

5.18 Discharge Distribution under the Development Scenario

The design discharge distribution under the formulated development scenario, which involves the Green Rivr scenarios in the Lower Atrai (Figure 5.35) and the Bangali floodway in the Upper Karatoya/Middle Bangali, is shown in Figure 3.36.

Table 5.1 SPILLAGE OF UPPER KARATOYA
(in 1987 condition)

Year	M.	Day	Kathak (m3/s)	Spillage (m3/s)	Cv.Cp (m3/s)	Vi (m.m3)	SVi (m.m3)
1987	7	20	263	0	790		
1987	7	21	244	0	790		
1987	7	22	296	0	790		
1987	7	23	384	0	790		
1987	7	24	557	0	790		
1987	7	25	772	0	790	0	0
1987	7	26	962	172	790	15	15
1987	7	27	1179	389	790	34	48
1987	7	28	1231	441	790	38	87
1987	7	29	1182	392	790	34	120
1987	7	30	1139	349	790	30	151
1987	7	31	1177	387	790	33	184
1987	8	1	1251	461	790	40	224
1987	8	2	1432	642	790	55	279
1987	8	3	1493	703	790	61	340
1987	8	4	1423	633	790	55	395
1987	8	5	1288	498	790	43	438
1987	8	6	1162	372	790	32	470
1987	8	7	1080	290	790	25	495
1987	8	8	1002	212	790	18	513
1987	8	9	925	135	790	12	525
1987	8	10	872	82	790	7	532
1987	8	11	998	208	790	18	550
1987	8	12	1189	399	790	34	584
1987	8	13	1397	607	790	52	637
1987	8	14	1440	650	790	56	693
1987	8	15	1355	565	790	49	742
1987	8	16	1244	454	790	39	781
1987	8	17	1117	327	790	28	809
1987	8	18	988	198	790	17	826
1987	8	19	868	78	790	7	833
1987	8	20	782	0	790	0	833
1987	8	21	746	0	790		
1987	8	22	704	0	790		
1987	8	23	658	0	790		
1987	8	24	613	0	790		
1987	8	25	582	0	790		
1987	8	26	572	0	790		
1987	8	27	551	0	790		
1987	8	28	529	0	790		
1987	8	29	506	0	790		
1987	8	30	482	0	790		
1987	8	31	463	0	790		

Cv.Cp : Conveyance capacity(m3/s)

Vi : Spillage volume (milliom cum)

SVi : Accumulative spillage volume (million cum)

Table 5.2 CHANNEL CROSS SECTIONS OF THE BANGALI FLOODWAY

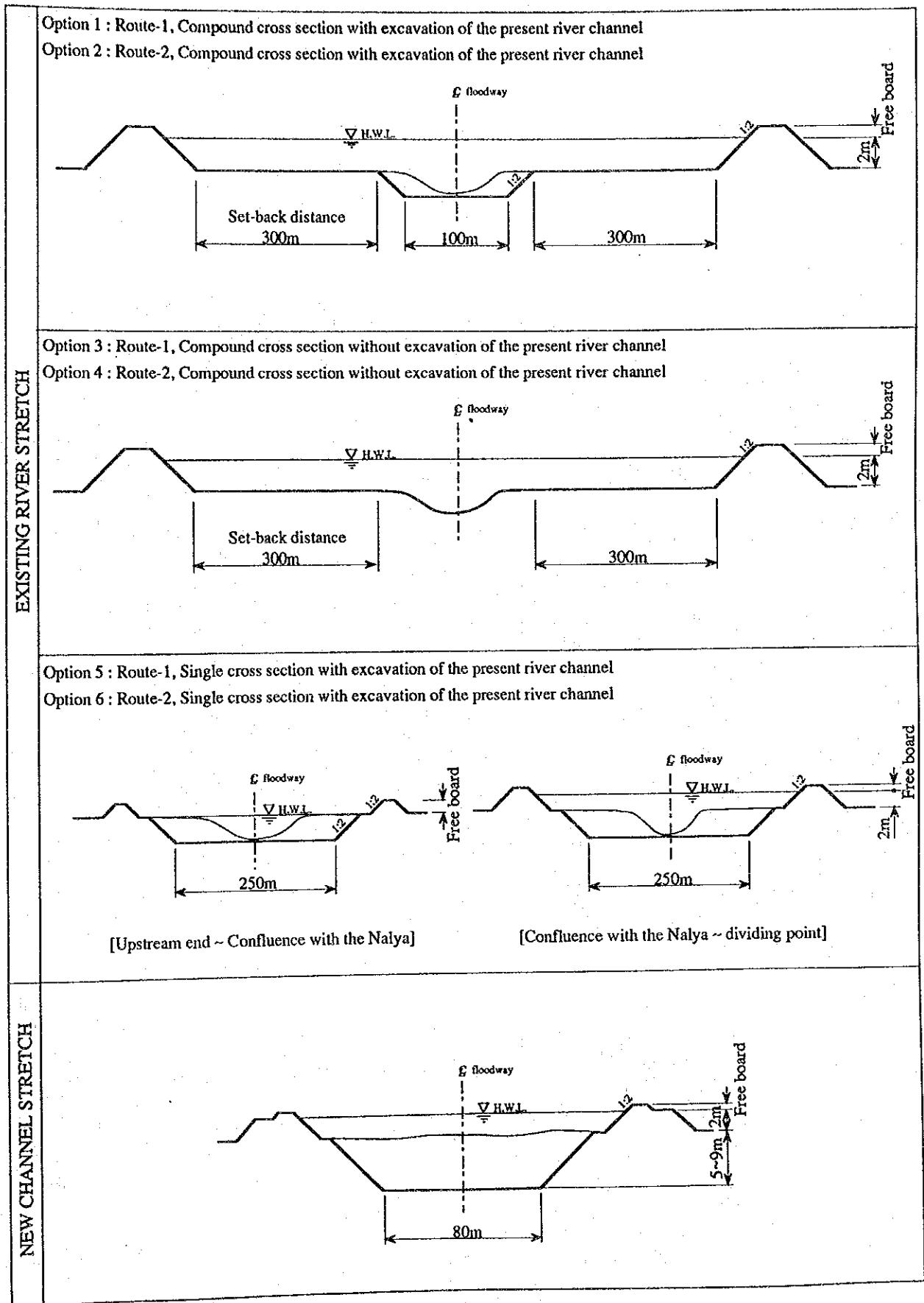
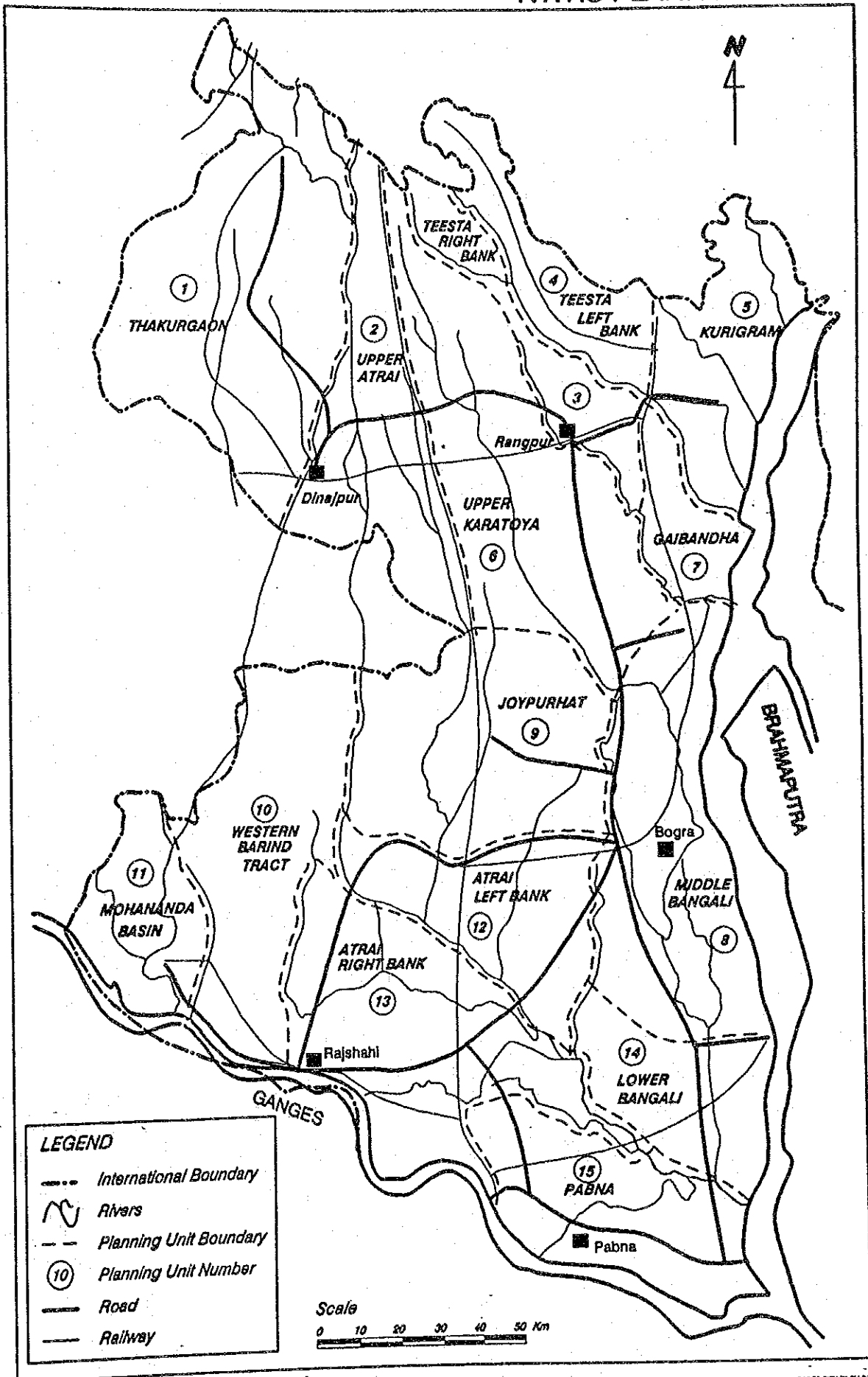


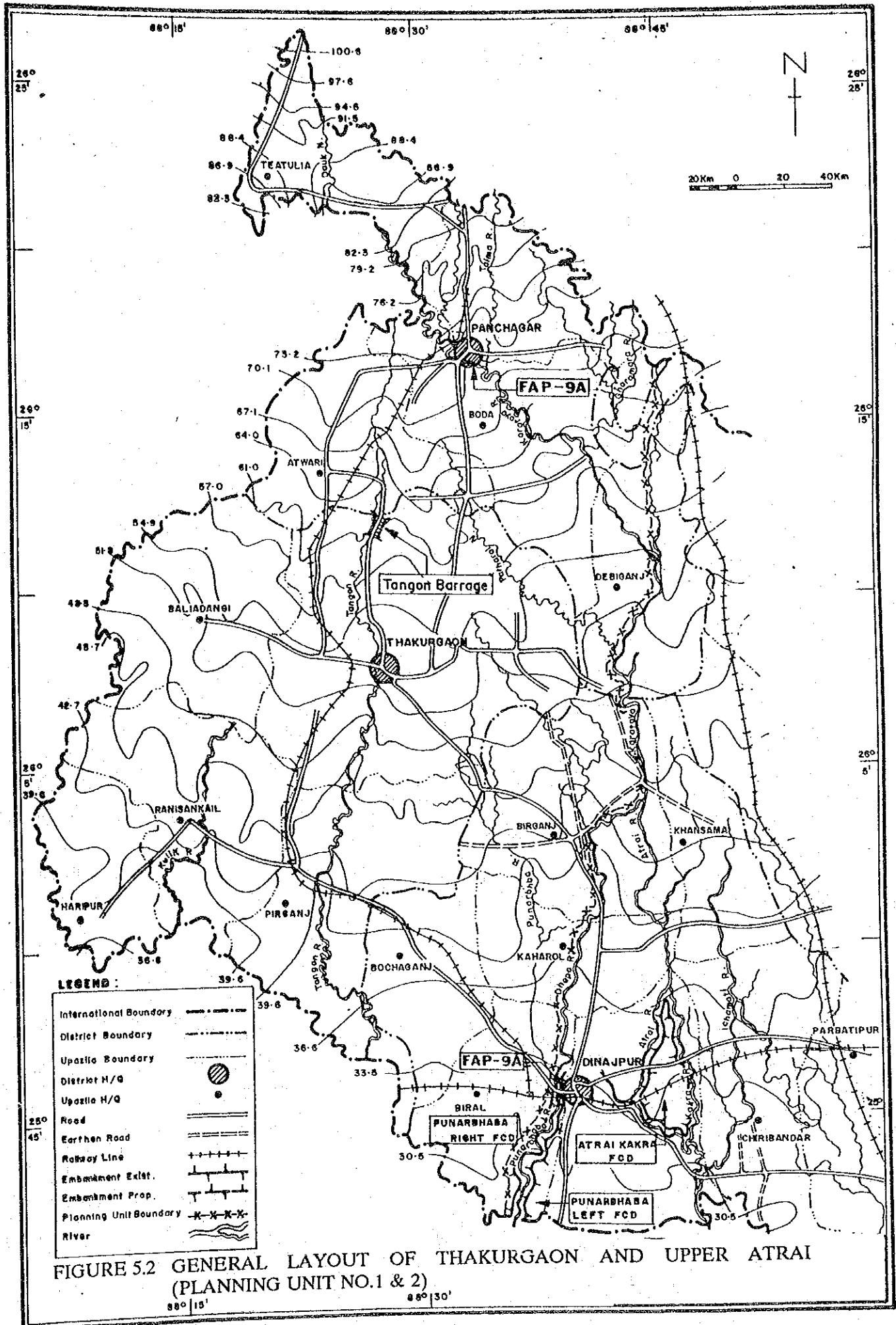
TABLE 5.3 COST COMPARISON OF OPTIONS OF THE BANGALI FLOODWAY

(Unit : TK Million)

Work Item	OPTION 1	OPTION 2	OPTION 3	OPTION 4	OPTION 5	OPTION 6
I. Construction cost						
1. Earthwork(manual and mechanical construction method)						
a) Flood embankment[manual]						
• Clearing & stripping	46	41	46	41	26	22
• Excavation & hauling(l=50m)	92	93	409	325	-	-
• Compaction & shaping	237	203	237	203	135	104
• Turfing	28	25	28	25	15	13
b) Channel excavation						
• Excavation & disposal(l=50m)[manual]	947	751	94	102	3,151	2,648
• Excavation & disposal(l=50m)[mechanical]	221	236	221	157	221	236
2. Structural Works						
a) Regulator						
• Sub-basin 1	4	4	4	4	-	-
• Sub-basin 2	2	2	2	2	-	-
• Sub-basin 3	4	5	4	5	4	5
• Sub-basin 4	4	4	4	4	4	4
• Sub-basin 5	4	5	4	5	4	5
• Sub-basin 6	2	-	2	-	2	-
b) Revetments						
• Concrete blocks	8	8	8	8	8	8
• Brick mattress(l=200)	7	7	7	7	7	7
c) Sluiceway						
• Sub-basin 1	-	-	-	-	2	2
• Sub-basin 2	-	-	-	-	2	2
d) Regulating weir						
• Bangali (6gates x 15m width x 10m height)	300	300	300	300	300	300
• New channel (6gates x 15m width x 3m height)	170	170	170	170	170	170
3. Land acquisition						
• Embankment	103	95	121	112	87	80
• Borrow pits	-	-	83	66	-	-
• Spoil-bank	132	105	15	11	635	540
• Channel excavation	-	-	-	-	88	65
Total of Item I.	2,311	2,054	1,759	1,547	4,861	4,211
II. Administration(3% of Total of Item 1. and 2.)						
	62	56	46	41	122	106
III. Physical contingency(25% of Total of Item 1. and 2.)						
	519	464	385	340	1,013	882
IV. Engineering cost(15% of Total of Items 1., 2. and II.)						
	389	348	289	255	760	661
Grand Total	3,282	2,921	2,479	2,183	6,756	5,860
V. Annual O&M cost (5% of Item 1. and 3% of Item 2.)						
	94	83	67	58	192	166

Figure 5.1
NWRS PLANNING UNITS

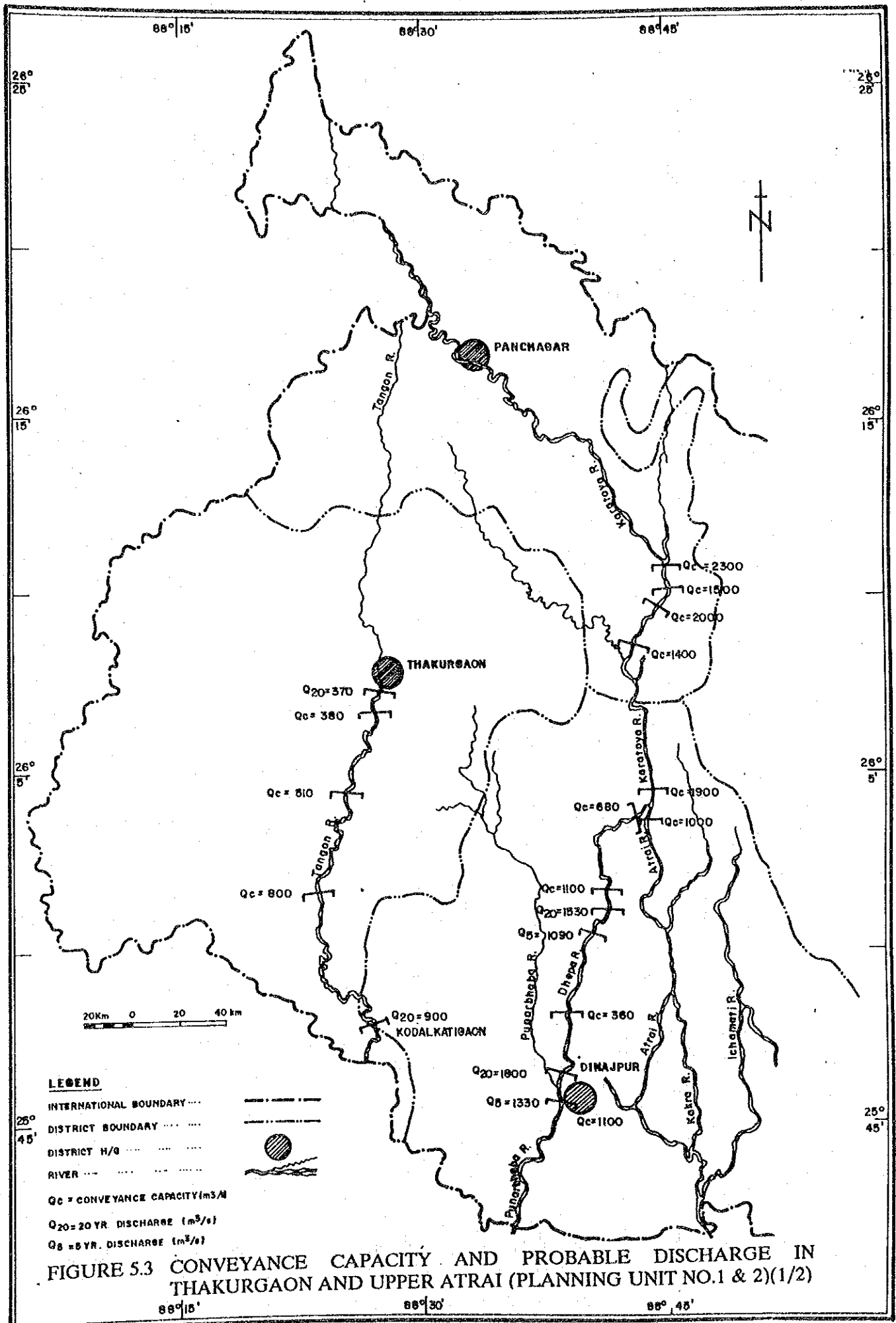




LEGEND:

International Boundary	— · — · — ·
District Boundary	— — — — —
Upastha Boundary	— · — · — ·
District H/Q	⊙
Upastha H/Q	●
Road	— — — — —
Earthen Road	— · — · — ·
Railway Line	— + + + —
Embankment Exist.	— + + + —
Embankment Prop.	— + + + —
Planning Unit Boundary	— x x x —
River	~~~~~

FIGURE 5.2 GENERAL LAYOUT OF THAKURGAON AND UPPER ATRAI (PLANNING UNIT NO.1 & 2)



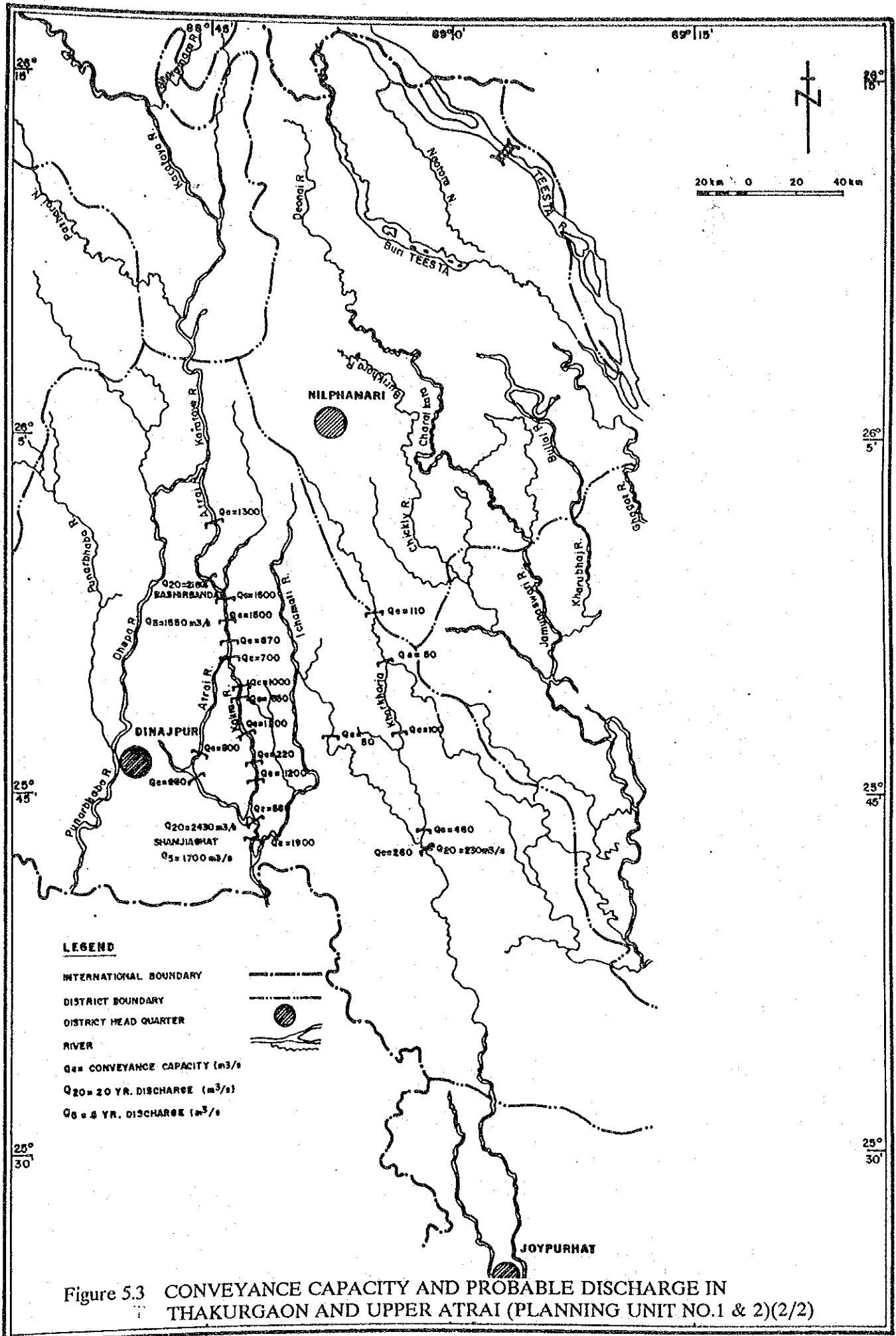
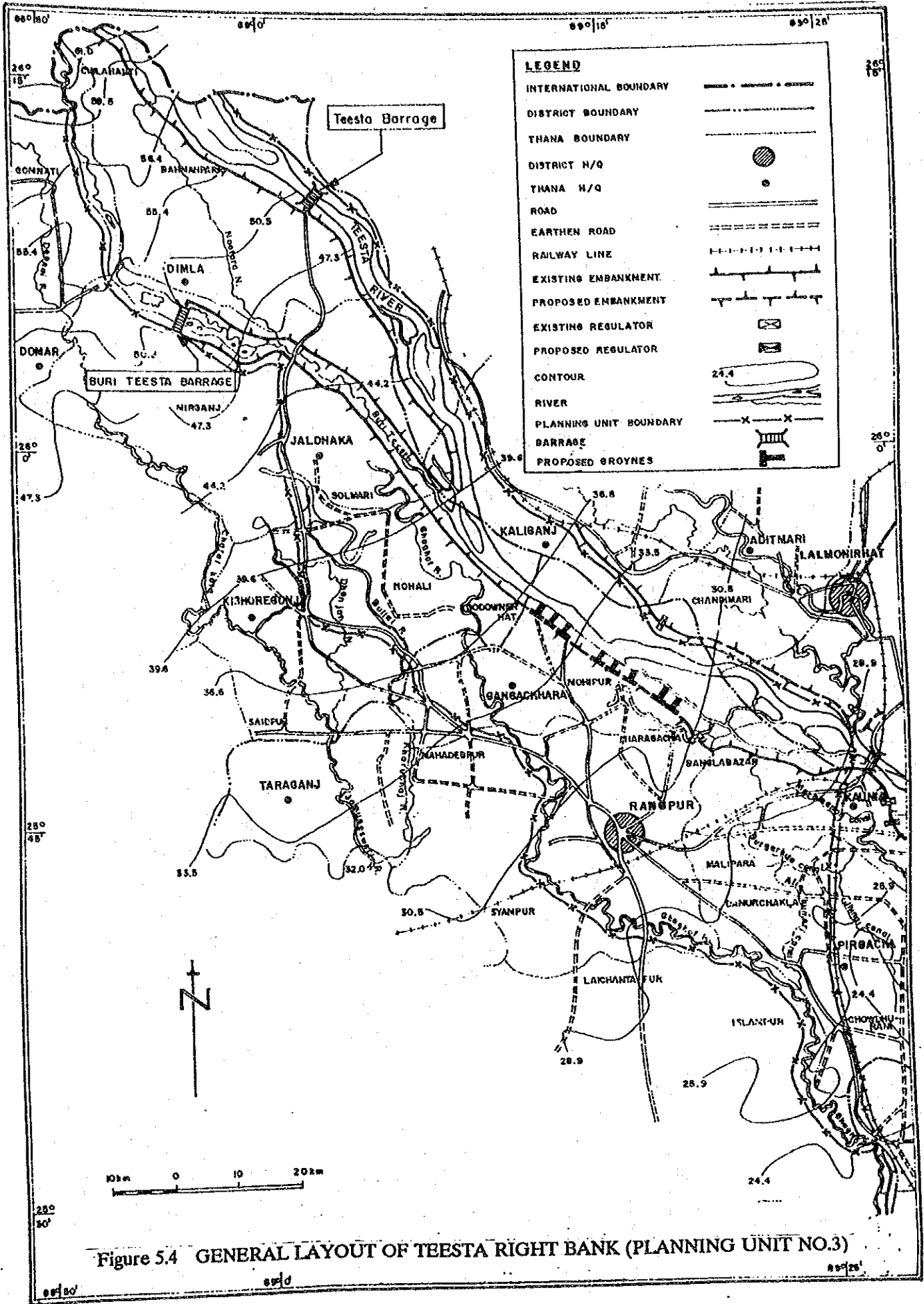


Figure 5.3 CONVEYANCE CAPACITY AND PROBABLE DISCHARGE IN THAKURGAON AND UPPER ATRAI (PLANNING UNIT NO.1 & 2)(2/2)



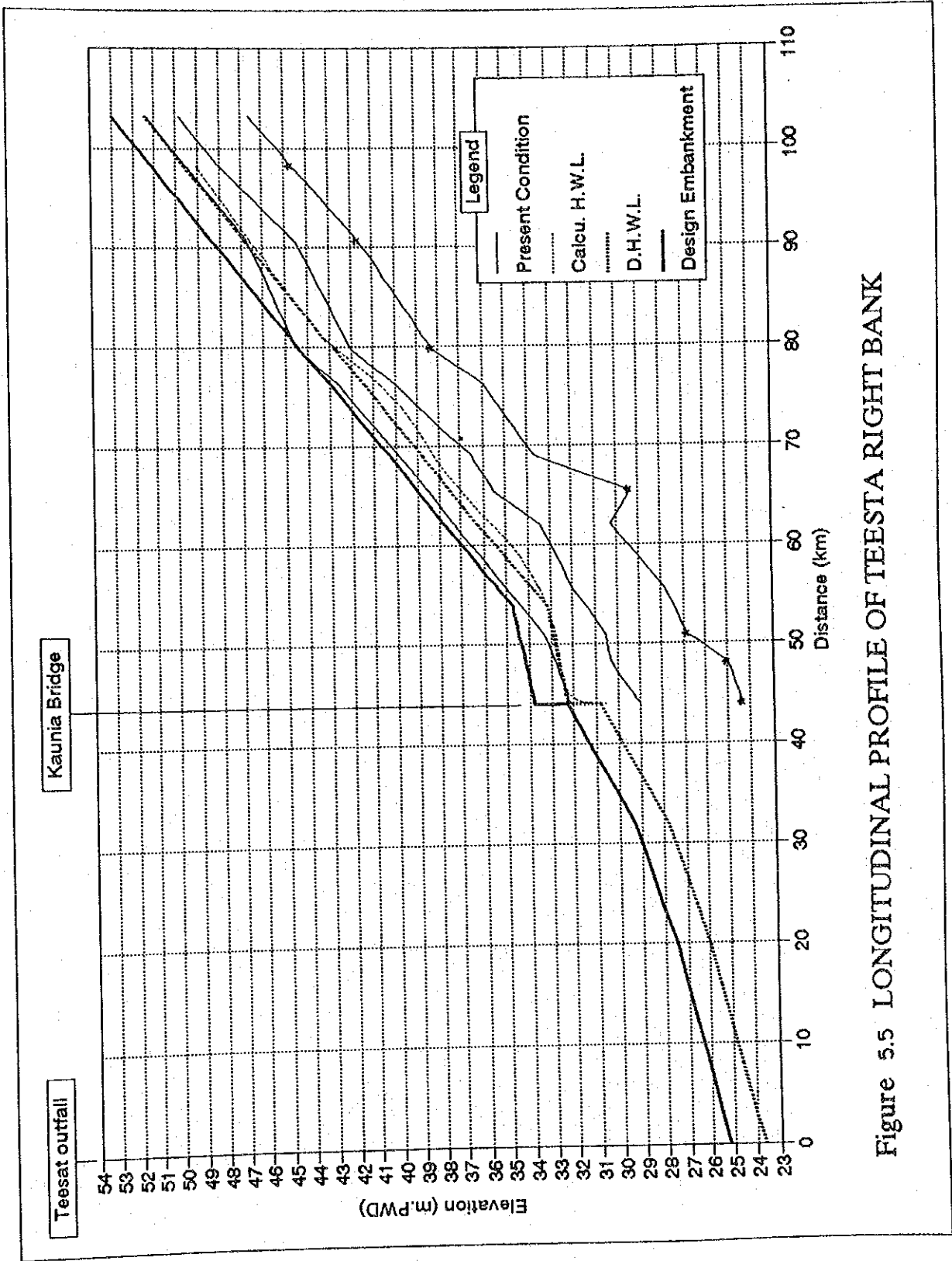


Figure 5.5 LONGITUDINAL PROFILE OF TEESTA RIGHT BANK

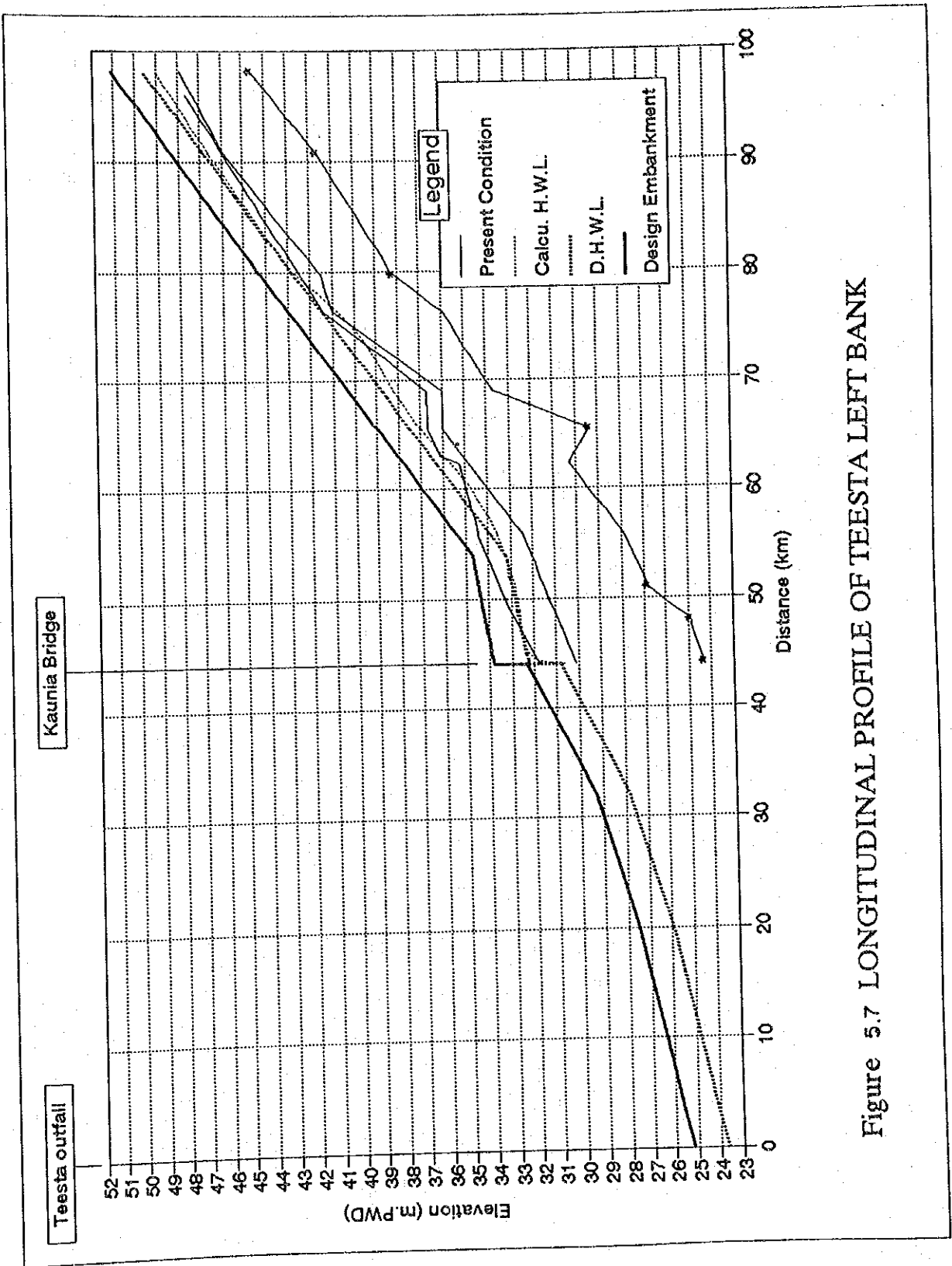


Figure 5.7 LONGITUDINAL PROFILE OF TEESTA LEFT BANK

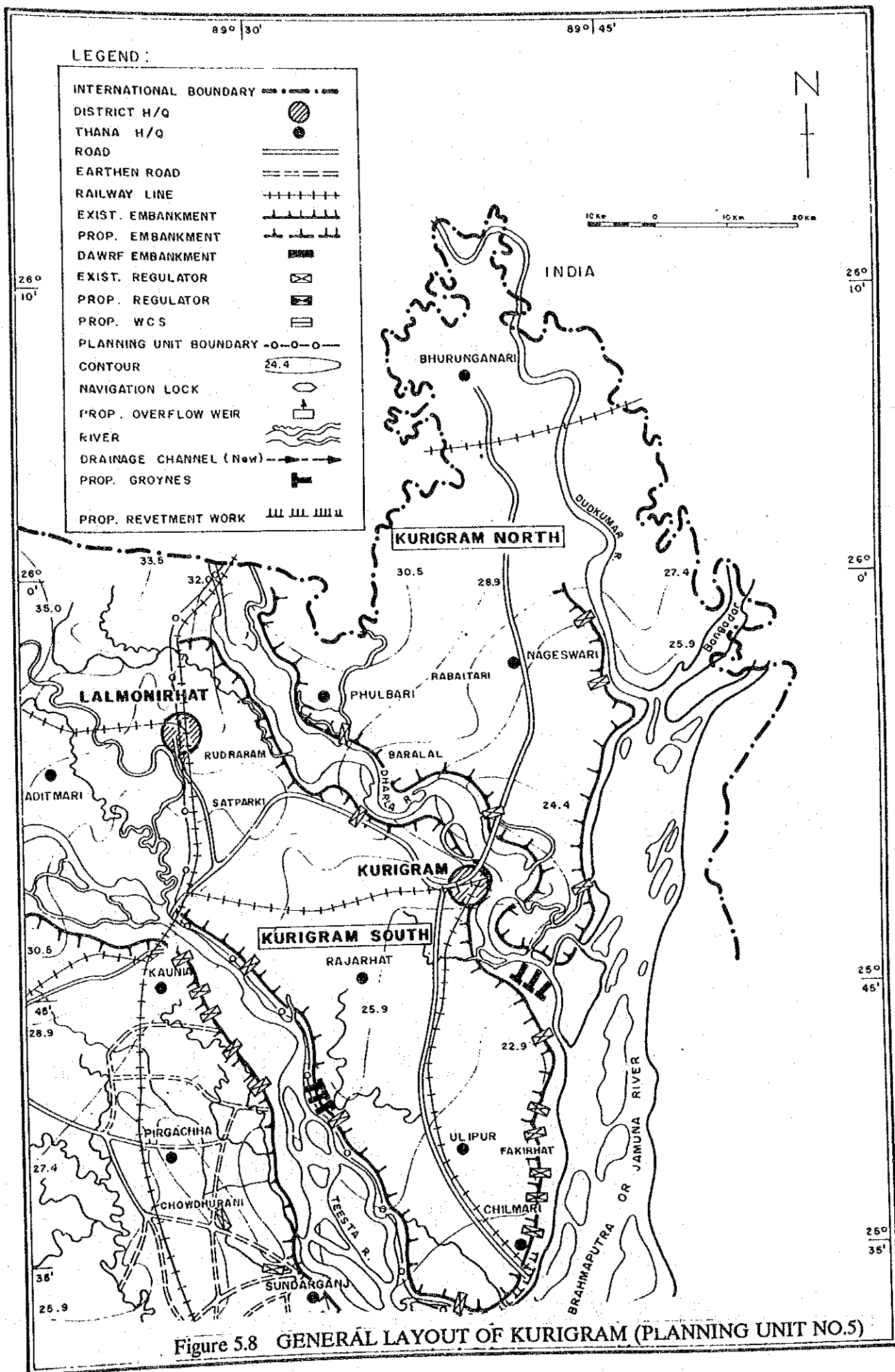
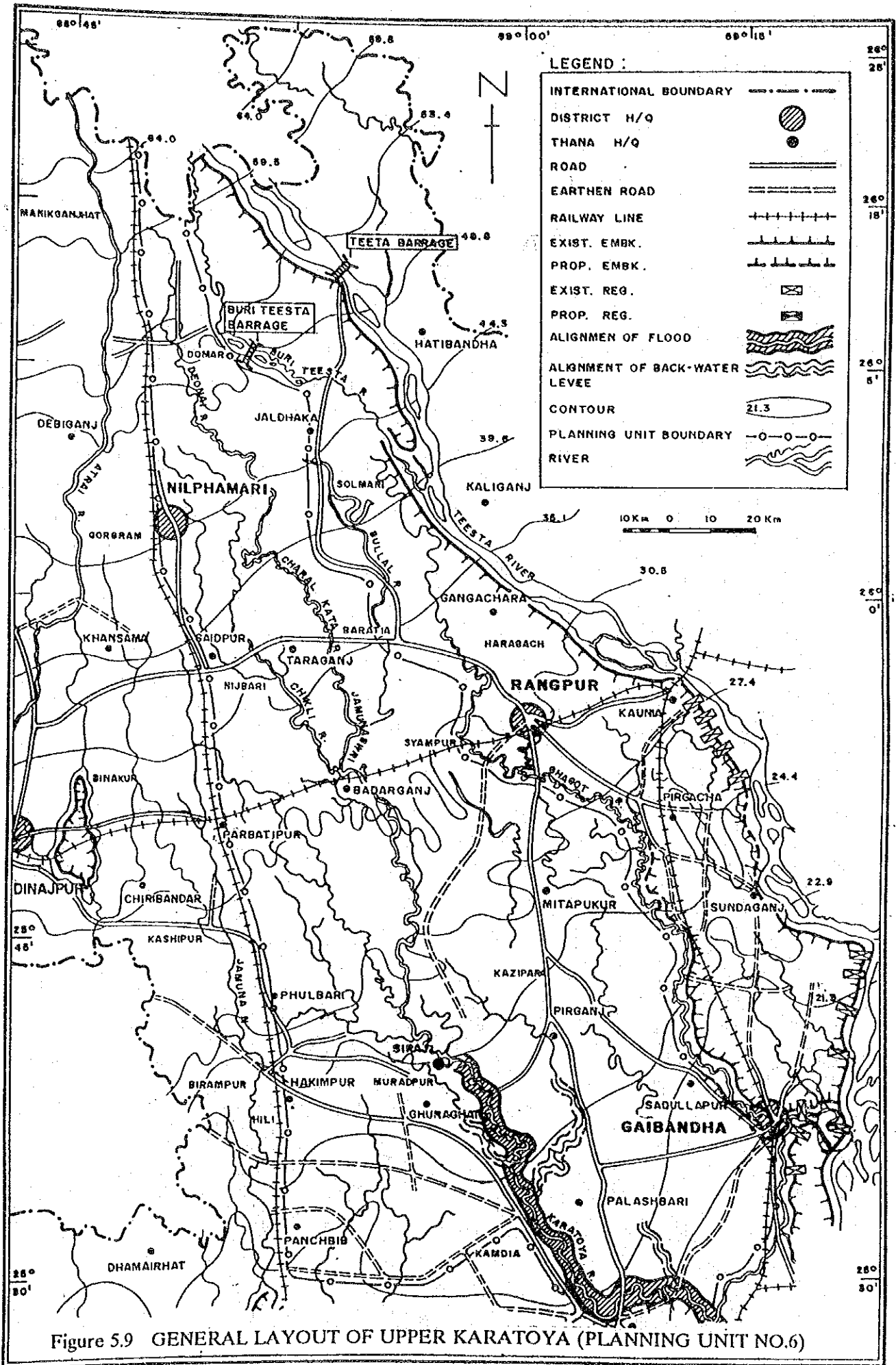
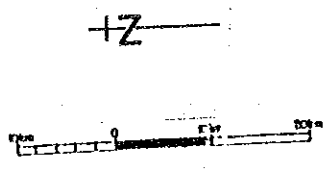
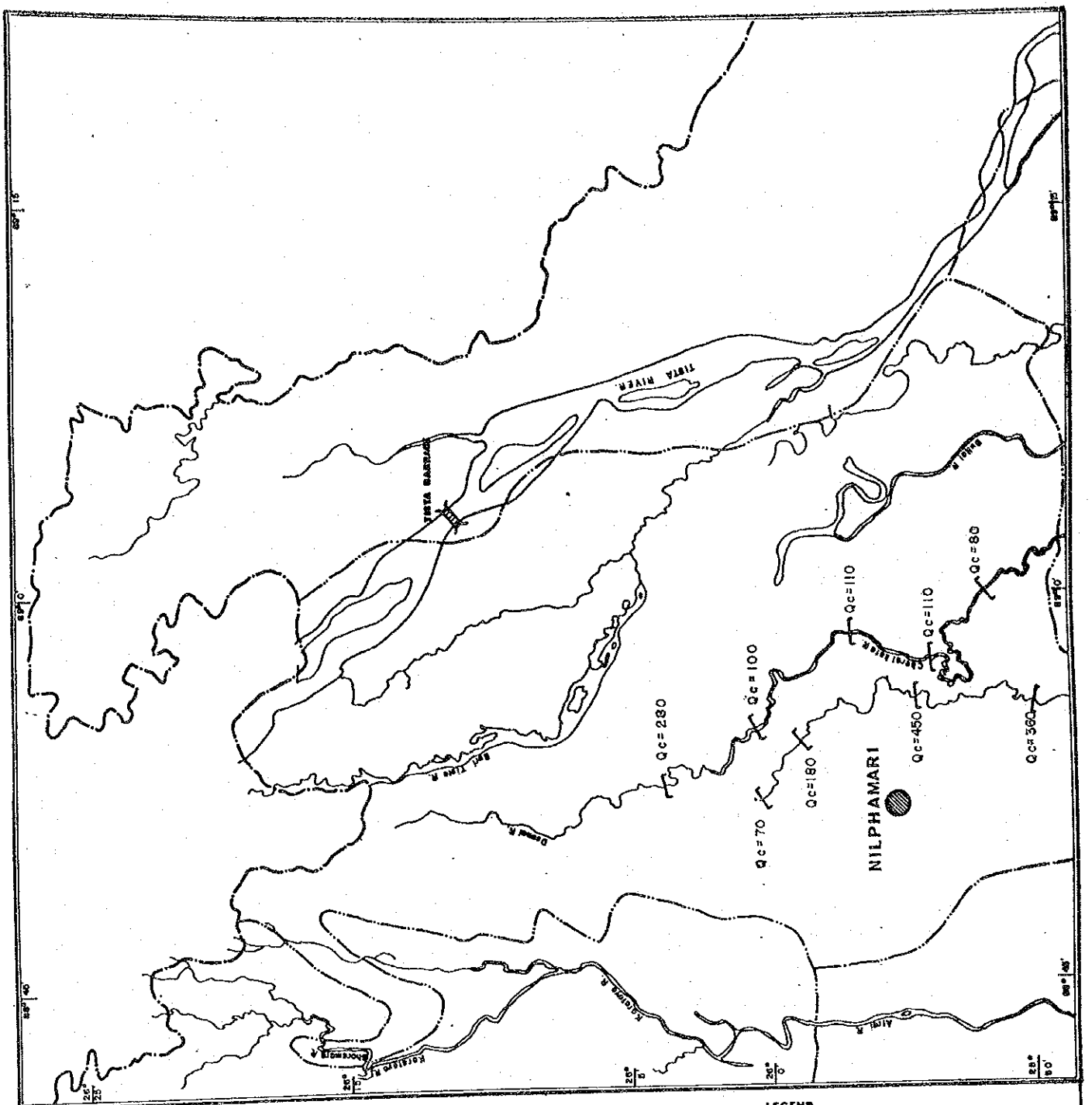


Figure 5.8 GENERAL LAYOUT OF KURIGRAM (PLANNING UNIT NO.5)





LEGEND





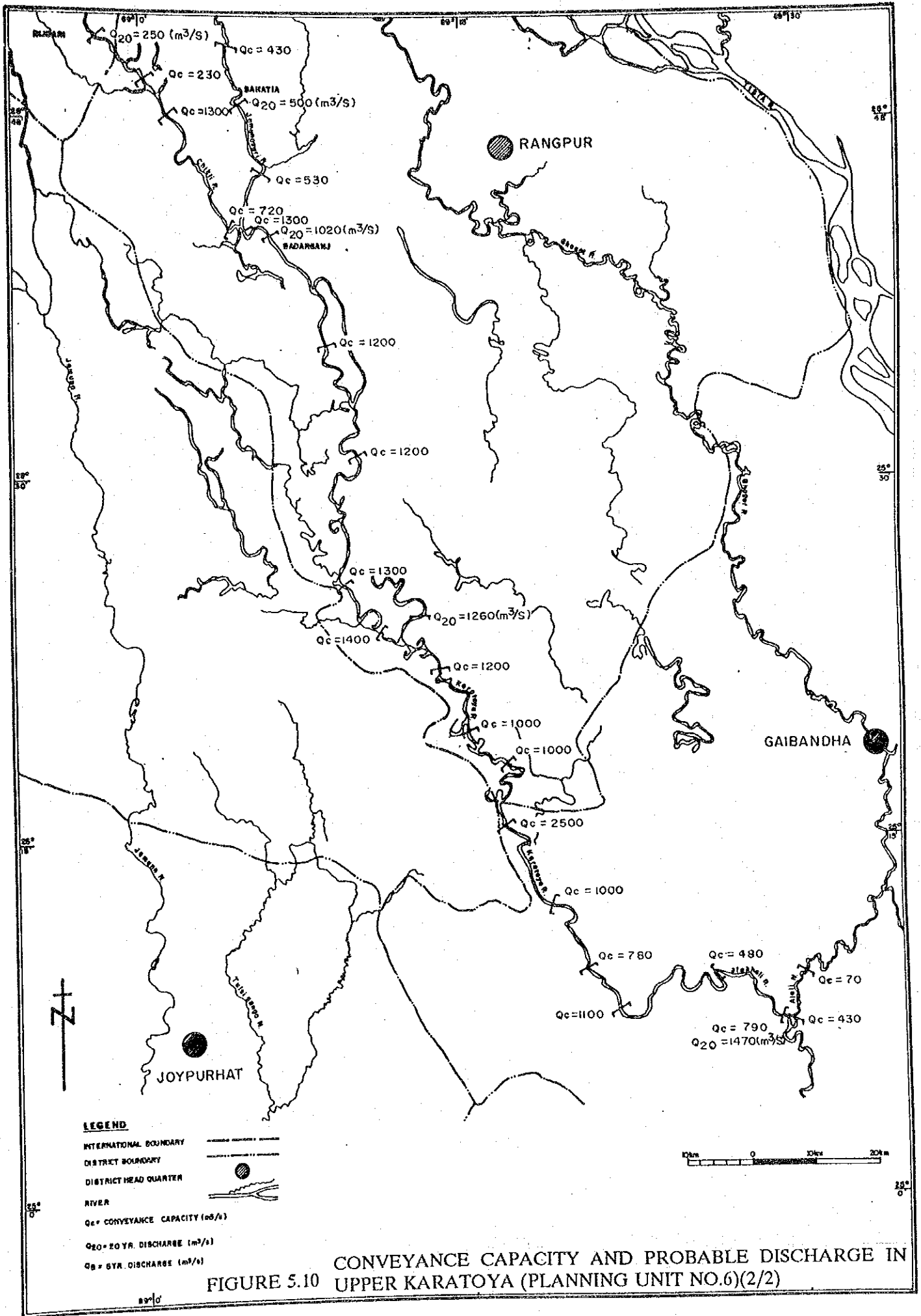
- INTERNATIONAL BOUNDARY 
- DISTRICT BOUNDARY 
- DISTRICT HEAD QUARTER 
- RIVER 
- Q_c = CONVEYANCE CAPACITY (m³/s)
- Q_{20} = 20 YR. DISCHARGE (m³/s)
- Q_5 = 5 YR. DISCHARGE (m³/s)

FIGURE 5.10

CONVEYANCE CAPACITY AND PROBABLE DISCHARGE IN UPPER KARATOYA (PLANNING UNIT NO.6)(1/2)



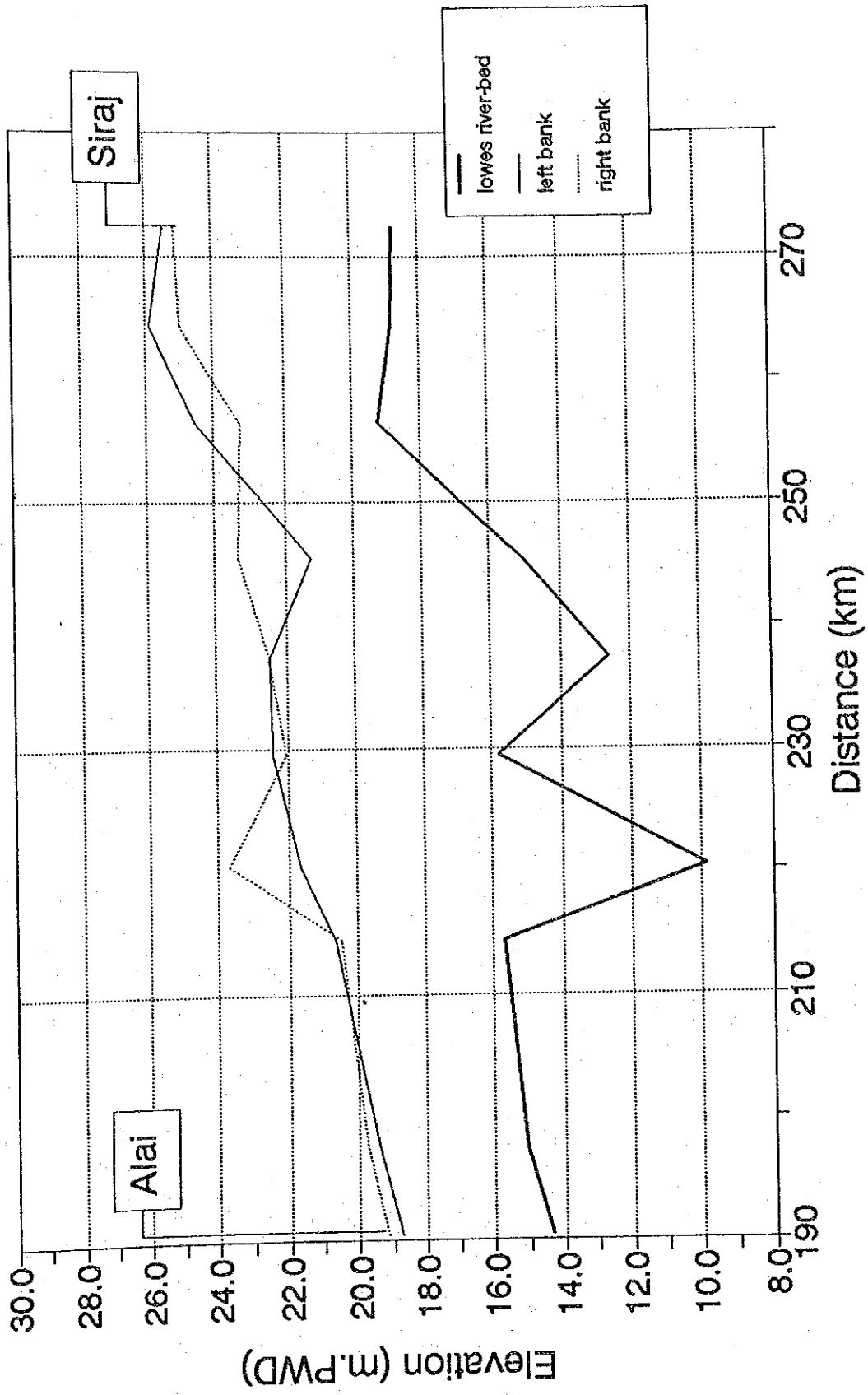
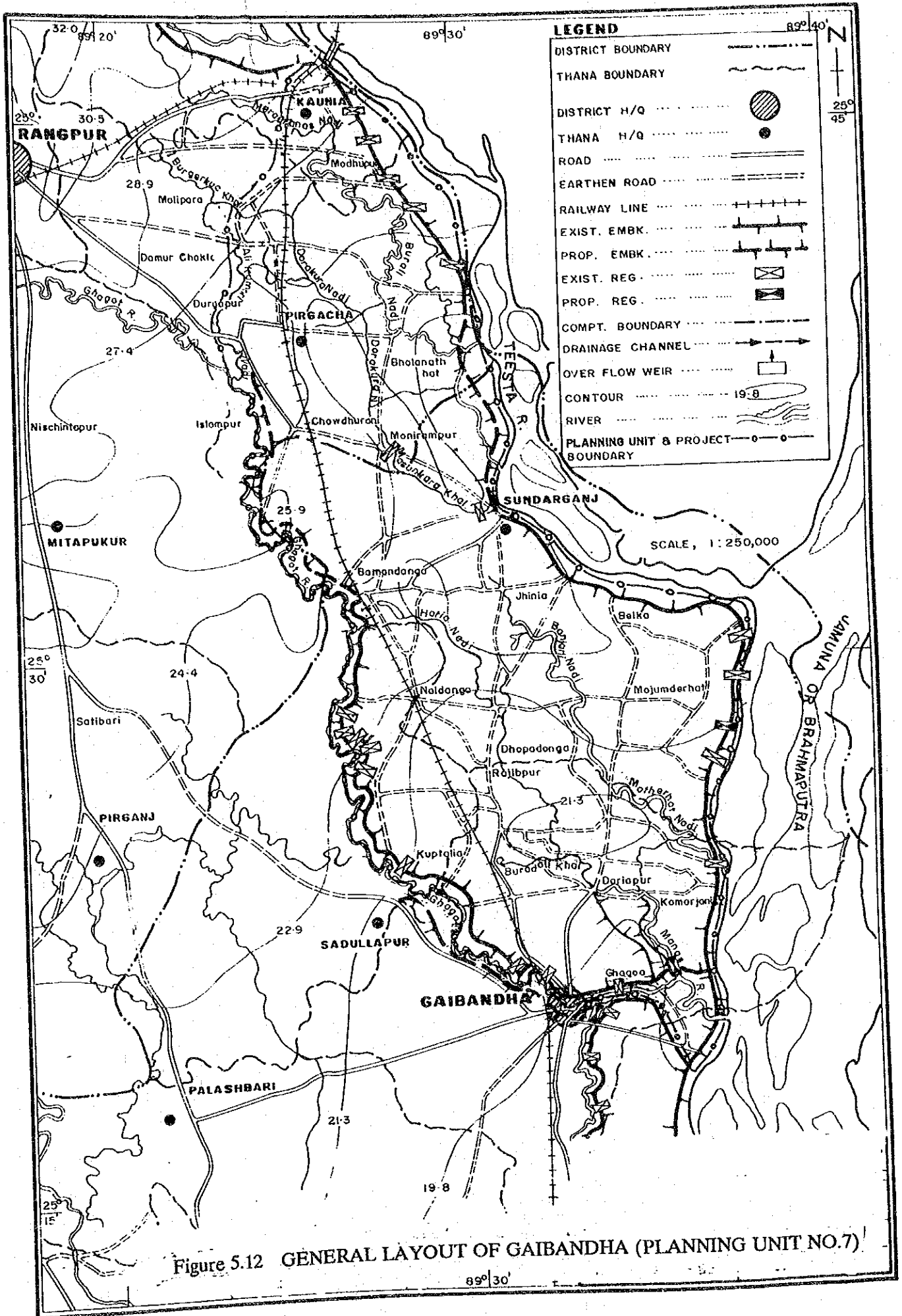
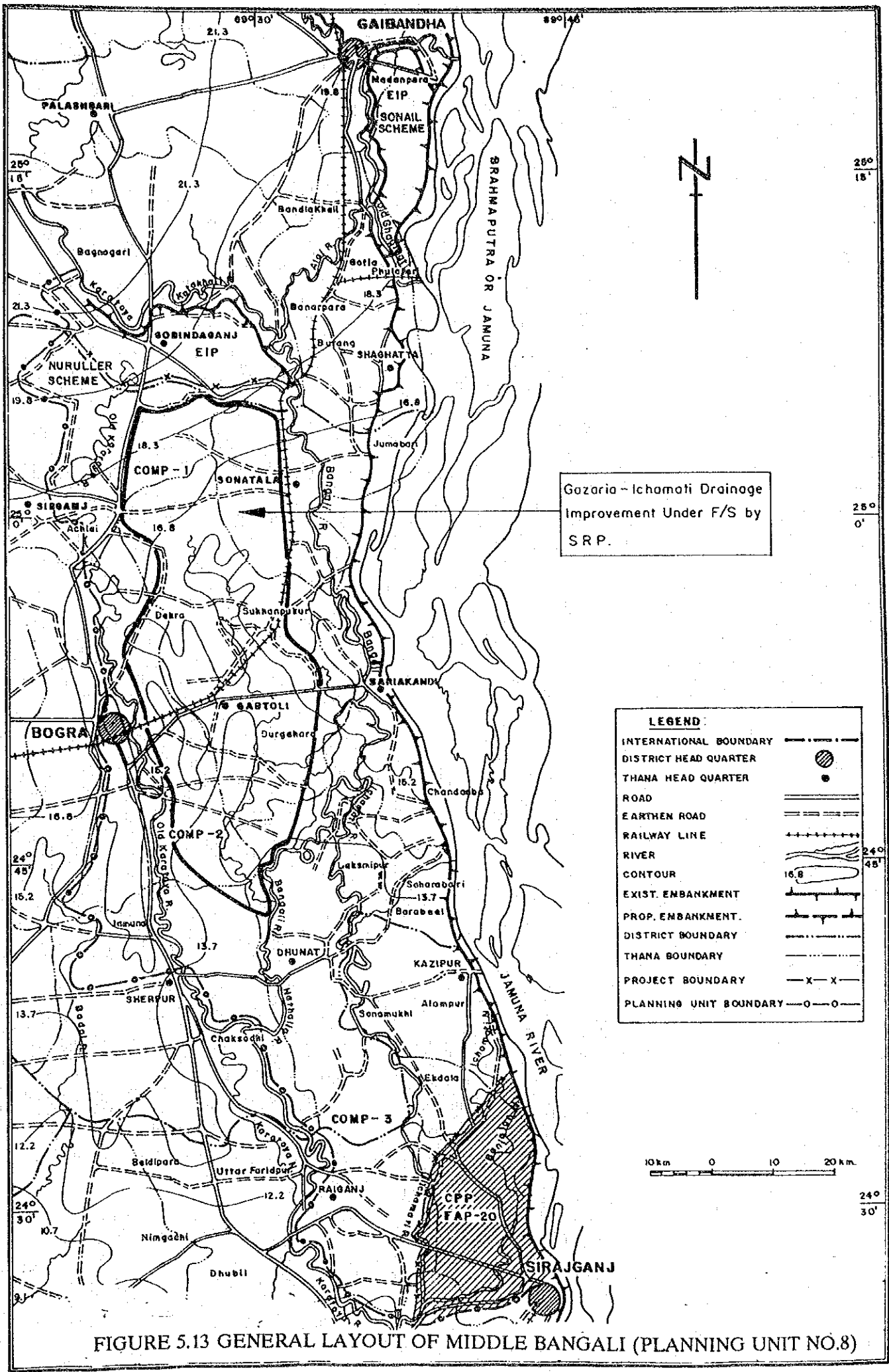


Figure 5.11 Longitudinal Profile of Upper Karatoya



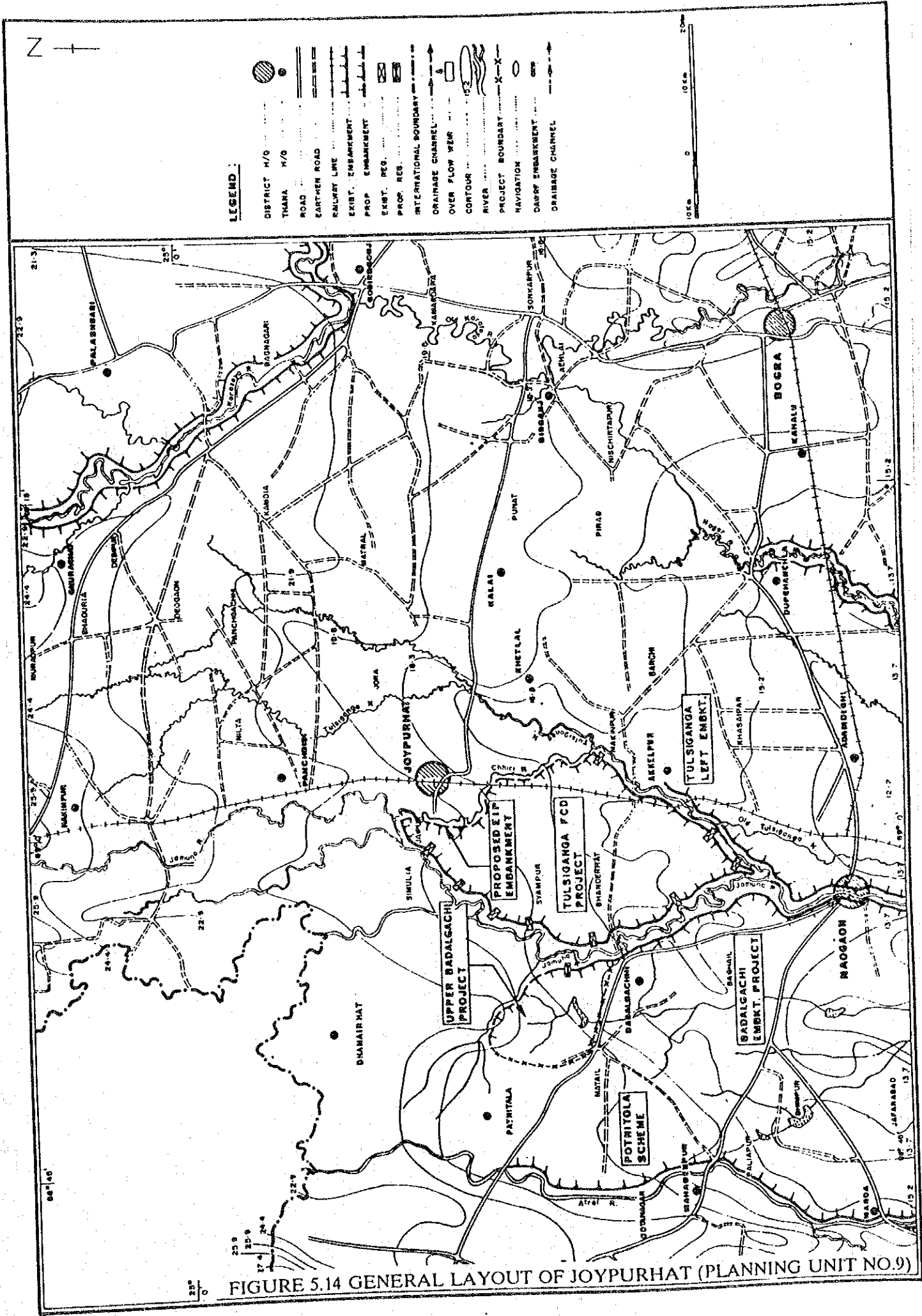


Gazaria - Ichamati Drainage Improvement Under F/S by S.R.P.

LEGEND:

INTERNATIONAL BOUNDARY	— · — · — · — · — · — · — · — · —
DISTRICT HEAD QUARTER	●
THANA HEAD QUARTER	●
ROAD	====
EARTHEN ROAD	— · — · — · — · — · — · — · — · —
RAILWAY LINE	— + + + + — + + + + — + + + + — + + + + —
RIVER	~~~~~
CONTOUR	16.8
EXIST. ENBANKMENT	— + — + — + — + — + — + — + — +
PROP. ENBANKMENT	— + — + — + — + — + — + — + — +
DISTRICT BOUNDARY	— · — · — · — · — · — · — · — · —
THANA BOUNDARY	— · — · — · — · — · — · — · — · —
PROJECT BOUNDARY	— x — x — x — x — x — x — x — x — x
PLANNING UNIT BOUNDARY	— o — o — o — o — o — o — o — o — o

FIGURE 5.13 GENERAL LAYOUT OF MIDDLE BANGALI (PLANNING UNIT NO.8)



LEGEND

- DISTRICT H/O
- THANA H/O
- ROAD
- EARTHEN ROAD
- RAILWAY LINE
- EXIST. EMBANKMENT
- PROP. EMBANKMENT
- EXST. REG.
- PROP. REG.
- INTERNATIONAL BOUNDARY
- DRAINAGE CHANNEL
- OVER FLOW WEIR
- CONTOUR
- RIVER
- PROJECT BOUNDARY
- NAVIGATION
- DAM OR EMBANKMENT
- DRAINAGE CHANNEL



FIGURE 5.14 GENERAL LAYOUT OF JOYPURHAT (PLANNING UNIT NO.9)

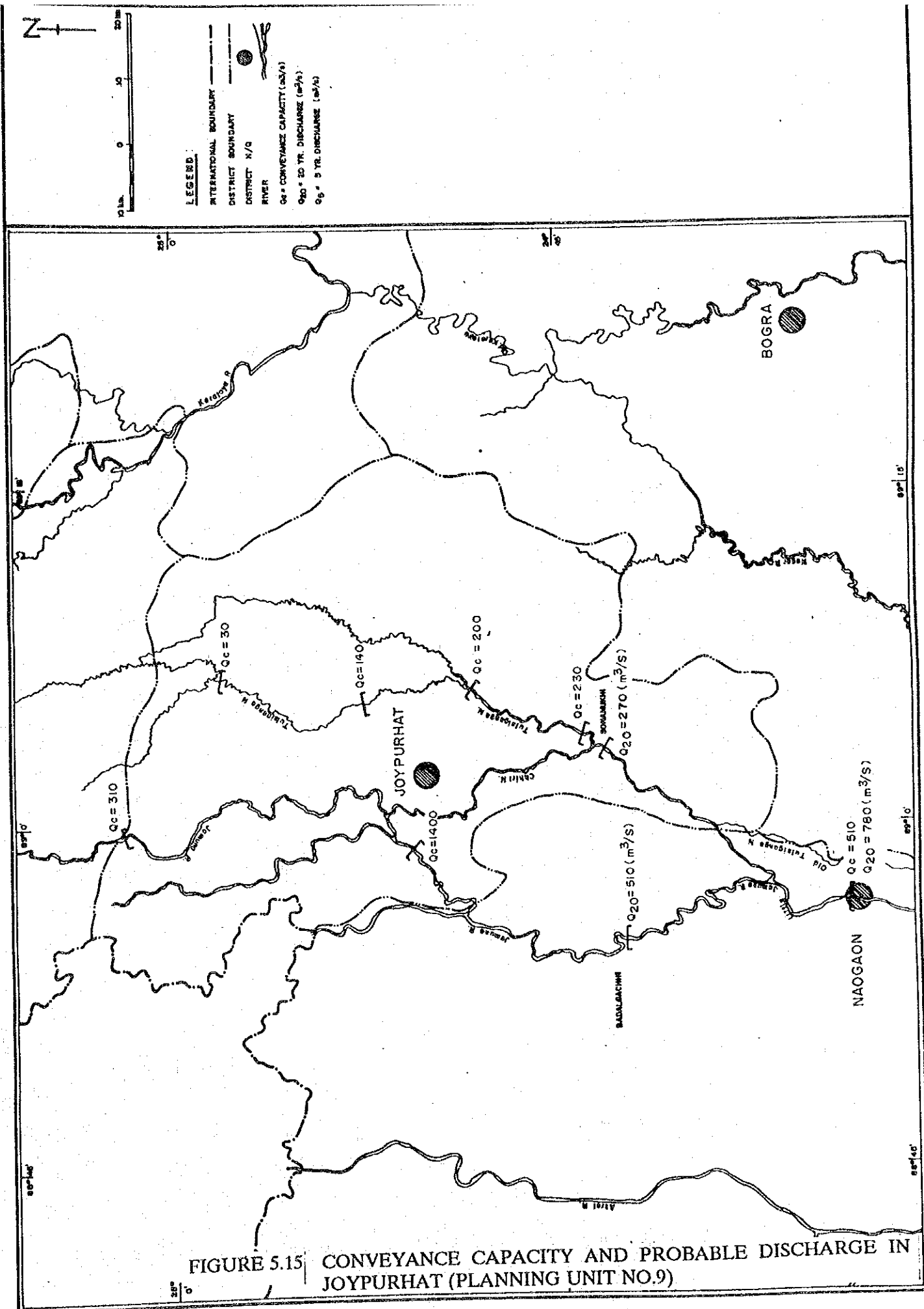


FIGURE 5.15 CONVEYANCE CAPACITY AND PROBABLE DISCHARGE IN JOYPURHAT (PLANNING UNIT NO.9)

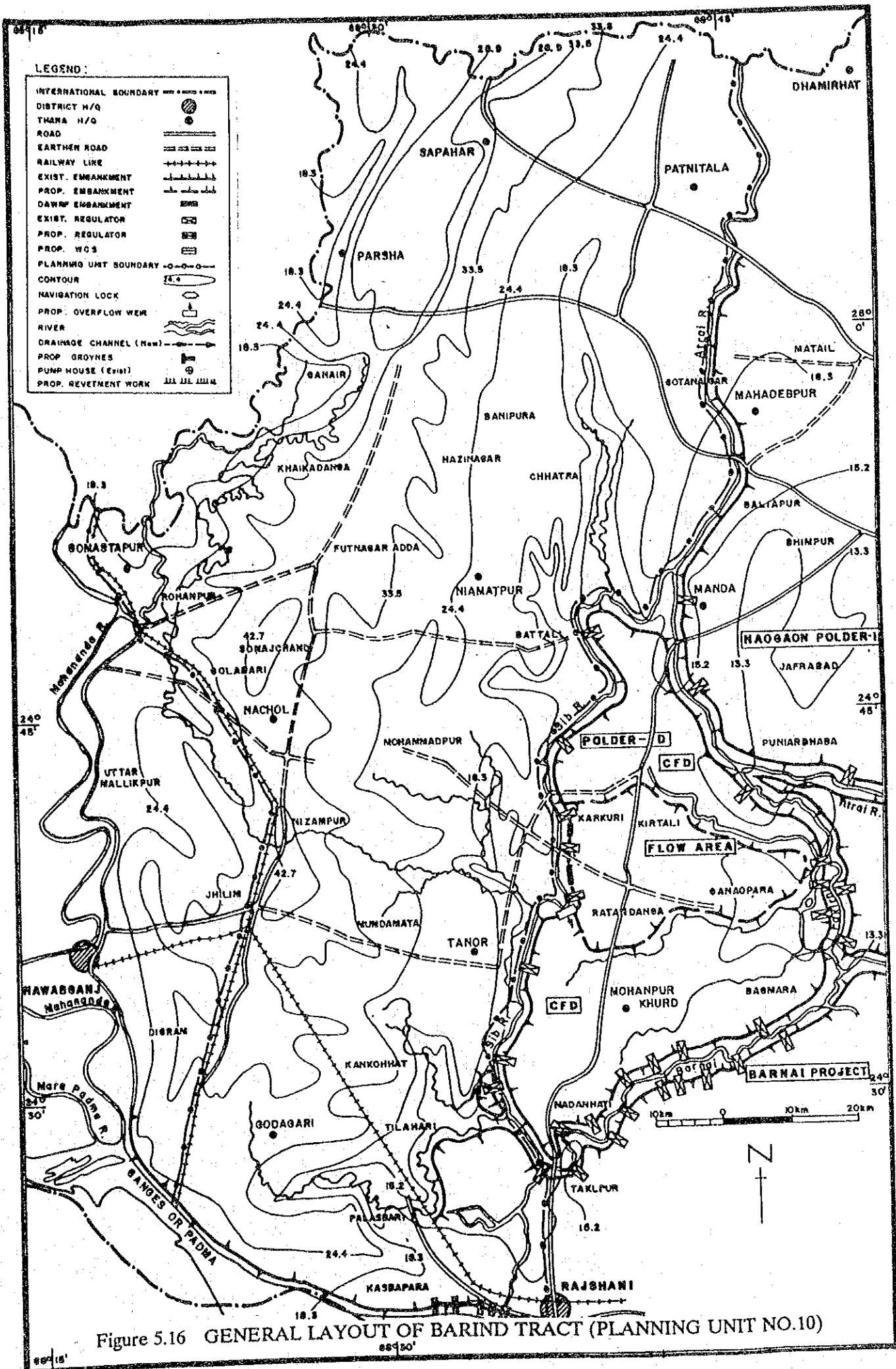


Figure 5.16 GENERAL LAYOUT OF BARIND TRACT (PLANNING UNIT NO.10)

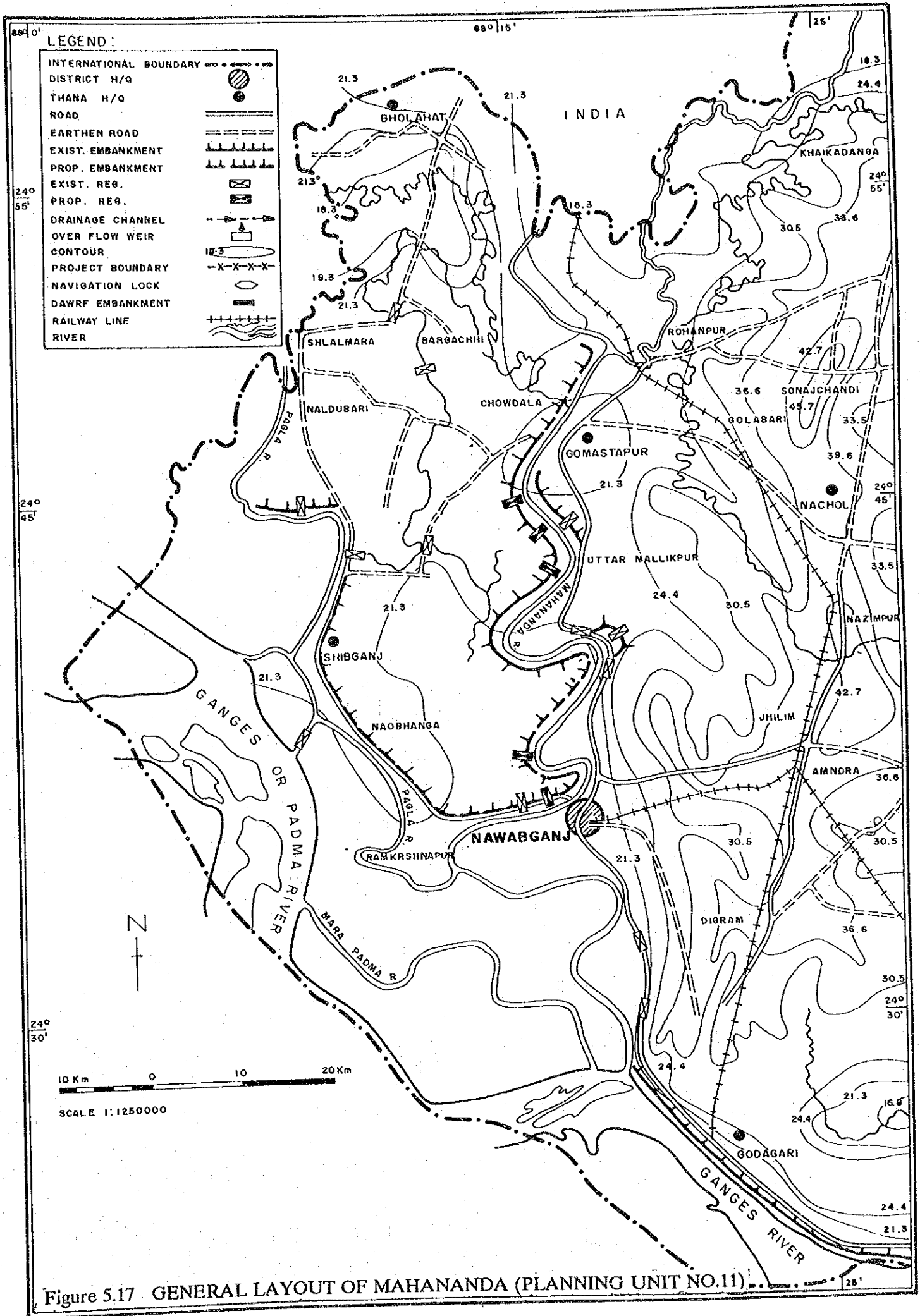


Figure 5.17 GENERAL LAYOUT OF MAHANANDA (PLANNING UNIT NO.11)

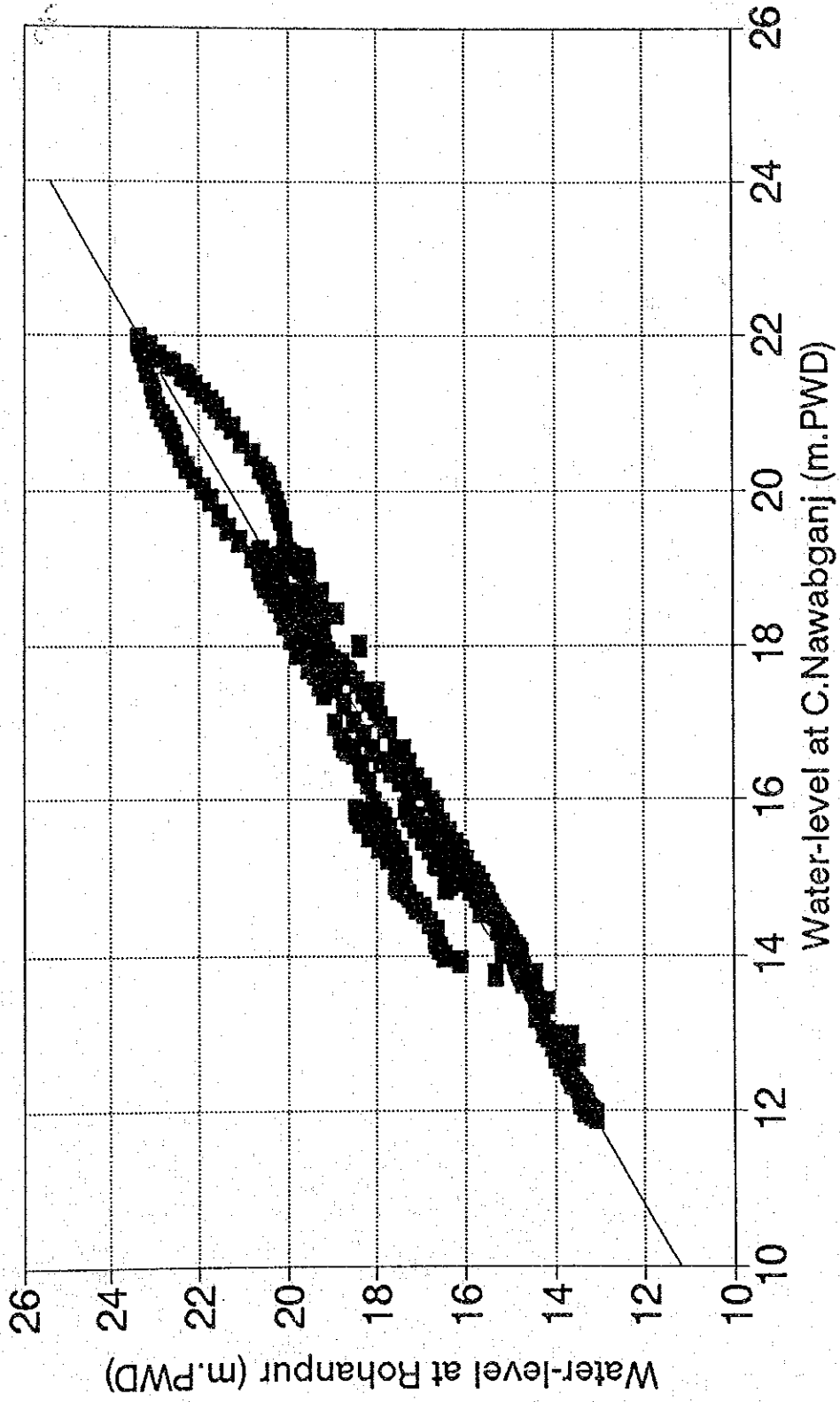


Figure 5.18 Relation of Daily Water Level between Rohanpur and C.Nawabganj

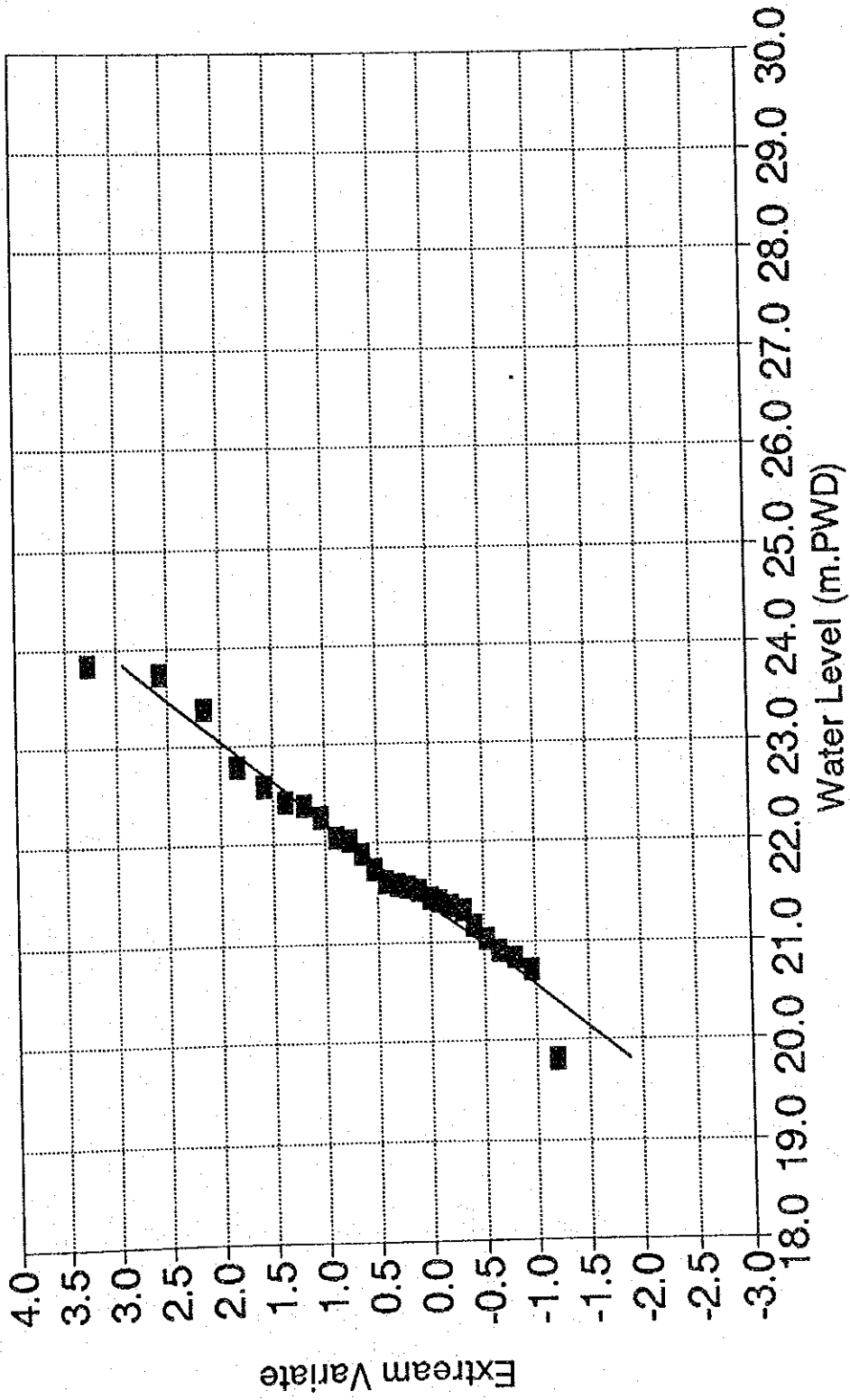


Figure 5.19 Probability Analysis of Peak Water Level at Rohanpur by Gumbel Method

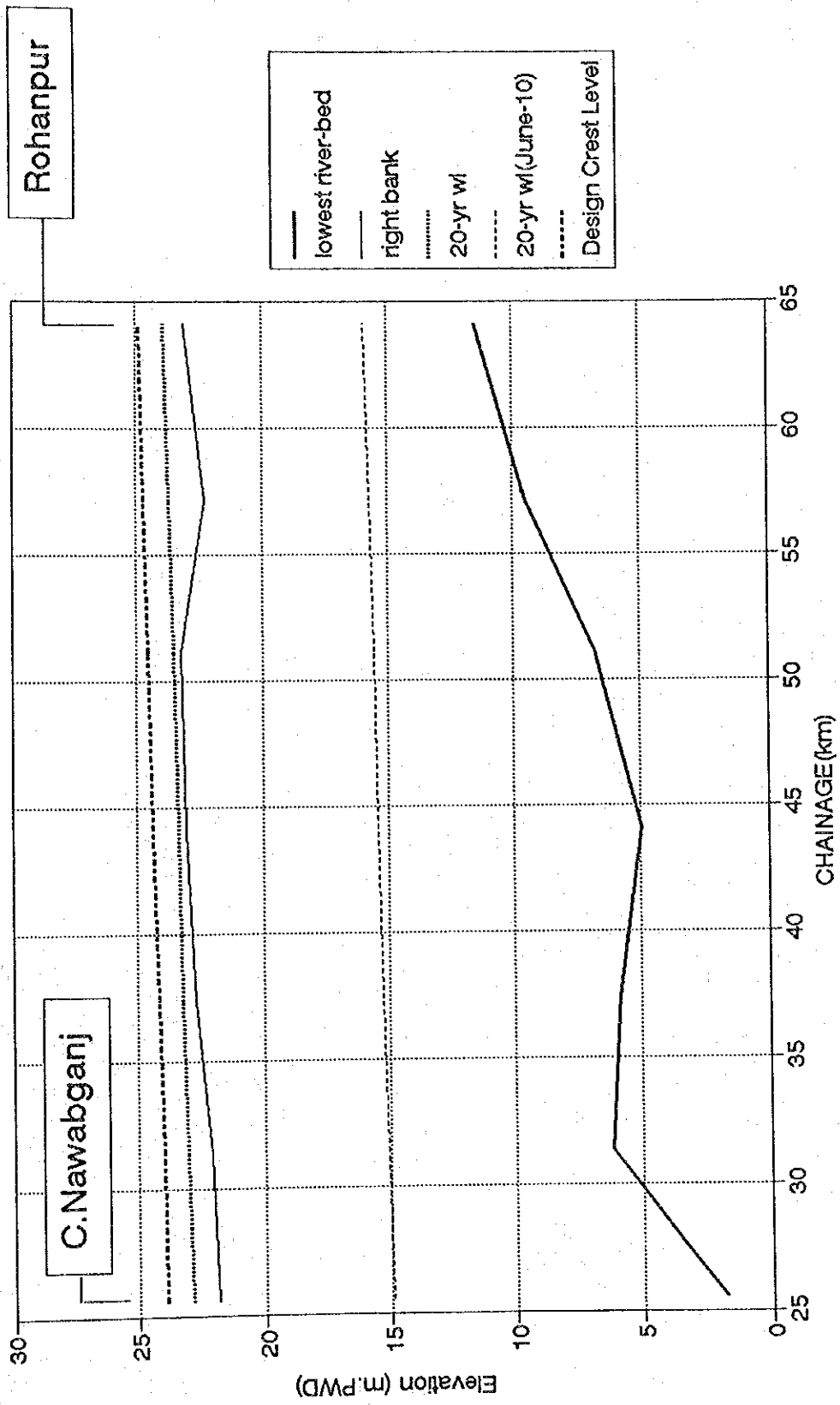
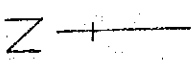
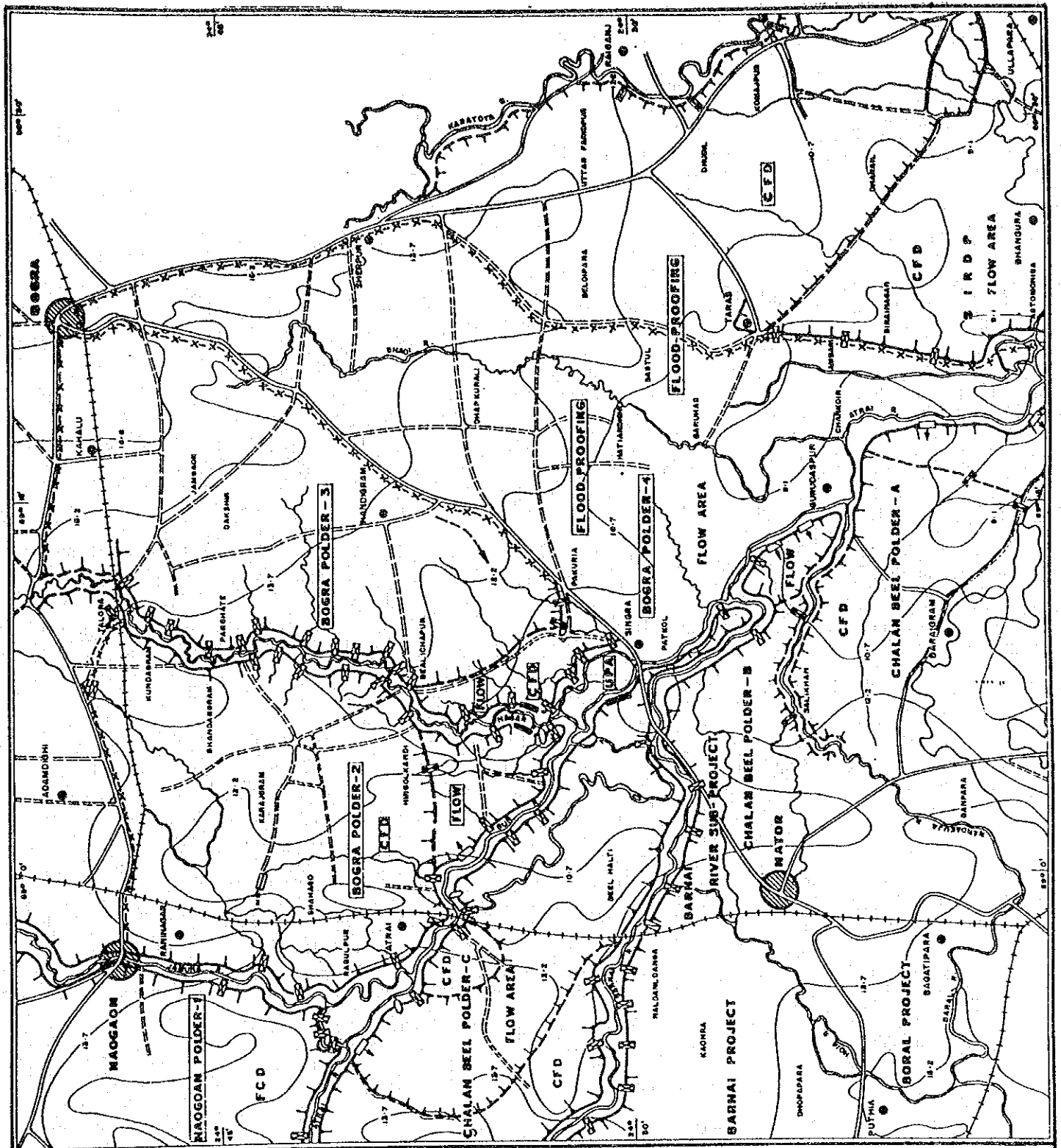


Figure 5.20 LONGITUDINAL PROFILE OF MAHANANDA



- LEGEND:**
- DICTIONARY N/G
 - THANA N/G
 - ROAD
 - EARTHEN ROAD
 - RAILWAY LINE
 - EXIST. EMBANKMENT
 - PROP. EMBANKMENT
 - EXIST. REGULATOR
 - PROP. REGULATOR
 - PROP. W.C.S.
 - PROJECT BOUNDARY
 - CONTOUR
 - RIVER
 - NAVIGATOR
 - PROP. OVERFLOW WEIR
 - DAMP EMBANKMENT
 - DRAINAGE CHANNEL (New)



Figure 5.21 GENERAL LAYOUT OF ATRAI LEFT BANK (PLANNING UNIT NO.12)

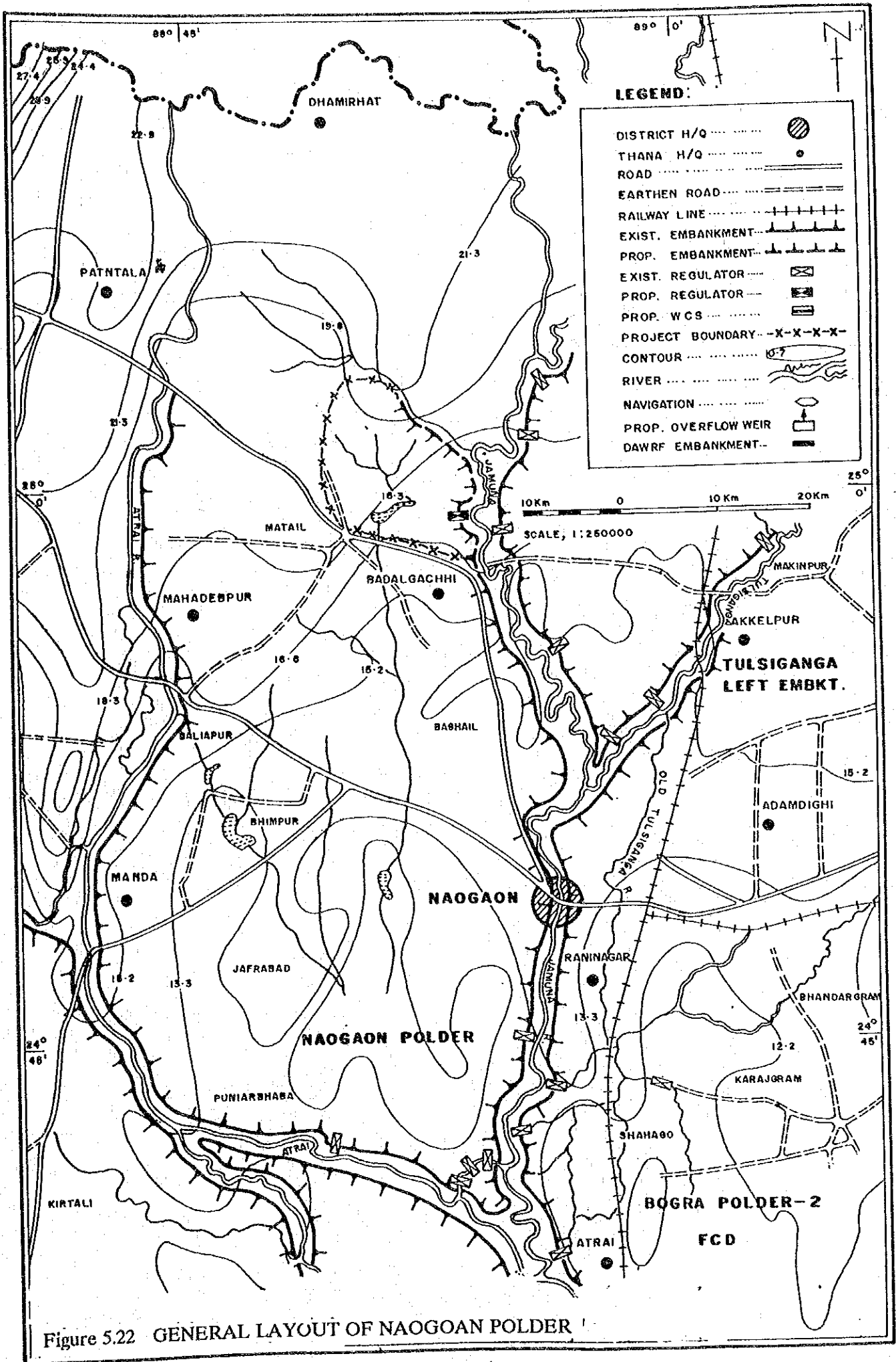


Figure 5.22 GENERAL LAYOUT OF NAOGAON POLDER

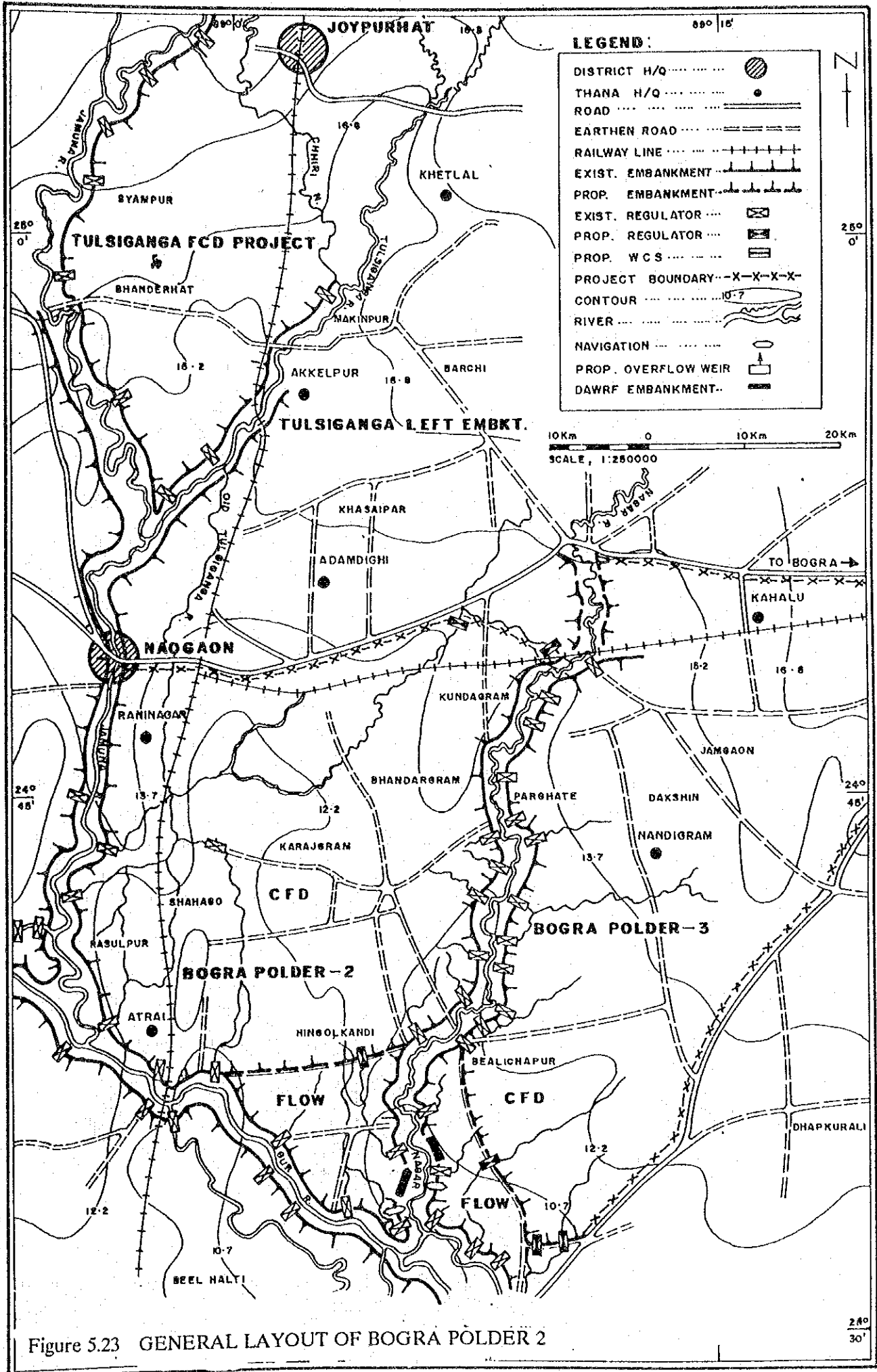
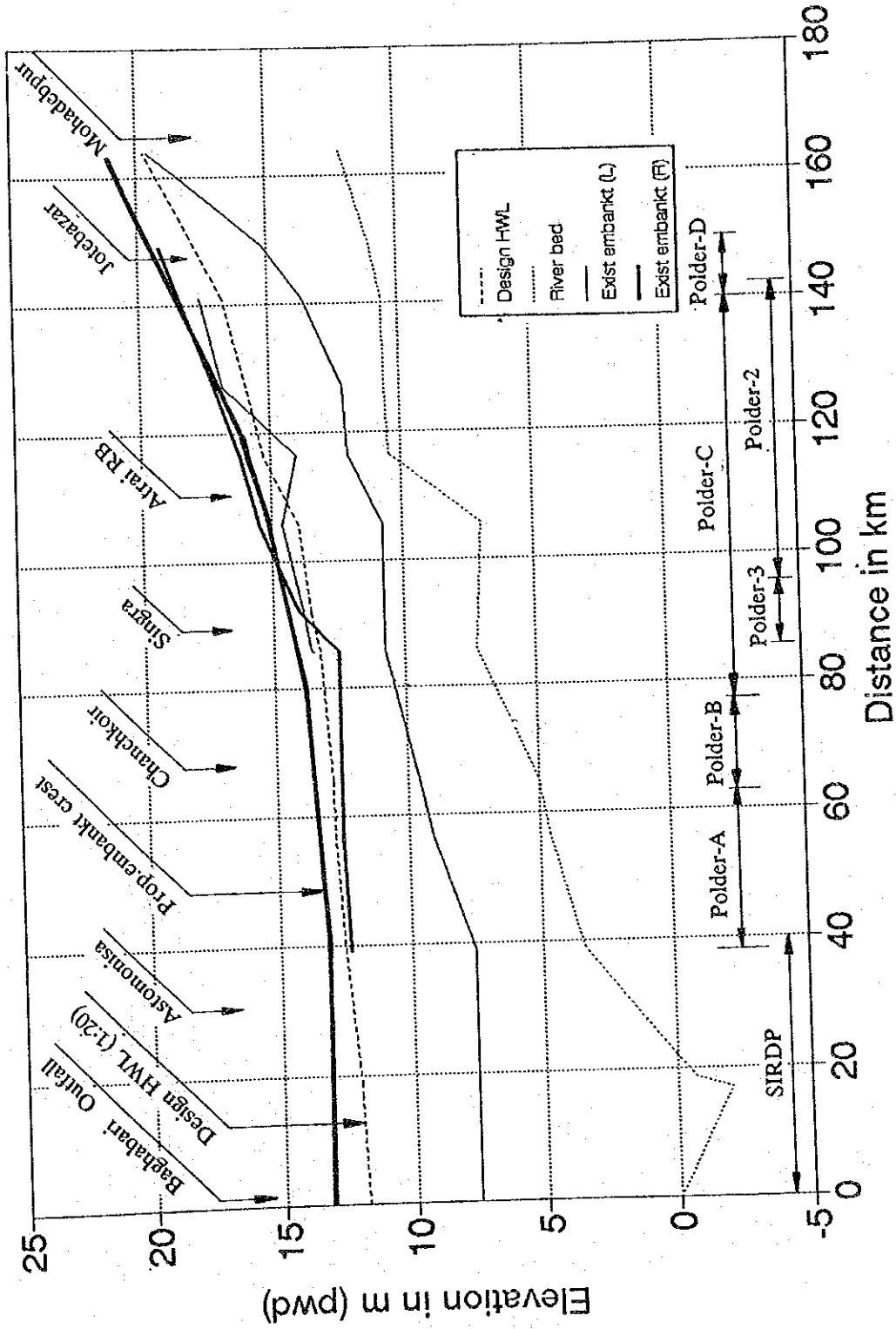
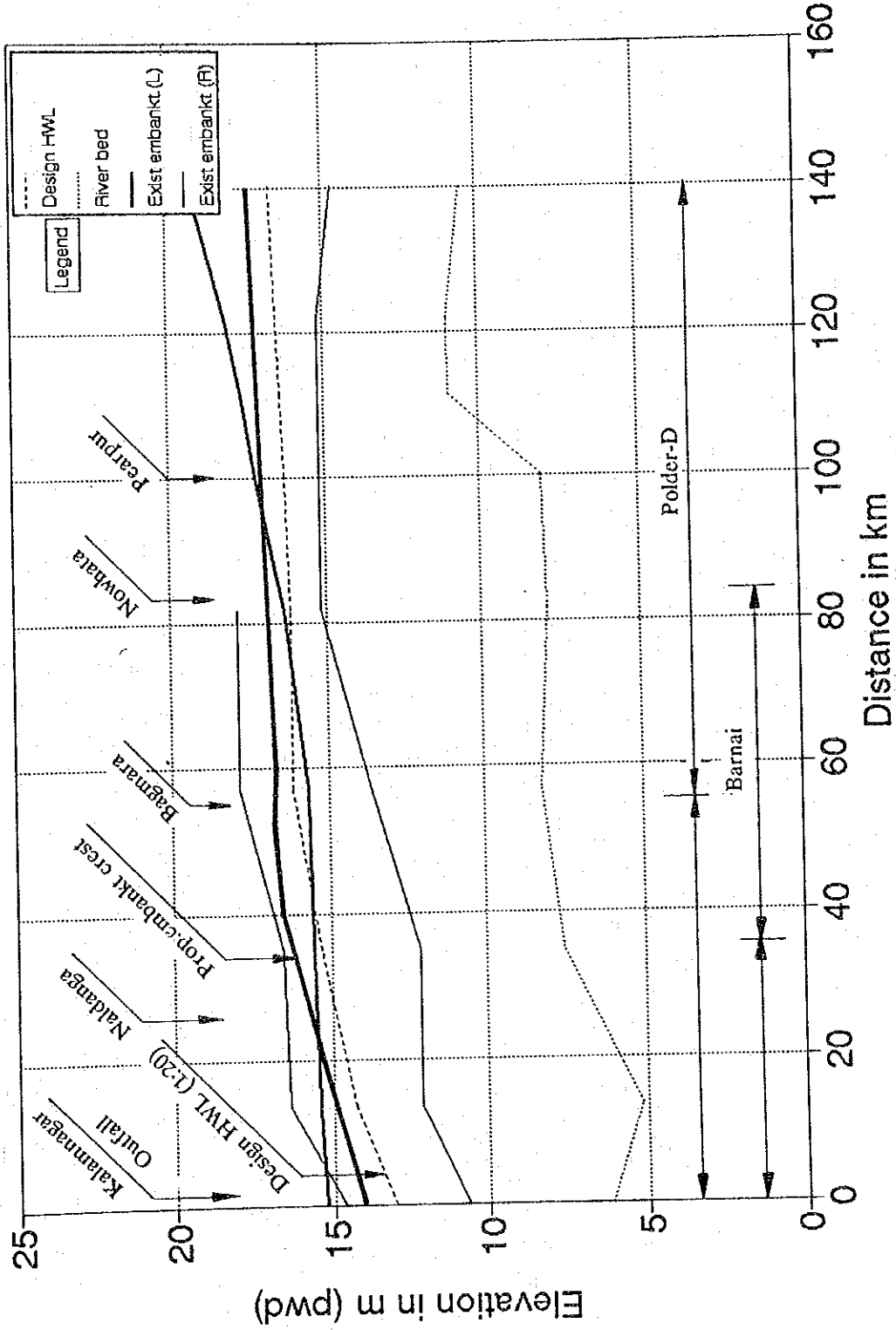


Fig-S.24



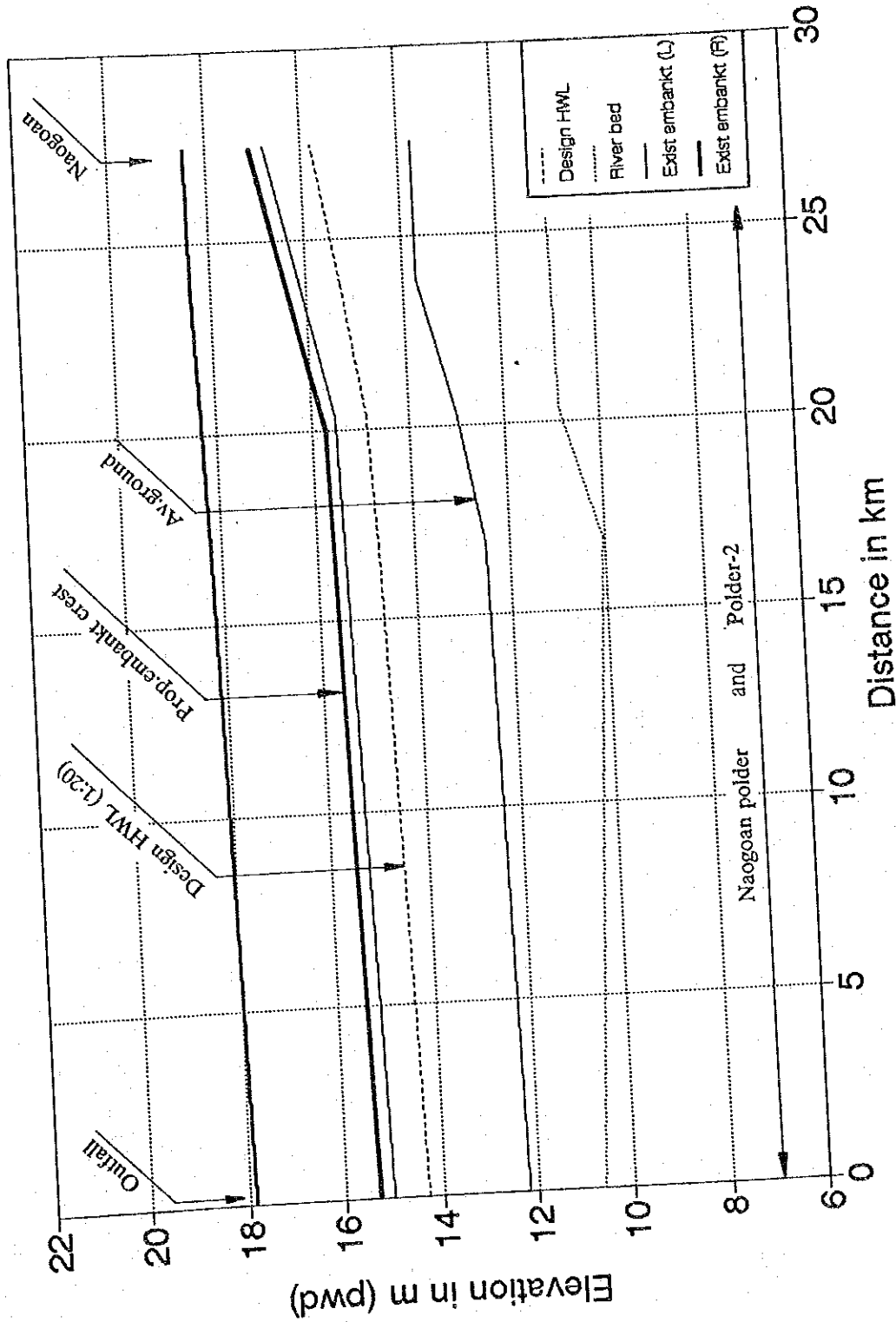
Atrai longitudinal profile

Fig-5.25



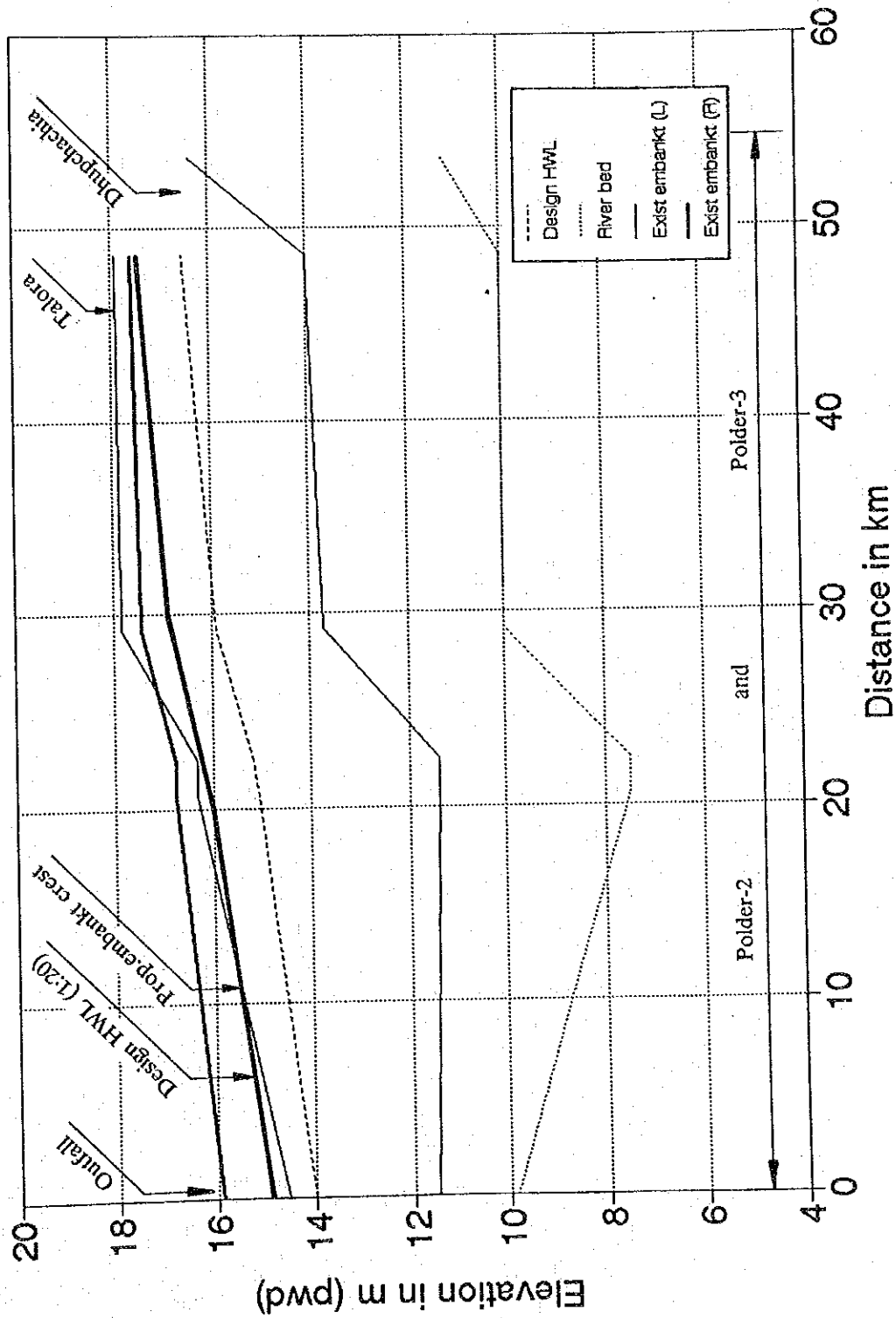
Siv-Barnai longitudinal profile

Fig-5.26



L. Jamuna longitudinal profile

Fig-5.27



Nagor river longitudinal profile

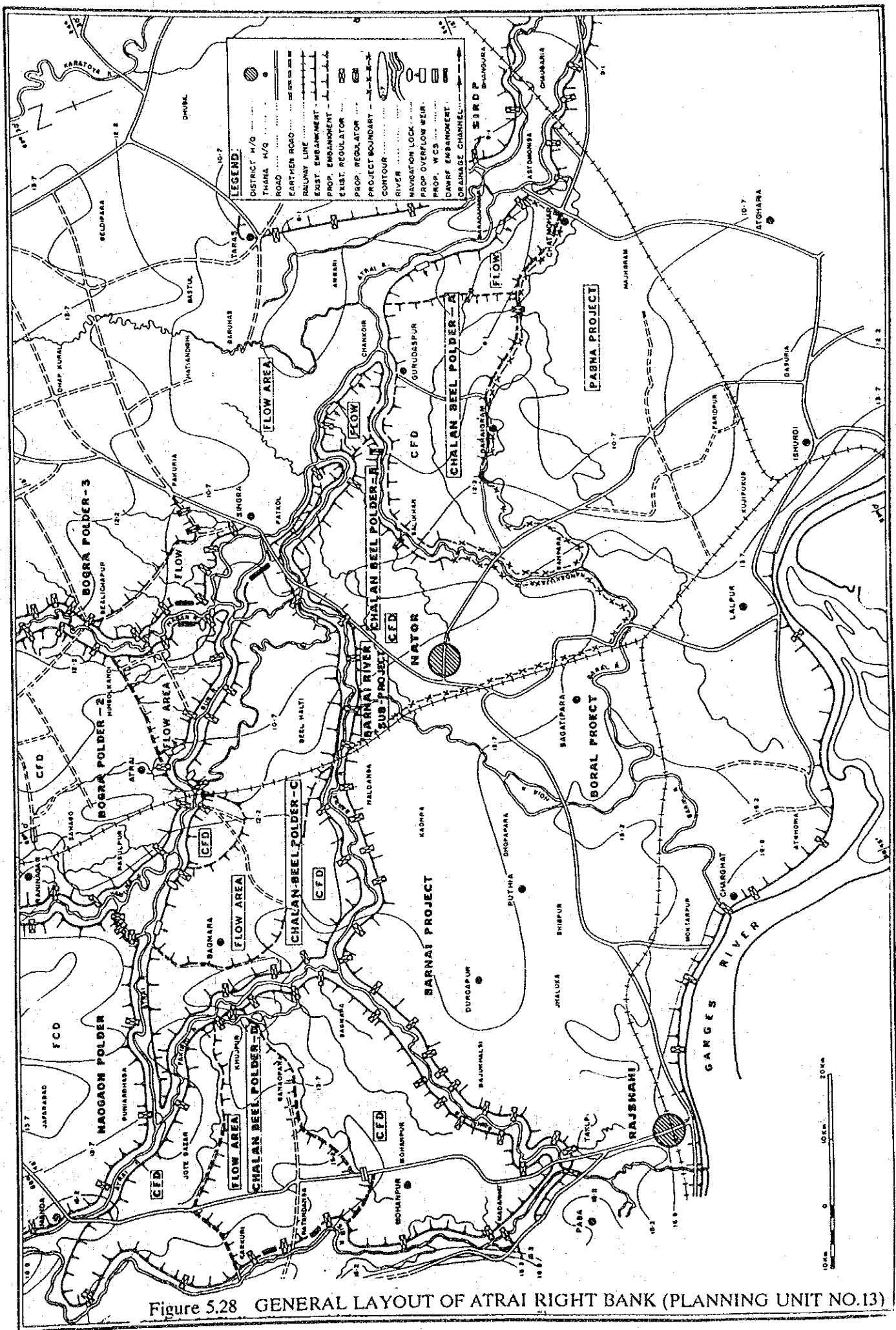


Figure 5.28 GENERAL LAYOUT OF ATRAI RIGHT BANK (PLANNING UNIT NO.13)

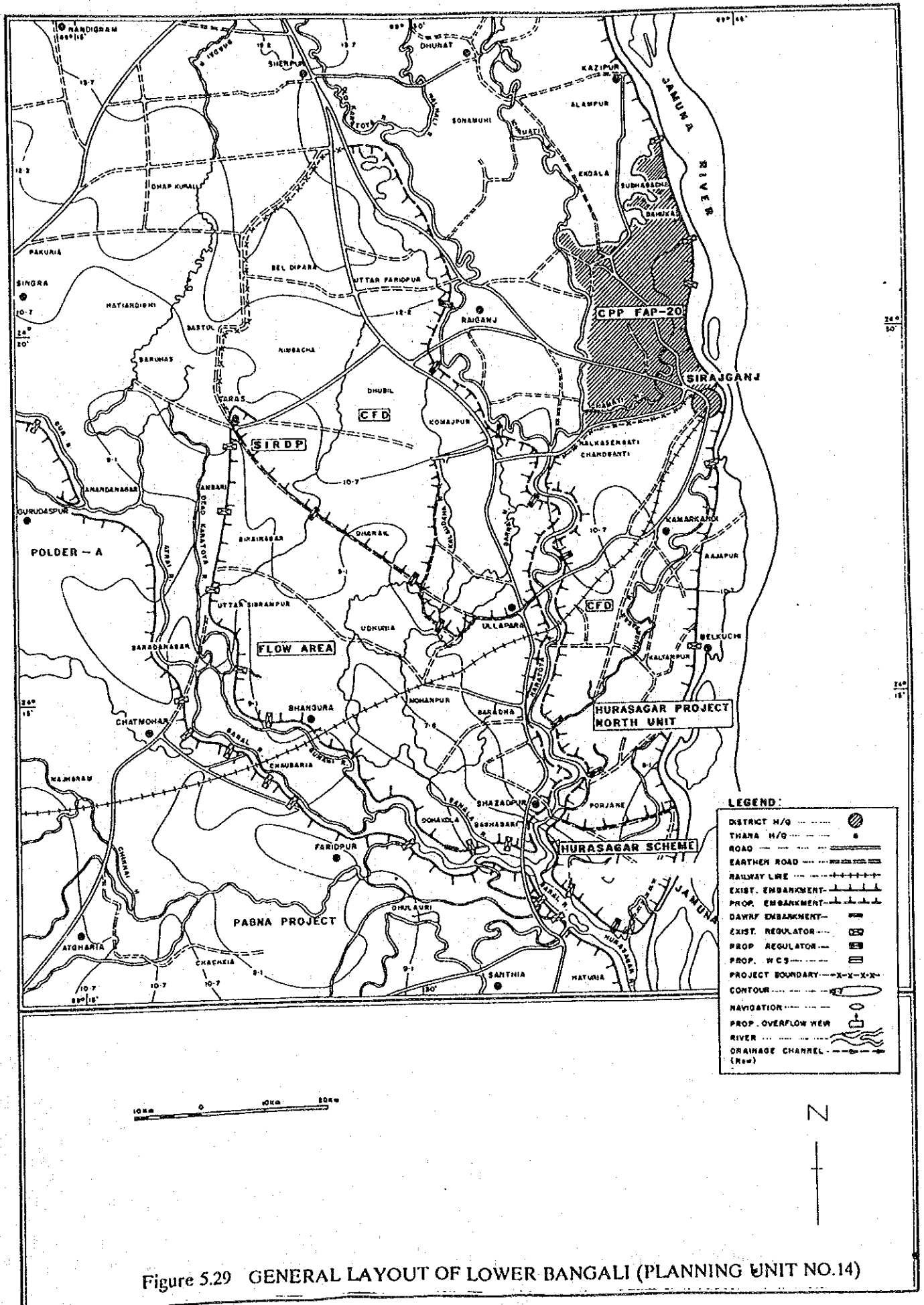
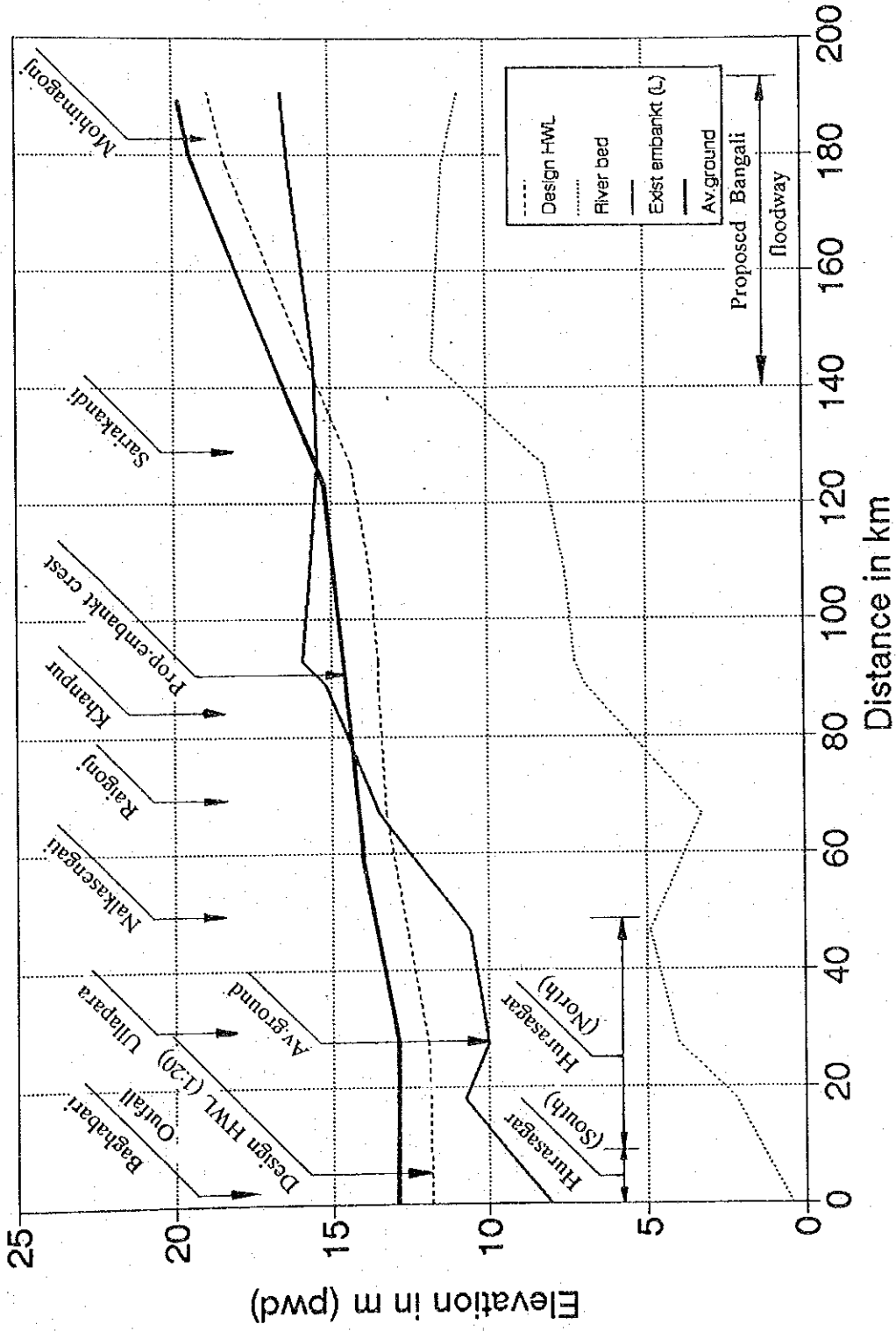
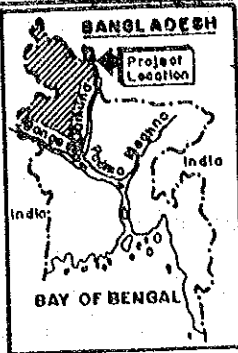
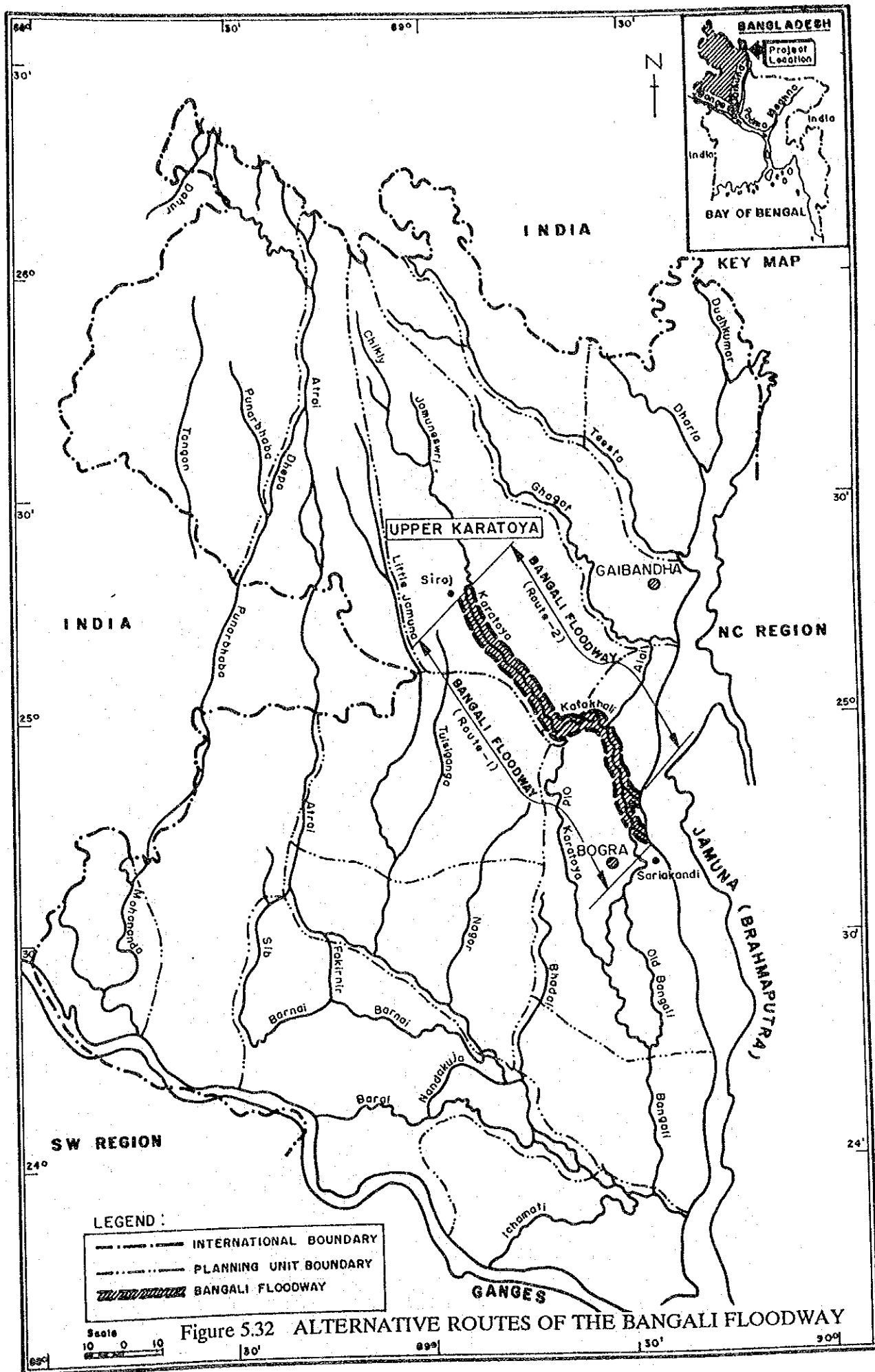


Figure 5.29 GENERAL LAYOUT OF LOWER BANGALI (PLANNING UNIT NO.14)

Fig-5.30



Bangali river long section



KEY MAP

INDIA

INDIA

NC REGION

SW REGION

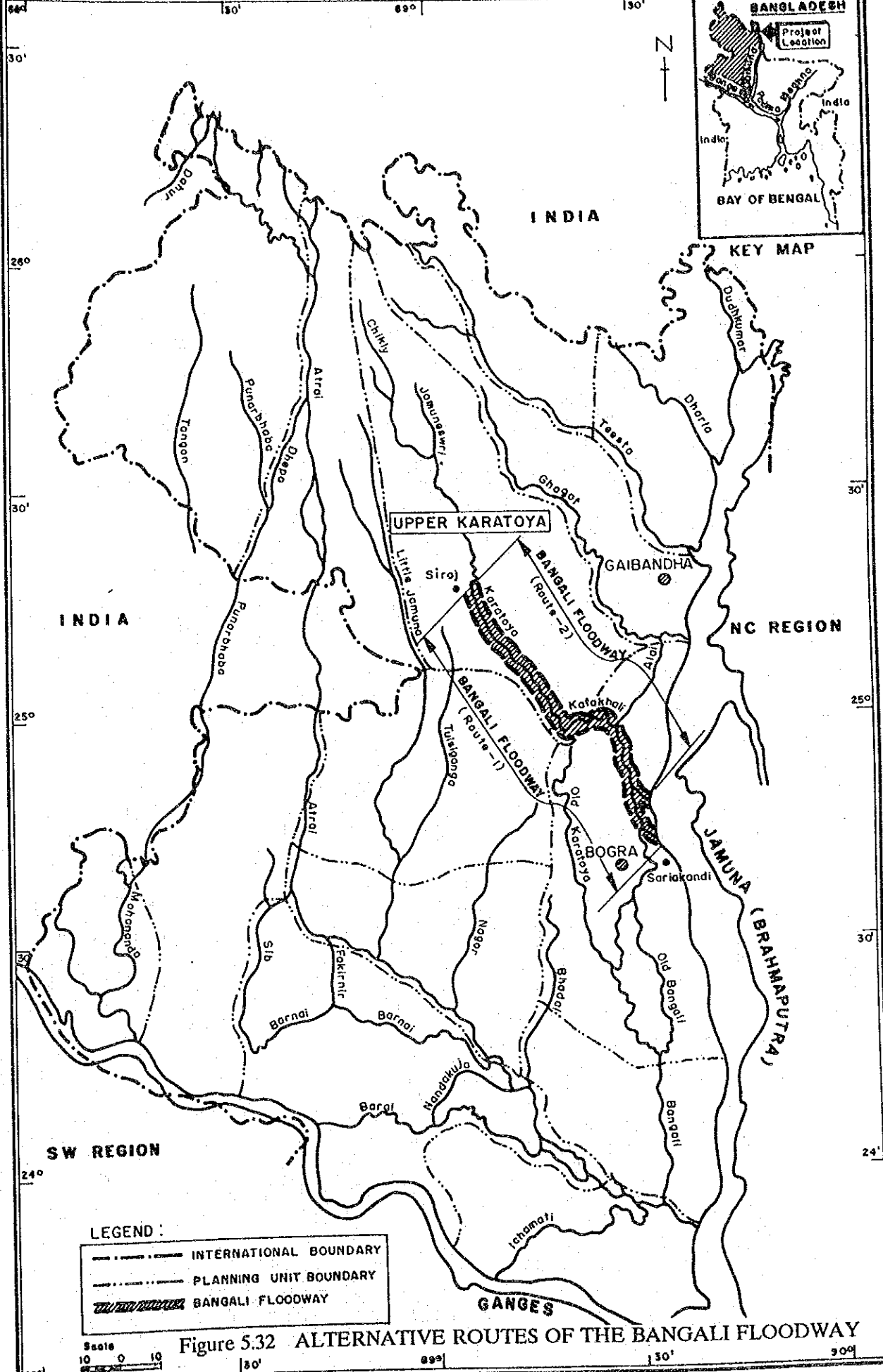
GANGES

JAMUNA (BRAHMAPUTRA)

UPPER KARATOYA

GAIBANDHA

BOGRA



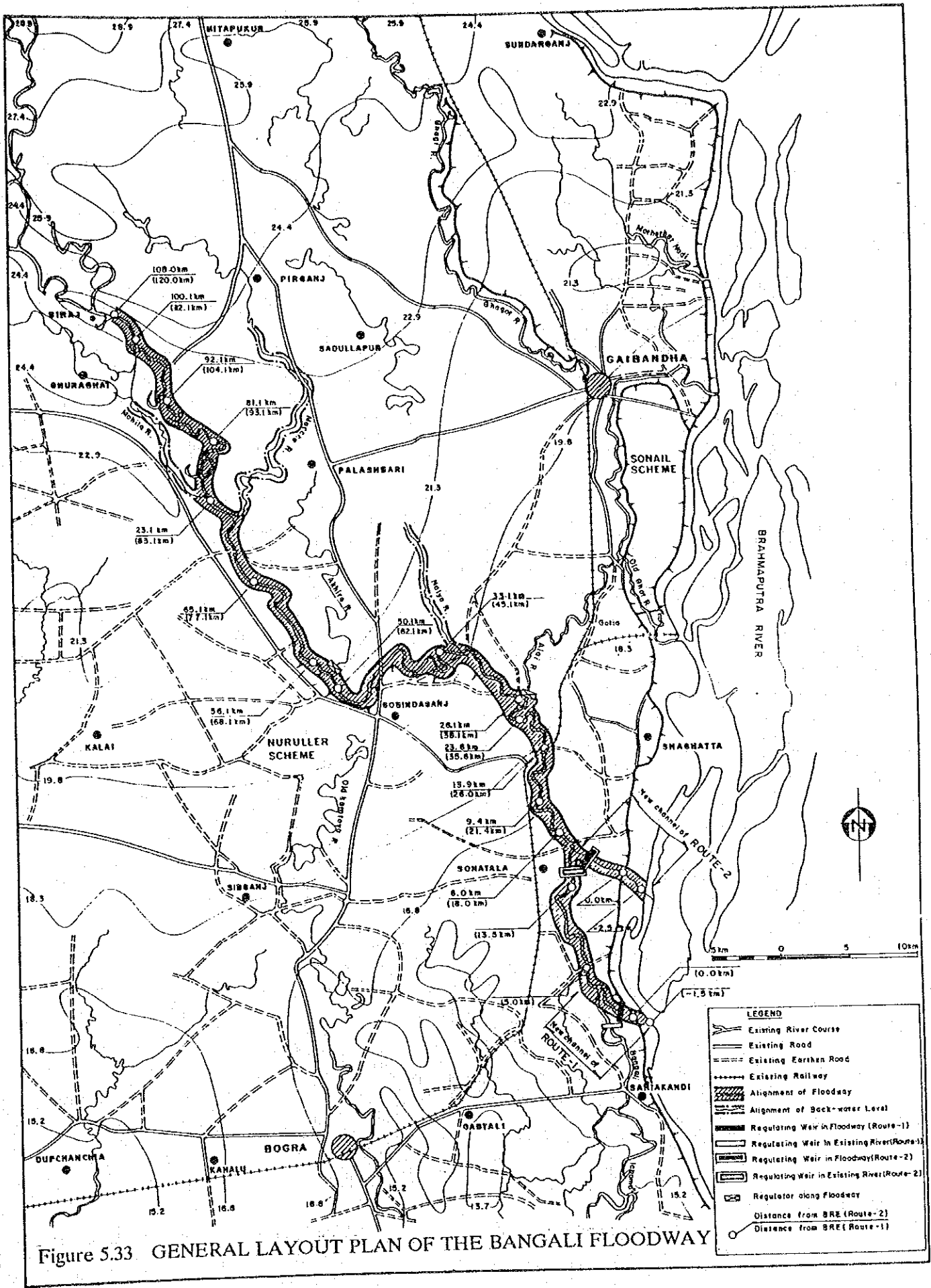
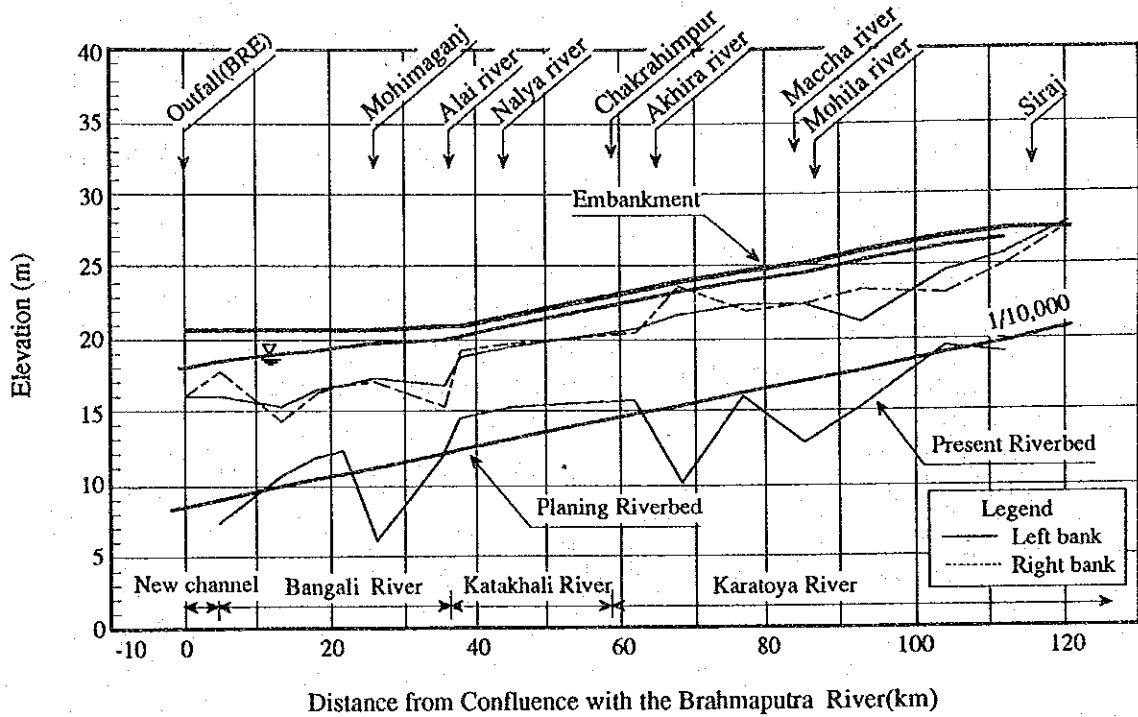


Figure 5.33 GENERAL LAYOUT PLAN OF THE BANGALI FLOODWAY

OPTION 1 : Route-1, Compound Cross Section with Excavation of Existing River



OPTION 2 : Route-2, Compound Cross Section with Excavation of Existing River

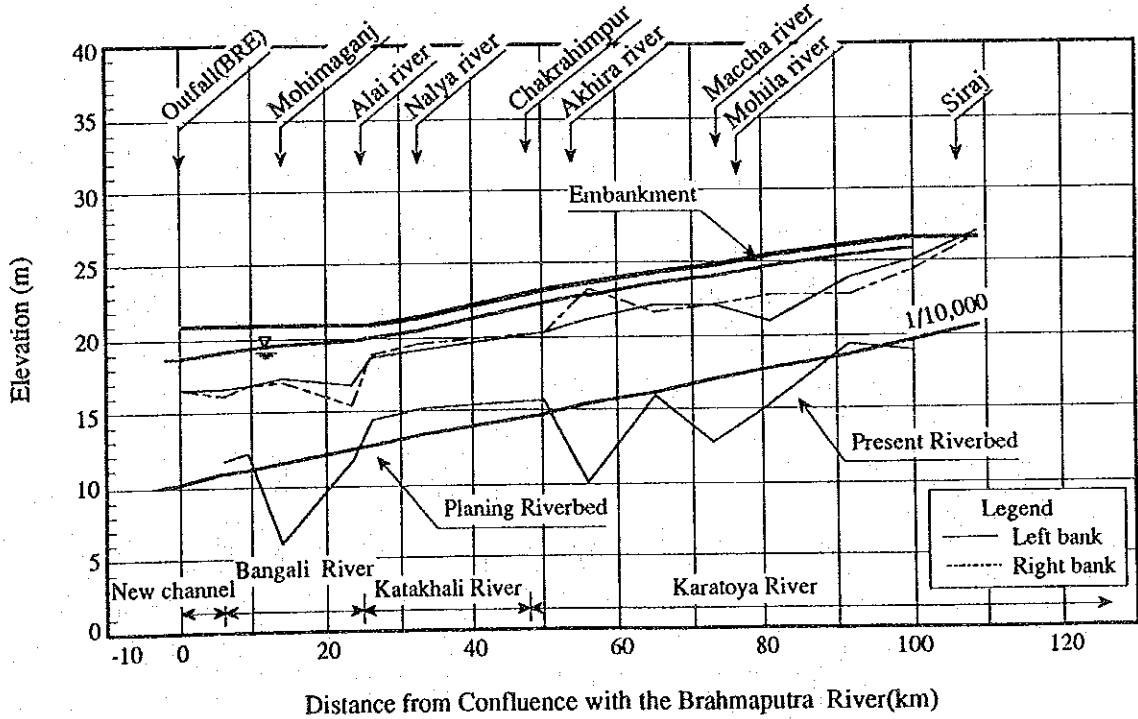
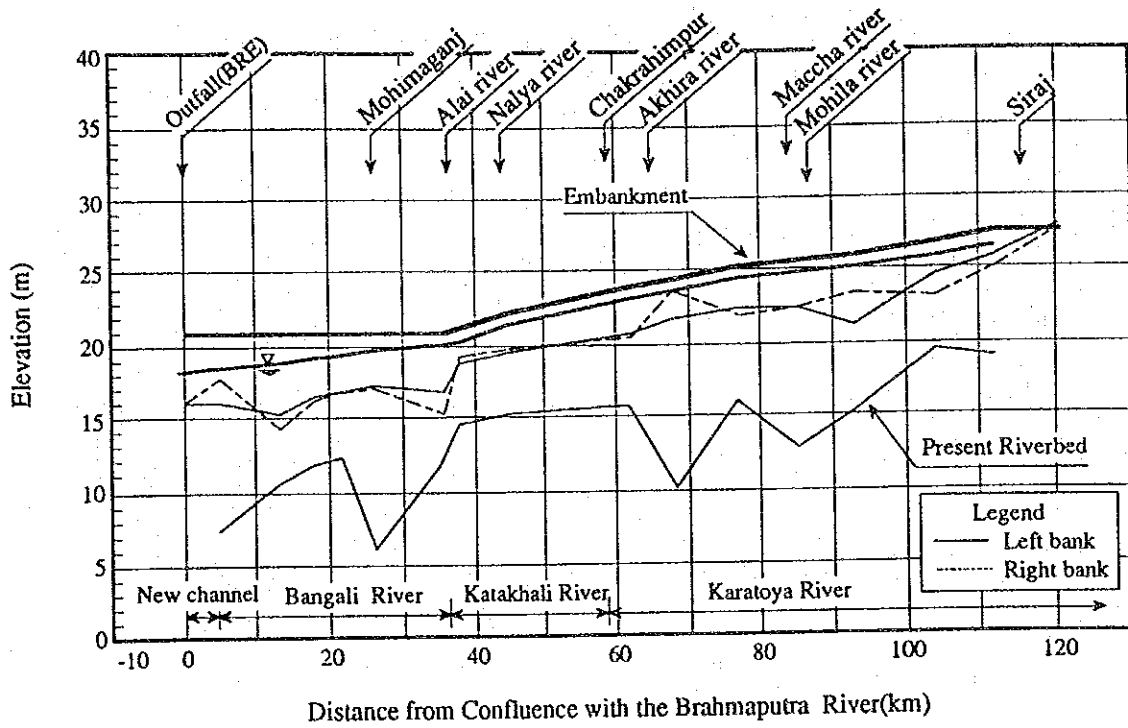


Figure 5.34 RIVER FEATURES OF THE BANGALI FLOODWAY (1/3)

OPTION 3 : Route-1, Compound Cross Section without Excavation of Existing River



OPTION 4 : Route-2, Compound Cross Section without Excavation of Existing River

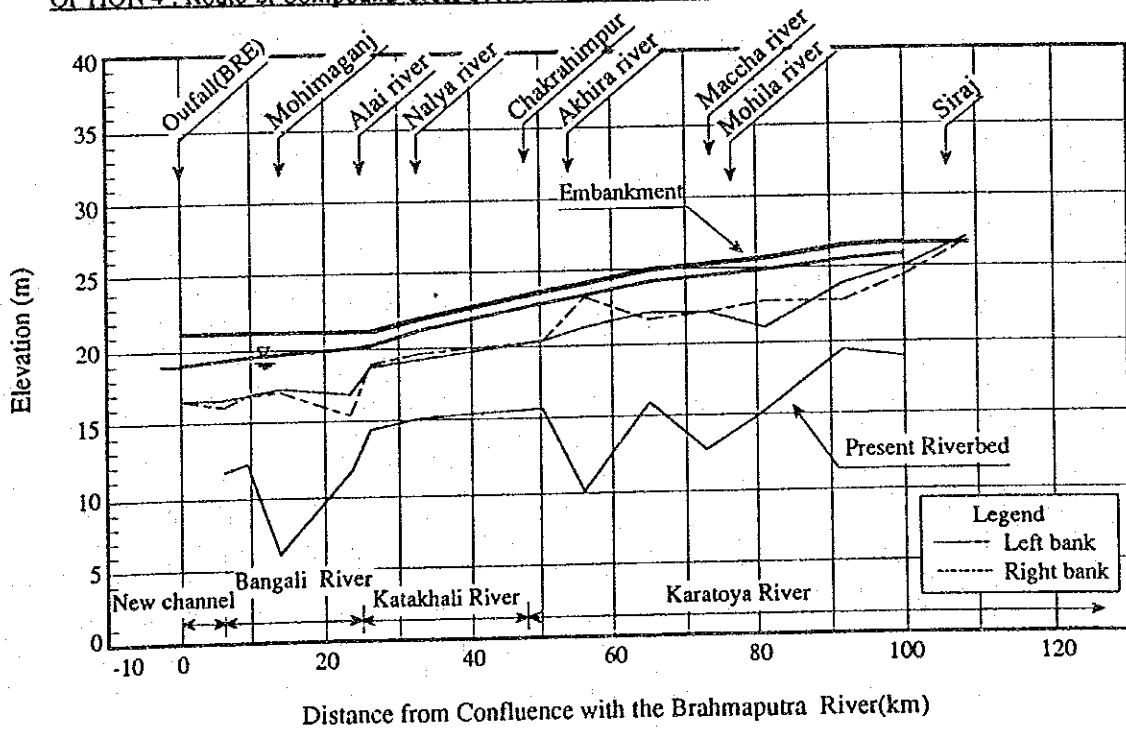
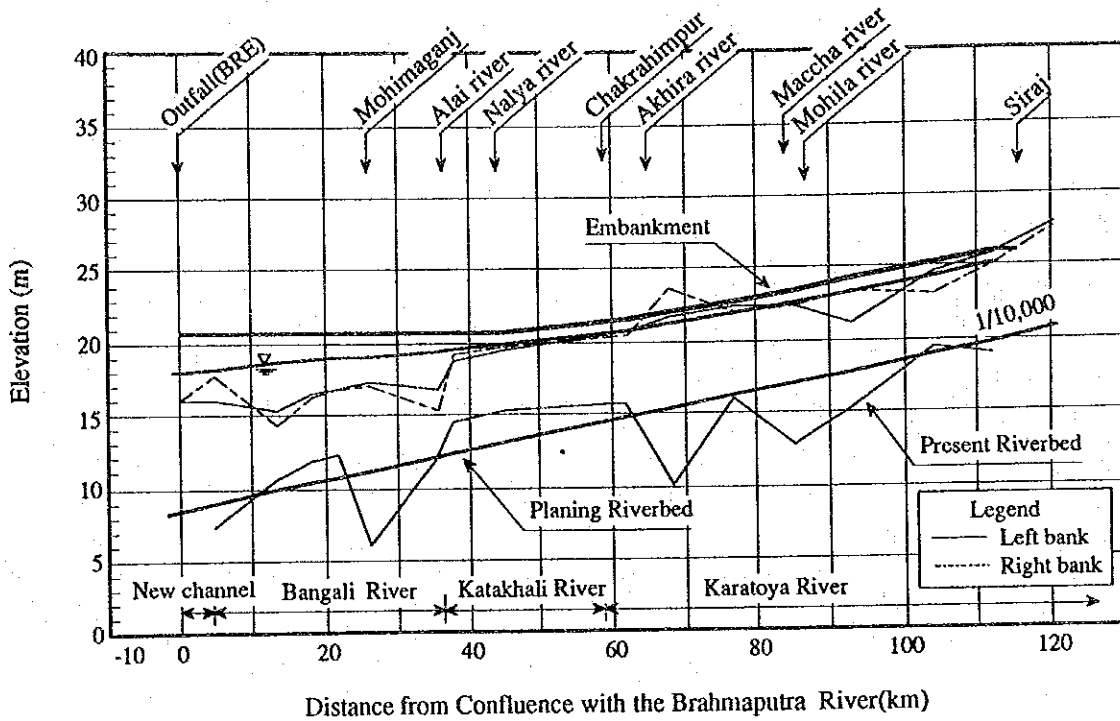


Figure 5.34 RIVER FEATURES OF THE BANGALI FLOODWAY (2/3)

OPTION 5 : Route-1. Single Cross Section



OPTION 6 : Route-2. Single Cross Section

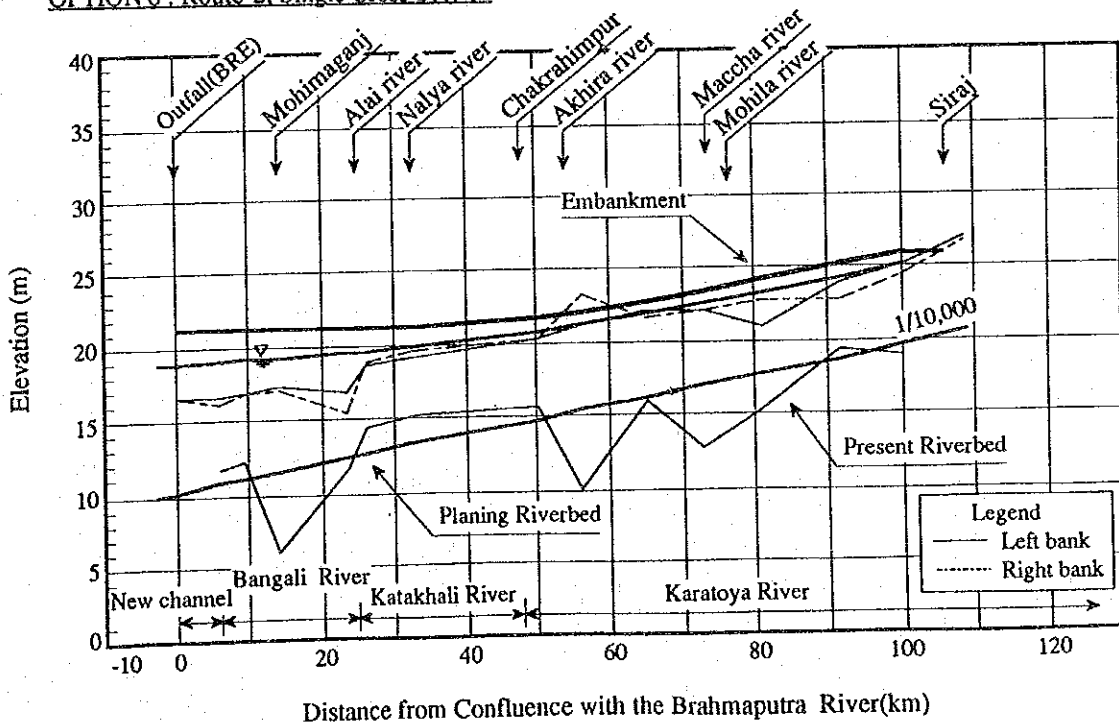


Figure 5.34 RIVER FEATURES OF THE BANGALI FLOODWAY (3/3)

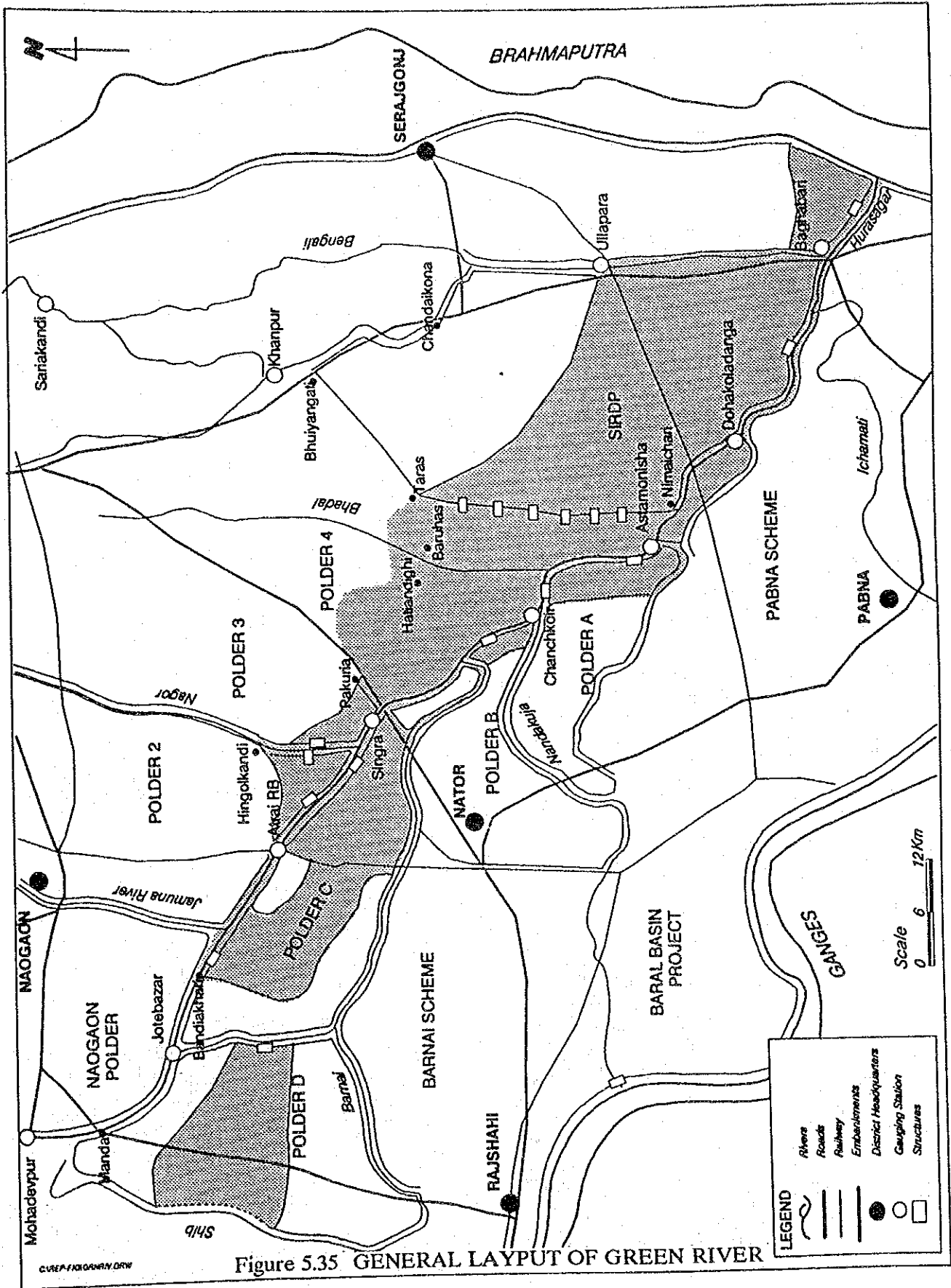


Figure 5.35 GENERAL LAYOUT OF GREEN RIVER

CVREP-FK000000N.DRW

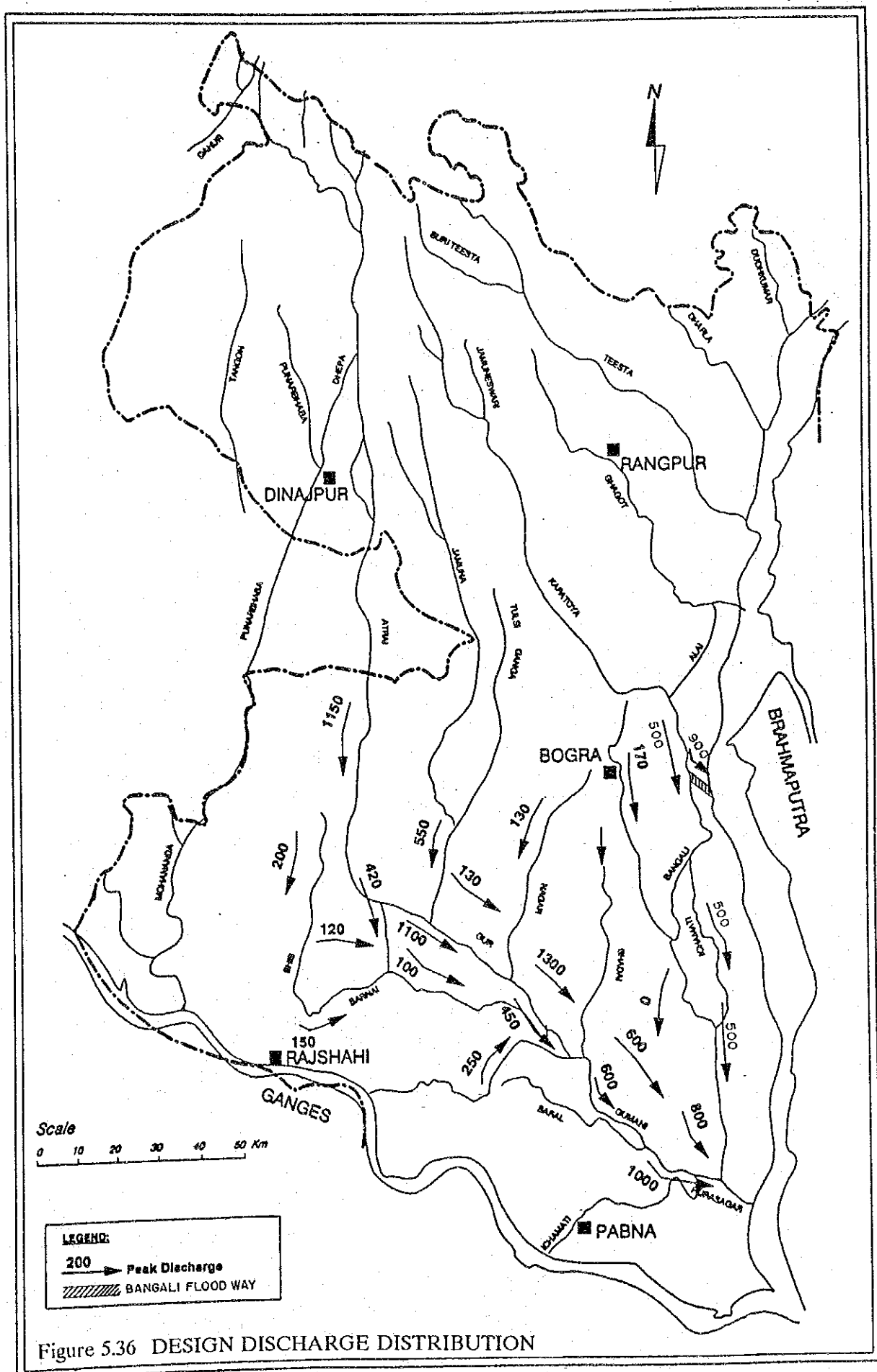


Figure 5.36 DESIGN DISCHARGE DISTRIBUTION

CHAPTER 6
COST ESTIMATE

6.1. Major Construction Items and Quantification

As described in the forgoing chapter 5, the promising flood control and drainage options are set up for the following planning units under the development scenario formulated in order to mitigate the flooding problems in the NW region;

No. of Planning Unit	Name of Planning Unit
3	Teesta Right Bank
4	Teesta Left Bank
6	Upper Karatoya
7	Gaibandha
8	Middle Bangali
9	Joypurhat
11	Mohananda Basin
12	Atrai Left Bank
13	Atrai Right Bank
14	Lower Bangali

Out of the above planning units for which new development is proposed, the Upper Karatoya and Middle Bangali are contemplated to be improved by means of provision of the Bangali floodway. Moreover, the Green River scenario is selected to be developed in the Lower Atrai basin which comprise the three planning units, namely; the Atrai Left Bank (No.12), Atrai Right Bank (No.13) and Lower Bangali (No.14).

This chapter presents the implementation cost for the option of each sub-unit under the formulated development scenario, as well as the methodology and procedure applied to estimate it.

The planning units or sub-units examined in the regional planning study for development comprise the following major works components;

- (1) Earthwork
 - Flood embankments
 - new flood embankment
 - retirement/set back at a new alignment
 - resectioning at the existing alignment
 - Channel excavation/dredging
- (2) River training work
 - Revetments
 - Groynes
- (3) Drainage work
 - Regulators
 - Overflow weirs

- (4) Others
- Navigation locks
 - Road pavements
 - Minor hydraulic structures

The quantification and costing of the above works are made at the prefeasibility level in accordance with the Guidelines for Project Assessment by FPCO (May 1992).

The design of each component and quantification thereof are made with reference to the design standards in Bangladesh and/or those adopted in the GIP study carried out a level of feasibility study. Besides, the quantification of the works is made in the following units;

Work items quantified	Unit of Quantification
a. Earthwork	
- Clearing, grubbing & stripping	sq.m
- Earth excavation & hauling (or disposal)	cu.m
- Earth compaction & shaping	cu.m
- Turfing	sq.m
b. Structural work	
- Regulators	vent
- Sluiceways	vent
- Groynes	l.m
- Overflow weirs	nos
- Navigation locks	nos
- Revetments (slope protection)	cu.m (sq.m)
- Revetments (footing)	cu.m
- Revetments (foot protection)	cu.m
- Road pavement (asphalt)	sq.m
- Road pavement (bricks metalling)	sq.m
- Road pavement (base course)	cu.m (sq.m)
c. Land acquisition	sq.m

6.2. Basic Conditions and Assumptions Adopted for Costing

Construction cost depends on different construction methods and work capacity of equipment used for construction. Site conditions as well as social circumstances are also predominant factors for costing. Costing for the regional planning is performed under the following conditions and assumptions;

(1) Construction method

The construction methods for earth works are deeply examined in the Volume 7, "Gaibandha Improvement Project, Engineering". In conclusion, two construction methods, namely; the manual construction method and a combination of the manual and mechanical ones, are retained as promising to be further examined in the subsequent stage. Assuming that the implementation of these projects

proposed in the regional planning study will be executed with the labor intensive method in line with the FAP's policy, it is determined that the construction costs for earth works are estimated applying the unit rates in the manual construction method.

(2) Workable days and working hours

Construction work is normally suspended by strong rainfall. Earthwork will be suspended due to rainfall with depths of 10 mm a day or more, while concrete and other structural works will be suspended when daily rainfall depth reaches 20 mm or more. Besides, no construction of work will be made during 4 months from June to October for earthwork, and 2.5 months from July to the middle of September for concrete and other structural works in the monsoon season regardless of daily rainfall depths. No work will be executed on regular Sundays and national holidays (17 days a year). Consequently annual workable days are adopted for the costing purpose as follows;

- earthwork : 150 days
- concrete and other structural works : 210 days

Daily working hours are assumed to be 8 hours for every type of works. Operation time of construction equipment will be 6.5 hours a day.

(3) Availability of labour, materials and equipment

Labour will be recruited in and around the project area. Earth material for flood embankment will be provided from borrow pits along the proposed alignment of the flood embankment. Cements, stones, gravels, sands, bricks, bamboo and wooden materials will be procured at work site, while steel materials will be transported from Dhaka or imported.

(4) Composition of cost

Costing will be made for the following items;

- Direct construction cost,
- Administration cost,
- Physical contingencies,
- Engineering cost, and
- Land acquisition cost

The direct construction cost and land acquisition cost are estimated based on general type-design, while the remaining costs are estimated in proportion to construction cost. The ratios to the total direct cost are determined by each of the cost items as follows;

- | | | |
|-----------------------------|---|--|
| - Administration cost | : | 3 % of the direct construction cost |
| - Physical contingency cost | : | 25 % of the direct construction cost |
| - Engineering cost | : | 15 % of the direct construction cost plus physical contingencies |

