4	154.6	180.8	342.2	2894.3
	21	22	22	22	17	19	16	15	17	14	17	20	222
1987	124.6	650.3	420.4	108.6	183.6	30.2	138.8	23.6	95.6	224.0	249.4	344.7	2593.8
	14	27	24	15	21	12	19	9	16	23	20	22	222
AVE	396.1	392.4	352.0	292.8	246.1	201.5	294.8	253.0	260.3	220.5	217.9	297.5	3424.3
	22.1	21.8	22.0	20.7	21.2	19.7	22.4	20.1	19.1	19.8	18.7	20.5	248.1

V-5 MUNDA MONTHLY AVERAGE MAXIMUM AND MINIMUM TEMPERATURE(℃)
1967-1987

YEAR		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	AVE
	MAX	30.9	30.3	31.6	30.0	30.7	30.6	28.6	29.0	30.0	30.4	31.1	30.6	3,638	30.3
1968	MIN	23.5	23.4	23.6	23.2	23.1	22.8	23.1	23.2	23.2	23.9	23.2	22.1	2,783	23.2
	MAX	30.8	30.4	30.6	30.5	30.7	30.7	30.5	29.2	30.0	30.4	29.5	30.5	3,638	30.3
1969	MIN	23.6	24.0	24.3	24.3	23.9	23.6	23.4	23.3	23.4	23.4	23.9	24.1	2,852	23.8
	MAX	31.3	30.6	32.3	32.7	30.2	30.1	29.7	30.3	30.4	30.8	30.4	30.8	3,696	30.8
1970	MIN	23.7	24.3	24.3	24.2	23.9	23.7	22.6	22.9	21.9	23.4	23.2	23.6	2,817	23.5
	MAX	30.5	30.3	29.9	30.1	30.5	30.8	29.8	30.6	30.6	30.9	32.2	30.2	3,664	30.5
1971	MIN	23.3	23.1	23.0	23.1	23.0	22.2	22.4	22.6	23.1	23.1	23.1	23.5	2,755	23.0
	MAX	29.4	29.7	27.3	29.1	30.0	29.6	29.1	30.4	28.0	30.1	31.0	30.7	3,544	29.5
1972	MIN	22.9	23.3	23.1	21.7	23.8	21.8	23.1	21.6	22.5	22.2	23.6	24.5	2,741	22.8
	MAX	31.4	30.3	31.0	31.4	30.9	30.4	29.5	29.6	30.2	30.7	31.6	31.8	3,688	30.7
1973	MIN	23.7	24.1	24.8	23.8	23.6	23.3	23.3	23.4	23.2	23.1	23.6	23.9	2,838	23.7
	MAX	31.1	30.7	31.0	31.4	30.6	30.3	30.5	30.3	31.1	31.5	31.2	30.7	3,704	30.9
1974	MIN	23.0	21.3	23.1	23.2	23.1	23.0	23.2	23.3	23.5	23.4	24.1	23.4	2,776	23.1
	MAX	30.1	31.1	30.4	31.1	30.8	31.0	30.3	29.7	30.9	30.7	30.5	30.7	3,673	30.6
1975	MIN	24.2	23.6	23.6	23.5	23.3	23.4	23.3	23.0	23.9	22.9	23.4	23.4	2,815	23.5
	MAX	29.6	29.5	28.6	30.3	30.9	30.3	29.3	29.2	29.8	30.9	31.8	30.9	3,611	30.1
1976	MIN	23.7	23.4	23.8	23.4	22.9	22.9	23.4	23.0	23.5	23.9	23.8	24.0	2,817	23.5
	MAX	30.2	31.3	30.6	31.1	30.6	29.9	29.8	29.6	29.8	30.4	30.4	31.5	3,652	30.4
1977	MIN	24.1	24.1	24.0	24.1	24.0	23.7	23.8	23.6	22.9	25.4	24.3	24.5	2,885	24.0
	MAX	31.2	30.2	31.3	30.8	31.1	30.8	30.0	29.5	30.0	30.3	31.1	31.3	3,676	30.6
1978	MIN	24.8	24.3	24.3	24.1	24.1	23.2	23.5	24.0	22.6	25.0	24.1	23.8	2,878	24.0
	MAX	30.3	30.3	30.8	31.8	30.6	30.2	29.3	29.1	29.7	30.2	31.0	30.7	3,640	30.3
1979	MIN	24.4	24.1	24.1	24.5	24.3	24.4	24.2	24.1	23.5	23.4	24.3	24.2	2,895	24.1
	MAX	30.8	30.2	30.4	30.5	30.0	29.5	28.9	29.3	29.0	30.3	30.9	31.4	3,612	30.1
1980	MIN	24.2	24.1	24.1	24.5	24.3	24.4	24.2	24.1	23.5	23.4	24.3	24.2	2,893	24.1
	MAX	29.1	29.7	31.3	31.3	31.2	31.2	29.7	29.7	30.1	31.1	31.5	31.0	3,669	30.6
1981	MIN	24.6	24.2	24.4	24.3	24.6	23.9	23.0	23.0	22.8	22.4	22.1	24.2	2,835	23.6
	MAX	31.5	30.5	30.5	30.3	30.1	30.0	29.0	29.0	31.0	29.0	29.8	31.5	3,622	30.2
1982	MIN	24.5	24.3	24.5	24.1	24.4	23.9	23.0	23.0	22.8	22.4	23.1	24.2	2,842	23.7
	MAX	30.7	31.6	29.2	31.0	30.6	29.8	28.9	29.2	29.5	30.5	30.9	30.1	3,620	30.2
1983	MIN	24.9	24.3	24.5	24.3	24.3	24.2	23.8	24.1	24.2	24.1	24.1	23.7	2,905	24.2
	MAX	31.5	32.0	31.0	31.0	30.2	29.6	29.1	29.7	30.0	30.5	30.7	31.3	3,666	30.6
1984	MIN	23.9	24.1	24.1	24.2	24.0	23.7	23.8	23.3	23.6	23.8	23.9	24.5	2,869	23.9
	MAX	31.0	30.8	30.1	30.9	30.9	30.4	29.9	29.5	30.5	31.1	30.8	31.5	3,674	30.6
1985	MIN	24.0	23.3	23.7	24.0	24.1	23.7	23.4	23.5	22.8	23.9	23.4	23.0	2,828	23.6
	MAX	29.2	31.2	30.0	30.6	30.1	29.5	28.4	30.1	30.9	30.7	30.8	31.6	3,631	30.3
1986	MIN	23.6	24.1	23.0	24.5	24.2	23.3	21.4	23.5	24.0	24.1	23.5	23.5	2,827	23.6
	MAX	31.6	29.8	30.3	30.8	29.0	30.0	29.0	29.2	30.3	30.2	31.0	33.0	3,642	30.4
1987	MIN	23.4	24.2	23.9	23.9	24.0	23.8	24.5	23.6	22.9	24.4	24.7	23.1	2,864	23.9
	MAX	6,122	6,105	6,082	6,167	6,097	6,047	5,893	5,922	6,018	6,107	6,182	6,218	72,960	
T.	MIN	4,780	4,756	4,782	4,769	4,769	4,689	4,664	4,661	4,638	4,716	4,737	4,754	56,715	
	MAX	30.6	30.5	30.4	30.8	30.5	30.5	29.5	29.6	30.1	30.5	30.9	31.1		30.4
AVE	MIN	23.9	23.8	23.9	23.8	23.8	23.4	23.3	23.3	23.2	23.6	23.7	23.8		23.7

V-6 MUNDA MONTHLY AVERAGE HUMIDITY

UNIT:PERCENT

1968-1987

2PM

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	AVE
1968	77	76	75	72	75	77	80	82	79	77	74	75	919	76.6
1969	75	79	77	77	75	78	76	81	81	77	79	77	932	77.7
1970	76	75	79	78	78	77	82	74	75	76	80	79	929	77.4
1971	80	74	77	78	78	72	75	75	72	78	74	79	912	76.0
1972	78	71	78	78	80	79	80	78	74	77	78	73	924	77.0
1973	79	81	78	77	70	79	78	73	78	71	77	77	918	76.5
1974	72	79	74	75	76	76	75	73	72	74	73	73	892	74.3
1975	79	76	74	76	81	73	75	76	73	77	71	79	910	75.8
1976	81	79	80	76	76	77	77	79	73	76	75	78	927	77.3
1977	79	76	77	78	77	77	80	79	79	70	76	72	920	76.7
1978	75	79	77	77	76	77	74	75	77	76	73	72	908	75.7
1979	76	80	76	78	78	78	76	75	73	70	76	76	912	76.0
1980	83	78	80	72	75	77	81	78	81	78	77	78	938	78.2
1981	78	82	76	75	73	73	79	75	77	75	76	75	914	76.2
1982	77	78	70	80	78	74	80	78	71	76	75	74	911	75.9
1983	77	80	79	77	79	78	78	77	75	78	72	76	926	77.2
1984	71	69	78	76	77	77	79	73	73	78	78	75	904	75.3
1985	74	76	75	78	74	74	74	74	75	74	75	75	898	74.8
1986	76	N/A	74	79	75	76	73	74	79	70	80	70	826	75.1
1987	66	74	79	73	78	76	74	66	66	76	66	74	868	72.3
TOTAL	1,529	1,462	1,533	1,530	1,529	1,525	1,546	1,515	1,503	1,504	1,505	1,507	18,188	
AVE	76.5	76.9	76.7	76.5	76.5	76.3	77.3	75.8	75.2	75.2	75.3	75.4		76.1

8AM

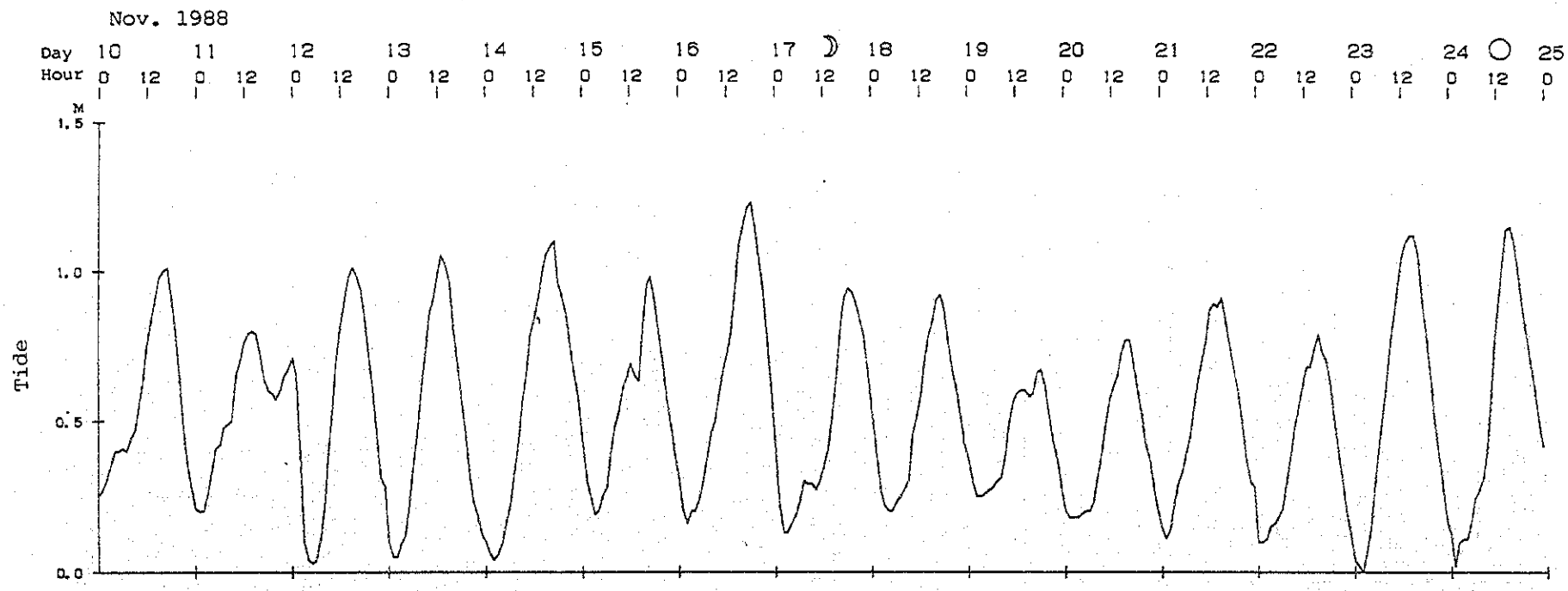
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	AVE
1968	92	92	93	89	92	94	93	N/A	N/A	N/A	86	88	819	91.0
1969	91	91	92	91	89	90	92	91	92	89	85	89	1,082	90.2
1970	89	91	93	89	93	93	94	94	91	88	86	89	1,090	90.8
1971	93	92	94	94	92	92	94	93	90	87	84	86	1.091	90.9
1972	92	89	90	92	91	90	89	74	86	85	85	75	1,038	86.5
1973	81	82	95	92	91	92	91	91	90	76	86	84	1,051	87.6
1974	88	91	92	89	91	92	91	90	88	86	88	87	1,073	89.4
1975	89	92	93	91	91	91	90	91	90	87	84	88	1,077	90.0
1976	89	92	92	91	89	93	92	89	84	87	86	83	1,067	88.9
1977	90	92	89	91	89	92	92	92	88	88	85	85	1,073	89.4
1978	85	93	90	88	88	89	88	88	87	81	89	86	1,052	87.7
1979	90	93	89	89	89	91	88	84	83	86	86	87	1,055	87.9
1980	93	93	89	88	90	87	90	88	88	83	84	87	1,060	88.3
1981	91	93	83	89	87	90	90	87	87	87	83	86	1,053	87.8
1982	88	88	92	92	90	88	91	86	88	88	87	87	1,065	88.8
1983	87	N/A	92	92	92	92	88	88	88	88	87	87	981	89.2
1984	87	87	92	91	90	92	89	89	90	87	85	84	1,063	88.6
1985	89	90	90	90	91	91	91	92	90	86	90	94	1,084	90.3
1986	89	N/A	90	84	92	92	87	87	89	84	81	83	958	87.1
1987	84	92	92	87	89	85	90	79	84	86	83	85	1,036	86.3
TOTAL	1,777	1,633	1,822	1,799	1,806	1,816	1,810	1,673	1,675	1,629	1,710	1,720	20,868	
AVE	88.9	90.7	91.1	90.0	90.3	90.8	90.5	88.1	88.2	85.7	85.5	86.0		88.8

V-7 HOURLY TIDAL OBSERVATIONS

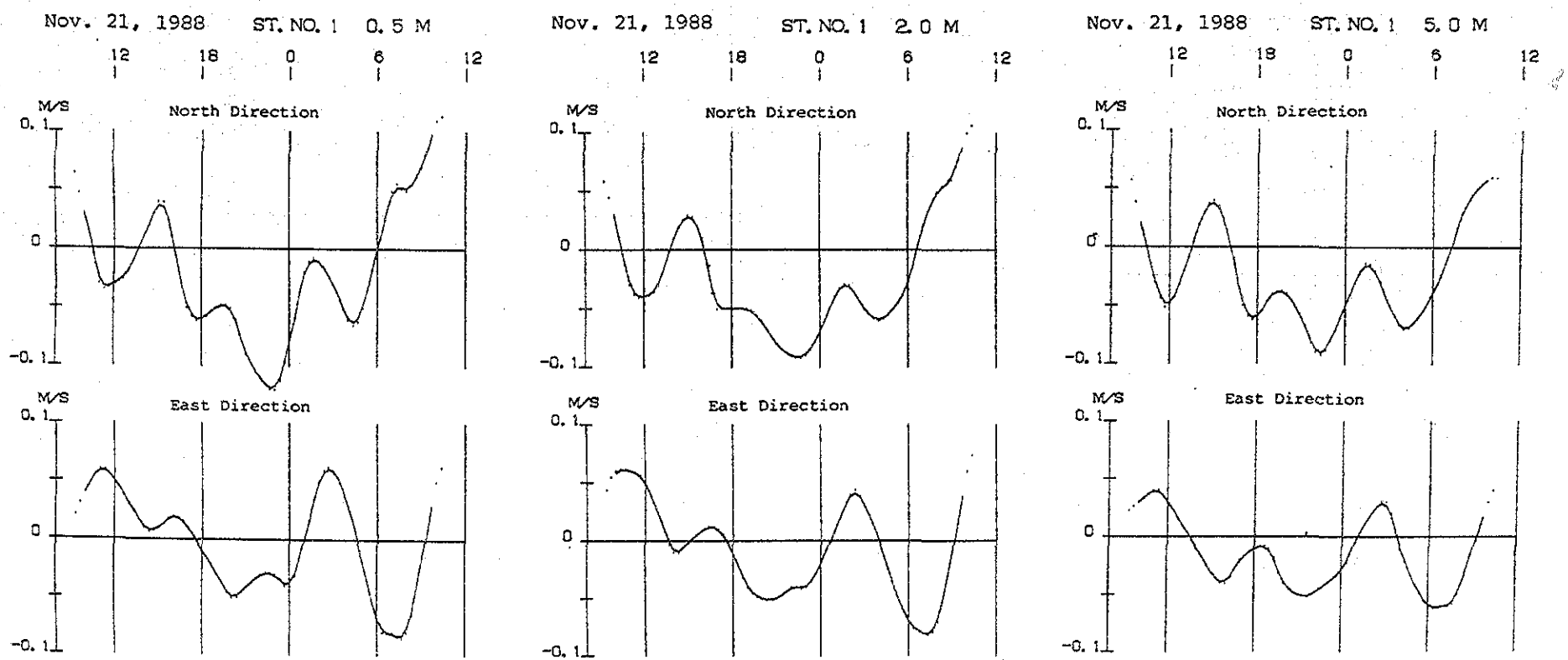
10-24, NOV.1988

UNIT : CENTIMETER

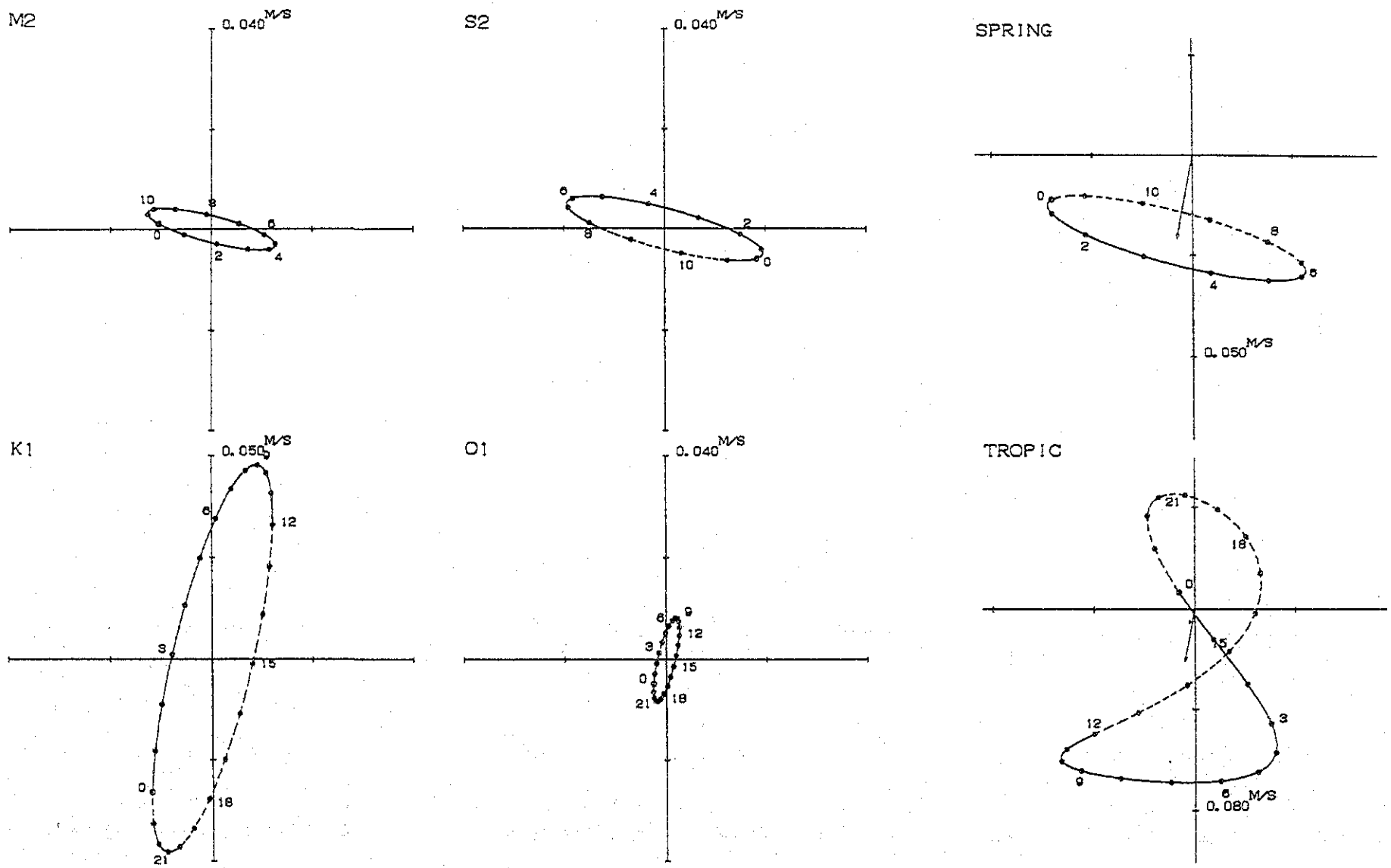
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	TOTAL
0	25	27	30	35	40	40	41	40	44	47	55	63	75	83	91	98	100	101	92	80	66	48	35	28	1,384
1	21	20	20	26	33	41	42	48	49	50	65	70	76	79	80	79	72	64	60	59	57	60	65	67	1,303
2	71	65	39	10	4	3	4	11	22	40	55	71	82	90	98	101	98	94	84	72	60	45	31	28	1,278
3	10	5	5	9	12	23	35	46	60	72	86	90	99	105	102	96	81	69	56	46	31	23	18	12	1,191
4	10	6	4	6	10	16	22	33	42	56	64	78	84	90	99	105	108	110	96	91	85	75	65	58	1,413
5	44	30	25	19	20	25	28	39	48	53	60	64	69	65	63	80	95	98	90	79	70	57	48	39	1,308
6	30	20	16	20	20	24	30	38	46	50	59	67	72	80	93	109	115	121	123	115	104	93	78	60	1,583
7	40	22	13	13	16	19	23	30	29	29	27	30	35	41	51	63	78	90	94	93	89	84	78	65	1,152
8	53	40	27	22	20	20	23	25	27	30	45	51	58	69	78	83	90	92	87	76	66	60	51	42	1,235
9	37	29	25	25	26	27	28	30	31	39	49	56	59	60	60	58	59	66	67	61	52	43	37	28	1,052
10	20	18	18	18	19	20	20	23	32	39	49	57	61	65	72	77	77	70	60	53	42	37	28	20	995
11	14	11	14	22	29	33	39	45	54	63	70	76	87	89	88	91	84	75	67	60	50	38	30	28	1,257
12	10	10	11	15	16	18	21	30	38	48	54	61	68	68	74	79	73	70	63	50	39	30	19	13	978
13	4	2	0	7	15	29	42	52	63	77	85	96	105	110	112	112	106	90	79	65	50	39	27	17	1,384
14	12	2	10	11	11	17	24	27	31	40	57	77	89	103	114	115	110	100	88	80	70	61	51	42	1,342
T.	401	307	257	258	291	355	422	517	616	733	880	1007	1119	1197	1275	1346	1346	1310	1206	1080	931	793	661	547	18855



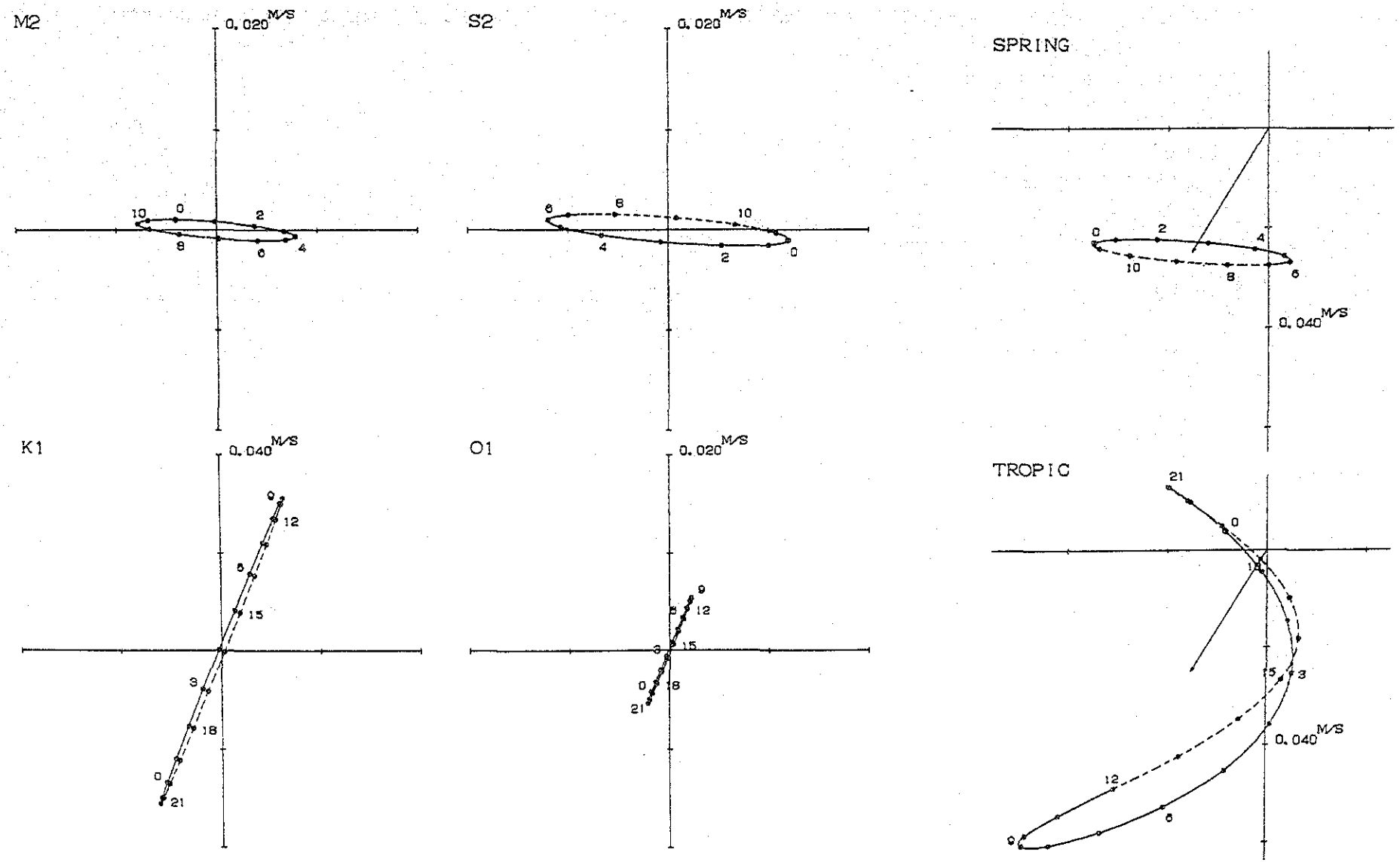
V-8 Curves for Harmonic Constants



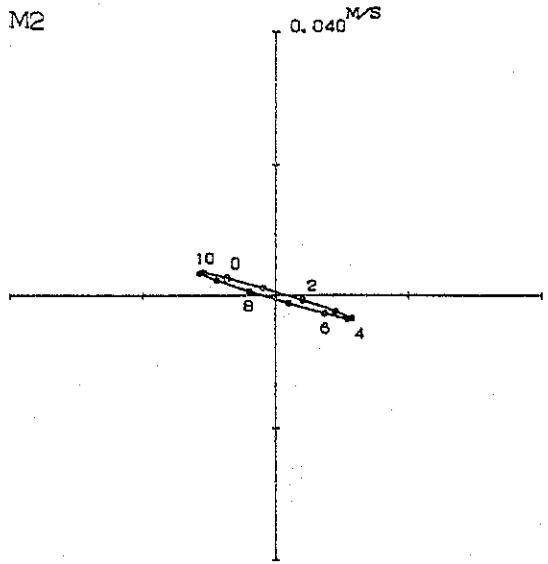
V-9 Curves for Sub-current Speed

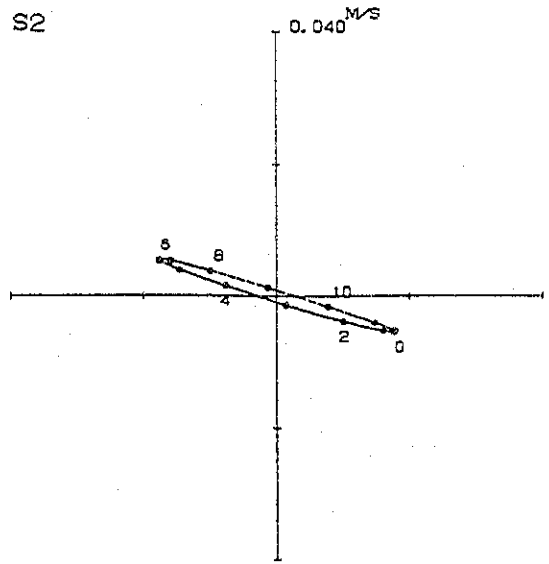


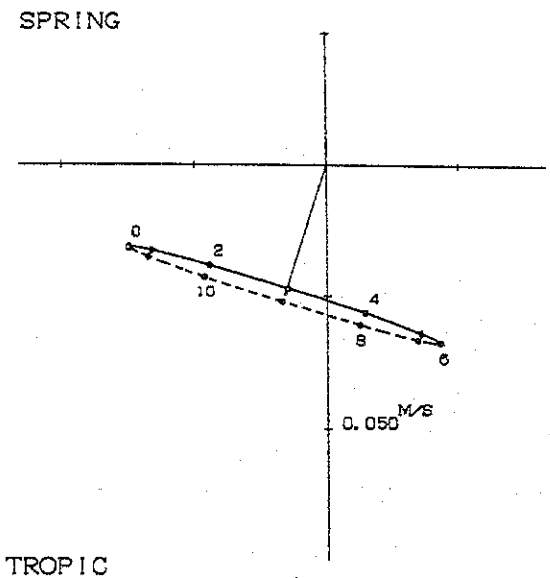
V-10 Elliptical Chart for Tidal Currents NO. 1 0.5M Observed on Nov. 21 - 22, 1988

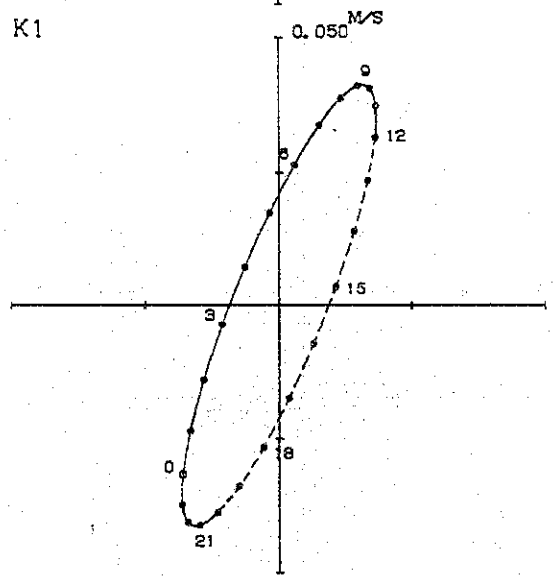


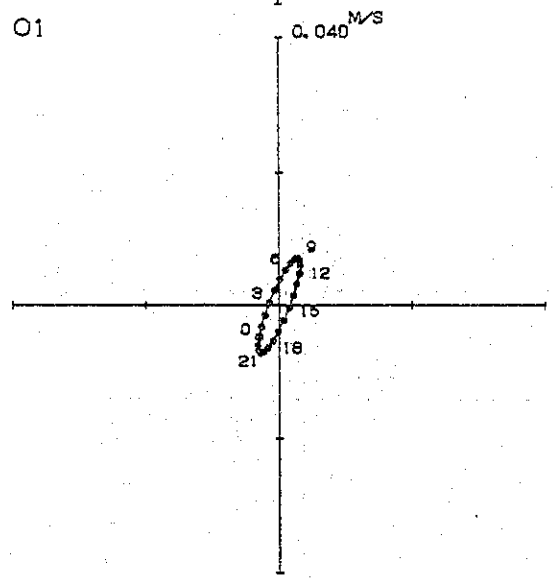
Elliptical Chart for Tidal Currents NO. 1 5.0M Observed on Nov. 21 - 22, 1988

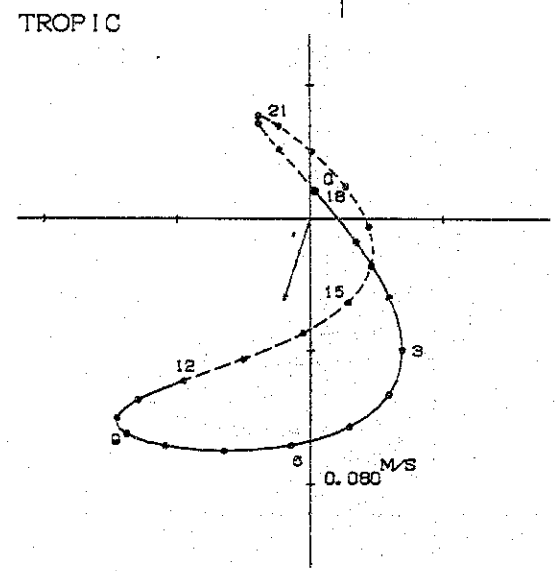






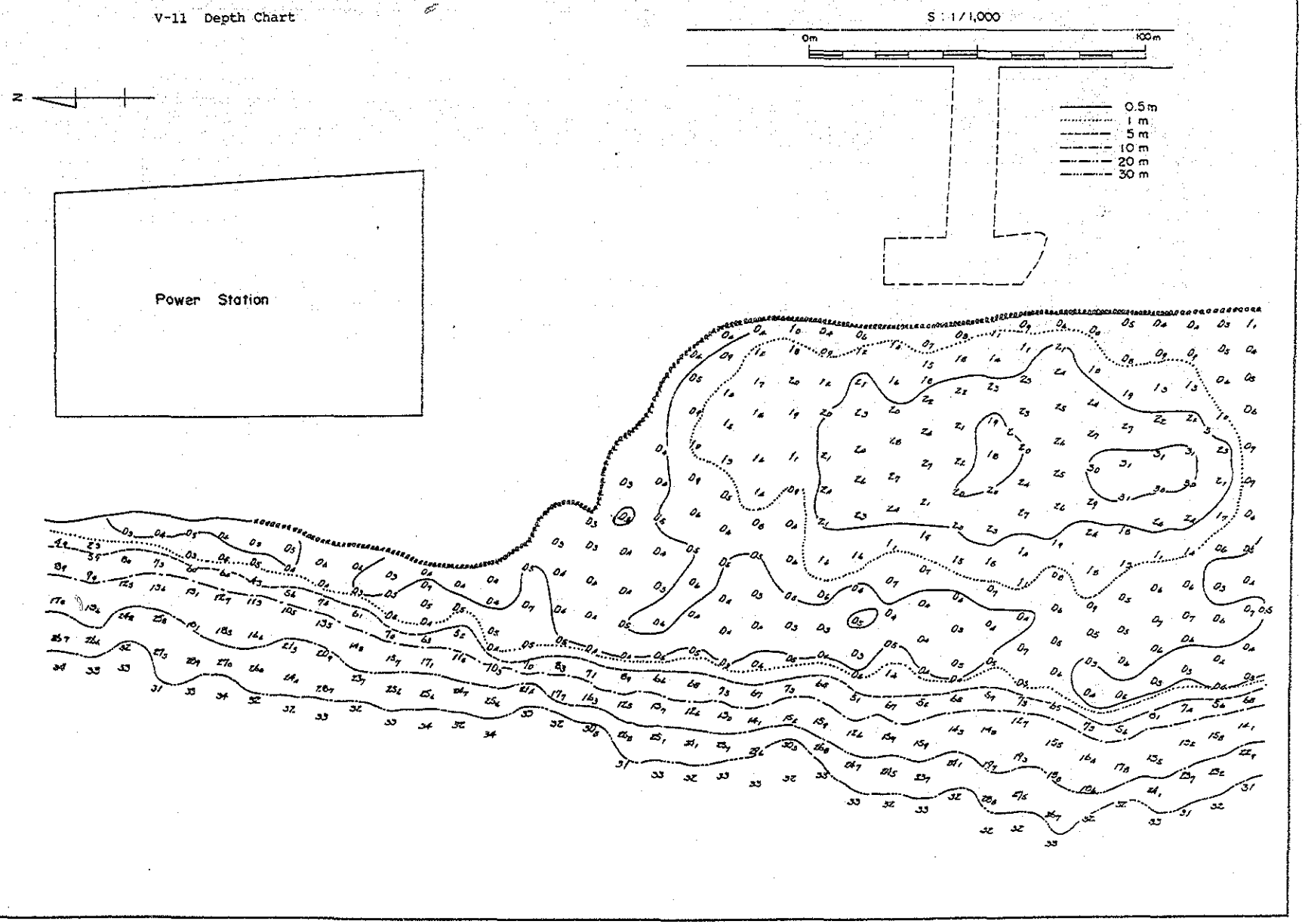




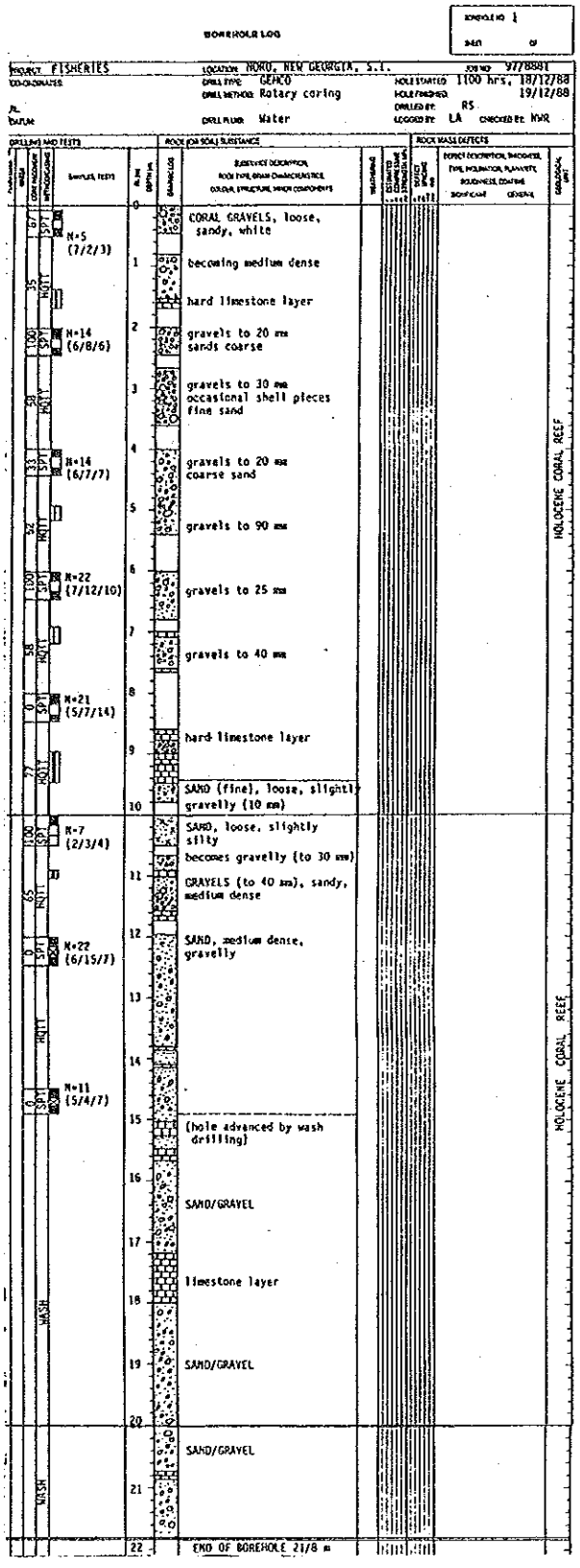


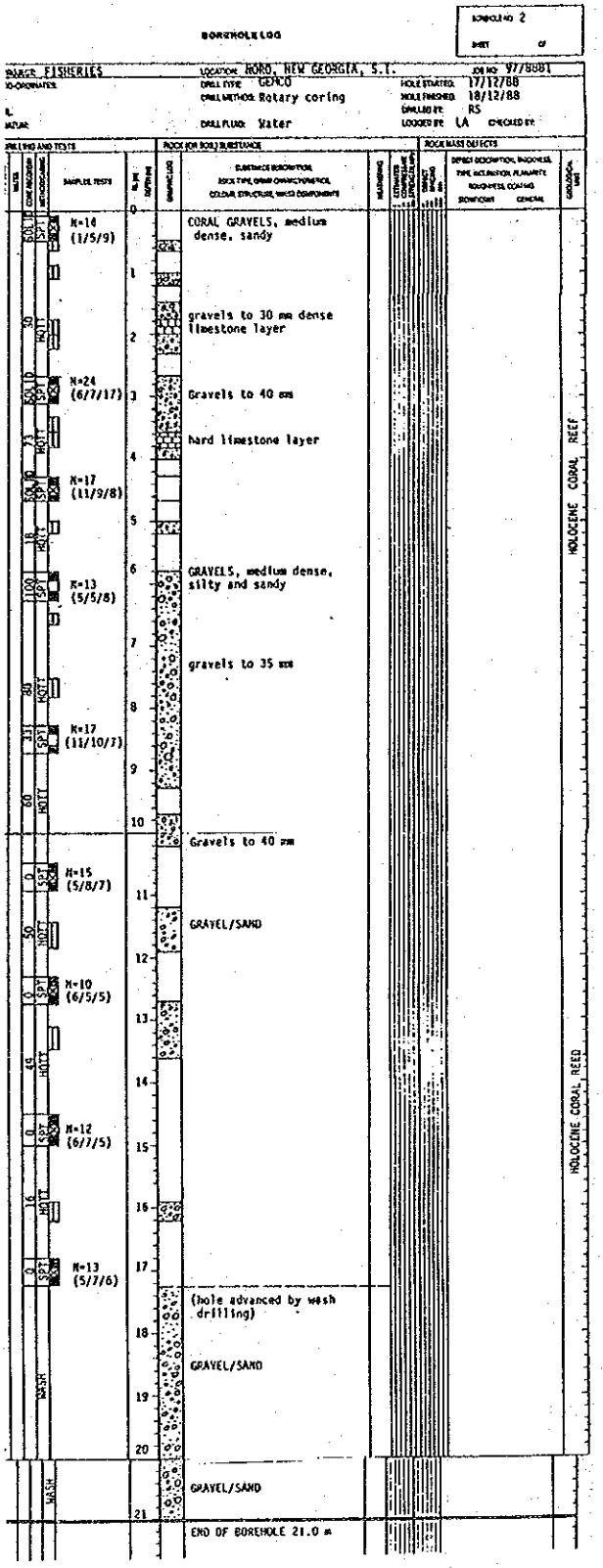
Elliprical Chart for Tidal Currents NO. 1 2.0M Observed on Nov. 21 - 22, 1988

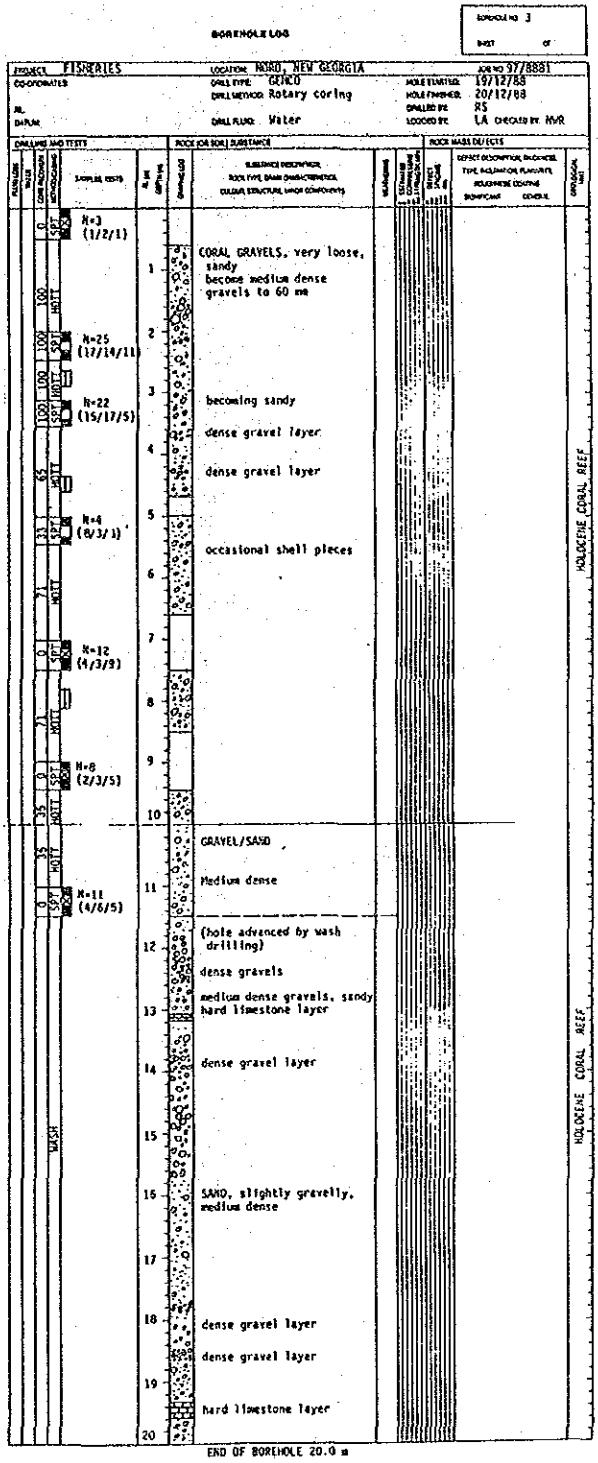
V-11 Depth Chart

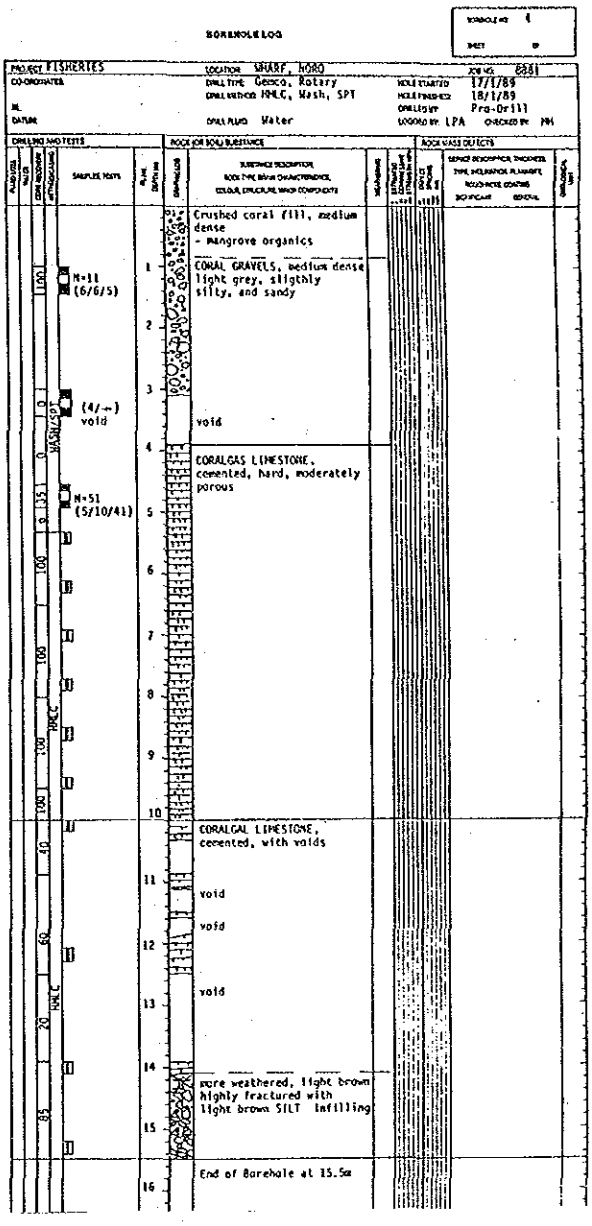


V-12 Boring Log






BOREHOLE LOG
BOREHOLE NO 3
SHEET OF
PROJECT FISHERIES
LOCATION NORO, NEW GEORGIA
JOB NO 97/8881
CO-ORDINATES
DRILL TYPE GEMCO
DRILL METHOD Rotary coring
DRILL FLUID Water
HOLE STARTED 19/12/88
HOLE FINISHED 20/12/88
DRILLED BY RS
LOGGED BY LA CHECKED BY MVR
DATUM
DRILLING AND TESTS
ROCK (OR SOIL) SUBSTANCE
ROCK MASS DEFECTS
SAMPLE TESTS
N=3 (1/2/1)
N=25 (17/14/11)
N=22 (15/17/5)
N=4 (0/3/1)
N=12 (4/3/9)
N=8 (2/3/5)
N=11 (4/6/5)
CORAL GRAVELS, very loose, sandy
become medium dense
gravels to 60 mm
becoming sandy
dense gravel layer
dense gravel layer
occasional shell pieces
GRAVEL/SAND
Medium dense
(hole advanced by wash drilling)
dense gravels
medium dense gravels, sandy
hard limestone layer
dense gravel layer
SAND, slightly gravelly, medium dense
dense gravel layer
dense gravel layer
hard limestone layer
HOLOCENE CORAL REEF
HOLOCENE CORAL REEF
END OF BOREHOLE 20.0 m


BOREHOLE LOG
BOREHOLE NO 4
SHEET OF
PROJECT FISHERIES
LOCATION SHARP, NORO
JOB NO 8881
CO-ORDINATES
DRILL TYPE Gemco, Rotary
DRILL METHOD HMLC, Wash, SPT
DRILL FLUID Water
HOLE STARTED 17/1/89
HOLE FINISHED 18/1/89
DRILLED BY Pro-Drill
LOGGED BY LPA CHECKED BY MH
DRILLING AND TESTS
ROCK (OR SOIL) SUBSTANCE
ROCK MASS DEFECTS
SAMPLE TESTS
N=11 (6/6/5)
(4/→) void
N=51 (5/10/41)
Crushed coral fill, medium dense
- mangrove organics
CORAL GRAVELS, medium dense light grey, slightly silty, and sandy
void
CORALGAS LIMESTONE, cemented, hard, moderately porous
CORALGAL LIMESTONE, cemented, with voids
void
void
void
more weathered, light brown highly fractured with light brown SILT infilling
End of Borehole at 15.5m

BOREHOLE LOG

BOREHOLE No. 81

SHEET OF

PROJECT: FISHERIES — LOCATION: WHARF, HORO — JOB NO. 8881

CO-ORDINATES: Refer Dwg 8881-5

DRILL TYPE: Gemco, rotary

DRILL METHOD: HWLC, SPT

DRILL FLUID: Water

HOLE STARTED: 15/1/89

HOLE FINISHED: 16/1/89

DRILLED BY: Pro-drill

LOGGED BY: LPA — CHECKED BY: MH

DRILLING AND TESTS — ROCK (OR SOIL) SUBSTANCE — ROCK MASS DEFECTS

Depth (m)	Sample/Test	Description
		SILT, organic, coral gravel
1	N=50+ (13/10/-) for 10mm	CORALGAL LIMESTONE, cemented, moderately porous with non-porous layers, occasional thin shattered gravelly layers, white
2	N=50+ (25/-/-) for 30mm	
3	N=50+ (21/-/-) for 50mm	
4		
5	N=50+ (27/-/-) for 50mm	
6		
7	N=50+ (21/-/-) for 50mm	
8	N=50+ (6/20/12) for 40mm	shattered, gravelly
9		
10		Shattered, gravelly coral, not cemented
11		End of Borehole @ 10.6m

BOREHOLE LOG

BOREHOLE No. 82

SHEET OF

PROJECT: FISHERIES — LOCATION: FUEL STORAGE TANK, HORO — JOB NO. 8881

CO-ORDINATES: Refer Dwg 8881-5

DRILL TYPE: Rotary coring

DRILL METHOD: Rotary coring

DRILL FLUID: Water

HOLE STARTED:

HOLE FINISHED:

DRILLED BY: RS

LOGGED BY: LPA — CHECKED BY: MMR

DRILLING AND TESTS — ROCK (OR SOIL) SUBSTANCE — ROCK MASS DEFECTS

Depth (m)	Sample/Test	Description	Geological Unit
1	N=50+ (37/8/10 for 50mm rebound)	CORAL GRAVELS, very dense, well graded up to 65mm, possibly weakly cemented, lt. brown/white	CORAL GRAVELS
2	N=38 (9/11/27)		
3		fine gravels (to 6mm)	
4	N=50+ (36/-/-)	CORALGAL LIMESTONE, cemented, hard, white	CORALGAL LIMESTONE
5	N=50+ (15/27/-)	open structure, porous	
6		becomes tight	
7	N=50+ (25/-/-) for 50mm		
8		open structre	
9	N=50+ (27/-/-) for 50mm		
10	N=50+ (21/-/-) for 50 mm	Coralgal LIMESTONE cemented, hard white	CORALGAL LIMESTONE
11		Sub horizontal jointing, tight	
12			
13			
14		closely jointed, tight	
15		END OF BOREHOLE 15.0 m	

V-13 Expected Training Program

Expected Training Program to be held at Noro Community Center

Organization	Program
1. Min. of Economic Planning	Provincial Planning/Seminars
2. Physical Planning Div., Min. of Agriculture & Lands	Provincial Workshop for Physical Planners
3. Fisheries Div., Min. of Natural Resources	Provincial Fisheries Officer Training Seminar
4. Min. of Health & Medical Service	Provincial Health Education/Training Activities
5. Min. of Finance	Training Course for Provincial Staff from all Ministries
6. Min. of Finance	Custom Officer Training for Responsibilities in Noro Port
7. SICHE, Min. of Education	Provincial Training Course for Schools of Finance and Administration, Marine and Natural Resources
8. Min. of Immigration & Labour	Training Courses for Staff to be based at Noro
9. Min. of Trade, Commerce & Industry	Provincial Trade Training and Testing for Apprentices
10. Statistics Div., Min. of Finance	Provincial Training Course for Cumulatives and Data Collection
11. Min. of Agriculture & Lands	Provincial Agricultural Officers Training
12. Min. of Trade, Commerce & Industry	Provincial Business Development Training

ADMINISTRATIVE TRAINING CENTRE
TRAINING PROGRAMME 1989

Date	Duration	Courses
*13 Feb - 17 Feb	1 Week	Management for Results (AIDAB)
13 Feb - 24 Feb	2 Weeks	First Management I
*20 Feb - 3 Mar	2 Weeks	Finance Planning & Budgetting (AIDAB)
27 Feb - 28 Feb	2 Days	Computer Introduction
27 Feb - 10 Mar	2 Weeks	Public Service Procedure (New Intake)
6 Mar - 22 Mar	2½ Weeks	Finance for Non-finance Managers
13 Mar - 24 Mar	2 Weeks	First Management II
29 Mar - 30 Mar	2 Days	Computer Introduction
3 Apr - 14 Apr	2 Weeks	Financial Management
10 Apr - 21 Apr	2 Weeks	Public Service Procedure (New Intake)
24 Apr - 25 Apr	2 Days	Computer Introduction
24 Apr - 19 May	4 Weeks	Middle Management
*1 May - 12 May	2 Weeks	Small Business Finance & Marketing (AIDAB)
1 May - 12 May	2 Weeks	Finance & Accounts (Statutory Authority)
22 May - 26 May	1 Week	TDO's (Trainers) (Training Development Officers)
22 May - 26 May	1 Week	Computer Introduction
22 May - 26 May	1 Week	Registry Procedure
22 May - 2 Jun	2 Weeks	Introduction to the Control of Public Finance in Solomon Islands.
29 May - 9 Jun	2 Weeks	Job Instruction
5 Jun - 9 Jun	1 Week	Finance and Accounts (G. Province)
19 Jun - 30 Jun	2 Weeks	First Management I
19 Jun - 30 Jun	2 Weeks	Financial Management
3 Jul - 4 Jul	2 Days	Computer Introduction
10 Jul - 21 Jul	2 Weeks	Public Service Procedure (Refresher)

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Dates	Duration	Courses
17 Jul - 21 Jul	1 Week	Finance & Accounts (Temotu Province)
24 Jul - 25 Jul	2 Days	Computer Introduction
24 Jul - 28 Jul	1 Week	Finance & Accounts (Makira Province)
Dates to be arranged	3 Weeks	Personnel Management (USP)
24 Jul - 4 Aug	2 Weeks	First Management II
31 Jul - 11 Aug	2 Weeks	Job Instruction
7 Aug - 11 Aug	1 Week	Finance & Accounts (Honiara Town Council)
14 Aug - 18 Aug	1 Week	Registry Procedure
14 Aug - 25 Aug	2 Weeks	Introduction to the Control of Public Finance in Solomon Islands
21 Aug - 25 Aug	1 Week	Word Processing (Computer)
4 Sep - 8 Sep	1 Week	Finance & Accounts (Malaita Province)
4 Sep - 15 Sep	2 Weeks	Public Service Procedure (Refresher)
18 Sep - 22 Sep	1 Week	Finance & Accounts (Central Province)
18 Sep - 22 Sep	1 Week	Use of Spread Sheets (Computer)
18 Sep - 13 Oct	4 Weeks	Middle Management
25 Sep - 26 Sep	2 Days	Computer Introduction
2 Oct - 13 Oct	2 Weeks	Public Service Procedure (Refresher)
16 Oct - 20 Oct	1 Week	Finance & Accounts (Western Province)
16 Oct - 20 Oct	1 Week	TDO's (Trainers) - Province
23 Oct - 27 Oct	1 Week	Data Base Management (Computer)
30 Oct - 3 Nov	1 Week	Finance & Accounts (Isabel Province)
20 Nov - 21 Nov	2 Days	Computer Introduction

Supervision Course - On request (Subject to Staffing Constraint).

NOTE: As in much of the Public Service, The Administrative

...../3

Training Centre is at present below establishment. In consequence some courses in the above mentioned Programme may have to be postponed or even cancelled, although every effort will be made to sustain the full series.

This is a preliminary announcement. The ATC prospectus (Brochure) is now being printed, will be circulated as soon as possible and will contain further details, including the criteria for selection of candidates for the various courses.

Courses marked * and 'indicated' AIDAB would be conducted by DIG used to be called ITI in the Solomon Islands presumably at ATC. Other venues may be arranged instead of the Centre. Changes will be notified.

VI Photograph

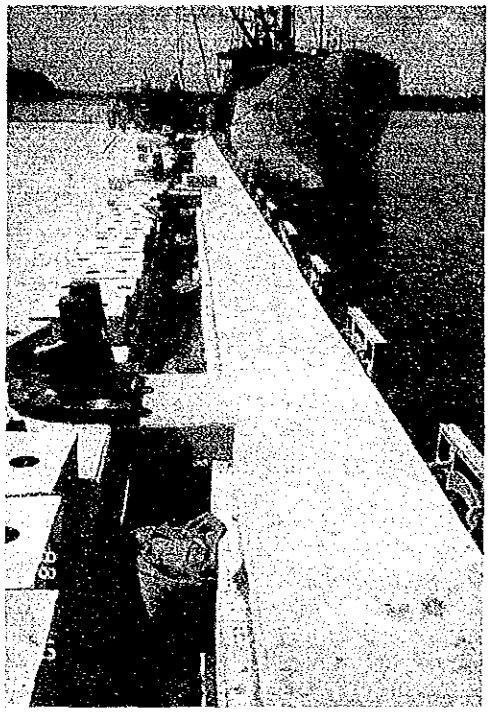
Construction Site for the Shore Facilities
(From left; STL, SIEA power station and the proposed site)

Site for Oil Storage Facility

Site for Dormitory

Site for Community Center (Right hand side of the road)

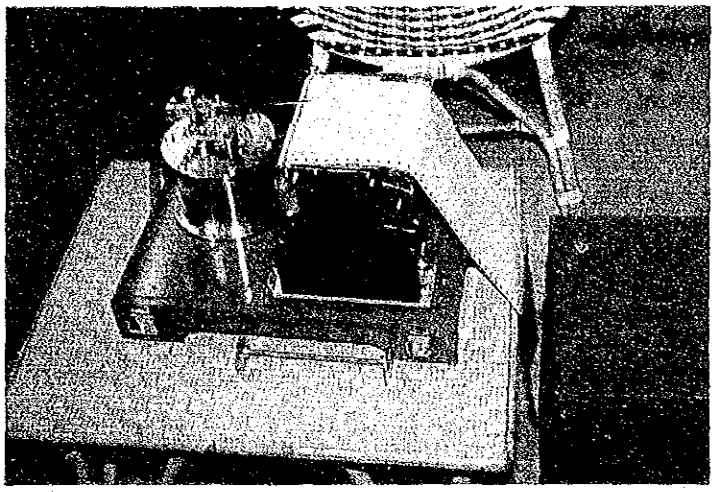
Deep-water wharf
Length 62m
Depth -20m
Crown height +2.2m



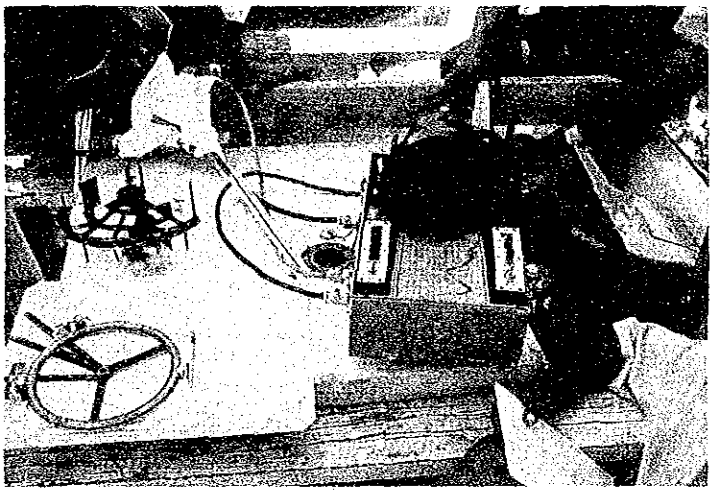
North-South trunk road

Residential area

Tide recorder



Depth sounding by an echo sounder



Boring survey

JICA