6.4. Operation and Maintenance Plan

6.4.1. Operation and Maintenance Organization

Organization of NIA

Since the Bohol Irrigation project belongs to the National Irrigation System, the operation and maintenance after completion of the project implementation will be supervised by NIA Assistant Administrator for Operation. The entire project facilities after completion are to be turned over to the Regional Irrigation Office VII and operated and maintained under its office. Actual operation and maintenance works are carried out by the Bohol Irrigation System Office, which will newly established in Bohol province.

The implementation of Bohol Irrigation Project is presently divided into two stages of Phase I and Phase II, and the Phase I project is under implementation stage and will be completed by 1988. Accordingly the proposed Bohol Irrigation System Office to operation and maintenance will be established at first for the Phase I project.

Since the Bohol Irrigation Projects of Phase I and Phase II have similar facilities and are closely related to each other from viewpoint of water operation which uses the diverting water from the Malinao dam, the operation and maintenance should be made with the same organization, namely, the organization established in Phase I project will be available also for Phase II operation and maintenance expanding its organization capacity.

Proposed organization chart for Bohol Irrigation System after integrating the Phase II system is shown in FIGURE 6-5. The office headed by an irrigation superintendent comprises of two sections: Operation & Maintenance Section and Administrative Section. The

Operation & Maintenance Section is responsible for engineering matters of system, major repairs of facilities, and supervising of operation and maintenance through zone offices. Administrative section serves personnel and records management, collection services and others.

Two Zone Offices will be founded for operation and maintenance of two irrigation systems: One is Zone I for Phase I area, and the other is Zone II for Phase II area respectively. Each zone area will be divided into operation divisions to be directed by water masters. Each operation division will be divided into operation sections to be direct supervision of ditch tenders.

With regard to the proposed operation system, Zone II area will be divided into five operation divisions with average area of about 1,000 ha (see FIGURE 6-6). Each operation division would be divided into five to six operation sections with average service area for about 200 ha. The total number of rotation area of Zone II area will be 145, accordingly each ditch tender will be in charge of five to six rotation areas and each division will be responsible for about 30 rotation areas.

At the early stage of system management for the Phase II System, Zone II office will be responsible for operation and maintenance of the whole system. However, the part of operation and maintenance responsibility will be turned over to the Farmer Irrigators' Associations in accordance with the NIA strategy with regard to operation and maintenance of National Irrigation System.

Organization of Farmers

At the early stage of project implementation, beneficial farmers by the project should be organized into Farmer Irrigators' Group with the initiatives and assistant of NIA. Proposed Farmer Irrigators' Group is organized on turnout

level, then it will be integrated to the Associations on each operation division level to meet a corresponding NIA organization at operation and maintenance stage.

The Farmer Irrigators' Group will be responsible for operation and management of on-farm level facilities. With regard to day-to-day water management, the cooperation activities between NIA and the Irrigators Group is essential requirement for satisfactory operation management. In this regard, an additional grouping by the Irrigators' Groups corresponding to operation section of NIA is proposed, which is tentatively named as Water Management Group.

Federation of Farmer Irrigators' Association will be formed by all Associations in the Phase II project area in order to make one representative of the Associations in their dealing with NIA. FIGURE 6-7 shows proposed organization chart of farmers organizations.

6.4.2. Operation and Maintenance Plan

a) Water Supply from Phase I System

The surplus water from Phase I irrigation system is the most important water resources for Phase II irrigation system, which is generated as a result of water management of Phase I irrigation system. The operation rule of Phase I irrigation system for the Malinao reservoir is assumed as follows:

- Effective capacity of the Malinao reservoir of 5.0 MCM is solely utilized for the irrigation requirement of Phase I system.

- Surplus water at the Malinao reservoir is firstly used for recovery of reservoir up to the full water level.

Surplus water for Phase II irrigation system is delivered through main canal of Phase I irrigation system, together with the irrigation water for Phase I system. Accordingly, it is required that diversions and turnouts installed in Phase I main canal are adequately managed as not to divert any excess water which could be used for Phase II irrigation system.

In addition, Phase I main canal is required to be provided with a diversion spillway so as to divert surplus water to Phase II system automatically without any effect on the water delivery of Phase I irrigation system.

b) Physical Structure of Phase II Irrigation System

The Phase II irrigation system consists of two irrigation systems: one is the Bayongan irrigation system of 4,140 ha located at the upper reaches and the other is the Capayas irrigation system of 1,160 ha at the lower reaches. Accordingly, the Capayas reservoir has the function of regulating reservoir in the Phase II irrigation system.

The Capayas irrigation system has own water resources for the Bayang river at the watershed area of the Capayas reservoir. Accordingly, water management of the system is practiced independently as far as sufficient water from the river or storage water is available. When available water is insufficient for the irrigation requirement, supplementary water is delivered from the Bayongan irrigation system to meet the balance of water.

c) Operation and Maintenance Structure

Operation and maintenance of Phase II irrigation system is assumed to be undertaken by Zone II office in accordance with the operation rule which will be prepared by the Phase II irrigation project office during the implementation period.

The operation and maintenance works will be divided into two phases; one is for major irrigation facilities of reservoirs and main canals undertaken by Zone II office, and the other is for lateral canals in charge of each operation division. Accordingly, the formation and roles of water management personnel of Zone II system in accordance with the phased works is proposed as follows:

- The water management of major system is carried out by gate keepers manned at Zone II office under the direction of operation staff.

- The water management of lateral canals in each operation division is undertaken by gate keepers under the direction of water master.

- Ditch tenders in their sections are engaged in their principal works for supervision and management of rotation areas in their section through Farmer Irrigators' Group. For this end they are freed from routine labor works for maintenance of the system.

Operation and maintenance of on-farm facilities on turnout level are undertaken under the responsibility of Farmer Irrigators' Group on each turnout level. NIA renders them necessary technical assistance, heavy equipment work and material supply for repair and maintenance. The Farmer Irrigators' Group is responsible for the man power requirement for operation and maintenance of the Phase II system.

d) Planning of Seasonal Water Supply

Zone II Office will prepare the water supply plan for each crop season in accordance with proposed operation rule. When sufficient water is available at the beginning of crop season, water supply is planned to meet full irrigation requirement for normal cropping pattern.

On the contrary, when available water resource is insufficient for proposed cropping pattern at the beginning of crop season, the water supply plan is arranged by the discounted rate to all rotation area evenly in accordance with the magnitude of proposed deficit water.

e) Water Management of Major Irrigation Facilities

Two groups of gate keepers are charged with two irrigation systems of Bayongan and Capayas respectively. They cooperate with each other for systematic water supply and water control in main canals and reservoir, under the direction of operation staff of Zone II office.

Water distribution control for the Capayas irrigation system will be required more intensive water management than the Bayongan irrigation system to cope with fluctuation of reservoir water level caused by fluctuation of river discharge. Accordingly, it is proposed to assign a team of gate keepers in charge of water management.

f) Water Management at Lateral Canals

Water management at lateral canal is undertaken by each operation division directed by a water master who conducts day-to-day water management of lateral canals in his operation division. Two gate keepers and five to six ditch tenders are assigned at each operation division for operation and management of lateral canals.

Gate keepers in an operation division will distribute water to each turnout under the direction of a water master in accordance with water distribution plan. All turnout gate should be operated systematically by gate keepers to maintain the equal distribution and to prevent misoperation which might damage the lateral canal section.

Efficient feed back system from each operation division to Zone II office should be established in order to minimize waste water of total system. To this end, each water master should transmit practical information regarding irrigation requirement to Zone II office in order to revice water distribution plan.

g) Maintenance of Irrigation Facilities

Periodical cleaning and maintenance works of all irrigation facilities should be ruled in order to keep the facilities in good conditions for a long life. In this connection, it is assumed that periodical routine maintenance works for irrigation facilities are implemented by the participation for of members of Farmer Irrigators' Association or Irrigators' Group depending on the scale and extent of maintenance work.

h) Turn Over of the Operation and Maintenance Responsibility

The responsibility for operation and maintenance of lateral canals is assumed to be turned over to the Farmers Irrigators' Associations as the final goal. To this end, appropriate training and instructions for group leaders and personnel of the Associations should be conducted by the Zone II office, and personnel assigned to each operation division are selected from the residents who are qualified by Farmer Irrigators' Association.

6.4.3. Operation and Maintenance Cost

Operation and maintenance costs were estimated at about 3.1 million pesos per annum, and they are summarized as follows;

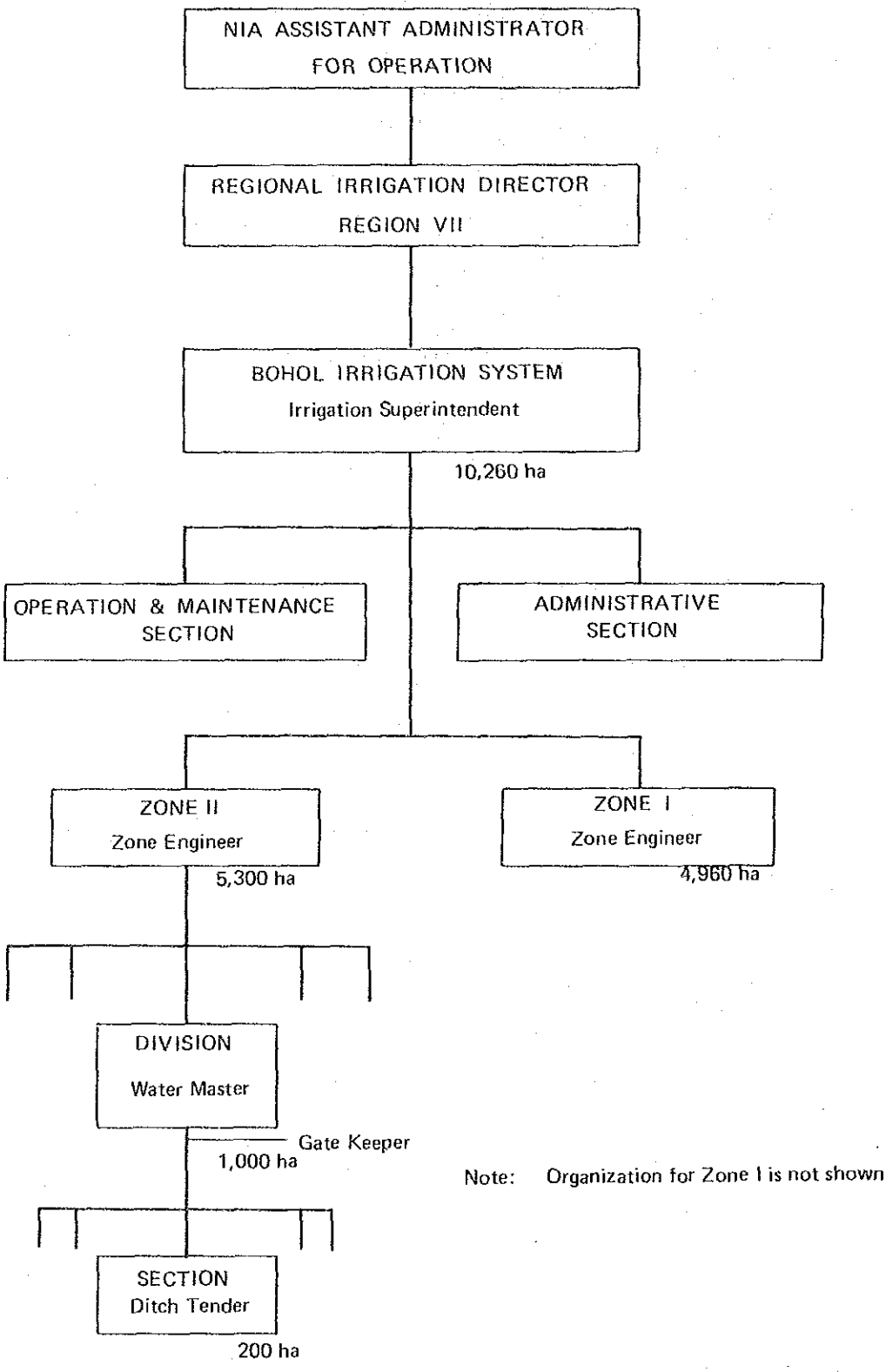
Annual Operation and Maintenance Cost

(Unit: 1,000 Pesos)

Description	Costs
Salary and Wages	913.1
Administration and General Expenditure	273.9
Equipment Repair and Depreciation Cost	1,040.0
Fuel Cost	508.0
Office Maintenance Cost	400.0
Total	3,135.0

Note: Details are given in Annex J, TABLE J2-20.

FIGURE 6-5 PROPOSED ORGANIZATION CHART FOR OPERATION AND MAINTENANCE



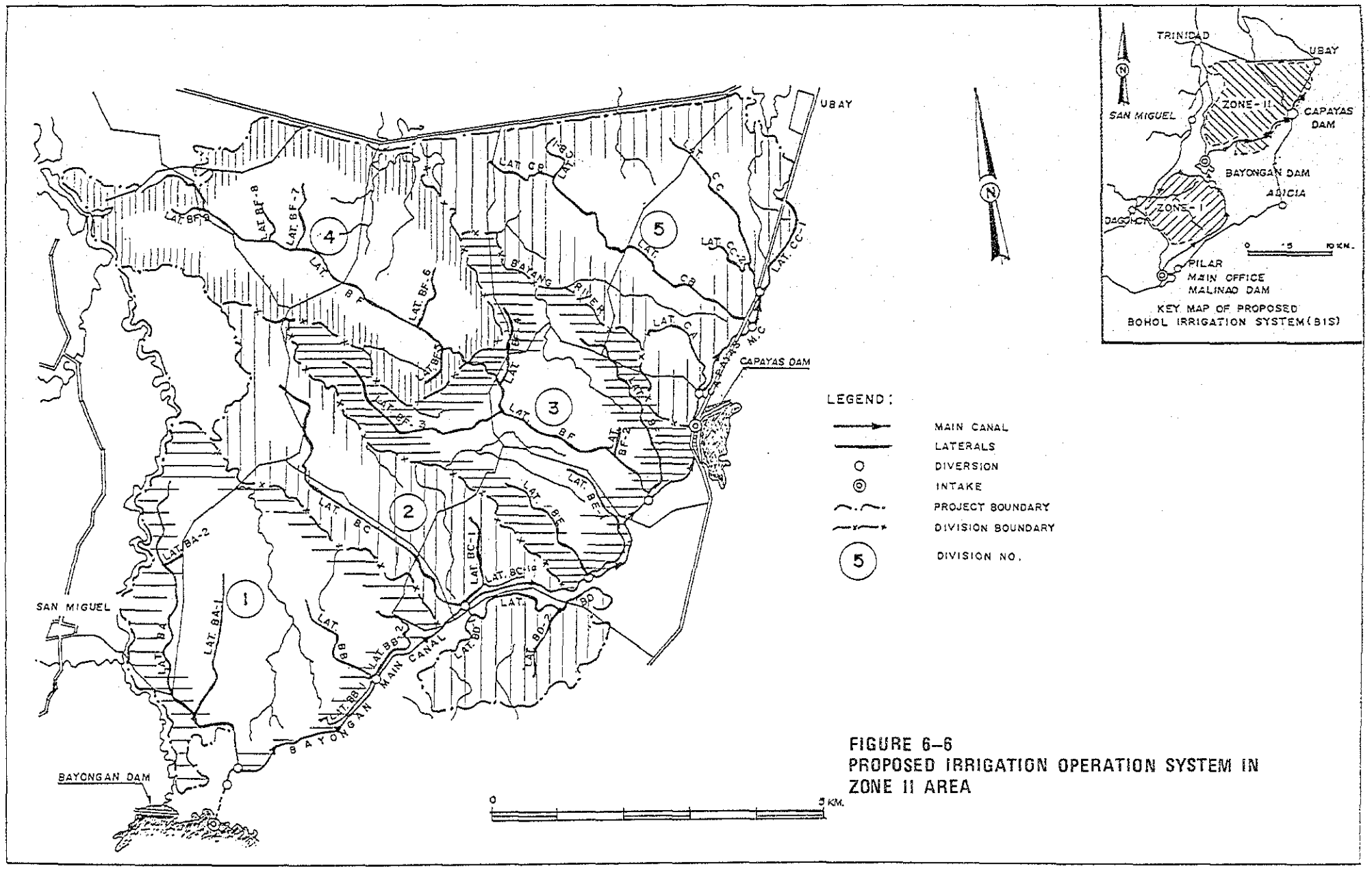


FIGURE 6-6
PROPOSED IRRIGATION OPERATION SYSTEM IN
ZONE II AREA

FIGURE 6-7 PROPOSED ORGANIZATION CHART FOR IRRIGATORS ASSOCIATIONS

Name of Organization
Area Coverage

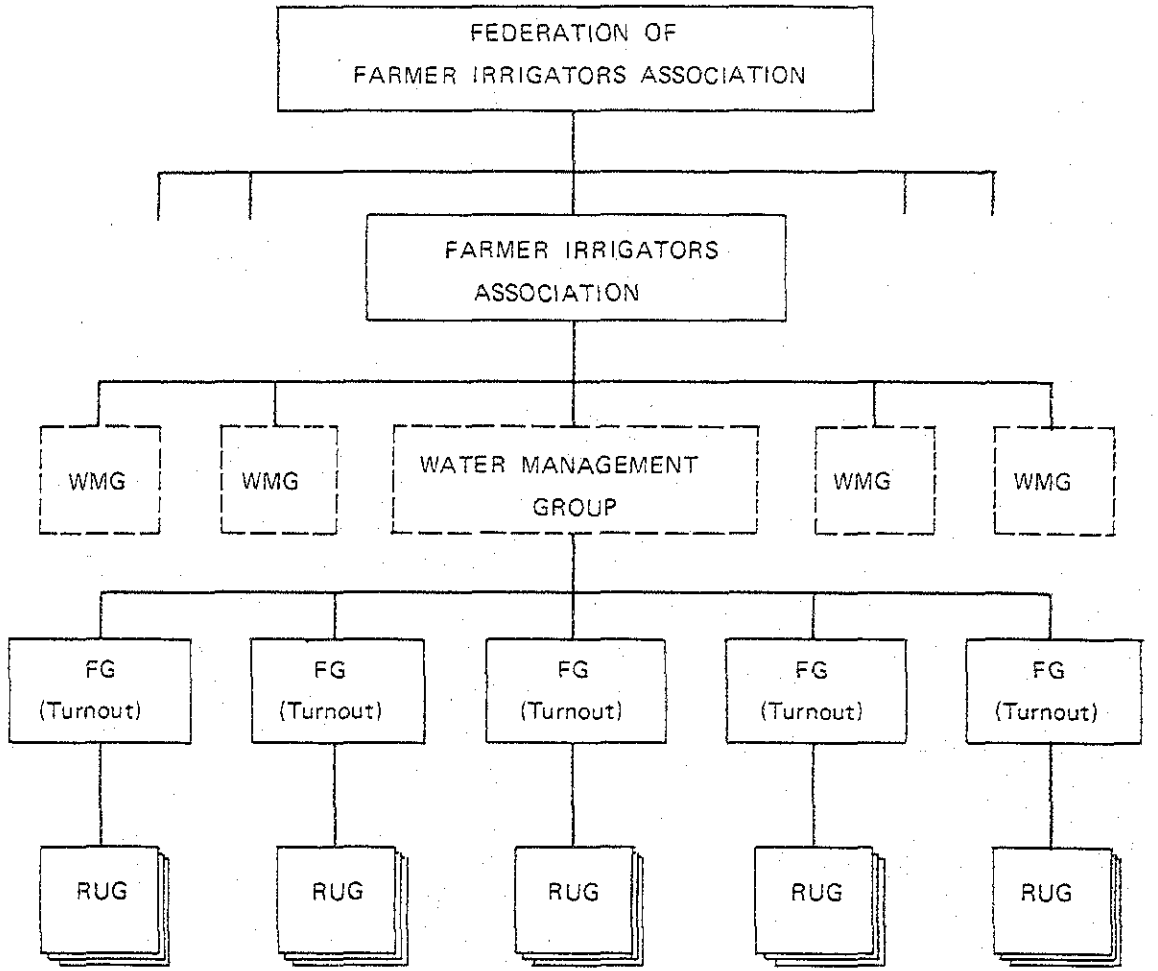
FFA : Federation of Farmer Irrigators Association
(Total 5,300 ha)

FIA : Farmer Irrigators Association
(Average 1,000 ha)

WMG : Water Management Group
(Average 200 ha)

FG : Farmer Irrigators Group
(Turnout area)
(25 – 50 ha)

RUG : Rotation Unit Group
(Supplementary Farm Ditch)



CHAPTER VII. PROJECT EVALUATION

CHAPTER VII. PROJECT EVALUATION

7.1. Introduction

The main objectives of the project are to improve the depressed socio-economy through an efficient development of potential resources. This would be represented by increase of farm labor opportunity, expansion of cash income and improvement of the living status of the people. Benefits of project would be realized as the results of increase and stabilization in yield of rice and diversification crops, intensive utilization of fields and organization of irrigation water control.

This project was also planned to meet the requirements of national and regional economy, such as supply of staple food, employment opportunity and correction of income disparity.

To accomplish these purposes, the project components mentioned in the previous chapters have been made up. After the completion of both dams of Bayongan and Capayas, the direct benefits would be generated from the cultivation of crops in the arable lands of 6,500 ha which would be developed from 3,680 hectares at present. An efficient use of irrigation water would bring about benefits from inland fishery. Dam reservoirs and grass land with the higher elevation would be utilized as an efficient resources for sightseeing and animal husbandry to grow indirect benefits respectively.

7.2. Economic Justification

7.2.1. Method of Economic Evaluation

The measurable economic benefits and costs are expressed in monetary terms and both streams of benefit and cost in annual form

over the project life are converted to the respective present worth values. The benefits and costs are evaluated with incremental value based on the difference between the "development with the project" and the "development without the project". The economic price presented as border price is applied to economic evaluation. The internal rate of return (IRR) is used as the main indicator for the economic evaluation of the project.

7.2.2. Economic Prices of Commodities

The value of traded goods is measured by border prices in Pesos. The value of nontraded goods which has been measured by domestic prices should be converted into border prices using conversion factor evaluated on the Philippines by the World Bank. A forecast of commodity prices was made in 1985 constant prices using the up-to-date data estimated by the World Bank. Official exchange rate used for this study is US$1.00=₱18.0.

Rice

Philippine rice has been exported in the recent years. The exported volume was 83,000 tons in 1981, 151,000 tons in 1982 and 40,000 tons in 1983. These exportable volumes could attain only 0.8 percent to 2.9 percent of total domestic rice production. Average FOB Philippine rice price was US$ 234 per MT in 1983. This value corresponds to the international price of 25 percent or 35 percent broken Thai white rice which FOB Bangkok was US$ 246 per MT of 25 percent broken and US$ 242 per MT of 35 percent broken.

According to the commodity price in 1983 constant Dollar forecasted by the World Bank, Thai white rice with five percent broken was forecasted as US$ 327 in 1995. Conversion of price from 1983 constant to 1985 constant is estimated using the weighted index of cereal foods which the World Bank computed

based on Manufacturing Unit Value Index. Annual index of cereal foods from 1983 to 1985 shows a steady rate. Hence, the forecasted price in 1985 constant is conservatively estimated using price of US$ 327.

Palay production in the Central Visayas was about 163,000 tons in 1980 and about 240,000 tons in 1981 of which Bohol province occupied about 82 percent and 47 percent respectively. These production volumes could not meet consumption in the Central Visayas. Deficit was about 47 percent in 1980 and about 25 percent in 1981. Rice producer in Bohol province exported palay of about 8,300 tons or 7.3 percent of total production in 1981 to Cebu.

In future, after completion of the project, the province would play more important role in supplying rice to the Central Visayas. Hence, the selling center to which incremental rice production from the project area would be sold, is considered as Cebu. Palay produced in the project area would be milled inside the project area or in an adjacent area. Milled rice shall be transferred from Talibon port to Cebu port and marketed in the consume center of Cebu.

The following table shows the rice price structure.

Rice Price Structure, 1995

Items	Unit	Financial	Economic
1) Export price of that 5% broken rice, FOB, Bangkok in 1983 constant price	US$/ton	327	327
2) Converted in 1985 Constant Price	US$/ton	327	327
3) Average export price of Philippine, FOB, Cebu broken 30%	US$/ton	253	253
	₱/ton	4,554	4,554
4) Price of milled rice, Project area	₱/ton	4,314	4,364
5) Palay equivalent price, Project area	₱/ton	2,890	2,924
6) Farm gate price of paddy	₱/ton	2,880	2,915

Note: Official exchange rate is used in ₱18/US$.
Conversion rate rice to paddy is 0.67.

Corn

Corn has been imported by about 340,000 tons in 1982 and 528,000 tons in 1983. These volumes are about 10 to 17 percent of domestic production. The supply and demand balance of corn in the Central Visayas had shown huge deficits from about 246,000 tons in 1977 to about 303,000 tons in 1981. Main reason of rising corn demand is derived from expanding livestock industry and increasing population. With regard to balance of corn supply and demand in three municipalities concerned the project would be forecasted as shortage in future. Hence, the project area is considered as the consumption place for the incremental corn.

FOB price, Gulf Port of yellow corn in 1983 constant, that is US$ 113 per ton, is used in this study. Farmgate price is estimated as follows;

Corn Price Structure, 1995

Item	US$	Financial	Economic
1) Export Price, US No.2 Yellow FOB, Gulf Ports in 1983 Constant	US$/ton	113	113
2) Converted in 1985 constant	"	113	113
3) CIF Price, Cebu	"	138	138
	₱/ton	2,485	2,485
4) Corn Price, ex-mill, Project area	"	2,800	2,735
5) Farm gate corn grain price	"	2,790	2,725

Mugbean

Mugbean is exported to Guam and the United States though an exportable volume is limited. FOB price per ton is estimated at US$ 1,365 or ₱24,570 with mugbean exported in 1983. Considering the limited exportable volume and comparatively high price, the present farmgate price of 11 Pesos per kilogram is used in this study.

Other Crops

Peanut, fresh vegetable, cassava and sweet potato are nontraded crops. Economic price is estimated based on the results of the field survey.

The following figures show the economic prices.

Economic Farmgate Price of Other Crops, 1995

Crops	Unit	Financial	Economic
Mungbeans	₱/ton	11,000	11,000
Peanuts (with shell)	"	10,000	8,200
Cassava	"	1,200	985
Camote	"	1,600	1,310
Watermelon	"	2,000	1,640

Fertilizer

Fertilizer price structure is studied based on the international prices in 1995 forecasted by the World Bank. Price in 1983 constant is converted to price in 1985 constant using the Manufacturing Unit Value Index reported by the World Bank. The fertilizer manufactures/importers whose ex-warehouse prices have been approved by the Fertilizer Industry Authority located at Cebu. These manufacturers/importers would be the distribution center of fertilizer for the project area. The following table shows the economic prices of fertilizer.

Fertilizer Price Structure, 1995

Item	Unit	Urea	DAP	Potassium Chloride
1) Projected price in 1983 constant, World Bank	US$/ton	260	294	100
2) Converted in 1985 constant price	"	290	329	112
3) CIF price, Cebu	"	309	369	137
	₱/ton	5,562	6,642	2,466
4) Ex-warehouse price for implementation by manufacture/importer Cebu	"	6,053	7,222	2,703
5) Farmgate price, project area	₱/ton	6,201	7,370	2,851
6) Per nutrient	₱/kg	N	P	K
		13.48	10.36	4.75

Pesticides and other Chemicals

The market prices of pesticides, fungicides and herbicide are available from BPI, farm marketing cooperative and results of farm management survey. These prices are converted to economic price using standard conversion factor of 0.82.

Economic Price of Farm Labor

Pricing of farm labor is the assessment of opportunity costs. The opportunity costs are estimated in the following general criteria; the opportunity for off-farm employment, the farm work season as usual (non-peak period), the full employment peak period and the attractive farm wage rate for outside labor market.

It is postulated that the marginal opportunity cost of labor supplied for farm work in the project area can be represented by an "S shaped" curve using minimum wage of seven pesos, average wage of ₱11.5 and maximum wage of ₱15.

7.2.3. Project Benefits

a) Crop Benefits

According to the implementation schedule, project benefits, at first, would be grown in the Capayas irrigation system area from dry season in the year 1990. An irrigation water is sourced from the base flow of the Capayas river up to the stage to be released from the Bayongan reservoir. The Bayongan irrigation system area would be cropped from wet season in the year 1992.

1) Crop Area

The irrigated paddy field is projected at 5,300 hectare. The beneficial irrigable area is estimated using 4,420 hectare

for the wet season or 83 percent of irrigable area and 4,780 hectare for the dry season or 94 percent. These areas are based on the annual cropping intensity on average described in page 4-92 of the Main Report and an average irrigation area estimated in Case II-5, TABLE E3-19, page E-55, Annex E. The cropped area with and without the project is shown as follows.

Crop Area

(Unit: ha)

Item	1990	1991	1992	1993 to 1999
Without Project				
Capayas				
Rainfed Paddy	550	550	550	550
Upland Crop	230	230	230	230
Sub-total	780	780	780	780
Bayongan				
Rainfed Paddy	1,940	1,940	1,940	1,940
Upland Crop	770	770	770	770
Sub-total	2,710	2,710	2,710	2,710
Total area	3,490	3,490	3,490	3,490
With Project				
Capayas				
Irrigated Paddy	390	1,090	1,690	1,690
Wet season	-	700	970	970
Dry season	390	390	720	720
Diversification	190	190	360	360
Un-irrigated crop	130	220	220	220
Sub-total	710	1,500	2,270	2,270
Bayongan				
Irrigated Paddy	-	-	6,030	6,030
Wet season	-	-	3,450	3,450
Dry season	-	-	2,580	2,580
Diversification	-	-	1,320	1,320
Un-irrigated Crop	-	-	980	980
Sub-total	-	-	8,330	8,330
Remaining area	3,110	2,710	-	-
Total area	3,820	4,210	10,600	10,600

2) Annual Yield

Target yield of irrigated paddy with the project would be projected to attain for eight years in new land reclamation area and for five years in existing field. Those of other crops also would be projected as eight years. Annual paddy yield with the project is estimated with the following growth rates.

Year	1st	2nd	3rd	4th	5th	6th	7th	8th
Newly developed area (%)	60	70	75	80	85	90	95	100
Existing area (%)	70	80	90	95	100	100	100	100

Annual yield of crops used in this study is as follows.

Annual Yield

(Unit: ton/ha)

Crops	1st Yr	2nd Yrs	3rd Yrs	4th Yrs	5th Yrs	7th Yrs	8th Yts
With Project							
Paddy (Wet)							
New area	2.5	2.9	3.2	3.4	3.6	4.0	4.2
Existing area	2.9	3.4	3.8	4.0	4.2		
Paddy (Dry)							
New area	2.7	3.2	3.4	3.6	3.8	4.3	4.5
Existing area	3.2	3.6	4.1	4.3	4.5		
Mungbean	0.6	0.7	0.8	0.8	0.9	1.0	1.0
Peanut	1.0	1.2	1.3	1.4	1.4	1.6	1.7
Corn	1.6	1.9	2.0	2.2	2.3	2.6	2.7
Watermelon	5.3	6.2	6.7	7.1	7.6	8.5	8.9
Without Project							
Paddy (Wet)	1.37	1.38	1.39	1.39	1.40	1.41	1.42
Paddy (Dry)	1.26	1.27	1.27	1.28	1.29	1.30	1.30

3) Production Quantity

Production quantity is estimated using cropped area and annual yield by crop mentioned above. The following table shows production quantity.

Production Quantity

(Unit: '000 ton)

Crop	1990	1991	1992	1995	1997	1999
With Project						
Irrigated Paddy	1.1	3.2	21.1	28.8	31.5	33.4
Mungbeans	0.03	0.03	0.3	0.3	0.4	0.4
Peanuts	0.05	0.06	0.4	0.6	0.6	0.7
Corn	0.08	0.09	0.7	0.9	1.0	1.1
Watermelon	0.3	0.3	2.3	3.0	5.6	6.1
Cassava	3.2	3.4	6.4	8.4	9.4	10.2
Sweet Potato	0.9	1.4	3.3	4.2	4.8	5.2
Rainfed Paddy	3.0	2.6	-	-	-	-
Without Project						
Rainfed Paddy	3.3	3.3	3.3	3.4	3.4	3.4
Cassava	2.7	2.7	2.7	2.7	2.7	2.7
Sweet Potato	0.9	0.9	0.9	0.9	0.9	0.9

4) Gross Income

In the full development stage, gross income with the project would be projected at 134 million pesos in the year 1999. Gross income without the project of 13.8 million pesos in the year 1999 would be expanded by income size of eight times. Gross income of 134 million pesos with the project is totalized by 100 million pesos of paddy (74 percent), 20 million pesos of diversification crops (15 percent) and non-irrigated upland crops of 14 million pesos (11 percent).

5) Crop Budget

Cost items used for economic evaluation are seed, chemical fertilizer, compost, lime, pesticide, herbicide, machinery, draft animal labor and other materials.

Compost is used in production of corn and vegetable. In the financial view point, compost value is considered as non-market price goods. However, the economic value of compost is available through two methods, namely estimation of fertilizer elements included in compost and estimation of actual costs. As the latter is not available, the former method is used.

The economic value of seed cutting of sweet potato or cassava is estimated by using unit price of pesos 0.05 of sweet potato cutting and pesos 0.07 of cassava cutting. These unit prices are available from data in the Experiment Station, Gabi, Ubay.

The ratio of covering area by machinery and draft animal is assumed at 45 percent and 55 percent respectively. Costs for machinery and draft animal per hectare are estimated as follows.

	Financial (₱/ha)	Economic (₱/ha)
Machinery cost (Paddy)	898	736
Machinery cost (Diversification)	425	349
Draft animal	165	135

Economic price of farm labor is calculated at 5.6 pesos per day as the opportunity cost (refer to Annex).

Crop budget is estimated as follows;

Crop Budget per Hectare-Economic

(Unit: Peso)

	Gross Income (a)	Production Cost (b)	NPV (a-b=c)	(c)/(a) (%)
With Project				
Paddy transplanting				
Wet	12,243	4,843	7,400	60
Dry	13,118	4,121	8,997	68
Direct seeding				
Wet	12,243	4,829	7,414	61
Dry	13,118	4,107	9,011	69
Mungbean	11,000	3,815	7,185	65
Peanut	13,940	4,060	9,880	71
Corn	7,358	5,140	2,218	30
Watermelon	14,596	9,384	5,212	36
Sweet Potato (Un-irrigated)	14,148	5,943	8,205	58
Cassava (Un-irrigated)	13,987	3,439	10,548	75
Without Project				
Rainfed Paddy (Wet)	3,994	1,435	2,559	64
Rainfed Paddy (Dry)	3,673	1,282	2,391	65
Sweet Potato	2,646	837	1,809	68
Cassava	4,639	943	3,696	80

Note: Application of lime for paddy is counted on wet season paddy.

6) Production Cost

Production cost of crops without the project is estimated based on the results of the agro-economic survey conducted by NIA. Production costs by crop estimated by the crop budget study are considered as inputs used in stage to attain the target yield. In the full development stage, in the year 1999, production cost with the project would be projected at 49.7 million pesos.

7) Incremental Net Production Value

Incremental net production value is shown as follows;

Incremental Net Production Value (NPV)

(Unit: million pesos)

	1990	1991	1992	1995	1997	1999
With Project						
Gross Production Value	17.14	23.36	84.31	113.85	125.14	133.92
Production Cost	7.00	9.20	41.86	46.39	49.72	49.72
N.P.V.	10.14	14.16	42.45	67.46	75.42	84.20
Without Project						
Gross Production Value	13.36	13.45	13.50	13.67	13.75	13.84
Production Cost	4.86	4.89	4.93	5.01	5.05	5.05
N.P.V.	8.50	8.56	8.57	8.66	8.70	8.79
Incremental N.P.V.	1.64	5.60	33.88	58.80	66.72	75.41

b) Domestic Water Benefits

Capacity of the Capayas reservoir includes the domestic water volume to be supplied to inhabitants of Ubay. Population of 2,323 in the year 1980 shall be forecasted to be about 3,200 in the year 2000. Hence, about 300,000 metric tons would be required using 150 liters per day per person.

At present well water is sold in town. Unit price is ₱0.75 per one water tank of 19 liters. This terminal price is equivalent to ₱39 per metric ton. On the other hand, original cost of water supplied through the Capayas reservoir is computed as follows;

Civil works cost including physical contingency
28,980,000 pesos / 7,400,000 metric tons = 3.9 ₱/MT

Economic justification would be studied using this original cost per metric ton. Incremental annual benefit would be expected as follows;

300,000 MT x 3.9 ₱/MT = 1.17 million pesos

c) Inland Fishery Benefits

Inland fishery benefits would be expected through fish culture in water surface area, namely 180 hectares of both reservoirs

totalized by about 140 hectares of Bayongan and by about 40 hectares of Capayas and 3.5 hectares of village ponds 22 places.

With the increasing demand for tilapia nilotica fingerlings, village ponds as small backyard fishpond culture would be useful to produce tilapia fingerling. A part of fingerling producted should be sent to both reservoirs to be fed by the floating cage. Breeding tilapia nilotica or nile tilapia is beeing successfully undertaken in small backyard fishponds built along irrigated ricefields along the shorelines of Languna de Bay. According to the draft feasibility study report on Dumanjug-Ronda SWIM Project, the floating cage fish culture with ten compartment is projected at Dumanjing, Cebu.

Inland fishery benefits would be estimated based on the data of fishing economy of both examples as mentioned above (refer to Annex K).

Incremental annual benefits of 2.05 million pesos for inland fishery would be expected as follows;

Village pond:

Benefit per square meter per year ... 54 pesos

3.5 ha x 54 ₱/m^2 ..... 1.89 million pesos

Dam reservoir:

Floating cage benefit with ten compartments (one compartment 5x10x4m) ... 39,800 pesos/unit

Three units for the Bayongan reservoir and one unit for the Capayas reservoir would be planned;

Four units benefits ..... 0.16 million pesos

7.2.4. Economic Project Cost

Project cost items comprise construction works, land acquisition and compensation, project administration, consulting

services and physical & price contingency. Price escalation cost is excluded from an estimation of economic project cost. Financial project cost excluded price escalation is converted to economic project costs using conversion factors. Conversion factors are applied to the cost of all the non-tradable commodities and services used or produced by the project. It is considered that all tariff is counted into the local cost. Financial local cost is converted to economic cost using construction conversion factor of 0.827.

Land acquisition cost of rice field and upland is eliminated because the reduction of acreage due to canal right of way is counted in estimation of crop benefits.

Economic project cost is estimated as follows;

Economic Project Cost

(Unit: million pesos)

Item	Total	1987	1988	1989	1990	1991	1992
Financial Cost	375.0	19.9	12.7	90.1	104.5	111.9	35.9
F.C.	261.0	15.1	7.5	61.7	72.2	78.8	25.7
L.C.	114.0	4.8	5.2	28.4	32.3	33.1	10.2
Economic Cost	352.0	19.1	10.2	83.5	98.9	106.2	34.1
F.C.	261.0	15.1	7.5	61.7	72.2	78.8	25.7
L.C.	91.0	4.0	2.7	21.8	26.7	27.4	8.4

Operation & maintenance cost items comprise salary & wage, administrative & general expenditure, equipment repair & maintenance, fuel cost and office maintenance cost. Financial cost is 592 pesos per hectare per year (US$ 33). Economic cost is counted at 485 pesos (₱529 x 0.827). Incremental economic cost is estimated at 2.57 million pesos.

Replacement cost would be counted on gate and operation & maintenance equipment. Economic life of both goods is 25 years and 10 years respectively.

Although the irrigation main canal capacity in Phase I project is sufficient with 7.0 cu.m/sec, the main canal capacity should be designed with the capacity of 11.8 cu.m/sec due to introduction of the surplus water from the Marinao Dam.

The different construction cost between the canal capacity of 7.0 and 11.8 cu.m/sec is estimated at approximately 1.0 million peso. This difference cost should be allocated for the Phase II project. In calculation of EIRR, this cost is added in the economic cost of the year 1987.

7.2.5. Economic Internal Rate of Return

Feasibility of the project is appraised by an estimation of economic internal rate of return (EIRR). EIRR is computed at 15.4 percent. The opportunity cost of capital as national parameter in the Philippines is 15.0 percent. Hence, since the minimum EIRR of 15.0 percent is satisfied, this project is economically feasible.

7.2.6. Sensitivity Test

Sensitivity test is studied on the following cases in consideration of the speciality of formulation of project benefits.

Sensitivity Test

Case	EIRR (%)
1. Original	15.35
2. Increase of Project Cost	
- 10%	14.23
- 20%	13.27
3. Decrease of Target Yield	
- 10%	12.97
- 20%	10.47
4. Fall of Paddy Price	
- 5%	14.48
- 10%	13.60
5. Increase of Production Cost of Crops	
- 10%	14.40
- 20%	13.45
6. Delay to Start Land Reclamation	
- One year	14.14
- Two year	13.31
- Three year	12.60

As shown in the above table, decrease of target yield would be most influential for the project economical justification. But the sensitivity test in case of delay of implementation year with land reclamation is not so influenced.

7.2.7. Socio-Economic Impact

a) Employment Opportunities

Labor requirement for the cropping in the project area would be annually enlarged from about 410,000 man days without the project to about 980,000 man days with the project. This means an enlargement of employment capacity in crop sector. In order to meet this expansion, about 1,200 farmers would be newly settled in the land reclamation area, then the existing farmers of 1,826 would be expected to increase in about 3,000 farmers or about 160 percent. To fill labor requirement grown in crop husbandry sector mentioned

above, labor should be supplied from inside and outside of the project area. Employment opportunities for available farm labor days per month including surrounding areas would be expanded from about 20 percent (ratio of requirement labor days divided by available labor days) without the project to about 35 percent with the project (refer to Annex-Economic costs of farm labor).

b) Income Distribution

Income Distribution by Class of Farm Size

The difference of farm income per farmer by class of size was studied in Farm Economy of Chapter 3.3.9. At present the farmers in class of size from 1.0 ha to 1.99 ha can gain gross income per ha rather higher than that of 3.0 ha to 6.5 ha. The main reason is due to difference on cropping intensity and paddy yield.

On the other hand, though number of large farmers groups at present is smaller than that of small farmers groups, greater part of arable land is occupied by large farmers group as shown in the following table.

Distribution of Farmers and Arable Land

Class of Farm Size	At present				With Project			
	No. of Farmer		Area of Arable Land		No. of Farmer		Area of Arable Land	
		(%)	(ha)	(%)		(%)	(ha)	(%)
Less 3.0 ha	1,388	(76)	1,690	(46)	2,644	(85)	4,510	(69)
Over 3.0 ha	438	(24)	1,990	(54)	438	(15)	1,990	(31)
Total	1,826	(100)	3,680	(100)	3,062	(100)	6,500	(100)

Note: Percentage are based on the results of the agro-economic survey carried out by NIA.

This imbalance would be redressed through the land disposal policy to distribute the reclaimed paddy field to new settlers. Figures with the project shown in table is estimated based on land distribution of 2.5 ha per one settler.

The following table shows distribution of farm income by class of farm size.

Class of Farm size	Farm Income at Present		Farm Income with Project	
	(₱x10^6)	(%)	(₱x10^6)	(%)
Less 3.0 ha	3.59	56	65.5	69
Over 3.0 ha	2.86	44	28.9	31
Total	6.45	100	94.4	100

Note: Farm income is estimated based on the following farm income per ha.

	At Present (₱)	With Project (₱)
Less 3.0 ha	2,125	14,530
Over 3.0 ha	1,440	14,530

Income Distribution by Industry Sector

The project will cause an increase of income in each sector of animal sector, inland fishery, agri-business and transportation. Transportation to the hilly grass land area located in a higher elevation shall be easily accessible after the reclamation of grass land with a lower elevation.

If the grazing system of cattle is developed through conversion of cogon land into pasture arounded by ipil-ipil trees, livestock income would be increased on village level.

The milling of paddy of about 34,000 tons per years, fish produced in reservoirs and village ponds and livestock to be fed by the grazing system mentioned above shall urge the development of agri-business, namely establishment of mill, grain storage, slaughter house and cold storage.

The road network should be improved to transport the incremental goods as paddy of about 30,000 tons and chemical fertilizer of about 3,000 tons. The trucking cost from the project area to Talibon amounts to about 300 pesos/one trip, 100 sacks. If the incremental goods are transported by truck, the trucking cost or marketing cost of about 1.9 million pesos would be newly accounted as provincial income.

19,500 tons + 9,800 tons + 3,000 tons = 32,300 tons
(Rice) (Cassava & Sweet Potato) (Fertilizer)
32,300 tons / 50 kg/sacks x 300 Peso/100 sacks
≒ 1.9 million Pesos

c) Political Stability

- The project area has been specialized as an economical depression area because of unstable low income. After completion of the project, a great deal of crop production would be expected to be marketed. The successful marketing can bring the steady cash economy to farmers. Thus, inhabitants in the project area should be relieved from poverty.

- Typhoon Nitang damaged the rice production of Bohol province in September, 1984. In order to quiet social anxiety due to shortage of staple food, the 200,000 sacks of rice were sent by Central Office of the National Food Authority (NFA) to Bohol province immediately after the typhoon. Thus the stockpile of NFA, Tagbilaran has been held in reserve. An incremental production with the project would make the stockpile of NFA, Tagbilaran steady.

- Large estate land ownership has been grown in the project area. These lands is projected to be included in the project area and to be sold to new settlers through the land reform policy of the Ministry of Land Reform. This shall contribute to the social or political stability in Bohol province.

- The beneficiaries can make annual cropping plan without anxiety of drought due to the steady supply of irrigation water. This feeling of security is an important matter in rural life.

7.3. Financial Analysis

7.3.1. Revenue and Expenditure of Typical Farm Budget

The farm management in the project area shall be conducted by the land holding farmers or the tenant farmers cultivating in the existing arable land and new farmer to cultivate in the reclaimed land. Farm budget has to be studied by the type of farmer.

Typical farm is represented by average size of farm of 1.87 hectare which was analyzed in Chapter 3.3.9. Land use of this farm consists of paddy land of 1.52 hectare and upland of 0.35 ha. Coconut land is not included in this area. Cropping pattern and target yield by crop are based on those used in the economic justification mentioned above. The financial prices of commodities in 1995 described in Chapter seven are used in this analysis. Irrigation fees to be paid by farmer with the project are estimated at two cavans for wet season and three cavans for dry season. Farm income is calculated by deduction of crop production cost from gross production income. Livestock income is not accounted in order to get the conservative income.

Land Owner:

Regarding cropping intensity and production quantities of paddy, 144 percent and 3.9 tons without the project would be expected to increase in 162 percent and 9.57 tons with the project respectively. Items of production cost consist of seeds, compost, lime, chemical fertilizer, pesticides, herbicides, other material,

man labor, animal day and machinery cost. Farm income is calculated at 7,681 pesos without the project and 22,747 pesos with the project. Disposal farm income with the project after deduction of irrigation fee and amortization cost of on-farm work amounts to 19,954 pesos. Disposal farm income should be applied to tax, living cost, additional capital for production and saving. The following table shows farm budget of average size farm.

Farm Budget of Average Size Farm

Item	Without Project	With Project
1. Size of Farm (ha)	1.87	1.87
2. Land Use (ha)		
Paddy land	1.52	1.52
Upland	0.35	0.35
3. Total Cropping Area (ha)	2.70	3.03
Paddy (Wet)	1.37	1.26
Paddy (Dry)	1.14	0.95
Diversification	-	0.47
Cassava & Potato	0.19	0.35
4. Cropping Intensity (%)	144	162
5. Production (ton)		
Paddy (Wet)	2.34	5.29
Paddy (Dry)	1.56	4.28
6. Gross Production Income (₱)	12,124	39,726
7. Production Cost (₱)	4,443	16,979
8. Farm Income (₱)	7,681	22,747
9. Irrigation Fee (₱)	-	1,000
10. Amortization Cost of On-farm Work	-	1,793
11. Disposal Farm Income (₱)	7,681	19,954

Note: Paddy field without project is rainfed and with project irrigated. The cropping area of paddy is average irrigable area based on hydrologic study for 28 years. Amortization cost of on-farm work is shown in TABLE K6-73.

Disposal farm income of 19,954 Pesos with the project would be gained under the expectation of target yield at 4.2 tons per hectare for wet season and 4.5 tons per hectare for dry season.

If these target yields are not attained, income shall be dropped as in the following table. Ratio of irrigation fee occupied in farm income will be raised with decrease of target yield.

Yield of Each Crop	Farm Income With Project (₱)	Irrigation Fee /Farm Income (%)
Target	22,747	4.4
90 %	18,774	5.3
80 %	14,802	6.8
70 %	10,829	9.2

According to the results of the agro-economic survey, average living cost is 5,310 Pesos. Living cost in future has to be forecasted considering the raising of standard of living. The following table shows the relation between living cost and disposal farm income which irrigation fee and amortization cost of on-farm work is deducted.

Annual Growth Rate of Living Cost (%)	Living Cost With Project (1999) (₱)	Living Cost/Disposal Farm Income - Yield of Each Crop - Target (%)	90 % (%)	80 % (%)	70 % (%)
2	7,100	36	44	59	88
3	8,300	42	52	69	negative
5	11,000	55	69	92	negative
7	14,600	73	91	negative	negative

When actual yield falls to 70 percent of target, income balance of this typical farmer shall be able to afford to pay living cost at annual growth rate of two percent. When annual growth rate of living cost is expected at five percent, farmer has to make an effort to prevent a decrease in target yield within around 20 percent of target yield.

Tenant Farmer:

According to the results of agro-economic survey conducted by NIA, average gross income per hectare obtained by tenant farmer is approximately the same value as that obtained by land owing farmer. But the production cost paied by tenant farmer is larger than that of land owing farmer because of land rent.

Farm budget on tenant farmer with the rent field of 1.87 hectare is studied. The ratio of land rent for paddy is estimated at 21 percent based on the farm economy analyzed in paragraph 3.3.9.

Farm Budget on Tenant Farmer

Item		Without Project	With Project
1. Farm Size	(ha)	1.87	1.87
2. Total Cropping Area	(ha)	2.70	3.03
Paddy (Wet + Dry)		2.51	2.21
Diversified Crop		-	0.47
Cassava and Sweet Potato		0.19	0.35
3. Production	(ton)		
Paddy (Wet + Dry)		3.9	9.57
4. Land Rent for Paddy	(ton)	0.82	2.01
5. Gross Production Income	(₱)	12,124	39,726
6. Production Cost Excl. Rent	(₱)	4,443	16,979
7. Farm Income Excl. Rent	(₱)	7,681	22,747
8. Land Rent	(₱)	2,362	5,789
9. Farm Income	(₱)	5,319	16,958
10. Irrigation Fee	(₱)	-	1,000
11. Disposal Farm Income	(₱)	5,319	15,958

Ratio of irrigation fee occupied in farm income will be raised with decrease of target yield as follows.

Yield of Each Crops	Farm Income With Project (₱)	Irrigation Fee/ Farm Income (%)
Target	16,958	5.9
90%	12,985	7.7
80%	9,013	11.1
70%	5,040	19.8

The following table shows the relation between living cost and disposal farm income.

Annual Growth Rate of Living Cost (%)	Living Cost With Project (1999) (₱)	Living Cost/Disposal Farm Income - Yield of Each Crop - Target (%)	90% (%)	80% (%)	70% (%)
2	7,100	44	59	89	negative
3	8,300	52	69	negative	negative
5	11,000	69	negative	negative	negative
7	14,600	91	negative	negative	negative

When actual yields falls to 70 percent of target, income balance of the tenant farmer will not allow the payment of living cost at annual growth rate of over two percent.

Farmer for the New Land:

The farmer to cultivate the new reclamated land will be classified into three type as follows.

Type 1. Existing farmer with additional new land leased or purchased.

Type 2. New settler to be transferred from the Bohol province or other province. They may be existing small farmer, landless farmer and compensation farmer because of dam construction.

Type 3. Land owner with large size of land. He should reclaim grass land by himself and cultivate the land using hired labor.

High market value of new land to be purchased will be a constraint factor for Type 1 farmer or Type 2 farmer.

If new settlers can purchase the new land through the agrarian reform regulation, an amortization value of land will not be so high cost. An amortization value per hectare is estimated based on the following regulations:

1. Average of three normal harvest year before October 21, 1972 x unit price per cavan x 2.5

2. Interest 6 percent, repayment period 25 years

3. Ten percent is cashed and 90 percent is borrowed from land bank.

If the regulations mentioned above are adapted to new settlers, they shall pay amortization cost of about 150 pesos to 200 pesos per hectare per year. Otherwise, new farmers should borrow the land under share rent of about 20 percent or rent fixted by low rate.

7.3.2. Repayment of Construction Cost

The foreign currency of construction cost is loaned by the international banking institutions and the local currency is covered under the responsibility of the Government. The loan must be repaid by the public finance and the beneficiaries. The fund for repayment of construction cost is the incremental benefit of the project from a standpoint of national economy.

The foreign currency to be repaid amounts to 375,344 thousand Pesos including price escalation. This value does not include the on-farm development cost. The on-farm development cost of 24,840 thousand Pesos excluding price escalation consists of 16,445 thousand Pesos of foreign currency and 8,395 thousand Pesos of local currency. This cost is not counted in NIA budget but paid by land owners.

An amortization value for foreign currency depends upon loan condition of the international banking institutions. In this study, the following loan condition is used;

Repayment period	:	30 years
Grace period	:	10 years (included in replacement period)
Interest	:	4 percent

An amortization value is shown in Annex K, TABLE TABLE K5-76. Summary is as follows.

1.	Total Principal	: 375,344,000 Pesos
2.	Grace Period	
	Total interest	: 150,140,000 Pesos
	Maximum interest for year	: 15,014,000 Pesos
3.	Repayment Period for Principal	
	Maximum amortization per year	: 22,709,000 Pesos

The preparation of new loan on the on-farm development cost should depend upon an establishment of new loan system by the domestic banks. A part of loan source is suggested to seek for an international bank.

7.4. Relation with Bohol Integrated Area Development Project

Bohol Integrated Area Development Project consist of eight line agencies funded by the followings;

I	Bohol Agricultural Promotion Center
II	Bohol Irrigation Project
III	Watershed Development Project
IV	Integrated Fishery Development Project
V	Hydrometeorological Project
VI	Roads and Ports Development Project
VII	Livestock Development Project
VIII	Upgrading of Provincial Engineer's Office

Watershed, fishery, livestock and engineer's office are projected as grant-in-aid project after the year 1986. Roads and ports project is scheduled as detailed engineering stage in the year 1987.

The finding of new associated projects with relation to the Bohol Irrigation Project Phase II would be the imperative matter in order to attain the project benefits.

The Bohol Agricultural Promotion Center (APC) has been indentified as a top priority component of the Bohol Integrated Area Development Project (BIADP). The Japanese Government through JICA has extended technical and financial assistance to the APC. The activities of APC should be applied in order to attain successfully benefits in the Bohol Irrigation Project Phase II.

The watershed development project has four components: i) agro-forestry, ii) reforestation, iii) extension and, iv) community organization. The beneficiary will be the marginal farmer occupants of uplands and forests. The project will cover three major watershed areas, namely: Loboc, Cabidian-Matulid and Wahig-Pamacsalan. Hence, the watershed project should include the Bohol Irrigation Project Phase II in future.

BIADP and Ministry of Resources (MNR) jointly prepared the Master Plan for integrated development of Bohol fishery industry. The Master Plan includes an inventory of projects that are deemed necessary in the development of nearshore, offshore and inland fisheries. Hence, the inland fishery plan recommended in this study should be included in the Master Plan mentioned above and be encouraged by the line agencies-funded project.

The development of grazing system of cattle in the hilly grass land area in and around the project area should be carried out through the technical supporting by the livestock development project at the Ubay Stockfarm.

The Bohol Road Network Feasibility Study is in line with the infrastructure program supporting of other projects of BIADP. The marketable commodities to be handled in the project area would need an expansion of road net work in future. Hence the Bohol Road Network Study should be identify the comprehensive net work plan considering the project component.

CHAPTER VIII. ENVIRONMENTAL IMPACT ANALYSIS

CHAPTER VIII. ENVIRONMENTAL IMPACT ANALYSIS

The introduction of the project may bring about local positive and negative impacts on the natural and socio-economic environment. According to the NEPC classification of environmentally critical projects, storage dam with capacity of 20 MCM and above is considered critical and necessitates environmental impact statement. The project includes the construction of a 31 m high Bayongan dam to store 27.5 MCM of surplus water from adjacent Bohol Irrigation Project I with water resources from the Wahig-Pamacsalan rivers. It would provide irrigation to some 5,300 ha which is politically part of Ubay, Trinidad and San Miguel. About 60 percent of the proposed service area has to be reclaimed and provided with on-farm facilities.

8.1. Environmental Setting

The project is geographically located in a plateau area in the province of Bohol. Physically the project area consists of rolling landscape with alluvial lowlands, open valleys and hills. The well known tourist attraction "Chocolate Hills" is located in the southern part of the area. Several small streams traverse the southern part of the service area and the northern part of the Soom river flows toward north. The elevation of the area ranges from 40 m above sea level descending to about 5 m above sea level towards north. The type of habitats presenting in the project area is a mixture of "Parang" vegetation (Savanna) and cultivated fields. In the proposed service area of 5,300 ha, about 30 percent is planted with rice. Scattered patches of coconut trees are intercropped between bananas and other fruit bearing trees. Other terrestrial floras are cogon, talahib, shrubs, crops and grasses. Even the sites of the Bayongan and Capayas reservoirs have the same terrestrial flora. Valley floors and some slopes of the ridges are

develop farms. Only minor erosions occur inspite of thin vegetative cover of some steep slope of hills. This could probably be attributed to the type of climate in the province which is characterized by even distribution of rainfall throughout the year. Moreover, it is located outside the typhoon belt.

Wildlife could not be found in the project area. The habitats consisting of "parang" and cultivated fields are an indication of ecological imbalance and poor life support systems. This is an effect in Bohol Island having forest cover already altered to a dangerous proportion. About 24 percent of the total land area is still forested in spite of the requirement of 40 percent in order to have proper protection to land and gain enough benefits from forest. Under this kind of environment, the endemic species recorded in Bohol Island such as stripped-button quail, rufous-tailed jungle flycatcher, yellow-bellied whistler, Philippine trogon and mountain sunbird of the avian fauna and bats, oriental civet, rats, wild pigs, deer and endangered Tarisus Philippinesis or "Malmoy" of mammals are not visible in the project area.

8.1.1. Aquatic Life

The Bayongan and Bayang rivers are the main streams in the project area that serve aquatic fresh water habitats. Several small streams spread over and flow from the south to the north in the project area with the Soom river draining the Bayang river Ubay. Among the presenting fresh water fish are mudfish (Ophicephalus striatus), carp (cyprinus carpio), tilapia (Tilapia mossambica) and the fresh water eel (Anguilla sp.). Their population is depleting due to overfishing. Comparing the two rivers with careful consideration, the Bayang river is a better water course with wider and deeper dimensions; both have no development, torrent, and have the same environmental uses; no pollution source except poor for vegetative cover that influences the water color when raining and

has small quantity of fish and animals. On the other hand, the Bayongan river has waterbasin with more agricultural activities. Both have the same characteristics with respect to land ownership, varying topography, grassland (developed to climax community) vegetation, open public access, low environmental use and less degree of erosion.

The quality of water is both slightly turbid with minor debris floating materials, minor siltation and little of algae. The riverine flora consists of common riparian plants and grasses.

8.1.2. Extension Environment

The scheme of the project includes drawing water from BIP Phase I Wahig - Pamacsalan river by which their respective watersheds have to be taken into consideration in the Phase II. In 1981 Man and Biosphere presented the terrestrial life and aquatic life descriptions in this area (Environmental Assessment of the Bohol Integrated Agricultural Development Project, pp. 45 and 49), in which it is indicated that the presence of mixture of dipterocarp forest in the mountains, molave in the hills, ipil-ipil dominating the second growth forest in the lower elevations and climax community of grassland in some areas where slashing and burning have taken place neglecting moisture to support the development of second-growth forest during ecological succession.

8.1.3. Social Enviroment

The proposed Bayongan reservoir including some parts of the watershed area are inhabited. Some 30 households would be inundated and another about 45 households near the inundated area would be adversely affected by either limited mobility and access from sources of human needs or sudden change of environment. The

residents are engaged in farming with crops of rice, copra and vegetables. In the Capayas reservoir and watershed, there are no indications of agricultural activities and existence of households that need to be relocated. The watersheds have no mining operation and claims recorded in the local government. The only activity noted is quarrying of the Ministry of Public Works and Highways at the upstream hill of the proposed Capayas damsite for use of the operation and maintenance of roads.

Below the proposed service area in Trinidad, about six barangays are reported with incidence of schistosomiasis, to wit: San Agustin, San Roque, San Vicente, Kinan-oan, Sto. Tomas and Cabigohan. The provision of irrigation water could cause the spread of the schistosoma japonicum to the service area unless proper check is made. The Health authorities in Trinidad should be informed of the project and close coordination has to be effected so that they could provide mitigating measures.

8.2. Environment Project Interaction

8.2.1. Construction Phase

The project areal topography would change distinctly, especially in the sites of Bayongan dam, Capayas dam, quarry site and the service areas where land reclamation and consolidation would be undertaken. The major topographic changes would be man-made lakes with surface area of 326 ha and 90 ha respectively, which are created by rise of dams across the Bayongan and Bayang rivers. Vegetative cover would be submerged and affect adversely thriving of population. New kind of population would rise adaptive to the created habitat characterized with deep water and more humid climate. Fish raising would be productive at early stage of storage due to increased nutrients availability resulted from the decayed submerged vegetation. But later fish production would deplete due to the limited source of food, thermal stratification and eutrophication.

Erosion and dust increase in the atmosphere would occur from the time of earth moving to the period of vegetative cover recovery in sites of dam construction, quarry, borrow areas, open excavation, along haul and access roads and in the service area where land reclamation and consolidation are to be undertaken. Precautionary measures have to be taken with these regards since these are only localized and temporary. Erosion could be minimized by means of considering and understanding the slope stability as well as soil cohesiveness. Also, dust presence in the atmosphere could be diminished to a tolerable level by spraying water in the earth-moving sites.

The 30 households located in the reservoir area would be relocated to the DBP foreclosed farms with an aggregate area of about 2,000 ha within the service area in the municipality of Trinidad.

The local governments have already informed their respective constituents of the project and their possible resettlement. The concerned residents are willing to cooperate without any conditions, but implementation should be made carefully to avoid development of suspicion and other incidents that could trigger social tension.

At the peak of construction, when there is an influx of laborers coming from neighboring localities, the proponent should look into the possible migration of laborers afflicted with schistosomiasis. Sanitary facilities should be installed to arrest the spread of the dreaded disease.

8.2.2. Operation and Maintenance Phase

Usually the project proponent trys to operate and manage project at less cost to gain substantial benefits without avoiding

consideration of cost additive that is equally important for component and aspects. The efforts of the environmentalist are not to dissuade the proponent from pushing through the project but rather assist him in looking properly the totality of the project and its relationship between the environmental contributory to the attainment of the designed project and expected benefits. Irrigation project should always consists of not only the dam and reservoir, irrigation facilities and service area but also the watershed. The watershed is the source of water of the rivers being tapped for irrigation. The annual flow and quality of the river water is influenced by the vegetative cover of the watershed. Several irrigation projects already implemented showed sound rivers characteristics during the study phase related to the design of the facilities and hectarage of the service area thereto. But during operation and maintenance phase, the water resources could not provide the considerable water volume and quality for the designed life span of the project. The possible causes of this tragedy is an alteration of watershed vegetation cover which is caused by excessive logging, slashing and burning, mineral extraction and population intrusion. NIA, therefore, has to establish coordination and control together with BFD about the quality of vegetation cover in 14.6 sq.km, 11.2 sq.km and 51 sq.km watersheds of Bayang, Bayongan and Wahig-Pamacasalan rivers. Rehabilitation has to be undertaken.

Manipulation of the environment covering 5,300 ha from grassy hills to cultivated level land would induce artificial manage ecosystem whereby rice, mungbean, peanut, corn, and water melon for irrigation; and sweet potatoes and cassava for non-irrigation are introduced. The natural ecological consequence would be the emergence of pests and diseases. But since the aim of development is for greater benefit gains, farmers would resort to use of farm chemicals, organochlorine and organophosphates, to combat weed, insects and other pests. Among the pesticides recommended for the proposed crop are seven furadan, thiodanon aldrex, malathion, lannate, difoltan and benlate; herbicides: buctachlor and hedonal.

The applied chemicals remain either in or on crop, or in the soil and drift to nearby crop areas or flow into streams and drainages, thereby create a hazard to aquatic and terrestrial life including man. Some chemicals like endrine and malathion which some farmers reportedly using are known to act on the nervous system causing spastic uncoordination, convulsion and paralysis, and death. Another catastrophic implication would be disruption of pest-predator-parasite ecology whereby insects which prey on species affected with insecticides may be killed. Birds and other vertebrates may in turn be poisoned by feeding on the affected species. So the situation is that target species declines diminish the natural controls giving way to dramatic resurgence of insecticide resistant pests. Information on dissemination and control of use of insecticides is therefore necessary to minimize danger and avoid production setbacks that could undermine development and threaten the financial viability of the project.

More distinct positive impact of the project would be manifested in increase of income, employment opportunities, improvement of nutrition mobility and lifestyle. This would beef-up the introduction of fishery development, tourism, and water based sports and recreation.

The impact identification and evaluation checklist is shown in FIGURE 8-1.

FIGURE 8–1 IMPACT IDENTIFICATION AND EVALUATION CHECKLIST FOR RECOMMENDED SCHEME

Environmental Parameters	Impact		Magnitude of Impact					
	+	–	O	L	M	H	U	N
A. Existing Physical and Chemical Characteristics								
1. Earth:								
a. Mineral Resources			X					
b. Soils		X		X				
c. Land Forms		X		X				
d. Unique Physical Features			X					
2. Water:								
a. Stream, Drainage, Effluent	X				X			
b. Groundwater	X				X			
c. Quality Temperature								
d. Recharge	X				X			
3. Processes:								
a. Floods	X			X				
b. Erosion		X			X			
c. Stress-Strain (Earthquake)		X					X	
d. Downstream Sedimentation	X				X			
B. Existing Cultural Factors								
1. Land Use:								
a. Agricultural	X					X		
b. Residential		X				X		
c. Industrial			X					
d. Commercial			X					
e. Forestry			X					
f. Grazing			X					
g. Wetlands	X				X			
2. Infrastructures:								
a. Major Structures			X					
b. Utility Networks	X				X			
c. Transportation Networks	X				X			

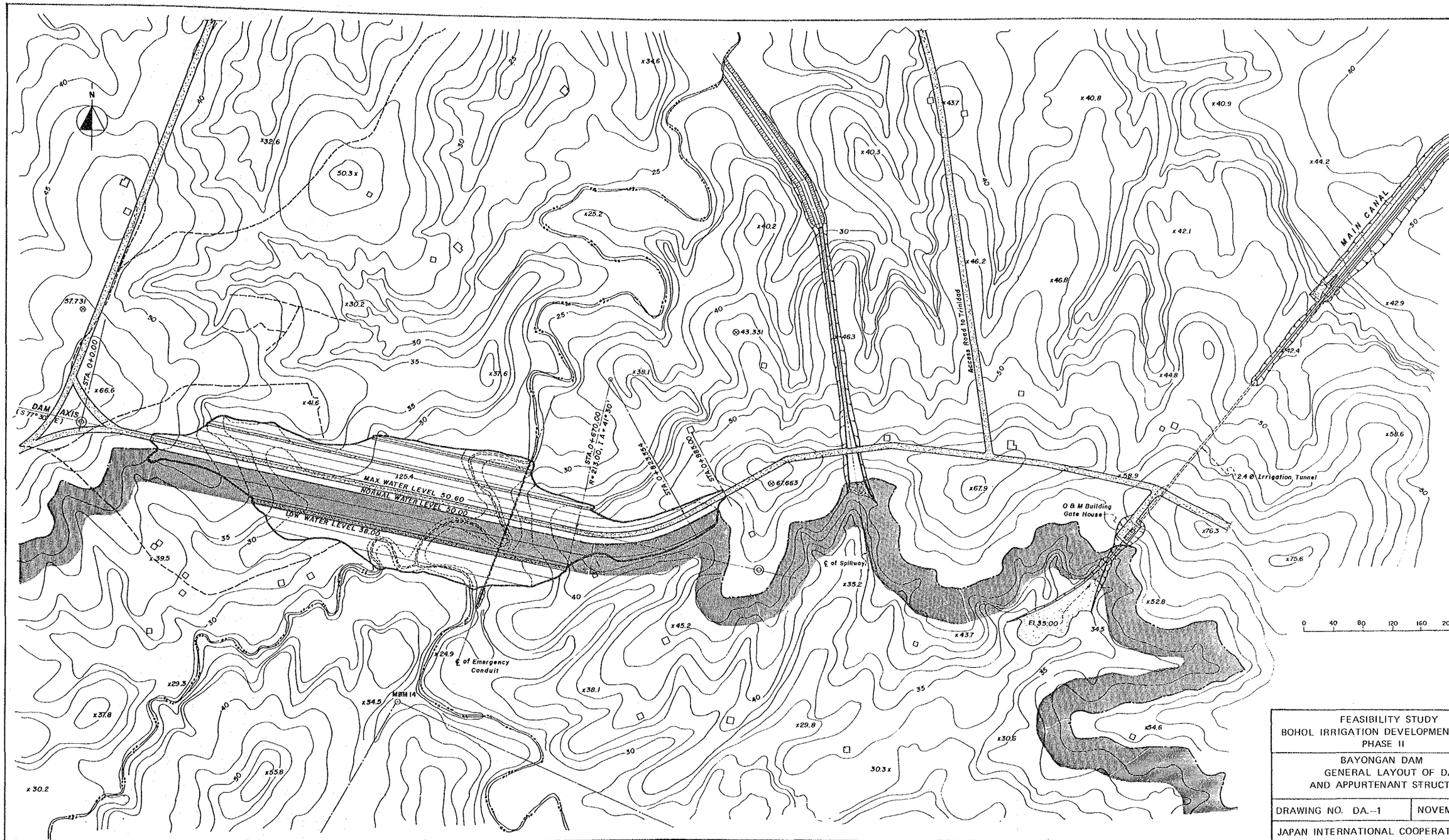
Environmental Parameters	Impact		Magnitude of Impact					
	+	–	O	L	M	H	U	N
3. Aesthetic and Human Interests:								
a. Scenic Views and Vistas	X					X		
b. Parks and Reserves	X			X				
c. Rare and Unique Species			X					
d. Historical and Archeological Sites and Objects			X					
4. Cultural Status:								
a. Employment	X			X				
b. Life Styles	X			X				
c. Health and Safety		X		X				
d. Population Density	X			X				
e. Food Production	X					X		
5. Recreation:								
a. Resorts	X				X			
b. Swimming, Fishing	X					X		
C. Ecological Relationship								
1. Food Chain	X						X	
2. Water-Related Disease Vectors		X			X			
3. Insect Vectors							X	
D. Others								

+ Positive Environmental Impact
– Negative Environmental Impact
O No Environmental Impact
L Minor Environmental Impact
M Moderate Environmental Impact
H High Environmental Impact
U Unknown Environmental Impact Magnitude
N Not Applicable

DRAWINGS

	DRAWINGS	NO.
1.	Bayongan Dam, General Layout of Dam and Appurtenant Structures	DA-1
2.	Bayongan Dam, Section Profile (from Sta. 0-100 to Sta. 1+100)	DA-2
3.	Bayongan Dam, Maximum Section of Dam	DA-3
4.	Bayongan Dam, Detail of Intake, Section of Outlet Works and Division Tunnel	DA-4
5.	Bayongan Dam, Plan of Bucket Dissapator Spillway and Bucket Dissapator Section	DA-5
6.	Capayas Dam, General Layout of Dam and Appurtenant Structures	DA-6
7.	Capayas Dam, Section Profile (from Sta. 0-700 to Sta. 1+100)	DA-7
8.	Capayas Dam, Standard Section of Dam	DA-8
9.	Capayas Dam, Section of Intake Facilities	DA-9
10.	Capayas dam, Details of Bucket, Channel Chute and Spillway Section	DA-10
11.	Proposed Irrigation and Drainage Canal Alignment	CA-1
12.	Canal Profile (1/4), B.M.C, C.M.C, LAT. BA	CA-2
13.	Canal Profile (2/4), LAT.BB, LAT.BC, LAT.BD, LAT.BE	CA-3
14.	Canal Profile (3/4), LAT,BF, LAT.BF-1	CA-4
15.	Canal Profile (4/4), LAT.CA, LAT.CB, LAT.CC, LAT.CC-1	CA-5
16.	Typical Canal Sections	CA-6
17.	Related Structure (1/4)	CA-7
18.	Related Structure (2/4)	CA-8
19.	Related Structure (3/4)	CA-9
20.	Related Structure (4/4)	CA-10

	DRAWINGS	NO.
21.	Typical Layout of On-farm Facilities in Sample Area "A"	OF-1
22.	Typical Layout of On-farm Facilities in Sample Area "B"	OF-2
23.	Standard Design of Rotation Area and On-farm Facilities	OF-3
24.	Standard Design of Division Box and Diversion Weir	OF-4

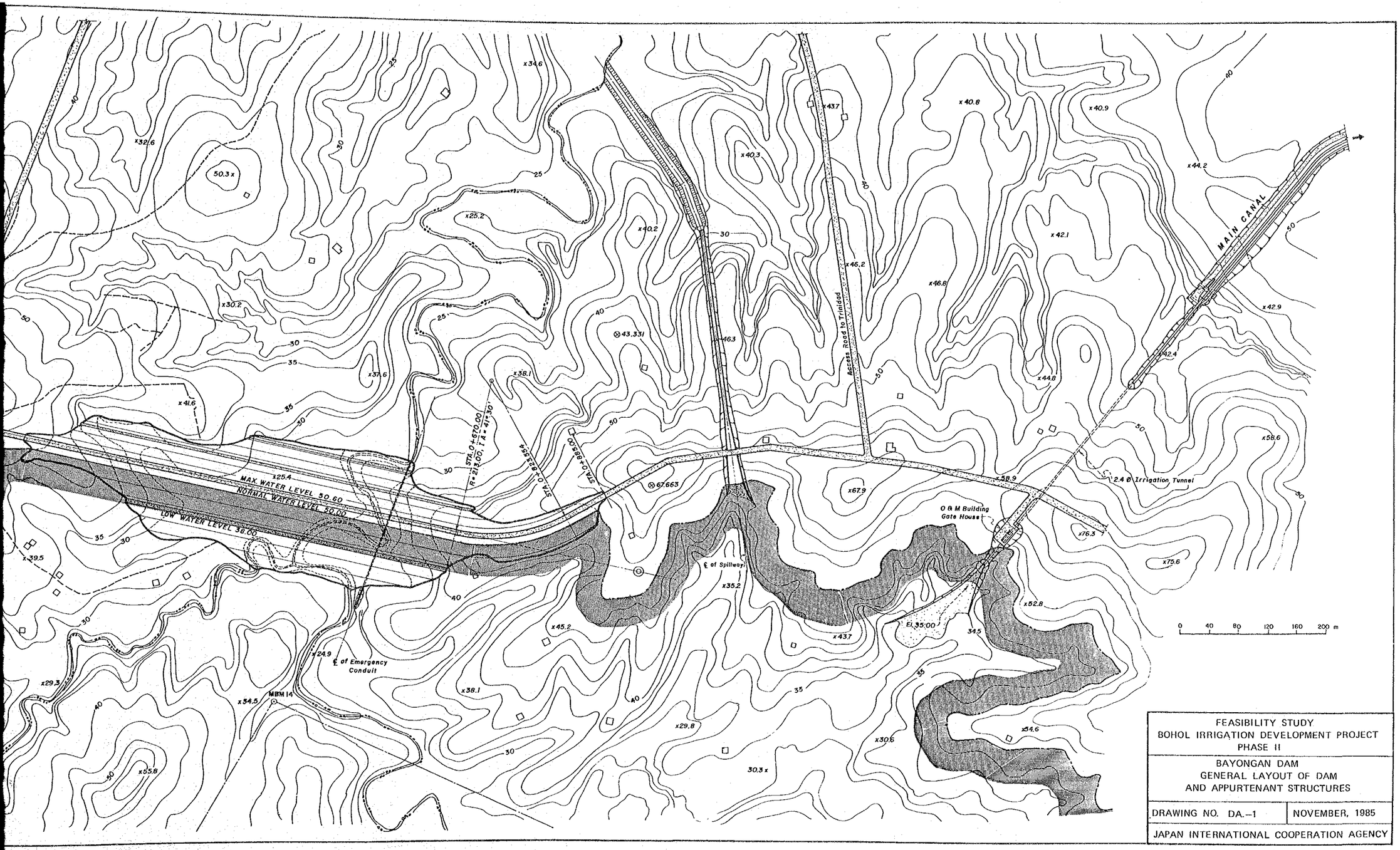


FEASIBILITY STUDY
BOHOL IRRIGATION DEVELOPMENT
PHASE II

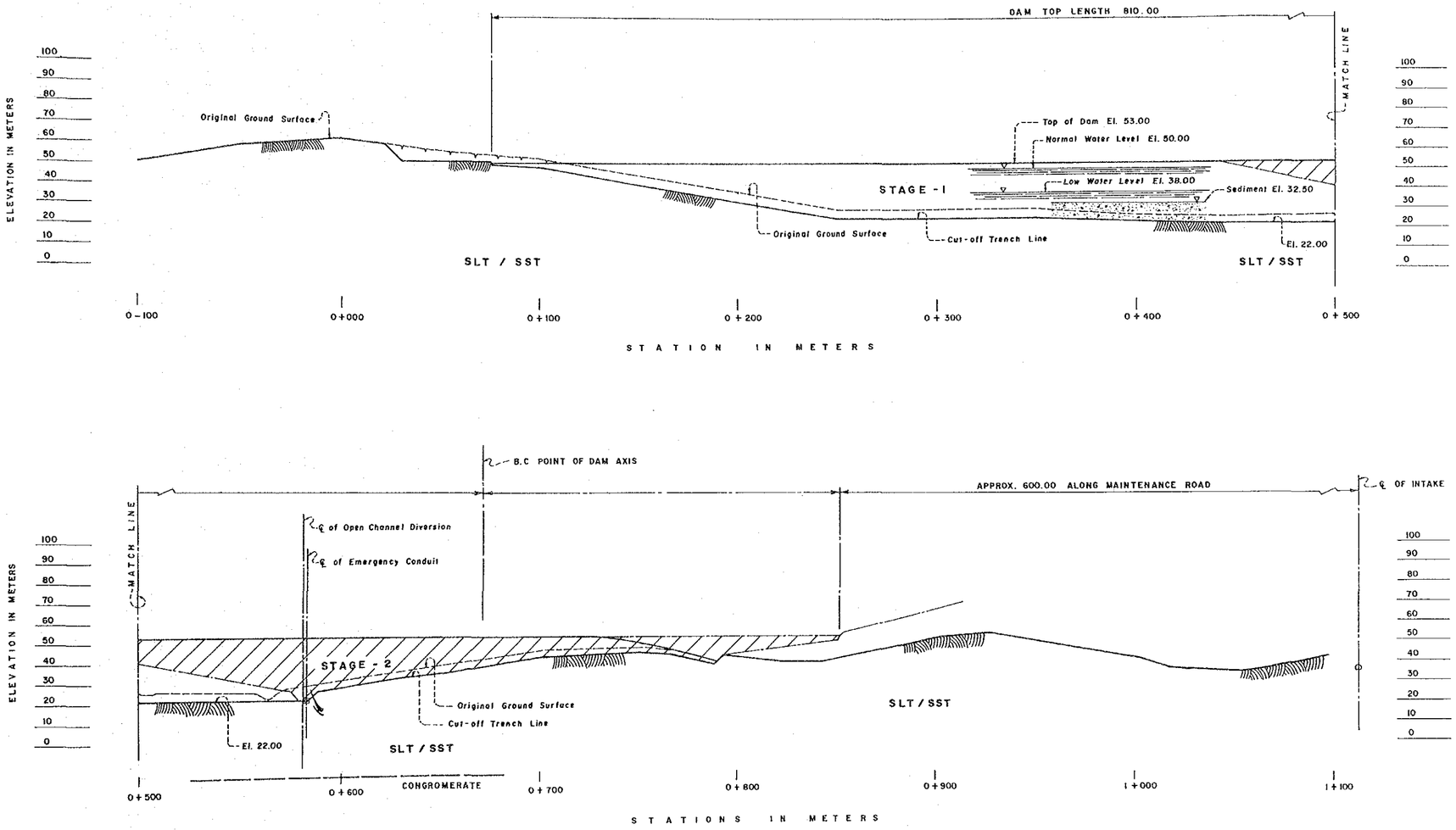
BAYONGAN DAM
GENERAL LAYOUT OF DAM
AND APPURTENANT STRUCTUR

DRAWING NO. DA.-1 | NOVEMBE

JAPAN INTERNATIONAL COOPERATIO



FEASIBILITY STUDY BOHOL IRRIGATION DEVELOPMENT PROJECT PHASE II	
BAYONGAN DAM GENERAL LAYOUT OF DAM AND APPURTENANT STRUCTURES	
DRAWING NO. DA.-1	NOVEMBER, 1985
JAPAN INTERNATIONAL COOPERATION AGENCY	



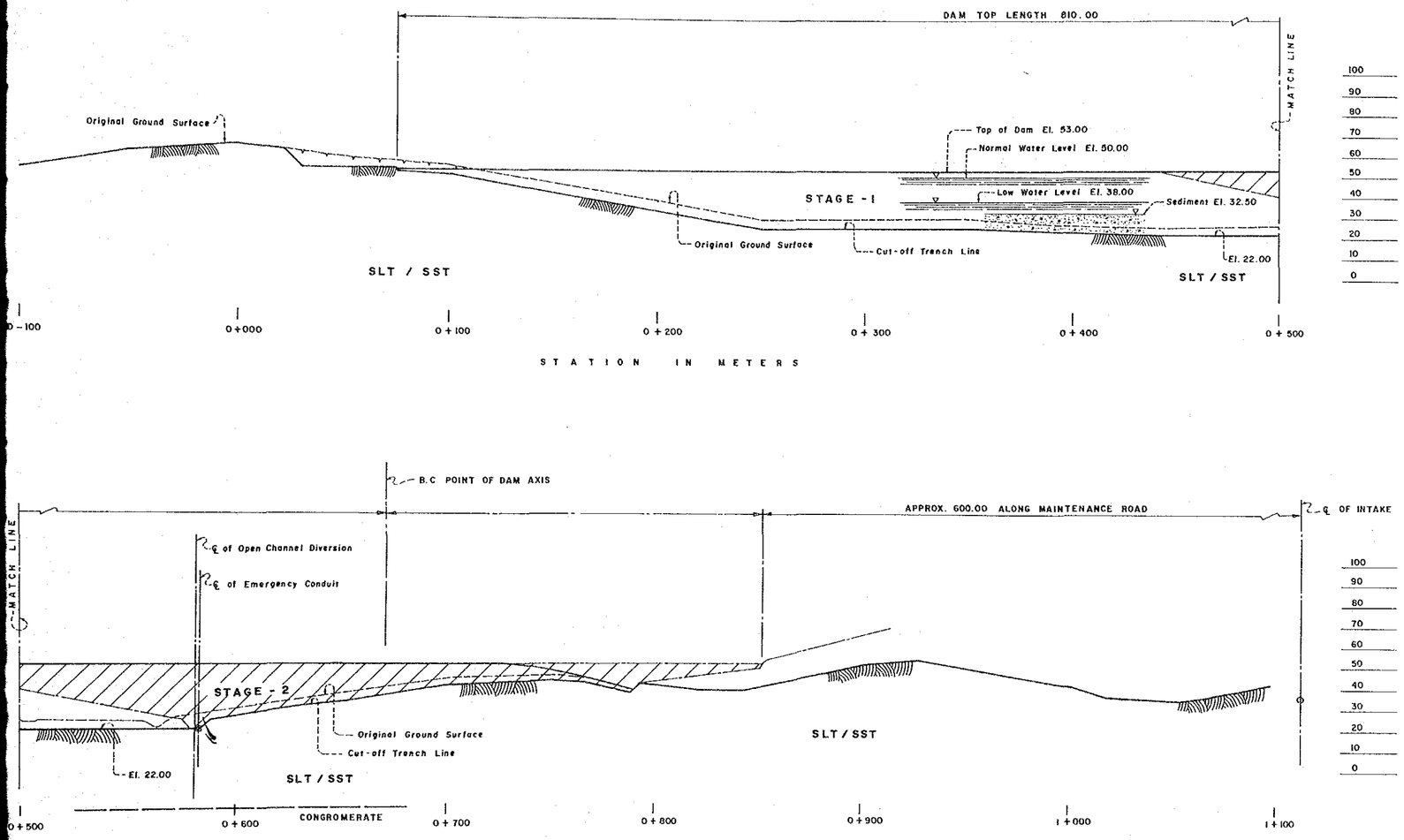
LONGITUDINAL SECTION OF BAYONGAN DAM AXIS

FEASIBILITY STUDY
BOHOL IRRIGATION DEVELOPM
PHASE II

BAYONGAN DAM
SECTION PROFILE
(FROM STA. 0 – 100 TO STA

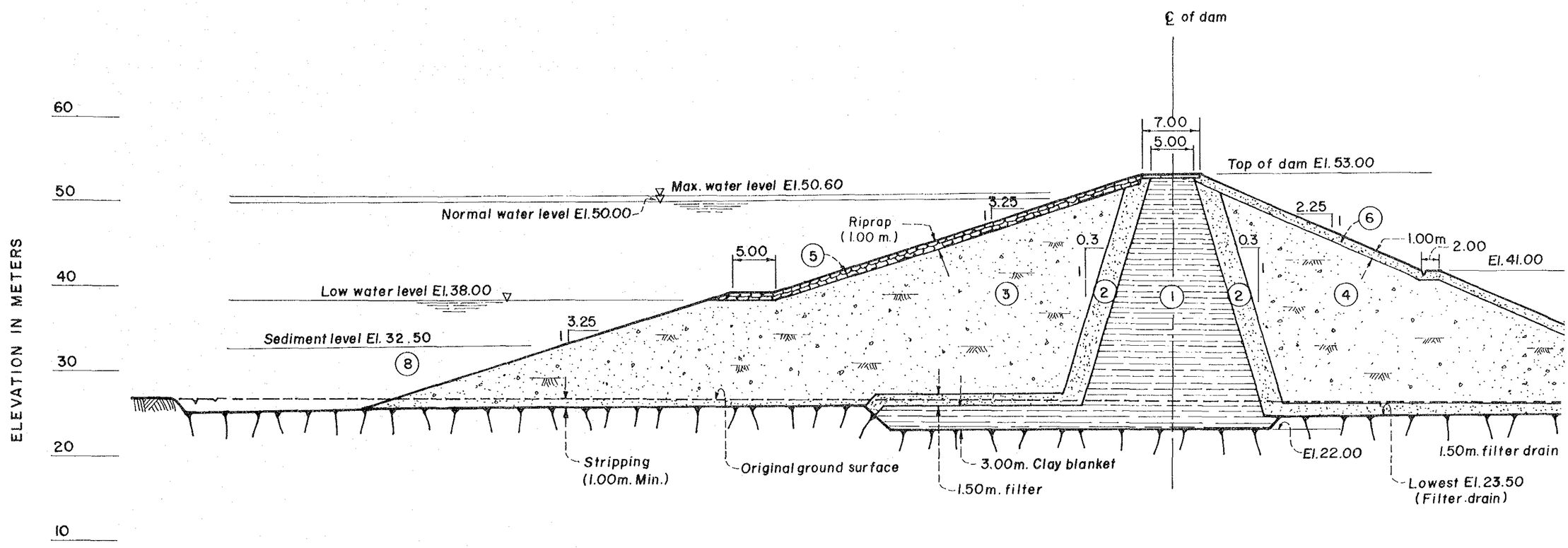
DRAWING NO. DA.–2 | NOV

JAPAN INTERNATIONAL COOPERA



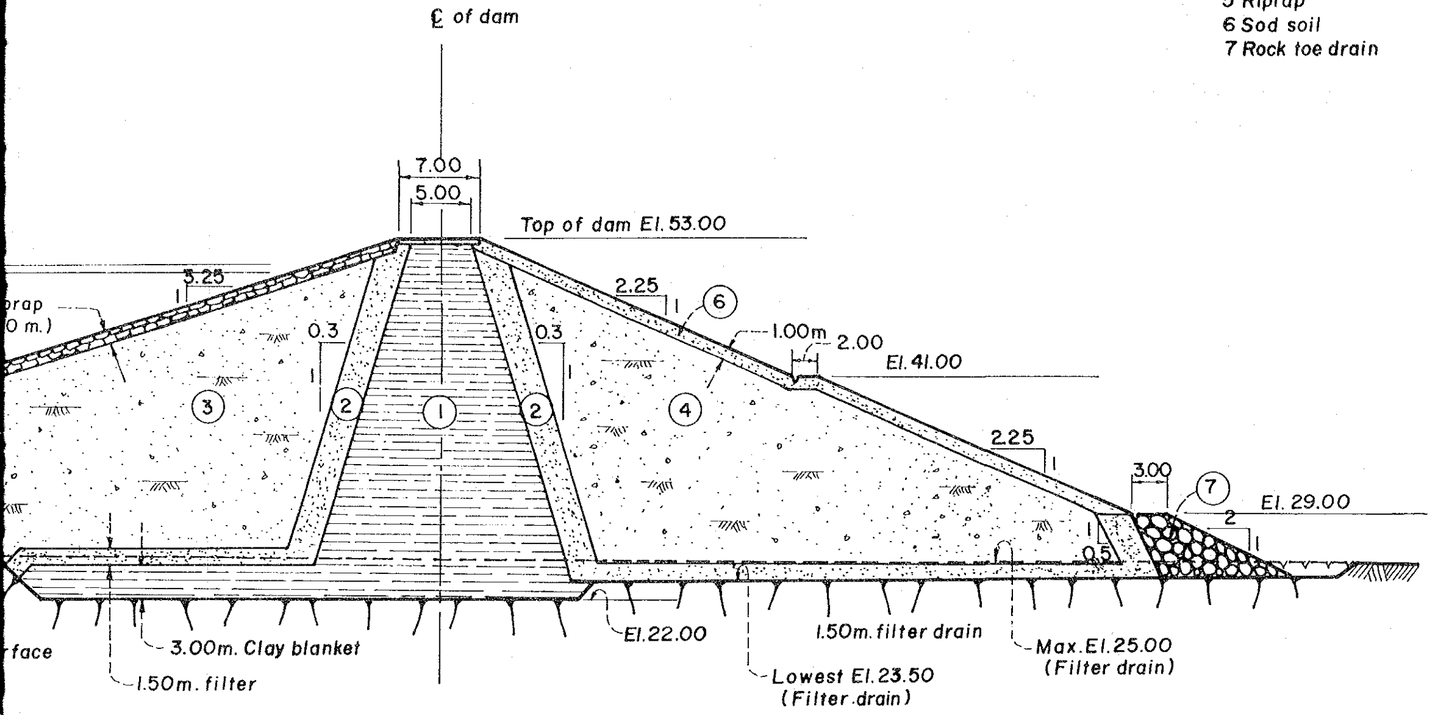
LONGITUDINAL SECTION OF BAYONGAN DAM AXIS

FEASIBILITY STUDY BOHOL IRRIGATION DEVELOPMENT PROJECT PHASE II	
BAYONGAN DAM SECTION PROFILE (FROM STA. 0 – 100 TO STA. 1 + 100)	
DRAWING NO. DA.–2	NOVEMBER, 1985
JAPAN INTERNATIONAL COOPERATION AGENCY	



MAXIMUM SECTION OF DAM EMBANKMENT

SCALE 1:400



LEGEND:	SOURCE:	REMARKS:
1 Core	Borrow area	
2 Filter	Quarry/ Borrow areas	Selected gravel from borrow area
3 U/S Shell	Borrow area	Selected gravel fill
4 D/S Shell	Borrow area	random fill materials
5 Riprap	Quarry sites	
6 Sod soil	Borrow area	Overburden soil
7 Rock toe drain	Quarry sites	

0 8 16 24 32 40 m

SCALE 1: 400

DAM EMBANKMENT

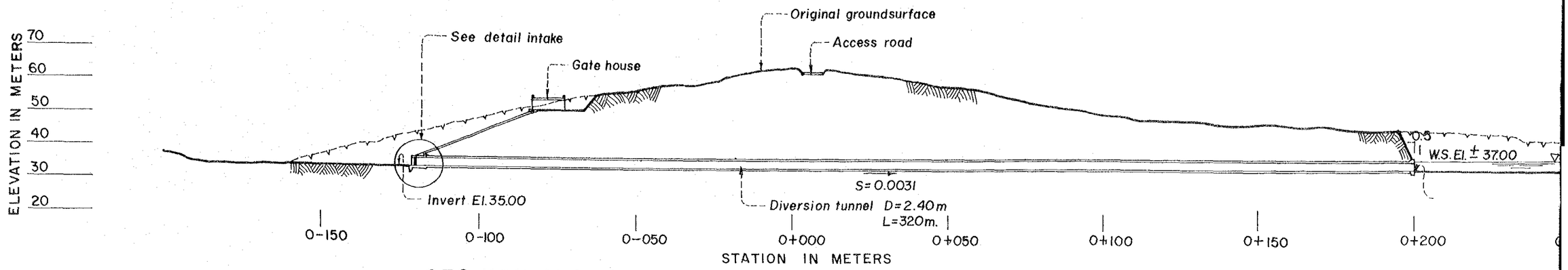
1:400

FEASIBILITY STUDY
BOHOL IRRIGATION DEVELOPMENT PROJECT
PHASE II

BAYONGAN DAM
MAXIMUM SECTION OF DAM

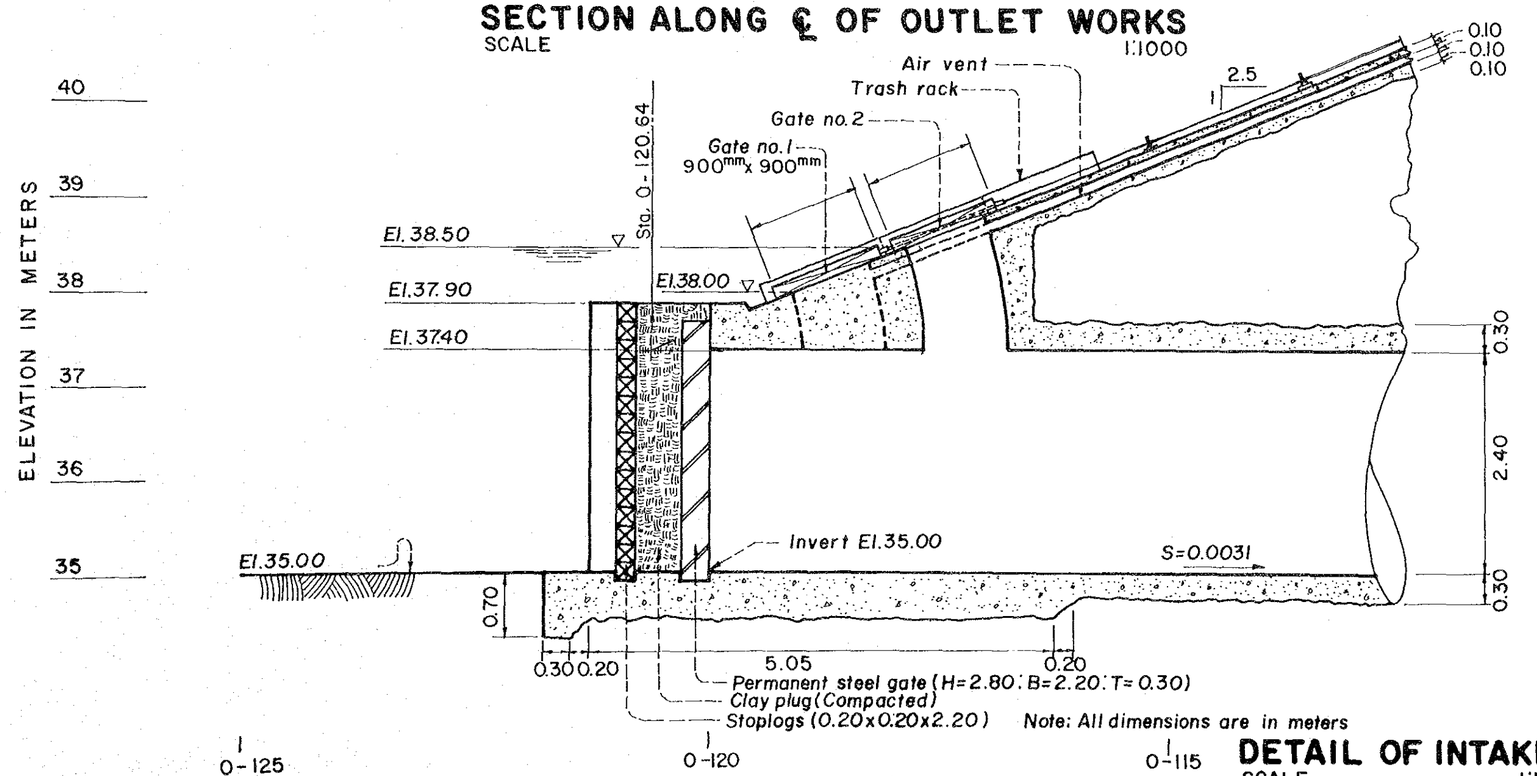
DRAWING NO. DA.-3 | NOVEMBER, 1985

JAPAN INTERNATIONAL COOPERATION AGENCY



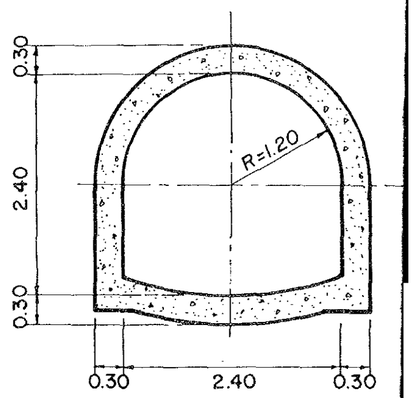
SECTION ALONG ℄ OF OUTLET WORKS

SCALE 1:1000



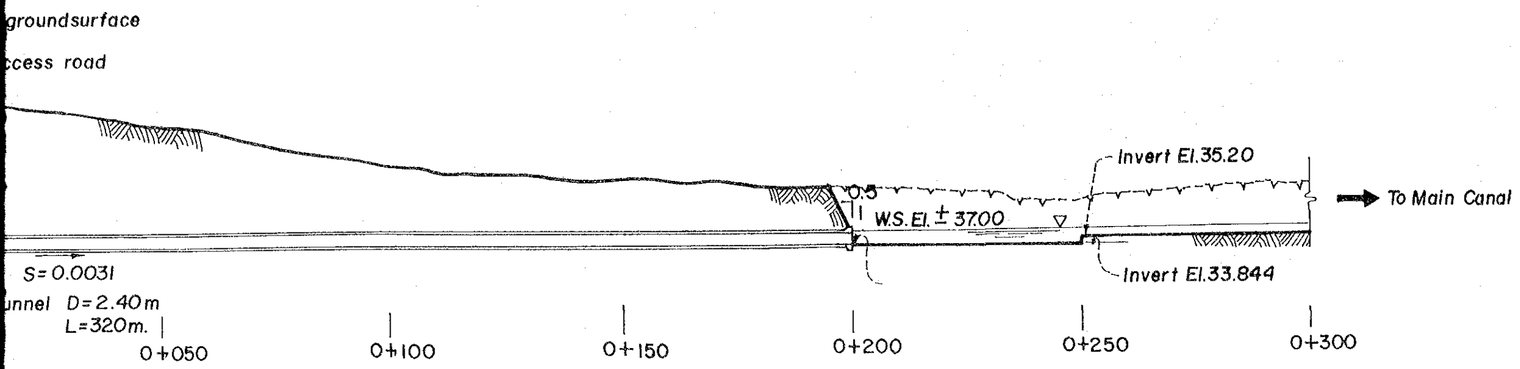
DETAIL OF INTAKE

SCALE 1:50



STD. CROSS SECTION DIVERSION TUNNE

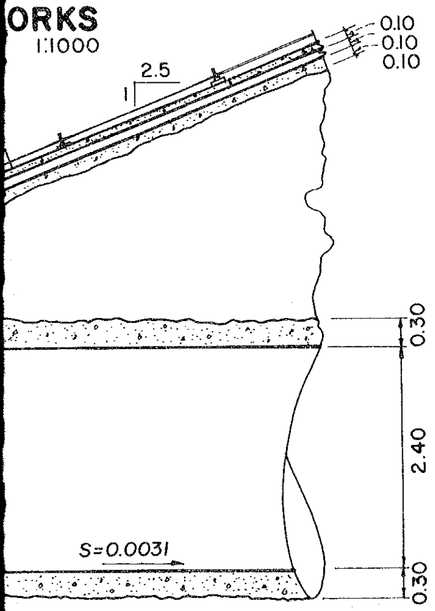
SCALE



ETERS

ORKS

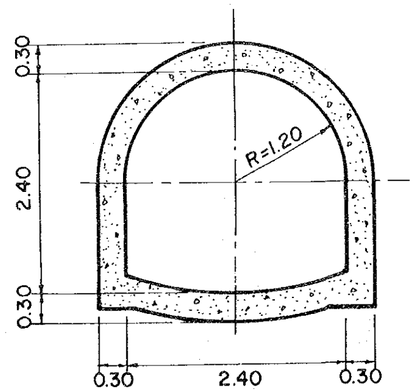
1:1000



0: T= 0.30)

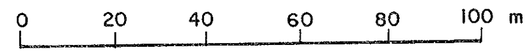
ll dimensions are in meters

0-115 **DETAIL OF INTAKE**
SCALE 1:50



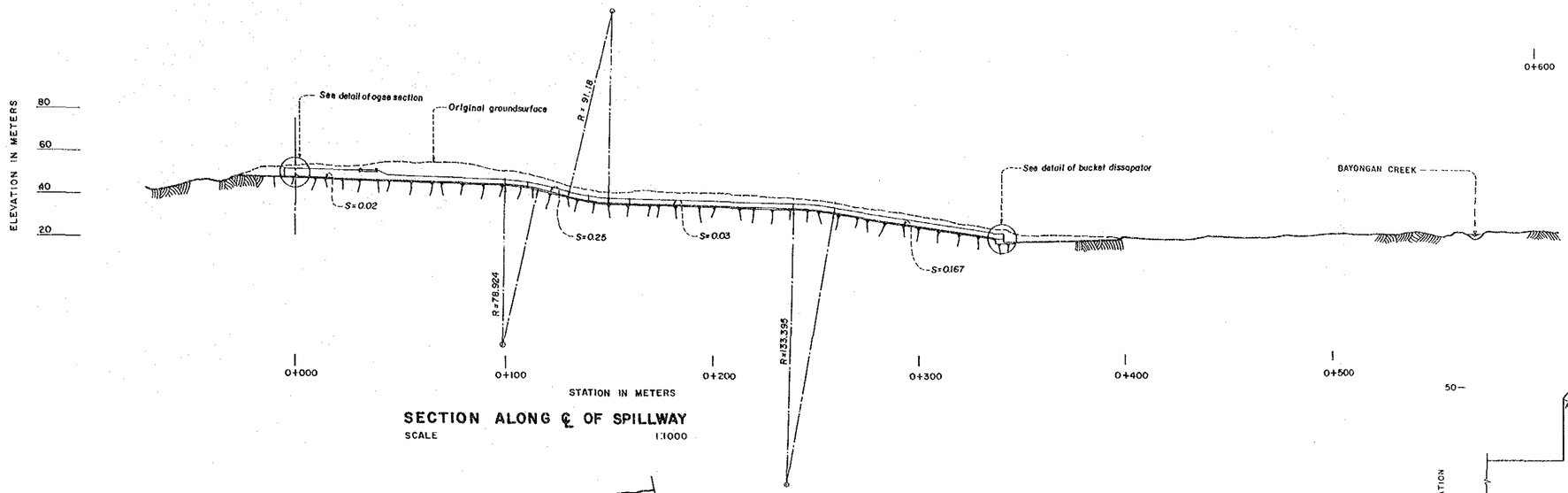
STD. CROSS SECTION OF DIVERSION TUNNEL
SCALE 1:50

SCALE 1 : 50



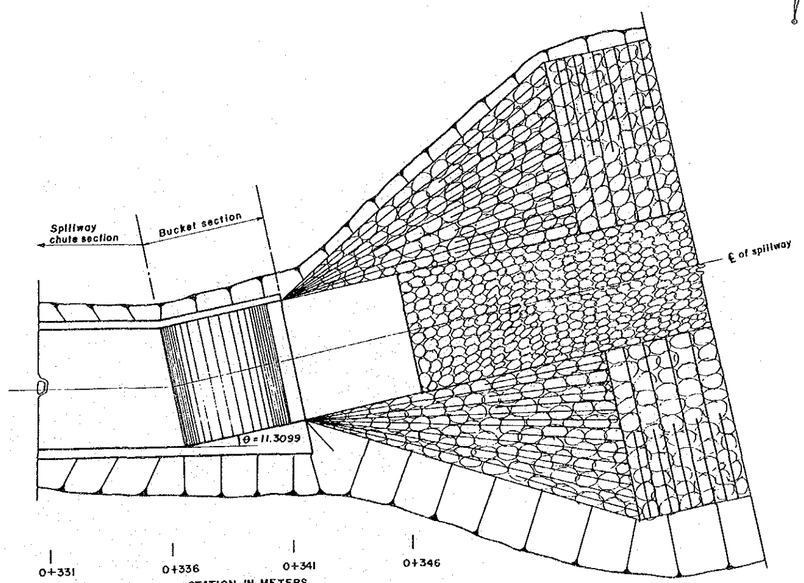
SCALE 1 : 1000

FEASIBILITY STUDY BOHOL IRRIGATION DEVELOPMENT PROJECT PHASE II	
BAYONGAN DAM DETAIL OF INTAKE, SECTION OF OUTLET WORKS AND DIVISION TUNNEL	
DRAWING NO. DA.-4	NOVEMBER, 1985
JAPAN INTERNATIONAL COOPERATION AGENCY	



SECTION ALONG ℄ OF SPILLWAY

SCALE 1:1000

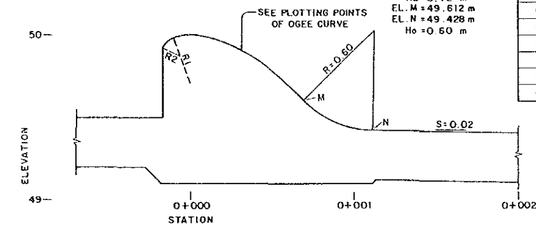


PLAN OF BUCKET DISSAPATOR

SCALE 1:100

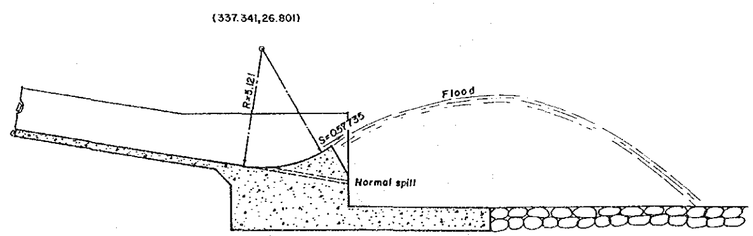
PLOTTING POINTS

STA. X	E
0	5
0.12	4
0.24	4
0.36	4
0.48	4
0.60	4
0.689	4



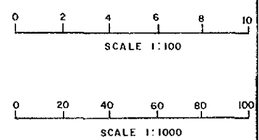
DETAIL OF OGEE SECTION

SCALE 1 : 14



SECTION ALONG ℄ OF BUCKET DISSAPATOR

SCALE 1:100

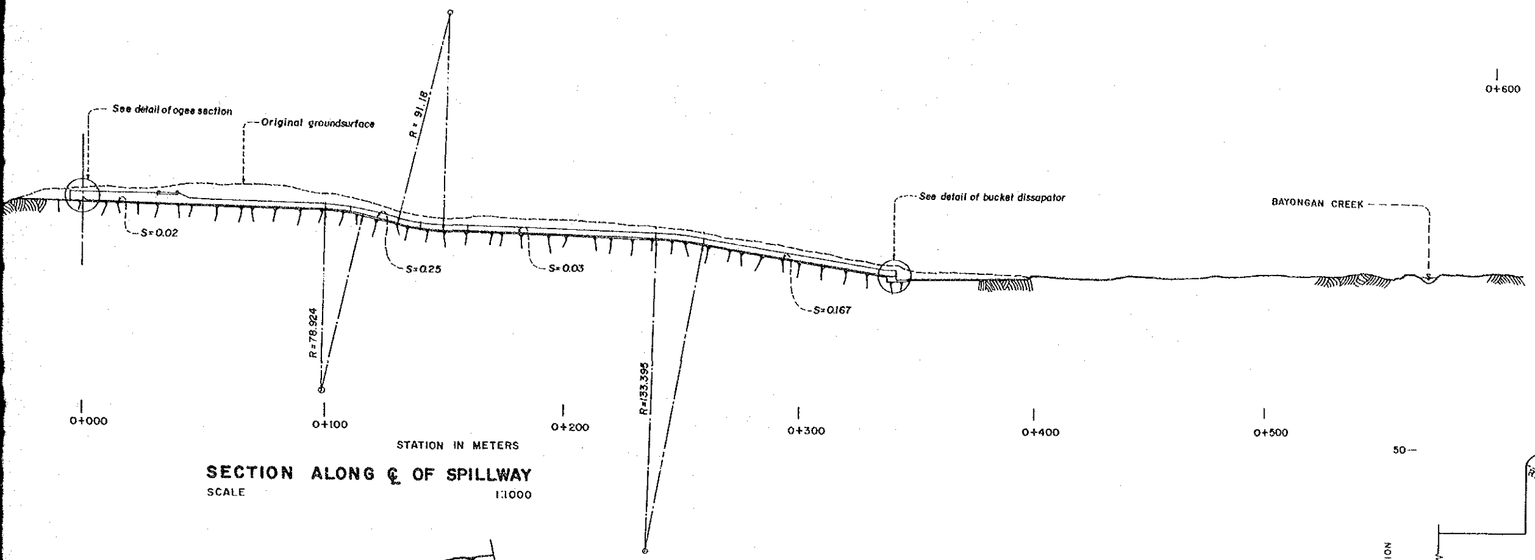


FEASIBILITY STUDY
BOHOL IRRIGATION DEVELOPME
PHASE II

BAYONGAN DAM
PLAN OF BUCKET DISSAPA
SPILLWAY AND BUCKET DISSAPA

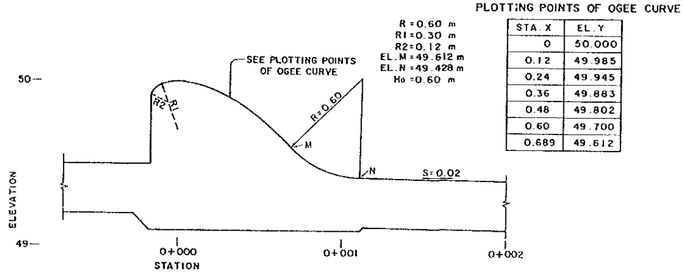
DRAWING NO. DA.–5 | NOV

JAPAN INTERNATIONAL COOPER



SECTION ALONG ℄ OF SPILLWAY

SCALE 1:1000



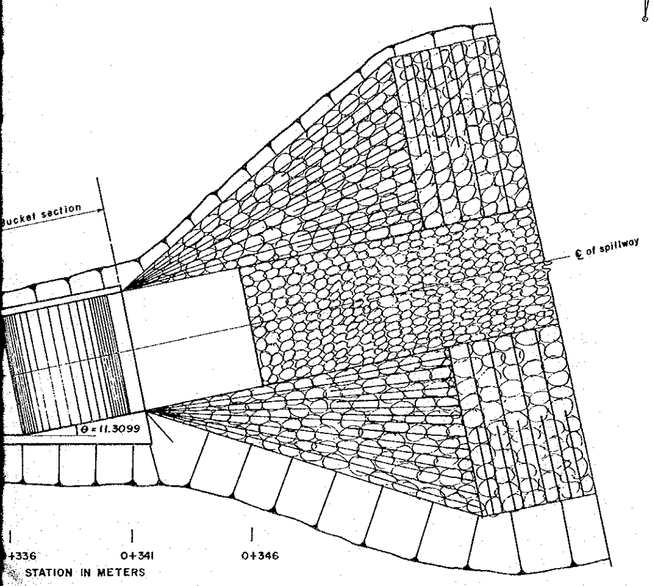
R = 0.60 m
R1 = 0.30 m
R2 = 0.12 m
EL. M = 49.612 m
EL. N = 49.428 m
Ho = 0.60 m

PLOTTING POINTS OF OGEE CURVE

STA. X	EL. Y
0	50.000
0.12	49.985
0.24	49.945
0.36	49.883
0.48	49.802
0.60	49.700
0.689	49.612

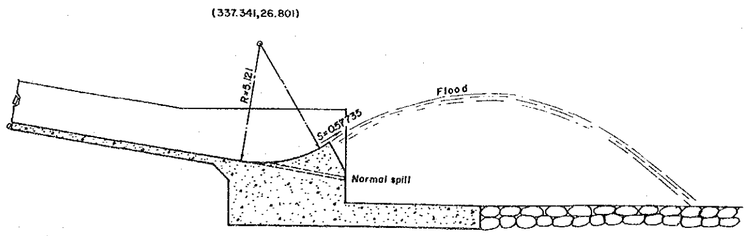
DETAIL OF OGEE SECTION

SCALE 1:14



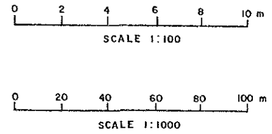
OF BUCKET DISSAPATOR

1:100



SECTION ALONG ℄ OF BUCKET DISSAPATOR

SCALE 1:100

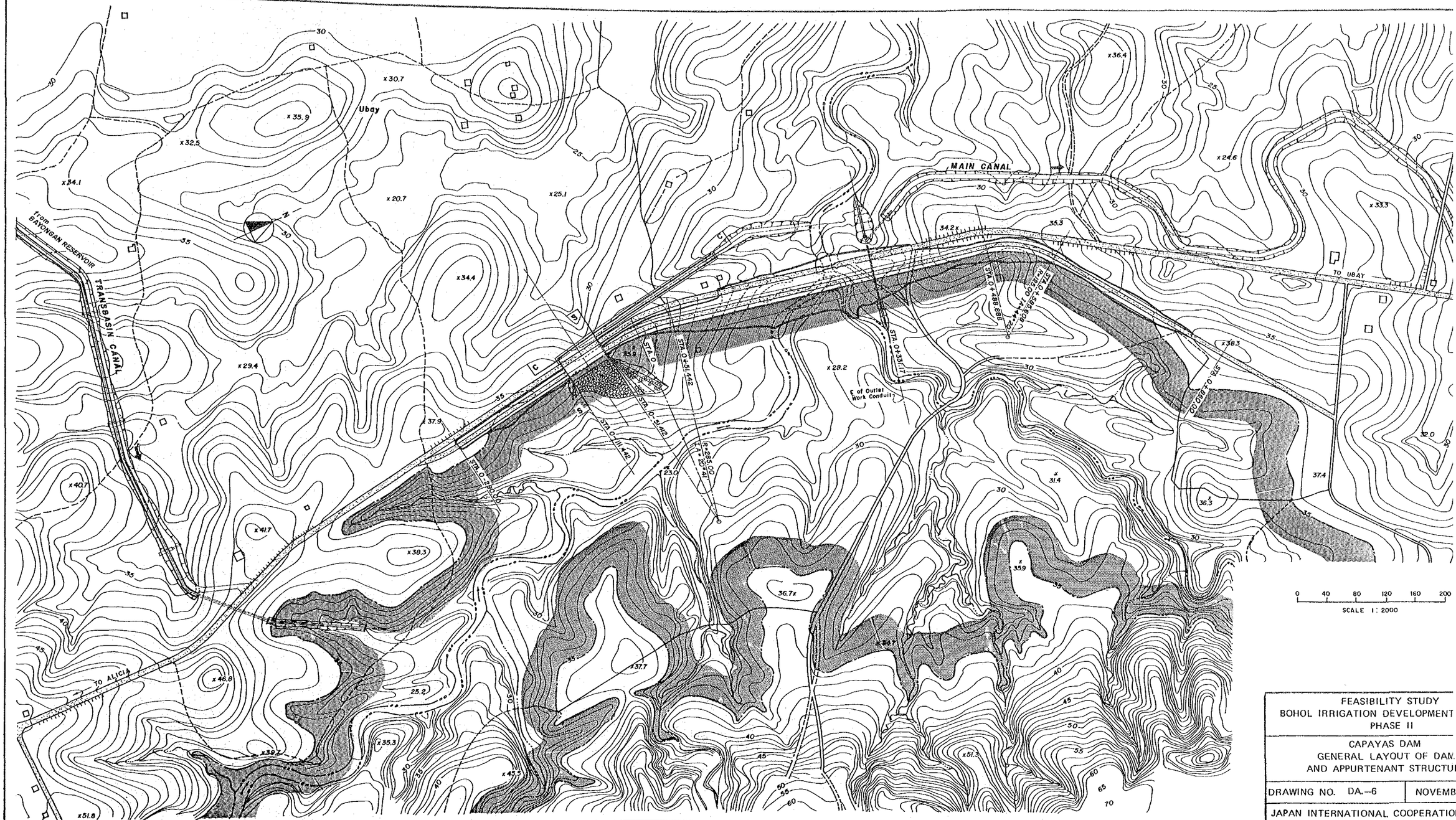


FEASIBILITY STUDY
BOHOL IRRIGATION DEVELOPMENT PROJECT
PHASE II

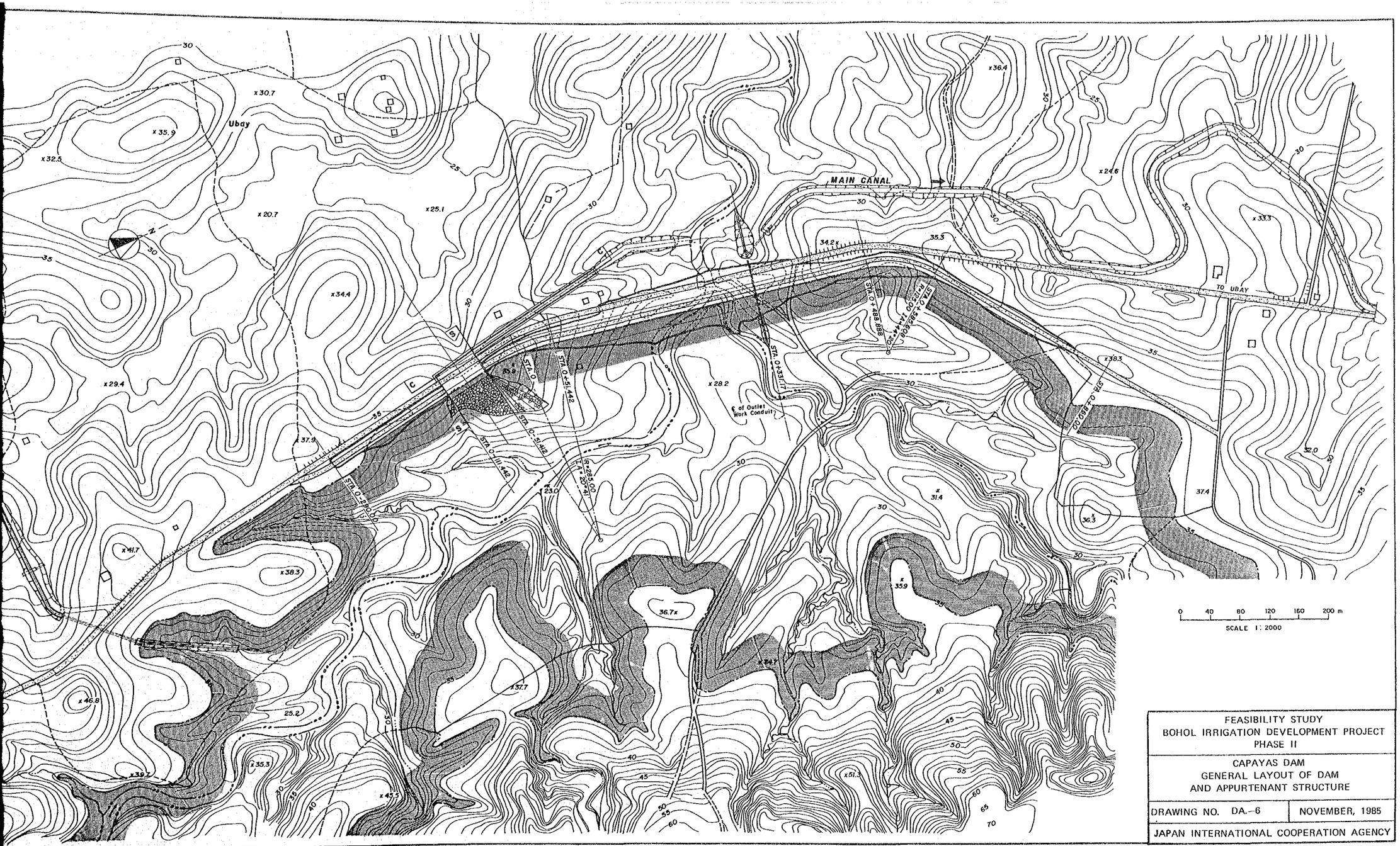
BAYONGAN DAM
PLAN OF BUCKET DISSAPATOR
SPILLWAY AND BUCKET DISSAPATOR SECTION

DRAWING NO. DA.-5 | NOVEMBER, 1985

JAPAN INTERNATIONAL COOPERATION AGENCY



FEASIBILITY STUDY BOHOL IRRIGATION DEVELOPMENT PHASE II	
CAPAYAS DAM GENERAL LAYOUT OF DAM AND APPURTENANT STRUCTU	
DRAWING NO. DA.–6	NOVEMB
JAPAN INTERNATIONAL COOPERATIO	

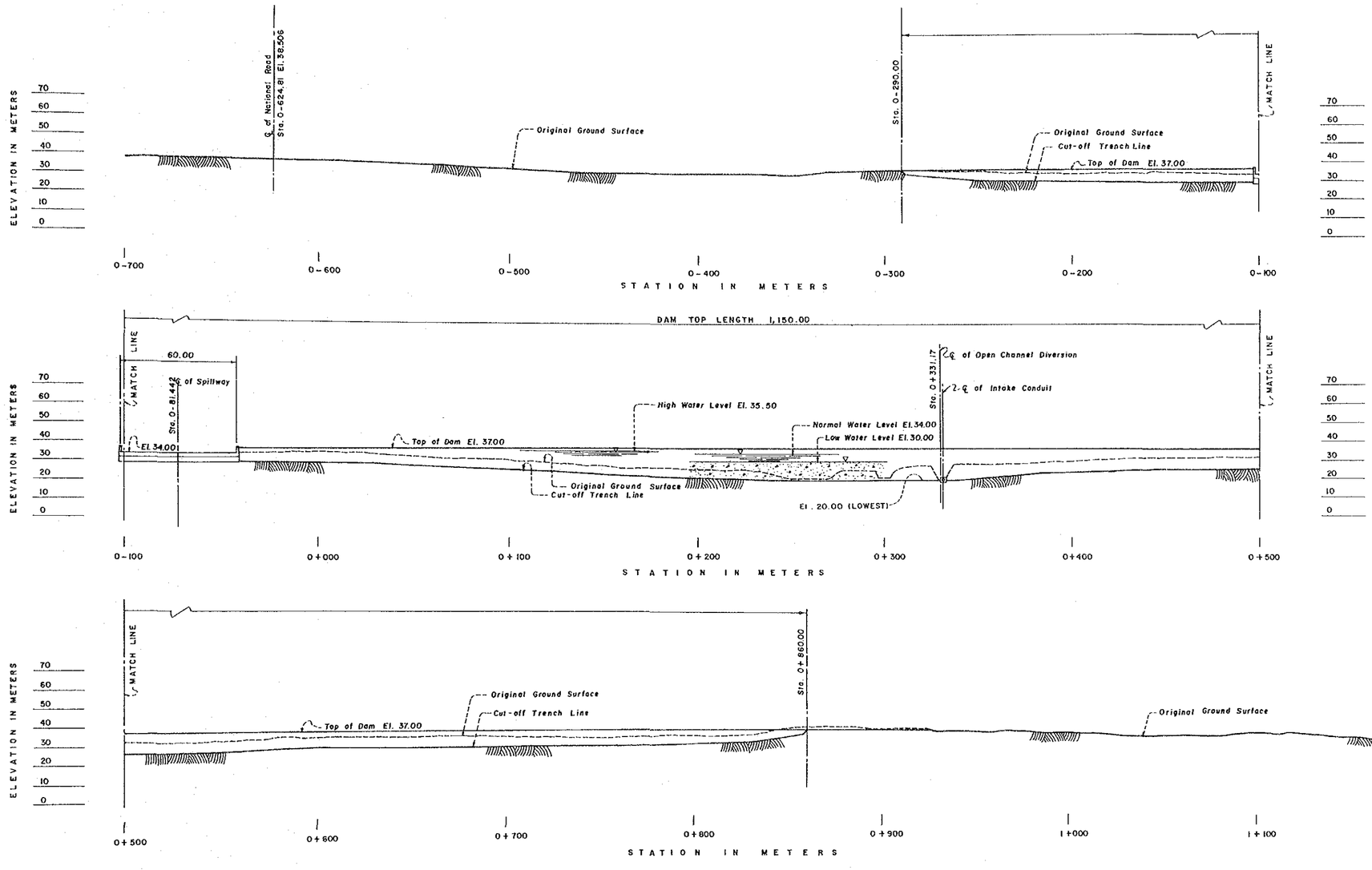


FEASIBILITY STUDY
BOHOL IRRIGATION DEVELOPMENT PROJECT
PHASE II

CAPAYAS DAM
GENERAL LAYOUT OF DAM
AND APPURTENANT STRUCTURE

DRAWING NO. DA.-6	NOVEMBER, 1985

JAPAN INTERNATIONAL COOPERATION AGENCY



LONGITUDINAL SECTION OF CAPAYAS DAM AXIS

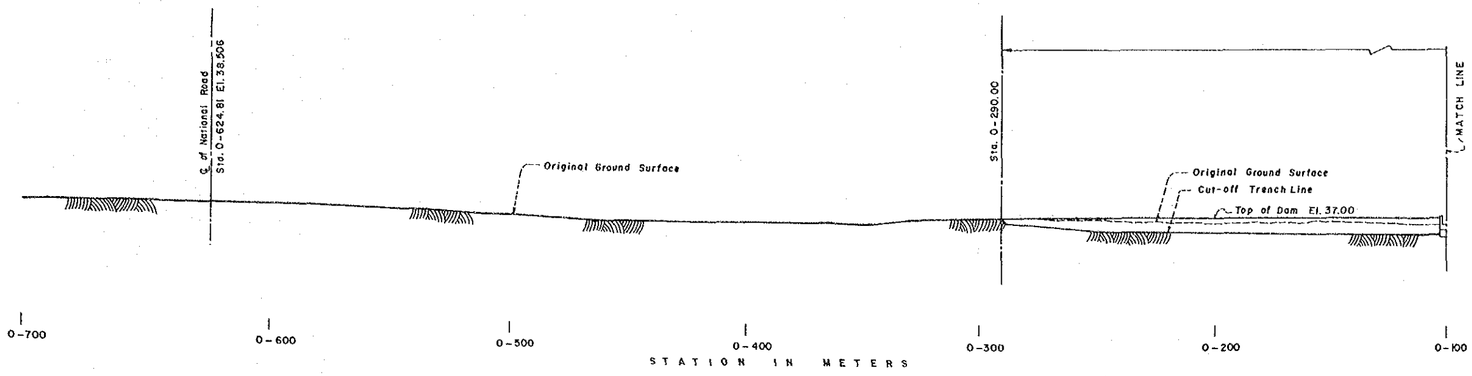
SCALE 1: 1000

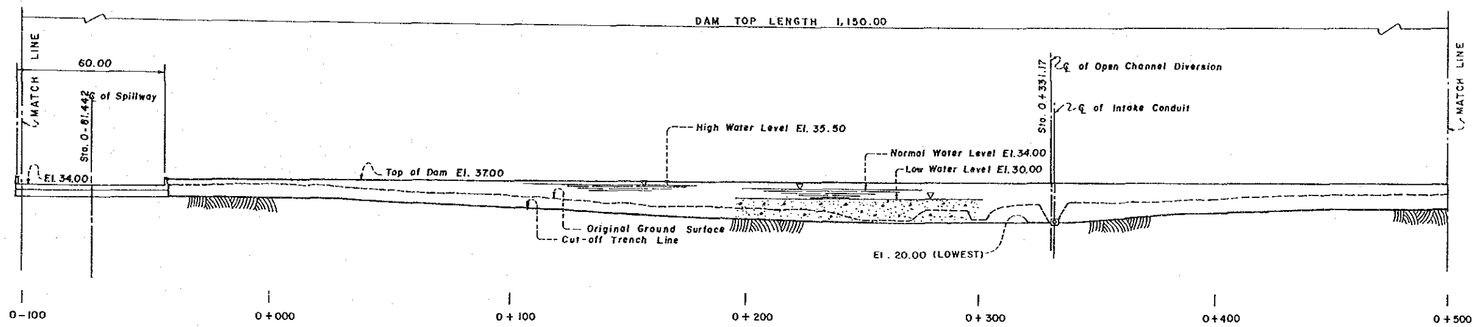
FEASIBILITY STUDY
BOHOL IRRIGATION DEVELOPMEN
PHASE II

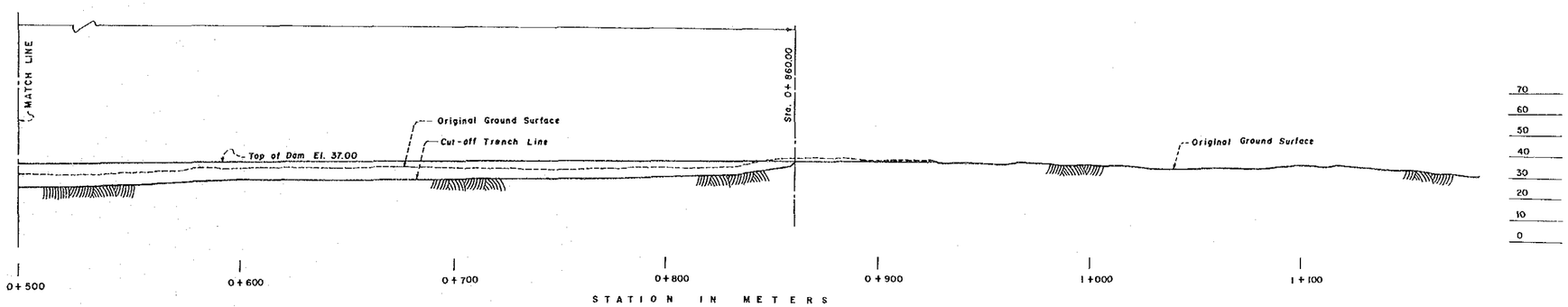
CAPAYAS DAM
SECTION PROFILE
(FROM STA. 0 – 700 TO STA.

DRAWING NO. DA.–7 | NOVE

JAPAN INTERNATIONAL COOPERA







70 60 50 40 30 20 10 0

0 20 40 60 80 100 m
SCALE 1:1000

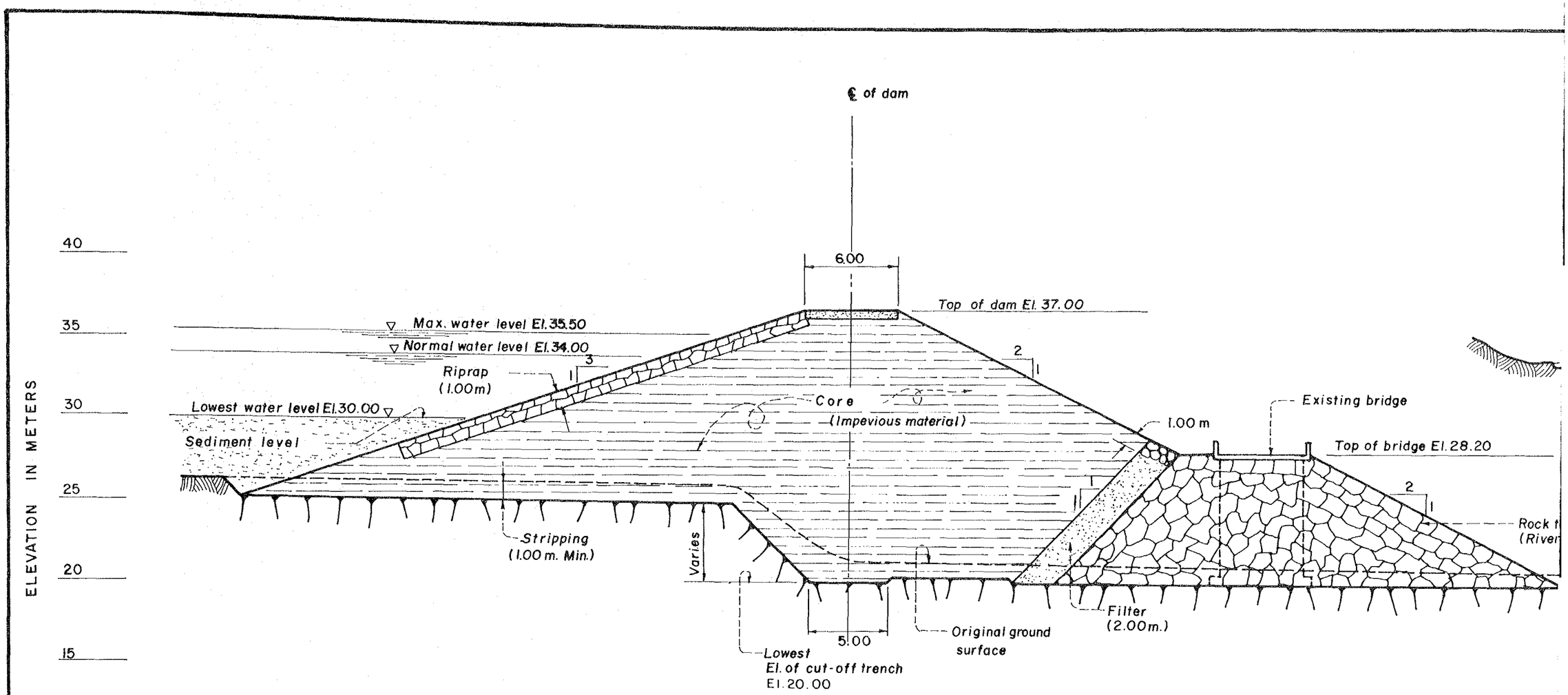
LONGITUDINAL SECTION OF CAPAYAS DAM AXIS
SCALE 1: 1000

FEASIBILITY STUDY
BOHOL IRRIGATION DEVELOPMENT PROJECT
PHASE II

CAPAYAS DAM
SECTION PROFILE
(FROM STA. 0 – 700 TO STA. 1 + 100)

DRAWING NO. DA.–7 | NOVEMBER, 1985

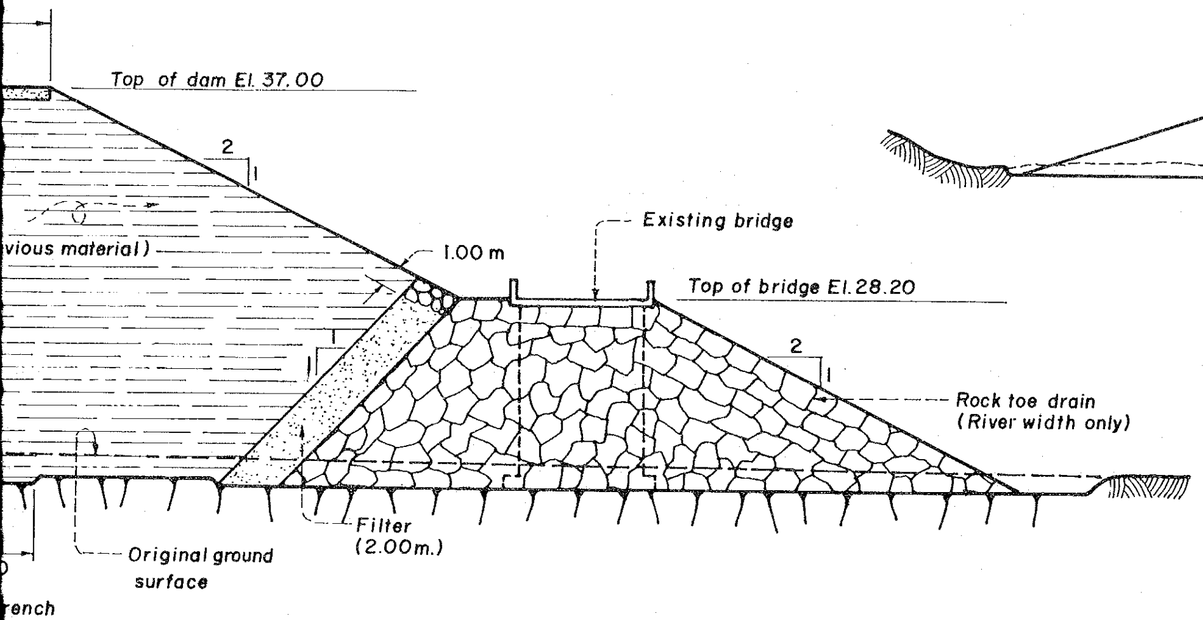
JAPAN INTERNATIONAL COOPERATION AGENCY



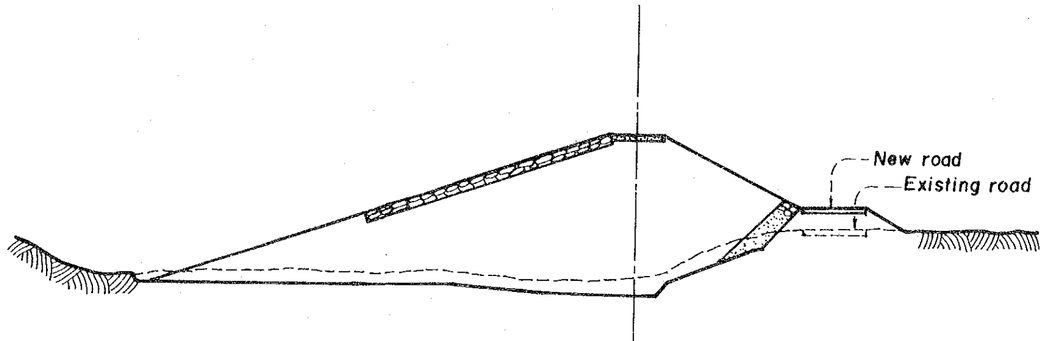
MAXIMUM SECTION OF DAM EMBANKMENT

SCALE 1:200

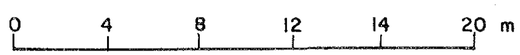
of dam



OF DAM EMBANKMENT
1:200

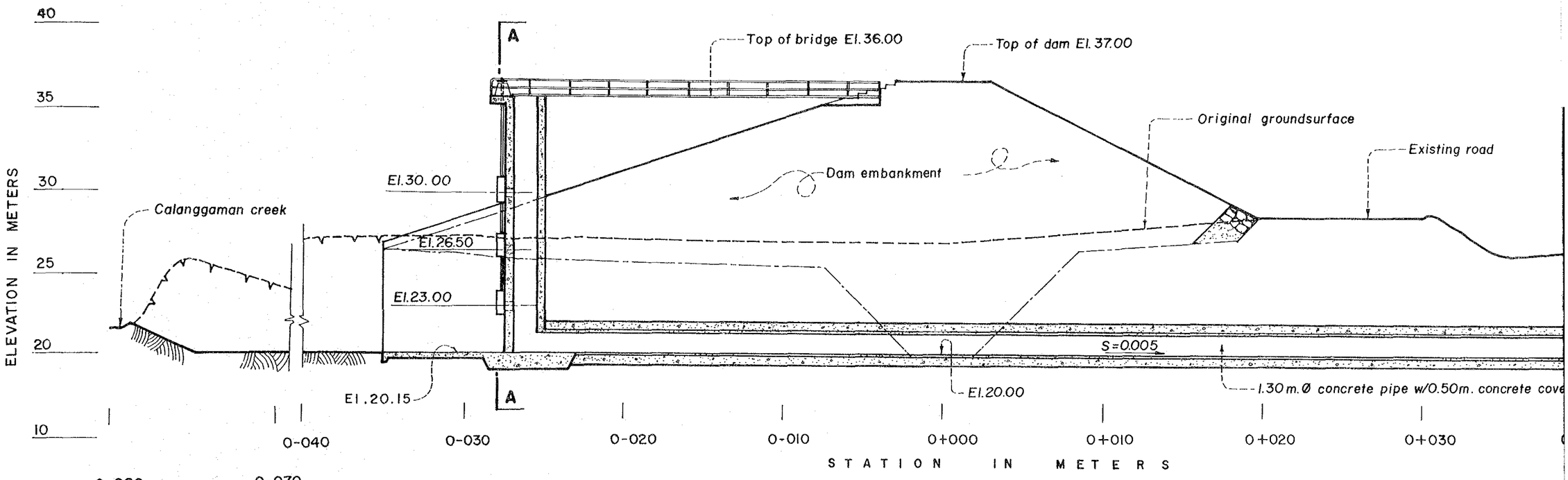


SECTION @ STA. 0+300



SCALE 1: 200

FEASIBILITY STUDY BOHOL IRRIGATION DEVELOPMENT PROJECT PHASE II	
CAPAYAS DAM STANDARD SECTION AT DAM	
DRAWING NO. DA.-8	NOVEMBER, 1985
JAPAN INTERNATIONAL COOPERATION AGENCY	

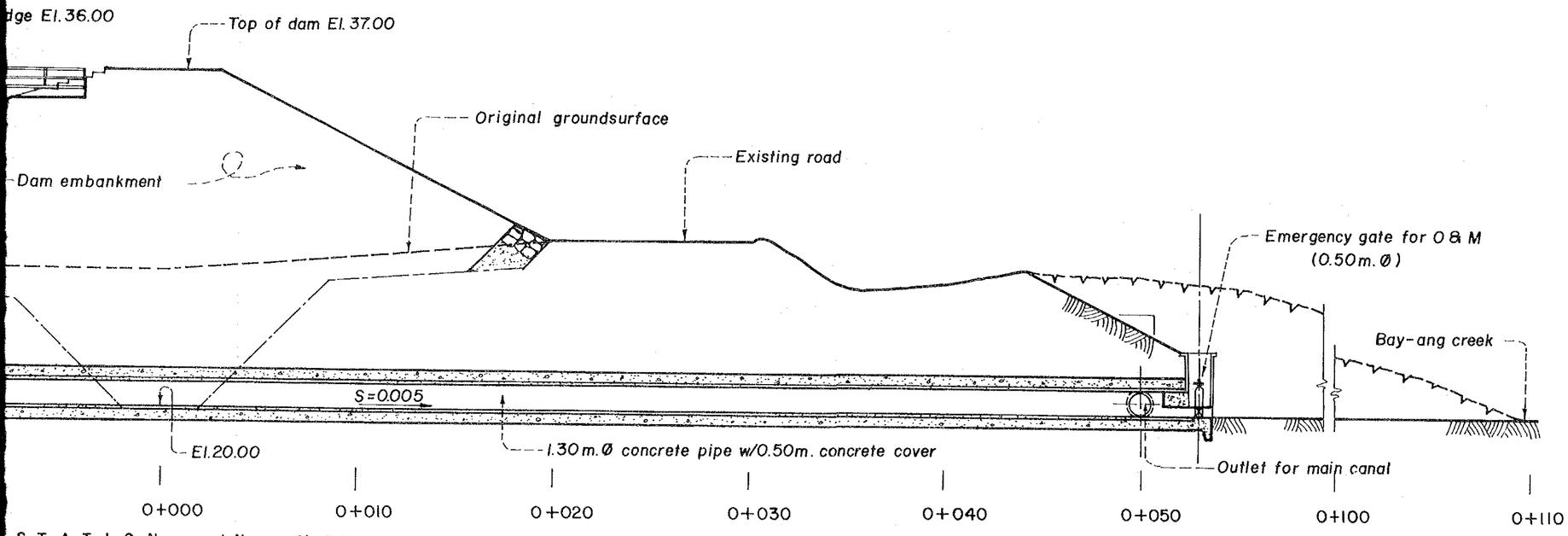


SECTION ALONG ℄ OF OUTLET WORKS (SIPHON TYPE)

SCALE 1:200

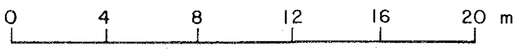
0 4 8 12 16

SCALE 1:200



OF OUTLET WORKS (SIPHON TYPE)

1:200



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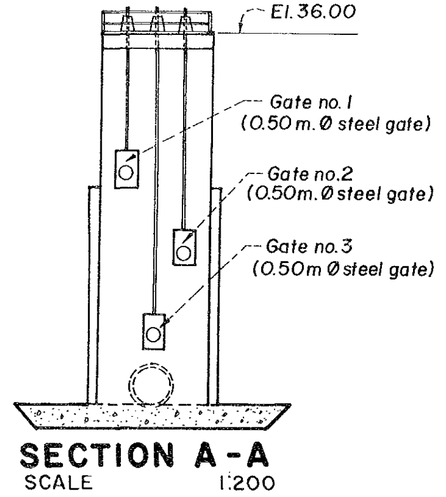

SECTION A-A

SCALE 1:200

FEASIBILITY STUDY
BOHOL IRRIGATION DEVELOPMENT PROJECT
PHASE II

CAPAYAS DAM

SECTIONS OF INTAKE FACILITY

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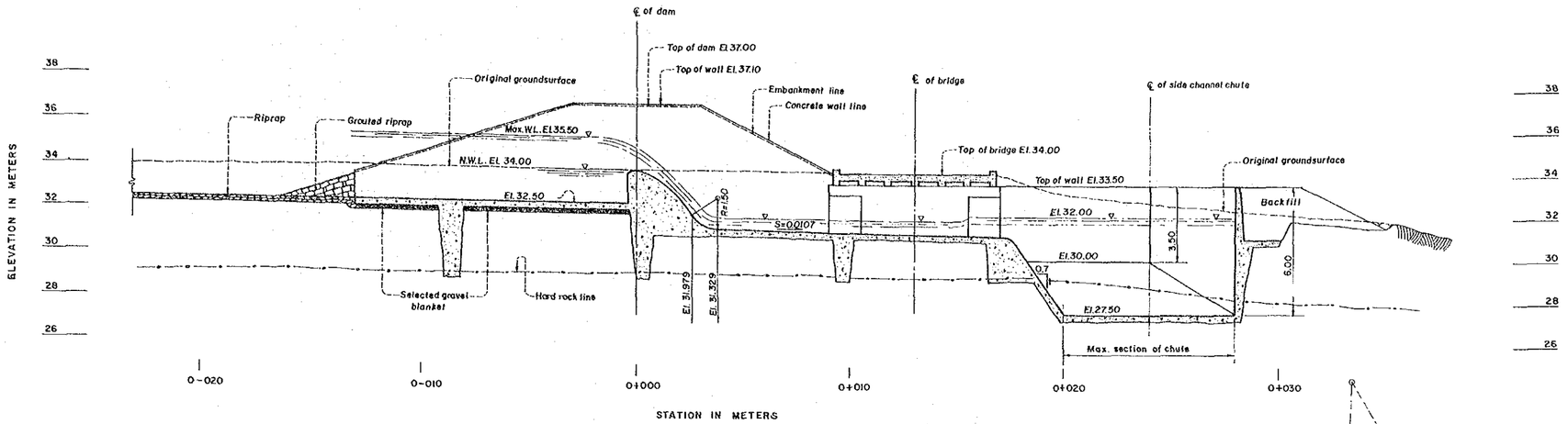
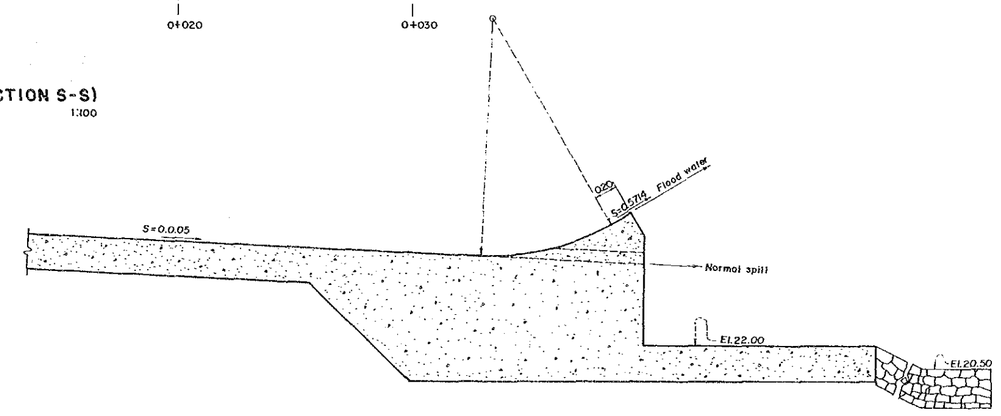


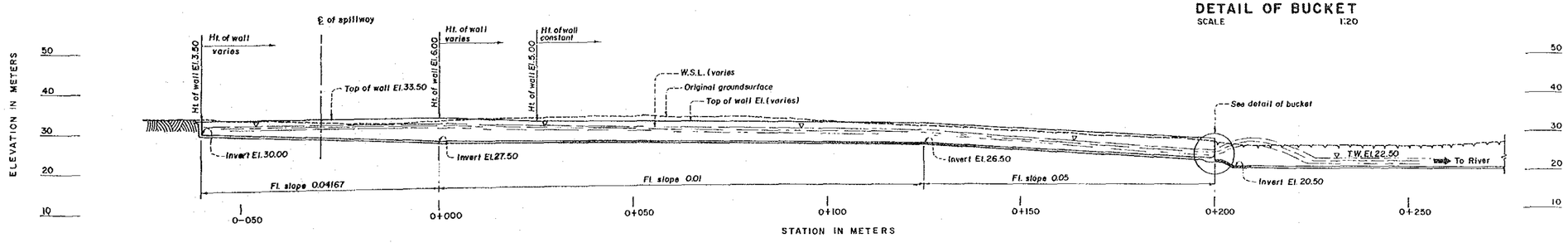
SECTION ALONG ℄ OF SPILLWAY (SECTION S-S)

SCALE 1:100



DETAIL OF BUCKET

SCALE 1:20



SECTION ALONG SIDE CHANNEL CHUTE (SECTION C-C)

SCALE 1:500

0 0.4 0.8 1.2 1.6 2 m
SCALE 1:20

0 2 4 6 8 10 m
SCALE 1:100

0 10 20 30 40 50 m
SCALE 1:500

FEASIBILITY STUDY
BOHOL IRRIGATION DEVELOPMENT
PHASE II

CAPAYAS DAM
DETAIL OF BUCKET
CHANNEL CHUTE AND SPILLWAY S

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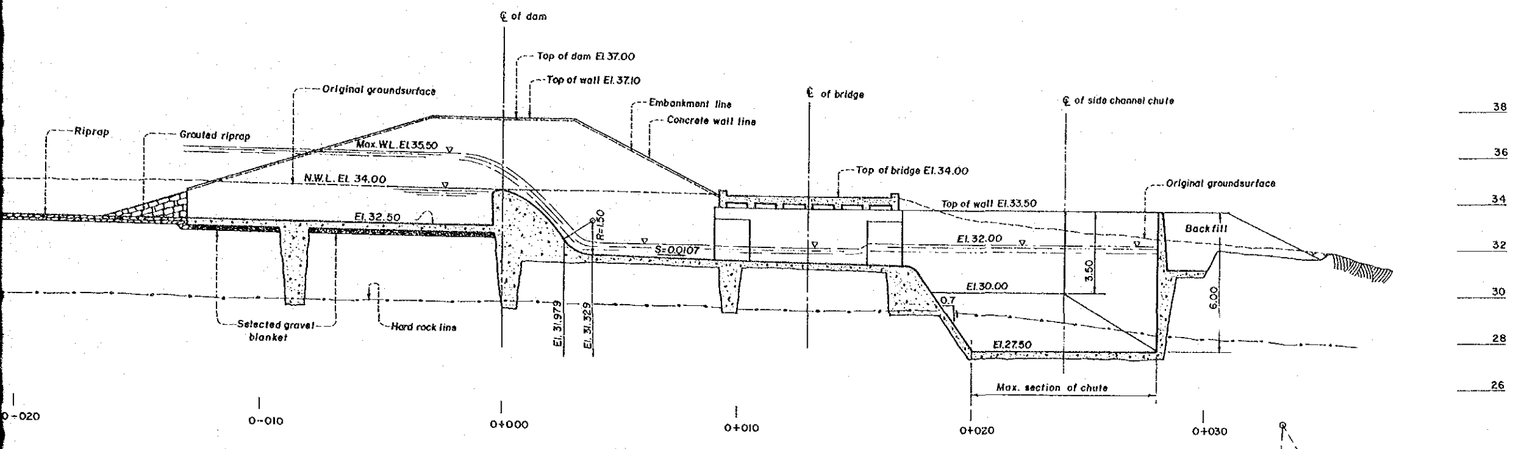
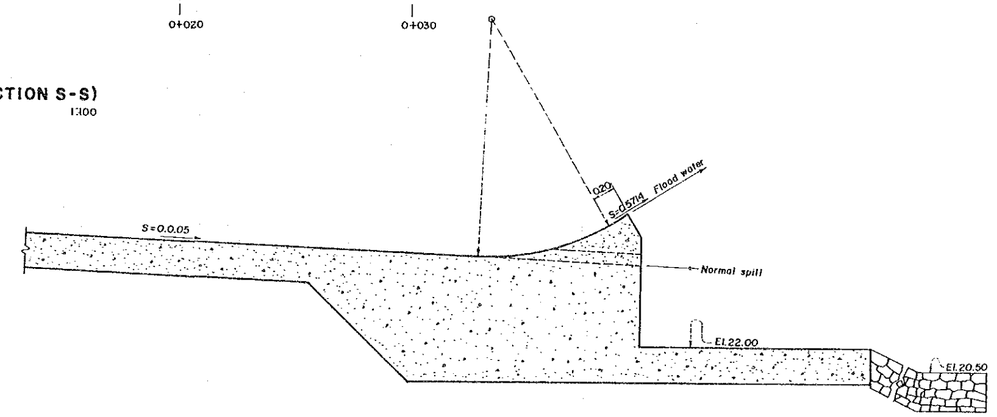


STATION IN METERS

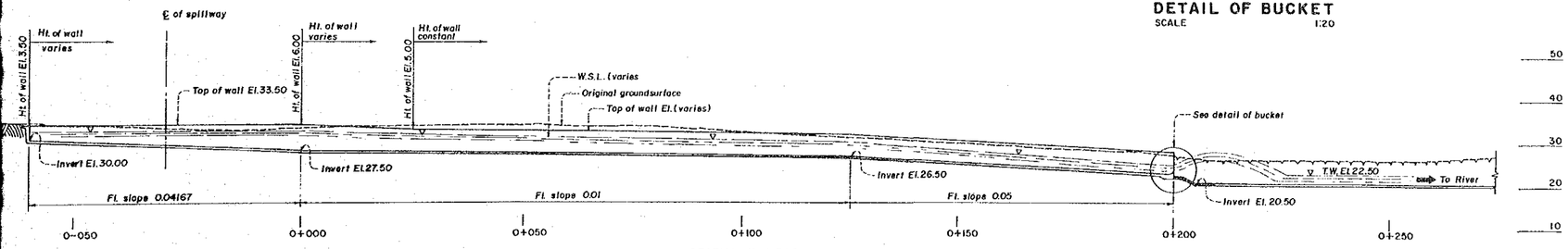
SECTION ALONG ℄ OF SPILLWAY (SECTION S-S)

SCALE 1:100



DETAIL OF BUCKET

SCALE 1:20



STATION IN METERS

SECTION ALONG SIDE CHANNEL CHUTE (SECTION C-C)

SCALE 1:500

0 0.4 0.8 1.2 1.6 2 m
SCALE 1:20

0 2 4 6 8 10 m
SCALE 1:100

0 10 20 30 40 50 m
SCALE 1:500

FEASIBILITY STUDY
BOHOL IRRIGATION DEVELOPMENT PROJECT
PHASE II

CAPAYAS DAM
DETAIL OF BUCKET
CHANNEL CHUTE AND SPILLWAY SECTION

DRAWING NO. DA.-10	NOVEMBER, 1985

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