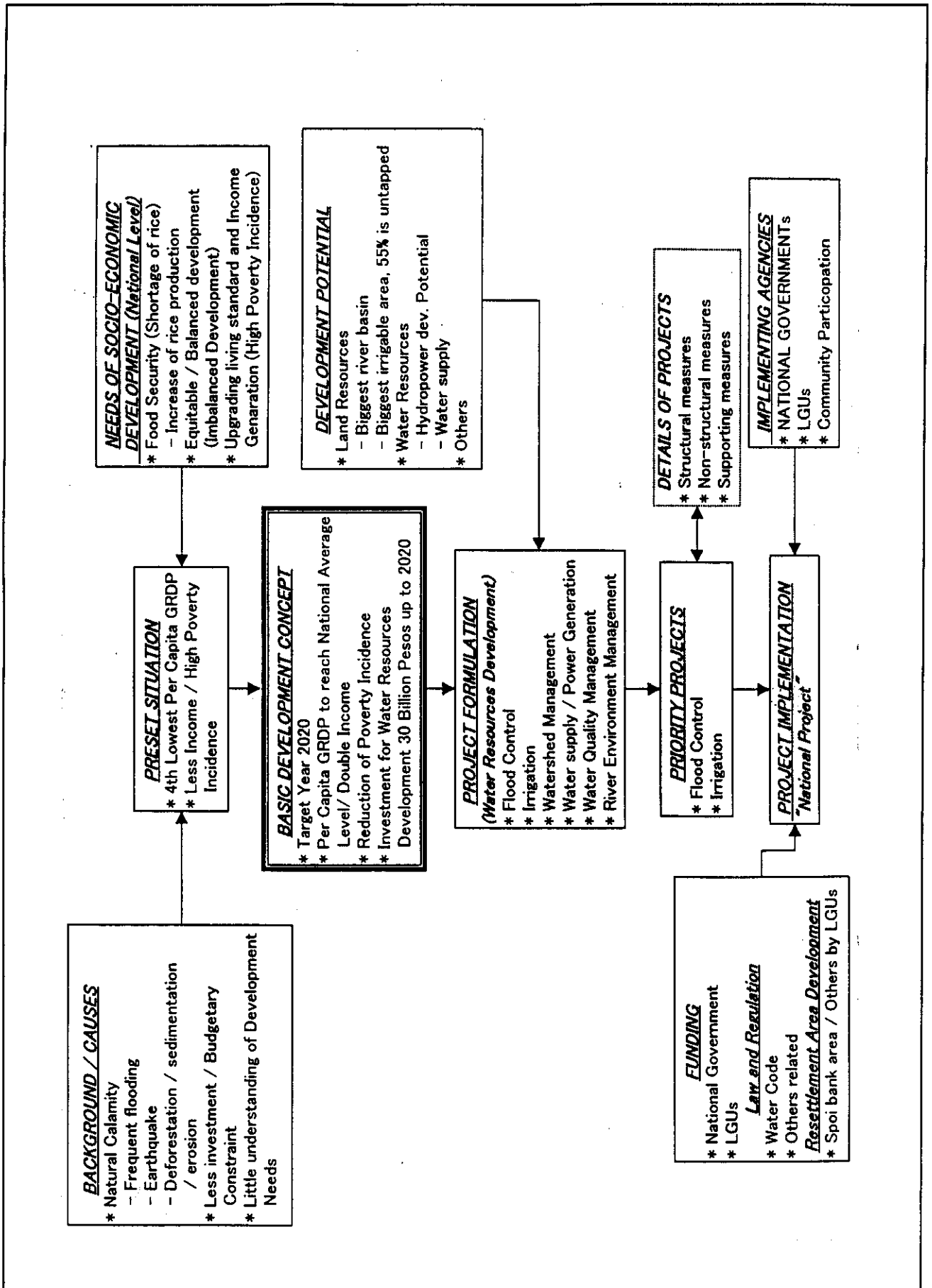

The Feasibility Study of the Flood Control Project for the Lower Cagayan River in the Republic of the Philippines

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Figure 10.2.1
Basic Concept of Cagayan River Basin Development

Integration of Flood Control and Basin Development in the Cagayan River Basin

Disasters have occured frequently in the Cagayan river basin : Disaster = Hazards□~Vulnerability
Hazards : Flood, Sedimentation and Bank Erosion, Typhoon, Drought
Vulnerability : Damage of Casualty and Assets, Low Productivity, Lack of Integrated Organization and Institution, and Low Capability

Figure 10.2.2
Comprehensive Disaster Prevention in the Cagayan River Basin

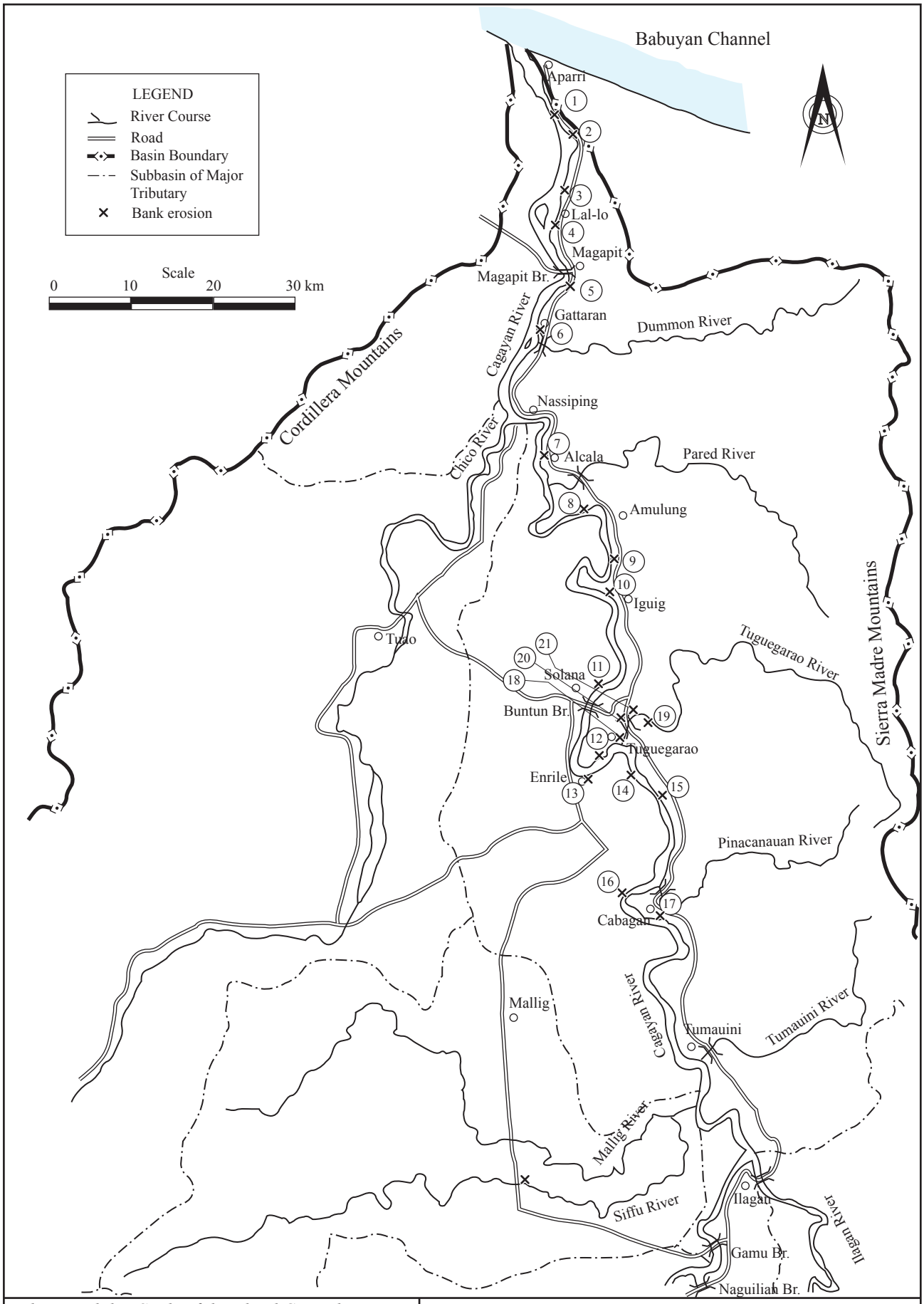

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Figure 10.4.1
Location of Bank Protection Works in the Lower Cagayan River

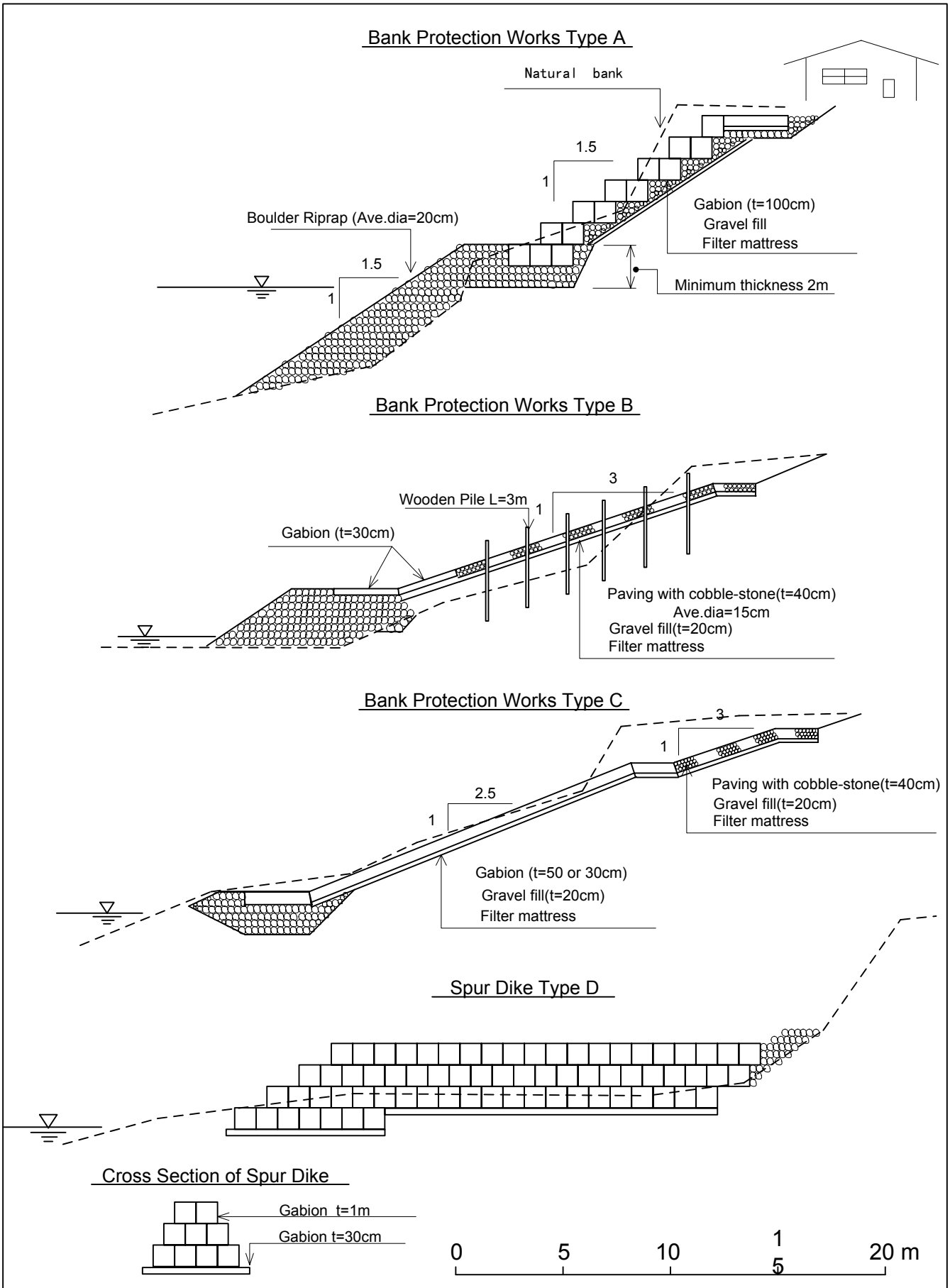

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Figure 10.4.2
Standard Design of Bank Protection Works

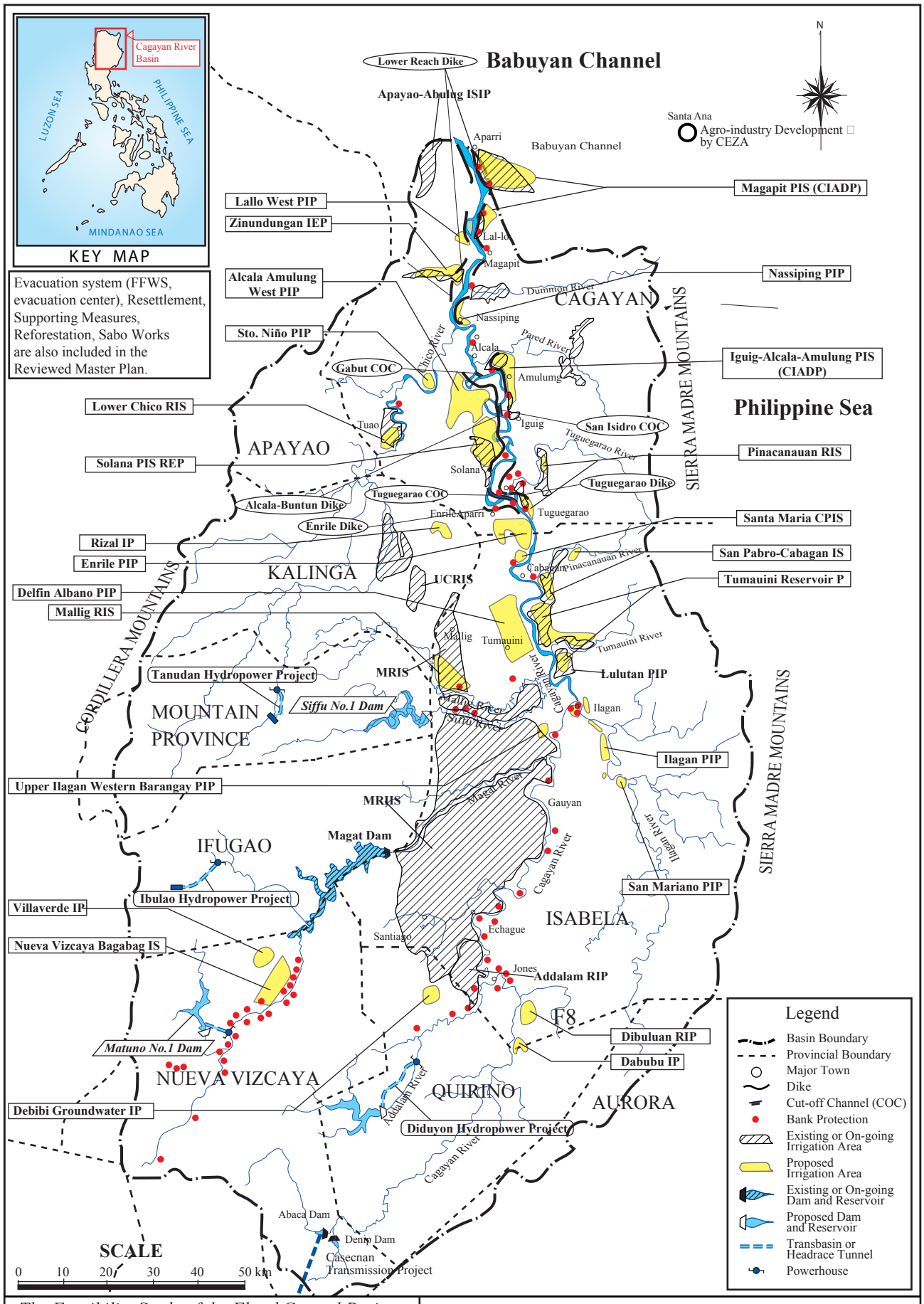

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Figure 10.7.1
Location of Projects in Reviewed Master Plan

Notes: ○ indicates projects to be implemented under the investment amount of Pesos 30 billion by the target year 2020.

Figure 10.9.1 Implementation Schedule for Reviewed Master Plan

Figure 10.10.1
Organization Chart of Cagayan River Basin Development

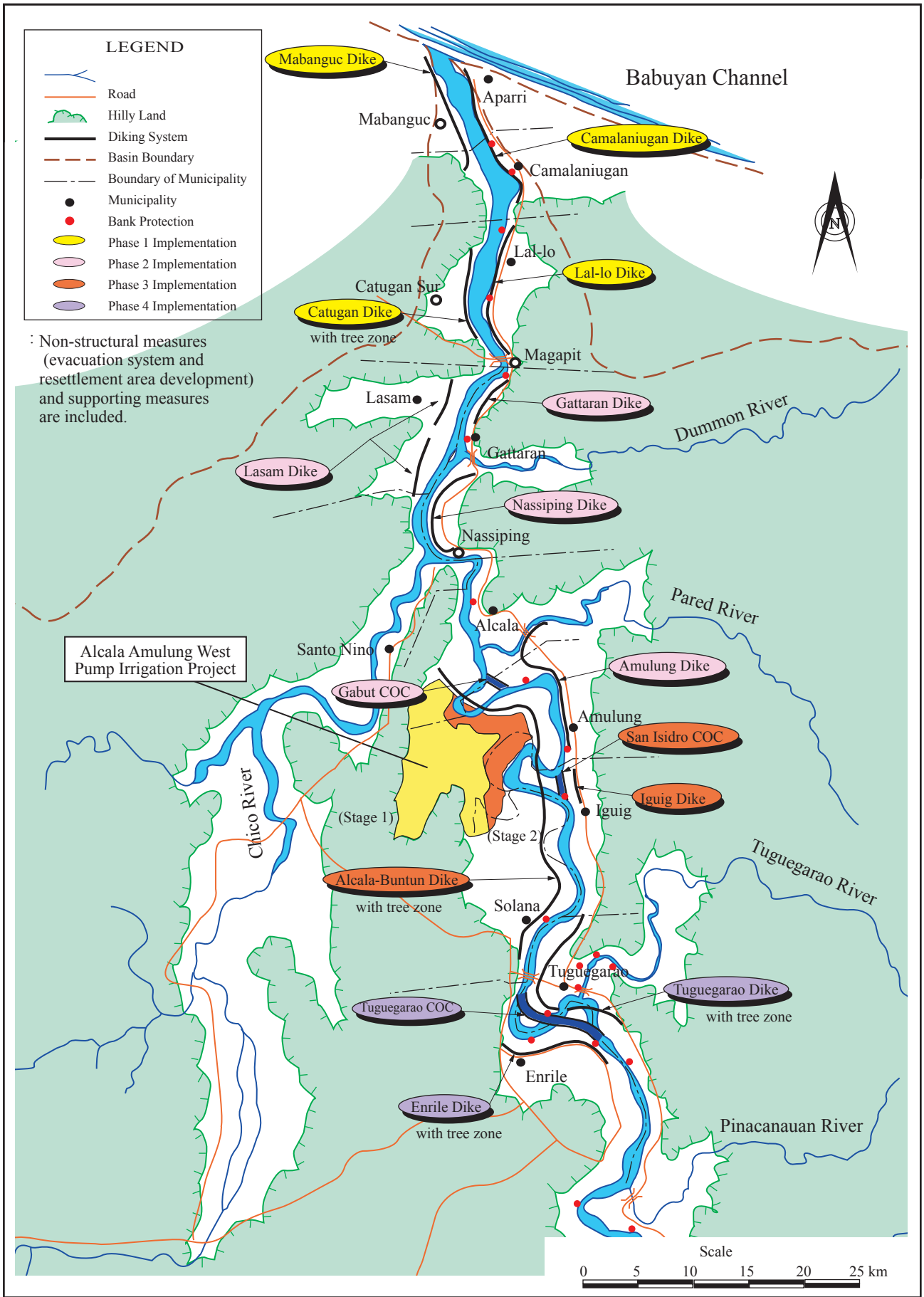

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Figure 11.2.1
Location of Flood Control Projects Subject to F/S

Visual Image of Earth Dike and Riverbank Tree Zone

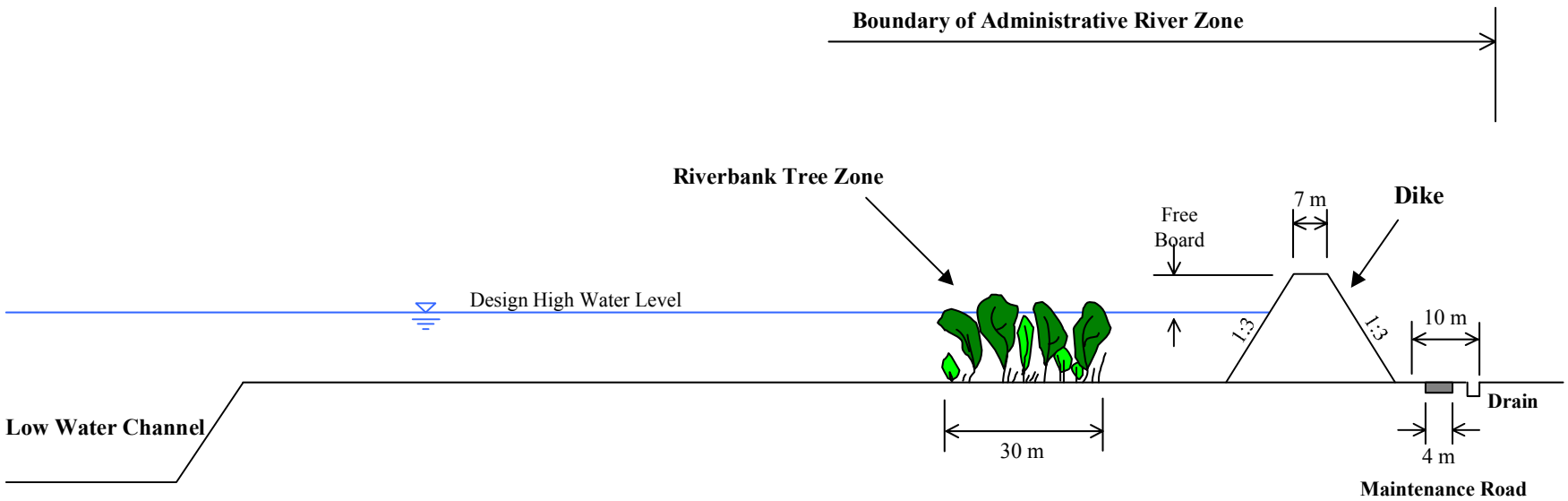

Figure 11.2.2
Typical Section of Dike and Tree Zone

Note;
Riverbank tree zone is recommended in the viewpoints of nature-oriented river improvment works and ecological landscape improvement in the river area.
The tree zone is constructed along dike in the upstream of Alcala provided that proper river management and maintenance systems are estabilished in the DPWH Region 2 office and related LGUs.

Dike Dimensions

Design Discharge	Free Board	Top Width
(cu.m/s)	(m)	(m)
5,000 to 10,000	1.5	6
more than 10,000	2	7

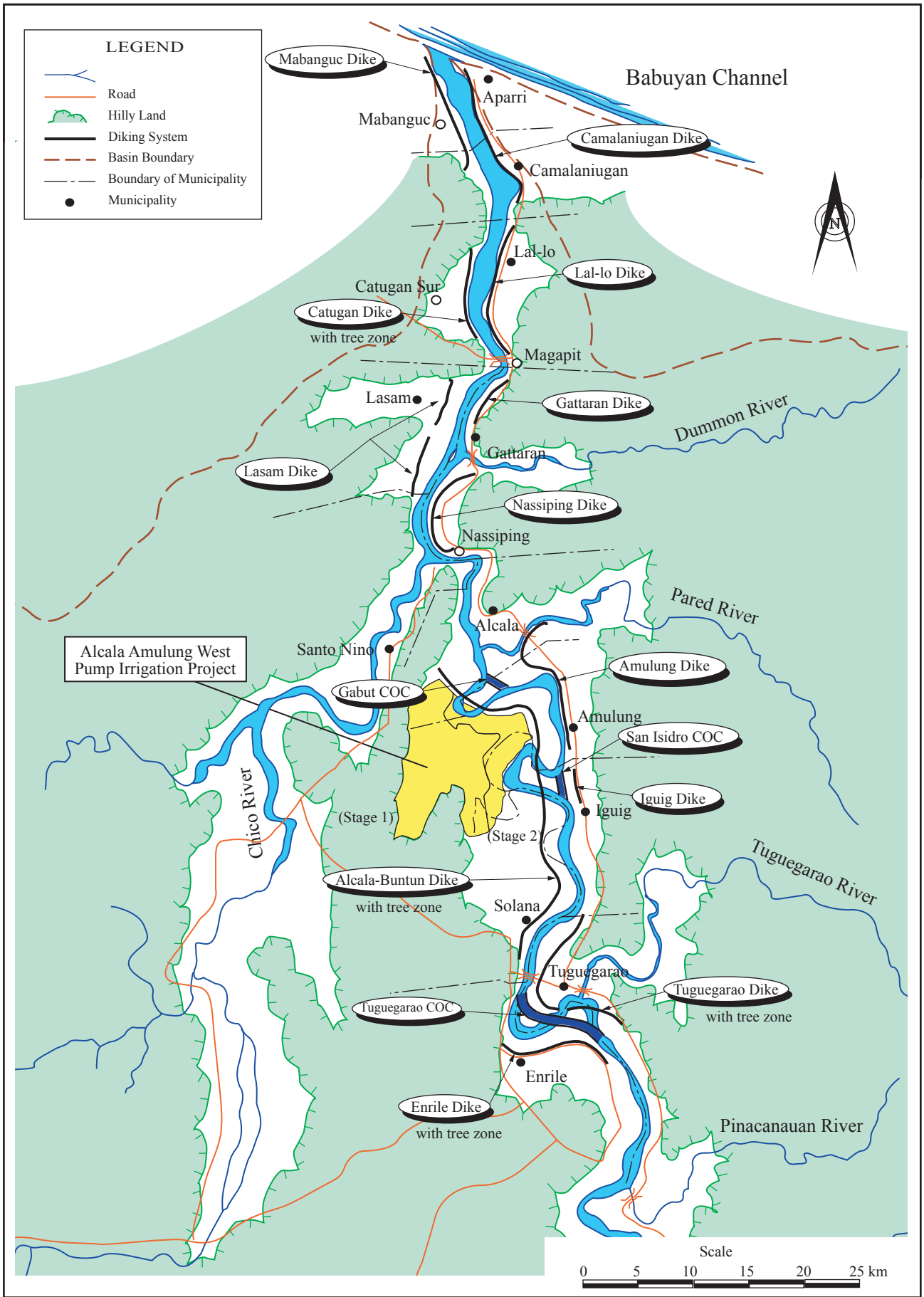

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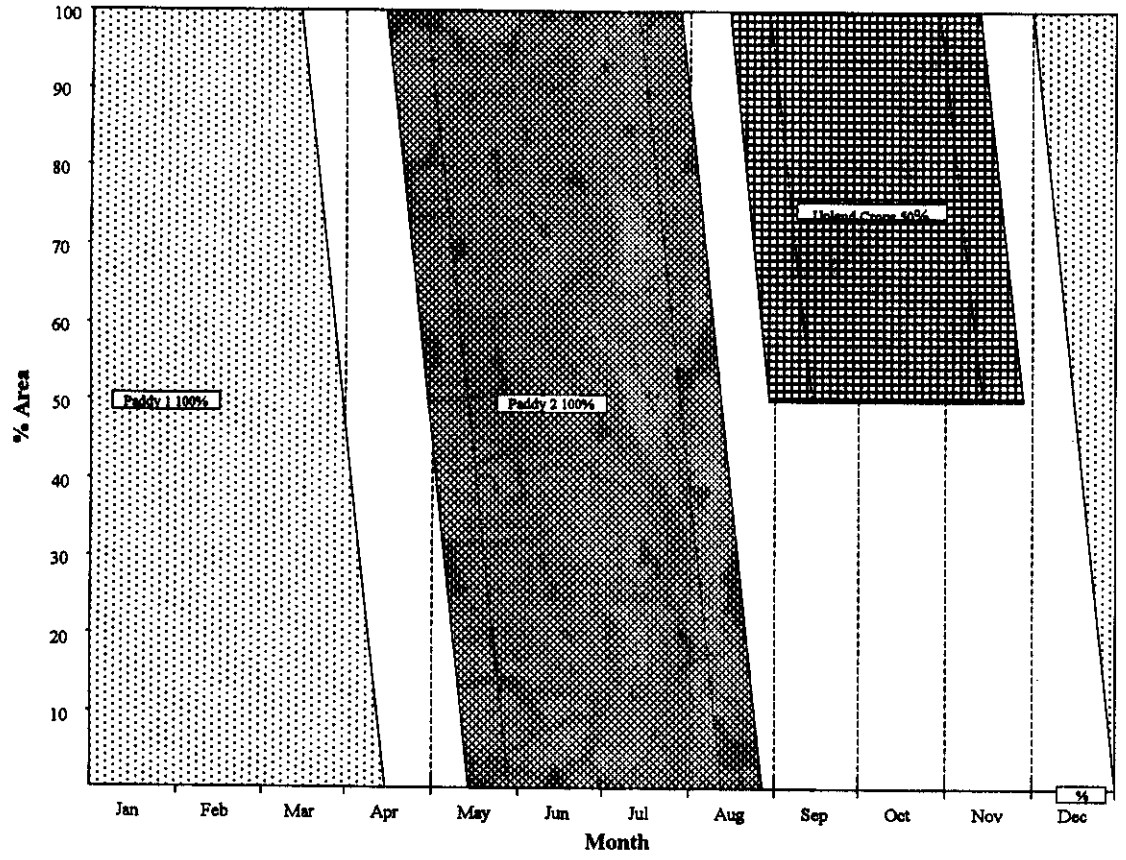
Figure 11.2.3
Location of Flood Control Projects □ in the Lower Cagayan



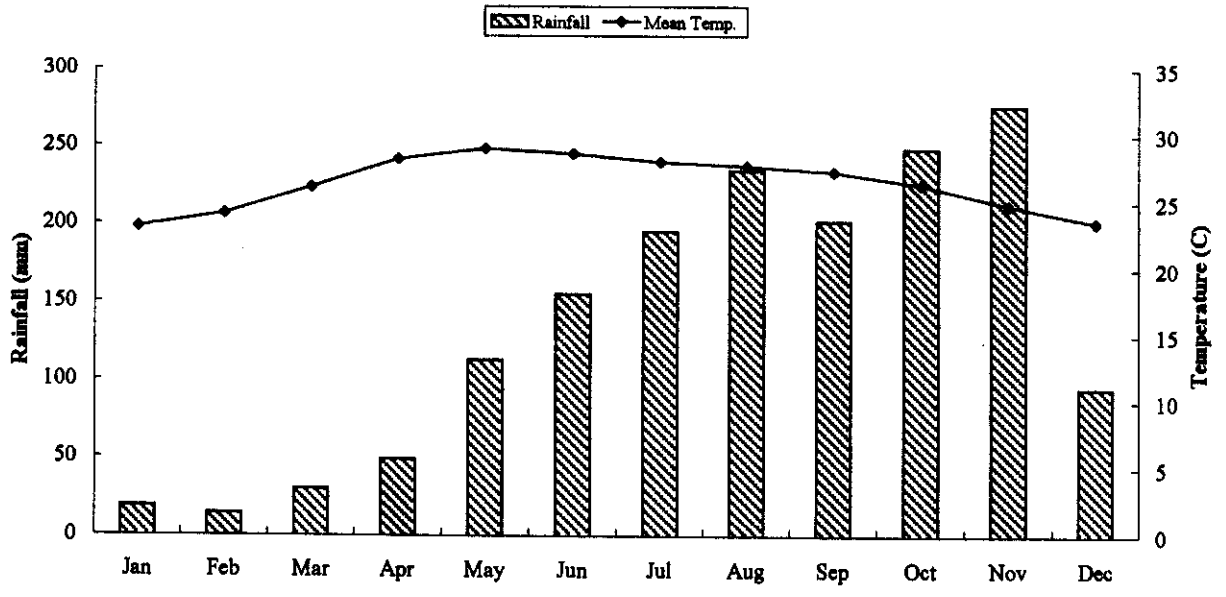


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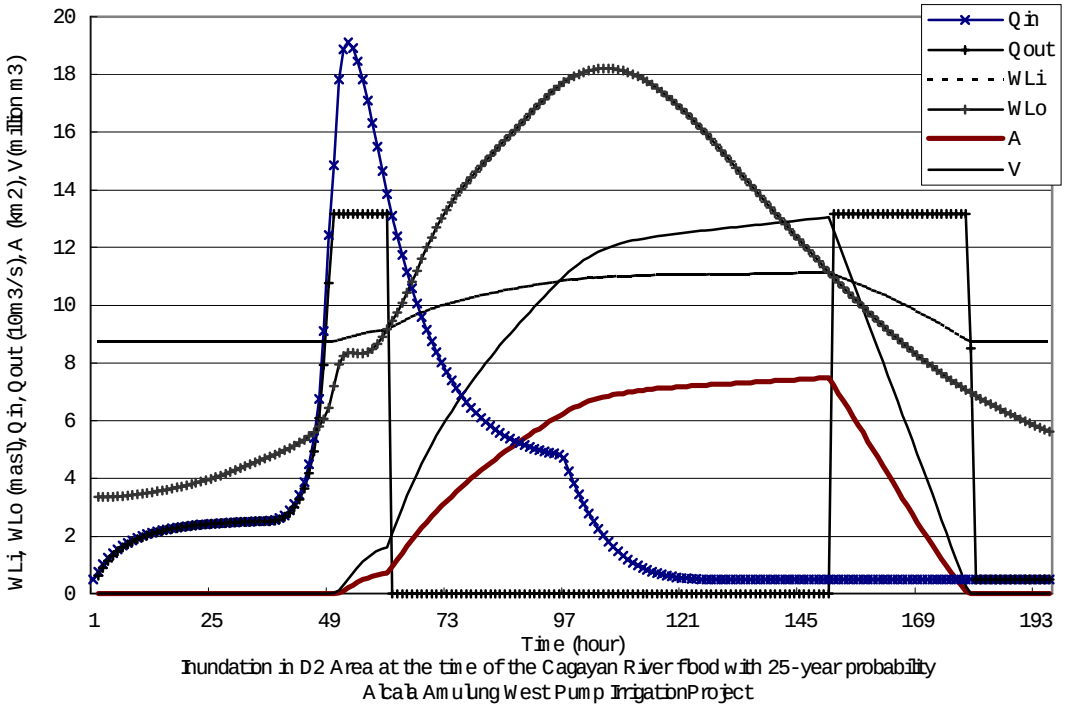
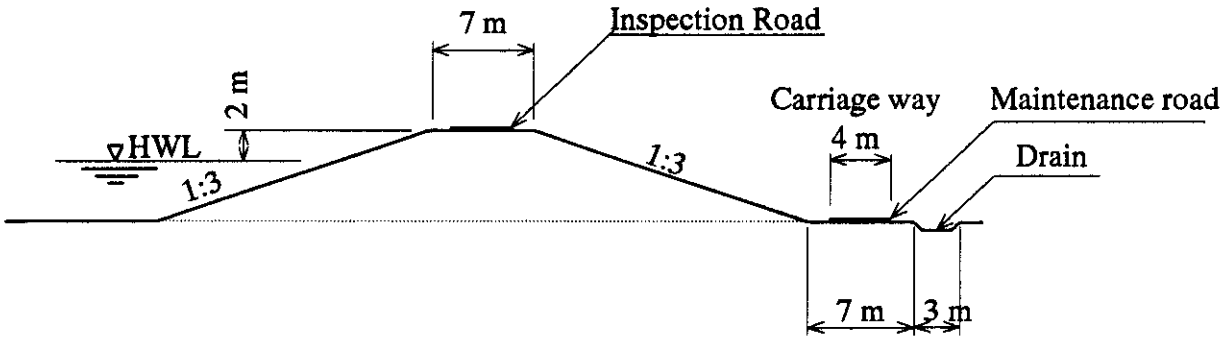
Figure 11.3.1
Proposed Cropping Pattern



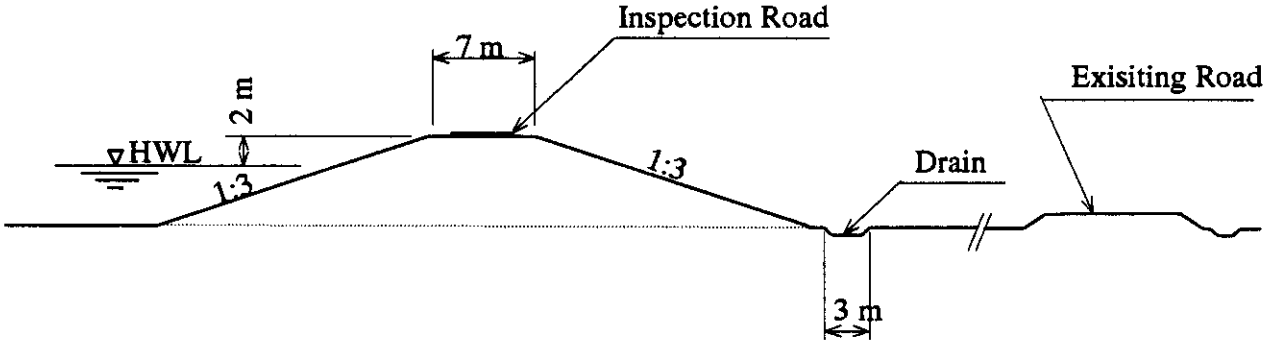
Qin: Discharge flowing into Drainage Area (DA)
Qout: Discharge drained from DA through sluice
WLi, H: Inside inundation water level
WLo: Outside or Cagayan River flood water level
A: Inundated area
V: Inundated volume

Figure 11.3.2
Inundation in Drainage Area 2 of AAWPIP

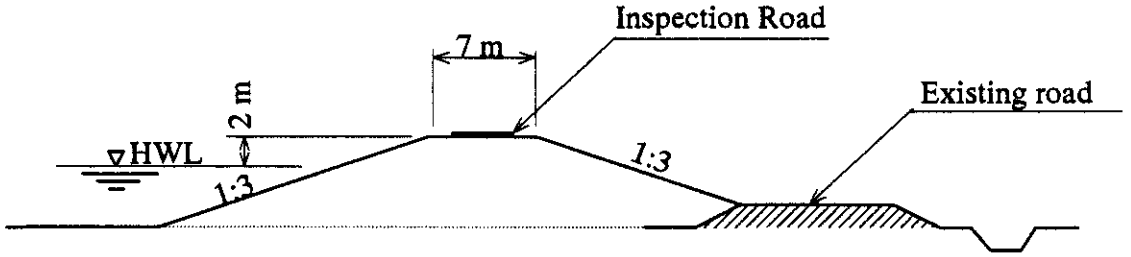
Type - 1



Type - 2



Type - 3



The Feasibility Study of the Flood Control Project for the Lower Cagayan River in the Republic of the Philippines	**Figure 12.2.1 Standard Dike Section**
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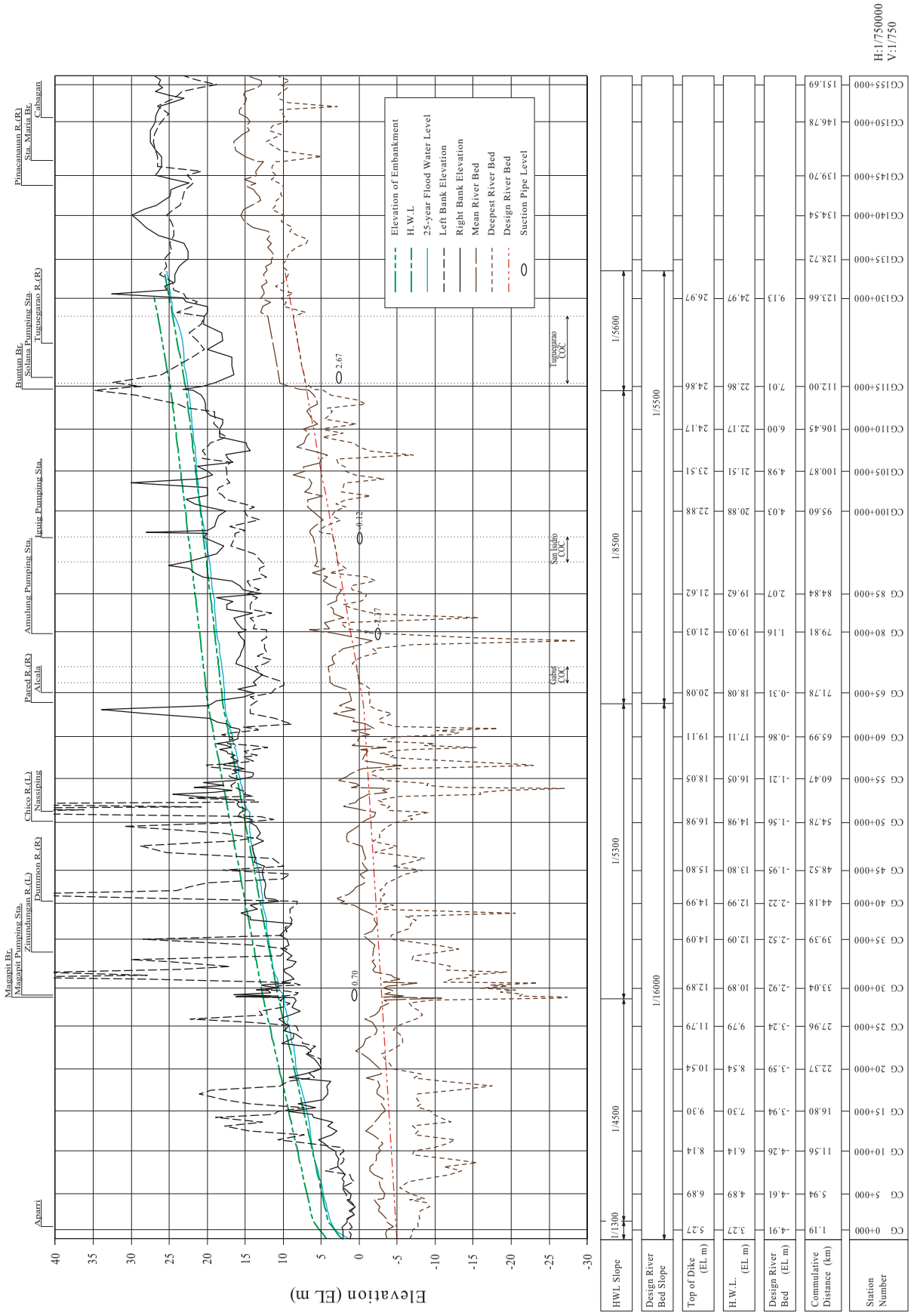

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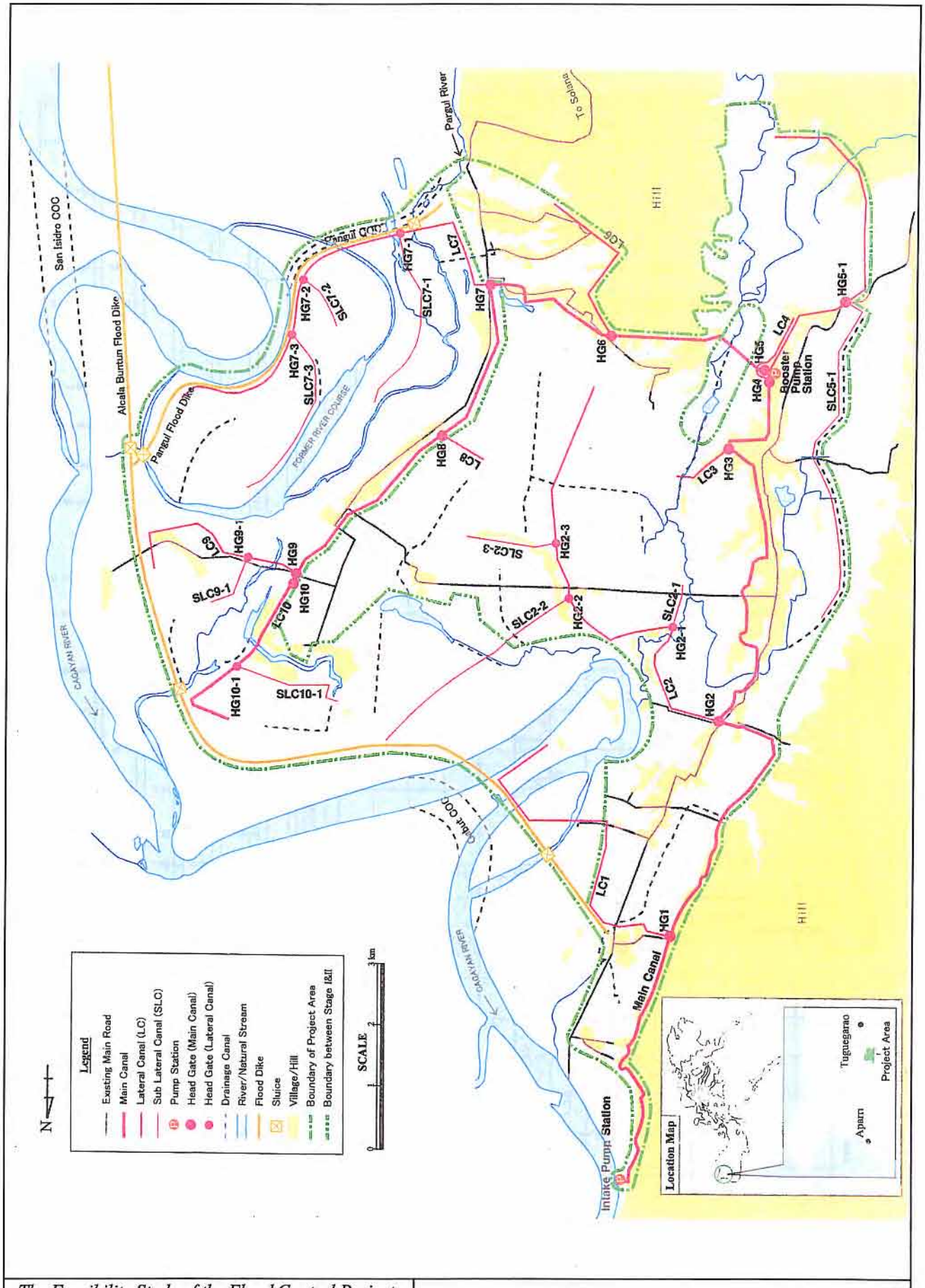
Figure 12.2.2

Longitudinal Profile of Lower Cagayan River



The Feasibility Study of the Flood Control Project for the Lower Cagayan River in the Republic of the Philippines

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Figure 12.5.1
General Layout of Alcala Amulung West Pump Irrigation Project

	Descriptions	Unit	Q'ty
	Flood control projects		
1	Feasibility Study	LS	1
2	Financial Arrangement	LS	1
3	Selection of Consultant	LS	1
4	Tender Design	LS	1
5	Tendering Procedures	LS	1
6	Development of Resettlement Area and Evacuation	LS	1
7	Land Acquisition and Compensation	LS	1
8	Construction Supervision	LS	1
9	Construction, Structure Measures		
	Phase 1 (2002-2007)		
	1) Urgent bank protection works	site	21
	2) Left & right dike systems w/tree zone, from R. Mouth to Magapit (Mabanguc 11.3 km, Catugan 6 km, Camalaniugan 13.1 km, Lal-lo 12.9 km)	km	43.3
	Phase 2 (2004-2011)		
	1) Left & right dike systems w/tree zone, from Magapit to Nassiping (Lasam 8 km, Gataran 6.1 km, Nassiping 9.7 km)	km	23.8
	2) Amulung dike system w/tree zone, from Nassiping to Amulung (Amulung 11.6 km)	km	11.6
	3) Gabut cut-off channel, 4.620,000 m3	km	0.7
	Phase 3 (2007-2015)		
	1) Alcala-Buntun dike system w/tree zone, from Amulung to Tuguegarao (Alcala-buntun 34 km, Iguig 4.1 km)	km	38.1
	2) San Isidoro cut-off channel, 9,560,000 m3	km	1.6
	Phase 4 (2011-2020)		
	1) Tuguegarao and Enrile dike systems w/tree zone, from Tuguegarao to Cabagan (Tuguegarao 21.3 km, Enrile 12.2 km)	km	33.5
	2) Tuguegarao cut-off channel, 19,130,000 m3	km	5.8
10	Related Non-structural & Supporting Measures	LS	1

Figure 13.2.1 Overall Implementation Schedule for the Lower Cagayan River Flood Control Project Phase 1 to 4 (2002-2020) in 4 Phases

	Descriptions	Unit	Q`ty	1 2002	2 2003	3 2004	4 2005	5 2006	6 2007
A	Flood Control Projects								
	1 Feasibility Study	LS	1						
	2 Financial Arrangement	LS	1						
	3 Selection of Consultant	LS	1						
	4 Tender Design	LS	1						
	5 Tendering Procedures	LS	1						
	7 Development of Resettlement Area and Resettlement	LS	1						
	8 Land Acquisition and Compensation	LS	1						
	9 Construction Supervision	LS	1						
	8 Construction, Structure Measures	LS	1						
	1) Urgent bank protection works	site	21						
	2) River bank tree zones	km	70						
	3) Left dike systems, river mouth to Magapit	km	17.3						
	4) Right dike systems, river mouth to Magapit	km	26.0						
	10 Related Non-structural & Supporting Measures	LS	1						
B	Irrigation project (AAWPIP stage 1)								
	1 Review of Feasibility Study	LS	1						
	3 Financial Arrangement	LS	1						
	4 Selection of Consultant	LS	1						
	5 Tender Design	LS	1						
	6 Tendering Procedures	LS	1						
	7 Development of Resettlement Area and Resettlement	LS	1						
	8 Land Acquisition and Compensation	LS	1						
	9 Construction Supervision	LS	1						
	10 Construction, Structure Measures								
	1) AAWPIP, stage 1	ha	4,090						
	11 Related Non-structural Measures	LS	1						

Figure 13.2.2 Implementation Schedule for the Lower Cagayan Flood Control Project, Phase 1 (2002-2007) in 4 Phases including AAWPIP Stage 1

No.	Sub Projects /Construction Items	Unit	Q`ty	1 2002	2 2003	3 2004	4 2005	5 2006	6 2007
1	Urgent bank protection works	site	21						
2	River bank tree zones	km	70						
3	Left dike systems in the lowermost from Rivermouth to Magapit	km	25.3						
	1) Preparatory works								
	2) Dike embankment, Mabanguc, l = 11.3 km	m3	1,196,000						
	3) Dike embankment, Catugan Sur, l = 6.0 km	m3	812,000						
	4) Maintenance road, Mabanguc	m2	43,500						
	5) Maintenance road, Catugan Sur	m2	29,500						
	6) Tree zone	m2	132,000						
	7) Culvert, Mabanguc	set	17						
	8) Culvert, Catugan Sur	set	9						
4	Right dike systems in the lower most from river mouth to Nassiping	km	42						
	1) Preparatory works								
	2) Dike embankment, Camalaniugan, l = 13.1 km	m3	1,150,000						
	3) Dike embankment, Lal-lo, l = 12.9km	m3	1,039,000						
	6) Bank protection (wet masonry), Camalaniugan	m2	26,200						
	7) Bank protection (wet masonry), Lal-lo	m2	6,900						
	8) Spur dike, Aparri	m3	19,000						
	9) Culvert, Camalaniugan	set	19						
	10) Culvert, Lal-lo	set	19						
6	Related non-structural measures	LS	1						

Figure 13.2.3 Construction Time Schedule for the Lower Cagayan River Flood Control Project, Phase 1 (2002-2007) in 4 Phases

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No.	Construction Items	Unit	Q`ty	1 2002	2 2003	3 2004	4 2005	5 2006	6 2007
1	Preparatory works	LS	1						
2	AAWPIP Intake pump station								
	1) Civil works	LS	1						
	2) Electro-mechanical works	LS	1			design, manufacture, procurement		installation	
	3) Building and concrete works	LS	1						
3	AAWPIP booster pump station								
	1) Civil works	LS	1						
	2) Electro-mechanical works	LS	1			design, manufacture, procurement		installation	
	3) Building and concrete works	LS	1						
4	Main irrigation system								
	1) Main canal	km	27.5						
	2) Related structure for main canal	LS	1						
	3) Lateral canal	km	30						
	4) Related structures for lateral canal	LS	1						
5	On-farm system								
	1) Farm ditch	LS	1						
6	Main drainage system								
	1) Main drain	km	7.6						
	2) Related structures	LS	1						
7	Pungul river ytraining								
	1) Short cut as floodway	LS	1						
	2) Flood dike	LS	1						
8	Related non-structural measures	LS	1						

Figure 13.2.4 Construction Time Schedule for Alcala Amulung West Pump Irrigation Project, Stage 1 in Phase 1 (2002-2007) in 4 Phases

The Feasibility Study of the Flood Control Project for the Lower Cagayan River in the Republic of the Philippines

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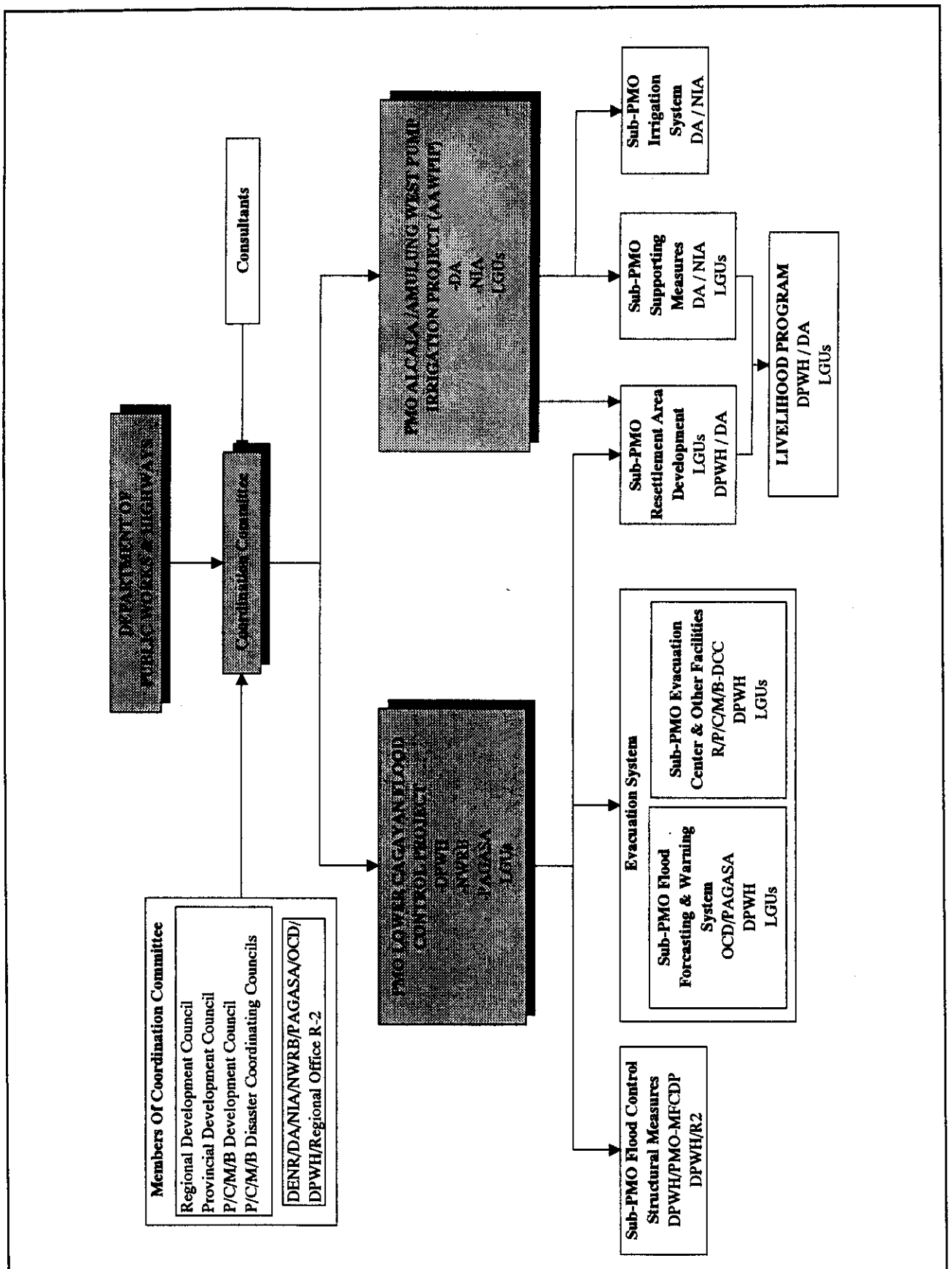

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Figure 14.2.1
Lower Cagayan Flood Control Project Organization Chart for 1st Phase Project Implementation