資　料

資料－１　調査団員･氏名

現地調査

氏　名	担　当	所　属	備　考
永　友　紀　章	総括	JICA　地球環境部　参事役	
早　川　　輝	協力企画	JICA　地球環境部　水資源・防災グループ　防災第二課　ジュニア専門員	
Denise de Souza	調達企画	クラウンエイジェンツ ガイアナ事務所代表	
コンサルタント			
田　中　英　正	業務主任 維持管理計画	㈱建設技術センター	平成22年10月8日～平成23年（業務開始）　6月30日
峯　田　　武	施設設計	㈱建設技術センター	
	業務主任 維持管理計画		平成23年7月1日～平成23年9月30日（業務終了）
松　本　裕　一	機材計画／積算	㈱三祐コンサルタンツ	
日　置　晴　夫	機材計画	㈱三祐コンサルタンツ	
森　　晃　二	水理・水文／環境社会配慮	㈱建設技術センター	平成22年11月30日 まで
早　川　　智		㈱建設技術センター	平成22年12月 1日 以降
西　園　裕　一	施工計画／積算	㈱建設技術センター	
三　好　俊太郎	業務支援（通訳・連絡）	㈱建設技術センター	自社負担参加

コンポーネント1:機材調達　概略設計概要説明調査

氏　名	担　当	所　属	備　考
松　本　重　行	総括	JICA　地球環境部　水資源・防災グループ　防災第二課　課長	
早　川　　輝	協力企画	JICA　地球環境部　水資源・防災グループ　防災第二課　ジュニア専門員	
コンサルタント			
田　中　英　正	業務主任／維持管理計画	株式会社　建設技術センター	
西　園　裕　一	施工計画／積算	株式会社　建設技術センター	
三　好　俊太郎	業務支援（通訳・連絡）	株式会社　建設技術センター	自社負担参加

コンポーネント2:附帯施設改修　概略設計概要説明調査

氏　名	担　当	所　属	備　考
山　口　尚　孝	総括	JICA　ドミニカ共和国事務所　次長	
早　川　　輝	協力企画	JICA　地球環境部　水資源・防災グループ　防災第二課　ジュニア専門員	
Denise de Souza	調達企画	クラウンエイジェンツ　ガイアナ(事)代表	
コンサルタント			
峯　田　　武	施設設計	株式会社　建設技術センター	
早　川　　智	水理・水文／環境社会配慮	株式会社　建設技術センター	
西　園　裕　一	施工計画／積算	株式会社　建設技術センター	自社負担参加
三　好　俊太郎	業務支援（通訳・連絡）	株式会社　建設技術センター	自社負担参加

資料ー2　調査行程

現地調査

	JICA 調査団員				クラウン エイジェンツ
	永友紀章　総括	松本重行　総括	山口尚孝　総括	早川　輝　協力企画	Denise de Souza
2010年10月					
/11（月）	（出発）			（出発）	
/12（火）	トリニダードトバゴ			トリニダードトバゴ	
	日本大使館表敬			日本大使館表敬	
	ガイアナ着			ガイアナ着	
/13（水）	NDIA, 対外貿易・国際			NDIA, 対外貿易・国際	JICA団員との会議
	協力省表敬、現地視察			協力省表敬、現地視察	
/14（木）	NDIA：IC/R協議			NDIA ：IC/R協議	NDIA：IC/R協議
	NDIA：議事録協議			NDIA：議事録協議	NDIA：議事録協議
/15（金）	NDIA：の議事録協議			NDIA：議事録協議	NDIA：議事録協議
	NDIA ：議事録署名			NDIA：議事録（署名）	NDIA：議事録（署名）
/16（土）	ガイアナ発			ガイアナ発	
/17（日）	（別件業務）				
/18（月）				帰国	

コンポーネント1：機材調達　概略設計概要説明調査

2011					
1/4（火）		（出発）		（出発）	
/5（水）		ガイアナ着		ガイアナ着	
		国際協力省表敬		国際協力省表敬	
		NDIA ：協議		NDIA：の協議	
/6（木）		NDIA：協議		NDIA：協議	
/7（金）		NDIA：議事録文書協議		NDIA：議事録文書協議	
		NDIA ：議事録署名		NDIA ：議事録（署名）	
/8（土）		ガイアナ発		ガイアナ発	
/9（日）					
/10（月）		帰国		帰国	

コンポーネント2：附帯施設改修　概略設計概要説明調査

2011					
5/29（日）			ガイアナ着		
/30（月）			（別件業務）	（出発）	
/31（火）				ガイアナ着	
			国際協力省表敬	国際協力省表敬	
			NDIA：概略設計説明	NDIA：概略設計説明	NDIA：概略設計説明会
6/1（水）			現場視察	現場視察	
			NDIA：議事録文書協議	NDIA：議事録文書協議	NDIA：議事録文書協議
/2（木）			現場視察	現場視察	
			NDIA ：議事録署名	NDIA ：議事録（署名）	NDIA：議事録（署名）
/3（金）			ガイアナ発	ガイアナ発	
			トリニダードトバゴ	トリニダードトバゴ	
			日本大使館報告	日本大使館報告	
			トリニダードトバゴ発	トリニダードトバゴ発	
/4（土）			ドミニカ着		
/5（日）				帰国	

	コンサルタント団員			
	田中 英正	峯田 武	松本 裕一	日置 晴夫
2010				
10/ 9(土)				
/10(日)				
/11(月)	(出発)		(出発)	
/12(火)	ガイアナ着		ガイアナ着	
/13(水)	NDIA, 対外貿易・国際協力省表敬、		NDIA, 対外貿易・国際協力省表敬、	
	現地視察、AC. 打合せ		現地視察、AC. 打合せ	
/14(木)	ガ国-JICA 会議出席		ガ国-JICA 会議出席、ローカルC. 面談	
/15(金)	関連資料収集		ローカルコンサルタント面談	
/16(土)	関連資料収集			
/17(日)				
/18(月)	機材メーカー面談、調査	(出発)	関連資料収集	(出発)
/19(火)	機材メーカー面談、調査	ガイアナ着、調査準備	機材調達調査	ガイアナ着、調査準備
/20(水)	機材メーカー面談、調査	NDIA 打合せ、コンサル社訪問	機材調達調査	機材調達調査
/21(木)	機材メーカー面談、調査	現地踏査	ガイアナ発	機材調達調査
/22(金)	機材メーカー面談、調査	現地踏査		機材調達調査
/23(土)	土質調査打合せ ・設計打合せ	土質調査打合せ ・設計打合せ	(帰国)	
/24(日)				
/25(月)	NDIA 打合せ	地質・土質調査仕様作成		機材調達調査
/26(日)	NDIA 打合せ	NDIA 打合せ		機材調達調査
/27(水)	地質・土質調査仕様作成	地質・土質調査仕様作成		機材調達調査
/28(木)	地質・土質調査仕様作成	地質・土質調査仕様作成		機材調達調査
/29(金)	土質調査打合せ	土質調査打合せ		機材調達調査
/30(土)	現地調査：マドウニ、ホープ	現地調査：マドウニ、ホープ		ガイアナ発
/31(日)	マドウニ ボーリング立会い	マドウニ ボーリング立会い		
11/ 1(月)				(帰国)
/ 2(火)	機材メーカー面談、調査	NDIA 打合せ		
/ 3(水)	機材メーカー面談、調査	設計打合せ		
/ 4(木)	現地踏査、NDIA 打合せ	現地踏査、NDIA 打合せ		
/ 5(金)	ソイルセメント室内混合	ソイルセメント室内混合		
/ 6(土)	測量打合せ 土質調査打合せ	測量打合せ 土質調査打合せ		
/ 7(日)				
/ 8(月)	機材メーカー面談、調査			
/ 9(火)	現地調査（ホープ、アンズグローブ）	現地調査（ホープ、アンズグローブ）		
/10(水)	機材メーカー面談、調査	ソイルセメント室内試験（4日養生）		
/11(木)	S. セメント現場混合4日養生試験	S. セメント現場混合4日養生試験		
/12(金)	ソイルセメント現場混合	ソイルセメント現場混合		
/13(土)	ソイルセメント室内試験（7日養生）	ソイルセメント室内試験（7日養生）		
/14(日)				
/15(月)	ガイアナ発	現地調査：アンズグローブ		
/16(火)		S. セメント現場混合4日養生試験		
/17(水)	(帰国)	設計仕様所作成		
/18(木)		S. セメント現場混合7日養生試験		
/19(金)		現地調査（ホープ、アンズグローブ）		
/20(土)		現地調査：アンズグローブ		
/21(日)				
/22(月)				
/23(火)		NDIA 打合せ		
/24(水)		設計打合せ		
/25(木)		設計打合せ		
/26(金)		ガイアナ発		
/27(土)				
/28(日)		(帰国)		
12/13(月)				
12/14(火)				
/15(水)				
/16(木)				
/17(金)				
/18(土)				
/19(日)				
/20(月)				
/21(火)				
/22(水)				
/23(木)				
/24(金)				
/25(土)				
/25(土)～1/3(月)				

	コンサルタント団員			
	森　晃二	早川　智	西園　裕一	三好俊太郎(自社負担参加)
2010				
10/ 9(土)	(出発)			
/10(日)	ガイアナ着			
/11(月)	設営・調査準備		(出発)	
/12(火)	設営・調査準備		ガイアナ着	
/13(水)	NDIA, 対外貿易・国際協力省表敬、		NDIA, 対外貿易・国際協力省表敬、	
	現地視察、Crown Agents 打合せ		現地視察、Crown Agents 打合せ	
/14(木)	関連資料収集		関連資料収集	
/15(金)	ローカルコンサルタント面談		関連資料収集	
/16(土)	関連資料収集		関連資料収集	
/17(日)				
/18(月)	ローカルコンサル面談、現地踏査		ローカルコンサル面談、現地踏査	
/19(火)	測量打合せ		測量、施工計画、積算資料、	
/20(水)	NDIA 打合せ、コンサル社訪問		収集	
/21(木)	現地踏査		現地踏査	
/22(金)	現地踏査		現地踏査	
/23(土)	土質調査打合せ　・設計打合せ			
/24(日)				
/25(月)	NDIA 打合せ		現地施工、現地立会・指導	
/26(日)	NDIA 打合せ		積算データ資料作成	
/27(水)	測量打合せ		測量打合せ	
/28(木)	NDIA 打合せ		NDIA 打合せ	
/29(金)	測量打合せ　　土質調査打合せ		測量打合せ　　土質調査打合せ	
/30(土)	現地調査：マドウニ、ホープ		ガイアナ発	
/31(日)	マドウニ　ボーリング立会い			
11/ 1(月)			(帰国)	
/ 2(火)	NDIA 打合せ			
/ 3(水)	設計打合せ			
/ 4(木)	NDIA 打合せ			
/ 5(金)	ソイルセメント室内混合			
/ 6(土)	測量打合せ　　土質調査打合せ			
/ 7(日)				
/ 8(月)	設計打合せ　　NDIA 打合せ			
/ 9(火)	現地調査　　NDIA 打合せ			
/10(水)	ソイルセメント試験・NDIA 打合せ			
/11(木)	NDIA 打合せ			
/12(金)	ソイルセメント現場混合			
/13(土)	ソイルセメント室内試験 (7日養生)			
/14(日)				
/15(月)	現地調査：アンズグローブ			
/16(火)	S. セメント養生試験/NDIA 打合せ			
/17(水)	設計打合せ			
/18(木)	NDIA 打合せ			
/19(金)	NDIA 打合せ			
/20(土)	現地調査：アンズグローブ			
/21(日)				
/22(月)	NDIA 打合せ/GWI			
/23(火)	NDIA 打合せ			
/24(水)	現地調査　　EPA			
/25(木)	現地調査　　GWI			
/26(金)	ガイアナ発			
/27(土)				
/28(日)	(帰国)			
12/13(月)		(出発)		
12/14(火)		ガイアナ着　　NDIA挨拶		
/15(水)		現地踏査		
/16(木)		NDIA打合せ		
/17(金)		協力会社と打合せ		
/18(土)		現地踏査・追加測量		
/19(日)				
/20(月)		NDIA打合せ		
/21(火)		協力会社と打合せ		
/22(水)		測量図照査		
/23(木)		測量・地質条件確認		
/24(金)		設計計算確認		
/25(土)		ガイアナ発		
/25(土)～1/3(月)		(ニューヨーク待機)		
		協議議事録の作成		

	コンサルタント団員			
	田中　英正	峯田　武	松本　裕一	日置　晴夫
2011				
1/3(月)	（出発）			
/4(火)	ガイアナ着			
/5(水)	NDIA,JICAの契約文章協議			
/6(木)	NDIA,JICAの契約文章協議			
/7(金)	NDIA,JICAの契約文章協議			
/8(土)				
/9(日)	ガイアナ発			
/10(月)	（ニューヨーク）			
/11(火)	（帰国）			
/12(水)				
2/3(木)				
/4(金)				
/5(土)				
/6(日)				
/7(月)				
/8(火)				
/9(水)				
/10(木)				
/11(金)				
/12(土)				
/13(日)				
/14(月)				
/15(火)				
/16(水)				
/17(木)				
/18(金)				
/19(土)				
/20(日)				
/21(月)				
/22(火)				
/23(水)				
/24(木)				
/25(金)				
/26(土)				
/27(日)				
/28(月)				
3/1(水)				
/2(水)				
5/30(月)		（出発）		
/31(火)		（ガ着）NDIA：調査報告書 提出説明 ミニッツ 協議に出席		
6/1(水)		NDIAとのM/D協議に出席		
/2(木)		JICA現場視察に同行、		
		JICA-NDIA ミニッツサイン に出席		
/3(金)		NDIA Mr. Surendra との会議		
/4(土)		資料整理		
/5(日)				
/6(月)		現地コンサルSRKNとの打合せ		
/7(火)		NDIA Mr. Surendra との会議		
/8(水)		Mr. Surendra,Ms.Denise 仕様書説明		
/9(木)		NDIA：Hope 放水路工事現場見学		
/10(金)		資料整理		
/11(土)		ガイアナ発		
/12(日)				
/13(月)		（帰国）		

	コンサルタント団員			
	森　晃二	早川　智	西園　裕一	三好俊太郎(自社負担参加)
2011				
1/3(月)		(ニューヨーク出発)	(出発)	
/4(火)		ガイアナ着　　NDIA挨拶	ガイアナ着	
/5(水)		NDIA,JICAの協議	NDIA,JICAの契約文章協議	
/6(木)		NDIA打合せ	NDIA,JICAの契約文章協議	
/7(金)		NDIA打合せ	NDIA,JICAの契約文章協議	
/8(土)		ガイアナ発		
/9(日)		(ニューヨーク)	ガイアナ発	
/10(月)		(帰国)	(ニューヨーク)	
/11(火)			(帰国)	
/12(水)				
2/3(木)				
/4(金)				
/5(土)		(出発)		
/6(日)		ガイアナ着		
/7(月)		協力会社と打合せ		
/8(火)		NDIAと協議		
/9(水)		協力会社と打合せ		
/10(木)		現地踏査		
/11(金)		協力会社と打合せ 現地踏査		
/12(土)		協力会社と打合せ 現地踏査		
/13(日)				
/14(月)		協力会社と打合せ 現地踏査		
/15(火)		協力会社と打合せ		
/16(水)		協力会社と打合せ		
/17(木)		NDIAに図面提出		
/18(金)		協力会社と打合せ		
/19(土)		協力会社と打合せ		
/20(日)				
/21(月)		協力会社と打合せ		
/22(火)		協力会社と打合せ NDIA打合せ		
/23(水)		協力会社と打合せ		
/24(木)		協力会社と打合せ		
/25(金)		協力会社と打合せ		
/26(土)		協力会社と打合せ NDIA打合せ		
/27(日)		出発		
/28(月)		ニューヨーク		
3/1(水)		(帰国)		
/2(水)				
5/30(月)		(出発)		
/31(火)		(ガ着)　NDIA：調査報告書 提出説明		
		ミニッツ 協議に出席		
6/1(水)		NDIAとのM/D協議に出席		
/2(木)		JICA現場視察に同行、		
		JICA-NDIA ミニッツサイン に出席		
/3(金)		NDIA Mr. Surendra との会議		
/4(土)		資料整理		
/5(日)				
/6(月)		現地コンサルSRKNとの打合せ		
/7(火)		NDIA Mr. Surendra との会議		
/8(水)		Mr. Surendra,Ms.Denise 仕様書説明		
/9(木)		NDIA：Hope 放水路工事現場見学		
/10(金)		資料整理		
/11(土)		ガイアナ発		
/12(日)				
/13(月)		(帰国)		

資料－3　関係者(面会者)リスト

組　織	名　前	役　職
Ministry of Foreign Trade and International Cooperation (MoFTIC)	Ms.Lorene Baird	Permanent Secretary
- Department of International Cooperation	Mr.Safraaz Shadood	Foreign Trade Officer
Ministry of Agriculture -National Drainage and Irrigation Authority (NDIA)	Mr. Robert Montogomery Persaud	Minister
	Mr. Walter Willis	Chairman of NDIA Board
	Mr. Lionel Wordsworth	Chief Executive Officer
	Mr. Surendra Singh	Liaison Engineer
	Mr. Dave Hicks	Senior Engineer
	Mr. Timot HY Inness	Senior Section Engineer
	Mr. Kelvin Thorne	Engineer
	Mr.Chowbay Aneel	Mechanical Engineer
	Mr. Avinasa Singh	Mechanical Engineer
	Mr.Changur Bhudu	Superintendent EDWC
在トリニダード・トバゴ日本大使館	好井　正信	参事官
	藤村　浩二	二等書記官
JICA	山田　盛	援助調整専門家
	吉田　拓	CARICOM専門家

資料－4　討議議事録(M/D)

資料 4-1 現地調査時 討議議事録

MINUTES OF DISCUSSIONS
ON THE PREPARATORY SURVEY
ON THE PROJECT FOR THE REHABILITATION
OF THE EAST DEMERARA WATER CONSERVANCY
IN REGION No.4
IN THE REPUBLIC OF GUYANA

Based on the results of the Preparatory Survey conducted in 2009, the Government of Japan decided to conduct a second Preparatory Survey (hereinafter referred to as "the Survey") for the Rehabilitation of the East Demerara Water Conservancy in Region No.4 (hereinafter referred to as "the Project") and entrusted the implementation of the Survey to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to the Republic of Guyana (hereinafter referred to as "Guyana") a Preparatory Survey team (hereinafter referred to as "the Team"), which is headed by Mr. Noriaki Nagatomo, Senior Advisor to the Director General, Global Environment Department, JICA. The duration of the Team's work in the country is from October 12 to November 24, 2010.

The Team held a series of discussions with the officials representing the Government of Guyana (hereinafter referred to as "GOG") and conducted a field survey in the study area.

In the course of the discussions and field survey, both parties confirmed the main items described on the attached sheets. The Team will continue further works and prepare the Preparatory Report.

Georgetown, October 14, 2010

永友紀章

Mr. Noriaki Nagatomo
Leader
Preparatory Survey Team
Japan International Cooperation Agency
Japan

Mr. Lionel Wordsworth
Chief Executive Officer (ag)
National Drainage and Irrigation Authority
Ministry of Agriculture
The Republic of Guyana

In witness of

Mr. Safraaz Shadood
Foreign Trade Officer
Ministry of Foreign Trade and International Cooperation
The Republic of Guyana

ATTACHMENT

1. Objective of the Project

The objective of the Project is to procure equipment and rehabilitate facilities for the improvement of the flood-control capacity of the East Demerara Water Conservancy (hereinafter referred to as "EDWC").

2. Project Site

The Project site is the EDWC in Region No. 4 as shown in **Annex-I** (as attached).

3. Responsible and Implementing Agency

3-1. The responsible agency is the Ministry of Agriculture of the GOG.

3-2. The implementing agency is the National Drainage and Irrigation Authority, Ministry of Agriculture (hereinafter referred to as "NDIA"). The Organization chart of NDIA is shown in **Annex-II**.

4. Items requested by the GOG

4-1. Following discussions with the Team, the items described in **Annex-III** were finally requested by the GOG.

4-2. The Project is divided into two components considering the difference of schedule and procurement procedure under Japan's Grant Aid Scheme.

Component-1. Procurement of Equipment

Component-2. Rehabilitation of Facilities

4-3. JICA will assess the appropriateness of the request from the GOG and will recommend to the Government of Japan for approval.

5. Japan's Programme Grant Aid

5-1. The GOG understands Japan's Grant Aid Scheme and the necessary measures to be taken by the GOG as explained by the Team and described in **Annex-IV** of the Minutes of Meeting signed by both parties on July 29, 2009.

5-2. The GOG understands Japan's Grant Aid Scheme using the Procurement Management Agent of the Government of Japan (hereinafter referred to as "the Agent") and the necessary measures to be taken by the GOG as explained by the Team and described in **Annex-IV**, **Annex-V** and **Annex-VI** of these Minutes of Discussions.

5-3. The former (5-1) shall be adopted for the procurement of equipment (Component-1). The latter (5-2) shall be adopted for the rehabilitation of facilities (Component-2).

6. Administration of Japan's Programme Grant Aid using the Agent

6-1. The Team explained the administrative setup of the Programme as shown in **Annex-VII**, and the GOG concurred.

6-2. For promoting proper and smooth execution of the Programme, both sides confirmed that the Consultative Committee of the Programme (hereinafter referred to as "the Committee") would be established by the Ministry of Foreign Trade and International Cooperation (hereinafter referred to as "MOFTIC") after the approval of the Programme by the Government of Japan. The functions and provisional composition are described in **Annex-VIII**.

7. Schedule of the Survey

7-1. Component-1

1) The consultant members of the Team (hereinafter referred to as "the Consultants") will proceed with further studies in Guyana until October 30, 2010.
2) JICA will prepare the draft Preparatory Report in English and dispatch a mission in order to explain its contents to the GOG around January 2011.

7-2. Component-2

1) The Consultants will proceed with further studies in Guyana until November 24, 2010.
2) JICA will prepare the draft Preparatory Report in English and dispatch a mission in order to explain its contents to the GOG around March 2011.
3) The Consultants will proceed with further studies in Japan for the detail design of the facilities and prepare the reference documents for tender by the middle of April 2011.
4) Once the contents of the report are accepted in principle by the GOG, JICA will proceed with further examination of the study results in Japan, complete the final Preparatory Report and send it to the GOG by June 2011.

8. Other Relevant Issues

8-1. Necessity and Justification of the Project

Both sides confirmed that the rehabilitation of the EDWC is consistent with the counter-flood policy of the GOG and would improve the capacity to discharge excess water from the EDWC which has functioned as flood control in heavy rainfall.

8-2. Relevance of the Project as Adaptation to Climate Change

Both sides confirmed that the Project shall be positioned as part of the adaptation measures to climate change in the policy of the GOG.

8-3. Rehabilitation of the Embankment

Both sides confirmed that the rehabilitation of the EDWC embankment is the responsibility of NDIA using procured equipment. The Consultants will share their findings on the operation and maintenance of the embankment with NDIA.

8-4. Operation and Maintenance of Equipment and Facilities

The GOG agrees to take any necessary measures including allocation of required budget and personnel in order to operate and maintain the equipment and facilities provided by the Project.

8-5. Technical Assistance

The GOG concurs that technical assistance, such as soft components, will be included in the Project, as necessary.

8-6. Tax Exemption

The GOG will ensure exemptions to taxes including Value Added Tax (VAT), customs duty, and all other taxes and imposts in Guyana which may arise from the activities of the Project.

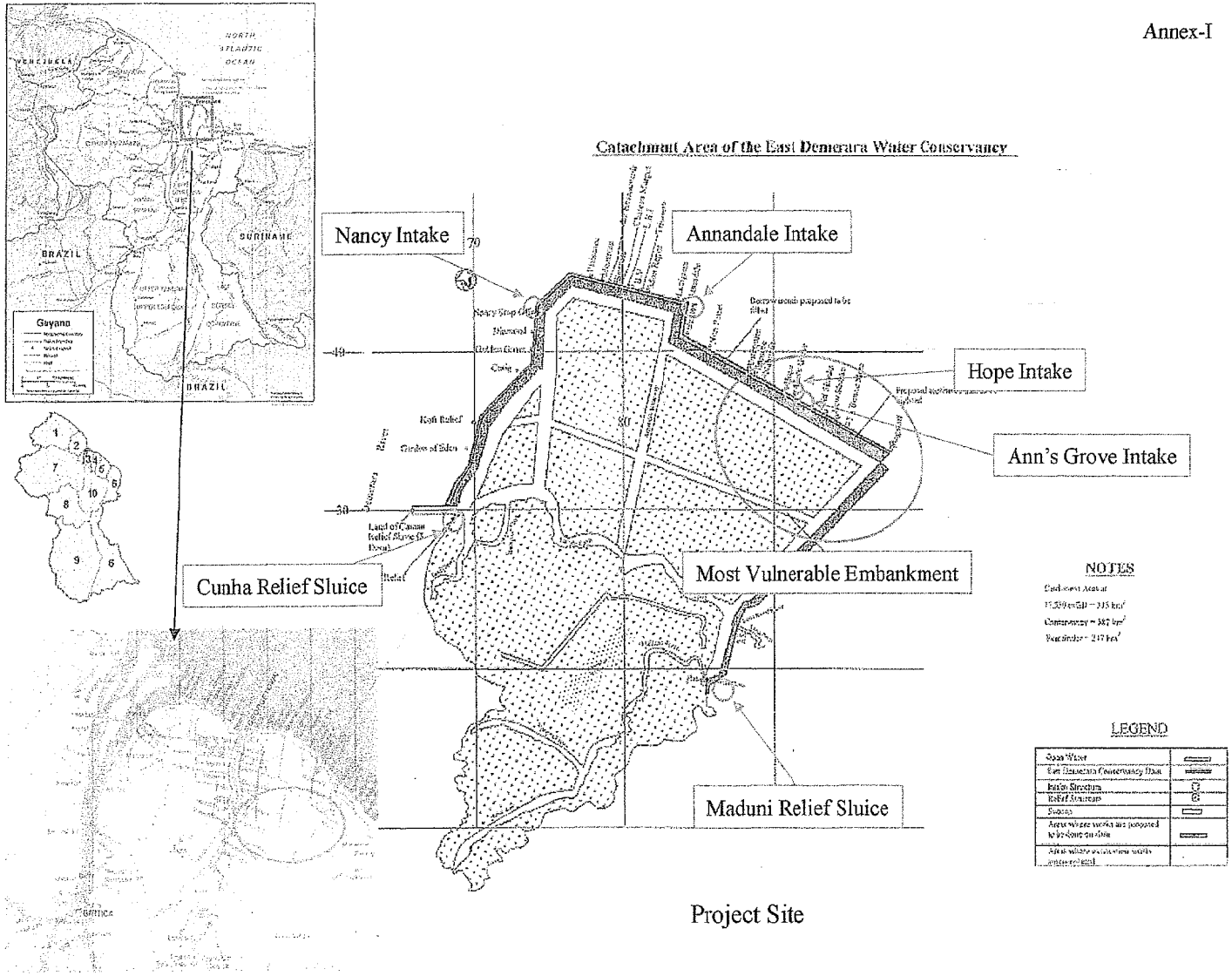
8-7. Environmental Impact Assessment (EIA)

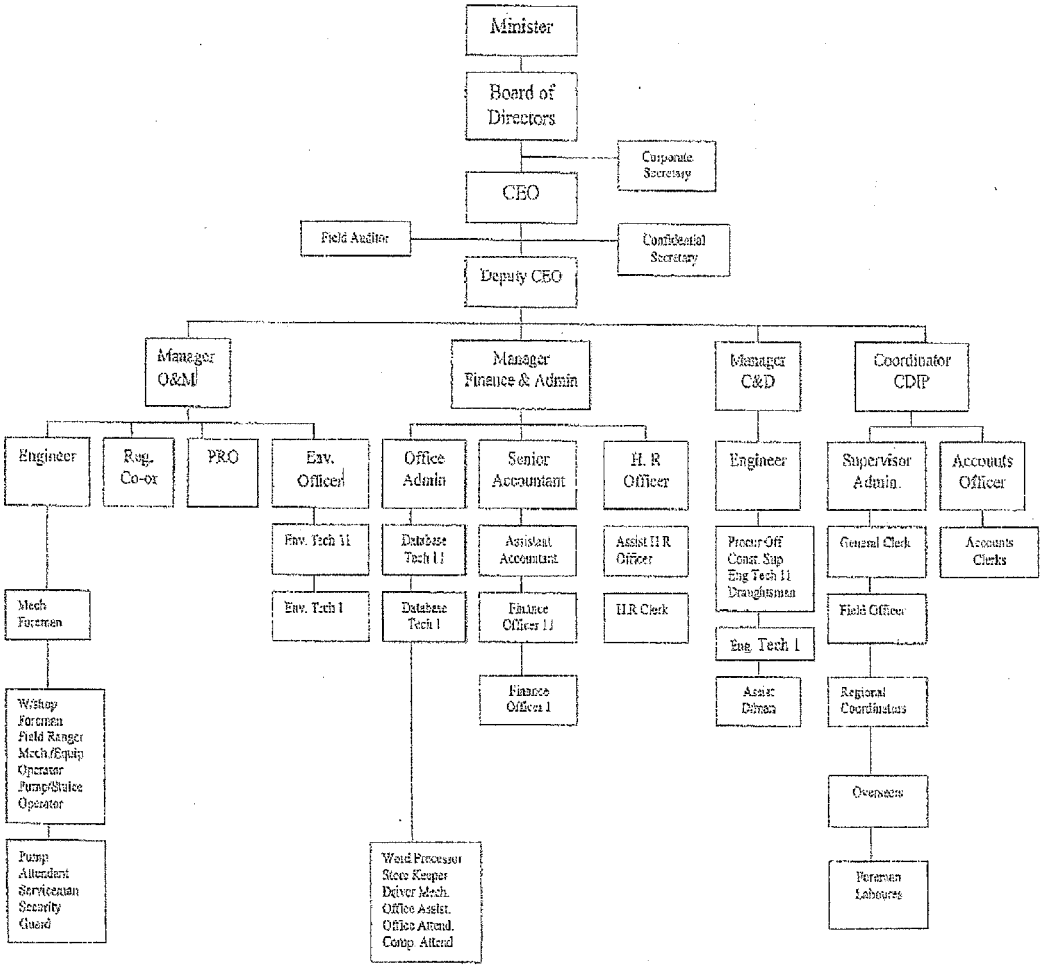
Both sides confirmed that an EIA shall be completed in accordance with the regulations of Guyana by the middle of March 2011, if necessary.

8-8. Coordination with Other Donors

The GOG will coordinate with other donor agencies to avoid duplication of the Project activities.

Annex-I	Project Site
Annex-II	Organization Chart of NDIA
Annex-III	Items Requested by the GOG
Annex-IV	Grant Aid using the Procurement Management Agent of the Government of Japan
Annex-V	Flow of Funds and Implementation of the Programme
Annex-VI	Major Undertakings to be Taken by Each Government
Annex-VII	Organization Chart for the Implementation of the Programme
Annex-VIII	Consultative Committee


Catachment Area of the East Demerara Water Conservancy
Nancy Intake
Annandale Intake
Hope Intake
Ann's Grove Intake
Most Vulnerable Embankment
Cunha Relief Sluice
Maduni Relief Sluice
NOTES
LEGEND
Project Site



Organization Chart of NDIA

Items Requested by the GOG

Component-1. Procurement of Equipment

No.	Item	Quantity
1	Super long reach track type hydraulic excavators, wide track	8
2	Pontoon with a mud bin to mount hydraulic excavators to work within conservancy waterways	2

Component-2. Rehabilitation of Facilities

No.	Item	Quantity
1	Cunha relief sluice	1
2	Maduni relief sluice	1
3	Hope intake structure	1
4	Anns Grove intake structure	1
5	Annandale intake structure	1
6	Nancy intake structure	1

Grant Aid using the Procurement Management Agent of the Government of Japan

(Provisional)

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

Multiple components can be combined to effectively meet the needs. Contractors, suppliers or consultants are not confined to Japanese firms only, and construction can be done based on the local method.

1. Procedures

Japan's Grant Aid Programme (hereinafter referred to as "the Programme") is executed trough the following procedures.

- Application
  - Request made by the Recipient
- Outline Design Study (hereinafter referred to as "the Study") by a Preparatory Survey
  - Outline Design Study conducted by JICA
- Appraisal &Approval
  - Appraisal by the Government of Japan and Approval by the Cabinet
- Determination of Implementation
  - The Notes exchanged between the Government of Japan (hereinafter referred to as "GOJ") and the Recipient
- Grant Agreement (hereinafter referred to as "the G/A")
  - Agreement concluded between JICA and the Recipient
- Implementation
  - Implementation of the Programme on the basis of the G/A

Firstly, the application or request for the Grant Aid submitted by the Recipient is examined by GOJ (the Ministry of Foreign Affairs) to determine whether or not it is eligible for the Grant Aid.

Secondly, if the request is deemed appropriate, JICA conducts the Outline Design Study, using Japanese consulting firms.

Thirdly, GOJ appraises the programme to see whether or not it is suitable for Japan's grant aid, based on the Outline Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the programme, once approved by the Cabinet, becomes official with the Exchange

of Notes (E/N) signed by GOJ and the Recipient. Simultaneously, the Grant will be made available by concluding a grant agreement between the Government of the Recipient or its designated authority and JICA (hereinafter referred to as "the G/A").

JICA is designated by GOJ as an organization responsible for the execution of the Grant.

Procurement management agent ("the Agent") is designated to conduct the procurement services of products and services (including fund management, preparing tenders, contracts and so on) on behalf of the Recipient. The Agent is an impartial and specialized organization and shall render services according to the Agent Agreement with the Recipient. The Agent is recommended to the Recipient by GOJ and agreed between the two Governments in the Agreed Minutes ("A/M").

2. Outline Design Study

1) Contents of the Study

The aim of the Outline Design Study ("the Study"), conducted by JICA on a requested programme ("the Programme"), is to provide a basic document necessary for the appraisal of the Programme by GOJ. The contents of the Study are as follows:

(1) Confirmation of the background, objectives, and benefits of the Programme and also institutional capacity of agencies and communities concerned of the Recipient necessary for the Programme's implementation.
(2) Evaluation of the appropriateness of the Programme to be implemented under the Grant Aid Scheme from a technical, social and economic point of view;
(3) Confirmation of items agreed upon by both parties concerning the basic concept of the Programme.
(4) Preparation of an outline design of the Programme.
(5) Estimation of cost for the Programme.

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid programme. The Outline Design of the Programme is confirmed considering the guidelines of Japan's Grant Aid scheme.

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

2) Selection of Consultants

For smooth implementation of the Study, JICA uses consulting firms. JICA selects firms based

on proposals submitted by interested firms. The firms selected carry out an Outline Design Study and write a report, based upon terms of reference set by JICA.

The consulting firms to work on the Programme's implementation after the Exchange of Notes could be, in principle, of any nationality as long as the Firm satisfies the conditions specified in the tender documents.

3. Implementation of the Grant Aid after the E/N

1) Exchange of Notes (E/N) and Grant Agreement (G/A)

The Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the programme, period of execution, conditions and amount of the Grant Aid, etc., are confirmed. The conclusion of the Grant Agreement (hereinafter referred to as "the G/A") between JICA and the recipient government will be followed to define the necessary engagement to implement the project such as payment conditions, responsibilities of the recipient government and procurement conditions.

2) Procedural details

Procedural details on the procurement of products and services under the Grant Aid will be agreed upon between the Recipient and JICA at the time of the signing of the E/N and G/A.

Essential points to be agreed upon are outlined as follows:

a) JICA is in a position to expedite the proper execution of the program.

b) The products and services shall be procured and provided in accordance with "Procurement Guidelines for Environment and Climate Change (Type I-E)" of JICA.

c) The Recipient shall conclude an employment contract with the Agent.

d) The Agent is the representative acting in the name of the Recipient concerning all transfers of funds to the Agent.

3) Focal Points of "The Procurement Guidelines of Japan's Programme Grant Aid for Environment and Climate Change (Type I - E)"

a) The Agent

The Agent is the organization which provides procurement services of products and services on behalf of the Recipient according to the Agent Agreement with the Recipient. The Agent is recommended to the Recipient by GOJ and agreed between the two Governments in the A/M.

b) Agent Agreement

The Recipient shall conclude an Agent Agreement, within two months after the date of entry into force of the E/N and the G/A, in accordance with the A/M. The scope of the Agent's services shall be clearly specified in the Agent Agreement.

c) Approval of the Agent Agreement

The Agent Agreement, which is prepared as two identical documents, shall be submitted to JICA by the Recipient through the Agent. JICA confirms whether or not the Agent Agreement is concluded in conformity with the G/A and the Procurement Guidelines, and approves the Agreement.

The Agent Agreement concluded between the Recipient and the Agent shall become effective after the approval by JICA in a written form.

d) Payment Methods

The Agent Agreement shall stipulate that "regarding all transfers of the fund to the Agent, the Recipient shall designate the Agent to act on behalf of the Recipient and issue a Blanket Disbursement Authorization ("the BDA") to conduct the transfer of the fund (Advances) to the Procurement Account from the Recipient Account."

The Agent Agreement shall clearly state that the payment to the Agent shall be made in Japanese yen from the Advances and that the final payment to the Agent shall be made when the total Remaining Amount becomes less than 3 % of the Grant and its accrued interest.

e) Products and Services Eligible for Procurement

Products and services to be procured shall be selected from those defined in the G/A.

f) Firms

In principle, a firm of any nationality could be contracted as long as the Firm satisfies the conditions specified in the tender documents.

The Firm, with approval by JICA, may be Japanese nationals and the products to be procured may be the products made in Japan or produced or manufactured by Japanese manufacturer(s) and/or its (their) affiliate(s) in any country.

g) Experts for Technical Assistance

Expert(s) could be deployed to carry out technical assistance. The expert(s) may be recommended by JICA when the conceptual consistency with the Studies is required. In principle, expert(s) is/are preferable to be Japanese nationals if appropriate.

h) Method of Procurement

In implementing procurement, sufficient attention shall be paid so that there is no unfairness among tenderers who are eligible for the procurement of products and services.

For this purpose, competitive tendering shall be employed in principle.

i) Tender Documents

The tender documents should contain all information necessary to enable tenderers to prepare valid offers for the products and services to be procured by the Grant Aid.

The rights and obligations of the Recipient, the Agent and the Suppliers of the products and services should be stipulated in the tender documents to be prepared by the Agent. Besides this, the tender documents shall be prepared in consultation with the Recipient.

j) Pre-qualification Examination of Tenderers

The Agent may conduct a pre-qualification examination of tenderers in advance of the tender so that the invitation to the tender can be extended only to eligible firms. The pre-qualification examination should be performed only with respect to whether or not the prospective tenderers have the capability of accomplishing the contracts concerned without fail. In this case, the following points should be taken into consideration:

(1) Experience and past performance in contracts of a similar kind
(2) Property foundation or financial credibility
(3) Existence of offices, etc. to be specified in the tender documents.

k) Tender Evaluation

The tender evaluation should be implemented on the basis of the conditions specified in the tender documents.

Those tenders which substantially conform to the technical specifications, and are responsive to other stipulations of the tender documents, shall be judged in principle on the basis of the submitted price, and the tenderer who offers the lowest price shall be designated as the successful tenderer.

The Agent shall prepare a detailed tender evaluation report clarifying the reasons for the successful tender and the disqualification and submit it to the Recipient to obtain confirmation before concluding the contract with the successful tenderer.

The Agent shall furnish JICA with a detailed evaluation report of tenders, giving the reasons for the acceptance or rejection of tenders.

l) Additional Procurement

If there is an additional procurement fund after competitive and / or selective tendering and / or direct negotiation for a contract, and the Recipient would like an additional procurement, the Agent is allowed to conduct an additional procurement, following the points mentioned below:

(1) Procurement of the same products and services

When the products and services to be additionally procured are identical with the initial tender and a competitive tendering is judged to be disadvantageous, the additional procurement can be implemented by a direct contract with the successful tenderer of the initial tender.

(2) Other procurements

When products and services other than those mentioned above in (1) are to be procured, the procurement should be implemented through a competitive tendering. In this case, the products and services for additional procurement shall be selected from among those in accordance with the G/A.

m) Conclusion of the Contracts

In order to procure products and services in accordance with the G/A, the Agent shall conclude contracts with firms selected by tendering or other methods.

n) Terms of Payment

The contract shall clearly state the terms of payment. The Agent shall make payment from the "Advances", against the submission of the necessary documents from the Firm on the basis of the conditions specified in the contract, after the obligations of the Firm have been fulfilled. When the services are the object of procurement, the Agent may pay certain portion of the contract amount in advance to the firms on the conditions that such firms submit the advance payment guarantee worth the amount of the advance payment to the Agent.

4) Undertakings required to the Government of the Recipient

In the implementation of the Grant Aid Programme, the Recipient is required to undertake such necessary measures as the following:

a) To secure land necessary for the sites of the Programme and to clear, level and reclaim the land prior to commencement of the Programme,
b) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites,
c) To secure buildings prior to the procurement in case the installation of the equipment,
d) To ensure prompt unloading and customs clearance at the port of disembarkation and to assist internal transportation therein,
e) To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Recipient with respect to the purchase of the Components including the employment of the Agent,
f) To accord all the concerned parties, whose services may be required in connection with supply of the products and services under the contracts, such facilities as may be necessary for their entry into the Recipient and stay therein for the performance of their work,
g) To ensure that the Facilities and/or the Components be maintained and used properly and effectively for the implementation of the Programme,

h) To bear all the expenses, other than those covered by the Grant and its accrued interest, necessary for the implementation of the Programme, and

i) To give due environmental and social consideration in the implementation of the Programme.

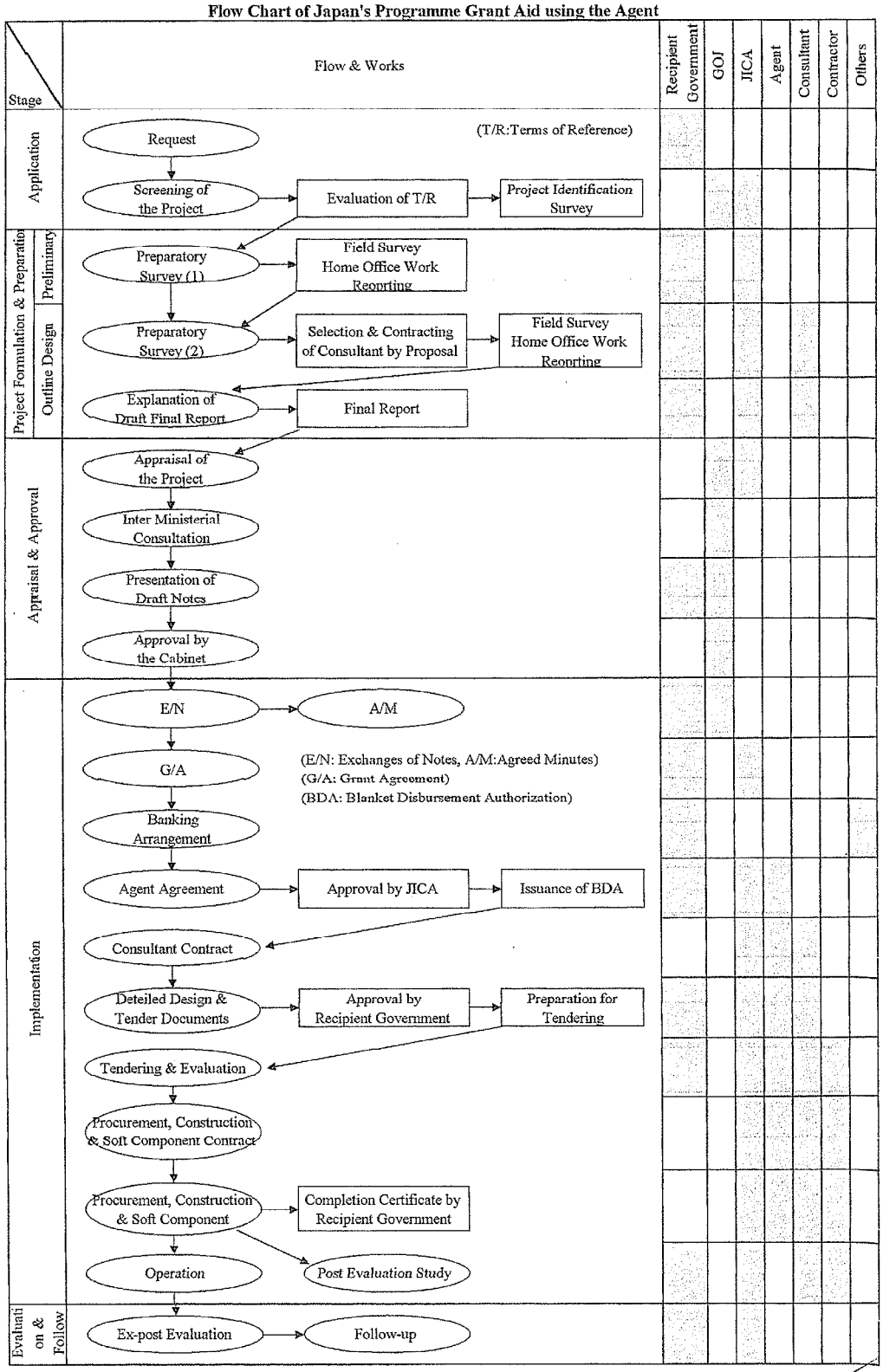
5) Proper Use

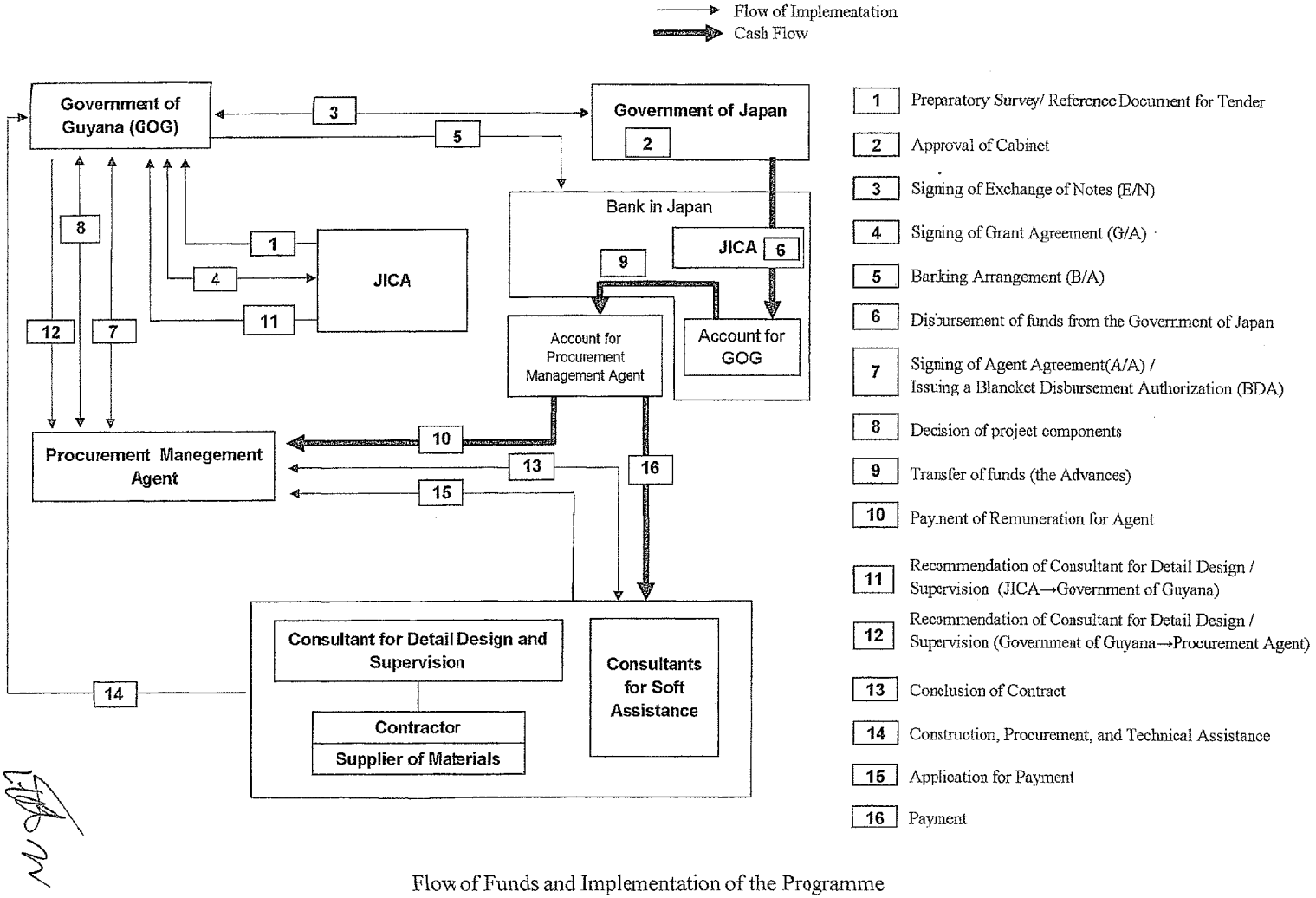
The Recipient is required to operate and maintain the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

6) Re-export

The products purchased under the Grant Aid should not be re-exported from the Recipient.

Flow Chart of Japan's Programme Grant Aid using the Agent





Flow of Funds and Implementation of the Programme

Major Undertakings to be taken by Each Government in relation to Equipment procurement (Component-1)

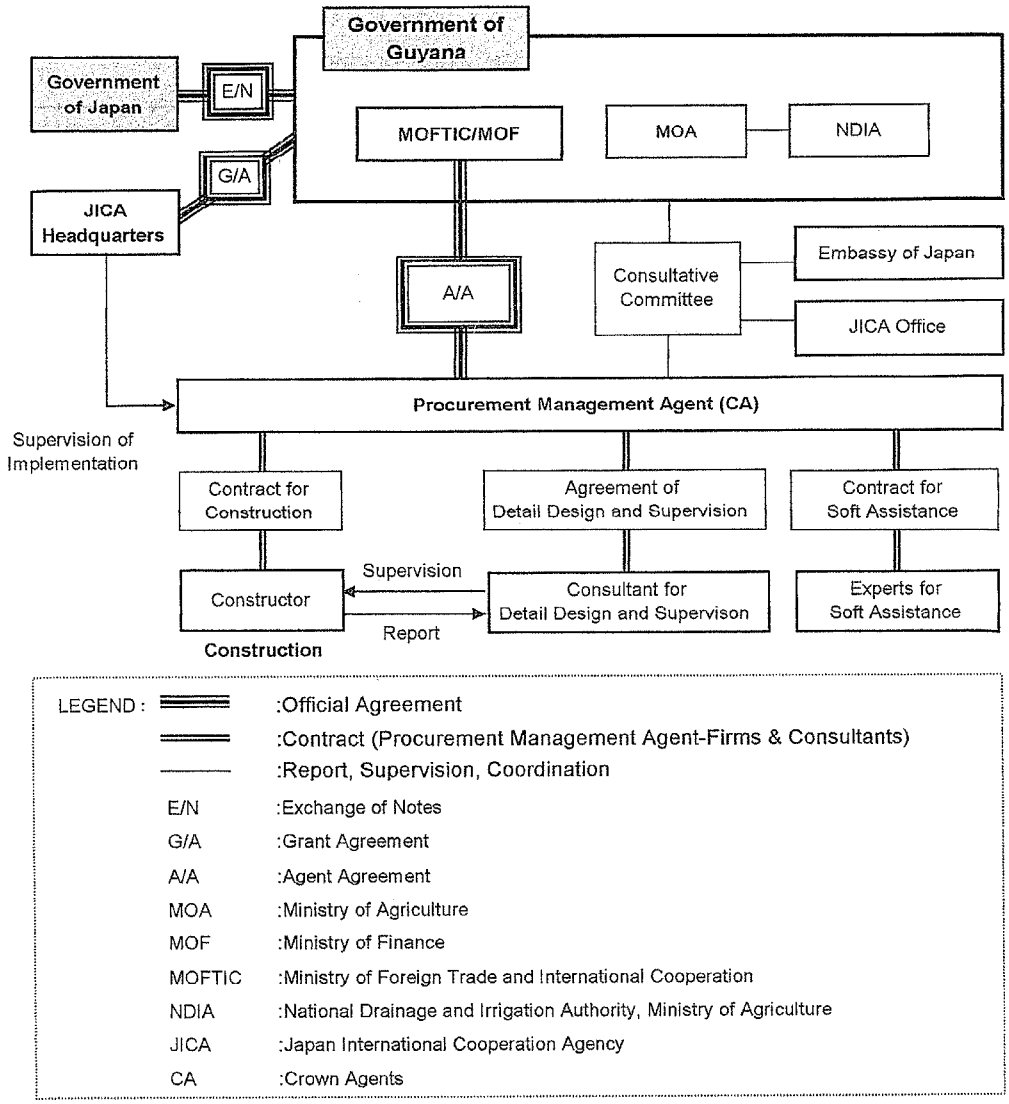
	Items	To be covered by the Grant	To be covered by Recipient side
1	To bear the following commissions to a bank of Japan for the banking services based upon the B/A		
	1) Advising on commission of A/P		●
	2) Payment of commission		●
2	To ensure prompt unloading and customs clearance at the port of entry in the Recipient country		
	1) Marine (Air) transportation of the products from Japan to the Recipient	●	
	2) Tax exemption and customs clearance of the products at the port of entry in the Recipient country		●
	3) Internal transportation from the port of entry to the Project site	●	
3	To accord all concerned parties, whose services may be required in relation to the supply of the products and the services under the approved contract such facilities as may be necessary for their entry into the Recipient country and stay therein for the performance of their work		●
4	To exempt or bear for all concerned parties the customs duties, internal taxes and other imposts which may be imposed in the Recipient country with respect to the supply of the products and services under the approved contract		●
5	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant		●
6	To bear all the expenses, other than those to be borne by the Grant, necessary for construction of the facilities as well as for the transportation and installation of the equipment		●
7	To give due environmental and social consideration in the implementation of the Programme		●

(B/A: Banking Arrangement, A/P: Authorization to Pay, N/A: Not Applicable)

Major Undertakings to be taken by Each Government in relation to Facility rehabilitation (Component-2)

	Items	To be covered by the Grant	To be covered by Recipient side
1	To secure land		●
2	To clear, level and reclaim the site when needed		●
3	To bear the following commissions to a bank of Japan for the banking services based upon the B/A		
	1) Payment of commission		●
4	To ensure prompt unloading and customs clearance at the port of entry in the Recipient country		
	1) Marine (Air) transportation of the products from Japan to the Recipient	●	
	2) Tax exemption and customs clearance of the products at the port of entry in the Recipient country		●
	3) Internal transportation from the port of entry to the Project site	●	
5	To accord all concerned parties, whose services may be required in relation to supplies, construction works and services under the approved contract such facilities as may be necessary for their entry into the Recipient country and stay therein for the performance of their work		●
6	To exempt or bear for all concerned parties the customs duties, internal taxes and other imposts which may be imposed in the Recipient country with respect to the supply of the products and services under the approved contract		●
7	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant		●
8	To bear all the expenses, other than those to be borne by the Grant, necessary for construction of the facilities as well as for the transportation and installation of the equipment		●
9	To give due environmental and social consideration in the implementation of the Programme		●

(B/A: Banking Arrangement, N/A: Not Applicable)



Organization Chart for the Implementation of the Programme

Consultative Committee

1. Function

The Consultative Committe (hereinafter referred to as "the Committee") will be established in order to fulfill the following functions:

1) To confirm an implementation schedule of the Programme for the speedy and effective utilization of the Grant and its accrued interest,
2) To discuss determination and/or modification of the Components, taking into account of the products enumerated in the list attached to the Procurement Guidelines and/or the result of the preparatory survey for the Programme by JICA,
3) To discuss modifications of the Programme,
4) To exchange views on allocations of the Grant and its accrued interest as well as on potential end-users,
5) To identify problems which may delay the utilization of the Grant and its accrued interest, and to explore solutions to such problems,
6) To exchange views on publicity related to the utilization of the Grant and its accrued interest; and
7) To discuss any other matters that may arise from or in connection with the G/A.

The first meeting of the Committee shall be held immediately after the approval of the Agent Agreement by JICA, which shall be convened by MOFTIC and the Procurement Management Agent (hereinafter referred to as "the Agent").

The selection of the Agent will be agreed between the two governments in the Agreed Minutes attached in the Exchange of Notes.

Further meetings will be held by the request of either the Guyanese side or the Japanese side. The Agent will also advise both sides on the necessity to call a meeting of the Committee.

2. Composition (Provisional)

1) Representative of Ministry of Agriculture
2) Representative of National Drainage and Irrigation Authority, Ministry of Agriculture
3) Representative of Ministry of Foreign Trade and International Cooperation
4) Representative of Ministry of Finance
5) Representative of the Procurement Management Agent
6) Representative of Embassy of Japan in Trinidad and Tobago
7) Representative of JICA Dominican Republic Office

資料 4-2 コンポーネント 1：機材調達概略設計概要説明調査時　討議議事録

MINUTES OF DISCUSSIONS
ON THE PREPARATORY SURVEY (OUTLINE DESIGN STUDY)
ON THE PROJECT FOR THE REHABILITATION
OF THE EAST DEMERARA WATER CONSERVANCY
IN REGION No.4
IN THE REPUBLIC OF GUYANA
(EXPLANATION ON DRAFT REPORT)

In October 2010, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a second Preparatory Survey Team on the Project for the Rehabilitation of the East Demerara Water Conservancy (hereinafter referred to as "the Project") to the Republic of Guyana (hereinafter referred to as "Guyana") and through discussion, field survey and technical evaluation of the results in Japan, JICA prepared a draft report of the survey for the procurement of equipment (Component-1) (hereinafter referred to as "the Draft Report").

In order to explain and consult with Guyana on the components of the Draft Report, JICA sent to Guyana the Draft Report Explanation Team (hereinafter referred to as "the Team"), which is headed by Mr. Shigeyuki Matsumoto, Director, Disaster Management Division 2, Global Environment Department, JICA, from January 5 to 8, 2011.

As a result of discussions, both parties confirmed the main items described on the attached sheets.

Georgetown, January 7, 2011

Mr. Shigeyuki Matsumoto
Leader
Draft Report Explanation Team
Japan International Cooperation Agency
Japan

Mr. Lionel Wordsworth
Chief Executive Officer (ag)
National Drainage and Irrigation Authority
Ministry of Agriculture
The Republic of Guyana

In witness of

Mr. Safraaz Shadood
Foreign Trade Officer
Ministry of Foreign Trade and International Cooperation
The Republic of Guyana

Attachment

1. Components of the Draft Report

1-1. The Government of Guyana (hereinafter referred to as "GOG") agreed and accepted in principle the contents of the Draft Report for the procurement of equipment (Component-1) explained by the Team. The contents of the procured equipment are as shown in Annex-1.

1-2. GOG agreed that the contents of the Draft Report would be confidential, be dealt with carefully and not be disclosed to any third parties.

1-3. GOG agreed that the Government of Japan (hereinafter referred to as "GOJ") would make a final decision on the procurement of equipment (Component-1) for the Project.

2. Japan's Grant Aid Scheme

GOG understood the Japan's Grant Aid Scheme and the necessary measures to be taken by GOG as explained by the Team and described in Annex-VI in the Minutes of Discussions (hereinafter referred to as "M/D") signed by both parties on October 14, 2010 as well as Annex-IV of the Minutes of Meeting signed by both parties on July 29, 2009.

3. Schedule of the Study

JICA will complete the final report in accordance with the confirmed items including not only the procurement of equipment (Component-1) but also the rehabilitation of facilities (Component-2), and send it to GOG by June 2011.

4. Confidentiality of the Project Cost Estimation

4-1. The Team explained the cost estimation of the Project as described in Annex-2. GOG agreed that the project cost estimation should never be duplicated or released to any outside parties before signing of all the contracts for the Project.

4-2. GOG agreed that the project cost estimation described in Annex-2 is a provisional one as a result of the Survey and could be subject to change following further examination by GOJ.

5. Other Relevant Issues

5-1. Undertakings to be taken by GOG

In the implementation of the Project, GOG is required to undertake such necessary measures as the following as well as measures mentioned in 2 of this attachment.

(1) Assembly and Installation of Equipment

- To secure storage sites for the equipment procured by the Project
- To secure assembly sites of the equipment procured by the Project at Land of Canaan
- To secure electric power for welding to assemble pontoons
- To assign staff for welding skill training conducted at the time of the pontoons' assembly
- To assign staff for initial operation and guidance of the equipment procured by the

Project

(2) Necessary Budget and Personnel

- To allocate enough budgets to properly operate and maintain the equipment procured by the Project by the time of the acceptance inspection
- To assign staff to properly operate and maintain the equipment procured by the Project by the time of the acceptance inspection

(3) Proper Use and Maintenance

- To facilitate proper use and maintenance of the equipment procured by the Project.
- To prepare records for the operation and maintenance of the equipment procured by the Project

(4) Use of Existing Equipment

- To secure 6 pontoons and 4 excavators other than the equipment procured by the Project to rehabilitate the embankment

5-2. Social and Environmental Considerations

(1) Both sides confirmed that the rehabilitation of the embankment to be conducted by the procured equipment would not impact the East Demerara Water Conservancy (EDWC) and its surroundings negatively since the conventional method of rehabilitation works in Guyana would be adopted.

(2) Since there are ongoing rehabilitation works on the embankment, the Environmental Permit is not required in Guyana. However, GOG shall confirm the need of the permit from Environmental Protection Agency (EPA) and report the result to JICA by 20th of January, 2011.

(3) Regarding the rehabilitation of facilities (Component-2), GOG shall confirm the need of the permit from EPA and report the result to JICA by February, 2011.

5-3. Projects with Other Donors

GOG explained projects with other donors and JICA confirmed that the equipment provided by the World Bank to GOG has been procured under the Conservancy Adaptation Project (CAP). The equipment is used to clear internal waterways in order to improve the flow in the EDWC. Since the CAP includes rehabilitation of some facilities, GOG shall submit their list (name of the facilities repaired or to be repaired, purpose and contents of their repair work) to JICA by 20th of January, 2011. Both sides confirmed that projects supported by other donors would avoid duplication with the Project as described in the M/D.

5-4. Rehabilitation of Facilities (Component-2)

(1) Cunha Relief Sluice

a) GOG requested to rehabilitate Cunha relief sluice, reconstruct discharge channel and construct a new access bridge which is necessary along with main public road to facilitate and improve discharge of excess water from the EDWC. However, the Team explained that the rehabilitation of the existing Cunha relief sluice was beyond the scope of the Project because it includes construction of a new bridge along with the

reestablishment of a section of the discharge channel. The Project in principle does not provide for any new construction of facilities.

b) Both sides confirmed that the gates of Sara Johanna sluice for Cunha outlet had already been rehabilitated in November 2010, and the wing walls of the inlet side of the gates would be rehabilitated in the Project.

(2) Hope Intake Structure

a) The Team explained that Hope intake structure may fail under high water level.

b) GOG agreed that the Hope intake structure would be rehabilitated with shielding water flow through the embankment using timber sheet piles to prevent failure of the structure under high water level, and with installing the guide rails for the door to open smoothly.

END

Annex-1: Contents of the Project
Annex-2: Project Cost Estimation

Annex-1

Contents of the Project
(Componet-1. Procurement of equipment)

Item	Quantity
Super long reach track type excavators, wide track (Operating weight : 25ton, Bucket capacity : 0.4 - 0.5m^3)	8
Pontoon with a mud bin to mount excavators to work within conservancy waterways (Live load : 65 ton or more)	2

Project Cost Estimation
(Componet-1. Procurement of Equipment)

(1) Project Cost borne by GOJ

The project cost borne by GOJ is estimated to be Japanese Yen 289 million. The contents of the project cost are shown in the table below.

Category	Amount (JY million)
Procurement of Equipment	275
Supervision of Procurement	14
Total	289

(2) Project Cost borne by GOG

The project cost borne by GOG is estimated to be USD 70,115. The contents of the project cost are shown the table below.

Category	Amount (USD)
Commission for Issuance of Authorization to Pay	115
Commission for Banking Arrangement	70,000
Total	70,115

(3) Condition of Estimation

a) Date of Estimation Base : October 2010
b) Exchange Rate : 1.00USD = 86.97 yen (Average of the past 6 months)
1.00GYD = 0.42 yen (Average of the past 6 months)
c) Implementation Period : As shown in the Annex of the Draft Report
d) Others : Cost estimation is in accordance with the framework with the Japan's Grant Aid Scheme.

(4) Remarks

a) The cost estimation is provisional and will be further examined by GOJ for the approval of the Grant.
b) According to the Guyanese tax system, the equipment procured by Japan's Grand Aid is exempted from value added tax (VAT) and import customs, etc.

資料 4-3 コンポーネント２：附帯施設改修概略設計概要説明調査時　討議議事録

MINUTES OF DISCUSSIONS
ON THE PREPARATORY SURVEY (OUTLINE DESIGN STUDY)
ON THE PROJECT FOR THE REHABILITATION
OF THE EAST DEMERARA WATER CONSERVANCY (COMPONENT II)
IN THE REPUBLIC OF GUYANA
(EXPLANATION OF DRAFT REPORT)

In October 2010, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the second Preparatory Survey Team on the Project for the Rehabilitation of the East Demerara Water Conservancy (hereinafter referred to as "the Project") to the Republic of Guyana (hereinafter referred to as "Guyana") and through discussion, field survey and technical evaluation of the results in Japan, JICA prepared a draft report of the survey for the rehabilitation of facilities (Component-2) (hereinafter referred to as "the Draft Report").

In order to explain and consult with Guyana on the components of the Draft Report, JICA sent the Draft Report Explanation Team (hereinafter referred to as "the Team") to Guyana, which is headed by Mr. Naotaka Yamaguchi, Senior Representative, JICA Caribbean Regional Representation Office in the Dominican Republic, JICA, from May 31 to June 2, 2011.

As a result of discussions, both parties confirmed the main items described on the attached sheets.

Georgetown, June 2, 2011

山口尚孝

Mr. Naotaka Yamaguchi
Leader
Draft Report Explanation Team
Japan International Cooperation Agency
Japan

Lionel Wordsworth

Mr. Lionel Wordsworth
Chief Executive Officer
National Drainage and Irrigation Authority
Ministry of Agriculture
Republic of Guyana

In witness of

Mr. Safraaz Shadood
Foreign Trade Officer
Ministry of Foreign Trade and International Cooperation
Republic of Guyana

Attachment

1. Components of the Draft Report

1-1. The Government of Guyana (hereinafter referred to as "GOG") agrees with and accepts in principle the contents of the Draft Report for the rehabilitation of facilities (Component-2) explained by the Team. The contents of the Project are as shown in Annex-1.

1-2. GOG agrees that the contents of the Draft Report would be confidential, be dealt with carefully and not be disclosed to any third parties.

1-3. GOG agrees that the Government of Japan (hereinafter referred to as "GOJ") has to make a final decision on the rehabilitation of facilities (Component-2) for the Project.

2. Japan's Grant Aid Scheme using a Procurement Management Agent

GOG understands the Japanese Grant Aid Scheme using the procurement management agent and the necessary measures to be taken by GOG as explained by the Team and described in **Annex-IV**, **Annex-V** and **Annex-VI** in the Minutes of Discussions (hereinafter referred to as "M/D") signed by both parties on October 14, 2010.

3. Schedule of the Study

3-1. The Consultants will proceed with further studies in Guyana to prepare the reference documents for the tendering process until the middle of June, 2011.

3-2. JICA will complete the final report in accordance with the confirmed items including not only the rehabilitation of facilities (Component-2) but also the procurement of equipment (Component-1), and send it to GOG by September, 2011.

4. Confidentiality of the Project Cost Estimation

4-1. The Team explained the cost estimation of the Project as described in Annex-2. Both parties agree that the project cost estimation should not be duplicated or released to any outside parties before signing of all the contracts for the Project.

4-2. GOG agrees that the project cost estimate described in Annex-2 is a provisional one as a result of the Survey and could be subject to change following further examination by GOJ.

5. Other Relevant Issues

5-1. Undertakings by GOG

In the implementation of the Project, the GOG shall be required to undertake such necessary measures as the following as well as measures mentioned in Annex-2 of this attachment.

(1) Rehabilitation Works

- To provide suitable storage sites for all materials, machinery and testing equipment for rehabilitation works

(2) Technical Assistance (Soft Components)

- To assign staff and identify rangers for technical training
- To provide space for technical training and workshops
- To provide necessary equipment to be used in the technical training

5-2. Operation and Maintenance System

(1) Allocation of Budget and Personnel

Both parties reconfirm that the GOG shall be responsible for taking any necessary measures including allocation of required budget and personnel in order to operate and maintain the facilities rehabilitated by the Project.

(2) Establishment of New Workshop

GOG reported on the progress on the establishment of the new workshop. The workshop is expected to be completed by the end of June, 2011.

(3) Continuing Capacity Development

Both parties confirmed that it would be important for GOG to train workers with expertise in inspection, operation and maintenance of the East Demerara Water Conservancy (hereinafter referred to as "EDWC"). Therefore, GOG agrees to hold necessary workshops and seminars for capacity development of rangers, contractors and staff.

5-3. Environmental and Social Considerations

(1) Acquisition of Environmental Permit

From the information submitted by NDIA and the site visit conducted, the Environmental Protection Agency (hereinafter referred to as "EPA") has determined on February, 2011 that the rehabilitation and revetment works within the EDWC would not have significant impacts on the environment and the Project would not need a detailed environmental impact assessment (DEIA).

(2) Summary Environmental Checklist

The environmental and social considerations including major impacts and mitigation measures for the Project are summarized in the Environmental Checklist based on JICA Guidelines for Environmental and Social Considerations attached as Annex-3. The checklist will be attached to the Final Report of the Preparatory Survey.

(3) Monitoring the impact of implementation on Environmental and Social Conditions

Monitoring the Environmental and Social conditions will be conducted by the National Drainage and Irrigation Authority, and the Ministry of Agriculture (hereinafter referred as to "NDIA") in accordance with the Monitoring Plan for the Project described in the Draft Report. The monitoring findings will be reported to JICA in the Monitoring Form, which is attached as Annex-4, as part of progress reports during the rehabilitation phase.

END

Annex-1: Contents of the Project
Annex-2: Project Cost Estimation (Confidential)
Annex-3: Environmental Checklist
Annex-4: Monitoring form

Contents of the Project

(Component-2. Rehabilitation of Facilities)

1. Rehabilitation works

Item		Contents of Rehabilitation				
		Gate	Structure	Cut-off wall	Retaining wall	Embankment
Intake structure	Ann's Grove	-	-	-	●	●
	Hope	●	●	●	●	●
	Annandale	●	-	-	●	●
	Nancy	-	-	-	●	●
Relief sluice	Maduni	●	-	-	●	●
	Sarah Johanna (Cunha)	-	-	-	●	-

2. Technical Assistance (Soft components)

(1) Capacity development for quality control and supervision of rehabilitation works

(2) Capacity development for inspection and maintenance of embankment and facilities

Confidential

Annex-2

Project Cost Estimation

(Component-2. Rehabilitation of Facilities)

1. Project Cost borne by GOJ

The project cost borne by GOJ is estimated to be Japanese Yen 310 million. The contents of the project cost are shown in the table below.

Rehabilitation works

Category	Amount (JY million)
Rehabilitation of Facilities	176
Procurement Management Agent	51
Supervision of Rehabilitation	68
Legal Services	3
Total	298

Technical Assistance (Soft components) : 12 JY million

2. Project Cost borne by GOG

The project cost borne by GOG is estimated to be USD 8,415. The contents of the project cost are shown the table below.

Category	**Amount (USD)**
Commission for Banking Arrangement	7,815
Equipment for Technical Assistance	600
Total	8,415

3. Condition of Estimation

a) Date of Estimation Base : October 2010

b) Exchange Rate : 1.00USD = 86.97 yen (Average of the past 6 months)
1.00GYD = 0.42 yen (Average of the past 6 months)

c) Implementation Period : As shown in the Annex of the Draft Report

d) Other : Cost estimation is in accordance with the framework of the Japanese Grant Aid Scheme that uses the procurement management agent.

4. Remarks

a) The cost estimation is provisional and will be further examined by GOJ for the approval of the Grant.

b) According to the Guyanese tax system, the material and equipment procured by Japanese Grant Aid

using the Procurement Management Agent shall be exempted from all taxes and duties in Guyana.
Annex 3 Environmental Checklist to be inserted.

Environmental Checklist: 3. Hydropower Stations, Dams and Reservoirs (1)

Annex-3

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) Y (b) Y (c) N (d) N	(a)(b)(c) Environmental Protection Agency (EPA, Guyana) has determined that it was not necessary to conduct EIA as the rehabilitation and revetment works on the East Demerara Water Conservancy (EDWC) would not have significant impacts on the environment on February 8, 2011. (d) There are no other approvals required.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) N (b) N	(a)(b) General scope of the Project was disseminated to stakeholders via the media. Although there will be some minor impact on land use and local resources, there will be reduced risk of flood damage. As such local stakeholders are not likely to raise objections.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) N	(a) As the scale of the rehabilitation is small, the social and environmental considerations are not relevant.
2 Pollution Control	(1) Water Quality	(a) 1.Does the water quality of dam pond/reservoir comply with the country's ambient water quality standards? (a) 2. Is there a possibility that proliferation of phytoplankton and zooplankton will occur? (b) Does the quality of water discharged from the dam pond/reservoir comply with the country's ambient water quality standards? (c) Are adequate measures, such as clearance of woody vegetation from the inundation zone prior to flooding planned to prevent water quality degradation in the dam pond/reservoir? (d) Is there a possibility that reduced the river flow downstream will cause water quality degradation resulting in areas that do not comply with the country's ambient water quality standards? (e) Is the discharge of water from the lower portion of the dam pond/reservoir (the water temperature of the lower portion is generally lower than the water temperature of the upper portion) planned by considering the impacts to downstream areas?	(a)1 Y (a)2 N (b) Y (c) Y (d) N (e) Y	(a)(b)(c)(d)(e) Although there is excavation work in the scope of the rehabilitation, social and environmental considerations will not be affected. There will be some minor impact on water pollution. However, quality control plan in the design phase provides for monitoring water quality during rehabilitation and for some time after rehabilitation.
	(2) Wastes	(a) Are earth and sand generated by excavation properly treated and disposed of in accordance with the country's regulations?	(a) Y	(a) As earth and sand generated by excavation is reused for the embankment work, there is little waste generated by excavation.
	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) It is not a protected area.

Environmental Checklist: 3. Hydropower Stations, Dams and Reservoirs (2)

Annex-3

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
3 Natural Environment	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) Is there a possibility that the project will adversely affect downstream aquatic organisms, animals, plants, and ecosystems? If yes, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Is there a possibility that installation of structures, such as dams will block the movement of the migratory fish species (such as salmon, trout and eel those move between rivers and sea for spawning)? If yes, are adequate measures taken to reduce the impacts on these species?	(a) N (b) N (c) N (d) N	(a)(b)(c)(d) There is no designated species of flora or fauna that should be protected in and around the EDWC. The scope of rehabilitation is limited, therefore, no impact on ecosystem will be expected.
	(3) Hydrology	(a) Is there a possibility that hydrologic changes due to the installation of structures, such as weirs will adversely affect the surface and groundwater flows (especially in "run of the river generation" projects)?	(a) N	(a) As there is no type of rehabilitation that affects groundwater and the scale of the rehabilitation is small, no impact on hydrological situation will be expected.
	(4) Topography and Geology	(a) Is there a possibility that reductions in sediment loads downstream due to settling of suspended particles in the reservoir will cause impacts, such as scouring of the downstream riverbeds and soil erosion? Is there a possibility that sedimentation of the reservoir will cause loss of the storage capacity, water logging upstream, and formation of sediment deposits at the reservoir entrance? If yes, are the possibilities of the impacts studied, and adequate prevention measures taken? (b) Is there a possibility that the project will cause a large-scale alteration of the topographic features and geologic structures in the surrounding areas (especially in run of the river generation projects and geothermal power generation projects)?	(a) N (b) N	(a)(b) As the scale of the rehabilitation is small, no impact on topography and geographical features will be expected.

Environmental Checklist: 3. Hydropower Stations, Dams and Reservoirs (3)

Annex-3

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Are the compensations going to be paid prior to the resettlement? (e) Are the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	(a) N (b) N (c) N (d) N (e) N (f) N (g) N (h) N (i) N (j) N	(a)(b)(c)(d)(e)(f)(g)(h)(i)(j) The rehabilitation is located within the EDWC, no impact concerning involuntary resettlement will be expected.

Environmental Checklist: 3. Hydropower Stations, Dams and Reservoirs (4)

Annex-3

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
4 Social Environment	(2) Living and Livelihood	(a) Is there any possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary? (b) Is there any possibility that the project causes the change of land uses in the neighboring areas to affect adversely livelihood of local people? (c) Is there any possibility that the project facilities adversely affect the traffic systems? (d) Is there any possibility that diseases, including infectious diseases, such as HIV, will be brought due to the immigration of workers associated with the project? Are adequate considerations given to public health, if necessary? (e) Is the minimum flow required for maintaining downstream water uses secured? (f) Is there any possibility that reductions in water flow downstream or seawater intrusion will have impacts on downstream water and land uses? (g) Is there any possibility that water-borne or water-related diseases (e.g., schistosomiasis, malaria, filariasis) will be introduced? (h) Is there any possibility that fishery rights, water usage rights, and common usage rights, etc. would be restricted?	(a) N (b) N (c) N (d) N (e) Y (f) N (g) N (h) N	(a) Although the risk of flood damage on social infrastructure is reduced and there may be some impact on social institutions, little negative impact is expected. (b) As the risk of flood damage is reduced for all the residents in the surrounding areas, land can be utilized more actively. Therefore, there will be some, though not significant, impact on the local economy such as employment and livelihood. No negative impact on distribution of benefit and damage and local conflicts of interest will also be expected. (c) As the traffic on arterial roads increases due to the construction of Cunha Sluice, some, though not significant, impact on existing social infrastructures and services will be expected. Infectious diseases will be decreased as the risk of flood damage decreases. Therefore, although there may be some impact on sanitation, little negative impact will be expected. (d) No possibility that diseases, including infectious diseases, such as HIV, will be brought due to the immigration of workers associated with the project will be expected. (e) The minimum flow required for maintaining downstream water uses will be secured. (f) No impact on downstream water and land uses will be expected. (g) Infectious diseases will be decreased as the risk of flood damage decreases. Therefore, although there may be some impact on sanitation, little negative impact will be expected. (h) As the rehabilitation of existing facilities is conducted only in limited areas, there will not be any problems of water rights.
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage sites? If yes, are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N	(a) As there is no cultural heritage sites in the EDWC, no impact will be expected.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? If yes, are necessary measures taken?	(a) N	(a) As the scale of the rehabilitation is small, no impact on landscape will be expected.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources to be respected?	(a) N (b) Y	(a)(b) Although there is a village of indigenous people along the upper stream of Mahaica River, it is located outside the catchment area of the EDWC. Therefore, no impact on the indigenous and ethnic people will be expected.

Environmental Checklist: 3. Hydropower Stations, Dams and Reservoirs (5)

Annex-3

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
4 Social Environment	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(a) Y (b) Y (c) Y (d) Y	(a)(b)(c)(d) As laws and ordinances are complied with and appropriate measures are ensured, no problem with the working conditions will be expected.
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce the impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce the impacts?	(a) Y (b) Y (c) Y	(a) Although machinery for the rehabilitation generates noise and vibration, there are no residential settlements around the project site. Therefore, no impact from noise and vibration will be expected. (b)(c) As the scale of the rehabilitation is small, no impact on the natural and social environment will be expected.
	(2) Accident Prevention Measures	(a) Is a warning system established to alert the inhabitants to water discharge from the dam?	(a) Y	(a) The warning system is established to alert the inhabitants to water discharge from the dam by NDIA.
	(3) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a) Y (b) Y (c) Y (d) Y	(a)(b)(c)(d) Monitoring items, methods and frequencies will be shown in the monitoring form.

Environmental Checklist: 3. Hydropower Stations, Dams and Reservoirs (6)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Forestry Projects checklist should also be checked (e.g., projects in the mountains including large areas of deforestation). (b) In the case of dams and reservoirs, such as irrigation, water supply, and industrial water purposes, where necessary, pertinent items described in the Agriculture and Water Supply checklists should also be checked. (c) Where necessary, pertinent items described in the Power Transmission and Distribution Lines checklist should also be checked (e.g., projects including installation of electric transmission lines and/or electric distribution facilities).	(a) N (b) N (c) N	(a)(b)(c) This item is not relevant to the Project.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N	(a) As the scale of the rehabilitation is small, no impact on transboundary or global issues will be expected.

1) Regarding the term "Country's Standards" mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are requested to be made.
In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).
2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.

Monitoring Form

NDIA will follow-up corrective actions taken by the contractors of any issues that are identified on the environmental checklist. The environmental checklist and reports on corrective actions including test data will be submitted to JICA as attachments to the periodic reports. . NDIA should utilize the attached monitoring forms for submitting reports.

-When monitoring plans including monitoring items, frequencies and methods are decided, project phase or project life cycle (such as construction phase and operation phase) should be identified.

1. Responses/Actions to Feedback and Suggestions from Public and Authorities

Monitoring Item and Phase of Project	Monitoring Results during Report Period
eg.) Phase: Constructions/ Operations, Responses/Actions to Feedback and Suggestions from Public and Authorities	

2. Mitigation Measures

(1) Arterial road adjacent to Cunha (Sarah Johanna) Relief Sluice work site

(Criteria in case of heavy traffic on the road)

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standards	Referenced International Standards	Remarks (Measurement Point, Frequency, Method, etc.) *
Cracks	%	30	40	-	MCI(JAP)	Sketching and crack ratio calculation
Roughness (longitudinal)	mm	4.0	5.0	-	MCI(JAP)	Roughness measurement
Rutting (lateral)	mm	30	40	-	MCI(JAP)	Rut depth measurement
Overall mitigation measures evaluation	MCI	3～5	less than 3 (urgent need)	-	MCI(JAP)	Quantification of Index-value by using evaluation formula

*Measuring at loading/Unloading area on the road, at the completion of the whole works.

(2) Water pollution at the potable water Intake of Nancy

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standards	Referenced International Standards	Remarks (Measurement Point, Frequency, Method, etc.)
pH	-	6.5	8.5	WHO	EPS(USA)	Sampling at the outlet of the Intake structure, at suggested time of 10:00 a.m., daily during work period
Chromaticity	Tcu	-	15	-	EPS(USA)	ditto
Turbidity	NTU	-	5	-	EPS(USA)	ditto

(3) Soil Test (in cases of using cement)

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standards	Referenced International Standards	Remarks (Measurement Point, Frequency, Method, etc.)
pH	-	-	-	-	-	Cement-mixed soil pH testing, one sample/day, during work execution

資料-5 ソフトコンポーネント計画

5.1 ソフトコンポーネントを計画する背景

本事業は、堤体修復のための機材調達（コンポーネント１）と附帯施設（排水門・取水口）の改修工事（コンポーネント２）で構成される。本事業の効果を最大限に発揮するためには、調達した機材（超ロングアーム掘削機、台船）によって適切な堤体修復作業が行われ、堤体や附帯施設が点検や維持管理作業を行いながら持続的に活用される必要がある。そのためには、同貯水池の維持管理に当たっている関連機関職員の品質・施工監理能力、維持管理能力を向上させる必要がある。よって、本事業の成果の持続性を高めるため、堤体修復及び附帯施設改修に係る品質・施工監理能力と点検・維持管理能力の向上のためのソフトコンポーネント（技術支援）を実施する必要性は非常に高い。

5.2 ソフトコンポーネントの目標

ソフトコンポーネントの目標は、東デメララ貯水池の関連機関において維持管理業務に携わる職員に対し、調達機材による堤体修復工事と附属施設改修工事の品質・施工監理ならびに附帯施設（排水門・取水口）の運用・維持管理を適切に行うために必要な知識を習得し、持続的な水資源の安定的確保と洪水被害の軽減を実現することにある。

5.3 ソフトコンポーネントの成果

ソフトコンポーネントの期待される成果は、表-1 に示す通りである。

表-1 ソフトコンポーネントの成果とその確認方法

成果	内容	達成度の確認方法
成果 1 （堤体修復及び附帯施設改修に係る品質・施工監理能力の向上）	堤体修復工事及び附帯施設改修工事における品質・施工監理方法についてのマニュアルが作成され、活用される。	マニュアルに則って、品質・施工監理が行われたか、目視及び管理記録等の台帳によって習熟度・理解度を確認する。
成果 2 （堤体及び貯水池附帯施設に係る点検・維持管理能力の向上）	堤体及び貯水池附帯施設の点検・維持管理についてのマニュアルが作成され、活用される。	マニュアルに則って、点検・維持管理の計画及び実施、体制の整備等が行われたかを、目視点検報告書、維持管理実施記録の作成等により習熟度・理解度を確認する。

5.4 成果達成度の確認方法

成果達成度の確認方法は、表-1 に示す通りである。

5.5 ソフトコンポーネントの活動（投入計画）

ソフトコンポーネントは、堤体修復工事及び附帯施設改修工事の品質・施工監理能力の向上と貯水池の点検・維持管理能力の向上のため、本邦コンサルタント 2 名による直接支

援型とし、その期間は国内作業を含めて 3.0 カ月（5.3M/M）とする。その活動計画を表-2 に示す。

表-2 ソフトコンポーネント活動計画

成果	必要とされる技術・業種	現況の技術と必要とされる技術レベル	ターゲットグループ	実施方法	実施リソース	成果品
成果 1（提体修復及び附帯施設改修に係る品質・施工監理能力の向上）	一級土木施工管理技士又はダム管理技士又はダムもしくは貯水池の施工監理経験者 1)	現在の堤体修復工事及び附帯施設改修工事の施工状況から判断し、品質にばらつきがあることから、品質管理及び施工監理方法に係る知識が不足している。そのため、堤体修復工事について品質・施工監理マニュアルを作成し、精度が高く均質な施工監理を行う必要がある。	・ワークショップ職員 6 名 ・EDWC Lama 事務所の品質・施工監理担当職員 8 名 ・品質・施工監理担当維持補修員 2 名	・品質・施工監理マニュアルのドラフト ・品質・施工監理状況の確認 ・品質・施工監理 OJT の実施（盛土材料試験、透水試験等 を含む） ・品質・施工監理マニュアルの修正、完成 ・ワークショップの開催 (1 回) ・品質・施工監理記録表の作成とその確認	品質・施工監理担当コンサルタント 2.50 M/M（直接支援型）	・品質・施工監理マニュアル ・品質・施工監理記録
成果 2（堤体及び貯水池附帯施設に係る点検・維持管理能力の向上）	一級土木施工管理技士又はダム管理技士又はダムもしくは貯水池の点検・維持管理経験者 1)	現在の堤体・附帯施設の管理状況から判断し、施工後に適切な管理が実施されていないことから、維持管理及び点検方法に係る知識が不足している。そのため、実施体制や手順、日常・定期点検手法、点検記録の作成方法について記述した点検・維持管理マニュアルを作成する必要がある。	・EDWC Lama 事務所の点検・維持管理担当職員 2 名 ・点検・維持管理担当維持補修員 8 名	・点検・維持管理マニュアルのドラフト ・点検・維持管理状況の確認 ・点検・維持管理 OJT の実施 ・点検・維持管理マニュアルの修正、完成 ・ワークショップの開催 (1 回) ・点検・維持管理記録表の作成とその確認	点検・維持管理担当コンサルタント 3.00 M/M（直接支援型）	・点検・維持管理マニュアル ・点検・維持管理記録

5.6 ソフトコンポーネントの実施リソースの調達方法

実施リソースは、本プロジェクトの機材調達及び附帯施設改修に関わる本邦コンサルタントによる直接支援型とする。その理由は以下の通りである。

・成果品となるマニュアルは、ローカルコンサルタントの知識が不足している施工時の品質・施工監理と構造物の日常点検手法について、日本のマニュアル等をベースにして作成することになる。そのため、日本の技術を理解している本邦コンサルタントによる直接支援型とする。

・日本のマニュアルを基にした試験・検査 2)のうち、「ガ」国で実施されていないものの導入する必要性が高いと考えられる試験・検査があるため、その内容を熟知し、高度な技術力を保有した技術者であることが必須条件である。そのため、本邦コンサルタントによる直接支援型とする。

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1) ダム又は貯水池、河川等の盛土工事、コンクリート構造物の施工（盛土の品質・施工監理試験及び日常管理、一般的なコンクリート構造物の品質・施工監理等）、又は貯水池の運営・維持管理の業務経験を必要とする。

2) セメント又は砂を混合した安定処理盛土材の基準試験及び品質・施工監理試験、高含水比粘土を使用した堤体盛土の透水試験及び品質・施工監理試験であり、品質・施工監理マニュアルに含まれる。

5.7 ソフトコンポーネントの実施工程

ソフトコンポーネントは、堤体修復工事と附帯施設改修工事の施工期間内の 3.0 カ月に渡って行うこととする。表-３にソフトコンポーネントの全体実施工程を示し、現地作業における日毎の活動予定と必要となる車両を添付「現地作業における活動予定表」に示す。

表-3 ソフトコンポーネント全体工程案

成果	要員	1 (10 20 30)	2 (10 20 30)	3 (10 20 30)	4 (10 20 30)
成果１ 堤体修復・附帯施設改修に係る品質・施工監理能力の向上	品質・施工監理担当コンサルタント	(15 0.50)	(45 1.50)	(12 0.40)	
成果2 堤体および貯水池附帯施設に係る点検・維持管理能力の向上	点検・維持管理担当コンサルタント	(15 0.5)	(60 2.00)		(12 0.4)
報告書等の提出	成果１（品質・施工監理マニュアル案）			▲英文	
	成果２（点検・維持管理マニュアル案）				▲英文
	完了報告書				▲英文

凡例)　　国内作業 ▭　　現地作業 ▬

・成果１は、土工事の実施が最も困難な時期（貯水池内の水位が最高値を示す雨期直後）に実施する。
・成果２は、堤体及び附帯施設が最も構造的に不安定な時期（貯水池内の水位が最高値から徐々に低下する雨期直後）に実施する。

5.8 ソフトコンポーネントの成果品

本ソフトコンポーネントにおける成果品は表-４のとおりである。

表-4 成果品一覧

分類	資料名	内容	頁数
マニュアル	品質・施工監理マニュアル案（英語）	・品質・施工監理方法及び留意点 ・施工実施体制 ・業務契約 TOR 案	30
	点検・維持管理マニュアル案（英語）	・日常・定期的な点検・維持管理方法及び留意点 ・緊急時の点検・維持管理方法及び留意点 ・点検・維持管理体制 ・業務契約 TOR 案	50
報告書	完了報告書（英語、日本語）	・活動計画と実績 ・点検・維持管理訓練結果 ・活動・成果の達成度 ・成果達成度に影響を与えた要因 ・効果の持続・発展のための今後の課題・提言等 ・成果品一式	30
プレゼンテーション資料	ワークショップ配布資料	・品質・施工監理マニュアル案の要点 ・点検・維持管理マニュアル案の要点	30
		合計	140

5.9 相手国実施機関の責務

ソフトコンポーネントの実施に関してガイアナ側の責務は、以下の通りである。

・ソフトコンポーネントに必要な人員・講習施設及び機材[3)]を確保する。

・ソフトコンポーネントの活動時に必要な人件費及び講習施設と機材[3)]の準備に必要な経費を負担する。

3) 簡易コーンペネトロメーター試験機、一軸圧縮試験に使用するモールド、養生槽、試験体押出し装置、成形機や試験用具・試験器具・土嚢袋等の試験器具（総額 5 万円程度）

［別添－1］　現地作業における活動予定表

	【要員1】 堤体修復工事及び附帯施設の改修に係る品質・施工監理担当	車両	車両
	【成果1：堤体修復工事に係る品質・施工監理能力の向上】	A	B
1			
2			
3	①既存マニュアルの問題点と修正内容の抽出、②技術資料の収集		
4			
5			
6	休日		
7	休日		
8			
9	①既存マニュアルの問題点と修正内容の抽出、②不足項目を補足した修正		
10	マニュアル案（案）の作成、③先方への説明資料の作成		
11			
12	上記資料の記載内容・指導方法等の打合せ（JICA）		
13	休日		
14	休日		
15	①上記資料の内容の修正・資料整理、②先方への説明資料の作成		
16	移動日		
17	移動日		
18	①会議準備、②JICA専門家説明、③現地視察	○	
19	NDIA への既存マニュアルの修正・補足箇所・内容の説明・協議・打合せ	○	
20	上記協議・打合せ結果に基づく記載内容の修正		
21	休日		
22	EDWC担当者へ既存マニュアルの修正・補足箇所・内容の説明・協議・打合せ	○	
23	①上記協議による記載内容の修正、②NDIAに修正内容の報告	○	
24	①修正マニュアル案に基づく品質・施工監理・試験実施の状況把握、		○
25	②担当者（ワークショップ・EDWC職員、レンジャー）への現地指導、		○
26	③盛土・地盤改良等の問題点の抽出、 ④同マニュアル案の修正事項・修正内容の整理		○
27	①マニュアル案（当該週に使用したもの）の追加修正・改良作業、 ②担当者会議の開催		○
28	休日		
29	①修正マニュアル案（前週に修正したもの）に基づく品質・施工監理・試験		○
30	の実施状況の把握、②担当者（ワークショップ・EDWC職員、レンジャー）		○
31	への現地指導、③盛土・地盤改良等の問題点の抽出、④同マニュアル案の修正内容の整理、⑤W/S資料作成		○
32	①マニュアル案（当該週に使用したもの）の修正・改良作業、 ②W/S資料作成		○
33	①W/Sの開催、②NDIA への状況報告及び修正マニュアル案の修正箇所・改善の説明、③同マニュアルの整理・取り纏め	○	
34	①W/Sの開催、②修正マニュアルの修正箇所・改善箇所等の説明・指導方向の変更説明、③第一回マニュアル案改訂版の作成（日本の内容も協議して織り込む	○	
35	休日		
36	①第一回マニュアル案改訂版の担当者（ワークショップ・EDWC職員、		○
37	レンジャー）の習熟度の把握、②品質・施工監理実施における問題点・		○
38	課題の抽出、		○
39	③担当者からの意見聴取（修正内容の整理）		○
40	①第二回マニュアル案改訂版の作成、②担当者会議の開催		○
41	休日		
42			○
43	①第二回マニュアル案改訂版に基づく品質・施工監理・試験方法等の		○
44	確認と施工における問題点の抽出、②勉強会の開催		○
45			○
46	①第三回マニュアル案改訂版の作成、②担当者会議の開催		○
47	休日		
48	①第三回マニュアル案改訂版の担当者の習熟度の把握、	○	
49	②品質・施工監理方法の指導、	○	
50	③堤体盛土等の施工における問題点の抽出		○
51	担当者との勉強会・意見交換会の開催（品質・施工監理マニュアル案		○
52	最終改訂版の修正箇所と全体説明）		○
53	休日		
54	①担当者との品質・施工監理マニュアル案版最終改訂版の記載方法・		○
55	内容等の打合せ、②同マニュアル案最終改定版の修正		○
56	①NDIA へ品質・施工管理マニュアル案最終版（英文）の提出、②指導		○
57	事項等の修正箇所と全体説明		○
58			○
59	移動日　休日		
60	移動日		
61	完了報告書（案）の作成		
62			
63			
64	完了報告書（案）の提出		
65	休日		
66	休日		
67			
68	完了報告書（案）の修正		
69			
70	①完了報告書の完成・提出、②品質・施工監理マニュアル案最終版の		
71	提出		

	【要員2】 堤体修復工事及び附帯施設に係る点検・維持管理担当	車両	車両
	【成果2：貯水池施設に係る点検・維持管理能力の向上】	A	B
1			
2			
3	①既存マニュアルの問題点と修正内容の抽出、②技術資料の収集		
4			
5			
6	休日		
7	休日		
8			
9	①既存マニュアルの問題点と修正内容の抽出、②不足項目を補足した修正		
10	マニュアル案（案）の作成、③先方への説明資料の作成		
11			
12	上記資料の記載内容・指導方法等の打合せ（JICA）		
13	休日		
14	休日		
15	①上記資料の内容の修正・資料整理、②先方への説明資料の作成		
16	移動日		
17	移動日		
18	①会議準備、②JICA専門家説明、③現地視察	○	
19	NDIA への既存マニュアルの修正・補足箇所・内容の説明・協議・打合せ	○	
20	上記協議・打合せ結果に基づく記載内容の修正		
21	休日		
22	EDWC担当者へ既存マニュアルの修正・補足箇所・内容の説明・協議・打合せ	○	
23	①上記協議による記載内容の修正、②NDIAに修正内容の報告	○	
24	①修正マニュアル案に基づく点検・維持管理方法、記載方法・報告書	○	
25	作成方法等の内容確認、	○	
26	②点検・維持管理状況の把握	○	
27	①マニュアル案（当該週に使用したもの）の追加修正・改良作業、 ②担当者会議の開催	○	
28	休日		
29	①修正マニュアル案（前週に修正したもの）に基づく点検・維持管理	○	
30	方法・報告書作成方法等の内容確認、②担当者（EDWC職員、レン	○	
31	ジャー）へ記載内容・点検方法等の現地指導、③問題点の抽出、 ④同マニュアル案の修正内容の整理、⑤W/S資料作成	○	
32	①マニュアル案（当該週に使用したもの）の修正・改良作業、 ②W/S資料作成	○	
33	①W/Sの開催、②NDIA への状況報告及び修正マニュアル案の修正箇所・改善の説明、③同マニュアルの整理・取り纏め	○	
34	①W/Sの開催、②修正マニュアルの修正箇所・改善箇所等の説明、指導方向の変更説明、③第一回マニュアル案改訂版の作成（日本の内容も協議して織り込む	○	
35	休日		
36	①第一回マニュアル案改訂版に基づく点検・維持管理方法、記載方法・	○	
37	報告書作成方法等の内容確認と点検・維持管理状況の把握、②担当者	○	
38	（EDWC職員、レンジャー）への現場指導、③点検・維持管理実施におけ	○	
39	る問題点・課題の抽出、④担当者からの意見聴取（修正内容の整理）	○	
40	①第二回マニュアル案改訂版の作成、②担当者会議の開催	○	
41	休日		
42	①第二回マニュアル案改訂版に基づく点検・維持管理方法、記載方法・	○	
43	報告書作成方法等の内容確認、②点検・維持状況の把握、③現時点	○	
44	での問題点・課題の抽出と意見聴取、④マニュアル案使用の習熟度	○	
45	の把握と点検・維持管理方法の指導	○	
46	①第三回マニュアル案改訂版の作成、②担当者会議の開催	○	
47	休日		
48	①第三回マニュアル案改訂版に基づく点検・維持管理方法、記載方法・	○	
49	報告書作成方法等の内容確認と現状の把握、②現時点での問題点・	○	
50	課題の抽出と意見聴取、③マニュアル案使用の習熟度の把握と点検・	○	
51	維持管理方法の指導（記載内容と伝達方法などの重点項目を設定）	○	
52	第四回マニュアル案改訂版の修正・改良作業と担当者会議の開催	○	
53	休日		
54	①第四回マニュアル案改訂版に基づく点検・維持管理方法、記載方法・	○	
55	報告書作成方法等の内容確認と現状の把握、②現時点での問題点・	○	
56	課題の抽出と意見聴取、③マニュアル案使用の習熟度の把握と点検・	○	
57	維持管理方法の指導（点検・維持管理内容全体の重点項目を設定）	○	
58	①第四回マニュアル案改訂版の中の課題・問題点の整理、 ②担当者会議の開催（翌週も使用）	○	
59	休日		
60	①第四回マニュアル案改訂版に基づく点検・維持管理方法、記載方法・	○	
61	報告書作成方法等の内容確認と現状の把握、②現場担当職員の現場	○	
62	指導、③現時点での問題点・課題の抽出と意見聴取、④マニュアル案	○	
63	使用の習熟度の把握と点検・維持管理方法の指導（点検・維持管理内容の全体の中の重点項目を設定）	○	
64	①第四回マニュアル案改訂版の課題・問題点の整理、 ②担当者会議の開催	○	
65	現地での点検・維持管理計画作成方法の講義	○	
66	休日		
67	①担当者会議の開催（第四回マニュアル案改訂版の内容と問題点・		
68	課題、記述方法・内容の再確認）、②第四回マニュアル案改訂版の修正	○	
69	①EDWCの点検・維持管理マニュアル案の最終改訂版における指導	○	
70	状況等説明と問題点・課題等の打合せ、②同マニュアル案の最終	○	
71	改訂版の作成、③協議内容・打合せ記録の作成	○	

【成果1：堤体修復工事に係る品質・施工監理能力の向上】		A	B
72	休日		
73	休日		

要員
車両A　8日
26日
車両B　13日

○　基本として業務の移動は車両Aを使用
○　【要員1】と【要員2】が同日に別行動をとる場合は車両Bは半日使用
○　【要員1】と【要員2】が同日に別行動をとる場合は車両Bは一日使用

車両A	8+45=53	53	日
車両B	26日→13日	13	日
合計		66	日

【成果2：貯水池施設に係る点検・維持管理能力の向上】		A	B
72	①NDIAと点検・維持管理マニュアル案最終改訂版の打合せ・協議、 ②指摘事項等の修正・打合せ記録等の提出、③同マニュアル案の 修正版の提出	○	
73	休日		
74	移動日		
75	移動日		
76			
77	完了報告書（案）の作成		
78			
79	休日		
80	休日		
81	完了報告書（案）の提出		
82			
83	完了報告書（案）の修正		
84			
85	①完了報告書の完成・提出、②点検・維持管理マニュアル案最終版の 提出		
86	休日		
87	休日		

要員
車両A　45日
車両B　0日

凡例　：

国内作業

ガイアナ国での作業

＊＊＊＊＊　資料作成

＊＊＊＊＊　NDIA ／ EDWC 職員との打合せ・討議

資料－6　技術検討資料

資料 6-1 台船(Pontoon) 安定性の検討

資料 6-2 土質定数設定及び擁壁設計

資料 6-3 擁壁施工機材の選定

資料　6-1　台船（Pontoon）安定性の検討

1.安定検討

機材調達（台船及び掘削機）の条件に応じて選定した機材について、掘削機（Super-long arm excavator）及び土砂収容槽（Vessel)を搭載する台船(pontoon)について安定性検討を行う。

2.検討条件

検討条件は次のとおりとする。

1）検討は次の２ケースについて行う。

ａ）軽荷時：掘削機１台搭載状態で、土砂ベッセル(Vessel)内に土砂がない場合（移動航行中の定位置にある状態）。

ｂ）重荷重時（作業時）：掘削機１台搭載、作業中の定位置状態で、土砂ベッセル内に土砂満載の場合。

2）作業員は軽荷時、作業時共に４名乗船とする。

3）作業区域は貯水池（淡水区域）とする。

4）復原性は、暴風時（風速60m/sec、波高1.5m）における軽荷状態時のもとで検討する。

5）復原性は、掘削機および土砂ベッセルは完全固定された条件で検討する。

6）作業台船は掘削機との一体船体と仮定して検討を行う。

3.機材一般図

掘削機および土砂ベッセル搭載の台船の一般状態を図－１に示す。

4.作業台船安定検討:(軽荷時)

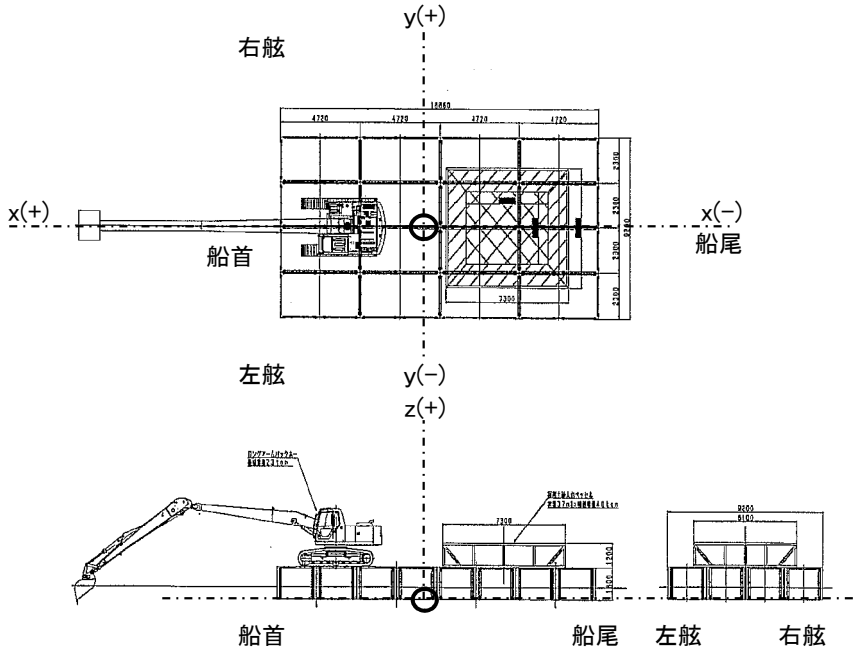
1）台船諸元（図－１　参照）

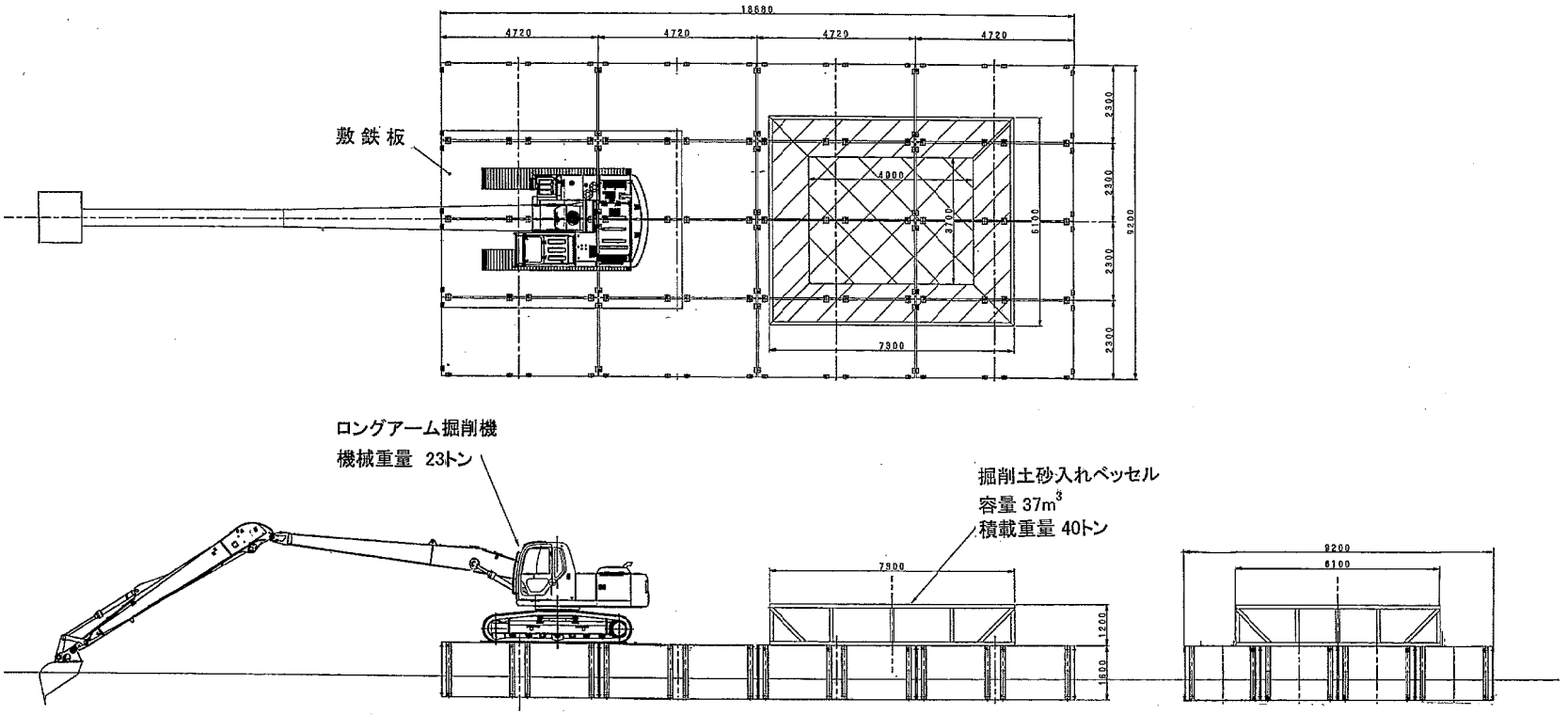
長さ　　L = 18.88m

幅　　B = 9.20m

高さ　　D = 1.60m

平均喫水　d = 0.63m





図－1　掘削機、土砂ベッセル搭載台船一般図

2) 重量分布及び重心計算

項　目	重量	X 方 向			Y 方 向			Z 方 向	
		X軸	モーメント(tf・m)		Y軸	モーメント(tf・m)		Z軸	モーメント
	W(tf)	CG(m)	(+)船首	(−)船尾	HG(m)	(−)左舷	(+)右舷	KG(m)	(tf・m)
台船(甲板下)	64	0	0	0	0	0	0	0.8	51.2
土砂ベッセル自重	18	−4	0	−72	0	0	0	1.9	34.2
土砂ベッセル内容物	0	−4	0	0	0	0	0	2.4	0
掘削機クローラー(右舷側)	11.5	3.5	40.25	0	1.2	0	13.8	1.6	18.4
〃　(左舷側)	11.5	3.5	40.25	0	−1.2	−13.8	0	1.6	18.4
係船柱(ボラード)－1	0.2	8	1.6	0	4	0	0.8	1.9	0.38
〃　－2	0.2	8	1.6	0	−4	−0.8	0	1.9	0.38
〃　－3	0.2	−8	0	−1.6	4	0	0.8	1.9	0.38
〃　－4	0.2	−8	0	−1.6	−4	−0.8	0	1.9	0.38
索導器(フェアリーダー)－1	0.3	9.2	2.76	0	3.8	0	1.14	1.8	0.54
〃　－1	0.3	9.2	2.76	0	−3.8	−1.14	0	1.8	0.54
作業員	0.3	3	0.9	0	3	0	0.9	3	0.9
燃料油	0.2	0	0	0	0	0	0	2.1	0.42
作業工具	2	2	4	0	0	0	0	1.6	3.2
合計	108.9		94.12	−75.2		−16.5	17.44		129.32
重心		0.17			0.01			1.19	

$$\frac{94.12-75.2}{108.9} = 0.17(\mathrm{m}) \qquad \frac{17.44-16.54}{108.9} = 0.01(\mathrm{m}) \qquad \frac{129.32}{108.9} = 1.19(\mathrm{m})$$

3) トリム(trim)、ヒール(heel) の計算結果

排水量 (W)	tf	108.9
(W) に対する喫水 (d)	m	0.63
(d) に対する横メタセンター (KM)	m	11.25
(d) に対する縦メタセンター (KML)	m	47.379
重心垂直位置 (KG)	m	1.19
横メタセンター高さ (GMB)	m	10.06
縦メタセンター高さ (GML)	m	46.189
重心の前後位置 (MG)	m	0.17
重心と浮心の前後位置 (BG)	m	0.17
(d) に対するトリムモーメント (MTC)	tf・m	2.66
(d) に対するヒールモーメント (MHC)	tf・m	1.19
トリム　T = W・BG／(100・MTC)	m	0.07
ヒール　H = W・HG／(100・MHC)	m	0.01
船首　喫水 (df)	m	0.592
船尾　喫水 (da)	m	0.662
平均　喫水 (dm)	m	0.627
左舷　喫水 (dp)	m	0.622
右舷　喫水 (ds)	m	0.632

5.作業台船安定検討:（作業時　:土砂満杯、掘削機の片側クローラーに全機重がかかる場合）

1）台船諸元（図－1　参照）

長さ　L = 18.88m ，幅　B = 9.20m ，　高さ　D = 1.60m ，平均喫水　d = 0.86m .

2) 重量分布および重心計算

項　目	重量	X 方 向			Y 方 向			Z 方 向	
		X軸	モーメント(tf･m)		Y軸	モーメント(tf･m)		Z軸	モーメント
	W(tf)	CG(m)	(+)船首	(−)船尾	HG(m)	(−)左舷	(+)右舷	KG(m)	(tf･m)
台船(甲板下)	64	0	0	0	0	0	0	0.8	51.2
土砂ベッセル自重	18	−4	0	−72	0	0	0	1.9	34.2
土砂ベッセル内容物	40	−4	0	−160	0	0	0	2.4	96
掘削機クローラー(右舷側)	23	5.4	124.2	0	1.2	0	27.6	1.6	36.8
〃　(左舷側)	0	5.4	0	0	−1.2	0	0	1.6	0
係船柱(ボラード)－1	0.2	8	1.6	0	4	0	0.8	1.9	0.38
〃　－2	0.2	8	1.6	0	−4	−0.8	0	1.9	0.38
〃　－3	0.2	−8	0	−1.6	4	0	0.8	1.9	0.38
〃　－4	0.2	−8	0	−1.6	−4	−0.8	0	1.9	0.38
索導器(フェアリーダー)－2	0.3	9.2	2.76	0	3.8	0	1.14	1.8	0.54
〃　－2	0.3	9.2	2.76	0	−3.8	−1.14	0	1.8	0.54
作業員	0.3	3	0.9	0	3	0	0.9	3	0.9
燃料油	0.2	0	0	0	0	0	0	2.1	0.42
作業工具	2	2	4	0	1.8	0	3.6	1.6	3.2
合計	148.9		137.8	−235.2		−2.74	34.84		225.32
重心		−0.65			0.22			1.51	

$\frac{137.82-235.2}{148.9} = -0.65(m)$　　$\frac{34.84-2.74}{148.9} = 0.22(m)$　　$\frac{225.32}{148.9} = 1.51(m)$

3) トリム(trim)、ヒール(heel)計算結果

排水量 (W)	tf	148.9
(W) に対する喫水 (d)	m	0.86
(d) に対する横メタセンター (KM)	m	8.228
(d) に対する縦メタセンター (KML)	m	34.651
重心垂直位置 (KG)	m	1.51
横メタセンター高さ (GMB)	m	6.718
縦メタセンター高さ (GML)	m	33.141
重心の前後位置 (MG)	m	−0.65
重心と浮心の前後位置 (BG)	m	−0.65
(d) に対するトリムモーメント (MTC)	tf･m	2.61
(d) に対するヒールモーメント (MHC)	tf･m	1.09
トリム　T = W･BG／100･MTC	m	0.37
ヒール　H = W･HG／100･MHC	m	0.30
船首　喫水 (df)	m	0.672
船尾　喫水 (da)	m	1.042
平均　喫水 (dm)	m	0.857
左舷　喫水 (dp)	m	0.707
右舷　喫水 (ds)	m	1.007

6.復原性(条件: 暴風時、軽荷状態、掘削機・土砂ベッセル完全固定状態)

1) 条件

風速　　V = 60m/sec
波高　　H = 1.5m
台船喫水　d = 0.63m
受圧面積　A = A1 + A2 + A3 = 199m2
　台船側面　　A1 = 162m2
　土砂ベッセル側面　A2 = 9m2
　掘削機側面　　A3 = 28m2

2) 限界傾斜角(舷端が水面に達する角度)

$\alpha = \tan^{-1}(Dm/(B/2)) * 0.8$
$= \tan^{-1}(0.97/4.6)*0.8 = 0.167$ rad (9.56°)

Dm = D − d = 1.60 − 0.63 = 0.97(m)

3) 限界傾斜角における復原挺

GZ = GMB * tanα = 10.06 * 0.167 = 1.69m
　ここに、GMBは 横メタセンター高さ(GMB = 10.06m)

4) 風圧、波圧による台船の傾き

・風圧による傾斜モーメント　Rw = Fw * H1= 53.95 * 2 = 107.9 tf・m
　風荷重　　$Fw = 1/2 * \rho a * Cw * A * V^2$
　　$= 1/2 * 1.23 * 1.2 * 199 * 60^2 = 528703.2N = 53.95tf$

　空気の密度　　$\rho a = 1.23kgf/m^3$
　風抗力係数　　Cw = 1.2
　受圧面積(側面)　　$A = 199m^2$
　風圧芯(水面より)　H1= 2m

・波圧による傾斜モーメント　Ra = $\rho 1$ * Hmax * L * d * H3
　　= 1.0 * 2.7 * 18.88 * 0.63 * 1.35 = 43.35 tf・m
　(波圧は台船の前後面の水位差から算出する)

　水の単位体積重量　　$\rho 1 = 1.0$ tf/m^3
　最大波高　Hmax = 1.8*H = 2.7m
　波圧芯　　H3 = Hmax/2 = 1.35m

5) 風圧および波圧による台船の傾斜角　　θ = tan-1(傾斜量/B)
　　$= \tan^{-1}(1.28/9.2) = 0.139$ rad (7.92°) < 9.56°　O.K.

　傾斜量(ヒール変化量) = (Rw + Ra)/(100*MHC)
　　= (107.9 + 43.35)/(100*1.19) = 1.28(m)

6) 上記傾斜角における偶力挺
　LL = GMB * tanθ = 10.06 * 0.139 = 1.40m ＜ 1.69m　O.K.

よって、台船は暴風時でも復原性に問題はない。

資料　6-2　土質定数設定及び擁壁設計

1. 土質設計定数の設定

(1) 概要

設計に採用する土質定数は、現地調査の結果を踏まえ、一般的な土質定数も考慮のうえ決定する。土の単位体積重量(γ)は、港湾基準および道路橋示方書も参考資料とし、N 値と粘着力 C との関係は､Mohr の定理によって C=qu/2 より算出する　（ここに､qu は一軸圧縮強さ)。N 値と粘着力 C との関係は、Design and Use of Sheet pile Wall in Stream Restoration and Stabilization Projects（設計方針で抜粋提示)、及び、道路土工仮設構造物工指針(平成１１年３月)日本道路協会によっても確認する。

N 値と粘着力 C との関係表

(2)　N値と粘着力 c との関係

粘性土の粘着力 c は一軸圧縮試験により強度 q_u を求めて決定することが望まれます。

粘性土の一軸圧縮強度 q_u や粘着力 c と N 値の関係は種々提案されています。代表的なものを表-3.2.8 および図-3.2.6 に示します。

表-3.2.8　粘性土の N 値と q_u、c の関係

	q_u, c (kN/m²)
Terzaghi,Peck	$q_u = \frac{N}{0.082}$
Peck	$q_u = \frac{N}{0.060}$
Dunham	$q_u = \frac{N}{0.077}$
森　田	$q_u = \frac{N}{0.040} \sim \frac{N}{0.055}$ （鋭敏比の高い粘土を除く）
福　岡	c = 5 + 7.5 N （シルト質粘土（N＜10）） c = 10 + 7.5 N （粘　土　（N＜10））
三　木	$q_u = \frac{N}{0.075}$

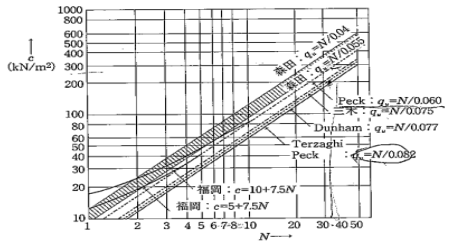


図-3.2.6　N 値と c の関係[12]

Mohr の定理より、q_u と c には次の関係式が成り立ちます。

$$c = \frac{q_u}{2} \tan\left(\frac{\pi}{4} - \frac{\phi}{2}\right) \quad (3.2.10)$$

近似的に $\phi \approx 0$ とすると、式（3.2.11）となります。

$$c = \frac{q_u}{2} \quad (3.2.11)$$

— 100 —

表 2－2－3　粘性土の粘着力と N 値の関係

硬　さ	非常に軟らかい	軟らかい	中　位	硬　い	非常に硬い	固結した
N値	2以下	2～4	4～8	8～15	15～30	30以上
粘着力 c (kN/m²(t/m²))	12以下 (1.2以下)	12～25 (1.2～2.5)	25～50 (2.5～5.0)	50～100 (5.0～10)	100～200 (10～20)	200以上 (20以上)

単位体積重量γの港湾基準（表 3.2.2)、道路橋示方書（3.2.3）の一覧表

表-3.2.2　代表的な土の単位体積重量と含水比[1]

	沖積粘土	洪積粘土	砂　質　土
湿潤単位体積重量 γ_t (kN/m³)	12～16	16～20	16～20
乾燥単位体積重量 γ_d (kN/m³)	5～14	11～14	12～18
含水比 w (%)	150～30	60～20	30～10

表-3.2.3　土の湿潤単位体積重量 (kN/m³)[2]

地盤	土　質	ゆるいもの	密なもの
自然地盤	砂及び砂れき	18	20
	砂　質　土	17	19
	粘　性　土	14	18
盛土	砂及び砂れき	20	
	砂　質　土	19	
	粘　性　土	18	

(2) 土質調査一覧と土質設計定数採用値

2-1.Ann's Grove～Hope

Ann's GroveJust Point	P1	BH1				C計算			採用		
	DEEP	γ	C	N	S	C	N	S	DEEP	γ	c
Soft silty CLAY	8		24.15	2		24.15	12.2		9.8		24.15
Firm silty CLAY	13	14		28			170.7		13		170.7

	P2	EMB1				C計算			採用		
	DEEP	γ	C	N	S	C	N	S	DEEP	γ	c
Soft silty CLAY	9	17	0	0					9	17	0
Firm silty CLAY	10	21		15	183		91.46	183	10	21	183

	P2	EMB2				C計算			採用		
	DEEP	γ	C	N	S	C	N	S	DEEP	γ	c
Soft silty CLAY	0								0		
Firm silty CLAY	10		46.04	15		46.04	91.46		10		46.04

	P2	EMB3				C計算			採用		
	DEEP	γ	C	N	S	C	N	S	DEEP	γ	c
Soft silty CLAY	7.3			3			18.29		0		18.29
Firm silty CLAY	10			38.5			234.8				234.8

	P2	EMB4				C計算			採用		
	DEEP	γ	C	N	S	C	N	S	DEEP	γ	c
Soft silty CLAY									0		
Firm silty CLAY	8		21.3			21.3			8		21.3
silty CLAY	15.8			21			128				128

Hope Just Point	P1	BH2				C計算			採用		
	DEEP	γ	C	N	S	C	N	S	DEEP	γ	c
Soft silty CLAY	8	13	24.15			24.15			13	13	24
Firm silty CLAY	14.3			18			109.8		14	18	105

Ann's Grove						C計算			設計採用		
	DEEP	γ	C	N	S	C	N	S	DEEP	γ	c
Soft silty	DeepはJust Point、γ,Cは平均値または一般値を考察し決定する。								8	15	24
Firm silty CLAY									13	17	125

Hope						C計算			設計採用		
	DEEP	γ	C	N	s	C	N	S	DEEP	γ	c
Soft silty CLAY	DeepはJust Point、γ,Cは平均値または一般値を考察し決定する。								11	15	24
Firm silty CLAY									14	17	125
Soft silty CLAY											

2-2.Annadale～Nancy

	P2	EMB8				C計算			採用		
	DEEP	γ	C	N	s	C	N	S	DEEP	γ	c
Soft silty CLAY	6	20	0	0					6	20	
Firm silty CLAY	10	19	0	22	53.42		134.1	53.42	10	19	53.42
Soft silty CLAY											

	P2	EMB9				C計算			採用		
	DEEP	γ	C	N	s	C	N	S	DEEP	γ	c
Soft silty CLAY	8		36.42	0		36.42			8		36.42
Firm silty CLAY	10			34			207.3		9		207.3
Soft silty CLAY											

	P2	EMB10				C計算			採用		
	DEEP	γ	C	N	s	C	N	S	DEEP	γ	c
Soft silty CLAY	8	16.5	0	0					8	16.5	
Firm silty CLAY	10		0	19			115.9		10		115.9
Soft silty CLAY											

Annadale Just Point	P2	EMB11				C計算			採用		
	DEEP	γ	C	N	s	C	N	S	DEEP	γ	c
Soft silty CLAY	11	19	41.91	0					11	19	41.91
Firm silty CLAY	16		0	24			146.3		16		146.3
Soft silty CLAY											

Annadale,Nancy						C計算			設計採用		
	DEEP	γ	C	N	s	C	N	S	DEEP	γ	c
Soft silty CLAY	DeepはJust Point、γ,Cは平均値または一般値を考察し決定する。								11	17	40
Firm silty CLAY									16	18	130

2-3.Maduni

Maduni JUST POINT	P1	BH3				C計算			採用		
	DEEP	γ	C	N	S	C	N	S	DEEP	γ	c
Soft silty CLAY	5.2	17	59.1						5.2	17	59.1
Firm silty CLAY	7			60	25.77		365.9	25.77	7		300
silty CLAY											

	P2	#10				C計算			採用		
	DEEP	γ	C	N	S	C	N	S	DEEP	γ	c
Soft silty CLAY	9	16.5							9	16.5	
Firm silty CLAY				18			150				150
silty CLAY											

Maduni						C計算			設計採用		
	DEEP	γ	C	N	S	C	N	S	DEEP	γ	c
Soft silty CLAY	DeepはJust Point、γ,Cは平均値または一般値を考察し決定する。								5.2	17	60
Firm silty CLAY									7	18	150
silty CLAY											

2. 土留め矢板の設計

(1) 概要

当設計は、INLET 側は貯水池堤体の保全を考慮してアンカー式矢板とし、OUTLET 側は、自立式矢板で安全を確保し設計することとする。また、材料は、ガイアナ国の安価で入手しやすい、木杭、木矢板を主として設計することとした。

(2) 適用仕様書

a) BS 8002: Code of Practice for Earth Retaining Structures

b) THE GUYANA GRADING RULES FOR HARDWOOD TIMBER

Forest Department, Georgetown, Guyana、September 1977

c) 道路土工「仮設構造物工指針」1999 年 3 月　社団法人 日本道路協会

d) 追加は設計方針を参照

(3) 材料

a) 木杭・土留め板

Strength Class　：Greenheart　D70　HS

Bending paralleled to grain　：23 N/mm2

Shear parallel to grain　：2.6 N/mm2

Modulus of elasticity　：21000 N/mm2

Safety factor　：0.8

Table 1 Strength graded hardwoods assigned to BS EN 338 strength classes

Species	Strength class				
	D30	D40	D50	D60	D70
Balau					HS
Ekki				HS	
Greenheart					HS
Iroko		HS			
Jarrah		HS			
Kapur				HS	
Karri			HS		
Kempas				HS	
Keruing			HS		
Merbau			HS		
Oak *	TH1 THB	THA			
Opepe			HS		
Teak		HS			

* Note that the TH2 grade of oak does not meet the requirements for the D30 strength class. Designs using TH2 grade oak should be based on the grade stresses given in BS 5268-2 for the individual species and grade.

Table 2 Characteristic values for hardwood strength classes (BS EN 338)

Strength properties N/mm²	**D30**	**D40**	**D50**	**D60**	**D70**
Bending	30	40	50	60	70
Tension parallel to grain	18	24	30	36	42
Tension perpendicular to grain	0.6	0.6	0.6	0.7	0.9
Compression parallel to grain	23	26	29	32	34
Compression perpendicular to grain	8.0	8.8	9.7	10.5	13.5
Shear	3.0	3.8	4.6	5.3	6.0
Stiffness properties kN/mm²					
Mean MOE parallel to grain	10	11	14	17	20
5th percentile MOE parallel to grain	8.0	9.4	11.8	14.3	16.8
Mean MOE perpendicular to grain	0.64	0.75	0.93	1.13	1.33
Mean shear modulus	0.60	0.70	0.88	1.06	1.25
Characteristic density kg/m³	530	590	650	700	900

Table 3 Grade stresses and moduli of elasticity for hardwood strength classes for Service Classes 1 and 2 (BS 5268-2).

N/mm²	D30	D40	D50	D60	D70
Bending parallel to grain	9.0	12.5	16.0	18.0	23.0
Tension parallel to grain	5.4	7.5	9.6	10.8	13.8
Compression parallel to grain	8.1	12.6	15.2	18.0	23.0
Compression perpendicular to grain*	2.8 / 2.2	3.9 / 3.0	4.5 / 3.5	5.2 / 4.0	6.0 / 4.6
Shear parallel to grain	1.4	2.0	2.2	2.4	2.6
Modulus of elasticity Mean Minimum	 9500 6000	 10800 7500	 15000 12600	 18500 15600	 21000 18000
Average density kg/m³ at 20°C/65% RH	640	700	780	840	1080
* When specification excludes wane at bearing areas, the higher value of compression perpendicular to grain stress may be used, otherwise the lower values apply					

b) 鋼材

b-1. Anchor (tie-rod)

Tensile strength of Steel　$F_y = 460 N/mm^2$

Allowable bending stress　$f_a = 0.9 \cdot F_y = 0.9 \cdot 460 N/mm^2 = 414 N/mm^2$

b-2. Bolt-Nut(3.6)

Tensile strength of Steel　$F_y = 180 N/mm^2$

Allowable bending stress　$f_a = 0.9 \cdot F_y = 0.9 \cdot 180 N/mm^2 = 160 N/mm^2$

(4) 設計方法

1) 荷重

a．上載荷重　$W=12 kN/m^2$

b．水の単位体積当重量　$\gamma w=9.81 kN/m^3$

c．土の単位体積当重量 γ、粘着力 C、内部摩擦角 φ （土質定数として後頁添付）

d．根入れ長の計算に用いる土圧、水圧、上載荷重

$Pa = Ka (\Sigma \gamma h + q) - 2c\sqrt{ka}$

$Pp = Kp (\Sigma \gamma h' + q) + 2c\sqrt{kp}$

ここに、

Pa ：主働土圧（kN/m2）

Pp ：受働土圧（kN/m2）

Ka ：着目点における地盤の主働土圧係数

$Ka=\tan^2(45° - \varphi/2)$

Kp ：着目点における地盤の受働土圧係数

$Kp=\tan^2(45°+\varphi/2)$

φ ：着目点における土のせん断抵抗角（度）

Σγh ：着目点における主働側の有効土かぶり圧（kN/m^2）

Σγh’：着目点における主働側の有効土かぶり圧（kN/m^2）

γ ：各層の土の湿潤単位体積重量（kN/m^3）で、地下水位以下は水中単位体積重量を考慮する。

H ：着目点までの主働側の各層の層厚(m)

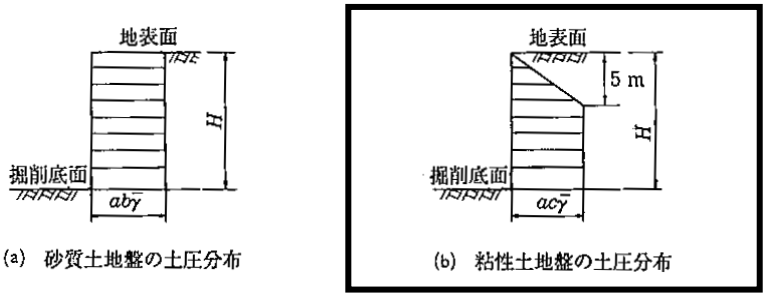
h’ ：着目点までの受動側の各層の層厚(m)

q ：地表面での上載荷重（kN/m^2）

c ：着目点における土の粘着力（kN/m^2）

ｅ．断面計算に用いる土圧

土留め壁、アンカーの断面積算定においては、下図に示し断面決定用土圧を用いる。



$\bar{\gamma}$：土の平均単位体積重量（kN/m^3（tf/m^3））

a, b, c：表2−3−4，表2−3−5による

H：掘削深さ

図 2−3−4 断面決定用土圧

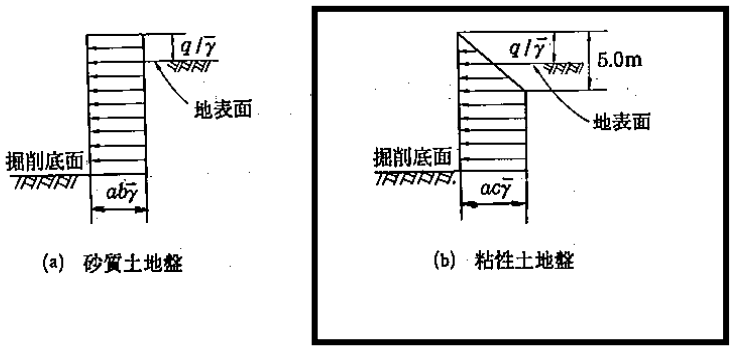
表 2−3−4 掘削深さHによる係数

5.0m≦H	$a=1$
5.0m＞H＞3.0m	$a=\frac{1}{4}(H-1)$

表 2−3−5 地質による係数

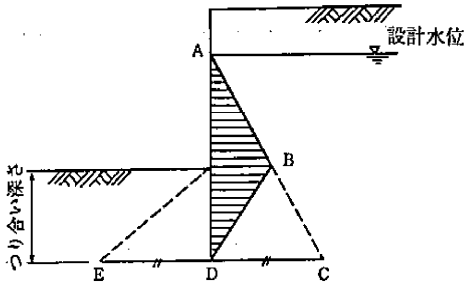
b	c	
砂 質 土	粘 性 土	
2	N＞5	4
	N≦5	6

土留め背面には、地表面での上載荷重として q=12kN/m^2 を考慮し、地表面より上方に存在するもとして下図のように換算土厚を考慮する。



f．水圧

土留めに作用する水圧は静水圧とし、水圧分布は下図の△ＡＢＤであらわされる三角形分布とする。



2) 設計計算

a. 親杭の最小根入れ長

最小根入れ長は、Ｌ＝15m とする。

控え杭の根入れは、自立式杭の根入れ長の計算に準じる。

ただし、杭長は、盛土沈下防止のため、堅硬なシルト層 (N 値 15~25) に到達するようにする。

b. 根入れ部の土圧および水圧に対する安定

b-1. アンカー式

根入れ深さは極限平衡法を用い、アンカー支持位置を中心とし、主働側圧による作用モーメントと、貯水側からの受働側圧による抵抗曲げモーメントとがつり合う深さとする。ただし、根入れ深さは、貯水池側河床より 1.5m 以上を確保することとする。

b-2.自立式

根入れ長は、Chang の式より計算する。ただし、土留め壁の根入れ長は半無限長とみなせる長さが原則であり、その長さは 3/β 以上といわれている。しかし、2.5/β とした場合と半無限長の杭とした場合の杭頭変位および曲げモーメントの差は数%であることから、根入れ長(Lo)は 2.5/β で求める。

c. 断面計算

c -1. アンカー式

・アンカーの計算

矢板天端からつり合い位置までの主働側水平荷重の合計 ΣH が、単純梁と想定した壁面に作用し、その 1/2 の水平荷重を反力としてアンカーが支持するものと考える。よって、アンカー張力(T)との関係は、T=ΣH/2 となる。

$f = T/As \leqq fa$

ここに、

許容引張応力度　$fa = 0.9 \cdot Fy = 0.9 \cdot 460N/mm^2 = 414N/mm^2$

鋼材の引張強度　$Fy = 460N/mm^2$

アンカー張力　T

アンカー断面積　As

・木杭の計算

親杭は単純梁として、矢板天端から河床までの主働側水平荷重合計 ΣH を、アンカーから河床までを単純梁の支間(S) とした等分布荷重 w により、最大曲げモーメント Mmax を算出し断面計算をする。

$W = \Sigma H/S$ 、$Mmax = w \cdot S^2/8$、$\sigma b = Mmax/z \leqq \sigma ba$

ここに

主働側水平荷重合計	：ΣH
支間	：S
等分布荷重	：w
最大曲げモーメント	：Mmax
Bending strength of Greenheart Timber	：σb
Allowable bending stress	：σba = 0.8*σb

・腹起しの計算

断面決定用土圧により、荷重を算出する。また、水圧、上載荷重も考慮する。腹起しにかかる荷重は、１段目は上下方荷重分担し、２段目以降は下方荷分担とする。

支間 S は、杭間隔とし、連続梁とし、最大曲げモーメント Mmax=w・s^2/10

として算出する。

・土留め板の計算

断面決定用土圧により、荷重を算出する。また、水圧、上載荷重も考慮する。

土留め板の設計支間 s は、腹起し間隔とし、最大曲げモーメント Mmax=w・s^2/10 として算出する。

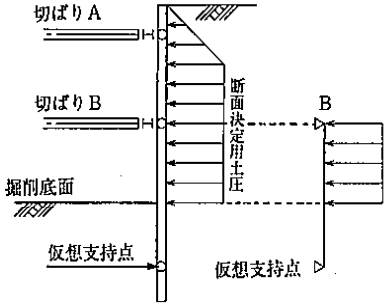


図 2－9－22　親杭の断面計算

・控え杭の計算

1. 根入れ長、断面計算、変位

$$L = 2.5 / \beta$$

$$Mm = 0.3224 \cdot H / \beta$$

ここに、

L　　：必要根入れ長(m)

Mm　：最大曲げモーメント(kN・m)

H　　：控え杭に作用する水平力（タイロッドの引張力）（kN）

β　　：杭の特性値(m^{-1})

控え杭のタイロッド取付け位置における変位量は下式で求める。

$$\delta = H / 2EI\beta^3$$

ここに、

δ　：タイロッド取付け位置の変位(m)

H　：控え杭に作用する水平力（タイロッドの引張力）(kN)

E　：控え杭のヤング係数（kN/m^2）

I　：控え杭の断面二次モーメント（m^4）

β　：杭の特性値（m^{-1}）

2. 控え杭の設置位置

控え杭は下図に示すとおり、土留め壁仮想支持点を起点として背面側の主働すべり面と、控え杭のタイロッド取付け点の下方 1 / β の位置を起点とした前面側の受働すべり面が、タイロッド位置以下で交差しない位

置に設けることを原則とする。

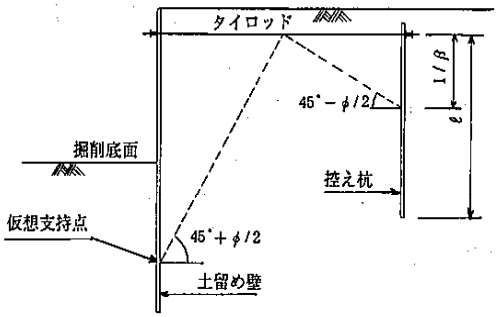


図 2－14－3　控え杭の設置位置

c-2. 自立式

・杭の断面計算

土留め壁の断面計算に用いる曲げモーメントは、土留め壁背面に荷重を作用させ、下式により計算する

$$M = \frac{P}{2\beta}\sqrt{(1+2\beta h_0)^2+1}\ \exp\left(-\tan^{-1}\frac{1}{1+2\beta h_0}\right)$$

ここに、

M　　：土留め壁に発生する最大曲げモーメント(kN・m)

P　　：側圧の合力（kN）単位幅の値とする。

H0　　：河床面から合力の作用位置までの高さ(m)

β　　：杭の特性値（m^{-1}）

（ただし、ここで用いる逆三角関数の単位は（rad）である。）

d．変位の計算

d-1. アンカー式

アンカー式は、控え杭の変位の照査を行うこととする。許容変位量は、矢板天端から河床面までの高さの 3%とする。変位量の計算は、chang 式より算出する。

d-2. 自立式

変位は、下記の式において、算出する。変位の許容値は、周辺の状況により、３段階に分けた。

・周辺に施設が無く、破損しても２次災害発生しない場合⇒土留め高 H の 5%とする。　　（δa=0.05xH：Ann's Grove, hope）

・周辺に管理用道路（歩道も含む）ある場合⇒土留め高 H の 4%とする。

（δa=0.04xH：0.04xH：Annandale, Nancy, Maduni）

・生活道路等の施設がある場合⇒　土留め高Hの 3%とする。

（δa=0.03xH：Sarah Johanna)

自立式土留め壁頭部の変位量の算出式を示す。

$\delta = \delta 1 + \delta 2 + \delta 3$

ここで、δ　：土留め壁頭部の変位量（m）

δ1　：河床面での変位量（m）

δ2　：河床面でのたわみ角による変位量（m）

δ3　：河床面以上の片持ばりのたわみ(m)

$\delta 1 = (1+\beta h 0) \cdot P / 2EI\beta^3$

$\delta 2 = (1+2\beta h 0) \cdot P \cdot H / 2EI\beta^2$

β　：杭の特性値（m^{-1}）

h0　：河床面から合力の作用位置までの高さ(m)

P　：側圧の合力（kN）

E　：土留め壁のヤング係数(kN/m^2)

I　：土留め壁の断面二次モーメント（m^4）

H　：河床深さ(m)

$\delta 3 = p_2' \cdot H^4 / 30EI$

p_2'　：モーメントを等価とする三角形

分布荷重の河床面での荷重強度(kN/m)

$p_2' = 6 \cdot \Sigma M / H^2$

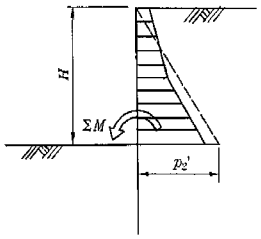


図 2－12－3　モーメントを等価とする三角形分布荷重

ΣM　：側圧による河床面回りのモーメント(kN・m)

3）ヒービングに対する検討

洪積粘性土地盤のような含水比の高い粘性土が厚く堆積する地盤では、ヒービングの危険性が増大する。

通常、河床面の安定の判断には安定数 Nb が用いられるが、安定数 Nb が 3.14 以下ならば、ヒービングに対する検討は省略してよい。安定数 Nb が 3.14 を超えると、塑性域が河床面の隅から発生し始め、Nb が 5.14 で河床部の破壊が生じるとされている。

$Nb = (\gamma \cdot H) / c \quad < \quad 3.14$

(5) 遮水工（土留め板）の検討

1) 概要

堤防の遮水は、土留め板で行う。土留め板の長さは、ヒービングを発生しない根入れ長で決定する。根入れ長は、レイン式を用いて計算する。６箇所の堤防において、検討する。

2) 適用及び参考文献

（社）日本河川協会 改定新版 建設省河川砂防技術基準（案）同解説 設計編[ ] P60、P28

3) レイン式

$C \leqq (L / 3 + \Sigma L) / \Delta H$

ここで、

C ：加重クリープ比

L ：本体及び翼壁の函軸方向の浸透路長(m)

ΣL ：遮水矢板等の浸透経路長(m)

⊿H ：内外水位差(m)

加重クリープ比

区分 （◆は選択区分を示す）	C
◆極めて細かい砂またはシルト	8.5
細砂	7.0
中砂	6.0
粗砂	5.0
細砂利	4.0
中砂利	3.5
栗石を含む粗砂利	3.0
栗石と礫を含む砂利	2.5
軟らかい粘土	3.0
中くらいの粘土	2.0
堅い粘土	1.8

4) 粘土のクリープ比

粘性層は、加重クリープ比表から軟らかい粘土とし、c＝3.0 を採用する。

5) 土留め板長の検討

X は、上記式を変形して、

$X > 1/2 \cdot (c \cdot \Delta H - 1/3 \cdot L)$

$\Sigma L = 2 \cdot X$

$Lreq = X + \Delta H + h$

（Lreq：土留め板の必要長、 h ：堤防高－H.W.L を示す。）

(検討結果表)

項目	Ann'sglove	Hope	Annandale	Nancy	Maduni	Cuhnia	適用
	INLET	INLET	INLET	INLET	INLET	INLET	
	Right	Right	Right	Right	Left	---	
C	3.0	3.0	3.0	3.0	3.0	---	重クリープ比
ΔH	2.833	0.950	2.603	2.793	1.977	---	水頭差
L	12.970	13.518	10.659	12.056	10.105	---	水平距離
X	2.088	0.000	2.128	2.180	1.281	---	鉛直距離
ΔH＋h	3.290	1.407	3.060	3.250	2.434	---	
ΣLreq	5.378	1.407	5.188	5.430	3.715	---	必要土留め長
ΣL	7.60	7.60	7.60	7.60	7.60	---	使用土留め長
判定	OK	OK	OK	OK	OK	---	ΣLreq<ΣL

注）Cunha は、堤防裏が高いため、省略する。

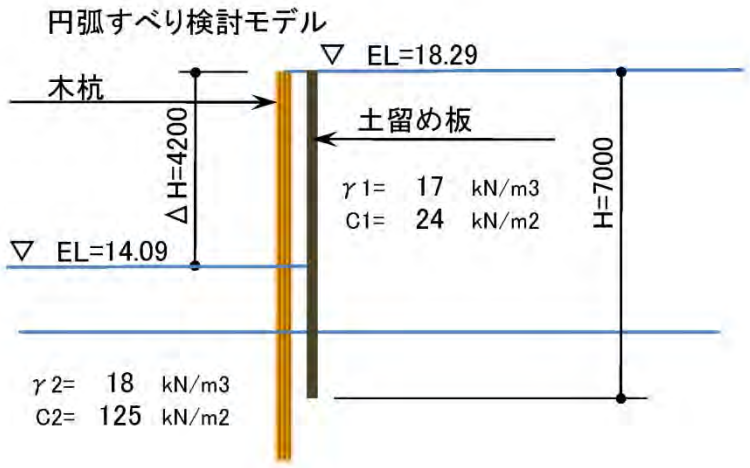
≪結論≫

遮水工（土留め板）は、長さ 7.6m で計画されているため、遮水性からは上表の ΣLreq（計算での必要長さ）で安全である。

(6) 外的安定の検討

外的安定の検討として、円弧すべりで検討を行う。検討は、最も危険となる状態で検討する。最も危険となる条件の組合せを仮定する。

・堤防裏の地盤高が、堤防天端高と同じ高さとする。
・土留め高を今回最大の H=4.2m とする。
・土の重量　　γ1＝17kN/m^3、γ2=18kN/m^3
・粘着力　　C1＝24kN/m^2、C2=125kN/m^2
・土留め版の長さは、7.6m であるが、安全を考慮し、L=7.0m とする。
・土留め版は円弧すべりのすべり面とならないこととする。



≪結果≫

Fs=2.53＞1.2　-----円弧すべりは発生しない。

以下に計算結果は、土留め矢板計算に添付する。

資料　6-3　擁壁施工機材の選定

1. 杭打ち機選定および施工

(1)選定条件

●吊り荷重

・フック量（表１　40T 日立住友重機参照）　W=0.41t

・吊り部材荷重（杭自重）

W=　15.24m x 0.126Kg/m=1,920kg= 1.92t　=　2.0t

・ヤットコ重量　　W=5.0t

吊り荷重 W=　0.41　+　2.0　+　5.0　=　7.41　≒　8.0t

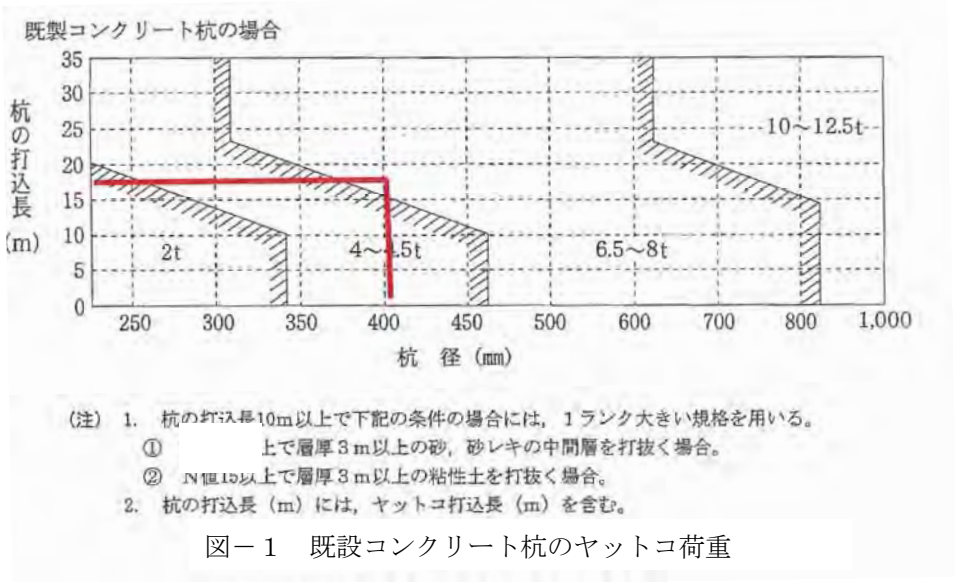
フック重量表

巻上ロープ掛数と定格総荷重の最大値、主フックの質量

フック容量 (t)	フック質量 (t)	定格総荷重の最大値 (t)					
		6 本掛	5 本掛	4 本掛	3 本掛	2 本掛	1 本掛
40.0	0.41	40.00	32.50	26.00	19.50	13.00	—
15.0	0.32				15.00	13.00	—

ヤットコ荷重の算出

・杭径 455mm　杭長 L=15.24m とし、ヤットコ荷重は、表２より、W　=4.5ｔ~6.5t の線上となるが、軟弱地盤であり、ガイヤナ国の調査より W=5.0t とする。



図－１　既設コンクリート杭のヤットコ荷重

抜粋：国道交通省土木工事積算基準 H22 版の基礎杭の既製コンクリートのヤットコ荷重

●ブーム長

揚程　　H=23m

作業半径　　B= 10m

ブーム長（表３より）　　L=28m

・揚程

・最大部材長　（表１より）　　H=　15.240m

・フック巻上限界（フック高）　　H=　1.000m

・余裕高　　H=　1.000m

・ヤットコ＋落下距離　　H=　5.000m

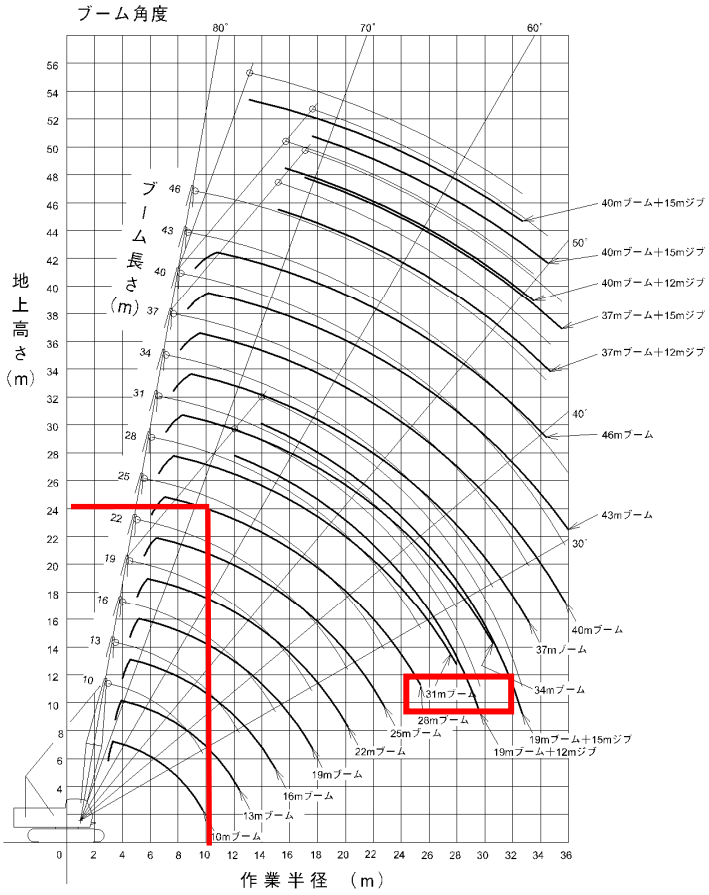
揚程　H= 15.24　＋　1.000　＋　1.000　＋ 5.000　=22.24≒23.0m

・作業半径

キャタピラ長／２－（回転軸とキャタピラの偏心量）+杭打ち込み位置

＝5.095/2　－　1.00　＋　（3.0~10.0）　=　4.55～11.54　≒　5.0　m~ 10.0 m

表３　作業半径と揚程からのブーム長



(2) クローラクレーンの最大定格総荷重の決定

選定条件

・吊り荷重　　W= 8.0t

・作業半径　　W=10.0m

・ブーム長　　L=31.0m

≪結論≫

40t クローラクレーン≪表 5≫より

吊り荷重 W=8.0t ＜吊り上げ能力 W=9.35t――――――OK

安全である。

表５　最大定格総荷重　40t

■主ブーム定格総荷重表

単位：t

作業半径 (m)	ブーム長さ(m)												
	10	13	16	19	22	25	28	31	34	37	40	43	46
3.5	40.00												
3.7	40.00	40.00											
4.0	35.45	35.40	4.2 / 32.65										
4.5	29.45	29.35	29.30	4.7 / 27.35									
5.0	25.15	25.05	25.00	24.95	5.3 / 22.85								
5.5	21.90	21.80	21.75	21.70	21.65	5.8 / 20.00							
6.0	19.40	19.30	19.20	19.15	19.10	19.05	6.4 / 17.35	6.9 / 15.55					
7.0	15.70	15.65	15.55	15.50	15.45	15.35	15.30	15.25	7.5 / 13.75				
8.0	13.20	13.10	13.00	12.95	12.90	12.80	12.75	12.65	12.60	11.95	8.6 / 10.40		
9.0	11.35	11.25	11.10	11.05	11.00	10.95	10.85	10.80	10.70	10.70	10.25	9.1 / 9.05	9.7 / 7.80
10.0	9.7 / 10.30	9.80	9.70	9.65	9.55	9.50	9.45	9.35	9.25	9.25	9.15	8.80	7.75
12.0		7.80	7.65	7.60	7.55	7.45	7.40	7.30	7.20	7.20	7.10	7.00	6.90
14.0		12.3 / 7.55	6.30	6.20	6.15	6.05	6.00	5.90	5.80	5.80	5.70	5.60	5.50
16.0			14.9 / 5.80	5.25	5.15	5.05	5.00	4.90	4.80	4.75	4.70	4.60	4.50
18.0				17.5 / 4.65	4.40	4.30	4.20	4.15	4.05	4.00	3.90	3.85	3.75
20.0					3.80	3.70	3.65	3.55	3.45	3.40	3.30	3.20	3.15
22.0					20.1 / 3.60	3.25	3.15	3.05	2.95	2.90	2.85	2.75	2.65
24.0						22.7 / 3.10	2.75	2.70	2.55	2.55	2.45	2.35	2.20
26.0							25.3 / 2.55	2.35	2.25	2.20	2.10	1.95	1.85
28.0								27.9 / 2.10	1.95	1.90	1.75	1.65	1.55
30.0									1.70	1.65	1.50	1.40	1.25
32.0									30.5 / 1.65	1.40	1.25	1.15	1.05
34.0										33.1 / 1.30	1.05	0.95	0.85
36.0											35.7 / 0.90	0.80	34.5 / 0.80

注) 1. 上表に示す定格総荷重表は、水平堅土上の定置荷役における値で、転倒荷重の 78%以内、および移動式クレーン構造規格で定める前方安定度 1.15 以上です。
2. 実際につり上げられる荷重は、上表の定格総荷重からフックなどのつり具一切の質量を差し引いた値です。
3. 作業半径とは、荷をつった状態での旋回中心からのつり荷の重心までの水平距離をいいます。
4. カウンタウエイトの質量は、12.5 t です。
5. 作業を行うときは、必ずサイドフレームを規定位置まで拡張してください。
6. 巻上ロープ掛数と定格総荷重の最大値、主フックの質量は下表のとおりです。

フック容量 (t)	フック質量 (t)	定格総荷重の最大値 (t)					
		6 本掛	5 本掛	4 本掛	3 本掛	2 本掛	1 本掛
40.0	0.41	40.00	32.50	26.00	19.50	13.00	―
15.0	0.32				15.00	13.00	―

7. 表中の○○ / ○○は、作業半径(m) / 定格総荷重(t)を示します。

(3) 地耐力の確認

・接地圧　＜表６参照＞　　P ＝ 0.61kg/cm2=5.98N/cm2=59.8kN/m2=60kN/m2

・地耐力　＜表７参照＞

Qa=1/N・ a （α･c･Nc+1/2・β･γ1･B･Nr+γ2･Df･Nq）

=1/2x2x（1.0x2.0x5.3 + 0 + 0）=　10.6 kg/m2 = 103.9 kN/m2

C=2.0kg/m2x2 倍　⇒表 7 の 2.0kg/m2 とする。

=4.0 kg/m2

N＝2（安全率短期）

a＝2（簡易動的コーン貫入試験の割増係数）

α、β=1.0（帯状）

θ=0°⇒Nc=5.3、Nr=0.0 、Nq=1.0、Df＝0.0m

≪結果≫

P＝60kN/m2　＜　Qa=103kN/m2――――OK

現地では、安全を確認する必要がある。

表６　仕様　（HITACHI　SUMITOMO

クローラクレーン 40t　を参照）

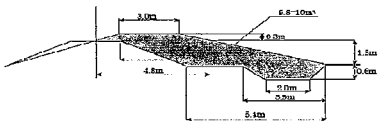
■仕　様

			クレーン仕様	
吊上げ荷重×作業半径		tXm	40X3.7	
基本ブーム長さ		m	10	
最長ブーム長さ		m	46	
クレーンジブ長さ		m	6～15	
ブーム＋クレーンジブ付き最長		m	40＋15	
ワイヤロープ速度	主・補巻巻上	m/min	※74/37	ロープ径22 mm
	主・補巻巻下	m/min	74/37	
	ブーム起伏巻上	m/min	※60	ロープ径16 mm
	ブーム起伏巻下	m/min	60	
旋回速度		min-1(rpm)	3.7 (3.7)	
走行速度		km/h	※1.9	
登坂能力		%(度)	40 (22)	
接地圧		kPa(kgf/cm²)	59.8 (0.61)	
定格出力		kW/min-1 (ps/rpm)	147/2,100 (200/2,100)（ファン無し）	
全装備質量		t	42.8（10 mブーム＋40 tフック）	

※ 1. 本表の単位は、国際単位系による SI 単位表示です。（ ）内は、従来の単位表示と併記したものです。
2. ※印は負荷により速度が変化します。

表７　簡易動的コーン貫入試験結果表

堤体の地質調査結果一覧表
(qcテスト)



① 法先水際部　② 堤頂の肩から50cm（左）　③ 堤頂の肩から50cm(右)
④ 後ろ刃金の中間(肩から2.0m)　⑤ 後ろ刃金の法先水際部(任意)

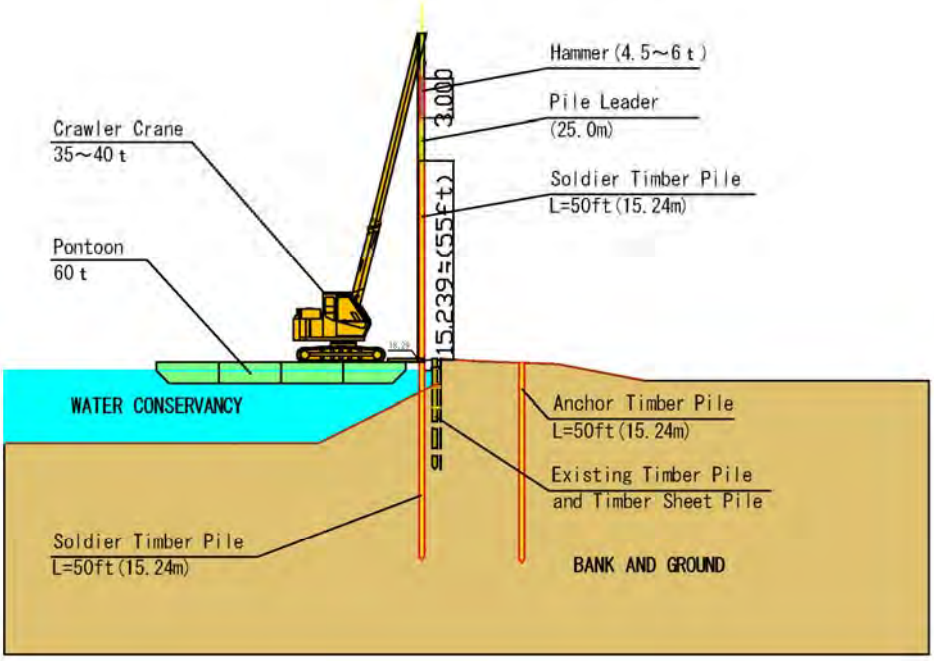
番号	測　点	堤体の観測地点(既存調査を含む)				
		①	②	③	④	⑤
	Flag Staff～Lama sluice			6km		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2
1	No 0+300	0.2	2.8	2.8	0.6	0.2
2	No 0+600	0.2	3.2	2.4	0.8	0.2
3	No 0+900	0.1	2.4	3.6	0.8	0.4
4	No 1+200	0.2	1.6	2.0	1.0	0.2
5	No 1+500	0.4	4.0	2.4	0.4	0.2
6	No 1+800	0.4	2.4	4.0	0.6	0.2
7	No 2+100	0.2	1.6	2.4	0.4	0.4
8	No 2+400	0.2	4.0	2.8	0.6	0.4
9	No 2+700	0.4	2.0	4.4	1.0	0.2
10	No 3+000	0.4	2.8	2.0	0.8	0.2
11	No 3+300	0.1	1.2	3.2	0.6	0.1
12	No 3+600	0.2	4.0	2.8	0.4	0.4
13	No 3+900	0.4	2.8	2.0	0.4	0.2
14	No 4+200	0.2	3.6	2.4	0.6	0.4
15	No 4+500	0.2	1.2	2.8	0.8	0.2
16	No 4+800	0.1	2.8	1.2	0.6	0.4
17	No 5+100	0.2	2.4	2.8	0.8	0.4
18	No 5+400	0.4	1.2	3.6	1.0	0.4
19	No 5+700	0.2	2.8	1.6	1.0	0.4
20	No 6+000	0.2	3.6	2.4	0.6	0.2
	Flag Staff～Annandeal			10km		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2
1	No 0+300	0.2	3.6	2.8	0.8	0.4
2	No 0+600	0.4	2.8	2.4	0.6	0.4
3	No 0+900	0.2	4.0	2.4	0.6	0.6
4	No 1+200	0.2	2.4	1.6	0.6	0.2
5	No 1+500	0.4	2.0	4.4	0.4	0.6
6	No 1+800	0.2	3.6	2.8	0.4	0.4
7	No 2+100	0.2	3.6	2.4	0.4	0.2
8	No 2+400	0.2	2.4	2.8	0.6	0.6
9	No 2+700	0.4	1.2	2.4	0.6	0.2
10	No 3+000	0.2	2.4	2.8	0.4	0.2
11	No 3+300	0.2	2.8	1.2	0.4	0.2
12	No 3+600	0.4	2.0	2.8	0.4	0.4
13	No 3+900	0.2	3.8	2.0	0.4	0.2
14	No 4+200	0.4	1.2	2.4	0.6	0.2
15	No 4+500	0.2	2.8	4.0	0.6	0.4
16	No 4+800	0.4	2.4	2.8	0.6	0.6
17	No 5+100	0.2	3.6	2.8	0.8	0.4
18	No 5+400	0.4	2.4	2.0	1.0	0.4
19	No 5+700	0.4	4.0	2.4	1.2	0.2
20	No 6+000	0.2	2.0	4.0	0.8	0.4
21	No 6+300	0.4	2.4	3.2	0.4	0.4
22	No 6+600	0.4	1.2	2.4	0.4	0.6
23	No 6+900	0.4	3.6	2.8	0.4	0.2
24	No 7+200	0.4	1.6	2.4	0.6	0.2
25	No 7+500	0.2	2.4	1.6	0.6	0.4
26	No 7+800	0.4	2.0	2.4	0.4	0.4
27	No 8+100	0.4	2.4	2.0	0.4	0.2
28	No 8+400	0.4	1.2	2.4	0.4	0.2
29	No 8+700	0.2	2.4	1.2	0.4	0.4
30	No 9+000	0.2	2.0	2.0	0.6	0.6
31	No 9+300	0.4	4.0	1.6	0.6	0.4
32	No 9+600	0.4	2.0	2.0	0.6	0.4
33	No10+000	0.2	2.0	1.2	0.8	0.2
		14.90	136.40	134.00	32.60	17.50
	平均値	0.28	2.57	2.53	0.62	0.33

支持力の計算

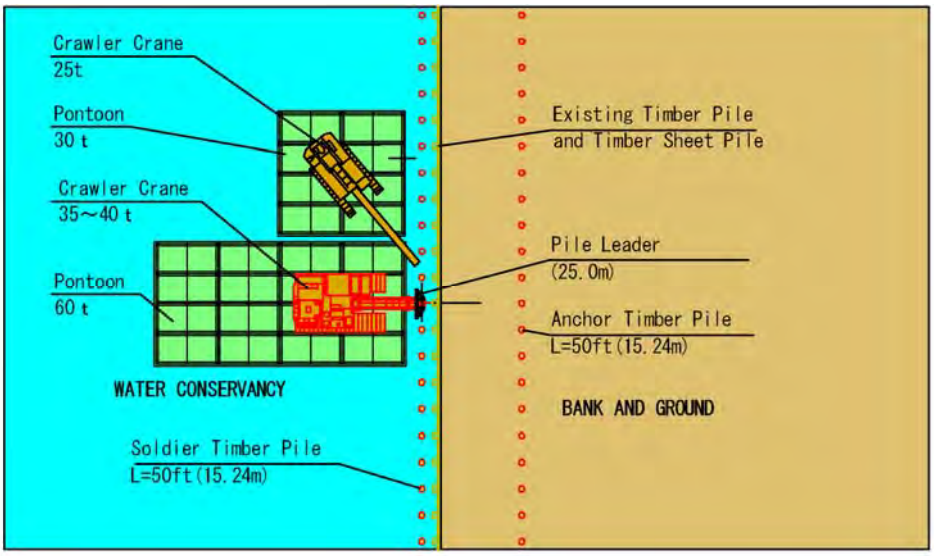
①ブロック　②ブロック ③ブロック ④ブロック ⑤ブロック

2. 施工イメージ図

(1) 杭打ち図

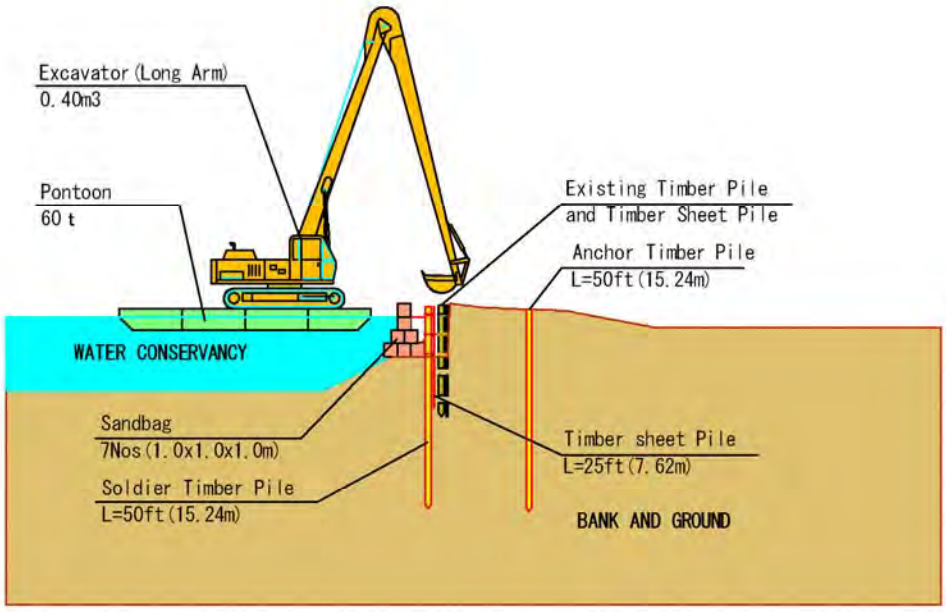


杭打ち施工側面図

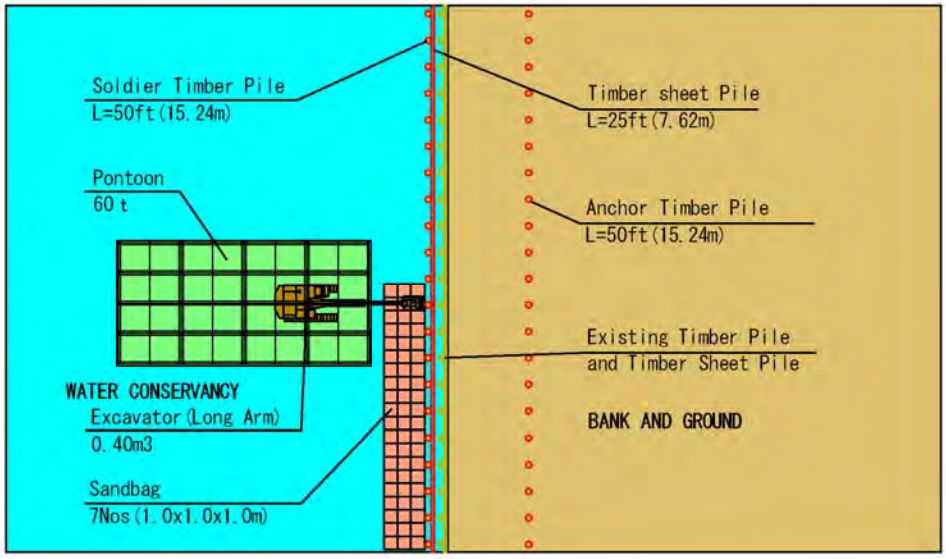


杭打ち施工平面図

(2) 土のう施工図（仮締切工）

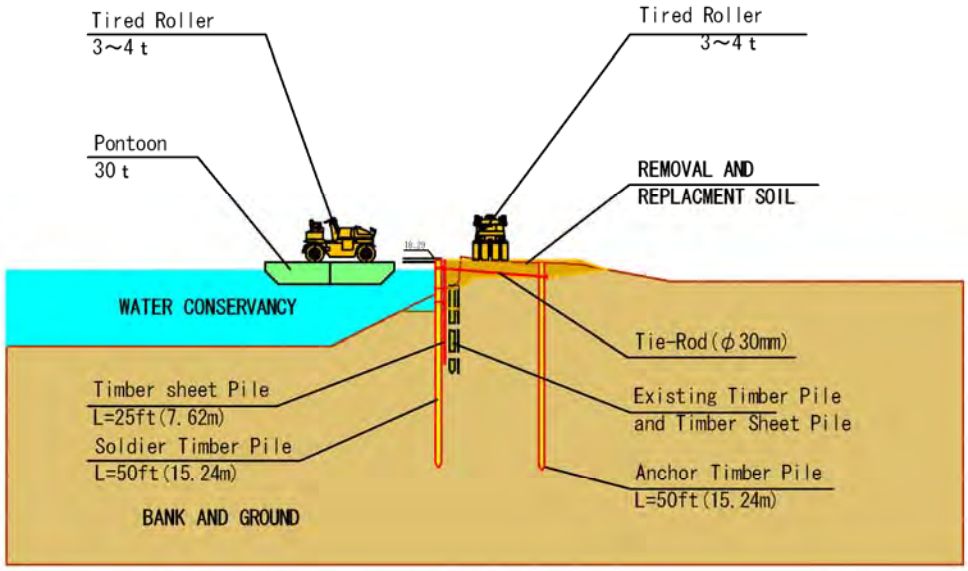


土のう仮締切り工側面図

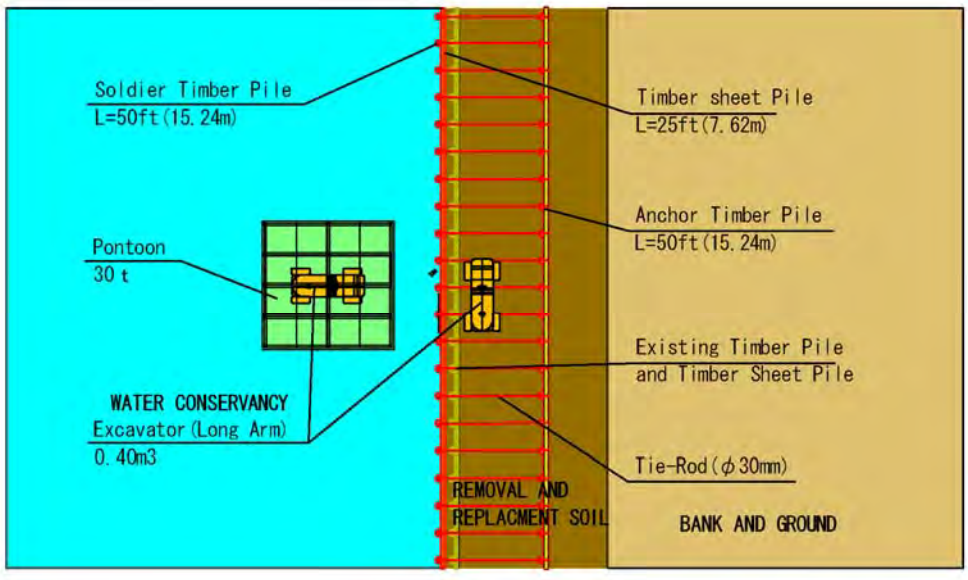


土のう仮締切り工平面図

(3) 盛土締切り工施工図



盛土締固め施工側面図



盛土締固め施工平面図

資料－7 関連資料

資料 7-1 測量調査

資料 7-2 土質・地質調査

資料 7-3 土工事品質管理用コーンペネトロメーター

資料 7-1 測量調査

(1) Object

Survey	Purpose
・Topography and General Plan Survey	・Location determination for rehablitation design of
for relief sluice and intake facilities	facilities
	・Calculation of earthwork Volumes
・Vertical Height Survey along	・Determination of embankment height in conformity
Embankment Crest	with the prescribed embankment height design
・Cros Section Survey of embankment	・Determination of cross section of embankment
and outfall canal	and location of revetment/anchor pile installations
	・Calculation of earthwork Volumes
	・Determination of timber-pile length in conformity
	with geological data
・Detailed Survey of existing relief	・Rehabilitation Design of the existing facilities
sluice and intake facilities	

(2) Drawings

Facilities	Survey			
	Topography Survey	Embankment Crest Survey	Embankment Cross Section Survey	Structure Survey
Ann's Grove Intake	○	4-sections	8	2
Hope Intake	○	1	9	3
Annandale Intake	○	2	9	2
Nancy Intake	○	3	9	3
Maduni Relief Sluice	○	4	9	2
Sarah Johanna Relief Sluice	○		3	

(3) Surveyor

Sworn Land Surveyor : Dwarka Ramkarran

資料 7-2 土質・地質調査

概　要

(1) EDWC 堤体盛土の状態把握および堤体補強工事のための計画設計に必要な地中基礎部の状態把握のための土質・地質調査を実施。

(2) 実施期間（2010 年）

・10 月 29 日～11 月 4 日
・11 月 15 日～11 月 23 日

(3) 実施工種

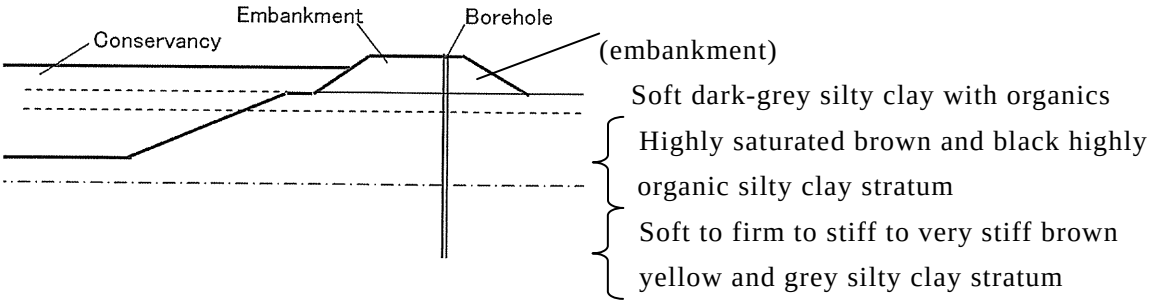
・機械ボーリング　20 孔
・ベーン(Vane)せん断試験
・室内試験用の試料採取（土試料、ソイルセメント試料）
・室内試験（土試料、ソイルセメント試料）
・孔内水位観測

(4) 室内試験

・アッターベルグ限界
・含水比
・湿潤単位体積重量
・一軸圧縮試験
・粒径
・比重
・pH 試験
・圧密試験

(5) 土性・地層概要

堤体上で実施したボーリングによる土性・地層概要；



(6) 地下水位状況

孔内水位は堤体天端下 1.22～1.52m に観測された。これらは、ボーリング孔の位置のみでの値であり、洪水や潮位、季節的変動などを反映したものではない。

(7) 試料採取

ほとんどの場合において、高有機質飽和粘性土の不撹乱試料採取は飽和特性のために不可能であり、標準貫入試験時に採取した試料で代用。

SUMMARY OFGEOTECHNICAL INVESTIGATION
EAST DEMERARA WATER CONSERVANCY

Table of Contents

1. Scope of Work

The investigation was conducted to understand the characteristics of EDWC embankment soil and foundation conditions of relief sluice and intake facilities.

This report presents the results of the geotechnical investigation undertaken for the Basic Design Study of the Project.

The geotechnical investigation was composed of field surveys, laboratory tests, analysis of data obtained and preparation of investigation report.

The analytical results are to be used for the quality control of the soil banking of the conservancy embankment and foundation/revetment designs of the relief sluice and intake structures.

The field survey was performed in two phases of October 29, 2010 to November 4, and November 15 to 23, comprising

- Machine boring of twenty(20) boreholes, of which hole was dug up to specified depth (ranging from 6 m to 16 m at which N-Value exceeding 15 blows/30 cm were recorded),
- Collection of soil test-piece out of borehole for laboratory tests, and
- Vane shear test in the borehole.

The following laboratory tests were performed in accordance with ASTM Specifications;

- Soil Sample collection (D1857-74)
- Vane shearing test of site (D2573-72)
- Classification of soil (D2487-69)
- Distinction of soil (D2488-69)
- Liquid limit test (D 423-66)
- Plastic limit test
- Grain Size Distribution test
- Soil Moisture Content test (D2216)
- Specific gravity of soil test
- pH test
- Ignition Loss test
- Organic Matter Content test
- Unconfined compression test(D2850)
- One-Dimensional Consolidation test(D2435)
- Wet & dry density

2. Subsurface Investigation

Disturbed or undisturbed soil test-piece was collected from the borehole in accordance with methods in ASTM D-1586 and ASTM D-1587 respectively.

Disturbed test-pieces were collected by Standard Penetration Test (SPT) at arbitrary depth in boreholes. Undisturbed samples were recovered by Shelby Tube sampling at selected intervals.

Immediately after recovery, all samples were visually classified in the field in terms of color, compactness or consistency and major and minor soil constituents.

Several attempts were made to recover undisturbed (Shelby Tube) samples of the very soft to soft silty clays encountered at locations. However, these attempts were all unsuccessful due to the very soft consistency of these clays. A partial sample was recovered at some locations where there was an intersection with the dense silty sand.

2.1 Regional and Site Geology

The project site is located within Guyana coastal plain. This coastal plain lies near sea level and is underlain by clays of the Demerara Clay and Coropina Formations*[1]. The area is also crossed by old shorelines and ridges mostly parallel with the present shoreline. The Coastal Plains occupy a strip approximately 40 km wide along Guyana entire coast (Bleackley, 1956).

In probably late Pleistocene times, the sea receded and the soft tidal flats and sandbars were subjected to strong erosion and weathering. The clays became oxidized and firmer in consistency by loss of water and the sandy areas podsolised*[2] resulting in what is now mapped as the Coropina Formation.

A rise in sea level in post glacial times to practically its former level caused inundation of the Coropina Formation and the laying down of soft clays of the Demerara Formation surrounding Coropina islands and filling river valleys.

The younger parts of the Demerara Clay formation are recent in age and clay indistinguishable from the Demerara Clay is being added at the present time to parts of the coast.

The borings confirmed the occurrence of both the Demerara Clay and Coropina Formations at the sites.

*[1] Coropina Formation

This type of soil formation is derived from older freshwater sediments (Pliocene and Pleistocene). It occurs in low-lying areas on flat or nearly flat topography and in situations with high rainfall. There is usually excessive leaching of plant nutrients and migration of clay from surface layers to lower depths over time. Relatively light texture surface layer dominated by silt and fine sand and very dense and compact subsurface horizon.

This type of formation gives SPT N-values in excess of 50 blows per 30cm.

*[2] Podsolised

This describes a soil that has experienced an extreme form of leaching which causes the eluviation of iron and aluminum sesquioxides.

The process generally occurs in areas where precipitation is greater than evapotranspiration. The minerals are removed by a process known as leaching.

2.2 Subsurface Stratigraphy

Field boring logs included in the report depict the soil stratigraphy encountered for each borehole.

<u>soil stratigraphy at Maduni(BH-3)</u>

Ground surface (0～5m stratum) is a firm red brown and grey silty clay, which is underlain by a stiff to very stiff red and grey silty clay of N-value≧60.

<u>soil stratigraphies except Maduni</u>

The general stratigraphy encountered consists of a soft dark grey clay with organics occurring at ground surface, overlying a highly saturated brown and black highly organic silty clay stratum. This highly saturated brown and black highly organic silty clay is underlain by a soft to firm to stiff to very stiff brown yellow and grey silty clay stratum.

2.2.1 Firm Silty Clay (CH)　硬質シルト質粘土

A firm silty clay stratum was encountered at ground surface in the borehole at East Demerara Region.

The stratum extended to a depth of approximately 4.0 m of the fill and the humus layers are contained. The firm consistency of this stratum is very likely attributable to desiccation.

The consistency of this stratum was determined by performing the Vane- Tests. This test consists of torque value . Vane value of this material ranged between 30 and 70 kpa torque value.

2.2.2 Soft to Very Soft Silty Clay (CH)　軟質シルト質粘土

A soft to very soft silty clay, second stratum encountered at borehole is a highly saturated brown and black highly organic silty clay. This stratum extended to depths ranging from approximately 7 m at all boring holes to 8 m at

Vane Tests (Vane -Values) in this material were generally less than10 kPa torque value at all boreholes.

2.2.3 Firm to Stiff Silty Clay (CL)　硬いシルト質粘土

This stratum was encountered immediately below the very soft to soft silty clay. It extended to depths of approximately10m.

The consistency of this stratum determined by performing the Vane-Tests in this material ranged between 35～50 kPa torque value .

2.2.4 Very Stiff to Hard Silty Clay　非常に硬質シルト質粘土

Maduni borehole site encounters at shallow depth of about 5 meters a stiff to very stiff to hard, red and grey silty clays of N-value≧60. This red and grey silty clays layer is assumed to be base layer of the low to hilly region

Overlying ground surface (0～5m stratum) embankment which is considered to be made of the excavated silty clay indicates a firm red brown and grey silty clay with Vane-values of 40～80kPa.

2.2.5 Groundwater Conditions

Groundwater was encountered at depths ranging from 1.0 to 1.5 m in the boreholes. The water levels are for the times noted on the drilling logs only. These levels do not reflect flood, tidal or seasonal fluctuations in groundwater levels.

It is highly likely that groundwater will be encountered during excavation for below grade structures. An adequate number of sumps and pumps should therefore be provided to control groundwater inflows.

2.2.6 Earthworks and Sub-grade Preparation

It is likely that embankment adjacent to conservancy facilities will require fill placement. Before placing new fills, all topsoil, organic matter and other deleterious materials shall be removed from the ground surface. The exposed sub-grade shall then be proof rolled to check whether any unstable areas exist. If any soft areas are detected by proof rolling, the unstable area shall be removed and be replaced with compacted granular fill. After confirming the test result of soil test, the site soil shall be used as much as possible as a backfill. The soil not satisfy the standard shall be removed from the site.

The fill shall be placed at 30cm. loose thicknesses at its maximum. All fills shall be compacted to not less than 3% of the laboratory determined minimum air void content in accordance with ASTM Method D-698. The sub-grade soils at these sites are silty. These soils will consequently remold and loose strength when saturated. It is therefore highly recommended that the sub-grade be covered with a layer of granular fill immediately after the completion of excavation.

2.3 Results

The results of the Vane-Tests are depicted graphically on the logs. Vane Shearing values for each borehole are given in Table 2-1.

Table 2-1 Results of Vane Shearing Tests(kPa)

Sample Depth(m)	BH1	BH2	BH3	BH5	BH7	BH8
0～2	21～29	29～25	54～82	33～37	33～25	33～16
2～4	33	29	41	33	33	25
4～6	37	33	max	25	16	16
6～8	21～16	16	max	33～49	21～29	16
8～10	12	21		91	54	20
10～12						

Sample Depth(m)	EMB-2	EMB-4	EMB-5	EMB-9	EMB-11	EMB-12
0～2	58～54	0～37	33	54～29	41～54	45～66
2～4	54	33	29	29	45	70
4～6	41	21	25	29	29	29
6～8	37～32	21～16	28～62	33～45	29～33	21
8～10						
10～12						

The results of the Standard penetration Tests are depicted graphically on the logs. Standard penetration values for each borehole are detailed in Table 2-2

Table 2-2 Results of Standard Penetration Tests

Borehole Depth(m)	BH1	BH2	BH3	BH4	BH5	BH6	BH7	BH8	EMB-1	EMB-2	EMB-3	EMB-4
0～4												
4～8	3		60								2-35	
8～12	3	2		50	90	20	20		15	15	43	
12～16	28	18						5-15				22

Borehole Depth(m)	EMB-5	EMB-6	EMB-7	EMB-8	EMB-9	EMB-10	EMB-11	EMB-12
0～4								
4～8								
8～12	32	30	30	22	32	17	23	
12～16								23

3. Laboratory Test

Laboratory tests were performed on selected soil samples after review in the laboratory. In general, classification, strength and deformation tests were performed on all undisturbed samples from each borehole.

All tests were performed in accordance with Volume 4.08 of the Annual Book of ASTM Standards (1999) Edition.

The laboratory tests results are presented in attached material.

3.1 Tests Performed and Methodology

Classifications tests were performed on at least five samples from each borehole. Soil strength and deformation tests were performed on all undisturbed samples recovered from each borehole.

The tests that were performed and the associated ASTM methods are presented below:

ASTM Method Description

D-2216 Soil Moisture Content
D-4318 Atterberg Limits
D-854 Specific Gravity
D-2850 Unconfined Compression Test
D-2435 One-Dimensional Consolidation

The wet and dry densities were also determined for undisturbed samples.

3.2 Summary of Test Results

The results obtained from the laboratory investigation are similar to those obtained from equivalent tests on samples recovered from Coastal Plain deposits elsewhere in Guyana. Detailed results are presented in the laboratory test results of Tables 3-1 and 3-2 below

.

3.2.1 Classification Test

The results of the classification tests indicate that primarily high plasticity silty clays underlie all borehole sites. Table 3-1 summarizes the results of the classification tests on samples from each borehole.

3.2.2 Unconfined Compression Tests

Soil unconfined compression strengths were determined. The soil undrained shear strength was obtained by taking one half the unconfined compression strength. In general, the Unconfined Compression strength of the very soft to soft silty clay (Demerara Clay) does not exceed 3.5 t/m2. Unconfined Compression strengths generally greater than 3 t/m2 but less than 10 t/m2 were recorded for the desiccated crust encountered at ground surface. Unconfined Compression strengths are also reported in Table 3-1. Stress-strain plots for these tests are provided in the laboratory test sum maries of attached material.

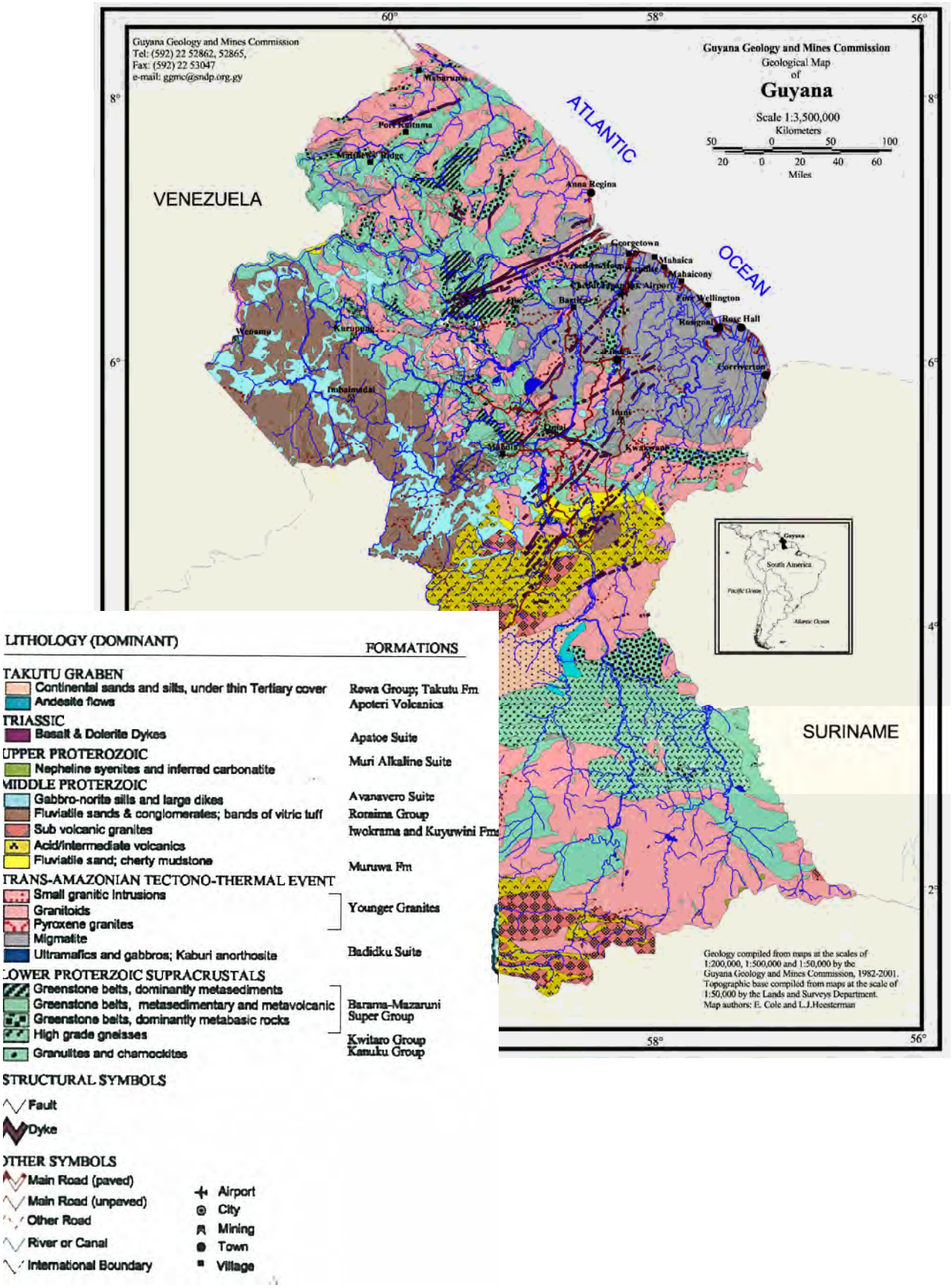
Table 3-1 Summary of Classification and Soil Strength Tests

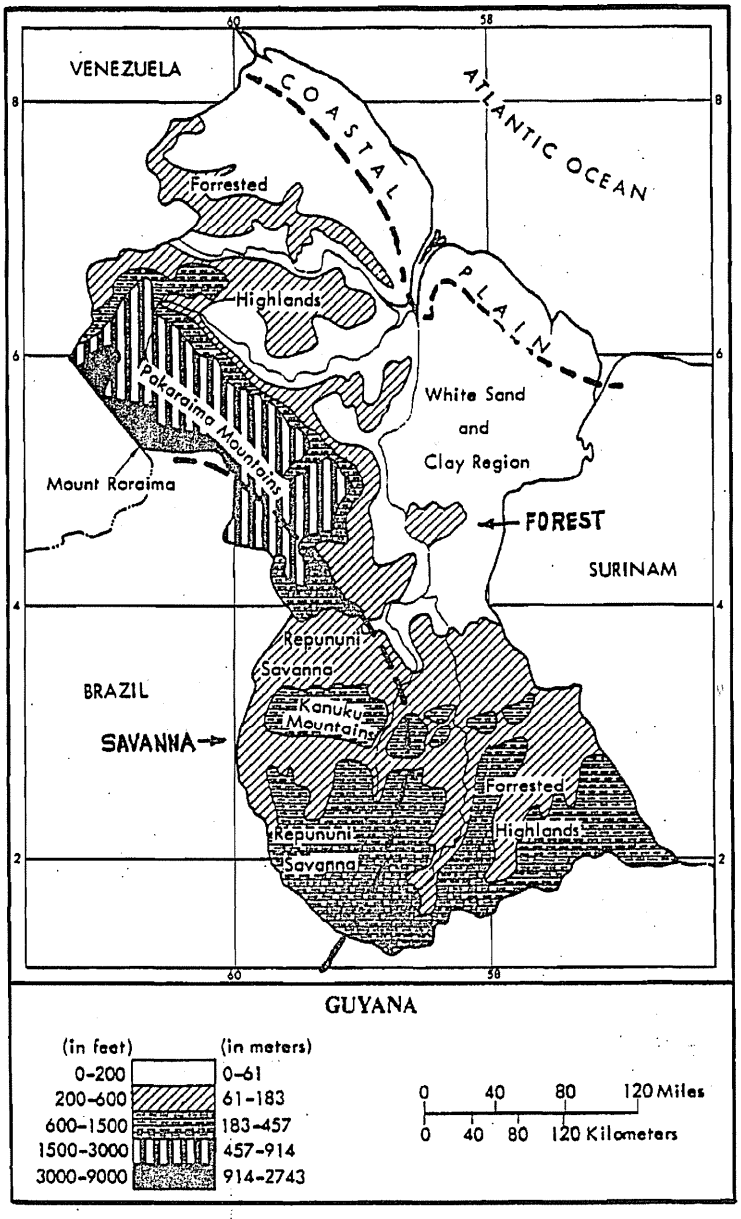
Borehole No	Sample No	Sample Depth (m)	LL	PL	PI	MC (%)	Specific Gravity	Unconfined Comp. Strength (tf /m²)
BH1	1	10	57	36	21	19	2.59	2.8
BH2	1	7	147	101	46	120	2.50	0.5
BH3	1	5	55	31	24	39	2.53	2.6
BH4	1	7.6	38	24	14	48	2.53	0.6
BH6	1	7.6	69	35	34	32	2.53	0.4
EMB-1	2	9.1	75	24	51	27	2.63	18.3
EMB-6	2	9.5	89	23	65	102	2.67	3.1
EMB-8	2	6.5	71	25	46	62	2.53	5.3
EMB-10	2	4.5	74	25	49	32	2.50	
EMB-12	2	9.0	58	30	28	49	2.63	

3.2.3 One-Dimensional Consolidation Tests

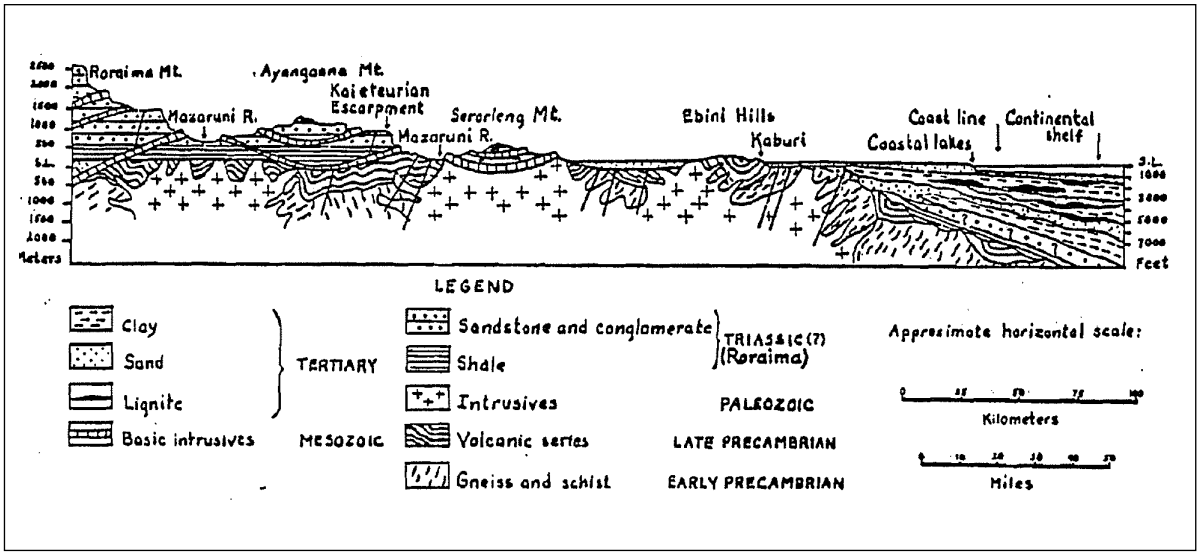
One-dimensional consolidation tests confirmed the high Compression Index, Cc, of the soft to very soft silty clays (Demerara Formation) in virgin compression.

Some over-consolidation was recorded for the upper zone of firm soil encountered at ground surface. This over-consolidation is due primarily to desiccation.

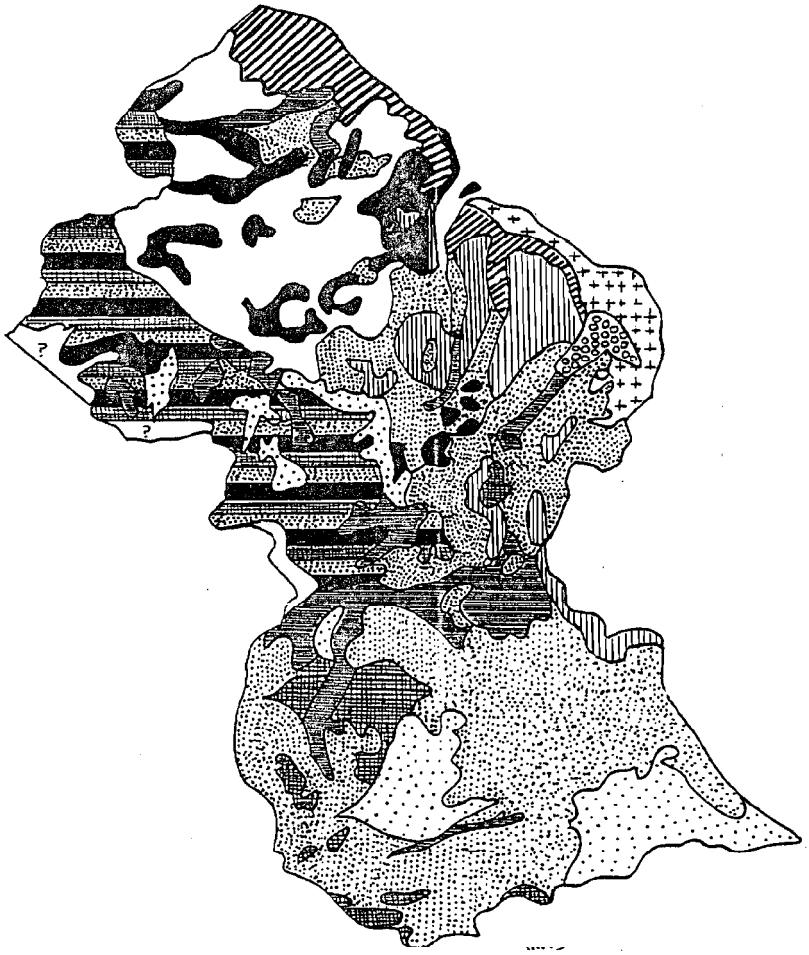

Guyana Geology and Mines Commission
Tel: (592) 22 52862, 52865,
Fax: (592) 22 53047
e-mail: ggmc@sndp.org.gy
Guyana Geology and Mines Commission
Geological Map
of
Guyana
Scale 1:3,500,000
Kilometers
50 0 50 100
20 0 20 40 60
Miles
VENEZUELA
ATLANTIC
OCEAN
SURINAME
Mabaruma
Port Kaituma
Matthews Ridge
Anna Regina
Georgetown
Mahaica
Mahaicony
Fort Wellington
Rose Hall
Corriverton
Kurupung
Wenamu
Imbaimadai
Dadanawa
Ituni
Kwakwani
Guyana
South America
Pacific Ocean
Atlantic Ocean
60°
58°
56°
8°
6°
4°
2°
LITHOLOGY (DOMINANT)
FORMATIONS
TAKUTU GRABEN
Continental sands and silts, under thin Tertiary cover
Rewa Group; Takutu Fm
Andesite flows
Apoteri Volcanics
TRIASSIC
Basalt & Dolerite Dykes
Apatoe Suite
UPPER PROTEROZOIC
Nepheline syenites and inferred carbonatite
Muri Alkaline Suite
MIDDLE PROTERZOIC
Gabbro-norite sills and large dikes
Avanavero Suite
Fluviatile sands & conglomerates; bands of vitric tuff
Roraima Group
Sub volcanic granites
Iwokrama and Kuyuwini Fms
Acid/intermediate volcanics
Fluviatile sand; cherty mudstone
Muruwa Fm
TRANS-AMAZONIAN TECTONO-THERMAL EVENT
Small granitic intrusions
Granitoids
Younger Granites
Pyroxene granites
Migmatite
Ultramafics and gabbros; Kaburi anorthosite
Badidku Suite
LOWER PROTERZOIC SUPRACRUSTALS
Greenstone belts, dominantly metasediments
Greenstone belts, metasedimentary and metavolcanic
Barama-Mazaruni Super Group
Greenstone belts, dominantly metabasic rocks
High grade gneisses
Kwitaro Group
Kanuku Group
Granulites and charnockites
STRUCTURAL SYMBOLS
Fault
Dyke
OTHER SYMBOLS
Main Road (paved)
Main Road (unpaved)
Other Road
River or Canal
International Boundary
Airport
City
Mining
Town
Village
Geology compiled from maps at the scales of 1:200,000, 1:500,000 and 1:50,000 by the Guyana Geology and Mines Commission, 1982-2001.
Topographic base compiled from maps at the scale of 1:50,000 by the Lands and Surveys Department.
Map authors: E. Cole and L.J.Heesterman



Typical geological features profile of Guyana



Geological plan of Guyana



COASTAL SOILS

FLUVISOLS. Good agricultural soils.

DYSTRIC HISTOSOL. Thick, sticky, poorly osygenated, poor drainage; little value for modern agriculture, fair grassland.

PLINTHIC ACRISOL. Low fertility, mostly savanna.

SOILS OF INTERIOR

DYSTRIC NITOSOL. Moderate suitability for agriculture and grassland; can be improved with careful management.

EUTRIC GLEYSOL. Highly variable. Along coast when drained are good for agriculture; inland usually forest cover.

ALBIC ARENOSOL. Extremely low fertility, very sandy. Natural vegetation may be forest but when cleared, scrub or grass returns. Poorest soils in Guyana for agriculture.

ORTHIC ACRISOL. Not used for agriculture in Guyana. Usually on hilly terrain and low fertility; subsoil dense. Restricted agric. use.

ACRIC FERRALSOL. Low nutrient content; usually support savanna.

SOILS OF SOUTHERN THIRD OF COUNTRY

ORTHIC FERRALSOL. Low nutrient content; usually support forest; suitable mainly for shifting agriculture.

ORTHIC FERRALSOL. As above. Distinction between these two Orthic Ferralsols, as shown on FAO map unclear.

MIXED: ORTHIC FERRALSOL, DYSTRIC NITOSOL, LITHOSOL. Lithosol. Rocky and on steep slopes. Not suitable for modern agriculture and rarely used.

EDWC 堤体上のボーリング

土質試験 （そのⅠ調査）

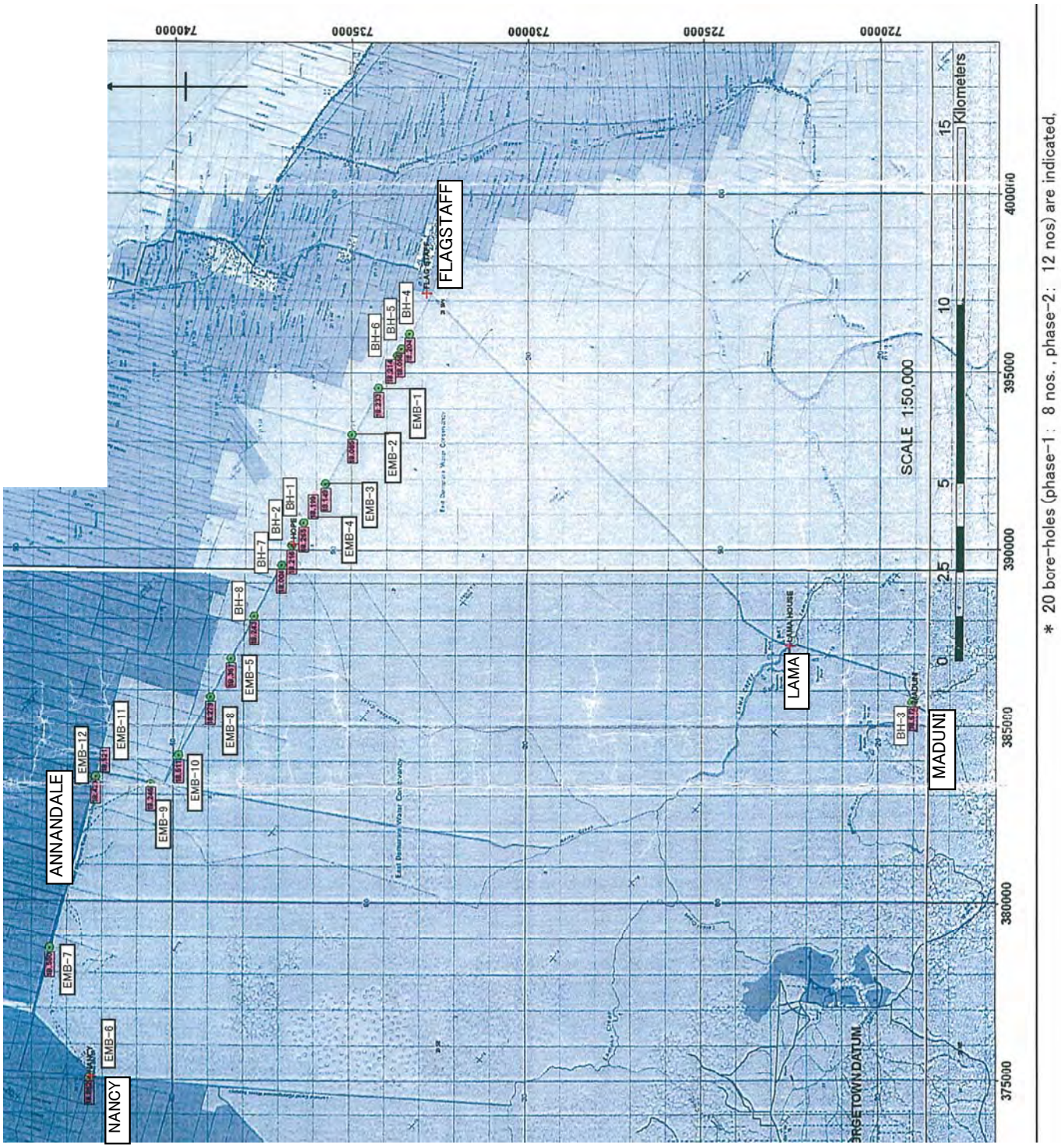
Boring location	BH 1	BH 2	BH 3	BH 4	BH 5	BH 6	BH 7	BH 8	Total
In-situ tests									
Investigation boring depth (m)	12.6	14.3	6.5	9.8	10.3	9.7	10.4	15.8	89.4
Standard penetration test (no.)	3	2	1	1	1	1	1	2	12
Thin-walled sampling (no.)	1	1	1	2		2			7
Spot vane shear test (no.)	7	7	5		7		7	7	40
Physical tests (no.)									
Technological classification method of soil	1	1	1	1		1			5
Density examination of soil particles	1	1	1	1		1			5
Moisture content test of soil	1	1	1	1		1			5
Mechanical analysis of soil grain	1	1	1	1		1			5
Liquid and plastic limits test of soil	1	1	1	1		1			5
Wet density test	1	1	1	1		1			5
Chemical tests (no.)									
pH test		1	1			1			3
Ignition loss test of soil	1			1					2
Organic matter content test of soil		1	1			1			3
Mechanical tests (no.)									
Standard consolidation test	1	1	1	1		1			5
Unconfined compression test	1	1	1	1		1			5
Shrinkage factor test									

土質試験 （そのⅡ調査）

Boring location	EMB- 1	EMB- 2	EMB- 3	EMB- 4	EMB- 5	EMB- 6	EMB- 7	EMB- 8	EMB- 9
In-situ tests									
Investigation boring depth (m)	10.3	9.7	9.9	15.8	9.7	12.6	9.7	9.7	9.7
Standard penetration test (no.)	1	1	3	1	1	1	1	1	1
Thin-walled sampling (no.)	2					2		2	
Spot vane shear test (no.)		6		6	6				6
Physical tests (no.)									
Technological classification method of soil	1					1		1	
Density examination of soil particles	1					1		1	
Moisture content test of soil	1					1		1	
Mechanical analysis of soil grain	1					1		1	
Liquid and plastic limits test of soil	1					1		1	
Wet density test	1					1		1	
Chemical tests (no.)									
pH test	1					1			
Ignition loss test of soil	1					1			
Organic matter content test of soil								1	
Mechanical tests (no.)									
Standard consolidation test	1					1		1	
Unconfined compression test	1					1		1	
Shrinkage factor test									

Boring location	EMB-10	EMB-11	EMB-12	Total
In-situ tests				
Investigation boring depth (m)	9.7	9.7	15.8	132.3
Standard penetration test (no.)	1	1	1	14
Thin-walled sampling (no.)	2		2	10
Spot vane shear test (no.)		6	6	36
Physical tests (no.)				
Technological classification method of soil	1		1	5
Density examination of soil particles	1		1	5
Moisture content test of soil	1		1	5
Mechanical analysis of soil grain	1		1	5
Liquid and plastic limits test of soil	1		1	5
Wet density test	1		1	5
Chemical tests (no.)				
pH test				2
Ignition loss test of soil			1	3
Organic matter content test of soil			1	2
Mechanical tests (no.)				
Standard consolidation test				3
Unconfined compression test				3
Shrinkage factor test				

ボーリング位置図


ANNANDALE
NANCY
FLAGSTAFF
LAMA
MADUNI
EMB-1
EMB-2
EMB-3
EMB-4
EMB-5
EMB-6
EMB-7
EMB-8
EMB-9
EMB-10
EMB-11
EMB-12
BH-1
BH-2
BH-3
BH-4
BH-5
BH-6
BH-7
BH-8
SCALE 1:50,000
Kilometers
0
5
10
15
25
375000
380000
385000
390000
395000
400000
725000
730000
735000
740000
* 20 bore-holes (phase-1 : 8 nos. , phase-2 : 12 nos) are indicated.

土 質 状 況

dep.(m)	BH-1	N-Value	Soil Description		BH-2	N-Value	Soil Description		BH-3	N-Value	Soil Description		BH-4	N-Value	Soil Description	
		20v	Soft dark grey silty clay with organics	moist		30v	Stiff dark grey silty clay with organics	moist		55v	Firm red brown and grey silty clay c=8t/㎡～15t/㎡	moist			Stiff dark grey silty clay with organics	moist
1																
		30v				25v				80v						
2			Soft dark grey silty clay with organics	moist											Soft brown and grey silty clay with organics	moist
3		35v	Highly saturated brown and black highly organic silty clay	very moist		30v				40v						
4		40v														
						35v										
5		3							MH							
										60	Stiff to very stiff red and grey silty clay c=10t/㎡	moist			Soft light grey silty clay	moist
6		20v	Very soft silty clay	moist		15v										
7						15v	Soft dark grey silty clay	moist					CL			
		15v			MH											
8																
														50	Stiff yellow, brown, red and grey silty clay	moist
9		15v				20v										
10	MH	3	Soft to firm light grey silty clay	moist		2	Soft light grey silty clay	moist								
11																
12		28	Firm yellow and grey silty clay	moist												
13																
14																
						18	Firm brown and grey silty clay	moist								
15																

v:In-situ Vane shear(kpa)

N value	Consistency	qu(t/㎡)	c(t/㎡)
～2	Very soft （ごく軟らかい）	～2.5	～1.3
2～4	Soft （軟らかい）	2.5～5	1.3～2.5
4～8	Intermediate （中位）	5～10	2.5～5
8～15	Hard （粘り強い）	10～20	5～10
15～30	Very hard （ごく粘り強い）	20～40	10～20
30～	Hardened. （硬い）	40～	20～

dep.(m)	BH-5	N-Values	Soil Description		BH-6	N-Value	Soil Description		BH-7	N-Value	Soil Description		BH-8	N-Value	Soil Description	
		30v	Soft dark grey silty clay with organics c=4t/㎡～13t/㎡	moist			Soft grey silty clay with organics	moist		30v	Soft dark grey silty clay with organics	moist		30v	Soft dark grey silty clay with organics c=3.3t/㎡～5t/㎡	moist
1																
		35v								15v				15v		
2																
3		30v								25v				25v		
4																
		25v								15v				15v		
5																
6		30v								15v				15v		
7													CL			
		50v			MH		Firm light grey silty clay	moist		15v				15v		
8																
9		90v								20v				20v		
						20	Very stiff red yellow and grey silty clay	moist			Very stiff red brown and grey silty clay	moist				
10	MH	90	Stiff yellow red brown grey silty clay	moist						20						
11																
12																
13																
															Soft light grey silty clay	moist
14														5		
15														15	Stiff yellow brown and grey silty clay	moist

N value	Consistency	qu(t/㎡)	c(t/㎡)
～2	Very soft	～2.5	～1.3
2～4	Soft	2.5～5	1.3～2.5
4～8	Intermediate	5～10	2.5～5
8～15	Hard	10～20	5～10
15～30	Very hard	20～40	10～20
30～	Hardened.	40～	20～

dep.(m)	EMB-1	N-Value	Soil Description		EMB-2	N-Value	Soil Description		EMB-3	N-Value	Soil Description		EMB-4	N-Value	Soil Description	
						60v								0v		
1																
						50v								40v		
2																
												moist				
3						55v										
											Soft dark brown highly organic silty clay and fibrous matter			35v		
4																
			Soft dark greenish black highly organic silty clay and fibrous matter	moist		40v	Soft dark greenish black highly organic silty clay and fibrous matter c=5t/㎡～10t/㎡	moist		2				20v	Soft dark greenish black highly organic silty clay and fibrous matter c=4t/㎡～8.4/㎡	moist
5																
6						40v								20v		
7																
						30v				35	Firm reddish brown silty clay	moist		15v		
8																
														50v		
9						15	Firm brownish greenish dark grey silty clay	moist		43						
			Very stiff dark brown silty clay	moist												
10		15														
															Firm reddish dark brown silty clay	moist
11																
12																
13																
14																
15														22	Dark brown silty clay	

N value	Consistency	qu(t/㎡)	c(t/㎡)
～2	Very soft	～2.5	～1.3
2～4	Soft	2.5～5	1.3～2.5
4～8	Intermediate	5～10	2.5～5
8～15	Hard	10～20	5～10
15～30	Very hard	20～40	10～20
30～	Hardened.	40～	20～

dep.(m)	EMB-5	N-Value	Soil Description		EMB-6	N-Value	Soil Description		EMB-7	N-Value	Soil Description		EMB-8	N-Value	Soil Description	
		30v	Soft dark greenish black highly organic silty clay and fibrous matter,damp c=4t/㎡～10/㎡	moist			Soft dark brown highly organic silty clay and fibrous matter	moist			Soft dark greenish black highly organic silty clay and fibrous matter	moist			Soft dark brown highly organic silty clay and fibrous matter	moist
1																
		30v														
2																
3		30v											CH			
4																
		25v														
5																
6		30v											CH		Firm greyish,greenish light brown silty clay	moist
7							Firm brownish grey silty clay	moist								
		60v														
8																
										30						
9		32												22	Firm greyish greenish light brown silty clay	moist
			Firm reddish grey silty clay	moist	CH						Firm greenish brownish light grey silty clay	moist				
10																
11																
12						30										
							Firm greenish brownish	moist								
13							grey silty clay									
14																
15																

N value	Consistency	qu(t/㎡)	c(t/㎡)
～2	Very soft	～2.5	～1.3
2～4	Soft	2.5～5	1.3～2.5
4～8	Intermediate	5～10	2.5～5
8～15	Hard	10～20	5～10
15～30	Very hard	20～40	10～20
30～	Hardened.	40～	20～

dep.(m)	EMB-9	N-Value	Soil Description		EMB-10	N-Value	Soil Description		EMB-11	N-Value	Soil Description		EMB-12	N-Value	Soil Description	
		50v	Soft dark greenish black highly organic silty clay and fibrous matter,damp c=5t/㎡～8.5/㎡	moist			Soft grey silty clay	moist		40v	Soft dark greenish black highly organic silty clay and fibrous matter c=5t/㎡～9.0/㎡	moist		45v	Soft dark grey silty clay	moist
1																
		30v								55v				65v		
2																
3		30v								45v				70v		
4																
		30v			CH					30v			CH	30v		
5							Soft brown silty clay	moist								
6		30v								30v				20v		
7																
		45v														
8										30v				20v		
9		32				17	Firm greyish brown silty clay	moist		23			CH			
			Firm dark grey silty clay								Firm dark greyish green silty clay					
10															Soft dark grey silty clay	moist
11																
12															Firm dark grey silty clay	
13																
14																
15														23		

N value	Consistency	qu(t/㎡)	c(t/㎡)
～2	Very soft	～2.5	～1.3
2～4	Soft	2.5～5	1.3～2.5
4～8	Intermediate	5～10	2.5～5
8～15	Hard	10～20	5～10
15～30	Very hard	20～40	10～20
30～	Hardened.	40～	20～

セメント混入土の室内試験

Laboratory tests on cement-mixed soil samples mixed both at embankment site and at laboratory, respectively were conducted.

(1) Soil/cement Mixing at Field

(a) Soil is an organic matter excavated from canal bed.

(b) The soil of prescribed volume was spread in the bucket furnished on the pontoon.

(c) Cement content ratio in three(3) cases and number of specimen are as follows;

・60kg, 120kg and 180kg weight of cement respectively for 1-metric cubic of soil

・Six(6) specimen for each cement content case, 3 for 4-days curing and 3 for 7-days curing

(2) Soil/cement Mixing at Laboratory

(a) Soil is an organic matter excavated from canal bed.

(b) The soil sample was carried into the laboratory in tightly sealed manner and the soil of prescribed volume was taken into the mixing bucket.

(c) Cement content ratio in three(3) cases and number of specimen are as follows;

・60kg, 120kg and 180kg weight of cement respectively for 1-metric cubic of soil.

・Six(6) specimen for each cement content case, 3 for 4-days curing and 3 for 7-days curing.

(3) Test Schedule

	Dates job-conductrd
Sampling and Mixing at Field	▬
	(11/11)
Sampling at Field	
and Mixing at Laboratory	▬
	(11/5)
Laboratory Tests	▬(L4) ▬(L7) ▬(F4) ▬(F7)
(4-days and 7-days curing)	(11/10) (11/13) (11/16 (11/18)

(4) Laboratory Tests

Following tests according to the ASTM test procedures were conducted;

・Unconfined Compression Test

・Wet Density test of Soil

(5) Laboratory Test Results

5-1 Field Mixing

Cement Content ratio (kgf/1m^3)	Wet Density (gf/cm^3) Curing		Undrained Shear Strength (kpa)	
	4-days	7-days	4-days	7-days
60	1.46 ~ 1.62	1.46 ~ 1.52	4 ~ 11	4 ~ 16
120	1.39 ~ 1.82	1.44 ~ 1.53	5 ~ 42	25 ~ 57
180	1.44 ~ 1.54	1.42 ~ 1.53	74 ~ 82	41 ~131

5-2 Laboratory Mixing

Cement Content ratio (kgf/1m^3)	Wet Density (gf/cm^3) Curing		Undrained Shear Strength (kpa)	
	4-days	7-days	4-days	7-days
60	1.46 ~ 1.77	1.29 ~ 1.44	23 ~ 33	23 ~ 30
120	1.49 ~ 1.58	1.35 ~ 1.39	50 ~ 70	36 ~ 56
180	1.74 ~ 1.86	1.40 ~ 1.45	73 ~134	117 ~156

Work Exercises for Soil Tests

Laborarory Mixing and Tests

Excavated Soil stored in pontoon bucket at Field

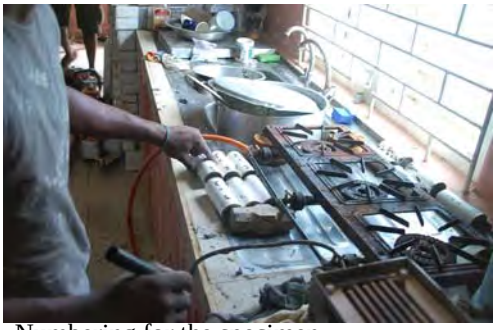
Soil sampling

Soil Sample tightly sealed in bucket

Soil Sample brought to the laboratory

Cement : Weight measuring

Moulds for the test



Numbering for the specimen

Curing (18-specimen in total)

Compression test instrument

In process of testing

Specimen after testing (Nov. 13th)

Field Mixing and Tests

Excavated Soil in bucket on pontoon

Soil Volume measuring

Cement adding and Mixing

Sampling and specimen in mould

Test after 4-days curing

Specimen after testing (Nov. 16th)

資料 7-3 土工事品質管理用コーンペネトロメーター

【Quality management of EDWC-concerned earthworks with CONE PENETROMETER】

(1) **Conventional quality control method for in-situ soil density**

Earthworks on the 'EDWC Facilities Rehabilitation' comprise excavating and banking for conservancy embankment and outfall canal banks as schematically given in Figure-1. To achieve superior quality control and maintenance performance on earthworks, soil test procedures and work execution criteria are precisely described in the proposed Technical Specifications.

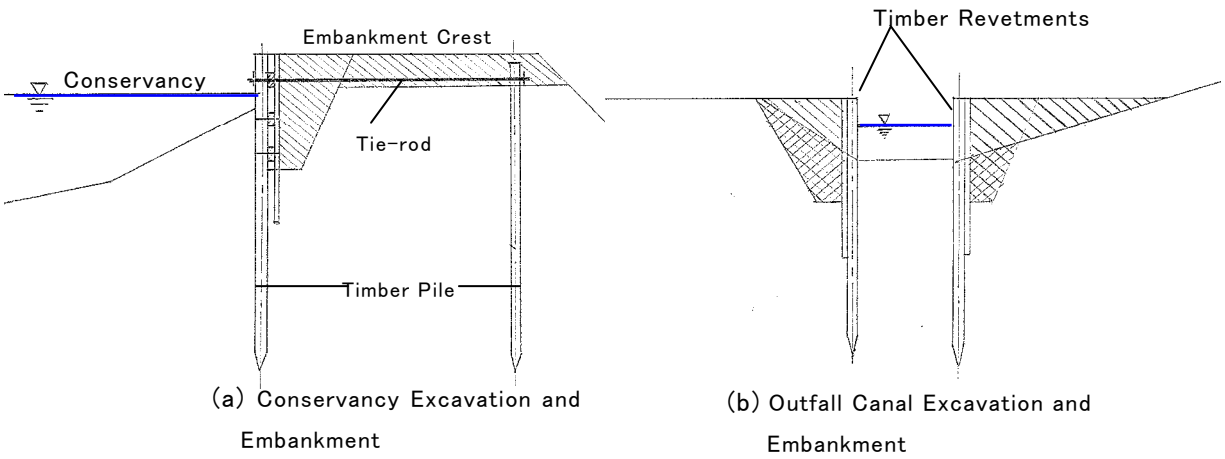


Figure-1 Excavation and Embankment for Revetment Works

As for "in-situ density control management", it is recommended in the said Specifications to follow the "In-situ Density, Sand Replacement Method, large and small cylinders. BS 1377-9 1990 Clause 2.1 & 2.2".

The in-situ density measurement by sand replacement method is to

- dig hole of specified-size (diameter & depth) in the embankment,
- weigh whole dug soils,
- replace the soil volume dug out with standard (particle sizes) sand, and measure the sand volume, and
- calculate the soil density by dividing the soils weight by the sand volume.

The procedure of the measurement has to go through various processes to complete taking much labor and time.

(2) **Compaction control with use of CONE PENETROMETER**

The embankment subsurface soil generally consists of alternate stratum of pegasse, blackish peat and silty clay of soft dark-grey. The soil properties in terms of cohesion, internal friction and permeability vary at location/stratum, but are in general unsuitable and poor.

For quality control of earthworks with such soil properties, CONE PENETROMETER has been conveniently employed for in-situ tests of natural or compacted soils. It serves as a rapid means for determining penetration resistance of the soil.

The penetration resistance which is expressed as cone-index (q_c N/mm^2) can well assess the intensity of subject soil in correlation with unconfined compressive strength (q_u N/mm^2), cohesive strength(c N/mm^2) and so on.

Measured data are timely applied to daily quality control and execution supervision, and regular inspection and maintenance of embankment.

The CONE PENETROMETER shown in Plate-1 is a handy, portable instrument in which the device is consisted mainly of;

- cross handle,
- proving ring for capacity measure,
- cone with top angle of 30-degrees , and
- extension rods(10-nos./50cm long each).

Plate-1 Set of CONE PENETROMETER
(courtesy；関西機器製作所)

Actual handling of the Instrument is shown in Plate-2.

Plate-2 Handlings of CONE PENETROMETER

(3) **Merits of introducing CONE PENETROMETER**

Employing CONE PENETROMETER for the earthworks has the advantages over the sand replacement method as follows;

- measured data are applied immediately to the succeeding work steps and accordingly the field works can be expedited.
- the equipments can be easily operated at narrow work area.
- special techniques are not required for handlings of the equipments.
- serious damages are not anticipated to the equipment.

資料 8 その他資料・参考資料

（本報告書で参考・引用した資料）

表　題	作成・発行機関	内　容
Guyana Floods : UNDAC Geotechnical and hydraulic assessment of the East Demerara Water Conservancy dam	Joint UNEP/OCHA Environment Unit, February, 2005	ガイアナ 2005 年 1～2 月の洪水時に、UNDAC チームへの協力者と共に EDWC の越流防止対策と今後へのアクションプランの立案
DRAFT DESIGN REPORT on Engineering Design for the East Demerara Water Conservancy Northern Relief Channel at Hope/Dochfour, East Coast Demerara, Region 4	National Drainage and Irrigation Authority, December, 2009 (CEMCo,SRKN'gineering Joint Venture in association with Mott MacDonald)	「2005 年 1 月の実績降雨同等以上の EDWC 流入水による堤体越水・破堤を避けるための大規模放水路 Hope/Dochfour の建設」に向けての設計報告書(Draft)
Draft Water Level Management Manual ; East Demerara Water Conservancy	June, 2005 Draft submitted to the Task Force	2005 年 1 月、EDWC 過去最大の流入量による堤体越流を経験し、その後に向けた緊急復旧対策はじめ堤防破堤防止への段階的水位管理に向けて（6-排水門: Land of Canaan, Maduni, Lama-1,-2, Cunha and Kofi)）の開扉運用指針の設定
On East Demerara Water Conservancy	National Assembly Minutes of Proceedings, GUYANA 3rd June,2010	EDWC 排水門（Relief Sluice）の現況および Hope/Dochfour 放水路の計画設計について MOA（農業省大臣）の議会答弁書
GUYANA Tide Tables and List of Lights for 2010	by Authority of the Director General, Maritime Administration Department, GUYANA	2010 年の全日に亘るガイアナ港海水位；最高・最低海水位、発生時刻の予測値
The GUYANA Grading Rules for Hardwood Timber	by Forest Department, Georgetown, Guyana, September, 1974 May, 1977 改訂	ガイアナ産；硬質・高強度木材の特性・使用性から強度に至る全容の説明・紹介
GEF(Global Environmental Facility) Project Document on a Proposed Grant from the Special Climate Change Fund to the Government of GUYANA for a Conservancy Adaptation Project	GEF(Global Environment Facility)：World Bank June 20, 2007	気候変動に起因する海面上昇による、ガイアナ低地の洪水災害減少に向けての施策への世界銀行の資金供与：基本調査、EDWC からの排水性向上への施策、および洪水救済マネジメント制度に向けての Grant 説明書

表　　題	作成・発行機関	内　　容
Engineering Survey showing Location of Kokers (Intake and Sluice) in the Demerara Water Conservancy from Plantation Land of Canaan to Maduni Lock December 2006 Surveyor : Vinyak V. H. Bandon	Prepared by the Guyana Lands and Surveys Commission. Land Information and Mapping Division January 2007	EDWC附帯施設位置について2006年12月に行った測量実績
Contract Document on Procurement of Hydraulic Excavator, May, 2009	Government of GUYANA, The World Bank, GEF SCCF (Global Environmental Facility, Special Climate Change Fund) Trust Grant, Ministry of Agriculture Conservancy Adaptation Project	掘削機1台調達への契約書式
Contract Document on Fabrication of Punt and Pontoon for the East Demerara Water Conservancy, May, 2009	同上	ポンツーン、小船等の製作に係る契約書式
Contract Document on Rehabilitation of Structures in the East Demerara Water Conservancy, May, 2009 (Lama Relief Sluice 1,2)	同上	既設の Lama 排水門-1,-2 について、擁壁工(Revetment)を含む改修工事への契約書式
EDWC Topography Map (1988) scale 1:50,000	Government of GUYANA, 2007 (by Guyana Lands & Surveys Commission)	EDWC と周辺を含む地形図
Survey Drawings (Plan, Profile and Cross Section) of EDWC : from Flagstaff to Big Island (8km)	NDIA, Government of GUYANA, September, 2010	EDWC 東側堤体測量
Urban Environment Outlook 2009 GEO Georgetown － An Integrated Environmental Assessment of Georgetown －	Prepared by a team led by Dr. Paulette Bynoe and 10 authors	・Brief Overview of Guyana ・State of the Environment ・Impacts ・Responses ・Future Perspectives ・Conclusions, Proposals and Recommendations
Engineering Assessment of 2006 Floods	UNDP, February 2006	2005年12月～2006年1月の洪水について、2005年1月洪水との比較も含む特性の評価書