APPENDICES

1. MEMBER LIST OF THE STUDY TEAM

1. MEMBER LIST OF THE STUDY TEAM

[First field survey]

Name	Assignment	Organization
Mitsuhisa NISHIKAWA	Chief Consultant/ Power Development Planning / Operation & Maintenance Planning	Yachiyo Engineering Co., Ltd.
Takayuki MIYAMOTO	Diesel Engine Generator Planning	Yachiyo Engineering Co., Ltd.
Kaoru NISHIWAKI	Renewable energy (Solar & hydraulic generation) Planning	Yachiyo Engineering Co., Ltd.
Mitsuharu NAKAGAWA	Equipment Procurement & Installation Planning / Cost estimation	Yachiyo Engineering Co., Ltd.

[Second field survey]

Name	Assignment	Organization
Fuyuki SAGARA	Team Leader	Japan International Corporation Agency
Yukiko MAEDA	Planning Management	Japan International Corporation Agency
Mitsuhisa NISHIKAWA	Chief Consultant/ Power Development Planning / Operation & Maintenance Planning	Yachiyo Engineering Co., Ltd.
Takayuki MIYAMOTO	Diesel Engine Generator Planning	Yachiyo Engineering Co., Ltd.
Hiroto SATO	Substation Facilities Planning	Takaoka Toko Co., Ltd.
Masayuki TAMAI	Transmission & Distribution Planning	Yachiyo Engineering Co., Ltd.
Kaoru NISHIWAKI	Renewable Energy (Solar & Hydraulic Generation) Planning	Yachiyo Engineering Co., Ltd.
Takayasu KASE	Natural Conditions /Facility Planning / Cost estimation	Yachiyo Engineering Co., Ltd.
Yuriko KUDO	Environment & Social Consideration	Yachiyo Engineering Co., Ltd.
Mitsuharu NAKAGAWA	Equipment Procurement & Installation Planning / Cost Estimation	Yachiyo Engineering Co., Ltd.
Masataka SATO	Coordinator / Diesel Engine Generator Planning (assistant)	Yachiyo Engineering Co., Ltd.

[Third field survey (additional field survey)]

Name	Assignment	Organization
Yukiko MAEDA	Team Leader /Planning Management	Japan International Corporation Agency
Mitsuhisa NISHIKAWA	Chief Consultant	Yachiyo Engineering Co., Ltd.
Takayuki MIYAMOTO	Diesel Engine Generator Planning	Yachiyo Engineering Co., Ltd.

[Fourth field survey]

Name	Assignment	Organization
Tadayuki Ogawa	Team Leader	
Yukiko MAEDA	Planning Management	Japan International Corporation Agency
Mitsuhisa NISHIKAWA	Chief Consultant	Yachiyo Engineering Co., Ltd.
Takayuki MIYAMOTO	Diesel Engine Generator Planning	Yachiyo Engineering Co., Ltd.
Hiroto SATO	Substation Facilities Planning	Takaoka Toko Co., Ltd.
Masataka SATO	Coordinator / Diesel Engine Generator Planning (assistant)	Yachiyo Engineering Co., Ltd.

2. STUDY SCHEDULE

2. STUDY SCHEDULE

[First Survey]

No.	Date	Day	Survey Team		Overnight location
			Nishikawa, Miyamoto (Kosrae State, Pohnpei State)	Nishiwaki, Nakagawa (Chuuk State, Yap State)	
1	January 11	Sun	- Transit [Narita 11:00→Guam 15:45 by UA827]	- Transit [Narita 11:00→Guam 15:45 by UA827] - Transit [Guam 19:45→Chuuk 21:39 by UA176]	Guam Chuuk
2	January 12	Mon	- Transit [Guam 08:20→Kosrae 14:52 by UA155]	- Courtesy call to the state governor/ Courtesy call to CPUC - Survey of CPUC power station	Kosrae Chuuk
3	January 13	Tue	- Explanation of the Inception Report - Discussion on the KUA power demand forecast - Survey and discussion on the potential of existing solar solar power generation - Survey of power generation and distribution by KUA	- Survey of CPUC power station - Survey of existing solar power generation systems	Kosrae Chuuk
4	January 14	Wed	- Discussion on the questionnaire - Discussion on the potential for renewable energy	- Survey of CPUC power station - Survey of existing solar power generation systems - Survey of potential sites for renewable energy	Kosrae Chuuk
5	January 15	Thu	- Courtesy call to Kosrae State governor - Discussion on the questionnaire - Discussion on the progress of renewable energy	- Survey of existing solar power generation systems - Survey of potential sites for renewable energy	Kosrae Chuuk
6	January 16	Fri	- Confirmation of the request contents concerning diesel generation equipment - Preparation and signing of T/M with KUA	- Survey of existing solar power generation systems - Survey of potential sites for renewable energy - Preparation and signing of T/M with CPUC	Kosrae Chuuk
7	January 17	Sat	- Transit [Kosrae13:47 → Pohnpei 14:50 by UA154]	- Transit [Chuuk16:20→Guam17:52 by UA154] - Transit [Guam20:25→Yap22:05 by UA185]	Pohnpei Yap
8	January 18	Sun	- Survey of existing solar power equipment	- Survey of YSPSC power station	Pohnpei Yap
9	January 19	Mon	- Courtesy call to PUC - Explanation of the Inception Report - Discussion on the questionnaire	- Courtesy call to the state governor - Courtesy call to YSPSC - Survey of potential sites for renewable energy	Pohnpei Yap
10	January 20	Tue	- Courtesy call to Government of the Federated States of Micronesia R&D - Courtesy call to Pohnpei State vice governor - Survey of existing solar power generation	- Survey of potential sites for renewable energy - Preparation and signing of T/M with YSPSC	Pohnpei Yap
11	January 21	Wed	- Courtesy call to the Japanese Embassy in the Federated States of Micronesia - Survey of potential sites for renewable energy (solar power) - Survey of existing hydropower plant - Survey of existing diesel power station	- Transit [Yap01:35→Guam03:05 by UA154] - Transit [Guam06:55→Chuuk09:35 by UA828]	Pohnpei
12	January 22	Thu	- Preparation and signing of T/M with PUC - Report of the Federated States of Micronesia survey findings to JICA - Transit [Pohnpei 14:35→Guam17:15 by UA154]		Guam
13	January 23	Fri	- Transit [Guam12:40→Narita 15:40 by UA196]		

[Second Survey]

No.	Date	Day	Survey Team			Overnight location
			Official Team Members (Team Leader)	Official Team Members (Team Leader)		
			Sagara, Maeda	Nishikawa, Miyamoto, Satoh (Hiro), Tamai, Kase, Kudoh, Nakagawa, Satoh (Masa)	Nishiwaki	
1	March 8	Sun		① Transit [Narita 11:00 → Guam 15:45 by UA827]	① Transit [Kansai 11:05→Guam15: 40 by UA150]	Guam
2	March 9	Mon		① Transit [Narita 08:20→Guam14:52 by UA155]		Kosrae
3	March 10	Tue		① Courtesy call to KUA (explanation of the survey schedule, project outline, questionnaire, etc.) ② Project site survey-Tofol Power Station ③ Discussions with KUA- confirmation of survey schedule and project sites		Kosrae
4	March 11	Wed		① Project site survey-Tofol Power Station ② Quantity surveying and geological survey ③ Survey of candidate site for hydropower generation in Kosrae State ④ Environmental and social consideration survey		Kosrae
5	March 12	Thu		① Project site survey-Tofol Power Station, Okat underground cable ② Discussions with KUA -environmental and social consideration ③ Discussions with KIRMA-EIA systems, environmental standards ④ Survey of candidate site for hydropower generation in Kosrae State		Kosrae
6	March 13	Fri		① Project site survey-Tofol Power Station, Lelu distribution line ② Discussions with KIRMA on nature reserves and cultural districts ③ Survey of weather conditions		Kosrae
7	March 14	Sat		① Team meeting ② Sorting and review of gathered materials ③ Kosrae State market survey ④ Lelu distribution line survey		Kosrae
8	March 15	Sun	① Transit [Narita 21:20→Guam 01:55 by UA827]	① Team meeting ② Sorting and review of gathered materials ③ Kosrae State market survey		Kosrae
9	March 16	Mon	(Flight cancelled due to typhoon)	① Project site survey-Tofol Power Station, existing distribution line, transport routes ② Survey of candidate site for hydropower generation in Kosrae State ③ Environmental and social consideration survey ④ Survey of hospital facilities in Kosrae State		Kosrae
10	March 17	Tue	① Transit [Guam 08:20 →Kosrae 14:52 by UA155]	① Project site survey-Tofol Power Station, Lelu distribution line, Lelu historic remains, existing distribution line ② Survey of candidate site for hydropower generation in Kosrae State ③ Environmental and social consideration survey		Kosrae

No.	Date	Day	Survey Team			Overnight location
			Official Team Members (Team Leader)	Official Team Members (Team Leader)		
			Sagara, Maeda	Nishikawa, Miyamoto, Satoh (Hiro), Tamai, Kase, Kudoh, Nakagawa, Satoh (Masa)	Nishiwaki	
11	March 18	Wed	① Courtesy call to the state government (governor) ② Project site survey-Tofol Power Station ③ Courtesy call to the state government (assembly speaker) ④ MD preparation	① Project site survey-Tofol Power Station, Lelu distribution line, existing distribution line ② Environmental and social consideration survey ③ Preparation of field report		Kosrae
12	March 19	Thu	① Explanation of the draft MD to KUA ② Project site survey- Okat underground cable, Lelu distribution line	① Project site survey-Tofol Power Station, Lelu distribution line, Okat underground cable, existing distribution line ② Environmental and social consideration survey ③ Preparation of field report		Kosrae
13	March 20	Fri	① Three-party discussions of the MD with the state government and KUA ② Modification of MD ③ Signing ceremony	① Project site survey-Tofol Power Station, Lelu distribution line, Okat underground cable, existing distribution line ② Environmental and social consideration survey ③ Preparation of field report ④ Discussions with the quantity surveying and geological survey subcontractor		Kosrae
14	March 21	Sat	① Transit [Kosrae 13:47 → Pohnpei 14:50]	① Quantity surveying and geological survey ② Team meeting ③ Preparation of field report	① Survey of candidate site for hydropower generation in Kosrae State ② Transit [Kosrae 13:47 → Pohnpei 14:50 by UA0154]	Kosrae Pohnpei
15	March 22	Sun	① Visit to Project site	① Team meeting ② Preparation of field report	① solar power site survey ② Pohnpei hydropower survey advance preparations	Kosrae Pohnpei
16	March 23	Mon	① Courtesy call to Pohnpei State government ② Courtesy call to DFA and DRD ③ Courtesy call to the Japanese Embassy	① Project site survey -Tofol Power Station, Lelu historical remains ② Preparation of field report	① Pohnpei hydropower survey plan explanation (JICAM Micronesia office, Pohnpei Public Works Authority)	Kosrae Pohnpei
17	March 24	Tue	① Transit [Pohnpei 15:31 → Guam 17:55]	① Preparation of field report ② Sorting of field survey findings ③ Environmental and social consideration survey	① Lehnmesi hydropower development site survey	Kosrae Pohnpei
18	March 25	Wed	① Transit [Guam 06:55 → Narita 09:35]	① Explanation and confirmation of the field report with KUA ② Sorting of field survey findings ③ Modification of field report	① Senpen hydropower development site survey ② solar power system (500kW) site survey	Kosrae Pohnpei

No.	Date	Day	Survey Team			Overnight location
			Official Team Members (Team Leader)	Official Team Members (Team Leader)		
			Sagara, Maeda	Nishikawa, Miyamoto, Satoh (Hiro), Tamai, Kase, Kudoh, Nakagawa, Satoh (Masa)	Nishiwaki	
19	March 26	Thu		① Sorting of field survey findings ② Modification of field report ③ Explanation and discussion of the field report with KUA	① Hydropower development site survey	Kosrae Pohnpei
20	March 27	Fri		① Field report signing ceremony ② Environmental and social consideration survey ③ Sorting of field survey findings ④ Sorting of gathered materials	① Report of survey findings to JICA Micronesia office (Flight cancelled due to poor weather)	Kosrae Pohnpei
21	March 28	Sat		(Flight delayed for 24 hours due to plane trouble)	(Flight delayed for 24 hours due to plane trouble)	
22	March 29	Sun		① Transit [Kosrae 13:47 → Guam 18:18 by UA2053]	① Transit [Pohnpei 15:52 → Guam 18:18 by UA2053]	
23	March 30	Mon		① Transit [Guam 6:55 → Narita 09:40 by UA0828 (Kudoh, Nakagawa, Satoh (Masa))] ② Transit [Guam 12:05 →Narita 15:00 by UA0196 (Nishikawa, Miyamoto, Tamai)] ③ Transit [Guam 17:05 →Narita 19:55 by UA0873 (Satoh (Hiro), Kase)] ④ Transit [Guam 7:10 → Kansai 10:10 by UA0151 (Nishiwaki)]		

[Third Survey (Additional Field Survey)]

No.	Date	Day	Survey Team		Overnight location
			Official Team Members (Team Leader)	Official Team Members (Team Leader)	
			Maeda	Nishikawa, Miyamoto	
1	October 4	Sun		- Transit [Narita 11:00→Guam 15:45 by UA827]	Guam Chuuk
2	October 5	Mon		- Transit [Guam 08:20→Kosrae 14:52 by UA155]	Kosrae
3	October 6	Tue	- Arrival of JICA Survey Team - Demand survey at fish trans-shipment facilities and Malem Elementary School	- Discussion on the KUA power demand forecast - Demand survey at fish trans-shipment facilities and Malem Elementary School	Kosrae
4	October 7	Wed	- Discussion on the KUA power demand forecast - Courtesy call to Kosrae State government - Demand survey at hospital and bottling plant		Kosrae
5	October 8	Thu	- Discussion on the KUA power demand forecast		Kosrae
6	October 9	Fri	- Discussion on the KUA power demand forecast		Kosrae
7	October 10	Sat	- Transit [Kosrae 13:47→Pohnpei 14:50 by UA154]		Pohnpei
8	October 11	Sun	- Team discussions		Pohnpei
9	October 12	Mon	- M/D signing - Report at the JICA Micronesia office		Pohnpei
10	October 13	Tue	- Transit [Pohnpei 15:31 → Guam 17:55 by UA154]		Pohnpei
11	October 14	Wed	- Transit [Guam 12:40→Narita 15:40 by UA196 (Maeda)]	- Transit [Guam 06:55→Narita 09:40 by UA828 (Nishikawa, Miyamoto)]	

[Fourth Survey]

No.	Date	Day	Survey Team		Overnight location
			Official Team Members (Team Leader)	Consultant Team Members	
			Ogawa, Maeda	Nishikawa, Miyamoto, Satoh (Hiro), Satoh (Masa)	
1	January 21	Thu	- Transit [Narita 17:20→Guam 22:15 by UA197]	- Transit [Narita 11:00→Guam 15:45 by UA827]	Guam
2	January 22	Fri	- Transit [Guam08:20→Kosrae14:52by UA155] - Courtesy call to Kosrae State government and KUA		Kosrae
3	January 23	Sat	- KUA explanation of draft report - Survey of Tofol Power Station and Lelu distribution system		Kosrae
4	January 24	Sun	- M/D preparations		Kosrae
5	January 25	Mon	- Discussions on tax exemptions at the Ministry of Finance of the Federated States of Micronesia - KIRMA EIA discussions - KUA explanation of draft report and MD draft - Site and consumer survey (Water bottling plant, fish trans-shipment facilities, underground cable)		Kosrae
6	January 26	Tue	- Transit [Kosrae13:47→Pohnpei 14:50 by UA154]		Pohnpei
7	January 27	Wed	- Federated States of Micronesia - Discussions on tax exemptions at the Ministry of Finance of the Federated States of Micronesia		Pohnpei
8	January 28	Thu	- M/D signing		Pohnpei
9	January 29	Fri	- PUC power station survey - Report at the JICA Micronesia office - Report at the Japanese Embassy in the Federated States of Micronesia		Pohnpei
10	January 30	Sat	- Transit [Pohnpei 15:31 → Guam17:55 by UA154]		Guam
11	January 31	Sun	- Transit [Guam06:55→Narita 09:40 by UA828 (Ogawa)] [Guam 12:40→ Narita 15:40 by UA196 (Maeda)]	- Transit [Guam 06:55→Narita 09:40 by UA828 (Satoh (Masa))] [Guam 12:40→Narita 15:40 by UA196 (Nishikawa, Miyamoto, Satoh (Hiro))]	-

3. LIST OF PARTIES CONCERNED IN THE RECIPIENT COUNTRY

3. LIST OF PARTIES CONCERNED IN THE RECIPIENT COUNTRY

[First survey]

Name	Position
Department of Foreign Affairs	
Mr. Samson Pretrick	Deputy Secretary
Department of Resources & Development	
Mr. Hubert K. Yamada	Assistant Secretary, Division of Energy
State of Kosrae	
Mr. Carson K. Sigrah	Deputy Governor
Mr. Lipar George	Administrator, Budget Statistics, ODA
Mr. Wadel R. Kinere	Port Director, Department of Public Works
State of Pohnpei	
Mr. Marcelo Peterson	Deputy Governor
State of Chuuk	
Mr. Johnson S. Elimo	Governor
Mr. Kichi Joseph	Chuuk Government State in Charge
State of Yap	
Mr. Ganngiyan Tony	Governor
Mr. Yangetmai James	Deputy Governor
Kosrae Utilities Authority (KUA)	
Mr. Fred N. Skilling	General Manager
Mr. Robert Taualupe	Operation Manager
Mr. Gerry Protacio	Electrical Engineer
Pohnpei Utilities Corporation (PUC)	
Mr. Marselino Actouka	General Manager
Mr. Sidney Kilmete	Renewable Energy Engineer
Mr. Nixon Anson	Assistant General Manager
Mr. John T. Martin	Distribution Manager

Chuuk Public Utility Corporation (CPUC)

Mr. Mark Waite	Chief Executive Officer
Mr. Albert Francis	Power Manager

Yap State Public Service Corporation (YSPSC)

Mr. Faustino Yangmog	General Manager
Mr. Victor Nabeyan	Assistant General Manager
Mr. Francis Falan	Power Generation Manager
Mr. Gidion Moofal	Customer Service Manager
Mr. Steven Libmad	Project District Manager
Mr. Joe Hafler	Project Manager
Mr. Mario Sukulbech	Outer Island Operation Manager

Embassy of Japan in the Federated States of Micronesia

Mr. Maki Sakai	Ambassador Extraordinary and Plenipotentiary
Ms. Hiroko Nobusada	Expert surveyor
Ms. Mihoko Sato	Grassroots eternal contractor

JICA Micronesia Office

Mr. Iwasaki Kaoru	Resident Representative
Ms. Judy L. Robert	Program Officer

[Second survey]

Name	Position

Kosrae State Government

Mr. Lyndon H. Jackson	Governor
Mr. Carson K. Sigrah	Deputy Governor
Mr. Lipar George	Administrator, Budget Statistics, ODA

Kosrae Utilities Authority (KUA)

Mr. Fred N. Skilling	General Manager
Mr. Robert Taualupe	Operation Manager
Mr. Gerry Protacio	Electrical Engineer
Mr. Nena G. Nena	Customer Service Head, Admin, Training Officer
Mr. Chris Marlow (Consultant of ADB)	KUA Water Operations Manager

Kosrae Island Resource Management Authority (KIRMA)

Mr. Robert A. Jackson	Program Director
Mr. Presley Abraham	Development Project Coordinator, Permitting Unit
Mr. Blair Charley	GIS Coordinator, GIS/Clearing House Mechanism
Mr. Erick Waguk	State Forester, Foresry & Wildlife

Kosrae Port Authority (KPA)

Mr. Wadel R. Kinere	Port Director
Mr. William Tosie	General Manager
Mr. Likiak Albert	AFIS, SAWRS Station

JICA Micronesia Office

Mr. Iwasaki Kaoru	Resident Representative
Mr. Takahisa Watanabe	Project Formulation Adviser

[Third survey]

Name	Position

Department of Resources & Development

Mr. Hubert K. Yamada	Assistant Secretary, Division of Energy
Mr. Burrnis Danis	World Bank ESDP Implementation Support Officer, Division of Energy

Kosrae State Government

Mr. Lyndon H. Jackson	Governor
Mr. Carson K. Sigrah	Deputy Governor
Mr. Lipar George	Administrator, Budget Statistics, ODA

Kosrae Utilities Authority (KUA)

Mr. Fred N. Skilling	General Manager
Mr. Robert Taualupe	Operation Manager
Mr. Gerry Protacio	Electrical Engineer
Mr. Nena G. Nena	Customer Service Head, Admin, Training Officer

JICA Micronesia Office

Mr. Iwasaki Kaoru	Resident Representative
Mr. Takahisa Watanabe	Project Formulation Adviser

[Fourth survey]

Name	Position
Department of Resources & Development	
Mr. Marion Henry	Secretary
Mr. Hubert K. Yamada	Assistant Secretary, Division of Energy
Department of Finance & Administration	
Sihna N. Lawrence	Secretary
Mr. Salvador S. Jacob	Assistant Secretary, Custom & Tax Administration Division
Mr. William K. Mongkeya	Deputy Assistant Secretary, Custom & Tax Administration, Kosrae Field Office
Department of Foreign Affairs	
Mr. Lorin S. Robert	Secretary
Mr. Jackson T. Soram	Assistant Secretary, Asia, Pacific, Africa & Multilaterals Affairs
Kosrae State Government	
Mr. Lyndon H. Jackson	Governor
Mr. Carson K. Sigrah	Deputy Governor
Mr. Lipar George	Administrator, Budget Statistics, ODA
Kosrae Utilities Authority (KUA)	
Mr. Fred N. Skilling	General Manager
Mr. Robert Taualupe	Operation Manager
Mr. Gerry Protacio	Electrical Engineer
Embassy of Japan in the Federated States of Micronesia	
Mr. Tsuneaki Sato	Second Secretary
Ms. Mika Okamura	Expert surveyor
JICA Micronesia Office	
Mr. Iwasaki Kaoru	Resident Representative
Mr. Takahisa Watanabe	Project Formulation Adviser

4. MINUTES OF DISCUSSIONS (M/D)

4. MINUTES OF DISCUSSIONS (M/D)

(1) Minutes of Discussion (March, 2015)

Minutes of Discussions
on
the Preparatory Survey
on
the Project for Power Sector Improvement for the State of Kosrae
in
Federated States of Micronesia

In response to the request from the Government of Federated States of Micronesia (hereinafter referred to as "FSM"), the Japan International Cooperation Agency (hereinafter referred to as "JICA"), in consultation with the Government of Japan, decided to conduct a Preparatory Survey (hereinafter referred to as "the Survey") on the Project for Power Sector Improvement for the State of Kosrae (hereinafter referred to as "the Project").

JICA sent to FSM the Preparatory Survey Team (hereinafter referred to as "the Team") to conduct the field surveys. The first field survey was carried out from January 12th to January 21st, 2015 and the second field survey, headed by Mr. Fuyuki Sagara, Advisor, Team 1, Energy and Mining Group, Industrial Development and Public Policy Department, JICA, has been dispatched and is scheduled to stay in the country from March 9th to March 27th, 2015.

The Team held a series of discussions with the concerned officials of FSM and conducted a field survey in the State of Kosrae, FSM.

In the course of the discussions, both sides have confirmed the main items described in the attached sheets hereto. The Team will proceed with further study and prepare the preparatory survey report.

Kosrae, Micronesia
March 20th, 2015

相良冬木

Mr. Fuyuki Sagara
Leader
Preparatory Survey Team
Japan International Cooperation Agency

Hon. Lyndon H. Jackson
Governor
Kosrae State Government
Federated States of Micronesia

Mr. Fred N. Skilling
General Manager
Kosrae Utilities Authorities

Hon. Lorin S. Robert
Secretary
Department of Foreign Affairs
Federated States of Micronesia

ATTACHMENT

1. Objective of the Project

The objective of the Project is to secure efficient and stable power supply through renewing diesel engine generator(s) and associated substation and distribution facilities in the State of Kosrae in order to improve the quality of life for the people, as well as to contribute to economic development of the country.

2. Title of the Project

The title of the project is "The Project for Power Sector Improvement for the State of Kosrae".

3. Project Site

The Project sites are located in the State of Kosrae, FSM, as shown in Annex-1. The proposed site plan of new power plant is shown in Annex-2.

4. Responsible and Implementing Organizations

4-1 The responsible organization is Kosrae State Government, FSM.

4-2 The implementing agency is Kosrae Utilities Authority (KUA).

4-3 The organization structure of Kosrae State Government of and KUA are shown in Annex-3 and Annex-4.

5. Items Targeted in the Project

5-1 Identification of project components

As the result of discussions, the components to be targeted in the Project have been identified as follows;

	Items	Proposed Specifications
1	Diesel engine generator(s) and necessary related facilities	Rated output :600 kW x 3 units, 13.8 kV, 720 or 900 rpm, 60 Hz
2	Indoor type substation and connection of existing distribution lines and the existing and new generators.	60 Hz, 13.8 kV
3	Underground distribution lines with necessary equipment and materials for airport area.	13.8 kV, Cross-linking polyethylene, 6,000 ft single core 6 cables for two (2) circuits
4	Overhead distribution lines with necessary equipment and materials at Lelu island area	13.8 kV, 3 phase

5-2 The Team will study and discuss with the FSM side further the appropriateness of each component and technical specifications from the viewpoint of necessity and relevance as Japan's Grant Aid scheme, and will compile the findings into the preparatory survey report for the project appraisal.

6. Environmental and Social Considerations

6-1 The Team explained JICA's Guidelines for Environmental and Social Considerations to the FSM side and the FSM side agreed to comply with the guidelines. The FSM side will take necessary measures of the environmental and social consideration for the Project in accordance with both the JICA's guidelines and related environmental regulations of FSM.

6-2 The Team confirmed the KUA submitted draft Environmental Impact Statement (EIS) to Kosrae Island Resources Management Authority (KIRMA) and obtained provisional approval and advices for the Project by KIRMA in July, 2013. Both sides confirmed that the Project shall comply with these advices and recommendation.

6-3 The FSM side will carry out the stakeholder meetings for the Project and will report the result

to the Team by the end of May, 2015 for smooth completion of the Survey.

7. Japan's Grant Aid Scheme

7-1 The FSM side has understood Japan's Grant Aid Scheme explained by the Team as described in Annex-5 and Annex-6.

7-2 The FSM side will take the necessary undertakings, as described in Annex-7, for smooth implementation of the Project.

8. Schedule of the Study

8-1 The First Field Survey Team was dispatched in Kosrae from 12th January to 21st January, 2015.

8-2 The Second Field Survey Team is scheduled to stay and continue their works from 9th March to 27th March, 2015.

8-3 JICA will prepare the draft report of the Preparatory Survey and dispatch the Team to Kosrae in August 2015 in order to explain its contents.

9. Other Relevant Issues

9-1. JICA's "Hybrid Islands Initiative"

The Team explained JICA's concept of "Hybrid Islands Initiative" which aims to reduce fossil fuel consumption and to enhance energy security for Pacific island countries by both adopting appropriate renewable energy and improving operation and maintenance for higher-efficient diesel engine generation (Annex-8). The FSM side understood the concept and the Project would also be in line with the concept.

9-2. Allowance of PV introduction for the grid system and necessity of PV output control

The Team explained as follows and the FSM side understood them.

(1) The total capacity of PV system introduced to the grid system of Kosrae should be considered to keep within a certain ratio of the grid capacity in order to secure the grid stability.

(2) The capacity of PV system planned to be installed in Kosrae (approx. 300 kw) will reach the level that may severely affect power supply stability of existing grid system in Kosrae. Therefore, the Team recommended the FSM side that controlling PV output in the daytime is necessary when the demand is low such as weekends.

9-3. Concept of diesel generator(s) component

In order to achieve an effective operation of diesel engine generator(s) conducive to reducing fossil fuel consumption in line with 9-1 and 9-2 above, the new generator(s) component shall be designed based on the following concepts. These concepts were also agreed by the FSM side.

(1) Total capacity of diesel engine generator(s) shall cover total demand of electricity in the State of Kosrae for the near future with reserved capacity. Both the Team and the FSM side also confirmed the demand in the State of Kosrae would not change drastically in the near future considering past 10 years demand records and the future trend of consumers.

(2) Diesel engine generator(s) shall keep the operation at more than 40% of generator's rated capacity even when the demand of grid is the minimum and PV output is the maximum. It is not recommendable that diesel engine generator(s) operating continuously more than 3 hours with 40 % or less load of rated capacity.

9-4. Operation and maintenance system of diesel engine generator(s)

(1)The Team explained KUA should secure the sufficient running cost of the facilities to be installed by the Project. KUA agreed with it. At the same time, KUA also requested the Team for supplying spare parts including emergency parts for at least covering the first overhaul. The team will study further on the spare parts covered by the Project.

(2) The team recommended KUA to obtain an exclusive internet line for the equipment of the

Project so that KUA may be able to get a remote advice service from equipment manufacturers on operation and maintenance of the equipment. KUA will study further on obtaining an exclusive internet line.

(3) KUA requested the Team that contractors (or equipment manufactures) of the Project will provide on the Job training for KUA's staff on how to operate and maintain equipment. KUA also showed their interests to take part in a technical cooperation project of operation and maintenance for diesel engine generators and PV system beside the Project if any opportunities are offered in the future. The Team took note their requests.

9-5. Distribution lines

-Overhead distribution lines at Lelu island area.

(1) The FSM side requested to use fiber glass electric poles for distribution lines. However, as the fiber glass poles are not manufactured and not commonly utilized in Japan, the Team will continue to study on the specification and the procurement condition of the poles including the possibility of installing concrete or treated wooden poles. The FSM side agreed with it.

(2) The FSM side requested distribution lines should be at the same place as existing lines as much as possible because the Project should avoid affecting to the lands owned by private owners. The Team accepted the request except the section where poles are currently constructed in the ocean. The Team explained new distribution lines should be on land because reconstruction of poles in the ocean cannot be recommended from their technical point of view. KUA agreed with it and will take necessary measures for getting right of way for the distribution lines on land.

(3) The FSM side requested the Japanese side to include clearing works of the existing distribution lines for the Project. The team took note the request and will further consider on it.

(4) The Team explained that works on the low voltage lines and cable TV lines attached on the existing poles should be covered by KUA. KUA agreed with it.

-Underground distribution lines for airport area

(5) The Team explained that KUA should carry out connection works of underground distribution lines to the existing grid. The FSM side agreed with it.

9-6. Substation system

(1) The FSM side requested that a new substation should be an indoor type, since an existing one is an outdoor type and its equipment and structure are rusty and damaged under strict natural conditions and the The team took note the request and will further consider on it.

(2)Both side confirmed that step up transformers are not necessary for new generators because voltage of new diesel engine generator(s) will be at 13.8 KV.

9-7. Site clearance for new power plant

The team explained that KUA and Kosrae State Government should be responsible for securing lots of land necessary for the implementation of the Project in accordance with Japan's Grant Aid Scheme. However, the KUA requested the Team that the Project includes the site preparation works for the power plant to secure a safe base of the power plant. The Team took note of it and further study on the request.

9-8. Tax exemption for the Project

The FSM side understood that KUA will make necessary arrangement with the Unified Revenue Authority, Department of Finance and Administration at Pohnpei for the procedure of tax exemption for the Project.

(End)

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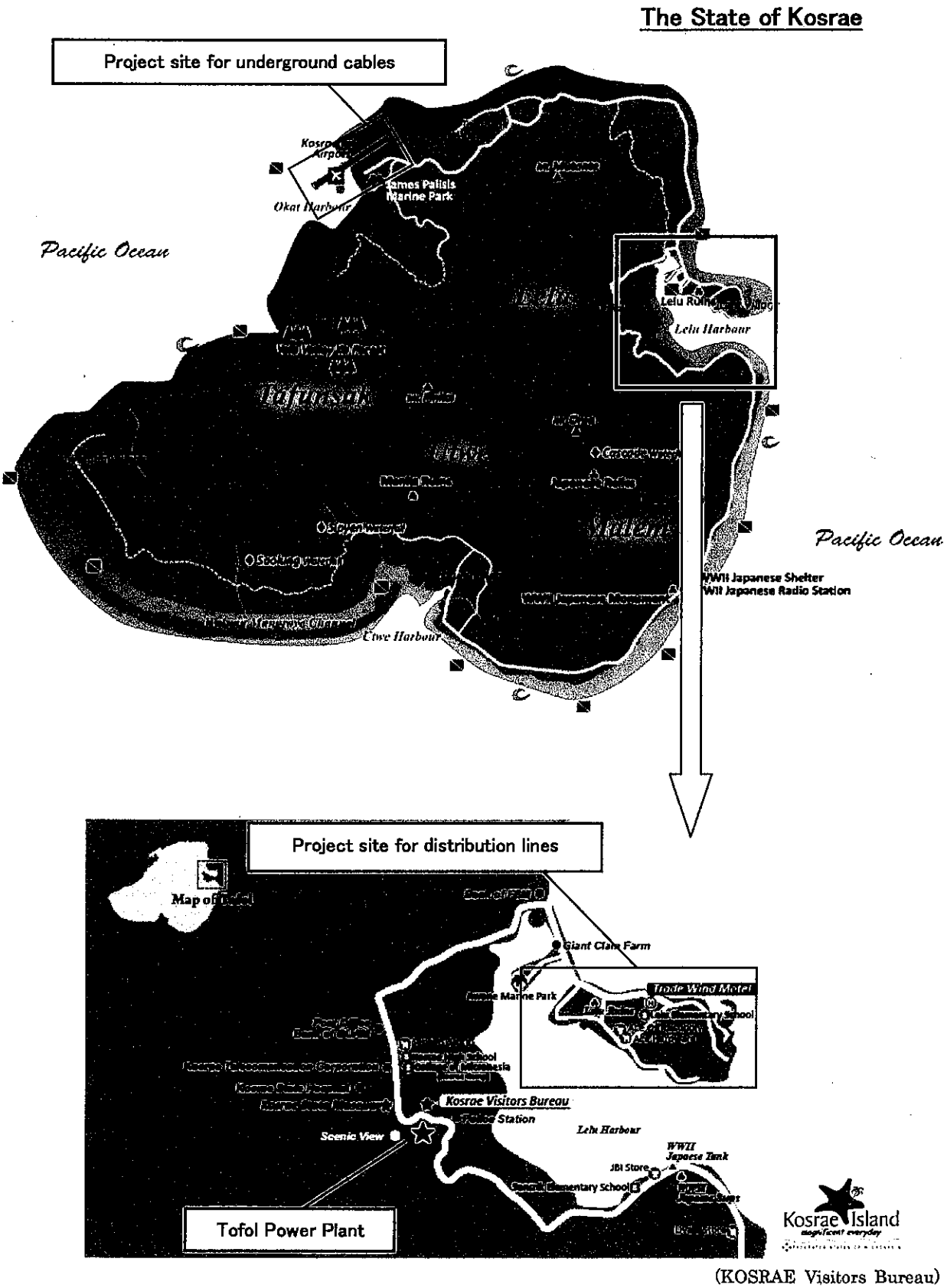
<List of Annex>

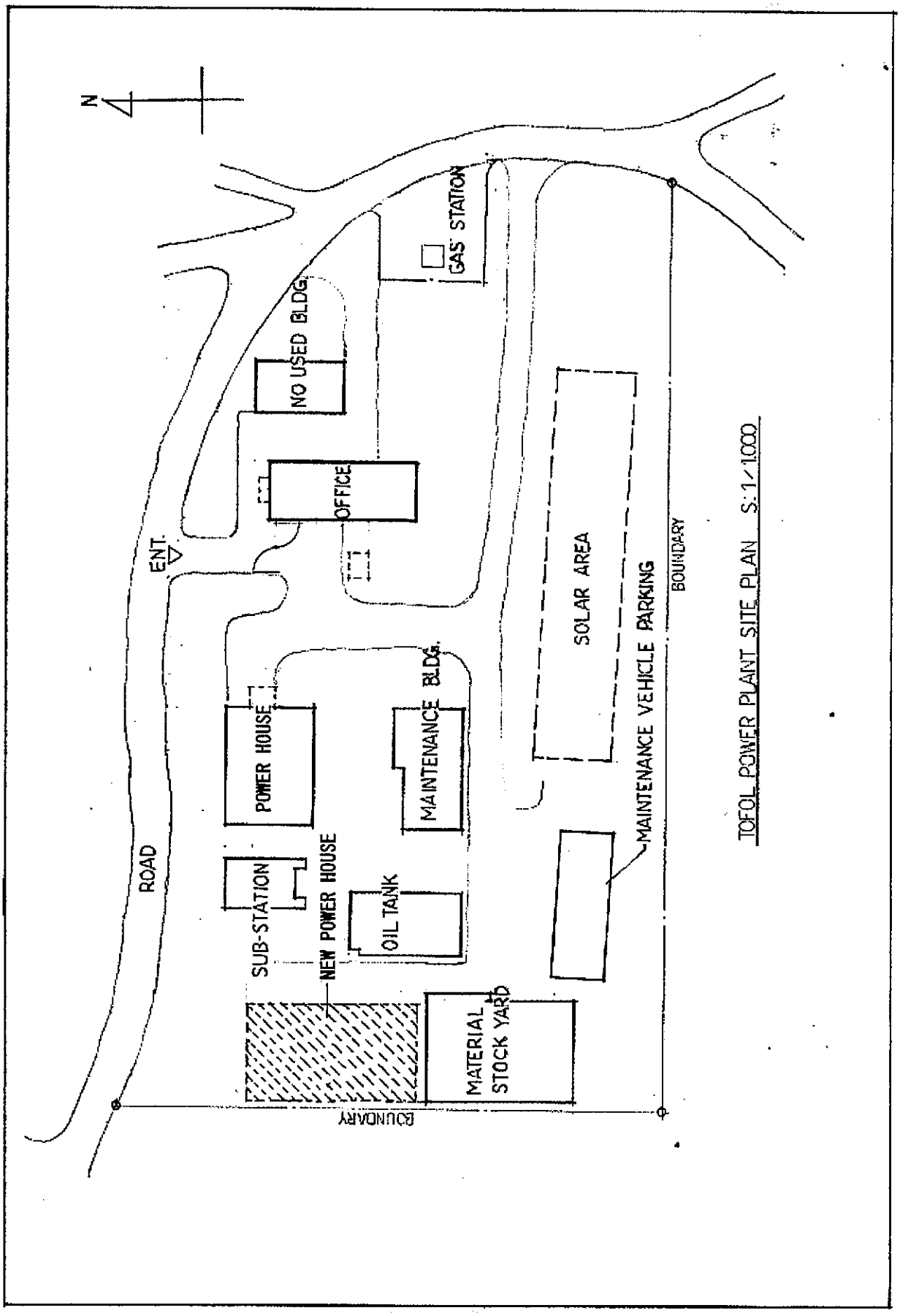
Annex - 1



(KOSRAE Visitors Bureau)

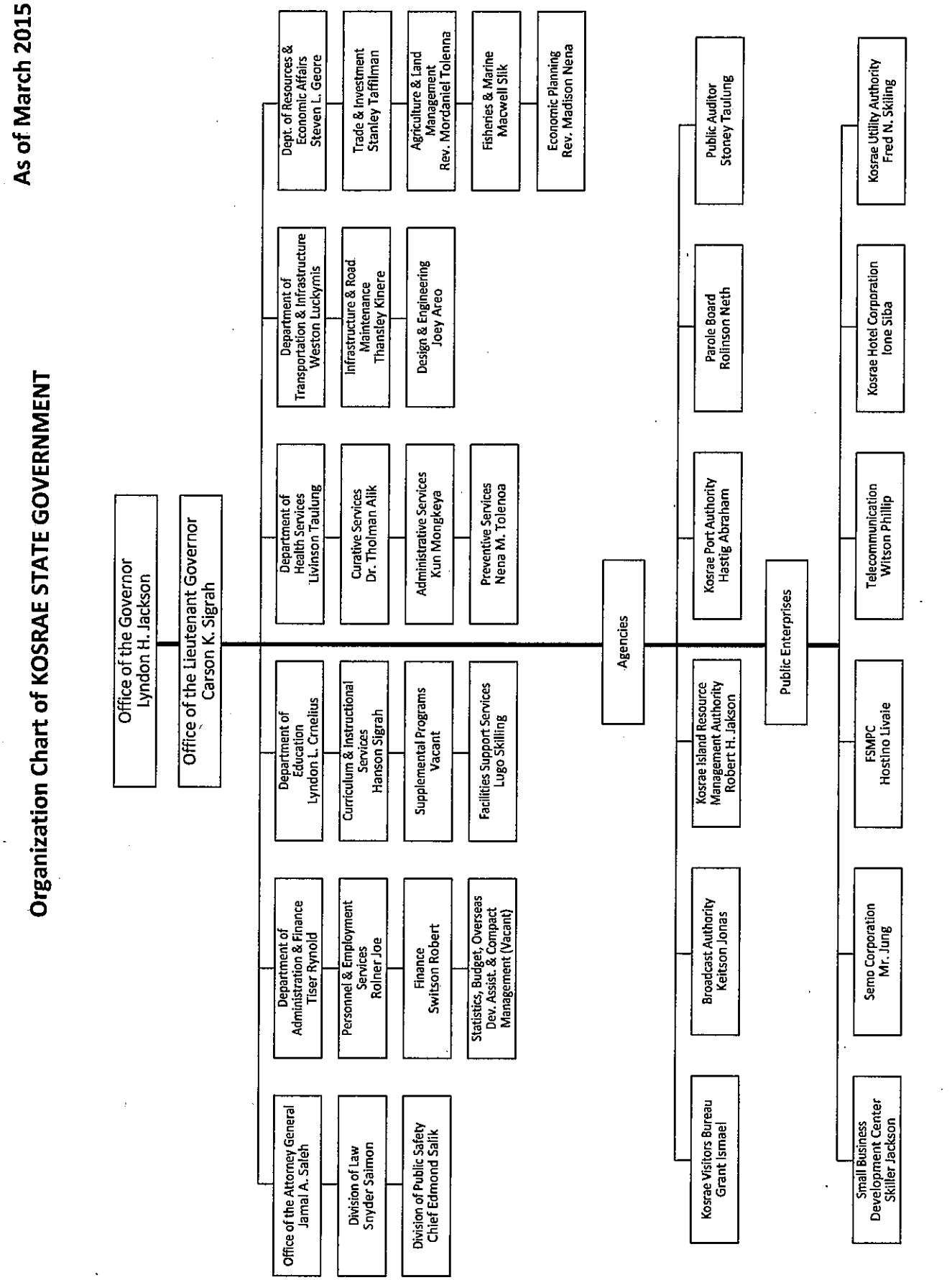
LOCATION OF THE PROJECT SITES

Annex-2



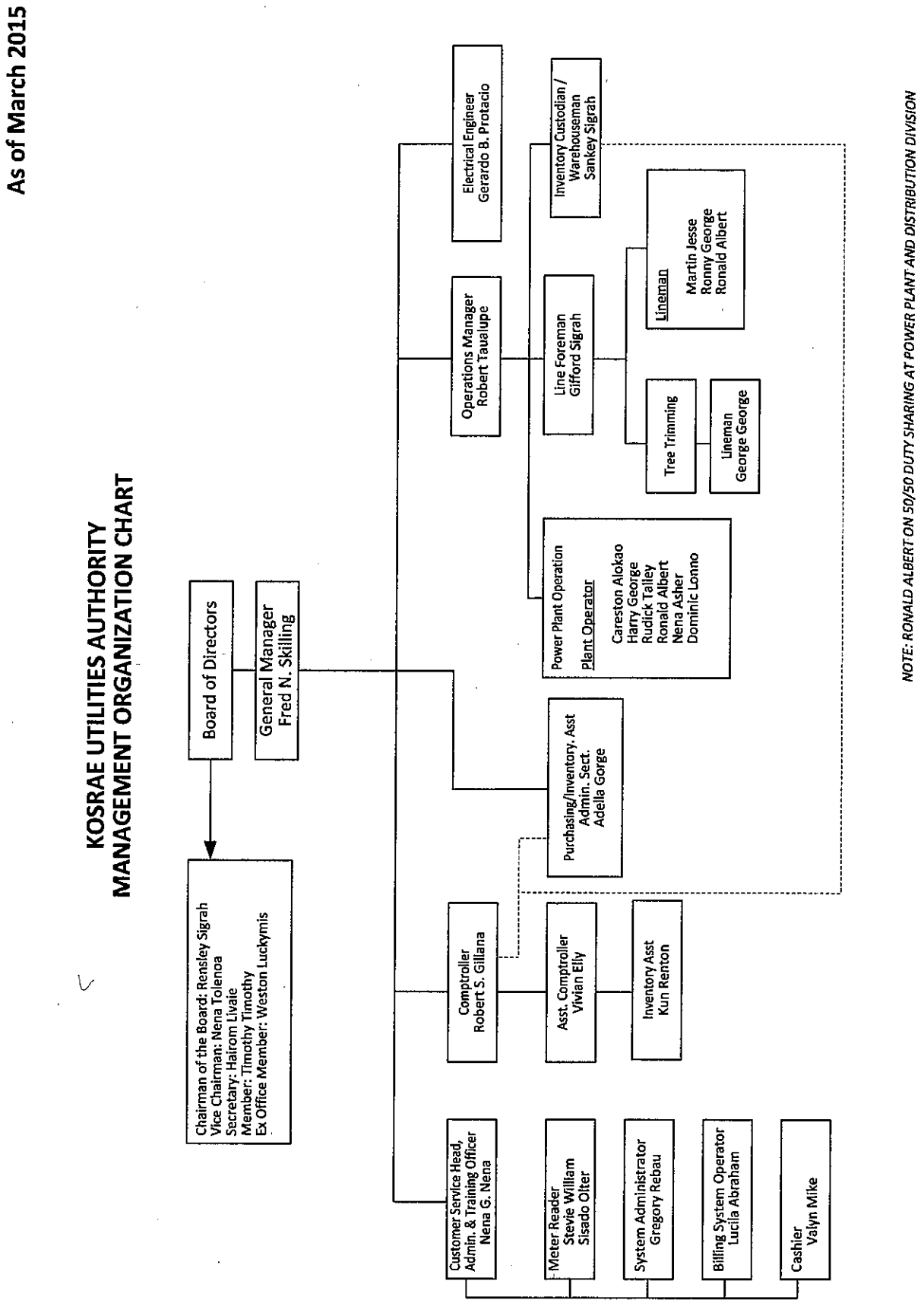
PROPOSED SITE PLAN OF NEW POWER PLANT

Annex-3



ORGANIZATION STRUCTURE OF KOSRAE STATE GOVERNMENT

Annex-4



ORGANIZATION STRUCTURE OF KOSRAE UTILITY AUTHORITY

Annex-5

JAPAN'S GRANT AID

The Government of Japan (hereinafter referred to as "the GOJ") is implementing the organizational reforms to improve the quality of ODA operations, and as a part of this realignment, a new JICA law was entered into effect on October 1, 2008. Based on the law and the decision of the Government of Japan (hereinafter referred to as "the GOJ"), JICA has become the executing agency of the Grant Aid for General Projects, for Fisheries and for Cultural Cooperation, etc.

The Grant Aid is non-reimbursable fund to a recipient country to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid Procedures

The Japanese Grant Aid is conducted as follows-

・Preparatory Survey (hereinafter referred to as "the Survey")
- The Survey conducted by JICA

・Appraisal &Approval
- Appraisal by The GOJ and JICA, and Approval by the Japanese Cabinet

・Determination of Implementation
- The Notes exchanged between the GOJ and a recipient country

・Grant Agreement (hereinafter referred to as "the G/A")
- Agreement concluded between JICA and a recipient country

・Implementation
- Implementation of the Project on the basis of the G/A

2. Preparatory Survey

(1) Contents of the Survey

The aim of the Survey is to provide a basic document necessary for the appraisal of the Project by JICA and the GOJ. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of agencies concerned of the recipient country necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, financial, social and economic point of view.
- Confirmation of items agreed on by both parties concerning the basic concept of the Project.
- Preparation of a basic design of the Project.
- Estimation of costs of the Project.

The contents of the original request by the recipient country are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of the Japan's Grant Aid scheme.

JICA requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA uses (a) registered consulting firm(s). JICA

selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

The Report on the Survey is reviewed by JICA, and after the appropriateness of the Project is confirmed, JICA recommends the GOJ to appraise the implementation of the Project.

3. Japan's Grant Aid Scheme

(1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as "the E/N") will be singed between the GOJ and the Government of the recipient country to make a plead for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions.

(2) Selection of Consultants

The consultant firm(s) used for the Survey will be recommended by JICA to the recipient country to also work on the Project's implementation after the E/N and the G/A, in order to maintain technical consistency.

(3) Eligible source country

Under the Japanese Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When JICA and the Government of the recipient country or its designated authority deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals".

(4) Necessity of "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by JICA. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

(5) Major undertakings to be taken by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as Annex-5.

(6) "Proper Use"

The Government of the recipient country is required to maintain and use the facilities constructed and the equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

(7) "Export and Re-export"

The products purchased under the Grant Aid should not be exported or re-exported from the recipient country.

(8) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). JICA will execute the Grant Aid by making

payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions to the Bank.

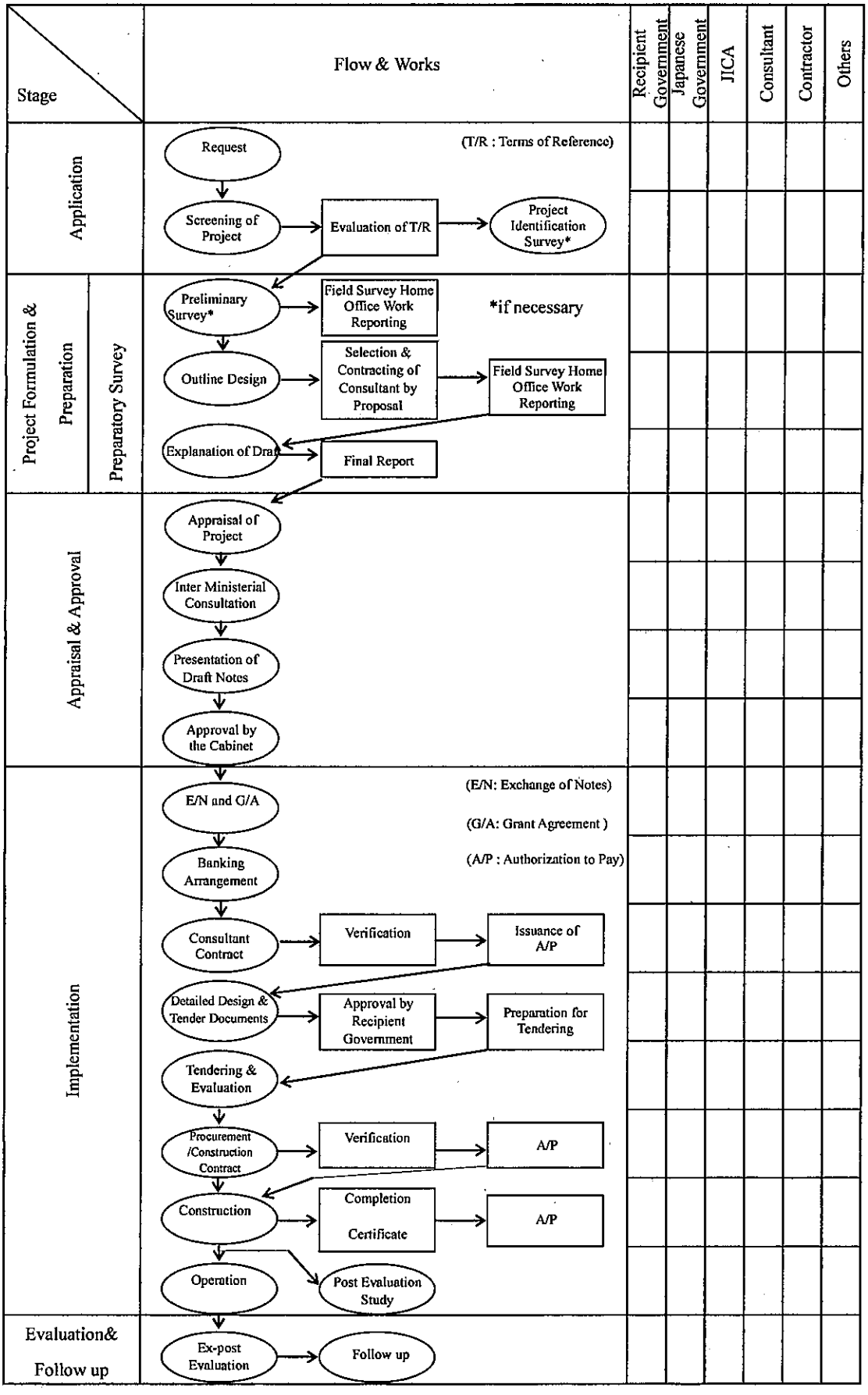
(10) Social and Environmental Considerations

A recipient country must ensure the social and environmental considerations for the Project and must follow the environmental regulation of the recipient country and JICA socio-environmental guideline.

(End)

Annex-6

Flow Chart of Japan's Grant Aid Procedures



Annex-7

Major Undertakings to be taken by Each Side

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	to secure lots of land necessary for the implementation of the Project and to clear the sites;		●
2	To construct the following facilities		
	1) The building	●	
	2) The gates and fences in and around the site		●
	3) The parking lot	●	
	4) The road within the site	●	
	5) The road outside the site (including Access road)		●
3	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the sites		
	1)Electricity		
	a. The distributing power line to the site		●
	b. The drop wiring and internal wiring within the site	●	
	c. The main circuit breaker and transformer	●	
	2) Water Supply		
	a. The city water distribution main to the site		●
	b. The supply system within the site (receiving and elevated tanks)	●	
	3) Drainage		
	a. The city drainage main (for storm sewer and others to the site)		●
	b. The drainage system (for toilet sewer, common waste, storm drainage and others) within the site	●	
	4) Gas Supply		
	a. The city gas main to the site		●
	b. The gas supply system within the site	●	
	5) Telephone System		
	a. The telephone trunk line to the main distribution frame/panel (MDF) of the building		●
	b. The MDF and the extension after the frame/panel	●	
	6) Furniture and Equipment		
	a. General furniture		●
	b. Project equipment	●	
4	To ensure prompt unloading and customs clearance of the products at ports of disembarkation in the recipient country and to assist internal transportation of the products		
	1) Marine (Air) transportation of the Products from Japan to the recipient country	●	
	2) Tax exemption and custom clearance of the Products at the port of disembarkation		●
	3) Internal transportation from the port of disembarkation to the project site	●	
5	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the products and the services be exempted		●
6	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		●
7	To ensure that the Facilities and the products be maintained and used properly and effectively for the implementation of the Project		●
8	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project		●
9	To bear the following commissions paid to the Japanese bank for banking services based upon the B/A		
	1) Advising commission of A/P		●
	2) Payment commission		●
10	To give due environmental and social consideration in the implementation of the Project.		●

FD

Annex-8

[Preliminary Concept Note]
"Hybrid Islands Initiative" in Pacific island countries

JICA
2015/3/2

1. Challenges
   1) Most of pacific island countries have too much dependency on imported fuel for power generation. It poses a continuing threat in terms of energy security.
   2) The reduction of fossil fuel consumption can contribute to mitigating the vulnerability of high import cost and its fluctuation. Adverse impact of climate change can also be mitigated.
   3) The advantages of Renewable Energy (sustainability) and efficient Diesel (reliability) should be utilized in each country. The optimal development can facilitate the fuel consumption reduction as well as reliable supply (=Hybrid Grid system).

2. JICA's approach
   1) Overall goal: Support to enhance the energy security through the reduction of fossil fuel consumption in pacific island countries.
   2) Approach: Reduce the fossil fuel consumption maintaining power system stability:
      a) Development of Renewable Energy: Grant (ex. grid-connected PV, WT, stabilized devices), Training, etc.
      b) Improvement of efficiency of Diesel Generation: Grant (DG upgrading), T/A(ex. capacity development of cost-effective O/M), Training, etc.

3. Cooperation
   1) Target countries: 13 countries (Fiji, Kiribati, Marshall Islands, FS of Micronesia, Vanuatu, Palau, Samoa, Solomon Islands, Tonga, Tuvalu, Cook Islands, Nauru, and Niue)
   2) Cooperation period: Phase I (2015-2017) and Phase II (2018-2020)
   3) Resources:
      - Mobilize the experience of island regions of Japan (ex. Okinawa).
      - Utilize Japanese technology and drive private sector initiative.

4. Work Schedule
   1) Program formulation study: January-June, 2015 (consultant work to propose the candidate cooperation programs)
   2) PALM 7 Meeting: End of May, 2015
   3) Program processing: Individual candidates (Grant, T/A, Training, etc) to be identified in the program formulation study, and to be processed after PALM 7 Meeting.

//

(2) Minutes of Discussion (January, 2016)

Minutes of Discussions
on the Preparatory Survey
for the Project for Power Sector Improvement for the State of Kosrae
(Explanation on Draft Preparatory Survey Report)

On the basis of the discussions and field survey in Federated States of Micronesia (hereinafter referred to as "FSM") in March 2015, and the subsequent technical examination of the results in Japan, the Japan International Cooperation Agency (hereinafter referred to as "JICA") prepared a draft Preparatory Survey Report for the Project for Power Sector Improvement for the State of Kosrae (hereinafter referred to as "the Draft Report").

In order to explain the Draft Report and to consult with the concerned officials of the Government of FSM on its contents, JICA sent to FSM the Preparatory Survey Team for the explanation of the Draft Report (hereinafter referred to as "the Team"), headed by Mr. Tadayuki Ogawa, Senior Advisor, JICA, and is scheduled to stay in the country from 22nd to 30th, January 2016.

As a result of the discussions, both sides confirmed the main items described in the attached sheets.

Pohnpei, 28th January, 2016

Mr. Tadayuki Ogawa
Leader
Preparatory Survey Team
Japan International Cooperation Agency

Hon. Marion Henry
Secretary
Department of Resources and Development
Federated States of Micronesia

for Hon. Lyndon H. Jackson
Governor
Kosrae State Government
Federated States of Micronesia

Witnessed by

Mr. Fred N. Skilling
General Manager
Kosrae Utilities Authorities
Federated States of Micronesia

Hon. Lorin S. Robert
Secretary
Department of Foreign Affairs
Federated States of Micronesia

ATTACHMENT

1. Title of the Preparatory Survey
   Both sides confirmed the title of the Preparatory Survey as "The Project for Power Sector Improvement for the State of Kosrae" (hereinafter referred to as "the Project").

2. Objective of the Project
   The objective of the Project is to secure efficient and stable power supply through replacing diesel engine generator(s) and associated substation and distribution facilities in the State of Kosrae in order to improve the quality of life for the people, as well as contributing to economic development of the country and countermeasures for environmental and climate change.

3. Project Site
   Both sides confirmed that the Project sites are located in the State of Kosrae, FSM, as shown in Annex-1.

4. Line Agency and Executing Agency
   Both sides confirmed the line agency and executing agency as follows:
   4-1. The line agency is Kosrae State Government, which would be the agency to supervise the executing agency. The organization charts are shown in Annex 2-1.
   4-2. The executing agency is Kosrae Utilities Authority (KUA). The executing agency shall coordinate with all the relevant agencies to ensure smooth implementation of the Project and ensure that the Undertakings are taken by relevant agencies properly and on time. The organization charts are shown in Annex 2-2.

5. Contents of the Draft Report
   After the explanation of the contents of the Draft Report by the Team, the FSM side agreed in principle to its contents.

6. Cost Estimation
   Both sides confirmed that the Project cost estimation described in Annex 3 was provisional and would be examined further by the Government of Japan for its final approval.

7. Confidentiality of the Cost Estimation and Specifications

Both sides confirmed that the Project cost estimation shown in Annex 3 and technical specifications in the Draft Report should never be duplicated or disclosed to any third parties until the procurement contract is concluded between FSM side and Japanese contractor.

8. Japanese Grant Scheme

The FSM side understands the Japanese Grant Scheme and its procedures as described in Annex 4, 5 and 6, and necessary measures to be taken by the Government of FSM.

9. Project Implementation Schedule

The Team explained to the FSM side that the expected implementation schedule is as attached in Annex 7.

10. Expected outcomes and Indicators

Both sides agreed that key indicators for expected outcomes as follows. The FSM side has responsibility to monitor the progress of the indicators and achieve the target in year 2021.

[Quantitative Effect]

Indicator	Current Value (As of End of 2014)	Planned Value (March 2021)
Maximum rated capacity to be replaced	0 kW	1,200 kW
Frequency of power interruption	48 times/year	24 times/year
Generating Energy	5,463 MWh	7,450 MWh
Fuel consumption per kWh	234 g/kWh	229 g/kWh

[Qualitative Effect]

It is expected to improve the quality of life for the people, as well as contributing to economic development of the country through stable power supply.

11. Soft Component of the Project

Considering the sustainable operation and maintenance of the provided facility, following technical assistance is planned to be provided under the Project.

- KUA will compile plans for the operation and maintenance and preventive maintenance of diesel engine generators, mechanical and electrical equipment, and interconnected operation with the PV system acquired.

The FSM side confirmed that it will assign necessary number of competent and appropriate C/Ps as described in the Draft Report.

12. Undertakings Taken by Both Sides

Both sides confirmed undertakings described in Annex 8. The FSM side (Kosrae State Government / KUA) assured to take the necessary measures and coordination including allocation of the necessary budget which are preconditions of implementation of the Project shown in Annex 3. It is further agreed that the costs are indicative, i.e. at Outline Design level. More accurate costs will be calculated at the Detailed Design stage.

13. Monitoring during the Implementation

The Project will be monitored at least every 3 months by the executing agency and using the Project Monitoring Report (PMR). The template of PMR is shown in Annex 9.

14. Ex-Post Evaluation

JICA will conduct ex-post evaluation three (3) years after the project completion with respect to five evaluation criteria (Relevance, Effectiveness, Efficiency, Impact, Sustainability) of the Project. Result of the evaluation will be publicized. The FSM side is required to provide necessary support for them.

15. Issues to be Considered for the Smooth Implementation of the Project

Both sides confirmed to the issues to be considered and taken necessary measures for the smooth implementation of the Project described in Annex 7.

16. Schedule of the Study

JICA will complete the Final Report of the Preparatory Survey in accordance with the confirmed items and send it to the FSM side around May 2016.

17. Environmental and Social Considerations

17-1 General Issues

17-1-1 Environmental Guidelines and Environmental Category

The JICA mission explained that 'JICA Guidelines for Environmental and Social Considerations (April 2010)' (hereinafter referred to as 'the Guidelines') is applicable for the Project. The Project is categorized as B because it is not likely to

have a significant adverse impact on the environment as the Project is not considered to be a large-scale power sector project, is not located in a sensitive area, has none of the sensitive characteristics under the JICA guidelines for environmental and social considerations.

17-1-2 Environmental Checklist

The environmental and social considerations including major impacts and mitigation measures for the Project are summarized in the Environmental Checklist attached as Annex 10. Both sides confirmed that in case of major modification of the content of the Environmental Checklist, The FSM side shall submit the modified version to JICA in a timely manner.

17-2 Environmental Issues

17-2-1 Environmental Impact Assessment (EIA)

Both sides confirmed the Interim Environmental Impact Statement (EIS) report has been approved by Kosrae Island Resources Management Authority (KIRMA) in July, 2013. Both side confirmed that the final EIS report should be approved by KIRMA and to be submitted it to JICA through KUA in March, 2016.

17-2-2 Environmental Management Plan and Environmental Monitoring Plan

Both sides confirmed Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP) of the Project is as Annex 11, respectively. Both side agreed that environmental mitigation measures and monitoring shall be conducted based on the EMP and EMoP, which may be updated during the detailed design stage.

17-3 Social Environment

Both sides confirmed that KUA will make an easement agreement with land owners for a part of distribution line in Lelu island which will be re-located and /or added in the Project before the tender notice for the Project shown in Annex 8.

17-4 Environmental and Social Monitoring

Both sides agreed that the FSM side will submit results of environmental and social monitoring to JICA by using the monitoring form attached as Annex 12.

18. Other Relevant Issues

18-1. Ownership of equipment and material

Both side confirmed the equipment and material are owned by Kosrae State Government upon the completion of the Project.

18-2. Operation and Maintenance of the Facilities (Equipment)

The Team explained the importance of operation and maintenance of the equipment procured by the Project considering that proper asset management impacts greatly on life-span of the equipment and its maintenance cost. The FSM side shall secure enough staff and budgets necessary for appropriate operation and maintenance of the equipment.

The Team strongly recommended concluding the Maintenance Contract between KUA and Japanese manufacturer of the diesel engine and generator, in order to ensure the implementation of periodical maintenance by the manufacturer.

18-3. The Equipment which may be procured from third countries

The Team explained that the equipment/material for the Project will be basically procured from Japan. However, some of the items listed below may be procured from third countries due to availability and commercial competency of products. The FSM side agreed on the explanation by the Team.

(1) Electrical installation materials (middle voltage cable)
(2) Utility poles, and necessary accessories
(3) Pole transformers
(4) 15 kV power distribution underground cables

18-4. Tax Exemption

Both side confirmed FSM side will ensure that customs duties, internal taxes and other fiscal levies which may be imposed in FSM with respect to the purchase of the products and the services to be exempted. Items of taxes to be exempted, organizations in charge, necessary documentations, and procedures need to be prepared are shown in Annex 13.

18-5. Cooperation among Relevant Organizations

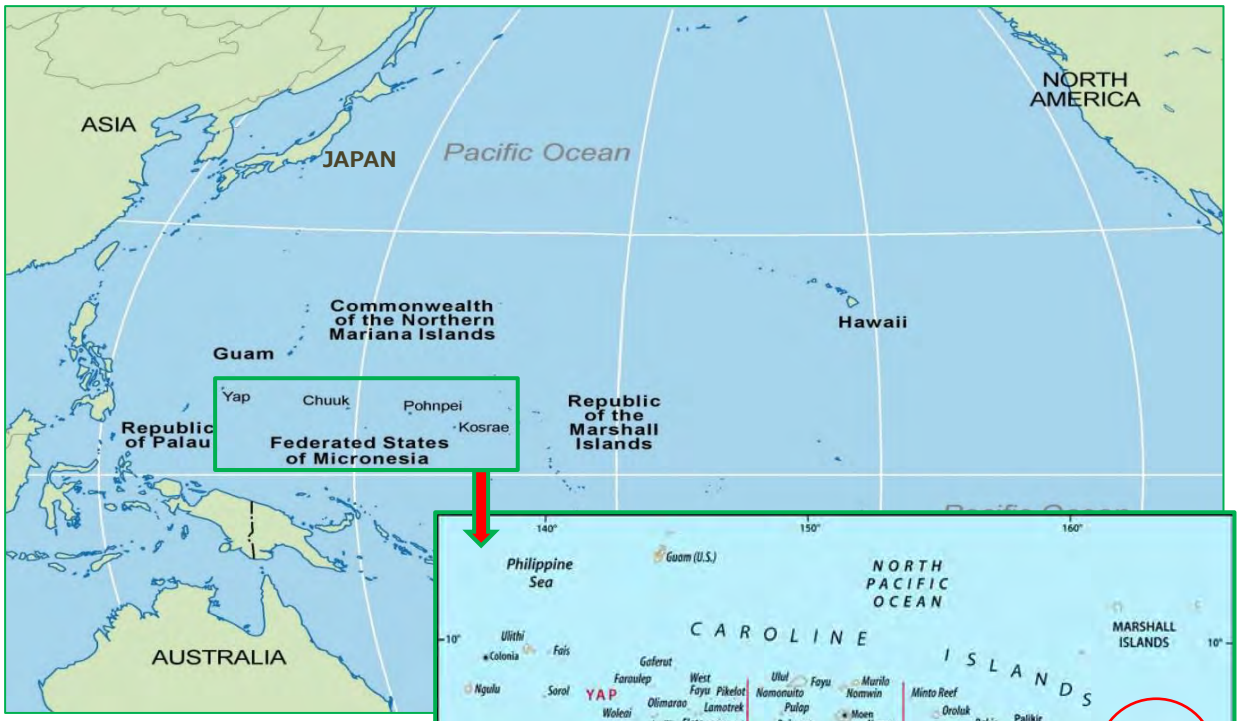
Both sides confirmed that Department of Resource and Development, FSM will coordinate the other donor's projects related to the powers sector of Kosrae and support KUA to assure smooth implementation and operation of the Project as well as to avoid any duplication or confusion among the donor's projects.

18-6. Disclosure of Information

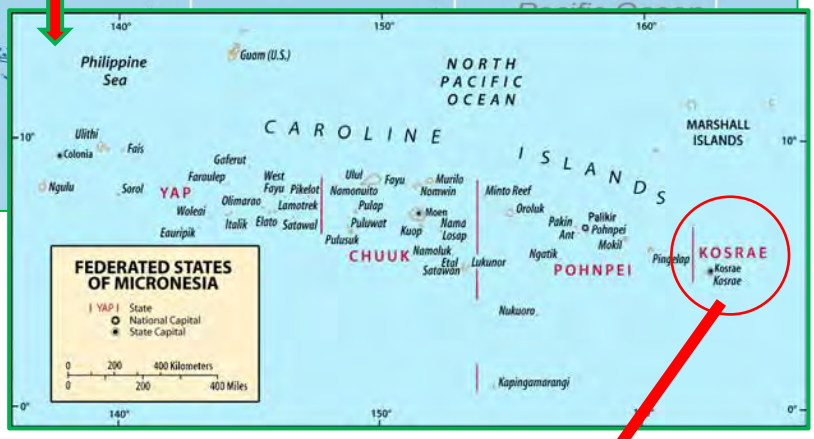
Both sides confirmed that the study results excluding the Project cost will be disclosed to the public after completion of the Preparatory Survey. All the study results including the project cost will be disclosed to the public after the procurement contract is concluded between FSM side and Japanese contractor.

【Annex 1 Project Site】
【Annex 2-1 Organization Chart of Kosrae State Government】
【Annex 2-2 Organization Chart of Kosrae Utilities Authority】
【Annex 3 Project Cost Estimation】
【Annex 4 Japanese Grant】
【Annex 5 Flow Chart of Japanese Grant Procedures】
【Annex 6 Financial Flow of Japanese Grant】
【Annex 7 Project Implementation Schedule】
【Annex 8 Major Undertakings to be taken by Each Government】
【Annex 9 Project Monitoring Report】
【Annex 10 Environmental Check List】
【Annex 11 Environmental Management Plan/Environmental Monitoring Plan】
【Annex 12 Environmental and Social Monitoring Form】
【Annex 13 Tax Exemption】

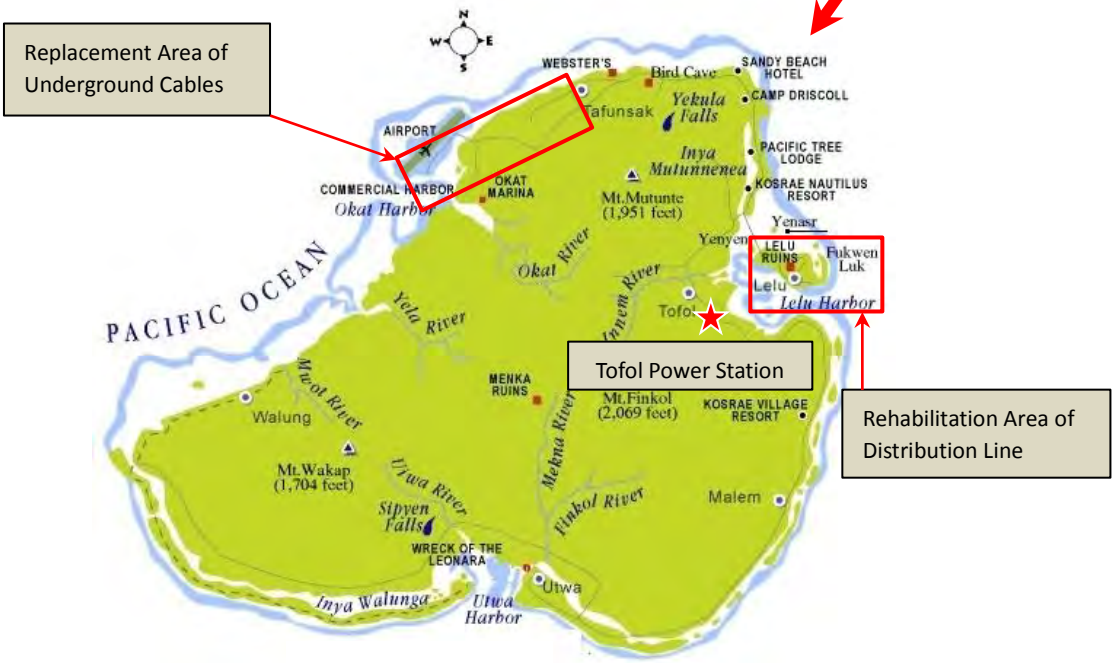
ANNEX-1



Location of the Federated States of Micronesia



Location of the States of Kosrae



State of Kosrae

LOCATION OF PROJECT SITE

As of March 2015

ORGANIZATION CHART OF KOSRAE STATE GOVERNMENT

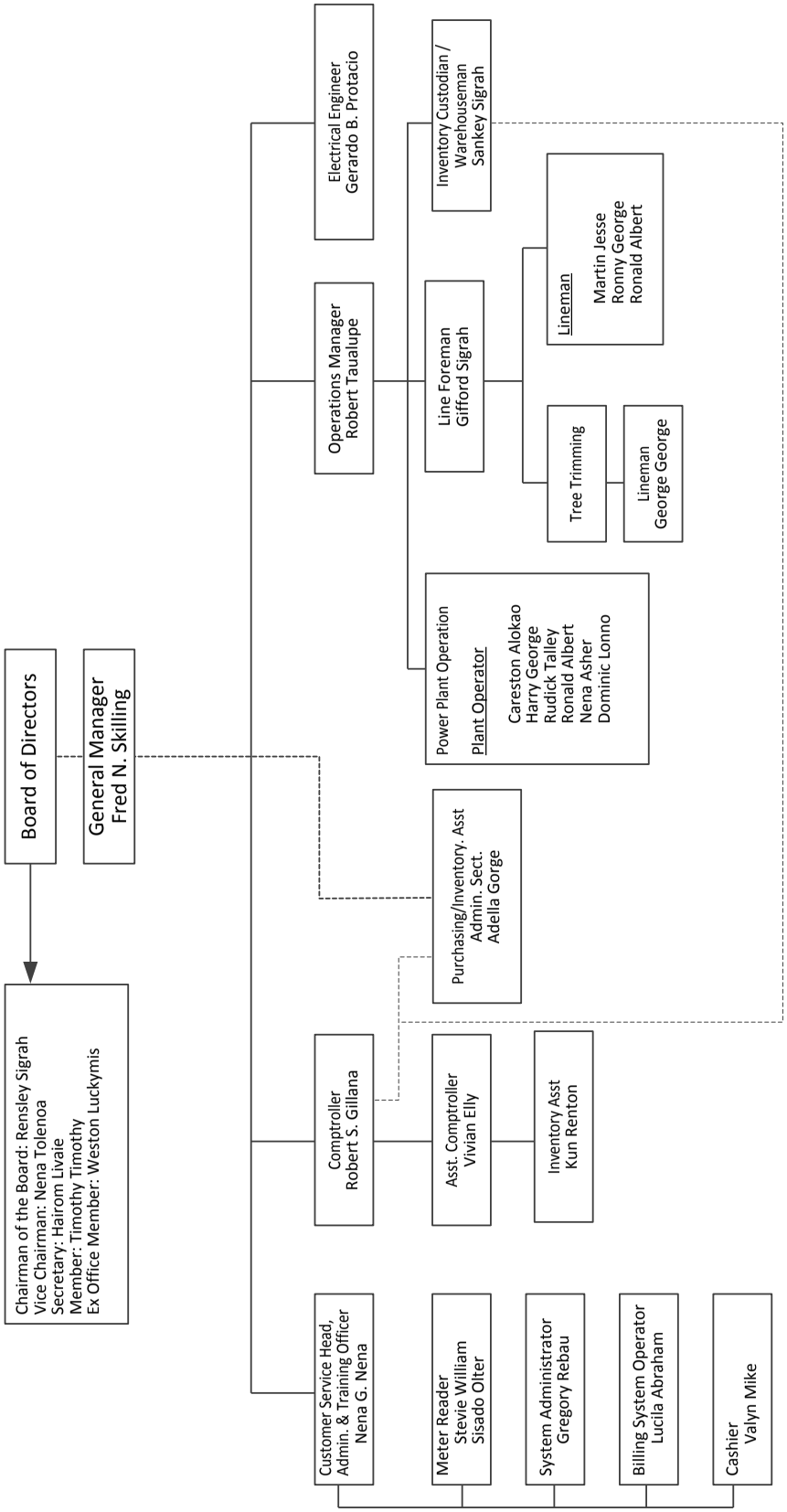
- Office of the Governor
Lyndon H. Jackson
  - Office of the Lieutenant Governor
Carson K. Sigrah
    - Office of the Attorney General
Jamal A. Saleh
      - Division of Law
Snyder Saimon
      - Division of Public Safety
Chief Edmond Salik
    - Department of Administration & Finance
Tiser Rynold
      - Personnel & Employment Services
Rolner Joe
      - Finance
Switson Robert
      - Statistics, Budget, Overseas Dev. Assist. & Compact Management (Vacant)
    - Department of Education
Lyndon L. Crnelius
      - Curriculum & Instructional Services
Hanson Sigrah
      - Supplemental Programs
Vacant
      - Facilities Support Services
Lugo Skilling
    - Department of Health Services
Livinson Taulung
      - Curative Services
Dr. Tholman Alik
      - Administrative Services
Kun Mongkeya
      - Preventive Services
Nena M. Tolenoa
    - Department of Transportation & Infrastructure
Weston Luckymis
      - Infrastructure & Road Maintenance
Thansley Kinere
      - Design & Engineering
Joey Areo
    - Dept. of Resources & Economic Affairs
Steven L. Geore
      - Trade & Investment
Stanley Taffilman
      - Agriculture & Land Management
Rev. Mordaniel Tolenna
      - Fisheries & Marine
Macwell Slik
      - Economic Planning
Rev. Madison Nena
    - Agencies
      - Kosrae Visitors Bureau
Grant Ismael
      - Broadcast Authority
Keitson Jonas
      - Kosrae Island Resource Management Authority
Robert H. Jakson
      - Kosrae Port Authority
Hastig Abraham
      - Parole Board
Rolinson Neth
      - Public Auditor
Stoney Taulung
    - Public Enterprises
      - Small Business Development Center
Skiller Jackson
      - Semo Corporation
Mr. Jung
      - FSMPC
Hostino Livaie
      - Telecommunication
Witson Phillip
      - Kosrae Hotel Corporation
Ione Siba
      - Kosrae Utility Authority
Fred N. Skiling

Annex-2-1

Annex-2-2

As of March 2015

KOSRAE UTILITIES AUTHORITY
MANAGEMENT ORGANIZATION CHART



NOTE: RONALD ALBERT ON 50/50 DUTY SHARING AT POWER PLANT AND DISTRIBUTION DIVISION

Annex 3

Project Cost Estimation

In the case of the actual implementation of the Project under the grant aid scheme of the Government of Japan, the Federated States of Micronesia Side is expected to pay the costs of its undertakings listed below.

(1) Costs to be borne by the Federated States of Micronesia Side

The total cost to be borne by the Federated States of Micronesia Side is approximately 71,000 USD (8.51 million JPY)

Item	Amount (US$)	Amount (1,000 yen)
1. Removal of obstructions, trees, weeds, etc. from the scheduled construction site for the new power station	US$ 1,000	120 k-yen
2. Construction of the following facilities on the scheduled construction site for the new power station (1) Gate and perimeter fence for the new power station (2) Guardroom	US$ 5,000-	600 k-yen
3. Connection of underground cable and overhead lines (3 lines) from the station 13.8 kV distribution board to the first pole under supervision by engineers of the Japanese contractor	US$ 2,000-	240 k-yen
4. Renewal of low-voltage lines of the Lelu Island distribution line to be renewed in the Project	US$ 44,000-	527 k-yen
5. Re-installation of water supply pipes for the new power station	US$ 2,000-	240 k-yen
6. PR activities concerning the scheduled power interruption plan in line with Project implementation (radio, newspapers, etc.)	US$ 2,000-	240 k-yen
7. Others (including opening of bank account and payment commission)	US$ 15,000-	1,800 k-yen
Total	US$ 71,000-	8,510 k-yen

(2) Estimation criteria

a) Estimation point : March 2015

b) Exchange rate : 1 US$=119.79 JPY
(TTS mean value from December 2014 to February 2015)

c) Works and procurement period:
The detailed design and equipment procurement and installation period is as shown in the implementation schedule

d) Other points : The Project will be implemented according to the Grant Aid scheme of the Government of Japan.

Annex-4

JAPAN'S GRANT AID

The Government of Japan (hereinafter referred to as "the GOJ") is implementing the organizational reforms to improve the quality of ODA operations, and as a part of this realignment, a new JICA law was entered into effect on October 1, 2008. Based on the law and the decision of the Government of Japan (hereinafter referred to as "the GOJ"), JICA has become the executing agency of the Grant Aid for General Projects, for Fisheries and for Cultural Cooperation, etc.

The Grant Aid is non-reimbursable fund to a recipient country to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid Procedures

The Japanese Grant Aid is conducted as follows-

- Preparatory Survey (hereinafter referred to as "the Survey")
  - The Survey conducted by JICA
- Appraisal &Approval
  - Appraisal by The GOJ and JICA, and Approval by the Japanese Cabinet
- Determination of Implementation
  - The Notes exchanged between the GOJ and a recipient country
- Grant Agreement (hereinafter referred to as "the G/A")
  - Agreement concluded between JICA and a recipient country
- Implementation
  - Implementation of the Project on the basis of the G/A

2. Preparatory Survey

(1) Contents of the Survey

The aim of the Survey is to provide a basic document necessary for the appraisal of the Project by JICA and the GOJ. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of agencies concerned of the recipient country necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, financial, social and economic point of view.
- Confirmation of items agreed on by both parties concerning the basic concept of the Project.
- Preparation of a basic design of the Project.
- Estimation of costs of the Project.

The contents of the original request by the recipient country are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of the Japan's Grant Aid scheme.

JICA requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA uses (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

The Report on the Survey is reviewed by JICA, and after the appropriateness of the Project is confirmed, JICA recommends the GOJ to appraise the implementation of the Project.

Annex-4

3. Japan's Grant Aid Scheme

(1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as "the E/N") will be singed between the GOJ and the Government of the recipient country to make a plead for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions.

(2) Selection of Consultants

The consultant firm(s) used for the Survey will be recommended by JICA to the recipient country to also work on the Project's implementation after the E/N and the G/A, in order to maintain technical consistency.

(3) Eligible source country

Under the Japanese Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When JICA and the Government of the recipient country or its designated authority deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals".

(4) Necessity of "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by JICA. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

(5) Major undertakings to be taken by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as Annex-5.

(6) "Proper Use"

The Government of the recipient country is required to maintain and use the facilities constructed and the equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

(7) "Export and Re-export"

The products purchased under the Grant Aid should not be exported or re-exported from the recipient country.

(8) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). JICA will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.
b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions to the Bank.

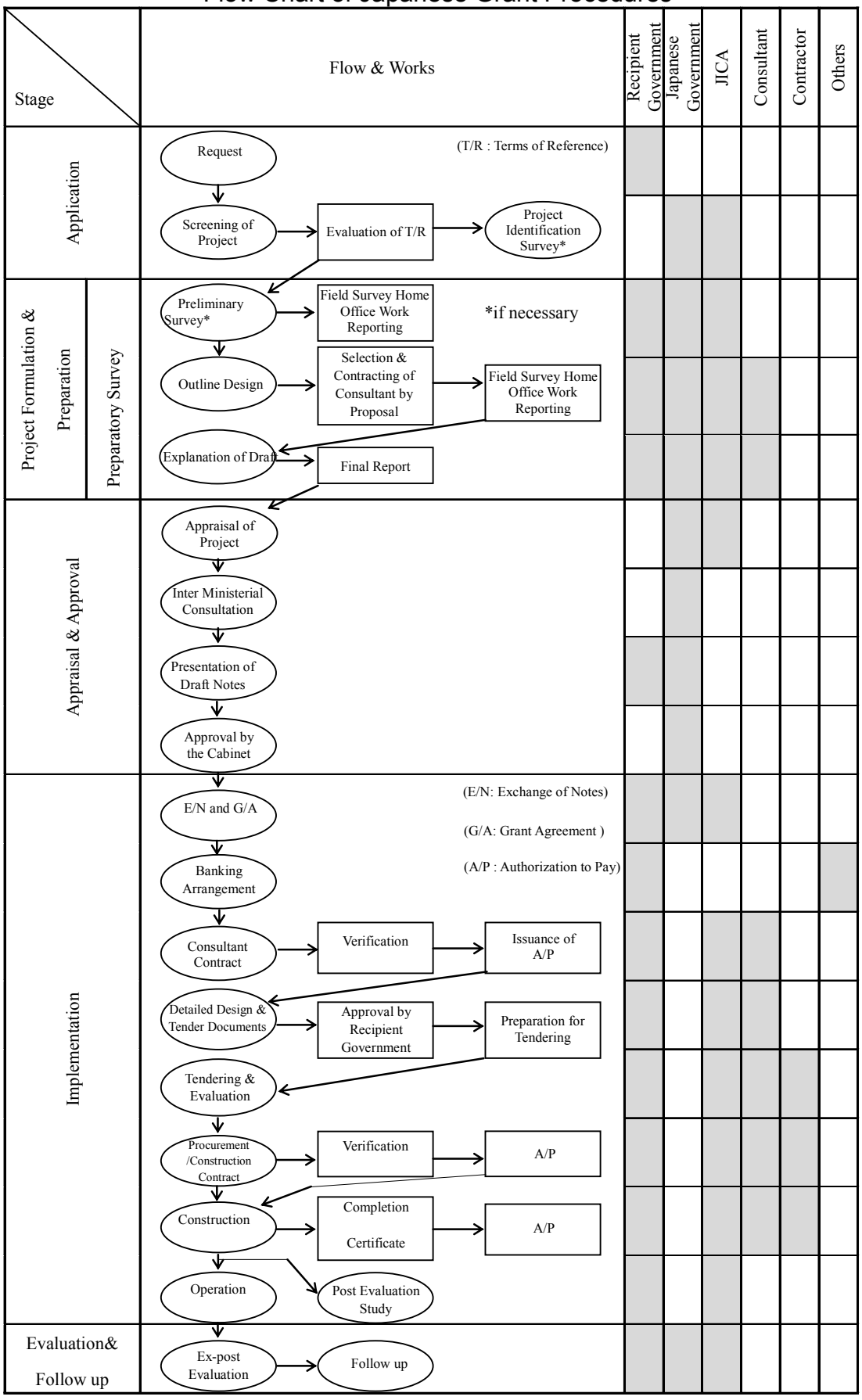
(10) Social and Environmental Considerations

A recipient country must ensure the social and environmental considerations for the Project and must follow the environmental regulation of the recipient country and JICA socio-environmental guideline.

(End)

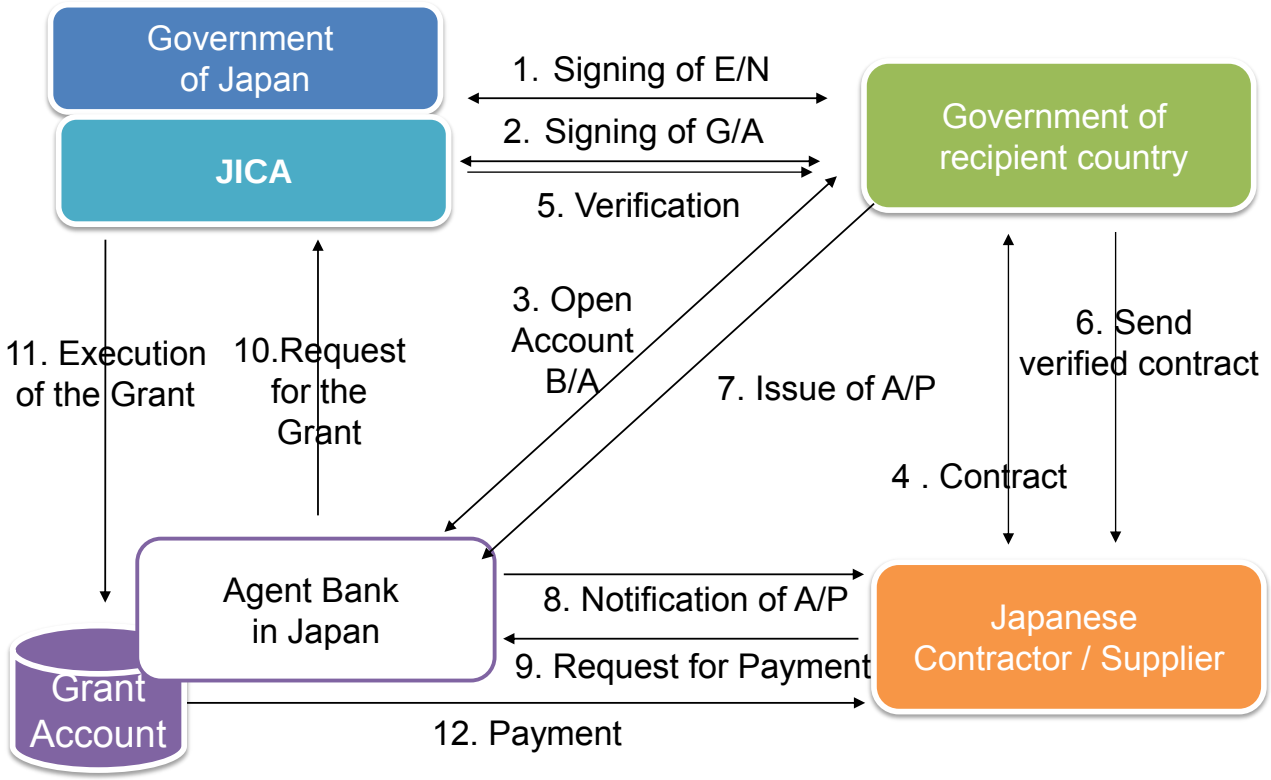
Annex-5

Flow Chart of Japanese Grant Procedures



Annex-6

Financial Flow of Japanese Grant



Project Implementation Schedule (Tentative)

Description	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Notes
I. Implementation Schedule																											
1. Contract																											
1.1 Cabinet Meeting of Japanese Government	★																										
1.2 Exchange of Notes for the Project		★																									: Work in Japan
1.3 Grant Agreement for the Project		★																									: Work in Kosrae
																											: Transportation
2. Detailed Design																											: FSM side Works
2.1 Consulting Services Agreement			★																								
2.2 Reconfirmation of Site Situation																											
2.3 Preparation of Tender Documents																											
2.4 Approvals for Tender Documents from FSM side																											
2.5 Announcement of the Tender					★																						
2.6 Preparation of Bid Documents by Tenderers																											
2.7 Tender Opening							★																				Attended by FSM side
2.8 Tender Evaluation																											
2.9 Contract with the successful Tenderer							★																				
3. Procurement of Equipment																											
3.1 Kick-off Meeting with the Contractor																											
3.2 Preparation & Approval of Shop Drawings																											
3.3 Fabrication and Procurement of Equipment																											
3.4 Pre-shipment Inspection of Equipment											★			★		★											
4.3 Transportation of Equipment																											
4. Construction of Building (New Powerhouse)																											
4.1 Preparation Works (Site office, Accommodation etc.)																											
4.2 Civil and Foundation Works of Building																											
4.3 Structure & Finishing Works of Building																											
4.4 Civil & Foundation Works of External Equipment																											
5. Installation of Equipment																											
5.1 Installation of Power Distribution Lines at Lelu Area																											
5.2 Installation of Diesel Engine Generators with Auxiliaries																											
5.3 Trial Run, Commissioning, OJT (On the Job Training)																											
5.4 Handing Over																											
II. FSM Side Works (by KUA)																											
1. Relocation of the existing city water pipeline and site clearance																											
2. Relocation of low voltage distribution lines from existing electrical poles																											
3. Connection of 13.8kV feeder cables to dead end poles																											

Annex-8

Major Undertakings to be taken by Recipient Government

1. Before the Tender

No	Items	Deadline	In charge	Cost (thousand USD)	Ref.
1	Payment of following Commissions based on a banking agreement (1)B/A(Banking Arrangement) (2) A/P (Authorization to Pay) commission	within 1 month after G/A	Department of Foreign Affairs / Department of Finance & Administration	12.0	E/N and G/A
2	To conclude the easement agreement with land owner(s) for installation works of re-located/added electric poles and underground cable for distribution line at Lelu island.	Before the tender notice for the Project	KUA	-	Development Review regulation by KIRMA
3	To obtain final approval from KIRMA for Environment Impact Assessment (EIA)	March, 2016	KUA/ KIRMA	-	Development Review regulation by KIRMA
4	To clear obstructs such as a pigpen, the existing store, heavy and old machinery and glasses/weeds at new power station site	Before the tender notice for the Project	KUA	1.0	M/D of the preparatory survey

2. During the Project Implementation

No	Items	Deadline	In charge	Cost (thousand USD)	Ref.
1	To ensure prompt unloading and customs clearance of the products at the port of disembarkation in recipient country and assist internal transportation of the products	During the Project	Department of Finance & Administration / Kosrae State Government	-	M/D of the preparatory survey
2	To accord Japanese nationals whose services may be requires in connection with the supply of the products and services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work	During the Project	Department of Foreign Affairs	-	M/D of the preparatory survey
3	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the Products and the Services to be exempted (1)Tax exemption and customs clearance of the products at the port of disembarkation (2) Exemption or bearing of domestic tax on locally procured construction materials and equipment	During the Project	(1)Department of Finance & Administration (2) Department of Administration and Finance, Kosrae State Government	-	M/D of the preparatory survey ** Refer to Annex 13**
4	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for construction of the facilities as well as for the transportation and installation of the equipment	During the Project	KUA	-	M/D of the preparatory survey
5	To construct for the project sites the following facilities (1) Gate and fences for new power house, if necessary (2) Guard house, if necessary Temporally fence & gate will be constructed by Japanese side	During the Project	KUA	5.0	M/D of the preparatory survey
6	To connect 13.8kV feeder cables to dead end poles of three (3) 13.8kV feeders under the supervision of the contractor's engineer(s)	During the Project	KUA	2.0	M/D of the preparatory survey
7	To repair the low voltage distribution lines and telecom lines at Lelu island	During the Project	KUA	44.0	M/D of the preparatory survey
8	Connection works of new cable and existing cable for Okat underground distribution line.	During the Project	KUA	1.0	M/D of the preparatory survey

Annex-8

No	Items	Deadline	In charge	Cost (thousand USD)	Ref.
9	Final connection of the existing city water pipe line, drainage line, and fuel oil system located near the site (Planned new power house site)	During the Project	KUA	1.5	-M/D of the preparatory survey -Field report signed by KUA & the Consultant
10	Internet for remote supervision of diesel engine generators	During the Project	KUA	0.5	Field report signed by KUA & the Consultant
11	To prepare measures necessary to obtain the following permits: (1) Permit for the construction work of new power station, if necessary (2) Permits for installation works of generators & auxiliaries and distribution line works, if necessary.	during the Project	KUA	-	Field report signed by KUA & the Consultant
12	To Secure temporary storage yard for materials & equipment, and parking lot.	during the Project	KUA	-	M/D of the preparatory survey
13	Cutting trees which interfering with distribution lines during the project.	during the Project	KUA	-	Field report signed by KUA & the Consultant
14	To provide the places to dispose of surplus soil and waste water, if necessary	during the Project	KUA	-	Field report signed by KUA & the Consultant
15	Publicity Works (radio and newspapers) and appropriate customer services of power outage programs (schedules, places, etc.)	during the Project	KUA	2.0	Field report signed by KUA & the Consultant
16	To conduct of installation works of schedule timer with PCS switching panels	during the Project	KUA	1.0	M/D of the preparatory survey
17	To monitor and supervise the implementation of Environmental Management Plan (EMP) and mitigation measures prepared through the environmental assessment and monitor environmental and social impacts caused by the Project with an adaptive management approach	during the Project	KUA	-	JICA environmental and social guide line (2010)
18	To provide general furniture for new stations (control room)	Upon the completion of the facilities	KUA	1.0	M/D of the preparatory survey

3. After the Project

No	Items	Deadline	In charge	Cost (thousand USD)	Ref.
1	To monitor environmental and social impacts during the operation with an adaptive management approach	After completion of the construction	KUA	-	-JICA environmental and social guide line (2010) -Development Review regulation by KIRMA
2	To conduct appropriate operation and maintenance for facilities and equipment & materials constructed/installed under the Project, and procurement of necessary spare parts after completion of the Project.	After completion of the construction	KUA	154/year	M/D of the preparatory survey

*; The cost estimates are provisional. This is subject to the approval of the Government of Japan.

Project Monitoring Report
on
The Project for Power Sector Improvement for the State of Kosrae
in
The Federated State of Micronesia
Grant Agreement No. XXXXXXX

January 2016

Organization Information

Authority (Signer of the G/A)	**Department of Foreign Affair, FSM** Person in Charge (Division) Contacts Address: Phone/FAX: Email:
Executing Agency	**Kosrae Utility Authority (KUA)** Person in Charge Mr. Fred N. Skilling (Division) General Manager Contacts Address: KUA office, Tofol, Kosrae, FSM Phone/FAX: Email: kua@mail.fm
Line Agency	**Kosrae State Government** Person in Charge Hon. Lindon H. Jackson (Division) Governor Contacts Address: Phone/FAX: Email:

Outline of Grant Agreement:

Source of Finance	Government of Japan: Not exceeding JPY mil. Government of ( ):
Project Title	The Project for Power Sector Improvement for the State of Kosrae
E/N	Signed date: Duration:
G/A	Signed date: Duration:

1: Project Description

1-1 Project Objective

To secure efficient and stable power supply through replacing diesel engine generator(s) and associated substation and distribution facilities in the State of Kosrae in order to improve the quality of life for the people, as well as to contribute to economic development of the country.

1-2 Necessity and Priority of the Project

- Consistency with development policy, sector plan, national/regional development plans and demand of target group and the recipient country.

Implementation of the Project will enable supply of stable, good quality electricity to approximately 6,600 residents of Kosrae State.

Because of existing generators are very old, there are frequent troubles and unscheduled power interruptions that arise from deterioration. This triggers problems such as deterioration of the living environment and decline of public services for residents, and damage to tourism in Kosrae State.

Accordingly, the urgent renewal of equipment is needed. Also the distribution lines of Lelu Island was constructed in 1975 and has been operating for almost 40 years; moreover, due to harsh natural conditions and deterioration over time, the poles and lines are badly deteriorated. Accordingly, there is need to carry out urgent renewal of the distribution line.

1-3 Effectiveness and the indicators

- Effectiveness by the project

Quantitative Effect（Operation and Effect indicators）

Indicators	Original (Yr 2014)	Target (Yr 2021)
Maximum rated capacity to be replaced	0 kW	1,200 kW
Frequency of power interruption	48 times/year	24 times/year
Generating Energy	5,463 MWh	7,450 MWh
Fuel Consumption per kWh	234 g/kWh	229 g/kWh

Qualitative Effect

2: Project Implementation

2-1 Project Scope

Table 2-1-1a: Comparison of Original and Actual Location

Location	**Original:** *(M/D)*Tofol Power Station, Lelu island and Okat area **Attachment(s):Map**	**Actual:**(PMR)Tofol Power Station, Lelu island and Okat area **Attachment(s):Map**

Table 2-1-1b: Comparison of Original and Actual Scope

Items	Original	Actual
(M/D)	*(M/D)*	*(PMR)*
(1) Diesel Engine Generators	(1) 2 sets of 600 kW with related facilities	
(2) Indoor type substation	(2) To connect of existing distribution lines and existing and new generators	
(3) Underground distribution line	(3) Underground cables with necessary equipment and materials for airport area	
(4) Overhead distribution lines	(4) Overhead distribution lines with necessary equipment and materials for Lelu island area	
(5) Soft component	(5) Soft component shall be included in Items (1) above and operation method of interconnected PV system	

2-1-2 Reason(s) for the modification if there have been any.

(PMR)

2-2 Implementation Schedule

2-2-1 Implementation Schedule

Table 2-2-1: Comparison of Original and Actual Schedule

Items	Original		Actual
	DOD	G/A	
【*M/D*】	*(M/D)*		*(PMR)* As of (Date of Revision)

'Soft component' shall be stated in the column of 'Items'. Project Completion Date*			Please state not only the most updated schedule but also other past revisions chronologically.

*Project Completion was defined as _____ at the time of G/A.

2-2-2 Reasons for any changes of the schedule, and their effects on the project.

2-3 Undertakings by each Government

2-3-1 Major Undertakings

See Attachment 2.

2-3-2 Activities

See Attachment 3.

2-3-3 Report on RD

See Attachment 4.

2-4 Project Cost

2-4-1 Project Cost

Table 2-4-1a Comparison of Original and Actual Cost by the Government of Japan
(Confidential until the Tender)

Items			Cost (Million Yen)	
	Original	Actual	Original	Actual
Construction Facilities (or Equipment)	'Soft component' shall be included in 'Items'.			Please state not only the most updated schedule but also other past revisions chronologically.
Consulting Services	- Detailed design -Procurement Management -Construction Supervision			
Total				

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar = Yen

Table 2-4-1b Comparison of Original and Actual Cost by the Government of XX

Items			Cost (Million USD)	
	Original	Actual	Original	Actual
				Please state not only the most updated schedule but also other past revisions chronologically.
Total				

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar = (local currency)

2-4-2 Reason(s) for the wide gap between the original and actual, if there have been any, the remedies you have taken, and their results.

(PMR)

2-5 Organizations for Implementation

2-5-1 Executing Agency:

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

Original: *(M/D)*
Actual, if changed: *(PMR)*

2-6 Environmental and Social Impacts

- The results of environmental monitoring as attached in Attachment 5 in accordance with Schedule 4 of the Grant Agreement.
- The results of social monitoring as attached in Attachment 5 in accordance with Schedule 4 of the Grant Agreement.
- Information on the disclosed results of environmental and social monitoring to local stakeholders, whenever applicable.

3: Operation and Maintenance (O&M)

3-1 O&M and Management

- Organization chart of O&M
- Operational and maintenance system (structure and the number ,qualification and skill of staff or other conditions necessary to maintain the outputs and benefits of the project soundly, such as manuals, facilities and equipment for maintenance, and spare part stocks etc)

Original*: (M/D)*
Actual: (*PMR*)

3-2 O&M Cost and Budget

- The actual annual O&M cost for the duration of the project up to today, as well as the annual O&M budget.

Original*: (M/D)*

4: Precautions (Risk Management)

- Risks and issues, if any, which may affect the project implementation, outcome, sustainability and planned countermeasures to be adapted are below.

Original Issues and Countermeasure(s)*: (M/D)*	
Potential Project Risks	Assessment
1.	Probability: H/M/L
(Description of Risk)	Impact: H/M/L
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action during the Implementation:
	Contingency Plan (if applicable):
2.	Probability: H/M/L
(Description of Risk)	Impact: H/M/L
	Analysis of Probability and Impact:
	Mitigation Measures:

	Action during the Implementation:
	Contingency Plan (if applicable):
3.	Probability: H/M/L
(Description of Risk)	Impact: H/M/L
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action during the Implementation:
	Contingency Plan (if applicable):
Actual issues and Countermeasure(s)	
(PMR)	

5: Evaluation at Project Completion and Monitoring Plan

5-1 Overall evaluation

Please describe your overall evaluation on the project.

5-2 Lessons Learnt and Recommendations

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

5-3 Monitoring Plan for the Indicators for Post-Evaluation

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.

Attachment

1. Project Location Map
2. Undertakings to be taken by each Government
3. Monthly Report
4. Report on RD
5. Environmental Monitoring Form / Social Monitoring Form
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries) (Final Report Only)

Annex 10

Environmental Check List

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIS reports been already prepared in official process? (b) Have EIS reports been approved by authorities of the host country's government? (c) Have EIS reports been unconditionally approved? If conditions are imposed on the approval of EIS reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) Y (b) Y (c) N (d) N	(a) Although KIRMA had advised KUA that an EIS report was not necessary, EIA was prepared voluntarily. (b) KIRMA Board of Commissions issued a provisional approval for the Project on July 13, 2013. KIRMA confirmed that KIRMA will issue the final approval for the Project after KIRMA board of commission and the community consultation meeting of LELU island are approved for the Project. (c) KIRMA approved the Project with conditions. However, the conditions only include mitigation measures and reporting duty. The Project needs to satisfy these conditions after the commencement. (d) No environmental permits other than EIA are required.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) Y	(a) KUA held a stakeholder meeting to provide information regarding the Project in April 2015. (b) All stakeholders agreed to endorse the project considering the current power shortage situation and liability.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) The alternative plans including zero-option have been examined in the preparatory survey implemented by JICA.
2 Pollution Control	(1) Air Quality	(a) In the case that electric power is generated by combustion, such as biomass energy projects, do air pollutants, such as sulfur oxides (SOx), nitrogen oxides (NOx), and soot and dust emitted by power plant operations comply with the country's emission standards and ambient air quality standards? Are any mitigating measures taken? (b) Do air pollutants emitted from other facilities comply with the country's emission standards?	(a) Y (b) Y	(a) There are no ambient air or emission standards in Micronesia. However, with proper operation and maintenance, mitigation measures, and with reference to international best practices, air emission from the power station is expected to be much minimized compared to the current operation. (b) Mitigation measures (proper construction planning, encouragement of idling stop to the workers, introduction of low emission construction machines, sprinkling water on ground) will be taken to minimize the impact.

Annex 10

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(2) Water Quality	(a) Do effluents (including thermal effluent) from various facilities, such as power generation facilities comply with the country's effluent standards? Is there a possibility that the effluents from the project will cause areas that do not comply with the country's ambient water quality standards? (b) Do leachates from the waste disposal sites comply with the country's effluent standards and ambient water quality standards? Are adequate measures taken to prevent contamination of soil, groundwater, and seawater by leachates?	(a) Y (b) Y	(a) There are no effluent or environmental water quality standards in Micronesia. Construction works may cause generation of turbid water and deteriorate sea water quality. Therefore, the Project shall adopt mitigation measures, such as the erosion and sedimentation control plan prepared by KUA in the EIA. (b) Fuel and waste oil shall be treated and stored properly with containment. Therefore, the impact on environmental water quality during the operation phase is not significant.
2 Pollution Control	(3) Wastes	(a) Are wastes generated by the plant operations properly treated and disposed of in accordance with the country's regulations (especially biomass energy projects)?	(a) Y	(a) A small amount of waste oil and sludge will be generated during the power plant operation. The Project will utilize a small-size waste oil incinerator on site for KUA's sludge and waste oil, which KIRMA agreed with considering waste oil issue in Kosrae.
	(4) Soil Contamination	(a) Has the soil in the project site been contaminated in the past? Are adequate measures taken to prevent soil contamination?	(a) N	(a) The site has not been contaminated in the past. Measures shall be implemented properly for early detection against soil and groundwater contamination.
	(5) Noise and Vibration	(a) Do noise and vibrations comply with the country's standards?	(a) Y	(a) There are no noise standards in Micronesia. The new generators will be installed in a new power house with noise reduction measures such as glass wool walls, and sufficient indoor cooling system so that the house can be closed at all times. Therefore, noise will be reduced compared to the current operation, and its impact is not significant.
	(6) Subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	(a) N	(a) There is no groundwater extraction in the Project.
	(7) Odor	(a) Are there any odor sources? Are adequate odor control measures taken?	(a) N	(a) There are no odor sources in the Project.
3 Natural Environment	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) The project site is not located in protected areas.

Annex 10

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Is there a possibility that localized micro-meteorological changes due to wind power generation will affect valuable vegetation in the surrounding areas (Is there valuable vegetation in the vicinity of the wind power generation facilities)? If impacts on vegetation are anticipated, are adequate measures considered? (e) Are the wind power generation facilities (wind turbines) sited by considering the habitats and migration routes of sensitive or potentially affected bird species?	(a) Y (b) N (c) N (d) N/A (e) N/A	(a) Mangroves are located on the coastline of Kosrae Island, and coral reefs surround the island nearshore. (b) The project sites are already occupied by the existing facilities. There is no rare and endangered species identified during the JICA field survey. (c) The project sites are already occupied by the current facilities and earthmoving works will be at minimum. Therefore, no significant impact is expected.
	(3) Hydrology	(a) Is there a possibility that hydrologic changes due to installation of the structures, such as weirs will adversely affect the water flows, waves and tides?	(a) N	(a) The Project sites are already occupied by the existing facilities and no hydrologic changes are anticipated.
	(4) Topography and Geology	(a) Is there a possibility that the project will cause a large-scale alteration of the topographic features and geologic structures in the surrounding areas?	(a) N	(a) The Project sites are already occupied by the existing facilities and no large-scale alternation of topographic features are anticipated.
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Are the compensations going to be paid prior to the resettlement? (e) Are the compensation policies prepared in document? (f) Does the resettlement plan pay	(a) N (b) N/A (c) N/A (d) N/A (f) N/A (g) N/A (h) N/A (i) N/A (j) N/A	(a) The Project sites are already occupied by the existing facilities and no involuntary resettlement is anticipated.

Annex 10

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plan developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?		
	(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary? (b) Is there a possibility that the amount of water (e.g., surface water, groundwater) used and discharge of effluents by the project will adversely affect the existing water uses and water area uses?	(a) Y (b) N	(a) Although the Lelu distribution lines will basically follow the existing right of way, there may be some relocation and new installation of electric poles and lines which require the easement with land owners in Lelu Island. KUA shall clarify the landownership for necessary easement, and agree with land owners prior to commencement of the construction work. (b) The Project will not use large amount of water.
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N	(a) There are several designated cultural sites in Lelu Island, but it is observed during the JICA field survey that these sites are located far enough from the electric poles to conduct construction work.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) The Project sites are already occupied by the existing facilities and there is no possibility that the project will adversely affect the local landscape.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a) N (b) Y	(a) There are no ethnic minorities or indigenous peoples in Kosrae who need to be specially paid attention to. (b) The project sites are already occupied by the existing facilities. All of the rights of residents in relation to land and resources will be respected.
4 Social Environment	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial	(a) N (b) Y (c) Y (d) Y	(a) The project will not violate any laws and ordinances associated with working conditions. (b) Tangible safety considerations are in place based on KUA's safety policy and regulations. (c) Tangible measures are planned and implemented for individuals involved in the project, based on KUA's safety policy

Annex 10

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?		and regulations. (d) There are appropriate measures being taken to ensure that workers, including security guards, involved in the project do not violate safety of other individuals involved, or local residents.
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?	(a) Y (b) Y (c) Y	(a) Environmental and social requirements will be implemented to reduce impacts by a contractor. (b) Construction activities are not going to affect the natural environment since the proper measures to prevent flowing turbid water into sea are implemented. (b) The project sites are already occupied by the existing facilities. (c) Construction activities may disturb the traffic around the site. KUA requires the contractor to control traffic with mitigation measures.
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a) Y (b) Y (c) Y (d) Y	(a) Monitoring program is developed for necessary environmental items. (b) The items, methods and frequencies are stated in the monitoring program for construction phase and for operation phase. (c) KUA establishes an adequate monitoring framework for the monitoring program. (d) KUA is required to yearly report hazardous materials and wastes to KIRMA as one of the EIA conditions. KUA will follow all KIRMA's requirements stated in the EIA approval.

Annex 11

Environmental Management Plan/Environmental Monitoring Plan

No		Item	Methods	Frequency	Responsible body
	Construction Phase				
1	Air quality	Dust scattering prevention	Visual inspection	Occasionally	KUA Contractor
2	Water quality	Turbid water management	Visual inspection	Occasionally (refer to Ecosystem)	KUA Contractor
3	Wastes	Waste generation	Daily recording of the approximate amount and types of wastes	Monthly	KUA Contractor
		Hazardous material management	Reporting to KIRMA in accordance with EIA approval	Yearly	KUA
4	Noise and vibration	Noise disturbance	Interviews with residents and complaint logs	Occasionally	KUA Contractor
5	Ecosystem	Turbid water management	Visual inspection of turbid water to sea in Lelu Island	Occasionally (during earthwork is active near shoreline)	KUA Contractor
			Visual inspection of turbid water flowing out of the KUA property	Occasionally (during earthwork is active)	KUA Contractor
6	Involuntary resettlement and land acquisition	Land easement agreement	Complaints from landowners (complaint logs)	Occasionally	KUA Contractor
7	Existing social infrastructure and services	Minimization of equipment transportation	Reporting in progress reports	Monthly	KUA Contractor
8	Cultural heritage	New archaeological site findings			
9	Sanitation and infectious diseases	Health and safety trainings			
10	Working conditions (including occupational safety)				
11	Accidents				
	Operation Phase				
1	Air quality	Complaint from residents	Interview with residents	6 months after the power station commencement	KUA
2	Water quality	Prevention of oil spill/leakage	Visual inspection	Occasionally	KUA
3	Wastes	Waste generation	Daily recording of the approximate amount and types of wastes	Monthly	KUA
		Oil incinerator management	Operation recording of the incinerator	Monthly	KUA

Annex 11

No		Item	Methods	Frequency	Responsible body
		Hazardous material management	Reporting to KIRMA in accordance with EIA approval	Yearly	KUA
4	Soil contamination	Prevention of oil spill/leakage	Visual inspection of fuel and waste tanks	Weekly	KUA
			Grass cutting around the waste tanks	Occasionally	KUA
5	Noise and vibration	Complaints from residents	Interview with residents	6 months after the power station commencement	KUA
6	Working conditions (including occupational safety)	Safety meetings	Safety meeting recording and accident report	Occasionally	KUA
7	Accidents				

Annex 12

Environmental and Social Monitoring Form

Below are drafts of monitoring forms based on the EMP.

Environmental Management

Construction Phase

	Monitoring Item	Parameters to be monitored	Monitoring result and reports made during this period	Measures to be taken	Frequency
1	Air pollution	Dust scattering			Throughout the construction phase
2	Water quality	Turbid water			Throughout the construction phase
3	Wastes	Waste generation amount and types			Throughout the construction phase
		Hazardous material management			Throughout the construction phase
4	Noise and vibration	Complaint from residents			Throughout the construction phase
5	Ecosystem	Turbid water flowing into sea/ out of the KUA property			Throughout the construction phase
6	Involuntary resettlement and land acquisition	Complaints from landowners			Throughout the construction phase
7	Existing social infrastructure and services	Road traffic			Throughout the construction phase
8	Cultural heritage	New archaeological site findings			Throughout the construction phase
9	Sanitation and infectious diseases	Health and safety trainings and accident logs			Throughout the construction phase
10	Working conditions (including occupational safety)				Throughout the construction phase
11	Accidents				Throughout the construction phase

Annex 12

Operation Phase

	Monitoring Item	Parameters to be monitored	Monitoring result and reports made during this period	Measures to be taken	Frequency
1	Air quality	Complaint from residents			6 months after the power station commencement
2	Water quality	Oil spill/leakage			Occasionally
3	Wastes	Waste generation amount and types			Monthly
		Operation records			Monthly
		Reporting to KIRMA in accordance with EIA approval			Yearly
4	Soil contamination	Oil spill/leakage			Weekly
		Grass cutting			Occasionally
5	Noise and vibration	Complaints from residents			6 months after the power station commencement
6	Working conditions (including occupational safety)	Safety meetings and accident logs			Occasionally
7	Accidents				

Tax exemption

(1) Items of taxes to be exempted	(2) Exempt of tax or reimbursement	(3) Organization in charge	(4) Documentation to be prepared	(5) Necessary Procedures	Notes
Custom Duties of imported equipment and materials	Exempt of tax	1) Dep. of Finance and Administration, Division of Customs & Tax Administration 2) Kosrae Field Office Custom & Tax Administration, Dep. of Finance and Administration	1) Bill of ladings 2) Invoice 3) Copy of G/A	1) The contractor will submit a request letter with the necessary documentations (see the left column (4)) attention to the Secretary of Dep. of Finance and Administration, Division of Customs & Tax Administration in Pohnpei. 2) Dep. of Finance and Administration, Division of Customs & Tax Administration will issue an approval letter to Kosrae Field Office, Custom & Tax Administration, Dep. of Finance and Administration. 3) Kosrae Field Office, Custom & Tax Administration, Dep. of Finance and Administration will stamp on the approval letter and send it to Kosrae Port Authority.	4 % for equipment and Materials
Sales tax (equipment, material and labor)	Exempt of tax	Department of Administration and Finance, Kosrae State Government	Copy of E/N & G/A	The contractor will submit necessary documentations (see the left column (4)) to the Department of Administration and Finance, Kosrae State Government.	Under Constitution of FSM

Notes: E/N: Exchange of Notes
G/A: Grant Agreement

5. TECHNICAL MEMORANDUM

5. TECHNICAL MEMORANDUM

5-1. TECHNICAL MEMORANDUM (JANUARY, 2015)

(1) Kosrae

(2) Pohnpei

(3) Chuuk

(4) Yap

PREPARATORY SURVEY
ON
THE PROJECT
FOR
POWER SECTOR IMPROVEMENT
FOR
THE STATE OF KOSRAE
IN
THE FEDERATED STATES OF MICRONESIA

TECHNICAL MEMORANDUM

JANUARY 2015

Confirmed and Agreed by

Fred N. Skilling
General Manager
Kosrae Utilities Authority (KUA)

Prepared and Submitted by

Mitsuhisa Nishikawa
Chief Consultant
JICA Preparatory Survey Team

dated 16 Jan. 2015

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

YACHIYO ENGINEERING CO., LTD.

1. Introduction

In response to the request made by the Government of Federated States of Micronesia (Micronesia) on "the Project for Power Sector Improvement for the State of Kosrae (the Project)", JICA has decided to implement a preparatory survey in order to ascertain the necessity and validity of the project under the grant aid scheme, as well as to collect the basic data and information on the power sector in Kosrae State (Kosrae Utilities Authority (KUA)) will be grasped, and those concerning the potential for renewable energy (solar power, micro hydropower, wave generation and wind turbine) will also be collected at the time of this first field survey (from 13 – 16 January 2015).

Collected data and information for the potential of renewable energy will be utilized to decide components of the Project.

2 Submission of Inception report

JICA preparatory survey team (the Team) submitted the inception report and explained main contents to KUA such as Outline of the request, Outline of the preparatory survey, Basic policy on the survey & Items to be discussed, etc., and KUA confirmed and understood them.

3 Collected data and Information

Based on answers for the questionnaire sent from JICA Micronesia Office to KUA, and through discussions and sites visit with KUA counterparts, the Team had obtained the following data and information from KUA at the time of the first field survey;

3.1 Basic Data and Information of the Electricity Sector of Kosrae state.

(1) General Information
(2) Summary of Existing Generating Facilities
(3) Quality of Existing Electric Power system
(4) Demand forecast
(5) Organization chart of KUA
(6) Financial data of KUA
(7) Others

3.2 Basic Data and Information of Potential of the Renewable Energy

(1) Photovoltaic (PV) Power Generation
(2) Hydropower Generation
(3) Wave Power Generation
(4) Waste materials Power Generation
(5) Attachment: Table A-1: Meteorological Data for necessary for Photovoltaic (PV) Power Plant

The Team understood that those main contents of data and information collected; also the request made by the Government of Micronesia for the Project. Therefore, the Team will commence to build the component of the Project under the consultation of JICA, and conduct 2nd field survey on March 2015 in order to ascertain the necessity and validity of the Project under Japan's Grant Aid scheme.

4 Insufficient data and information

Although the Team received answers for questionnaire from KUA, both KUA and the Team confirmed that the additional data and information will be sent by KUA to the Team by e-mail as soon as possible (E-mail number of the Team are shown in Cluase-5), in case insufficient and/or lack of data and information for the study are found by the Team during data analysis works in Japan.

5 Attendance of the meeting between Kosrae state side and the Team

5.1 Attendance from Kosrae State Governments and KUA

Name	Position	E-mail	Notes
Mr. Carson K. Sigrah	LT. Governor, Kosrae State Government		Courtesy call only
Mr. Lipar George	Administrator, Budget Statistics, ODA, Kosrae State Government		ditto
Fred N. Skilling	General Manager, KUA		
Mr. Robert Taualupe	Operation Manager, KUA		Counterpart of the Team
Mr. Gerry Protacio	Electrical Engineer, KUA		Counterpart of the Team
Mr. Wadel R. Kinere	Port Director, Department of Public Works, Kosrae State Government		Meteorological Data

5.2 Attendance from the Team

Name	Position	E-mail	Notes
Takahisa Watanabe	Project Formulation Adviser, JICA Micronesia Office		
Mitsuhisa Nishikawa	Chief Consultant, Yachiyo Engineering Co.,Ltd.		
Takayuki Miyamoto	Generating facilities Yachiyo Engineering Co.,Ltd.		

- End -

PREPARATORY SURVEY
ON
THE PROJECT
FOR
EXPANSION OF GRID-CONNECTED SOLAR GENERATION SYSTEM
IN
THE FEDERATED STATES OF MICRONESIA

TECHNICAL MEMORANDUM

JANUARY 2015

Confirmed and Agreed by	Prepared and Submitted by
Marselino Actouka	Mitsuhisa Nishikawa
General Manager	Chief Consultant
Pohnpei Utilities Corporation (PUC)	JICA Preparatory Survey Team

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

YACHIYO ENGINEERING CO., LTD.

1. Introduction

In response to a request made by the Government of Federated States of Micronesia (Micronesia) on "the Project for Expansion of Grid Connected Solar Generation System (the Project)", JICA has decided to dispatch a survey team to Micronesia in order to collect the basic data and information on the overall power sector (at Pohnpei state, Chuuk state, Yap State and Kosrae state) in Micronesia will be grasped, and those concerning the potential for renewable energy (solar power, micro hydropower, wave generation and wind turbine) will also be collected at the time of this field survey (from 18 – 22 January 2015).

Collected data and information on the power sectors and the potential of renewable energy will be utilized to ascertain the necessity and validity of the project under the grant aid scheme, as well as to consider the future Japan's assistance project.

2. Collected data and Information

JICA survey team (the Team) has received the answers to a questionnaire sent from JICA Micronesia Office to Pohnpei Utilities Corporation (PUC), and through the discussions between the Team and PUC counterparts, the Team have received the following data and information from PUC at the time of the field survey;

2.1 Basic Data and Information of the Electricity Sector.

(1) General Information (such as organization, tariff, financial statues, etc.)

(2) Summary of Existing Generating Facilities (Diesel engine generators and solar generation system)

(3) Quality of Existing Electric Power system (distribution system, adopted voltage, frequency, etc.)

The Team visited PUC Nanpohmnal Power plant to confirm present operation statues of existing diesel engine generating facilities under the guidance of PUC's counterpart.

2.2 Basic Data and Information of Potential of the Renewable Energy

(1) Photovoltaic (PV) Power Generation

1) Features of Existing PV Power Plant

2) Future Plan of PV Power Project. (There is no concrete plant sites selected)

3) Data necessary for PV Power Generation design.

The Team visit existing solar generation system sites (President Office (20kW), COM-FSM (160kW) and Netti elementary school (200kW)), and confirmed that operation situations of all three (3) sites are very good, although a monitoring panel at President Office is temporary shutdown at moment.

Meteorological Data necessary for Photovoltaic (PV) Power Plant (Attachment: Table A-1) is not submitted by PUC to the Team. Therefore PUC requested to send such data to the Team by the end of January 2015.

(2) Hydropower Generation

1) Features of Existing Power Facilities.

2) Planned Future Hydropower Project

The Team visit existing Nampil hydro power plant (rated output capacity 725kW) guided by PUC counterparts and confirmed that it is in good operation conditions.

3. Insufficient data and information

Although the Team received answers for questionnaire from PUC, both PUC and the Team confirmed that the additional data and information will be sent by PUC to the Team by e-mail as soon as possible (E-mail number of the team members are shown in Cluase-5), in case insufficient and/or lack of data and information for the study are found by the Team during analysis works of data and information in Japan.

4. Attendance of the meeting between PUC and the Team

4.1 Attendance from Kosrae State Governments and PUC

Name	Position	E-mail	Notes
Mr. Hubert Yamada	Assistant Secretary, Division of Energy, Department of Resources & Development		
Mr. Samson Pretrick	Deputy Secretary, Department of Foreign Affairs		
Mr. Marselino Actouka	General Manager, PUC		
Mr. Sidney Kilmete	Renewable Energy Engineer, PUC		
Mr. Nixon Anson	Assistant General Manager for Power distribution and Generation, PUC		
Mr. John T. Martin	Distribution Manager, PUC		

4.2 Attendance from the Team

Name	Position	E-mail	Notes
Takahisa Watanabe	Project Formulation Adviser, JICA Micronesia Office		
Mitsuhisa Nishikawa	Chief Consultant, Yachiyo Engineering Co.,Ltd.		
Takayuki Miyamoto	Generating facilities Yachiyo Engineering Co.,Ltd.		

- End -

PREPARATORY SURVEY
ON
THE PROJECT
FOR
POWER SECTOR IMPROVEMENT
FOR
THE STATE OF KOSRAE
IN
THE FEDERATED STATES OF MICRONESIA

TECHNICAL MEMORANDUM

JANUARY 2015

Confirmed and Agreed by

Mr. Mark Waite
Chief Executive Officer
Chuuk Public Utility Corporation

Mr. Albert Francis
Power manager
Chuuk Public Utility Corporation

Prepared and Submitted by

Mr. Kaoru Nishiwaki
Consultant
JICA Preparatory Survey Team

Mr. Mitsuharu Nakagawa
Consultant
JICA Preparatory Survey Team

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

YACHIYO ENGINEERING CO., LTD.

1. Introduction

In response to the request made by the Government of Federated States of Micronesia (Micronesia) on "the Project for Power Sector Improvement for the State of Kosrae", JICA has decided to implement a preparatory survey in order to ascertain the necessity and validity of the project under the grant aid scheme, as well as to collect the basic data and information on the overall power sector in Micronesia will be grasped, and those concerning the potential for renewable energy (solar power and micro hydropower) will also be collected and analyzed at the time of this first field survey.
Basic data and information collected at Pohnpei, Chuuk and Yap states will be utilized for further examinations to consider the future Japan's assistance project.

2 Collected data and Information

Based on a questionnaire sent from JICA Micronesia Office to Chuuk Public Utility Corporation (CPUC), JICA preparatory survey Team (the Team) have received the following data and information to be collected from CPUC at the time of first field survey;

2.1 Basic Data and Information of the Electricity Sector of the each state.

(1) General Information

(2) Summary of Existing Generating Facilities

(3) Quality of Existing Electric Power system

2.2 Basic Data and Information of Potential of the Renewable Energy

(I) Photovoltaic (PV) Power Generation

I) Features of Existing PV Power Plant

2) Future Plan of PV Power Project

3) Data necessary for PV Power Generation design

(2) Hydropower Generation (There is no plan and potential is minimal)

Attachment: Questionnaire for Basic Information Survey (Chuuk Public Utility Corporation)

3 Insufficient data and information

Although the Team received answers for questionnaire from CPUC, both CPUC and the Team confirmed that the following answers are insufficient and/or lacking. Therefore, CPUC agreed to send again the sufficient answers the Team by e-mail by the end of January 2015.(E-mail number of the Team are shown in Cluase-5)

Items to be re-sent by CPUC to the Team

No.	Questionnaires No.	Insufficient contents	New/additional answers	Nos. of attachments
1		Drawing for the existing PV system		
2		Electrical Standards for CPUC		
3		Tariff documents		
4		Layout of the Existing Power Plant		
5		Single line diagram for Power Plant and distribution line		

4 Others

4.1 Current situation of the price of petroleum

CPUC does not consider that the Chuuk State Action Plan will not be changed at the present time, even though the price of petroleum is going down continuously. The major goal of the Policy is that the share of renewable energy sources will be at least 30% of total energy production by 2020. CPUC and the Consultant confirmed it.

4.2 Collected Data & Information

CPUC and the Consultant confirmed that Collected Data & Information will be utilized for further examinations to consider the future Japan's assistance project. There is no commitment from the Japanese side concerning the realization of the Project at the First Field Survey. CPUC and the Consultant confirmed it.

5 Attendance of the meeting between CPUC and the Team

5.1 Attendance from CPUC

Name	Position	E-mail	Notes
Mr. Mark Waite	CEO		
Mr. Albert Francis	Power Manager		

5.2 Attendance from the Team

Name	Position	E-mail	Notes
Mr. Kaoru Nishiwaki	Consultant		
Mr. Mitsuharu Nakagawa	Consultant		

- End -

PREPARATORY SURVEY
ON
THE PROJECT
FOR
POWER SECTOR IMPROVEMENT
FOR
THE STATE OF KOSRAE
IN
THE FEDERATED STATES OF MICRONESIA

TECHNICAL MEMORANDUM

JANUARY 2015

Confirmed and Agreed by

Mr. Victor Nabeyan
Assistant General Manager
Yap State Public Service Corporation

Prepared and Submitted by

Mr. Kaoru Nishiwaki
Consultant
JICA Preparatory Survey Team

Mr. Mitsuharu Nakagawa
Consultant
JICA Preparatory Survey Team

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

YACHIYO ENGINEERING CO., LTD.

1. Introduction

In response to the request made by the Government of Federated States of Micronesia (Micronesia) on "the Project for Power Sector Improvement for the State of Kosrae", JICA has decided to implement a preparatory survey in order to ascertain the necessity and validity of the project under the grant aid scheme, as well as to collect the basic data and information on the overall power sector in Micronesia will be grasped, and those concerning the potential for renewable energy (solar power and micro hydropower) will also be collected and analyzed at the time of this first field survey.
Basic data and information collected at Pohnpei, Chuuk and Yap states will be utilized for further examinations to consider the future Japan's assistance project.

2 Collected data and Information

Based on a questionnaire sent from JICA Micronesia Office to Yap State Public Service Corporation (YSPSC), JICA preparatory survey Team (the Team) have received the following data and information to be collected from YSPSC at the time of first field survey;

2.1 Basic Data and Information of the Electricity Sector of the each state.

(1) General Information

(2) Summary of Existing Generating Facilities

(3) Quality of Existing Electric Power system

2.2 Basic Data and Information of Potential of the Renewable Energy

(1) Photovoltaic (PV) Power Generation

1) Features of Existing PV Power Plant

2) Future Plan of PV Power Project

3) Data necessary for PV Power Generation design

(2) Hydropower Generation (There is no plan and potential is minimal)

Attachment: Questionnaire for Basic Information Survey (Yap State Public Service Corporation)

3 Insufficient data and information

Although the Team received answers for questionnaire from YSPSC, both YSPSC and the Team confirmed that the following answers are insufficient and/or lacking. Therefore, YSPSC agreed to send again the sufficient answers the Team by e-mail by the end of January 2015.(E-mail number of the Team are shown in Cluase-5)

Items to be re-sent by YSPSC to the Team

No.	Questionnaires No.	Insufficient contents	New/additional answers	Nos. of attachments
1		Electrical Standards for YSPSC		
2		Financial and Technical Data		
3		Drawing for the existing PV system		
4		Tariff documents		
5		Generated power data by solar energy		

4 Others

4.1 Current situation of the price of petroleum

YSPSC does not consider that the Yap State Action Plan will not be changed at the present time, even though the price of petroleum is going down continuously. The major goal of the Policy is that the share of renewable energy sources will be at least 30% of total energy production by 2020. YSPSC and the Consultant confirmed it.

4.2 Collected Data & Information

YSPSC and the Consultant confirmed that Collected Data & Information will be utilized for further examinations to consider the future Japan's assistance project. There is no commitment from the Japanese side concerning the realization of the Project at the First Field Survey. YSPSC and the Consultant confirmed it.

5 Attendance of the meeting between YSPSC and the Team

5.1 Attendance from YSPSC

Name	Position	E-mail	Notes
Mr. Faustino Yangmog	General Manager		
Mr. Victor Nabeyan	Assistant General Manager		
Mr. Francis Falan	Power Generation Manager		
Mr. Gidion Moofal	Customer Service		
Mr. Steven Libmad	Project District Manager		
Mr. Joe Hafler	Project Manager		
Mr. Mario Sukulbech	Outer Island Operation Manager		

5.2 Attendance from the Team

Name	Position	E-mail	Notes
Mr. Kaoru Nishiwaki	Consultant		
Mr. Mitsuharu Nakagawa	Consultant		

- End -

5-2. TECHNICAL MEMORANDUM (OCTOBER, 2015)

TECHNICAL MEMORANDUM
ON
THE PREPARATORY SURVEY
ON
THE PROJECT FOR POWER SECTOR IMPROVEMENT FOR THE STATE OF KOSRAE
IN
FEDERATED STATES OF MICRONESIA

The Japan International Cooperation Agency (hereinafter referred to as "JICA") sent the JICA's Study Team for the 3rd field survey on the Project for Power Sector Improvement for the State of Kosrae (hereinafter referred to as "the Project") from 5th October to 13th October 2015. The purpose of the mission is to accelerate the realization of this JICA's new project by reaching a consensus from all stakeholders for finalized demand forecast in Kosrae. This coordination for the consensus on the demand forecast is also expected to contribute the parallel on-going project funded by World Bank; Federated States of Micronesia, Energy Sector Development (P148560).

JICA's Study Team conducted at first the analysis of the power demand at Kosrae State during the 2nd field survey in March 2015. Based on the analysis and explanation of the demand survey, Kosrae State Government, Kosrae Utilities Authority (hereinafter referred to as "KUA") and JICA mutually confirmed major components of the Project in the Minutes of Discussion (M/D) signed on 20th March 2015 and the Field Report signed on 27th March 2015. However, KUA has later informed to JICA Study Team that the additional power demand should be considered in the Project as some of new business entities might come in the State in the near future.

Followed by a number of discussions related to this issue among all the stakeholders including Kosrae State, KUA and Federated States of Micronesia (hereinafter referred to as "FSM"), World Bank and JICA, it was shared as a common understanding that the components of both World Bank's and JICA's projects should be established on the basis of one shared demand forecast in Kosrae, as to avoid the duplication of assistance which might result in inefficient resource mobilization for FSM and Kosrae State. The stakeholders also confirmed that the report on the demand forecast in Kosrae and the selection of capacity of diesel engine generators presented by JICA Study Team should be reviewed and validated through this 3rd field survey of the Team.

As a result of the discussions and examination in the 3rd field survey, all parties have confirmed the reviewed demand forecast and the subsequent result on the selection of capacity of diesel engine generators as described in this Technical Memorandum hereto.

Pohnpei Micronesia
October 20th ,2015

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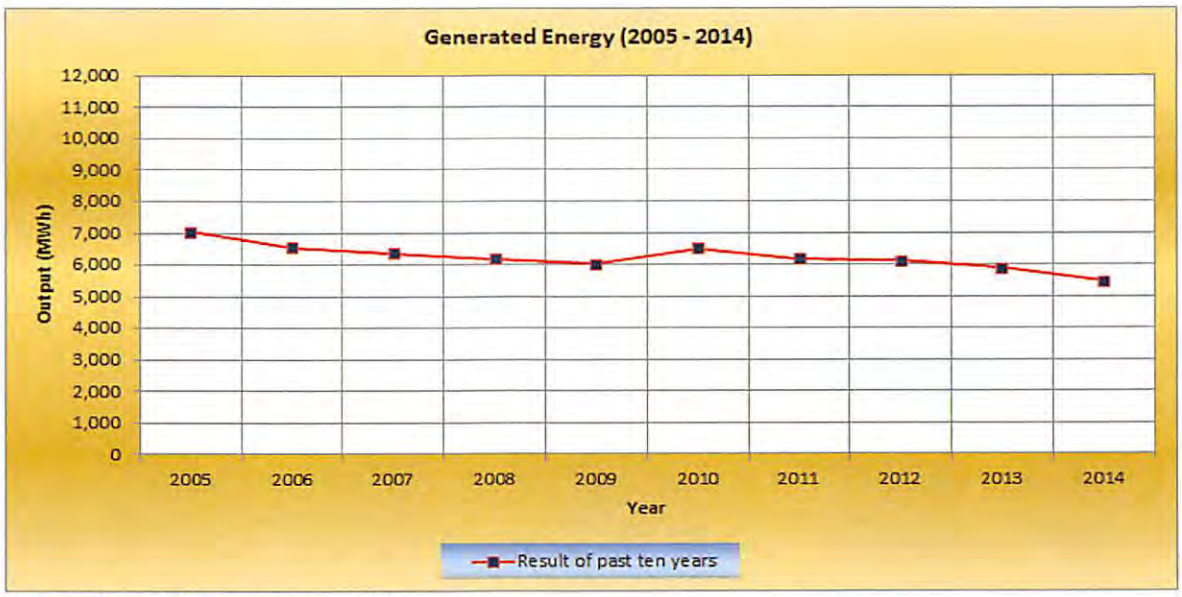
Demand Forecast and Selection of Diesel Engine Generators' Capacity

This report was prepared by JICA study team based on the results of 2nd field survey conducted from March 9th to March 27th, 2015, and the 3rd field survey, additionally conducted from 5th October to 13th October, 2015.

Detailed survey results are as follows.

1. Power Generation Record in Kosrae

Based on the power generation record from year 2005 to 2014 provided by KUA as shown in Figure-1, a tendency of generating output is moderately decreasing from 7,034 MWh in 2005 to 5,463 MWh in 2014 (decreasing ratio is approximately 22% for the last ten (10) years).



Source: Kosrae Utilities Authority (KUA)

Figure-1 Generation Record (2005 – 2014) in Kosrae

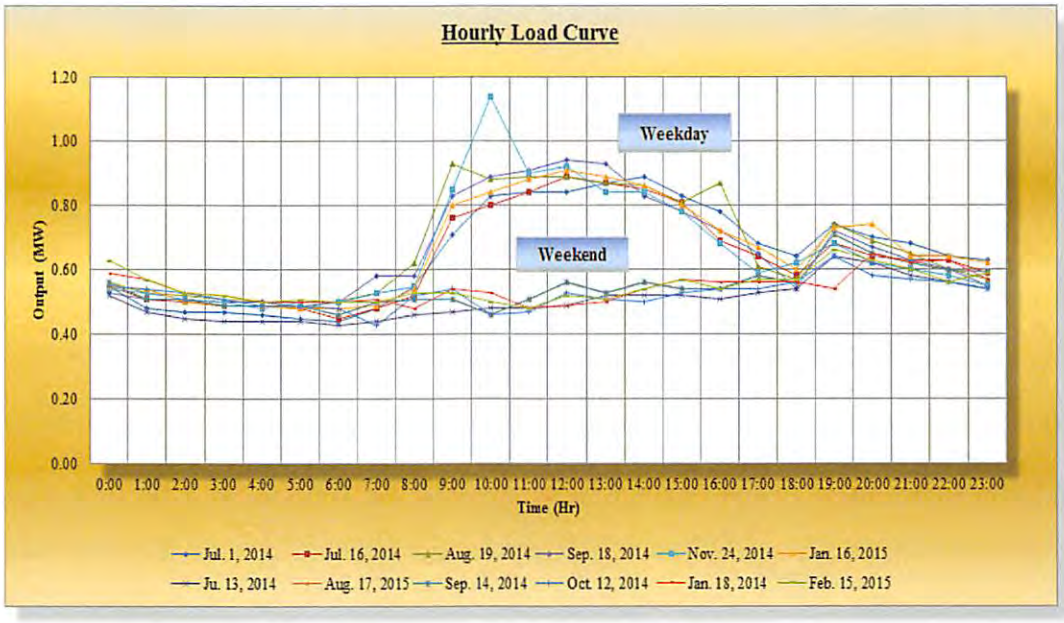
One of the reasons of decreasing tendency of generation output was assume to be decreasing tendency of numbers of population shown in Table-1 below:

Table-1 Population of Kosrae State

Year	Population	Percentage
2000	7,686	
2010	6,616	-13.6% from year of 2000

Source: Kosrae Utilities Authority (KUA)

The JICA study team also received the hourly load data from the beginning of year 2014 up to February 2015 from KUA, and prepared a typical hourly Load curve as shown in Figure-2, which shows the highest recorded load among the data and typical daytime loads of weekday and weekend. The typical daytime loads were clearly different in weekday and weekend, and the typical daytime loads on the weekend in 2014 were 0.53 MW as average of midday and those on the weekday were 0.89 MW. The highest load of the year 2014 was 1.14 MW recorded on Nov. 24th.



Source: Kosrae Utilities Authority (KUA)

Figure-2 Typical Hourly Load Curve (Jan.2014 – Feb. 2015) in Kosrae

2. Demand Forecast

2.1 Demand Forecast Prepared by KUA

The actual generated peak load record from the year 2005 to 2014 of the Tofol Power Station and the demand forecast from the year 2015 to 2024 prepared by the KUA is indicated in Figure -3.

Source: Kosrae Utilities Authority (KUA)

Figure-3 Peak Demand Forecast Prepared by KUA

KUA anticipated that peak demand would be increased up to 2,200kW in the next ten (10) years. The following facilities are to be constructed / renewal as additional demands in near future as shown in Figure-3.

(a) Hospital (200kW)

(b) School (100kW)
(c) Fish transhipment facility (500kW)

2.2 Demand forecast determined by 2nd Field Survey

In order to confirm the above new demand shown in the clause 2.1, JICA team discussed with officials from KUA during the 2nd field survey on March, 2014.
As results of discussions between KUA and the JICA study team during the 2nd field survey, the demand in the State of Kosrae was confirmed that would not change drastically in the near future in accordance with the following reasons;

(1) No detailed information and evidences (such as National/District development plans, specifications, schedule, facilities' planning and financial planning etc.) of the above mentioned three (3) new demands was presented by KUA.
(2) The power generation output in 2014 had been declined to 78% of the one in 2005 (Refer to clause 1)

Based on the above, the peak and the low demand in the near future for Kosrae State determined by 2nd field survey assumed as follows:

- Peak load : 1.14MW as shown clause - 1.
- Low load of daytime (from 9:00AM to 4:00PM) on weekdays : approximately 710kW which was based on the data from KUA data
- Low load of daytime (from 9:00AM to 4:00PM) on weekend : approximately 460 kW which was based on the data from KUA data

These loads were extracted from generated output record at the normal operating conditions in the year 2014.

2.3 Assessment of additional demand determined by the 3rd Field Survey

After the 2nd field survey, KUA and Kosrae State has later informed the following additional demands, and JICA study team conducted the 3rd field survey in order to review and reconfirm the latest and forecasted power demand situations.
Based on the 3rd survey, the team determined the appropriateness including the following loads for the future demand.

(1) Fish Transhipment Facilities
Peak Load: 180kW, Regular Load: 110kW
(2) Water Bottling Facility
Peak Load: 180kW, Regular Load: 126kW
(3) Dr. Arthur P. Sigrah Memorial Hospital
Peak Load: 101kW, Regular Load: 71kW
(4) Malem Elementary School
No additional demand was confirmed.

Total Additional Peak Load was forecasted 461 kW, Additional Regular Load was forecasted 307kW

(Note);

a) Installed 15 containers of maximum capacity 12kW for each and regular capacity 7.3kW for each container was confirmed for Fish Transhipment Facilities.

b) Installed necessary process equipment in the plant house of Water Bottling Facilities was confirmed. The commencement of operation is expected after distribution line connected. The 13.8kV distribution line is under construction by KUA and expected to complete by the end of November 2015. KUA will install a single phase distribution transformer of 3 sets of 75kVA (Total 225kVA capacity. 13.8kV/420/242V).

c) According to the PMU (National Government of FSM), Dr. Arthur P. Sigrah Memorial Hospital will commence a renewal project assisted by the US Grant, from early next year (2016), and bidding/construction period is approximately 3 years.

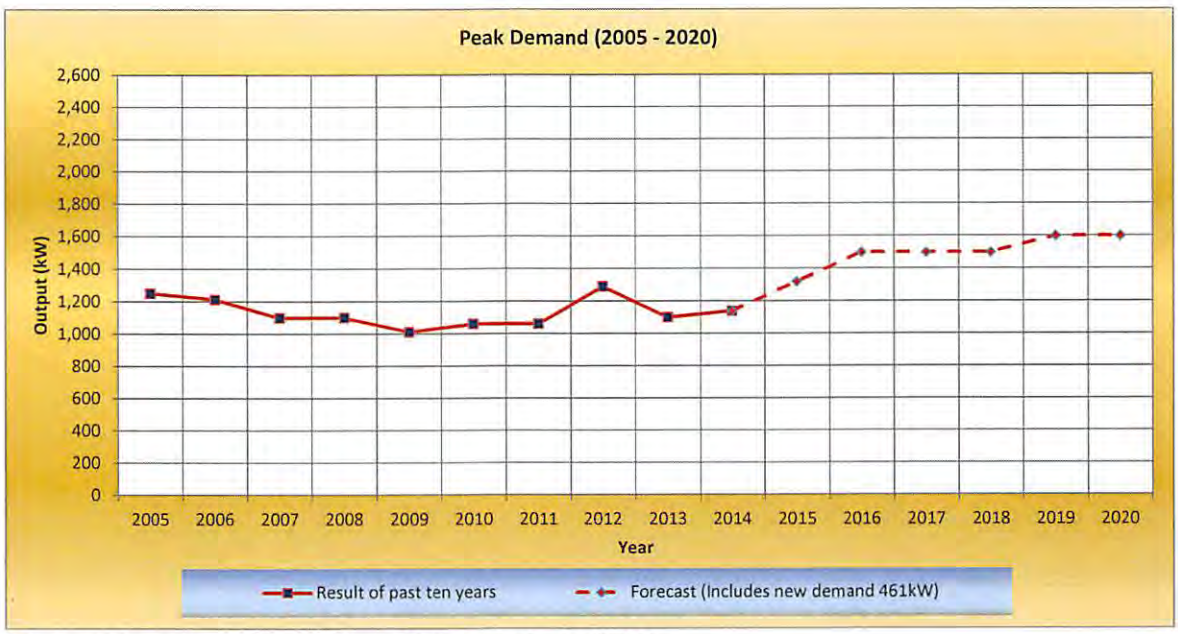
The PMU plans that the total demand of hospital is 341kW.The existing demand of the Memorial Hospital is 240kW.

Therefore, the additional demand will be assumed101 kW (341kW-240kW) according to KUA's data and information.

d) Since all the equipment is not simultaneously operated at normal operation load in general, the team evaluated a demand factor (Simultaneous usage percentage) for the following facilities;

- Water Bottling Facilities : 70% of the peak load
- New Dr. Arthur P. Sigrah Memorial Hospital : 70% of the peak load

Based on the assessment shown clause 2.3 of additional loads confirmed by the 3rd Field survey above, the peak demand forecast up to year 2020 in Kosrae was assumed as follows: (Figure-4)



Source of data of past 10 years: Kosrae Utilities Authority (KUA)

Figure-4 Peak Demand Record and Forecast

3 Conditions to select Suitable Unit and Total Capacity of Diesel Generators

Based on the demand forecast described in the clause 2 above, JICA team arranged the following conditions in order to select the suitable unit capacity and total capacity of diesel generators.

(1) Conditions of Peak and Lowest Demand

1) Peak demand : 1,140 + 461 (Assumed additional load) =1,601kW
(Assumed additional load is shown in clause 2.3)

2) Low demands of Weekend : 460kW + 50 (Assumed additional load) = 510kW
(Assumed additional load of weekend is assumed 50% of the peak load of the memorial hospital (101kW). For the other facilities such as fish transhipment facilities and the water bottling facility, JICA study team assumed the cases their operation would stop on the weekend).

(2) Conditions of Other Power Source

Solar Power Generation : 300kWp (Recommended weekend generating capacity: 50% = 150kWp)

(Note): In Kosrae state, there are two (2) solar power generation projects. One (1) project with 200kWp output capacity assisted by PEC fund which was completed at within Tofol power station premises. It started operation on last April. The other PV project assisted by EU with 100 kWp capacity at the parking area of Kosrae state office is still under the construction and it is expected to start operation from the beginning of the next year.

The power demand of weekend is low compared with the one of weekday. PV generation ratio of the Kosrae State is high against total power demand. Therefore, JICA team recommended KUA to stop 50% of PV system output on the weekend, in order to keep the power quality (such as frequency and voltage) and KUA agreed with JICA's recommendation.

On the other hand, necessity to stop 50% of PV system output on the weekday is not confirmed, since PV output affects small on system frequency due to the large enough amount of diesel generators output of the weekday's daytime, even in the case when PV output suddenly decreases due to weather conditions.

(3) Operating Condition of Diesel Generator

a) Minimum Operation Load: Recommended as more than 40% of rated unit capacity, in order to protect cylinders from soot caused by incomplete combustion.
b) Limited of Load Change Ratio: Recommended as less than 25% of total rated capacity of diesel generators, in order to keep power quality against a change of PV output from sudden output decrease caused by weather conditions.
c) Minimum unit capacity of diesel generator: Recommended at least equal to minimum system load during weekend.

(4) Load covered by Diesel Generator (refer to item 3.1 (1) above)

a)	Peak Load	: 1,601kW	= 1,601kW
b)	Low load of Weekend	: 510kW - (PV: 300kWx50%)	= 360kW

(5) Calculation of Suitable Total and Unit Capacity of Diesel Generator

a) Suitable total capacity for generators considering with installed PV capacity

Minimum total capacity of diesel generators considered from the view point of "Limit of Load Change Ratio (25%)" caused by PV power generation, based on item (2) & (3) of clause 3 above, is calculated as follows;

- Minimum total capacity = 300kW / 25% = 1,200kW
  Hereby;
  300kW : Rated capacity of PV
  25% : Load change ratio at moment
- Result: Suitable total capacity of diesel generators should be 1,200kW or more from the view point of the total PV generation capacity (300kW).

b) Suitable unit capacity for generators considering with installed PV capacity

Suitable unit capacity of diesel generator considered from the view point of "minimum weekend load", is calculated as follows;
(Minimum operation load of diesel generator is recommended more than 40% of rated capacity)

- Unit maximum diesel generator capacity = 360 kW /40% = 900 kW
  Hereby;
  360 kW : Assumed minimum weekend load
  40 % : Minimum load of diesel generator
- Result: Suitable unit capacity of diesel generator should be less than 900 kW

From the results of the above, the unit capacity of generator is recommended between 360 kW (Low load of weekend covered by diesel generator) and 900 kW.

4. Appropriate unit generator capacity and total capacity for assistant

Through the whole study of JICA study team, appropriate units and size for assistant components for KUA funded by World Bank and JICA are presented as three (3) sets of 600kW diesel engine generators (continuous rating) hereto. All stakeholders will make the best effort that KUA is going to procure recommended unit capacity of diesel engine generator as close to and not less than 600 kW (continuous rating).

The correlation among the total available capacity of all generators including proposed assistant units and existing units, the firm capacity (defined as "Total generation capacity of Tofol power station – the largest unit generator capacity"), and the peak demand determined in clause 2 is shown Figure-5.

"Total generation capacity of Tofol power station" in Figure-5 is determined based on the KUA's operation schedule of all related generators shown in Table -2.

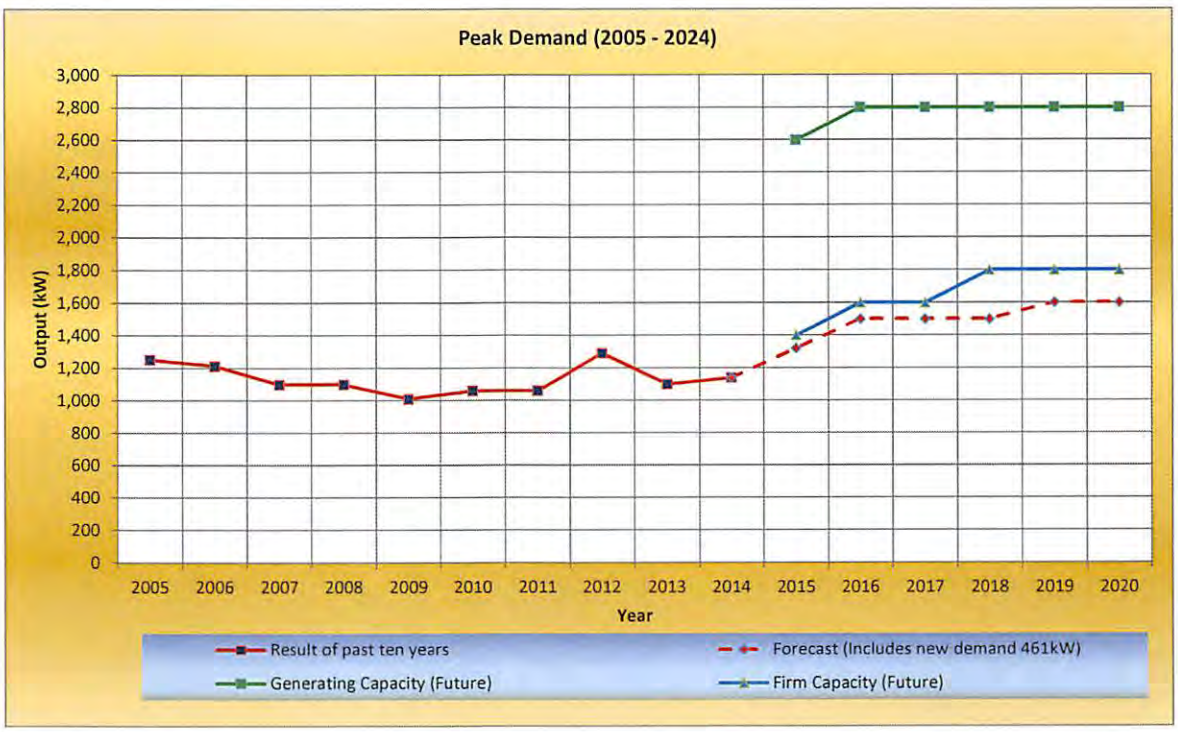


Figure-5 Available Capacity of Generators and Peak Demand

Table-2 Operation Schedule of Diesel Engine Generators

DEG No.	Description	Available Capacity (kW)	Year					
			2015	2016	2017	2018	2019	2020
G-4	Existing	400		Retire				
G-6	Existing	1,200				Retire		
G-8	Existing	1,000						
G-9	Assisted by WB	600						
G-10	Assisted by JICA	600						
G-11	Assisted by JICA	600						
Total		4,400						

The concepts of the presented components are as follows;

(1) Total generation capacity of Tofol power station including newly installed 3 units of 600 kW covers enough for the peak demands from the year 2016 to the year 2020 as shown in the Figure-5.

(2) Any kind of diesel generators should be conducted periodical maintenance works at every 6 months and its maintenance period is 2 weeks to 3 months. In order to consider these maintenance cycles for Tofol power station, the firm capacity (defined as "Total generation capacity of Tofol power station – the largest unit generator capacity") was taken account for the study. The firm capacity shown in Figure-5 was made sure that there are some margin capacities against the peak demand from the year 2016 to the year 2020.

(3) 600 kW capacity generators are suitable for Kosrae's situation from the view point of better availability in the market, fewer consumption of fuel and longer life period of the unit due to less low load operation time, comparing to the one of larger capacity such as 750 kW and 900 kW.

6. SOFT COMPONENT PLAN

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THE PROJECT FOR POWER SECTOR IMPROVEMENT FOR KOSRAE STATE IN FEDERATED STATES OF MICRONESIA

SOFT COMPONENT PLAN

APRIL 2016

YACHIYO ENGINEERING CO., LTD.

The Project for Power Sector Improvement for Kosrae State
in Federated States of Micronesia

Soft Component Plan

Contents

1. Background to Planning the Soft Component

The Project intends to construct and procure a generator house, diesel generating equipment, transformation equipment and distribution equipment, and thereby upgrade the power generating, transformation and distribution equipment and facilities of Kosrae Utilities Authority (KUA), which is the electric power utility operator in Kosrae State, Micronesia and the Executing agency on the Federated States of Micronesia side. KUA will carry out operation and maintenance following the handover of the supplied equipment.

KUA has 23 employees that conduct power supply in Kosrae State, and around seven of these are involved in the technical operation and maintenance. Three diesel generators (G-4, G-6, G-8) are currently in working order and KUA is able to conduct routine maintenance of the generating equipment, however, in the case where new equipment is introduced, it will be necessary to build an organized maintenance structure and implement maintenance capacity building (implementation, recording, sorting, analysis and archiving of routine inspections) in order for the equipment to be operated and maintained appropriately.

Except for small-scale (low voltage connected systems) systems, no large-scale (grid-connected) solar power systems have so far not been installed in Kosrae State, however, a new solar power generating system (200 kWp) was installed under support from the Pacific Environment Community (PEC) Fund in April 2015, while another 100 kWp solar power generating system was introduced based on aid from the EU in December 2015, meaning that 300 kWp has been connected to the 13.8 kW power grid. As a result, the total power of 300 kWp from these solar power systems will come to account for between 32.6% of system capacity in Kosrae State (maximum daytime mean approximately 920 kW). However, KUA has no system stabilizing equipment, etc., and it will need to firmly establish the concept and methodology for operating and maintaining the Project diesel generators in tandem with the solar power systems that will be connected to the 13.8 kW grid.

Equipment maintenance is broadly divided into preventive maintenance and follow-up maintenance. The maintenance activities of KUA largely consist of unplanned emergency follow-up maintenance. Such follow-up maintenance is regarded as a problem for the following reasons: (1) major damage is imparted to equipment and massive costs are incurred in repairs, and (2) equipment operation needs to be stopped for long periods in order to implement repairs.

The technical education that is currently implemented by KUA mainly consists of OJT inside the power station and on the solar power systems. In the Project, OJT (on the job training) focusing on operation and maintenance using actual equipment will be implemented by the equipment suppliers during the works period, trial operation and commissioning, however, in order for the local staff to acquire the technology to conduct the general operation and maintenance of

generating equipment unaided, OJT focusing on operation and maintenance training by equipment suppliers for KUA maintenance personnel will not suffice. Therefore, in the Soft Component, it is planned to conduct a comprehensive package of technical guidance ranging from classroom study on equipment operating principles, structures and systems to preventive maintenance comprising operation, maintenance, patrol inspections and record keeping for the KUA maintenance personnel. Technical guidance will also be conducted on maintenance of interconnected operation with solar power systems.

2. Objectives of the Soft Component

In the Soft Component, the Consultant will conduct technical guidance to KUA (the Executing agency). The guidance will cover the operation and maintenance of the Project diesel generator equipment (two 600kW generators), and interconnected operation with the solar power systems that have been or are being constructed in Kosrae State under assistance from the Pacific Environment Community (PEC) Fund and European Union (EU). The guidance will cover operation methods to ensure that impacts on the diesel generating equipment from the solar power systems are kept to a minimum. The Consultant will implement the Soft Component with the objective of disseminating maintenance (preventive maintenance) via classroom learning of diesel engine and generator operating principles, structure, etc. and guidance on practical knowledge and technology using actual equipment. The goals of the Soft Component are indicated below.

- Transfer of systematic knowledge concerning the structure, functions and theory of internal combustion engines (diesel engines)
- Transfer of systematic knowledge concerning the structure, functions, systems, etc. of generators
- Transfer of systematic knowledge concerning the structure, functions and composition of mechanical equipment systems (lubricating oil systems, cooling water systems, and electrical equipment systems)
- Guidance in systematic knowledge concerning the preventive maintenance of diesel engines, generators, mechanical and electrical equipment systems
- Formulation of plans for the preventive maintenance of diesel engines, generators, mechanical and electrical equipment systems
- Formulation of operation plans and preventive maintenance plans for grid-interconnected solar power systems that are subject to constraints from the operation of diesel engines and mechanical and electrical equipment systems

3. Outputs of the Soft Component

Through introducing the Soft Component, the following outputs will be achieved in terms of preventive maintenance planning.

- KUA will compile plans for the operation and maintenance of diesel engines, generators, mechanical and electrical equipment systems and interconnected operation with grid-interconnected solar power systems in light of structures, functions and theory acquired via the classroom learning and practical training.
  : Formulation of a standard values data sheet for operation management of systems

- KUA will compile plans for preventive maintenance of diesel engines, generators, mechanical and electrical equipment systems and grid-interconnected solar power systems in light of structures, functions and theory acquired via the classroom learning and practical training.
  : Establishment of a table showing periodic inspection intervals

4. Method for Confirming Achievement of Outputs

Tests to confirm understanding will be implemented to check the level of achievement when each of the following categories is completed:

- Structure and functions of internal combustion engines
- Structure and functions of mechanical equipment
- Structure and functions of generators and electrical equipment
- Formulation of operation and maintenance plans for generating equipment (including interconnected operation with solar power systems)
- Formulation of preventive maintenance plans

5. Soft Component Activities (Plan of Inputs)

(1) Contents of Activities

In the Soft Component, in order to implement preventive maintenance activities, the following technical guidance including the necessary classroom learning will be conducted focusing on guidance in operation and maintenance knowledge using actual equipment. Moreover, tests, internal debate and so on will be conducted in order to grasp the degree to which knowledge is being absorbed.

a) Principles of 4-cycle diesel engines and generators
b) Structure of generators including coupling with engines
c) Outline of fuel oil systems, maintenance of thermal efficiency, exhaust gas control, management of fuel oil properties
d) Outline of lubricating oil systems, operating principles of lubricating oil cleaning devices, fluid lubrication, management of lubricating oil properties

e) Outline of cooling water systems, relationship between cooling performance and thermal efficiency, prevention of corrosion in cooling systems, management of cooling water properties
f) Outline of compressed air systems, and diesel engine starting method
g) Structure and connection method of cable connecting terminals on the secondary side of generators
h) Generator test methods and test apparatus
i) Outline of air supply and exhaust systems, and importance of exhaust temperature
j) Attachment of sensors and conditions of wiring
k) Outline of waste oil treatment systems, and important points from the perspective of environmental impact
l) Equipment failures and preventive maintenance (formulation of spare parts purchasing plans)
m) Important points in preventive maintenance of diesel engines
n) Important points in preventive maintenance of mechanical equipment systems
o) Formulation of a periodic inspection interval sheet for diesel engines
p) Formulation of a standard values data sheet for operation management of diesel engines
q) Formulation of a periodic inspection interval sheet for mechanical equipment systems
r) Formulation of a standard values data sheet for operation management of mechanical and electrical equipment systems
s) Diesel generator starting conditions and operation constraints on solar power systems arising from power load
t) Operation planning (weekdays and holidays) of solar power systems interconnected with diesel generators

(2) Plan of Inputs

In implementing the Soft Component, in the work in Japan, the Consultant will appoint ① a Japanese engineer (diesel power generation engineer) who has been involved and is well-versed in design, operation and maintenance of diesel engines, and ② a Japanese person (grid-interconnected system engineer) who has been involved in design of interconnected operation of diesel generators with solar power systems and is well-versed in operation and maintenance technologies. Their terms of activity in the Federated States of Micronesia will be 1.0 month and 0.5 months respectively between the end of the contractor's contract and completion of the handover of facilities and equipment, and staff planning will be conducted to ensure that the technical guidance is finished by the start of Project equipment operation.

In the work in Japan before being dispatched to the Federated States of Micronesia, the instructors will analyze the technical levels of KUA mechanical and electrical engineers based on the gathered KUA operation and maintenance materials, and compile the technical guidance materials (materials on structure, functions and theory of diesel engines, technical materials on

mechanical equipment systems, features of generators that conduct interconnected operation with solar power systems, issues for examination, and test questions) (1.0 month and 0.5 months).

Table-1 shows the contents of activities of Soft Component personnel in Japan, while Table-2 shows the contents of activities in the Federated States of Micronesia.

Table-1 Detailed Plan of Soft Component Activities (in Japan)

Category	Contents of Activities	Implementation Period
Theory of internal combustion engines	Preparation of texts, manuals and test questions concerning the following: ① "Principles of 4-cycle diesel engines" ② "Principles and structure of coupled generators"	0.25 months
Theory of mechanical and electrical equipment systems	Preparation of texts, manuals and test questions concerning the following: ③ "Outline of fuel oil systems, maintenance of thermal efficiency, exhaust gas control, management of fuel oil properties" ④ "Outline of lubricating oil systems, operating principles of lubricating oil cleaning devices, fluid lubrication, management of lubricating oil properties" ⑤ "Outline of cooling water systems, relationship between cooling performance and thermal efficiency, prevention of corrosion in cooling systems, management of cooling water properties" ⑥ Structure and connection of terminals of cables on the secondary side of generator ⑦ "Generator test methods and test apparatus" ⑧ "Outline of air supply and exhaust systems, and importance of exhaust temperature" ⑨ "Outline of air supply and exhaust systems, and importance of air temperature management" ⑩ Attachment of sensors and conditions of wiring ⑪ "Outline of waste oil treatment systems, and important points from the perspective of environmental impact"	0.25 months
Preventive maintenance	Preparation of texts, manuals and test questions concerning the following: ⑫ "Equipment failures and preventive maintenance" ⑬ "Important points in preventive maintenance of diesel engines" ⑭ "Important points in preventive maintenance of mechanical equipment systems"	0.25 months
Formulation of preventive maintenance plan	Preparation of texts, manuals and test questions concerning the following: ⑮ "Formulation of a periodic inspection interval sheet for diesel engines" ⑯ "Formulation of a standard values data sheet for operation management of diesel engines" ⑰ "Formulation of a periodic inspection interval sheet for mechanical equipment systems" ⑱ "Formulation of a standard values data sheet for operation management of mechanical and electrical equipment systems"	0.25 months
Subtotal	Diesel power generation engineer	1.0 month x 1 person
Features and issues of generating equipment that conducts grid-interconnected operation	Preparation of texts, manuals and test questions concerning the following: ① "Principles and basic knowledge of generating equipment that conducts grid-interconnected operation" ② "Features of generating equipment that conducts grid-interconnected operation" ③ "Issues for examination when introducing generating equipment that conducts grid-interconnected operation" ④ "Output fluctuations in generating equipment that conducts grid-interconnected operation"	0.5 months
Subtotal	Grid-interconnected system engineer	0.5 month x 1 person

Table-2 Detailed Plan of Soft Component Activities (in the Federated States of Micronesia)

Category	Contents of Activities	Implementation Period
Theory of internal combustion engines	① Principles of 4-cycle diesel engines, auxiliary units, generators and electrical equipment	0.20 months
Theory of mechanical and electrical equipment systems	② Start and stop training using actual diesel engines and generators (including compressed air systems) ③ Outline of fuel oil systems, maintenance of thermal efficiency, exhaust gas control, management of fuel oil properties ④ Outline of lubricating oil systems, operating principles of lubricating oil cleaning devices, fluid lubrication, management of lubricating oil properties ⑤ Outline of cooling water systems, relationship between cooling performance and thermal efficiency, prevention of corrosion in cooling systems, management of cooling water properties ⑥ Outline of air supply and exhaust systems, importance of exhaust temperature ⑦ Outline of waste oil treatment systems, important points from the perspective of environmental impact	0.40 months
Preventive maintenance	⑧ Equipment failures and preventive maintenance ⑨ Important points in preventive maintenance of diesel engines ⑩ Preventive maintenance of generators and electrical equipment systems ⑪ Important points in preventive maintenance of mechanical equipment systems	0.20 months
Formulation of preventive maintenance plan	⑫ Formulation of a periodic inspection interval sheet for diesel engines ⑬ Formulation of a periodic inspection interval sheet for generators and electrical equipment ⑭ Formulation of a standard values data sheet for operation management of diesel engines ⑮ Formulation of a periodic inspection interval sheet for mechanical equipment systems ⑯ Formulation of a standard values data sheet for operation management of mechanical equipment systems	0.20 months
Subtotal	Diesel power generation engineer	1.0 month x 1 person
Theory and practical training on generating equipment that conducts interconnected operation with solar power systems	⑤ Explanation and lecture concerning “Principles and basic knowledge of generating equipment that conducts grid-interconnected operation” ⑥ Grasping of “Features of generating equipment that conducts grid-interconnected operation” ⑦ Guidance on preparation of materials concerning “Output fluctuations in generating equipment that conducts grid-interconnected operation” ⑧ Guidance concerning “Preparation of operation manual on interconnected operation of diesel generator equipment and solar power systems”	0.5 months
Subtotal	Grid-interconnected system engineer	0.5 months x 1 person

6. Method for Procuring Resources for Soft Component Implementation

Since it will be necessary to provide guidance on coherent knowledge and technology ranging from the functions, structures and theory of diesel engines and generators to operation and maintenance of actual diesel generating equipment, the Japanese Consultant will conduct overall supervision and guidance in the Soft Component of the Project. However, to ensure smooth implementation and effective and efficient operation and maintenance after that, it will be vital for the KUA

maintenance personnel to display initiative and make independent efforts. Therefore, a leader will be appointed from among the KUA trainees when implementing the Soft Component.

7. Soft Component Implementation Schedule

Table-3 shows the implementation schedule of the Project Soft Component.

Table-3 Soft Component Implementation Schedule

Number of Months	1	2
1. Theory of internal combustion engines and generators		
2. Theory and practical training for mechanical and electrical equipment systems		
3. Necessity of preventive maintenance, and practical training		
4. Formulation of preventive maintenance plan		
5. Interconnected operation of diesel generator equipment and solar power systems		

8. Outputs of the Soft Component

The following outputs will be produced through implementation of the Soft Component.

- Soft Component completion report
- Technical materials for diesel generating equipment (English)
- Results of tests for confirming understanding of technical guidance contents (English)
- Periodic inspection interval sheet for diesel generating equipment (English)
- Standard values data sheet for operation management of diesel generating equipment (English)
- Output fluctuation sheet for grid-interconnected operation (English)

9. Soft Component Cost Estimate (Draft)

The cost estimate (draft) is as follows.

Item	**Cost at time of estimation (1000 yen)**	**Remarks**
(1) Direct personnel costs	2,568	• No local subcontracting, etc.
(2) Direct expenses	1,181	
(3) Indirect expenses	3,287	
Total	**7,036**	

10. Obligations of the Counterpart Agency

- To appoint counterparts from KUA for implementing the Soft Component.
- To appoint participants in the Soft Component from KUA.
- To provide a venue for the Soft Component classroom training

7. REFERENCES

7. REFERENCES

(1) Topographic Survey and Soil Investigation Report

REPORT

Yachiyo Engineering Co.Ltd.

Project for Power Station Improvements in the State of Kosrae, Micronesia
Topographical Survey and Soil Explorations

Prepared for:

Yachiyo Engineering Co.Ltd.

Prepared by:

Tonkin & Taylor International Ltd

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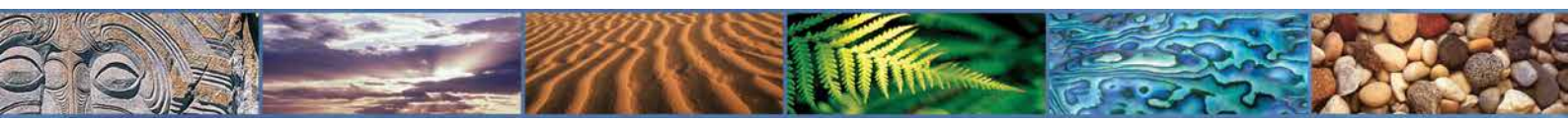

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1 Introduction

1.1 General

Tonkin & Taylor International (T&TI) was engaged by Yachiyo Engineering Co., Ltd. (YEC) to undertake soil investigations and a topographic survey for a proposed new power house at the existing Tofol Power Station (defined herein as 'the site') in Kosrae, Micronesia.

The investigations and survey have been carried out in accordance with the "Contract of Topographical Survey and Soil Explorations" provided to T&TI by YEC. The soil investigations comprised 6 hand augered boreholes (two of which BH1 and BH5 were carried out through the base of trial pits), 3 trial pits and 7 Scala penetrometer tests, at locations directed by the representative of YEC. Laboratory testing of recovered soil samples from the site was also undertaken. This work scope was agreed with YEC.

The topographic survey of the site was undertaken by New Zealand based topographical surveyors, under the supervision of T&TI.

The geotechnical assessment was undertaken in accordance with our proposal dated 27 February 2015[1].

The scope of the geotechnical investigations has included:

- A review of relevant existing information held in T&TI archives.
- T&TI supervision of the Topographical Survey conducted by a NZ based surveyor.
- 6 hand augered boreholes to a maximum of 5m depth.
- 3 machine excavated trial pits to a maximum to 2.2m depth
- 7 Scala penetrometer tests to a maximum of 5m depth.
- Assessment of suitable foundation solutions for structures on the site.
- Preparation of this report outlining the geology, site subsurface conditions and presenting preliminary geotechnical information and recommendations to support the development of the site.

This report summarises the results of the soils investigations carried out at the site.

1.2 Project Description

Kosrae lies in the eastern Caroline Islands and is a single island State making up part of the Federated States of Micronesia. Kosrae consists of three islands. The main island which is triangular in shape and occupies a total land area of 112 square kilometres while two smaller islands along the eastern coast occupy an area of 0.5km^2 and 100m^2 respectively. Kosrae has a relatively elevated and steep interior which is almost entirely vegetated, surrounded by coastal mangroves and a coral reef in the low lands. The population of Kosrae is approximately 6000.

The project involves construction of a new power house building at the existing Tofol power generation plant in Tofol. Based on preliminary design drawings provided by YEC we understand the proposed power house will consist of a new building with an approximate 20m by 30m footprint. We understand that the northern two thirds of the building will comprise a two storey steel structure housing three new generation units along with electrical control rooms and offices. The southern third of the building will be single level, open air and contain the sludge treatment

[1] Tonkin and Taylor International Ltd. (27 February 2015) , Preparatory Survey on the Project for Power Sector Improvements for the State of Kosrae in the Federated States of Micronesia

area. In addition a concrete access road will also be constructed down the eastern side of the new building.

2 Site Description

The site is located on the main island road at the eastern extent of the village of Tofol, Kosrae. The site is approximately 14km from Kosrae International Airport.

The existing power station site is located on a relatively flat plateau above the main island road. It is bound by the island road to the north and east and steep slopes to the south and west. A number of existing buildings currently occupy the site including the main office building, machinery and maintenance sheds, power generation building, oil tanks and a partially completed solar energy generation area.

It is proposed that the new power house building will be located along the western boundary of the site, directly north of the existing Material Stock Yard Building. The proposed location of the new power house is currently occupied by a 40ft shipping container which has been converted into an office facility which is currently disused. A pig sty and large tree are also present to the northeast. At least three abandoned motor vehicles were located within an overgrown part of the proposed building site.

The proposed new building is to be constructed on a plateau approximately 3 to 4m above the road. The plateau is gently sloping from the south to the north before it drops off rapidly down to the road. Gully features are present to both the east and west of the proposed development area.

Within the proposed building footprint, the site topography varies by approximately 1m from the south to the north (being higher to the south). Accordingly site earthworks are likely to be required to create a level building platform. Based on discussions with YEC representatives, we understand the cut to fill will be designed to try and achieve a balance (i.e. all material cut from the higher southern end of the site will be used to fill the lower northern end of the site to create a level platform).

3 Summary of the Topographic Survey

A topographical survey of the site was undertaken by NZ based surveyors in March 2015 under the supervision of T&TI. The topographical survey details and results are summarised in the following section.

Topographical survey of the site was undertaken from the 21st to 26th March 2015.

Equipment used included:	Sokkia RTK GPS XR1 Base and Rover
	Sokkia SET4130R3-36T Reflectorless Total Station
Local Benchmark used:	N/A
Coordinate system used:	Universal Transverse Mercator (UTM WGS84)
Height Datum:	Assumed Height 100m at BM2 (14m above Lelu Sea level)

The Topographical Survey plans and report have been presented in Appendix B.

4 Summary of the Soils Investigation

4.1 General

The soil investigations were carried out in March 2015 and the scope of the work was completed in accordance with the 'Contract of Topographical Survey and Soil Explorations', presented in Appendix A. All field tests were terminated at refusal or at the target depth provided by YEC.

The following tasks were completed for the soils investigation:

- 6 No. Hand auger boreholes (BH1 to BH6) to 5.0m below existing ground level.
- 7 No. Scala penetrometer tests (SC1 and SC2) to 5.0m below ground level.
- 1 No. excavated trial pit (TP1) to 2.2m below ground level

The subsections below present a summary of the investigation work and laboratory testing results. Site investigation logs are presented in Appendix C and laboratory testing results are presented in Appendix D.

4.2 Hand auger and Scala penetrometer investigations

The soil investigation testing, including hand augered boreholes and Scala penetrometer tests, were located within and surrounding the proposed new building footprint over a period of 6 days (21 March – 26 March 2015). The hand augered boreholes extended to a depth of up to 4.8m below existing ground level. The Scala penetrometer tests were terminated at 5.0m below ground level (except SC1 which met refusal at 4.2m due to the presence of hard ground)

In-situ shear strength testing was carried out in the hand auger boreholes in cohesive materials using a calibrated pilcon shear vane and samples were collected for geotechnical laboratory testing. The subsurface soils were described in accordance with NZ Geotechnical Society guidelines and shear strengths are recorded on the borehole logs presented in Appendix C. The Scala penetrometer provides continuous soil strength data until hard ground/refusal is achieved (10 - 20 blows per 50mm penetration). The results of the Scala penetrometer tests are included in Appendix C.

Published correlations between Scala penetrometer test results and SPT 'N' values have been used to assess the soil material properties used.

4.3 Geotechnical Laboratory Schedule

The recovered samples were transported back to Auckland and geotechnical laboratory testing was carried out by Geotechnics Ltd. The laboratory tests have been completed in accordance with the relevant New Zealand standards and the laboratory is fully accredited with international Accreditation New Zealand (IANZ) registration.

The soil testing consisted of the following:

- Atterberg limits (3 No.)
- Natural moisture contents (3 No.)
- Particle size distribution (3 No.)
- Solid density (3 No.)
- pH for acidity (3 No.)

5 Subsurface Conditions

5.1 Geological Setting

Published Geological information[2] indicates the island of Kosrae is volcanic in origin with the basement rock consisting of either the Kosrae Main Lava series (KMLS) or the Kosrae Nepehlinite Series (KNS). The rocks of the KMLS typically comprise basalts, ankaramited and hawaiites while the rock of the KMS group are typically highly to moderately under-saturated lavas and dikes.

Soils on the island typically fall into one of four categories; highly weathered oxisols (typical of lowland areas), inceptisols (younger, less weathered soils typical of mountainous areas) entisols (typical of low lying swampy areas) and mangrove muds (containing mucky organic peats). Due to the volcanic origin of the soils, the high rainfall on the island and high degree of weathering the soils are typically acidic in nature. In addition the soils typically contain a moderate amount of organic material[3].

Based on the topography and location of the site it is likely that the site is underlain by predominately oxisol residual soils (soils formed from the weathering of parent rock) overlying volcanic rocks (basalt etc.) at varying stages of weathering. The results of the geotechnical investigations across the proposed development area confirmed the presence of volcanic soils as expected.

5.2 Ground and Groundwater Conditions

5.2.1 General

The results of the geotechnical investigations across the proposed development area indicate the subsurface conditions typically comprise topsoil overlying either coral sand (fill) and uncontrolled fill or residual soils. In the south east and north of the proposed development area, uncontrolled fill and coral sands were encountered directly below the topsoil, with either the fill overlying the coral sand (TP1) or coral sand overlying the fill (BH1 and BH5). Below these layers the natural volcanic soils were encountered.

Across the remainder of the site, natural volcanic soils were encountered directly below either the topsoil or coral sand layers. Minor fibrous organic lenses (peat) were encountered in BH3 (4.1m deep, 0.2m thick) and BH5 (2.4m deep and 0.1m thick). The organic material was found to be relatively intact, (still retaining most of its structure) dark purple in colour and moist to wet. However, approximately 5m to the west of the development area (outside the proposed building footprint) a thicker and shallower layer of organic material was encountered in BH4 (2.2m deep, at least 2m thick).

A summary of the ground conditions is presented in Table 1 below.

[2] Hafiz, R. U. et al 2013, *Geological Origin of the Volcanic Islands of the Caroline Group in the Federated States of Micronesia*, *Western Pacific* South Pacific Studies Vol.33, No. 2 2013

[3] Merlin, M. Taulung, R. Juvik, J. 1993, *Sahk Kap Ac Kain In Can Kosrae: Plants and Environments in Kosrae*, University of Hawai'i at Mānoa

Table 1-Summary of typical ground conditions within the building footprint

Depth (Below ground level)	Geological Unit	Soil Description	Soil Undrained shear strength (Cu)
0-0.1m	Topsoil	Silty TOPSOIL with minor organics and some sand and gravels, loose, dry , non- plastic	N/A
0.1-0.5m	Coral Sand (Fill)	Medium to coarse SAND, with fine gravels white grey, medium dense, dry (BH1, BH2 and TP1)	N/A
0.3-1.2m	Uncontrolled fill	SILT to silty CLAY with sand and gravel inclusions and some refuse (tin cans, cloth, car parts), orange brown to dark brown low plasticity, moist (BH1, BH5, and TP1)	45-110kPa
0.2-4.7m	Residual soils	CLAY, Silty CLAY and SILT (some cemented), with occasional fine gravels, low to moderately plastic, orange brown mottled purple and black moist to wet	40-220kPa
2.4-2.5m (BH5) 4.1-4.3m (BH3) 2.2-4.5 (BH4)*	Organics	Fibrous PEAT and rootlets, spongy dark purple colour, non-plastic, wet	N/A

*Note: outside building footprint

Groundwater inflows into the investigation holes were typically encountered at the base of the fill or coral sand layers at the interface between the highly permeability fills / coral sands and the lower permeable volcanic soils. Groundwater levels were typically measured at between 1m and 2.5m depth at the completion of each borehole.

Scala penetrometer tests were carried out adjacent to each of the hand augered boreholes. From this in-situ testing, we can assess the soil strengths at specific depths below the site. The Scala results and inferred soil strengths are summarised in Table 2 below:

Table 2- Summary of Scala penetrometer results

Depth (Below ground level)	Average Scala Blows per 50mm	Soil Type	Inferred Consistency	Equivalent SPT "N" values
0-0.1m	N/A	Topsoil	Loose	N/A
0.1-0.5m	6-8	Coral Sand	Medium Dense	24-32
0.3-1.2m	2-4	Uncontrolled fill (cohesive)	Firm to stiff	8-16
0.2-4.7m	1-4	Residual soils (cohesive)	Firm to very stiff	4-16
2.25 – 4.5	4-7	Organics	Medium Dense	16-28

5.2.2 Summary of Scala Penetrometer results and equivalent SPT "N" value

Tables 3-9 below provide Scala Penetrometer results and equivalent SPT "N" values for SC1 to SC7 at 0.5m intervals.

Table 3- Summary of Scala Penetrometer results and equivalent SPT "N" value-SC1

Depth (Below ground level)	Average Scala Blows per 50mm	Inferred Strength	Equivalent SPT "N" values
0.5	5	Medium Dense	20
1.0	2.5	Stiff	10
1.5	3.5	Stiff	14
2.0	2.5	Stiff	10
2.5	3	Stiff	12
3.0	3	Stiff	12
3.5	3	Stiff	12
4.0	2.5	Stiff	10
4.5	5	Very Stiff	20

Table 4- Summary of Scala Penetrometer results and equivalent SPT "N" value-SC2

Depth (Below ground level)	Average Scala Blows per 50mm	Inferred Strength	Equivalent SPT "N" values
0.5	5	Medium Dense	20
1.0	2	Firm	8
1.5	1.5	Firm	6
2.0	1	Firm	4
2.5	3.5	Stiff	14
3.0	4.5	Stiff	18
3.5	4.5	Stiff	18
4.0	5	Very Stiff	20
4.5	4	Stiff	16
5.0	5	Very Stiff	20

Table 5- Summary of Scala Penetrometer results and equivalent SPT "N" value-SC3

Depth (Below ground level)	Average Scala Blows per 50mm	Inferred Strength	Equivalent SPT "N" values
0.5	2	Loose	8
1.0	1	Firm	4
1.5	1	Firm	4
2.0	2	Stiff	8
2.5	2	Stiff	8
3.0	1.5	Firm	6
3.5	2	Stiff	8
4.0	2.5	Stiff	10
4.5	3	Stiff	12
5.0	5	Very Stiff	20

Table 6- Summary of Scala Penetrometer results and equivalent SPT "N" value-SC4

Depth (Below ground level)	Average Scala Blows per 50mm	Inferred Strength	Equivalent SPT "N" values
0.5	2.5	Loose	10
1.0	2.0	Stiff	8
1.5	3	Stiff	12
2.0	2.5	Stiff	10
2.5	3.5	Stiff	14
3.0	4.5	Stiff	18
3.5	4.5	Stiff	18
4.0	6	Very Stiff	24
4.5	6.5	Very Stiff	26
5.0	7	Very Stiff	28

Table 7- Summary of Scala Penetrometer results and equivalent SPT "N" value-SC5

Depth (Below ground level)	Average Scala Blows per 50mm	Inferred Strength	Equivalent SPT "N" values
0.5	1.5	Loose	6
1.0	2	Stiff	8
1.5	4	Stiff	16
2.0	2.5	Stiff	10
2.5	2.5	Stiff	10
3.0	1.5	Firm	6
3.5	2	Stiff	8
4.0	1.5	Firm	6
4.5	3	Stiff	12
5.0	4.5	Stiff	18

Table 8- Summary of Scala Penetrometer results and equivalent SPT "N" value-SC6

Depth (Below ground level)	Average Scala Blows per 50mm	Inferred Strength	Equivalent SPT "N" values
0.5	1	Loose	4
1.0	10	Dense	40
1.5	7	Medium Dense	28
2.0	3	Stiff	12
2.5	2.5	Stiff	10
3.0	4	Stiff	16
3.5	5	Very Stiff	20
4.0	4.5	Stiff	18
4.5	5	Very Stiff	20

5.0	5	Very Stiff	20

Table 9- Summary of Scala Penetrometer results and equivalent SPT "N" value-SC7

Depth (Below ground level)	Average Scala Blows per 50mm	Inferred Strength	Equivalent SPT "N" values
0.5	3	Medium dense	12
1.0	1.5	Firm	6
1.5	1.5	Firm	6
2.0	2	Stiff	8
2.5	2.5	Stiff	10
3.0	2	Stiff	8
3.5	2	Stiff	8
4.0	2	Stiff	8
4.5	2.5	Stiff	10
5.0	3.5	Stiff	14

6 Geotechnical Laboratory Testing Results

A summary of the geotechnical laboratory testing results is presented in Table 10 below. A full set of the geotechnical testing data sheets is presented in Appendix D.

Table 10 – Summary of the geotechnical laboratory testing

Hand Auger No.	Sample Depth (m)	Solid Density	Grain Size Analysis	Moisture Content	pH
BH1	0.1-0.2	-	Coral SAND with minor silt and trace clay light yellowish orange brown mottled red	-	-
BH1	0.8-0.9	-	-	-	6.4
BH3	0.3-0.6	-	Silty SAND with some clay and some gravel brown mottled orange	-	6.5
BH3	1.3-1.5	-	-	35.2%	-
BH4	0.4-0.6	-	-	41%	-
BH4	1.0-1.2	2.88 t/m3	-	-	-
BH5	0.6-0.7	2.87 t/m3	-	-	-
BH5	1.2-1.3	-	-	38.4%	6.8
BH5	2.7-2.9	-	Silty SAND with some clay and gravel greyish brown mottled orange-red	-	-
BH5	3.9-4.1	2.86 t/m3	-	-	-

7 Discussion and Engineering properties

7.1 General

Recommendations and opinions in this report are based upon data from 6 No. hand augered boreholes, 1 No. trial pit and 7 No. Scala penetrometer tests from the subject site.

The nature and continuity of the subsoil away from the test locations is inferred, but it must be appreciated that actual conditions could vary from the assumed model.

From the results of the soils investigation, geotechnical laboratory testing and published empirical relationships, we have assessed the engineering properties for the underlying soils at the site for the designer's consideration in the following subsections.

During construction actual ground conditions should be confirmed by a geotechnical engineer competent to judge whether the soils exposed in the foundation excavations are compatible with those described within this report.

7.2 Foundation Design

Following discussions with YEC, it is understood that shallow foundations will be constructed for the proposed power house, providing the ground conditions are suitable.

The site investigation data has indicated the presence of uncontrolled fill across the south east and north of the site. Due to the highly variable nature of its placement and properties as well as the presence of refuse (tin cans, cloth and car parts etc.) throughout we do not consider this material to be suitable for founding the new structure on. We recommend that the fill is removed prior to construction and replaced with compacted crushed gravel to an engineered standard (where required). The coral sand will also require removal to excavate the uncontrolled fill. However, the coral sand should be stockpiled for re-use on-site with the engineered fill.

As outlined in Section 5.2 above, fibrous organic peat was encountered across the western and northern areas of the site (in BH3 at 4.1m depth and BH5 at 2.2m depth). As the thickness of the organic layers encountered within these boreholes is relatively thin, it is unlikely that significant settlements will result from foundation loading. The overlying residual soils can be expected to reduce the applied bearing stress from foundations

However we do note that a significant deposit of organic material was encountered in BH4, approximately 5m west of the proposed building footprint. Constructing foundations over this deposit would likely result in moderate to relatively high settlements which could require mitigation measures such as pre-loading with vertical drains or deep / pile foundation options to be considered. It is therefore recommended that the building be constructed as far to the east as practical to mitigate this risk.

It is expected that shallow foundations bearing on the residual volcanic soils or compacted gravel fill may be utilised as a founding layer for the proposed power house depending on the actual loads. We have provided bearing capacities for these material types.

We recommend using a strength reduction factor of 0.5 (Φ_G=0.5) to give an ultimate limit state (ULS) bearing capacity, in accordance with New Zealand Design Standards (ref: NZS 1170). For serviceability limit state design we recommend a strength reduction factor of 0.33 (Φ_G=0.3) to give an allowable bearing capacity. Recommended bearing capacities are presented in Tables 11 - 17 below. These values have been evaluated based on empirical design charts between allowable bearing pressure, to give 25mm of settlement, and SPT 'N' values as developed by Terzaghi and Peck 1948 for a 1.5m wide footing. Note: ULS =Ultimate Limit State (ref. NZS1170)

Table 11- Bearing Capacities of volcanic soils for SC1

Depth (Below existing ground level)	Geotechnical Bearing Capacities			Foundation Type
	Allowable - (kPa or kN/m2) (FoS=3)	ULS* - (kPa or kN/m2)	Ultimate(kPa or kN/m2)	
500mm	N/A-Fill	-	-	Shallow strip footings up to 1m wide
1m	N/A-Fill	-	-	
1.5m	150	225	450	
2m	100	200	300	
2.5m	120	225	450	
3m	150	225	450	Deep Foundation (i.e. Bored piles) '3 x B' Embedment into the founding layer (volcanic soils)
3.5m	150	225	450	
4m	150	225	450	
4.5m	200	300	600	
5m	200	300	600	

Table 12- Bearing Capacities of volcanic soils for SC2

Depth (Below existing ground level)	Geotechnical Bearing Capacities			Foundation Type
	Allowable - (kPa or kN/m2) (FoS=3)	ULS* - (kPa or kN/m2)	Ultimate(kPa or kN/m2)	
500mm	N/A-Fill	-	-	Shallow strip footings up to 1m wide
1m	80	120	240	
1.5m	50	75	150	
2m	50	75	150	
2.5m	150	225	450	
3m	150	225	450	Deep Foundation (i.e. Bored piles) '3 x B' Embedment into the founding layer (volcanic soils)
3.5m	170	250	500	
4m	170	250	500	
4.5m	200	300	600	
5m	200	300	600	

Table 13- Bearing Capacities of volcanic soils for SC3

Depth (Below existing ground level)	Geotechnical Bearing Capacities			Foundation Type
	Allowable - (kPa or kN/m2) (FoS=3)	ULS* - (kPa or kN/m2)	Ultimate(kPa or kN/m2)	
500mm	80	120	240	Shallow strip footings up to 1m wide
1m	50	75	150	

1.5m	50	75	150	
2m	80	120	240	
2.5m	80	120	240	
3m	80	120	240	Deep Foundation (i.e. Bored piles) '3 x B' Embedment into the founding layer (volcanic soils)
3.5m	80	120	240	
4m	100	150	300	
4.5m	150	225	450	
5m	200	300	600	

Table 14- Bearing Capacities of volcanic soils for SC4

Depth (Below existing ground level)	Geotechnical Bearing Capacities			Foundation Type
	Allowable - (kPa or kN/m2) (FoS=3)	ULS* - (kPa or kN/m2)	Ultimate(kPa or kN/m2)	
500mm	100	150	300	Shallow strip footings up to 1m wide
1m	80	120	240	
1.5m	120	180	360	
2m	100	150	300	
2.5m	150	225	450	
3m	150	225	450	Deep Foundation (i.e. Bored piles) '3 x B' Embedment into the founding layer (volcanic soils)
3.5m	170	250	500	
4m	170	250	500	
4.5m	200	300	600	
5m	200	300	600	

Table 15- Bearing Capacities of volcanic soils for SC5

Depth (Below existing ground level)	Geotechnical Bearing Capacities			Foundation Type
	Allowable - (kPa or kN/m2) (FoS=3)	ULS* - (kPa or kN/m2)	Ultimate(kPa or kN/m2)	
500mm	N/A-Fill	-	-	Shallow strip footings up to 1m wide
1m	N/A-Fill	-	-	
1.5m	160	240	480	
2m	100	150	300	
2.5m	100	150	300	
3m	150	225	450	Deep Foundation (i.e. Bored piles) '3 x B' Embedment into the founding layer (volcanic soils)
3.5m	170	250	500	
4m	170	250	500	
4.5m	200	300	600	

5m	200	300	600	

Table 16- Bearing Capacities of volcanic soils for SC6

Depth (Below existing ground level)	Geotechnical Bearing Capacities			Foundation Type
	Allowable - (kPa or kN/m2) (FoS=3)	ULS* - (kPa or kN/m2)	Ultimate(kPa or kN/m2)	
500mm	N/A-Fill	-	-	Shallow strip footings up to 1m wide
1m	N/A-Fill	-	-	
1.5m	N/A-Fill	-	-	
2m	120	180	360	
2.5m	100	150	300	
3m	150	225	450	Deep Foundation (i.e. Bored piles) '3 x B' Embedment into the founding layer (volcanic soils)
3.5m	170	250	500	
4m	170	250	500	
4.5m	200	300	600	
5m	200	300	600	

Table 17- Bearing Capacities of volcanic soils for SC7

Depth (Below existing ground level)	Geotechnical Bearing Capacities			Foundation Type
	Allowable - (kPa or kN/m2) (FoS=3)	ULS* - (kPa or kN/m2)	Ultimate(kPa or kN/m2)	
500mm	120	180	360	Shallow strip footings up to 1m wide
1m	50	75	150	
1.5m	50	75	150	
2m	80	120	240	
2.5m	100	150	300	
3m	100	150	300	Deep Foundation (i.e. Bored piles) '3 x B' Embedment into the founding layer (volcanic soils)
3.5m	100	150	300	
4m	100	150	300	
4.5m	100	150	300	
5m	150	225	450	

7.3 Solid Density, Undrained Shear Strength, Cohesion and Internal Friction Angle Range

Table 18 below summarises the approximate solid densities, undrained shear strengths, cohesion and effective internal friction angles for the different sites. These have been assessed using results of the site investigations and laboratory testing.

Table 18- Summary of Solid Density, Undrained Shear Strength, Cohesion and Internal Friction Angle- Proposed Transmission House

Depth (Below existing ground level)	Soil Description	Unit Weight (KN/m^3)	Undrained Shear Strength (kPa)	Cohesion (kPa)	Effective Internal Friction Angle (deg)
0-0.1m	Topsoil	16	N/A	N/A	N/A
Compacted gravel	Gravel Fill	20	N/A	0	38°
0.2-4.7m	Residual soils	17	40-220kPa	5	30°
2.25 – 4.5	Organics	16	N/A	0	25°

7.4 Site Seismic Classification

7.4.1 General

It is appropriate to design the foundations and structure in accordance with the New Zealand Standard NZS 1170.5:2004 subject to confirmation with the local Government authorities. From the geotechnical investigations undertaken we consider that the site should be classified as a Class C- (Shallow soil site).

Alternatively the U.S. International Building Code should be applied given that Kosrae is a former U.S. Trust Territory.

7.4.2 Importance Level

In accordance with NZS 1170.0:2002[4] we have completed this assessment on the basis that the proposed development will be an Importance Level 2 structure. If this is changed during detailed design then updates will be required to this report.

7.4.3 Peak Ground Acceleration

The probabilistic earthquake hazard assessment for Australia and the South Pacific prepared by McCue[5] provides recommendations with respect to estimated ground accelerations. Peak ground accelerations (PGAs) expected from the design earthquakes under serviceability limit state (SLS) and ultimate limit state (ULS) conditions are presented in Table 19 below.

[4] NZS 1170:0: 2002 *Structural design actions – Part 0: General Principles*

[5] McCue, K. (1999). Seismic Hazard Mapping in Australia, the Southwest Pacific and Southeast Asia, Annali Di Geofisica 42, 1191-1198.

Table 19: Design Peak Ground Accelerations

Design Life (years)*	Serviceability Limit State (SLS)		Ultimate Limit State (ULS)	
	Return Period	Peak Ground Accelerations	Return Period	Peak Ground Accelerations
50	1 in 25 years	0.05g	1 in 500 years	0.20g

** Design Life to be confirmed by the structural engineer/architect as appropriate. If different from that assumed, or if this changes during the project life then these values and the opinions in this report may require reviewing and amending as and where necessary.*

8 Applicability

This report has been prepared for the benefit of YEC with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

Tonkin & Taylor International Ltd

Environmental and Engineering Consultants

Report prepared by:

.....

Chris Thurlow

Geotechnical Engineer

Reviewed for Tonkin & Taylor International Ltd by:

.....

Andy Pomfret

Project Manager

Authorised for Tonkin & Taylor International Ltd by:

.....

Chris Freer

Project Director

Appendix A: Contract of Topographical Survey and Soils Explorations

PREPARATORY SURVEY
ON
THE PROJECT
FOR
The Project for Power Sector Improvement for the State of Kosrae
IN
THE FEDERATED STATES OF MICRONESIA

CONTRACT
OF
TOPOGRAPHICAL SURVEY AND SOIL EXPLORATIONS

THIS CONTRACT is entered into on this **16th day of March 2015** by and between **Yachiyo Engineering Co., Ltd.** (hereinafter referred to as "YEC") and **Tonkin & Taylor International**, duly organized and existing under the laws of New Zealand, (hereinafter referred to as "the Contractor").

WHEREAS, YEC requested the Contractor to perform the Topographical Survey and Soil Explorations work which is outlined in Annex (hereinafter referred to as "the Work").

WHEREAS, the Contractor has accepted to perform the Work in accordance with the specifications and conditions set forth in this Contract and Annex hereto.

THEREFORE, based on and in consideration of the foregoing premises and of the terms and conditions hereinafter provided, both parties hereto agree as follows:

Clause 1 : WORK

The Contractor shall implement the Work as hereinafter defined under the terms and conditions of this Contract.

Clause 2 : YEC's REPRESENTATIVE

YEC shall assign a representative (hereinafter referred to as "the Representative") at the site. The Representative shall have the right to supervise, inspect and give approval for the Work.

Clause 3 : SPECIFICATIONS

The Work shall be performed in accordance with specifications in Annex.

Clause 4 : SITE LOCATION

Location of site is shown in Annex.

Clause 5 : WORK ITEMS

The Work shall cover the followings;

1) Topographical Survey
   (a) Preparation for topographical survey
   (b) Survey work at the site and data collections
   (c) Making drawing(s)
   (d) Reporting
   (e) Attending the site meeting with State of Kosrae Government for confirmation of boundary line of project site.
2) Soil Exploration
   (a) Preparation for field test
   (b) Dynamic cone penetration test and Soil sampling
   (c) Soil laboratory test
   (d) Reporting

Clause 6 : PREPARATION FOR THE WORK

The Contractor shall prepare all the necessary highly-skilled personnel and all of the required materials, facilities and equipment for the performance of the Work at the site and laboratory. The Representative shall have the right to check and review such materials, facilities and equipment at any time during the execution of the Work.

Clause 7 : REPORTING

The Contractor shall submit a written daily report of the Work in English to YEC.

Clause 8 : INSPECTIONS OF RESULTS

The Contractor shall request YEC for an inspection of results immediately at the completion of each item of the Work. If such results are not accepted by YEC, the Contractor shall redeem those works as soon as possible to the satisfaction of YEC, the Contractor shall once more submit the results to YEC for inspection.

Clause 9 : TIME FOR COMMENCEMENT AND COMPLETION

The Contractor shall commence the Work at the site on **23rd day of March 2015** and submit a DRAFT copy of the report (without the result of laboratory testing) by **27th day of March 2015**. The Contractor shall complete all the Work including both Topographical Survey and Soil Exploration by **27th day of March 2015**. The Contractor shall submit the final report for

approval by YEC. If such the final report is not accepted by YEC, the Contractor shall redeem the final report as soon as possible to the satisfaction of YEC. The Contractor shall complete to submit the final report to YEC by posting after confirming acceptance of YEC by **30th day of April 2015.**

Clause 10 : CONTRACT AMOUNT

The Contract amount shall be **39,950 US. Dollars.**

Clause 11 : METHOD OF PAYMENT

(a) Advance payment

YEC shall pay an advance payment of thirty (30) percent of the Contract amount to the Contractor upon signing of the Contract.

(b) Final payment

Payment of the remaining balance of the Contract amount shall be effected to the Contractor immediately after the Work has been finished and approved by YEC.

Clause 12 : PENALTY

A penalty of one/one hundred (1/100) of the Contract amount shall be imposed upon the Contractor per day by YEC, with maximum of ten (10) percent of the total Contract amount for a delay in the performance of the Work for which the Contractor is responsible to complete within the period as set forth in Clause 9.

The penalty amount shall be deducted from the final payment amount to be made to the Contractor.

Clause 13 : FORCE MAJEURE

The Contractor shall not be responsible for any delay caused by Force Majeure such as change in laws and regulations of The Federated States of Micronesia, strikes and sabotage, natural disasters, declared or undeclared war, blockades, revolutions, and natural calamities and severe weather conditions (e.g. cyclone) beyond the control of the Contractor. If it appears that such Force Majeure continues to the end of the Contract period mentioned in Clause 9, YEC shall have the right to terminate this Contract at any time.

Clause 14 : LIABILITY

YEC shall be exempted from or kept harmless against any damage, loss and/or accident incurred by or arising from a third party in connection with any activity of the Contractor during the period of the Work.

Clause 15 : TERMINATION OF CONTRACT

YEC has the right to terminate the Contract by giving a written prior notice to the Contractor, in case of any of the following cases;

(a) Due to causes attributable to the Contractor, if YEC judges that completion of the Work cannot be expected within the time set forth in Clause 9, and in accordance with the detailed time schedule submitted by the Contractor and approved by YEC.

(b) If the Work is not fully performed by the Contractor in accordance with the Contract and specifications without (at YEC's discretion) justified reasons.

(c) If the Contractor does not commence the Work or if the Contractor suspends the Work for a certain period without (at YEC's discretion) justified reasons after the effective date of this Contract.

(d) If the Contractor violates any provision of this Contract and does not rectify it within ten (10) days after the Contractor has received notice of breach of contract from YEC.

Clause 16 : ASSIGNMENT AND/OR SUBCONTRACT

Without prior written consent of YEC, the Contractor shall not assign any or this entire Contract to a third party.

Clause 17 : EFFECTIVE DATE OF THIS CONTRACT

This Contract shall become effective on the date first above written.

Clause 18 : CHANGES IN WORKING PROGRAM

YEC has the right to change the contents of the Work, if modifications are necessary. In case of such change, the time for completion and the Contract amount may be modified by mutual agreement in writing of both parties hereto. However, if extension of Contract period or increase in contract amount is required due to reasons attributable to the improper execution of the Work by the Contractor, such request from the Contractor shall not be approved by YEC. Should the YEC order additional works, an additional fee shall be paid to the Contractor, however, the Contractor shall not refuse to carry out the additional works without satisfactory reasons.

Clause 19 : DOUBTS OR UNSPECIFIED ITEMS

Any doubts in connection with this Contract or anything not specified in this Contract shall be determined amicably by mutual agreement between both parties.

Clause 20 : MAINTENANCE OF SECRECY

Without obtaining YEC's prior written approval, the Contractor shall not disclose, not only during the effective period of this Contract but also after the termination or completion of the

Contract, any information and/or data etc., which has been made known to the Contractor in executing the Work.

Clause 21 : EVALUATION OF ADDITIONAL AND OMITTED WORK

All work added or omitted under the instructions of YEC shall be evaluated at rates and prices set out in this Contract. If no applicable rates or prices are set out in this Contract, then suitable rates or prices shall be agreed upon between YEC and the Contractor. In the event of disagreement, YEC shall determine such rates or prices as shall, in his opinion, be reasonable and proper.

IN WITNESS WHEREOF; the parties hereto have executed this Contract by there duly authorized representatives as of the date first above written.

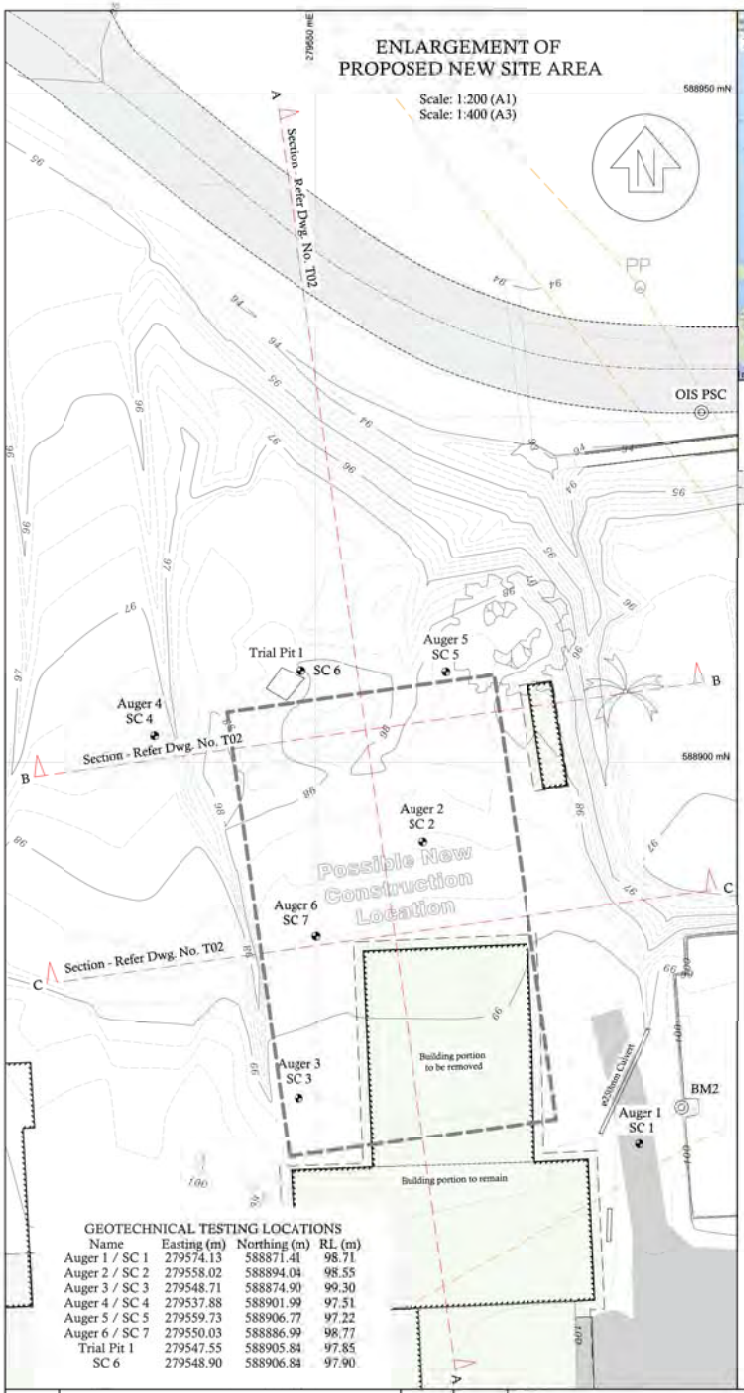
For and On Behalf of
The YEC

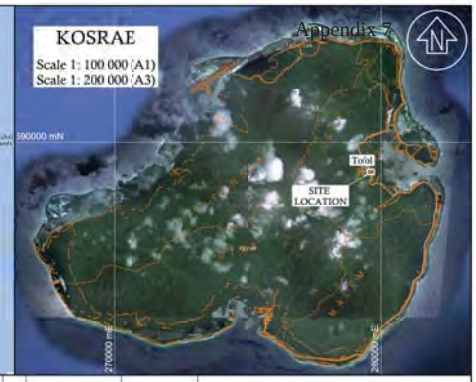
Mitsuhisa Nishikawa
Chief Consultant
Yachiyo Engineering Co., Ltd.
(JICA Study Team)

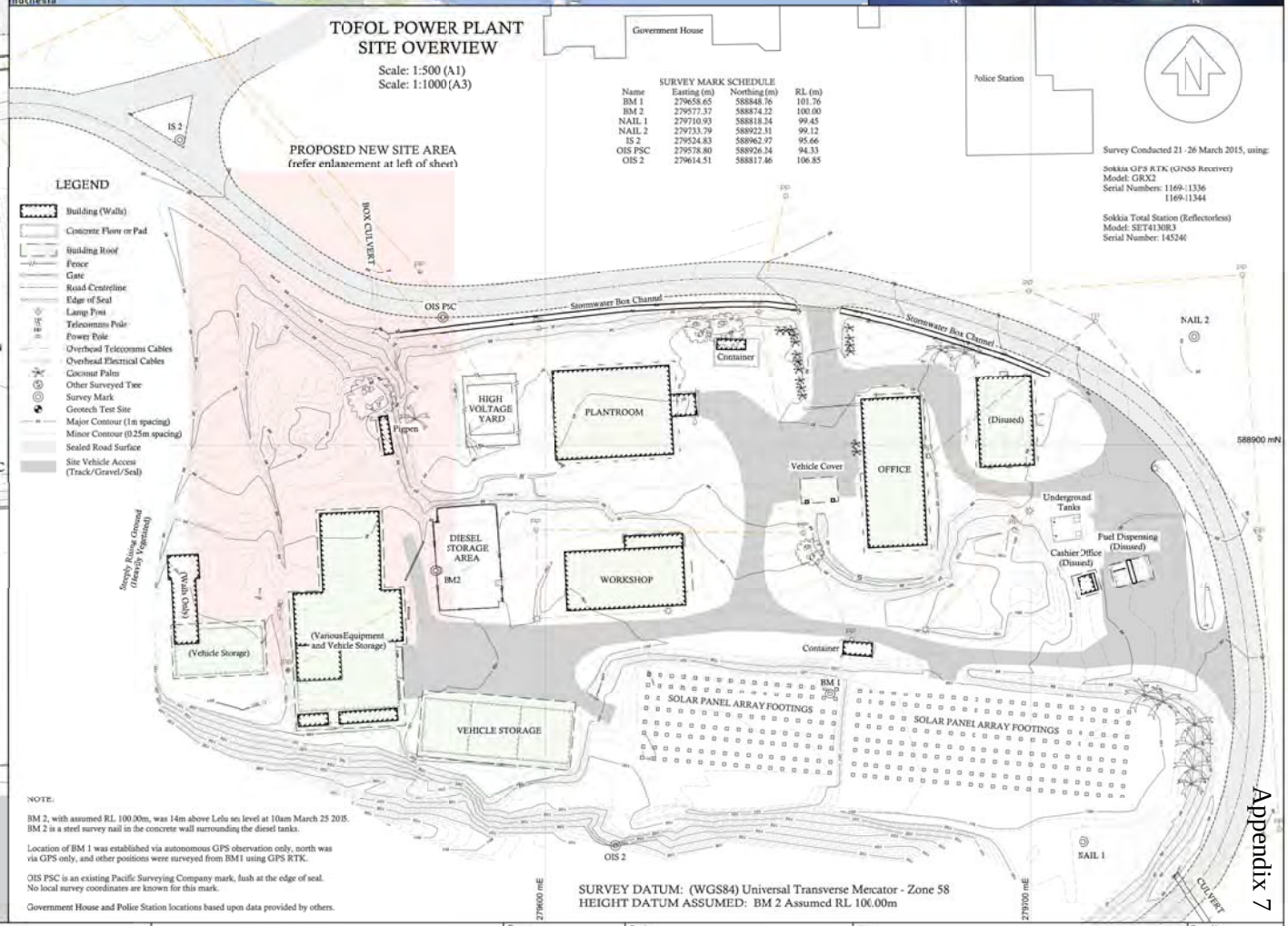
For and On Behalf of
The Contractor

Chris Freer
Project Director
Tonkin & Taylor International

Appendix B: Topographical Survey and Geotechnical Investigation Location Plans







Revision	Description	Approved	Date
DRAFT2	For Information		04-05-15
DRAFT	For Information		30-01-15

Client: Tonkin & Taylor

A-7-26

Drawn	ES
Designed	
Surveyed	ES
Project:	Kosrae Topo
Scale	As Shown

Title: Topographical Survey Plan
Kosrae Utilities Authority Site
Tofol, Kosrae
Federated States of Micronesia

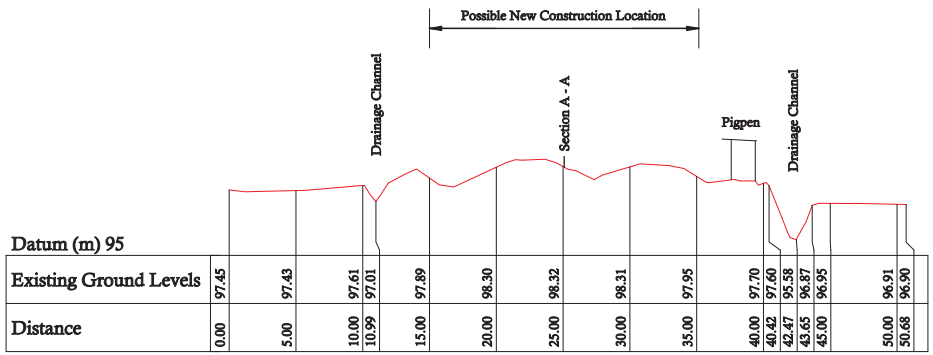
Dwg. No.	T01
Job No.	15009
Revision	DRAFT2

Date Plotted: Mon May 04 08:26:55 2015

A-7-26

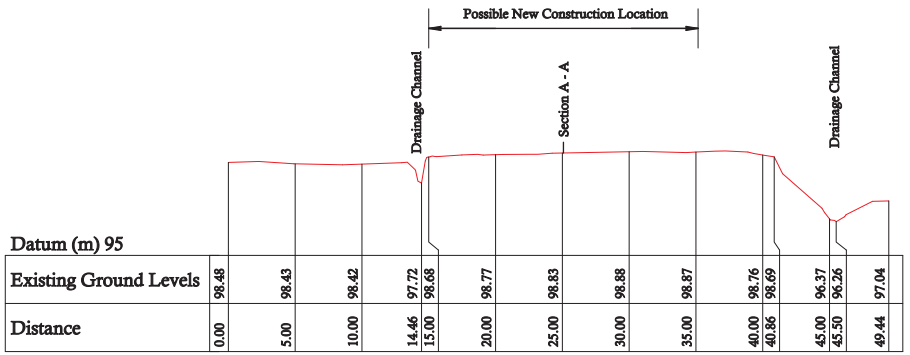
Appendix 7

REFER Dwg. No. T01 for Section Locations



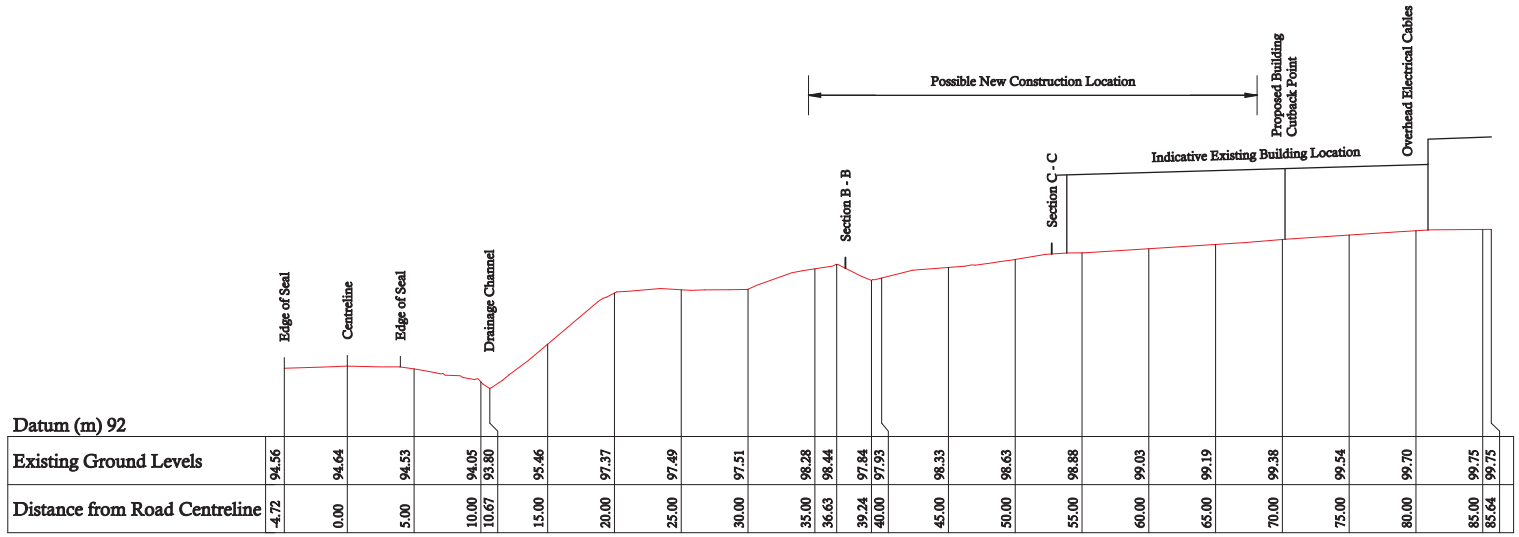
Datum (m) 95																														
Existing Ground Levels	97.45		97.43		97.61	97.01	97.89		98.30		98.32		98.31		97.95		97.70	97.60	95.58	96.87	96.95		96.91	96.90						
Distance	0.00		5.00		10.00	10.99	15.00		20.00		25.00		30.00		35.00		40.00	40.42	42.47	43.65	45.00		50.00	50.68						

Section B - B



Datum (m) 95																														
Existing Ground Levels	98.48		98.43		98.42		97.72	98.68	98.77		98.83		98.88		98.87		98.76	98.69			96.37	96.26		97.04						
Distance	0.00		5.00		10.00		14.46	15.00	20.00		25.00		30.00		35.00		40.00	40.86			45.00	45.50		49.44						

Section C - C



Datum (m) 92																														
Existing Ground Levels	94.56		94.64		94.53		94.05	93.80	95.46		97.37		97.49		97.51		98.28	98.44	97.84	97.93	98.33		98.63		98.88		99.03		99.19		99.38		99.54		99.70		99.75	99.75
Distance from Road Centreline	-4.72		0.00		5.00		10.00	10.67	15.00		20.00		25.00		30.00		35.00	36.63	39.24	40.00	45.00		50.00		55.00		60.00		65.00		70.00		75.00		80.00		85.00	85.64

Section A - A

HEIGHT DATUM ASSUMED: BM 2 Assumed RL 100.00m

				Client		Drawn: ES	Scale: H - 1:200 (A1), V - 1:100 (A1), H -1:400 (A3), V -1:200 (A3)	Title: Sections A–A, B–B, and C–C Tofol Power Plant site, Tofol, Kosrae Federated States of Micronesia	Dwg. No.: T02
				Tonkin & Taylor	A-7-27	Designed			Job No.: 15009
						Surveyed: ES			Revision: DRAFT
DRAFT	For Information		04-05-15			Project: Kosrae Topo			
Revision	Description	Approved	Date						

Date Plotted: Sun May 03 22:56:12 2015

Appendix C: Geotechnical Investigation Data

- **Hand auger borehole Logs**
- **Scala Penetrometer results**

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No:BH1
Hole Location: Refer to site plan.

SHEET 1 OF 1

PROJECT: Kosrae Power Plant		LOCATION: Tofol Kosrae	JOB No: 751122
CO-ORDINATES:	588871 mN 279574.13 mE	DRILL TYPE: 50mm Hand Auger	HOLE STARTED: 21/3/15 HOLE FINISHED: 21/3/15
R.L.:	99.62 m	DRILL METHOD: HAND AUGER	DRILLED BY: CJT
DATUM:	UTM WGS84	DRILL FLUID: N/A	LOGGED BY: CJT CHECKED:

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.

FLUID LOSS | WATER | CORE RECOVERY (%) | METHOD | CASING | TESTS | SAMPLES | R.L. (m) | DEPTH (m) | GRAPHIC LOG | CLASSIFICATION SYMBOL | MOISTURE CONDITION / WEATHERING | STRENGTH/DENSITY CLASSIFICATION | SHEAR STRENGTH (kPa) | COMPRESSIVE STRENGTH (MPa) | DEFECT SPACING (mm)

SOIL DESCRIPTION
Soil type, minor components, plasticity or particle size, colour.
ROCK DESCRIPTION
Substance: Rock type, particle size, colour, minor components.
Defects: Type, inclination, thickness, roughness, filling.

TOPSOIL CORAL SAND FILL			Digger Excavated			Bag	99.5	0.5			D	MD				TOPSOIL, organic silt inclusions; dark brown. Non-plastic.
												F				Medium to coarse SAND, with regular fine to coarse gravel (coral) inclusions; light brown and white colour. Dry, non-plastic.
					48/5kPa											SILT, with medium to coarse gravels; orange brown. Non-plastic, weakly cemented. 0.5
							99.0				M					Silty CLAY, with some medium gravel inclusions and refuse (tin can); blue grey colour. Moist, low plasticity. 1.0
					193/43kPa	Bag		1.0				VSt				
RESIDUAL SOIL							98.5									CLAY, some silt, with occasional sand inclusions; orangey brown. Moist, plastic.
					96/32kPa							St				
					72/24kPa		98.0	1.5								1.5
					72/16kPa											
					129/16kPa		97.5	2.0			MW	VSt				CLAY, with occasional fine gravel and weakly cemented silt (purple brown); dark orange brown. Becoming wet (sticky). 2.0
	On completion				125/29kPa			2.5								2.5
			Hand Auger		120/16kPa		97.0				W					Silty CLAY, some minor sand inclusions; bright orange. Wet, plastic.
					96/24kPa			3.0				St				Sandy SILT; purple black. Damp, weakly cemented. 3.0
					145/24kPa		96.5					VSt				SILT, with some sand; green brown mottled purple black. Saturated, low plasticity.
					>225kPa		96.0	3.5			S	H				SILT; grey blue stained orange red. Damp, weakly cemented. 3.5
					UTP			4.0								Clayey SILT, minor sand; orange brown mottled purple/red. Saturated, plastic. Silty CLAY, some sand; bright orange. Saturated, moderate plasticity. 4.0
							95.5									**END OF BOREHOLE AT 4.1m.** Unable to auger.
							95.0	4.5								4.5
								5								

T+T DATATEMPLATE.GDT ilb

Log Scale 1:25

BORELOG 751122.GPJ 10-Apr-2015

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No:BH2
Hole Location: Refer to site plan.

SHEET 1 OF 1

PROJECT: Kosrae Power Plant | LOCATION: Tofol Kosrae | JOB No: 751122

CO-ORDINATES: 588894.04 mN, 279558.02 mE | DRILL TYPE: 50mm Hand Auger | HOLE STARTED: 21/3/15

R.L.: 98.54 m | DRILL METHOD: HAND AUGER | HOLE FINISHED: 21/3/15 | DRILLED BY: CJT

DATUM: UTM WGS84 | DRILL FLUID: N/A | LOGGED BY: CJT | CHECKED:

GEOLOGICAL										ENGINEERING DESCRIPTION						
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION: Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION: Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
TOPSOIL								98.5			D	MD				Organic SILT; dark brown. Dry, non-plastic.
FILL																Medium to coarse GRAVEL; dark grey. Moderately strong, angular.
CORAL SAND																Medium to coarse SAND, with gravel (coral); white/light grey. Non-plastic, moderately strong. 0.5
RESIDUAL SOIL		On completion		Hand Auger				98.0 0.5			M	L				SILT, some fine to medium, weakly cemented gravel inclusions; dark brown green. Moist, non-plastic.
								97.5 1.0			W					1.0 - becoming wet.
								97.0 1.5								1.5 - orangy yellow staining.
						201/40kPa						H				SILT, some sand; grey blue. Saturated, non-plastic. 2.0
						UTP		96.5 2.0			M					Clayey SILT, some weakly cemented and some sand; orange brown. Moist, low plasticity.
						UTP										- minor blue grey staining.
								96.0 2.5								2.5 - purple black, cemented silt inclusions.
						UTP										
						UTP		95.5 3.0								- medium weathered gravel inclusions; black with yellow red staining. Strong, angular. 3.0
																- fine gravel inclusions becoming more regular.
																END OF BOREHOLE AT 3.2m.
								95.0 3.5								Unable to auger. 3.5
								94.5 4.0								4.0
								94.0 4.5								4.5
								5								

T+T DATATEMPLATE.GDT ilb

Log Scale 1:25

BORELOG 751122.GPJ 10-Apr-2015

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No:BH3
Hole Location: Refer to site plan.
SHEET 1 OF 1

PROJECT: Kosrae Power Plant | LOCATION: Tofol Kosrae | JOB No: 751122

CO-ORDINATES: 588874.9 mN, 279548.71 mE | DRILL TYPE: 50mm Hand Auger | HOLE STARTED: 23/3/15

DRILL METHOD: HAND AUGER | HOLE FINISHED: 23/3/15

R.L.: 99.30 m | DRILLED BY: CJT

DATUM: UTM WGS84 | DRILL FLUID: N/A | LOGGED BY: CJT | CHECKED:

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	WEATHERING: MOISTURE CONDITION	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION / ROCK DESCRIPTION
TOPSOIL								99.0	0.0			D/M	H				TOPSOIL, silt, with gravels, with organic inclusions; dark brown. Non-plastic.
RESIDUAL SOIL		On completion		Hand Auger		>225kPa	Bag		0.5								Silty CLAY; orangey brown. Dry to moist, plastic.
						106/17kPa		98.5					VSt				- occasional sand inclusions.
						61/29kPa			1.0				St				- some fine to medium gravel inclusions. 1.0
						193/14kPa						W					SILT, some clay, with fine to coarse sand inclusions; grey green mottled orange colour. Wet, moderate plasticity.
						154/13kPa	Bag	98.0	1.5				VSt				1.5
						96/8kPa		97.5					St				- occasional red/purple, highly weathered, fine to medum gravel inclusions.
						40/24kPa			2.0				F				2.0
						124/21kPa		97.0	2.5				VSt				SILT, some minor clay, with regular gravel inclusions; green. Wet, low plasticity; gravel highly weathered, purple grey, weak rock. 2.5
						48/32kPa		96.5					F				
						108/32kPa			3.0				VSt				SILT, some cemented with fine to coarse sand inclusions; grey green. Wet, low plasticity. 3.0
						48/32kPa		96.0					F				- becomes brown orange colour. 3.5
						145/32kPa			3.5				VSt				- grey blue.
						64/32kPa		95.5					St				4.0
						80/35kPa		95.0	4.0								Fibrous PEAT; purple black. Firm, saturated, non-plastic.
						195/40kPa											Clayey SILT; grey purple. Wet, plastic. 4.5
								94.5	4.5								**END OF BOREHOLE AT 4.5m.**
									5								

T+T DATATEMPLATE.GDT ilb

Log Scale 1:25

BORELOG 751122.GPJ 10-Apr-2015

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No:BH4
Hole Location: Refer to site plan.

SHEET 1 OF 1

PROJECT: Kosrae Power Plant | LOCATION: Tofol Kosrae | JOB No: 751122

CO-ORDINATES: 588901.99 mN, 279537.88 mE | DRILL TYPE: 50mm Hand Auger | HOLE STARTED: 23/3/15

R.L.: 97.51 m | DRILL METHOD: HAND AUGER | HOLE FINISHED: 23/3/15

DATUM: UTM WGS84 | DRILL FLUID: N/A | DRILLED BY: CJT | LOGGED BY: CJT | CHECKED:

GEOLOGICAL														ENGINEERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION: Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION: Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
TOPSOIL AND HARDFILL								98.0 / 97.5			M					Organic SILT, with regular to fine coarse gravel inclusions (hardfill); dark brown. Moist, non-plastic.
RESIDUAL SOIL						>225kPa	Bag	97.0 / 0.5			D	H				Silty CLAY; orange brown. Dry, non-plastic.
		On completion				141/29kPa						VSt				Clayey SILT, with some minor sand; dark green. Dry, low plasticity. 0.5
						116/19kPa	Bag	96.5 / 1.0			M					- highly weathered, fine gravel inclusions; purple orange. - occasional weakly cemented silt inclusions.
						112/16kPa										Silty CLAY, with some cemented silt inclusions; brown green. Moist, moderate plasticity. 1.0
																SILT, with some sand and minor clay; dark green. Moist, moderate plasticity.
						85/19kPa		96.0 / 1.5				L				SAND lense with fine gravel inclusions; dark green. Non-plastic. 1.5
						61/29kPa					W	St				SILT, with some sand and regular firm, highly weathered gravel inclusions; grey green/purple green. Wet, low plasticity. 2.0
				Hand Auger		64/17kPa		95.5 / 2.0								
						>225kPa	Bag	95.0 / 2.5				H				Fibrous PEAT; dark purple black. Wet, non-plastic, spongy. 2.5
						>225kPa										
						64/28kPa		94.5 / 3.0				St				3.0
						80/16kPa										
						146/32kPa		94.0 / 3.5				VSt				SILT, some clay, sand and fine gravel; grey purple blue. Wet, plastic. 3.5
						64/45kPa		4.0				St				Fibrous PEAT; dark purple black. Wet, non-plastic, spongy. 4.0
						72/32kPa										
						72/24kPa		4.5								END OF BOREHOLE AT 4.5m. 4.5
								5								

T+T DATATEMPLATE.GDT jlb

Log Scale 1:25

BORELOG 751122.GPJ 10-Apr-2015

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No:BH5
Hole Location: Refer to site plan.
SHEET 1 OF 1

PROJECT: Kosrae Power Plant | LOCATION: Tofol Kosrae | JOB No: 751122

CO-ORDINATES: 588906.51 mN, 279560.65 mE | DRILL TYPE: 50mm Hand Auger | HOLE STARTED: 24/3/15

R.L.: 98.40 m | DRILL METHOD: HAND AUGER | HOLE FINISHED: 24/3/15

DATUM: UTM WGS84 | DRILL FLUID: N/A | DRILLED BY: CJT | LOGGED BY: CJT | CHECKED:

GEOLOGICAL | ENGINEERING DESCRIPTION

GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION / WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION / ROCK DESCRIPTION
TOPSOIL												M					Organic SILT, with gravels. Moist, non-plastic.
FILL				Digger Excavated		80/16kPa		98.0	0.5				St				Clayey SILT, some cemented with highly weathered gravels, some refuse present (cloth); orangey brown. Moist, low plasticity. 0.5
						104/24kPa	Bag						VSt				
						129/16kPa		97.5	1.0								1.0
RESIDUAL SOIL						104/16kPa	Bag										Coarse coral SAND, with silt; white/light grey. Moist, non-plastic.
						90/24kPa		97.0	1.5				St				Silty CLAY, with some minor coarse sand to fine gravel inclusions; orange brown. Moist, moderate plasticity. 1.5
						80/19kPa		96.5	2.0								
						109/27kPa							VSt				- highly weathered, fine gravel inclusions becoming more regular; grey with purple-orange staining. 2.0
		On completion		Hand Auger		UTP		96.0	2.5			M/W	H				- minor organic inclusions. - becoming wet. 2.5
						206/61kPa	Bag					W					Clayey SILT, some weakly cemented, with regular, highly weathered coarse sand to medium gravels; brown mottled grey-green and orange. Wet, moderate plasticity.
						188/16kPa		95.5	3.0				VSt				3.0
						169/48kPa		95.0	3.5				H				SILT, some clay; brown mottled yellow white and red. Wet, moderate plasticity. - grading to grey blue/green. 3.5
						>225kPa											
RESIDUAL SOIL/COMPLETELY WEATHERED ROCK						>225kPa	Bag	94.5	4.0								Cemented SILT, with some some completely weathered gravel inclusions; grey blue mottled orange and white. Moist, non-plastic. 4.0
						UTP											- highly weathered gravel inclusions becoming regular.
								94.0	4.5								END OF BOREHOLE AT 4.3m. 4.5
								93.5	5								

T+T DATATEMPLATE.GDT ilb

Log Scale 1:25

BORELOG 751122.GPJ 10-Apr-2015

TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No:BH6
Hole Location: Refer to site plan.

SHEET 1 OF 1

PROJECT: Kosrae Power Plant | LOCATION: Tofol Kosrae | JOB No: 751122

CO-ORDINATES: 588886.99 mN, 279550.03 mE | DRILL TYPE: 50mm Hand Auger | HOLE STARTED: 26/3/15

DRILL METHOD: HAND AUGER | HOLE FINISHED: 26/3/15

R.L.: 98.70 m | DRILLED BY: CJT

DATUM: UTM WGS84 | DRILL FLUID: N/A | LOGGED BY: CJT | CHECKED:

GEOLOGICAL														ENGINEERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	WEATHERING / MOISTURE CONDITION	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION: Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION: Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
TOPSOIL								98.5 / 0.0			M					Organic SILT, with regular fine to coarse gravels. Moist, non-plastic.
RESIDUAL SOIL						>225kPa					D/M	H				SILT, some clay, occasional highly weathered (red/purple colour), fine to medium gravels; yellow brown colour. Dry to moist, moderate plasticity. 0.5
		On completion				117/21kPa		98.0 / 0.5			M	VSt				Clayey SILT, some weakly cemented with occasional fine to medium gravel; greeny brown colour. Moist, low plasticity.
						64/16kPa		1.0				St				- becoming wet. 1.0
						>225kPa		97.5			W	H				
						152/16kPa		1.5				VSt				1.5
						UTP		97.0			M					SILT, some cemented, with regular highly weathered gravel inclusions and some minor sand; dark yellow brown colour, mottled orange red. Moist, low plasticity.
						80/40kPa		2.0				St				- gravels becoming less regular. 2.0
				Hand Auger		88/39kPa		96.5 / 2.5								2.5
						80/40kPa		96.0			W/S					Silty CLAY, some sand and occasional gravel; orange brown colour. Wet to saturated, moderate plasticity.
						72/16kPa		3.0								3.0
						128/38kPa		95.5				VSt				3.5
						64/19kPa		3.5			D	St				SILT; bright orange colour. Dry, non-plastic.
						88/48kPa		95.0			W					Silty CLAY, some sand and occasional gravel; orange brown colour. Wet, moderate plasticity. 4.0
						104/40kPa		4.0 / 94.5								
						64/24kPa		4.5								4.5
								94.0 / 5								END OF BOREHOLE AT 4.6m.

T+T DATATEMPLATE.GDT ilb

Log Scale 1:25

BORELOG 751122.GPJ 10-Apr-2015

TONKIN & TAYLOR LTD

EXCAVATION LOG

EXCAVATION No: TP1
Hole Location: Refer to site plan.

SHEET 1 OF 1

PROJECT: Kosrae Power Plant		LOCATION: Tofol Kosrae	JOB No: 751122
CO-ORDINATES:	588905.84 mN 279547.55 mE	EXPOSURE TYPE: DIGGER BUCKET	EXCAV. STARTED: 25/3/15
		EQUIPMENT: Excavator	EXCAV FINISHED: 25/3/15
R.L.	97.85 m	OPERATOR: Local Contractor	LOGGED BY: CJT
DATUM	UTM WGS84	DIMENSIONS:	CHECKED BY:

EXCAVATION TESTS | ENGINEERING DESCRIPTION | GEOLOGICAL

PENETRATION 1 2 3	SUPPORT	WATER	SAMPLES, TESTS	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION / WEATHERING	STRENGTH / DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa) 10 25 50 100 200	ORIGIN TYPE, MINERAL COMPOSITION, DEFECTS, STRUCTURE	UNIT
				97.5	0.5			Organic SILT, with regular fine to coarse gravels. Moist, non-plastic.	M	L		TOPSOIL	
				97.0	1.0			SILT, with some clay, sand and fine to coarse gravel; dark brown colour. Moist, low plasticity. Occasional rubbish/refuse including: cans, car bodies, organics.		MD		FILL	
				96.5	1.5			Medium to coarse SAND to medium GRAVEL (coral); light brown. Medium dense, dry, non-plastic.				CORAL SAND (FILL)	
								Medium to coarse GRAVELS, with some silt and sand infilling; dark blue colour. Non-plastic. Gravels moderately to slightly weathered, weak to moderately strong,.				GRAVEL FILL	
			●>225kPa	96.0	2.0			Clayey SILT, with some occasional fine gravel; orange/yellow brown colour. Moist, moderate plasticity.		H		RESIDUAL SOIL	
			●>225kPa										
			●>225kPa	95.5				- minor fibrous organic inclusions.					
					2.5			**END OF TEST PIT AT 2.4m.**					
				95.0									

SKETCH

T+T DATATEMPLATE.GDT 11b

Log Scale 1:25

EXCAVLOG 751122.GPJ 10-Apr-2015

Scala results.xlsx

TONKIN & TAYLOR

SCALA PENETROMETER LOG

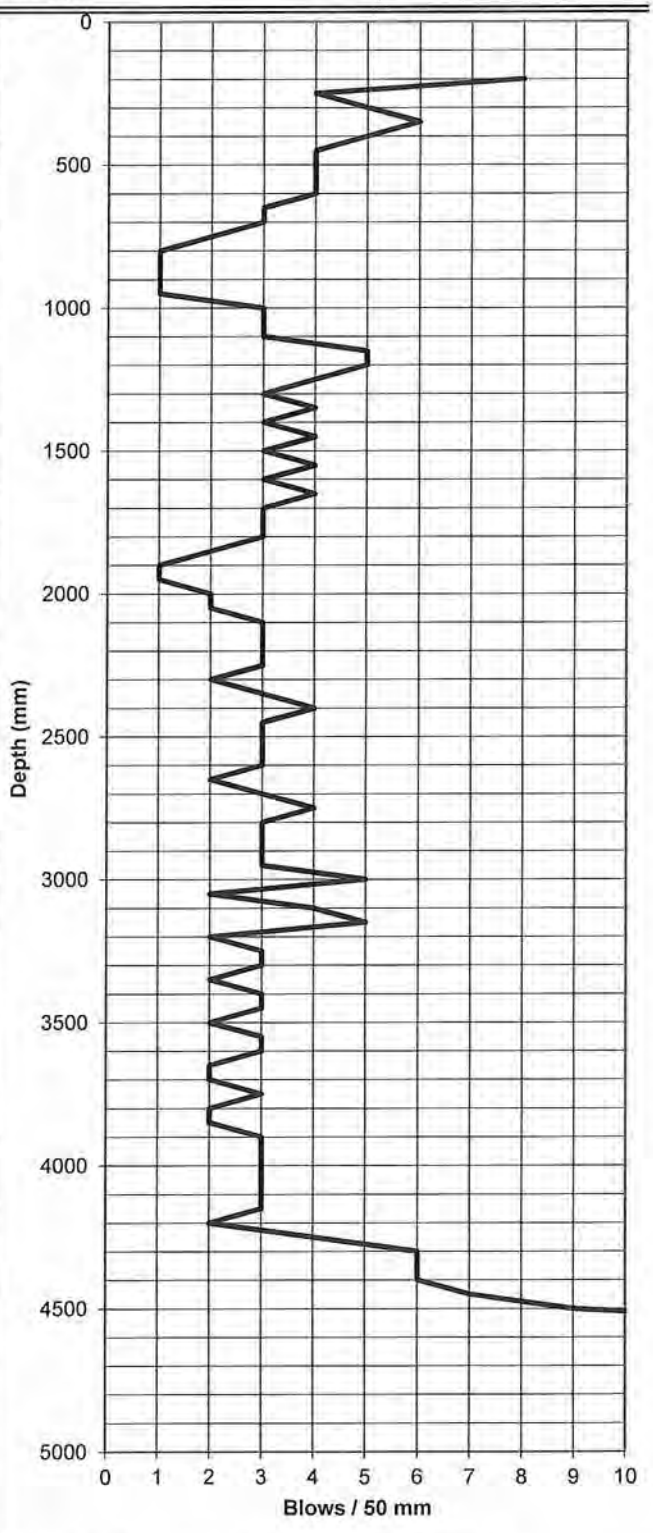
Job No: *751122*
Project: *Kosrae Power Sttion*
Location: *tofol, Kosrae*
RL:

Date: *21/03/2015*
Operated by: *CJT*
Logged by: *CJT*
Checked by:

Test No. *SC1*
Sheet *1*
of *1*

mm Driven	No. of Blows
50	
100	
150	
200	8
250	4
300	5
350	6
400	5
450	4
500	4
550	4
600	4
650	3
700	3
750	2
800	1
850	1
900	1
950	1
1000	3
1050	3
1100	3
1150	5
1200	5
1250	4
1300	3
1350	4
1400	3
1450	4
1500	3
1550	4
1600	3
1650	4
1700	3
1750	3
1800	3
1850	2
1900	1
1950	1
2000	2
2050	2
2100	3
2150	3
2200	3
2250	3
2300	2
2350	3
2400	4
2450	3
2500	3

mm Driven	No. of Blows
2550	3
2600	3
2650	2
2700	3
2750	4
2800	3
2850	3
2900	3
2950	3
3000	5
3050	2
3100	4
3150	5
3200	2
3250	3
3300	3
3350	2
3400	3
3450	3
3500	2
3550	3
3600	3
3650	2
3700	2
3750	3
3800	2
3850	2
3900	3
3950	3
4000	3
4050	3
4100	3
4150	3
4200	2
4250	4
4300	6
4350	6
4400	6
4450	7
4500	9
4550	14
4600	20
4650	
4700	
4750	
4800	
4850	
4900	
4950	
5000	



Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer

Scala results.xlsx

TONKIN & TAYLOR

SCALA PENETROMETER LOG

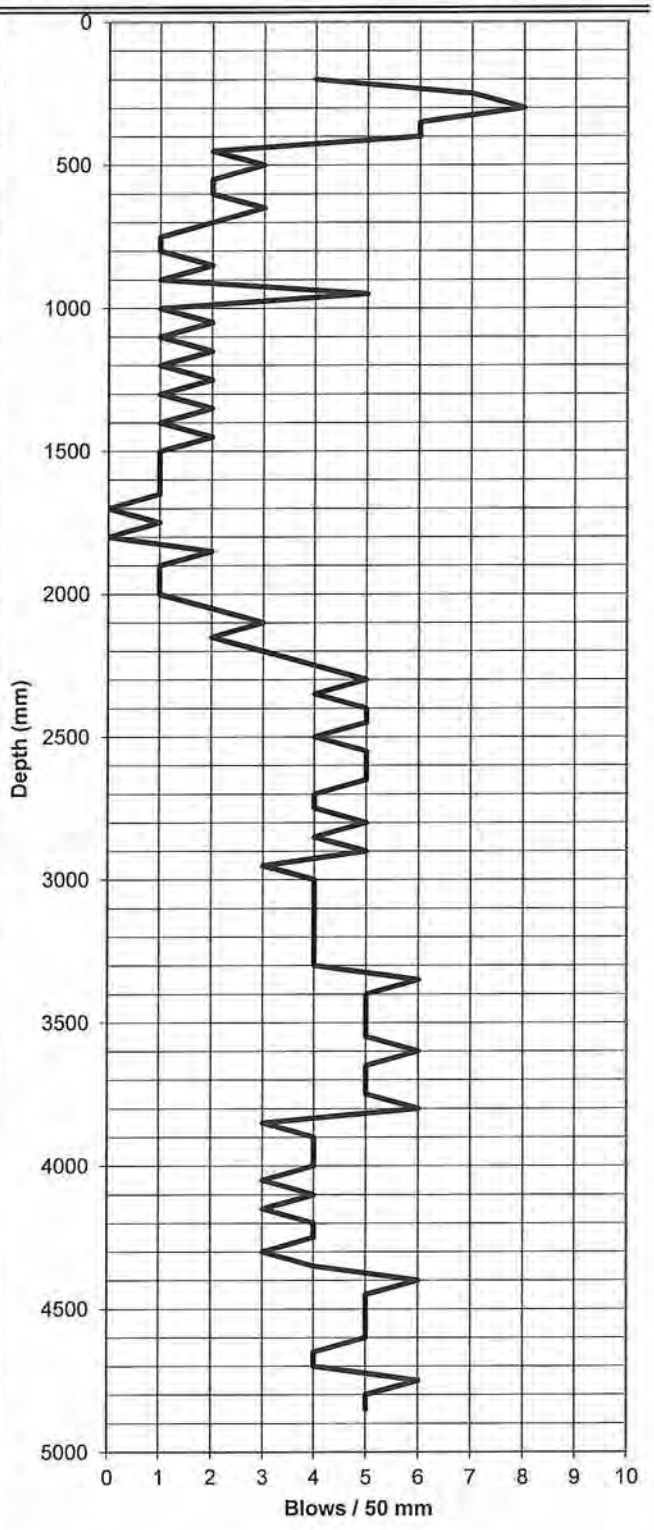
Job No: *751122*
Project: *Kosrae Power Station*
Location: *Tofol Kosrae*
RL:

Date: *21/03/2015*
Operated by: *CJT*
Logged by: *CT*
Checked by:

Test No. *SC2*
Sheet *1* **of** *1*

mm Driven	No. of Blows
50	
100	
150	
200	4
250	7
300	8
350	6
400	6
450	2
500	3
550	2
600	2
650	3
700	2
750	1
800	1
850	2
900	1
950	5
1000	1
1050	2
1100	1
1150	2
1200	1
1250	2
1300	1
1350	2
1400	1
1450	2
1500	1
1550	1
1600	1
1650	1
1700	0
1750	1
1800	0
1850	2
1900	1
1950	1
2000	1
2050	2
2100	3
2150	2
2200	3
2250	4
2300	5
2350	4
2400	5
2450	5
2500	4

mm Driven	No. of Blows
2550	4
2600	5
2650	5
2700	5
2750	4
2800	4
2850	5
2900	4
2950	5
3000	3
3050	4
3100	4
3150	4
3200	4
3250	4
3300	4
3350	4
3400	6
3450	5
3500	5
3550	5
3600	5
3650	6
3700	5
3750	5
3800	5
3850	6
3900	3
3950	4
4000	4
4050	4
4100	3
4150	4
4200	3
4250	4
4300	4
4350	3
4400	4
4450	6
4500	5
4550	5
4600	5
4650	5
4700	4
4750	4
4800	6
4850	5
4900	5
4950	
5000	



Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer

Scala results.xlsx

TONKIN & TAYLOR

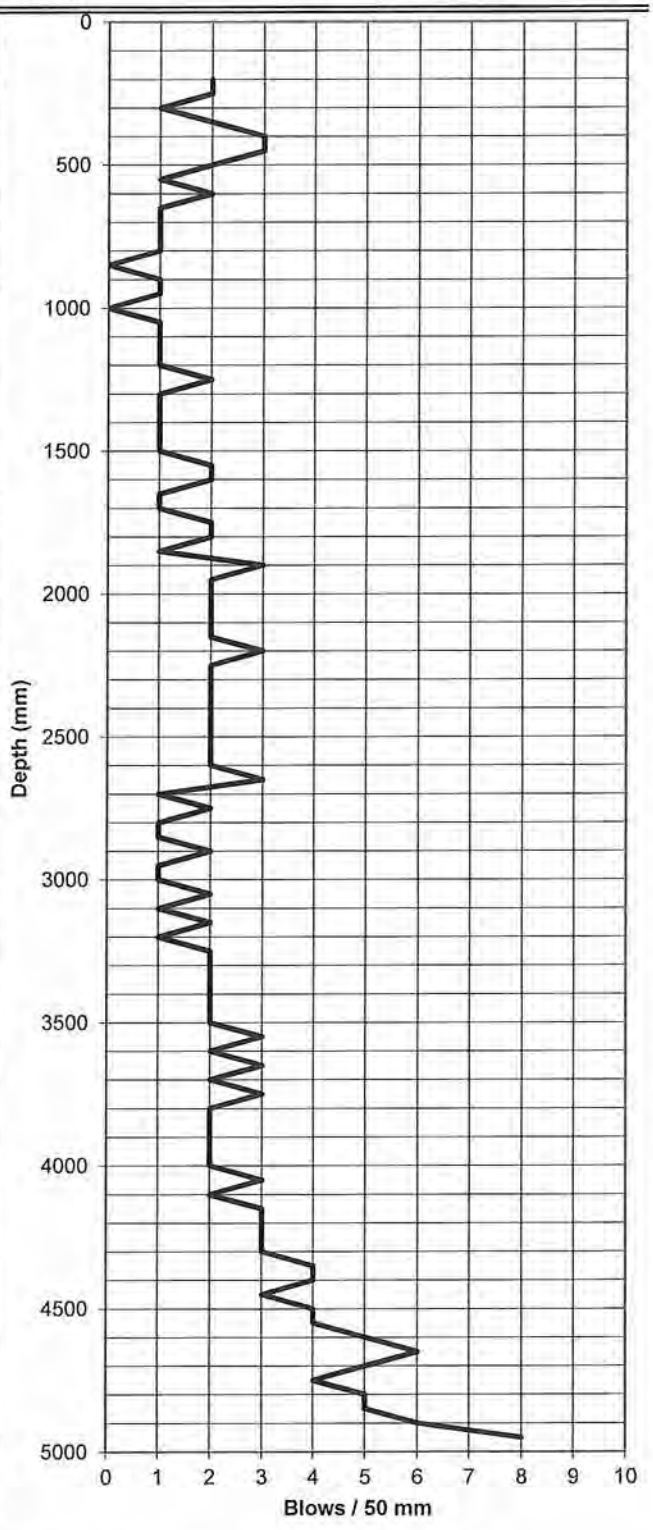
SCALA PENETROMETER LOG

Job No: *751122*
Project: *Kosrae Power Station*
Location: *Tofol, Kosrae*
RL:

Date: *24/03/2015*
Operated by: *CJT*
Logged by: *CJT*
Checked by:

Test No. *SC3*
Sheet *1*
of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50		2550	2
100		2600	2
150		2650	3
200	2	2700	1
250	2	2750	2
300	1	2800	1
350	2	2850	1
400	3	2900	2
450	3	2950	1
500	2	3000	1
550	1	3050	2
600	2	3100	1
650	1	3150	2
700	1	3200	1
750	1	3250	2
800	1	3300	2
850	0	3350	2
900	1	3400	2
950	1	3450	2
1000	0	3500	2
1050	1	3550	3
1100	1	3600	2
1150	1	3650	3
1200	1	3700	2
1250	2	3750	3
1300	1	3800	2
1350	1	3850	2
1400	1	3900	2
1450	1	3950	2
1500	1	4000	2
1550	2	4050	3
1600	2	4100	2
1650	1	4150	3
1700	1	4200	3
1750	2	4250	3
1800	2	4300	3
1850	1	4350	4
1900	3	4400	4
1950	2	4450	3
2000	2	4500	4
2050	2	4550	4
2100	2	4600	5
2150	2	4650	6
2200	3	4700	5
2250	2	4750	4
2300	2	4800	5
2350	2	4850	5
2400	2	4900	6
2450	2	4950	8
2500	2	5000	



Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer

Scala results.xlsx

TONKIN & TAYLOR

SCALA PENETROMETER LOG

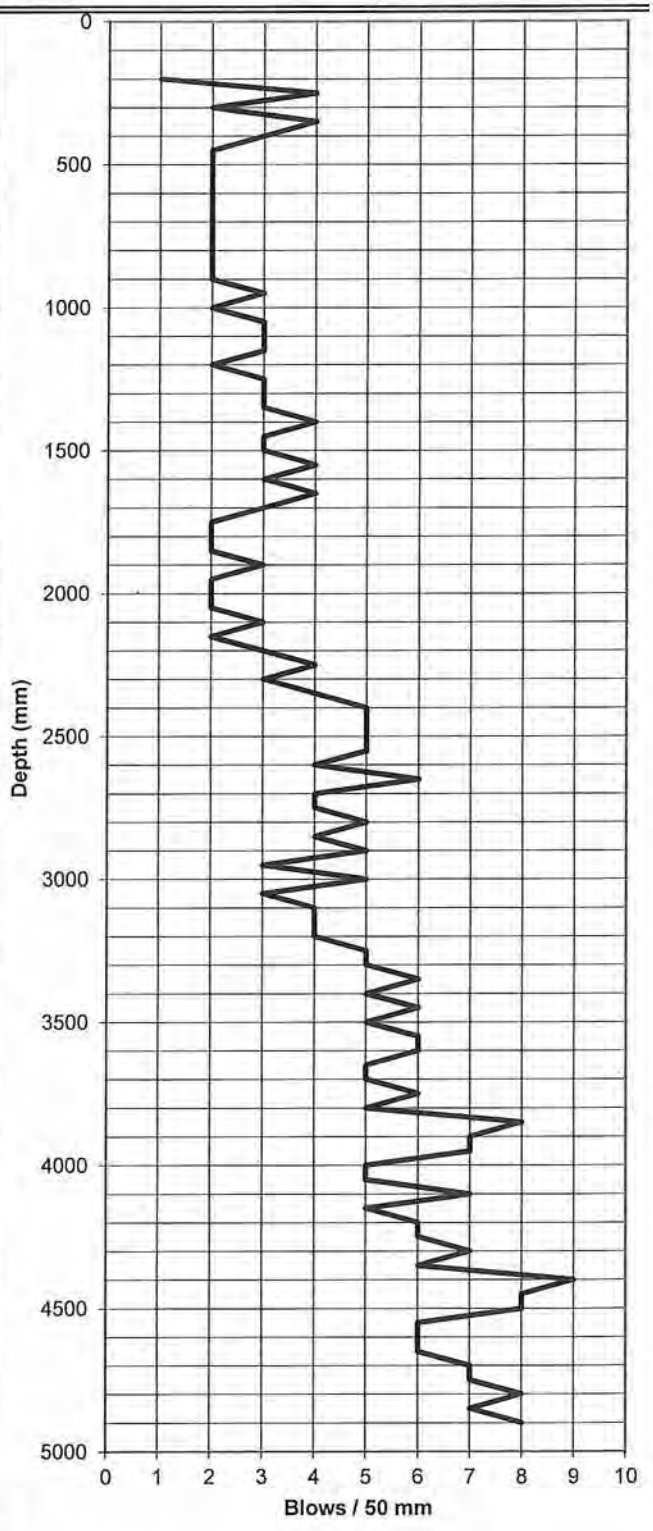
Job No: *751122*
Project: *Kosrae Power Station*
Location: *Tofol, Kosrae*
RL:

Date: *24/03/2015*
Operated by: *CJT*
Logged by: *CJT*
Checked by:

Test No. *SC4*
Sheet *1*
of *1*

mm Driven	No. of Blows
50	
100	
150	
200	1
250	4
300	2
350	4
400	3
450	2
500	2
550	2
600	2
650	2
700	2
750	2
800	2
850	2
900	2
950	3
1000	2
1050	3
1100	3
1150	3
1200	2
1250	3
1300	3
1350	3
1400	4
1450	3
1500	3
1550	4
1600	3
1650	4
1700	3
1750	2
1800	2
1850	2
1900	3
1950	2
2000	2
2050	2
2100	3
2150	2
2200	3
2250	4
2300	3
2350	4
2400	5
2450	5
2500	5

mm Driven	No. of Blows
2550	5
2600	4
2650	6
2700	4
2750	4
2800	5
2850	4
2900	5
2950	3
3000	5
3050	3
3100	4
3150	4
3200	4
3250	5
3300	5
3350	6
3400	5
3450	6
3500	5
3550	6
3600	6
3650	5
3700	5
3750	6
3800	5
3850	8
3900	7
3950	7
4000	5
4050	5
4100	7
4150	5
4200	6
4250	6
4300	7
4350	6
4400	9
4450	8
4500	8
4550	6
4600	6
4650	6
4700	7
4750	7
4800	8
4850	7
4900	8
4950	
5000	



Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer

Scala results.xlsx

TONKIN & TAYLOR

SCALA PENETROMETER LOG

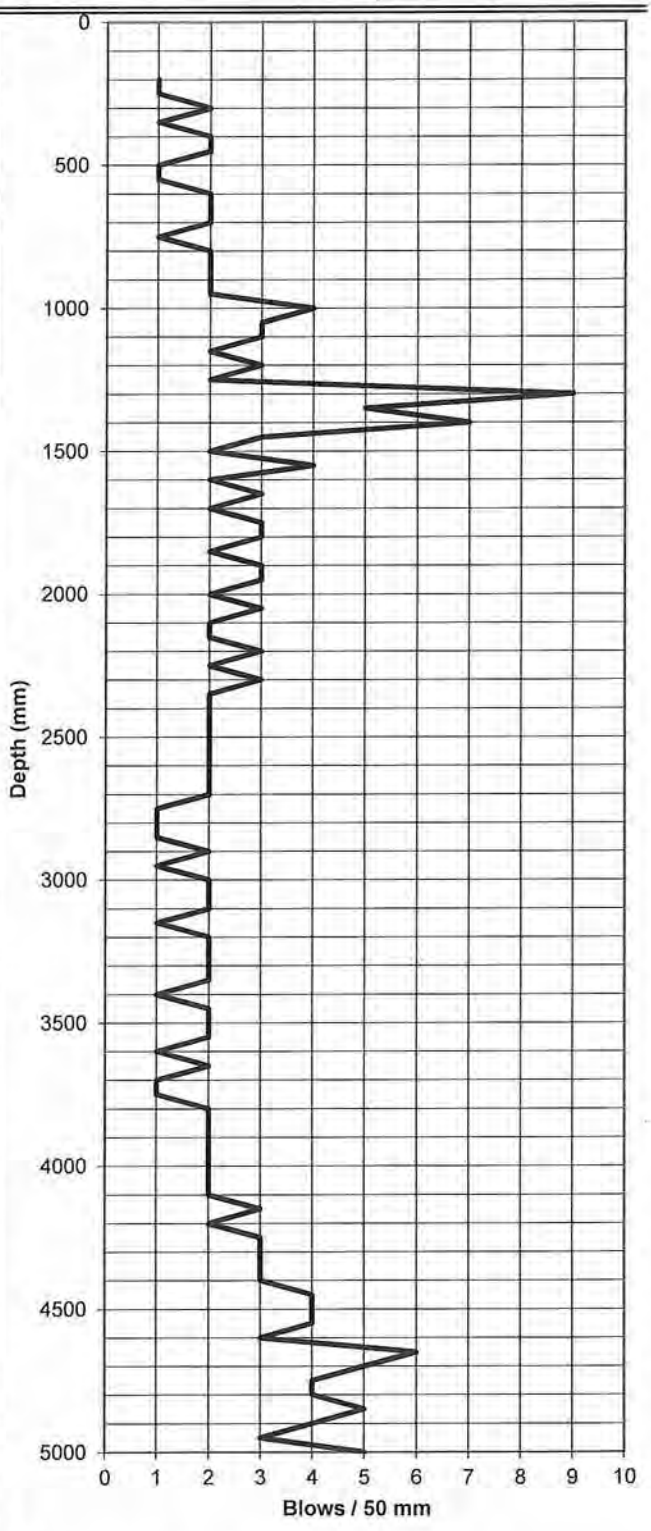
Job No: *751122*
Project: *Kosrae Power Station*
Location: *Tofol, Kosrae*
RL:

Date: *25/03/2015*
Operated by: *CJT*
Logged by: *CJT*
Checked by:

Test No. *SC5*
Sheet *1*
of *1*

mm Driven	No. of Blows
50	
100	
150	
200	1
250	1
300	2
350	1
400	2
450	2
500	1
550	1
600	2
650	2
700	2
750	1
800	2
850	2
900	2
950	2
1000	4
1050	3
1100	3
1150	2
1200	3
1250	2
1300	9
1350	5
1400	7
1450	3
1500	2
1550	4
1600	2
1650	3
1700	2
1750	3
1800	3
1850	2
1900	3
1950	3
2000	2
2050	3
2100	2
2150	2
2200	3
2250	2
2300	3
2350	2
2400	2
2450	2
2500	2

mm Driven	No. of Blows
2550	2
2600	2
2650	2
2700	2
2750	1
2800	1
2850	1
2900	2
2950	1
3000	2
3050	2
3100	2
3150	1
3200	2
3250	2
3300	2
3350	2
3400	1
3450	2
3500	2
3550	2
3600	1
3650	2
3700	1
3750	1
3800	2
3850	2
3900	2
3950	2
4000	2
4050	2
4100	2
4150	3
4200	2
4250	3
4300	3
4350	3
4400	3
4450	4
4500	4
4550	4
4600	3
4650	6
4700	5
4750	4
4800	4
4850	5
4900	4
4950	3
5000	5



Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer

Scala results.xlsx

TONKIN & TAYLOR

SCALA PENETROMETER LOG

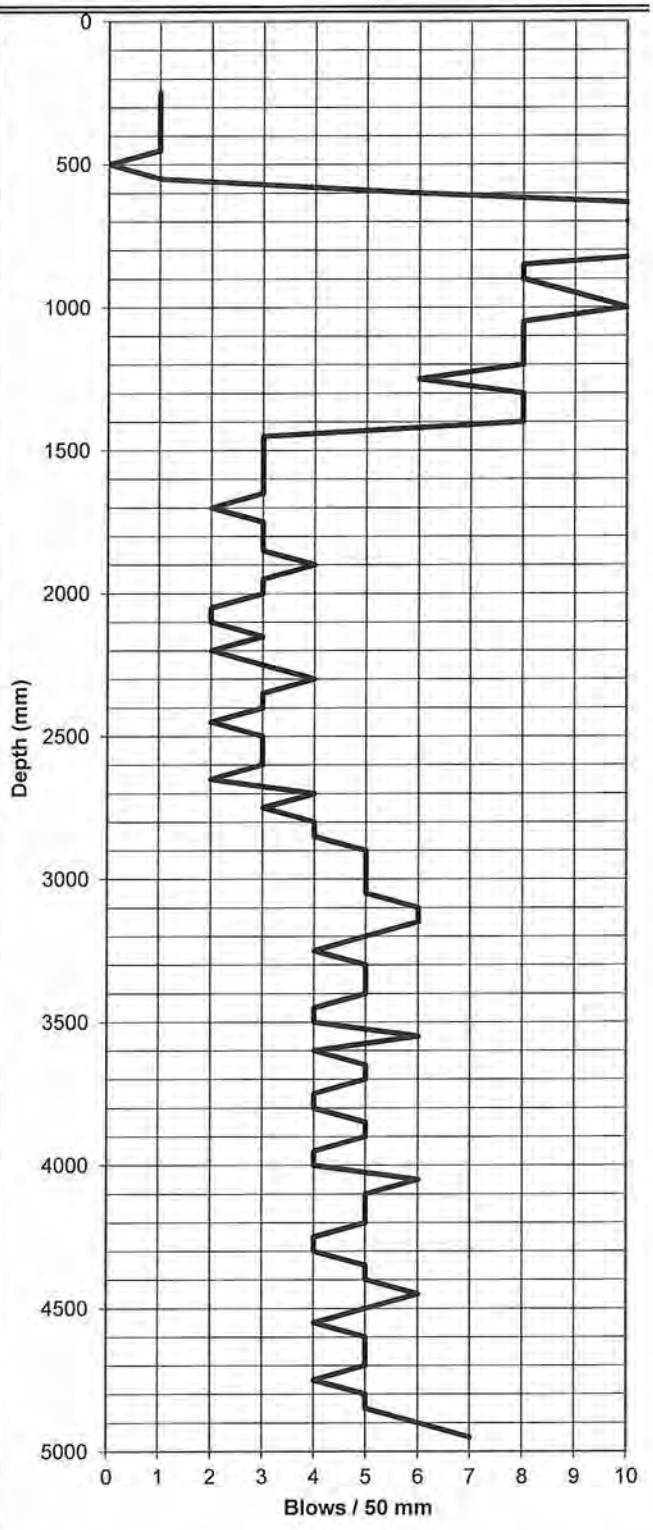
Job No: *751122*
Project: *Kosrae Power Station*
Location: *Tofol, Kosrae*
RL:

Date: *26/03/2015*
Operated by: *CJT*
Logged by: *CJT*
Checked by:

Test No. *SC6*
Sheet *1*
of *1*

mm Driven	No. of Blows
50	
100	
150	
200	
250	1
300	1
350	1
400	1
450	1
500	0
550	1
600	6
650	12
700	10
750	20
800	12
850	8
900	8
950	9
1000	10
1050	8
1100	8
1150	8
1200	8
1250	6
1300	8
1350	8
1400	8
1450	3
1500	3
1550	3
1600	3
1650	3
1700	2
1750	3
1800	3
1850	3
1900	4
1950	3
2000	3
2050	2
2100	2
2150	3
2200	2
2250	3
2300	4
2350	3
2400	3
2450	2
2500	3

mm Driven	No. of Blows
2550	3
2600	3
2650	2
2700	4
2750	3
2800	4
2850	4
2900	5
2950	5
3000	5
3050	5
3100	6
3150	6
3200	5
3250	4
3300	5
3350	5
3400	5
3450	4
3500	4
3550	6
3600	4
3650	5
3700	5
3750	4
3800	4
3850	5
3900	5
3950	4
4000	4
4050	6
4100	5
4150	5
4200	5
4250	4
4300	4
4350	5
4400	5
4450	6
4500	5
4550	4
4600	5
4650	5
4700	5
4750	4
4800	5
4850	5
4900	6
4950	7
5000	



Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer

Scala results.xlsx

TONKIN & TAYLOR

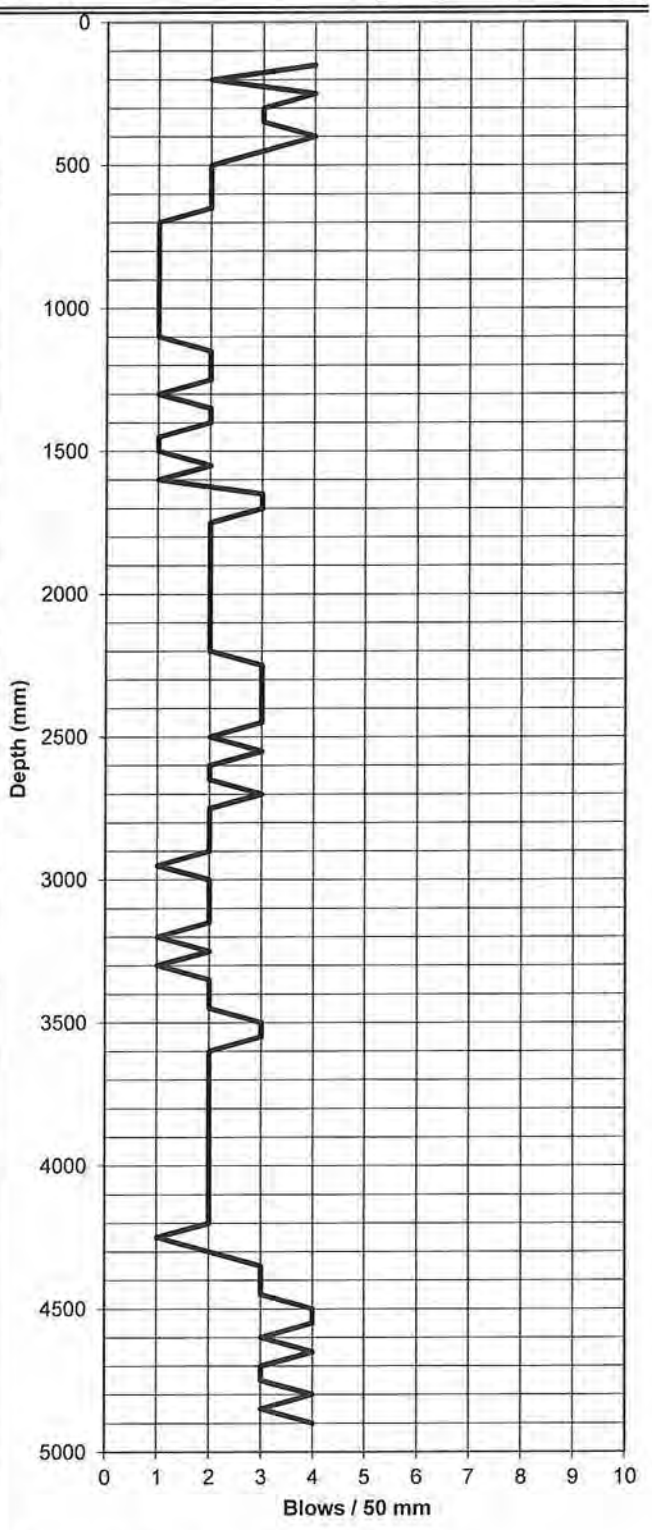
SCALA PENETROMETER LOG

Job No: *751122*
Project: *Kosrae Power Station*
Location: *Tofol, Kosrae*
RL:

Date: *26/03/2015*
Operated by: *CJT*
Logged by: *CJT*
Checked by:

Test No. *SC7*
Sheet *1*
of *1*

mm Driven	No. of Blows	mm Driven	No. of Blows
50		2550	3
100		2600	2
150	4	2650	2
200	2	2700	3
250	4	2750	2
300	3	2800	2
350	3	2850	2
400	4	2900	2
450	3	2950	1
500	2	3000	2
550	2	3050	2
600	2	3100	2
650	2	3150	2
700	1	3200	1
750	1	3250	2
800	1	3300	1
850	1	3350	2
900	1	3400	2
950	1	3450	2
1000	1	3500	3
1050	1	3550	3
1100	1	3600	2
1150	2	3650	2
1200	2	3700	2
1250	2	3750	2
1300	1	3800	2
1350	2	3850	2
1400	2	3900	2
1450	1	3950	2
1500	1	4000	2
1550	2	4050	2
1600	1	4100	2
1650	3	4150	2
1700	3	4200	2
1750	2	4250	1
1800	2	4300	2
1850	2	4350	3
1900	2	4400	3
1950	2	4450	3
2000	2	4500	4
2050	2	4550	4
2100	2	4600	3
2150	2	4650	4
2200	2	4700	3
2250	3	4750	3
2300	3	4800	4
2350	3	4850	3
2400	3	4900	4
2450	3	4950	
2500	2	5000	



Test Method Used: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer

Appendix D: Laboratory testing

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File: P:\616587.000\Working Material\pH Value_summary.xlsx

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Your Job No.: 751122

Site : Kosrae, Micronesia

Our Job No.: 616587.000

Test Method Used: NZS 4402:1986 Test 3.3.1 Determination of the pH value by electrometric method.

TEST RESULTS

Table 1: pH Test Results Summary

BH No.	1	3	5
Depth (m)	0.8-0.9	0.3-0.6	1.2-1.3
Average pH Value	6.4	6.5	6.8

Remarks : A standard soil:water ratio of (**1 : 2.5**) was used to perform the test.

The average pH value reported to the nearest 0.1 of the soil suspension.

Tested by: ST Date: 22/4/15 Checked by: MP Date: 22/4/15

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Your Job No.: 751122

Site : Kosrae, Micronesia

Our Job No.: 616585.000

Test Method Used:NZS 4402:1986 Test 2.7.2 Determination of Solid Density of Soil Particles - Vacuum Method

SOLID DENSITY TEST RESULTS

Table 1: Solid Density

BH No.:		4	5	5
Depth	(m)	1.0-1.2	0.6-0.7	3.9-4.1
Average Solid Density	(t/m^3)	2.88	2.87	2.86

Remarks : The average solid density was reported to the nearest 0.01 t/m^3.

Tested by: ST Date: 22/4/15 Checked by: MP Date: 22/4/15

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Your Job No.: 751122

Site : Kosrae, Micronesia

Our Job No.: 616587.000

Test Method Used: NZS 4402:1986

Test 2.1 Determination of the Water Content

Test 2.2 Determination of the Liquid Limit

Test 2.3 Determination of the Plastic Limit

Test 2.4 Determination of the Plasticity Index

TEST RESULTS

Atterberg Limits Test Results Summary

BH No.:	3	4	5
Deoth (m)	1.3-1.5	0.4-0.6	1.2-1.3
Water Content (%)	35.2	41.0	38.4
Liquid Limit	70	69	73
Plastic Limit	39	40	39
Plasticity Index	31	29	34

Remarks : Atterberg limits performed on material passing 0.425mm test sieve.

Tested by: ST Date: 22/4/15 Checked by: MP Date: 22/4/15

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Geotechnics Project ID 616587

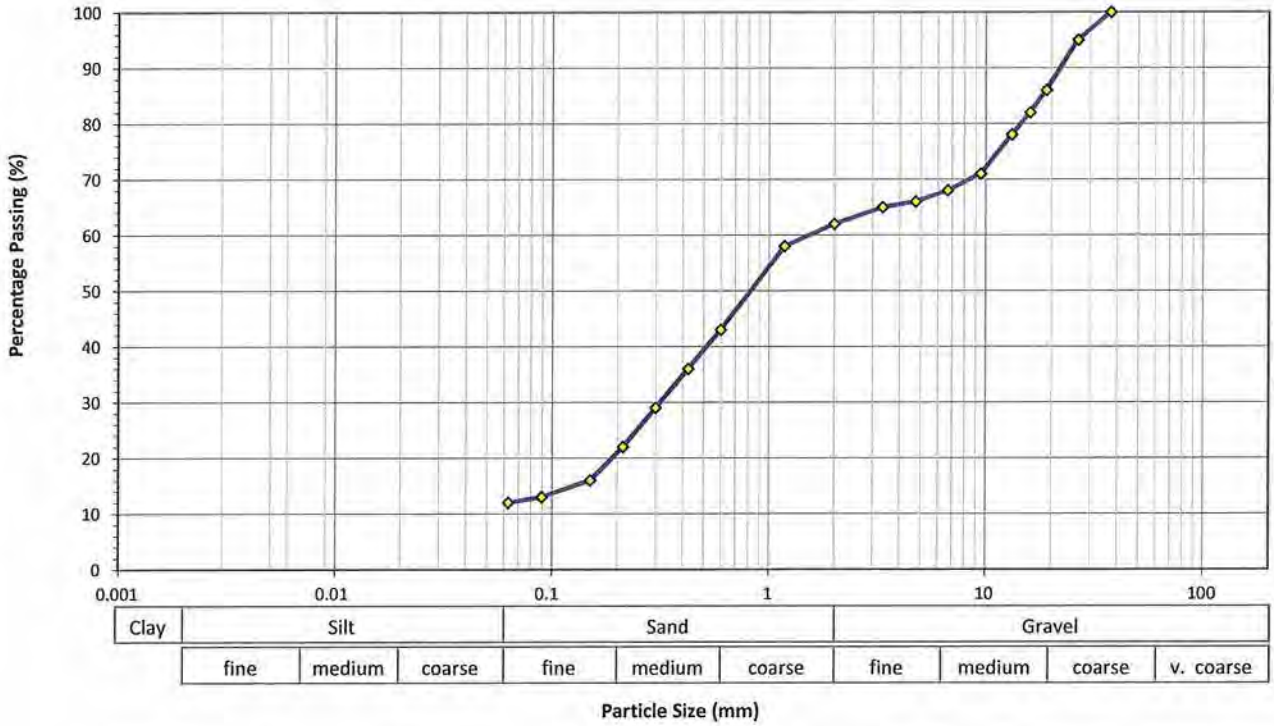
Customer Project ID 751122

Determination of the Particle Size Distribution - NZS 4402:1986 Test 2.8.1 (Wet Sieve)

Sample Details

Geotechnics Sample ID	Kosrae, Micronesia
Date Tested	9/04/2015
Sample	**Kosrae, Micronesia - BH1_0.1-0.2m**
Sample Description	Coral SAND with minor silt and trace of clay, loose, White mixed with light to dark grey and light yellowish orange brown, mottled red.
Specimen	N/A
Specimen Description	N/A

Test Result



Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)
150	-	26.5	95	4.75	66	0.300	29
100	-	19.0	86	3.35	65	0.212	22
75.0	-	16.0	82	2.00	62	0.150	16
63.0	-	13.2	78	1.18	58	0.090	13
53.0	-	9.50	71	0.600	43	0.075	-
37.5	100	6.70	68	0.425	36	0.063	12

Test Remark(s)

• The material used for testing was natural, whole soil. • The percentage passing the <0.063mm was obtained by difference. • The minimum mass of sample required for sieving is 15 kg, but due to insufficient sample mass the sieving was caried out on ~ 1.47 kg. The sample description is not IANZ accredited.

This test is not IANZ accredited and the results are therefore not endorsed.

Approved By ST Date 21/04/2015

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GEOTECHNICS

Geotechnics Project ID 616587

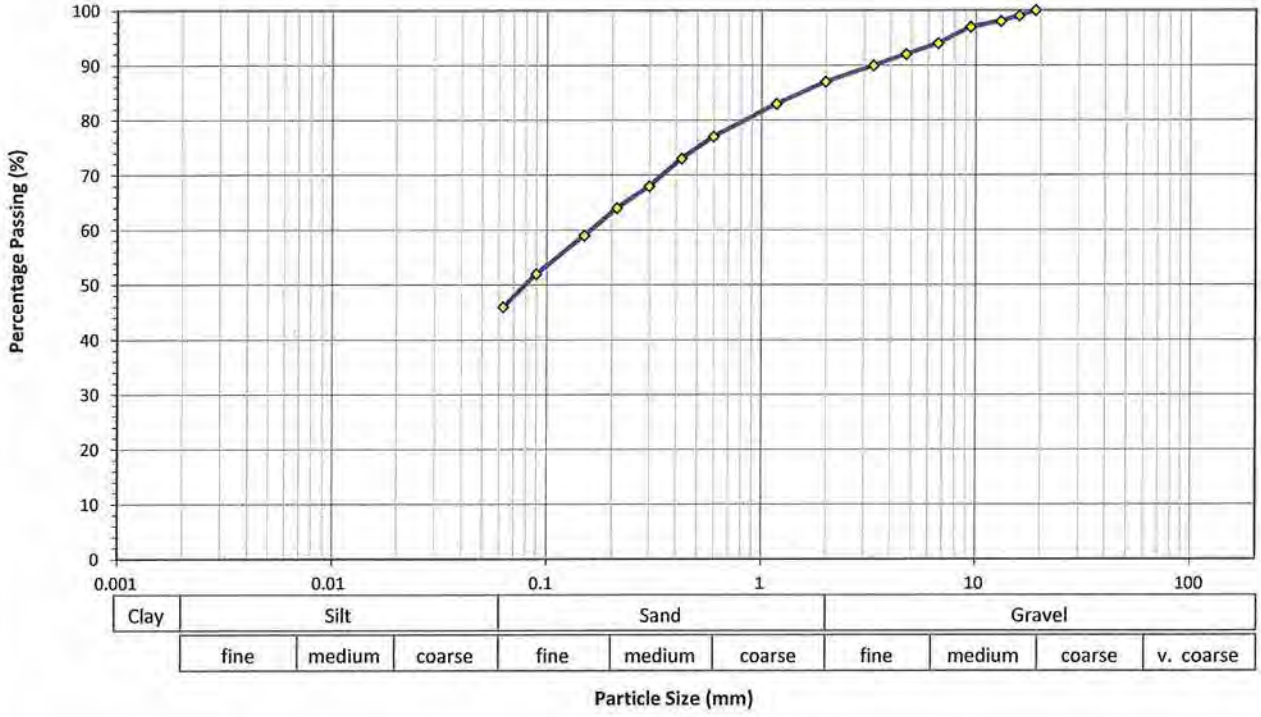
Customer Project ID 751122

Determination of the Particle Size Distribution - NZS 4402:1986 Test 2.8.1 (Wet Sieve)

Sample Details

Geotechnics Sample ID	Kosrae, Micronesia
Date Tested	9/04/2015
Sample	**Kosrae, Micronesia - BH3_0.3-0.6m**
Sample Description	silty SAND with minor to some clay and some gravel, soft, brown, mottled orange.
Specimen	N/A
Specimen Description	N/A

Test Result



Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)
150	-	26.5	-	4.75	92	0.300	68
100	-	19.0	100	3.35	90	0.212	64
75.0	-	16.0	99	2.00	87	0.150	59
63.0	-	13.2	98	1.18	83	0.090	52
53.0	-	9.50	97	0.600	77	0.075	-
37.5	-	6.70	94	0.425	73	0.063	46

Test Remark(s)

• The material used for testing was natural, whole soil. • The percentage passing the <0.063mm was obtained by difference. • The minimum mass of sample required for sieving is 2 kg, but due to insufficient sample mass the sieving was caried out on ~ 0.71 kg. The sample description is not IANZ accredited.

This test is not IANZ accredited and the results are therefore not endorsed.

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Geotechnics Project ID 616587

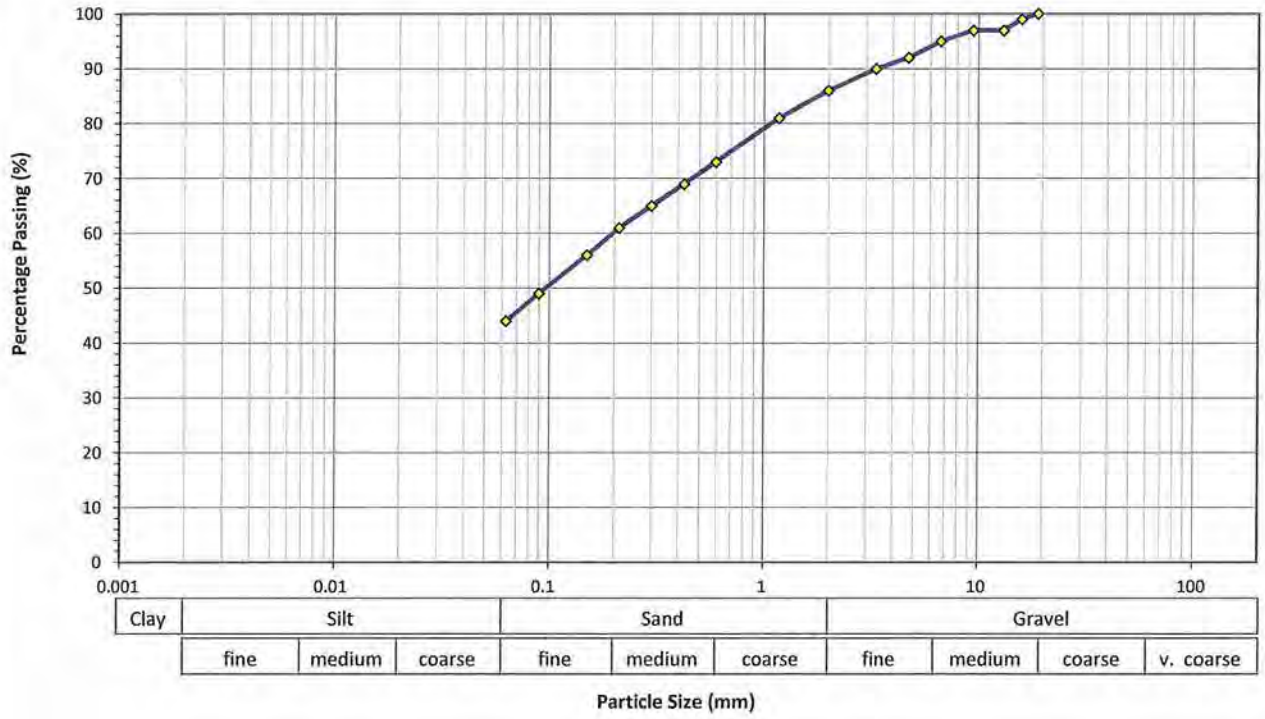
Customer Project ID 751122

Determination of the Particle Size Distribution - NZS 4402:1986 Test 2.8.1 (Wet Sieve)

Sample Details

Geotechnics Sample ID	Kosrae, Micronesia
Date Tested	9/04/2015
Sample	**Kosrae, Micronesia - BH5_2.7-2.9m**
Sample Description	silty SAND with minor to some clay and some gravel, soft, greyish brown, mottled orange-red.
Specimen	N/A
Specimen Description	N/A

Test Result



Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)	Sieve Size (mm)	Percentage Passing (%)
150	-	26.5	-	4.75	92	0.300	65
100	-	19.0	100	3.35	90	0.212	61
75.0	-	16.0	99	2.00	86	0.150	56
63.0	-	13.2	97	1.18	81	0.090	49
53.0	-	9.50	97	0.600	73	0.075	-
37.5	-	6.70	95	0.425	69	0.063	44

Test Remark(s)

• The material used for testing was natural, whole soil. • The percentage passing the <0.063mm was obtained by difference. • The minimum mass of sample required for sieving is 2 kg, but due to insufficient sample mass the sieving was caried out on ~ 0.59 kg. The sample description is not IANZ accredited.

This test is not IANZ accredited and the results are therefore not endorsed.

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