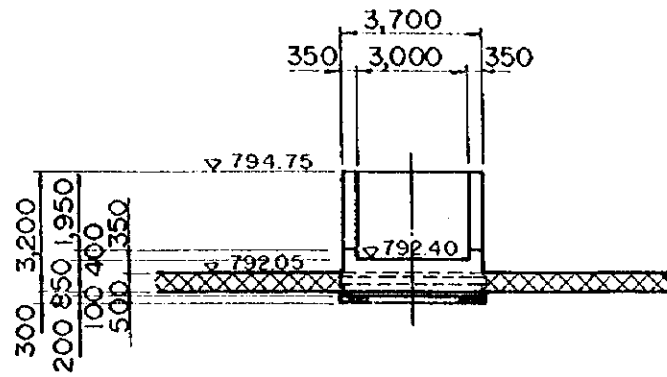
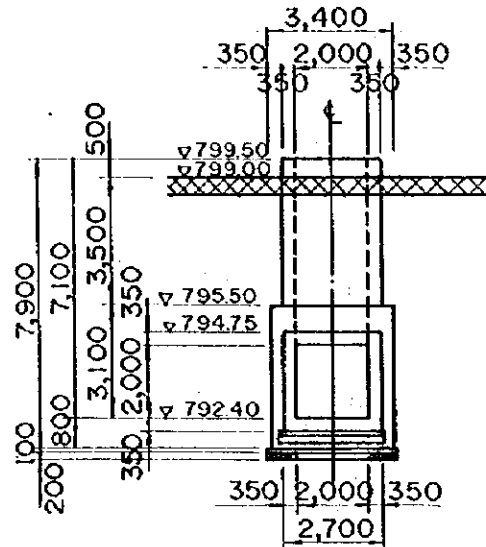


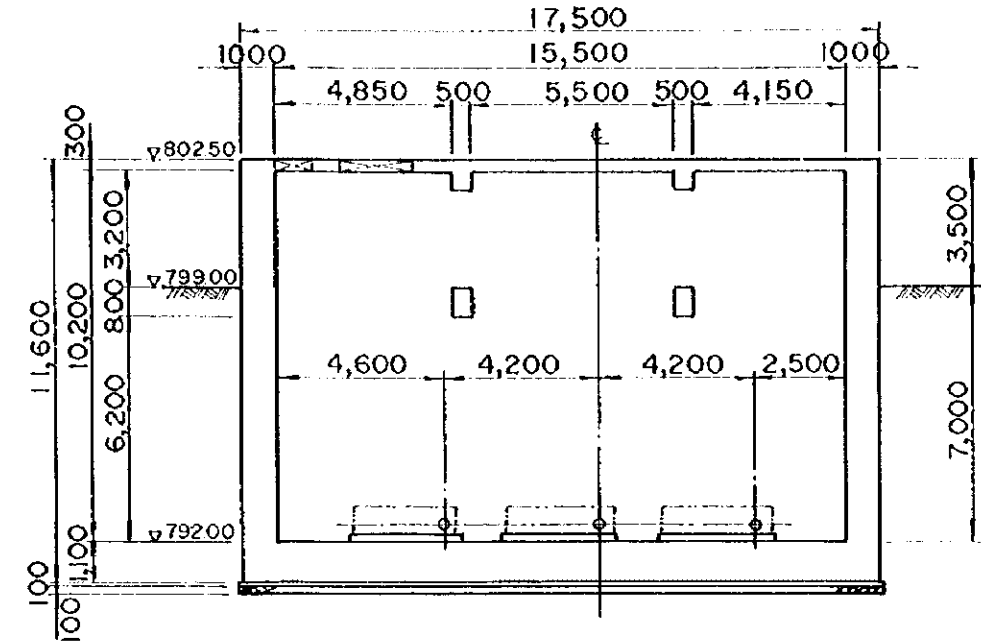
PUMP STATION E SECTION S=1:100



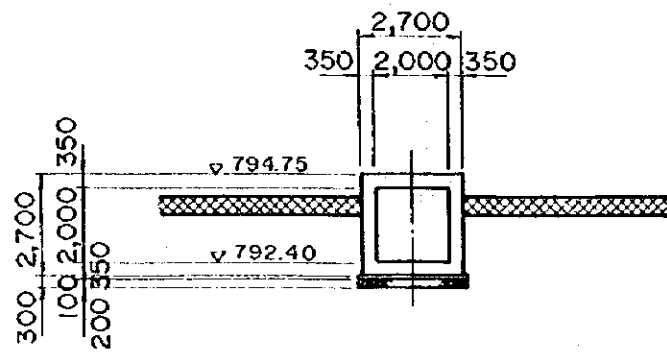
1-1



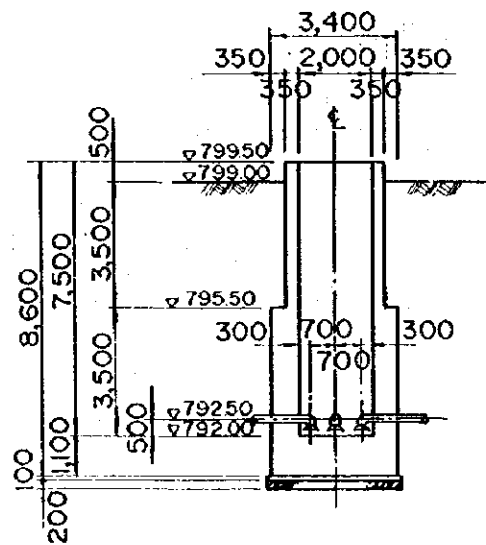
3-3



5-5

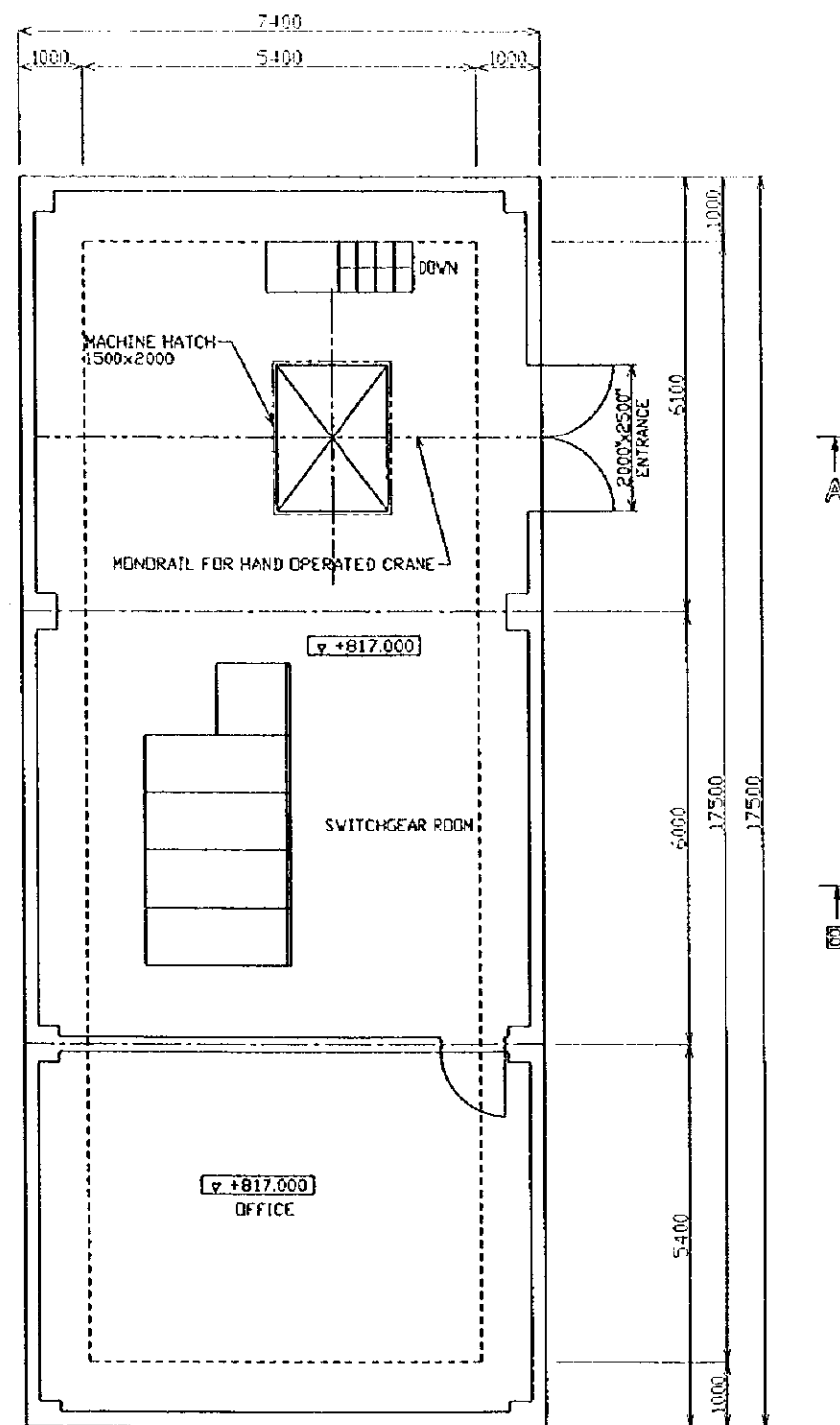
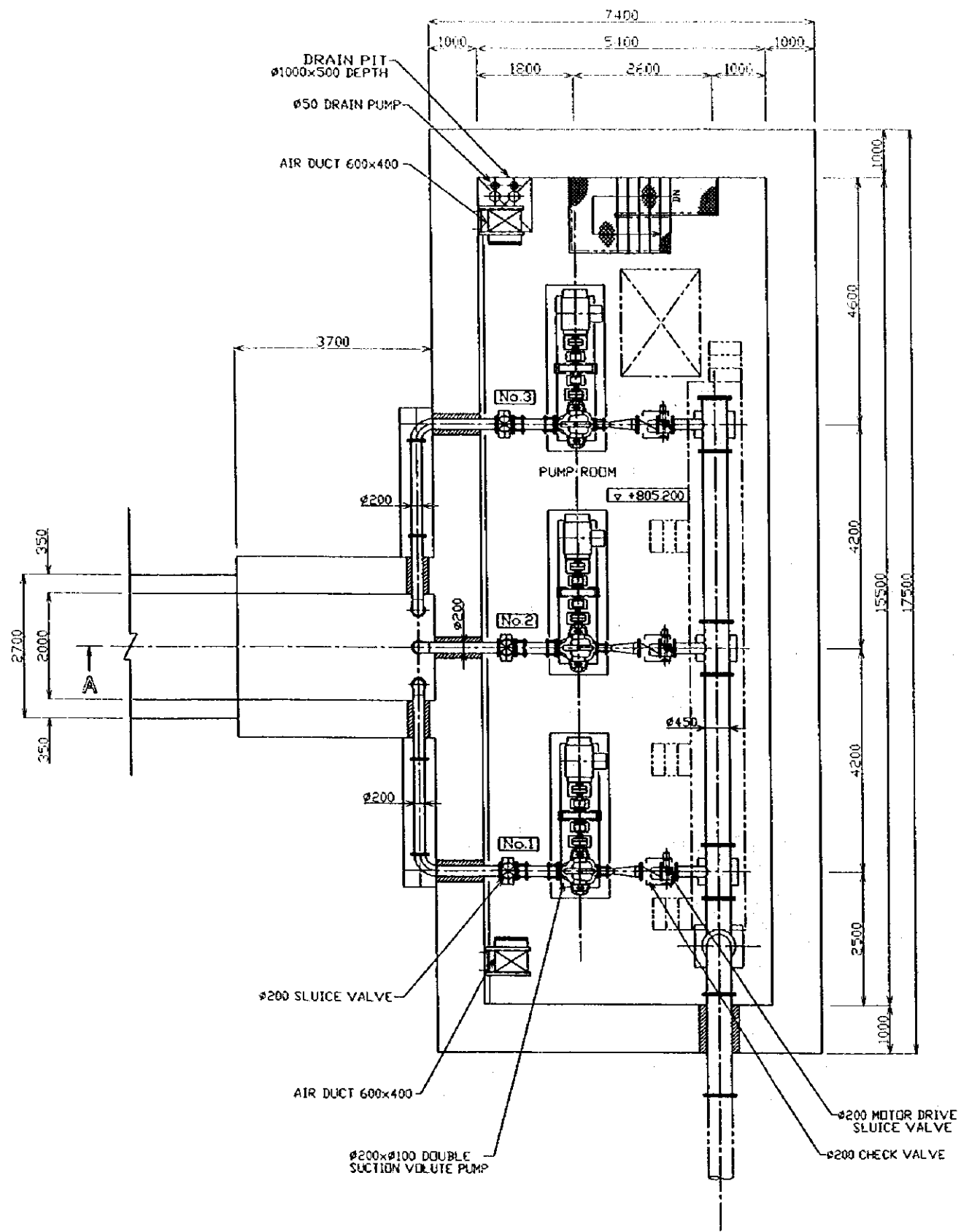


2-2

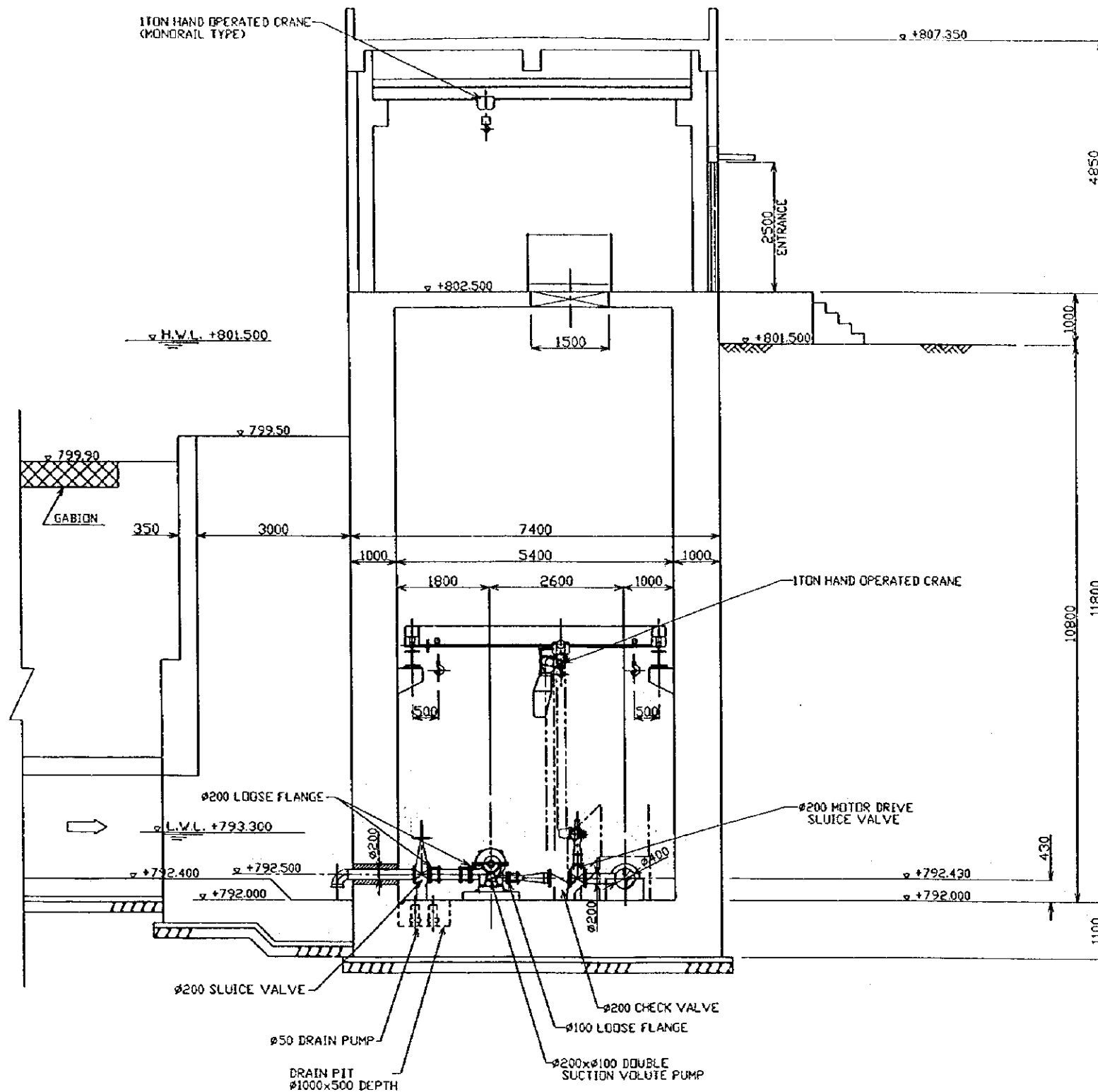


4-4

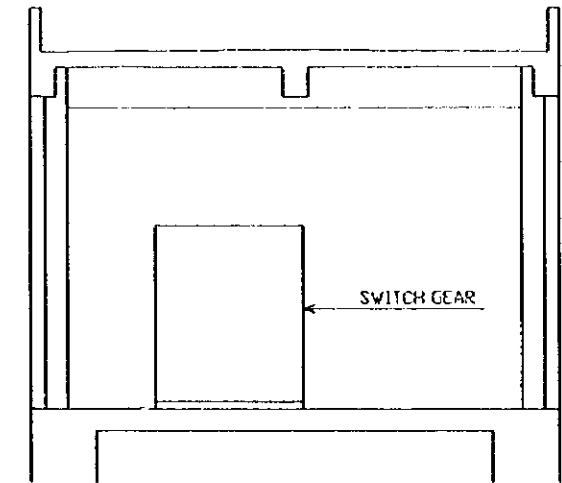
THE REPUBLIC OF ZIMBABWE			
THE BASIC DESIGN STUDY ON THE PROJECT FOR THE NYAKOMBA IRRIGATION DEVELOPMENT PROJECT (PHASE 2)			
PUMP STATION E SECTION			
Date		No.	4
JAPAN INTERNATIONAL COOPERATION AGENCY			



THE REPUBLIC OF ZIMBABWE		
THE BASIC DESIGN STUDY ON THE PROJECT FOR THE NYAKOMBA IRRIGATION DEVELOPMENT PROJECT (PHASE 2)		
PUMP STATION (BLOCK E) PLAN		
Date	No.	41
JAPAN INTERNATIONAL COOPERATION AGENCY		

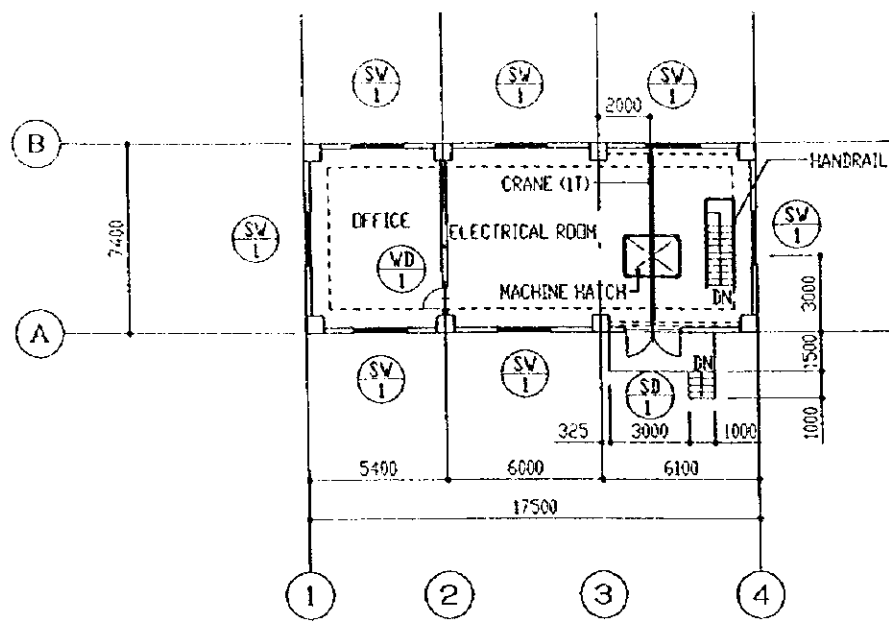


SECTION A

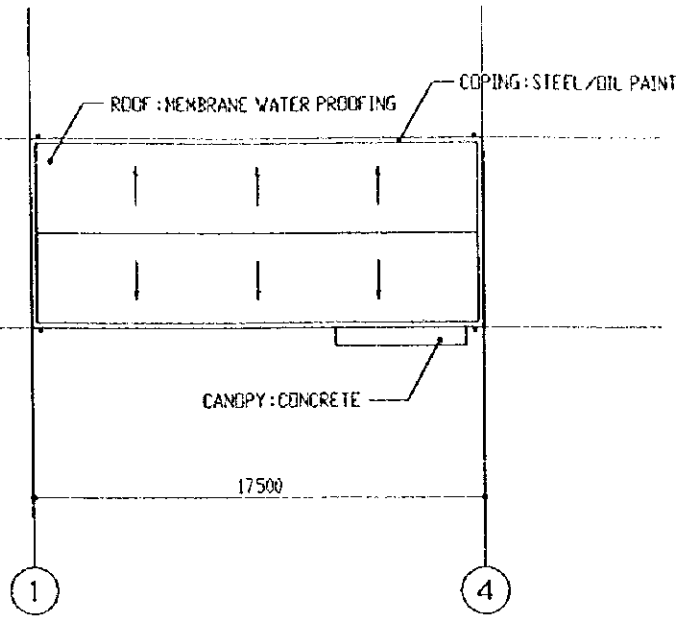


SECTION B

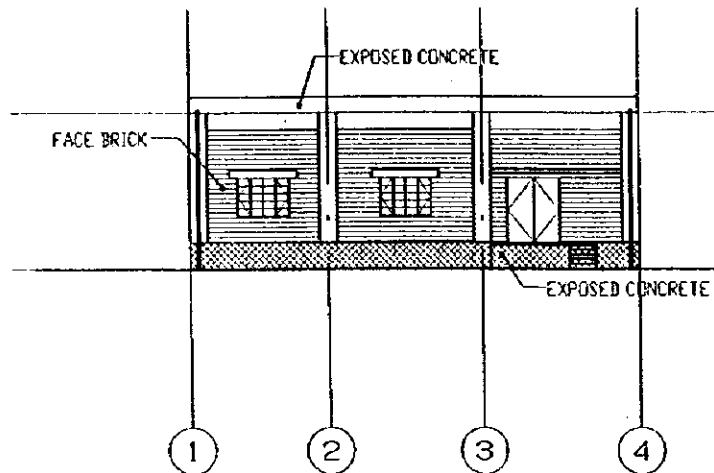
THE REPUBLIC OF ZIMBABWE			
THE BASIC DESIGN STUDY ON THE PROJECT FOR THE NYAKOMBA IRRIGATION DEVELOPMENT PROJECT (PHASE 2)			
PUMP STATION (BLOCK E) SECTION			
Date		No.	42
JAPAN INTERNATIONAL COOPERATION AGENCY			



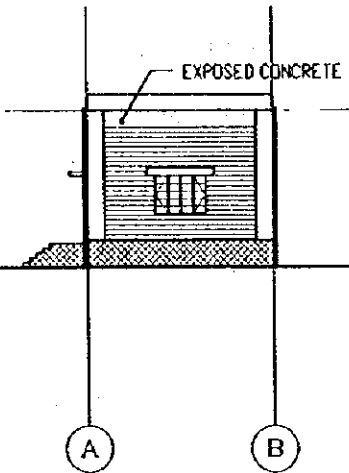
FLOOR PLAN



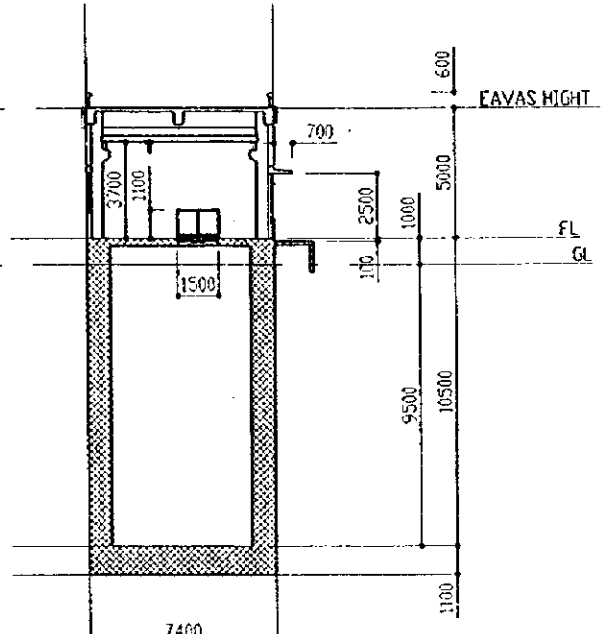
ROOF FLOOR PLAN



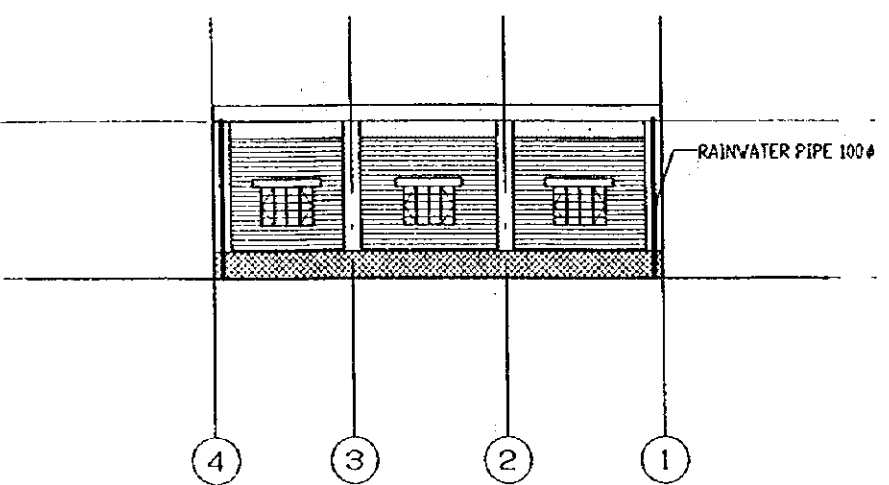
A ELEVATION



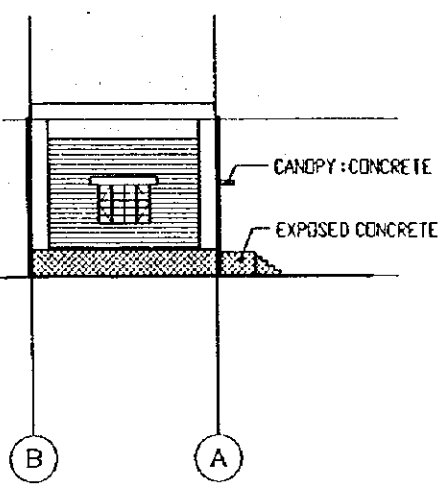
B ELEVATION



SECTION

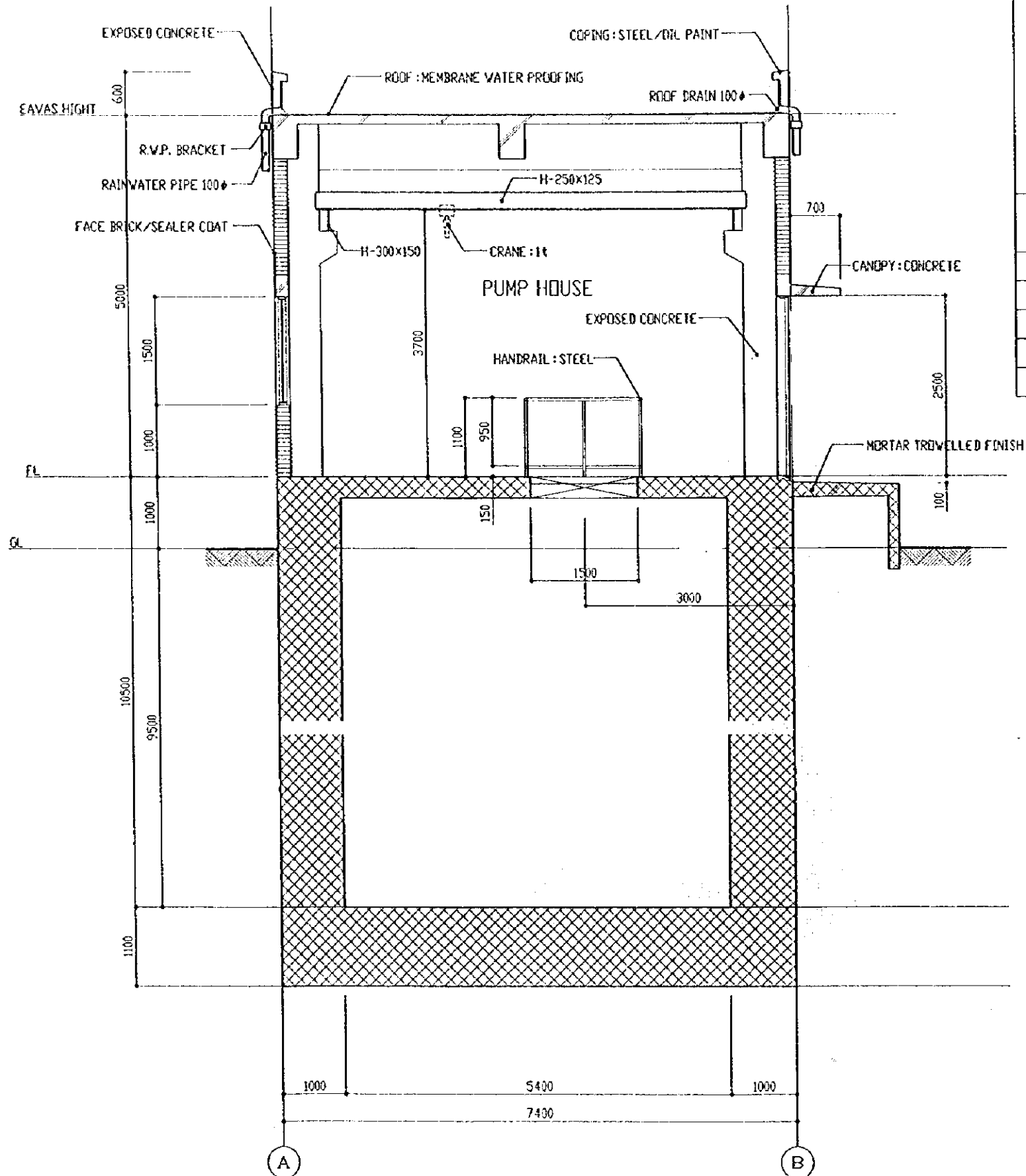


C ELEVATION



D ELEVATION

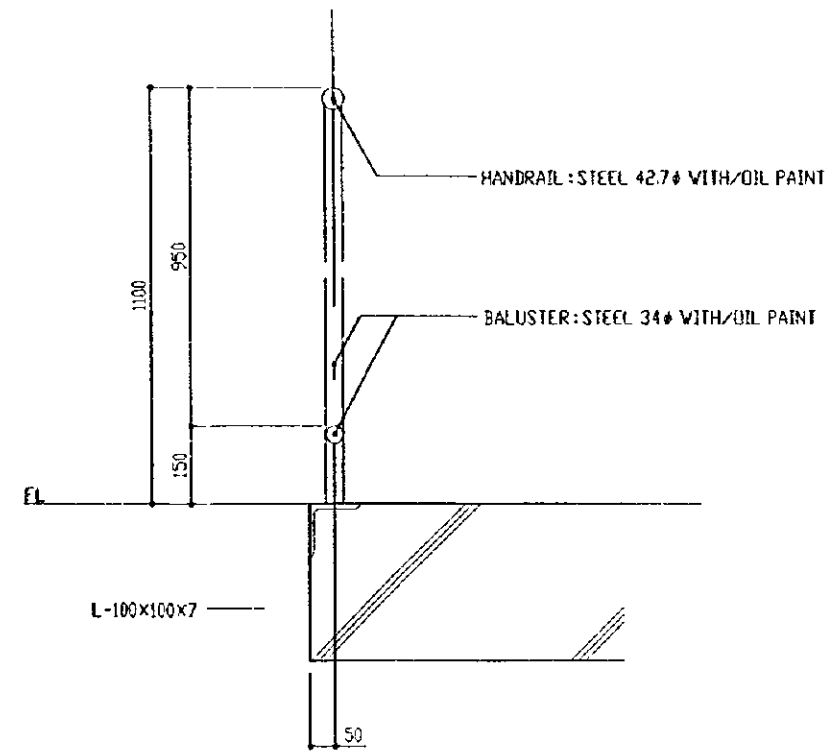
THE REPUBLIC OF ZIMBABWE			
THE BASIC DESIGN STUDY ON THE PROJECT FOR THE NYAKOMBA IRRIGATION DEVELOPMENT PROJECT (PHASE 2)			
PUMP ROOM (BLOCK E)			
FLOOR PLAN • ELEVATION • SECTION • KEYPLAN			
Date		No.	43
JAPAN INTERNATIONAL COOPERATION AGENCY			



TYPICAL DETAIL SECTION

DOORS & WINDOWS SCHEDULE

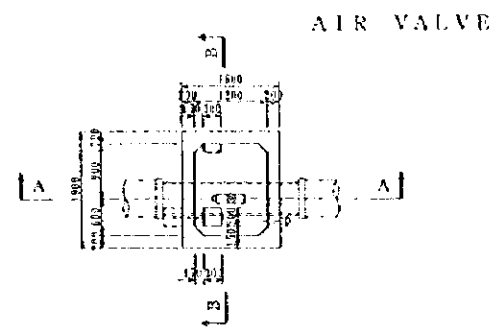
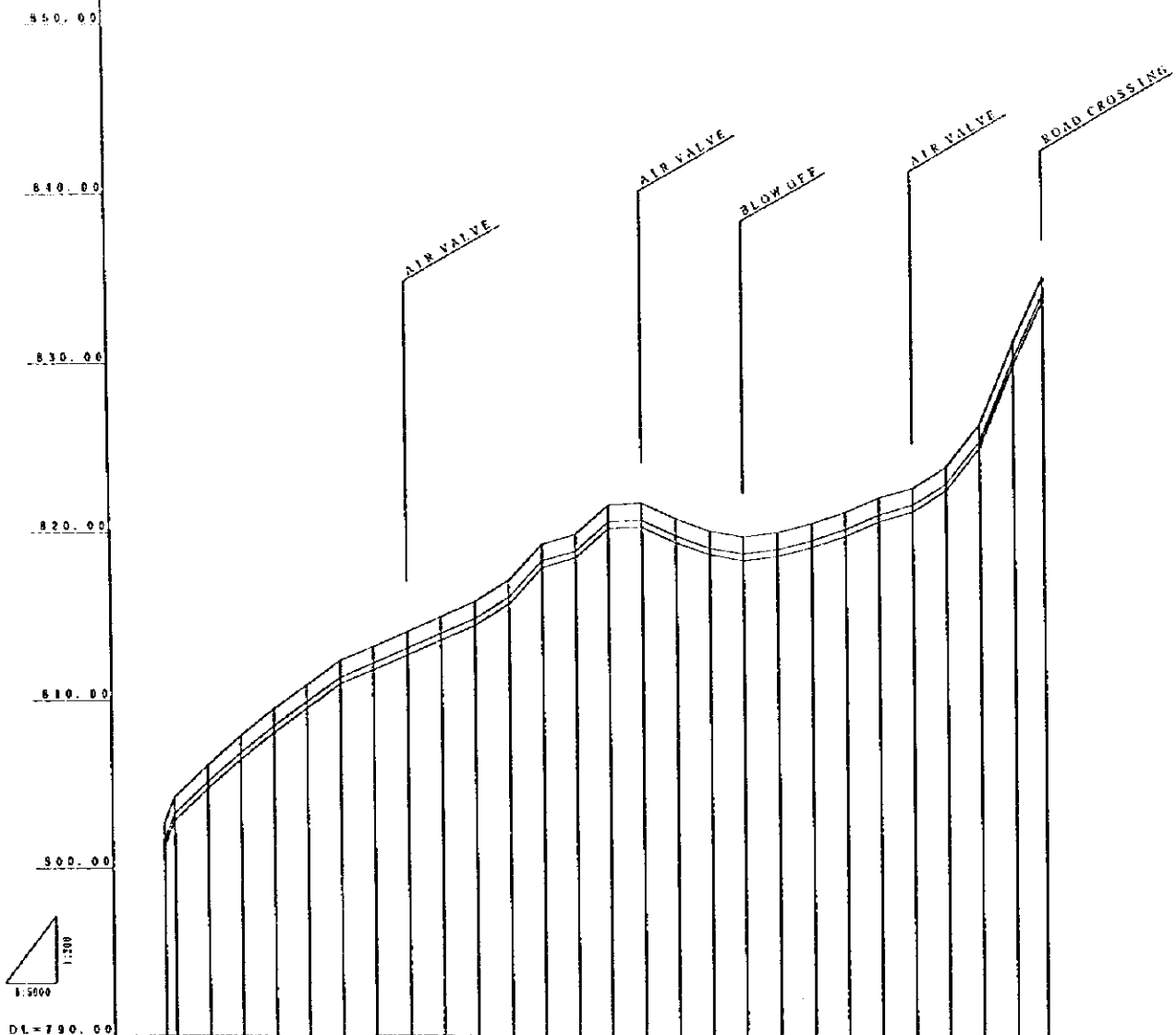
SYMBOL	(SD)	QUANTITY	1	(SW)	QUANTITY	7	(WD)	QUANTITY	1
FIGURE ELEVATION & DIMENSION			1:100			1:100			1:100
TYPE & MATERIAL	DOUBLE SWING			FIXED +			SINGLE SWING		
	FLUSH DOOR/STEEL			CASEMENT WINDOW/STEEL			FLUSH DOOR/PLAYWOODEN		
THICKNESS	230						230		
GLASS				4mm OBSCURE GLASS					
FINISH	OIL PAINT			OIL PAINT			OIL PAINT		
HARD WARE	ONE SET			ONE SET			ONE SET		
REMARK									



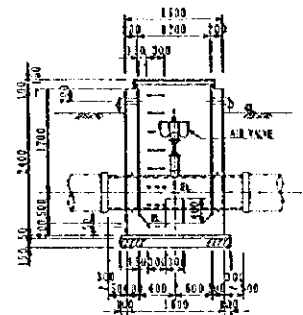
HANDRAIL DETAIL

THE REPUBLIC OF ZIMBABWE			
THE BASIC DESIGN STUDY ON THE PROJECT FOR THE NYAKOMBA IRRIGATION DEVELOPMENT PROJECT (PHASE 2)			
PUMP ROOM (BLOCK E)			
TYPICAL SECTION - DETAIL DOORS & WINDOWS SCHEDULE			
Date		No.	44
JAPAN INTERNATIONAL COOPERATION AGENCY			

HEAD RACE
LONG SECTION
E-P-1 $\phi 400$

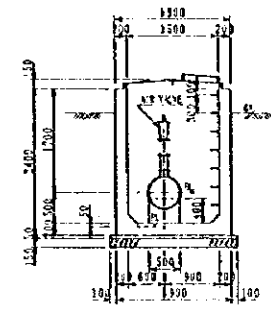


A-A



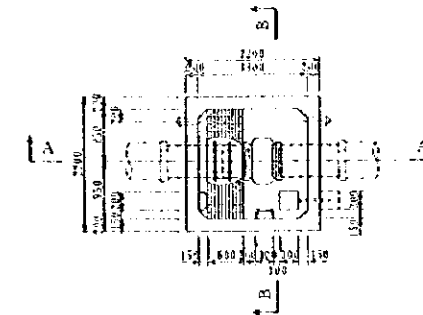
TYPICAL SECTION

B-B

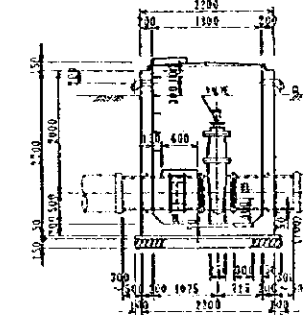


CONCRETE PROTECTION

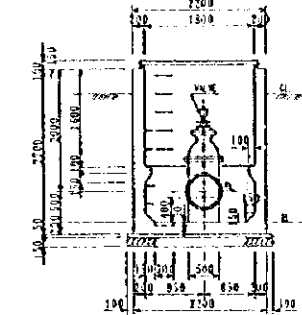
ISORATING VALVE
 $\phi 100 \sim \phi 600$



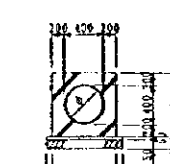
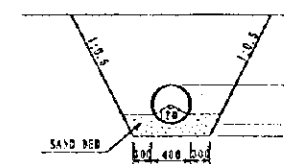
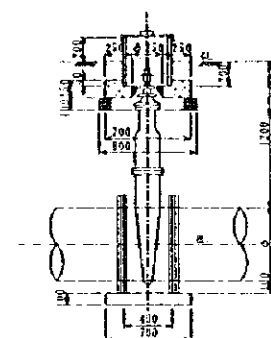
A-A



B-B



SLUICE VALVE



PIPE	FIBERGLASS PIPE $\phi 400$ C-1512 078	
PIPE ELEVATION	501.50	522.25
GROUND LEVEL	502.70	503.00
ACCUMULATED DISTANCE	0.00	100.00
DISTANCE	0.00	100.00
STATION	0+00	0+100
CURVE		

THE REPUBLIC OF ZIMBABWE

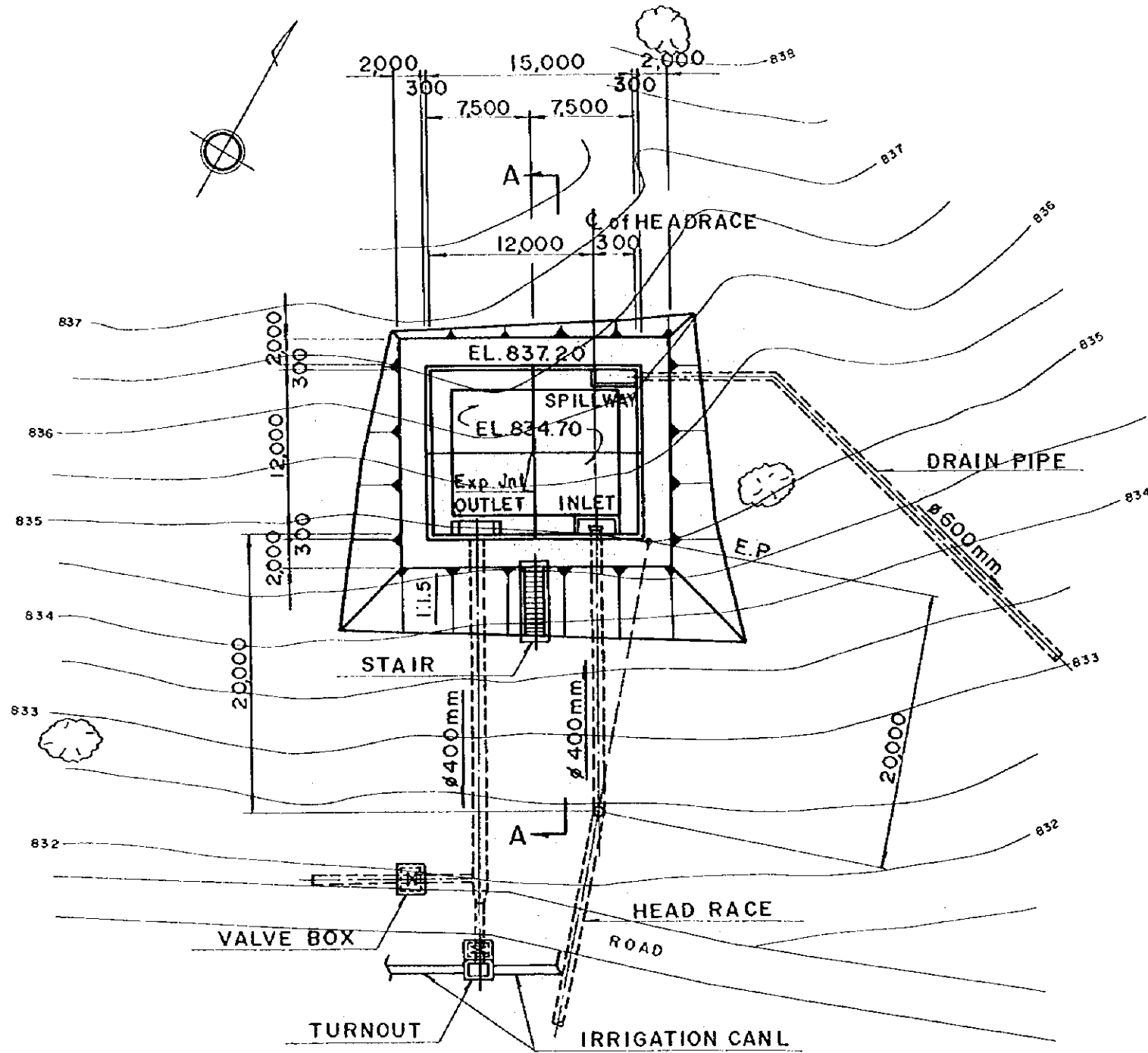
THE BASIC DESIGN STUDY ON THE PROJECT
FOR
THE NYAKOMBA IRRIGATION DEVELOPMENT PROJECT (PHASE 2)

HEAD RACE (BLOCK E)
LONG SECTION E-P-1

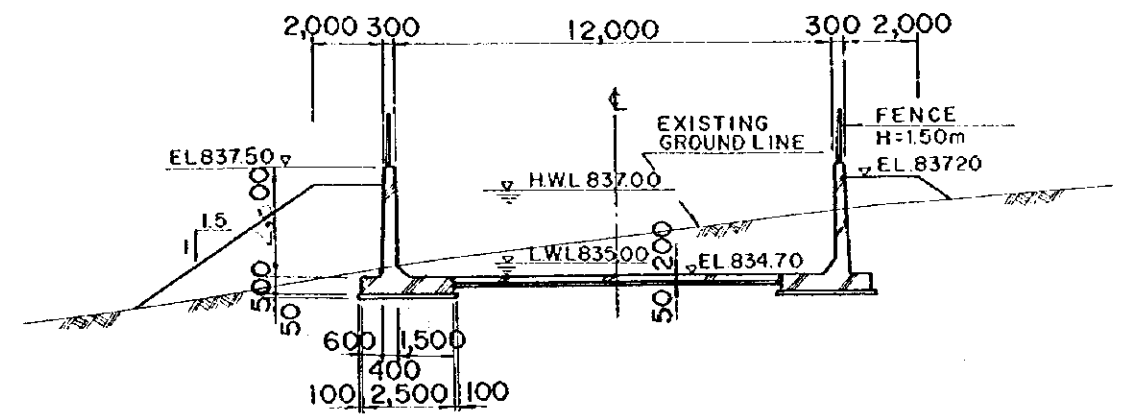
Date: _____ No. 45

JAPAN INTERNATIONAL COOPERATION AGENCY

FARM POND E



PLAN
S=1:200

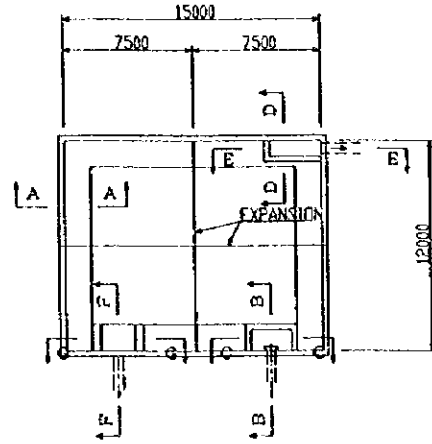


SECTION A-A
S=1:100

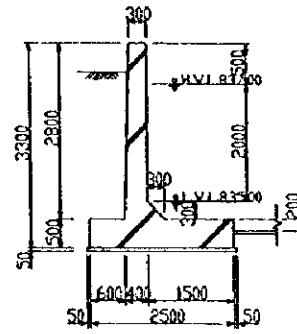
THE REPUBLIC OF ZIMBABWE			
THE BASIC DESIGN STUDY ON THE PROJECT FOR THE NYAKOMBA IRRIGATION DEVELOPMENT PROJECT (PHASE 2)			
FARM POND E			
PLAN AND SECTION			
Date		No.	4E
JAPAN INTERNATIONAL COOPERATION AGENCY			

FARM POND E
DETAILS OF FARM POND

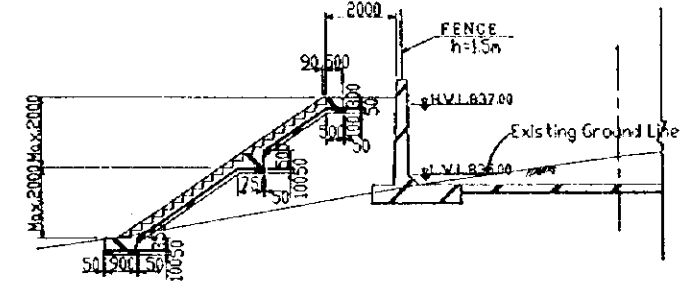
TYPICAL PLAN SCALE 1:200



SECTION A-A SCALE 1:60



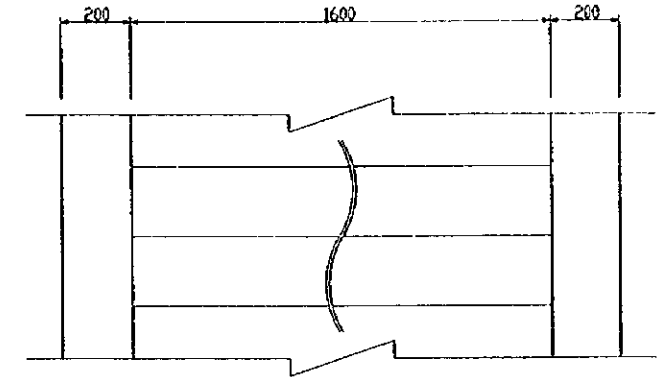
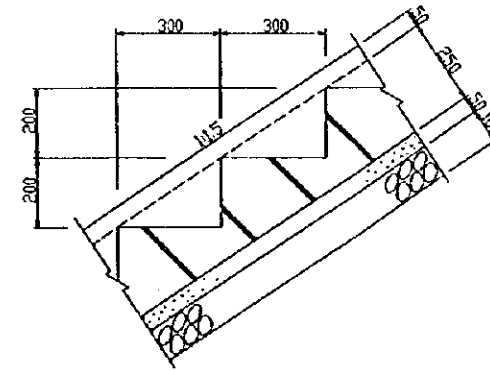
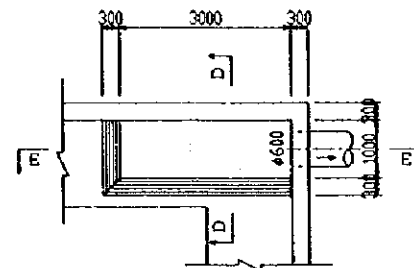
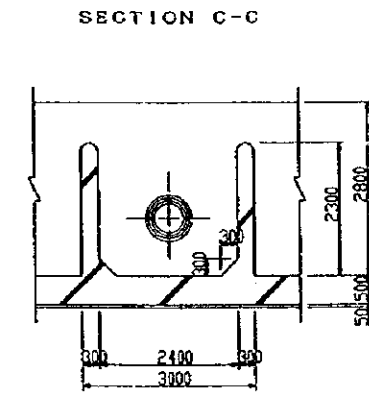
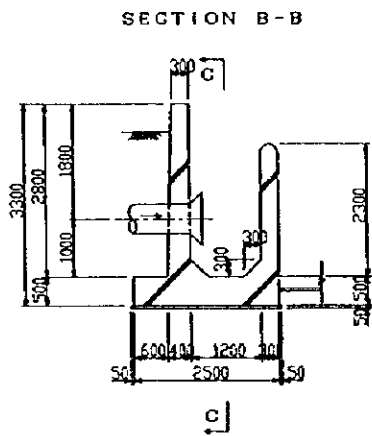
STAIR CASE SECTION SCALE 1:100



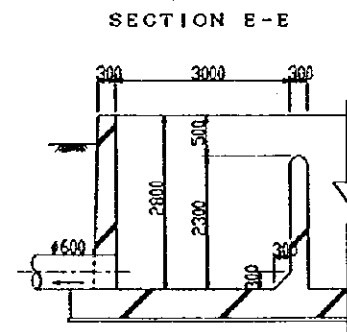
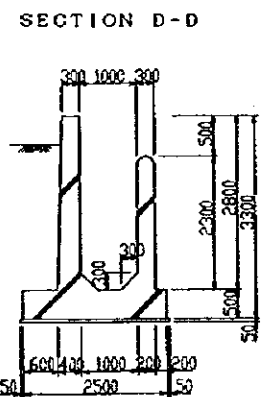
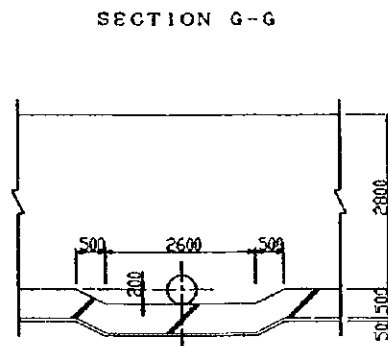
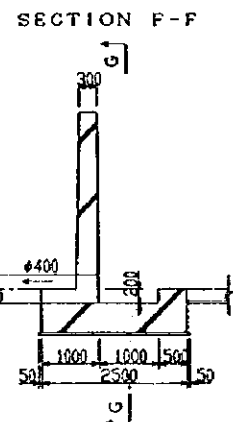
INLET SCALE 1:60

SPILL WAY SCALE 1:60

STAIR CASE DETAIL SCALE 1:10



OUTLET SCALE 1:60



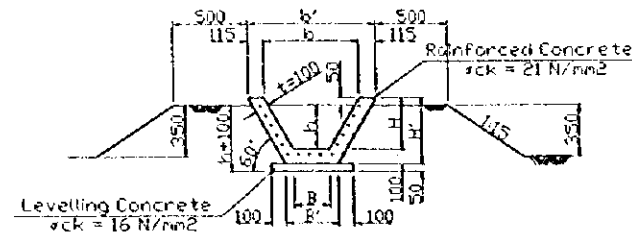
THE REPUBLIC OF ZIMBABWE			
THE BASIC DESIGN STUDY ON THE PROJECT FOR THE NYAKOMBA IRRIGATION DEVELOPMENT PROJECT (PHASE 2)			
FARM POND E DETAILS OF FARM POND			
Date		No.	47
JAPAN INTERNATIONAL COOPERATION AGENCY			

IRRIGATION FACILITIES (1/3)

SCALE 1:50

IRRIGATION CANAL

TYPICAL SECTION



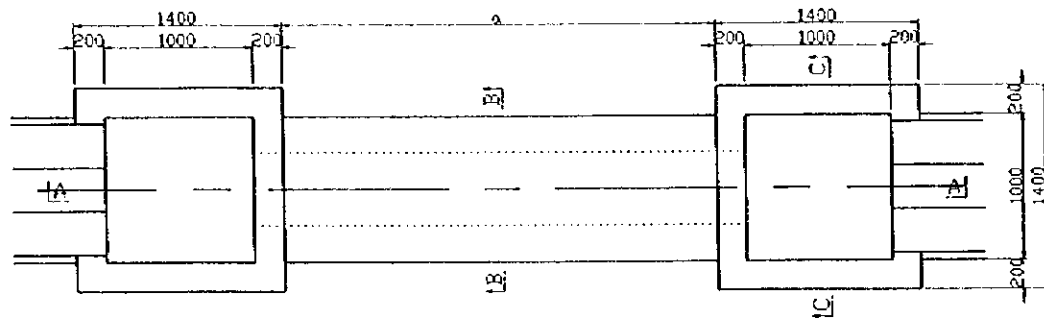
	B	B'	b	b'	H	H'	h
Type A	300	415	762	992	400	500	350
Type B	250	364	654	884	350	450	300
Type C	200	314	546	776	300	400	250

NOTE

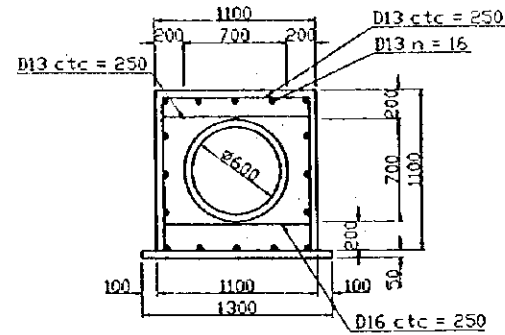
REINFORCEMENT SHALL BE WELDED MESHED WIRE $\phi 6\text{mm}$ (MESH 100 x 100)

ROAD CROSS SIPHON

PLAN

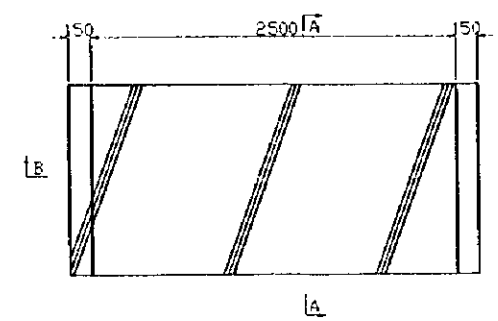


SECTION B - B

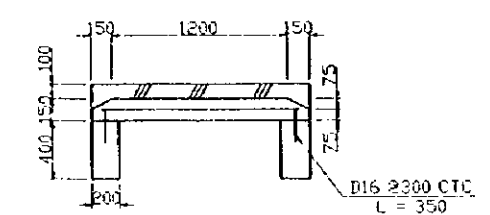


ENTRANCE WORKS

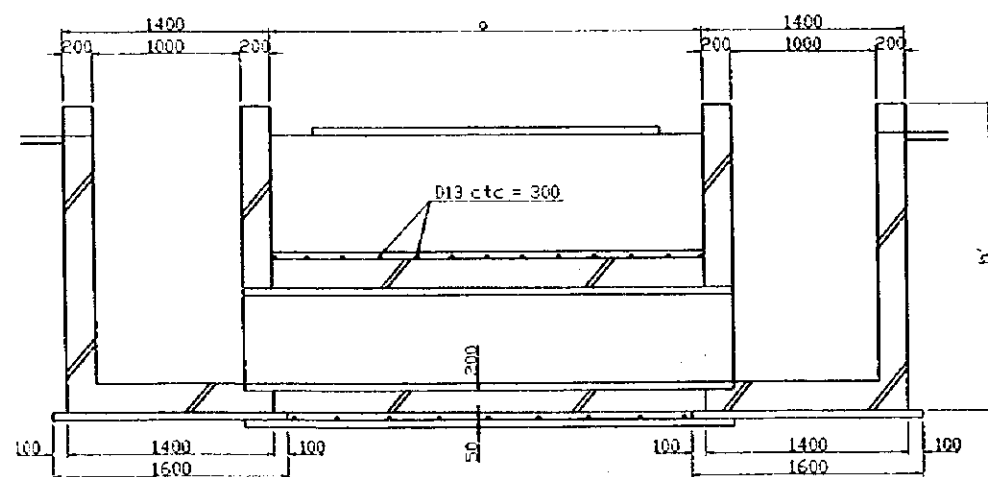
PLAN



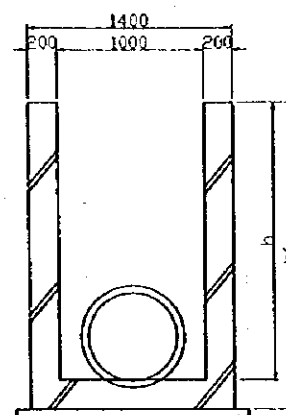
SECTION A - A



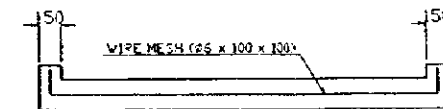
SECTION A - A



SECTION C - C



SECTION B - B



Road Cross Siphon (Irrigation)

	a	b	h	h'	t (<)
Type 1	3000	600	1850	2100	50
Type 2	7000	600	1850	2100	50
Type 3	10000	600	1850	2100	50
Type 4	15000	600	2150	2400	50
Type 5	19000	600	2150	2400	50

THE REPUBLIC OF ZIMBABWE

THE BASIC DESIGN STUDY ON THE PROJECT FOR THE NYAKOMBA IRRIGATION DEVELOPMENT PROJECT (PHASE 2)

IRRIGATION FACILITIES (1/3)
BLOCK E

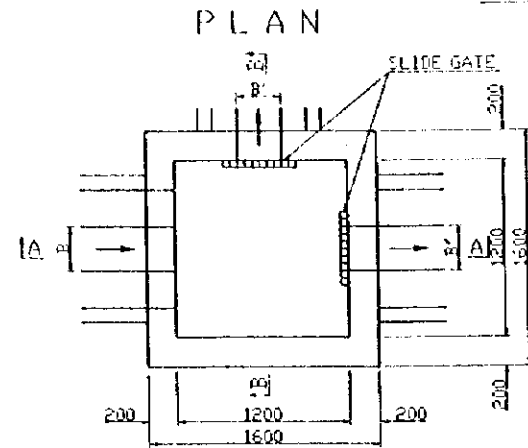
Date _____ No. _____ 48

JAPAN INTERNATIONAL COOPERATION AGENCY

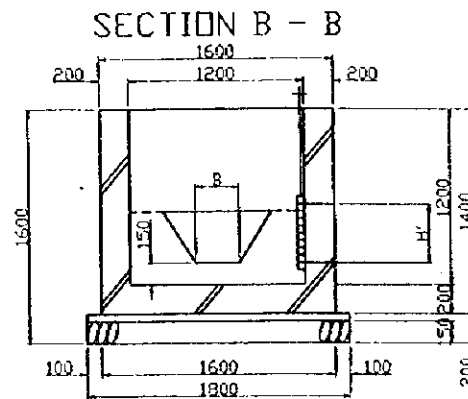
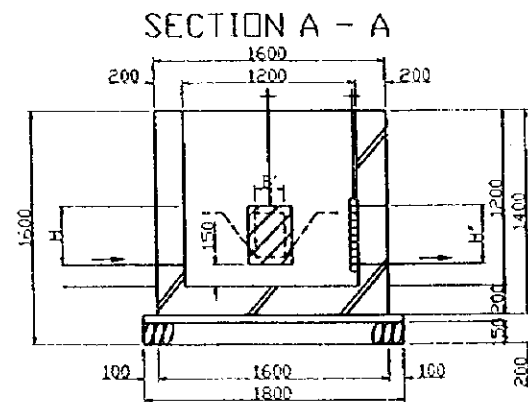
IRRIGATION FACILITIES (2/3)

SCALE 1:50

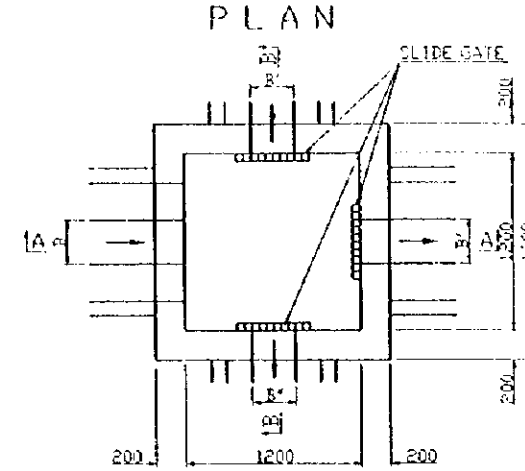
DIVISION WORKS



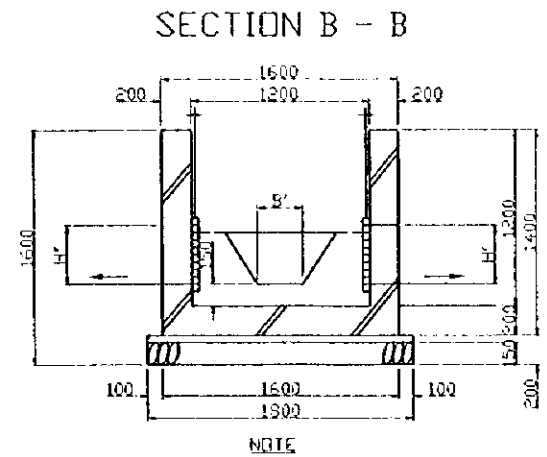
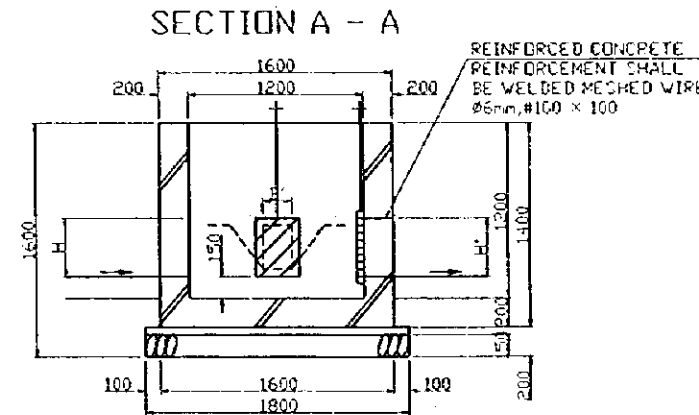
Type	B	H	B'	H'	GATE	B''	H''	GATE
Type 1	300	400	250	350	300 x 350 x 1	250	350	300 x 350 x 1
2	300	400	250	350	300 x 350 x 1	200	300	250 x 300 x 1
3	250	350	250	350	300 x 350 x 1	250	350	300 x 350 x 1
4	250	350	250	350	300 x 350 x 1	200	300	250 x 300 x 1
5	250	350	200	300	250 x 300 x 1	200	300	250 x 300 x 1
6	200	300	200	300	250 x 300 x 1	200	300	250 x 300 x 1



DIVISION WORKS

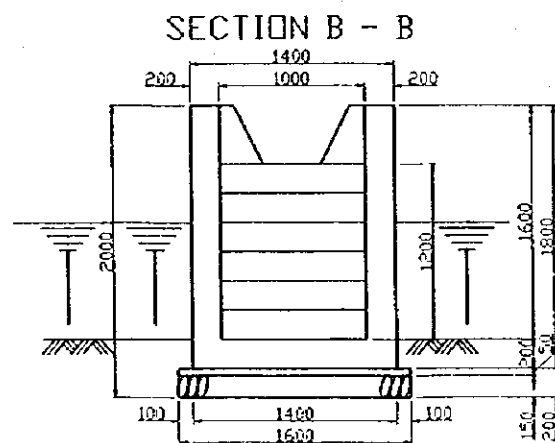
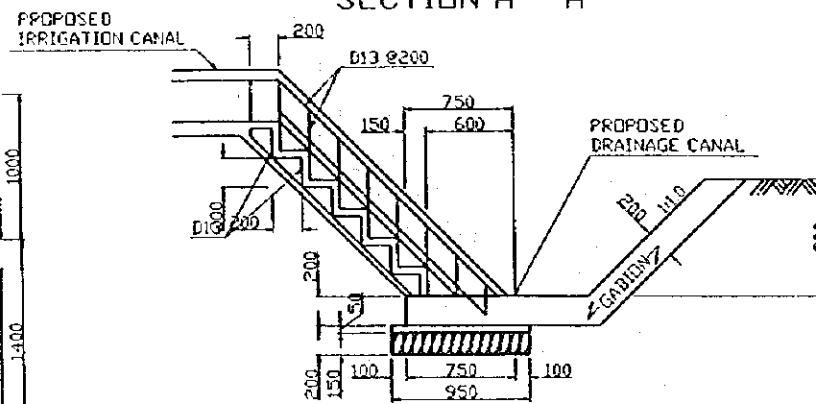
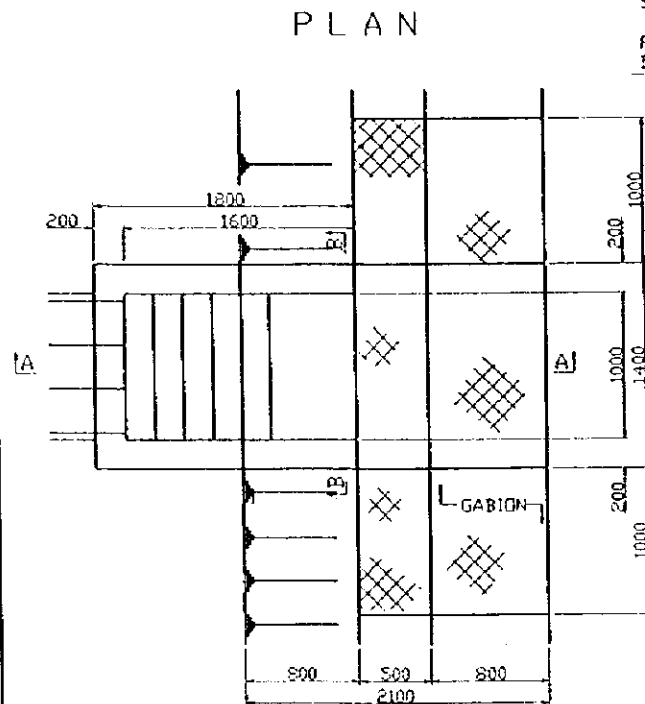


Type	B	H	B'	H'	GATE	B''	H''	GATE
Type 7	300	400	250	350	300 x 350 x 1	200	300	250 x 300 x 1

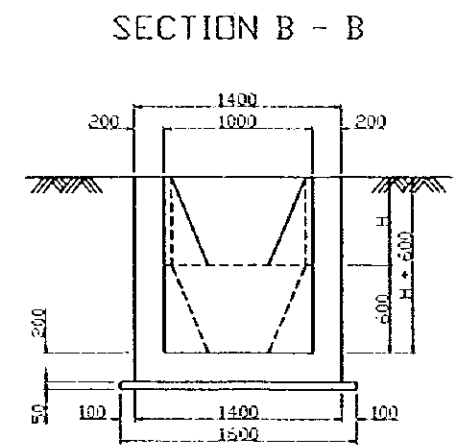
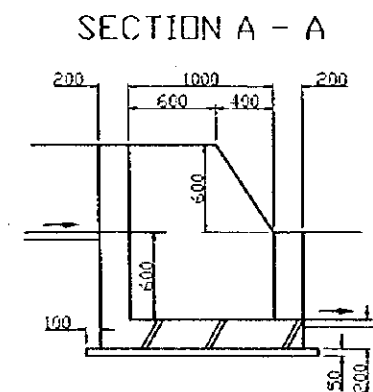
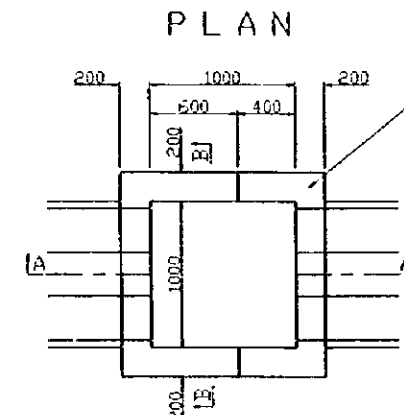


CUT-THROAT FLUME SHALL BE INSTALLED AT THE STARTING PORTION OF EVERY DIVERTED CANAL. THE STANDARD OF THE FLUME SHALL BE SUBJECT TO IRRIGATION MANUAL ISSUED BY AGRITEX.

CHUTE



DROP



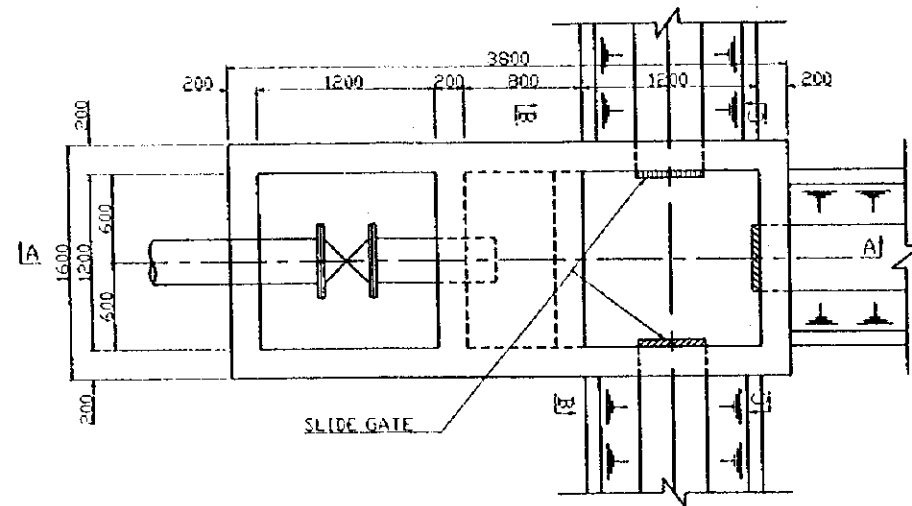
THE REPUBLIC OF ZIMBABWE			
THE BASIC DESIGN STUDY ON THE PROJECT FOR THE NYAKEMBA IRRIGATION DEVELOPMENT PROJECT (PHASE 2)			
IRRIGATION FACILITIES (2/3) BLOCK E			
Date		No.	49
JAPAN INTERNATIONAL COOPERATION AGENCY			

IRRIGATION FACILITIES (3/3)

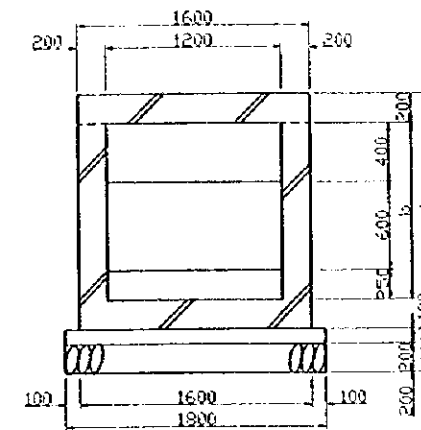
SCALE 1:50

DISCHARGE CHAMBER

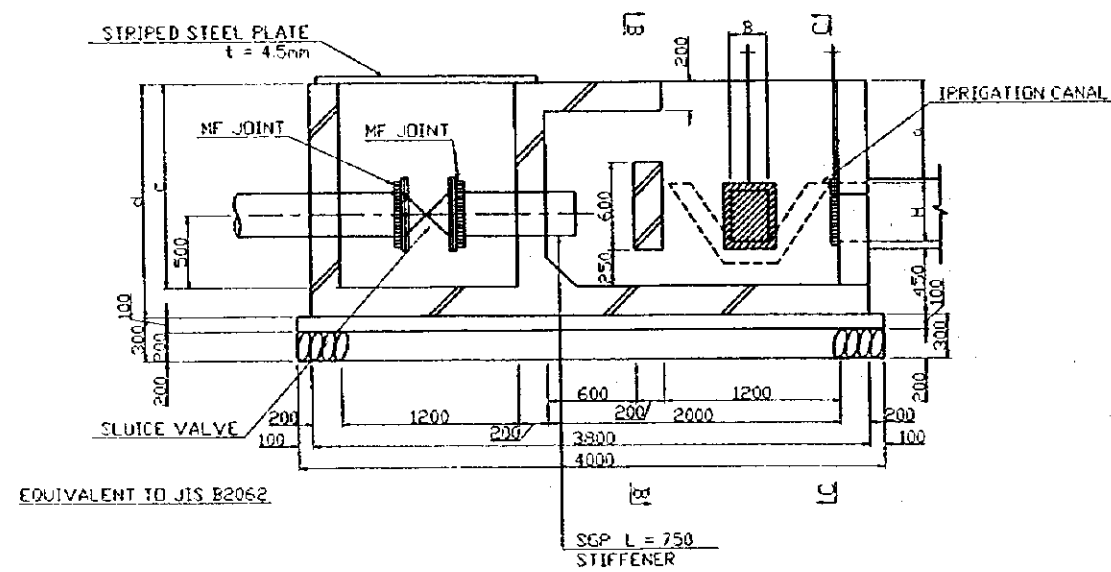
PLAN



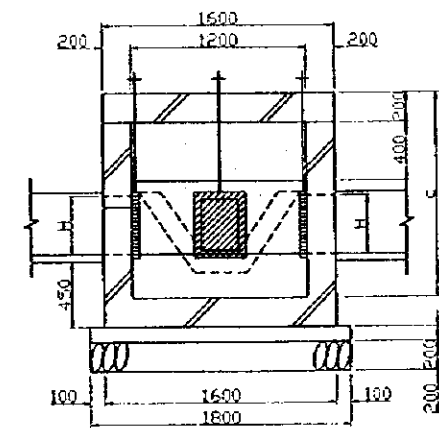
SECTION B - B



SECTION A - A



SECTION C - C



TYPE	B-1	H-1	B-2	H-2	B-3	H-3	SLUICE VALVE	MF JOINT
Type 1	200	300	250	350	-	-	#200	#200
Type 2	200	300	200	300	250	350	#300	#300
Type 3	250	350	300	400	-	-	#300	#200

note: To a front d shall be adjusted to the site ground levels width of Slide Gate should be wider than bottom of canal by 5 cm.

THE REPUBLIC OF ZIMBABWE

THE BASIC DESIGN STUDY ON THE PROJECT
FOR
THE NYAKOMBA IRRIGATION DEVELOPMENT PROJECT (PHASE 2)

IRRIGATION FACILITIES (3/3)
BLOCK E

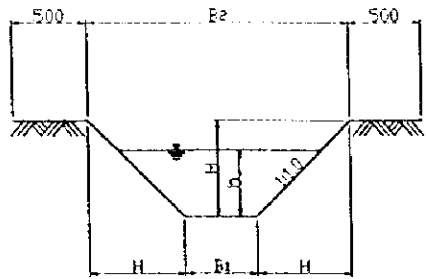
Date No. 50

JAPAN INTERNATIONAL COOPERATION AGENCY

DRAINAGE FACILITIES (1/2)

SCALE 1:50

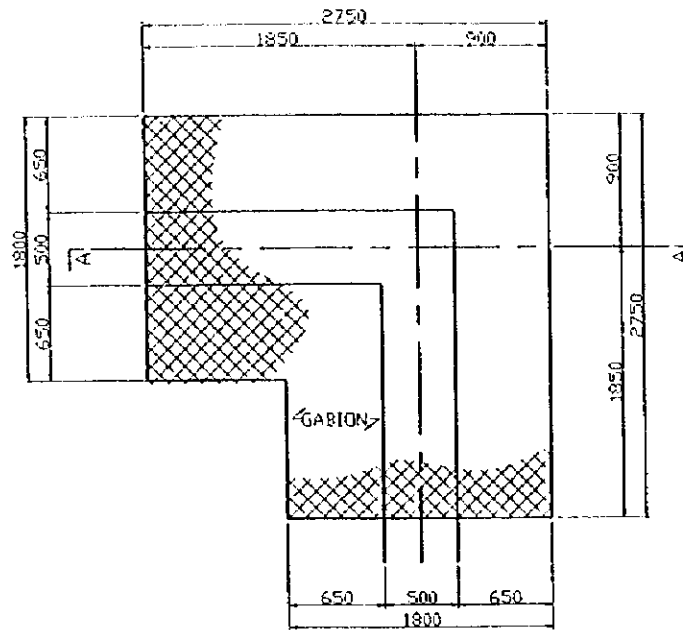
DRAINAGE CANAL TYPICAL SECTION



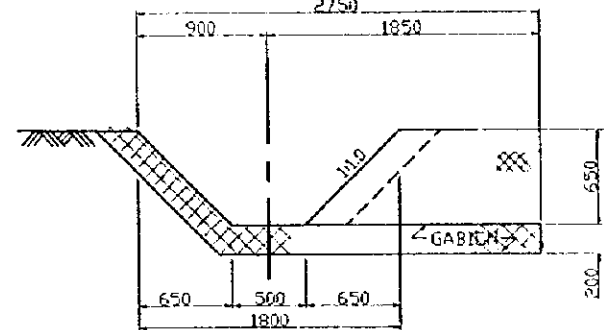
	B1	B2	h	H
Type 1	0.60	2.50	0.35	0.95
Type 2	0.70	2.70	0.40	1.00
Type 3	0.70	2.90	0.50	1.10

SLOPE PROTECTION

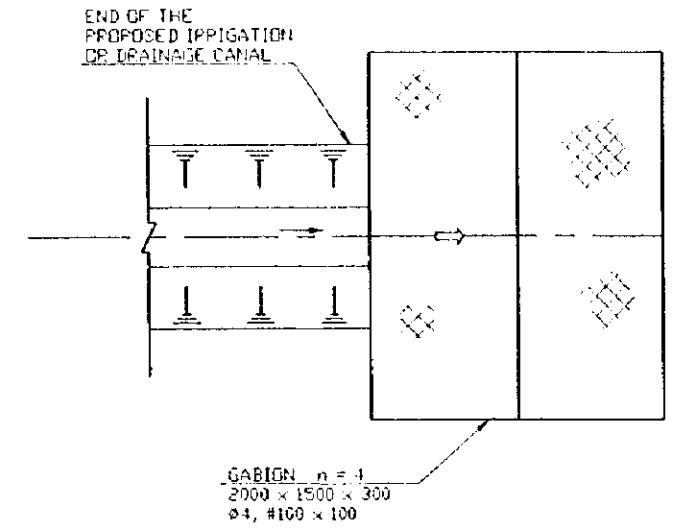
PLAN



SECTION A - A

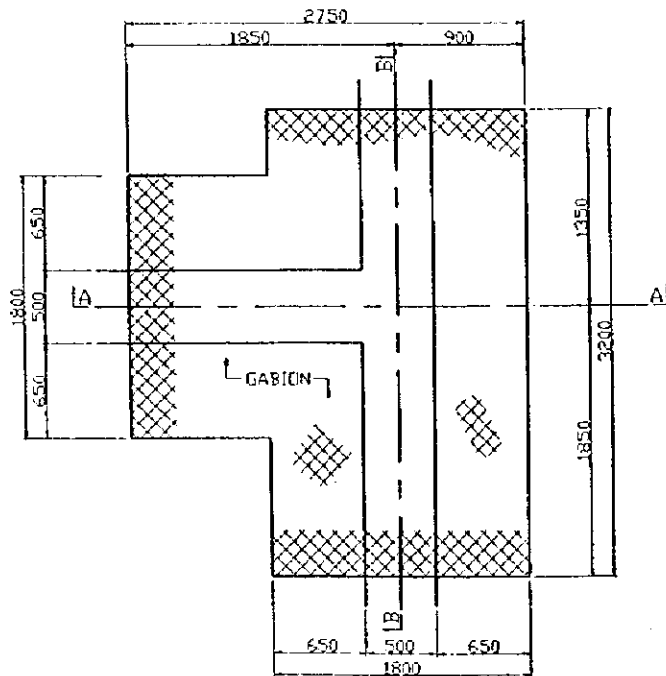


WASTEWAY

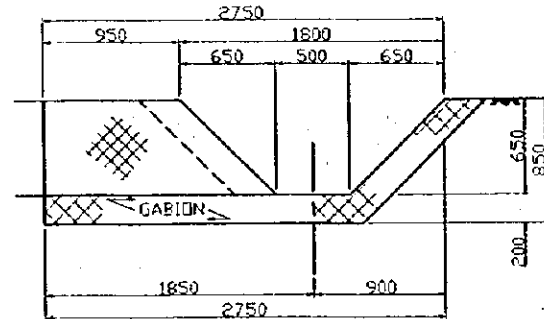


CONFLUENT FACILITIES

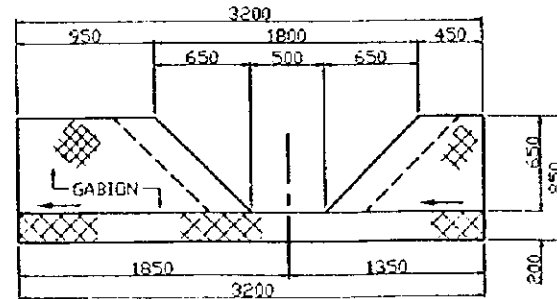
PLAN



SECTION A - A

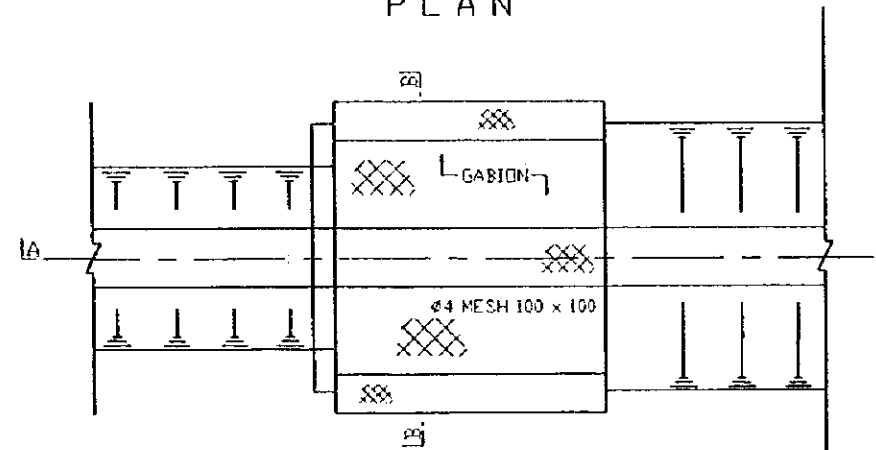


SECTION B - B

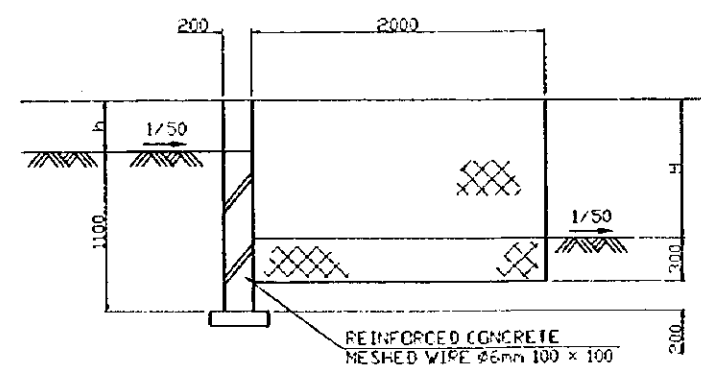


DROP STRUCTURE FOR DRAINAGE CANAL

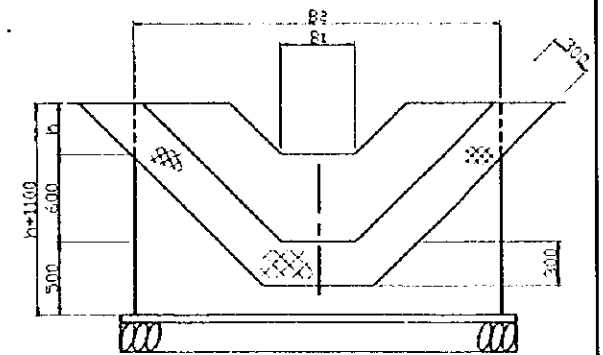
PLAN



SECTION A - A



SECTION B - B



	B1	B2	h	H
Type 1	0.60	2.50	0.35	0.95
Type 2	0.70	2.70	0.40	1.00
Type 3	0.70	2.90	0.50	1.10

THE REPUBLIC OF ZIMBABWE

THE BASIC DESIGN STUDY ON THE PROJECT FOR THE NYAKOMBA IRRIGATION DEVELOPMENT PROJECT(PHASE 2)

DRAINAGE FACILITIES (1/2) BLOCK E

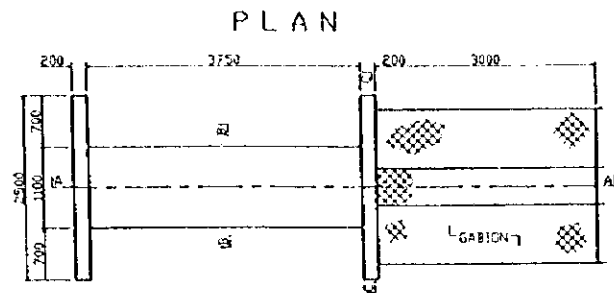
Date		No.	51
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JAPAN INTERNATIONAL COOPERATION AGENCY

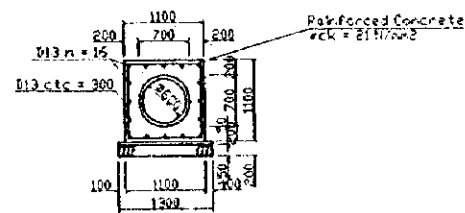
DRAINAGE FACILITIES (2/2)

SCALE 1:100

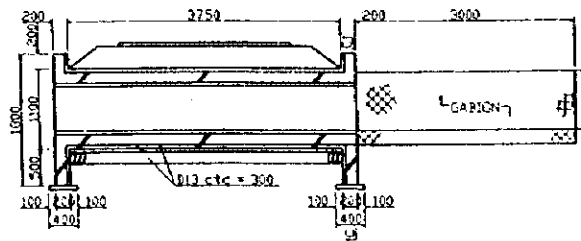
ROAD CROSS CULVERT



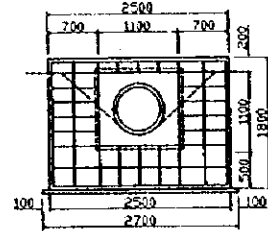
SECTION B - B



SECTION A - A

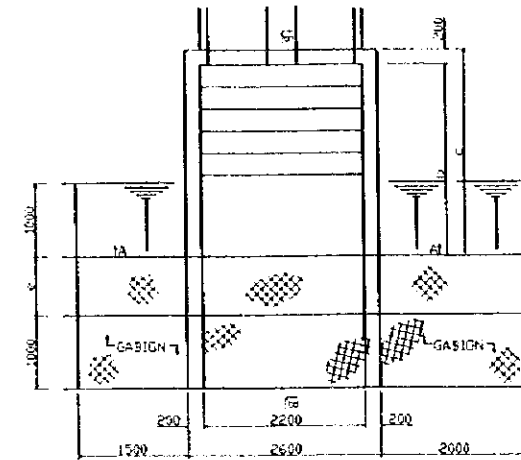


SECTION C - C

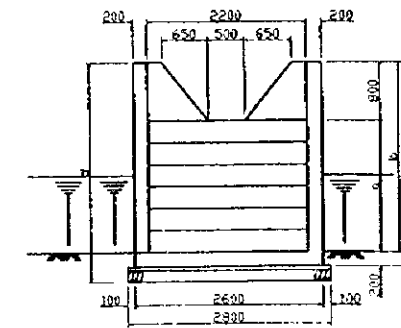


CHUTE

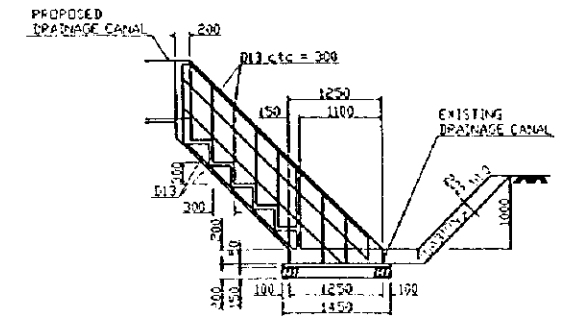
PLAN



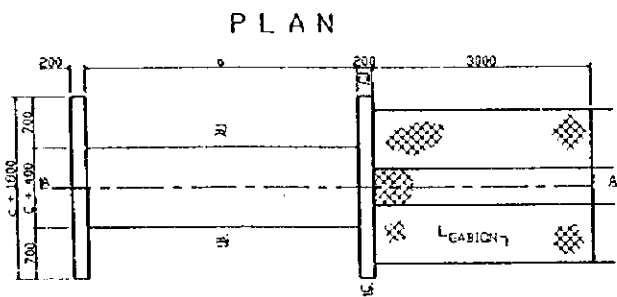
SECTION A - A



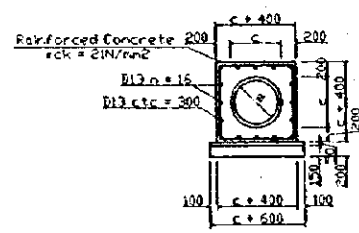
SECTION B - B



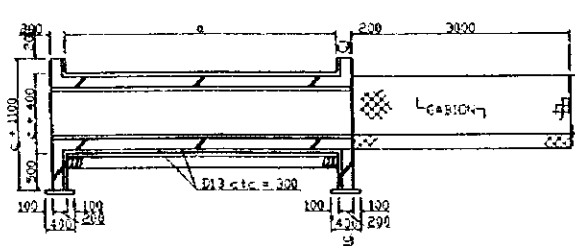
CANAL CROSS CULVERT (ENTRANCE WORKS)



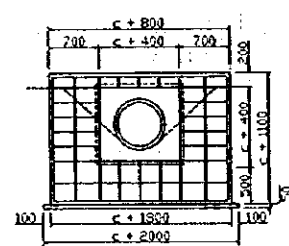
SECTION B - B



SECTION A - A



SECTION C - C



Canal Cross Culvert (Drainage)
(Entrance Works)

	Road Type	a	b	c
Type 1	b = 3	3000	600	700
Type 2	b = 5	5000	600	700
Type 3	b = 5	5000	1000	1180
Type 4	b = 5	5000	1200	1420

Chute

	a	b	c	d
Type 1	1800	2600	2800	3000
Type 2	12000	13500	14000	14200

THE REPUBLIC OF ZIMBABWE

THE BASIC DESIGN STUDY ON THE PROJECT
FOR
THE NYAKOMBA IRRIGATION DEVELOPMENT PROJECT (PHASE 2)

DRAINAGE FACILITIES (2/2)
BLOCK E

Date

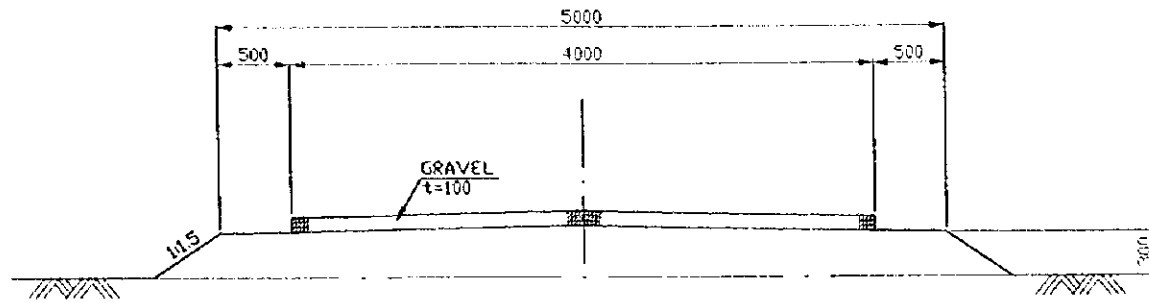
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52

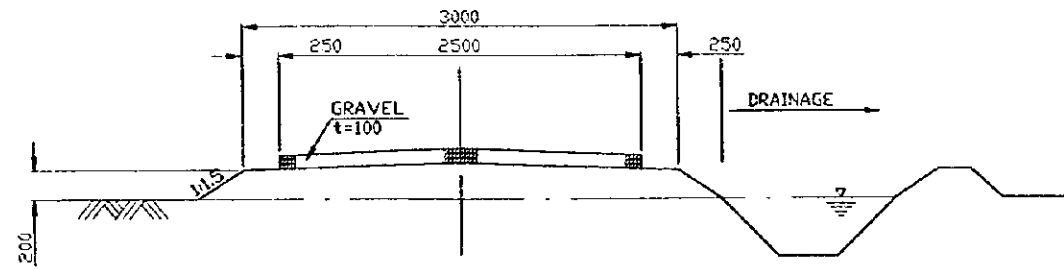
JAPAN INTERNATIONAL COOPERATION AGENCY

FARM ROAD TYPICAL SECTION

TRUNK ROAD



SECONDARY ROAD



THE REPUBLIC OF ZIMBABWE			
THE BASIC DESIGN STUDY ON THE PROJECT FOR THE NYAKOMBA IRRIGATION DEVELOPMENT PROJECT(PHASE 2)			
FARM ROAD TYPICAL SECTION BLOCK E			
Date		No.	53
JAPAN INTERNATIONAL COOPERATION AGENCY			

【 資 料 編 】

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1. 調査団氏名

A. 基本設計現地調査時 (1998年7月25日～8月23日)

担当	氏名	所属
1)総括	二本 光	国際協力総合研究所 専門員/JICA
2)技術参与	武岡 康夫	北海道開発局農業水産部農業設計課開発専門官
3)計画管理	山田 克巳	無償資金協力調査部調査第一課/JICA
4)業務主任 / 運営・維持管理計画	山田 朝男	太陽コンサルタンツ株式会社
5)施設計画・設計(1) (灌漑・排水/水路)	坂梨 良介	太陽コンサルタンツ株式会社
6)施設計画・設計(2) (施設/機材)	山本 明紀	株式会社三祐コンサルタンツ
7)農家経済	石田 良作	太陽コンサルタンツ株式会社
8)積算/調達計画	佐藤 総成	太陽コンサルタンツ株式会社

B. 基本設計ドラフト・ファイナルレポート説明時 (1998年10月21日～10月30日)

担当	氏名	所属
1)総括	伊藤 富章	無償資金協力調査部調査第一課 課長代理/JICA
2)業務主任 / 運営・維持管理計画	山田 朝男	太陽コンサルタンツ株式会社
3)施設計画・設計(1) (灌漑・排水/水路)	坂梨 良介	太陽コンサルタンツ株式会社

2. 調査日程

A 基本設計現地調査時（1998年7月25日～8月23日）

年月日・曜日	調査内容
11.10.7.25(上)	(移動日)成田～シンガポール～機中泊
26(日)	(移動日)～ヨハネスブルグ～ハラレ着
27(月)	JICA、日本大使館表敬・打合せ。農業省表敬・協議
28(火)	AGRITEX 及び DWD にて協議
29(水)	ムタレへ移動。AGRITEX、DWD の州事務所及び AGRITEX のニャンガ事務所にて打合せ
30(木)	現地調査、農民(ブロック C)との話し合い
31(金)	現地調査、農民(ブロック D)との話し合い、機場位置選定。ハラレへ移動 コンサルタント団員2名はニャンガに残り、現地調査継続
8.1(土)	団内打合せ
2(日)	団内打合せ
3(月)	AGRITEX にて協議 再委託業務(測量、土質調査)現地作業開始
4(火)	AGRITEX にて協議
5(水)	農業省にてミニッツ協議
6(木)	農業省にてミニッツ協議、その後署名
7(金)	官ベース(団長他2名)帰国。ニャンガへ移動
8(土)	ニャコンバ地区調査(聞き取り、再委託業務立ち会い、地区内踏査等)
9(日)	ニャコンバ地区調査(聞き取り、再委託業務立ち会い、地区内踏査等)
10(月)	ニャコンバ地区調査(聞き取り、再委託業務立ち会い、地区内踏査等) ムタレの AGRITEX 及び DWD の州事務所にて打合せ
11(火)	ニャコンバ地区調査(聞き取り、再委託業務立ち会い、地区内踏査等)
12(水)	ニャコンバ地区調査(聞き取り、再委託業務立ち会い、地区内踏査等)
13(木)	ニャコンバ地区調査(聞き取り、再委託業務立ち会い、地区内踏査等) 川内の3灌漑プロジェクト (Musikavanhu, Bonde, Nyanyadzi) 視察・情報収集
14(金)	ニャコンバ地区調査(聞き取り、再委託業務立ち会い、地区内踏査等)
15(土)	内業 (資料整理)、再委託業務立ち会い
16(日)	内業 (資料整理)、再委託業務立ち会い
17(月)	ブロック D の農民との公聴会出席。 2名：ハラレへ移動
18(火)	3名：農家聞き取り調査

	2名：ハラレにて資料収集、AGRITEX と打ち合わせ
19(木)	3名：再委託業務立ち会い、農家聞き取り調査
	2名：ハラレにて資料収集、AGRITEX と打ち合わせ
20(木)	2名：AGRITEX にて打合せ、ハラレ市内資料収集
	3名：ムタレの AGRITEX, DWD, ZESA にて打合せ後、ハラレへ移動
21(金)	JICA 事務所にて打合せ、日本大使館表敬・報告
22(土)	(移動日) ハラレ～ヨハネスブルグ～機中泊
23(日)	(移動日) ～シンガポール～成田着

B 基本設計ラフ・ファイナルレポート説明時 (1998年10月21日～10月30日)

年月日・曜日	調査内容
11/10.10.21 (木)	(移動日) 成田～シンガポール～機中泊
22 (木)	(移動日) ～ヨハネスブルグ～ハラレ着
23 (金)	AGRITEX, MOLA, DWD 表敬。AGRITEX にて協議
24 (土)	国内打合せ
25 (日)	ニャンガへ移動
26 (月)	現地調査、聞き取り調査。ハラレへ移動
27 (火)	ミニッツについて国内打合せ。午後よりミニッツ協議
28 (水)	ミニッツ署名。JICA、大使館表敬・報告
29 (木)	(移動日) ハラレ～ヨハネスブルグ～機中泊
30 (金)	(移動日) ～シンガポール～成田着

MOLA(Ministry of Lands and Agriculture)：土地・農業省

AGRITEX(Dep. of Agricultural technical & Extension Services)：農業技術普及局

DWD (Department of Water Development)：水開発局

ZESA(Zimbabwe Electricity Supply Authority)：電気公社

3. 相手国関係者リスト

(1) 在ジンバブエ日本国大使館

東原 麻夫	特命全権大使(基本設計現地調査時)
新田 宏	特命全権大使(ドラフトファイルレポート説明時)
丸山 和彦	参事官

(2) 国際協力事業団ジンバブエ事務所

中村 光夫	事務所長
関 智宏	事務所長代理
Mandiveyi Michael	所員

(3) Ministry of Lands and Agriculture(MOLA)

T. Takavarasha	Permanent Secretary
G. Sithole	Deputy Secretary
David Mfote	Principal Agricultural Economist
N. Zitsanza	Chief Agricultural Economist
Emmanuzi Makiwa	Economist
P. Goko	Senior Agricultural Economist
Mayayo	Agricultural Economist

(4) Department of Agricultural Technical and Extension Services(AGRITEX), MOLA

Headquarters (Harare)

L. M. Makadho	Director
R. J. Chitsiko	Deputy Director
Godfrey Nehanda	Acting Deputy Director
E. Chidenga	Chief Irrigation Specialist
Simon Madyiwa	Irrigation Specialist
L. Madiri	Irrigation Specialist
Felix Dzvurumi	Irrigation Agronomist
K. E. Motsi	Irrigation Engineer
D. Tawonezwi	Irrigation Economist
A. C. Guzha	Irrigation Engineer
三苦 繁廣	長期派遣専門家 (JICA)

Manicaland Office(Mutare)

Tipachiso	Chief Agricultural Extension Officer
F. G. Sitole	Principal Agricultural Extension Officer
Josepe B. Chivizhe	Principal Agricultural Extension Officer
George Zengeni	Executive Officer

Nyanga Office

James C. Nduna	District Agricultural Extension Officer
Chipindura Tawanda	Agricultural Extension Officer
N. Sikume	Agricultural Extension Officer
E. T. Mubvakure	Agricultural Extension Officer

(5) Department of Water Development, Ministry of Rural Resources and Water Development

Headquarters (Harare)

Vararirai H. Choga	Director
D. S. Durham	Deputy Director (Planning and Hydrology)
W. Nyarota	Chief Engineer (Operations)
Emmanuzi Makiwa	Acting Chief Engineer (Operations)

Manicaland Office (Mutare)

Thomas Murinye	Provincial Water Engineer
G. Pazvakawambwa	Acting deputy Provincial Water Engineer
Alec Chagonda	Acting Water Supplies Engineer
T. Murinye	Provincial Water Engineer

(6) Zimbabwe Electricity Supply Authority (ZESA)

Manicaland Office (Mutare)

Joseph Magadze	Senior Engineer
Barbali	Sales Officer
Chikuni Ephraim	Senior Clerk Billing

(7) Department of Physical Planning, Ministry of Local Government

Manicaland Office (Mutare)

Daisy Mwandambira	Town Planning Officer
-------------------	-----------------------

(8) Agricultural Financial Cooperation (AFC)

Nyanga Office (Mutare)

P. Magaya	Head of Nyanga Office
E. Vheriwa	Staff

(9) Cotton Company of Zimbabwe

G. Mugerezi	Head of Loans & Extension Officer, Mutare
-------------	---

(10) Local Government

E. S. C. Nyagwaya	District Administrator, Nyanga
-------------------	--------------------------------

4. 協議議事録

(1)基本設計現地調査時 (1998年8月6日)

MINUTES OF DISCUSSIONS
ON
THE BASIC DESIGN STUDY ON THE PROJECT
FOR
THE NYAKOMBA IRRIGATION DEVELOPMENT PROJECT (PHASE 2)
IN
THE REPUBLIC OF ZIMBABWE

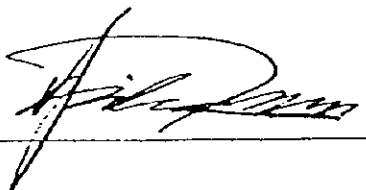
In response to the request from the Government of Zimbabwe, the Government of Japan decided to conduct a Basic Design Study on the Nyakomba Irrigation Development Project (hereinafter referred to as "the Project"), and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to the Republic of Zimbabwe a Basic Design Study Team (hereinafter referred to as "the Team"), which is headed by Dr. Hikaru Niki, Development Specialist, Institute for International Cooperation, JICA, and is scheduled to stay in the country from July 26 to August 22, 1998.

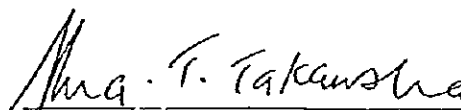
The Team held discussions with the officials concerned of the Government of Zimbabwe and conducted field surveys at the study area.

In the course of the discussions and the field surveys, both parties have confirmed the main items described on the attached sheets. The team will proceed to further work and prepare the Basic Design Study report.

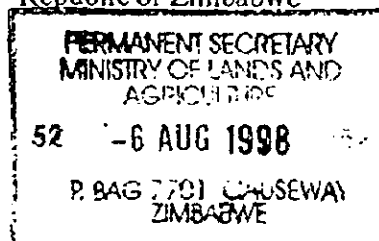
Harare, August 6, 1998



Dr. Hikaru Niki
Leader
Basic Design Study Team
JICA



Dr. Tobias Takavarasha
Permanent Secretary
Ministry of Lands and Agriculture
Republic of Zimbabwe



ATTACHMENT

1. Objective

The objective of the Project is to develop the proposed project area by the construction of the irrigation facilities so as to increase and stabilize agricultural production in the area, to upgrade the rural life of the farmers and to encourage the rural economy of the community.

2. Proposed Project Areas

The proposed project sites are Villages of Mwarazi (A block), Nyachere (D block), Choo (E block) in the Nyakomba Ward, Manicaland Province (See Annex-I).

3. Responsible Agency ; Executing Agency

Responsible and Executing agency is Department of Agricultural, Technical and Extension Services (AGRITEX), Ministry of Lands and Agriculture.

4. Items requested by the Government of Zimbabwe

The items shown in Annex II were requested by the Government of Zimbabwe.

5. Japan's Grant Aid System

(1) The Government of Zimbabwe has understood the system of Japan's Grant Aid on Annex- III as explained by the Team.

(2) The Government of Zimbabwe will take the necessary measures described in Annex- IV for the smooth implementation of the Project, on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

6. Other Relevant Issues

(1) The Team explained that it is crucially important and essential for implementing the next phase to confirm whether or not the farmers in phase 1 acquired both agronomical and financial advantages and benefit.

These could be studied from the view point of the household financial aspects such as the increased income by the Project and the associated costs.

They depend on the irrigated area, planted crops, available family labour, market system, all the running costs such as daily canal maintenance, repairing or replacement of pumps and pipelines and electricity costs .

Above items from the results of phase 1 should be thoroughly scrutinized in order to draw the lessons for the next phase.

Zimbabwean side totally understood the purpose and role of the Team as stated above.

(2) The Team stressed to the Zimbabwean side that it is very important to strengthen the present Irrigation Management Committee (IMC) to undertake the integrated operation and maintenance of overall water management system such as maintenance of irrigation facilities, operation and maintenance fee collection. The Zimbabwean side acknowledged this proposition.

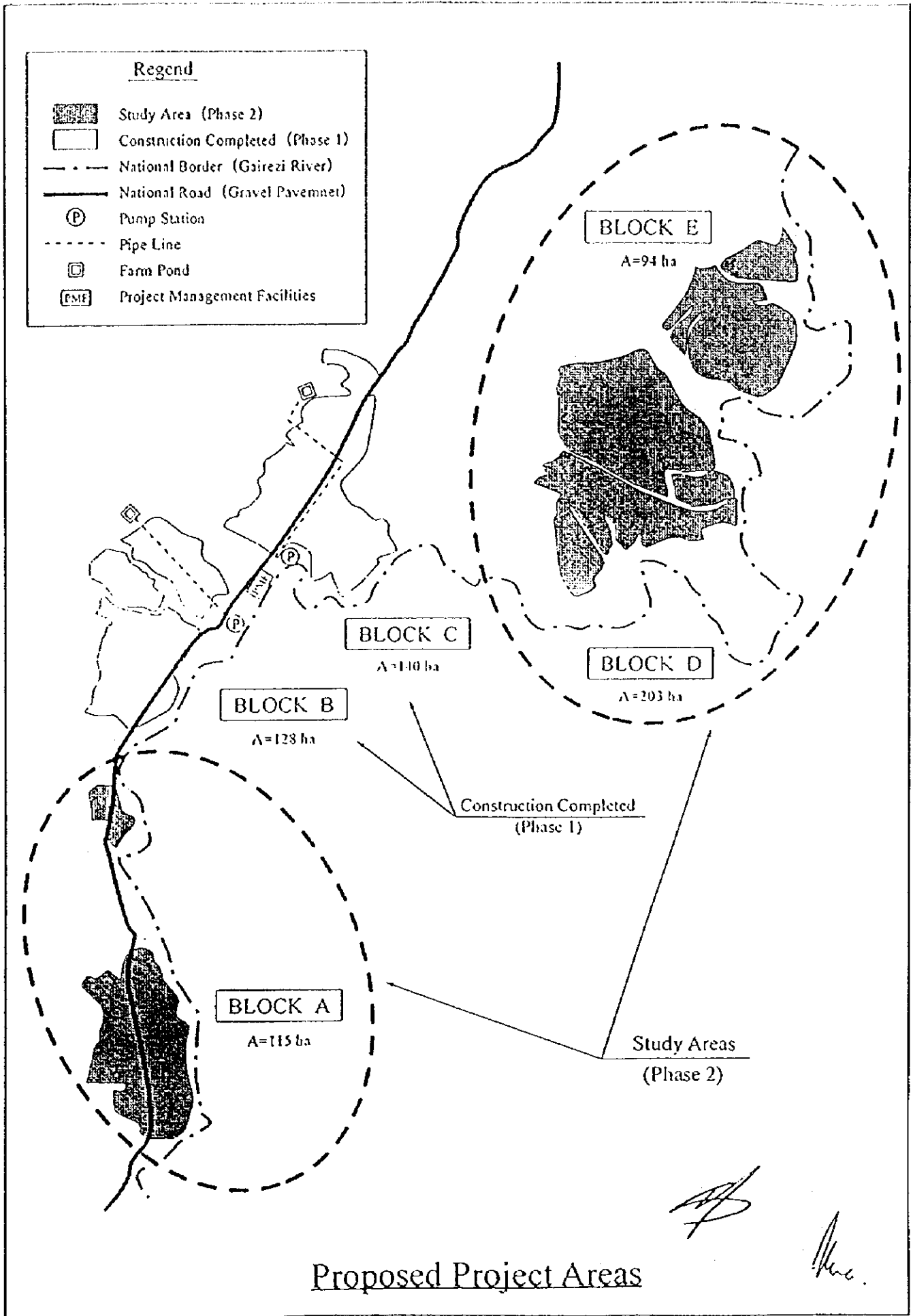
(3) The Zimbabwean side undertakes to secure the budget for compensating any damages of agricultural crops or villager's assets in phase 2.

(4) Both sides confirmed that Zimbabwean side should prepare the land needed for the Project, extend necessary infrastructure (such as roads, electricity, extension workers' houses, telephone and field latrines) to the Project sites, field leveling and site preparation and implement all the necessary administrative procedures related to the above items.



- (5) Both sides confirmed that the Zimbabwean side should arrange the budget, staff and organization relevant to the future operation of all the facilities.
- (6) The Team observed the prosperous crop operation in Block C, meanwhile, Block B has not yet been prepared for cultivation. Both sides confirmed the need to speed up the land leveling and fencing works for Block B.
- (7) The mutual expectation and the ultimate goal of both sides were confirmed to be the replication of this irrigation model in the similar communal lands in Zimbabwe. In this respect, the Team expressed the wishes to the Zimbabwean side to make efforts to disseminate this model after the completion of the Project.
- (8) Both sides confirmed that sustainability of the development in the Project areas depends on the will and skills of the farmers there. Other important factors are proper assistance from the Zimbabwean government and empowerment of the farmers by extension services.
- (9) The Team confirmed the need for irrigation in the proposed project areas through a Project Cycle Management (PCM) workshop with farmers and field observations.
- (10) The Zimbabwean side is willing to consider the alternative designs which may require minimum costs for implementing the Project in the proposed blocks.





Items requested by the Government of Zimbabwe

	Irrigation Area (ha)	Pump Station	Pipe Line (km)	Irrigation Canal (km)	Farm Pond
Block A	115	ϕ 250 x 3 one station	ϕ 500 - ϕ 200 3.5	300 x 400 7.1	110m ³ x 1 1,080m ³ x 1
Block D	203	ϕ 300 x 3 one station	ϕ 700 - ϕ 450 2.2	300 x 400 9.8	830m ³ x 1 1,260m ³ x 1
Block E	94	ϕ 200 x 2 one station	ϕ 450 - ϕ 350 1.4	300 x 300 4.9	450m ³ x 1 520m ³ x 1

	Trunk Road (km)	Farm Road (km)
Block A	5.4	3.0
Block D	3.3	7.3
Block E	3.6	3.9




ON JAPAN'S GRANT AID PROGRAM

1. Japan's Grant Aid Procedures

(1) The Japan's Grant Aid Program is executed by the following procedures.

- Application (request made by a recipient country)
- Study (Preliminary Study / Basic Design Study conducted by JICA)
- Appraisal & Approval (Appraisal by the Government of Japan and Approval by the Cabinet of Japan)
- Determination of Implementation (Exchange of Notes between both Governments)
- Implementation (Implementation of the Project)

(2) Firstly, an application or a request for a project made by the recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to see whether or not it is suitable for Japan's grant Aid. If the request is deemed suitable, the Government of Japan entrusts a study on the request to JICA (Japan International Cooperation Agency).

Secondly, JICA conducts the Study (Basic Design Study), using a Japanese consulting firm. If the background and objective of the requested project are not clear, a Preliminary Study is conducted prior to a Basic design Study.

Thirdly, the Government of Japan appraises to see whether or not the Project is suitable for Japan's Grant Aid Program, based on the Basic Design Study report prepared by JICA and the results are then submitted for approval by the Cabinet.

Fourthly, the Project approved by the Cabinet becomes official when pledged by the Exchange of Notes signed by both Governments.

Finally, for the implementation of the Project, JICA assists the recipient country in preparing contracts and so on.

2. Contents of the Study

(1) Contents of the Study

The purpose of the Study (preliminary Study / Basic Design Study) conducted on a project requested by JICA is to provide a basic document necessary for




appraisal of the project by the Japanese Government. The contents of the Study are as follows:

- a) to confirm background, objectives, benefits of the project and also institutional capacity of agencies concerned of the recipient country necessary for project implementation.
- b) to evaluate appropriateness of the Project for the Grant Aid Scheme from a technical, social and economical point of view,
- c) to confirm items agreed on by both parties concerning a basic concept of the project,
- d) to prepare a basic design of the project,
- e) to estimate cost involved in the project.

Final project components are subject to approval by the Government of Japan and therefore may differ from an original request.

Implementing the project, the Government of Japan requests the recipient country to take necessary measures involved which are itemized on Exchange of Notes.

(2) Selecting (a) Consulting Firm(s)

For smooth implementation of the study, JICA uses (a) consulting firm(s) registered. JICA selects (a) firm(s) through proposals submitted by firms which are interested. The firm(s) selected carry(ies) out a Basic Design Study and write(s) a report, based upon terms of reference made by JICA.

The consulting firm(s) used for the study is(are) recommended by JICA to a recipient country after Exchange of Notes, in order to maintain technical consistency and also to avoid possible undue delay in implementation caused if a new selection process is repeated.

(3) Status of a Preliminary Study in the Grant Aid Program

A Preliminary Study is conducted during the second step of a project formulation & preparation as mentioned above.

A result of the study will be utilized in Japan to decide if the Project is to be suitable for a Basic Design Study.

Based on the result of the Basic Design Study, the Government would proceed to the stage of decision making process (appraisal and approval).

It is important to notice that at the stage of Preliminary Study, no commitment is made by the Japanese side concerning the realization of the Project in the scheme of Grant Aid Program.



3. Japan's Grant Aid Scheme

(1) What is Grant Aid?

The Grant Aid Program provides a recipient country with non reimbursable funds needed to procure facilities, equipment and services for economic and social development of the country under the following principles in accordance with relevant laws and regulations of Japan. The Grant Aid is not in a form of donation or such.

(2) Exchange of Notes (E/N)

The Japan's Grant Aid is extended in accordance with the Exchange of Notes by both Governments, in which the objectives of the Project, period of execution, conditions and amount of the Grant, etc. are confirmed.

(3) "The period of the Grant Aid" means one Japanese fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedure such as Exchange of Notes, concluding a contract with (a) consulting firm(s) and (a) contractor(s) and a final payment to them must be completed.

(4) Under the Grant, in principle, products and services of origins of Japan or the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant may be used for the purchase of products or services of a third country origin.

However the prime contractors, namely, consulting, contractor and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means Japanese physical persons or Japanese juridical persons controlled by Japanese physical persons.)

(5) Necessity of the "Verification"

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

(6) Undertakings required to the Government of the recipient country

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

- a) to secure land necessary for the sites of the project and to clear and level the land prior to commencement of the construction work,
- b) to provide facilities for distribution of electricity, water supply and drainage and other incidental facilities in and around the sites,



- c) to secure buildings prior to the installation work in case the Project is providing equipment,
- d) to ensure all expenses and prompt execution for unloading, customs clearance at the port disembarkation and internal transportation of the products purchased under the Grant Aid,
- e) to exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts,
- f) to accord Japanese nationals whose services may be required in connection with the supply of the products and services under the Verified Contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

(7) Proper Use

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

(8) Re-export

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

(9) Banking Arrangement (B/A)

- a) The Government of the recipient country or its designated authority shall open an account in the name of the Government of the recipient country in an authorized foreign exchange bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by Government of the recipient country or its designated authority under the contracts verified.
- b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an Authorization to Pay issued by the Government of the recipient country or its designated authority.



NECESSARY MEASURES TO BE TAKEN BY THE GOVERNMENT OF ZIMBABWE IN CASE JAPAN'S GRANT AID IS EXTENDED.

1. To provide data and information necessary for the Project.
2. To secure the site for the Project.
3. To bear two kinds of commissions to the Japanese foreign exchange bank for its banking services based upon the Banking Arrangement (B/A) namely,
 - the advising commission of the "Authorization to Pay (A/P)" and
 - the payment commission.
4. To ensure prompt unloading, tax exemption, and customs clearance at the port of disembarkation in Zimbabwe and prompt internal transportation therein of the materials and equipment for the project purchased under the Grant Aid.
5. To exempt Japanese nationals or a staff from a third country engaged in the project from customs duties, internal taxes and other fiscal levies which may be imposed in Zimbabwe with respect to the supply of the products and services under the verified contracts.
6. To accord Japanese nationals or a staff from a third country whose services may be required in connection with supply of the products and services under the verified contracts, such facilities as may be necessary for their entry into Zimbabwe and stay therein for the performance of their work.
7. To provide necessary permissions, licenses, and other authorization for implementing the Project, if necessary.
8. To assign appropriate budget and staff members for proper and effective operation and maintenance of the facilities constructed under the Project.
9. To maintain and use properly and effectively the facilities constructed and equipment provided under the Project;
10. To bear all the expenses other than those to be borne by the Grant Aid within the scope of the Project.



(2)基本設計ドラフト・ファイナルレポート説明時

(1998年10月28日)

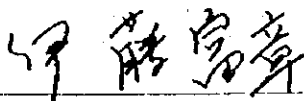
MINUTES OF DISCUSSIONS
BASIC DESIGN STUDY ON THE PROJECT
FOR
THE NYAKOMBA IRRIGATION DEVELOPMENT PROJECT (PHASE 2)
IN THE REPUBLIC OF ZIMBABWE
(CONSULTATION ON DRAFT REPORT)

In July 1998, the Japan International Cooperation Agency (JICA) dispatched a Basic Design Study Team on the Nyakomba Irrigation Development Project (hereinafter referred to as "the Project") to the Republic of Zimbabwe. After the assessment of the data and information obtained through the study, JICA has prepared the Draft Basic Design of the Project.

In order to explain and consult with the officials concerned of the Government of Zimbabwe on the components of the Draft Basic Design, JICA sent to the Republic of Zimbabwe a Study Team (hereinafter referred to as "the Team") headed by Mr. Tomiaki Ito, First Project Study Division, Grant Aid Project Study Department, JICA, which is scheduled to stay in the country from October 22 to 29, 1998.

As a result of the discussions held between the Team and the officials concerned of the Government of Zimbabwe, both parties have confirmed the main items described on the attached sheets.

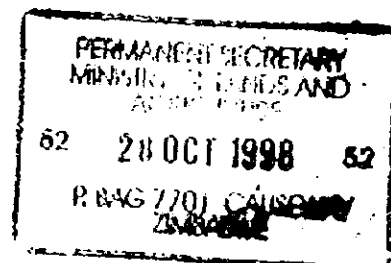
Harare, October 28, 1998



Mr. Tomiaki ITO
Team Leader,
Study Team,
JICA



Dr. Tobias TAKAVARASHA
Permanent Secretary,
Ministry of Lands and Agriculture,
The Republic of Zimbabwe



ATTACHMENT

1. Components of the Draft Report

The Government of Zimbabwe has agreed and accepted in principle the components of the Draft Report proposed by the Team.

2. Japan's Grant Aid System

- (1) The Government of Zimbabwe has understood Japan's Grant Aid System explained by the Team.(see Annex- I)
- (2) The Government of Zimbabwe will take necessary measures described in Annex-II for the smooth implementation of the Project in case Japan's Grant Aid is extended to the Project.

3. Schedule of the Study

JICA will produce the final report in accordance with the confirmed items, and send it to the Government of Zimbabwe by March, 1999.

4. Other relevant issues

- (1) The Team confirmed the following:
 - 1) The constructed irrigation facilities and provided equipment should be maintained ordinarily by farmers' organization, under the responsibility of the Department of Agricultural, Technical and Extension Services (AGRITEX), Ministry of Lands and Agriculture.
 - 2) The Department of Water Development (DWD), Ministry of Rural Resources and Water Development should maintain the major irrigation facilities such as pumping stations, pipe lines, and farm ponds.
- (2) Both sides reconfirmed that the proper operation and maintenance of the Project was needed to realize sustainable agricultural production, and therefore, the establishment of irrigation block committee and securing the budget for farmer training, staff salaries, etc., by AGRITEX and DWD were essential.
- (3) The Team explained the necessary works to be borne by the Zimbabwean side as shown in Annex-III. The Zimbabwean side understood and agreed to the matter.
- (4) The Zimbabwean side requested the Team to provide a bulldozer (11t class) to expedite the land leveling work in the Project area. The Team replied that the request would be communicated to the Government of Japan.
- (5) The Zimbabwean side also requested the Team to allow for flexibility of further discussion at the detailed design stage.

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JAPAN'S GRANT AID SYSTEM

1. Japan's Grant Aid Procedures

(1) The Japan's Grant Aid Program is executed by the following procedures.

Application (Request made by a recipient country)

Study (Preliminary Study / Basic Design Study conducted by JICA)

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Determination of Implementation (Exchange of Notes between the both Governments)

Implementation (Implementation of the Project)

(2) Firstly, an application or a request for a project made by the recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to see whether or not it is suitable for Japan's Grant Aid. If the request is deemed suitable, the Government of Japan entrusts a study on the request to JICA (Japan International Cooperation Agency).

Secondly, JICA conducts the Study (Basic Design Study), using a Japanese consulting firm. If the background and objective of the requested project are not clear, a Preliminary Study is conducted prior to a Basic Design Study.

Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Program, based on the Basic Design Study Report prepared by JICA and the results are then submitted to the Cabinet for approval.

Fourthly, the Project approved by the Cabinet becomes official when pledged by the Exchange of Notes signed by both Governments.

Finally, for the implementation of the Project, JICA assists the recipient country in preparing contracts and so on.

2. Contents of the Study

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- a) to confirm background, objectives, benefits of the project and also institutional capacity of agencies concerned of the recipient country necessary for project implementation,
- b) to evaluate appropriateness of the Project for the Grant Aid Scheme from a technical, social and economical point of view,
- c) to confirm items agreed on by the both parties concerning a basic concept of the project,
- d) to prepare a basic design of the project,
- e) to estimate cost involved in the project.

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h.

Final project components are subject to approval by the Government of Japan and therefore may differ from an original request.

In implementing the project, the Government of Japan requests the recipient country to take necessary measures involved which are itemized in the Exchange of Notes.

(2) Selecting (a) Consulting Firm(s)

For smooth implementation of the study, JICA uses (a) registered consulting firm(s). JICA selects (a) firm(s) through proposals submitted by interested firms. The firm(s) selected carry(ies) out a Basic Design Study and write(s) a report, based upon terms of reference made by JICA.

The consulting firm(s) used for the study is(are) recommended by JICA to a recipient country after the Exchange of Notes, in order to maintain technical consistency.

(3) Status of a Preliminary Study in the Grant Aid Program

A Preliminary Study is conducted during the second step of a project formulation & preparation as mentioned above.

The results of the study will be utilized in Japan to decide if the Project is suitable for a Basic Design Study.

Based on the results of the Basic Design Study, the Government would proceed to the stage of decision making process (appraisal and approval).

It is important to notice that at the stage of Preliminary Study, no commitment is made by the Japanese side concerning the realization of the Project in the scheme of Grant Aid Program.

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(1) What is Grant Aid?

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(3) "The period of the Grant Aid" means one Japanese fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedure such as Exchange of Notes, concluding a contract with (a) consulting firm(s) and (a) contractor(s) and a final payment to them must be completed.

(4) Under the Grant, in principle, products and services of origins of Japan or the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant may be used for the purchase of products or services of a third country of origin.

However the prime contractors, namely, consulting, contractor and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means Japanese physical persons or Japanese juridical persons controlled by Japanese physical persons.)

(5) Necessity of the "Verification"

The Government of the recipient country or its designated authority will conclude contracts

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in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. The "Verification" is deemed necessary to secure accountability to Japanese tax payers.

(6) Undertakings required to the Government of the recipient country

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

- a) to secure land necessary for the sites of the project and to clear and level the land prior to commencement of the construction work,
- b) to provide facilities for distribution of electricity, water supply and drainage and other incidental facilities in and around the sites,
- c) to secure buildings prior to the installation work in case the Project is providing equipment,
- d) to ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid,
- e) to exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts,
- f) to accord Japanese nationals whose services may be required in connection with the supply of the products and services under the Verified Contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

(7) Proper Use

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

(8) Re-export

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

(9) Banking Arrangement (B/A)

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

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Necessary Measures to be taken by the Government of Zimbabwe

Following necessary measures should be taken by the Government of Zimbabwe on condition that the Grant Aid by the Government of Japan is extended to the Project:

1. To provide data and information necessary for the Project;
2. To secure the site for the Project;
3. To bear commissions to a bank of Japan for its banking services based upon the Banking Arrangement, namely the advising commission of the "Authorization to Pay " and payment commission;
4. To ensure prompt unloading, tax exemption, customs clearance before entering in Zimbabwe and prompt internal transportation therein of the materials and equipment for the Project purchased under the Grant Aid;
5. To exempt Japanese juridical and physical nationals engaged in the Project from customs duties, internal taxes and other fiscal levies which may be imposed in Zimbabwe with respect to the supply of the products and services under the verified contracts;
6. To accord Japanese nationals whose services may be required in connection with supply of the products and the services under the verified contract such facilities as may be necessary for their entry into Zimbabwe and stay therein for the performance of their work;
7. To provide necessary permissions, licenses, and other authorizations for implementing the Project, if necessary;
8. To assign appropriate budget and staff for proper and effective use of equipment and instruments provided under the Grant Aid;
9. To maintain and use properly and effectively the equipment and instruments provided under the Project; and
10. To bear all the expenses, other than those to be borne by Japan's Grant Aid within the scope of the Project.

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The Project Cost borne by the Government of Zimbabwe

The Project cost is estimated as follows;

1) Construction in Block D, Area: 203 ha		
Land leveling work	203 ha	Z\$ 1,000,000
Fencing work	8.0 km	Z\$ 640,000
Extension of power line	3.7 km	Z\$ 1,000,000
Installation of transformer	1,000 KVA	Z\$ 500,000
	Sub-total	Z\$ 3,140,000
2) Construction in Block A, Area: 115 ha		
Land leveling work	115 ha	Z\$ 600,000
Fencing work	11.0 km	Z\$ 880,000
Extension of power line	0.5 km	Z\$ 150,000
Installation of transformer	750 KVA	Z\$ 300,000
	Sub-total	Z\$ 1,930,000
3) Construction in Block E, Area: 94 ha		
Land leveling work	94 ha	Z\$ 450,000
Fencing work	5.2 km	Z\$ 420,000
Extension of power line	4.2 km	Z\$ 1,150,000
Installation of transformer	750 KVA	Z\$ 300,000
	Sub-total	Z\$ 2,320,000
Total		Z\$ 7,390,000

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5. 当該国の社会経済事情

国名	ジンバブエ共和国 Republic of Zimbabwe	1998.03	1/2
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一般指標					
政体	議会民主制	*1	首都	ハラレ	*1
元首	Exec. President Robert G. MUGABE	*1	主要都市名	ハラレ、ブタボ、ムタペ	*1
独立年月日	1980年4月18日	*1	経済活動可人口	5,000千人 (1995年)	*4
人種(部族)構成	77万人(シナ族、ツバペ族、白人)93%	*1	義務教育年数	8年間 (1997年)	*5
			初等教育就学率	% (年)	*5
言語・公用語	英語、シナ語、ツバペ語	*1	初等教育終了率	% (年)	*6
宗教	シクリファ(キリスト教+地域信仰) 50%	*1	識字率	84.7% (1994年)	*7
国連加盟	1980年08月	*2	人口密度	29.15人/Km ² (1996年)	*1
世銀加盟	1980年09月	*3	人口増加率	1.4% (1996年)	*1
IMF加盟	1995年02月	*3	平均寿命	平均41.85 男41.91 女41.78	*1
面積	390.58千Km ²	*1	5歳児未満死亡率	74/1000 (1995年)	*7
人口	11,271,314千人(1996年)	*1	カロリー供給量	1,989.0 cal/日/人 (1992年)	*7

経済指標					
通貨単位	ジンバブエドル	*1	貿易量	(1995年)	*8
為替(1US\$)	1US\$=18.62 (1997年12月)	*8	輸入	2,119.0百万ドル	*8
会計年度	7月~6月	*1	輸出	百万ドル	*8
国家予算	(1993年)	*9	輸入カバー率	2.5月 (1994年)	*10
歳入	1,529.2百万ドル	*9	主要輸出品目	農産物、工業製品、金 (1995年)	*1
歳出	1,902.2百万ドル	*9	主要輸入品目	機械、輸送機器、化学製品 (1995年)	*1
国際収支	-85.80百万ドル(1994年)	*9	日本への輸出	162.7百万ドル (1996年)	*11
ODA受取額	490.00百万ドル(1995年)	*7	日本からの輸入	117.7百万ドル (1996年)	*11
国内総生産(GDP)	6,522.00百万ドル(1995年)	*4			
一人当たりGNP	540.0百万ドル(1995年)	*4	外貨準備総額	160.1百万ドル(1997年12月)	*8
GDP産業別構成	農業 15.0% (1995年)	*4	対外債務残高	651.0百万ドル(1995年)	*10
	鉱工業 36.0% (1995年)		対外債務返済率	25.6% (1994年)	*10
	サービス業 48.0% (1995年)		インフレ率	36.2% (1993年)	*7
産業別雇用	農業 68.0% (1990年)	*7			
	鉱工業 8.0% (1990年)				
	サービス業 24.0% (1990年)		国家開発計画	第2次国家開発5ヵ年計画 (91~95年)	*12
経済成長率	1.0% (1995年)	*4			

気象(1961~1990年平均)													場所:Harare		(標高 1,473 m)	
月	1	2	3	4	5	6	7	8	9	10	11	12	平均/計			
最高気温	26.0	26.0	26.0	26.0	23.0	21.0	21.0	23.0	26.0	28.0	27.0	26.0	24.9℃	*13		
最低気温	16.0	16.0	14.0	13.0	9.0	7.0	7.0	8.0	12.0	14.0	16.0	16.0	12.3℃	*13		
平均気温	20.4	20.0	19.6	18.1	15.5	13.1	13.1	15.2	18.6	20.6	20.7	20.3	17.9℃	*14		
降水量	196	178	117	28	13	3	0	3	5	28	97	163	831mm	*13		
雨期	雨	雨	雨			乾	乾	乾	乾			雨				

*1 CIA World Fact Book 1997-1998
 *2 States Members of United Nations
 *3 International Financial Statistics Yearbook 1996
 *4 World Development Report 1997
 *5 UNESCO Statistical Yearbook 1997
 *6 Status and Trends 1997
 *7 Human Development Report 1997

*8 International Financial Statistics February 1993
 *9 International Financial Statistics Yearbook 1997
 *10 Global Development Finance 1997
 *11 世界の国一覽表 1997年版
 *12 最新世界各國要覽 97年版
 *13 The Times Book World Weather Guide, Update Edition
 *14 理科年表, 国立天文台(1997)

国名	ジンバブエ共和国
	Republic of Zimbabwe

1998.03 2/2

*15

項目	年度	1992	1993	1994	1995
技術協力		2,699.97	2,892.93	3,087.67	2,796.65
無償資金協力		2,194.95	2,244.22	2,456.48	3,256.28
有償資金協力		5,852.05	3,939.97	4,352.21	3,878.11
総額		10,746.97	9,077.12	9,896.36	9,931.04

*15

項目	年度	1992	1993	1994	1995
技術協力		4.24	6.81	8.66	12.35
無償資金協力		38.04	16.11	16.63	54.77
有償資金協力		7.57	5.28	0.37	-1.49
総額		49.85	28.20	25.66	65.63

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	贈与 (1)	有償資金協力 (2)	政府開発援助 (ODA) (1)+(2)=(3)	その他政府資金 及び 民間資金 (4)	経済協力総額 (3)+(4)
二国間援助 (主要供与国)	400.30	-52.60	347.70		347.70
1. 日本	67.10	-1.50	65.60		65.60
2. イギリス	46.10	-0.20	45.90		45.90
3. ドイツ	27.90	14.20	42.10		42.10
4. オランダ	61.60	-25.90	35.70		35.70
多国間援助 (主要援助機関)	39.70	108.90	148.60		148.60
1. CEC					
2. IMF					
その他					
合計	440.00	56.30	496.30		496.30

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技術	関係省庁・機関→大蔵・経済計画・開発庁
無償	
協力隊	

*15 Japan's ODA Annual Report 1996
 *16 Geographical Distribution of Financial Flows to Aid Recipients 1991-1995
 *17 国別協力情報(JICA)

6. 資料収集リスト

1. MANICALAND PROVINCIAL ANNUAL DEVELOPMENT PLAN 1997/98
: マニカランド州第3次5ヶ年計画 (1996/97-2000/01年) の内の1997/98年次版
2. MANICALAND PROVINCIAL ANNUAL DEVELOPMENT PLAN 1999(Draft)
: マニカランド州第3次5ヶ年開発計画 (1996/97-2000/01年) の内の1999年次(案)
3. Consumer Price Index / 98-7 (統計データ)
4. Civil Engineering Price Index / 98-6 (統計データ)
5. Business Trends Zimbabwe / May 1998 (銀行発行の経済情報誌)
6. The Cotton Company of Zimbabwe Limited のカタログ、年報 (1996年)
7. SOURCES OF FINANCE AND INVESTMENT (農民金融政策資料)
8. Land Classification Map, 1995, 1:1,000,000
9. GENERAL MAP OF ZIMBABWE, 1997, 1:1,000,000
10. 月別雨量データ: Nyamaropa Irrigation Project / 1990-1998
11. AGRITEX の組織図
12. DWD (本部、州) 組織図
13. Block C 地区の電気料金支払い状況資料
14. Block C 地区ポンプ運転記録
15. ZESA 電気料金表
16. AFC Brochure
17. 市中銀行預金利率資料
18. 建設産業労働者賃金改定資料
19. Zimbabwe Programme for Economic and Social Transformation 1996-2001 (ZIMPREST)
20. Water Act

7. ボーリングデータ

GEOTECHNICAL SERVICES (1980) (Pvt) Limited

NYAKOMBA IRRIGATION PROJECT REPORT

INTRODUCTION

Foundation Investigations at the proposed Nyakomba Irrigation Project Site which is located on the Gairezi River in Nyamaropa Communal Lands were done by Geotechnical Services (1980) (Pvt) Ltd, supervised by Engineers from Taiyo Consultants Company, Tokyo, Japan.

These investigations which consisted of Rotary Core Drilling, Standard Penetration Tests and Trial Pits which commenced on 09/08/98 and were completed on the 15/08/98.

1. KEY PERSONNEL

1 -	Project Manager	-	Mr S Lord (Managing Director)
1 -	Technician	-	Mr S Mpambavachiki
1 -	Driver	-	Mr J Mtambalika
1 -	Driller	-	Mr S Chaparira
3 -	Drill Assistants		

2. DRILLING EQUIPMENT

1 No.	7 Ton Truck - Mercedes Benz 1313
1 No.	BBS18 Rotary Core Drill c/w Ancillary Equipment
1 No.	D40/BH30 Mono Pump Driven by a Diesel Engine
1 No.	Honda Water Pump (Petrol Powered) Supply Pump
1 No.	65kg Jarring hammer
	Various Drilling Crowns
30m	Black Polypipe (for water supply)
4 No.	200 litre Drums (for water supply)
1 No.	NX Core Barrel
2 No.	NXC Core Barrel (Starter)
1 No.	Delta Hut
1 No.	Tent
15m	"B" Drilling Rods

TEST EQUIPMENT

2 No.	S.P.T. Split Barrels c/w Cutting Edges
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3. SUMMARY OF OPERATIONS

A total of 6 Investigatory Boreholes were drilled on site. There were two types of drilling. Type A consisted of 3 boreholes which were drilled along the Gairezi River for the Pump Stations. Original maximum depth was 7 metres but they were drilled to 8.20m, 9.00m and 10.00m, as per the Engineers instructions. S.P.T.'s were carried out at 1m intervals as per the Engineers instructions.

Type B consisted of 3 Boreholes on the Farm Ponds. All the Type B holes were drilled to a maximum depth of 5.00m and S.P.T.'s were carried out at 1m intervals. U4 Samples could not be sampled due to ground conditions and this was confirmed with the Engineer on site.

Sampling

On each position a Trial Pit was dug to a maximum depth of 1 metre and a 5kg sealed sample and a 50kg sample were obtained from each pit. A total of 6 pits were excavated. All samples from drill holes were sealed on removal from the boreholes, labelled then packed in order in wooden Core Boxes, including S.P.T. samples. On Farm Pond E, S.P.T.'s could not be undertaken due to ground conditions. On Pump Station A at 6 metres the S.P.T. could not obtain sample recovery after a full penetration of 450mm on a total of 27 blows. At 8m there was also no recovery. It is assumed that the water level of the river caused saturated conditions hindering sample recovery.











Standard Penetration Tests

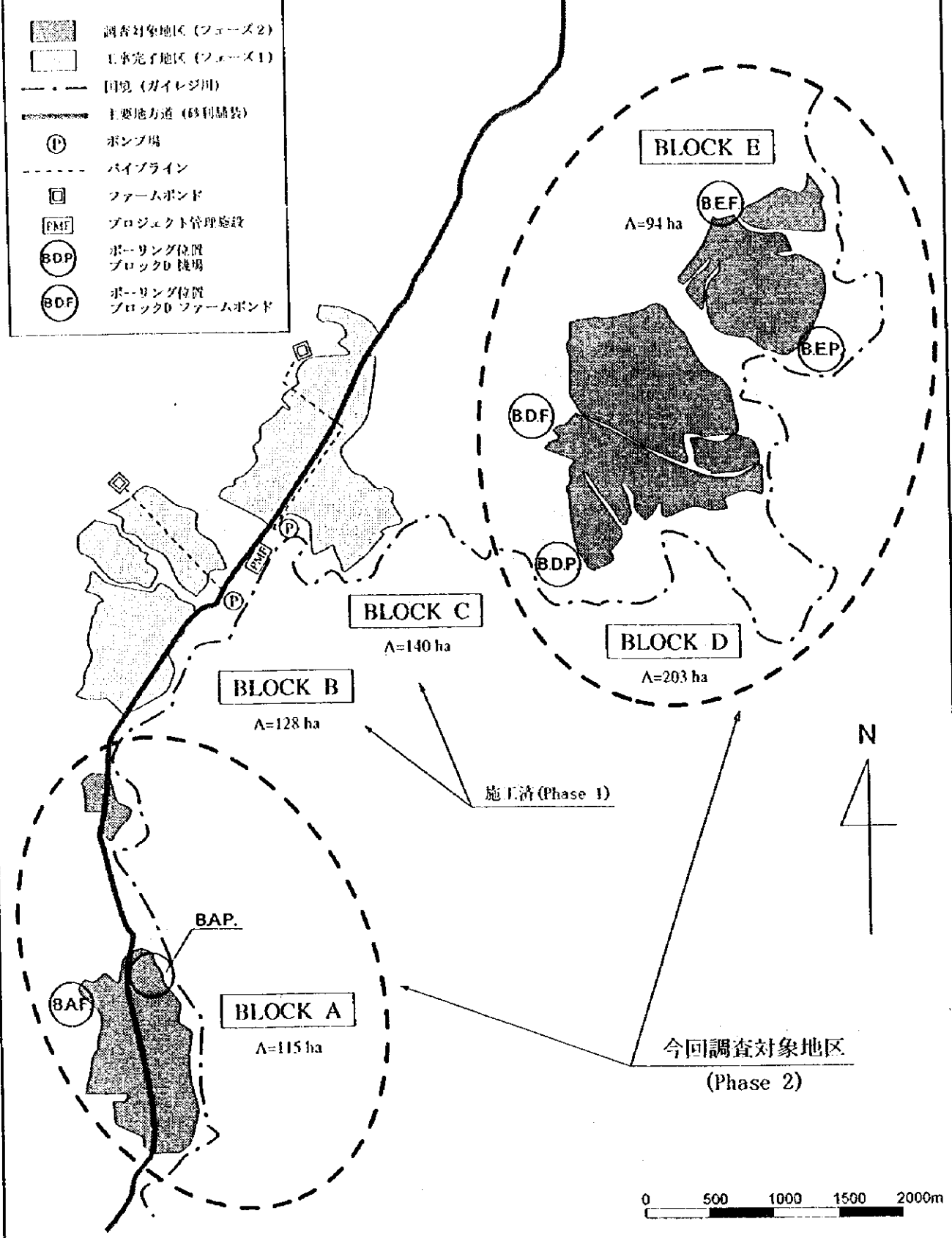
These tests were done in the overburden zones. The method used is as follows ;

A Split barrel Sample Tube complete with a cutting edge was attached to the drill rods and lowered into the borehole by the drilling rig. A 65kg Hammer was then made to free fall a distance of 760mm on to an anvil attached to the drill rods thus driving the sample tube into the material at the bottom of the hole. The blows and penetration rate were recorded after every 75mm. A maximum of 40 blows for 300mm of penetration was allowed on this project.

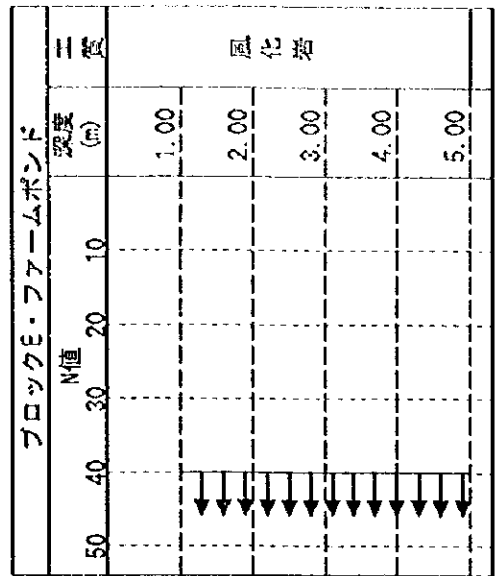
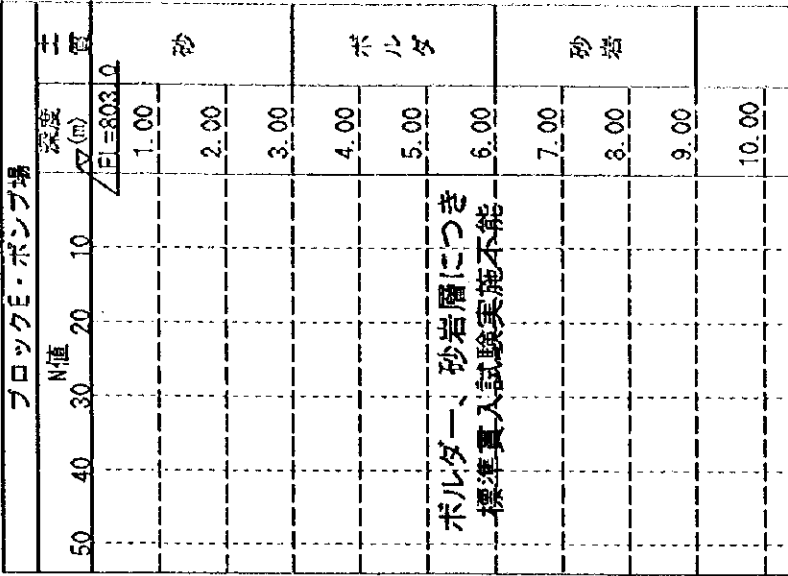
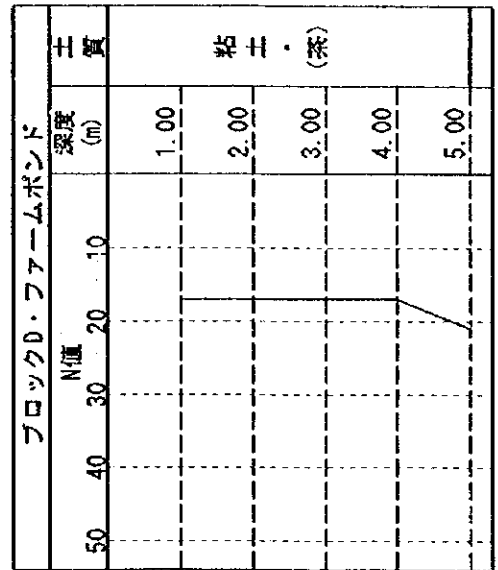
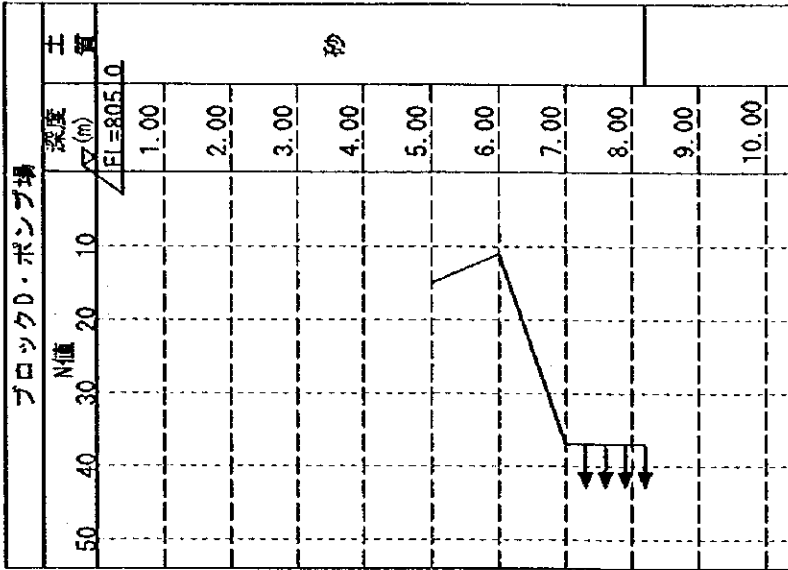
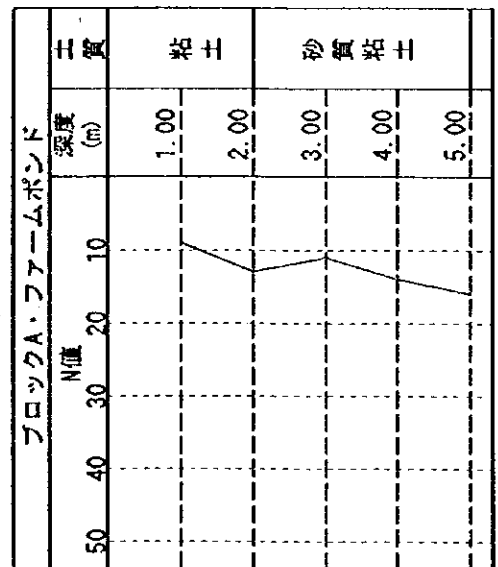
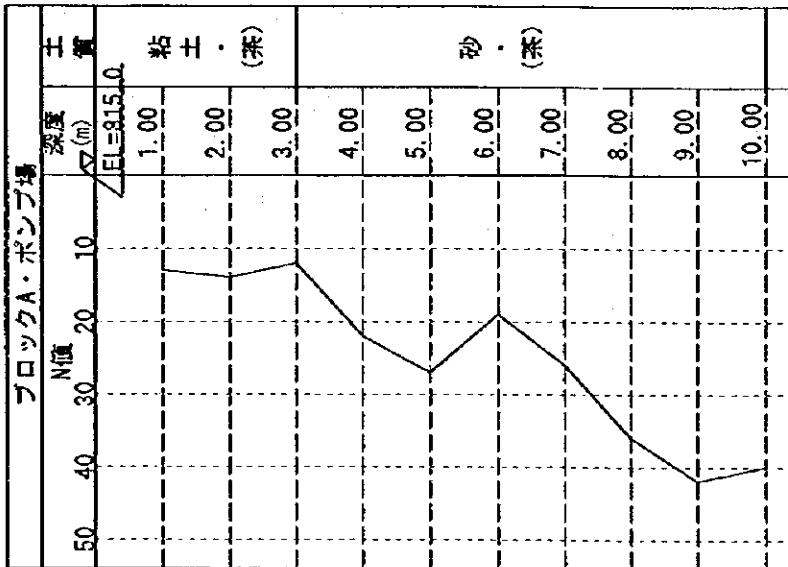
GENERAL

All drilling and testing done on this project were in accordance with BS 5390 (1981) and the results are presented in the following pages for analysis by the Consultants TAIYO CONSULTANTS COMPANY (JAPAN) acting on behalf of Japan International Co-operative Agency (JICA).

- 凡例
-  調査対象地区 (フェーズ2)
 -  工事完了地区 (フェーズ1)
 -  国境 (ガイレジ川)
 -  主要地方道 (砂利詰装)
 -  ポンプ場
 -  ハイプライン
 -  ファームボンド
 -  プロジェクト管理施設
 -  ボーリング位置
ブロックD 機場
 -  ボーリング位置
ブロックD ファームボンド



ボーリング調査位置図



**GEOTECHNICAL SERVICES (1980) (PVT) LTD
DAILY DIAMOND DRILLING REPORT**

CONTRACT NO: Nyakomba Irrigation Project		LOCATION: Inyanga (Block A)				
DATE: 15 08 98		BOREHOLE NO: Pump Station A				
		INCLINATION: 90 degrees				
DRILL RUNNER'S SIGNATURE: S Chaparira		HOURS: 11	PRESENT DEPTH: 10 m 000 cm			
DAY: Day			PREVIOUS DEPTH: 0 m 000 cm			
AFTERNOON			AMOUNT DRILLED: 10 m 000 cm			
NIGHT			RATE OF DRILLING: 1000 m M.S.M/ Hour			
LABOUR NO: 4						
		PREVIOUS TOTAL DEPTH: 0.00 m				
RUN No	BIT SIZE & No	PREVIOUS TOTAL DEPTH		Advance	Core Recovery	REMARKS <small>Formation Filled/ Lost or Required Water Table</small>
		From	To			
1	NXC Har	0.00	1.00	1.00	S.P.T.	Brown clay
2	NXC Har	1.00	2.00	1.00	S.P.T.	Brown clay
3	NXC Har	2.00	3.00	1.00	S.P.T.	Brown clay
4	NXC Har	3.00	4.00	1.00	S.P.T.	Brown sand
5	NXC Har	4.00	5.00	1.00	S.P.T.	Brown sand
6	NXC Har	5.00	6.00	1.00	S.P.T.	Brown sand
7	NXC Har	6.00	7.00	1.00	S.P.T.	Brown sand
8	NXC Har	7.00	8.00	1.00	S.P.T.	Brown sand
9	NXC Har	8.00	9.00	1.00	S.P.T.	Brown sand
10	NXC Har	9.00	10.00	1.00	S.P.T.	Brown sand
E.O.H. - 10.00m						
SET		RECOVERED		LOST		
SIZE	LENGTH	SIZE	LENGTH	SIZE	DEPTH	LENGTH
MATERIALS	TYPE					
	UNIT					
	STOCK					
	USED					
BALANCE						
1. DRILLING		RE-DRILLING		CEMENT		REAMING
2. DELAYS (with details)						
3. OTHER WORK (with details)						
CONTRACTOR'S REPRESENTATIVE: S MBAMBAVACHIKI		ENGINEER'S REPRESENTATIVE				
DATE: 15 08 98		DATE				

GEO TECHNICAL SERVICES (1980) (PVT) LTD

PENETROMETER LOG SHEET

PROJECT : NYAKOMBA IRRIGATION PROJECT		OPERATOR : S.CHAPARRA								
PUMP STATION A		DATE : 15.08.98								
GEOLOGY : CLAY & SAND		WEATHER : WINDY								
DEPTH	BLOWS / PENETRATION						ADJUSTED NO OF BLOWS	PENETRATION AT ADJUSTED BLOWS	N VALUE	REMARKS
AT 1.00m										
NO. OF BLOWS	3	5	3	2	3	4				
PENETRATION (mm)	75	75	75	75	75	75	13	300	13	
AT 2.00m										
NO. OF BLOWS	2	2	5	4	3	7				
PENETRATION (mm)	75	75	75	75	75	75	14	300	14	
AT 3.00m										
NO. OF BLOWS	3	3	3	3	3	4				
PENETRATION (mm)	75	75	75	75	75	75	12	300	12	
AT 4.00m										
NO. OF BLOWS	9	6	5	5	6	6				
PENETRATION (mm)	75	75	75	75	75	75	22	300	22	
AT 5.00m										
NO. OF BLOWS	6	6	6	7	8	8				
PENETRATION (mm)	75	75	75	75	75	75	27	300	27	
AT 6.00m										
NO. OF BLOWS	3	4	5	5	5	5				
PENETRATION (mm)	75	75	75	75	75	75	19	300	19	No Recovery

pensoft.wk4

GEOTECHNICAL SERVICES (1980) (PVT) LTD

PENETROMETER LOG SHEET

PROJECT : NYAKOMBA IRRIGATION PROJECT												OPERATOR : S.CHAPARIRA						
PUMP STATION A												DATE : 15.08.98						
GEOLOGY : CLAY & SAND												WEATHER : WINDY						
DEPTH	BLOWS / PENETRATION											ADJUSTED NO. OF BLOWS	PENETRATION AT ADJUSTED BLOWS	N VALUE	REMARKS			
AT 7.00m																		
NO. OF BLOWS	6	6	6	6	6	6	6	6	6	6	6	6	26	300	26			
PENETRATION (mm)	75	75	75	75	75	75	75	75	75	75	75	75						
AT 8.00m																		
NO. OF BLOWS	7	7	7	7	7	7	7	7	7	7	7	7	36	300	36			No Recovery
PENETRATION (mm)	75	75	75	75	75	75	75	75	75	75	75	75						
AT 9.00m																		
NO. OF BLOWS	9	9	9	9	9	9	9	9	9	9	9	9	42	300	42			42
PENETRATION (mm)	75	75	75	75	75	75	75	75	75	75	75	75						
AT 10.00m																		
NO. OF BLOWS	9	9	9	9	9	9	9	9	9	9	9	9	40	300	40			40
PENETRATION (mm)	75	75	75	75	75	75	75	75	75	75	75	75						
AT																		
NO. OF BLOWS																		
PENETRATION (mm)																		
AT																		
NO. OF BLOWS																		
PENETRATION (mm)																		

panoshi.wk4

**GEOTECHNICAL SERVICES (1980) (PVT) LTD
DAILY DIAMOND DRILLING REPORT**

CONTRACT NO: Nyakomba Irrigation Project		LOCATION: Inyanga (Block D)						
DATE: 09 08 98		BOREHOLE NO: Pump Station D						
		INCLINATION: 90 degrees						
DRILL RUNNER'S SIGNATURE: S Chaparira		HOURS: 11	PRESENT DEPTH: 8 m 0 20 cm					
DAY: Day			PREVIOUS DEPTH: 0 m 0 00 cm					
AFTERNOON			AMOUNT DRILLED: 8 m 0 20 cm					
NIGHT			RATE OF DRILLING: 8 20 m M Spm/Hour					
LABOUR NO: 4								
RUN No	BIT SIZE & No	PREVIOUS TOTAL DEPTH: 0.00 m				REMARKS <small>Formation, Fugate, Lost or Regained Water Table</small>		
		From	To	Advance	Core Recovery			
1	NXC Har	0.00	1.00	1.00		Sand		
2	NXC Har	1.00	2.00	1.00		Sand		
3	NXC Har	2.00	3.00	1.00		Sand		
4	NXC Har	3.00	4.00	1.00		Sand		
5	NXC Har	4.00	5.00	1.00		S.P.T. - Sand		
6	NXC Har	5.00	6.00	1.00		S.P.T. - Sand		
7	NXC Har	6.00	7.00	1.00		S.P.T. - Sand		
8	NXC Har	7.00	8.20	1.20		S.P.T. - Sand E.O.H. - 8.20m		
SET		RECOVERED		LOST		M A T E R I A L S	TYPE	
SIZE	LENGTH	SIZE	LENGTH	SIZE	DEPTH		LENGTH	UNIT
								STOCK
								USED
							BALANCE	
1. DRILLING		RE-DRILLING		CEMENT		REMARKS		
2. DELAYS (with details)		From 7.00am to 10.00am Setting Up The Machine And Digging The Sump						
		From 10.00am to 6.00pm Drilling To E.O.H.						
3. OTHER WORK (with details)								
CONTRACTOR'S REPRESENTATIVE		S MBAMBAVACHIKI		ENGINEER'S REPRESENTATIVE				
DATE		09 08 98		DATE				

GEO-TECHNICAL SERVICES (1980) (PVT) LTD

PENEIROMETER LOG SHEET

PROJECT :		NYAKOMBA IRRIGATION PROJECT		OPERATOR :		S. CHAPARRA					
PUMP NO :		PUMP STATION D		DATE :		09.08.96					
GEOLOGY :		SAND		WEATHER :		HOT					
DEPTH		BLOWS / PENETRATION						REMARKS			
AT											
5.00m											
NO. OF BLOWS		14	R					15	300	15	
PENETRATION (mm)		300	150								
AT											
6.00m											
NO. OF BLOWS		5	6	7				11	300	11	
PENETRATION (mm)		150	150	150							
AT											
7.00m											
NO. OF BLOWS		17	20					37	300	37	
PENETRATION (mm)		150	150								
AT											
8.00m											
NO. OF BLOWS		40									R Boulders
PENETRATION (mm)		0									
AT											
NO. OF BLOWS											
PENETRATION (mm)											
AT											
NO. OF BLOWS											
PENETRATION (mm)											

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**GEOTECHNICAL SERVICES (1980) (PVT) LTD
DAILY DIAMOND DRILLING REPORT**

CONTRACT NO: Nyakomba Irrigation Project				LOCATION: Inyanga (Block E)			
DATE: 12 08 98				BOREHOLE NO: Pump Station E			
				INCLINATION: 90 degrees			
DRILL RUNNER'S SIGNATURE: S. Chaparira			HOURS 10	PRESENT DEPTH: 9 m		0 00 cm	
DAY				PREVIOUS DEPTH: 0 m		0 00 cm	
AFTERNOON			Day	AMOUNT DRILLED: 9 m		0 00 cm	
NIGHT				RATE OF DRILLING: 9 00 m		M. Shift Hour	
LABOUR NO			4				
		PREVIOUS TOTAL DEPTH: 0 00 m				REMARKS	
RUN No	BIT SIZE & No	PREVIOUS TOTAL DEPTH		Advance	Core Recovery	Formation/Fluids/Loss or Page no & Water Table	
		From	To				
1	NXC Har	0 00	1 00			Sand	
2	NXC Har	1 00	2 00			Sand	
3	NXC Har	2 00	3 00			Sand	
4	NXC Har	3 00	4 00			Boulders	
5	NXC Har	4 00	5 00			Boulders	
6	NXC Har	5 00	6 00			Boulders	
7	NXC Har	6 00	7 43			Sandstone	
8	NXC Har	7 43	9 00			Sandstone	
						E.O.H - 9 00m	
SET		RECOVERED		LOST			
SIZE	LENGTH	SIZE	LENGTH	SIZE	DEPTH	LENGTH	M A T E R I A L S
						TYPE	
						UNIT	
						STOCK	
						USED	
						BALANCE	
1. DRILLING		RE-DRILLING		CEMENT		REAMING	
2. DELAYS (with details)		From 6 00am To 10 00am Moving To The Next Borehole And Setting Up The Rig					
3. OTHER WORK (with details)							
CONTRACTOR'S REPRESENTATIVE: S MBAMBAVACHIKI				ENGINEER'S REPRESENTATIVE:			
DATE: 12 08 98				DATE:			

**GEOTECHNICAL SERVICES (1980) (PVT) LTD
DAILY DIAMOND DRILLING REPORT**

CONTRACT NO: Nyakonba Irrigation Project		LOCATION: Inyanga (Block A)					
DATE: 14 08 98		BOREHOLE NO: Farm Pond A					
		INCLINATION: 50 degrees					
DRILL RUNNER'S SIGNATURE: S Chaparira		HOURS: 11	PRESENT DEPTH: 5 m 0.00 cm				
DAY: Day			PREVIOUS DEPTH: 0 m 0.00 cm				
AFTERNOON: NIGHT: LABOUR NO: 4			AMOUNT DRILLED: 5 m 0.00 cm				
			RATE OF DRILLING: 5.00 m M.Sh.M./Hour				
		PREVIOUS TOTAL DEPTH: 0.00 m					
RUN No	BIT SIZE & No	PREVIOUS TOTAL DEPTH				REMARKS <small>Formation/Fault-List or Regene/Water Table</small>	
		From	To	Advance	Cora Recovery		
1	NXC Har	0.00	1.00	1.00		Clay	
2	NXC Har	1.00	2.00	1.00		Clay	
3	NXC Har	2.00	3.00	1.00		Sand & clay	
4	NXC Har	3.00	4.00	1.00		Sand & clay	
5	NXC Har	4.00	5.00	1.00		Sand & clay	
						E.O.H. - 5.00m	
						No U4 Sample Taken	
SET		RECOVERED		LOST			
SIZE	LENGTH	SIZE	LENGTH	SIZE	DEPTH	LENGTH	
						MATERIALS	TYPE
							UNIT
							STOCK
							USED
						BALANCE	
1. DRILLING		RE-DRILLING		CEMENT		REAMING	
2. DELAYS (with details)		From 7.00am To 10.30am Moving To The Next Site And Setting Up					
3. OTHER WORK (with details)							
CONTRACTOR'S REPRESENTATIVE: S MBAMBAVACHIKI		ENGINEER'S REPRESENTATIVE					
DATE: 14 08 98		DATE					

GEOTECHNICAL SERVICES (1980) (PVT) LTD
PENETROMETER LOG SHEET

PROJECT : NYAKOMBA IRRIGATION PROJECT		OPERATOR : S. CHAPABIRA								
BH NO : FARM POND A		DATE : 14.06.98								
GEOLOGY : SAND & CLAY		WEATHER : CLEAR & COOL								
DEPTH	BLOWS / PENETRATION						ADJUSTED NO. OF BLOWS	PENETRATION AT ADJUSTED BLOWS	N VALUE	REMARKS
AT 1.00m										
NO. OF BLOWS	2	2	2	2	3	3				
PENETRATION (mm)	75	75	75	75	75	75	9	300	9	
AT 2.00m										
NO. OF BLOWS	3	3	3	3	4	4				
PENETRATION (mm)	75	75	75	75	75	75	13	300	13	
AT 3.00m										
NO. OF BLOWS	2	2	3	3	3	3				
PENETRATION (mm)	75	75	75	75	75	75	11	300	11	No Recovery
AT 4.00m										
NO. OF BLOWS	3	3	3	4	4	4				
PENETRATION (mm)	75	75	75	75	75	75	14	300	14	
AT 5.00m										
NO. OF BLOWS	4	4	4	4	4	4				
PENETRATION (mm)	75	75	75	75	75	75	16	300	16	
AT										
NO. OF BLOWS										
PENETRATION (mm)										

penetr1.wk4

**GEOTECHNICAL SERVICES (1980) (PVT) LTD
DAILY DIAMOND DRILLING REPORT**

CONTRACT NO: Nyakomba Irrigation Project		LOCATION: Inyanga (Block D)							
DATE: 10-08-93		BOREHOLE NO: Farm Pond D							
		INCLINATION: 90 degrees							
DRILL RUNNER'S SIGNATURE: S Choparira		HOURS 10	PRESENT DEPTH: 5 m 0.00 cm						
DAY AFTERNOON Day			PREVIOUS DEPTH: 0 m 0.00 cm						
NIGHT			AMOUNT DRILLED: 5 m 0.00 cm						
LABOUR NO: 4			RATE OF DRILLING: 5.00 m M SH/1 Hour						
		PREVIOUS TOTAL DEPTH: 0.00 m							
RUN No	BIT SIZE & No	PREVIOUS TOTAL DEPTH				Advance	Core Recovery	REMARKS <small>Formation/Fault/Lead or Repeated Water Table</small>	
		From	To						
1	NXC Har	0.00	1.00			1.00		Brown clay	
2	Dry Drilling	1.00	2.00			1.00		S.P.T. - Brown clay	
3	Dry Drilling	2.00	3.00			1.00		S.P.T. - Brown clay	
4	Dry Drilling	3.00	4.00			1.00		S.P.T. - Brown clay	
5	Dry Drilling	4.00	5.00			1.00		S.P.T. - Brown clay	
								E.O.H. - 5.00m	
								No U4 Sample Taken	
SET		RECOVERED		LOST				M A T E R I A L S	TYPE
SIZE	LENGTH	SIZE	LENGTH	SIZE	DEPTH	LENGTH	UNIT		
							STOCK		
							USED		
								BALANCE	
1. DRILLING		RE-DRILLING		CEMENT		REAMING			
2. DELAYS (with details)		From 7.00am To 3.00pm Moving To The Next Borehole							
		Chain Broke Causing A Delay							
3. OTHER WORK (with details)									
CONTRACTOR'S REPRESENTATIVE		S MBAMBAVACHIKI			ENGINEER'S REPRESENTATIVE				
DATE		10-08-93			DATE				

GEOTECHNICAL SERVICES (1980) (PVT) LTD
PENEIROMETER LOG SHEET

PROJECT : NYAKOMBA IRRIGATION PROJECT		OPERATOR : S. CHAPARRA								
BH NO : FARM POND D		DATE : 10.08.98								
GEOLOGY : BROWN CLAY		WEATHER : HOT								
DEPTH	BLOWS / PENETRATION						ADJUSTED NO OF BLOWS	PENETRATION AT ADJUSTED BLOWS	N VALUE	REMARKS
AT 2.00m										
NO. OF BLOWS	6	3	4	5	4					
PENETRATION (mm)	75	75	75	75	75	75	17	300	17	
AT 3.00m										
NO. OF BLOWS	4	5	4	4	4	4				
PENETRATION (mm)	75	75	75	75	75	75	17	300	17	
AT 4.00m										
NO. OF BLOWS	3	3	4	4	4	6				
PENETRATION (mm)	75	75	75	75	75	75	17	300	17	
AT 5.00m										
NO. OF BLOWS	3	4	5	6	6	6				
PENETRATION (mm)	75	75	75	75	75	75	21	300	21	
AT										
NO. OF BLOWS										
PENETRATION (mm)										
AT										
NO. OF BLOWS										
PENETRATION (mm)										

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GEOTECHNICAL SERVICES (1980) (PVT) LTD DAILY DIAMOND DRILLING REPORT

CONTRACT NO: Nyakumba Irrigation Project		LOCATION: Inyanga (Block E)					
DATE: 11 08 98		BOREHOLE NO: Farm Pond E					
		INCLINATION: 90 degrees					
DRILL RUNNER'S SIGNATURE: S. Chaparira		HOURS: 10	PRESENT DEPTH: 5 m 000 cm				
DAY: Day			PREVIOUS DEPTH: 0 m 000 cm				
AFTERNOON: Day			AMOUNT DRILLED: 5 m 000 cm				
NIGHT: Day			RATE OF DRILLING: 5 00 m M.S.M/Hour				
LABOUR NO: 4							
		PREVIOUS TOTAL DEPTH: 0 00 m	REMARKS				
		Formation/Fault/lost or Regains/Water Table					
RUN No	BIT SIZE & No	PREVIOUS TOTAL DEPTH		Advance	Core Recovery	REMARKS	
		From	To				
1	NXC Har	0 00	1 00	1 00		Weathered rock	
2	NXC Har	1 00	2 00	1 00		S.P.T. - Weathered rock	
3	NXC Har	2 00	3 00	1 00		S.P.T. - Weathered rock	
4	NXC Har	3 00	4 00	1 00		S.P.T. - Weathered rock	
5	NXC Har	4 00	5 00	1 00		S.P.T. - Weathered rock	
						E.O.H. - 5.00m	
						No U4 Sample Taken	
SET		RECOVERED		LOST		MATERIALS	
SIZE	LENGTH	SIZE	LENGTH	SIZE	DEPTH		LENGTH
							TYPE
							UNIT
							STOCK
							USED
							BALANCE
1. DRILLING		RE-DRILLING		CEMENT		REAMING	
2. DELAYS (with details)		From 7.00am to 11.00am Moving To The Next Site And Digging The Sump					
		Started Drilling Borehole From 0.00m to 5.00m E.O.H.					
3. OTHER WORK (with details)							
CONTRACTOR'S REPRESENTATIVE		S MBAMBAVACHIKI		ENGINEER'S REPRESENTATIVE			
DATE		11 08 98		DATE			

GEOTECHNICAL SERVICES (1980) (PVT) LTD

PENETROMETER LOG SHEET

PROJECT :		NYAKOMBA IRRIGATION PROJECT		OPERATOR :		S. CHATAPIRA	
BH NO :		FARM POND E		DATE :		11.08.98	
GEOLOGY :		WEATHERED ROCK		WEATHER :		CLEAR & COOL	
DEPTH	BLOWS / PENETRATION						REMARKS
AT 2.00m							
NO. OF BLOWS	40						
PENETRATION (mm)	38						
ADJUSTED NO OF BLOWS	+ 200						
PENETRATION AT ADJUSTED BLOWS	300						
N VALUE	+ 200						No Recovery
AT 3.00m							
NO. OF BLOWS	40						
PENETRATION (mm)	28						
ADJUSTED NO OF BLOWS	+ 200						
PENETRATION AT ADJUSTED BLOWS	300						
N VALUE	+ 200						No Recovery
AT 4.00m							
NO. OF BLOWS	40						
PENETRATION (mm)	32						
ADJUSTED NO OF BLOWS	+ 200						
PENETRATION AT ADJUSTED BLOWS	300						
N VALUE	+ 200						No Recovery
AT 5.00m							
NO. OF BLOWS	40						
PENETRATION (mm)	0						
ADJUSTED NO OF BLOWS	+ 200						
PENETRATION AT ADJUSTED BLOWS	300						
N VALUE	+ 200						40 Blows & Bouncing No Recovery
AT							
NO. OF BLOWS							
PENETRATION (mm)							
ADJUSTED NO OF BLOWS							
PENETRATION AT ADJUSTED BLOWS							
N VALUE							
AT							
NO. OF BLOWS							
PENETRATION (mm)							
ADJUSTED NO OF BLOWS							
PENETRATION AT ADJUSTED BLOWS							
N VALUE							

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8. ポンプ水撃圧作用の検討

1. 検討目的

ポンプ停電時に生じる水撃作用を検討する。

2. 検討方法

流体過渡現象解析プログラムを使用する。

3. 基本条件

(1) ポンプ

ポンプ名称	: 揚水ポンプ
設置台数	: 3台
運転台数	: 3台
定格吐出力	: 8.63m ³ /min
全揚程	: 60m
定格回転数	: 1,500/min
ポンプ効率	: 71%

(2) 電動機及びGD²値

電動機出力	: 132kW
電動機型式	: かご形
電動機電圧	: 400V
電動機周波数	: 50Hz
電動機極数	: 4P
電動機GD ² 値	: 5.3 kg・m
ポンプGD ² 値	: 6.0 kg・m

(3) 逆止弁

逆止弁口径	: 300mm
対策前逆止弁形式	: 普通逆止弁

(4) 管路

送水管管種	: FRPM管
送水管口径	: 600mm
送水管管厚	: 12mm
K/E値	: 0.15
圧力伝播速度	: 488m/sec
区間管路長	: 1,400m
C値	: 150

区間損失水頭 : 4.65m

(5)運転状態における諸条件値

送水条件 : 計画最大水量
 送水量 : 25.89m³/min
 吸込み水位 : L.W.L.=799.80m
 吐出し水位 : H.W.L.=852.20m
 実揚程 : 52.40m
 管路損失水頭 : 4.65m
 場内損失水頭 : 2.95m
 ポンプ流量比 : 100%
 全揚程比 : 100%

4.検討結果

(1)対策前

対策前 GD²値に基づく検討結果は、以下のとおりである。

区 分	圧力 (kgf/cm ²)	管路起点からの距離 (m)	管路高さ (m)	備考
最低時	-3.278	1,050	835.25	—
最高時	—	—	—	—

上表に示すとおり、水中分離が発生し対策が必要である。

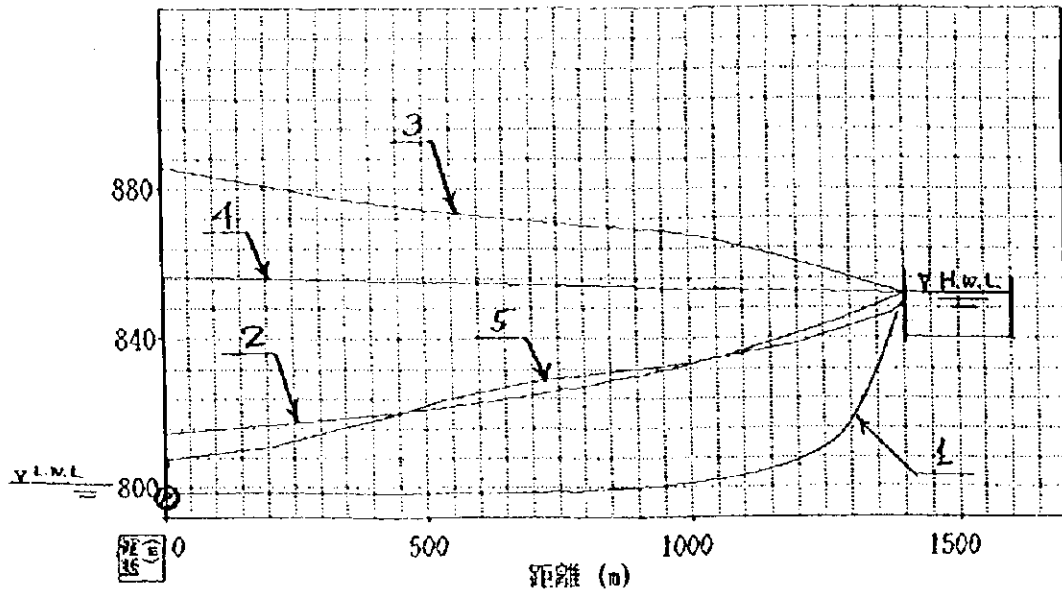
(2)対策後

対策として、フライホイールを設置し、GD²値を向上させる。

フライホイール GD²値 : 100.0 kg・m
 合計 GD²値 : 111.3 kg・m

区 分	圧力 (kgf/cm ²)	管路起点からの距離 (m)	管路高さ (m)	備考
最低時	-0.355	699.9	829.0	—
最高時	8.700	起点部	799.0	—

上表に示すとおり、負圧が発生するが、水中分離が発生の恐れはない。また最高圧力については、管路の許容内圧が 10bar(=9.80kgf/cm²)であるから、安全である。



最高・最低压力线图

- 1: 对策前最低压力线
- 2: 对策后最低压力线
- 3: 对策后最高压力线
- 4: 动水勾配线
- 5: 管路纵断

9. ポンプ台数の検討

1. ポンプ場工事費の比較

(1) 機器設備・土木・建築工事

機器名称	2台案		3台案		4台案	
	数量	価格	数量	価格	数量	価格
A. 機械設備						
1. 主ポンプ	2台	17,360,000	3台	20,400,000	4台	24,960,000
2. 電動機	2台	17,520,000	3台	15,000,000	4台	17,600,000
3. 電動スルース弁	2台	3,780,000	3台	5,070,000	4台	5,680,000
4. 手動スルース弁	2台	2,280,000	3台	2,550,000	4台	2,640,000
5. 逆止弁	2台	1,400,000	3台	1,650,000	4台	1,040,000
6. 場内排水ポンプ	2台	720,000	2台	720,000	2台	720,000
7. 吸吐出管	1式	5,600,000	1式	5,792,176	1式	6,300,000
8. 水位計	1台	800,000	1台	800,000	1台	800,000
9. 天井クレーン	1基	1,320,000	1基	1,000,000	1基	1,000,000
10. 天井クレーン	1基	6,680,000	1基	5,500,000	1基	5,500,000
11. 送風機	2台	600,000	2台	600,000	2台	600,000
12. 井戸ポンプ	1台	1,020,000	1台	1,020,000	1台	1,020,000
13. 高架水槽	1基	450,000	1基	450,000	1基	450,000
14. パースクリーン	1式	650,000	1式	650,000	1式	650,000
15. 予備品	1式	1,800,000	1式	1,662,000	1式	1,550,000
16. 据付材料	1式	2,200,000	1式	1,830,680	1式	1,600,000
小計		64,180,000		64,694,856		72,110,000
B. 電気設備						
1. 低圧引込盤	1面	7,200,000	1面	7,200,000	1面	7,200,000
2. 主ポンプ盤	2面	10,400,000	3面	14,400,000	4面	19,200,000
3. 補機盤	1面	5,600,000	1面	5,600,000	1面	5,600,000
4. 現場盤	2面	1,600,000	3面	2,400,000	4面	3,200,000
5. 電源盤	1面	250,000	1面	250,000	1面	250,000
6. 予備品	1式	375,000	1式	375,000	1式	375,000
7. 配線材料	1式	3,660,000	1式	3,175,470	1式	3,020,000
小計		29,085,000		33,400,470		38,845,000
C. ポンプ機器据付費	1式	6,226,651	1式	6,549,097	1式	7,407,689
D. 上屋工	127.5㎡	4,201,253	146㎡	4,810,840	178.25㎡	5,873,516
E. 下部工	127.5㎡	28,680,105	146㎡	32,841,567	178.25㎡	40,095,912
合計		132,373,009		142,296,830		164,332,117
		(0.93)		(1.00)		(1.15)

注1. ポンプ機器据付費は3台案で積算額の比率： $(A+B) \times 0.066763$ を使用。

注2. 上屋工は3台案・積算額の32,951円/㎡を使用。

注3. 下部工は3台案・積算額の224,942円/㎡を使用。

(2) 電気料金

F. 年間電気料金		2,237,814		1,765,927		2,029,633
G. その他電気廻費用	F×20%	447,563	F×20%	353,185	F×20%	405,927
合計		2,685,377		2,119,112		2,435,560
H. 20年間電気料金	小計×20	53,707,540	小計×20	42,382,240	小計×20	48,711,200

注4. ポンプ機器・設備の耐用年数は20年と設定。

(3) 総合比較

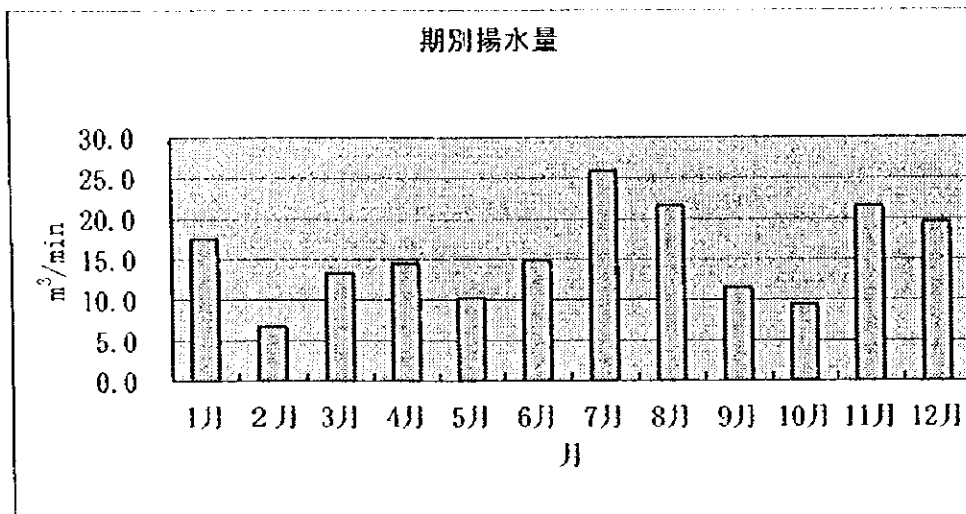
総計 (①+②)	186,080,519 (1.01)	181,679,070 (1.00)	213,043,317 (1.15)
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結論：耐用年数20年とした比較において、ポンプ3台案が最も経済的であると判断された。またポンプの危険分散や汎用部品(φ300mm以下)の入手の容易さを考えると、φ300mm以下のポンプの導入が適当と判断された。従って、3台分割案が最適と考えられる。

2.電気料金算定根拠

(1) 期別用水量 (Dブロック)

項目	1月	2月	3月	4月	5月	6月	7月	8月	9月	10月	11月	12月
月当り (千 m^3)	261.1	90.4	197.7	208.8	151.3	215.2	385.3	320.8	165.3	140.5	309.6	291.1
分当り (m^3/min)	17.5	6.7	13.3	14.5	10.2	14.9	25.9	21.6	11.5	9.4	21.5	19.6



(2) 設定吐出量、及びモータ出力

項目	ポンプ口径	吐出量	⇒	設定吐出量	モータ出力
2台案	φ350mm	12.0~18.0 m^3/min		18.0 m^3/min	220kW
3台案	φ300mm	8.0~12.0 m^3/min		12.0 m^3/min	132kW
4台案	φ250mm	5.0~8.0 m^3/min		8.0 m^3/min	110kW

(3) ポンプ稼働台数

項目	1月	2月	3月	4月	5月	6月	7月	8月	9月	10月	11月	12月	計
2台案	1	1	1	1	1	1	2	2	1	1	2	2	16台・月
3台案	2	1	2	2	1	2	3	2	1	1	2	2	21台・月
4台案	3	1	2	2	2	2	4	3	2	2	3	3	29台・月

(d) 電気料金

電気料金 = 基本料金(月) + 使用電力料金(kWh)
基本料金 : 181.26 Z\$/月 (ジンバブエ電力公社料金表より)
使用電力量 : 33.83 Zc/kWh (ジンバブエ電力公社料金表より)

項目	基本料金	使用電力料金	計	備考
2台案	181.26×12ヶ月	0.3383×220kw×(16台×30日×80時間)	Z\$ 288,007	¥2,237,814
3台案	同上	0.3383×132kw×(21台×30日×80時間)	Z\$ 227,275	¥1,765,927
4台案	同上	0.3383×110kw×(29台×30日×80時間)	Z\$ 261,214	¥2,029,633

ポンプ形式及び口径の決定方法

関連条項〔基準9, 運用9-3〕

ポンプの標準口径と吐出量

ポンプの標準口径と吐出量の関係は、おおむね表-8.1及び表-8.2のとおりであるが、吐出量の範囲はポンプ形式、全揚程によって異なることがあるので、ポンプ口径は図-8.3～図-8.7により決定する。

表-8.1 高揚程ポンプの標準口径と吐出量

標準口径 (mm)	周波数 (Hz)	吐出量 (m ³ /min)	標準口径 (mm)	周波数 (Hz)	吐出量 (m ³ /min)	標準口径 (mm)	周波数 (Hz)	吐出量 (m ³ /min)
50	50	0.20~0.35	250	50	5~8	700	50	50~70
	60	0.20~0.35		60				
65	50	0.35~0.45	300	50	8~12	800	50	70~90
	60	0.35~0.50		60				
80	50	0.45~0.70	350	50	12~18	900	50	90~115
	60	0.50~0.80		60				
100	50	0.70~1.20	400	50	18~23	1,000	50	115~150
	60	0.80~1.25		60				
125	50	1.20~1.80	450	50	23~28	1,200	50	150~200
	60	1.25~2.00		60				
150	50	1.80~3.00	500	50	28~36		50	
	60	2.00~3.50		60				
200	50	3.00~5.00	600	50	36~50		50	
	60	3.50~5.00		60				

- 注1) ポンプの標準口径は、「立軸斜流ポンプ」の場合は吐出口径を、他のポンプにおいては、吸込口径を表す。
 2) 渦巻ポンプにおいては、標準口径は標準揚程約25mにおけるものを示してある。渦巻ポンプは、その特性上揚程が高くなると口径が小さくなることもある。

表-8.2 低揚程ポンプの標準口径と吐出量

標準口径 (mm)	吐出量 (m ³ /min)	標準口径 (mm)	吐出量 (m ³ /min)	標準口径 (mm)	吐出量 (m ³ /min)
400	12~23	1,000	115~150	2,000	480~600
500	23~36	1,200	150~200	2,200	600~740
600	36~50	1,350	200~255	2,400	740~850
700	50~70	1,500	255~325	2,600	850~1,000
800	70~90	1,650	325~400	2,800	1,000~1,150
900	90~115	1,800	400~480		

- 注1) ポンプの標準口径は、「立軸軸流・斜流ポンプ」の場合は吐出口径を、他のポンプにおいては吸込口径を表す。

10. ポンプ機場浮力に対する検討

1. 機場のうける浮力

	$7.70 \times 19.00 \times 10.90 \times 1.00$	= 1,595 ton
	$0.35 \times 4.20 \times 19.00 \times 2 \times 1.00$	= 56 ton
合計		= 1,651 ton

2. 抵抗力

側壁	$0.90 \times 10.10 \times 19.00 \times 2 \times 2.50$	= 864 ton
	$0.90 \times 10.10 \times 5.90 \times 2 \times 2.50$	= 268 ton
	$0.35 \times 4.20 \times 19.00 \times 2 \times 2.50$	= 140 ton
底版	$7.70 \times 19.00 \times 1.20 \times 2.50$	= 439 ton
頂版	$7.70 \times 19.00 \times 0.60 \times 2.50$	= 219 ton
土重	$0.35 \times 6.70 \times 19.20 \times 1.00$	= 45 ton
ポンプ機器類		= 35 ton
合計		= 2,010 ton

3. 結論

$$\text{安全率} = (\text{抵抗力}) \div (\text{機場のうける浮力}) = 2,010 / 1,651 = 1.22$$

上部工の荷重を考慮しなくても安全率 1.20 を確保することができるので、浮力に対して安全である。

11. 機場下部工構造計算

1. 設計条件

土地改良事業計画設計基準設計「ポンプ場」基準書・技術書 農林水産省構造改善局 平成 9 年 1 月 (以下、ポンプ場基準書)、土地改良事業計画設計基準等「水路工その 1」(以下、水路工その 1)、等に基づき次のように定める。

1) 単位体積重量

種 類	単位体積重量 (tf/m ³)
鉄筋コンクリート	2.50
無筋コンクリート	2.35
湿 潤 土 (γ)	1.80
水 中 土 (γ')	1.00
飽 和 土 (γ _s)	2.00
水 (γ _w)	1.00

(ポンプ場基準書 p. 293)

2) 使用する土圧公式 (常時のみを考慮する)

① 静止土圧係数 $k_a=0.50$

$$\textcircled{2} K_a = \frac{\cos^2(\phi + j) \cdot \cos \delta}{\cos j \cdot \cos(\delta - j) \cdot \left\{ 1 + \left[\frac{\sin^2(\phi + \delta) \cdot \sin(\phi - \alpha)}{\cos(i + j) \cdot \cos(\delta - j)} \right]^{1/2} \right\}^2}$$

①、②の土圧係数のうち、静止土圧の方が大きい方ので、これを採用する。

$$K_a = \frac{\cos^2(\phi + j) \cdot \cos \delta}{\cos j \cdot \cos(\delta - j) \cdot \left\{ 1 + \left[\frac{\sin^2(\phi + \delta) \cdot \sin(\phi - \alpha)}{\cos(i + j) \cdot \cos(\delta - j)} \right]^{1/2} \right\}^2}$$

ここに、
 ϕ : 土の内部摩擦角 (=30°)
 j : 壁背面と鉛直面のなす角度 (=0°)
 δ : 土と壁面との摩擦角 (=0°)
 i : 盛土の傾斜角 (=0°)

$$K_a = \frac{\cos^2 30 \cdot \cos 0}{\cos 0 \cdot \cos 0 \cdot \left\{ 1 + \left[\frac{\sin^2 30 \cdot \sin 30}{\cos 0 \cdot \cos 0} \right]^{1/2} \right\}^2} = \frac{0.75}{\left[1 + \left(\frac{0.125}{1} \right)^{1/2} \right]^2} = 0.409$$

3) 許容応力度

鉄筋コンクリートの許容応力度は、以下のとおり。

許容応力度 (kgf/cm ²)		設計基準強度 (kgf/cm ²)	210	備考
曲げ圧縮 (σ _{ca})			80	
剪断	斜め引張り鉄筋の計算をしない場合 (τ _{a1})	梁の場合	4.2	
		スラブの場合	8.5	
	斜め引張り鉄筋の計算をする場合 (τ _{a2})	剪断力のみの場合	19	
付着	異型棒鋼 (τ _{oa2})		15	

(ポンプ場基準書 p. 294)

鉄筋の許容応力度は、以下のとおり。

応力度、部材の種類		鉄筋の種類	SD295A SD295B	備考
引張り 応力 度	荷重の組み合わせに衝突荷重あるいは地震の影響を含まない場合	一般の部材	1,800	
		水中あるいは地下水以下に設け部材	1,600	
	鉄筋の重ね継手長あるいは定着長を算出する場合		1,800	

(ポンプ場基準書 p. 295)

4) 鉄筋の継手長

引張り鉄筋の重ね継手および定着の長さは、次式で求めた長さ L 以上で、かつ鉄筋直径の 20 倍以上とする。(ポンプ場基準書 p. 295)

$$L = \frac{\sigma_{sa}}{4 \cdot \tau_{oa}} \cdot \phi$$

ここに、L : 継手および定着長さ (cm)

σ_{sa} : 鉄筋の許容引張り応力度 (=1,800kgf/cm²)

τ_{oa} : コンクリートの許容付着応力度 (=15kgf/cm²)

φ : 鉄筋の直径 (cm)

上式より、継手および定着長さは鉄筋直径の 30 倍とする。

5) 鉄筋の定着

引張り鉄筋の端部は、原則として引張り応力の受けないコンクリートに定着する。やむを得ずコンクリートの引張り部に鉄筋を定着させる場合には、鉄筋は計算上曲げ応力を受

ける必要のなくなった点から部材の有効高さに等しい距離だけ延長し、そこから必要な定着長以上を延ばす。(ポンプ場基準書 p. 295)

6) 群集荷重

側壁に作用する群集荷重は、大型自動車の入らない耕作道の値とし、 300kgf/m^2 を採用する。(水路工その1 p. 82)

7) 最小鉄筋量

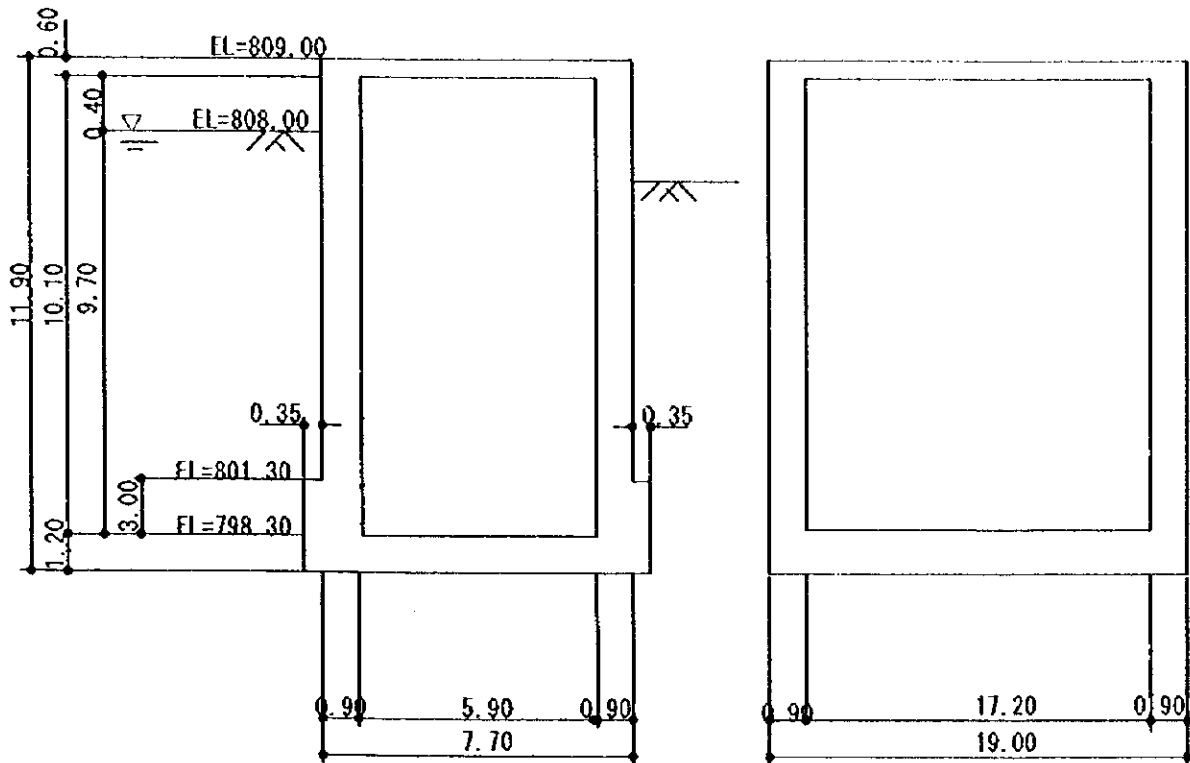
最小鉄筋量は、以下により求める。

- | | |
|---|-------|
| ① 継目間隔が 9m 以下で土に接する面 | 0.10% |
| ② 継目間隔が 9m 以下で土に接しないで凍結や直射日光を受けない面 | 0.15% |
| ③ 継目間隔が 9m 以下で土に接しないで凍結や直射日光を受ける面 | 0.20% |
| ④ 継目間隔が 9m を超えるものについては 0.05%追加する | |
| ⑤ スラブが一端固定されている場合、固定端から自由端までの長さが 9m を超えるか否かにより①～④を準用する。 | |

ただし、部材厚は 45cm を上限とする。(水路工その1 p. 122)

2. 構造寸法

構造計算は、下記の断面においてボックスラーメンとして解く。



3. 荷重計算

頂版

パネル、事務機器他		=10ton
m ² 当り	10ton/(6.80×18.10)	=0.081 ton/m ²
群集荷重		=0.300 ton/m ²
自重	$\gamma_c \cdot t = 2.50 \times 0.60$	=1.500 ton/m ²
合計		=1.881 ton/m ²

側壁上部・EL=808.0m

群衆荷重	$K_a \cdot q = 0.50 \times 0.300$	=0.150 ton/m ²
------	-----------------------------------	---------------------------

側壁下部・EL=801.3m 地点

群衆荷重	$K_a \cdot q = 0.50 \times 0.300$	= 0.150 ton/m ²
水平土圧 I	$K_a \cdot \gamma' \cdot H = 0.50 \times 1.00 \times 6.70$	= 3.350 ton/m ²
水圧	$\gamma_w \cdot H = 1.00 \times 6.70$	= 6.700 ton/m ²

合計 $=10.200 \text{ ton/m}^2$

側壁下部・EL=797.7m地点

群衆荷重 $Ka \cdot q = 0.50 \times 0.300 = 0.150 \text{ ton/m}^2$
水平土圧1 $Ka \cdot \gamma' \cdot H = 0.50 \times 1.00 \times 10.30 = 5.150 \text{ ton/m}^2$
水圧 $\gamma_w \cdot H = 1.00 \times 10.30 = 10.300 \text{ ton/m}^2$
合計 $=15.600 \text{ ton/m}^2$

底版

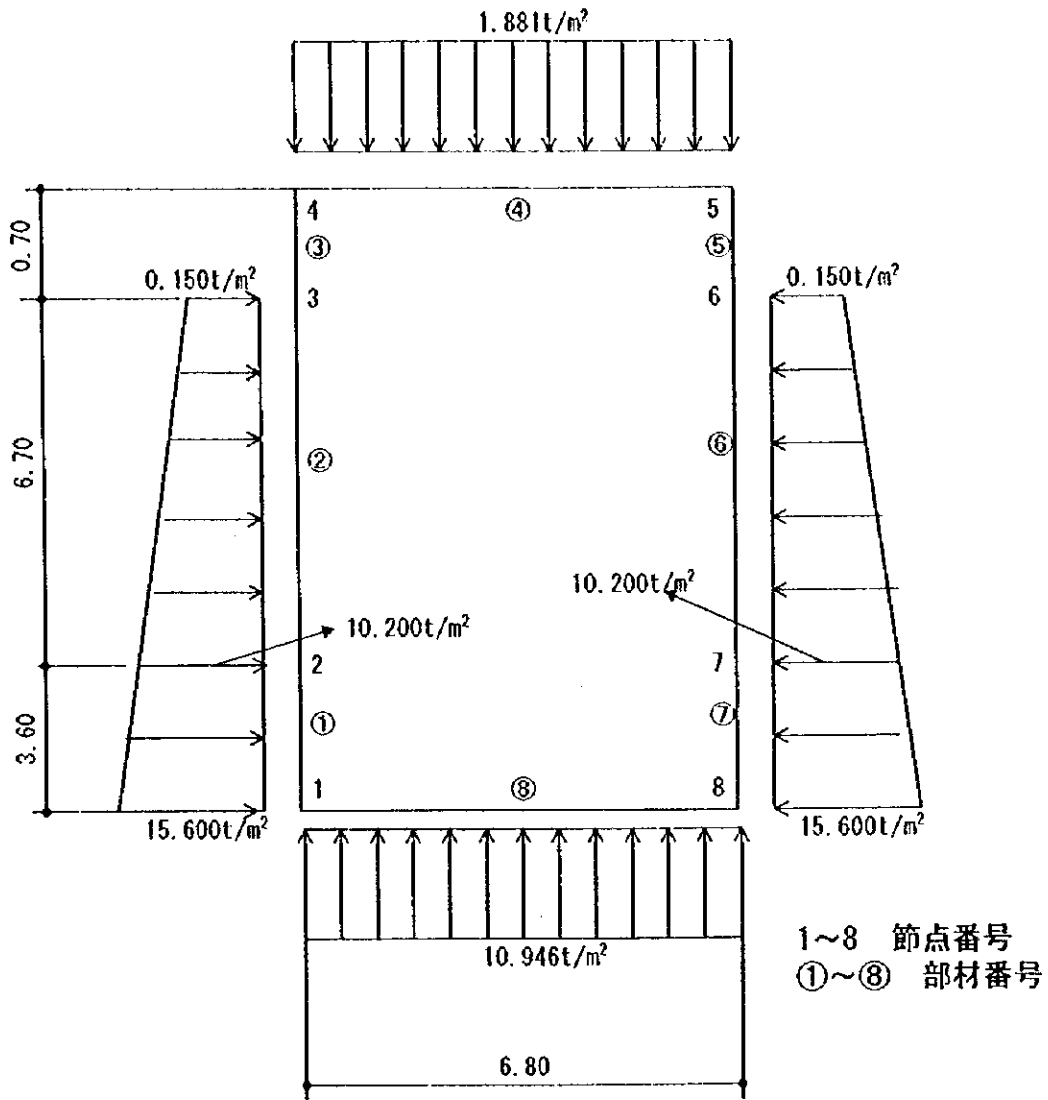
側壁重量 $(1.25 \times 3.00 + 0.90 \times 7.10) \times 2.50 \times 2 = 50.70 \text{ ton/m}$
側壁土重 $0.35 \times 6.70 \times 1.00 \times 2 = 4.69 \text{ ton/m}$
合計 $= 55.39 \text{ ton/m}$
m²当り $55.39/6.80 = 8.146 \text{ ton/m}^2$
頂版自重 $0.60 \times 2.50 = 1.500 \text{ ton/m}^2$
上部工荷重 $= 1.000 \text{ ton/m}^2$
群集荷重 $= 0.300 \text{ ton/m}^2$
合計 $=10.946 \text{ ton/m}^2$

上部工荷重計算

壁ブロック類 70ton
柱 20ton
パネル、事務機器他 10ton
屋根、トラス、クレーン類 20ton
合計 120ton
m²あたり $120\text{ton}/(18.10\text{m} \times 6.80\text{m}) = 0.975\text{ton/m}^2$

その他荷重を考慮して上部工荷重は 1.00ton/m^2 とする。

4. 荷重図



1~8 節点番号
①~⑧ 部材番号

5. モーメント、剪断力の計算

***** データー出力 *****

節点数 全要素数 X, Y 方向変位拘束節点数 部材回転角拘束節点数 ヒンジ部節点数
 NODT= 8 NHELT= 8 KOX= 1 KOY= 2 KOZ= 0 NHINGE= 0

部材番号	節点番号	部材断面積	断面二次モーメント
1	1- 2	1.25000	0.16276
2	2- 3	0.90000	0.06075
3	3- 4	0.90000	0.06075
4	4- 5	0.60000	0.01800
5	5- 6	0.90000	0.06075
6	6- 7	0.90000	0.06075
7	7- 8	1.25000	0.16276
8	8- 1	1.20000	0.14400

***** X 方向 変位拘束節点番号 *****

1

***** Y 方向 変位拘束節点番号 *****

1 8

***** 外力 *****

NO= 1 分布荷重 QX= 15.600 10.200
 位 置 XLX= 0.000 3.600
 NO= 2 分布荷重 QX= 10.200 0.150
 位 置 XLX= 0.000 6.700
 NO= 3 ** 無荷重 *****
 NO= 4 分布荷重 QX= 1.881 1.881
 位 置 XLX= 0.000 6.800
 NO= 5 ** 無荷重 *****
 NO= 6 分布荷重 QX= -0.150 -10.200
 位 置 XLX= 0.000 6.700
 NO= 7 分布荷重 QX=-10.200 -15.600
 位 置 XLX= 0.000 3.600
 NO= 8 分布荷重 QX=-10.946 -10.946
 位 置 XLX= 0.000 6.800

***** モーメント、及びせん断力 *****

部材	位置 (M)	せん断力 (T)	軸力 (T)	MOMENT (T-M)	所要AS (CM2)	必要厚 (CM)	鉄筋量 (CM2)	有効厚 (CM)	剪断応力 (KG/CM2)
1- 2	0.000	62.900	6.381	-98.819	74.323	87.601	47.979	119.000	6.099
	0.360	57.381	6.381	-77.174	65.954	78.186	37.498	119.000	5.564
	0.720	52.057	6.381	-57.482	57.348	68.505	27.964	119.000	5.048
	1.080	46.927	6.381	-39.673	48.351	58.383	19.341	119.000	4.550
	1.440	41.991	6.381	-23.677	38.666	47.488	11.596	119.000	4.072
	1.800	37.250	6.381	-9.427	27.597	35.034	4.696	119.000	3.612
	2.160	32.703	6.381	3.148	21.195	27.832	1.656	119.000	3.171
	2.520	28.351	6.381	14.117	31.627	39.568	6.967	119.000	2.749
	2.880	24.193	6.381	23.550	38.580	47.391	11.534	119.000	2.346
	3.240	20.229	6.381	31.515	43.661	53.106	15.391	119.000	1.961
3.600	16.460	6.381	38.169	47.519	57.447	18.613	119.000	1.596	
2- 3	0.000	16.460	6.381	38.169	46.257	56.028	26.313	84.000	2.261
	0.670	9.963	6.381	46.982	51.067	61.438	32.358	84.000	1.369
	1.340	4.139	6.381	51.664	53.457	64.127	35.570	84.000	0.569
	2.010	-1.012	6.381	52.659	53.952	64.684	36.253	84.000	0.139
	2.680	-5.489	6.381	50.416	52.830	63.422	34.714	84.000	0.754
	3.015	-7.475	6.381	48.220	51.709	62.160	33.207	84.000	1.027
	3.350	-9.293	6.381	45.381	50.225	60.491	31.260	84.000	1.276
	4.020	-12.423	6.381	38.000	46.161	55.919	26.197	84.000	1.707
	4.690	-14.881	6.381	28.720	40.522	49.575	19.832	84.000	2.044
	5.360	-16.665	6.381	17.987	32.929	41.033	12.470	84.000	2.289
6.030	-17.775	6.381	6.249	22.175	28.934	4.418	84.000	2.442	
6.700	-18.212	6.381	-5.484	21.312	27.964	3.893	84.000	2.502	
3- 4	0.000	-18.212	6.381	-5.484	21.310	27.962	3.892	84.000	2.502
	0.140	-18.212	6.381	-8.033	24.080	31.077	5.642	84.000	2.502
	0.280	-18.212	6.381	-10.583	26.595	33.908	7.391	84.000	2.502
	0.420	-18.212	6.381	-13.133	28.917	36.519	9.140	84.000	2.502
	0.560	-18.212	6.381	-15.684	31.083	38.956	10.890	84.000	2.502
	0.700	-18.212	6.381	-18.234	33.121	41.249	12.639	84.000	2.502

***** モーメント、及びせん断力 *****

部材	位置 (M)	せん断力 (T)	軸力 (T)	MOMENT (T-M)	所要AS (CM ²)	必要厚 (CM)	鉄筋量 (CM ²)	有効厚 (CM)	剪断応力 (KG/CM ²)
4- 5	0.000	6.410	18.212	-18.234	29.873	44.990	19.830	54.000	1.370
	0.680	5.128	18.212	-14.328	26.988	41.744	15.664	54.000	1.096
	1.360	3.846	18.212	-11.294	24.580	39.035	12.427	54.000	0.823
	2.040	2.564	18.212	-9.130	22.754	36.981	10.117	54.000	0.550
	2.720	1.282	18.212	-7.835	21.612	35.697	8.736	54.000	0.276
	3.400	-0.000	18.212	-7.410	21.229	35.265	8.282	54.000	0.000
	4.080	-1.282	18.212	-7.835	21.630	35.717	8.757	54.000	0.276
	4.760	-2.564	18.212	-9.130	22.789	37.020	10.160	54.000	0.550
	5.440	-3.846	18.212	-11.294	24.629	39.090	12.491	54.000	0.823
	6.120	-5.128	18.212	-14.328	27.049	41.812	15.749	54.000	1.096
6.800	-6.410	18.212	-18.234	29.944	45.069	19.936	54.000	1.370	
5- 6	0.000	18.212	6.410	-18.234	33.200	41.356	12.707	84.000	2.502
	0.140	18.212	6.410	-15.684	31.168	39.070	10.958	84.000	2.502
	0.280	18.212	6.410	-13.133	29.009	36.641	9.209	84.000	2.502
	0.420	18.212	6.410	-10.583	26.696	34.040	7.460	84.000	2.502
	0.560	18.212	6.410	-8.033	24.192	31.222	5.711	84.000	2.502
	0.700	18.212	6.410	-5.484	21.438	28.124	3.962	84.000	2.502
6- 7	0.000	18.212	6.410	-5.484	21.438	28.124	3.962	84.000	2.502
	0.670	17.775	6.410	6.249	22.473	29.288	4.598	84.000	2.442
	1.340	16.665	6.410	17.987	33.012	41.145	12.541	84.000	2.289
	2.010	14.881	6.410	28.720	40.515	49.586	19.826	84.000	2.044
	2.680	12.423	6.410	38.000	46.114	55.885	26.145	84.000	1.707
	3.015	9.293	6.410	45.381	46.114	55.885	26.145	84.000	1.276
	3.350	7.475	6.410	48.220	50.169	60.446	31.192	84.000	1.027
	4.020	5.489	6.410	50.416	52.787	63.392	34.662	84.000	0.751
	4.690	1.012	6.410	52.659	53.944	64.693	36.247	84.000	0.139
	5.360	-4.139	6.410	51.664	53.505	64.199	35.641	84.000	0.569
	6.030	9.963	6.410	46.982	51.200	61.606	32.538	84.000	1.369
	6.700	16.460	6.410	38.169	46.198	55.979	26.245	84.000	2.261

***** モーメント、及びせん断力 *****

部材	位置 (M)	せん断力 (T)	軸力 (T)	MOMENT (T-M)	所要AS (CM ²)	必要厚 (CM)	鉄筋量 (CM ²)	有効厚 (CM)	せん断応力 (KG/CM ²)
7- 8	0.000	-16.460	6.410	38.169	47.467	57.406	18.565	119.000	1.596
	0.360	-20.229	6.410	31.515	43.639	53.100	15.370	119.000	1.961
	0.720	-24.193	6.410	23.550	38.542	47.366	11.502	119.000	2.346
	1.080	-28.351	6.410	14.117	31.570	39.522	6.926	119.000	2.749
	1.440	-32.703	6.410	3.148	21.108	27.753	1.610	119.000	3.171
	1.800	-37.250	6.410	-9.427	27.703	35.172	4.745	119.000	3.612
	2.160	-41.991	6.410	-23.677	38.738	47.587	11.643	119.000	4.072
	2.520	-46.927	6.410	-39.673	48.401	58.457	19.383	119.000	4.550
	2.880	-52.057	6.410	-57.482	57.380	68.559	27.997	119.000	5.048
	3.240	-57.381	6.410	-77.174	65.969	78.222	37.520	119.000	5.564
3.600	-62.900	6.410	-98.819	74.355	87.656	48.027	119.000	6.099	
8- 1	0.000	37.370	62.900	-98.919	63.657	110.926	51.293	114.000	3.782
	0.680	29.899	62.900	-76.046	56.810	103.224	39.734	114.000	3.026
	1.360	22.428	62.900	-58.255	51.109	96.810	30.741	114.000	2.270
	2.040	14.957	62.900	-45.544	46.792	91.954	24.317	114.000	1.514
	2.720	7.486	62.900	-37.914	44.088	88.912	20.460	114.000	0.758
	3.400	0.000	62.900	-35.363	43.163	87.871	19.171	114.000	0.000
	4.080	-7.486	62.900	-37.917	44.081	88.904	20.450	114.000	0.758
	4.760	-14.957	62.900	-45.544	46.779	91.938	24.297	114.000	1.514
	5.440	-22.428	62.900	-58.255	51.089	96.788	30.711	114.000	2.270
	6.120	-29.899	62.900	-76.046	56.786	103.196	39.693	114.000	3.026
6.800	-37.370	62.900	-98.819	63.628	110.894	51.243	114.000	3.782	