

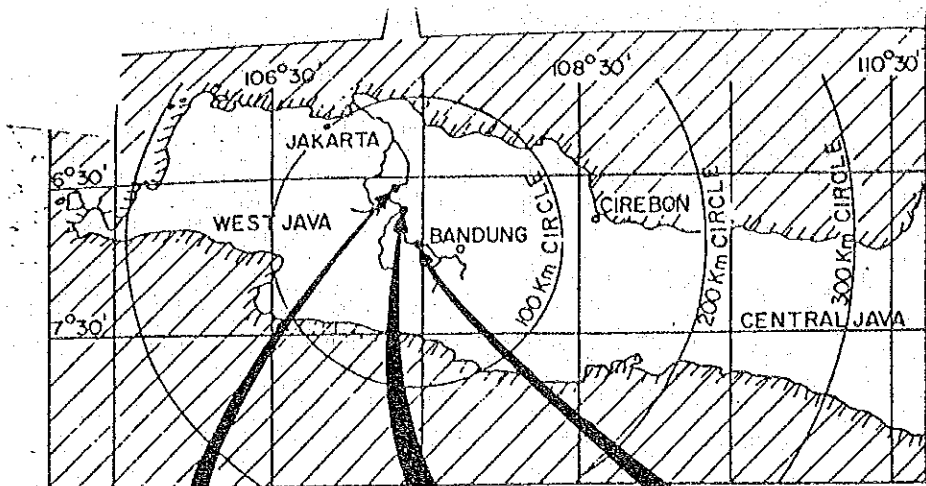
4-6. ダム事業の概要

チタルム川はバンドン高地から一気に約600 mを下る急流となっているが、この落差を利用してジャティールフル、チラタ、サグリンの3ダムが建設されており、このうち、ジャティールフルダム、サグリンダムについては、それぞれ1967年、1986年5月に完成している。なお、チラタダムは1987年12月に完成予定である。図4-6-1、2に3ダムの位置図と標高を示す。

これらの3ダムはいずれも発電を主体としたダムであるが、ジャティールフルダムについては、ジャティールフル公団(JATILUHUR AUTHORITY)が管理しており、かんがい用水、ジャカルタへの上水などを供給するダムとなっている。表4-6-1、2にジャティールフルダム、チラタダムの諸元を示す。図4-6-3はジャティールフルダムの管理者であるジャティールフル公団の管理区域を示したものである。

4-4-(1) 河川の現況でも述べたように、サグリンダムのバックの影響はジョムボン溪谷(貯水位との落差9.5 m)が存在することから、この滝から上流には及ばないが、チタルム川は流出土砂が多い河川であることから、ダム堆砂が上流域に与える影響についても検討すべき項目となる場合も考えられる。

写真4-6-1~7にこれら3ダムの現況を示す。



JATILUHUR DAM FOR FLOOD CONTROL IRRIGATION AND GENERATION (EXISTING)	
DAM	
TYPE	ROCKFILL
HEIGHT	103 m
CREST LENGTH	1,200 m
VOLUME	$9,100 \times 10^3 \text{ m}^3$
RESERVOIR	
F.W.L.	111.6 m
GROSS STORAGE	$3,430 \times 10^6 \text{ m}^3$
EFFECTIVE STORAGE	$3,290 \times 10^6 \text{ m}^3$
POWER STATION	
MAX. OUTPUT	150 MW
MAX. DISCHARGE	$324 \text{ m}^3/\text{SEC}$
EFFECTIVE HEAD	58.5 m
GENERATED ENERGY	$790 \times 10^3 \text{ MWH}$

CIRATA PROJECT FOR HYDROELECTRIC POWER	
DAM	
TYPE	CONCRETE FACED ROCK FILL
HEIGHT	125 m
CREST LENGTH	453 m
VOLUME	$3,600 \times 10^3 \text{ m}^3$
RESERVOIR	
F.W.L.	220 m
GROSS STORAGE	$1,920 \times 10^6 \text{ m}^3$
EFFECTIVE STORAGE	$796 \times 10^6 \text{ m}^3$
POWER STATION	
MAX. OUTPUT	500 MW
MAX. DISCHARGE	$540 \text{ m}^3/\text{SEC}$
EFFECTIVE HEAD	112.5 m
GENERATED ENERGY	$1,428 \times 10^3 \text{ MWH}$

SAGULING PROJECT FOR HYDROELECTRIC POWER	
DAM	
TYPE	ROCKFILL
HEIGHT	99.0 m
CREST LENGTH	301.4 m
VOLUME	$2,750 \times 10^3 \text{ m}^3$
RESERVOIR	
F.W.L.	645 m
GROSS STORAGE	$982 \times 10^6 \text{ m}^3$
EFFECTIVE STORAGE	$609 \times 10^6 \text{ m}^3$
POWER STATION	
MAX. OUTPUT	700 MW
MAX. DISCHARGE	$224 \text{ m}^3/\text{SEC}$
EFFECTIVE HEAD	362.4 m
GENERATED ENERGY	$2,156 \times 10^3 \text{ MWH}$

LOCATION

图 4-6-1 大坝位置图

HYDRO ELECTRIC POWER PLANTS ALONG CITARUM RIVER AND ITS TRIBUTARIES

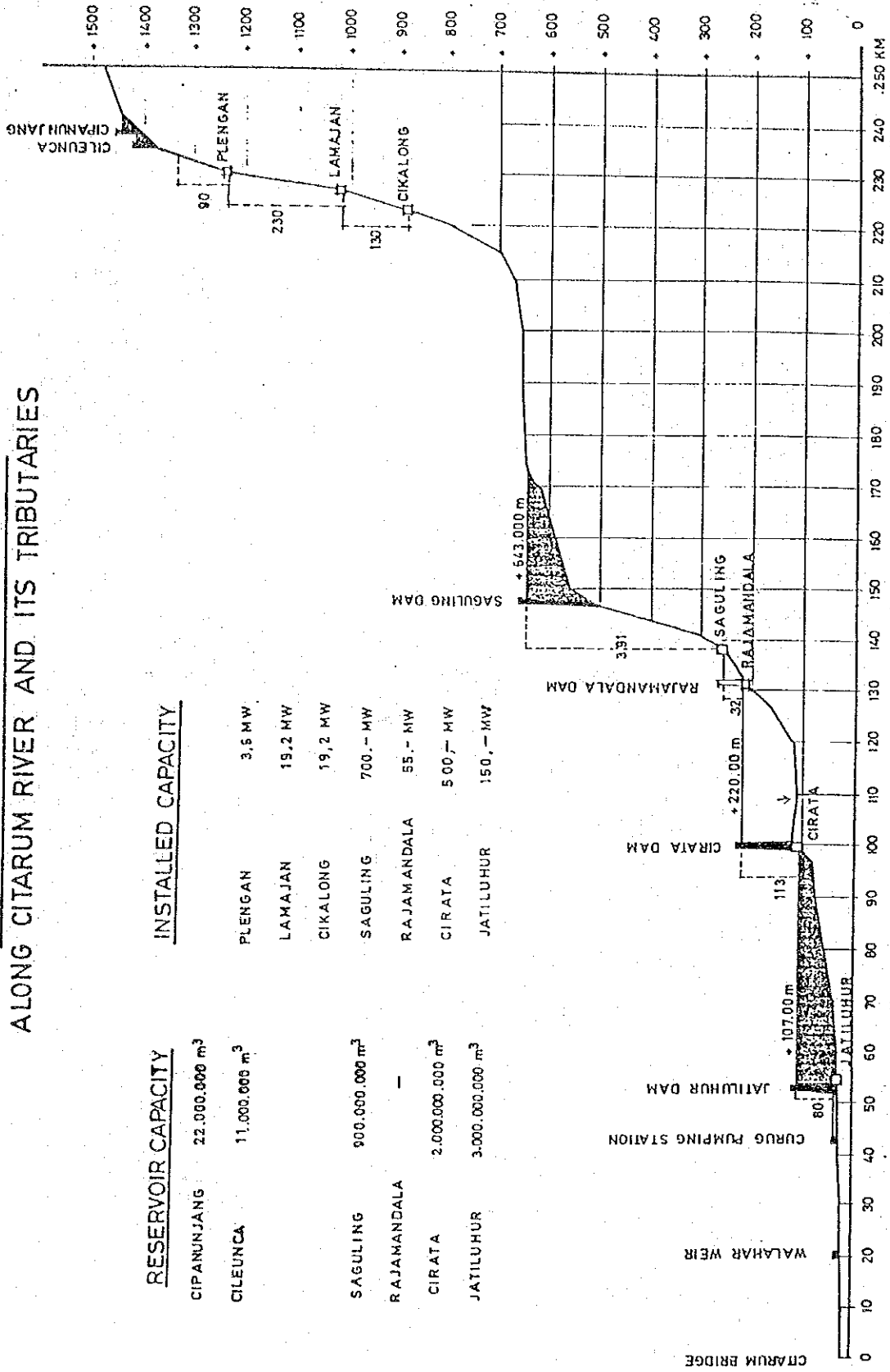


図 4-6-2 チタルム川縦断面図

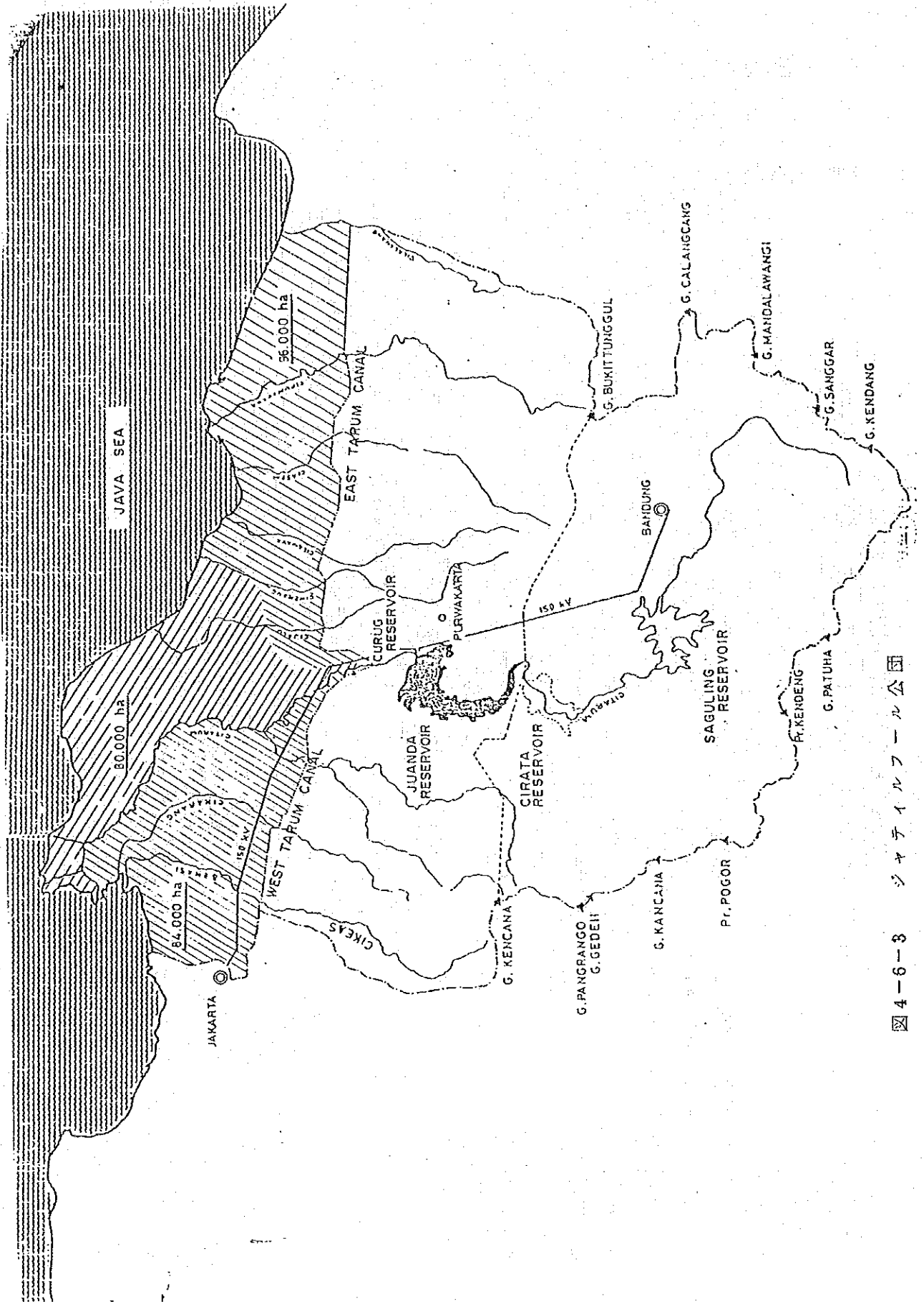


図 4-6-3 ジャバイルール公団

表4-6-1 ジャティルフルダム諸元

BASIC DATA

- 2 -

* Location	- Northern Part West Java Province.
* Purpose	- Irrigation, Water Supply, Flood Control, Hydro Electric Power, Land Fishery, Tourism.
* River	- Citarum.
* Catchment Area	- 4,500 km ² .
* Annual mean Run-off	- 5.5 x 10 ⁹ m ³ .
* Design Flood Discharge	- 3,000 m ³ /sec.
* Date of commencement of Construction Work	- 1958.
* Date of completion of Construction Work	- 1967.
* Dam	
Type	- Rockfill with Inclined Core.
Bedrock	- Claystone, Sandstone.
Height (above foundation)	- 100 m.
Crest length	- 1,220 m.
Total volume content	- 9.1 x 10 ⁶ m ³ .
* Spillway	
Type	- Over flow spillway, Morning Glory.
* Reservoir	
Gross Storage Capacity	- 3 x 10 ⁹ m ³ .

Effective Storage Capacity - 2.1 x 10⁹ m³.

Reservoir Area - 83 km².

* Dikes

Type - Earthfill.

Bedrock - Claystone, Sandstone.

Height (above foundation) - 17 m.

Total length - 2,970 m (Pasir Gombong, Ciganes, Ubrug).

Total Volume content - 2.9 x 10⁶ m³. (Pasir Gombong, Ciganes, Ubrug).

* Emergency Spillway - Over flow spillway with fixed gate (Arch Concrete).

* Designer - Coyne & Bellier.

* Contractor - Compagnie Francaise d'Entreprise (Main Contractor).

- Soletanche.

* Owner - Jatiluhur Authority.

* Power Plant

Type - Indoor.

Effective head - 66 m.

Installed Capacity - 150 MW. (6 x 25 MW).

Annual Energy Production - 800 x 10⁶ kWh.

* Designer - Coyne & Bellier.

* Contractor - C.G.E.
- Cogellex.

表4-6-2 チラタダム諸元

PROJECT DATA			
1. MAIN SCALE			
Installed Capacity		500,000 Kw (500,000 Kw for 2nd stage)	
Max. Discharge		540 m ³ /sec.	
Max. Effective Head		112.5 m	
2. RESERVOIR SCALE AND HYDROLOGY			
Drainage Area	4,119 Km ²	Total Reservoir Capacity	2.165 x 10 ⁶ m ³
Reservoir Area	62.0 Km ²	Flood Surcharge Capacity	1.92 x 10 ⁶ m ³
Max. Flood Water Level (F.W.L.)	223.0 m.	Live Storage Capacity	7.96 x 10 ⁶ m ³
Max. Normal Water Level (H.W.L.)	220.0 m.	Dead Storage Capacity	1.177 x 10 ⁶ m ³
Low Water Level (L.W.L.)	205.0 m.	Mean Annual Discharge	170.0 m ³ /sec
		Probable Flood Discharge (P.M.F.)	8.400 m ³ /sec
		Probable Flood Discharge (After Saguling)	5.900 m ³ /sec
3. OUTPUT			
Max. Normal Water Level (H.W.L.)	220.0 m.	Installed Capacity	500,000 Kw.
Low Water Level (L.W.L.)	205.0 m.	Minimum Output	436,000 Kw.
Normal Water Level for Design (N.W.L.'D)	215.0 m.	Annual Generated Energy	1,428 Gwh.
Tailrace Water Level (T.W.L.)	103.0 m.	Firm Discharge	140 m ³ /sec.
Gross Head (Max.)	117.0 m.	Peak Discharge	540 m ³ /sec.
Gross Head (Min.)	102.0 m.		
Max. Effective Head For N.W.L.'D	107.5 m.		
4. DAM			
Type		Concrete Faced Rockfill Dam	
Height		125.0 m	
Crest Length		456.5 m	
Crest Elevation		E.L. 225.0 m	
Dam Volume		3,600,000 m ³	
5. SPILLWAY			
Type		Tunnel Type Connected With Diversion Tunnels.	
Max. Capacity		2,600 m ³ /sec.	
Gate		Four Radial Gates.	
Cross Section		Circular With Gradual Diameter Of 25 m to 10m	
Length		L ₁ = 544.04 L ₂ = 559.04	
6. DIVERSION TUNNEL			
Length		Approximately 800 m Each (Number = 2)	
Cross Section		Circular Of 10m Diameter.	
7. BOTTOM OUTLET WORKS			
Location		Separated Tunnel	
Type		Hollow Bunker Cone Valve With Butterfly Guard Valve	
Max. Discharge		Approximately 100 m ³ /sec.	
Cross Section		Horse Shoe Shape (4.0m x 4.5m)	
8. INTAKE			
Type		Side Intake With Gate Shafts (Number = 2)	
Capacity		Max. 540 m ³ /sec.	
9. HEADRACE TUNNEL			
Length		L ₁ = 639.84 m L ₂ = 639.95m	
Cross Section		Circular Tunnel With Inside Diameter 8.4 m	
10. SURGE TANK			
Type		Circular Restricted Orifice Type (Number = 2)	
Inside Diameter		18.60 m	
Height		82.0 m.	
11. PENSTOCK TUNNEL			
Length		197.2 m (Number = 4)	
Cross Section Of Steel Lining		Circular Shaped 5.2 m Inside Diameter	
12. UNDERGROUND POWERHOUSE			
Type		Egg Type (Width = 35.0m, Length = 230.0m, Height = 50.0m)	
13. TAILRACE			
Length		Appro 150 m (Number = 4)	
Cross Section		Circular Tunnel With Inside Diameter 8.4 m	
14. TURBINE			
Type		Vertical Shaft Francis (Number = 4)	
Speed		187.5 r.p.m.	

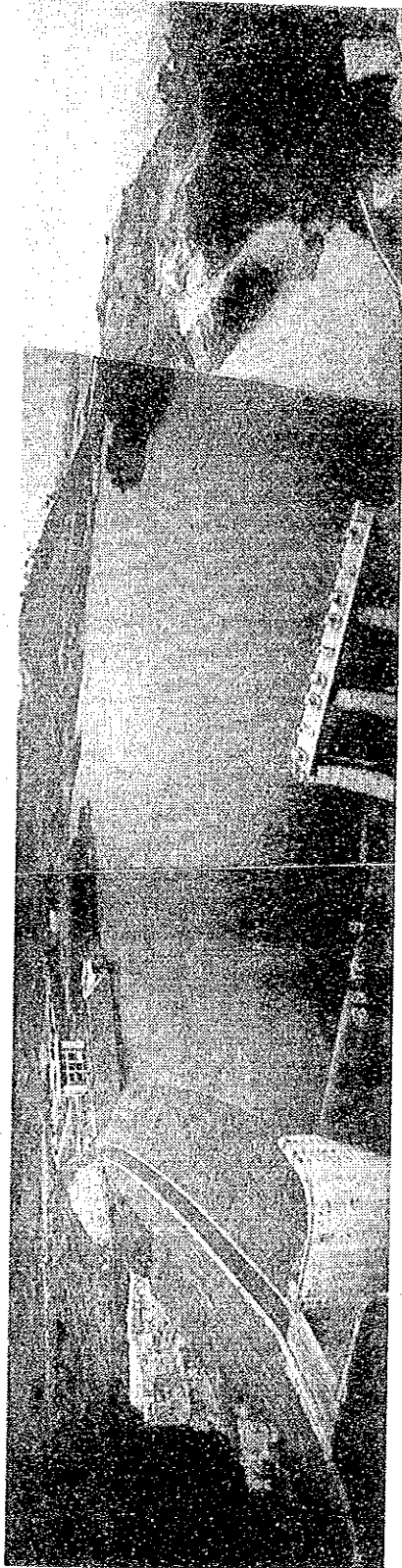


写真4-6-1 サグリンダム

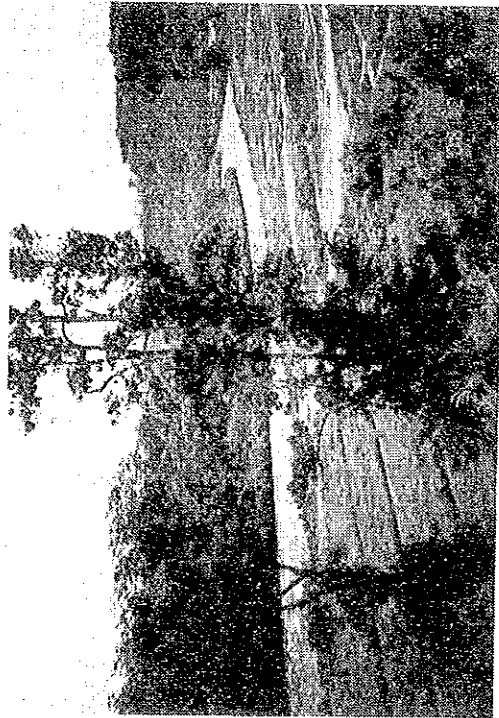


写真4-6-2 サグリンダム発電所放流口 直下流チタルム川
(ダム直下流から、放流口までチタルム川には水が流れていない)

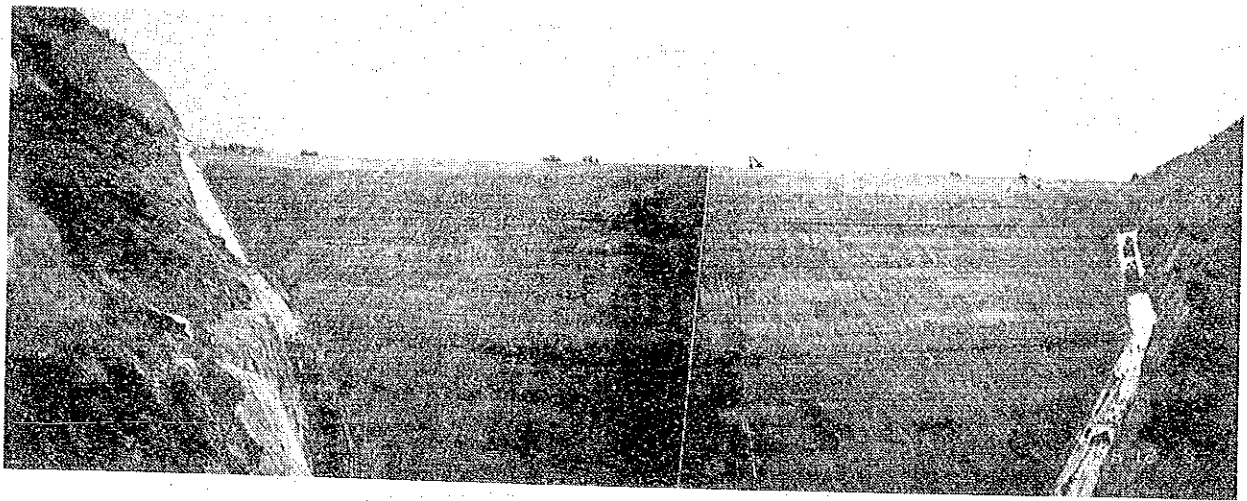


写真4-6-3 チラタダム堤体

写真4-6-5 チラタダム地下発電所

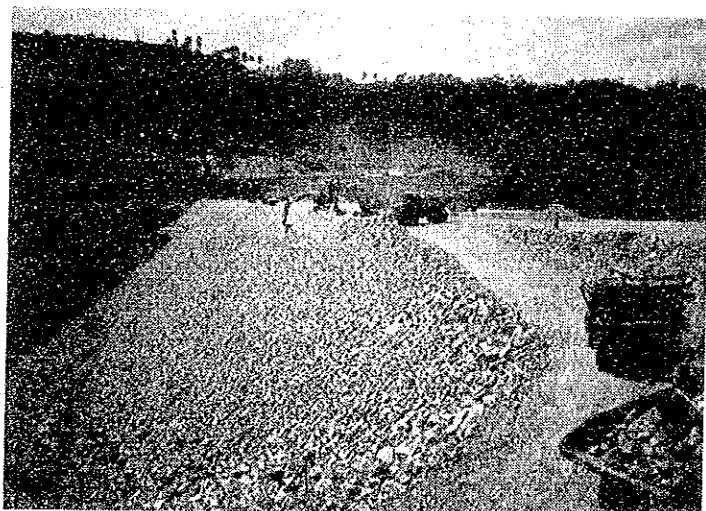


写真4-6-4 工事状況

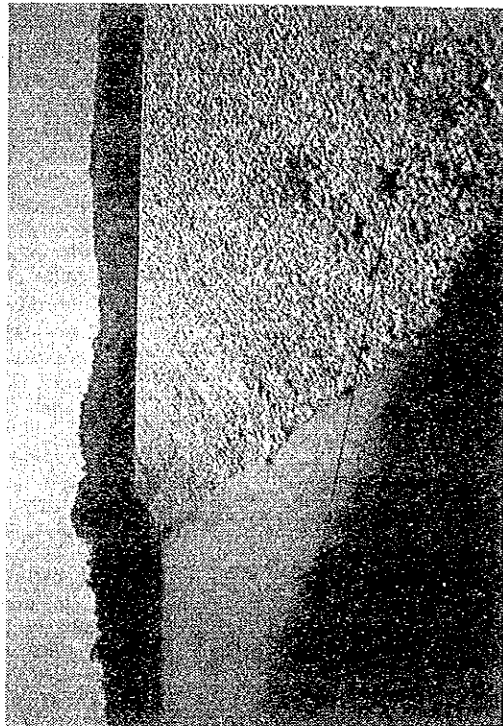


写真 4-6-6 ジャティルフルダム

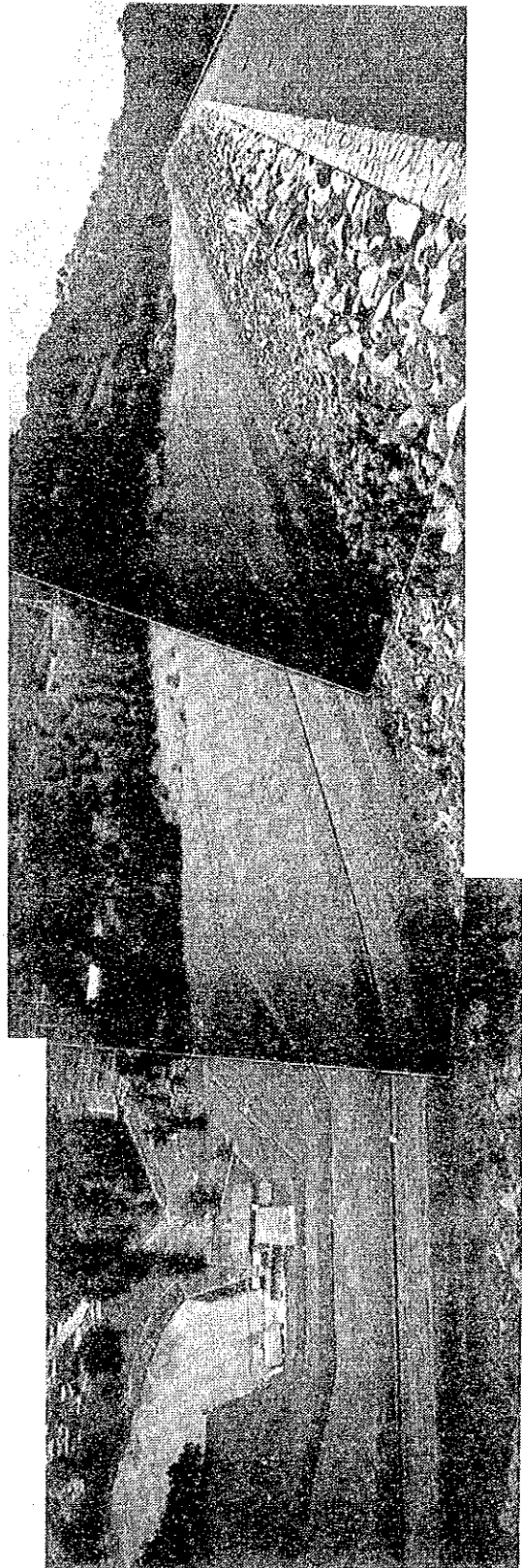


写真 4-6-7 ジャティルフルダム

V 本 格 調 査 の 内 容

5-1. 目的及び背景

1) 本格調査の背景 —ジャワ島における地域開発状況と洪水被害—

- ① ジャワ島においては、インドネシアの最も重要な地域であるとともに人口においても超過密な状況であり、山地に入ってもほとんど何らかの開発が行われている。
- ② チタルム川流域においても例外ではなく、農地開発、森林開発ばかりでなく、都市開発的な事業も数多く実施されている。
- ③ チタルム川上流域最大の都市バンドン市は、インドネシア第3の都市規模を有し、しかも学術的文化的に高度な施設（大学、研究所等）を数多くかかえ、人口も増加しつつあり、「バンドン都市圏」を形成している。
- ④ 今回の調査区域であるジョムボン溪谷上流域は、バンドン市が右支川上流（標高約700m）に広がっており、その他小都市あるいは集落が上流山地に点在している。そして、これらの山地に囲まれて非常に緩勾配（本川勾配約1/10,000～3/10,000）の盆地が広がっている。
- ⑤ このような盆地（昔は大きな湖だったといわれている）に、疎通能力の少ない、改修上は初期の形態の河川が流れており、治水上の課題を有する農業用水等の堰が点在している。
- ⑥ このような状況の地域に上流山地域のバンドン市を始めとする都市開発、農業開発、工業開発等が行われた結果流域に降雨があった場合の河川への流出率が土地利用の変化に従って徐々に増加した。
- ⑦ 現在の河道の持つ能力いっぱいまでは何とか持ちこたえてきたものの、その能力を越えるに至り、急激に洪水が頻発するようになったものである。
- ⑧ 又、周辺の開発地域からの土砂流出も大きく、長年の河道への土砂堆積により疎通能力が少くなっている。
- ⑨ このような課題は、日本でも急激な都市化により頻発している課題であり、ジャワ島のような開発が進んだ地域では、地域開発や土地利用の変化に伴って、流域全体の立場から管理する必要があり、それに伴うマネジメント手法が取り入れられるべきである。

2) 調査の目的

1) Scope of Work for the study における調査目的

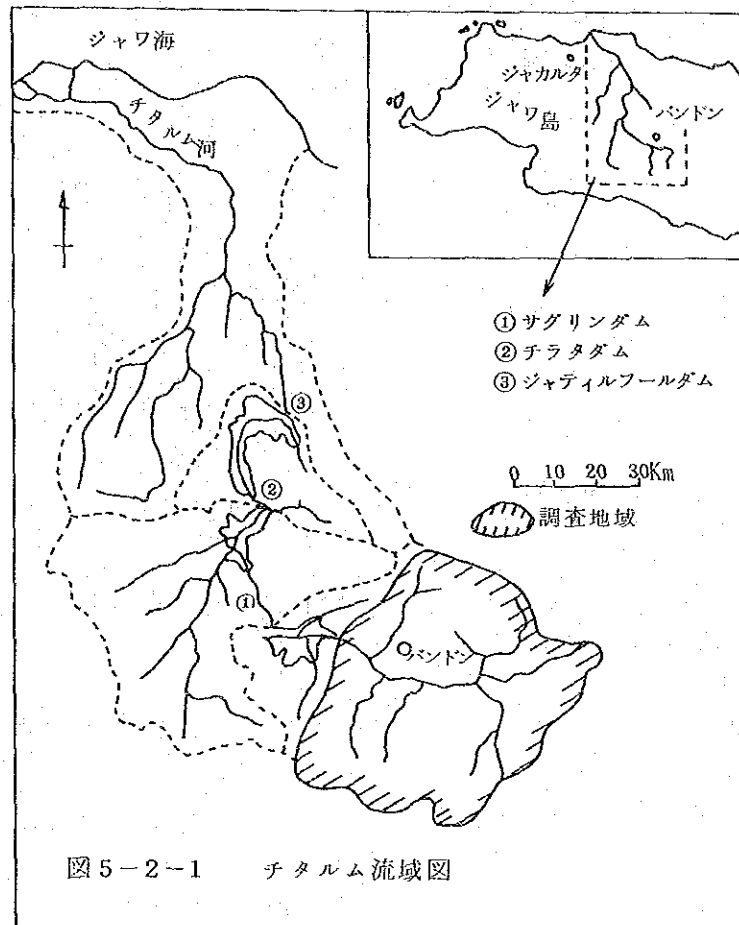
- ① チタルム川上流域の洪水防御計画を策定する。
- ② 上記洪水防御計画の中の緊急に行う必要のあるプロジェクトについて、フィージビリティ調査を行う。
- ③ これらの調査技術についてインドネシア側カウンターパートに技術移転を行う。

2) 洪水防御計画調査

- ① ジョムボン溪谷上流域全体について流域の土地利用変化に伴う降雨時の河川への流出機構の変化を、過去、現在、将来の状況に合わせて検討する。(その際、治水を主体としながらも水資源賦存量の立場からの初期的解析も行い、流域水資源マネジメント調査への参考資料とする。)
 - ② 流域治水計画上の最も重要な基礎となる流域基本高水をはじめとする総合的な流域洪水防御計画を策定する。
 - ③ 前項の解析検討に基づく各流域特性に応じた治水対策について「チタルム川上流域洪水防御計画」を策定する。
- 3) フィージビリティ調査
- ① 2)における調査結果を分析評価し、当面緊急対策が必要な流域、河道について実施計画を樹てるために必要な「高水流量計画」を策定する。
 - ② ①の「高水流量計画」に対して総合的な治水対策メニューを検討する。
 - ③ これらを総合的に分析、評価して「チタルム川上流域緊急治水計画」を策定する。

5-2. 調査対象区域

1) チタルム川全流域と調査対象地域



- ① チタルム川は、上流域にインドネシア第三の都市バンドン（人口約150万人）を抱え、中流部には、ジャティルフルダム、チラタダム（建設中）、サグリンダムがあり、これらのダムにより、下流部かんがいを始めジャカルタの電力や水道水を担う重要な河川である。
- ② 河川流域は、すでに全域に何らかの開発が行われており、流域の変化状況をふまえた治水計画が必要な流域である。

2) 調査対象地域

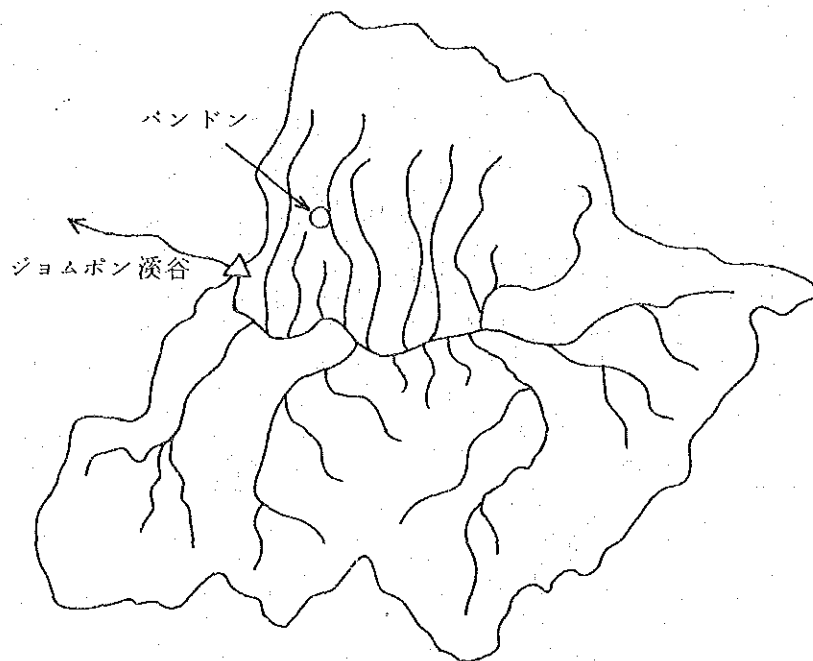


図5-2-2 調査対象地域

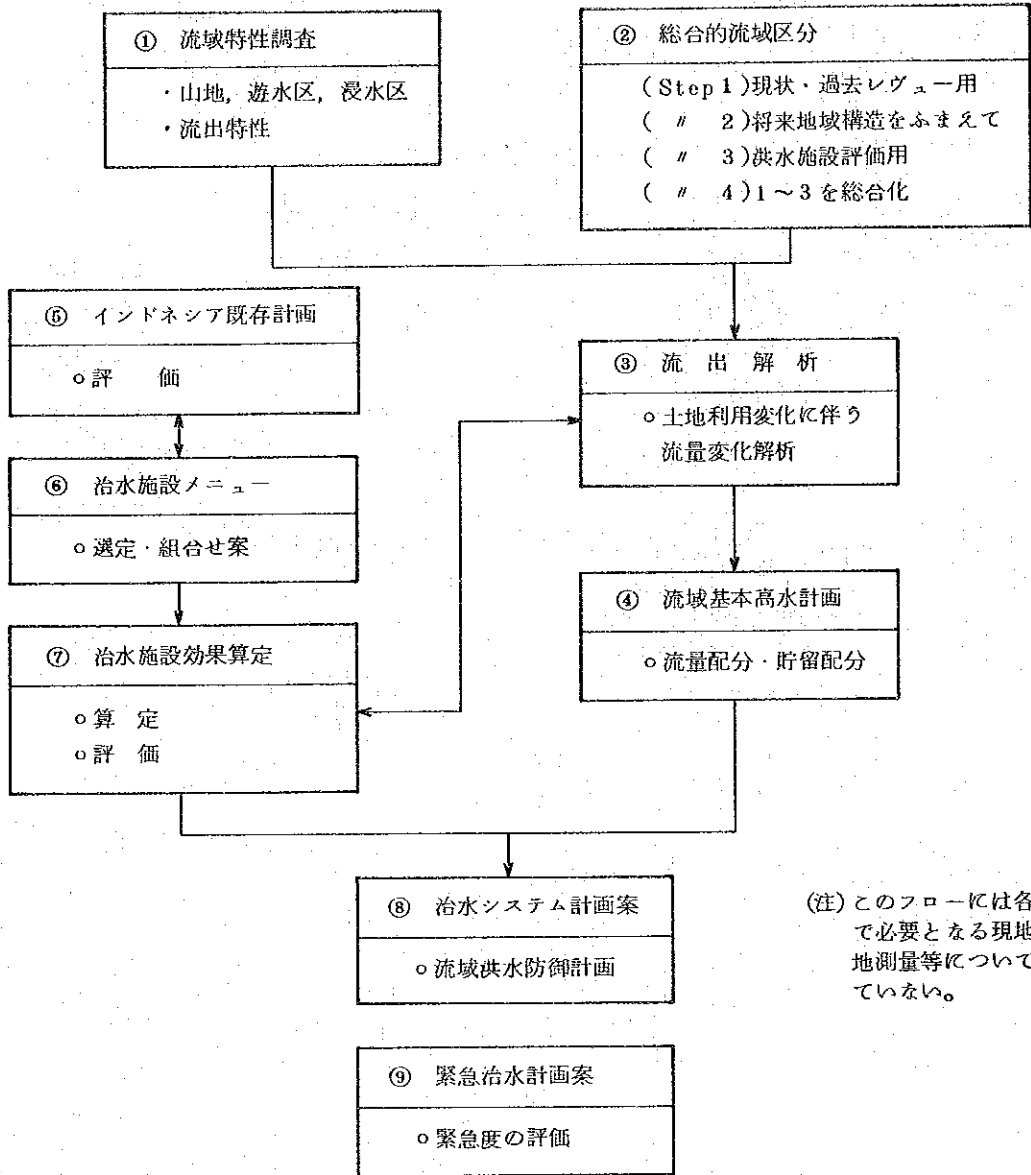
- ① ジョムボン溪谷より上流域はかつて湖であったといわれており、流域の形状は、ほぼ円形に近く、周辺は1,200 m～1,700 m（海面より）の山地となっている。
- ② 山地から平地になると盆地を形成し、本川勾配が1/10,000から3/10,000程度の緩勾配となっている。
- ③ ジョムボン溪谷では約10 m位の滝となってサグリンダム貯水池上流端へと続いている。

5-3. 調査の基本方針

- 1) 今回の調査はジャワ島のような過密地域において、地域開発が進められる場合に考慮されるべき河川流域全体のマネジメントを行う場合の基礎的な調査として、治水上の課題を調査し、流域水資源マネジメントの第一段階とするものである。
- 2) これらの調査に基づき、チタルム川上流域の総合的な流域洪水防御計画を策定する。
- 3) 現在毎年洪水被害を受けている地域のうち、緊急に対応すべき地域について都市部を主体としてフィージビリティ調査を行う。
- 4) 技術移転については、バンドン市に、バンドン工科大学をはじめ、公共事業省の水工研究局等があり、関連する技術分野のレベルの高い技術者が多い。そのため、これらの人達にも調査のワーキンググループに入ってもらい、実地の立場で現地資料収集や現地事情評価に協力してもらおうと同時に、解析手法、計画手法について技術移転を行う。

5-4. 実施要領

1) 調査の全体フロー図



(注) このフローには各ブロックで必要となる現地観測, 現地測量等については記されていない。

2) 調査内容

① 流域特性調査

各流域をその水文特性から山地、遊水区域、浸水区域に区分し、各区域の水文特性と地域計画上の特性を分析する。

② 総合的流域区分

〈第1ステップ〉チタルム川上流域の主要支川の流域毎にその現状と過去の水文流出特性をレビューするために流域を区分する。

〈第2ステップ〉主要支川流域毎に将来の地域構造変化と流出特性の変化を表現できるように流域を区分する。特にバンドン都市の将来計画に留意する。

〈第3ステップ〉流出特性とそれから考えられる治水施設効果を上流域全体の観点から表現できるように流域を区分する。

第1～第3ステップの各流域区分を総合化する。

各ステップの区分を考える際、サブ的課題として、水資源利用の立場からの低水流出解析にも利用できる区分とする。

③ 流出解析

〈第1ステップ〉現状及び過去の土地利用を考慮して上流域の流出モデルを作成し、過去から現在までの洪水特性と地域計画について分析・評価する。

〈第2ステップ〉氾濫戻し解析を含め、将来の土地利用変化を見込んだ流出解析を行い、流域基本高水計画を樹てるための資料とする。

〈第3ステップ〉第2ステップのモデルを用い、各種治水施設の効果を分析し、流域洪水防御計画のための資料とする。

④ 流域基本高水及び高水流量計画の確定及び評価

流域全体の治水計画規模の確定・評価

流域基本高水計画の確定・評価

流域貯留、河道等総合的な流量配分計画

⑤ 治水施設計画構想検討

流域基本高水の治水施設からの評価（主要流域別）

検討すべき治水施設メニューの組合せを選定

治水システム計画案の検討（計画案のしぼり込み）

M-8 法律上の規制（高床等）

M-9 ダム上流端の影響排除

- ① 影響の評価（滝，堆砂）
- ② 将来の可能性

M-1 小ダム群の可能性（山岳部）

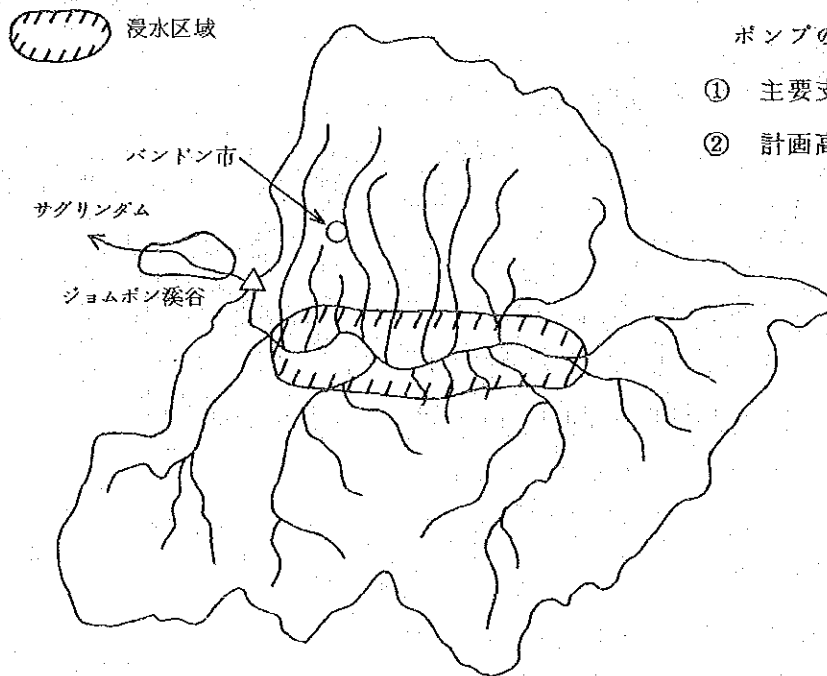
- ① 雨量分布上有効か
- ② ダムサイトが適切にあるか
- ③ 山岳地の流域区分が可能か

M-2 山岳部流域変更ショートカット

M-3 遊水池配置

M-4 通常の河道改修・堤防と内水ポンプの組合せ

- ① 主要支川別流出解析
- ② 計画高水評価



M-10 疎通能力増大（既存計画）

M-11 局部ショートカット（ " ）

M-12 流域貯留施設（雨水貯留）の可能性

- ① 流域基本高水の評価
- ② 大バンドン都市計画への可能性

M-5 南部海への放水路の可能性

- ① トンネル長さとかット流域との効率
- ② ダムナトンネル放水路の可能性

M-6 緊急計画としての拡巾計画及び評価

M-7 緊急計画としての輪中堤+内水

- ① 洪水防除区域の選定
- ② 基本的な構造・コスト

図5-4-1 治水施設計画メニュー検討図

⑥ インドネシア政府既存計画の評価

既存計画資料の分析

各計画の技術的評価

・ショートカット計画

・河道改修計画

・ダイユコロット市関連三州バイパス計画

・その他都市計画，農地計画等関連計画

地域社会的技術評価（用地補償的観点も含めて）

・実施可能性評価（地質・土質的観点も含めて）

・事業費評価

⑦ 緊急計画及び長期計画の考え方

長期計画の位置付け（中期計画，長期計画）

緊急計画の位置付け

⑧ 緊急計画案の確定

緊急計画の具体的内容の確定

⑨ 現地研究会の設置

公共事業省本省，バンドン公共事業局，バンドン工科大学，水工研究局，その他必要とする関係者で，研究会を設置する。

この研究会は，調査団に現地状況資料を提供してもらおうと同時に調査団から技術移転を行う。

⑩ 技術移転

流域管理計画の調査技術

流域洪水防御計画の調査技術

各種治水施設組合せ技術

⑪ 今後の展開へ向けて

水需要特性からの水資源調査

工業・上水と地下水調査

各流域別水質管理計画

河川・下水道計画の総合的展開

5-5. 要員計画

本件調査の主要担当分野は以下のとおりである。

総括（団長），治水計画，土地利用，洪水被害，地形，河川，水文・水理，流出解析，地質，施設計画，施工・積算，社会・経済評価

項目	月																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
準備作業																				
○調査実施方針の																				
決定	■									■										
現地作業																				
○資料収集	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
○補足測量				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
○地質・土質調査				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
解析作業																				
○水文・水理解析																				
／流出解析	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
○洪水防御計画策定				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
○施設の設計，O/M																				
及び施工計画														■	■	■	■	■	■	■
○積算及び評価														■	■	■	■	■	■	■
○F/R作成																				■
報告書																				
○洪水防御計画	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△
○フィージビリティ調査	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△

図5-5-1 調査工程

5-6. 調査資機材の例

	使用目的	機材	備考
1) 基礎的機材	① 現地での調査団の移動 ② 資料・データのジャカルタ 及び日本への送付 ③ 資料・データの複写 ④ 流出解析・文書作成	四輪駆動車 2台 ファンクス コピー バリコン 1台 トランシット レベル ステアールテープ 箱 尺	現地調達予定
2) 測量用機材	① 既存測量資料の確認 及び補足測量	[粒度分析器 改良型土研式帯流採砂器 A型, B型 簡易採水器 B型 (浮遊砂用) 一軸(3軸)試験機 室内土質試験器 (比重, コンシメンション, 含水比, 密度)]	
3) 地質・土質 調査用機材	① 流域土砂流出調査 ② 提体, 河道土質調査	転倒マス式自記雨量計 数カ所 [水研62型水位計 自記水位計]	購送予定 購送予定
4) 水文流出 観測用機材	① 雨量分布観測 ② 主要流域の 流量臨時観測	[携帯用実体鏡 2台 机上型実体鏡 1台]	
5) 航空写真 解析用機材	① 航空写真立体視		

VI 参 考 资 料

6-1 インドネシア共和国政府の Terms of Reference

COMPREHENSIVE WATER RESOURCES DEVELOPMENT STUDY AND FEASIBILITY
FOR URGENT FLOOD CONTROL OF THE UPPER CITARUM BASIN.

1. Project Title : Comprehensive Water Resources Development Study and Feasibility for Urgent Flood Control of The Upper Citarum Basin
2. Location : West Jawa Province
3. Executing Agency : Directorate General of Water Resources Development, Ministry of Public Works
4. Objectives :
 - (1) To formulate a comprehensive plan of water resources development to support the regional development of the Upper Citarum Basin toward and beyond the year 2000.
 - (2) To formulate a feasible urgent flood control plan to alleviate recurrent inundation along the Citarum and its tributaries.
5. Project Description: The Citarum is the largest river in the West, Jawa Province flowing into the Jawa Sea. The project area covers Bandung City and a 2000 g fertile valley bounded by the newly constructed Saguling Dam. The area is being developed rapidly because of its various functions and as (1) capital of the well developed proving (2) center of industries for textile, food processing, defense, aircrafts etc., (3) education and research, (4) agriculture for paddy, horticulture, inland fish culture etc., (5) recreation and tourism. Shortage of water and conflict of interest among variety sectors have already been experienced. Insuring damage due to recurrent inundation in Bandung and its suburb has become a service problem which hinders development. In valve the above, it is considered necessary to formulate a comprehensive water resources development plan and formulate an effective scheme of flood control for immediate imputation.
6. Scope of Assistance Required:

a. Expert service	:	115 m.m.	=	US\$1,150,000
b. Fellowship	:	15 m.m.	=	US\$ 75,000
c. Equipment	:			US\$ 200,000
				Total
				US\$1,425,000
7. Related to Project Aid

TERM OF REFERENCE
FOR
COMPREHENSIVE WATER RESOURCES DEVELOPMENT
STUDY AND FEASIBILITY FOR URGENT FLOOD
CONTROL OF THE UPPER CITARUM BASIN

WEST JAVA - INDONESIA

OCTOBER, 1983

MINISTRY OF PUBLIC WORKS
DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
DIRECTORATE OF PLANNING AND PROGRAMMING

I. Background and Supporting Information

1. Background of the project

The project area of about 2,000 square kilometers comprises the upper stream region of Sungai Citarum, beginning from its tributaries until the Saguling dam. The area lies in the center of Jawa Barat Province and drains through the valley north-west ward into the Java sea.

There are approximately 70,000 ha of existing paddy field (16,000 ha are irrigated technically), 76,600 ha forest, and 45,400 ha horticulture land.

Sungai Citarum is so important not only for the 2,300,000 population in the upperstream region but also for the whole area under the Jatiluhur Authority.

The increasing trend of urbanization and urban development in the area tend to a critical conditions for its water resources. As shown by increasing demand of urban and industrial water supply, hydro-electric, agriculture and fishery, while the floods happen annually inside and the vicinity of Bandung city and satellite towns in its surroundings.

From the view of all elements, the Government is under heavy pressure to undertake the masterplan and urgent effective measures.

2. Justification of the Project

The variable demands for water resources in the project area tend to increase yearly.

To assure that the water resources should be developed in an effecient and equitable manner it is essential that the overall plan including flood control in the area should be prepared and agreed with all agencies concerned.

The objective of the study are to prepare such a masterplan dealing with various needs toward the year 2000 and to prepare individual projects presented by feasibility study on urgent flood control measures to protect the city of Bandung and its sattellite towns.

3. Institutional frameworks

The executing agency for the study is the Directorate of Planning and Programming, Directorate General of Water Resources Development, Ministry of Public Works. Technical assistance is expected to be provided by overseas aid.

Counterparts and logistics support to the extent necessary for the satisfactory completion of the project will be provided by the Directorate of Planning and Programming and Provincial Public Works of Jawa Barat. Liason with other local government and ministries will be arranged through the counterparts.

4. Preceding Study

The Directorate of Planning of Programming and Provincial Public Works of Jawa Barat have activity been engaged in the basic surveys and studies in the water resources development of the project area.

Main references relevant to the project are listed below:

- i) Rancangan Rencana Kerangka Umum Tata Ruang Metropolitan Bandung (Bandung Raya), June 1983, prepared by Direktorat Tata Kota dan Tata Daerah, Direktorat Jenderal Cipta Karya, Ministry of Public Works.
- ii) Studi Perencanaan Sistim Pengembangan Sumber-sumber Air Wilayah Sungai Citarum, 1982, Direktorat Bina Program Pengairan, Direktorat Jenderal Pengairan, Ministry of Public Works.
- iii) Pekerjaan Penyelidikan Geologi and Mekanika Tanah Bantaran Alur Sungai Citarum Hulu, 1983, Direktorat Bina Program Pengairan, Direktorat Jenderal Pengairan, Departemen Pekerjaan Umum.
- iv) Perencanaan Teknis Pengendalian Banjir Kota Bandung, 1982, Direktorat Sungai, Direktorat Jenderal Pengairan, Departemen Pekerjaan Umum.
- v) Several publication available at the office of Bandung Urban Development Project, Dinas Cipta Karya Propinsi Jawa Barat, Bappeda Jawa Barat and others.

II. Objectives of the Project

- i) Prepare a masterplan for the development of the water resources of the project area including the feasibility study of urgent flood control.
- ii) Recommend a suitable water management system and facilities in the area including review the present plans and reconstruction of the existing facilities for irrigation and fishery.
- iii) Recommend a suitable flood control system in conjunction with the urban drainage and irrigation systems.
- iv) Recommend soil and water conservation measures in the mountainous region and alongside the rivers.
- v) Recommend water utilization monitoring system for the whole project area (including the Saguling dam).
- vi) Recommend regional land use subject to maintaining the environmental quality.

III. Plan of Operation

1. Scope of works

- i) To review the previous studies and existing data relevant to the project objectives.
- ii) To carry out topographic survey needed by the project.
- iii) To carry out hydrological survey and analysis.
- iv) To analyze the existing land use in the project area.
- v) To analyze the recurrent inundation area.
- vi) To assess the existing water utilization.
- vii) To assess the existing water resources schemes.
- viii) To assess the existing and potential hydroelectric schemes.
- ix) To assess the existing utilization and condition of groundwater development.

- x) To evaluate the development policy and program for urban, villages and public housing.
- xi) To assess the existing and potential condition of industry and industrial pollution problems.
- xii) To formulate masterplan for comprehensive water resources development.
- xiii) To rank individual projects covered by the masterplan within its implementation schedule.
- xiv) To identify the feasible measures for urgent flood control
- xiiv) To recommend future actions to be accommodated by the next phase.

2. Time schedule of the study

Month Activity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Field Study	-----																		
Inception Report		x																	
Interim Report				x				x				x				x			x
Draft Final Report																			
Final Report																			

IV. External and Governmental Inputs

1. External inputs

a. Expert service

A total of 115 Man-months of experts service as attached (see Attachment 2) will be required.

Specification and qualification of experts are as follows:

- 1) Team Leader: a civil engineer with long experience in planning and design of multipurpose and comprehensive water resources development project preferably in tropical countries.

- 2) One (1) Hydrologist with experience in planning and design of water resources preferably in tropical countries.
- 3) One (1) Topographic Surveyor with experiences of photogrammetry and cartography in developing countries.
- 4) One (1) Geologist with experience with exploration, aerialphoto interpretation, and planning for water resources development in developing countries.
- 5) One (1) River Engineer with experience in planning, design and maintenance of river improvement projects.
- 6) One (1) Irrigation Engineer with experience in planning, design, and maintenance of irrigation system preferably in tropical countries.
- 7) One (1) Agriculture Engineer with experience in planning, and extension services for agriculture development preferably in tropical countries.
- 8) One (1) Groundwater Engineer with experience in planning and design groundwater development projects.
- 9) One (1) Sanitary Engineer with experience in planning, design and maintenance of urban water supply system, sewerage system and urban drainage in developing countries.
- 10) One (1) Economic Analyst with experience in project evaluation of multipurpose water resources development.
- 11) Specialist as required such as experts in inland fishery, water shed management, hydropower generation, environmental scientiest, etc.

2. Equipment

Equipment needed to implement the studies will be provided by aid. The following is provisional list of equipment which will be required:

- | | |
|---|--------|
| - 4 long chasis 4 wheel drive vehicles | |
| - telemetric system | 1 set |
| - survey equipment | 4 sets |
| - geological instrument for investigation | 2 sets |
| - soil tester | 1 set |

- stereoscope (standard and pocket size)	2 sets
- desktop computer	1 set
- current meter	2 sets
- distance meter	4 sets
- sediment samplers	2 sets
- electrostatic copying machine	1

Estimate cost

1) Expert service of 115 mm	: US\$1,150,000
2) Fellowship of 15 mm	: US\$ 75,000
3) Equipment listed	: US\$ 200,000
	<hr/>
Total	: US\$1,425,000

3. Government inputs

Items of undertakings:

- 1) To provide counterparts and an English speaking typist and draftmen as required.
- 2) To provide necessary furnished office in the project area and to bear its running costs including water, electricity and local telephone charges.
- 3) To provide necessary stationaries and other material which are locally available.
- 4) To provide vehicles for the counterparts.
- 5) To provide four drivers and bear the running cost for the vehicles externally.
- 6) To provide available data, maps and aerophotos as required.
- 7) To carry out supplementary topographical survey and geological investigation as required.
- 8) To exempt import duties which may be imposed on the personal effects the experts and the equipments to brought in for the purpose of study

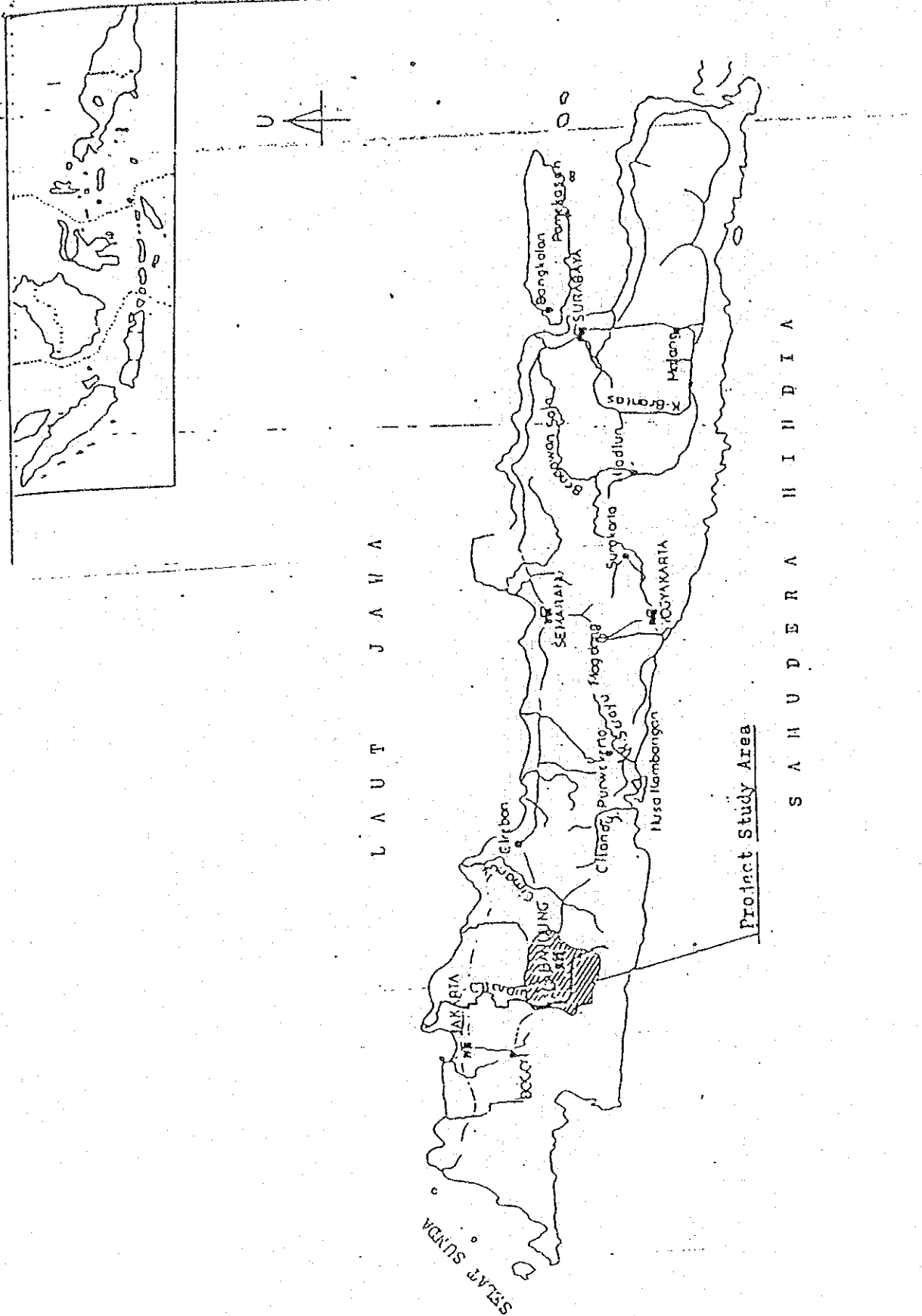
Estimated cost:

Approximately Rp. 200,000,000.-

ATTACHMENT 2

ASSIGNMENT SCHEDULE OF EXPERTS REQUIRED

Expert	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	MM
1) Team Leader	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	20
2) Hydrologist	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	10
3) Topographic Surveyor	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	8
4) Geologist	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	8
5) River Engineer	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	12
6) Irrigation Engineer	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	12
7) Agriculture Engineer	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	12
8) Groundwater Engineer	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	6
9) Sanitary Engineer	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	8
10) Economic Analyst	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	8
11) Specialist	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX	11
TOTAL																					115



S A M U D E R A I N D I A

MINUTES OF MEETING
BETWEEN DGWRD AND JICA PRELIMINARY STUDY TEAM
ON
THE SCOPE OF WORK FOR THE STUDY
ON
THE FLOOD CONTROL PLAN OF THE UPPER CITARUM BASIN

The preliminary Study Team of Japan International Cooperation Agency (JICA) of the Government of Japan for the Study on the Flood Control Plan of the Upper Citarum Basin and the Directorate General of Water Resources Development (DGWRD), Ministry of Public Works, the Government of the Republic of Indonesia exchanged their views concerning the Scope of Work for the Study on the Flood Control Plan of the Upper Citarum Basin.

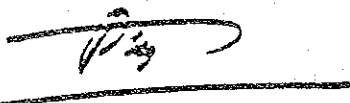
Both sides agreed to adopt the Scope of Work as attached hereto with the following understandings:

- (1) The Study on the Flood Control Plan of the Upper Citarum Basin is considered as an initial stage of Comprehensive Water Resources Development Plan of the Upper Citarum Basin.
- (2) The Flood Control Plan covers the aspects necessary for the river basin management.
- (3) Feasibility study of urgent flood control will be conducted with emphasis on the habitual inundation area in the southern part of Bandung.
- (4) DGWRD strongly requested to JICA to take into account the current budget condition of the Government of Indonesia in conducting the field survey.
- (5) A simple monthly report for the periodical meeting at Bandung will be prepared.
- (6) The involvement of the Institute of Hydraulic Engineering

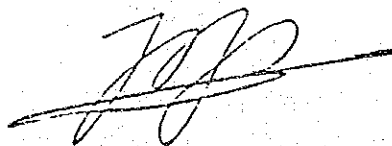
for the Study will be considered.

- (7) JICA Study Team agreed to take into consideration of necessity of training programme during the Study in Japan.
- (8) DGWRD will provide drivers, fuel and maintenance cost while JICA will provide vehicles.
- (9) The Study is expected to commence at the latest on May 1987.

Jakarta, December 11, 1986



IR. PUTRA DUARSA
ASSISTANT DIRECTOR GENERAL
FOR RIVER DEVELOPMENT,
MINISTRY OF PUBLIC WORKS,
GOVERNMENT OF THE REPUBLIC
OF INDONESIA



MR. TOSHIYUKI YAMAGISHI
LEADER OF THE JICA PRELIMINARY
STUDY TEAM,
THE JAPAN INTERNATIONAL
COOPERATION AGENCY

SCOPE OF WORK
FOR
THE STUDY
ON
THE FLOOD CONTROL PLAN
OF
THE UPPER CITARUM BASIN

I. INTRODUCTION

In response to the request of the Government of the Republic of Indonesia, the Government of Japan, in accordance with the relevant laws and regulations in force in Japan, has decided to conduct the Study on the Flood Control Plan of the Upper Citarum Basin in the Republic of Indonesia (hereinafter referred to as "the Study").

The Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programmes of the Government of Japan, will extend technical cooperation, in close cooperation with the authorities of the Republic of Indonesia.

The Directorate General of Water Resources Development, The Ministry of Public Works (hereinafter referred to as "DGWRD") shall act as counterpart agency to the Japanese study team and also as coordinating body to other relevant organizations for the smooth implementation of the Study.

II. OBJECTIVES

The objectives of the Study are:

1. to prepare a flood control plan of the upper Citarum basin,
2. to conduct a feasibility study on an urgent project corresponding to the identified component of the flood control plan, and
3. to perform technology transfer to the Indonesian counterpart personnel.

III. STUDY AREA

The study area will cover the upper Citarum basin (the catchment area of Curug Jompong) which is approximately 2,000 sq. km.

IV. SCOPE OF WORK

1. Collection and Review of Existing Data

- (1) topographical maps, and profile and cross-section maps of the main river and its tributaries
- (2) development plans and socio-economic condition of the study area
- (3) existing flood control measures and facilities
- (4) present land use
- (5) damages caused by flood
- (6) hydrological and meteorological data

2. Field Surveys

- (1) Hydrological and meteorological surveys
- (2) geological survey
- (3) supplementary surveys on profile and cross-section of the river, if necessary

3. Analysis and Examination

- (1) hydrological and hydraulic analysis
- (2) socio-economic feature of the study area
- (3) flood damage analysis

4. Formulation of a Flood Control Plan

- (1) formulation of flood control scheme of the study area
- (2) identification of a project to be urgently implemented

5. Feasibility Study on an Urgent Flood Control Project

- (1) preliminary design
- (2) operation & maintenance plan
- (3) cost estimation and implementation schedule
- (4) evaluation and justification of the project

V. STUDY SCHEDULE

The Study will be executed in accordance with the attached tentative schedule.

VI. R E P O R T S

JICA shall prepare and submit the following reports in English to the Government of Indonesia.

1. Inception Report

Thirty (30) copies within one (1) month from the commencement of the Study.

2. Progress Report (I)

Thirty (30) copies within seven (7) months from the commencement of the Study.

3. Progress Report (II)

Thirty (30) copies within nine (9) months from the commencement of the Study.

4. Interim Report

Thirty (30) copies within fourteen (14) months from the commencement of the Study.

5. Draft Final Report

Thirty (30) copies within seventeen (17) months from the commencement of the Study.
The authorities concerned shall submit their comments within forty-five (45) days after receipt of the draft final report.

6. Final Report

Fifty (50) copies within one and a half (1.5) months after receipt of the comments from the authorities concerned on the Draft Final Report.

VII. UNDERTAKING OF THE GOVERNMENT OF INDONESIA.

The Government of Indonesia shall accord privileges and other benefits to the Japanese study team, and through the authorities concerned, take necessary measures to facilitate the smooth implementation of the Study.

1. DGWRD shall make necessary arrangement with the cooperation of other relevant organizations for the followings:

- (1) to secure the safety of the Japanese study team,

- (2) to permit the members of the Japanese study team enter, leave and sojourn in Indonesia for duration of their assignment therein, and exempt them from alien registration requirements (and consular fees),
 - (3) to exempt the members of the Japanese study team from taxes, duties and other charges on equipment, machinery and other materials brought into Indonesia necessary for the implementation of the Study,
 - (4) to exempt the members of the Japanese study team from income tax and other charges imposed on or in connection with any emoluments or allowances paid to the members of the Japanese study team for their services in connection with the implementation of the Study,
 - (5) to provide necessary facilities to the Japanese study team for remittance as well as utilization of funds introduced into Indonesia from Japan in connection with the implementation of the Study,
 - (6) to provide medical services as needed. Its expenses will be chargeable on the members of the Japanese study team, and
 - (7) to secure permission to take all data, documents and necessary materials related to the Study out of Indonesia to Japan by the Japanese study team.
2. DGWRD shall, at its own expense, provide the Japanese study team with the followings, in cooperation with other relevant organizations:
- (1) available data and information related to the Study
 - (2) counterpart personnel
 - (3) suitable office with necessary equipment in Bandung
 - (4) credential or identification cards
3. The Government of Indonesia shall bear claims, if any arises against the members of the Japanese study team resulting from, occurring in the course of, or otherwise connected with the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or wilful misconduct on the part of the members of the Japanese study team.
4. The Government of Indonesia shall carry out following works:

- (1) topographical survey
 - (2) geological survey
5. The Government of Indonesia shall provide necessary vehicles for the implementation of the Study.

VIII. UNDERTAKING OF JICA

For the implementation of the Study, JICA shall take the following measures :

1. to dispatch as its own expense, study team to Indonesia,
2. to provide equipment necessary for the Japanese study team, and
3. to perform technology transfer to the Indonesia counterpart personnel in the job site in Japan in the course of the Study.

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IX. CONSULTATION

JICA and DGWRD will consult each other in respect of any matter that is not mentioned in this document and may arise from or in connection with the Study.

TENTATIVE STUDY SCHEDULE

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Study in Indonesia																					
Study in Japan																					
Reports																					

▲ Inception Report

▲ Progress Report (I)

▲ Progress Report (II)

▲ Interim Report

▲ Draft Final Report

▲ Final Report

6-3. 既存資料リスト

(測量関係)

- (1) 縦横断図・平面図 (Scale n=1:1000, v=1:100)

UPPER CITARUM 本川 (PART I)

UPPER CITARUM 本川 (PART II)

- (2) 平面図 (Scale 1:20,000)

UPPER CITARUM 本川

UPPER CITARUM 本川, 右支川

- (3) 縦断図 (Scale 1:50,000)

UPPER CITARUM 本川

(地形図関係)

- (1) 地形図 (Scale 1:50,000)

UPPER CITARUM BASIN

この地形図の収集リストを
あてあかす見当りません

(水文観測関係資料)

- (1) 雨量観測所位置図
(2) 雨量観測所番号コード
(3) 水位観測所位置図
(4) 水位観測データ例
(5) 水位-流量観測データ例
(6) 流量観測データ例

(流出土砂関係資料)

- (1) 浮遊砂観測資料

(氾濫関係資料)

- (1) 氾濫図 (1984~1986), 写真(1984)
(2) 1986.3洪水流量観測データ例
(3) 1986.3洪水雨量観測データ例

(地表植生関係資料)

- (1) 森林図

(利水関係資料)

- (1) 取水地点名
(2) 取水地点図

(ダム関係資料)

- (1) JATILUHUR AUTHORITY (1984) (パンフレット)
- (2) ジャティルフルダム及び電力プラント説明書
- (3) ジャティルフルダム設計諸元
- (4) チタラダム計画概要

MINISTRY OF PUBLIC WORKS

Assistant Director General

1. Ir. K. Putra Duarsa Assistant Director General for River
Development

Directorate General of Water Resources Development

Directorate of Planning and Programming

2. Ir. Sarbini Ronodibroto Director
3. Drs. Tata Sukarta Chief, Administration Division
4. Ir. Mohamad Sidharto Chief, Sub-Directorate of River Basin
Development Planning
5. Drs. Djoko Sarjono Chief, Sub-Directorate of Foreign Aid
Administration
6. Ir. Suharto, Dipl. HE Chief, Survey Section
7. Ir. Mr. Aziz Booking Chief, Bilateral Aid Section
8. Ir. B. Pramono Chief, Section II
9. Ir. Djumpono, M. Eng. Staff

Directorate of Rivers

10. Ir. Hartono Pramudo, Dipl. HE Director
11. Ir. Siswoko, Dipl. HE Chief, Design Section I
12. Ir. Edi Wahab Sub-Directorate for O & M of Rivers
13. Mr. Kira Sicacahi Staff

West Java Province Regional Office

- | | | |
|-----|-------------------------|--------------------------|
| 14. | Ir. Sadeli Wiramihardja | Head |
| 15. | Ir. A. Hidajat | Manager, Project Citarum |
| 16. | Mr. Rasmoko | Project Citarum |
| 17. | Ir. Svafrudin | Project Citarum |
| 18. | Mr. M. Sumarna | Project Citarum |
| 19. | Ir. Marna | Project Citarum |
| 20. | Ir. Zainal Abidin | Project Citarum |
| 21. | Ir. Rosyid | Project Citarum |
| 22. | Mr. Djaenal | Project Citarum |

JATILUHUR AUTHORITY

- | | | |
|-----|-----------------------------|------------------------|
| 23. | Mr. Citrohardoyo Suhatmanto | Water Management Dept. |
| 24. | Mr. Djarkasih Husen | Public Relations |

JICA