

添付資料

資料一 1 調査団員・氏名

1. 調査団員氏名、所属

「概略設計調査団」(第一回調査)

氏名	担当分野	所属等
井出 博之	団長／総括	独立行政法人国際協力機構 国際協力専門員（情報通信分野）
竹内 博史	副総括	独立行政法人国際協力機構 社会基盤・平和構築部 運輸交通・情報通信グループ 第一チーム 課長
岡田 薫	計画管理	独立行政法人国際協力機構 社会基盤・平和構築部 運輸交通・情報通信グループ 第一チーム 主任調査役
田中 清房	業務主任／放送計画	八千代エンジニアリング株式会社 国際事業本部 施設部 部長
長友 勝實	放送機材計画／積算	八千代エンジニアリング株式会社 国際事業本部 施設部 情報通信システム課 参事
那須 光弘	施設改修計画 1／積算	八千代エンジニアリング株式会社 国際事業本部 施設部
長曾 善之	社会状況調査	八千代エンジニアリング株式会社 国際事業本部 社会・経済基盤部 社会開発課
加瀬 徹康	施設改修計画 2／自然条件調査	八千代エンジニアリング株式会社 国際事業本部 施設部 公共施設課 参事

「概略設計調査団」(追加自然条件調査)

氏名	担当分野	所属等
小松 大記	施設改修計画 2／自然条件調査	八千代エンジニアリング株式会社 国際事業本部 施設部 公共施設課

「概略設計概要説明調査団」(第二回調査)

氏名	担当分野	所属等
岡田 薫	団長／計画管理	独立行政法人国際協力機構 社会基盤・平和構築部 運輸交通・情報通信グループ 第一チーム 主任調査役
田中 清房	業務主任／放送計画	八千代エンジニアリング株式会社 国際事業本部 施設部 部長
長友 勝實	放送機材計画／積算	八千代エンジニアリング株式会社 国際事業本部 施設部 情報通信システム課 参事

資料一2 調査行程

2. 調査行程

概略設計調査（第一回調査）

No.	日付		JICA 団員			コンサルタント団員					宿泊地		
			団長	計画管理	副団長	業務主任 /放送計画	放送機材計 画 / 積算	施設改修計 画 / 積算	社会状況調 査	施設改修計画2 / 自然条件調査			
			井出 博 之	岡田 薫	竹内 博史	田中 清房	長友 勝實	那須 光弘	長曾	加瀬敏康			
1	9月29日	月				移動 [成田→シドニー]					機内		
2	9月30日	火				移動 [シドニー→ナンディ] 移動 [ナンディ→スバ]					スバ		
3	10月1日	水				<ul style="list-style-type: none"> JICA フィジー事務所にて協議 公営企業・観光省訪問 FBC との協議(インセプションレポート、調査日程等) FBC 既設機材調査 (送信網、番組制作機材、組織、人事、輸送) FBC との協議 (調査詳細、調査包括日程) 					スバ		
4	10月2日	木				<ul style="list-style-type: none"> 既設機材調査(ラジオ送信所) FBC との協議 (財務関係担当、分担等) 国家災害管理局、他関係省庁、FBC 訪問、財務諸表解析 					スバ		
5	10月3日	金				FBC との協議					スバ		
6	10月4日	土				社会状況調査等、港湾施設調査等					スバ		
7	10月5日	日				移動[成田→ナンディ] 移動[ナンディ→スバ]					スバ		
8	10月6日	月				<ul style="list-style-type: none"> コンサルタント団内協議、資料解析 既設機材調査(ラジオ送信所) FBC との協議 (技術、財務) 					スバ		
9	10月7日	火				<ul style="list-style-type: none"> 在フィジー日本国大使館表敬 JICA フィジー事務所 訪問 公営企業・観光省訪問、FBC 訪問 FBC との M/D 協議 既設機材調査 質問票の回収(FBC) FBC との合同協議 (事前質問事項) サイト訪問 					スバ		
10	10月8日	水				<ul style="list-style-type: none"> FBC との M/D 協議 他国ドナー訪問 情報省 	<ul style="list-style-type: none"> 既設機材調査 (送信機) 	<ul style="list-style-type: none"> FBC との協議 (既設建屋) 	<ul style="list-style-type: none"> 質問票回収(FBC) 財務資料解析 	<ul style="list-style-type: none"> FBC との協議 (M/D 協議) 他国ドナー訪問 情報省 	スバ		
11	10月9日	木				<ul style="list-style-type: none"> FBC と協議 	移動 [スバ→ナンディ]	<ul style="list-style-type: none"> 機材調達手順調査、地形調査、土壌調査、材料輸送進捗確認 			スバ		
12	10月10日	金				移動 [ナンディ→成田]	<ul style="list-style-type: none"> 設計条件検討、図面作成等 フィールドレポート作成 	<ul style="list-style-type: none"> 設計条件検討、図面作成等 フィールドレポート作成 	<ul style="list-style-type: none"> 社会状況調査 ラジオ聴取者聞き取り調査 	スバ			
13	10月11日	土				移動 [ジャカルタ→シドニー]	<ul style="list-style-type: none"> フィールドレポート作成 					移動 [成田→シドニー]	スバ
14	10月12日	日				移動 [シドニー→ナンディ]	<ul style="list-style-type: none"> コンサルタント団内協議、資料解析 					移動 [ナンディ→スバ]	スバ
15	10月13日	月				移動 [ナンディ→スバ]	<ul style="list-style-type: none"> M/D 準備 	<ul style="list-style-type: none"> フィールドレポート作成 戦略計画省 FBC との協議 農業省 	<ul style="list-style-type: none"> フィールドレポート作成 フィジーテレコムとの協議 	<ul style="list-style-type: none"> 自然環境調査 戦略計画省 FBC との協議 農業省 	<ul style="list-style-type: none"> 自然条件調査 	スバ	
16	10月14日	火				<ul style="list-style-type: none"> 南太平洋大学表敬訪問 	<ul style="list-style-type: none"> フィールドレポート作成 教育省 	<ul style="list-style-type: none"> フィールドレポート作成 	<ul style="list-style-type: none"> 設計条件検討、図面作成等 	<ul style="list-style-type: none"> フィールドレポート作成 教育省 	<ul style="list-style-type: none"> 同上 	スバ	
17	10月15日	水				<ul style="list-style-type: none"> FBC との M/D 協議 	<ul style="list-style-type: none"> フィールドレポート作成 国家災害管理局 通信省 	<ul style="list-style-type: none"> 同上 	<ul style="list-style-type: none"> 同上 	<ul style="list-style-type: none"> 国家災害管理局 通信省 	<ul style="list-style-type: none"> 同上 	スバ	
18	10月16日	木				<ul style="list-style-type: none"> FBC との M/D 協議 JICA フィジー事務所への調査進捗報告 	<ul style="list-style-type: none"> FBC との M/D 協議 フィジー電力公社 	<ul style="list-style-type: none"> フィールドレポート作成 	<ul style="list-style-type: none"> フィールドレポート作成 フィジー電力公社 	<ul style="list-style-type: none"> フィールドレポート作成 	<ul style="list-style-type: none"> フィールドレポート作成 	スバ	
						<ul style="list-style-type: none"> ICT 情報調査 	移動 [スバ→ナンディ]	移動 [スバ→ナンディ]	<ul style="list-style-type: none"> FBC とのフィールドレポート協議 			スバ	

No.	日付		JICA 団員			コンサルタント団員					宿泊地
			団長	計画管理	副団長	業務主任 /放送計画	放送機材計 画 / 積算	施設改修計 画1/積算	社会状況調 査	施設改修計画2 / 自然条件調査	
			井出 博 之	岡田 薫	竹内 博史	田中 清房	長友 勝實	那須 光弘	長曾	加瀬敏康	
19	10月17日	金	・ M/D 締結 移動 [スバ → ナンディ]	移動 [ナンディ → 成田]		移動 [ナンディ → 成田]	・ M/D 締結	移動 [スバ → ナンディ] ・ 航空局 ・ 気象局 移動 [ナンディ → スバ]	・ M/D 締結	スバ	
20	10月18日	土	移動 [ナンディ → シドニー]				・ 市場調査			スバ	
21	10月19日	日	移動 [シドニー → ジャカルタ]				・ コンサルタント団内協議, 資料解析			スバ	
22	10月20日	月					・ 市場調査, 調査報告書作成	・ ローカル建築訪問 ・ 建築コスト見積取得	・ ラジオ視聴者聞き取り調査	・ 自然条件調査確認	スバ
23	10月21日	火				移動 [成田 → ナンディ]	・ 市場調査 ・ 調査報告書作成	・ 同上		スバ	
24	10月22日	水				移動 [ナンディ → スバ] ・ 調査報告書作成 ・ FBC とのフィールドレポート協議	・ 調査報告書作成 ・ FBC とのフィールドレポート協議	・ FBC とのフィールドレポート協議	・ 測量士から報告(自然条件調査), 報告精査	スバ	
25	10月23日	木				・ 調査報告書作成				スバ	
26	10月24日	金				・ FBC からフィールドレポート承認取得		・ 財務省	・ FBC からフィールドレポート承認取得	スバ	
27	10月25日	土				・ 調査報告書作成				スバ	
28	10月26日	日				・ 調査報告書作成				スバ	
29	10月27日	月				・ 大使館への調査進捗報告 ・ JICA フィジー事務所への調査進捗報告 移動 [スバ → ナンディ]				ナンディ	
30	10月28日	火				移動 [ナンディ → シドニー]				シドニー	
31	10月29日	水				移動 [シドニー → 成田]					

概略設計調査（追加自然条件調査）

No.	日付		JICA 団員	コンサルタント団員		宿泊地
				施設改修計画2 / 自然条件調査		
				小松 大記		
1	1月25日	日		移動 [成田 → インチョン] 移動 [インチョン → ナンディ]		機内
2	1月26日	月		移動 [シドニー → ナンディ] 移動 [ナンディ → スバ]		スバ
3	1月27日	火		・ 現地再委託業者との打合せ (自然条件調査)		スバ
ㄥ	ㄥ	ㄥ		・ 現地再委託業者との打合せ (自然条件調査) ・ 自然条件調査確認 ・ 測量士から報告(自然条件調査), 報告精査		スバ
20	2月13日	金		・ 測量士から報告(自然条件調査), 報告精査		スバ
21	2月14日	土		・ 書類整理		スバ
22	2月15日	日		移動 [スバ → ナンディ]		ナンディ
23	2月16日	月		移動 [ナンディ → インチョン] 移動 [インチョン → 成田]		

概略設計概要説明調査（第二回調査）

No.	日付		JICA 団員	コンサルタント団員			宿泊地
				施業務主任/放送計画	放送機材計画/積算	積算	
				岡田 薫	田中 清房	長友 勝實	
1	3月7日	土	移動 [羽田→香港] 移動 [香港→ナンディ]	移動 [成田→シドニー]			機内
2	3月8日	日	移動 [ナンディ→スバ]	移動 [シドニー→ナンディ] 移動 [ナンディ→スバ]			スバ
3	3月9日	月	<ul style="list-style-type: none"> JICA フィジー事務所表敬・打合せ FBC 協議 (前回合意事項の確認・「準備調査報告書(案)」説明) 				スバ
4	3月10日	火	<ul style="list-style-type: none"> 公営企業省・財務省・FBC 協議 (「準備調査報告書(案)」説明、先方負担事項に係る現状・各事項実施時期・期限確認) ナウル・レワ送信所視察・調査 				スバ
5	3月11日	水	<ul style="list-style-type: none"> テレコムフィジー協議、FBC 協議 (「準備調査報告書(案)」説明、機材仕様詳細等) 				スバ
6	3月12日	木	<ul style="list-style-type: none"> FBC 協議 (その他、ミニッツ案確認) ミニッツ最終確認、関連関連資料作成 				スバ
7	3月13日	金	<ul style="list-style-type: none"> ミニッツ署名 (公営企業省及びFBC) 在フィジー日本国大使館・JICA フィジー事務所 報告 				ナンディ
8	3月14日	土	移動 [ナンディ→香港] 移動 [香港→羽田]	移動 [ナンディ→シドニー]			
9	3月15日	日	移動 [シドニー→成田]				

資料－3 関係者(面会者)リスト

3. 関係者（面会者）リスト

<u>所属及び氏名</u>	<u>職位</u>
公営事業省	
Ministry of Public Enterprises	
Shaheen Ali	Acting Permanent Secretary
Maciu N. Lumelume	Deputy Secretary
Sovaia Marawa	Deputy Secretary for Trade
Sujeet Chand	Principal Economic Planning Officer
Laisa Bolalevu	Acting Principal Financial Analyst
Sawaran Lata	Economic Planning Officer
Rachna Kumari	Economic Planning Officer
フィジー放送会社	
Fiji Broadcasting Corporation (FBC)	
Riyaz Sayed-Khaiyum	Chief Executive Officer
Vimlesh Sagar	Chief Financial Officer
Nitendra Prasad	Chief Officer of Technology and Logistics
Shammi Lochan	Manager Radio Programs
財務・戦略計画・国家開発・統計省	
Ministry of Finance, Strategic Planning, National Development & Statistics	
Kamal Gounder	Principal Economic Planning Officer
Nanise Vosayaco	Chief Economic Planning Officer
Mereseini Waibuta	Chief Economic Planning Office
Mere Cakaunitabua	Senior Economic Planning Officer
Mosese Ravasavula	Senior Economic Planning Officer
Tevita Tuicakau	Principal Accounts Officer
情報省	
Ministry of Information, National Archives & Library Services	
Sharon Smith Jones	Permanent Secretary
Sunia Ratulevu	Principal Officer National Disaster Management
教育省	
Ministry of Education	
Pita Kaulotu Cavakilagi	Director
Lusiana Bainivalu Fotofili	Director

Aporosa Duwai

Officer

通信省

Ministry of Communication

Elvin Prasad

Senior Engineer

農業省

Ministry of Agriculture (MOA)

Ilimeleki Kaiyanuyanu

Chief Economist

Reama Naco

Principal Agriculture Officer

Mere Nakota

Principal Information Officer

Diana Ralulu

Secretary

Varea Pasapasa

Officer

国家災害管理局

National Disaster Management Office (NDMO)

Manasa Tagicakibau

Director

Sunia Ratulevu

Principal Officer National Disaster Management

気象局

Fiji Meteorological Service (FMS)

Alipate Waqaicelua

Director of Meteorology (Suva Met. Office)

Jale Uluilakeba

Officer in Charge (Suva Met. Office)

Terry Atalifo

Officer in Charge (Nadi Met. Office)

航空局

Civil Aviation Authority of Fiji

Netava Waqa

Chief Executive

Ajai Kumar

Manager

Ilairia Abakaucoro

Air Traffic Management Inspector

Isei Tuganilau Tudreu

Controller Ground Safety

フィジー電力公社

Fiji Electric Authority (FEA)

Krishneel Prasad

Acting GM System Planning & Control

Vuate Karawalevu

Unit Leader for Telecommunications & SCADA

オーストラリア大使館

Australian Embassy

John Morley
Marcus Khan
Tukatara Tangi

First Secretary
Governance Specialist
Program Manager – Regional (Growth and Resilience)

在フィジー日本大使館

Embassy of Japan in Fiji

中郡錦蔵
Kinzo Nakagun
中井忍
Shinobu Nakai
國場幸恒
Yukitsune Kokuba

次席
Counsellor and Deputy Chief of Mission
一等書記官
First Secretary
二等書記官
Second Secretary

JICA フィジー事務所

JICA Fiji Office

吉新主門
Shumon Yoshihara
澤田寛之
Hiroyuki Sawada
三村一郎
Ichiro Mimura
大原克彦
Katsuhiko Ohara
石垣滋樹
Shigeki Ishigaki
澤田秀貴
Sawada Hideki
大橋勇一
Ohashi Yuichi
Nila Prasad

所長（概略設計調査）
Resident Representative
所長（概略設計概要説明調査）
Resident Representative
次長
Deputy Director
企画調査員（広域インフラ）
Assistant Resident Representative
企画調査員（防災・環境）
Assistant Resident Representative
所員
Assistant Resident Representative
所員
Assistant Resident Representative
Program Officer

資料一4 討議議事録(M/D)

**MINUTES OF DISCUSSIONS
ON THE PREPARATORY SURVEY ON
THE PROJECT FOR THE REHABILITATION OF THE MEDIUM WAVE RADIO
TRANSMISSION
IN THE REPUBLIC OF FIJI**

In response to a request from the Government of the Republic of Fiji, Japan International Cooperation Agency (hereinafter referred to as “JICA”) in consultation with the Government of Japan had decided to conduct a Preparatory Survey for Outline Design on the Project for the Rehabilitation of the Medium Wave Radio Transmission (hereinafter referred to as “the Project”), and sent a Preparatory Survey Team (hereinafter referred to as “the Team”) to the Republic of Fiji.

The Team is headed by Mr. Hiroyuki IDE, Senior Advisor, JICA, and is scheduled to stay in the Republic of Fiji from 30 September to 28 October 2014.

The Team held a series of discussions with officials concerned of the Government of the Republic of Fiji and conducted field surveys in the Project area. In the course of discussions and field surveys, both sides have confirmed the main items described in the attached sheets. The team will proceed to further studies and prepare a Preparatory Survey Report.

Suva, 17 October 2014

井出 増之

Hiroyuki IDE
Leader
Preparatory Survey Team
Japan International Cooperation Agency
Japan



Shaheen Ali
Acting Permanent Secretary
Ministry of Public Enterprises
Republic of Fiji



Riyaz Sayed-Khaiyum
Chief Executive Officer
Fiji Broadcasting Corporation
Republic of Fiji

ATTACHMENTS

1. Title of the Project

Both sides confirmed that the title of the Project shall be “The Project for the Rehabilitation of the Medium Wave Radio Transmission”.

2. Objective of the Project

Both sides confirmed that the objective of the Project is to provide stable national medium wave radio broadcasting service in the Republic of Fiji, excluding Rotuma Island, through the rehabilitation of the medium wave radio transmission.

3. Project Site

The Project site is located in Naulu Rewa, about 10 kilometer north-east from central Suva, Republic of Fiji, which is shown in Annex 1.

4. Objective of the Preparatory Survey

Both sides confirmed the objective of the Survey as follows:

- 4-1. To understand the background and objective of the Project and examine its impacts and appropriateness;
- 4-2. To identify the components, and conduct outline design and cost estimation of the Project, based on the data and information collected from and the results of discussions with the Fijian side; and
- 4-3. To study the issues of environmental and social considerations through the Survey.

5. Responsible and Implementing Organization

The Responsible and Implementing Organization of the Project is Ministry of Public Enterprises, affiliated with Fiji Broadcasting Corporation (hereinafter referred to as “FBC”). The organization charts are shown in Annex 2.

6. Items requested by the Government of the Republic of Fiji

- 6-1. By reconfirming application submitted by the Republic of Fiji in December 2013, the items described in Annex 3 were finally requested by the Fijian side with the priority.
- 6-2. Both sides confirmed that the appropriateness of the request would be examined in accordance with the further studies and analysis in Japan and the final components of the Project would be decided by the Japanese side from the viewpoint of necessity, technical and financial viability, sustainability and cost-effectiveness.
- 6-3. Both sides confirmed that there were no duplication for the Project to be conducted by other development partners or private enterprises.

mi

PKL

7. Japan's Grant Aid Scheme

- 7-1. The Fijian side understands the Japan Grant Aid scheme explained by the Team, as described in Annex 4 and Annex 5.
- 7-2. The Fijian side will take the necessary measures, as described in Annex 6, to facilitate the smooth implementation of the Project, as a condition for the Japan Grant Aid to be implemented.

8. Environmental and Social Considerations

The Team explained that environmental and social considerations for the Project is categorized as "Category C" according to the JICA Environmental and Social Consideration Guideline, since the components of the Project are limited to reconstruction of existing Antenna system and Transmitting House in the FBC site, and installation of equipment.

9. Schedule of the Survey

Both sides confirmed the schedule of the Survey as follows. The schedule may be subject to change during the preparation and the course of the Survey.

- 9-1. The Team will continue further studies in the Republic of Fiji until 28 October 2014.
- 9-2. JICA will prepare the Draft Final Report and send a mission team to explain the details of the Project including the final components and cost estimation to the Fijian side around March 2015.
- 9-3. JICA will finalize the Final Report and send it to the Fijian side around April 2015.

10. Other Relevant Issues

10-1. Provision of Conveniences to the Team by the Fijian Side

The Fijian side shall, at its own expenses, provide the Team with the following items in cooperation with FBC and other organizations concerned.

- (1) Security-related information as well as measures to ensure the safety of the Team members;
- (2) Information as well as support in obtaining medical service;
- (3) Data and information related to the Preparatory Survey;
- (4) Counterpart personnel;
- (5) Suitable office space with necessary equipment and services;
- (6) Credentials or identification cards;
- (7) Entry permits necessary for the survey team members to conduct field surveys; and
- (8) Support in obtaining other privileges and benefits if necessary.

10-2. Provision of Conveniences to the Project by the Fijian Side

The Fijian side confirmed that undertakings described in Annex 7 should be taken

hi 16

130

by the Fijian side at its own expense if implementation of the Project is approved by the Government of Japan.

10-3. Privatization

As for the possible ideas of privatization of radio broadcasting services which currently Ministry of Public Enterprises and FBC deals, Ministry of Public Enterprises and FBC confirmed that all of the equipment and facilities to be procured by Japan Grant Aid would not be deemed within the scope of possible privatization. Even if the possibility of privatization issues arises in the future, Ministry of Public Enterprises and FBC shall consult with JICA with sufficient information in accordance with the major undertakings described in Annex 6 and 7 prior to any important decision-makings. Ministry of Public Enterprises and FBC agreed to obtain the prior concurrence of JICA by providing sufficient information and explanations as well.

10-4. Interruption of Broadcasting Service on Medium Wave

The Team explained that 11-month interruption is required when the construction of new antenna will be done at the same location as the existing antenna because the construction should be started from the foundation work after the removal of the existing antenna. The Team also explained that, even in the case that the construction of new antenna will be done at the location adjacent to the existing antenna, 6-month interruption is required due to the following reasons.

- 1) Electromagnetic waves from the existing antenna will affects workers engaged in the construction work of new antenna mast; and
- 2) Existing antenna may fall down and it makes workers in dangerous situation as they work in high place and it's difficult for them to evacuate immediately.

Therefore, the existing antenna should be removed by the time of the completion of foundation work and before starting the antenna mast construction.

There is a possibility that the interruption period becomes less than 6 months if the suitable location for new antenna is found at about 300 meter away from the existing antenna in the FBC site, where the effect of electromagnetic wave from the existing antenna is considered relatively small. Even in this case, an interruption of the existing antenna is unavoidable but probably limited in the period of adjustment and test of broadcasting from new antenna.

Both sides recognized that the interruption period mentioned above should be shorten as much as possible so that necessary information should be provided to the Fijian people by using the existing antenna or by other means whenever a natural disaster is foreseen, even in the construction period of new antenna.

The Team continue to consider the suitable location of new antenna in the FBC site

hi *AS*

RSK

for keeping the existing antenna functional as long as possible. The location of new antenna will be decided based on the result of detailed survey and analysis from technical viewpoints on the effect of electromagnetic wave, soil condition and natural condition.

10-5. Countermeasure against a Cyclone

The Fijian side strongly requested to avoid the interruption of the broadcasting service on medium wave during the cyclone season from October to March in the Republic of Fiji as the broadcasting is a vital source for getting related information.

The Team will consider steps to construct the new antenna in non-cyclone season from April to September and both sides agreed to consider other methods so as to provide necessary information to the Fijian people. If keeping the existing antenna is technically possible during setting up the new antenna, following countermeasures will be considered.

- 1) Broadcasting by using the existing antenna at night while construction work does not taken
- 2) Pause of the construction work and restarting of broadcasting on medium wave by using the existing antenna in case of foreseeing natural disaster

Besides, the Fijian side will consider alternative methods for providing public service for announcing news and related information by SMS, internet and other methods in the period of interruption of broadcasting service on medium wave.

Annex 1: Project Site

Annex 2: Organization Charts of Ministry of Public Enterprises and Fiji Broadcasting Corporation

Annex 3: Items Requested by the Fijian Side

Annex 4: Japan's Grant Aid

Annex 5: Flow Chart of Japan's Grant Aid Procedures

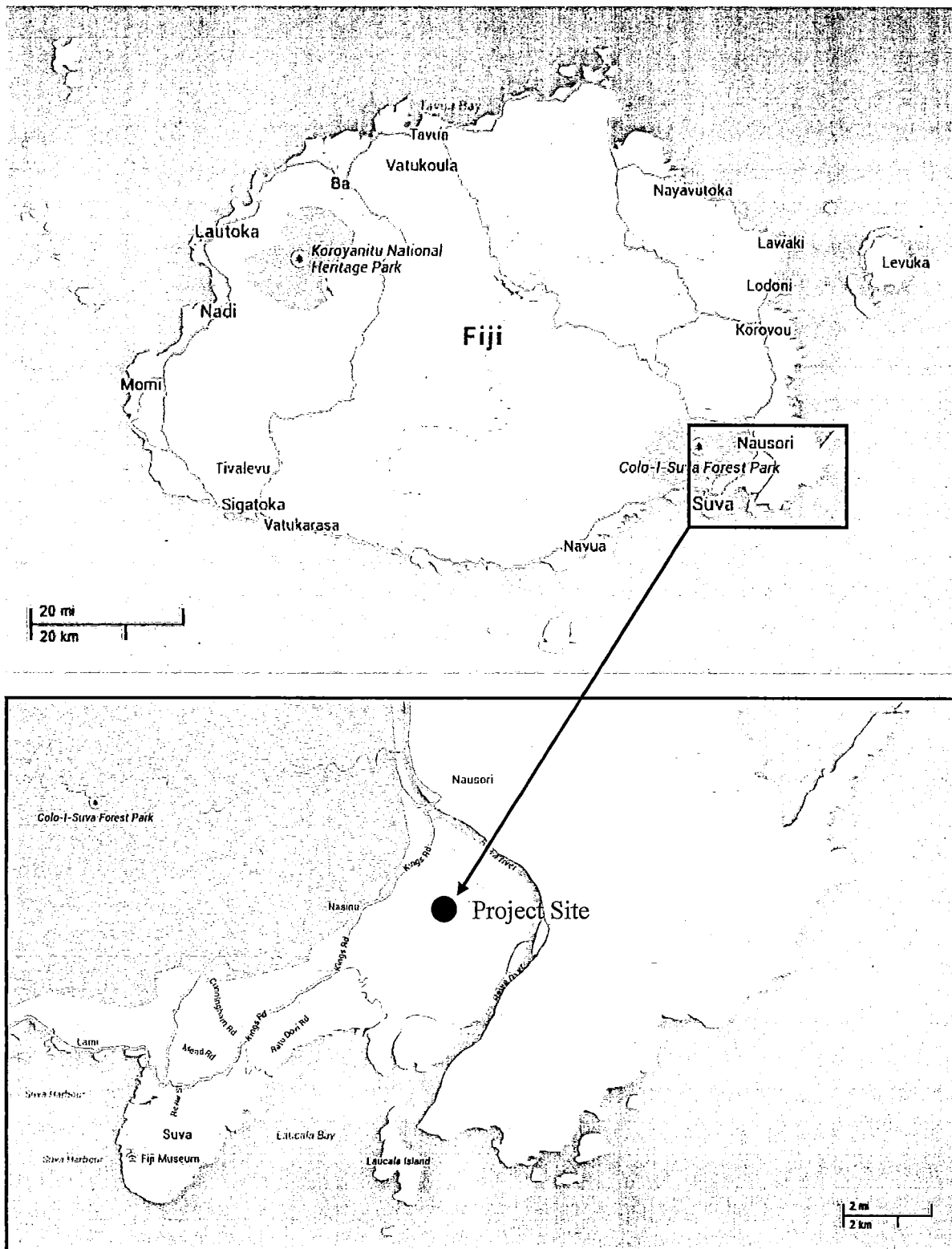
Annex 6: Major Undertakings to be taken by Each Government as a condition for the Japan Grant Aid to be implemented

Annex 7: Major Undertakings to be taken by Each Government after an approval of Project implementation

hi 1/12

PSC

Project Site



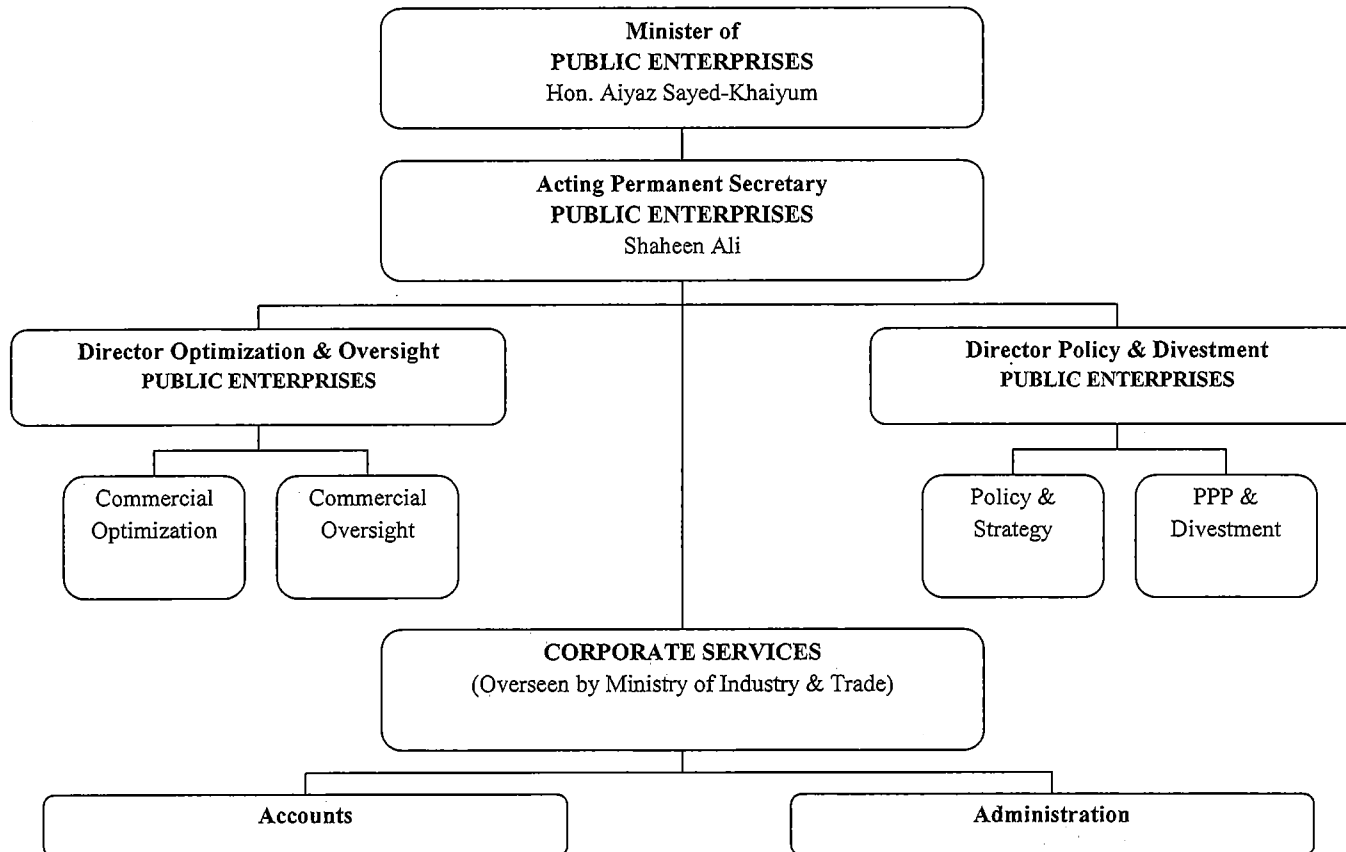
Project Site: Naulu Rewa, about 10 km north-east from central Suva, Fiji

hi 16

RSE

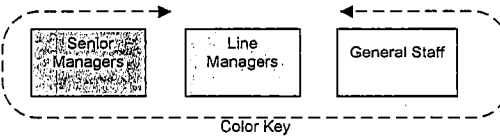
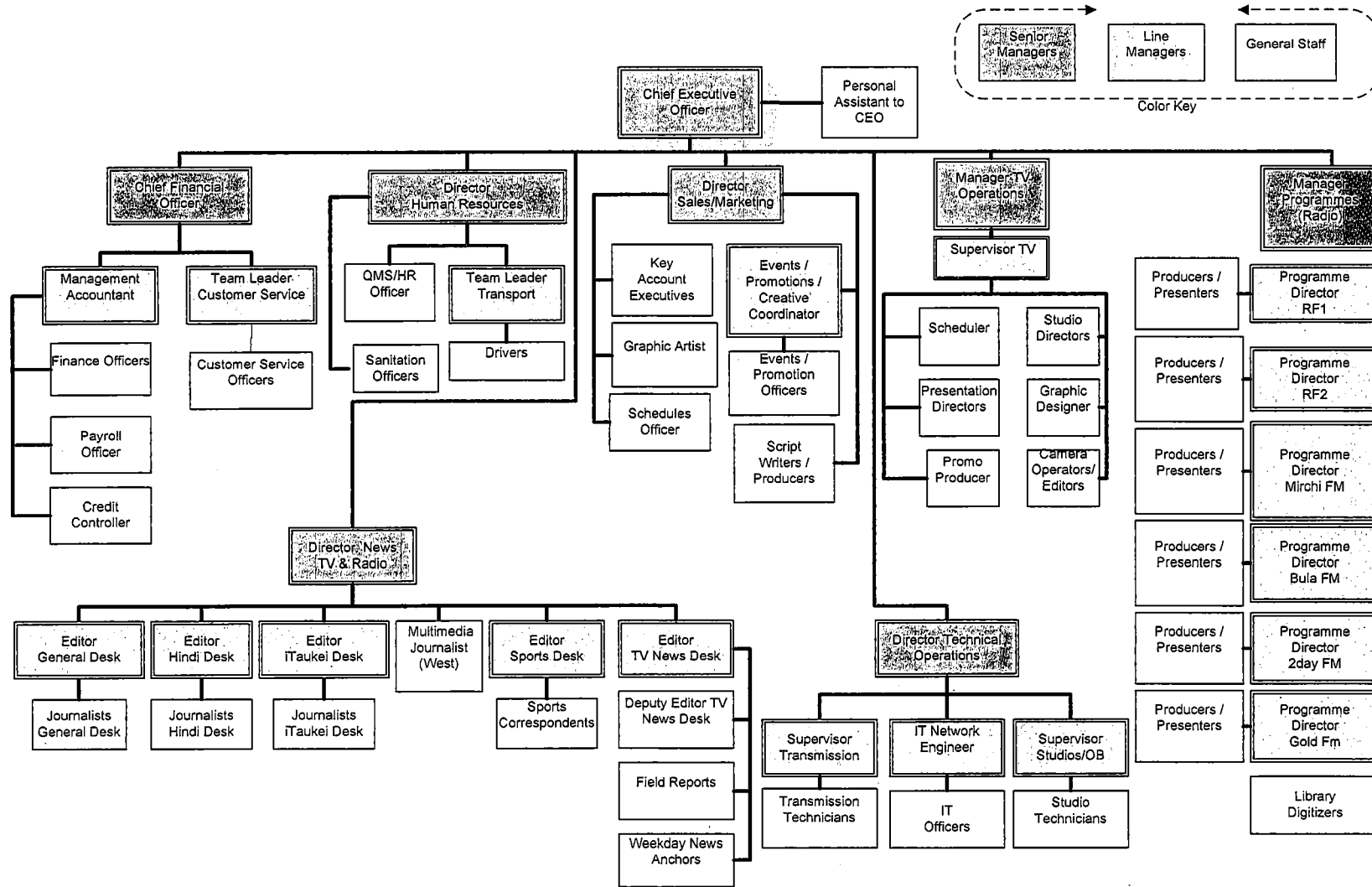
Organization Charts

1. Ministry of Public Enterprises



ni

2. Fiji Broadcasting Corporation



A-4-8

APD

Items Requested by the Fijian Side

No.	Item	Q'ty	Note
1	Transmitting Antenna (Two wave common use)	1 set	Height: 60 m Type: Umbrella Radial Earth Obstacle Warning Light Austin Transformer
	Diplexer/Combiner	1 set	558 kHz/990 kHz
	ATU (Two wave common use)	1 set	
	Feeder Cable	1 set	
	Transmitter 1	1 set	558 kHz 10 kW
	Transmitter 2	1 set	990 kHz 10 kW
	Coaxial Patch Panel (U Link)	1 set	
	Dummy Load	1 set	
	Power Supply		
	- Isolation and Lightning Protection Transformer	1 set	
	- Automatic Voltage Regulator (AVR)	1 set	
	- Primary Distribution Board (PDB)	1 set	
	Program Input Equipment (PIE) Rack System	1 lot	2 sets of PIE
2	Transmitting House	1 set	
3	Spare Parts	1 set	*including Maintenance Equipment and Tools
	Consumable parts	1 set	
4	Engine Generator	1 set	
	Air Condition	1 set	
5	ISDN Codec	4 pairs	

hi AB

PSS

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 this law and the decision of 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 provided to a recipient country to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for its economic and social development 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 supplied through following procedures:

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

2. Preparatory Survey

(1) Contents of the Survey

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

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies 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 between both parties concerning the basic concept of the Project.
- Preparation of an outline 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 Outline Design of the Project is confirmed based on the guidelines of the Japan's Grant Aid scheme.

JICA requests the Government of the recipient country to take whatever measures necessary to achieve 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 of the recipient country which actually implements the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country based on the Minutes of Discussions.

(2) Selection of Consultants

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

(3) Result of the Survey

JICA reviews the Report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the appropriateness 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 signed between the GOJ and the Government of the recipient country to make a pledge 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

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the recipient country to continue to work on the Project's implementation after the E/N and G/A.

(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 fulfill 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 6.

(6) "Proper Use"

The Government of the recipient country is required to maintain and use properly and effectively the facilities constructed and the equipment purchased under the Grant Aid, to assign staff necessary for this operation and maintenance and 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 under 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 paid to the Bank.

(10) Social and Environmental Considerations

A recipient country must carefully consider social and environmental impacts by the

hi

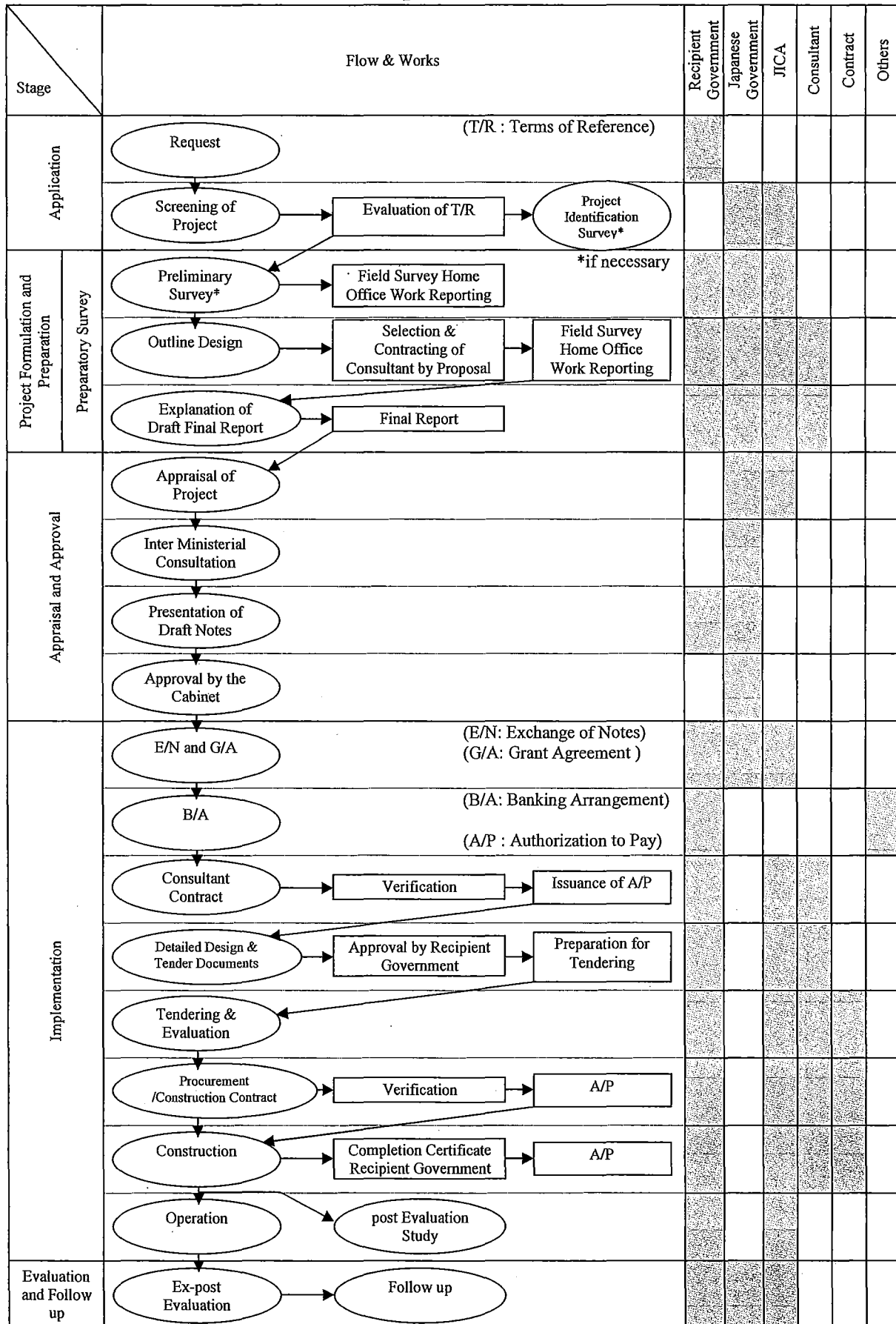
RAE

Project and must comply with the environmental regulations of the recipient country and JICA socio-environmental guidelines.

hi 16

PSC

Flow Chart of Japan's Grant Aid Procedures



hi

206

**Major Undertakings to be taken by Each Government
as a condition for the Japan Grant Aid to be implemented**

No.	Items	To be covered by		Remarks
		Grant Aid	Recipient Side	
1	To confirm land registration and its property, and permission for the implementation of the Project and to clear the site		●	
2	To bear the following commissions paid to the Japanese bank for banking services based upon the Banking Arrangement (B/A)		●	
	1) Advising commission of Authorization to pay (A/P)		●	
	2) Payment commission		●	
3	To ensure prompt unloading and customs clearance at the port(s) of disembarkation, and internal transportation in the recipient country			
	1) Marine or Air transportation of the procured equipment and components from Japan and/or third countries to the recipient country	●		
	2) Tax exemption and customs clearance of the equipment and components at the port(s) of disembarkation in the recipient country		●	
	3) Internal transportation of the equipment and components from the port(s) of disembarkation to the project site in the recipient country	●		
4	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/be borne by the Authority without using the Grant		●	
5	To accord Japanese physical persons and / or physical persons of third countries 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		●	
6	To maintain and use properly and effectively the facilities constructed and the equipment provided under the Grant Aid		●	
7	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project		●	
8	To give due environmental and social consideration in the implementation of the Project		●	

●: denote the side responsible for the work

**Major Undertakings to be taken by Each Government
after an approval of Project implementation**

No.	Items	To be covered by		Remarks
		Grant Aid	Recipient Side	
1	To provide the power supply from the existing substation to the new Transmitting House		•	
2	To secure sites for the installation of the equipment, material storing yard, temporary construction yard and waste disposal		•	
3	To provide four (4) ISDN lines (including two (2) spare lines) for radio program between existing studio and new Transmitting House		•	
4	Procurement of the Equipment			Listed in Annex 3
	1) Materials for Transmitting House	•		
	2) Materials for Antenna foundation, building and radial earth	•		
	3) Antenna system including Antenna Tuning Unit (ATU) component, engine generator and air conditioning	•		
	4) Transmitter system and ATU	•		
5	To remove designated equipment and obstacles from the Project site		•	
6	To demolish the existing Antenna, feeder, foundation and Transmitting House, and leveling the site		•	
7	To construct the following facilities and install the equipment			
	1) The Transmitting House and Antenna (including the safety gate and fence around the Antenna pole)	•		
	2) The security gates and fences around the Transmitting House and allocation of security guard(s) in the site (excluding the safety gate and fence around the Antenna pole)		•	
	3) The temporary road within the site for construction of the Transmitting House and Antenna	•		
	4) The road outside the site if necessary		•	
	5) The parking lot if necessary		•	
8	To secure enough budget and personnel necessary for the operation and maintenance of the facilities constructed and the equipment provided under the Grant Aid, including the periodical maintenance work after the completion of the Project		•	

•: denote the side responsible for the work

**MINUTES OF DISCUSSIONS
ON THE PREPARATORY SURVEY
FOR THE PROJECT FOR THE REHABILITATION OF THE MEDIUM WAVE
RADIO TRANSMISSION
IN THE REPUBLIC OF FIJI
(Explanation of the Draft Outline Design)**

On the basis of the previous preparatory survey in the Republic of Fiji from September to October 2014, and the following technical examination in Japan, Japan International Cooperation Agency (hereinafter referred to as “JICA”) prepared a Draft Preparatory Survey Report (hereinafter referred to as “the Report”) describing the outline design on the Project for the Rehabilitation of the Medium Wave Radio Transmission (hereinafter referred to as “the Project”).

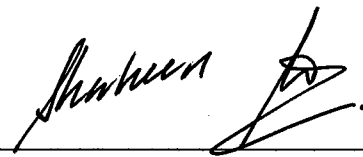
The Preparatory Survey Team visiting the Republic of Fiji from 8 March 2015 to 14 March 2015 (hereinafter referred to as “the Team”), headed by Mr. Kaoru Okada, Deputy Director, Transportation and ICT Group, Infrastructure and Peacebuilding Department, JICA, explained to and consulted with the Ministry of Public Enterprises, Fiji Broadcasting Corporation (hereinafter referred to as “FBC”) and concerned officials of the Government of the Republic of Fiji (hereinafter referred to as “GOF”) on the contents of the Report.

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

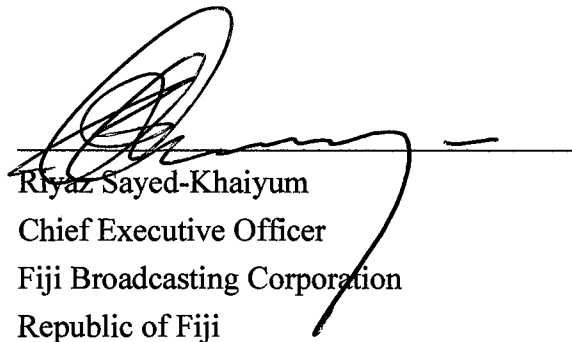
Suva, 13 March 2015



Kaoru Okada
Leader
Preparatory Survey Team
Japan International Cooperation Agency
Japan



Shaheen Ali
Acting Permanent Secretary
Ministry of Public Enterprises
Republic of Fiji



Riyaz Sayed-Khaiyum
Chief Executive Officer
Fiji Broadcasting Corporation
Republic of Fiji

ATTACHMENT

1. Components of the Draft Outline Design Report

GOF, Ministry of Public Enterprises and FBC (herein after referred to as “the Fijian side”) agreed and accepted the contents of the Report explained by the Team. In particular, the components of the Project described below as (1) to (3), which were presented by the Team during its stay in this time, as a result of succeeding surveys and thorough technical examination, were discussed and agreed by both sides to be conducted.

- (1) Procurement of equipment listed in Annex-1
- (2) Construction of a new antenna including the safety gate and fence around the antenna pole, and installation of the related equipment
- (3) Construction of a new transmitter house and installation of the related equipment

2. Cost Estimation for the Project

- 2.1. The Team explained to the Fijian side the Project Cost Estimation in Annex-2; while the final Project Cost to be described in the Exchange of Notes (hereinafter referred to as “E/N”) would be appraised by the Government of Japan.
- 2.2. Both sides further confirmed that details of the planned procurement and construction works in the Report should never be duplicated and/or disclosed to any third parties until all the contracts for the Project would be concluded.

3. Validity of the Previous Minutes of Discussions

Both sides confirmed that all the agreements in the Minutes of Discussions concluded in the preceding Preparatory Survey signed on 17 October 2014 shall be valid unless information was updated by the Report.

4. Japan’s Grant Aid Scheme

The Fijian side reconfirmed and fully understood the scheme of the Japan’s Grant Aid and the necessary measures to be undertaken by the Fijian side, which was explained by the Team and agreed as the Minutes of Discussions signed on 17 October 2014.

(12)

[Handwritten signature]

[Handwritten signature]

5. Undertakings by the Fijian Side

- 5.1. The Fijian side promised to execute the Major Undertakings to be Taken by the Fijian side for the Project listed in Annex-3 in time, at full responsibility and its own expenses based on the contents of the Report.
- 5.2. The Fijian side fully understood the possibilities of the suspension/termination of the Project if any violations on the undertakings occurred.
- 5.3 Both sides confirmed that while an annual budget of FJD 2,910,000 to FBC was fixed until 2016 based on the contract between GOF and FBC, GOF should continue budgeting FBC in and after 2017 so as to stabilize its finances and secure the necessary budget to maintain its setup as a public broadcasting agency. If the budget cannot be approved in time and/or appropriately, there is a possibility that the Project might be suspended or terminated.
- 5.4. After the commencement of broadcasting operation with equipment procured by the Project, FBC promised to request budgeting for appropriate operation and maintenance of the facilities procured and constructed by the Project in a timely manner, to make their best efforts to obtain the budget approval from the office of the Prime Minister on behalf of the GOF in time and to report its approval progress to JICA Fiji office.
- 5.5. The Fijian side confirmed that the customs duties, internal taxes and other fiscal levies imposed in the Republic of Fiji with respect to the purchase of the products and the services should be exempted in accordance with the regulations of E/N between the both governments.
- 5.6. Both sides confirmed that FBC should take all necessary procedures for the exemption of customs duties, internal taxes and other fiscal levies, in collaboration with Ministry of Public Enterprises. In case the exemption would not be processed in a timely manner, anyhow, both sides confirmed such tentative payment(s) should be owed by the Fijian side. The procedures required for the exemption are as follows.
 - 5.6.1. For the equipment and materials imported from Japan and /or third country
 - (1) The Japanese contractor will send shipping documents including a list of equipment to FBC before loading the procured equipment and materials onto the ship in Japan and/or third country.
 - (2) Based on the concession letter which Ministry of Finance is planning to issue to FBC by the end of March 2015, FBC will conduct prompt

(5)
1/2

unloading and customs clearance of all equipment and materials at the port of disembarkation in the Republic of Fiji. The copy of the concession letter in 2014 issued by the Ministry of Finance is attached as Annex-5.

5.6.2. For the equipment and materials procured in the Republic of Fiji

- (1) The Japanese contractor will send a list of equipment to FBC before purchasing the necessary equipment and materials in the Republic of Fiji.
- (2) FBC will temporarily bear internal taxes and other fiscal levies on equipment and materials.
- (3) After completion of the procurement, FBC will request and receive a refund of internal taxes and other fiscal levies from Fiji Revenue and Customs Authority on the basis of the assessment result by the Authority.

5.7. Both sides confirmed that FBC should conduct following administrative procedures with related agencies in a timely manner, since the procedures exert crucial influence on the progress of the Project. Both sides further confirmed that all the following procedures should be finished by the end of April 2015, as a condition for the implementation of the Project.

5.7.1. Environmental and social consideration assessment

As the removal work of existing facilities and installation of new ones are planned on the FBC site, it is unlikely that implementation of the Project will cause negative impact on the environment or resettlement of residents. However, in line with a regulation for the construction work in the Republic of Fiji, it is required to undergo an Environmental and social consideration assessment by the Department of Environment (hereinafter referred to as "DOE").

DOE had already conducted the preliminary survey (DOE Ref 5/1/1/A (VI) 21/02/2014) for Environmental Impact Assessment (EIA) in the construction and environmental management plan. Besides, based on the request from FBC with detailed plan of the Project including design drawings of the new antenna and transmitter house, DOE is planning to conduct a field investigation in the upcoming weeks. As a result of the survey, written approval from a standpoint of environmental impact should be given to FBC by DOE.

5.7.2. Aviation Impact Assessment

The existing antenna is not situated on any aircraft take-off or landing paths and does not infringe any legislation or regulations. The Civil Aviation Authority of FIJI (hereinafter referred to as "CAAF") mentioned that no restriction would be imposed on the new antenna found at 300 meter away from the existing antenna



Handwritten signature

in the FBC site and with same height (60 meters) as the existing antenna. However, in light of the Aviation Law of the Republic of Fiji, it is required to undergo an Aviation Impact Assessment by CAAF, and as a result, written approval for the construction of the new antenna should be given to FBC by CAAF.

5.7.3. Building permits

With regard to building legislation, it is required to apply for building authorization to Nausori Town Council in terms of the construction of new antenna and transmitter house, and as a result, written approval as a building permits should be given to FBC by the Council.

- 5.8. Both sides confirmed that FBC shall report to JICA Fiji office the progress of Major Undertakings by the Fijian side until all the works to be done. Reports to JICA Fiji office shall be submitted monthly with actual progress bar chart in Annex-3. Besides, other than the monthly report, Ministry of Public Enterprises and FBC shall reply if requested by JICA.

6. Operation and Maintenance of the Facilities

The Fijian side agreed to secure enough staff and budgets, and to take every necessary action for appropriate operation and maintenance of the facilities procured and constructed by the Project. The annual operation and maintenance costs are estimated as shown in Annex-4.

7. Schedule of the Study

JICA will complete the Final Report of the Preparatory Survey both in Japanese and English, in accordance with the confirmed items, and send the English version to the Fijian side around April 2015. The schedule is tentative and subject to change.

8. Disclosure of Information

Both sides confirmed that the study results excluding the Project cost estimation and details of the construction works shall be disclosed to the public after completion of the Preparatory Survey. All the study results including the Project cost and details of the construction works will be disclosed to the public after all the contracts for the Project are concluded.



9. Collaboration among Relevant Organizations

Ministry of Public Enterprises and FBC promised to work closely with relevant organizations, such as the Ministry of Finance, Department of Environment and Civil Aviation Authority of Fiji.

10. Misconduct

Both sides confirmed that if there were any suspicion of corruption or fraudulent practices in the implementation process of the Project, Ministry of Public Enterprises and FBC shall provide JICA with related information reasonably requested by JICA, including information of any concerned official of the government and/or public organizations of the Republic of Fiji. Ministry of Public Enterprises and FBC shall not treat unfairly or unfavorably the physical persons and juridical persons that provide the information.

11. Safety Measures

11.1. To avoid accidents on the site during the implementation of the Project, the Fijian side agreed to take and cause the consultant and the contractor to take safety measures such as setting safety assurance to the site, providing information for security control to public and deploying adequate security personnel, based on “The Guidance for the Management of Safety for Construction Works in Japanese ODA Projects”. The Guidance has been published on JICA’s website below.

http://www.jica.go.jp/activities/schemes/oda_safety/ku57pq00001nz4eu-att/guidance_en.pdf

11.2. The Team recommended Ministry of Public Enterprises and FBC to explain the citizens about the necessity and significance of the Project, interruption period of broadcasting service on medium wave, impact and so forth, so as to enhance their understanding and support for the smooth implementation of the Project.

Annex-1: List of Equipment Procured (CONFIDENTIAL)

Annex-2: Project Cost Estimation (CONFIDENTIAL)

Annex-3: Major Undertakings to be Taken by the Fijian Side

Annex-4: Annual Operation and Maintenance Costs (CONFIDENTIAL)

Annex-5: The Copy of the Concession Letter in 2014 issued by the Ministry of Finance

(18)


List of Equipment Procured

No.	Description	Quantity
1	MW Antenna System (60 m, Umbrella Type, dual frequency antenna)	
1.1	Antenna System	1 set
1.2	OB Lighting System	1 set
1.3	Radial Earthing	1 set
1.4	Diplexer with Antenna Tuning Unit (ATU)	1 set
1.5	ATU Compartment	1 set
1.6	Auxiliary Material for ATU Compartment	1 set
1.7	Coaxial Feeder	2 sets
1.8	Dehydrator	1 set
2	Transmitter-1 (558 kHz)	
2.1	10 kW Medium Wave Transmitter (558 kHz)	1 set
2.2	Program Input Equipment (PIE) Rack	1 set
(1)	Audio Processor Amplifier	2 sets
(2)	Control Panel (Input Select Switch, Meter Panel and Monitor Switcher)	1 set
(3)	Monitor Amplifier	1 set
(4)	Monitor Speaker	1 set
(5)	ON AIR Monitor Receiver with Receiving Antenna	1 set
(6)	Audio Input Panel	1 set
(7)	NFB Panel	1 set
(8)	Rack	1 set
3	Transmitter-2 (990 kHz)	
3.1	10 kW Medium Wave Transmitter (990 kHz)	1 set
3.2	Program Input Equipment (PIE) Rack	1 set
(1)	Audio Processor Amplifier	2 sets
(2)	Control Panel (Input Select Switch, Meter Panel and Monitor Switcher)	1 set
(3)	Monitor Amplifier	1 set
(4)	Monitor Speaker	1 set
(5)	ON AIR Monitor Receiver with Receiving Antenna	1 set
(6)	Audio Input Panel	1 set
(7)	NFB Panel	1 set
(8)	Rack	1 set
4	Output Change-over Switch, Dummy Load	
4.1	Output Change-over Switch (5 Port U-link)	1 set
4.2	Dummy Load	1 set

(2) 

No.	Description	Quantity
5	Power Supply Equipment and Air Conditioning System	
5.1	65 kVA Engine Generator with Fuel Tank	1 set
5.2	Control panel with Automatic Change-over Switch	1 set
5.3	65 kVA Automatic Voltage Regulator & Primary Distribution Board (PDB)	1 set
5.4	65 kVA Isolation and Lightning Protection Transformer	1 set
5.5	Air Conditioning	2 sets
6	ISDN Codec	
6.1	ISDN Codec	8 sets
7	Maintenance Equipment and Tools	
7.1	Distortion Meter/Oscillator	1 set
7.2	Audio Attenuator	1 set
7.3	Oscilloscope	1 set
7.4	Frequency Counter	1 set
7.5	Circuit Tester	1 set
7.6	Impedance Bridge, Receiver / Generator	1 set
7.7	Field Strength Meter	1 set
7.8	Tool Kit	1 set
8	Spare Parts	
8.1	PA Module for Transmitter (1pc each type)	2 sets
8.2	Power FET for PA Module	2 sets
8.3	RF Driver Unit for Transmitter	2 sets
8.4	Power Supply Module for Transmitter (1pc each type)	2 sets
8.5	Control Board for Transmitter	2 sets
8.6	Monitor Board for Transmitter	2 sets
8.7	Printed Board for AVR	1 set
8.8	Maintenance Kit for Antenna System	1 set
9	Consumable Parts	
9.1	Fan unit for Transmitter	10 sets
9.2	Air Filter for Transmitter	10 sets
9.3	Fuse for Transmitter	10 sets
9.4	Surge Absorber for Isolation Transformer	5 sets
9.5	Limp for OB Lighting System	5 sets
9.6	Fuse for PIE	10 sets
9.7	Fuse for AVR	5 sets

(17)

S.B.

Project Cost Estimation

1. Cost Estimation Borne by the Government of Japan

This section is closed due to confidentiality.

2. Cost Estimation Borne by the Government of the Republic of Fiji

Item	Cost Estimation (FJD)	Note
Removal of obstacles from the site of new antenna	6,600	Removal work: FJD 50 x 60 person-day = FJD 3,000 Equipment: FJD 3,600
Removal of existing antenna, feeder, foundation and leveling the site	10,000	Removal work: FJD 50 x 100 person-day = FJD 5,000 Equipment: FJD 5,000
Securing of commercial power supply from the existing substation to the new Transmitter House	30,000	Cable approx. 75 mm ² : FJD 150/m x 80 m = FJD 12,000 kWh meter: FJD 1,000 Installation: FJD 17,000

(*) *[Handwritten signature]*

[Handwritten mark]

Item	Cost Estimation (FJD)	Note
Installation of four (4) ISDN lines (including two (2) spare lines) for radio program between FBC headquarters and new Transmitter House	350	Installation: FJD 350
Installation of fences and gates around the new transmitter house (excluding the safety gate and fence around the Antenna pole)	14,000	FJD 200/m x 70 m = FJD 14,000
Administrative approval from DOE, CAAF and Nausori Town Council for implementation of the Project	300	Application: FJD 300
Bank commissions (Advising commission of Authorization to Pay (A/P) and payment commission)	15,350	Rough approx. 0.1% of the total Project cost
Total	76,600	

Notes:

1) Conditions of cost estimation

- Estimated timing: October 2014
USD 1.00 = JPY 104.83
- Exchange rates: FJD 1.00 = JPY 55.741

2) Others

The project is implemented in accordance with the scheme of Japan's Grant Aid. The above cost estimation does not assure the ceiling cost on the E/N and shall be reviewed by the Government of Japan before the conclusion of E/N between the both governments.

(12)

[Handwritten signature]

[Handwritten mark]

Major Undertakings to be Taken by the Fijian Side

1. Undertakings as a condition for the Japan Grant Aid to be implemented

No.	Items	Remarks
1	To confirm land registration and its property, and permission for the implementation of the Project and to clear the site	
2	To bear the following commissions paid to the Japanese bank for banking services based upon the Banking Arrangement (B/A)	
	1) Advising commission of Authorization to pay (A/P)	
	2) Payment commission	
3	To ensure prompt unloading and customs clearance at the port(s) of disembarkation, and internal transportation in the Republic of Fiji	
4	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Republic of Fiji with respect to the purchase of the products and the services be exempted/be borne by the Authority without using the Grant	
5	To accord Japanese physical persons and / or physical persons of third countries 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 Republic of Fiji and stay therein for the performance of their work	
6	To maintain and use properly and effectively the facilities constructed and the equipment provided under the Grant Aid	
7	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project	
8	To give due environmental and social consideration in the implementation of the Project	

2. Undertakings of which progress required to be shared with and to be reported to JICA in a timely manner

The Fijian side is required to implement following items described below and report to JICA Fiji office monthly and the times when the items marked “▼” is done. Furthermore, FBC is also required to report to JICA on an ad-hoc basis in response to JICA’s inquiries.

Undertaking	Month	2015												2016												2017				
		Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May			
Project Implementation	Conclusion of E/N and G/A (P)		▲																											
	Detailed Design																													
	Tender Notice																													
	Tender																													
	Shop drawings and working drawings																													
	Equipment manufacture																													
	Transportation: 1 st ship																													
	Transmitter house building works																													
	Antenna foundation work																													
	Transportation: 2 nd ship																													
	Transportation: 3 rd ship																													
	Antenna constructing works																													
	Transmitter Installation works																													
	Adjustment, testing, OJT																													
Securing budget	Budget for 2015 and 2016	Plan	Annual budget of FJD 2,910,000 to FBC was fixed until 2016																											
		Actual																												
	Request of budget for 2017 - 2020	Plan																												
		Actual																												
Approval of budget for 2017 - 2020	Plan																													
	Actual																													
Bank arrangement	Opening of bank account and arrange Authorization to Pay	Plan																												
		Actual																												
	Payment of bank commission	Plan																												
		Actual																												
Tax exemption	Submission of application for tax exemption	Plan																												
	Actual																													

Temporary halt of construction to avoid interruption of existing radio broadcasting in cyclone season

A-4-28

AP

Undertaking		Month	2015												2016												2017				
			Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May			
Environmental & social consideration assessment by DOE	Request of DOE's assessment	Plan	FBC already done																												
		Actual	FBC already done																												
	Assessment by DOE	Plan	▼																												
		Actual																													
Issuance of the letter of approval by DOE	Plan	▼																													
		Actual																													
	Actual																														
Aviation assessment by CAAF	Request of CAAF's assessment	Plan	FBC already done																												
		Actual	FBC already done																												
	Assessment by CAAF	Plan	▼																												
		Actual																													
Issuance of the letter of approval by CAAF	Plan	▼																													
		Actual																													
	Actual																														
Building authorization by Nausori Town Council	Request of Nausori Town Council's assessment	Plan	FBC already done																												
		Actual	FBC already done																												
	Authorization by Nausori Town Council	Plan	▼																												
		Actual																													
Issuance of the letter of approval by Nausori Town Council	Plan	▼																													
		Actual																													
	Actual																														
Preparation for storing the equipment	Provision of temporary storage area close to the Project site	Plan																													
		Actual																													
Preparation before starting the antenna foundation works	Keep the construction site clear	Plan	■												▼																
		Actual	■																												
	Provision of a waste disposal site	Plan																													
		Actual																													
Preparation before new antenna adjustment and testing	Securing of commercial power supply	Plan																													
		Actual																													
	Removal of existing antenna, feeder, foundation and leveling the site	Plan																									▼				
		Actual																													
Telecom cables	Installation of 4 ISDN lines between FBC HQ and transmitter house	Plan																													
		Actual																													

A-4-29

(3)

MSQ

AB

Undertaking	Month	2015												2016												2017				
		Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May			
		Provision of safety measures	Installation of fences and gates around the new transmitter house	Plan																										
		Actual																												
Trial operation	Implementation of test broadcasts	Plan																												
		Actual																												
Public Announcement by TV, Radio and Newspaper	Information of Interruption	Plan																												
		Actual																												
	Advertisement of New MW broadcasting	Plan																												
		Actual																												

(1/2)

pe

Annual Operation and Maintenance Costs

1. Expenditure

The equipment to be procured by the Project will be operational in 2017, and the annual operation and maintenance costs are estimated as shown in the following table.

Item	Unit price (FJD)	Quantity	Total (FJD)
Electric Power Cost including New Transmitter	133,500	1 set	133,500
ISDN Fee	2,100	1 set	2,100
Maintenance Cost			
Maintenance for Electric Equipment	3,700	1 set	3,700
Service Maintenance for Air Conditioning	2,700	1 set	2,700
Painting for Antenna Pole	20,000	1 set	20,000
Consumable Parts and Spare Parts			
Fan unit for Transmitter	1,250	2 sets	2,500
Air Filter for Transmitter	1,250	4 sets	5,000
Lamp for OB Lightning System	1,667	3 sets	5,000
Each kind of fuse	500	10 sets	5,000
Surge Absorber for Isolation Transformer	2,500	2 sets	5,000
PA Module (average cost per year)	2,500	2 sets	5,000
RF Driver Unit (average cost per year)	2,500	2 sets	5,000
Power Supply Module (average cost per year)	2,500	2 sets	5,000
Each kind of control printed board (average cost per year)	5,000	2 sets	10,000
Power FET (average cost per year)	2,500	2 sets	5,000
Fuel cost for Engine Generator	4,000	1 set	4,000
Total (FJD)			218,500

(1) Electric Power Cost

The annual electric power cost will be increased due to a replacement of transmitter. Increased cost is calculated as below.

- (a) Annual electric power cost for the new 10 kW transmitter: FJD 133,500
- (b) Annual electric power cost for the current 2 kW transmitter: FJD 19,500
- (c) Increased annual cost (= (a) – (b)): FJD 114,000

(*)




(2) Maintenance Cost

The breakdown of the maintenance cost includes the fee of new transmitter and other related equipment, ISDN lines, air conditioning, and new antenna pole procured by the Project. In particular, maintenance of air conditioning facility is important for operating the installed equipment, and painting of the antenna pole is essential to prevent rusting.

(3) Consumable Parts and Spare Parts

Measuring cables, fans, filters, fuses, light bulbs, etc. have high frequency of use and need to be replaced or renewed almost every year. The tri-annual replacement parts costs are adjusted into annualized costs. The Fijian side is required to secure the budget to purchase consumable parts every year to make sure that appropriate maintenance is continued, while the parts necessary for a year or first replacements are procured by the Project.

2. Saving for Equipment Renewal Cost

The Fijian side is required to save part of the renewal cost (FJD 415,000 out of FJD 3,320,000) annually as a reserve fund for eight years until 2025 after starting operation with new equipment in 2017. The following table shows the breakdown of equipment renewal costs saved over eight years.

Item	Unit price (FJD)	Quantity	Total (FJD)
Transmitter (1 set)	1,260,000	2 sets	2,520,000
Guy Wire, Insulator (1 set)	500,000	1 set	500,000
Air Conditioning	150,000	1 set	150,000
Engine Generator	150,000	1 set	150,000
Total (FJD)			3,320,000

(FJD)



MINISTRY OF FINANCE

P.O. Box 2212, Government Buildings, Suva, Fiji; Tele: (679) 330 7011, Fax: (679) 330 0834
 Website: www.finance.gov.fj, Email: info@finance.gov.fj
 Ro Lalabalavu House, 370 Victoria Parade, Suva



10th January, 2014

Fin File: 20/4/3

Riyaz Saiyad Khaliyum
 The Chief Executive Officer
 Fiji Broadcasting Corporation
 P.O. Box 334
 Suva.

Dear Sir,

Re: Extension for Duty Concession on the Importation of Technical Equipment for Radio and Free to Air Television Project.

Reference is made to your letter dated 27th November, 2013, with regards to the above mentioned subject.

Please be informed that the Minister for Finance has granted approval for the extension of duty concession to Fiji Broadcasting Corporation under ad hoc Section 10 of the Customs Tariff Act for the upgrading of radio station and free to air television at a concessionary rate of Free Fiscal, Free Import Excise and 15% VAT payable.

This approval will be valid until 31/12/2014.

Any disposal or usage of goods under concession for any purpose other than what the concession is granted for shall invoke Section 17 of the Customs Tariff Act and the goods shall be liable for duty.

We trust that the above clarifies Ministry of Finance's position on this matter.

Yours faithfully,

Manuqalo Banivalu
 for **Permanent Secretary – Ministry of Finance.**

cc: The Chief Executive Officer – Fiji Revenue & Customs Authority

Page 1 of 1

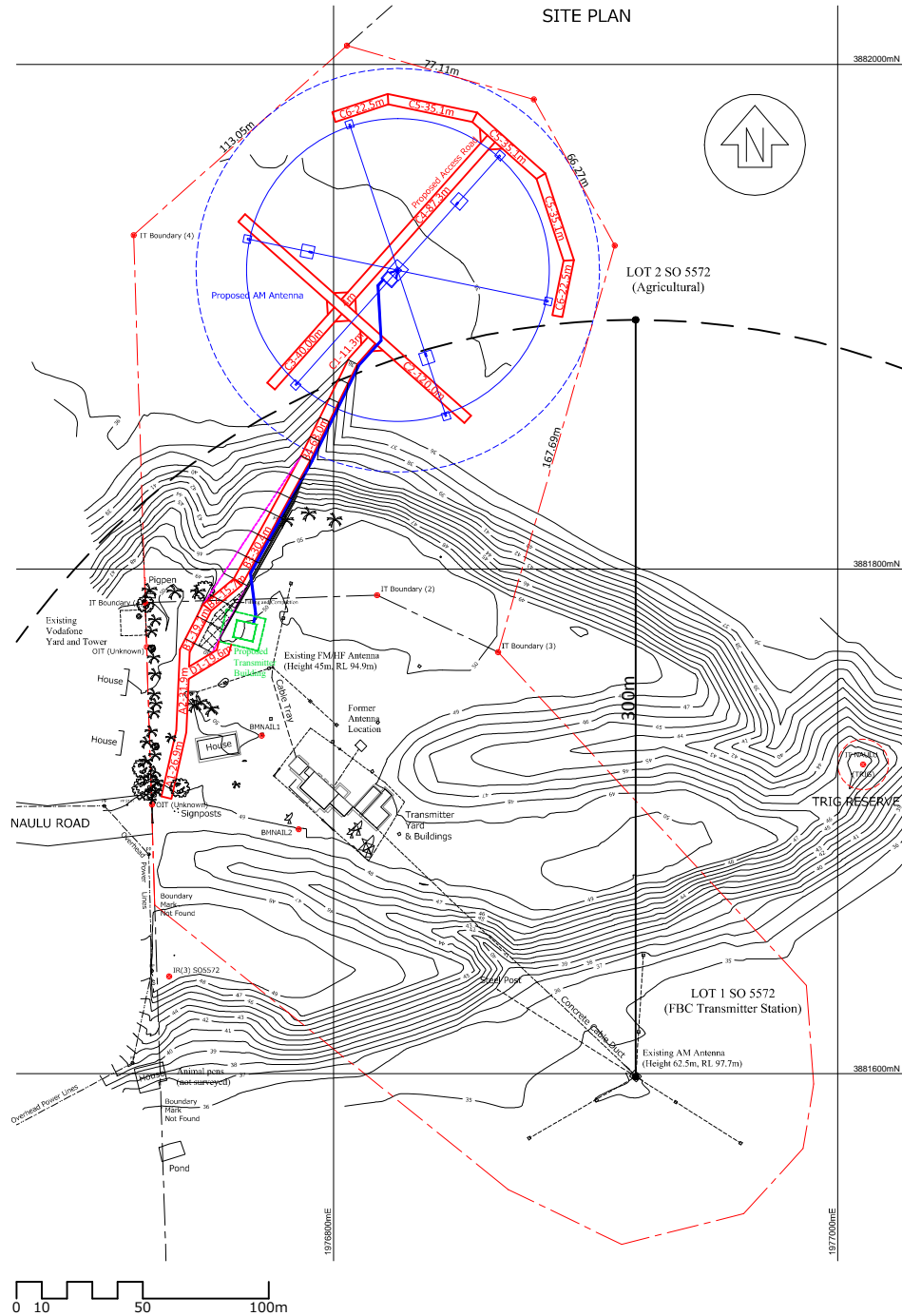
All Correspondence to Permanent Secretary for Finance

Vision: Prudent Stewardship of Government Finances. Mission: Sound management of Government resources in order to facilitate economic growth, achieve financial stability and build a better Fiji for all. Values: Integrity, Professionalism, Quality, Accountability, Efficiency, Excellence and Teamwork

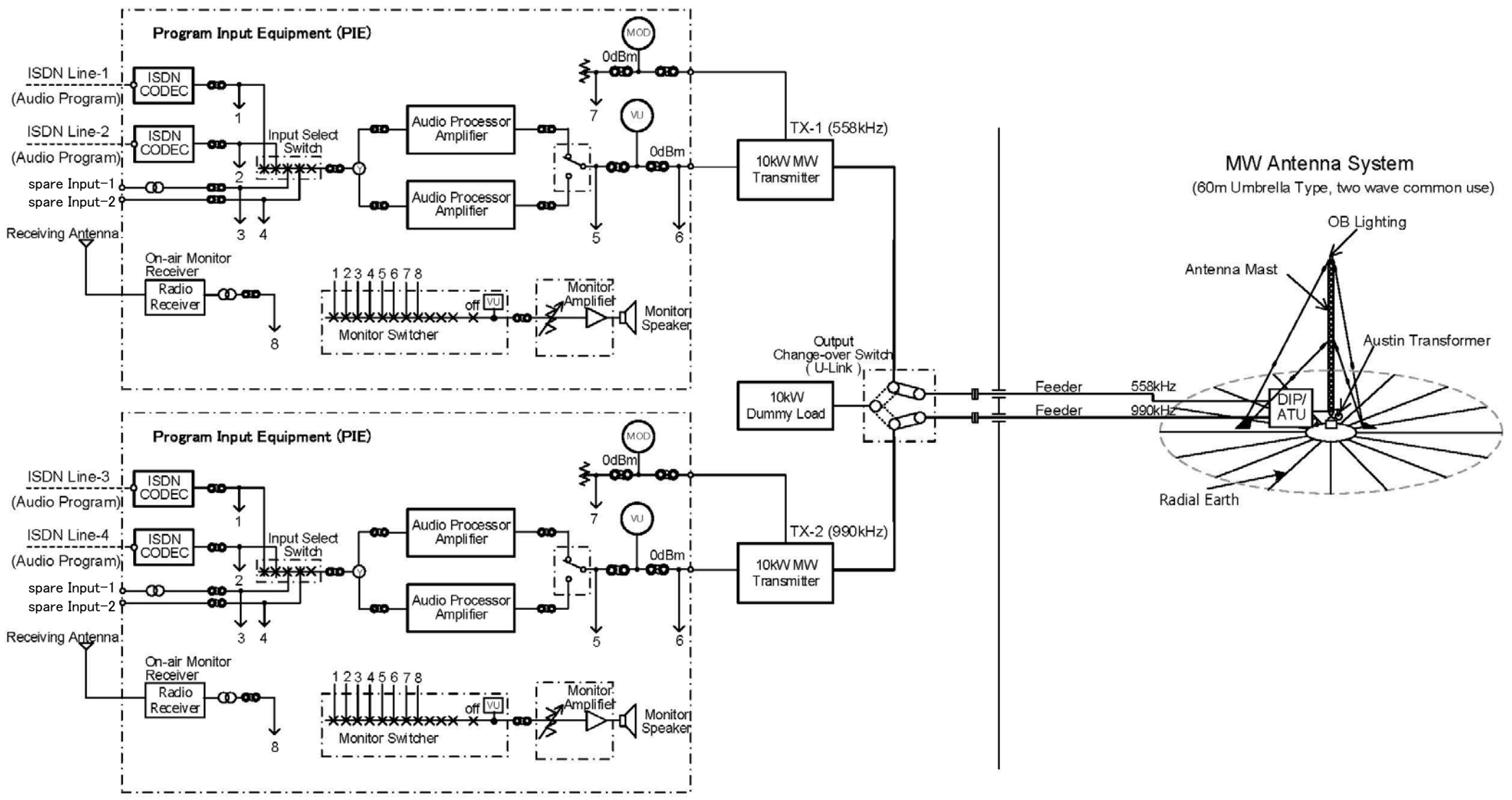
資料一5 概略設計図

5. 概略設計図

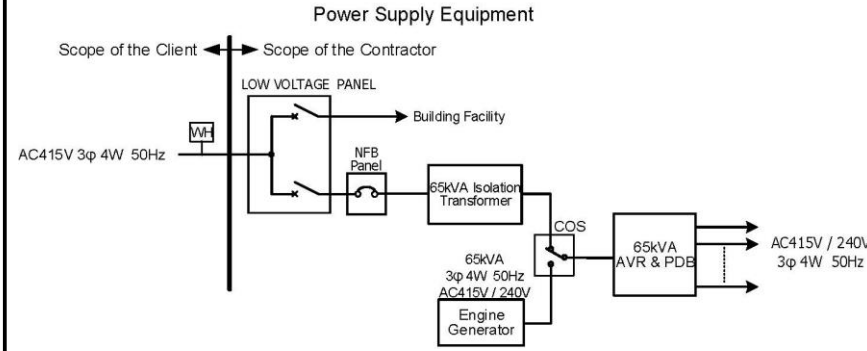
図面番号	図面名称
G-01	Site Location /Site Plan
S-01	Block Diagram of MW Transmitting System
MA-01	MW Antenna Layout
MA-02	MW Antenna Elevation
A-01	New Transmitter House Site Plan
A-02	New Transmitter House Floor Plan
A-03	New Transmitter House Elevation /Section



The Project for the Rehabilitation of the Medium Wave Radio Transmission in the Republic of Fiji					SCALE
					None
Site Location / Site Plan					DWG. No.
					G-01
DATE	DESIGNED	CHECKED	APPROVED	REVISION	
28 Nov. 2014	H. Komatsu	T. Kobayashi	K. Tanaka		
YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN					

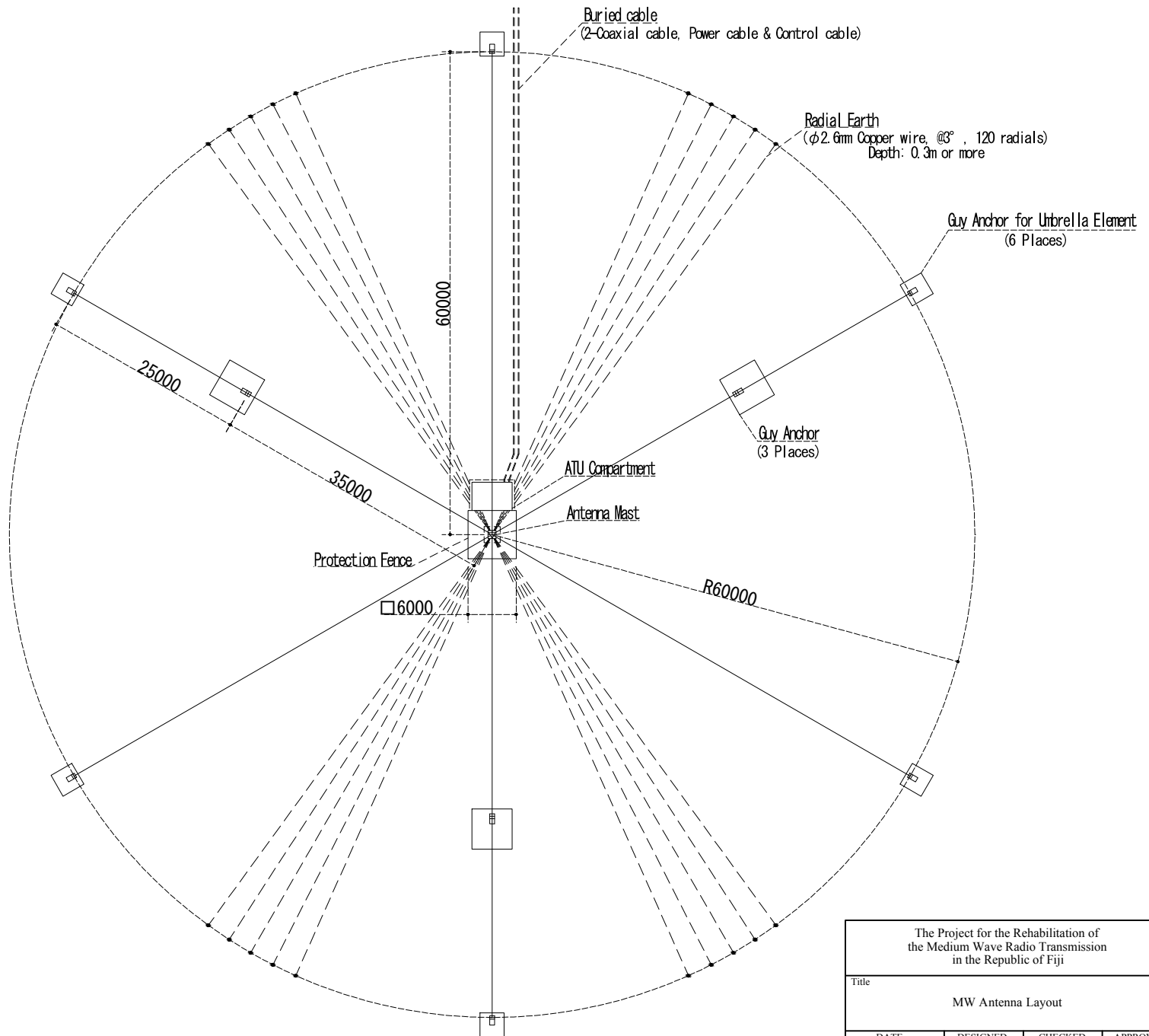


A-5-3

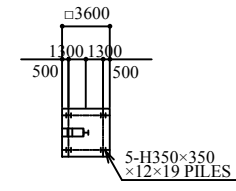
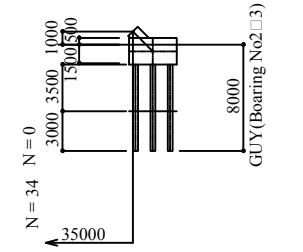
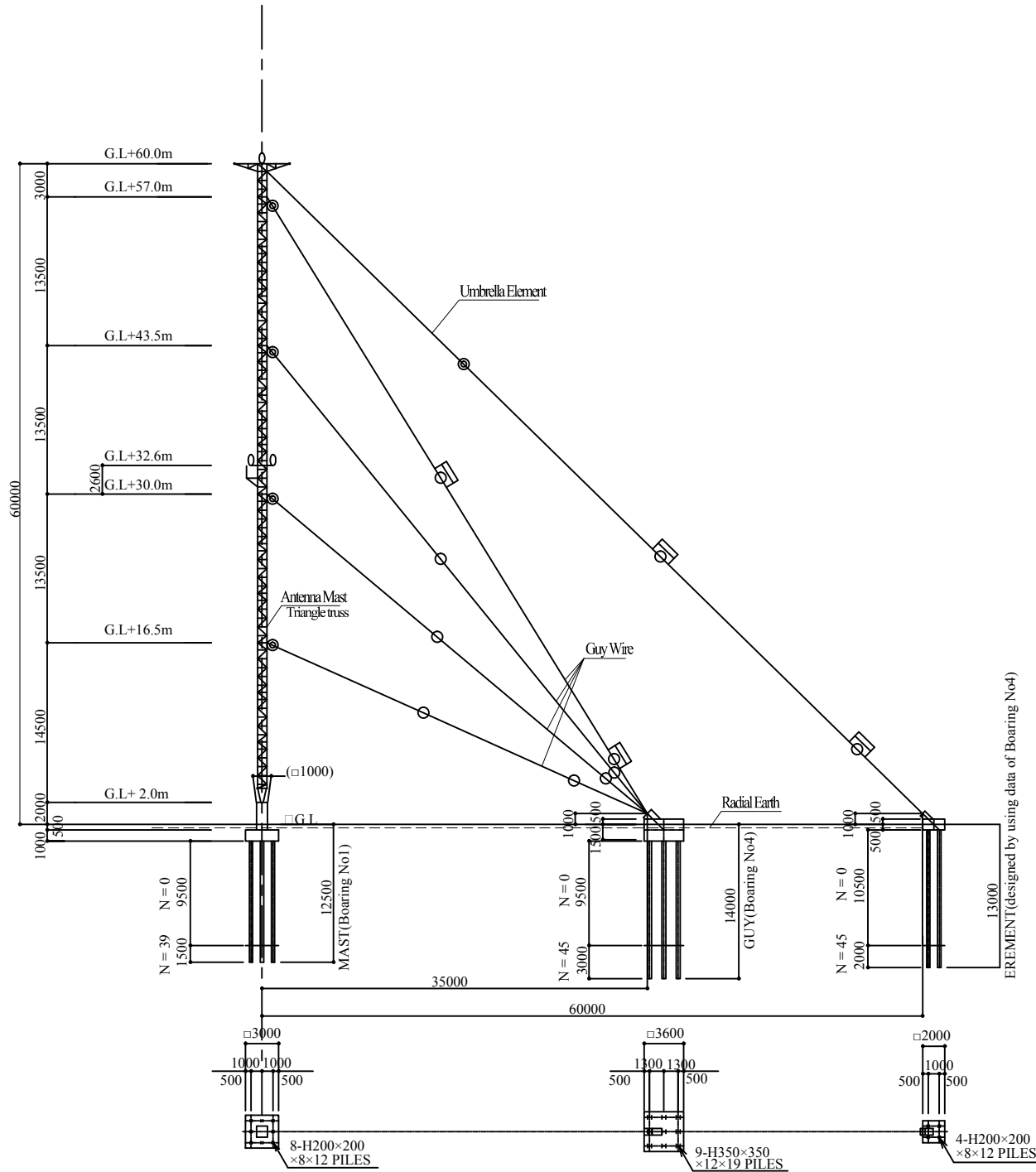


- Abbreviation**
- ATU : Antenna Tuning Unit
 - AVR : Automatic Voltage Regulator
 - COS : Change-over Switch
 - DIP : Diplexer / Combiner
 - MW : Medium Wave
 - NFB : Non Fuse Breaker
 - PDB : Primary Distribution Board
 - OB : Obstruction (Lighting)
- Symbol**
- : Molded Case Circuit Breaker
 - : VU (Audio Level) Meter
 - : Modulation Percent Meter
 - : Audio Jack

The Project for the Rehabilitation of the Medium Wave Radio in the Republic of Fiji				
Title				DWG. No.
Block Diagram of MW Transmitting System				S-01
DATE	DESIGNED	CHECKED	APPROVED	REVISION
18 Sep 2014	K. Nagatomo	T. Kobayashi	K. Tanaka	
YACHIYO ENGINEERING CO., LTD. TOKYO JAPAN				

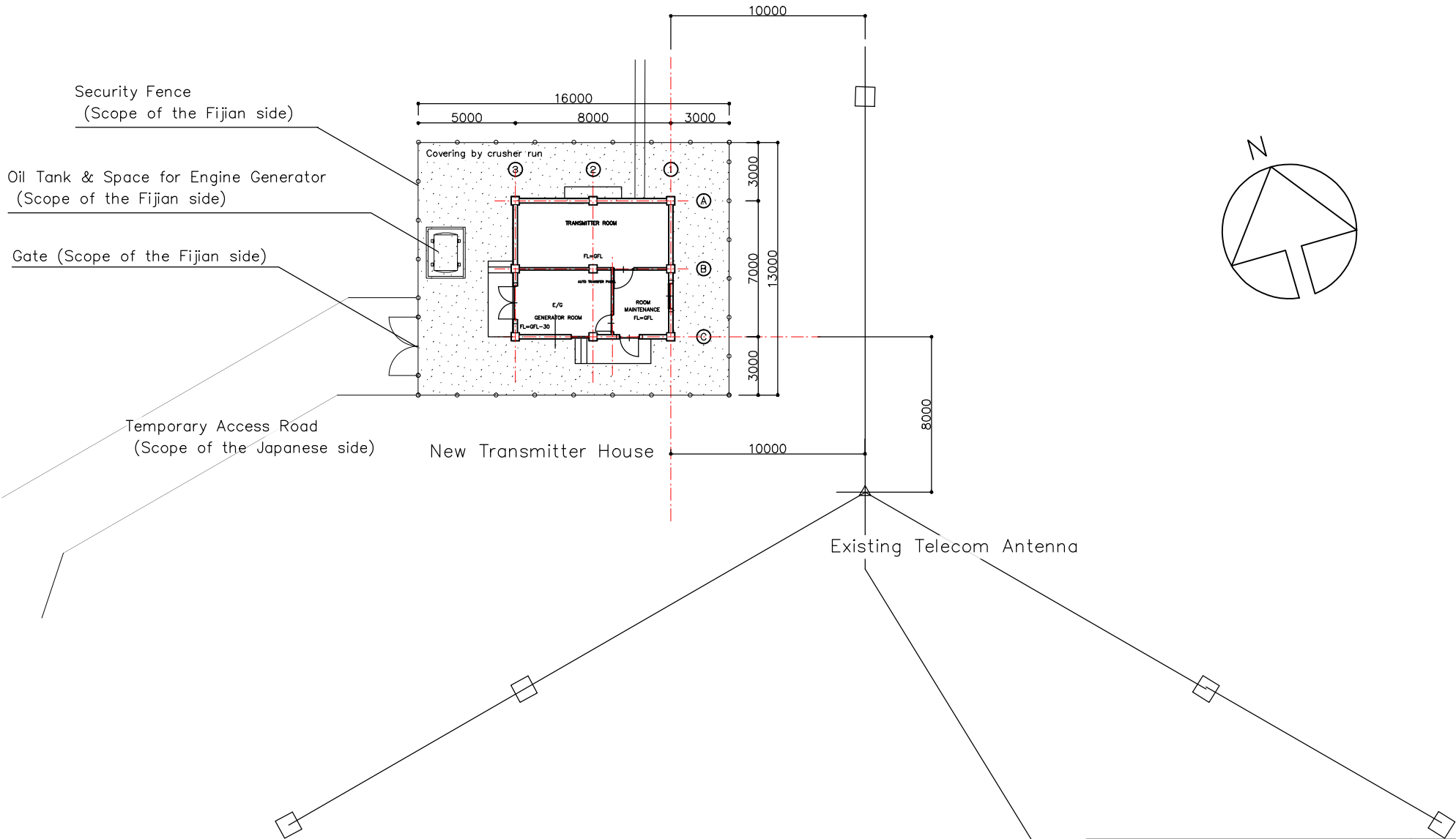


The Project for the Rehabilitation of the Medium Wave Radio Transmission in the Republic of Fiji					SCALE	
					S=1/500 (for A3 paper)	
Title MW Antenna Layout					DWG. No.	
					MA-01	
DATE	DESIGNED	CHECKED	APPROVED	REVISION		
28 Nov. 2014	K. Nagatomo	T. Kobayashi	K. Tanaka			
YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN						

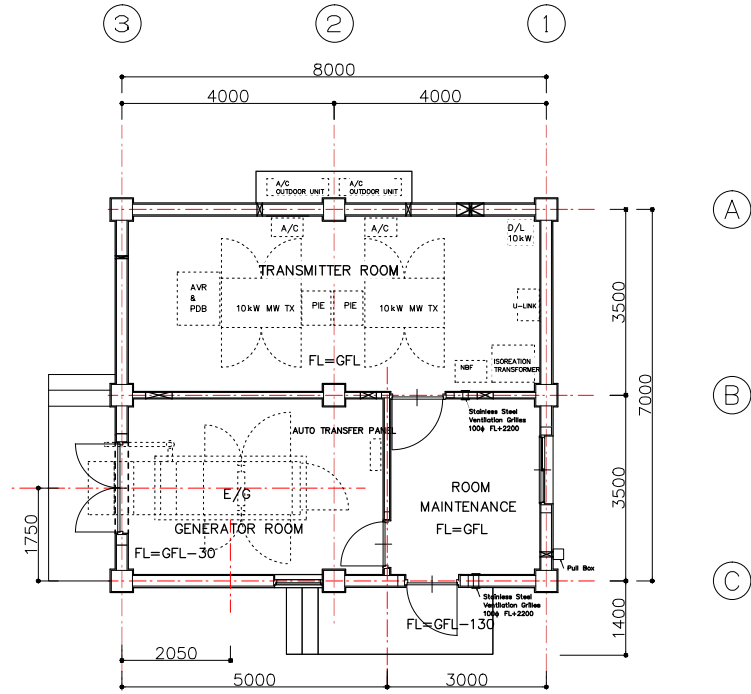


The Project for the Rehabilitation of the Medium Wave Radio Transmission in the Republic of Fiji					SCALE
Title MW Antenna Elevation					S=1/400 (for A3 paper)
					DWG. No. MA-02
DATE	DESIGNED	CHECKED	APPROVED	REVISION	
28 Nov. 2014	K. Nagatomo	T. Kobayashi	K. Tanaka		
yec YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN					

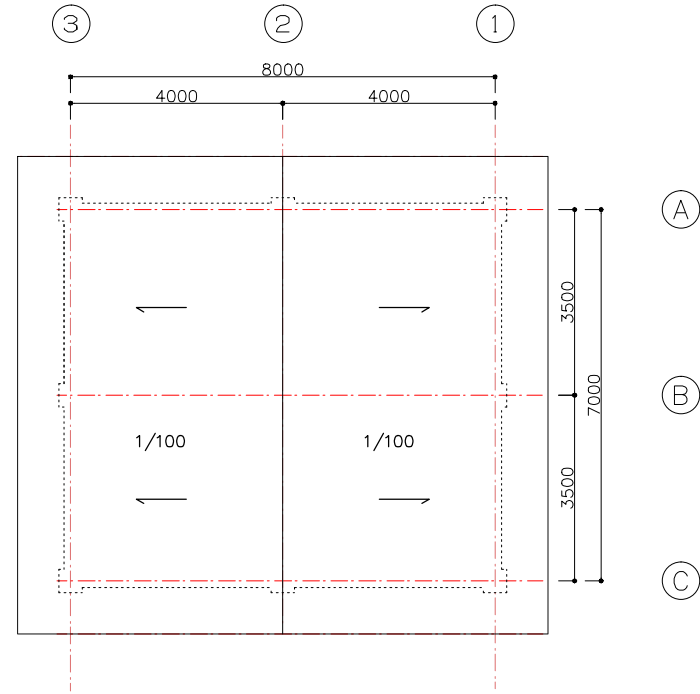
A-5-6



The Project for the Rehabilitation of the Medium Wave Radio Transmission in the Republic of Fiji					SCALE
Title					S=1/200 for A3 paper
New Transmitter House Site Plan					DWG. No. A-01
DATE	DESIGNED	CHECKED	APPROVED	REVISION	
28 Nov. 2014	M. Nasu	H. Komatsu	K. Tanaka		
YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN					

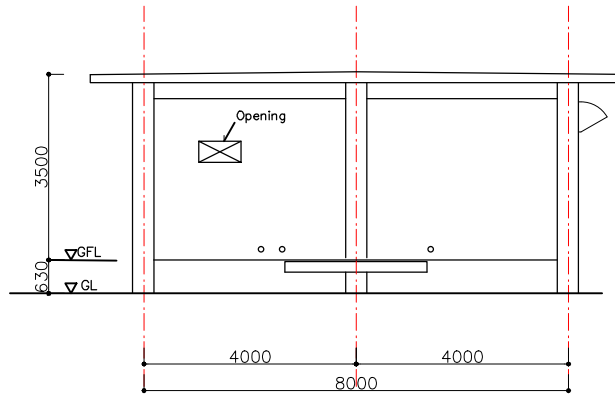


GROUND FLOOR PLAN S=1/100

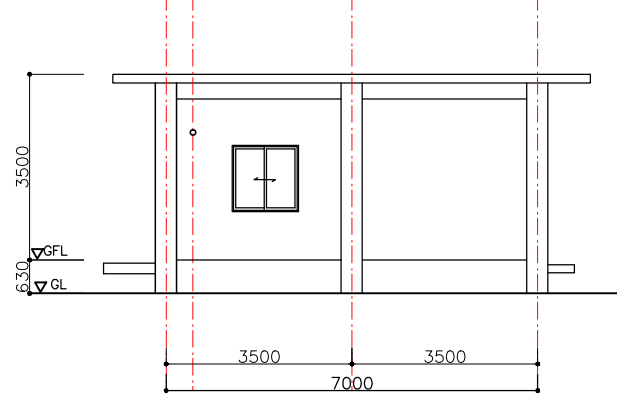


ROOF PLAN S=1/100

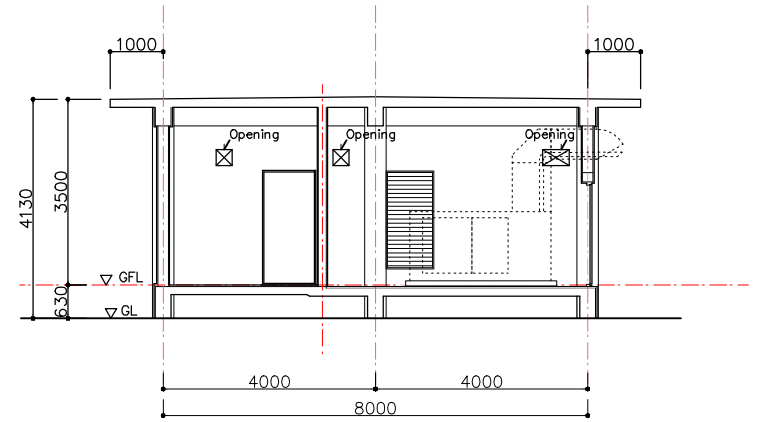
The Project for the Rehabilitation of the Medium Wave Radio Transmission in the Republic of Fiji					SCALE					
					S=1/100 for A3 paper					
Title New Transmitter House Floor Plan					DWG. No.					
					A-02					
DATE	DESIGNED	CHECKED	APPROVED	REVISION						
28 Nov. 2014	M. Nasu	H. Komatsu	K. Tanaka							
YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN										



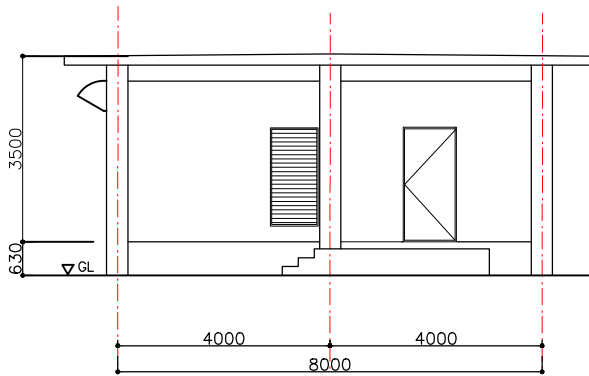
① ② ③
①-A LINE ELEVATION



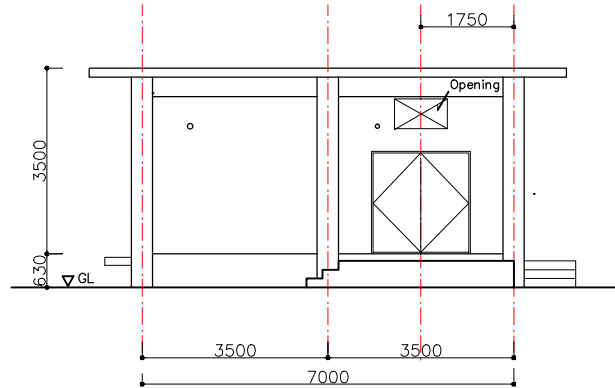
③ ② ①
①-B LINE ELEVATION



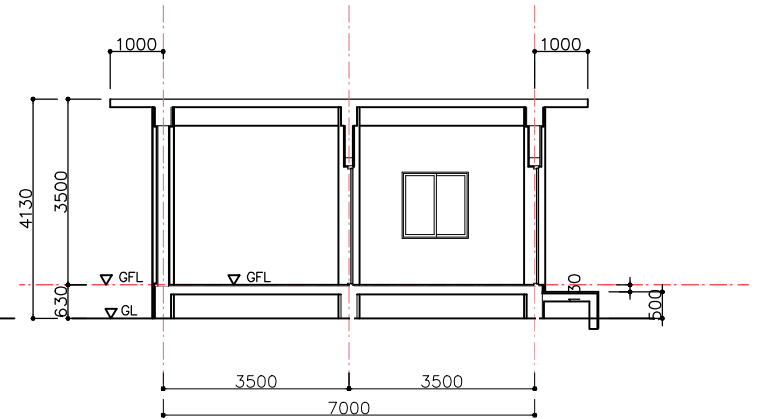
① ② ③
①-B LINE SECTION



③ ② ①
①-C LINE ELEVATION



③ ② ①
①-C LINE ELEVATION



③ ② ①
①-C LINE SECTION

The Project for the Rehabilitation of the Medium Wave Radio Transmission in the Republic of Fiji				SCALE
Title New Transmitter House Elevation / Section				S=1/100 for A3 paper
				DWG. No. A-03
DATE	DESIGNED	CHECKED	APPROVED	REVISION
28 Nov. 2014	M. Nasu	H. Komatsu	K. Tanaka	
YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN				

資料一6 地盤調査・測量調査結果

REPORT

Yachiyo Engineering Co. Ltd

The Rehabilitation of The Medium
Wave Radio Transmission in The
Republic of Fiji
Topographical Survey and Soil
Explorations

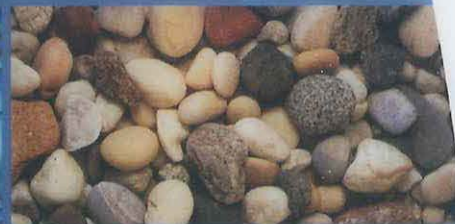
6. Report of Topographic Survey and Soil Investigation

- (1) Report of Simple boring and Simple penetration test
at the site of new Transmitter house



Tonkin & Taylor

ENVIRONMENTAL AND ENGINEERING CONSULTANTS



105 Carlton Gore Road, Newmarket

PO Box 5271, Wellesley Street

Auckland 1141, New Zealand

Auckland
105 Carlton Gore Road, Newmarket
PO Box 5271, Wellesley Street
Auckland 1141, New Zealand
Ph: 64-9-355 6000
Fax: 64-9-307 0265
Email: auck@tonkin.co.nz
Website: www.tonkin.co.nz

Table of contents

1	Introduction	2
1.1	General	2
1.2	Project Description	2
2	Site Description	3
3	Summary of the Topographic Survey	3
4	Summary of the Soils Investigation	3
4.1	General	3
4.2	Hand auger and Scala penetrometer Investigations	4
4.2.1	Site 1- Proposed transmission house	4
4.2.2	Site 2- Proposed temporary road	4
4.2.3	Site 3- Proposed antenna support location	5
4.2.4	Site 4- Proposed antenna mast location	5
4.3	Geotechnical Laboratory Schedule	5
5	Subsurface Conditions	6
5.1	Geological Setting	6
5.2	Ground and Groundwater Conditions	6
5.2.1	Site 1- Proposed Transmission House	6
5.2.2	Site 2- Proposed Temporary Road	7
5.2.3	Site 3- Proposed Antenna Support	8
5.2.4	Site 4- Proposed Antenna Mast location	9
5.2.5	Summary of Scala Penetrometer results and equivalent SPT "N" value	10
6	Geotechnical Laboratory Testing Results	13
7	Discussion and Engineering properties	14
8	Site Seismic Classification	14
8.1.1	General	14
8.1.2	Importance Level	14
8.1.3	Peak Ground Acceleration	14
8.2	Solid Density, Undrained Shear Strength, Cohesion and Internal Friction Angle Range	15
8.3	Foundation Design	16
8.3.1	General	16
8.3.2	Transmission House	16
8.3.3	Temporary Road	17
8.3.4	Antenna Mast	18
9	Applicability	20
Appendix A:	Contract of Topographical Survey and Soils Explorations	
Appendix B:	Topographical Survey and Geotechnical Investigation Location Plans	
Appendix C:	Geotechnical Investigation Data	
Appendix D:	Laboratory testing	

1 Introduction

1.1 General

Tonkin and Taylor International (T&TI) was engaged by Yachiyo Engineering Co., Ltd. (YEC) to undertake soil investigations and a topographic survey for a proposed new medium wave radio antenna and transmission house (defined herein as 'the site') in Suva, Fiji.

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 5 hand augered boreholes and 6 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 6 October 2014¹.

The scope of the geotechnical investigations has included:

- A review of relevant existing information held in T&TI archives.
- A site walkover by an engineering geologist from T&TI.
- T&TI supervision of the Topographical Survey conducted by a NZ based surveyor.
- 5 handaugered boreholes to maximum of 6m depth.
- 6 Scala penetrometer tests to maximum of 9m depth.
- Assessment of suitable foundation solutions for structures on the site.
- Geotechnical assessment of the planned access road.
- 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

The republic of Fiji comprises an archipelago of more than 332 islands, of which 110 are permanently inhabited, and more than 500 islets, amounting to a total land area of about 18,300 square kilometres (7,100 sq mi). The two major islands, Viti Levu and Vanua Levu, account for 87% of the population of almost 860,000. The capital and largest city, Suva, is on Viti Levu.

The proposed works are part of the 'The Rehabilitation of The Medium Wave Radio Transmission in The Republic of Fiji', located east of Suva, approximately 4km west of Nausori airport.

The project involves construction of a new medium wave antenna mast and transmission house as well as temporary roads needed for access across the site. Excavation of the slope between the transmission house and the antenna mast will be required to establish a suitable grade for the access road.

¹ Tonkin and Taylor International Ltd. (6 October 2014) , Basic Design Study project for the Rehabilitation of the Medium Wave Radio Transmission for a site in Fiji- Topographical Survey and Soil Investigation: Alternative Methodology

2 Site Description

The site is located at the end of Naulu Road, Naulu, Fiji. The Site lies to the east of Suva city on the city fringes. The site is approximately 12km from Suva CBD and 4km from Nausori Airport.

The site is located on a river terrace on the eastern outskirts of Suva. To the north, east and south of the site are the floodplains of the Rewa River. The Rewa River is located to the east of the site and the area surrounding the site consists of swamps and floodplain deposits with dense vegetative cover. The land to the west is largely residential with many small dwellings located along the western boundary of the site. The central section of the site comprises the existing buildings on gently sloping land (<5°) to the southwest. The banks of the terrace slope at approximately 20°.

The site, in its current layout includes an existing transmission house serving a telecommunications antenna. The telecommunications antenna is located slightly north of the current transmission house along a terraced portion of the site. The existing medium wave antenna is located to the south of the current transmission house.

The site of the proposed medium wave antenna is largely covered in vegetation, from small scrub and grass in the central section to dense bush located within the floodplains. Coconut palms lie along the western boundary of the site.

3 Summary of the Topographic Survey

A topographical survey of the site was undertaken by surveyors in October 2014 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 on 16th to 18th October 2014.

Equipment used included:	Sokkia RTK GPS XR1 Base and Rover
	Sokkia SET4130R3-36T Reflectorless Total Station
Local Benchmark used:	BMNALI1 RL 50.00m
Coordinate system used:	Fiji Geodetic Datum 1986
Height Datum:	Assumed (refer note below)

Note: Topographical plans of Fiji list the height of Naulu Trig as 56 feet (approximately 17m). Our survey has included this benchmark- 'It NAULU (TRIG) on our plans, with assumed RL 47.92m.

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 October 2014 and the scope of the work was completed in accordance with the 'Contract of Topographical Survey and Soil Explorations', appended for convenience in Appendix A. All field tests were terminated in hard ground or at the target depth.

The following tasks were completed for the soils investigation:

- Proposed Transmission House
 - 2 No. Hand auger boreholes (BH1 and BH2) to 5.0m below existing ground level.
 - 2 No. Scala penetrometer tests (SC1 and SC2) to 5.0m below ground level.
- Proposed temporary road
 - 1 No. Hand auger (BH3) to 3.6m below existing ground level.
 - 1 No. Scala penetrometer (SC3) to 3.1m below existing ground level.
- Proposed antenna support location.
 - 1 No. Hand auger borehole (BH4) to 5.0m below existing ground level.
 - 1 No Scala penetrometer (SC4) to 4.2m below existing ground level.
- Proposed antenna mast location
 - 1 No. Hand auger borehole (BH5) to 6.0m below existing ground level.
 - 3 No. Scala penetrometer (SC5, SC6) to maximum of 9.0m 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, was undertaken over a period of 4 days (16 October – 19 October 2014) at the site. 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 taken 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.

Correlations between Scala penetrometer test results and SPT 'N' values have been developed over a long period of time. The developed correlations are particularly relevant in granular soils.

4.2.1 Site 1- Proposed transmission house

Two hand auger boreholes and two Scala penetrometer tests were undertaken in the area of the proposed transmission house, immediately northwest of the existing transmission house on 16 October 2014. The hand auger boreholes extended to a depth of up to 5.0m below existing ground level. Groundwater was observed at 3.3-3.4m below existing ground level. The Scala penetrometer tests were terminated at 5.0m below ground level.

4.2.2 Site 2- Proposed temporary road

One hand auger borehole and one Scala penetrometer test were undertaken in the area of the proposed temporary road, to be constructed to provide access to the new antenna location. This location was approximately 100m northwest of the existing transmission house. The hand auger borehole extended to 3.6m where very dense sands were encountered. No groundwater was encountered. The Scala penetrometer test was terminated at 3.1m below ground level (due to refusal).

4.2.3 Site 3- Proposed antenna support location

One hand auger borehole and one Scala penetrometer test were undertaken in the area of the proposed antenna support location. This location was approximately 200m northwest of the existing transmission house. The hand auger borehole extended to 5.0m where hard silts were encountered. Groundwater was measured as being 0.3m below ground level. The Scala penetrometer test was terminated at 4.2m below ground level (due to refusal).

4.2.4 Site 4- Proposed antenna mast location

One hand auger borehole and three Scala penetrometer tests were undertaken in the area of the proposed antenna mast location. This location was approximately 200m north of the existing transmission house. The hand auger borehole extended to 6.0m below ground level. Groundwater was measured as being 0.3m below ground level. The Scala penetrometer test was terminated at 9.0m below ground level (the maximum depth attainable).

4.3 Geotechnical Laboratory Schedule

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

The soil testing consisted of the following:

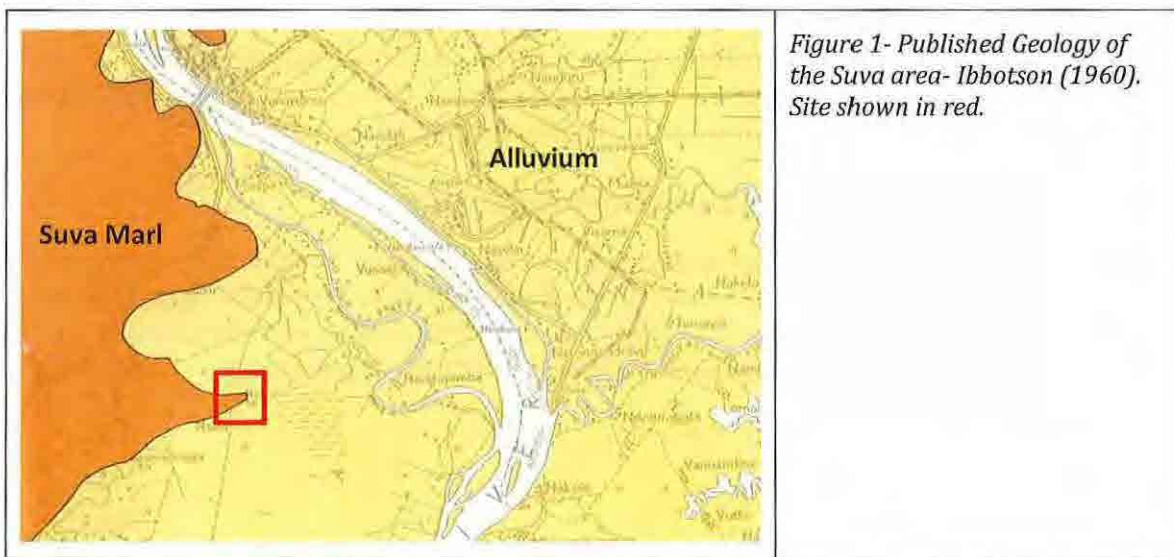
- -Moisture content (8 No.)
- -Solid density (8 No.)
- -Particle size distribution (8 No.)
- - Chloride content (8 No.)

5 Subsurface Conditions

5.1 Geological Setting

Published Geological information² suggests the central section of the site is underlain by Suva Marl of Miocene age. To the north, east and south the site is underlain by recent alluvium.

Observations on site confirmed the presence of alluvial deposits on the floodplain surrounding the site. Suva Marl was observed in road cuttings leading to the site, however no outcrops of Suva Marl were observed on site.



5.2 Ground and Groundwater Conditions

5.2.1 Site 1- Proposed Transmission House

The two hand auger boreholes located at the proposed transmission house encountered very similar ground conditions and these are summarised in Table 1 below. The investigations extended to 5.0m below ground level.

Table 1-Summary of ground conditions (Site 1-Proposed Transmission House)

Depth (Below ground level)	Geological Unit	Soil Description	Soil Undrained shear strength (Cu)
0-0.3m	Topsoil	Sandy TOPSOIL with minor organics and trace silt, loose, dry, low plasticity	N/A
0.3-1.3m	Alluvial Sediments	Silty fine SAND, light yellowish brown, loose, dry	N/A
1.3-1.7m	Alluvial Sediments	Silty fine SAND, minor medium sand, trace fine gravel, light brown streaked red, loose, dry	N/A

² Ibbotson, P., 1960, *Geology of the Suva Area, Viti Levu*, Geological Survey Department, Suva, Fiji,

1.7-2.6m	Alluvial Sediments	Fine SAND with minor silt and medium sand, light greyish brown, loose, dry	N/A
2.6-3.7m	Alluvial Sediments	Sandy SILT, trace clay, light brown streaked red, very stiff, moist, low plasticity	110-145kPa
3.7-4.3m	Alluvial Sediments	Sandy SILT, trace fine gravels, light greyish brown, stiff, saturated, low plasticity	90-116kPa
4.3-5.0m	Alluvial Sediments	Silty fine SAND, dark grey, loose, saturated	N/A

Groundwater encountered between 3.3 m and 3.4 m below ground level.

The two Scala penetrometer tests SC1 and SC2 were terminated between 4.9 and 5.0m. SC2 reaching refusal at 4.90m. 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 (Site 1-Proposed Transmission House)

Depth (Below ground level)	Average Scala Blows per 50mm	Soil Type	Inferred Consistency	Equivalent SPT "N" values
0-0.4m	0.5	Topsoil (Non-Cohesive)	Very Loose	2
0.4-0.9m	0.5-1	Sands (Non-Cohesive)	Loose	3
0.9-3.0m	2-3	Sands (Non-Cohesive)	Medium Dense	8-12
3.0-4.7m	3	Silts (Cohesive)	Stiff	12 (Cu 90 to 145kPa)
4.7-5.0m	5-11	Sands (Non-Cohesive)	Dense	20-40

5.2.2 Site 2- Proposed Temporary Road

The hand auger borehole located at the location of the proposed temporary road is summarised in Table 3 below. The investigations extended to 3.6m below ground level.

Table 3-Summary of ground conditions (Site 2-Proposed Temporary Road)

Depth (Below ground level)	Geological Unit	Soil Description	Soil Undrained shear strength
0.0-0.1m	Topsoil	Silty TOPSOIL, dark brown, firm, dry	N/A
0.1-3.2m	Alluvial Sediments	SILT, minor organics and trace clay, stiff to very stiff, dry	70-200kPa
3.2-3.6m	Alluvial Sediments	Silty fine SAND, dark greenish grey, dense, moist	N/A

Groundwater was not encountered in this borehole during the geotechnical investigations at this site. It is anticipated that the ground water level is likely at approximately 6.0m depth at this site.

The Scala penetrometer test SC3 was terminated at 3.1m (Due to refusal). 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 4 below:

Table 4- Summary of Scala penetrometer results (Site 2-Proposed Temporary Road)

Depth (Below ground level)	Average Scala Blows per 50mm	Soil Type	Inferred Strength	Equivalent SPT "N" values
0-0.1m	0.5	Topsoil (Non-Cohesive)	Very Loose	2
0.1-2.9m	2	Silts (Cohesive)	Stiff to very stiff	8
2.9-3.1m	7	Sands (Non-Cohesive)	Medium Dense	28

5.2.3 Site 3- Proposed Antenna Support

The hand auger borehole located at the location of the proposed antenna support is summarised in Table 5 below. The investigations extended to 5.0m below ground level.

Table 5-Summary of ground conditions (Site 3-Proposed Antenna Support)

Depth (Below ground level)	Geological Unit	Soil Description	Soil Undrained shear strength
0.0-1.8m	Organic deposits	Organic SILT with rootlets, dark brown, soft, wet, low plasticity	15-25kPa
1.8-3.0m	Organic deposits	SILT with minor organics and fine sands, dark brown, soft, saturated, low plasticity	38-59kPa
3.0-3.7m	Alluvial Sediments	Sandy SILT, trace fine gravels, grey, firm, saturated	52-100kPa
3.7-4.2m	Alluvial Sediments	Silty SAND, trace medium gravels, dark grey, med dense, saturated	N/A
4.2-5.0m	Alluvial Sediments	Sandy SILT, greenish grey, hard, wet, low Plasticity, weakly cemented	UTP*

*UTP= unable to penetrate soil with shear vane

Groundwater was encountered at 0.3m below ground level in this borehole during the geotechnical investigations at this site.

The Scala penetrometer test SC3 was terminated at 4.9m (Due to refusal). 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 6 below:

Table 6- Summary of Scala penetrometer results (Site 3-Proposed Antenna Support)

Depth (Below ground level)	Average Scala Blows per 50mm	Soil Type	Inferred Strength	Equivalent SPT "N" values
0-3.0m	0	Organic Silts (Cohesive)	Very Soft	0
3.0-3.8m	1.5	Silts (Cohesive)	Soft	5
3.8-4.2m	7-10	Silt (Cohesive)	Hard	28-40

5.2.4 Site 4- Proposed Antenna Mast location

The hand auger borehole located at the location of the proposed antenna mast location is summarised in Table 7 below. The investigations extended to 6.0m below ground level.

Table 7-Summary of ground conditions (Site 4-Proposed Antenna Mast location)

Depth (Below ground level)	Geological Unit	Soil Description	Soil Undrained shear strength
0.0-3.0m	Organic deposits	Organic SILT with rootlets, dark brown, soft, wet, low plasticity	15-29kPa
3.0-3.4m	Alluvial Sediments	Sandy SILT, dark grey, soft, saturated	20kPa
3.4-5.5m	Alluvial Sediments	Silty fine SAND, dark grey, loose, saturated	N/A
5.5-6.0m	Alluvial Sediments	Silty medium to fine SAND, minor organics and trace coarse sand, dark grey, loose, saturated	N/A

Groundwater was encountered at 0.3m below ground level in this borehole during the geotechnical investigations at this site.

The Scala penetrometer test SC3 was terminated at 9.0m (The maximum depth attainable). 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 8 below:

Table 8- Summary of Scala penetrometer results (Site 4-Proposed Antenna Mast location)

Depth (Below ground level)	Average Scala Blows per 50mm	Soil Type	Inferred Strength	Equivalent SPT "N" values
0-3.0m	0	Organic Silts (Cohesive)	Very Soft	0
3.0-5.0m	2	Silts (Cohesive)	Very Soft	8
5.0-6.5m	3	Sands (Non-Cohesive)	Medium Dense	12

6.5-9.0m	4	Unknown	Dense	16
----------	---	---------	-------	----

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

Tables 9-13 below provide Scala Penetrometer results and equivalent SPT "N" values for SC1, 2, 4, 5 and 6 at 0.5m intervals.

Table 9- 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	1	Loose	4
1.0	2	Loose	8
1.5	2.5	Medium Dense	10
2.0	2	Loose	8
2.5	2	Loose	8
3.0	1	Loose	4
3.5	2	Loose	8
4.0	2	Loose	8
4.5	2	Loose	8
5.0	4	Medium Dense	16

Table 10- 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	0.5	Very Loose	2
1.0	2	Loose	8
1.5	2.5	Medium Dense	10
2.0	2	Loose	8
2.5	3	Medium Dense	12
3.0	3	Medium Dense	12
3.5	4	Medium Dense	16
4.0	4	Medium Dense	16
4.5	4	Medium Dense	16
5.0	10	Dense	40

Table 11- 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	0	Very Loose	0
1.0	0	Very Loose	0
1.5	0	Very Loose	0
2.0	0	Very Loose	0
2.5	0	Very Loose	0
3.0	1	Loose	4
3.5	2	Loose	8
4.0	8	Dense	32

Table 12- Summary of Scala Penetrometer results and equivalent SPT "N" value-SC5

Depth (Below ground level)	SC5-Average Scala Blows per 50mm	SC5- Inferred Strength	SC5-Equivalent SPT "N" values
0.5	0	Very loose	0
1.0	0	Very loose	0
1.5	0	Very loose	0
2.0	0	Very loose	0
2.5	0	Very loose	0
3.0	0	Very loose	0
3.5	1	Loose	4
4.0	1.5	Loose	6
4.5	2	Loose	8
5.0	5	Medium Dense	20
5.5	3	Medium Dense	12
6.0	3	Medium Dense	12
6.5	3	Medium Dense	12
7.0	4	Medium Dense	16
7.5	4	Medium Dense	16
8.0	5	Medium Dense	20
8.5	6	Medium Dense	25
9.0	7	Medium Dense	28

Table 13- 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	0	Very Loose	0
1.0	0	Very Loose	0
1.5	0	Very Loose	0
2.0	0	Very Loose	0
2.5	0	Very Loose	0
3.0	0	Very Loose	0
3.5	1	Loose	4
4.0	2	Loose	8
4.5	2	Loose	8
5.0	3	Medium Dense	12
5.5	3	Medium Dense	12
6.0	3	Medium Dense	12
6.5	3	Medium Dense	12
7.0	4	Medium Dense	16
7.5	4	Medium Dense	16
8.0	4.5	Medium Dense	18
8.5	5	Medium Dense	20
9.0	4.5	Medium Dense	18

6 Geotechnical Laboratory Testing Results

A summary of the geotechnical laboratory testing results is presented in Table 14 and 15 below. A full set of the geotechnical testing data sheets is presented in Appendix D.

Table 14 – Summary of the geotechnical laboratory testing

Site Location	Hand Auger No.	Sample Depth (m)	Solid Density	Grain Size Analysis	Moisture Content
Transmitter House	BH1	1.0-1.5	2.68 t/m ³	Silty SAND with minor clay, light yellow grey brown with light red	30.7%
Transmitter House	BH1	3.0-3.5	2.69 t/m ³	Sandy SILT with minor to some clay, light yellow grey brown with light red	49.2%
Transmitter House	BH2	2.0	2.65 t/m ³	Silty SAND with minor clay, light yellow grey brown with light red	41.8%
Transmitter House	BH2	3.5	2.66 t/m ³	Sandy SILT with minor to some clay, light yellow brown with light red	53.7%
Access Road	BH3	0.5-1.5	2.78 t/m ³	Sandy SILT with minor to some clay, light yellow brown mottled light red	51.0%
Access Road	BH3	2.0-3.0	2.80 t/m ³	Sandy SILT with minor to some clay, light yellow grey brown mottled light red	48.9%
Antenna Support	BH4	3.5	2.67 t/m ³	Sandy SILT with some clay, soft to firm, light greenish grey, mottled black	72.9%
Antenna location	BH5	6.0	2.82 t/m ³	Silty SAND with trace of clay and a trace of organics, light green dark grey mottled black	56.7%

Table 15: Summary of chloride content testing results

Chloride content test location and depth (bgl)	Site Location	Chloride content (mg/kg dry wt)
BH1-2.0m	Transmission House	<50
BH2-0.5m	Transmission House	<50
BH2-1.0m	Transmission House	<50
BH2-1.5m	Transmission House	<50
BH4-4.0m	Antenna Support	<50
BH4-5.0m	Antenna Support	53
BH5-3.0m	Antenna Mast	<50
BH5-4.5m	Antenna Mast	57

7 Discussion and Engineering properties

Recommendations and opinions in this report are based upon data from 5 No. hand augered boreholes and 6 No. Scala penetrometer tests from the following sites.

- Proposed new transmission house
- Proposed temporary road to the new antenna
- Proposed antenna support position
- Proposed antenna mast location

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 also using published empirical relationships, we have assessed the engineering properties for the underlying soils at the four sites for the designer's consideration in the following subsections.

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.

8 Site Seismic Classification

8.1.1 General

It is appropriate to design the foundations and structure in accordance with the New Zealand Standard NZS 1170.5:2004³ which is adopted in Fiji. From the geotechnical investigations undertaken we consider that the site should be classified as a Class D- (Deep or soft soil sites). If rock is encountered in future geotechnical investigations at a depth of less than 20m below ground level the site classification could change to Class C (Shallow Soils).

8.1.2 Importance Level

In accordance with NZS 1170.0:2002⁴ which is adopted in Fiji 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.

8.1.3 Peak Ground Acceleration

The probabilistic earthquake hazard assessment for Fiji prepared by Jones⁵ 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 16 below.

³ NZS 1170.5: 2004 *Structural design actions – Earthquake Actions (New Zealand)*. SANZ.

⁴ NZS 1170.0: 2002 *Structural design actions – Part 0: General Principles*

⁵ Jones, T, 1997, *Probabilistic Earthquake Hazard Assessment for Fiji*, AGSO, Canberra, Australia,

Table 16: 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	0.08g	1 in 500 years	0.30g

* 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.

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

Table 17 and 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 17- 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)
0.5-1.0m	Silty fine SAND, loose, dry	18	N/A	0	28
1.5-2.5m	Fine SAND with minor silt and medium sand, loose, moist	18	N/A	0	30
2.5-4.2m	Sandy SILT, trace clay, very stiff, wet, minor gravels from 3.7m	18	143kPa	4	30
4.2-5.0m	Silty fine SAND, loose, saturated	18	N/A	0	30

Table 18- Summary of Solid Density, Undrained Shear Strength, Cohesion and Internal Friction Angle- Proposed Antenna Mast Location

Depth	Soil Description	Unit Weight (KN/m ³)	Undrained Shear Strength (kPa)	Cohesion (kPa)	Effective Internal Friction Angle (deg)
0.0-3.0m	Organic SILT, soft, wet	18	16-29	2	25

3.0-3.4m	Sandy SILT, dark grey, Soft, saturated	18	20	2	25
3.4-5.0m	Silty fine SAND, loose, saturated	18	N/A	0	28
5.0-6.0m	Silty medium to fine SAND, minor organics, loose, saturated	18	N/A	0	30
7.0-9.0m	Unknown	Unknown	Unknown	Unknown	30

8.3 Foundation Design

8.3.1 General

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

The site investigation data has indicated that shallow foundations may be utilised for the proposed Transmission house depending on the actual loadings. We have provided bearing capacities for the upper 1m of the subsoil.

The proposed antenna mast site is located on very poor ground conditions, as such it is expected the antenna will require deep piled foundations, as will the antenna supports.

We recommend using a strength reduction factor of 0.5 ($\Phi_G=0.5$) 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 ($\Phi_G=0.3$) to give an allowable bearing capacity.

8.3.2 Transmission House

Shallow foundations would be suitable for the proposed transmission house, founded at a depth of at least 600mm below the finished surface level. This is typical foundation depth for buildings.

Both SC1 and SC2 indicated similar bearing capacities for the founding material based on the in situ testing undertaken. This is shown in the Table 19 below.

If some of the proposed equipment to be located within the Transmission House require specific foundations, we have also provided a bearing capacities at 1m, 2m 3m, 4m and 5m.

Table 19- Summary of bearing capacities for the proposed Transmission House

Site	Depth (Below existing ground level)	Geotechnical Bearing Capacities			Foundation Type
		Allowable - (kPa or kN/m ²)	ULS* - (kPa or kN/m ²)	Ultimate(kPa or kN/m ²)	
Transmission House (SC1/SC2 and BH1/BH2)	600mm	75	110	225	Shall strip footings up to 1m wide
	1m	100	150	300	
	2m	180	270	540	Deep Foundation (i.e. Bored piles) '3 x B' Embedment into the founding layer
	3m	180	270	540	
	4m	270	405	810	
	5m	360	540	1080	

*ULS =Ultimate Limit State (ref. NZS1170)

8.3.3 Temporary Road

We have provided a California Bearing Ratio (CBR) for the possible cut depths for the temporary road. CBR values are used to design roads/pavements for construction. These are shown in Table 20 below.

Table 20- Summary of CBR Value for the proposed temporary road

Site	Depth (Below existing ground level)	CBR Value for pavement design
Temporary Road (BH3/SC3)	0.3m	3%
	0.6m	4%
	0.9m	5%
	1.2m	8%
	1.5m	9%
	1.8m	9%
	2.1m	8%
	2.4m	6%
	2.7m	6%
3.0m	7%	

⁽¹⁾ULS =Ultimate Limit State (ref. NZS1170)

8.3.4 Antenna Mast

Due to the poor ground conditions observed during the site investigations at this location, shallow foundations are unlikely to be suitable. We understand that deep machine drilled boreholes are to be undertaken to investigate ground conditions at depth. Structural verification will be needed to ensure both bearing capacity and settlement of the underlying soil are within design tolerances. This should consider both dead and live (e.g. wind) loadings for the Antenna Mast design.

Based on the site investigations at the Antenna location the bearing capacities are as follows. Typically these would not be suitable for design and the practicalities of constructing deep pad foundation in very poor and wet ground would be very difficult. We would not recommend this option. Bearing capacities for the Antenna Mast location are provided in Table 21.

Table 21- Summary of bearing capacities for the proposed Antenna Mast

Site	Depth (Below existing ground level)	Geotechnical Bearing Capacities									Foundation Type
		Allowable - (kPa or kN/m ²)			ULS* - (kPa or kN/m ²)			Ultimate - (kPa or kN/m ²)			
		SC4/BH4	SC5/BH5	SC6	SC4/BH4	SC5/BH5	SC6	SC4/BH4	SC5/BH5	SC6	
Antenna Mast	0.50m	40	25	25	60	35	35	120	75	75	Shall strip footings up to 1m wide
	1.0m	25	40	30	35	60	45	75	120	90	
	1.5m	40	40	40	60	60	60	120	120	120	
	2.0m	105	75	60	155	110	90	315	225	180	Deep Foundation (i.e. Bored piles) '3 x B' Embedment into the founding layer
	2.5m	165	45	45	240	65	65	495	135	135	
	3.0m	270	45	45	405	65	65	810	135	135	
	4.0m	330	120	120	495	180	180	990	360	360	
	5.0m	#	165	165	#	245	245	#	495	495	
	6.0m	#	165	165	#	245	245	#	495	495	
	7.0m	#	165	165	#	245	245	#	495	495	
	8.0m	#	165	165	#	245	245	#	495	495	
9.0m	#	#	255	#	#	380	#	#	765		

*ULS =Ultimate Limit State (ref. NZS1170); # - did not drill to these depths

We also consider that the placement of large shallow pad foundations for the Antenna mast and supports could lead to large ground settlements.

We have provided below some Coefficient's of Volume Compressibility (M_v) for the soils types observed in the investigations. Typical M_v values are provided in Table 22.

Table 22- Typical M_v values for the soil types at the Antenna Mast site

Site	Depth Range (Below existing ground level)	Soil Type	M_v Values (m^2/MN)
Antenna Mast (BH5/SC5)	0.0m – 3.0m	Soft organic SILT	1.5
	3.0m – 3.4m	Soft Sandy SILT	1.0
	>3.4m	Loose silty SAND	N/A

9 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:

Reviewed for Tonkin & Taylor International Ltd by:



P.P

Jamie Yule

Andy Pomfret

Engineering Geologist

Project Manager

Authorised for Tonkin & Taylor International Ltd by:



Chris Freer

Project Director

JWY

p:\751078\workingmaterial\751078-report-jwyrev2.docx

Appendix B:

**Topographical Survey and Geotechnical
Investigation Location Plans**

PREPARATORY SURVEY ON THE PROJECT FOR
IMPROVEMENT OF EQUIPMENT FOR DISASTER
RISK MANAGEMENT IN THE REPUBLIC OF FIJI

CONTRACT OF TOPOGRAPHICAL
SURVEY AND SOIL EXPLORATIONS

SITE PLAN

3882000mN



LOCATION GUIDES
(not to scale)



LEGEND

- Boundary
- - - Major Contour (1m spacing)
- · - · Minor Contour (0.25m spacing)
- ▭ Housing
- / - Fence
- Gate
- Concrete Kerb (Driveway Edge)
- Gravel Road Edge
- Buy Anchor Block (Concrete)
- Satellite Dish
- Coconut Palm
- Other Tree
- Power Pole
- Soil Test Site
- Survey Mark

3881800mN



3881600mN

SOIL TEST LOCATION SCHEDULE

Name	Easting (m)	Northing (m)	RL (m)
BH1/SC1	1976784.80	3881776.56	30.02
BH2/SC2	1976767.18	3881771.57	49.91
BH3/SC3	1976741.38	3881833.15	42.31
BH4/SC4	1976741.42	3881896.06	35.50
BH5/SC5/SC5A	1976804.49	3881917.33	35.16
SC5	1976798.78	3881915.72	35.20

SURVEY MARK SCHEDULE

Name	Easting (m)	Northing (m)	RL (m)
IT NAULU (TRIG)	1977010.53	3881722.55	47.52
IR(3) SO5572	1976734.84	3881638.53	49.59
IT Boundary (1)	1976725.52	3881786.69	50.21
IT Boundary (2)	1976817.28	3881789.66	50.23
IT Boundary (3)	1976865.26	3881767.05	30.08
IT Boundary (4)	1976726.75	3881932.40	35.52
IT Boundary (5)	1976844.42	3882032.20	34.81
BMNAI1	1976771.52	3881733.96	50.00
BMNAI2	1976786.17	3881696.86	49.04
OTT (Unknown)	1976725.95	3881769.12	50.24
OTT (Unknown)	1976728.01	3881706.67	49.23

Note:
BMNAI1 is flush within concrete may block between house and transmitter buildings.
BMNAI2 is in concrete kerb alongside southern access to transmitter buildings yard.
Centre and outermost may locations of proposed new AM antenna were marked with wooden pegs (protruding ~1.2m)
Not all trees shown (generally only those along western site boundary, and those at the top of the slope north of existing buildings)

Survey Conducted 16 - 18 October 2014, using:

Sokkia GPS RTK (GNSS Receiver)
Model: GRX1/U
Serial Numbers: 633-00426
633-00141

Sokkia Total Station (Reflectorless)
Model: SEP4130R3
Serial Number: 145240

SURVEY DATUM: FIJI GEODETIC DATUM 1986
(Coordinate and Bearing Origins from SO 5572)
HEIGHT DATUM: ASSUMED
(BMNAI1 = 50.00m)

Revised	Description	Approved	Date
D	Section Locations A, A and B - B Show		09-11-14
C	Equipment Description Amended		29-10-14
B	Task Location Labels Amended		20-10-14
A	For Information		25-10-14



Drawn	ES	Scale	1:1000 (A1) 1:2000 (A3)
Designed			
Surveyed			
Project	FIJ		

Title
Topographical Survey
Fiji Broadcasting Corp. site,
Naulu Road, Nasinu
Viti Levu, FIJI

Dwg. No.	T01
Job No.	14018
Revision	D

A-6-25

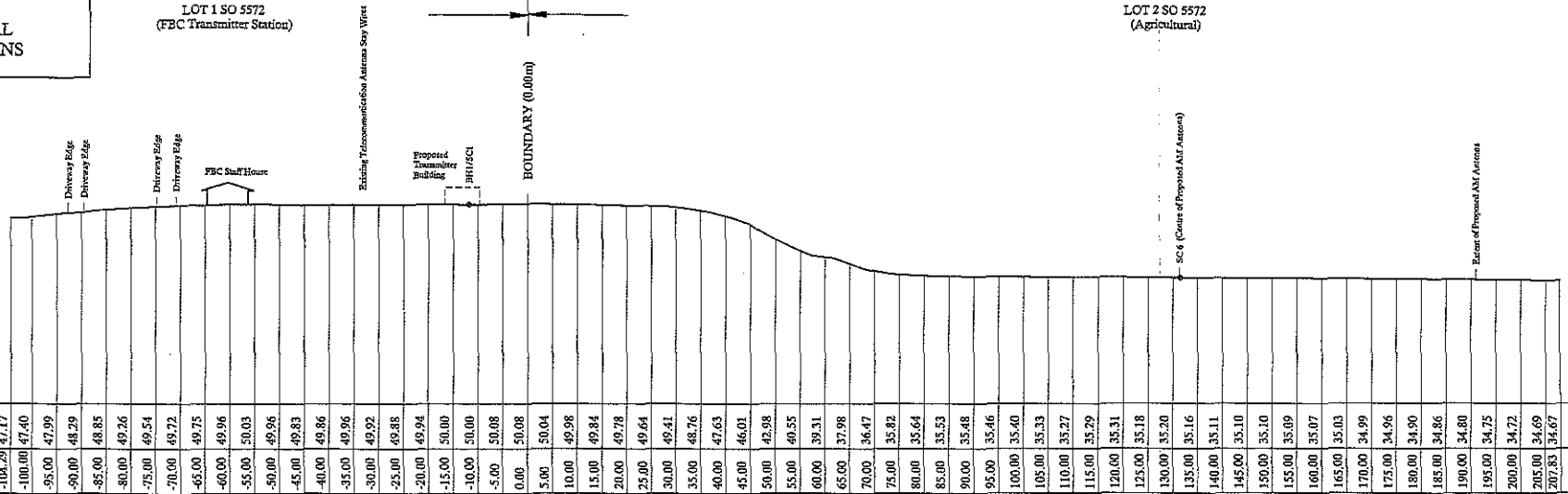
CONTRACT OF TOPOGRAPHICAL
SURVEY AND SOIL EXPLORATIONS

HEIGHT DATUM: ASSUMED
(BMNAIL1 = 50.00m)

For Section Locations refer Dwg. No. T01

LOT 1 SO 5572
(FBC Transmitter Station)

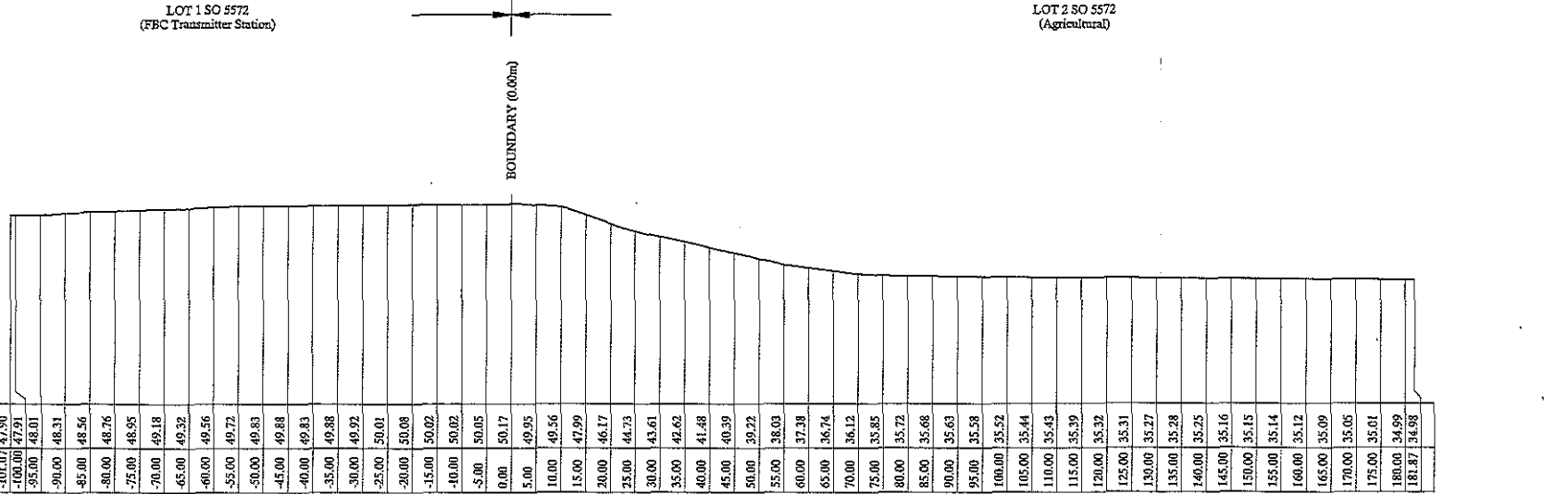
LOT 2 SO 5572
(Agricultural)



Section B - B

LOT 1 SO 5572
(FBC Transmitter Station)

LOT 2 SO 5572
(Agricultural)



Section A - A

Client		Tonkin & Taylor	
A		06-11-14	
Revision	Description	Approval	Date



Drawn	ES	Scale	H - 1:500 (A1) V - 1:500 (A1)	Title	Cross Sections A-A and B-B	Dwg. No.	T02
Designed					Fiji Broadcasting Corp. site,	Job No.	14018
Surveyed	Civil Services (HB) Ltd		H -1:1000 (A3) V -1:1000 (A3)		Naulu Road, Nasinu	Revision	A
Project	Fiji				Viti Levu, FIJI		

A-6-27

Appendix C: Geotechnical Investigation Data

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



TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: BH1

Hole Location: Proposed Transmitter House

SHEET 1 OF 1

PROJECT: Suva Radio		LOCATION: Suva, Fiji		JOB No: 751078																
CO-ORDINATES: 3881776.56 mN 1976764.8 mE		DRILL TYPE: 50mm Hand Auger		HOLE STARTED: 16/10/14																
R.L.: 50.20 m		DRILL METHOD: HAND AUGER		HOLE FINISHED: 16/10/14																
DATUM: Fiji Geodetic Datum 1986		DRILL FLUID: N/A		LOGGED BY: JWY																
				CHECKED: ADP																
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 / WEATHERING 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.	
														0-25	25-50	50-100	100-200			0-6
TOPSOIL								50		SW	D	L							Sandy TOPSOIL, with minor organics and trace silt. Loose, dry.	
ALLUVIAL SEDIMENTS								49		SM									Silty, fine SAND; light yellowish brown. Loose, dry. - minor orange brown mottling. - grades siltier. - grades sandier.	
								48		SW		M							Silty, fine SAND, minor medium sand, trace fine gravel; light brown streaked red. Loose, dry. Fine SAND, with minor silt and medium sand; light greyish brown. Loose, dry. - minor red streaks. - becomes moist. - mottled red.	
						● 144/72kPa		47		ML	W	VSt							Sandy SILT, trace clay; light brown streaked red. Very stiff, wet, low plasticity. - becomes saturated.	
						● 143/75kPa		46				Sat							Sandy SILT, trace fine gravels; light greyish brown. Very stiff, saturated, low plasticity. - becomes minor medium gravels, becomes stiff.	
						● 114/49kPa		45											Silty, fine SAND; dark grey. Loose, saturated. - becomes medium dense.	
						● 114/77kPa		44												
						● 116/81kPa														
						● 90/25kPa														
																				END OF BOREHOLE AT 5m.

T+T DATATEMPLATE.GDT.crg



TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: BH2
Hole Location: Proposed Transmitter House
SHEET 1 OF 1

PROJECT: Suva Radio	LOCATION: Suva, Fiji	JOB No: 751078
CO-ORDINATES: 3881771.36 mN 1976767.18 mE	DRILL TYPE: 50mm Hand Auger	HOLE STARTED: 16/10/14
R.L.: 49.91 m	DRILL METHOD: HAND AUGER	HOLE FINISHED: 16/10/14
DATUM: Fiji Geodetic Datum 1986	DRILL FLUID: N/A	LOGGED BY: JWY CHECKED: ADP

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 / WEATHERING 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.						
																		0	10	20	30	40	50
TOPSOIL											D	L					Sandy TOPSOIL, trace silt, minor organics; dark brown. Loose, dry.						
ALLUVIAL SEDIMENTS	100 HAND AUGER	24 hours after drilling				<ul style="list-style-type: none"> 98/36kPa 60/38kPa 156/94kPa 117/36kPa 115/32kPa 	1	49	1								Silty, fine SAND; light brown, streaked red. Loose, dry.						
							2	48	2		M							Silty, fine SAND, minor gravels; greyish brown streaked red. Loose, dry. - becomes moist. Fine SAND, some silt; greyish brown, streaked red. Loose, moist.					
							3	47	3		St								Sandy SILT; greyish red, streaked red. Stiff, wet, low plasticity.				
							4	46	4		Sat								- becomes very stiff. Sandy SILT, with trace fine gravel; light greyish brown. Very stiff, saturated, low plasticity.				
							5	45	5		MD									Silty, fine SAND; dark grey. Medium dense, saturated.			
							6	44	6														
							7	43	7														
							END OF BOREHOLE AT 5m.																
							Target depth.																

T&T DATATEMPLATE.GDT.crg



TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: BH3
 Hole Location: Proposed Access Road
 SHEET 1 OF 1

PROJECT: Suva Radio	LOCATION: Suva, Fiji	JOB No: 751078
CO-ORDINATES: 3881833.75 mN 1976741.38 mE	DRILL TYPE: 50mm Hand Auger	HOLE STARTED: 17/10/14
R.L.: 42.31 m	DRILL METHOD: HAND AUGER	HOLE FINISHED: 17/10/14
DATUM: Fiji Geodetic Datum 1986	DRILL FLUID: N/A	LOGGED BY: JWY CHECKED: ADP

GEOLOGICAL										ENGINEERING DESCRIPTION									
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.										SOIL DESCRIPTION									
FLUID LOSS										ROCK DESCRIPTION									
WATER										Substance: Rock type, particle size, colour, minor components.									
CORE RECOVERY (%)										Defects: Type, inclination, thickness, roughness, filling.									
METHOD																			
CASING																			
TESTS																			
SAMPLES																			
R.L. (m)																			
DEPTH (m)																			
GRAPHIC LOG																			
CLASSIFICATION SYMBOL																			
MOISTURE / WEATHERING CONDITION																			
STRENGTH/DENSITY CLASSIFICATION																			
										SHEAR STRENGTH (kPa)									
										COMPRESSIVE STRENGTH (kPa)									
										DEFECT SPACING (mm)									
TOPSOIL										Silty TOPSOIL; brown. Firm, dry.									
ALLUVIAL DEPOSITS										SILT, minor organics, trace clay; dark brown. Firm, dry.									
71/29kPa										- becomes dark brown, mottled light brown.									
81/28kPa										- becomes moist.									
104/49kPa										- becomes with minor clay.									
195/39kPa										- becomes hard.									
203/33kPa																			
203/49kPa										- becomes light brownish grey mottled brown. Becomes very stiff.									
187/42kPa																			
130/29kPa																			
143/33kPa										2.7m: iron stained gravels.									
160/42kPa																			
END OF BOREHOLE AT 3.6m.										Too stiff to auger.									

T&T DATATEMPLATE.GDT.crg



TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: BH4
 Hole Location: Mast Support
 Location
 SHEET 1 OF 1

PROJECT: Suva Radio	LOCATION: Suva, Fiji	JOB No: 751078
CO-ORDINATES: 3881896.06 mN 1976741.42 mE	DRILL TYPE: 50mm Hand Auger	HOLE STARTED: 17/10/14
R.L.: 35.50 m	DRILL METHOD: HAND AUGER	HOLE FINISHED: 17/10/14
DATUM: Fiji Geodetic Datum 1986	DRILL FLUID: N/A	DRILLED BY: JWY CHECKED: ADP

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.	
													0	100	0	1000			
SWAMP DEPOSITS	During Drilling	90	HA	• 24/20kPa		35			OL	W	S							Organic SILT, with rootlets; dark brown. Soft, wet, low plasticity.	
		40	HA	• 16/8kPa		1				Sat								- fibrous organics and rootlets.	
				• 24/18kPa			34												- becomes saturated.
				• 38/16kPa			2												- poor recovery of risings.
		10	HA	• 59/24kPa		2	33												SILT, minor organics and fine sand; dark brown. Soft, saturated, low plasticity.
ALLUVIAL DEPOSITS				• 52/39kPa		3			ML		St							- poor recovery of risings, becomes stiff.	
		40	HA	• 98/88kPa		3	32											Sandy SILT, trace fine gravels; grey. Stiff, saturated, low plasticity.	
						4			SM		MD							Silty SAND, trace medium gravels; dark grey. Medium dense, saturated.	
	100	HA				31			W	H								Sandy SILT; greenish grey. Hard, wet, low plasticity, weakly cemented.	
						5												END OF BOREHOLE AT 5m.	
																		Target depth.	

T-T DATATEMPLATE.GDT.cdf



TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No: BH5

Hole Location: New Mast
Location

SHEET 1 OF 1

PROJECT: Suva Radio		LOCATION: Suva, Fiji		JOB No: 751078				
CO-ORDINATES: 3881917.35 mN 1976804.49 mE		DRILL TYPE: 50mm Hand Auger		HOLE STARTED: 17/10/14				
R.L.: 35.16 m		DRILL METHOD: HAND AUGER		HOLE FINISHED: 17/10/14				
DATUM: Fiji Geodetic Datum 1986		DRILL FLUID: N/A		LOGGED BY: JWY CHECKED: ADP				
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 / WEATHERING 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.
SWAMP DEPOSITS	During drilling	16/8kPa 20/13kPa 26/16kPa 29/23kPa 16/10kPa	35 34 33 32	OL W S Sat				Organic SILT, with some rootlets; dark brown. Soft, wct. - very poor recovery.
ALLUVIAL SEDIMENTS	70 HA	20/16kPa	32	ML				Sandy SILT; dark grey. Soft, saturated, low plasticity.
	0 HA		31	SW	L			Silty, fine SAND; dark grey. Loose, saturated, poorly graded. - poor recovery. - recovery improves.
ALLUVIAL SEDIMENTS	100 HA		30	SW	Sat L			- trace gravels and medium sand. 5.1m: grades siltier. 5.4m: grades sandier. Silty, medium to fine SAND, minor organics and trace coarse sand; dark grey. Loose, saturated.
			29					END OF BOREHOLE AT 6m. Target depth.

T-T DATATEMPLATE.GDT.cgr



TONKIN & TAYLOR

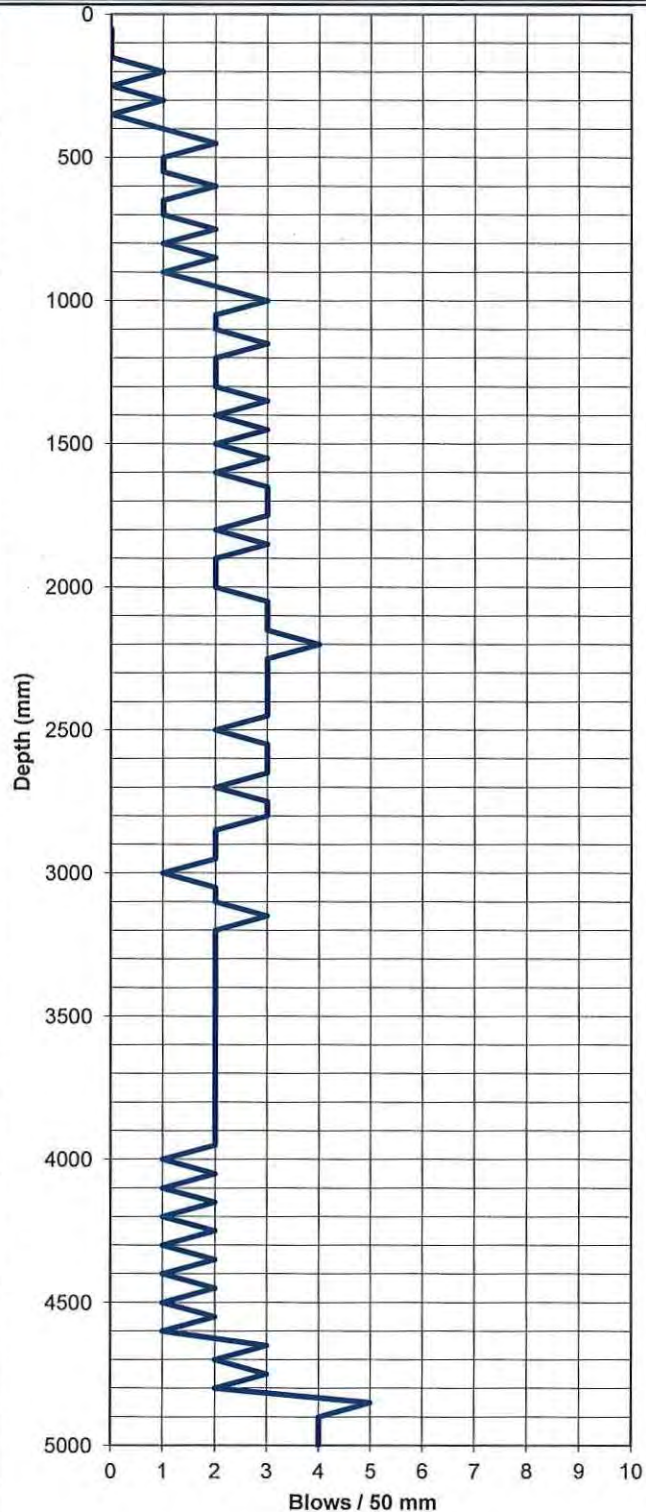
SCALA PENETROMETER LOG

Job No: 751078
 Project: Suva Radio
 Location: Suva
 RL:

Date: 16/10/2014
 Operated by: JWY
 Logged by: JWY
 Checked by:

Test No. SC1
 Sheet of 1
 of 1

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



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



Yachiyo Engineering Company
 Suva Radio
 REFERENCE No. 751078

October 2014

(1)



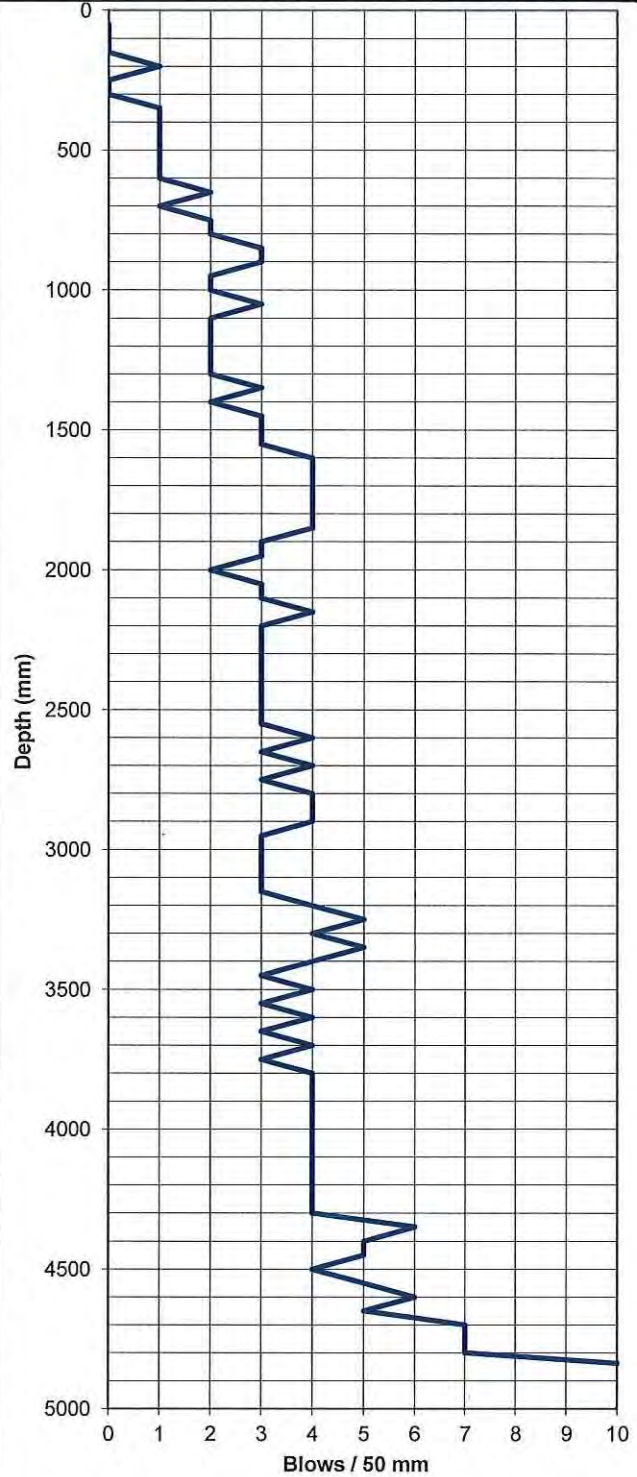
SCALA PENETROMETER LOG

Job No: 751078
 Project: Suva Radio
 Location: Suva
 RL:

Date: 16/10/2014
 Operated by: JWY
 Logged by: JWY
 Checked by:

Test No. SC2
 Sheet of 1/1

mm Driven	No. of Blows	mm Driven	No. of Blows
50	0	2550	3
100	0	2600	4
150	0	2650	3
200	1	2700	4
250	0	2750	3
300	0	2800	4
350	1	2850	4
400	1	2900	4
450	1	2950	3
500	1	3000	3
550	1	3050	3
600	1	3100	3
650	2	3150	3
700	1	3200	4
750	2	3250	5
800	2	3300	4
850	3	3350	5
900	3	3400	4
950	2	3450	3
1000	2	3500	4
1050	3	3550	3
1100	2	3600	4
1150	2	3650	3
1200	2	3700	4
1250	2	3750	3
1300	2	3800	4
1350	3	3850	4
1400	2	3900	4
1450	3	3950	4
1500	3	4000	4
1550	3	4050	4
1600	4	4100	4
1650	4	4150	4
1700	4	4200	4
1750	4	4250	4
1800	4	4300	4
1850	4	4350	6
1900	3	4400	5
1950	3	4450	5
2000	2	4500	4
2050	3	4550	5
2100	3	4600	6
2150	4	4650	5
2200	3	4700	7
2250	3	4750	7
2300	3	4800	7
2350	3	4850	11
2400	3	4900	11
2450	3	4950	
2500	3	5000	



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





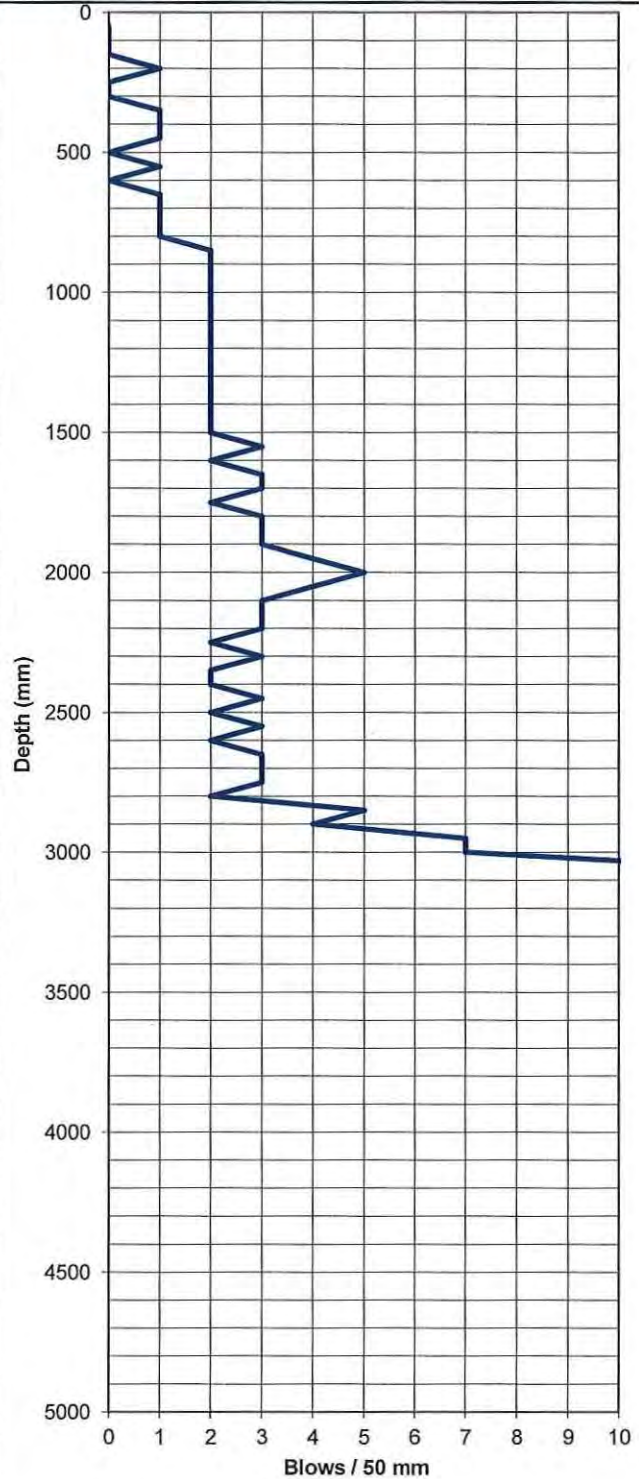
TONKIN & TAYLOR
SCALA PENETROMETER LOG

Job No: **751078**
 Project: **Suva Radio**
 Location: **Suva**
 RL:

Date: **17/10/2014**
 Operated by: **JWY**
 Logged by: **JWY**
 Checked by:

Test No.	SC3
Sheet of	1 / 1

mm Driven	No. of Blows	mm Driven	No. of Blows
50	0	2550	3
100	0	2600	2
150	0	2650	3
200	1	2700	3
250	0	2750	3
300	0	2800	2
350	1	2850	5
400	1	2900	4
450	1	2950	7
500	0	3000	7
550	1	3050	12
600	0	3100	13
650	1	3150	
700	1	3200	
750	1	3250	
800	1	3300	
850	2	3350	
900	2	3400	
950	2	3450	
1000	2	3500	
1050	2	3550	
1100	2	3600	
1150	2	3650	
1200	2	3700	
1250	2	3750	
1300	2	3800	
1350	2	3850	
1400	2	3900	
1450	2	3950	
1500	2	4000	
1550	3	4050	
1600	2	4100	
1650	3	4150	
1700	3	4200	
1750	2	4250	
1800	3	4300	
1850	3	4350	
1900	3	4400	
1950	4	4450	
2000	5	4500	
2050	4	4550	
2100	3	4600	
2150	3	4650	
2200	3	4700	
2250	2	4750	
2300	3	4800	
2350	2	4850	
2400	2	4900	
2450	3	4950	
2500	2	5000	



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



Yachiyo Engineering Company
 Suva Radio
 REFERENCE No. 751078

October 2014

(1)



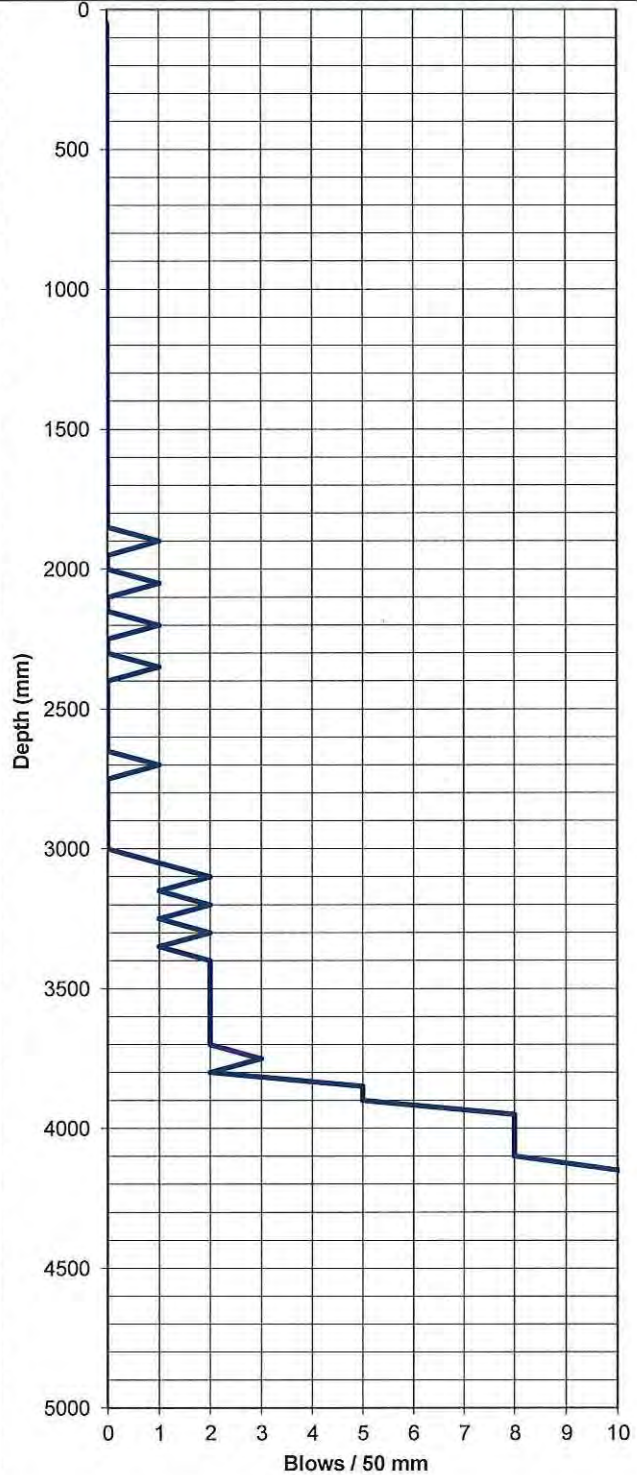
SCALA PENETROMETER LOG

Job No: 751078
 Project: Suva Radio
 Location: Suva
 RL:

Date: 17/10/2014
 Operated by: JWY
 Logged by: JWY
 Checked by:

Test No.	SC4
Sheet of	1 / 1

mm Driven	No. of Blows	mm Driven	No. of Blows
50	0	2550	0
100	0	2600	0
150	0	2650	0
200	0	2700	1
250	0	2750	0
300	0	2800	0
350	0	2850	0
400	0	2900	0
450	0	2950	0
500	0	3000	0
550	0	3050	1
600	0	3100	2
650	0	3150	1
700	0	3200	2
750	0	3250	1
800	0	3300	2
850	0	3350	1
900	0	3400	2
950	0	3450	2
1000	0	3500	2
1050	0	3550	2
1100	0	3600	2
1150	0	3650	2
1200	0	3700	2
1250	0	3750	3
1300	0	3800	2
1350	0	3850	5
1400	0	3900	5
1450	0	3950	8
1500	0	4000	8
1550	0	4050	8
1600	0	4100	8
1650	0	4150	10
1700	0	4200	16
1750	0	4250	
1800	0	4300	
1850	0	4350	
1900	1	4400	
1950	0	4450	
2000	0	4500	
2050	1	4550	
2100	0	4600	
2150	0	4650	
2200	1	4700	
2250	0	4750	
2300	0	4800	
2350	1	4850	
2400	0	4900	
2450	0	4950	
2500	0	5000	



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



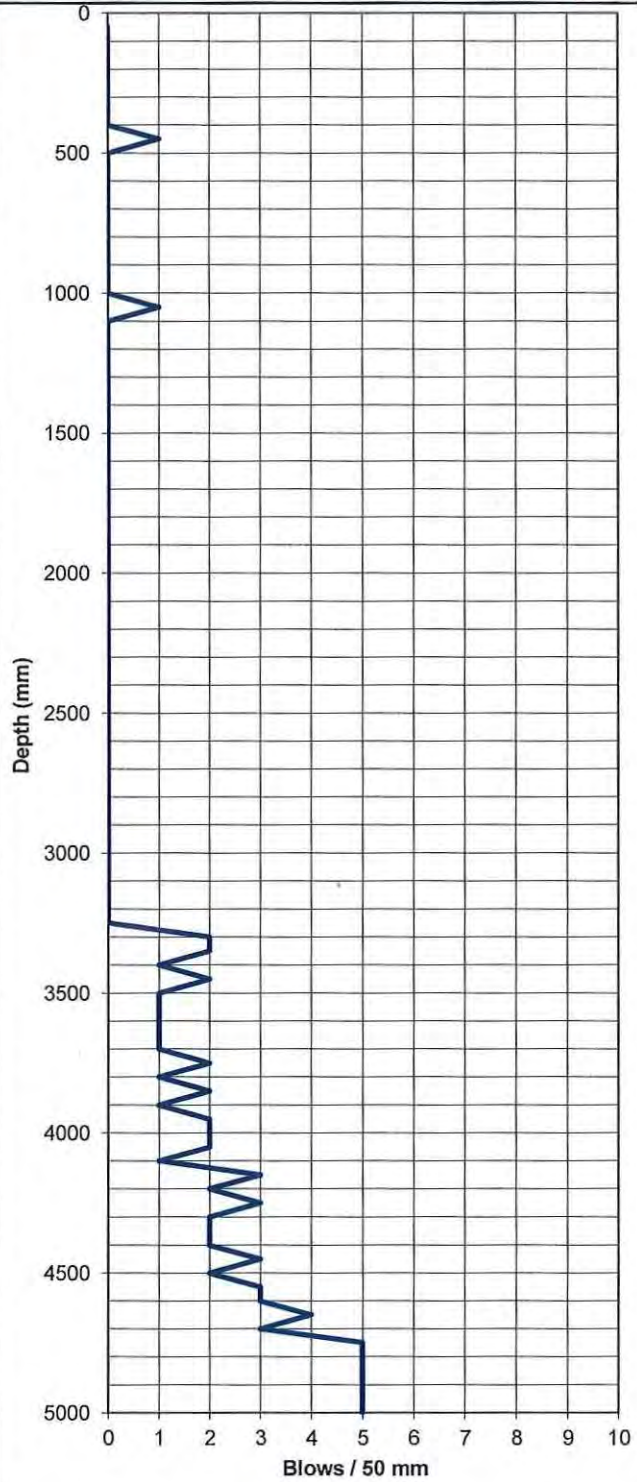
TONKIN & TAYLOR
SCALA PENETROMETER LOG

Job No: **751078**
Project: **Suva Radio**
Location: **Suva**
RL:

Date: **17/10/2014**
Operated by: **JWY**
Logged by: **JWY**
Checked by:

Test No.	SC5
Sheet of	1 / 2

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



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



Yachiyo Engineering Company
Suva Radio
REFERENCE No. 751078

October 2014



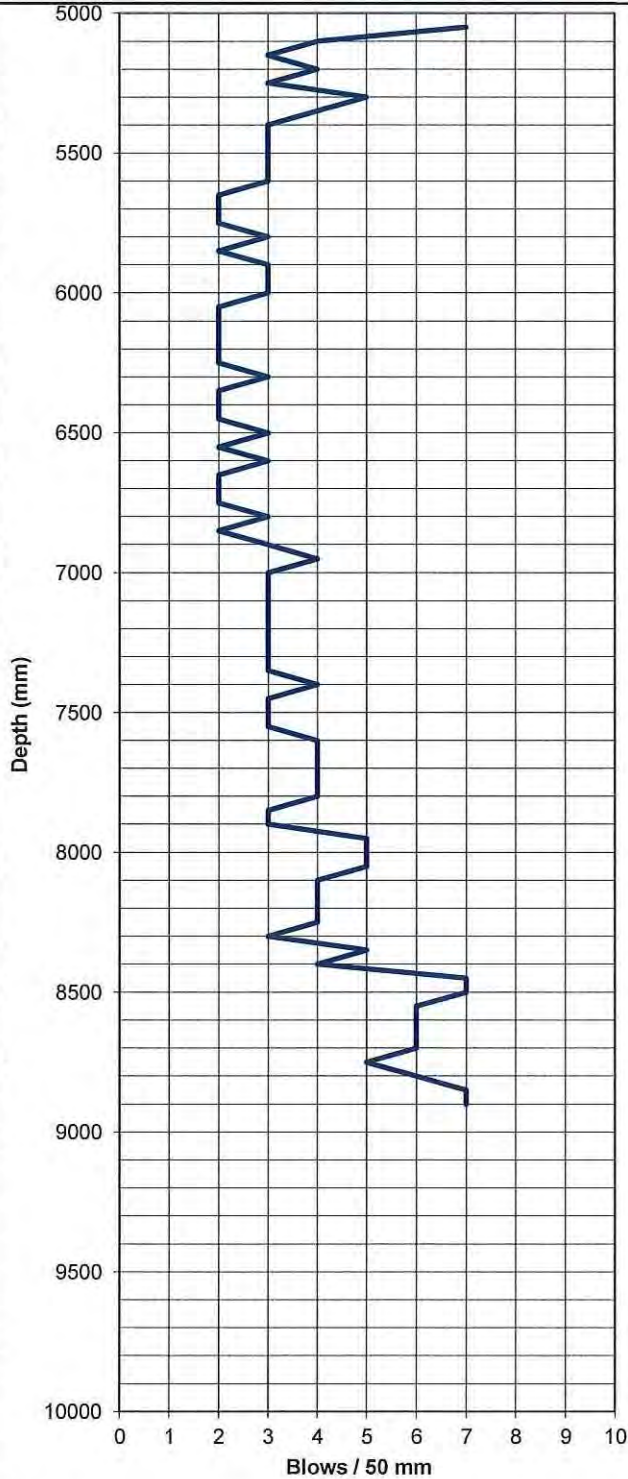
SCALA PENETROMETER LOG

Job No: 751078
 Project: Suva Radio
 Location: Suva
 RL:

Date: 17/10/2014
 Operated by: JWY
 Logged by: JWY
 Checked by:

Test No.	SC5
Sheet of	2 / 2

mm Driven	No. of Blows	mm Driven	No. of Blows
5050	7	7550	3
5100	4	7600	4
5150	3	7650	4
5200	4	7700	4
5250	3	7750	4
5300	5	7800	4
5350	4	7850	3
5400	3	7900	3
5450	3	7950	5
5500	3	8000	5
5550	3	8050	5
5600	3	8100	4
5650	2	8150	4
5700	2	8200	4
5750	2	8250	4
5800	3	8300	3
5850	2	8350	5
5900	3	8400	4
5950	3	8450	7
6000	3	8500	7
6050	2	8550	6
6100	2	8600	6
6150	2	8650	6
6200	2	8700	6
6250	2	8750	5
6300	3	8800	6
6350	2	8850	7
6400	2	8900	7
6450	2	8950	
6500	3	9000	
6550	2	9050	
6600	3	9100	
6650	2	9150	
6700	2	9200	
6750	2	9250	
6800	3	9300	
6850	2	9350	
6900	3	9400	
6950	4	9450	
7000	3	9500	
7050	3	9550	
7100	3	9600	
7150	3	9650	
7200	3	9700	
7250	3	9750	
7300	3	9800	
7350	3	9850	
7400	4	9900	
7450	3	9950	
7500	3	10000	



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





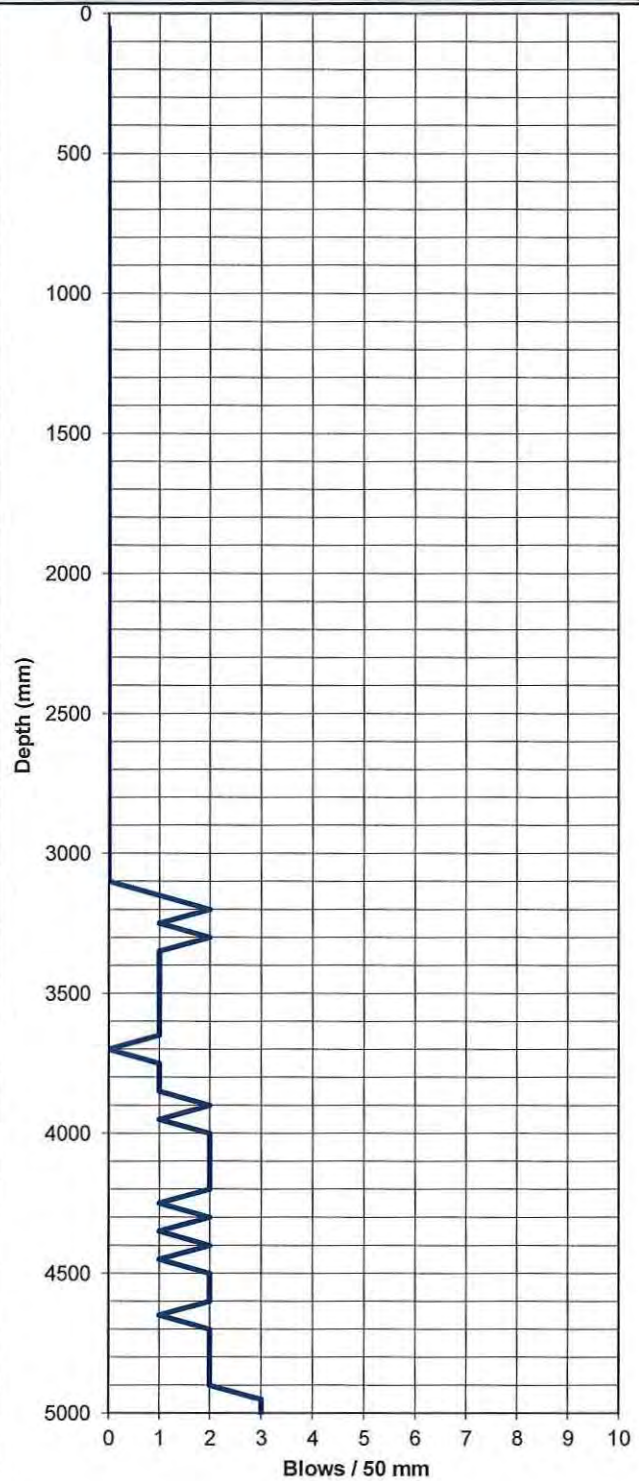
TONKIN & TAYLOR
SCALA PENETROMETER LOG

Job No: **751078**
 Project: **Suva Radio**
 Location: **Suva**
 RL:

Date: **19/10/2014**
 Operated by: **JWY**
 Logged by: **JWY**
 Checked by:

Test No.	SC6
Sheet of	1 / 1

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



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





TONKIN & TAYLOR

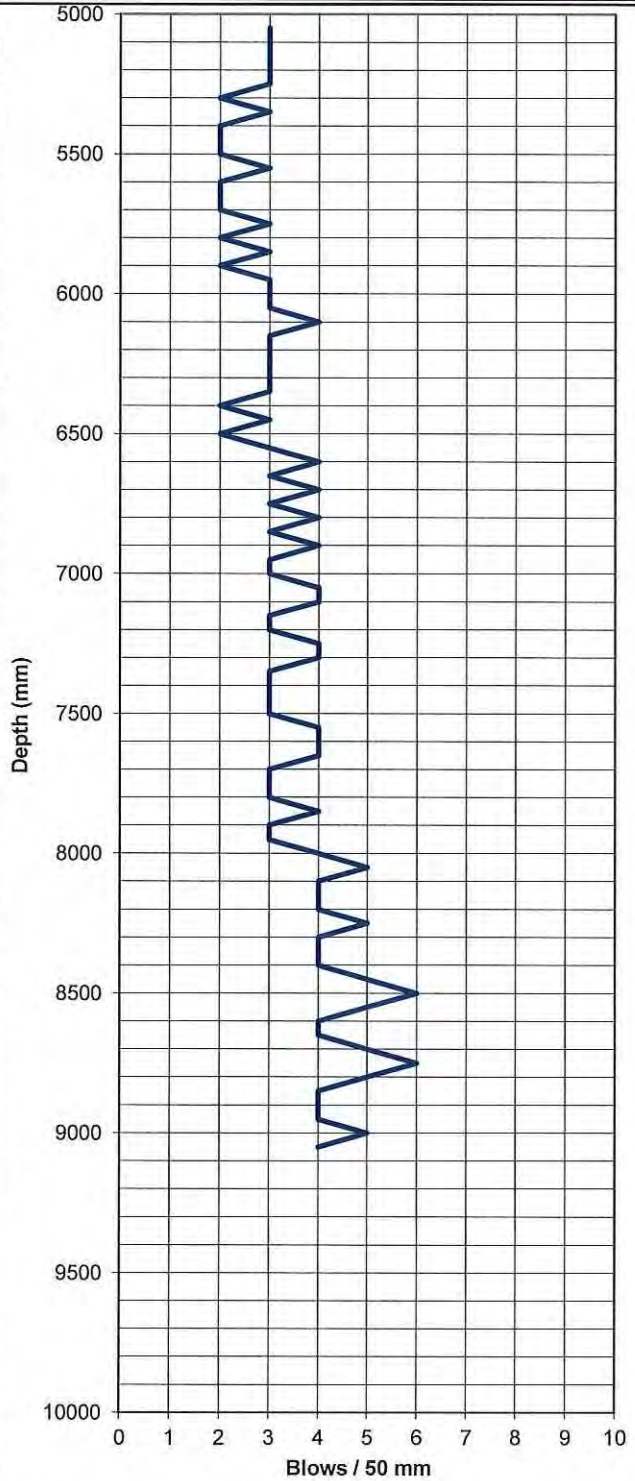
SCALA PENETROMETER LOG

Job No: 751078
 Project: Suva Radio
 Location: Suva
 RL:

Date: 17/10/2014
 Operated by: JWY
 Logged by: JWY
 Checked by:

Test No.	SC6
Sheet of	2 / 1

mm Driven	No. of Blows	mm Driven	No. of Blows
5050	3	7550	4
5100	3	7600	4
5150	3	7650	4
5200	3	7700	3
5250	3	7750	3
5300	2	7800	3
5350	3	7850	4
5400	2	7900	3
5450	2	7950	3
5500	2	8000	4
5550	3	8050	5
5600	2	8100	4
5650	2	8150	4
5700	2	8200	4
5750	3	8250	5
5800	2	8300	4
5850	3	8350	4
5900	2	8400	4
5950	3	8450	5
6000	3	8500	6
6050	3	8550	5
6100	4	8600	4
6150	3	8650	4
6200	3	8700	5
6250	3	8750	6
6300	3	8800	5
6350	3	8850	4
6400	2	8900	4
6450	3	8950	4
6500	2	9000	5
6550	3	9050	4
6600	4	9100	
6650	3	9150	
6700	4	9200	
6750	3	9250	
6800	4	9300	
6850	3	9350	
6900	4	9400	
6950	3	9450	
7000	3	9500	
7050	4	9550	
7100	4	9600	
7150	3	9650	
7200	3	9700	
7250	4	9750	
7300	4	9800	
7350	3	9850	
7400	3	9900	
7450	3	9950	
7500	3	10000	



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



Yachiyo Engineering Company
 Suva Radio
 REFERENCE No. 751078

October 2014

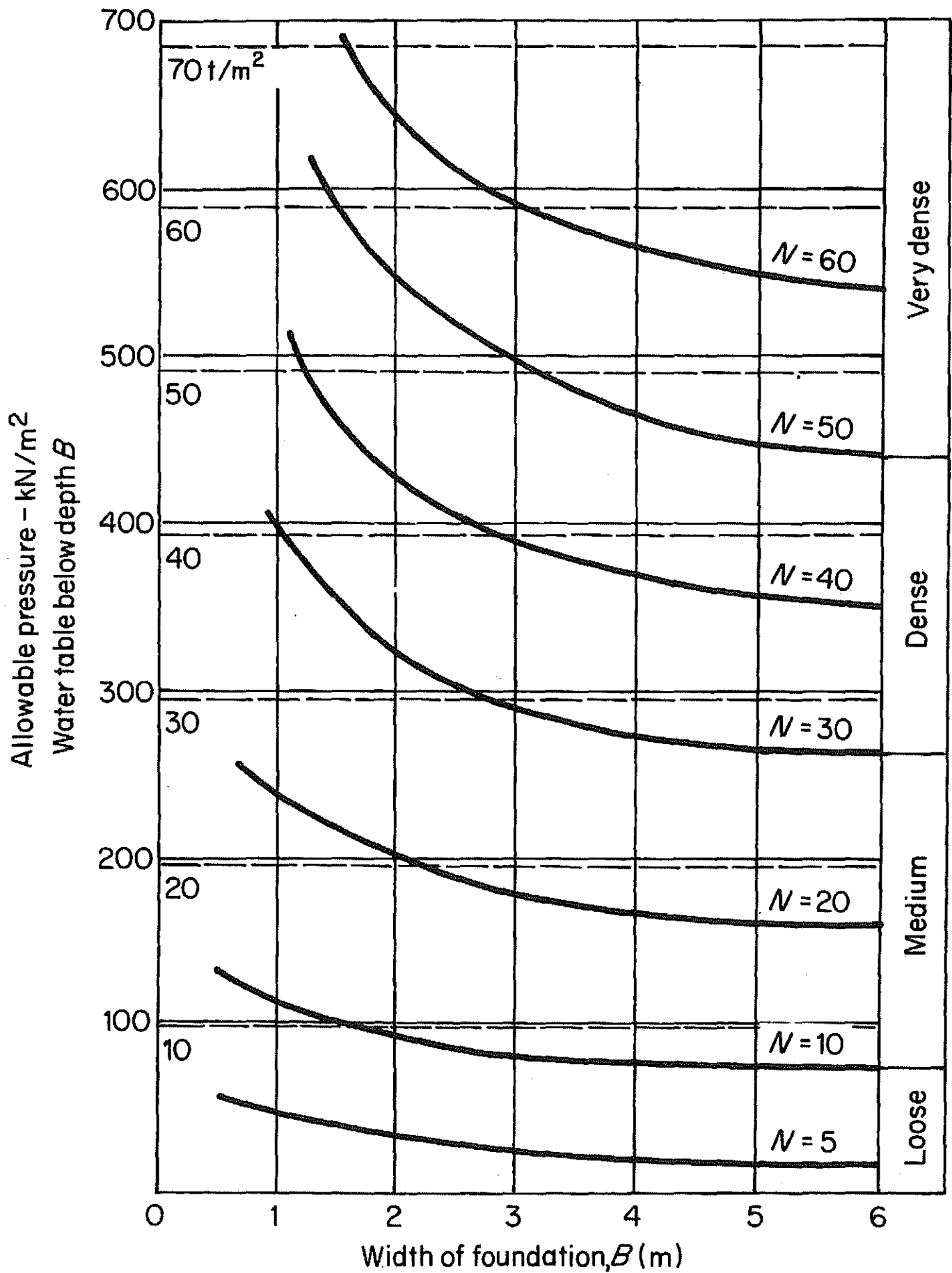


Fig. 2.19 Chart for estimating allowable bearing pressure for foundations in sand on basis of results of standard penetration test (Terzaghi and Peck^{2.8}). N values are shown in blows per 300 mm.

Appendix D:

Laboratory testing

10/10/10



23 Morgan Street, Newmarket
Auckland 1023, New Zealand
p. +64 9 356 3510
w. www.geotechnics.co.nz

File Path: \\1720\hr\casar\1501\density_Summary.doc

Page of

Your Job No.: 751078

Site : Suva Radio, Fiji

Our Job No.: 616417.000

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.:		1	1	2	2	3	3
Depth (m)		1.0-1.5	3.0-3.5	2.0	3.5	0.5-1.5	2.0-3.0
Solid Density (t/m ³)		2.68	2.69	2.65	2.66	2.78	2.80

Table 2: Solid Density

BH No.:		4	5
Depth (m)		3.5	6.0
Solid Density (t/m ³)		2.67	2.82

Remarks : The minimum mass for the test is less than the required by the method. Therefore the test results are not IANZ accredited.
The solid density was reported to the nearest 0.01 t/m³.

Tested by: *ST*

Date: *7/11/14*

Checked by: *AN*

Date: *7/11/14*



23 Morgan Street, Newmarket
Auckland 1023, New Zealand

p. +64 9 356 3510
w. www.geotechnics.co.nz

File: P:\616417\000\Working Material\BH4_3.5m_Wet Sieve.xls

Page of

Your Job No.: 751078

Site : Suva Radio, Fiji

Our Job No.: 616417.000

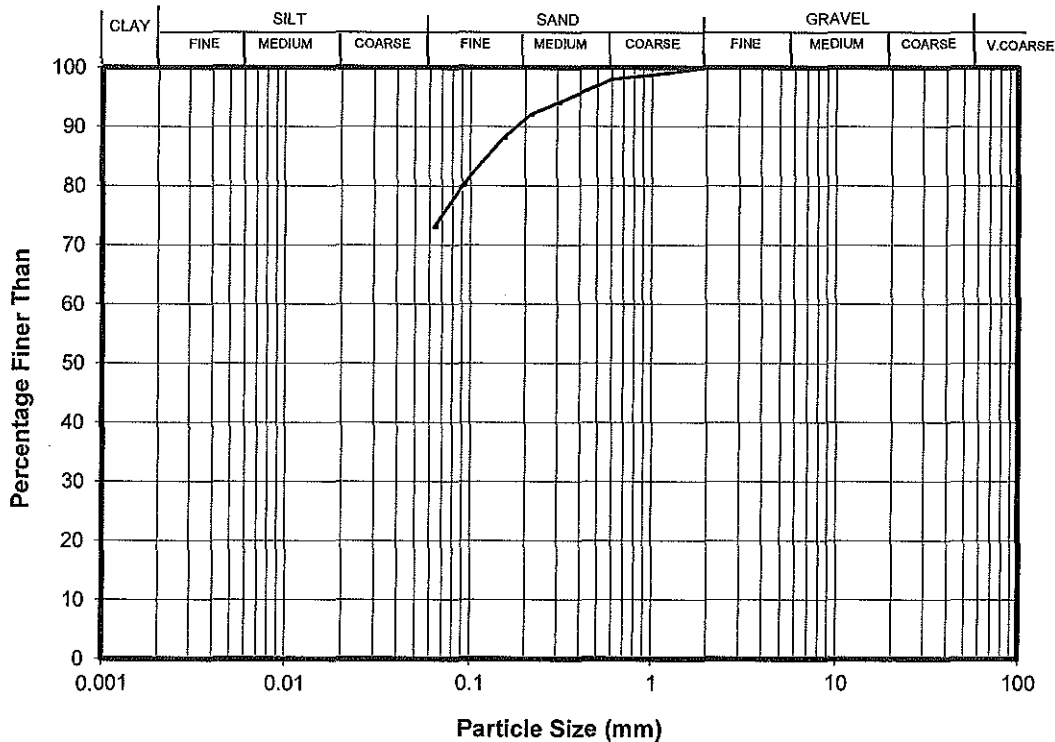
BH No.: 4

Sample No.: ---

Depth (m): 3.5

Test Method Used : NZS 4402 : 1986 Test 2.8.1 Wet Sieve

PARTICLE SIZE ANALYSIS



Sieve (mm)	Total % Passing
63.0	---
53.0	---
37.5	---
26.5	---
19.0	---
13.2	---
9.50	---
6.70	---
4.75	100
3.35	100

Sieve (mm)	Total % Passing
2.00	100
1.18	99
0.600	98
0.425	96
0.300	94
0.212	92
0.150	88
0.090	80
0.063	73

Sample history : As received.

Sample Description : sandy SILT with some clay, soft to firm, light greenish-dark grey, mottled black.

Remarks : The percentage passing the finest sieve was obtained by difference.
The sample description is not IANZ accredited.

Entered by : SJ

Date : 7/11/14

Checked by : AH

Date : 7/11/14



23 Morgan Street, Newmarket
 Auckland 1023, New Zealand
 p. +64 9 356 3510
 w. www.geotechnics.co.nz

File Path: \\P:\Marketing\external\G&G\Geotech\Documents\

Page of

Your Job No.: 751078

Site : Suva Radio, Fiji

Our Job No.: 616417.000

Test Method Used: NZS 4402:1986 Test 2.1 Determination of the water content

WATER CONTENT TEST RESULTS

Table 1: Water Content

BH No.:	1	1	2	2	3	3
Depth (m)	1.0-1.5	3.0-3.5	2.0	3.5	0.5-1.5	2.0-3.0
Water Content (%)	30.7	49.2	41.8	53.7	51.0	48.9

Table 2: Water Content

BH No.:	4	5
Depth (m)	3.5	6.0
Water Content (%)	72.9	56.7

Tested by: ST

Date: 11/11/14

Checked by: AH

Date: 11/11/14



23 Morgan Street, Newmarket
Auckland 1023, New Zealand

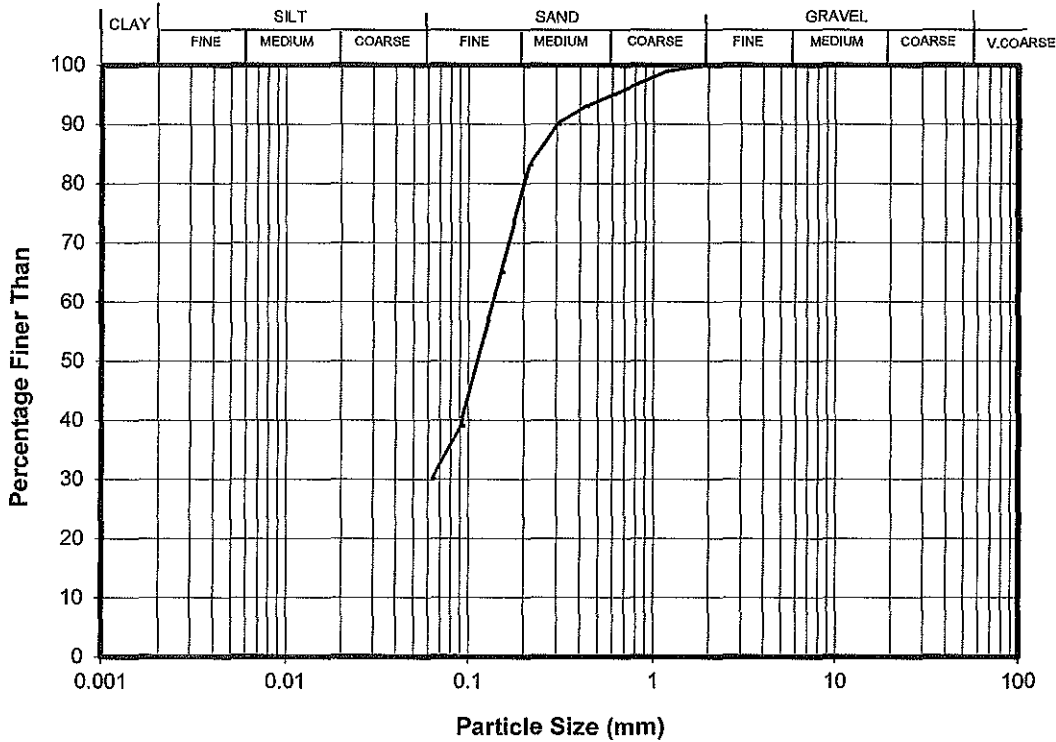
p. +64 9 356 3510

w. www.geotechnics.co.nz

File: P016417.000\Working Maps\BHI_1.0-1.5m_Wet Sieve.dwg

Page of Your Job No.: 751078
 Site : Suva Radio, Fiji Our Job No.: 616417.000
 BH No.: 1 Sample No.: --- Depth (m): 1.0-1.5
 Test Method Used : NZS 4402 : 1986 Test 2.8.1 Wet Sieve

PARTICLE SIZE ANALYSIS



Sieve (mm)	Total % Passing
63.0	---
53.0	---
37.5	---
26.5	---
19.0	---
13.2	---
9.50	---
6.70	---
4.75	---
3.35	100

Sieve (mm)	Total % Passing
2.00	100
1.18	99
0.600	95
0.425	93
0.300	90
0.212	83
0.150	65
0.090	39
0.063	30

Sample history : As received.

Sample Description : silty SAND with minor clay, soft, light yellowish-greyish brown with light red.

Remarks : The percentage passing the finest sieve was obtained by difference.
 The sample description is not IANZ accredited.

Entered by : ST

Date : 11/11/14

Checked by : AH

Date : 11/11/14



23 Morgan Street, Newmarket
Auckland 1023, New Zealand

p. +64 9 356 3510

w. www.geotechnics.co.nz

File: P:\616417.000\Working Material\BH_3.03.5m_Vet Sieve.xls

Page of

Your Job No.: 751078

Site : Suva Radio

Our Job No.: 616417.000

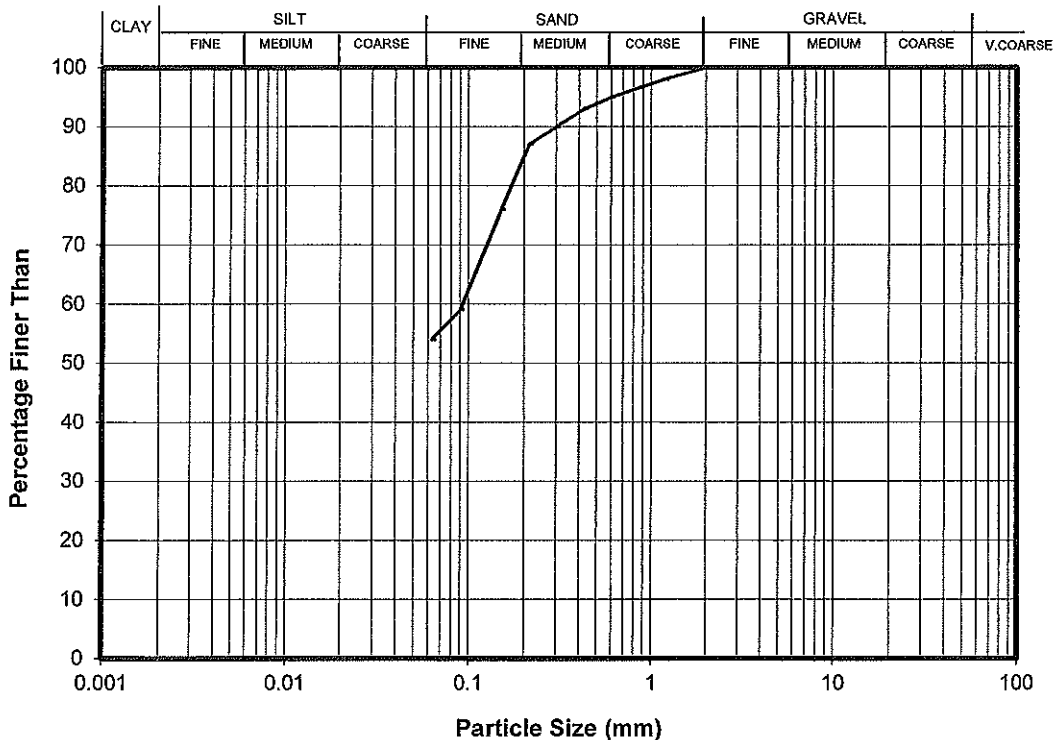
BH No.: 1

Sample No.: ---

Depth (m): 3.0-3.5

Test Method Used : NZS 4402 : 1986 Test 2.8.1 Wet Sieve

PARTICLE SIZE ANALYSIS



Sieve (mm)	Total % Passing
63.0	---
53.0	---
37.5	---
26.5	---
19.0	---
13.2	---
9.50	---
6.70	---
4.75	---
3.35	100

Sieve (mm)	Total % Passing
2.00	100
1.18	98
0.600	95
0.425	93
0.300	90
0.212	87
0.150	76
0.090	59
0.063	54

Sample history : As received.

Sample Description : sandy SILT with minor clay, soft to firm, light yellowish brown with light red.

Remarks : The percentage passing the finest sieve was obtained by difference.
The sample description is not IANZ accredited.

Entered by : ST

Date : 11/11/14

Checked by : AH

Date : 11/11/14



GEOTECHNICS

23 Morgan Street, Newmarket
Auckland 1023, New Zealand

p. +64 9 356 3510

w. www.geotechnics.co.nz

File: P:\16417\000\Working\16417_2\16417_Wet Sieve.doc

Page of

Your Job No.: 751078

Site : Suva Radio

Our Job No.: 616417.000

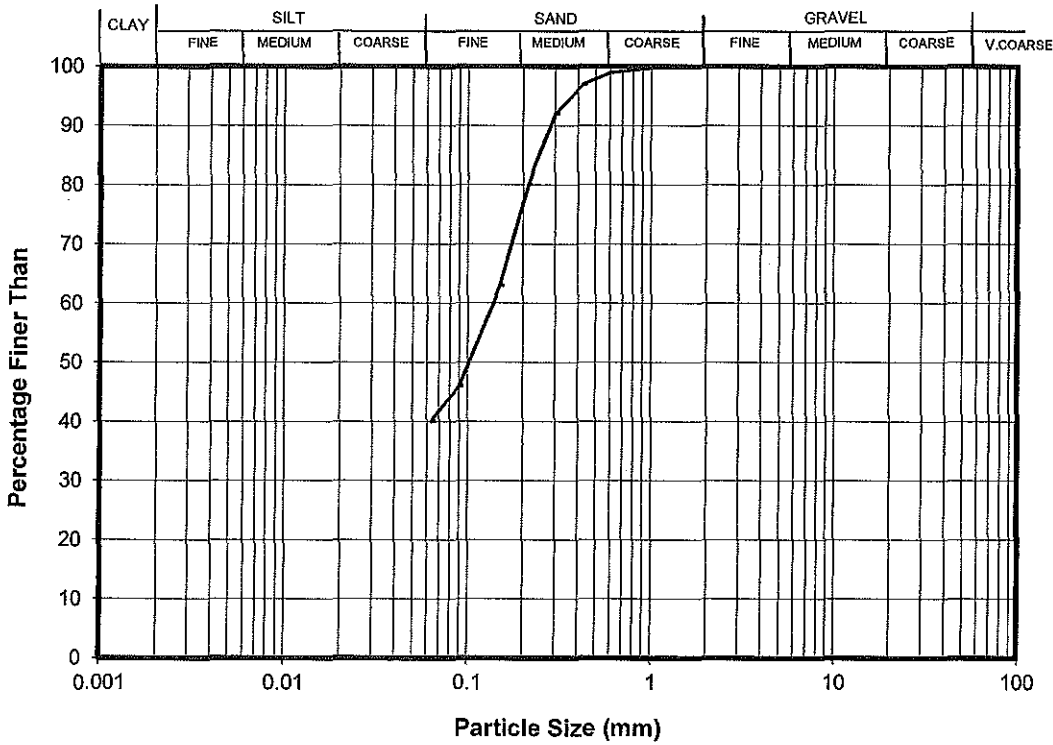
BH No.: 2

Sample No.: ---

Depth (m): 2.0

Test Method Used : NZS 4402 : 1986 Test 2.8.1 Wet Sieve

PARTICLE SIZE ANALYSIS



Sieve (mm)	Total % Passing
63.0	---
53.0	---
37.5	---
26.5	---
19.0	---
13.2	---
9.50	---
6.70	---
4.75	---
3.35	---

Sieve (mm)	Total % Passing
2.00	100
1.18	100
0.600	99
0.425	97
0.300	92
0.212	80
0.150	63
0.090	46
0.063	40

Sample history : As received.

Sample Description : silty SAND with minor clay, soft, light yellowish-greyish brown with light red.

Remarks : The percentage passing the finest sieve was obtained by difference.
The sample description is not IANZ accredited.

Entered by : ST

Date : 11/11/14

Checked by : AH

Date : 11/11/14



Page of

Your Job No.: 751078

Site : Suva Radio

Our Job No.: 616417.000

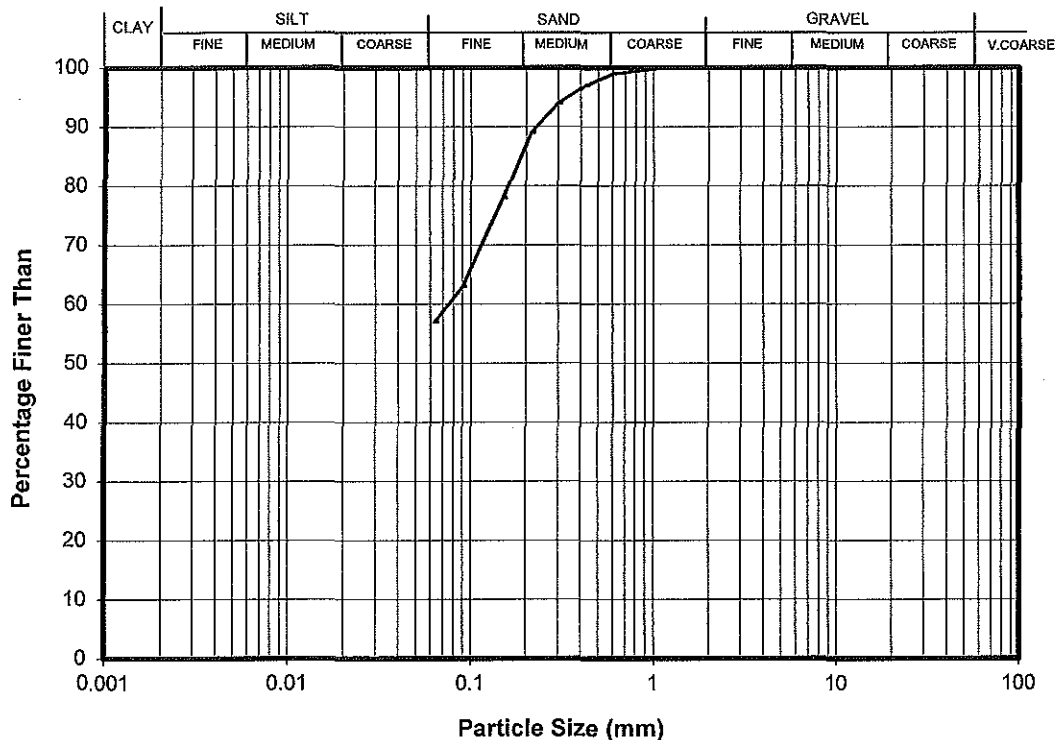
BH No.: 2

Sample No.: ---

Depth (m): 3.5

Test Method Used : NZS 4402 : 1986 Test 2.8.1 Wet Sieve

PARTICLE SIZE ANALYSIS



Sieve (mm)	Total % Passing
63.0	---
53.0	---
37.5	---
26.5	---
19.0	---
13.2	---
9.50	---
6.70	---
4.75	---
3.35	100

Sieve (mm)	Total % Passing
2.00	100
1.18	100
0.600	99
0.425	97
0.300	94
0.212	89
0.150	78
0.090	63
0.063	57

Sample history : As received.

Sample Description : sandy SILT with minor to some clay, soft, light yellowish-greyish brown with light red.

Remarks : The percentage passing the finest sieve was obtained by difference.
The sample description is not IANZ accredited.

Entered by : ST

Date : 11/11/14

Checked by : AH

Date : 11/11/14



GEOTECHNICS

23 Morgan Street, Newmarket
Auckland 1023, New Zealand

p. +64 9 356 3510

w. www.geotechnics.co.nz

File: P:\16417\000\Working\Kale\4\BFD_05-15m_Wet Sieve.doc

Page of

Your Job No.: 751078

Site : Suva Radio

Our Job No.: 616417.000

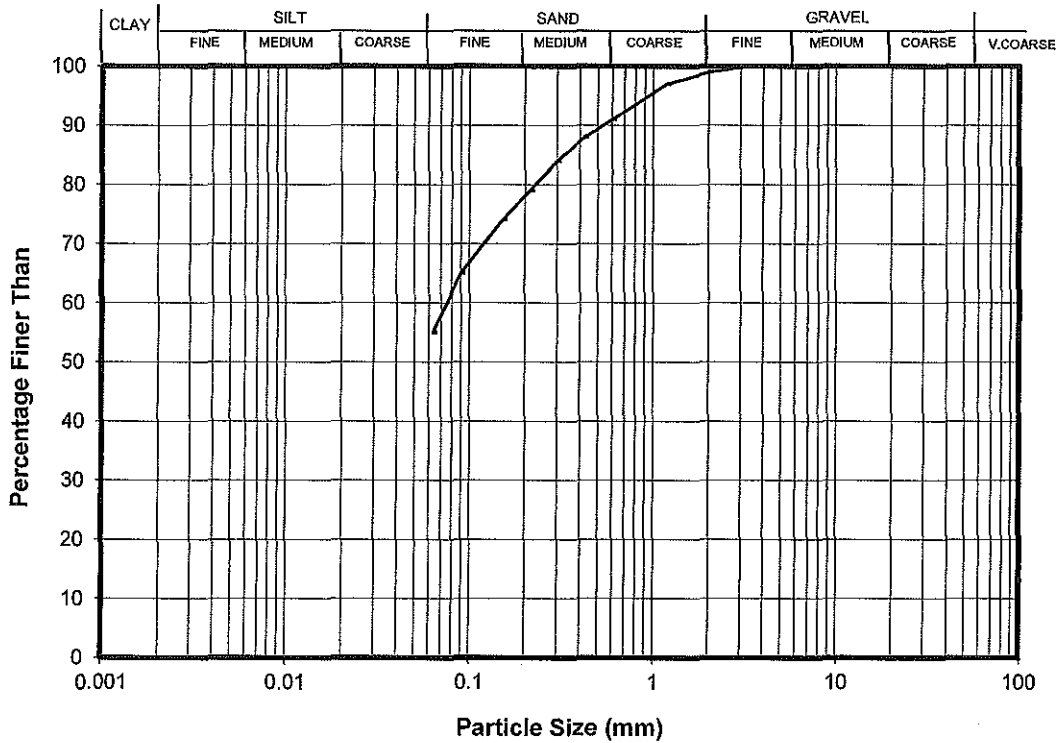
BH No.: 3

Sample No.: ---

Depth (m): 0.5-1.5

Test Method Used : NZS 4402 : 1986 Test 2.8.1 Wet Sieve

PARTICLE SIZE ANALYSIS



Sieve (mm)	Total % Passing
63.0	---
53.0	---
37.5	---
26.5	---
19.0	---
13.2	---
9.50	---
6.70	---
4.75	100
3.35	100

Sieve (mm)	Total % Passing
2.00	99
1.18	97
0.600	91
0.425	88
0.300	84
0.212	79
0.150	74
0.090	65
0.063	55

Sample history : As received.

Sample Description : sandy SILT with minor to some clay, soft, light yellowish brown, mottled red.

Remarks : The percentage passing the finest sieve was obtained by difference.
The sample description is not IANZ accredited.

Entered by : ST

Date : 11/11/14

Checked by : AH

Date : 11/11/14



GEOTECHNICS

23 Morgan Street, Newmarket
Auckland 1023, New Zealand

p. +64 9 356 3510

w. www.geotechnics.co.nz

File: P616417.000\Working Material\NHQ_2.03.0m_Wet Sieve.xlsx

Page of

Your Job No.: 751078

Site : Suva Radio

Our Job No.: 616417.000

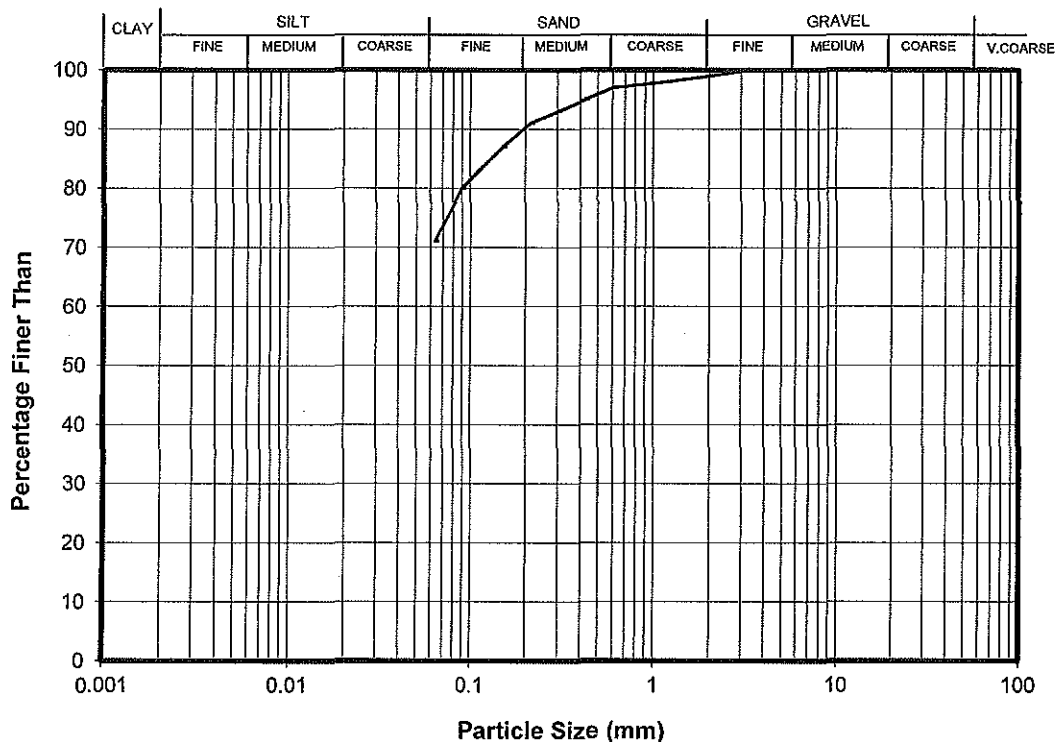
BH No.: 3

Sample No.: ---

Depth (m): 2.0-3.0

Test Method Used : NZS 4402 : 1986 Test 2.8.1 Wet Sieve

PARTICLE SIZE ANALYSIS



Sieve (mm)	Total % Passing
63.0	---
53.0	---
37.5	---
26.5	---
19.0	---
13.2	---
9.50	---
6.70	---
4.75	100
3.35	100

Sieve (mm)	Total % Passing
2.00	99
1.18	98
0.600	97
0.425	95
0.300	93
0.212	91
0.150	87
0.090	80
0.063	71

Sample history : As received.

Sample Description : sandy SILT with minor to some clay, firm to stiff, light yellowish-greyish brown, mottled red.

Remarks : The percentage passing the finest sieve was obtained by difference.
The sample description is not IANZ accredited.

Entered by : ST

Date : 11/11/14

Checked by : AH

Date : 11/11/14



GEOTECHNICS

23 Morgan Street, Newmarket
Auckland 1023, New Zealand

p. +64 9 356 3510

w. www.geotechnics.co.nz

File: P016417.000\Wading Marsh\BMS_6 On_Wet Sieve.xls

Page of

Your Job No.: 751078

Site : Suva Radio

Our Job No.: 616417.000

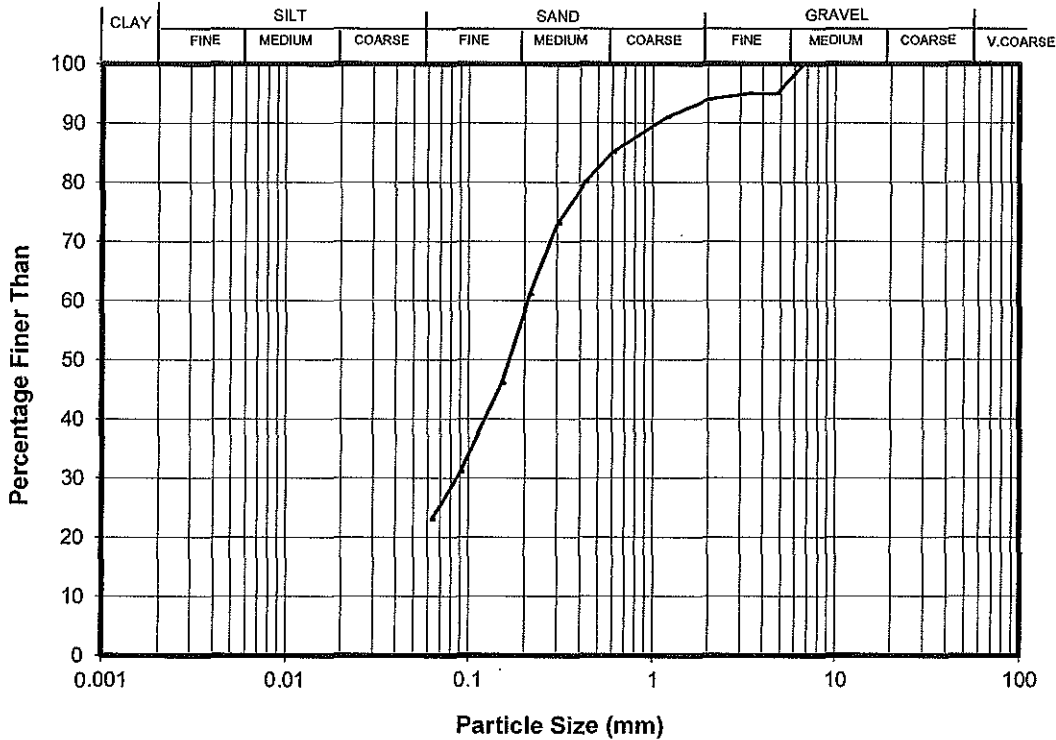
BH No.: 5

Sample No.: ---

Depth (m): 6.0

Test Method Used : NZS 4402 : 1986 Test 2.8.1 Wet Sieve

PARTICLE SIZE ANALYSIS



Sieve (mm)	Total % Passing
63.0	---
53.0	---
37.5	---
26.5	---
19.0	---
13.2	---
9.50	---
6.70	100
4.75	95
3.35	95

Sieve (mm)	Total % Passing
2.00	94
1.18	91
0.600	85
0.425	80
0.300	73
0.212	61
0.150	46
0.090	31
0.063	23

Sample history : As received.

Sample Description : silty SAND with trace of clay and trace of organics, soft, light greenish-dark grey, mottled black.

Remarks : The percentage passing the finest sieve was obtained by difference.
The sample description is not IANZ accredited.

Entered by : SJ

Date : 11/11/14

Checked by : AH

Date : 11/11/14



www.tonkin.co.nz

ENVIRONMENTAL AND ENGINEERING CONSULTANTS



REPORT

Yachiyo Engineering Company Ltd

The Rehabilitation of the Medium
Wave Radio Transmission in the
Republic of Fiji
Second phase of investigations

Report prepared for:
Yachiyo Engineering Company Ltd

Report prepared by:
Tonkin & Taylor International Ltd

Distribution:

Yachiyo Engineering Company Ltd	2 copies
Tonkin & Taylor International Ltd (FILE)	1 copy

March 2015

Job No: 751078



Table of contents

1	Introduction	1
	1.1 General	1
	1.2 Project Description	1
2	Site Description	1
3	Summary of temporary access road construction	2
4	Summary of the Soils investigations	2
	4.1 Geotechnical Investigation Equipment	2
	4.2 General	3
	4.3 Machine borehole Investigations	3
	4.3.1 Site 1- Field Test Location 1	3
	4.3.2 Site 2- Field Test Location 2	3
	4.3.3 Site 3- Field Test Location 3	4
	4.3.4 Site 4- Field Test Location 4	4
5	Subsurface Conditions	4
	5.1 Geological Setting	4
	5.2 Ground and Groundwater Conditions	4
	5.2.1 Site 1- Field test location 1	4
	5.2.2 Site 2- Field test location 2	5
	5.2.3 Site 3- Field test location 3	6
	5.2.4 Site 4- Field test location 4	6
6	Geotechnical Laboratory Testing Results	8
7	Discussion and Engineering properties	8
	7.1 Site Seismic Classification	9
	7.1.1 General	9
	7.1.2 Importance Level	9
	7.1.3 Peak Ground Acceleration	9
	7.2 Solid Density, Undrained Shear Strength, Cohesion and Internal Friction Angle Range	9
	7.3 Foundation Design	13
	7.3.1 General	13
	7.3.2 Piled Foundations	13
8	Applicability	15
	Appendix A : Contract of Soils Explorations	
	Appendix B : Soils Explorations Plans	
	Appendix C : Soils Explorations Logs	
	Appendix D : Core Photographs	
	Appendix E : Laboratory Testing	

1 Introduction

1.1 General

Tonkin and Taylor International (T&TI) was engaged by Yachiyo Engineering Co., Ltd. (YEC) to undertake deep soil investigations for a proposed new medium wave radio antenna and transmission house (defined herein as 'the site') in Suva, Fiji.

The investigations have been carried out in accordance with the "Contract of Soil Explorations" provided to T&TI by YEC. The soil investigations comprised 4 machine drilled boreholes and pressuremeter testing 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 geotechnical assessment was undertaken in accordance with our proposal dated 2 December 2014¹.

The scope of the geotechnical investigations has included:

- A review of relevant existing information held in T&TI archives.
- A site walkover by an engineering geologist from T&TI.
- Construction of a temporary access track to the borehole locations.
- Supervision of the construction of the access track.
- 4 Machine drilled boreholes to a maximum depth of 15.95m with SPT and shear vane testing at regular intervals.
- Pressuremeter testing at the location of BH1.
- 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

The republic of Fiji comprises an archipelago of more than 332 islands, of which 110 are permanently inhabited, and more than 500 islets, amounting to a total land area of about 18,300 square kilometres (7,100 sq mi). The two major islands, Viti Levu and Vanua Levu, account for 87% of the population of almost 860,000. The capital and largest city, Suva, is on Viti Levu.

The proposed works are part of the 'The Rehabilitation of the Medium Wave Radio Transmission in the Republic of Fiji', located east of Suva, approximately 4km west of Nausori airport.

The project involves construction of a new medium wave antenna mast and transmission house as well as temporary roads needed for access across the site. Excavation of the slope between the transmission house and the antenna mast will be required to establish a suitable grade for the access road.

2 Site Description

The site is located at the end of Naulu Road, Naulu, Fiji. The Site lies to the east of Suva city on the city fringes. The site is approximately 12km from Suva CBD and 4km from Nausori Airport.

¹ Tonkin and Taylor International Ltd. (2 December 2014) , Basic Design Study project for the Rehabilitation of the Medium Wave Radio Transmission for a site in Fiji- Stage 2, Deeper Soils Investigations

The site is located on a river terrace on the eastern outskirts of Suva. To the north, east and south of the site are the floodplains of the Rewa River. The Rewa River is located to the east of the site and the area surrounding the site consists of swamps and floodplain deposits with dense vegetative cover. The land to the west is largely residential with many small dwellings located along the western boundary of the site. The central section of the site comprises the existing buildings on gently sloping land (<math><5^\circ</math>) to the southwest. The banks of the terrace slope at approximately

The site, in its current layout includes an existing transmission house serving a telecommunications antenna. The telecommunications antenna is located slightly north of the current transmission house along a terraced portion of the site. The existing medium wave antenna is located to the south of the current transmission house.

The site of the proposed medium wave antenna is largely covered in vegetation, from small scrub and grass in the central section to dense bush located within the floodplains. Coconut palms lie along the western boundary of the site.

3 Summary of temporary access road construction

The works on site were completed between Wednesday 4 and 11 February 2015. The plant used consisted of three excavators and two bulldozers which were mobilised by Kwicksift to the site to complete the works. A temporary track was constructed using locally sourced fill from the site (weathered Suva Marl). The resulting track was approximately 200m in length and between 5-9m wide. The thickness of the fill placement over the swampy area was approximately 0.5m. Due to continued heavy rainfall the final completion of the access track was delayed until Wednesday 14 February.

4 Summary of the Soils investigations

4.1 Geotechnical Investigation Equipment

The geotechnical investigations were undertaken by Geotech Drilling International Ltd (GDI) under the supervision of T&TI. The machine drilled boreholes were performed using a tracked rig using HQT (HQ Triple Tube) wireline techniques with Standard Penetration Testing (SPT) performed at regular intervals. A photo of the equipment used is shown in Figures 4.1 and 4.2 below.



Figure 4.1: GDI drilling rig used during the investigations.



Figure 4.2: Pressuremeter

4.2 General

The soils investigations were carried out in February 2015 and the scope of work was completed in accordance with 'Contract of Soils Explorations' - appended for convenience in Appendix A. All field tests were terminated in hard ground following at least 5m of SPT 'N' counts greater than 30.

The following tasks were completed for the soils investigation:

- Field test location 1
 - 1 Machine borehole to 15.95m below existing ground level.
 - 2 Pressuremeter tests (at depths of 8.3 and 8.8m below existing ground level)-Both tests did not record reliable results due to collapse of the borehole.
- Field test location 2
 - 1 machine drilled borehole to 11.45m below existing ground level.
- Field test location 3
 - 1 machine drilled borehole to 11.45m below existing ground level.
- Field test location 4
 - 1 machine drilled borehole to 15.95m below existing ground level.

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

4.3 Machine borehole Investigations

The soil investigation testing, including machine drilled boreholes, was undertaken over a period of 4 days (9 February– 13 February 2015) at the site. In-situ shear strength testing was carried out in the machine drilled boreholes in cohesive materials using a calibrated pilcon shear vane and samples were taken 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. Standard Penetration Testing (SPT) was conducted in the boreholes within cohesive materials and the Suva Marl bedrock.

4.3.1 Site 1- Field Test Location 1

One machine drilled borehole was conducted at the Centre mast position (BH1). The machine drilled borehole extended to 15.95m. Groundwater was observed at 0.2m below existing ground level. The borehole was terminated once 5m of rock had been proven ('N'>30). Push tube samples were recovered at 3.5-4.0m and 9.5-10.0m. Pressuremeter testing was attempted within the borehole at depths of 8.3 and 8.8m below existing ground level. Testing did not record reliable results due to the collapse of the borehole.

4.3.2 Site 2- Field Test Location 2

One machine drilled borehole was conducted at the eastern support position (BH2). The machine drilled borehole extended to 11.45m. Groundwater was observed at 0.2m below existing ground level. The borehole was terminated once 5m of rock had been proven ('N'>30). A Push tube sample was recovered at 1.5-2.0m.

4.3.3 Site 3- Field Test Location 3

One machine drilled borehole was conducted at the western support position (BH3). The machine drilled borehole extended to 11.45m. Groundwater was observed at 0.2m below existing ground level. The borehole was terminated once 5m of rock had been proven ('N' $>$ 30).

4.3.4 Site 4- Field Test Location 4

One machine drilled borehole was conducted at the northern support position (BH4). The machine drilled borehole extended to 15.95m. Groundwater was observed at 0.2m below existing ground level. The borehole was terminated once 5m of rock had been proven ('N' $>$ 30). Push tube samples were recovered at 2.0-2.5m, 5.0-5.5m and 9.5-10.0m.

5 Subsurface Conditions

5.1 Geological Setting

Published Geological information² suggests the site is underlain by Suva Marl of Miocene age. To the north, east and south the site is underlain by recent alluvium.

Observations on site confirmed the presence of alluvial deposits overlying the Suva Marl at depths of between 4.5-10.5m below existing ground level. Suva Marl was also observed in road cuttings of the temporary access road.

A map of the local geology is shown in Figure 5.1 below.

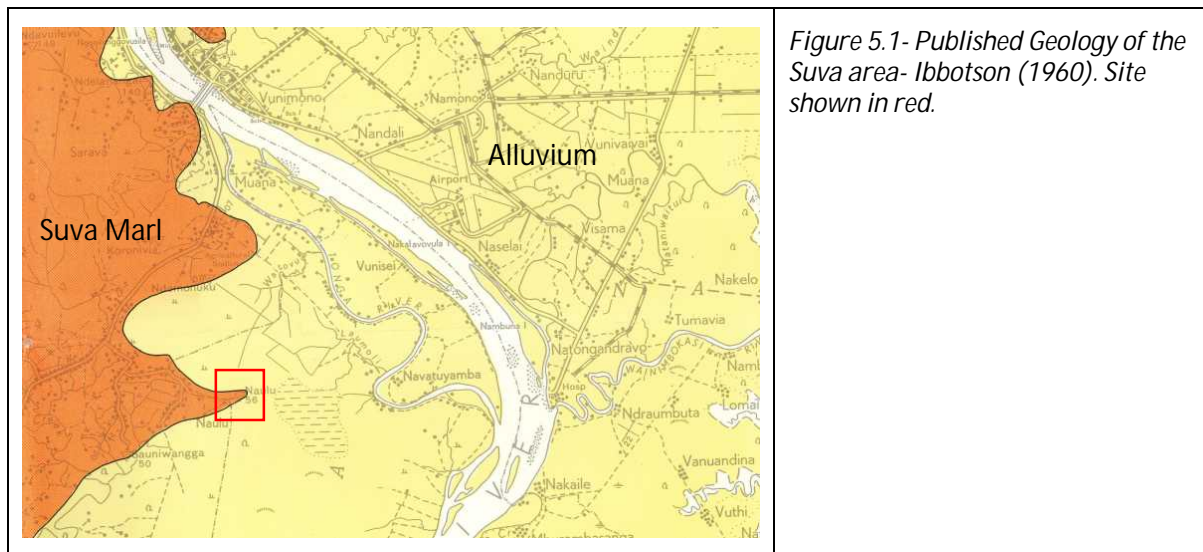


Figure 5.1- Published Geology of the Suva area- Ibbotson (1960). Site shown in red.

5.2 Ground and Groundwater Conditions

5.2.1 Site 1- Field test location 1

The subsurface conditions for the central mast location are summarised in Table 5.1. The investigations extended to 15.95m below ground level.

² Ibbotson,P, 1960, *Geology of the Suva Area, Viti Levu*, Geological Survey Department, Suva, Fiji,

Table 5.1: Summary of ground conditions (Site 1-Central Mast position)

Depth (Below ground level)	Geological Unit	Soil Description	Soil Undrained shear strength (Cu) *	Typical SPT 'N' value
0-1.5m (Core loss 0.3-1.5m)	Fill	Sandy SILT, some clay, brown, soft, moist, low plasticity	N/A	0
1.5-2.6m (Core loss 2.0-2.3m)	Organics	ORGANICS with rootlets, trace silt, black, very soft, wet	N/A	0
2.6-4.5m (Core loss 4.0-4.4m)	Alluvial Sediments	Sandy SILT with some organics, dark brownish grey, very soft, wet, low plasticity	6 kPa	0
4.5-6.5m	Alluvial Sediments	Silty fine SAND, some organics and decomposed wood, dark brownish grey, saturated, loose	N/A	0
6.5-8.7m (Core loss 6.5-7.25m)	Alluvial Sediments	Sandy SILT, some carbonaceous material and trace coarse gravels, dark grey, very soft, saturated, low plasticity	5kPa	5
8.7-10.1m	Highly Weathered Suva Marl	Highly weathered SILTSTONE (Sandy SILT, some coarse gravels, dark grey, stiff, wet)	10kPa	N/A
10.1-10.5m (Core loss 10.1-10.5m)	Slightly Weathered Suva Marl	Slightly Weathered bluish grey SILTSTONE, extremely weak, well cemented	N/A	N/A
10.5-15.95m	Unweathered Suva Marl	Unweathered bluish grey SILTSTONE, trace carbonaceous inclusions, extremely weak, well cemented, massive,	N/A	39-57

*Measurements taken using hand held pilcon shear vane in the end of the HQ (63.5mm) diameter open-barrel.

Groundwater encountered at 0.2m below ground level.

5.2.2 Site 2- Field test location 2

The subsurface conditions at the location of the eastern support location are summarized below. The investigations extended to 11.45m below ground level.

Table 5.2: Summary of ground conditions (Site 2-Eastern support position)

Depth (Below ground level)	Geological Unit	Soil Description	Soil Undrained shear strength (Cu)*	Typical SPT 'N' value
0.0-1.5m (core loss 0.2-1.5)	Fill	Sandy SILT, trace clay, brown, firm, wet, low plasticity	N/A	0
1.5-2.0m	Organics	Organics, some silt, fibrous with rootlets, blackish brown, very soft, wet, low plasticity	0kPa	0

2.0-4.0m	Organics	Organic SILT with rootlets, blackish brown, very soft, wet, low plasticity	6kPa	0
4.0-4.35m	Alluvial Sediments	Silty fine SAND, some organics including rootlets, dark brownish grey, loose, wet	N/A	1-5
4.35-4.90m	Slightly Weathered Suva Marl	Slightly weathered, dark bluish grey SILTSTONE, extremely weak, well cemented	N/A	N/A
4.90-11.45m (Core loss 5.45-5.6m)	Unweathered Suva Marl	Slightly weathered, dark bluish grey SILTSTONE, extremely weak, well cemented	N/A	30-50

*Measurements taken using hand held pilcon shear vane in the end of the HQ (63.5mm) diameter open-barrel.

Groundwater was encountered in this borehole at 0.1m below ground level.

5.2.3 Site 3- Field test location 3

The subsurface conditions for location 3 are summarised below. The investigations extended to 11.45m below ground level.

Table 5.3: Summary of ground conditions (Site 3-Western support location)

Depth (Below ground level)	Geological Unit	Soil Description	Soil Undrained shear strength (Cu)*	Typical SPT 'N' value
0.0-1.75m (Core loss 0.2-1.75m)	Fill	Sandy SILT, trace clay, brown, firm, wet, low plasticity	N/A	0
1.75-3.8m (Core loss 3.5-3.7m)	Organics	Organics, with rootlets, blackish brown, very soft, wet, low plasticity	0-6kPa	0
3.8-4.6m	Alluvial Sediments	Silty Fine SAND, some organics, dark grey, loose, wet	N/A	N/A
4.6-5.0m	Slightly Weathered Suva Marl	Slightly weathered dark bluish grey SILTSTONE, extremely weak, well cemented	N/A	N/A
5.0-11.45m (Core loss 5.5-9.5m)	Unweathered Suva Marl	Unweathered dark bluish grey SILTSTONE, extremely weak, well cemented, carbonaceous	N/A	34-46

*Measurement taken using hand held pilcon shear vane in the end of the HQ (63.5mm) diameter open-barrel.

Groundwater was encountered at 0.1m below ground level.

5.2.4 Site 4- Field test location 4

The subsurface conditions for location 4 are summarised below. The investigations extended to 15.95m below ground level.

Table 5.4: Summary of ground conditions (Site 4-Northern support location)

Depth (Below ground level)	Geological Unit	Soil Description	Soil Undrained shear strength (Cu)*	Typical SPT 'N' value
0.0-1.5m (Core loss 0.25-1.5m)	Fill	Sandy SILT, trace clay, brown, soft, wet, low plasticity	N/A	0
1.5-3.5m (Core loss 2.5-2.85m)	Organics	ORGANICS, fibrous with rootlets, minor silt blackish brown, very soft, wet, low plasticity	6kPa	0
3.5-4.45m	Organics	Organic SILT, some rootlets, minor fine sand, dark brownish grey, very soft, wet, low plasticity	N/A	0
4.45-5.5m	Alluvial Sediments	Medium to fine SAND, some silt, minor organics, minor gravels, dark grey, loose, wet	N/A	0
5.5-6.0m	Alluvial Sediments	Silty fine SAND, minor organics ad fine gravels, dark brownish grey, loose, saturated	N/A	0
6.0-6.4m	Alluvial Sediments	SILT, minor fine sand and organics, dark brownish grey, very soft, wet, low plasticity	N/A	0
6.4-7.7m	Alluvial Sediments	Silty fine SAND, trace calcareous inclusions, dark grey, loose, wet	N/A	0
7.7-8.45m	Alluvial Sediments	Silty fine SAND, some organics, minor fine gravel, trace coarse gravel, dark greyish brown, loose, wet, dark	N/A	0
8.45-9.2m	Highly Weathered Suva Marl	Highly Weathered SILTSTONE (Clayey Silt, some fine to medium gravel, bluish grey mottled brown, firm, wet, low plasticity)	UTP	N/A
9.2-10.4m	Highly Weathered Suva Marl	Highly Weathered SILTSTONE (Sandy SILT, trace clay and fine gravels, bluish grey, mottled brown, firm ,wet)	UTP	N/A
10.4-15.95m	Unweathered Suva Marl	Unweathered dark bluish grey SILTSTONE, extremely weak, well cemented, massive	N/A	43-53

*Measurement taken using hand held pilcon shear vane in the end of the HQ (63.5mm) diameter open-barrel.

Groundwater was encountered at 0.1m below ground level.

6 Geotechnical Laboratory Testing Results

The following laboratory testing has been performed from samples taken by push tube or core samples during the soils investigations. The full set of laboratory testing results are shown in Appendix E.

Tables 6.1-6.3 summarises the testing results from samples collected during the geotechnical investigations.

Table 6.1: Laboratory testing summary-UU Triaxial tests

Machine Borehole No.	Sample Depth (m)	Undrained Shear Strength c_u (kPa)
1	9.73-9.85	45-55
4	9.78-9.90	33-37

Table 6.2: Laboratory testing summary-Solid Density

Machine Borehole No.	Sample Depth (m)	Average Solid Density (t/m^3)
1	15.5	2.75
1	11.0	2.77
2	6.5	2.74
2	4.8	2.76
2	9.5	2.80
3	5.0	2.70
3	11.0	2.69
4	10.0	2.77
4	11.0	2.78

Table 6.3: Laboratory testing summary- UCS testing

Machine Borehole No.	Sample Depth (m)	Unconfined compressive strength (kPa)
1	15.20	2641
2	8.70	1868
3	10.50	2376
4	10.80	1701

7 Discussion and Engineering properties

Recommendations and opinions in this report are based upon data from 4 No Machine borehole tests from the following sites.

- Field test location 1- Mast Centre
- Field test location 2- Eastern support position
- Field test location 3- Western support position

- Field test location 4- Northern support position

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 also using published empirical relationships, we have assessed the engineering properties for the underlying soils at the four sites for the designer's consideration in the following subsections.

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.

7.1 Site Seismic Classification

7.1.1 General

It is appropriate to design the foundations and structure in accordance with the New Zealand Standard NZS 1170.5:2004³ which is adopted in Fiji. From the geotechnical investigations undertaken we consider that the site should be classified as a Class C- (Shallow soil sites).

7.1.2 Importance Level

In accordance with NZS 1170.0:2002⁴ which is adopted in Fiji 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.

7.1.3 Peak Ground Acceleration

The probabilistic earthquake hazard assessment for Fiji prepared by Jones⁵ 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 7.1 below.

Table 7.1: 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	0.07	1 in 500 years	0.28

* 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.

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

Summaries of the approximate soil parameters for boreholes 1-4 are included in Table 7.2 - 7.5. These have been assessed using results of the site investigations and laboratory testing.

³ NZS 1170.5: 2004 *Structural design actions – Earthquake Actions (New Zealand)*. SANZ.

⁴ NZS 1170.0: 2002 *Structural design actions – Part 0: General Principles*

⁵ Jones, T, 1997, *Probabilistic Earthquake Hazard Assessment for Fiji*, AGSO, Canberra, Australia,

Table 7.2: Summary of Solid Density, Undrained Shear Strength, Effective Cohesion and Internal Friction Angle-Field Test location 1

Depth (Below existing ground level)	Soil Description	Unit Weight (KN/m ³)	Undrained Shear Strength, Cu (kPa)	Effective Cohesion C' (kPa)	Effective Internal Friction Angle ϕ (deg)
0-1.5m (Core loss 0.3-1.5m)	Sandy SILT, some clay, brown, soft, moist, low plasticity	18	N/A	2	25
1.5-2.6m (Core loss 2.0-2.3m)	ORGANICS with rootlets, trace silt, black, very soft, wet	18	N/A	2	25
2.6-4.5m (Core loss 4.0-4.4m)	Sandy SILT with some organics, dark brownish grey, very soft, wet, low plasticity	18	6KPa	2	25
4.5-6.5m	Silty fine SAND, some organics and decomposed wood, dark brownish grey, saturated, loose	18	N/A	0	25
6.5-8.7m (Core loss 6.5-7.25m)	Sandy SILT, some carbonaceous material and trace coarse gravels, dark grey, very soft, saturated, low plasticity	18	5kPa	2	25
8.7-10.1m	Highly weathered SILTSTONE (Sandy SILT, some coarse gravels, dark grey, soft, wet)	18	10kPa	5	28
10.1-10.5m (Core loss 10.1-10.5m)	Slightly Weathered bluish grey SILTSTONE, extremely weak, well cemented	19	N/A	15	30
10.5-15.95m	Unweathered bluish grey SILTSTONE, trace carbonaceous inclusions, extremely weak, well cemented, massive,	19	N/A	15	30

Table 7.3: Summary of Solid Density, Undrained Shear Strength, Cohesion and Internal Friction Angle- Field Test location 2

Depth	Soil Description	Unit Weight (KN/m ³)	Undrained Shear Strength, Cu (kPa)	Effective Cohesion C' (kPa)	Effective Internal Friction Angle ϕ (deg)
0.0-1.5m (core loss 0.2-1.5)	Sandy SILT, trace clay, brown, firm, wet, low plasticity	18	N/A	2	25
1.5-2.0m	Organics, some silt, fibrous with rootlets, blackish brown, very soft, wet, low plasticity	18	0kPa	2	25
2.0-4.0m	Organic SILT with rootlets, blackish brown, very soft, wet, low plasticity	18	6kPa	2	25
4.0-4.35m	Silty fine SAND, some organics including rootlets, dark brownish grey, loose, wet	18	N/A	0	25
4.35-4.90m	Slightly weathered, dark bluish grey SILTSTONE, extremely weak, well cemented	19	N/A	15	30
4.90-11.45m (Core loss 5.45-5.6m)	Slightly weathered, dark bluish grey SILTSTONE, extremely weak, well cemented	19	N/A	15	30

Table 7.4: Summary of Solid Density, Undrained Shear Strength, Cohesion and Internal Friction Angle- Field Test Location 3

Depth (Below existing ground level)	Soil Description	Unit Weight (KN/m ³)	Undrained Shear Strength, Cu (kPa)	Effective Cohesion C' (kPa)	Effective Internal Friction Angle ϕ (deg)
0.0-1.75m (Core loss 0.2-1.75m)	Sandy SILT, trace clay, brown, firm, wet, low plasticity	18	N/A	2	25
1.75-3.8m (Core loss 3.5-3.7m)	Organics, with rootlets, blackish brown, very soft, wet, low plasticity	18	0-6kPa	2	25
3.8-4.6m	Silty Fine SAND, some organics, dark grey, loose, wet	18	N/A	0	25
4.6-5.0m	Slightly weathered dark bluish grey SILTSTONE,	19	N/A	15	30

	extremely weak, well cemented				
5.0-11.45m (Core loss 5.5-9.5m)	Unweathered dark bluish grey SILTSTONE, extremely weak, well cemented, carbonaceous	19	N/A	15	30

Table 7.5: Summary of Solid Density, Undrained Shear Strength, Cohesion and Internal Friction Angle- Field test location 4

Depth	Soil Description	Unit Weight (KN/m ³)	Undrained Shear Strength, Cu (kPa)	Effective Cohesion C' (kPa)	Effective Internal Friction Angle ϕ (deg)
0.0-1.5m (Core loss 0.25-1.5m)	Sandy SILT, trace clay, brown, soft, wet, low plasticity	18	N/A	2	25
1.5-3.5m (Core loss 2.5-2.85m)	ORGANICS, fibrous with rootlets, minor silt blackish brown, very soft, wet, low plasticity	18	6kPa	2	25
3.5-4.45m	Organic SILT, some rootlets, minor fine sand, dark brownish grey, very soft, wet, low plasticity	18	N/A	2	25
4.45-5.5m	Silty Fine SAND, some organics, dark grey, loose, wet	18	N/A	0	25
5.5-6.0m	Silty fine SAND, minor organics ad fine gravels, dark brownish grey, loose, saturated	18	N/A	0	25
6.0-6.4m	SILT, minor fine sand and organics, dark brownish grey, very soft, wet, low plasticity	18	N/A	2	25
6.4-7.7m	Silty fine SAND, trace calcareous inclusions, dark grey, loose, wet	18	N/A	0	28
7.7-8.45m	Silty fine SAND, some organics, minor fine gravel, trace coarse gravel, greyish brown, loose, wet, dark	18	N/A	0	28
8.45-9.2m	Highly Weathered SILTSTONE (Clayey Silt, some fine to medium gravel, bluish grey mottled brown, firm, wet, low plasticity	18	UTP	5	28
9.2-10.4m	Highly Weathered SILTSTONE (Sandy SILT, trace clay and	19	UTP	5	28

	fine gravels, bluish grey, mottled brown, firm ,wet)				
10.4-15.95m	Unweathered dark bluish grey SILTSTONE, extremely weak, well cemented, massive	19	N/A	15	30

7.3 Foundation Design

7.3.1 General

Based on the site investigations at the Antenna location, the bearing capacities of the upper soil would not be adequate for shallow foundation design. It would not be feasible to construct deep pad foundations in very poor and wet ground. We also consider that the placement of large shallow pad foundations for the Antenna mast and supports could lead to large ground settlements.

Accordingly we consider that pile foundations would be suitable to support the proposed antenna and the antenna supports.

We recommend using a strength reduction factor of 0.5 ($\Phi_G=0.5$) 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 ($\Phi_G=0.3$) to give an allowable bearing capacity.

7.3.2 Piled Foundations

If the antenna loads are to be supported on piled foundations, these would need to be extended down to the Suva Marl rock material, found at a depth of approximately 10.5m bgl. Piles could be either driven steel tube or driven steel UC piles. The variation in rock levels based on our recent investigations (where rock has been observed at depths of between 4.5 – 10.5m bgl) should be taken into consideration.

The following strength reduction factor should be applied to the stated end bearing and skin friction capacities for ULS and working load design cases:

- Ultimate Limit State Strength reduction factor (ϕ_g) 0.5
- Working Load Strength reduction factor (ϕ_g) 0.33

Design criteria are presented below for these respective pile types.

7.3.2.1 Driven Piles

Driven steel UC piles may be considered to support the antenna. These would be driven to refusal into the Suva Marl rock.

The capacity of a driven pile may be calculated using pile driving formulae (e.g. Hiley), or using PDA (Pile Driving Analysis) equipment. If PDA testing is utilised, the ULS strength reduction factor can be increased from $\phi_g=0.5$ up to $\phi_g = 0.75$ provided that a minimum of 10% of the piles are tested.

We expect that the steel driven sections could penetrate 2 to 4 m into rock depending on the section size. Pile lengths are expected to be at least 12.5m below existing ground level.

Uncoated steel has the potential to corrode in contact with either the soil or atmosphere. Based upon published guidelines, we consider a corrosion rate of 0.015mm/face /year should be allowed for steel piles.

Table 7.7 displays pile capacities of driven universal column (UC) piles.

Table 7.7: Pile capacities of driven universal columns

Pile Material	Pile Size	Approximate driving energy required to install pile (tonne - metres)	Capacity to which piles may be driven to achieve - R_{Drive} (kN)	Maximum ultimate limit state capacity (kN)	
			Embedded within soil/weak rock	No pile testing ($\phi_g=0.5$)	Dynamic Testing 10% of the piles ($\phi_g=0.75$)
Steel - 300MPa grade	200UC46	2.3	1,000	500	750
	200UC52	2.6	1,140	570	850
	200UC60	3.0	1,320	660	990
	250UC73	3.5	1,600	800	1,200
	250UC89	4.4	2,000	1,000	1,500

If more than a single pile is required to support the design load, piles should be no closer than " $3 \times D$ " c/c to minimise group effects; where D = pile diameter.

8 Applicability

This report has been prepared for the benefit of Yachiyo Engineering Company Ltd 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.

During construction and excavation the site should be examined by an engineer competent to determine whether the exposed subsoils are consistent with those inferred in this report and in associated appendices. We would be happy to provide this service and believe your project would benefit from the continuity.

Tonkin & Taylor International Ltd

Environmental and Engineering Consultants

Report prepared by:

Reviewed for Tonkin & Taylor International Ltd by:

.....
 Jamie Yule
 Engineering Geologist

.....
 pp. Andy Pomfret
 Project Manager

Authorised for Tonkin & Taylor International Ltd by:

.....
 Chris Freer
 Project Director

JWY
 p:\751078\workingmaterial\751078_second stage report-jwy.docx

Appendix B: Soils Explorations Plans

THE PROJECT FOR THE REHABILITATION OF
THE MEDIUM WAVE RADIO TRANSMISSION
IN THE REPUBLIC OF FIJI
CONTRACT OF SOILS EXPLORATIONS
STAGE 2, DEEPER SOILS INVESTIGATIONS



LOCATION GUIDES
(not to scale)



SOIL TEST LOCATION SCHEDULE

Name	Easting (m)	Northing (m)	RL (m)
MB1	1976825.5	3881918.5	35.1
MB2	1976837.0	3881883.7	35.1
MB3	1976789.7	3881925.9	35.2
MB4	1976849.8	3881945.8	34.8

SURVEY MARK SCHEDULE

Name	Easting (m)	Northing (m)	RL (m)
IT NAULU (TRIG)	1977010.03	3881722.55	47.92
IR(3) SO5572	1976734.84	3881638.53	49.59
IT Boundary (1)	1976725.32	3881786.69	50.21
IT Boundary (2)	1976817.28	3881789.66	50.33
IT Boundary (3)	1976865.26	3881767.05	50.08
IT Boundary (4)	1976720.75	3881932.40	35.52
IT Boundary (5)	1976844.42	3882042.20	34.81
BMNAIL1	1976771.52	3881733.96	50.00
BMNAIL2	1976786.17	3881696.86	49.04
OIT (Unknown)	1976725.95	3881769.12	50.24
OIT (Unknown)	1976728.01	3881706.67	49.33

Note:

BMNAIL1 is flush within concrete stay block between house and transmitter buildings.

BMNAIL2 is in concrete kerb alongside southern access to transmitter buildings yard.

Not all trees shown (generally only those along western site boundary, and those at the top of the slope north of existing buildings)

Four machine boreholes (MB1 - MB4) were conducted in February 2015. A pressuremeter test was also conducted at site MB1. The locations of MB1 - MB4 and the Access Road were supplied by YEC. RLs listed for MB1-MB4 are the October 2014 ground levels at the supplied locations.

SURVEY DATUM: FIJI GEODETIC DATUM 1986
(Coordinate and Bearing Origins from SO 5572)
HEIGHT DATUM: ASSUMED
(BMNAIL1 = 50.00m)

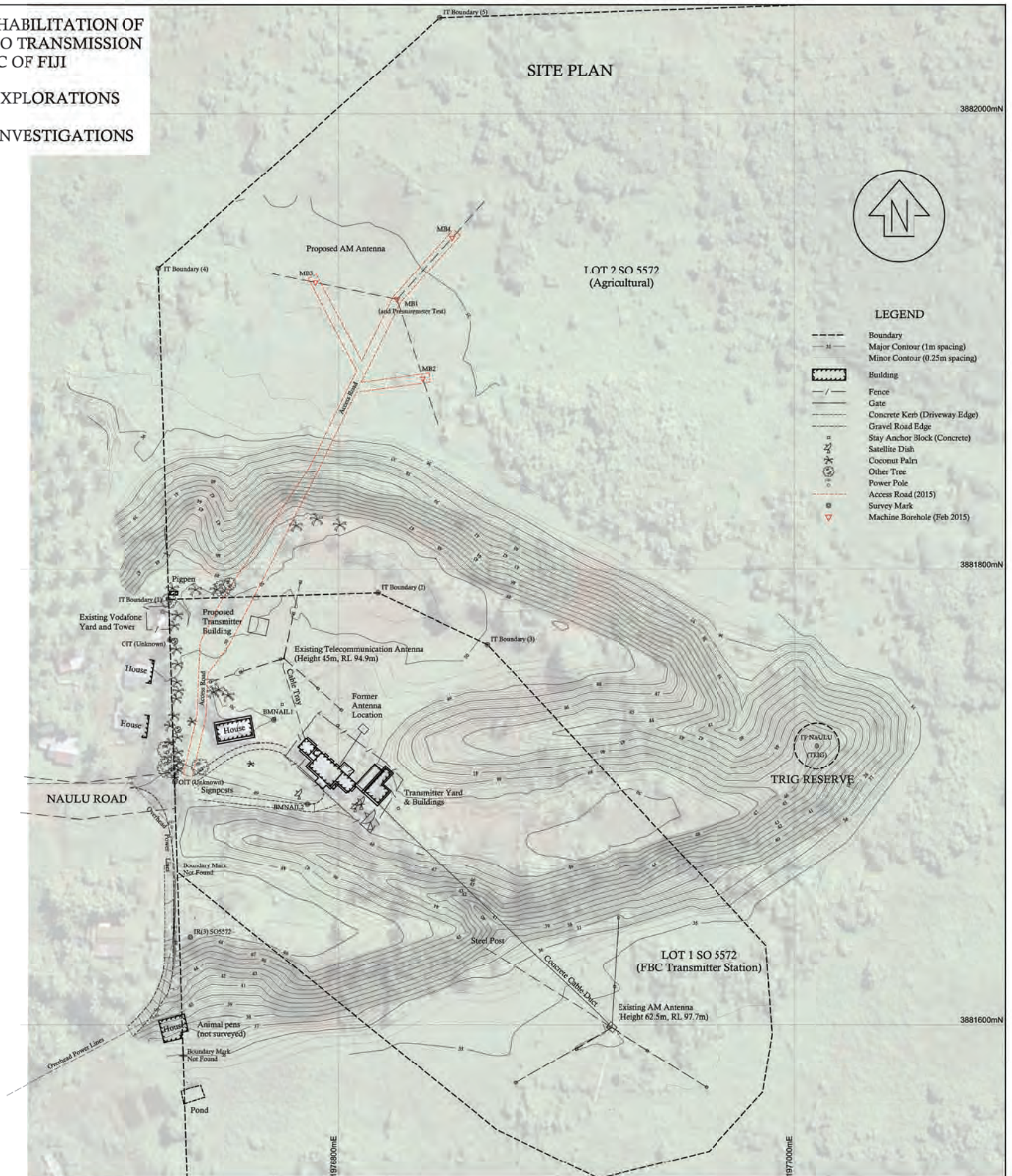
Survey Conducted 16 - 18 October 2014, using:

Sokkia GPS RTK (GNSS Receiver)
Model: GRX1/U
Serial Numbers: 633-00426
633-00141

Sokkia Total Station (Reflectorless)
Model: SET4130R3
Serial Number: 145240

Revision	Description	Approved	Date
F	Access Road Location Added, and Machine Borehole Locations Amended		16-03-15
E	Deeper Soils Investigation Locations Added		20-02-15
D	Section Locations A - A and B - B Shown		05-11-14
C	Equipment Description Amended		30-10-14
B	Test Location Labels Amended		29-10-14
A	For Information		28-10-14

Client



LEGEND

- Boundary
- - - Major Contour (1m spacing)
- Minor Contour (0.25m spacing)
- ▭ Building
- / - Fence
- Gate
- Concrete Kerb (Driveway Edge)
- Gravel Road Edge
- Stay Anchor Block (Concrete)
- Satellite Dish
- Coconut Palm
- Other Tree
- Power Pole
- Access Road (2015)
- Survey Mark
- Machine Borehole (Feb 2015)

Drawn	ES	Scale	1:1000 (A1) 1:2000 (A3)	Title	Dwg. No.
Designed					
Surveyed	ES	Project	Fiji	Topographical Survey Fiji Broadcasting Corp. site, Naulu Road, Nasinu Viti Levu, FIJI	Job No. 14018
Project					

A-6-77

Appendix C: Soils Explorations Logs

- BH1-BH4



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH1

SHEET 1 OF 4

DRILLED BY:

LOGGED BY: JWY

CHECKED:

START DATE: 11/2/15

FINISH DATE: 11/2/15

CONTRACTOR: GB

PROJECT: Suva Radio

JOB No: 751078

LOCATION: FBC Site, Naulu Road, Suva

CO-ORDINATES: 18.06694 °S
178.53106 °E

DIRECTION:

ANGLE FROM HORIZ.:

R.L. GROUND: 35.70m

R.L. COLLAR:

DATUM: Assumed

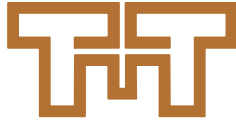
SURVEY: WGS84

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering LW SW HW CW	Rock Strength ES SS MS LS WS VS EW	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS			Water Loss (%) 25 50 75	Water Level	Casing	Installation	Core Box
										Defect Log	Fracture Spacing (cm)	ROD %					
FILL	Sandy SILT, with some clay; brown. Soft, moist, low plasticity.																
	0.3-1.5m: CORE LOSS.																
ORGANIC ALLUVIAL DEPOSITS	ORGANICS, with rootlets, trace silt; black. Very soft, wet.			HQ3	100												
	2-2.3m: CORE LOSS.																
	Sandy SILT, with some organics; dark brownish grey. Very soft, wet, low plasticity.			HQ3	80												
	3.5-4m: Push Tube			PT		6kPa in barrel											
	4-4.4m: CORE LOSS.																
	Silty, fine SAND, some organics and decomposed wood; dark brownish grey. Loose, saturated.			HQ3	60												

2-4hrs after drilling

T-T DATATEMPLATE.GDTL.jib

COMMENTS:



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH1

SHEET 2 OF 4

DRILLED BY:

LOGGED BY: JWY

CHECKED:

START DATE: 11/2/15

FINISH DATE: 11/2/15

CONTRACTOR: GB

PROJECT: Suva Radio

JOB No: 751078

LOCATION: FBC Site, Naulu Road, Suva

CO-ORDINATES: 18.06694 °S
178.53106 °E

R.L. GROUND: 35.70m

R.L. COLLAR:

DATUM: Assumed

SURVEY: WGS84

DIRECTION:

ANGLE FROM HORIZ.:

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering LW SW HW CW	Rock Strength ES SS MS LS VS LV VW VH EV	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS			Water Loss (%) 25 50 75	Water Level	Casing	Installation	Core Box
										Defect Log	Fracture Spacing (cm)	ROD %					
ORGANIC ALLUVIAL DEPOSITS	5-5.75m: CORE LOSS. Silty, fine SAND, as above.			HQ3	50		30.5	5.5									
ALLUVIAL SEDIMENTS	6.5-7.25m: CORE LOSS. Sandy SILT, some carbonaceous material and trace coarse gravels; dark grey. Very soft, saturated, low plasticity.			HQ3	50	5kPa in barrel Sample	29.0	7.0									
HW SUVA MARL	Highly weathered, Suva Marl (SILTSTONE). Soil Description: Sandy SILT, some coarse gravel; dark grey. Loose, wet.			HQ3	75		27.0	9.0									
				SPT	30		27.5	8.5									
				PT		10kPa	26.0	9.5									

COMMENTS:

T&T DATATEMPLATE.GDT1.jib

Log Scale 1:25

GENERAL LOG 751078BH2.GPJ 16-Mar-2015



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH1

SHEET 3 OF 4

DRILLED BY:

LOGGED BY: JWY

CHECKED:

START DATE: 11/2/15

FINISH DATE: 11/2/15

CONTRACTOR: GB

PROJECT: Suva Radio

JOB No: 751078

LOCATION: FBC Site, Naulu Road, Suva

CO-ORDINATES: 18.06694 °S
178.53106 °E

R.L. GROUND: 35.70m

R.L. COLLAR:

DATUM: Assumed

SURVEY: WGS84

DIRECTION:

ANGLE FROM HORIZ.:

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering LW SW HW CW	Rock Strength ES SS MS LS LV LW EW	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS			Water Loss (%) 25 50 75	Water Level	Casing	Installation	Core Box	
										Defect Log	Fracture Spacing (cm)	ROD %						
SUVA MARL	Slightly weathered, bluish grey SILTSTONE. Extremely weak, well cemented. 10.1-10.5m: CORE LOSS.			HQ3	55	UCS Sample	25.5	10.5	X									
	Unweathered, bluish grey SILTSTONE. Extremely weak, well cemented, massive. With trace carbonaceous material.			SPT	100	14 15 20 29 N=39	24.5	11.0	X									
				HQ3	100		24.0	12.0	X									
	Unweathered, bluish grey, fine SANDSTONE. Very weak, well cemented, massive.			SPT	100	13 20 26 N=46	23.0	12.5	X									
				HQ3	100		23.5	13.0	X									
	Unweathered, bluish grey SILTSTONE. Very weak, well cemented.			HQ3	100		22.5	13.5	X									
				SPT	100	12 25 25 N=50	21.5	14.0	X									
				HQ3	100		21.0	14.5	X									
				HQ3	100		15.0		X									

COMMENTS:

T-T DATATEMPLATE.GDT.jib



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH2

SHEET 1 OF 3

DRILLED BY:

LOGGED BY: JWY

CHECKED:

START DATE: 9/2/15

FINISH DATE: 9/2/15

CONTRACTOR: GB

PROJECT: Suva Radio

JOB No: 751078

LOCATION: FBC Site, Naulu Road, Suva

CO-ORDINATES: 18.06725 °S
178.53117 °E

R.L. GROUND: 36.00m

R.L. COLLAR:

DATUM: Assumed

SURVEY: WGS84

DIRECTION:

ANGLE FROM HORIZ.:

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering LW SW HW CW	Rock Strength ES SS MS LS WS VS EW	Sampling Method	Core Recovery (%)	Testing	RL (m)	36.5	Depth (m)	Graphic Log	ROCK DEFECTS			Water Loss (%) 25 50 75	Water Level	Casing	Installation	Core Box
											Defect Log	Fracture Spacing (cm)	ROD %					
FILL	Sandy SILT, trace clay; brown. Firm, wet, low plasticity. 0.2-1.5m: CORE LOSS.			HQ3	13		36.0											
ORGANIC ALLUVIAL DEPOSITS	Organics, some silt; black, fibrous with rootlets. Very soft, wet, low plasticity. 1.5-2m: Push Tube			PT			34.5											
	Grades to Organic SILT, with rootlets; blackish brown. Very soft, wet, low plasticity.						34.0											
	- becomes dark brownish grey.			HQ3	90		33.5											
SUVA MARL	Silty, fine SAND, some organics including rootlets; dark brownish grey. Loose, wet.						32.5											
	Slightly weathered, dark bluish grey SILTSTONE. Extremely weak, well cemented.			HQ3	100		32.0											

COMMENTS:

T-T DATATEMPLATE.GDT1.jib



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH3

SHEET 1 OF 3

DRILLED BY:

LOGGED BY: JWY

CHECKED:

START DATE: 11/2/15

FINISH DATE: 11/2/15

CONTRACTOR: GB

PROJECT: Suva Radio

JOB No: 751078

LOCATION: FBC Site, Naulu Road, Suva

CO-ORDINATES: 18.06686 °S
178.53072 °E

R.L. GROUND: 35.70m

R.L. COLLAR:

DATUM: Assumed

SURVEY: WGS84

DIRECTION:

ANGLE FROM HORIZ.:

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering LW SW CW HW VW	Rock Strength ES SS MS WS VS VW EW	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS			Water Loss (%) 25 50 75	Water Level	Casing	Installation	Core Box
										Defect Log	Fracture Spacing (cm)	ROD %					
FILL	Sandy SILT, trace clay; brown. Firm, moist, low plasticity.																
	0.25-1.5m: CORE LOSS.			HQ3	20		35.5										
ALLUVIUM	1.5-1.75m: CORE LOSS.																
	ORGANICS with rootlets and trace silt; blackish brown. Very soft, wet.			HQ3	40		34.0										
	2-3.1m: CORE LOSS.																
S MARL	ORGANICS, as above.			HQ3	27		33.0										
	3.5-3.7m: CORE LOSS.																
	Silty, fine SAND, with some organics; dark grey. Loose, wet.																
	Slightly weathered, dark bluish grey SILTSTONE. Extremely weak, well cemented.			HQ3	87		31.0										

COMMENTS:

T-T DATATEMPLATE.GDT.jib



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH3

SHEET 2 OF 3

DRILLED BY:

LOGGED BY: JWY

CHECKED:

START DATE: 11/2/15

FINISH DATE: 11/2/15

CONTRACTOR: GB

PROJECT: Suva Radio

JOB No: 751078

LOCATION: FBC Site, Naulu Road, Suva

CO-ORDINATES: 18.06686 °S
178.53072 °E

R.L. GROUND: 35.70m

R.L. COLLAR:

DATUM: Assumed

SURVEY: WGS84

DIRECTION:

ANGLE FROM HORIZ.:

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering LW SW HW CW	Rock Strength ES SS MS LS WS VS LW VW EW	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS			Water Loss (%) 25 50 75	Water Level	Casing	Installation	Core Box
										Defect Log	Fracture Spacing (cm)	ROD %					
SUVA MARL	Unweathered, bluish grey SILTSTONE. Extremely weak, well cemented. 5.45-6.5m: CORE LOSS.			SPT	100	11 16 18 N=34	30.5	5.5	XXXXXX								Box 1
				HQ3	0			6.0	XXXXXX		0						
				SPT	100	14 18 18 N=36	29.0	6.5	XXXXXX								
				HQ3	100			7.5	XXXXXX		100						
				SPT	100	12 20 20 N=40	27.5	8.0	XXXXXX								
				HQ3	100			9.0	XXXXXX		90						
				SPT	100	14 20 23 N=43	26.0	9.5	XXXXXX								
								10.0	XXXXXX								Box 2
																	Box 3

COMMENTS:

9.3m: Joint 70°, PL,SM,MN, clay infill

T-T DATATEMPLATE.GDT.jib



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH4

SHEET 1 OF 4

DRILLED BY:

LOGGED BY: JWY

CHECKED:

START DATE: 11/2/15

FINISH DATE: 11/2/15

CONTRACTOR: GB

PROJECT: Suva Radio

JOB No: 751078

LOCATION: FBC Site, Naulu Road, Suva

CO-ORDINATES: 18.06669 °S
178.53128 °E

DIRECTION:

ANGLE FROM HORIZ.:

R.L. GROUND: 35.40m

R.L. COLLAR:

DATUM: Assumed

SURVEY: WGS84

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering LW SW CW HW VW	Rock Strength ES SS MS WS VS VW EW	Sampling Method Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS			Water Loss (%) 25 50 75	Water Level	Casing	Installation	Core Box	
									Defect Log	Fracture Spacing (cm)	ROD %						Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill
FILL	Sandy SILT, some clay; brown. Soft, moist, low plasticity. 0.25-1.5m: CORE LOSS.			HQ3	17		35.0										
HIGHLY ORGANIC ALLUVIAL DEPOSITS	ORGANICS, fibrous with rootlets; minor silt; brownish black. Very soft, wet. 2-2.5m: Push Tube.			HQ3	100		34.5										
	2.5-2.85m: CORE LOSS.			PT			34.0										
	Grades to organic SILT, some rootlets, minor fine sand; dark brownish grey. Very soft, wet, low plasticity.			HQ3	65		33.0										
	Medium to fine SAND, some silt, minor gravels, minor organics; dark grey. Loose, wet. 4.7m: grades finer.			HQ3	80		31.0										

24 hrs after drilling

T-T DATATEMPLATE.GDT.jib

COMMENTS:



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH4

SHEET 2 OF 4

DRILLED BY:

LOGGED BY: JWY

CHECKED:

START DATE: 11/2/15

FINISH DATE: 11/2/15

CONTRACTOR: GB

PROJECT: Suva Radio

JOB No: 751078

LOCATION: FBC Site, Naulu Road, Suva

CO-ORDINATES: 18.06669 °S
178.53128 °E

R.L. GROUND: 35.40m

R.L. COLLAR:

DATUM: Assumed

SURVEY: WGS84

DIRECTION:

ANGLE FROM HORIZ.:

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering LW SW HW CW	Rock Strength ES SS MS WS LW EW	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS			Water Loss (%) 25 50 75	Water Level	Casing	Installation	Core Box
										Defect Log	Fracture Spacing (cm)	ROD %					
ALLUVIUM	5-5.5m: Push Tube.			PT													
	Silty, fine SAND, minor organics and fine gravels; dark brownish grey. Loose, saturated.																
	SILT, minor fine sand and organics; dark brownish grey. Very soft, wet, low plasticity.			HQ3	100	Sample											
	Silty, fine SAND, trace calcareous inclusions; dark grey. Loose, wet.			SPT	100												
	Grades to silty, fine SAND, some organics, minor fine gravel, trace coarse gravel; dark greyish brown. Loose, saturated.			HQ3	80												
WEATHERED SUVA MARL	Highly weathered SILTSTONE. Soil Description: Clayey SILT, some fine to medium gravel; bluish grey mottled brown. Firm, wet, low plasticity.			HQ3	100												
	Grades to sandy SILT, trace clay, trace gravels; bluish grey mottled brown. Firm, wet.																
	9.5-10m: Push Tube			PT													

COMMENTS:

T-T DATATEMPLATE.GDTL.jib

Log Scale 1:25

GENERAL LOG 751078BH2.GPJ 16-Mar-2015



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH4

SHEET 3 OF 4

DRILLED BY:

LOGGED BY: JWY

CHECKED:

START DATE: 11/2/15

FINISH DATE: 11/2/15

CONTRACTOR: GB

PROJECT: Suva Radio

JOB No: 751078

LOCATION: FBC Site, Naulu Road, Suva

CO-ORDINATES: 18.06669 °S
178.53128 °E

R.L. GROUND: 35.40m

R.L. COLLAR:

DATUM: Assumed

SURVEY: WGS84

DIRECTION:

ANGLE FROM HORIZ.:

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering LW SW HW CW	Rock Strength ES SS MS LS VS VW EV	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS			Water Loss (%) 25 50 75	Water Level	Casing	Installation	Core Box
										Defect Log	Fracture Spacing (cm)	ROD %					
	Highly weathered SILTSTONE, as above.					Sample											
	Unweathered, dark bluish grey SILTSTONE. Extremely weak, well cemented, massive.			HQ3	100	UCS Sample	25.0	10.5			10						
				SPT	10	N=45	24.5	11.0									
				HQ3	100		24.0	11.5									
				SPT	100	N=47	23.0	12.0			100						
				HQ3	100		22.5	12.5									
				SPT	100	N=48	22.0	13.0									
				HQ3	100		21.5	13.5			100						
				SPT	100	N=48	21.0	14.0									
				HQ3	25		21.0	14.5			100						
							15.0										

COMMENTS:

T-T DATATEMPLATE.GDI.jib

Log Scale 1:25

GENERAL LOG 751078BH2.GPJ 16-Mar-2015

Appendix D: Core Photographs

- BH1-BH4



Photograph 1- BH1 0.0-4.8m



Photograph 2- BH1-4.8-8.9m



Photograph 3- BH1-8.9-13.0m



Photograph 4-BH1-13.0-15.95m



Photograph 5- BH2-0.0-3.5m



Photograph 6- BH2-3.5-5.80m



Photograph 7- BH2-5.8-8.0m



Photograph 8- BH2-8.0-9.9m



Photograph 9- BH2-9.90-11.45m



Photograph 10- BH3-0.0-5.45m



Photograph 11-BH3-5.45-8.40m



Photograph 12- BH3-8.40-11.45m



Photograph 13- BH4-0.0-4.80m



Photograph 14- BH4-4.80-8.45m



Photopgraph 15-BH4-8.45-10.70m



Photograph 16-BH4-10.70-12.95m



Photograph 17-BH4-12.95-15.95m

Appendix E: Laboratory Testing

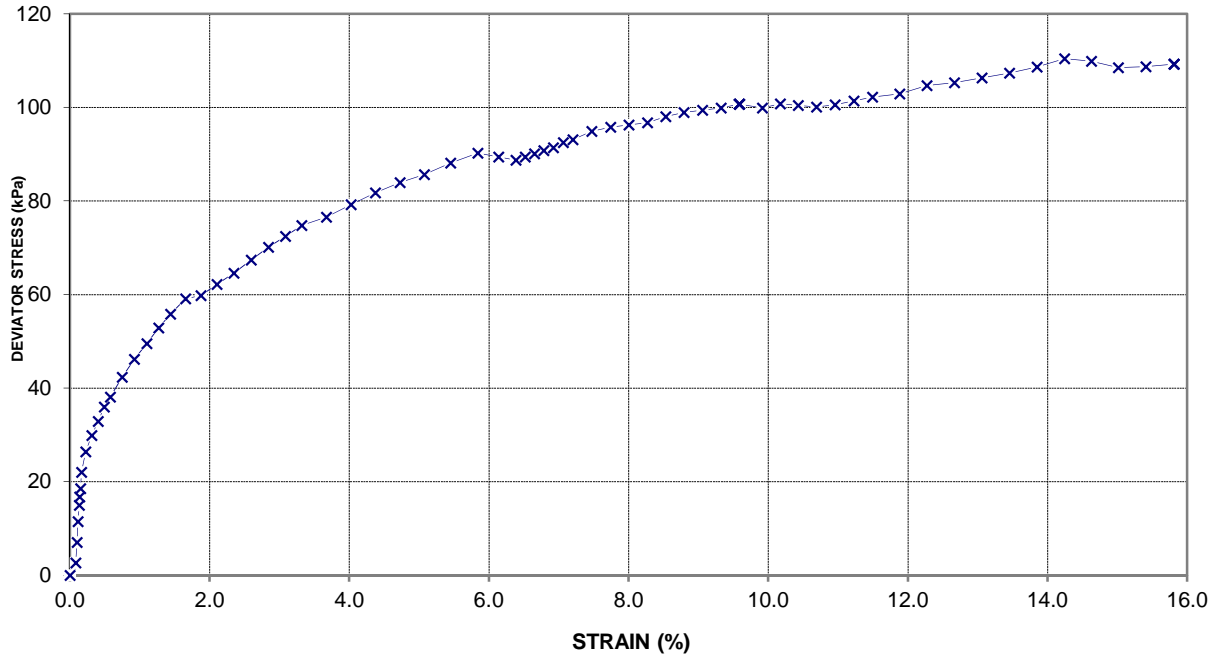
- UU Triaxial results
- Solid Density results
- UCS results



Plate No.: _____ Page of _____
 Site: Suva Radio Your Ref No.: 751078 Job No.: 616525.001
 Test pit/Bh No.: BH1 Sample No.: 1 Depth: 9.73 -- 9.85 (m)
 Test Method Used: BS 1377:Part 7:1990 Test 9 Determination of the Undrained Shear Strength in Triaxial Compression with Multistage Loading and without Measurement of pore Pressure

UNCONSOLIDATED-UNDRAINED COMPRESSION TEST

DEVIATOR STRESS VS STRAIN



Initial Sample Parameters:

Sample Height:	113.92	mm	Bulk Density:	1.73	t/m ³
Sample Diameter:	53.66	mm	Dry Density:	1.13	t/m ³
Height / Diameter:	2.12		Water Content:	53.3	%

Membrane Correction at Failure:

Membrane thickness:	0.5	mm	Correction:	1.41	kPa
---------------------	-----	----	-------------	------	-----

Failure Value:

	Cell Pressure σ_3 (kPa)	Axial Strain ϵ (%)	Corrected Maximum Deviator Stress $\sigma_1 - \sigma_3$ (kPa)	Shear Strength C_u (kPa)	Test Speed (mm/min)
Stage 1	85	5.84	90.19	45	0.82
Stage 2	170	9.59	100.71	50	
Stage 3	350	14.63	110.38	55	

Mode of Failure: Planar / Plastic.

Sample History: Undisturbed core trimmed at its natural moisture content.

Soil Description: SILT, with some clay, firm, bluish grey with orange brown stripes, medium to high plasticity, slightly dilatant. A trace of shell fragments were present.

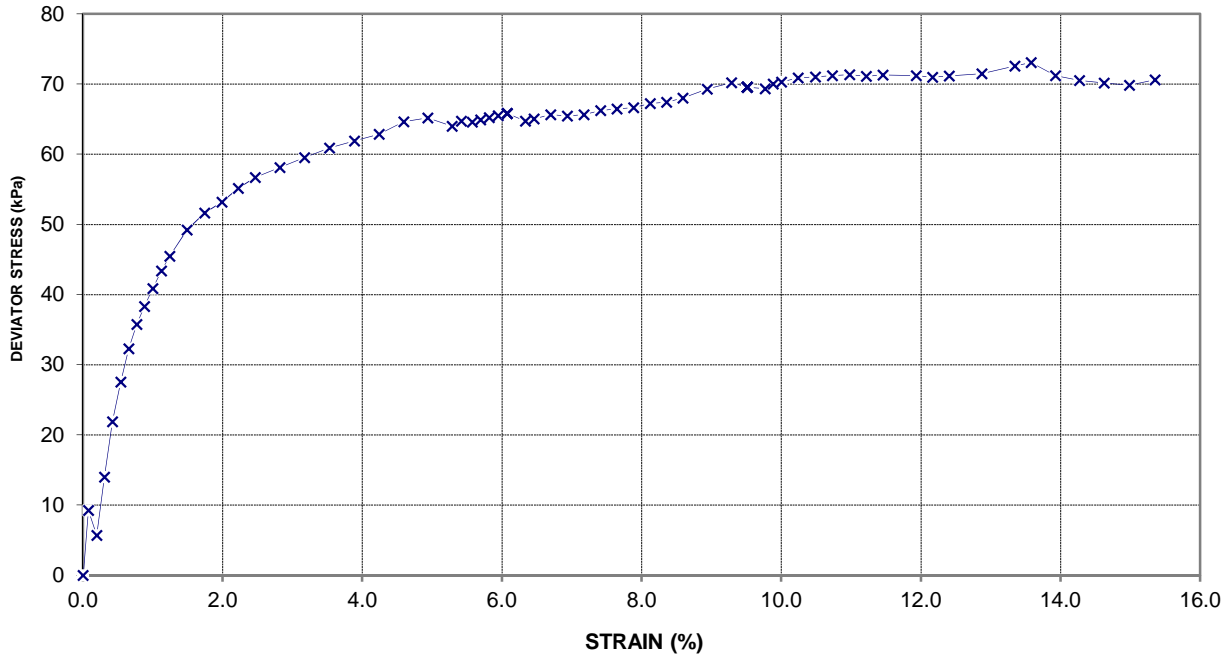
Test Remarks: --



Plate No.: _____ Page of _____
 Site: Suva Radio Your Ref No.: 751078 Job No.: 616525.001
 Test pit/Bh No.: BH4 Sample No.: 6 Depth: 9.78 -- 9.90 (m)
 Test Method Used: BS 1377:Part 7:1990 Test 9 Determination of the Undrained Shear Strength in Triaxial Compression with Multistage Loading and without Measurement of pore Pressure

UNCONSOLIDATED-UNDRAINED COMPRESSION TEST

DEVIATOR STRESS VS STRAIN



Initial Sample Parameters:

Sample Height:	112.96	mm	Bulk Density:	1.73	t/m ³
Sample Diameter:	53.67	mm	Dry Density:	1.13	t/m ³
Height / Diameter:	2.10		Water Content:	52.7	%

Membrane Correction at Failure:

Membrane thickness:	0.5	mm	Correction:	1.46	kPa
---------------------	-----	----	-------------	------	-----

Failure Value:

	Cell Pressure σ_3 (kPa)	Axial Strain ϵ (%)	Corrected Maximum Deviator Stress $\sigma_1 - \sigma_3$ (kPa)	Shear Strength C_u (kPa)	Test Speed (mm/min)
Stage 1	85	6.07	65.80	33	0.80
Stage 2	170	9.29	70.17	35	
Stage 3	350	13.58	73.07	37	

Mode of Failure: Planar / Plastic.

Sample History: Undisturbed core trimmed at its natural moisture content.

Soil Description: SILT, with some clay and minor sand, soft, grey with orange brown, medium to high plasticity, slightly dilatant.

Test Remarks: --



23 Morgan Street, Newmarket
Auckland 1023, New Zealand

p. +64 9 356 3510
w. www.geotechnics.co.nz

File: P161625.000Working materialSolid density_Summary.docx

Page of

Your Job No.: 751078

Site : Suva Radio, Fiji

Our Job No.: 616525.000

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.:	1	1	2	2	2	3
Sample No.:	9	18	8	11	12	14
Depth (m)	15.5	11.0	6.5	4.8	9.5	5.0
Average Solid Density (t/m ³)	2.75	2.77	2.74	2.76	2.80	2.70

Table 2: Solid Density

BH No.:	3	4	4
Sample No.:	15	16	17
Depth (m)	11.0	10.0	11.0
Average Solid Density (t/m ³)	2.69	2.77	2.78

Remarks : The solid density was reported to the nearest 0.01 t/m³.

Tested by: ST

Date: 4/3/15

Checked by: AH

Date: 4/3/15



23 Morgan Street, Newmarket
Auckland 1023, New Zealand

p. +64 9 356 3510
w. www.geotechnics.co.nz

File: P:\616525.000\Working Material\BH1_2_15.2m.xlsx

Page of

Your Job No.: 751078

Site: Suva Radio, Fiji

Our Job No.: 616525.000

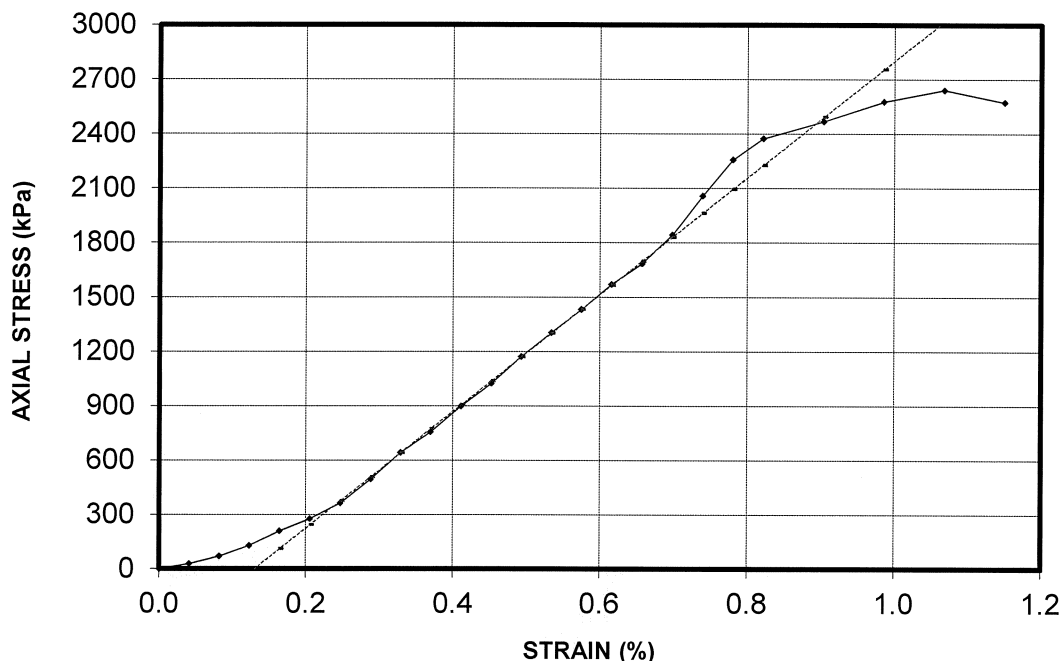
BH No.: 1

Sample No.: 2

Depth (m): 15.20

Test Method Used: NZS 4402 :1986 TEST 6.3.1 Determination of the unconfined compressive strength of cohesive soil

**UNCONFINED COMPRESSIVE STRENGTH TEST
AXIAL STRESS VS STRAIN**



Sample Parameters:

Sample Height:	121.79 mm	Bulk Density:	1.86 t/m ³
Sample Diameter:	60.37 mm	Dry Density:	1.38 t/m ³
Test Height:	121.79 mm	Water Content:	34.4 %
Test H/D Ratio:	2.02		

Failure Value:

Axial Strain (%)	Unconf. Compressive Strength (kPa)	Rate of Compression (mm/min)	Modulus of Elasticity (MPa)
1.15	2641	0.16	322

Mode of Failure: Shear

Sample History: Undisturbed core trimmed at natural water content.

Sample Description: Light greenish grey, very weak, Suva Marl.

Test Remarks: Unconfined Compressive Strength reported to the nearest 1 kPa.
Modulus of Elasticity value reported based upon straight line portion of the curve and provided as indicative only.
Sample description and modulus of elasticity value reported are not IANZ accredited.

Entered by: ST

Date: 3/3/15

Checked by: AH

Date: 3/3/15



Site: Suva Radio, Fiji

Our Job No.: 616525.000

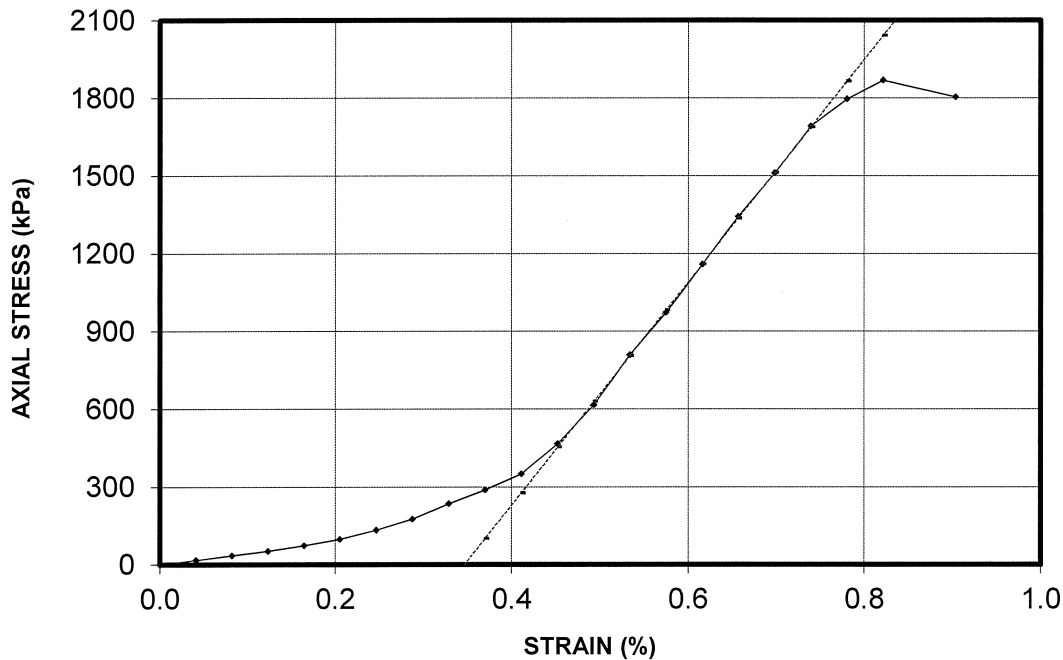
BH No.: 2

Sample No.: 3

Depth (m): 8.70

Test Method Used: NZS 4402 :1986 TEST 6.3.1 Determination of the unconfined compressive strength of cohesive soil

UNCONFINED COMPRESSIVE STRENGTH TEST
AXIAL STRESS VS STRAIN



Sample Parameters:

Sample Height:	121.78 mm	Bulk Density:	1.84 t/m ³
Sample Diameter:	60.14 mm	Dry Density:	1.35 t/m ³
Test Height:	121.78 mm	Water Content:	35.7 %
Test H/D Ratio:	2.02		

Failure Value:

Axial Strain (%)	Unconf. Compressive Strength (kPa)	Rate of Compression (mm/min)	Modulus of Elasticity (MPa)
0.90	1868	0.16	430

Mode of Failure: Shear

Sample History: Undisturbed core trimmed at natural water content.

Sample Description: Light greenish grey, very weak, Suva Marl.

Test Remarks: Unconfined Compressive Strength reported to the nearest 1 kPa.
Modulus of Elasticity value reported based upon straight line portion of the curve and provided as indicative only.

Sample description and modulus of elasticity value reported are not IANZ accredited.

Entered by: ST

Date: 3/3/15

Checked by: AH

Date: 3/3/15



23 Morgan Street, Newmarket
Auckland 1023, New Zealand

p. +64 9 356 3510
w. www.geotechnics.co.nz

File: P:\616525.000\Working Material\BH3_4_10.5m.xlsx

Page of

Your Job No.: 751078

Site: Suva Radio, Fiji

Our Job No.: 616525.000

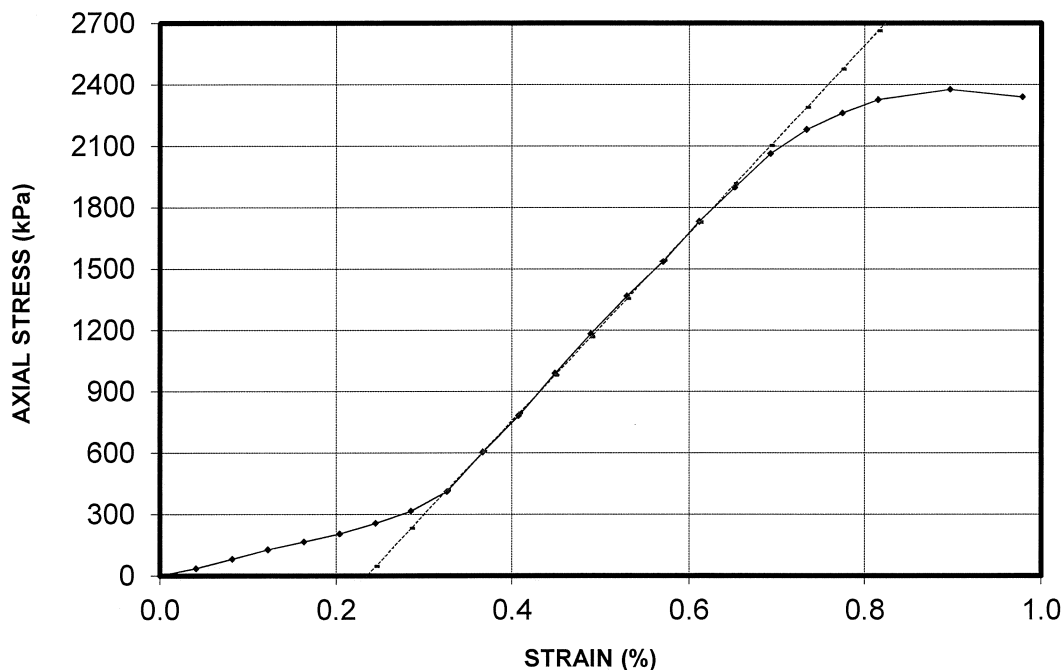
BH No.: 3

Sample No.: 4

Depth (m): 10.50

Test Method Used: NZS 4402 :1986 TEST 6.3.1 Determination of the unconfined compressive strength of cohesive soil

UNCONFINED COMPRESSIVE STRENGTH TEST
AXIAL STRESS VS STRAIN



Sample Parameters:

Sample Height:	122.72 mm	Bulk Density:	1.88 t/m ³
Sample Diameter:	60.10 mm	Dry Density:	1.40 t/m ³
Test Height:	122.72 mm	Water Content:	34.4 %
Test H/D Ratio:	2.04		

Failure Value:

Axial Strain (%)	Unconf. Compressive Strength (kPa)	Rate of Compression (mm/min)	Modulus of Elasticity (MPa)
0.98	2376	0.17	459

Mode of Failure: Shear

Sample History: Undisturbed core trimmed at natural water content.

Sample Description: Light greenish grey, very weak, Suva Marl.

Test Remarks: Unconfined Compressive Strength reported to the nearest 1 kPa.
Modulus of Elasticity value reported based upon straight line portion of the curve and provided as indicative only.
Sample description and modulus of elasticity value reported are not IANZ accredited.

Entered by: SJ

Date: 3/3/15

Checked by: AH

Date: 3/3/15



23 Morgan Street, Newmarket
Auckland 1023, New Zealand

p. +64 9 356 3510
w. www.geotechnics.co.nz

File: P:\616525.000\Working Material\BH4_5_10.8m.xlsx

Page of

Your Job No.: 751078

Site: Suva Radio, Fiji

Our Job No.: 616525.000

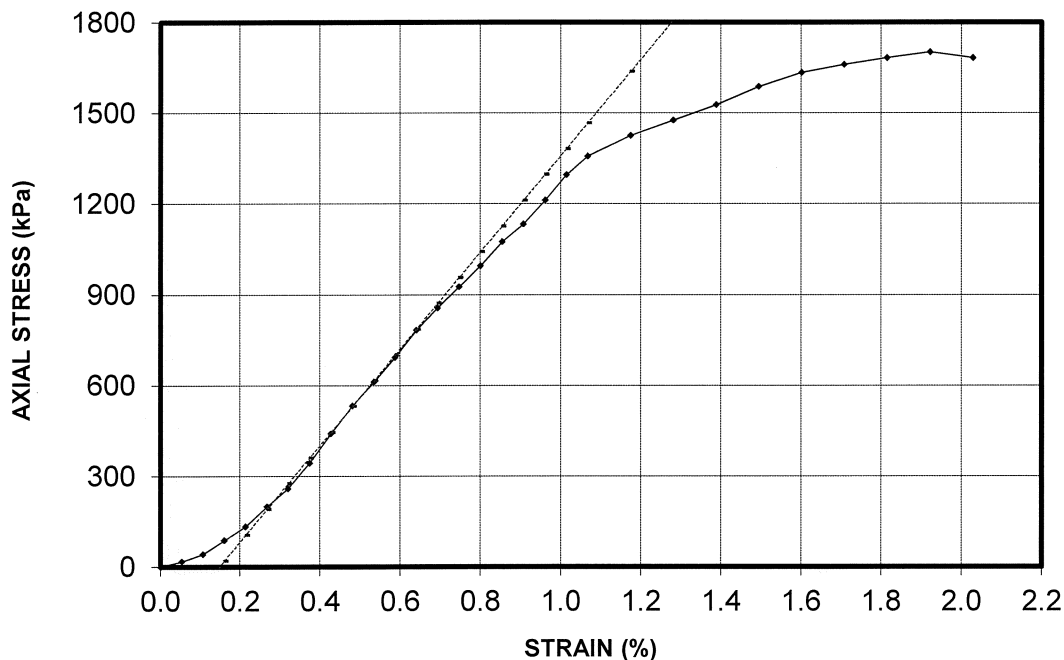
BH No.: 4

Sample No.: 5

Depth (m): 10.80

Test Method Used: NZS 4402 :1986 TEST 6.3.1 Determination of the unconfined compressive strength of cohesive soil

**UNCONFINED COMPRESSIVE STRENGTH TEST
AXIAL STRESS VS STRAIN**



Sample Parameters:

Sample Height:	93.67 mm	Bulk Density:	1.86 t/m ³
Sample Diameter:	60.16 mm	Dry Density:	1.37 t/m ³
Test Height:	93.67 mm	Water Content:	35.6 %
Test H/D Ratio:	1.56		

Failure Value:

Axial Strain (%)	Unconf. Compressive Strength (kPa)	Rate of Compression (mm/min)	Modulus of Elasticity (MPa)
2.03	1701	0.21	159

Mode of Failure: Shear

Sample History: Undisturbed core trimmed at natural water content.

Sample Description: Light greenish grey, very weak, Suva Marl.

Test Remarks: The sample height to diameter ratio is less than the required 2. The strength may be lower, due to the h/d ratio.
Unconfined Compressive Strength reported to the nearest 1 kPa and provided as indicative only.
Modulus of Elasticity value reported is indicative only.
Sample description, UCS and modulus of elasticity value reported are not IANZ accredited.

Entered by: ST

Date: 3/3/15

Checked by: AH

Date: 3/3/15