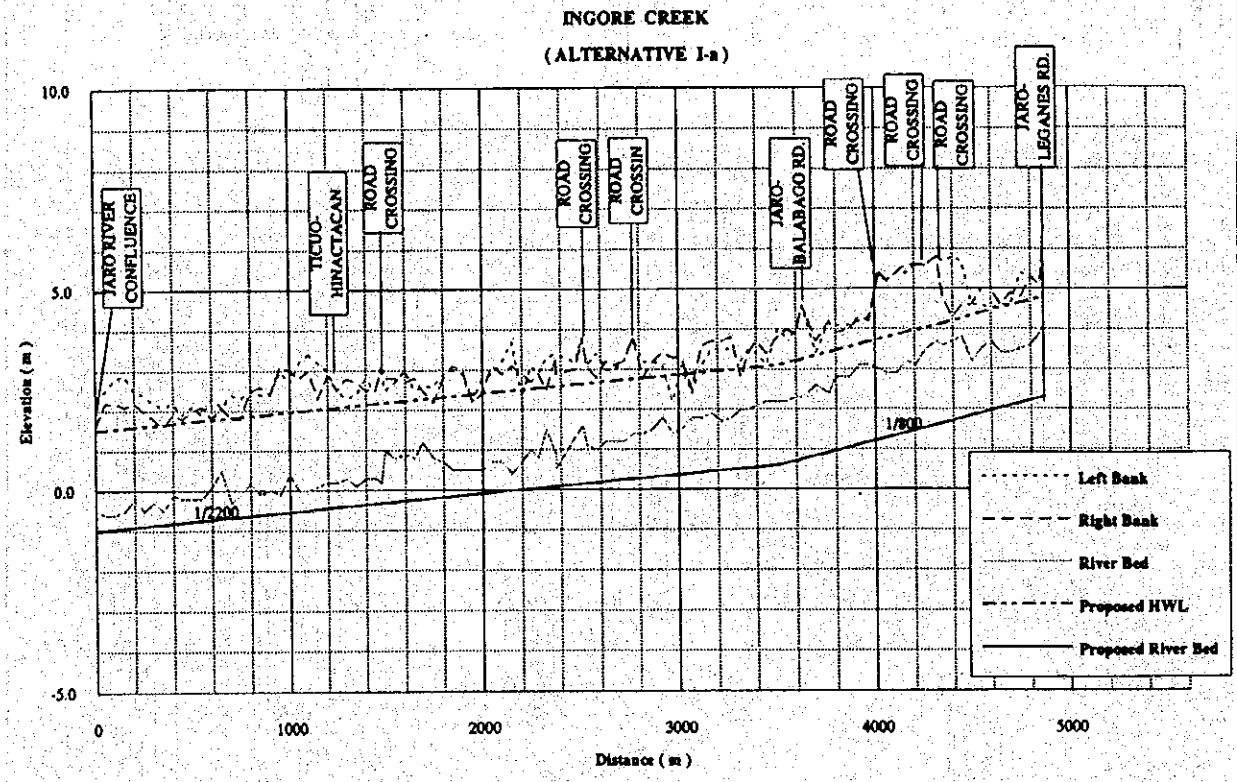

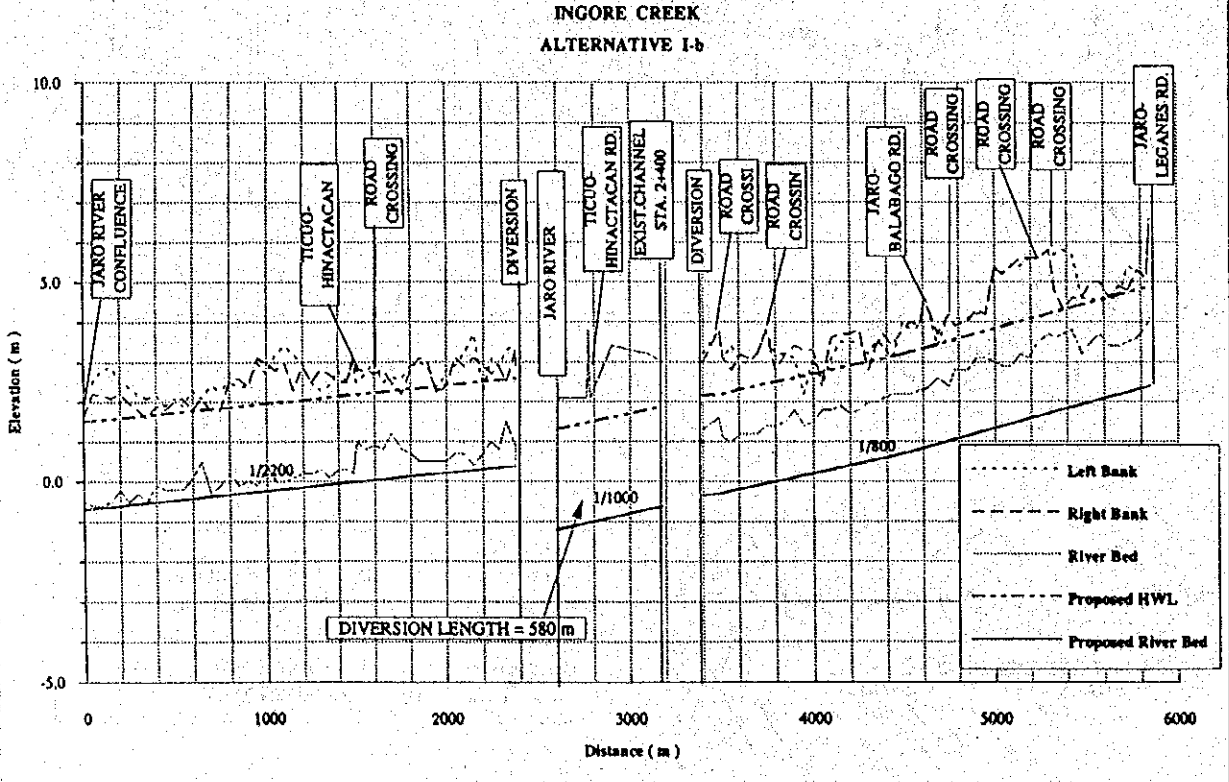

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Fig. 5.5
Alternative Profile of Drainage Channel Improvement (Ingore Creek)

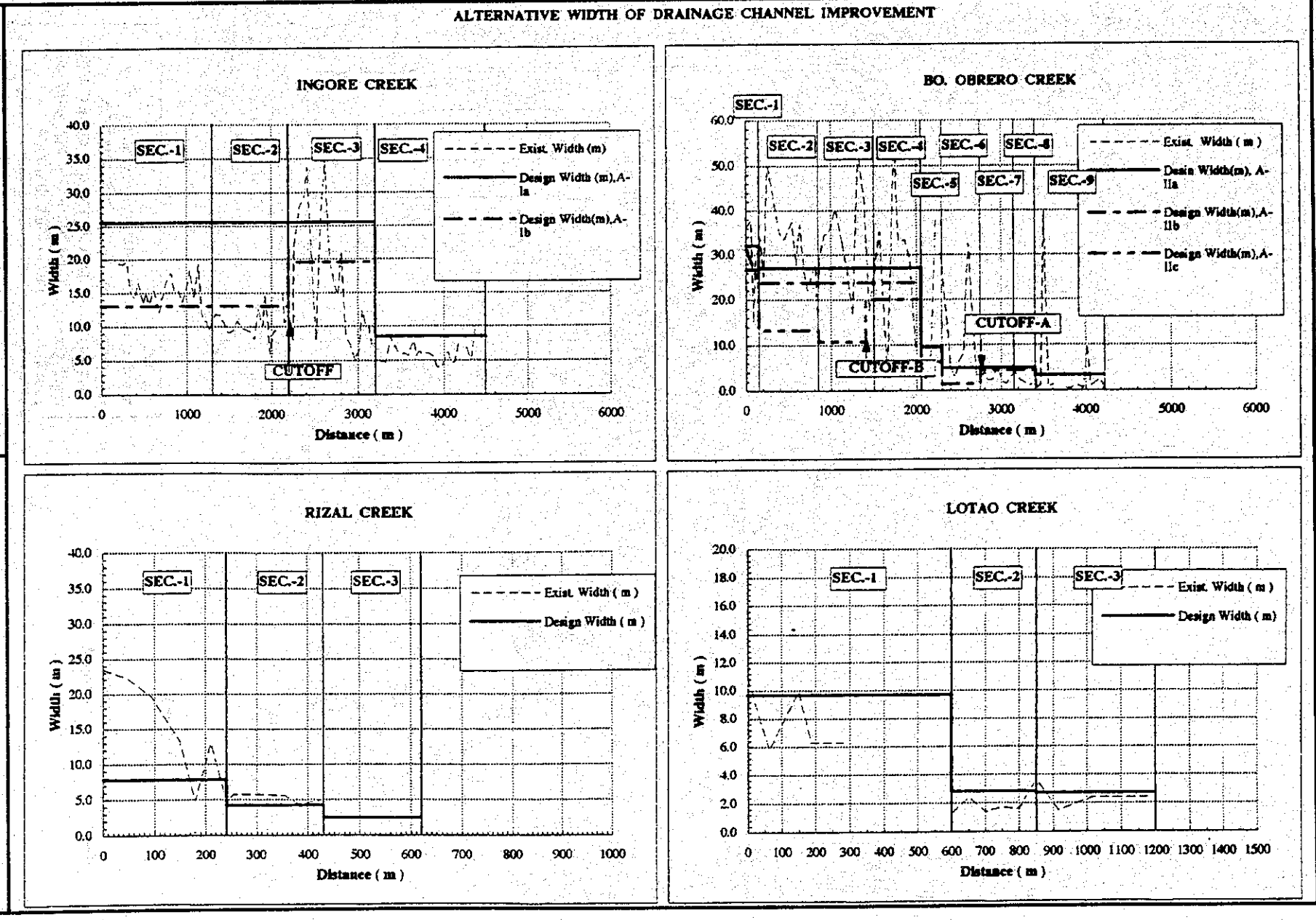
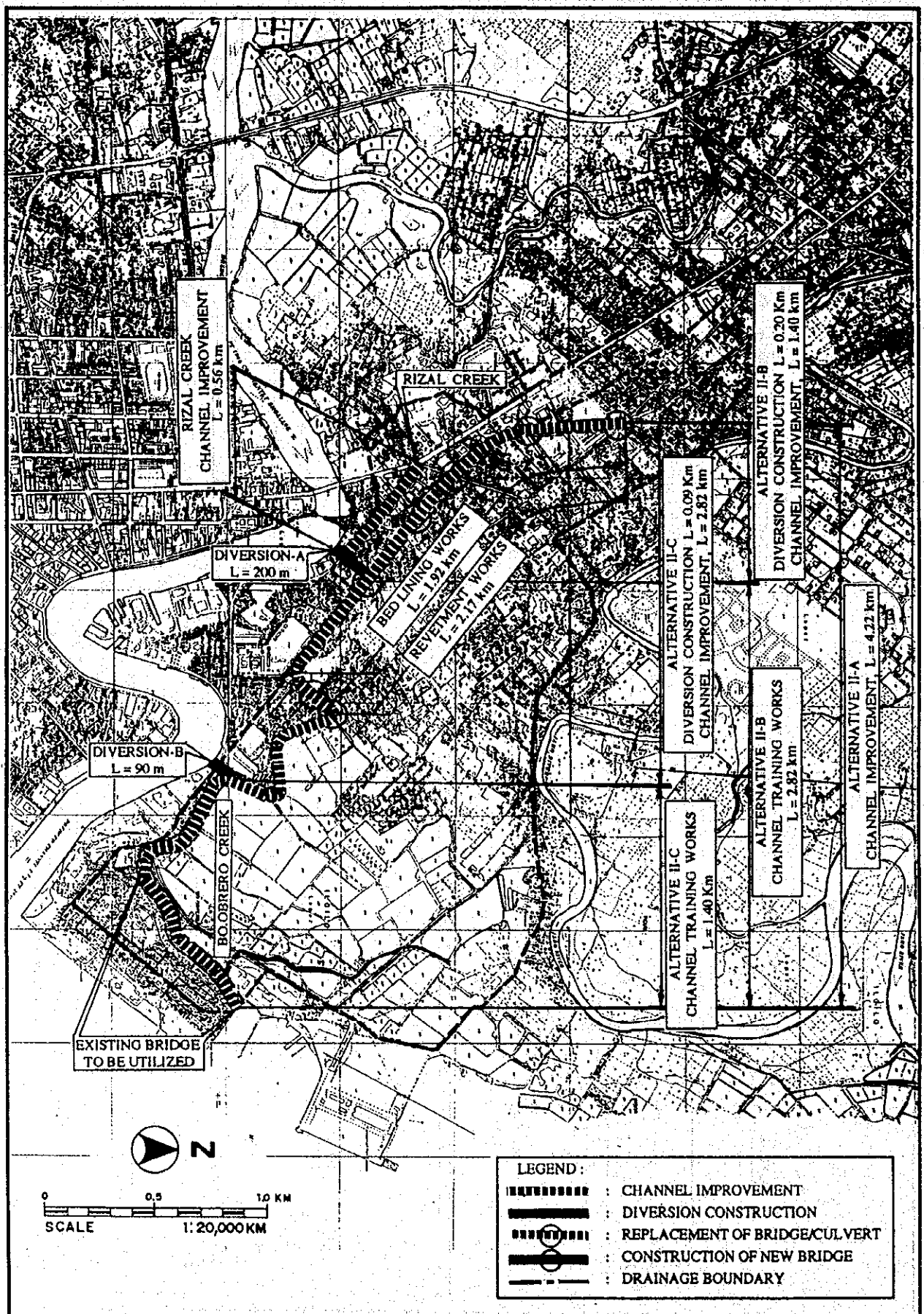


Fig. 5.6
Alternative Width of Drainage Channel Improvement



THE STUDY ON THE FLOOD CONTROL FOR RIVERS IN THE SELECTED URBAN CENTERS	Fig. 5.7 Alternative Schemes of Drainage Channel Improvement (Bo. Obrero Creek)
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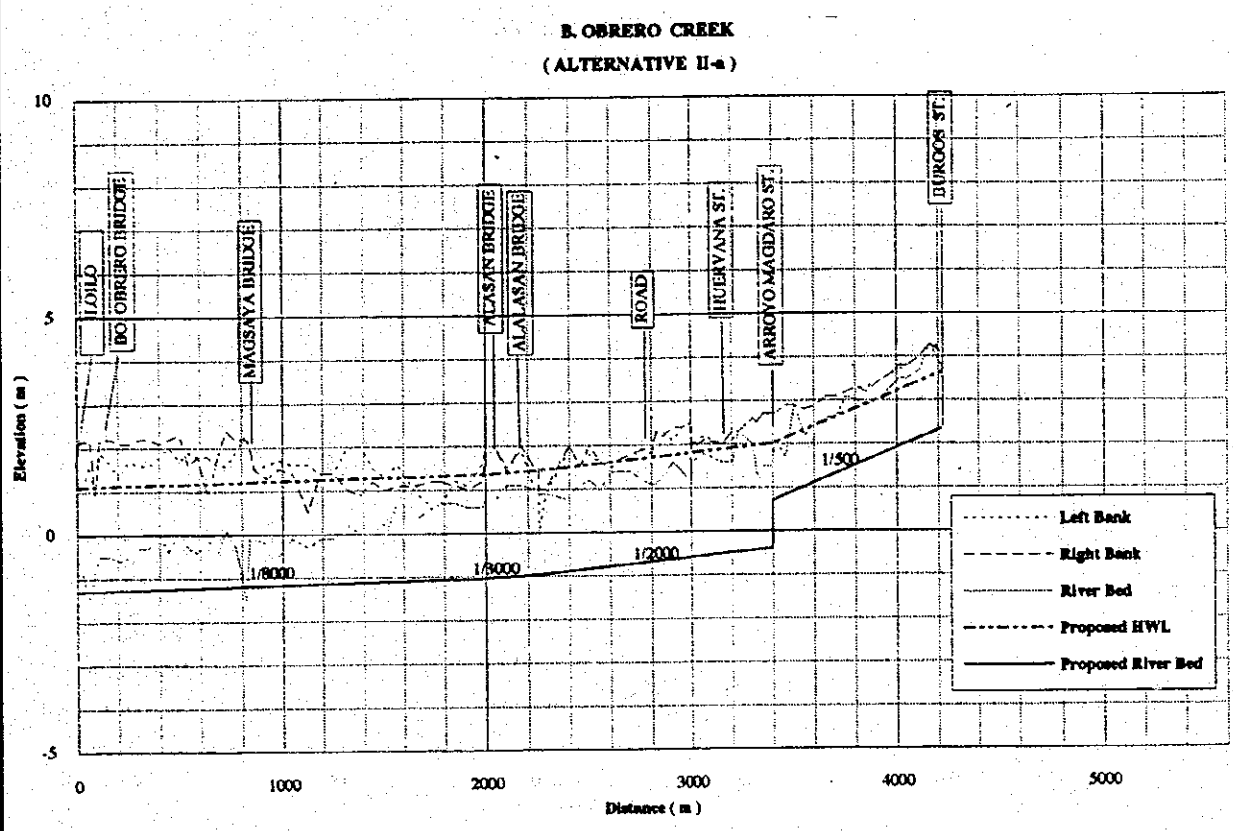
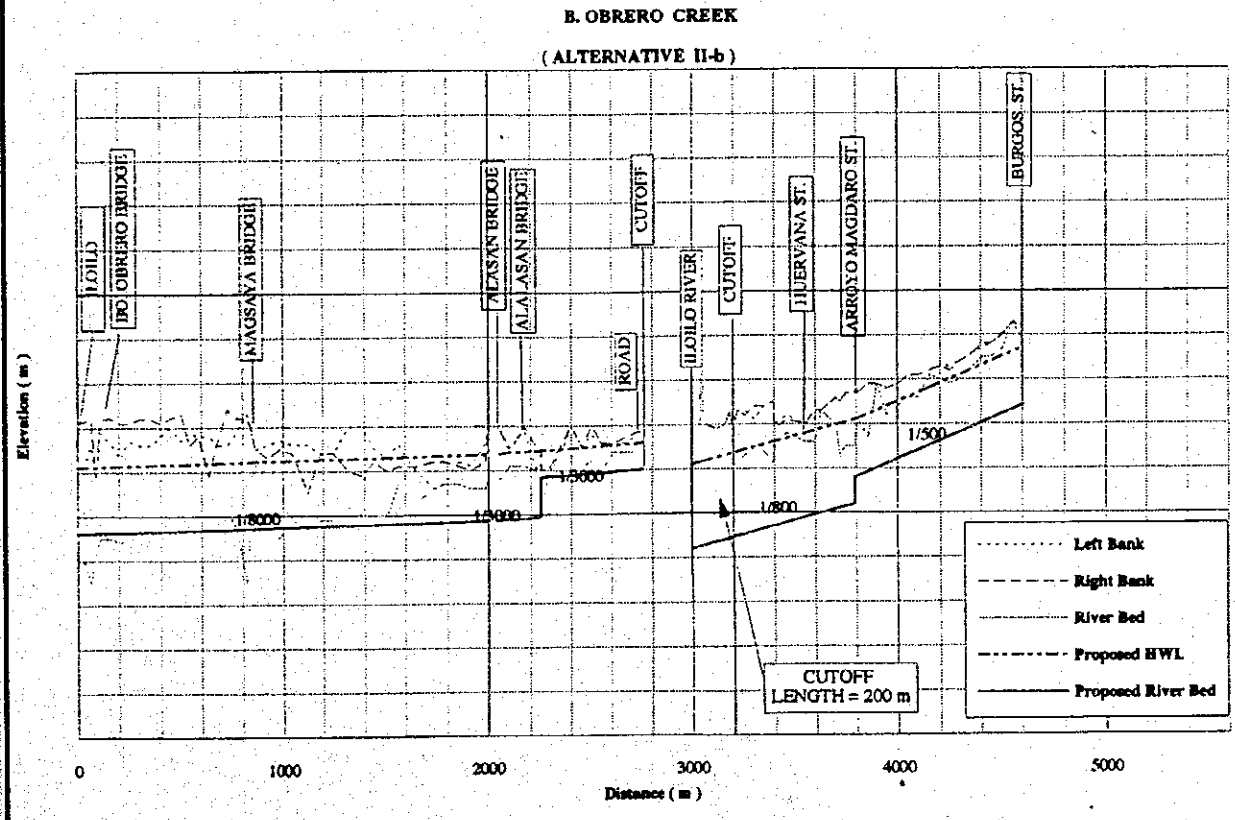
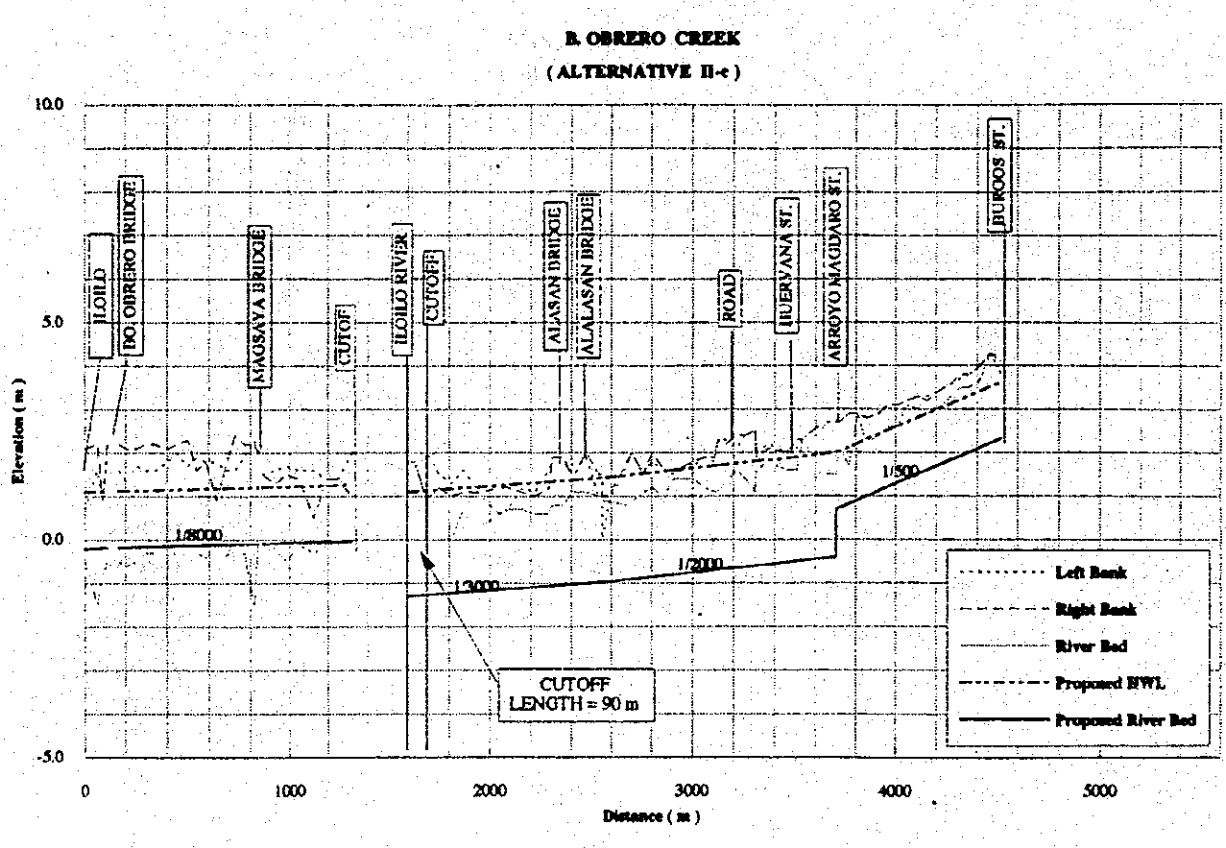




THE STUDY ON THE FLOOD CONTROL FOR RIVERS IN THE SELECTED URBAN CENTERS JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 5.8 Alternative Profile of Drainage Channel Improvement (Bo. Obrero Creek)(1/2)



THE STUDY ON THE FLOOD CONTROL FOR RIVERS IN THE SELECTED URBAN CENTERS	Fig. 5.8 Alternative Profile of Drainage Channel Improvement (Bo. Obrero Creek)(2/2)
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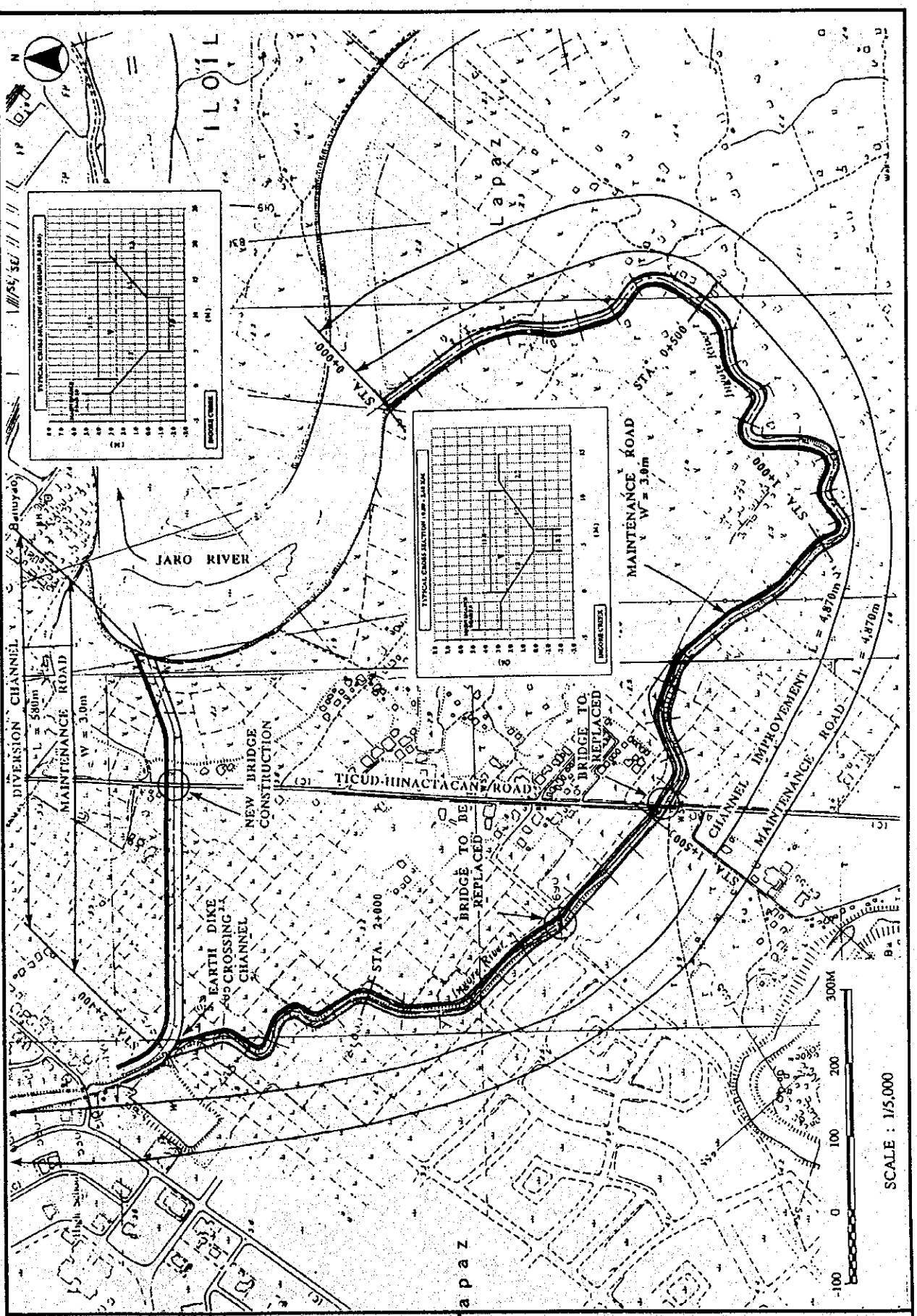
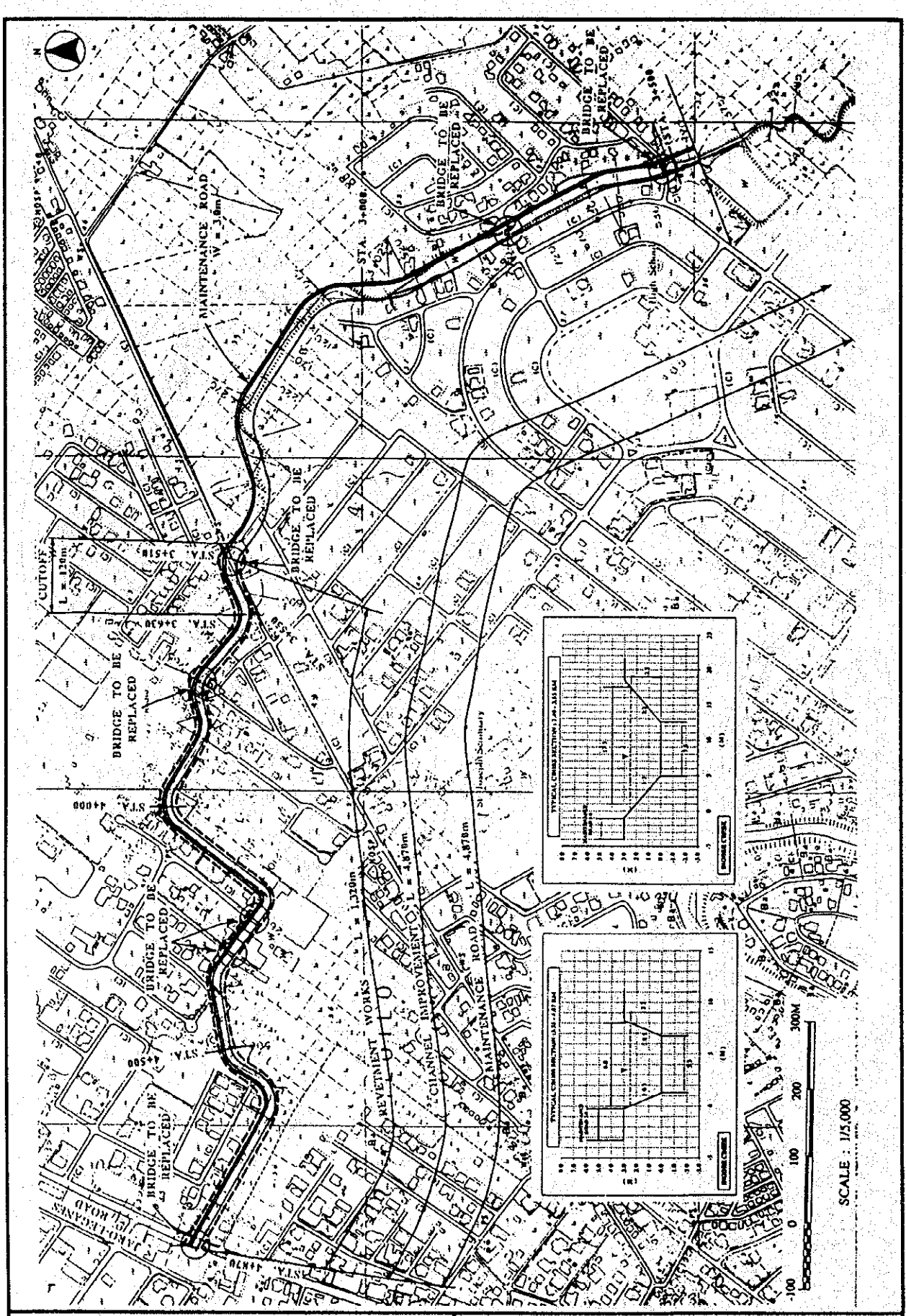
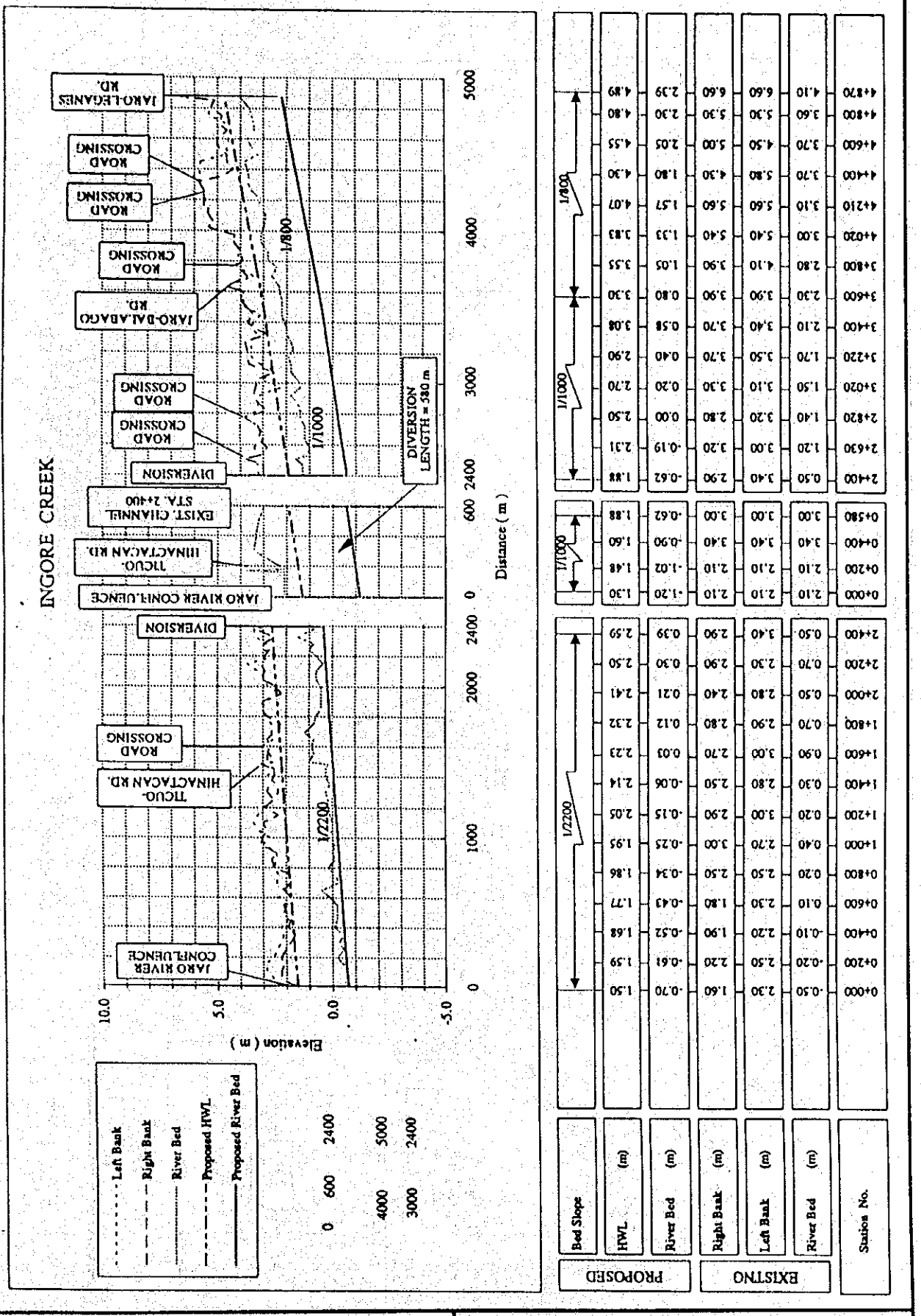


THE STUDY ON THE FLOOD CONTROL FOR RIVERS IN THE SELECTED URBAN CENTERS JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 5.9 Proposed Channel Alignment and Typical Cross Section, Ingore Creek(1/2)



THE STUDY ON THE FLOOD CONTROL FOR RIVERS IN THE SELECTED URBAN CENTERS JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 5.9 Proposed Channel Alignment and Typical Cross Section, Ingore Creek(2/2)



THE STUDY ON THE FLOOD CONTROL FOR RIVERS IN THE SELECTED URBAN CENTERS

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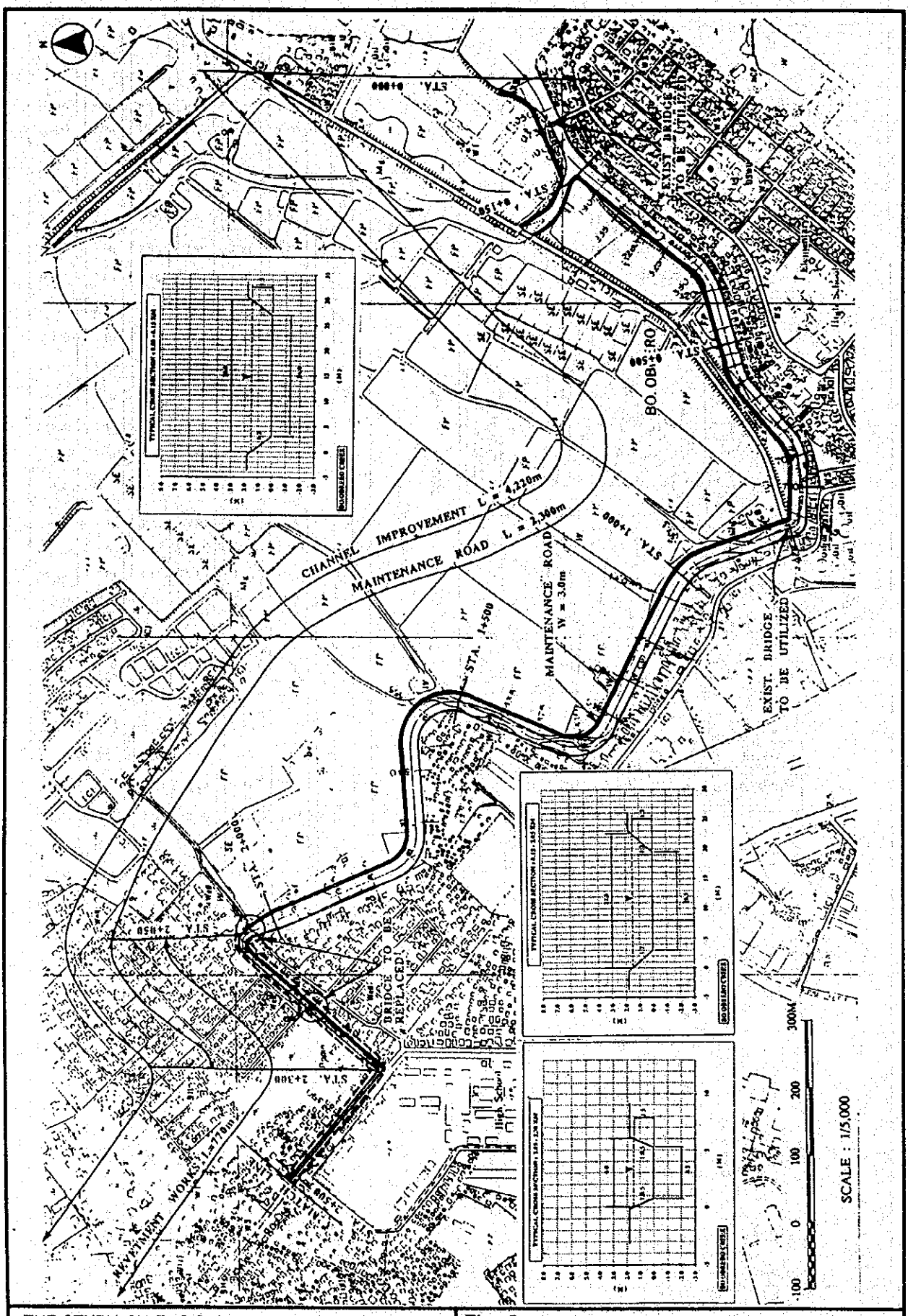
Fig. 5.10
Longitudinal Profile, Ingore Creek



THE STUDY ON THE FLOOD CONTROL FOR RIVERS IN THE SELECTED URBAN CENTERS	Fig. 5.11 Proposed Channel Alignment and Typical Cross Section, Bo. Obrero Creek(1/3)
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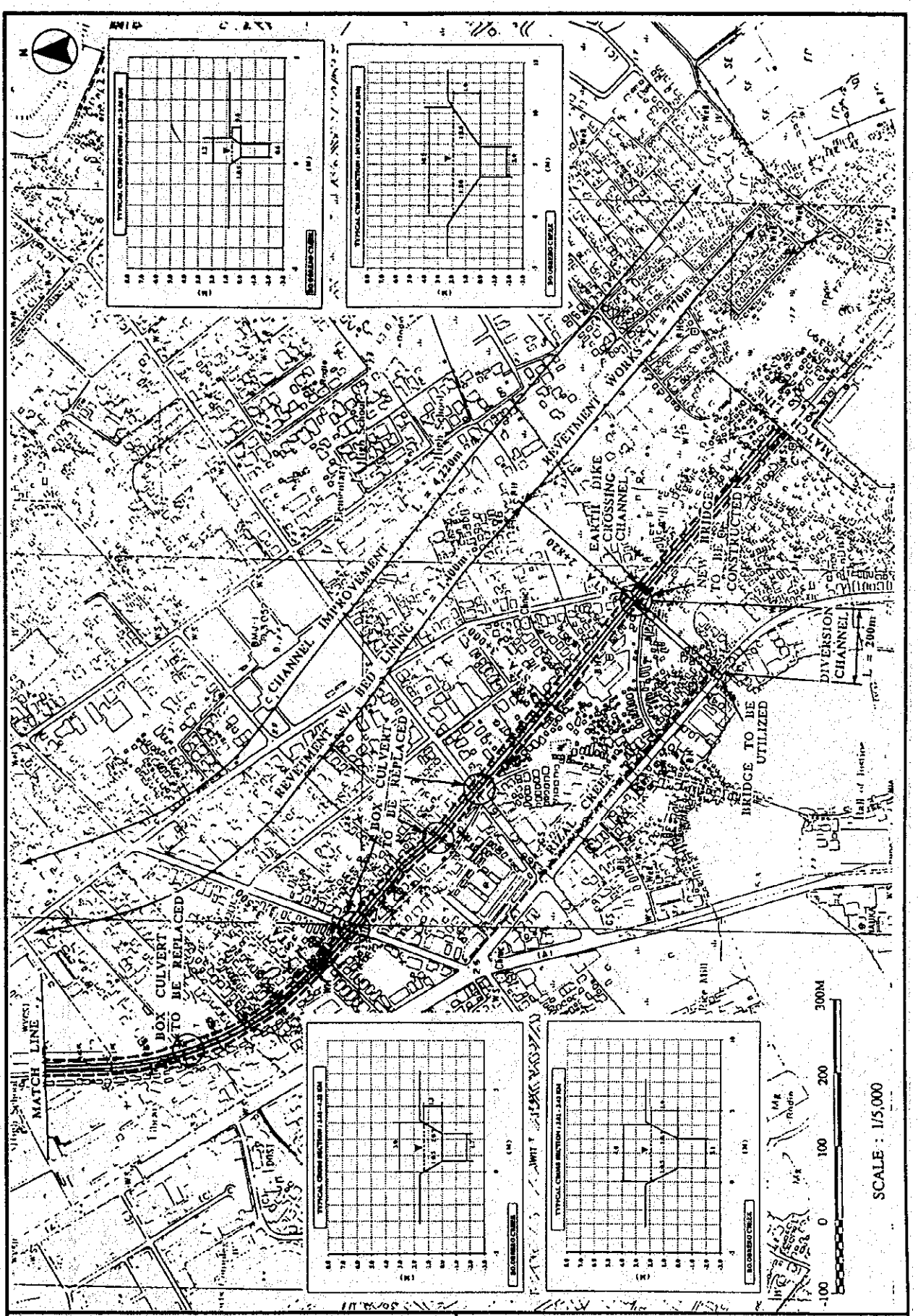

THE STUDY ON THE FLOOD CONTROL FOR RIVERS IN THE SELECTED URBAN CENTERS	Fig. 5.11 Proposed Channel Alignment and Typical Cross Section, Bo. Obrero Creek(2/3)
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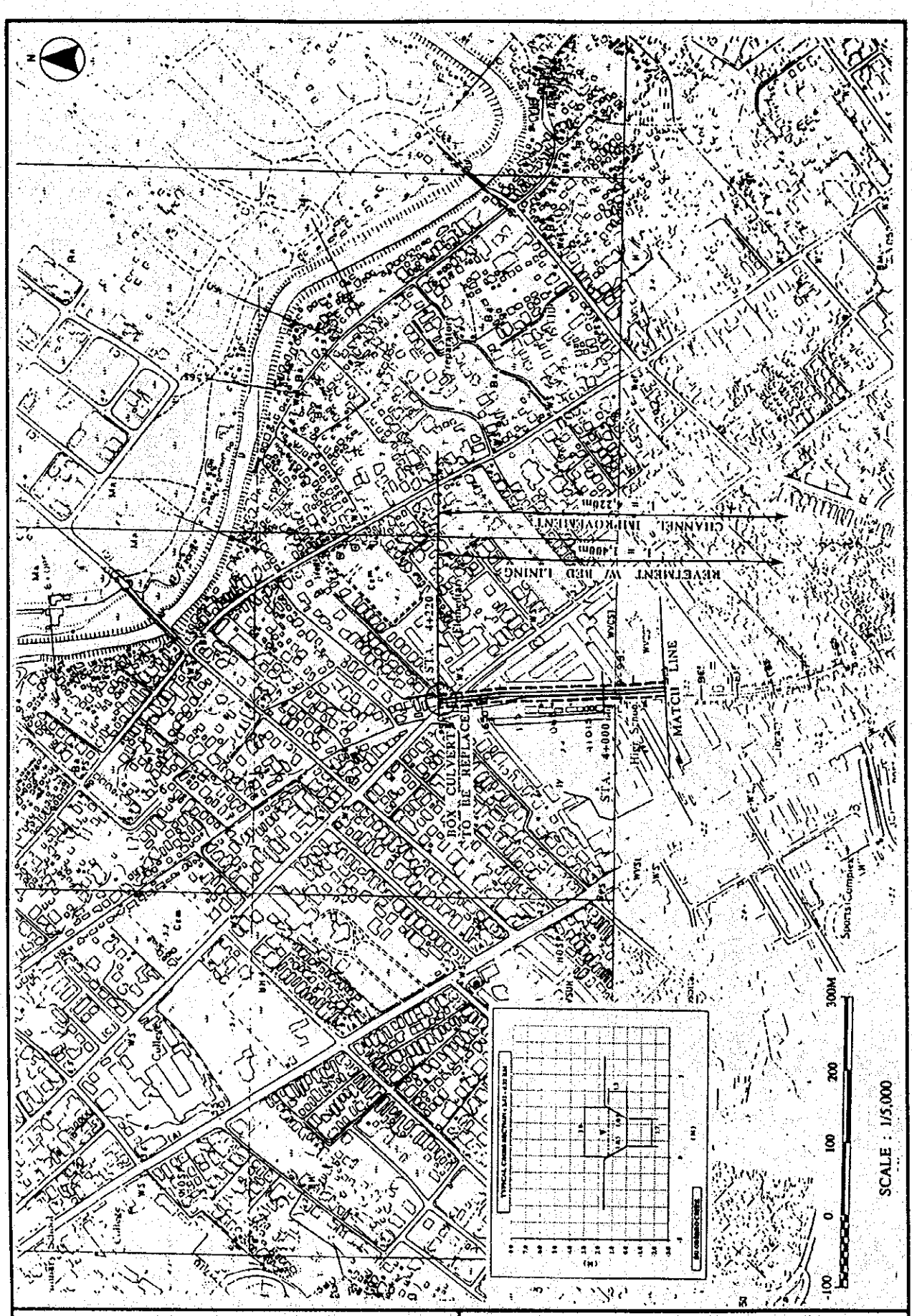

THE STUDY ON THE FLOOD CONTROL FOR RIVERS IN THE SELECTED URBAN CENTERS	Fig. 5.11 Proposed Channel Alignment and Typical Cross Section, Bo. Obrero Creek(3/3)
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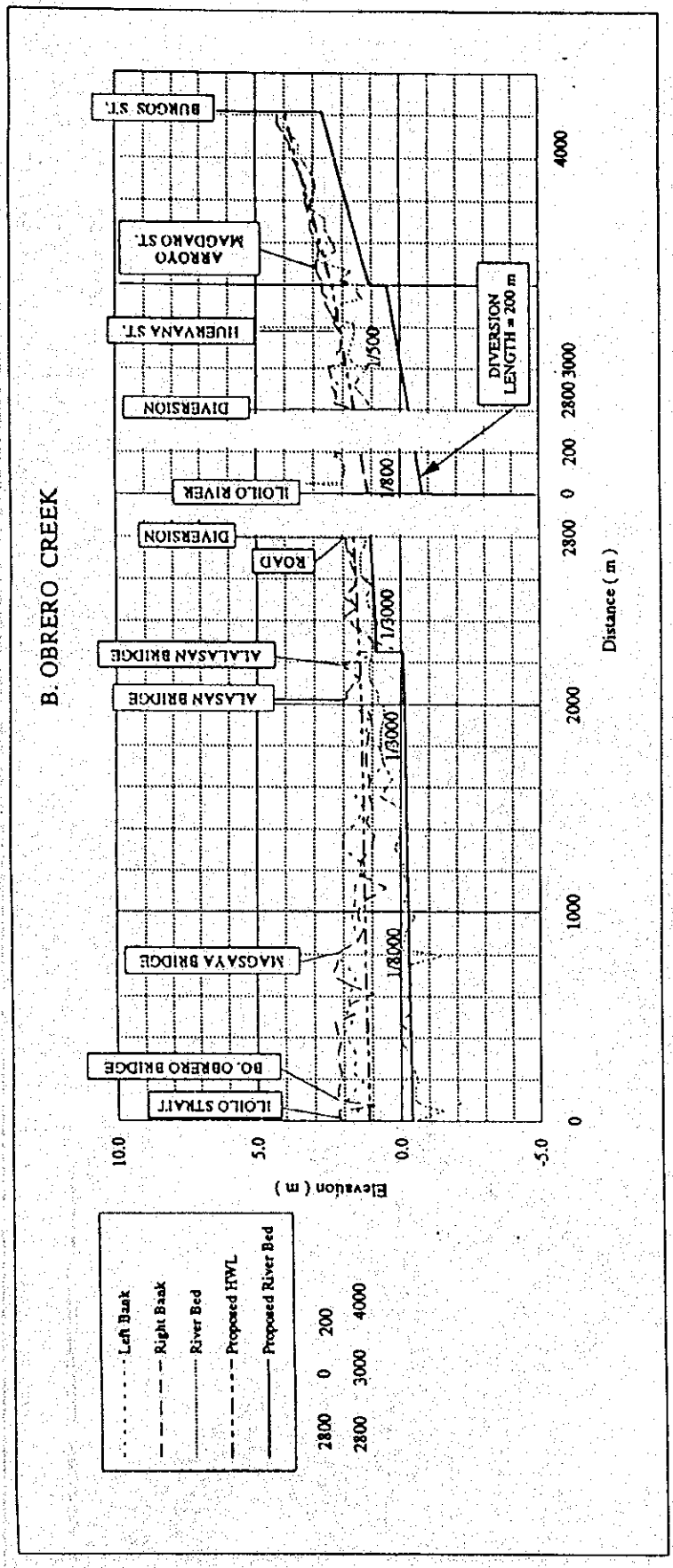

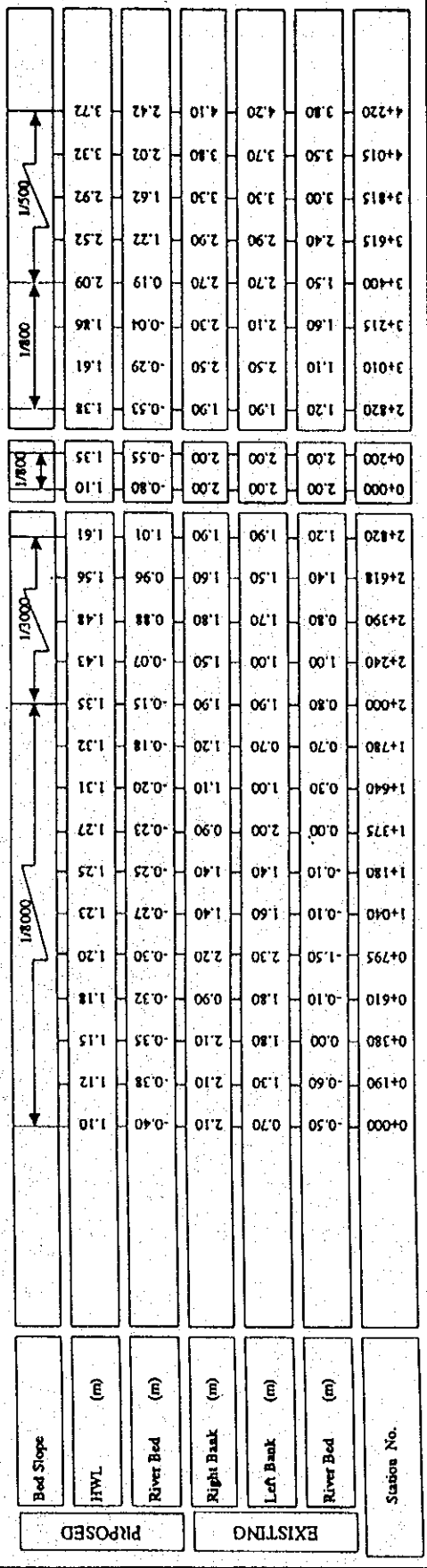

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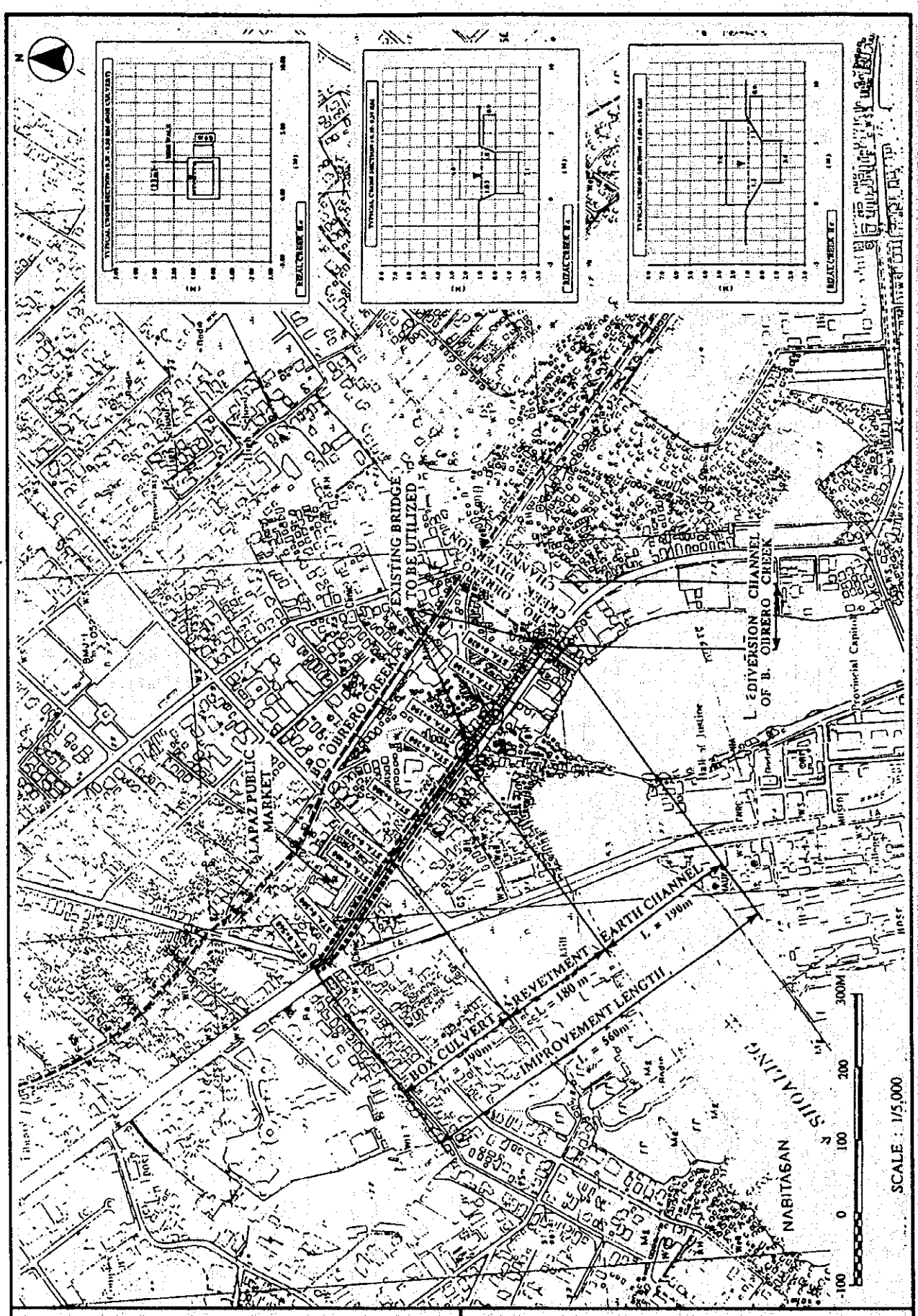
Fig. 5.12
Longitudinal Profile, Bo. Obrero Creek



THE STUDY ON THE FLOOD CONTROL FOR RIVERS IN THE SELECTED URBAN CENTERS	Fig. 5.13 Proposed Channel Alignment and Typical Cross Section, Rizal Creek
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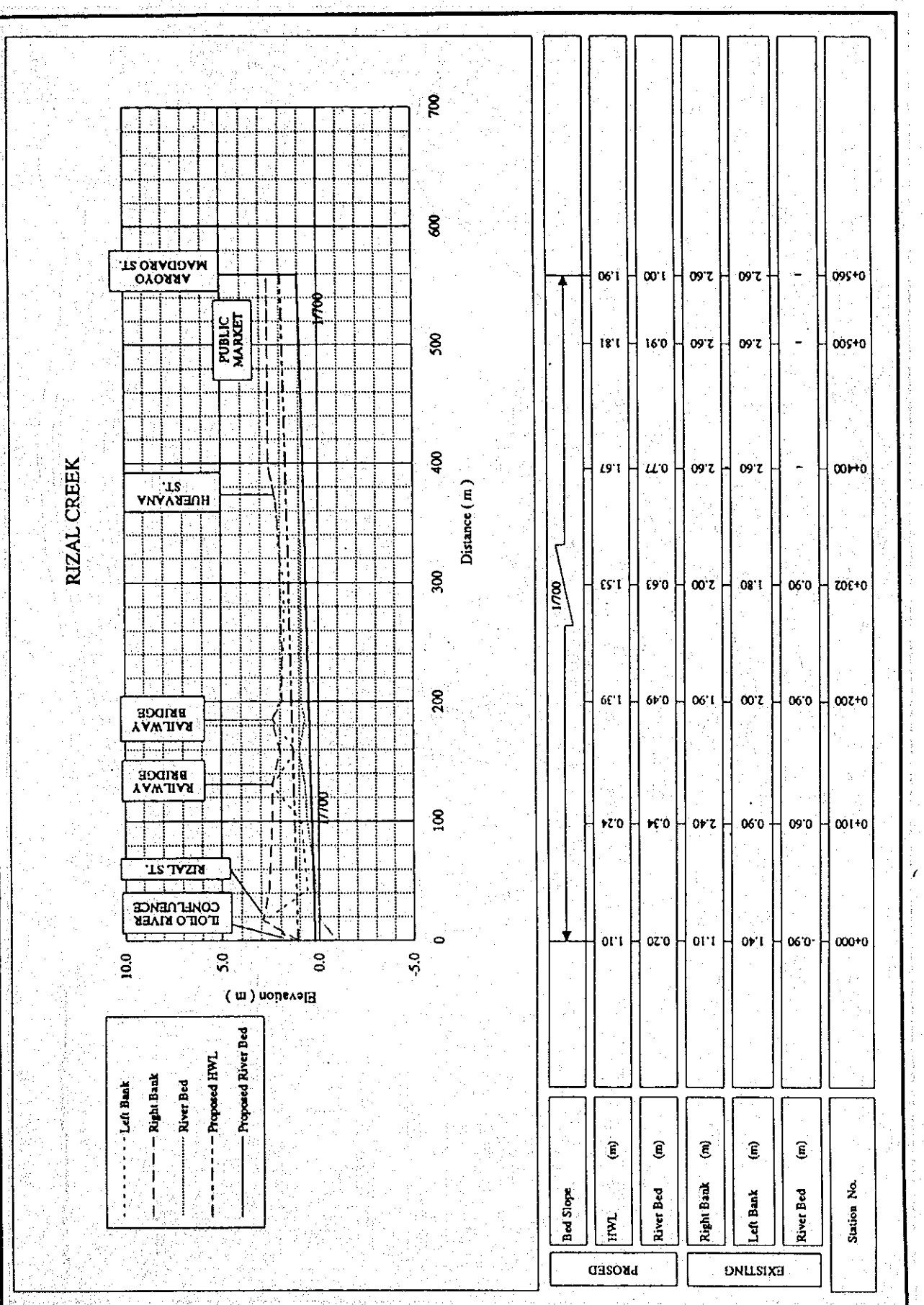

THE STUDY ON THE FLOOD CONTROL FOR RIVERS IN THE SELECTED URBAN CENTERS	Fig. 5.14 Longitudinal Profile, Rizal Creek
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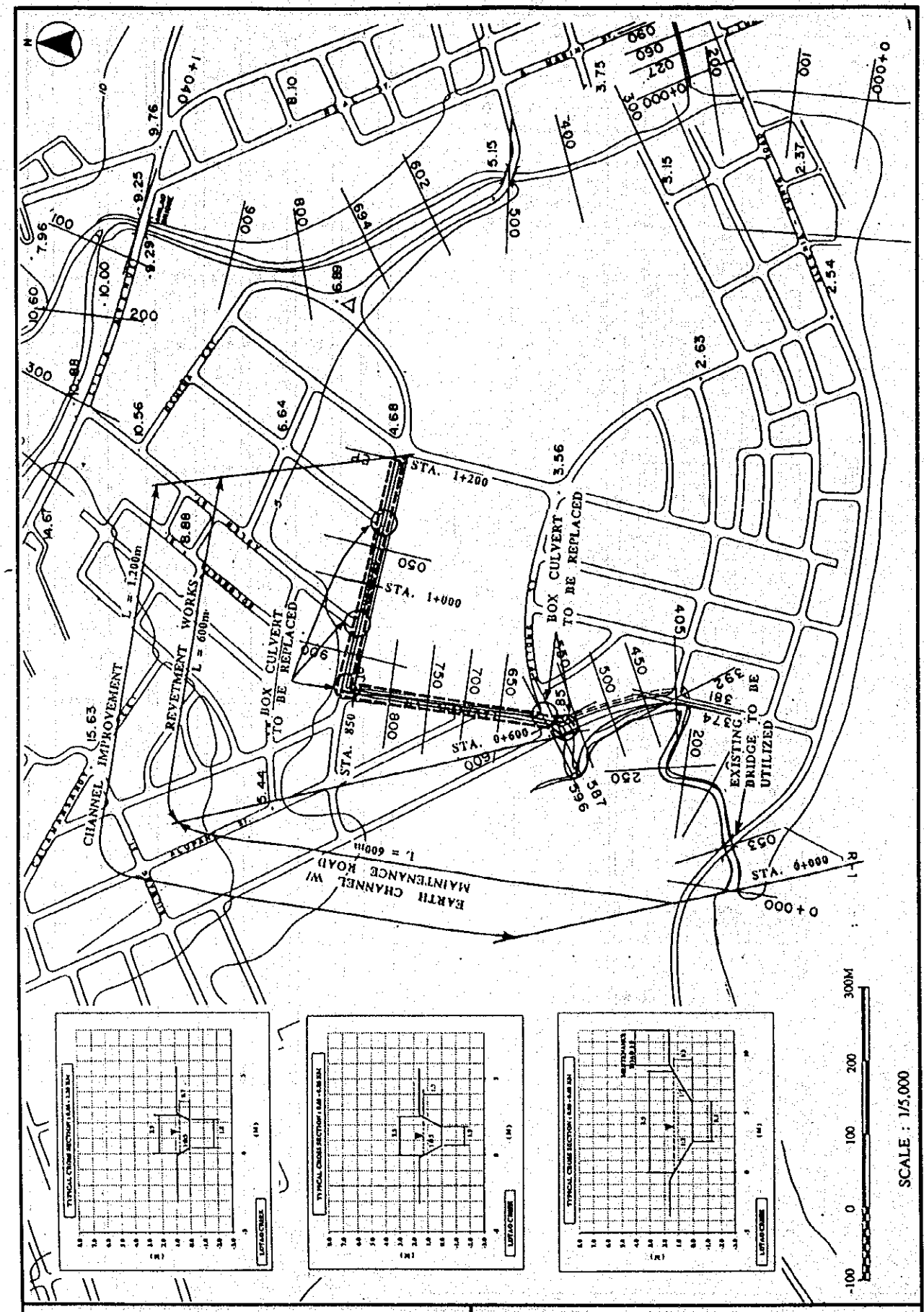
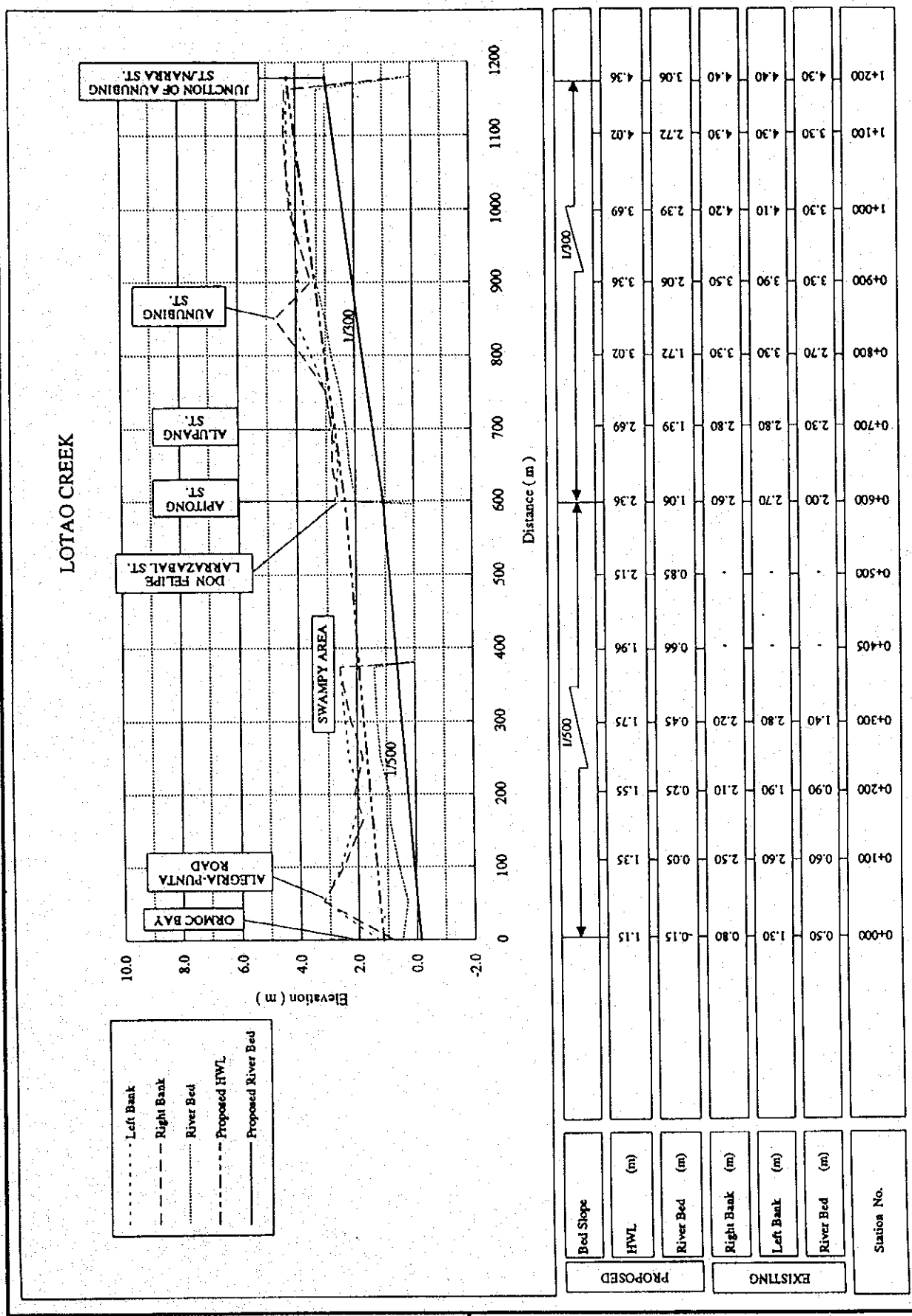


THE STUDY ON THE FLOOD CONTROL FOR RIVERS IN THE SELECTED URBAN CENTERS JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 5.15 Proposed Channel Alignment and Typical Cross Section, Lotao Creek



THE STUDY ON THE FLOOD CONTROL FOR RIVERS IN THE SELECTED URBAN CENTERS

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 5.16
Longitudinal Profile, Lotao Creek

SUPPORTING REPORT

ON

CONSTRUCTION PLAN AND COST ESTIMATE

SUPPORTING REPORT
ON
CONSTRUCTION PLAN AND COST ESTIMATE

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1. INTRODUCTION

Various structural types and earth works of river/drainage improvement are proposed in the Supporting Reports on River Improvement Plan and Urban Drainage Plan. The purpose of this Supporting Report on Construction Plan and Cost Estimate is to study the procedure of construction and estimate project cost. Four (4) cities have been selected for the Master Plan; namely, Iloilo, Cebu, Ormoc and Tacloban, and the Feasibility Study has been executed for two (2) cities, Iloilo and Ormoc.

2. CONSTRUCTION PLAN

The construction plan is based on the results of interview and site investigation surveys with the local DPWH office, the City Engineer's Office and Contractors, as well as the general construction method employed in Japan. This section gives an outline of the possible sequence of construction works, construction method and type of construction equipment, which will be the basic considerations for the engineer's cost estimate of the project.

2.1 Basic Conditions

The construction plan at each of the four (4) cities is based on past civil works in the city. However, basic conditions such as workable days, standard construction methods and materials have been examined as discussed below.

2.1.1 Workable Days

River and drainage improvement works shall be carried out only in the dry season because they consist mostly of earthworks such as excavation and embankment which are not expected to have a good performance under the rain; besides, it is a risky job to undertake these works under the threat of flooding.

Based on the rainfall data, the annual workable days were estimated, as shown in the following table, on condition that rainy days have a daily rainfall of more than 10 mm and official holidays are considered. Official holidays include national holidays, Sundays and every two Saturdays.

Name of City	Mean Annual Rainfall (mm)	No. of Rainy Days	Assumed Workable Days	Source of Data
Iloilo	2,055	65	215	PAGASA, Iloilo
Cebu	1,634	57	229	PAGASA, Mactan Airport, Cebu
Ormoc	2,279	62	218	EDC, Tongonan Leyte
Tacloban	2,913	65	223	PAGASA, Tacloban City

Note: Data of Iloilo, Cebu and Tacloban is the average for 5 years; while that of Ormoc is the average for 3 years.

2.1.2 Standard Construction Method

Construction is to be carried out by the conventional construction methods using standard types of equipment. The major construction work items such as excavation, embankment, revetment and dredging are discussed below.

(1) Soil Excavation

Excavation works are accomplished by backhoe and wheel loader. Excavated materials are hauled by dump truck to the spoil area, and spreading and grading work is carried out by backhoe and bulldozer. Excavation works are planned to be carried out by the open-cut method, and the proposed spoil area is near the construction site.

(2) Embankment

The dike embankment shall be carried out by using a combination of bulldozer and soil compactor. The embankment materials shall be excavated by backhoe and wheel loader at the borrow pit and hauled to the embankment site by dump truck. The material excavated from the floodway and river basin can also be used as long as such materials are suitable for embankment.

The control of water content of the embankment material shall be carried out by a water tanker which will sprinkle water at the borrow area and embankment side after the embankment material is spread by bulldozer and grader.

(3) Revetment Work

Wet stone masonry revetment shall be provided at the bank of river/drainage. The revetment works shall be carried out gradually to follow the river/drainage excavation.

The procedure of revetment work is proposed in the following order:

(a) Excavation/Hauling
(b) Compacting/Grading
(c) Base Concrete Work
(d) Backfill Gravel Work
(e) Backfill Concrete Work
(f) Wet Masonry
(g) Top Concrete Work

(4) Dredging Work

A cutter suction pump dredger is selected for dredging the river channel, and grab dredger near the river mouth. The cutter suction pump dredger will discharge the dredged material to the spoil bank through a pipeline and the grab dredger will be used with the open bottom hopper barge for dumping into the sea.

Based on the interview survey at PPA Iloilo, the guidelines pertaining to the dumping of dredged material at sea are as follows:

(a) Dumping site is to be located at least 5 km away from the dredging site; and
(b) Water depth at dumping site is to be more than 15 m.

2.1.3 Construction Materials

The common construction materials, concrete aggregate, sand, gravel and boulder to be required will be obtained in the vicinity of the project site at the four (4) cities. Even if the materials are not available nearby the site, the transportation system is well established. Therefore, unit costs will differ according to local conditions. The difference among the four cities is mentioned below:

(a) Reinforcement steel bars are not produced in Iloilo, Ormoc and Tacloban.
(b) Sand, gravel and boulder for Cebu and Tacloban are to be transported from outside the cities.
(c) Steel sheet piles for all cities are transported from Manila.
(d) Prestressed concrete piles can be produced only in Cebu City.

2.2 Master Plan

The Master Plan area covers the four (4) cities, Iloilo, Cebu, Ormoc and Tacloban. The study area also covers the 12 related river basins of Jaro, Iloilo (Iloilo City), Bulacao, Kinalumsan, Guadalupe, Lahug, Subang Daku (Cebu City), Anilao and Malbasag (Ormoc City); as well as the proposed 21 drainage areas having an aggregate area of approximately 62 km^2, namely, three (3) in Iloilo, nine (9) in Cebu, two (2) in Ormoc and seven (7) in Tacloban.

2.2.1 Outline of Works

Based on the project scale proposed for river/drainage flood control plans, the construction area of river improvement works are estimated as follows:

(1) Length of River/Drainage Improvement Works

City/River	Length (m)	Drainage	Length (m)
Iloilo			
(1) Jaro	14,000	(1) Ingore Creek	5,000
Floodways	5,400	(2) Bo. Obrero Creek	4,400
(2) Iloilo	6,500	(3) Rizal Creek	620
Mandurriao	4,200		
Cebu			
(1) Bulacao	2,650	(1) Mabolo Creek	1,930
(2) Kinalumsan	4,000	(2) Lahug Tributary	1,680
(3) Guadalupe	4,500	(3) Tinago Creek	1,220
(4) Lahug	5,000	(4) Pahina Central	1,100
(5) Subang Daku	5,540	(5) Calamba Drainage Main	830
		(6) Sta. Teresita	530
		(7) Basak-San Nicolas	860
		(8) Sto. Niño Creek	1,200
		(9) Barangay Inayawan	1,500
Ormoc			
(1) Anilao	2,000	(1) Lotao Creek	1,200
(2) Malbasag	2,220	(2) City Proper Creek	630
Tacloban			
		(1) Abucay	1,700
		(2) Naga-Naga Creek	1,000
		(3) Mangonbangon	4,000
		(4) Langhas Lirang Creek	3,750
		(5) Sagkahan Creek	380
		(6) Pleasantville Creek	1,600
		(7) Burayan	3,500

(2) River/Drainage Improvement Works at Four Cities

Particulars	Iloilo		Cebu		Ormoc		Tacloban
	River	Drainage	River	Drainage	River	Drainage	Drainage
(1) Excavation	mu	mu	m	m	mu	mu	m
(2) Embankment	mu		m		mu		
(3) Revetment	mu	mu	m	m	mu	mu	m
(4) Retaining Wall			m		mu		
(5) Backfill Concrete	u		m		mu		
(6) Sodding	mu	u	m		mu	u	
(7) Gravel Pavement	mu	u	m		mu	u	
(8) Drops			m		mu		
(9) Bridge	mu	mu	m	m	mu	m	m
(10) Concrete Dike	mu	m		m		m	
(11) Diversion Work	mu						
(12) Sluice	mu				mu		
(13) Jetty	mu						
(14) Invert Siphon	mu						
(15) Bridge Protection	m						
(16) Box Culvert		mu		m		u	
(17) Dredging	mu						
(18) Slit Dam					m		
(19) MFC Protection	mu						

m : Master Plan; u : Urgent Plan; MFC : maintenance flow channel

2.2.2 Work Volume

The work volume of major construction items for river/drainage in the four cities are given below.

Particulars	Unit	Iloilo		Cebu		Ormoc		Tacloban
		River	Drainage	River	Drainage	River	Drainage	Drainage
(1) Excavation	$1000m^3$	3,144	178	1,294	85	391	6	183
(2) Embankment	$1000m^3$	598		36		45		
(3) Dredging	$1000m^3$	1,265						
(4) Revetment	1000m	17	17	1	14	10	3	25
(5) Retaining Wall	m			43,320		2,190		
(6) Backfill Concrete	$1000m^3$	43		11		105		
(7) Sodding	$1000m^2$	275		39		22		
(8) Gravel Pavement	$1000m^2$	183		16		22		
(9) Drops	m			746		219		
(10) Bridge	m^2	5,940	1,100	8,758	285	2,080	174	480
(11) MFC Protection	$1000m^2$	275				31		
(12) Concrete Dike	m	4,780						
(13) Diversion Works	m	244						
(14) Sluice	no.	21				7		
(15) Jetty	m^3	2,400						
(16) Invert Siphon	no.	3						
(17) Bridge Protection	m^2	3,600						
(18) Slit Dam	no.					3		
						1,400*		
(19) Box Culvert	m				680			

* Maintenance road for slit dam (m)

2.2.3 Construction Plan

The construction plan is based on the work volume in Subsection 2.2.2. Construction schedule is determined by optimum management among dominant work items.

The work capacity of each item is given below.

Work Item	Work Capacity Iloilo, Cebu	Work Capacity Ormoc, Tacloban
Excavation	4,000 m^3/day	2,000 m^3/day
Embankment	1,600 m^3/day	400 m^3/day
Dredging	2,500 m^3/day	
Revetment	850 m/mouth	600 m/day
Retraining Wall	120 m/day	40 m/day
Bridge	300 m^2/month	150 m^2/month
Silt Dam		1 no./3 months

(1) Iloilo City

The dominant works in Iloilo City are excavation, embankment, dredging, revetment and bridge. The excavation for Jaro Floodway is located in the suburbs and the stockyard is nearby the excavation site. Work capacity of excavation in Iloilo City is estimated to be 5,000 m^3/day.

Work Items	Calculation	Work Period
Excavation	3,144,000 m^3 / 5,000 m^3 / 215 days	2.92 years
Embankment	598,000 m^3 / 1,600 m^3 / 215 days x 1.2*	2.09 years
Dredging	1,265,000 m^3 / 2,500 m^3 / 286 days	1.77 years
Revetment	17,000 m / 850 m / 12 months x 1.7**	2.83 years
Bridge	5,100m^2 / 300 m2 / 12 months x 1.7**	2.41 years

* Safety factor for drying soil

** Conversion factor for workable day = 365 / 215

Work period in Iloilo City is dominated by excavation and revetment works, the total construction period for each river is three (3) years. Drainage improvement work requires two (2) years.

(2) Cebu City

The dominant works in Cebu City are excavation, retaining wall and bridge work. The work period is as calculated below:

Work Items	Calculation	Work Period
Excavation	1,176,000 m^3 / 4,000 m^3 / 229 days	1.28 years
Retaining Wall	42,400 m / 120 m / 229 days	1.54 years
Bridge	6,665 m^2 / 300 m^2 / 12 months x 1.6*	2.96 years

* Conversion factor for workable day = 365 / 229

The construction period for each river improvement is estimated to be three (3) years and drainage improvement is two (2) years.

(3) Ormoc

The dominant works in Ormoc City are excavation, embankment, revetment, bridge and silt dam. The work period for each work item is as estimated below:

Work Items	Calculation	Work Period
Excavation	391,000 m^3 / 2,000 m^3 / 218 days	0.90 years
Embankment	45,000 m^3 / 400 m^3 / 218 days x 1.2*	0.62 years
Revetment	10,000 m / 600 m / 12 months x 1.7**	2.36 years
Bridge	2,080m^2 /150 m^2 /12 months x 1.7**	1.96 years
Silt Dam	3 x 3 months	0.75 years

* Safety factor for drying soil

** Conversion factor for workable day = 365 / 218

The construction period for each river improvement is three (3) years and drainage improvement takes two (2) years.

(4) Tacloban

The dominant improvement work in Tacloban City is revetment work. The total work period is as estimated below.

Work Item	Calculation	Work Period
Excavation	183,000 m^3 / 2,000 m^3 / 223 days	0.41 years
Revetment	25,000 m / 600 m / 12 months x 1.6*	5.56 years
Bridge	480 m^2 / 150 m^2 / 12 months x 1.6*	0.43 years

* Conversion factor for workable day = 365 / 223

Mangonbangon River has the longest length of revetment work in Tacloban City which is 7.0 km. Based on the above analysis, the revetment work period is 1.56 years. Therefore, the construction period for each drainage improvement work is estimated to be two (2) years. The implementation schedule for the Master Plan is shown in Fig. 2.1.

2.3 Urgent Plan

This subsection presents the proposed construction plan which includes the major earth works and dredging necessary to implement the river/drainage improvement project for the cities of Iloilo and Ormoc. The study area covered the 5 related river basins of the Jaro, Iloilo and Mandurriao (Iloilo City); Anilao and Malbasag (Ormoc City); and 4 drainage areas proposed for the Urgent Plan which are three (3) in Iloilo one (1) in Ormoc.

2.3.1 Outline of Work

River improvement work in the Urgent Plan has a reduced work volume and scale compared with the Master Plan. However, drainage improvement work is estimated to have almost the same work length as the Master Plan.

(1) Length of River/Drainage Improvement Works

River		Length (m)	Drainage		Length (m)
Iloilo					
1	Jaro	14,000	1	Ingore Creek	5,450
	Floodway	4,800			
2	Iloilo	6,500	2	Bo. Obrero Creek	4,420
3	Mandurriao	4,200	3	Rizal Creek	560
Ormoc					
1	Anilao	2,000	1	Lotao Creek	1,200
2	Malbasag	2,220			

Improvement work of river/drainage for the Urgent Plan is tabulated in Subsection 2.2.1.

2.3.2 Work Volume

Based on the Urgent Plan, major construction work volumes at Iloilo and Ormoc City are as calculated below:

Work Items	Unit	Iloilo				Ormoc		
		Jaro River	Iloilo River	Mandurriao River	Drainage	Anilao River	Malbasag River	Drainage
(1) Excavation	$1000m^3$	1,865	0	75	187	123	201	6
(2) Embankment	$1000m^3$	231	63	72		38	7	
(3) Dredging	$1000m^3$	22		250				
(4) Revetment	m	4,850	300	2,900	3,700	7,200	5,010	600
(5) Backfill Concrete	$1000m^3$		23	20		60	45	
(6) Sodding	$1000m^2$	118	20	3		16	6	
(7) Gravel Pavement	$1000m^2$	72	26	5		11	11	
(8) Drops	m					78	73	
(9) Bridge	m^2	2,110	1,100	0	1,092	1,440	640	0
(10) MFC Protection	m^2					21,000	10,225	
(11) Concrete Dike	m		4,780					
(12) Diversion Works	m	80						
(13) Sluice	no.	12	5	4		3	4	
(14) Jetty	m^3	5,900						
(15) Invert Siphon	no.	3						
(16) Bridge Protection	m^2			1,200				
(17) Box Culvert	m				245			75

2.2.3 Construction Plan

(1) Excavation

Excavation works are planned to be carried out by a combination of the following major equipment.

Backhoe, 0.6 m^3	:	2 units/set
Wheel Loader 1.2 m^3		1 unit/set
Dump Truck, 11 ton	:	8 units/set

The work capacity of each set is 950 m^3/day.

(2) Spoil Bank

The spoil bank for excavation at Iloilo City is proposed nearby the construction site, as shown in Fig. 2.2. Jaro Floodway will produce a certain volume of excavated material and the required land for the spoil area is estimated at about 31.5 ha. Therefore, the spoil area is located in four (4) sites along the Jaro Floodway which are paddy fields and open spaces at present.

(3) Embankment

The excavated earth material is utilized partly for the embankment at each site as practically as possible. These materials will be stockpiled temporarily near the construction site for improvement of quality. Excess and inferior excavated material will be disposed at the spoil bank area. The other earth embankment material will be obtained from borrow pits. One set of embankment equipment, a combination of the following major equipment.

Bulldozer, 21 ton	:	1 unit/set
Compactor, 20 ton	:	1 unit/set
Grader, 10 ton	:	1 unit/set
Water Tanker, 5.0 m^3	:	1 unit/set
Backhoe, 0.6 m^3	:	1 unit/set

The work capacity of each set is 400 m^3/day.

Therefore, excavated materials at Jaro River and the upstream of Anilao and Malbasag rivers are utilized for embankment work. The Iloilo and Mandurriao river are proposed to use the excavated materials from Jaro River, and the downstream of the Anilao and Malbasag rivers are supplied with embankment materials from the borrow pit near the construction sites shown in Figs. 2.2 and 2.3.

(4) Revetment

The combination of construction equipment for revetment work is given in work items below.

(1)	Excavation/Hauling	:	Backhoe, 0.6 m^3
		:	Dump Truck, 11-ton
(2)	Compacting/Grading	:	Vibration Rammer
(3)	Base Concrete Work	:	Re-bar Cutter
		:	Vibrator
(4)	Backfill Gravel Work	:	Vibration Rammer
		:	Backhoe, 0.6 m^3
(5)	Backfill Concrete Work	:	Concrete Mixer, 0.8 m^3
		:	Vibrator
(6)	Wet Masonry	:	Concrete Mixer, 0.8 m^3
(7)	Top Concrete Work	:	Concrete Mixer, 0.8 m^3
		:	Vibrator

Revetment works will require a certain number of manpower and working period. To complete the revetment works, 100 m long, the cycle time is calculated to be 75 days. The work capacity of each set is 1.33 m/day by 10.1 persons at Iloilo City where the height of structure is mainly 6.0 m. On the other hand, the structure height at Ormoc City is less than 3.0 m, therefore, the work capacity of each set at Ormoc is 2.66 m/day.

(5) Dredging

Dredging work is conducted only in Iloilo City, at the river mouth of Jaro Floodway and the channel of Mandurriao River. Sea/river bed materials are identified as sand to clay having an N-Value of 3 to 7, or an average of 5. The cutter suction pump

dredger is selected, discharging by pipe into the spoil bank and grab dredger for dumping to the sea. The dredging capacity is estimated to be 200 m^3/hr. The combination of equipment is shown below.

Spoil on Land	:	Dredger (suction pump)	:	1 unit/set
		Bulldozer (for soft ground)	:	1 unit/set
		Plying Boat	:	1 unit/set
		Anchor Boat	:	1 unit/set
Spoil at Sea	:	Dredger (grab)	:	1 unit/set
		Pusher-Boat	:	1 unit/set
		Barge	:	2 units/set
		Plying Boat	:	1 unit/set
		Anchor Boat	:	1 unit/set

The work capacity of each set is 1,600 m^3/day.

(a) Spoil on Land

Spoil bank is proposed at the left side junction of Iloilo River and Mandurriao River of about 50 ha. Spoil bank treatment is required, i.e., dike around spoil area, temporary support for pipeline and splash pipe, and sedimentation pond for water contamination at waste way. The spoil bank treatment work will be done by bulldozer for the weak ground type.

The average total pipeline length is 1,400 m including 1,200 m in river and 300 m in spoil bank. Pumped waste water is discharged from the inside of spoil bank to the sedimentation pond and flow out from the waste way.

(b) Spoil at Sea

The dredging work procedure is to directly transport dredged material to a bottom open hopper barge. Then, the barge is pulled to the spoil area by tugboat and another barge is set beside the dredger for continuous work.

The spoil area is the PPA proposed area, which is located between the Iloilo river mouth and the estuary of Jaro Floodway and should satisfy PPA's guidelines. Environmentally, the spoil materials have to be subjected to chemical component soil testing considering harmful materials.

However, it is not necessary to do the soil testing in the case of maintenance dredging and dredging at sea. The estuary of Jaro Floodway faces Iloilo Strait, therefore, dumping the dredged material will not cause any harmful damage around this area.

In consideration of the above premises, therefore, the working period for each major work volume at Iloilo and Ormoc are summarized in the following table.

(1) Iloilo City

(Unit: year)

	Excavation	Embankment	Dredging	Revetment
One Day Work Volume	4,750 m^3	2,000 m^3	1,600 m^3	16 m
Number of Sets	5	5	1	12
Workable Day	215	179	286	215
Jaro River	1.83	0.27	0.05	1.41
Jaro Floodway	1.45	0.16	0.05	0.00
Main Stream	0.38	0.11	0.00	1.41
Iloilo River	0.00	0.07	0.00	0.09
Mandurriao River	0.07	0.08	0.55	0.84
Drainage	0.18	0.00	0.00	1.08

(2) Ormoc City

(Unit: year)

	Excavation	Embankment	Revetment
One Day Work Volume	2,850 m^3	1,200 m^3	26.6 m
Number of Sets	3	3	10
Workable Day	218	181	218
Anilao River	0.20	0.07	1.24
Malbasag River	0.32	0.01	0.86
Drainage	0.01	0.00	0.10

Therefore, the construction period in Iloilo City is determined to be three (3) years for river improvement works and two (2) years for drainage improvement works. On the other hand, the construction period in Ormoc City is determined to be two (2) years for river improvement works and one (1) year for drainage improvement works. The implementation schedule for the Urgent Plan is shown in Fig. 2.4.

3. COST ESTIMATE

The main objective of the cost estimate is to obtain the cost of construction works for the comparative study on alternative flood control plans in the Master Plan and the Urgent Plan.

3.1 Cost Estimation Criteria for Master Plan

3.1.1 Constitution of Project Cost

Project cost is estimated on the following assumptions:

(1) Construction works are to be executed by contract system;

(2) Unit cost of each construction work item is estimated on the unit price basis, except for some work items which are estimated on the lump sum/percentage basis; and

(3) Unit prices are based on the price level as of June 1994.

Project cost is classified into two (2) categories: financial cost and economic cost. Financial cost is the budgetary cost required to implement the project and the economic cost is used for the economic evaluation of the project. The financial project cost consists of the main construction cost, compensation cost, administration cost, engineering cost and contingencies.

(1) Main Construction Cost

The main construction cost consists of the cost of preparatory works, main works and miscellaneous works.

(a) Preparatory Works

The cost of preparatory works for flood control and river improvement is usually within 5 to 10% of the cost of main construction works depending on the project study status. Therefore, in this estimation, the maximum of 10% is applied.

(b) Main Works

The cost for main works is computed by multiplying the unit cost with the work quantity. The unit cost of each item consists of direct cost and indirect cost.

The direct cost in unit cost consists of materials cost, equipment expenses and labor cost which are estimated on unit price based on similar projects and studies in the study area. Indirect cost consists of (1) overhead, contingencies and miscellaneous expenses (OCM); (2) profit; (3) mobilization and demobilization expenses for contractor; and, (4) Value Added Tax (VAT). Each component of the indirect cost is computed in percent according to the guidelines of the DPWH, as follows:

Overhead, Contingencies and Miscellaneous (OCM)	:	9% of estimated direct cost
Profit	:	7% of estimated direct cost
Mobilization and Demobilization	:	5% of estimated direct cost
Value Added Tax	:	10% of equipment expenses and labor cost in direct cost

(c) Miscellaneous Works

The cost of miscellaneous works is, in general, to be accounted as a certain percentage of the sum of preparatory and main works depending upon the accuracy of the investigation and design. When the project is in detailed engineering stage supported by detailed survey and investigation, miscellaneous works are not considered. Since this study is in the feasibility study stage, 15% is applied to the miscellaneous works.

(2) Compensation Cost

Compensation cost is divided into the costs of land acquisition and house evacuation, and estimated on unit basis of land acquisition, i.e., commercial, residential, agricultural, fishpond, industrial and ideal area. Moreover, residential area is divided into three types based on tax declarations and interview survey at the city office. House compensation is determined on the average area of house at each city.

(3) Administration and Engineering Services

The administration cost for the government is computed at 5% of the sum of main construction cost and compensation cost according to the standard criteria of DPWH.

The engineering of flood control works is principally divided into master planning of the basin-wide flood control scheme, feasibility study, detailed design and construction supervision. The objective and scope of works of the engineering services differ in each stage of study of the project.

The cost of engineering services herein estimated is to cover the detailed design and construction; therefore, 16% of the main construction works is adopted as the rate of engineering cost.

(4) Project Contingencies

Project contingencies consist of physical contingencies and price contingencies. Physical contingency is usually estimated at 10% to 20% depending on the project study stage; hence, 15% is applied in this study.

3.2 Standard Unit Construction Cost

3.2.1 Basic Cost

The basic cost changes not only with annual escalation but also with Government Codes. Based on Republic Act No. 7160, Rules and Regulations Implementing the Local Government Code of 1991, the Local Government Unit (LGU) has to do the devolution which means the transfer of power and authority from the national government to LGUs to enable them to perform specific functions and responsibilities. The National Compensation Circular No. 72, March, 1994 was issued to prescribe rules and regulations to govern the initial implementation of the Revised Compensation and Position Classification System to increase basic salaries effective on January 1, 1994.

Materials such as sand, gravel and other quarry resources are the objections to collect tax which is a very important source of income for LGU and labor cost has been revised since January, 1994. Therefore, price escalation between 1993 and 1994 has increased more than other annual periods. Unit cost is estimated in the Master Plan for each four cities; however, because of the above reasons, unit cost is adjusted beyond the normal situation. Consequently, construction cost for the Master Plan is converted according to 1994's unit cost, same as the Urgent Plan. Based on cost comparison, Cebu City can apply the Iloilo prices and Tacloban City, the Ormoc prices.

(1) Materials Cost

Data on the updated material costs were obtained from the DPWH Region VI and VIII offices, the local city office and the DPWH main office. Soil and stone materials price escalation between 1993 and 1994 is about 10 % in Iloilo City and about 30 % in Ormoc City.

(2) Labor Rate

The labor cost is increased at about 9% in Iloilo City and about 20% in Ormoc City.

(3) Equipment Rental Rate

Cost of construction equipment is based on equipment rental rates. The equipment rental rates in the ACEL Equipment Guidebook (Edition 19, Nov. 1989) which are adopted in the DPWH are used as the basis for equipment rental rates in this study.

(4) Compensation Cost

Compensation cost is composed of land acquisition cost and house resettlement cost. The acreage of land and the number of houses are estimated by using the topographic map on the scale of 1/5000 for Iloilo and Ormoc. The number of houses in Cebu and Tacloban is based on the average density of each type of residential area. Land subject to right-of-way is delineated according to the following conditions:

(a) The river/drainage area which is confined by existing dikes/drainage channels is not subject to compensation; and

(b) The river/drainage area which is planned to be confined by new dike or structures is subject to compensation.

Unit compensation cost is determined by using the tax declarations and interview survey with each city assessor. Based on the past project, the compensation cost is decided by the negotiation between the local government and the land or house owner. The cost is agreed in the range between tax declaration and market price. However, the compensation cost is difficult to set up, because of the invisible value of the location. The compensation cost for Iloilo and Ormoc is based on the 1994 survey. The compensation cost for Cebu and Tacloban is estimated according to the Economic Indicators of April, 1994, NSCB. The increase in house rate between 1993 and 1994 is 11.1%; therefore, Cebu and Tacloban applied this index for calculating compensation cost.

The list of basic cost is shown in Table 3.1 to 3.4.

3.2.2 Unit Cost for Construction Work

Unit cost for construction works is estimated by using the basic costs and actual unit costs adopted in projects under construction by DPWH. The unit cost is estimated as shown in Table 3.5.

3.2.3 Unit Cost for River/Drainage Structures

Based on the unit cost for construction work, the unit prices for river/drainage structures were estimated, as shown in Table 3.6.

3.3 Results of Cost Estimate

Based on the work volume and unit cost estimation, the project cost for the Master Plan and the Urgent Plan is calculated.

3.3.1 Master Plan

Project cost for river/drainage improvement works in the four cities is given below. Project cost for each river and drainage is given listed in Table 3.7 to 3.13

(Unit: million pesos)

Particulars	No.	Main Construction*	Compensation	Total Cost
Iloilo City		1,977.9	696.6	2,674.5
River	3	1,834.5	664.3	2,498.8
Drainage	3	143.4	32.3	175.7
Cebu City		1,655.3	2,416.2	4,071.5
River	5	1,314.5	1,988.9	3,303.4
Drainage	9	340.8	427.3	768.1
Ormoc City		377.8	65.6	443.4
River	2	356.9	62.6	419.5
Drainage	2	20.9	2.9	23.9
Tacloban City				
Drainage	7	247.4	98.3	345.7
Total		4,258.4	3,276.6	7,535.0

* Main Construction Cost including Administration Cost and Engineering Services.

3.3.2 Urgent Plan

The project cost for the Urgent Plan in Iloilo and Ormoc is listed in below. Cost estimated for river and drainage works are shown in Tables 3.14 to 3.17.

(Unit: million pesos)

Particulars	Main Construction*	Compensation	Total Cost
Iloilo City	1,194.4	293.0	1,487.4
Jaro	602.8	128.7	731.5
Iloilo	245.9	59.7	305.6
Mandurriao	206.2	78.4	284.6
Drainage	139.5	26.2	165.7
Ormoc City	318.0	63.4	381.4
Anilao	179.8	33.5	213.3
Malbasag	128.9	29.1	158.0
Drainage	9.3	0.8	10.1
Total	1,512.4	356.4	1,868.8

* Main construction cost includes administration cost and engineering services cost.