REPUBLIKA NG PILIPINAS
PAMBANSANG KORPORASYON SA ELEKTRISIDAD
(NATIONAL POWER CORPORATION)

REPORT
FOR
STUDY ON HYDROPOWER POTENTIALS IN LUZON ISLAND

APPENDIX - A

AUGUST 1987

JICA

JAPAN INTERNATIONAL COOPERATION AGENCY

CONTENTS OF APPENDIX – A

HYDROLOGY

HYDROLOGY

CONTENTS

Region I (1/2)

River ID #	River Name	NWRC Code #	NPC Code #	Catchment (km^2)
100100	San Jose			70
100200	Aringay	044		507
100300	Naguilian	043		528
100400	Caba			85
100500	Barorok	042		191
100600	Gantay			78
100700	Maragayap			60
100800	Darigayos			117
100900	Barobor			25
101000	Amburayan	041	088	1,095
101001	Bakum			
101100	Chico			273
101200	Dili			26
101300	Padaoi			36
101400	Bayogao			24
101500	Buaya	040		228
101600	Oaig Daya			52
101700	Bucong			127
101800	Candon			40
101900	Narvacan			22
102000	Santa Maria	039		300
102100	Salvec			162
102200	Abra	036	036	5,085
102201	Tineg	038		
102202	Binongan	037		
102203	Malanas			
102204	Baay			
102205	Ikmin			
102206	Utip			
102207	Balasean			
102300	Mestizo			18
102400	Vigan			95
102500	Sta. Catalina			115

Region I(2/2)

River ID #	River Name	NWRC Code #	NPC Code #	Catchment (km^2)
102600	Parsua			16
102700	Bicol			32
102800	Lapog			33
102900	Lupting			47
103000	Cabugao			75
103100	Sapitang			22
103200	Sinait			41
103300	Badoc			17
103400	Tibangran			241
103500	Curimao			36
103600	Quigot	035		273
103700	Laoag	034		1,320
103701	Cabugaon			
103702	Bornay			
103800	Bacarra			38
103900	Vintar	033		672
104000	Pasuquin			84
104100	Sto. Domingo			25
104200	Bocal			12
104300	Nubla			30
104400	Tulnagan			24
104500	Boraon			45
104600	Banban	032		147
104700	Bulu	031		236
104800	Cabacanan			42
104900	Caparispisan			12
105000	Caunayan			37
105100	Pansian			20
105200	Pasaling			47

Region II (1/3)

River ID #	River Name	NWRC Code #	NPC Code #	Catchment (km^2)
200100	Centenela Pt.	030		265
200200	Pata Pt.			64
200300	Bangan			51
200400	Pamplona			71
200500	Gattu	029		735
200501	Marag			
200600	Abulog	028	016	3,024
200601	Apayao			
200700	Linao	027		284
200800	Cagayan	001	100	28,095
200801	Zinundungan	002		
200802	Dummon	003		
200803	Chico	004	011	
200804	Matalag	005	032	
200805	Saltan	006	018	
200806	Tanudan	007	024	
200807	Paret	008	021	
200808	Pinacanauan de Tuguegarao	009	025	
200809	Pinacanauan	010		
200810	Balasig	011		
200811	Tumauini	012	026	
200812	Siffu	013	019	
200813	Mallig		101	
200814	Ilagan	014	080	
200815	Abuan	015		
200816	Disabungan	016		
200817	Magat	017	017	
200818	Taotao	018		
200819	Alimit	019	031	
200820	Ibulao	020		
200821	Lamunit	021		
200822	Matuno	022	030	
200823	Sta. Cruz			

Region II (2/3)

River ID #	River Name	NWRC Code #	NPC Code #	Catchment (km^2)
200824	Sta. Fe			
200825	Gunano	024		
200826	Addalam	025	074	
200827	Dibuluan	026		
200828	Conwap			
200829	Casecanan		029	
200900	Apragonan			255
201000	Banurbur (Buguey)			152
201100	Gulasing			108
201200	Mission			86
201300	Aunugay	045		126
201400	Tapel			85
201500	Baua	046		135
201600	Nacaragaddan			65
201700	Casambalangan			15
201800	Diora			30
201900	Palawig	047		166
202000	Tangatan			30
202100	Gotan			37
202200	Barraibi			44
202300	Patunungan			42
202400	Labig			43
202500	Apulagon			32
202600	Magui			32
202700	Linawan			95
202800	Tabuan			78
202900	Pageglan			30
203000	Macarabur			22
203100	Ninauan			32
203200	Tabuan	048		372
203300	Valley Cove			53
203400	Baguio			28
203500	Ilang-Ilang			20
203600	Dulang			87
203700	Lobod			46

Region II (3/3)

River ID #	River Name	NWRC Code #	NPC Code #	Catchment (km^2)
203800	Bolos			69
203900	Dikatayan	049		284
204000	Oway			85
204100	Masalansan			53
204200	Dikotongladen	050		134
204300	Dirinamaran			127
204400	Dilacnadanom			103
204500	Disukad			20
204600	Dimapnat			48
204700	Palanan	051		805
204800	Debenbenan			65
204900	Digollorin			48
205000	Dimatatno Point			48
205100	Lukban			120
205200	Kanamuan			182
205300	Dinapiqui			30
205400	Ditubo			65
205500	Lasapsapan			216

Region III (1/3)

River ID #	River Name	NWRC Code #	NPC Code #	Catchment (km^2)
300100	Casiguran	052		260
300200	Gomanginang			33
300300	Dibel			38
300400	Calabgan			85
300500	Talagas			65
300600	Sangab			70
300700	Ditauini			40
300800	Jagdawan			53
300900	Dinajawan			73
301000	Dibulonan			93
301100	Delali			60
301200	Dipaculao			45
301300	Cabatangan	053		600
301400	Baler			150
301500	Disalit			148
301600	-			68
301700	-			53
301800	-			48
301900	-			110
302000	-			58
302100	Dingalan			51
302200	Imulat			115
302300	Umiray	054		626
302400	Idlang			52
302500	Pampanga	059		11,196
302501	Angat	055	012	
302502	Penaranda	056		
302503	Coronel	057		
302504	Digmala			
302505	Carranglan	058		
302506	Talavera		149	
302507	Rio Chico			
302508	San Fernando			

Region III (2/3)

River ID #	River Name	NWRC Code #	NPC Code #	Catchment (km^2)
302600	Caulaman			255
302700	Colo			717
302800	Hermosa			61
302900	Orani			83
303000	Pilar	060		178
303100	Orion			61
303200	Miray Cr.			29
303300	Lamao			58
303400	Amo			40
303500	Alasasin			70
303600	Mariveles			53
303700	Agloloma			54
303800	Dinuangan			49
303900	Panayan			54
304000	Umagol			75
304100	Batalan			20
304200	Bayandati			50
304300	Moron	061		80
304400	Sta. Rita			73
304500	Calapandayan			121
304600	Marelalec			63
304700	Cawag			59
304800	Agusuhin			33
304900	Silanguin			35
305000	Wildhorse Cr.			24
305100	Deer Cr.			20
305200	Pundaquit			18
305300	Pantawan	062		154
305400	Sto. Tomas	063		438
305500	Anonang			255
305600	Dalayan			66
305700	Bucao	064		748
305800	Bancal	065		188
305900	Bagsit			148

Region III (3/3)

River ID #	River Name	NWRC Code #	NPC Code #	Catchment (km^2)
306000	Pedro			44
306100	Alasa			120
306200	Bunga			88
306300	Lawis	066		455
306400	Agnacon			44
306500	Pinalabanan			154
306600	Nayom			155
306700	Banog			65
306800	Bayambang	067		313
306900	Eguia			50
307000	Dasol			135
307100	Lotuan			61
307200	Baruan			84
307300	Balineaguan	068		358
307400	Balingasay			485
307500	Alaminos	069		218
307600	Masedem (Barcadero)			86
307700	Agno	070	002	6,287
307701	Camiling	071		
307702	O. Donnel(Tarlac)	072		
307703	Bulsa	073		
307704	Ambayadan	073	084	
307800	Dagupan	074		573
307900	Sinocalan	075		901
307901	Tagamusing			

Region IV (1/4)

River ID #	River Name	NWRC Code #	NPC Code #	Catchment (km^2)
400100	Palasan Cr.			44
400200	Magnoc			39
400300	Depalyon			50
400400	Masla			35
400500	Tamala Cr.			33
400600	Viguig			41
400700	Agos	108	033	961
400701	Kaliwa			
400800	Munting Sabang			104
400900	Kinanliman			24
401000	Tignoan	107		103
401100	Labayat	106		106
401200	Dalavinan			61
401300	Tayabas			80
401400	Macabagan			53
401500	Pigpi			53
401600	Ginabihan			74
401700	Lagimbayan Malaki	105		90
401800	Bajao			38
401900	Mauban			25
402000	Maapon	104		151
402100	Lugan	103		99
402200	St. Lucia	102		111
402300	Biogan			44
402400	Atimonan			115
402500	Salin			33
402600	Macbuhan			36
402700	Gumaca			34
402800	Hagakhakin			19
402900	San Vicente			34
403000	Lopez			133
403100	-	101		123
403200	Calauag	100		210
403300	Quezon Canal(Tabogon)			33

Region IV (2/4)

River ID #	River Name	NWRC Code #	NPC Code #	Catchment (km^2)
403400	-			245
403500	Kilbay	112		328
403600	Dapdap			46
403700	Inas			95
403800	Vinas	099		188
403900	Capuluan			96
404000	Peris			131
404100	Guinhalinan	098		155
404200	Campiton Cr.			81
404300	Bicol			93
404400	Bahay	097		61
404500	Fuay Cr.			69
404600	Yabahan	096		43
404700	Pagsajan	095		103
404800	Batanlog			35
404900	Silongin	094		120
405000	Bondo			73
405100	Ayoni			104
405200	Matataja			89
405300	Mulanay			78
405400	Catanuan	093		213
405500	Cutcutan Cr.			70
405600	Hingoso			95
405700	Macalelon	092		163
405800	Mayuboc			70
405900	Lagalag			58
406000	Kalilayan			153
406100	Cabuyao			56
406200	Yawe			30
406300	Marao			33
406400	Cabog			23
406500	Binahaan			26

Region IV (3/4)

River ID #	River Name	NWRC Code #	NPC Code #	Catchment (km^2)
406600	Palsabangan			26
406700	Pacbilao			25
407800	Tayabas			101
406900	Morong	091		199
407000	Sariaya			91
407100	Lanagdong			100
407200	Lagnos	090		849
407300	Boibok	089		107
407400	Bignay			53
407500	Bombong			21
407600	Garban			74
407700	Laiya			30
407800	-			23
407900	-			15
408000	Rosario	088		226
408100	Banali			44
408200	-			28
408300	Pinamucan			56
408400	Malitam			69
408500	Kalumpang	087		389
408600	Manginao			71
408700	Mojon			48
408800	-			51
408900	-			44
409000	Pansipit	086		755
409100	Colong-Colong			38
409200	Payay Cr.			58
409300	Bolbok Cr.			44
409400	Dacanlao			43
409500	Benabang	085		140
409600	-			41
409700	Santiago			91
409800	Bigaa			41

Region IV (4/4)

River ID #	River Name	NWRC Code #	NPC Code #	Catchment (km^2)
409900	Wawa			34
410000	Lian	084		250
410100	Balaytigue			23
410200	Looc			55
410300	Cutad			30
410400	Bayabay			40
410500	Maragondon	083		318
410600	Balsahan			151
410700	Alemang			24
410800	Timalan			30
410900	Calibuyo			24
411000	Canas			130
411100	San Juan			125
411200	Imus			157
411300	Zapote			91
411400	Canalez			65
411500	**Pasig**	076	020	4,049
411501	Marikina	077	068	
411502	Mayor	078		
411503	Pagsanjen	079		
411504	Sta.Cruz	080		
411505	San Juan	081		
411506	San Cristobal	082		

Region V(1/4)

River ID #	River Name	NWRC Code #	NPC Code #	Catchment (km^2)
500100	Angas			26
500200	Santol			68
500300	Del Pilar			79
500400	Bunot			44
500500	Calaboca			45
500600	Mactang			45
500700	Camagsaan			43
500800	Balud-Balud			86
500900	-			54
501000	Alasanin			36
501100	Panang			25
501200	Mangrove Point			49
501300	Magsimato			115
501400	Matogdon	110		988
501401	Labo			
501500	Daet	111		275
501600	Matoogtoog			73
501700	Culasi			30
501800	Mangaras Point			33
501900	Manga			115
502000	Bicol	114		2,965
502001	Sipocot			
502100	Inagyanan			63
502200	Tigman			60
502300	Caaluman			61
502400	Himoragat			215
502500	Bayang			51
502600	Panasan			213
502700	Maslog (Sitio)			24
502800	Tambang	116		154
502900	Guibahoy			73
503000	Pulpog			93
503100	Bahi			46
503200	Catanagan			150

Region V (2/4)

River ID #	River Name	NWRC Code #	NPC Code #	Catchment (km^2)
503300	Tabagon			39
503400	Oroc-Osoc			50
503500	Manapon			65
503600	-			26
503700	Cobacognan (Sitio)			24
503800	Cabugo Bay (mouth)			18
503900	Licongcong			30
504000	Rabel			93
504100	Orocosoc			30
504200	Cagayag			63
504300	Lagonoy	117		243
504400	Quinarag			71
504500	Sagnay			204
504600	Ford (Sitio)			30
504700	Mayon			25
504800	Barit			33
504900	Visitang			41
505000	Gajo			43
505100	Quinale	118	055	205
505200	San Vicente			70
505300	Bacalayon			51
505400	Basud			51
505500	Yawa			125
505600	Joracpon (Sitio)			43
505700	Ticman			125
505800	Malabago (Sitio)			25
505900	Buyo			44
506000	Cavit (Sitio)			35
506100	Bayong			24
506200	Parang			23
506300	Maigang			53
506400	Malabong Creek			22

Region V (3/4)

River ID #	River Name	NWRC Code #	NPC Code #	Catchment (km^2)
506500	Calao			63
506600	-			61
506700	Layog			40
506800	Calagoto			55
506900	Buhang			45
507000	Tawog Creek			25
507100	Hinabayan Creek			25
507200	Bulusan			18
507300	Patubayan			24
507400	Talaonga (Sitio)			26
507500	Matnog	125		95
507600	Buhol			51
507700	Ginablan			25
507800	Hinablan			24
507900	Suja	124		86
508000	San Ramon	123		75
508100	Banuangdoan			58
508200	Guibalon			21
508300	Caditaan			39
508400	Pulangduta			69
508500	Cadalan			24
508600	San Francisco	122		205
508700				29
508800	Namuat			43
508900				83
509000				28
509100	Cawayan Creek		010	35
509200	Rizal			38
509300	Menito			33
509400	Dulangan			83
509500	Macalaya			71
509600	Pilar			154

Region V (4/4)

River ID #	River Name	NWRC Code #	NPC Code #	Catchment (km^2)
509700	Cumadcad	121		121
509800	Ogod	120		215
509900	Donsol	119		365
510000	Sibago			58
510100	Buenavista			30
510200	Panganiran			25
510300	Bagalayog Point			76
510400	Badian			55
510500	Dawagan			40
510600	Nagas			39
510700	Itagnan			35
510800	Hamoraon			18
510900	Macabugas			23
511000	Unknown			25
511100	Bual (Sitio)			28
511200	Ngaran			71
511300	Mapatos			22
511400	Caranan			79
511500	Calibayan (Sitio)			69
511600	Tinalmud	115		119
511700	Caima			70
511800	Ragay	113		210
511900	Paculago			49
512000	Omon			103
512100	Comagaycay			34

INVENTORY OF STREAMFLOW KEY STAIONS

HR	ID No.	Station Name	River System	Location		D.A. (Sq. km.)
				Lat.	Long.	
A	42005NW203	Atok	Abulog	18-12-15	121-21-30	2,066
B	41003NW102	Bangay	Laoag	18-05	120-42	534
	41008NW106	Bumagcat	Abra	17-37-40	120-42-40	2,575
C	42020NW225	Larion	Cagayan	17-37-30	121-46-15	655
	42044NW244	Pangal	Cagayan	16-36-12	121-40-25	4,244
	42055NW	Bato	Cagayan	16-25-54	121-07-00	1,784
	42063NP	Basao	Cagayan	17-14-18	121-07-21	874
D	41017NW114	Mamat-ing	Bauang	16-35-16	120-25-00	304
	43017NW325	Guisguis	Nayom	15-48-31	119-58-48	128
E	43009NW326	Baluarte	Carranglan	15-58-00	121-03-14	258
	43052NW361	Sta. Ines	Pampanga	15-09-15	121-04-12	204
	43093NP	Ambuklao H.E. Plant	Agno	16-28-42	120-44-45	690
F	44001NW3118	Diamman	Cabatangan	15-44-09	121-24-48	242
	44021NW418	Magdalena	Laguna	14-12-24	121-26-33	116
G	44025NW417	Calumpang	Laguna Lake	14-11-55	121-26-30	103
H	44003NW430	Banugao	Agus	14-45-15	121-36-45	879
	45001NW501	Matogdon	Labo	14-08-53	122-50-18	28
I	45039NW529	Bibongsuran	Bicol	13-14-00	123-31-30	164
J	—					

Remarks: HR - Hydrological Region

MONTHLY STREAMFLOW DATA

GAGE ID	: 4-1-003-NW-102		
NAME OF STATION	: BANGAY DINGRAS	NAME OF RIVER SYSTEM	: LAOAG
NAME OF PROVINCE	: ILOCOS NORTE	NAME OF RIVER	: BONGA
CATCHMENT AREA (SQ.KMS.)	: 534.0	WATER RESOURCES REGION	: I
LATITUDE	: N 18-05-00	RECORD PERIOD (YEARS)	: 34 (1946-1979)
LONGITUDE	: E 120-42-00	RECORD NUMBER	: 3
FILING TYPE	: EXISTING FILE, NEW ADDRESS		

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1946	-1.	-1.	-1.	2.	3.	25.	50.	53.	29.	20.	10.	7.
1947	5.	3.	2.	1.	2.	28.	26.	38.	32.	148.	80.	20.
1948	8.	4.	2.	2.	3.	28.	72.	38.	50.	12.	44.	30.
1949	8.	5.	3.	2.	2.	8.	28.	34.	181.	135.	12.	15.
1950	6.	4.	3.	3.	3.	24.	82.	102.	75.	55.	33.	19.
1951	16.	12.	11.	10.	20.	49.	106.	88.	119.	21.	8.	6.
1952	4.	3.	2.	2.	10.	20.	17.	59.	58.	18.	18.	10.
1953	3.	1.	1.	2.	5.	88.	49.	81.	50.	28.	57.	15.
1954	7.	5.	3.	4.	9.	27.	42.	81.	95.	49.	28.	6.
1955	5.	5.	4.	3.	3.	9.	40.	40.	18.	14.	15.	10.
1956	5.	4.	3.	2.	8.	20.	30.	80.	106.	28.	13.	9.
1957	6.	5.	4.	3.	3.	65.	49.	79.	150.	30.	20.	8.
1958	5.	4.	3.	2.	3.	43.	52.	46.	77.	41.	8.	4.
1959	3.	3.	3.	2.	3.	5.	25.	72.	50.	9.	26.	3.
1960	3.	3.	4.	3.	5.	12.	14.	77.	32.	18.	7.	5.
1961	4.	3.	3.	3.	4.	17.	153.	140.	48.	21.	8.	5.
1962	4.	3.	2.	2.	2.	26.	171.	145.	79.	48.	27.	21.
1963	15.	9.	5.	2.	2.	114.	144.	80.	108.	8.	4.	4.
1964	4.	4.	4.	2.	7.	33.	28.	194.	196.	32.	21.	27.
1965	11.	7.	5.	2.	15.	72.	69.	32.	76.	43.	17.	7.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID : 4-1-003-NW-102
NAME OF STATION : BANGAY DINGRAS

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAN	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1966	5.	4.	3.	2.	5.	8.	20.	125.	46.	10.	14.	7.
1967	2.	3.	2.	4.	1.	125.	94.	116.	146.	32.	9.	7.
1968	5.	3.	2.	2.	2.	6.	27.	61.	80.	21.	6.	4.
1969	3.	3.	2.	2.	5.	21.	9.	37.	40.	40.	12.	7.
1970	5.	4.	3.	2.	2.	21.	13.	24.	25.	25.	23.	9.
1971	2.	2.	1.	1.	1.	2.	42.	31.	15.	25.	5.	3.
1972	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.
1973	3.	3.	3.	3.	3.	4.	6.	8.	19.	43.	3.	1.
1974	1.	1.	1.	1.	1.	4.	2.	30.	38.	70.	31.	1.
1975	1.	2.	7.	7.	5.	16.	13.	48.	7.	7.	3.	2.
1976	1.	1.	1.	1.	14.	16.	32.	23.	37.	24.	16.	8.
1977	1.	1.	1.	1.	1.	-1.	-1.	19.	-1.	-1.	-1.	0.
1978	-1.	1.	1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.
1979	-1.	0.	-1.	-1.	1.	1.	4.	1.	1.	1.	1.	1.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID	: 4-1-008-NW-106		
NAME OF STATION	: BUNMAGCAT TAYUM	NAME OF RIVER SYSTEM	: ABRA
NAME OF PROVINCE	: ABRA	NAME OF RIVER	: ABRA
CATCHMENT AREA (SQ.KMS.)	: 2575.0	WATER RESOURCES REGION	: I
LATITUDE	: N 17-37-40	RECORD PERIOD (YEARS)	: 20 (1958-1977)
LONGITUDE	: E 120-42-40	RECORD NUMBER	: 5
FILING TYPE	: EXISTING FILE, NEW ADDRESS		

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAN	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1958	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	49.
1959	32.	21.	21.	16.	56.	110.	200.	288.	269.	101.	203.	85.
1960	40.	31.	27.	39.	70.	107.	94.	725.	288.	243.	63.	31.
1961	18.	15.	16.	-1.	-1.	-1.	-1.	-1.	377.	217.	66.	41.
1962	31.	27.	27.	29.	37.	119.	732.	487.	547.	125.	52.	35.
1963	25.	19.	16.	15.	26.	200.	318.	203.	553.	120.	55.	42.
1964	31.	25.	25.	33.	64.	148.	108.	478.	549.	169.	119.	108.
1965	48.	32.	25.	32.	67.	163.	249.	175.	195.	101.	52.	35.
1966	27.	24.	24.	27.	81.	85.	97.	258.	202.	60.	57.	44.
1967	31.	25.	24.	33.	33.	469.	226.	309.	301.	423.	87.	40.
1968	29.	-1.	17.	13.	30.	78.	337.	633.	664.	209.	47.	37.
1969	33.	29.	28.	31.	59.	129.	397.	176.	187.	196.	53.	46.
1970	44.	37.	38.	47.	135.	203.	123.	244.	295.	116.	78.	53.
1971	42.	37.	30.	25.	33.	82.	475.	300.	230.	308.	76.	60.
1972	48.	33.	30.	39.	79.	98.	1313.	438.	105.	62.	39.	32.
1973	30.	30.	30.	30.	56.	67.	68.	97.	147.	297.	60.	45.
1974	42.	43.	43.	44.	44.	51.	-1.	309.	208.	516.	326.	59.
1975	35.	34.	33.	36.	68.	111.	116.	237.	116.	87.	34.	35.
1976	33.	33.	36.	35.	159.	245.	378.	-1.	112.	115.	51.	36.
1977	31.	25.	18.	19.	31.	65.	-1.	-1.	-1.	-1.	-1.	-1.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID	: 4-1-017-NW-14		
NAME OF STATION	: MAMAT-ING NAGUILIAN	NAME OF RIVER SYSTEM	: BAUANG
NAME OF PROVINCE	: LA UNION	NAME OF RIVER	: NAGUILIAN
CATCHMENT AREA (SQ.KMS.)	: 304.0	WATER RESOURCES REGION	: I
LATITUDE	: N 16-35-16	RECORD PERIOD (YEARS)	: 35 (1946-1980)
LONGITUDE	: E 120-25-00	RECORD NUMBER	: 14
FILING TYPE	: EXISTING FILE, NEW ADDRESS		

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAN	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1946	-1.	-1.	-1.	-1.	-1.	33.	180.	55.	29.	25.	11.	6.
1947	4.	3.	3.	6.	10.	44.	35.	31.	36.	80.	114.	9.
1948	5.	4.	2.	4.	24.	15.	48.	114.	67.	30.	10.	9.
1949	4.	4.	3.	3.	3.	18.	45.	36.	67.	75.	6.	8.
1950	4.	3.	3.	3.	12.	21.	98.	179.	53.	50.	10.	5.
1951	4.	3.	2.	3.	9.	43.	69.	136.	54.	11.	6.	3.
1952	3.	2.	2.	3.	16.	27.	29.	77.	46.	19.	8.	4.
1953	3.	2.	2.	2.	8.	37.	54.	114.	51.	15.	63.	11.
1954	5.	4.	5.	8.	9.	14.	20.	55.	49.	30.	21.	4.
1955	2.	2.	2.	3.	9.	19.	38.	41.	36.	26.	14.	5.
1956	3.	5.	2.	4.	12.	13.	25.	75.	144.	40.	14.	7.
1957	5.	3.	3.	3.	4.	46.	28.	54.	97.	25.	7.	6.
1958	4.	3.	2.	2.	4.	53.	97.	45.	87.	28.	18.	4.
1959	3.	3.	3.	2.	7.	21.	28.	68.	56.	13.	10.	6.
1960	3.	4.	3.	5.	16.	23.	36.	231.	42.	29.	10.	5.
1961	4.	3.	3.	3.	6.	50.	156.	107.	90.	38.	9.	4.
1962	3.	3.	2.	2.	3.	12.	110.	76.	82.	21.	5.	3.
1963	2.	2.	2.	2.	3.	100.	66.	35.	185.	17.	7.	4.
1964	3.	2.	2.	2.	9.	42.	22.	206.	96.	47.	20.	15.
1965	5.	3.	4.	5.	34.	83.	88.	64.	55.	29.	11.	5.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID : 4-1-017-NW-14
NAME OF STATION : MAMAT-ING NAGUILIAN

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAN	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1966	3.	2.	2.	2.	45.	40.	51.	107.	159.	23.	14.	8.
1967	5.	5.	3.	5.	6.	57.	27.	150.	82.	64.	96.	4.
1968	3.	3.	2.	2.	2.	5.	55.	145.	134.	33.	4.	3.
1969	3.	3.	2.	2.	8.	45.	114.	72.	108.	46.	11.	5.
1970	3.	3.	2.	2.	21.	47.	36.	79.	84.	26.	14.	6.
1971	5.	4.	2.	1.	4.	36.	98.	98.	53.	30.	2.	1.
1972	2.	2.	2.	2.	10.	40.	174.	63.	33.	13.	4.	3.
1973	2.	2.	3.	2.	8.	20.	39.	58.	35.	51.	6.	2.
1974	1.	1.	1.	1.	1.	2.	17.	-1.	43.	-1.	101.	10.
1975	4.	2.	1.	2.	10.	21.	41.	102.	62.	30.	12.	6.
1976	3.	2.	2.	1.	-1.	-1.	-1.	-1.	51.	29.	13.	8.
1977	6.	4.	2.	2.	7.	11.	-1.	-1.	-1.	9.	2.	1.
1978	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.
1979	-1.	-1.	-1.	-1.	-1.	8.	50.	60.	9.	13.	1.	1.
1980	1.	1.	1.	1.	8.	4.	-1.	-1.	-1.	-1.	-1.	-1.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID	: 4-2-005-NW-203		
NAME OF STATION	: ATOK PUDTOL	NAME OF RIVER SYSTEM	: ABULUG
NAME OF PROVINCE	: KALINGA APAYAO	NAME OF RIVER	: ABULUG
CATCHMENT AREA (SQ.KMS.)	: 2066.0	WATER RESOURCES REGION	: II
LATITUDE	: N 18-12-15	RECORD PERIOD (YEARS)	: 20 (1952-1971)
LONGITUDE	: E 121-21-30	RECORD NUMBER	: 18
FILING TYPE	: EXISTING FILE, NEW ADDRESS		

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1952	237.	133.	72.	37.	45.	48.	59.	179.	254.	420.	403.	454.
1953	205.	52.	35.	29.	31.	46.	70.	217.	134.	125.	351.	591.
1954	160.	208.	123.	71.	37.	52.	65.	154.	181.	408.	709.	333.
1955	298.	107.	80.	62.	56.	58.	66.	105.	164.	413.	-1.	484.
1956	263.	216.	216.	199.	147.	99.	156.	186.	195.	483.	-1.	845.
1957	402.	129.	100.	72.	41.	169.	281.	233.	593.	507.	750.	333.
1958	241.	108.	68.	63.	49.	137.	142.	160.	333.	430.	375.	265.
1959	132.	97.	181.	35.	31.	56.	70.	173.	100.	233.	640.	390.
1960	425.	394.	122.	115.	49.	62.	33.	147.	163.	494.	160.	354.
1961	185.	69.	57.	25.	69.	61.	440.	405.	232.	467.	503.	495.
1962	283.	194.	120.	100.	77.	136.	241.	261.	320.	649.	430.	290.
1963	190.	207.	75.	70.	35.	192.	226.	117.	300.	256.	226.	442.
1964	167.	156.	85.	36.	51.	120.	98.	332.	424.	419.	-1.	255.
1965	273.	194.	79.	51.	75.	206.	353.	141.	260.	110.	130.	226.
1966	106.	40.	80.	59.	181.	154.	129.	210.	208.	328.	411.	432.
1967	369.	109.	47.	189.	22.	236.	664.	461.	393.	569.	553.	332.
1968	227.	162.	98.	96.	61.	172.	223.	778.	354.	417.	339.	259.
1969	195.	80.	49.	21.	10.	51.	181.	142.	7.	74.	102.	191.
1970	212.	296.	329.	40.	10.	179.	196.	127.	163.	405.	924.	453.
1971	1.	0.	0.	12.	71.	75.	26.	311.	324.	802.	1202.	1273.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID	: 4-2-020-NW-225		
NAME OF STATION	: LARION TUGUEGARAO	NAME OF RIVER SYSTEM	: CAGAYAN
NAME OF PROVINCE	: CAGAYAN	NAME OF RIVER	: PINACANAUAN
CATCHMENT AREA (SQ.KMS.)	: 655.0	WATER RESOURCES REGION	: II
LATITUDE	: N 17-37-30	RECORD PERIOD (YEARS)	: 21 (1956-1976)
LONGITUDE	: E 121-46-15	RECORD NUMBER	: 21
FILING TYPE	: EXISTING FILE, NEW ADDRESS		

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAN	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1956	6.	5.	6.	-1.	-1.	-1.	11.	26.	41.	64.	136.	102.
1957	52.	24.	21.	16.	14.	25.	42.	24.	67.	88.	115.	34.
1958	21.	20.	14.	10.	9.	12.	12.	21.	76.	88.	115.	34.
1959	18.	30.	76.	15.	13.	12.	11.	33.	24.	58.	133.	115.
1960	69.	86.	17.	9.	6.	6.	7.	11.	23.	121.	39.	38.
1961	22.	12.	16.	14.	8.	6.	51.	40.	36.	98.	164.	66.
1962	27.	21.	13.	13.	9.	9.	21.	19.	25.	68.	105.	54.
1963	21.	20.	11.	11.	7.	25.	56.	23.	22.	20.	18.	93.
1964	32.	27.	17.	10.	10.	19.	19.	51.	61.	106.	467.	101.
1965	73.	43.	21.	12.	72.	56.	-1.	-1.	29.	44.	93.	69.
1966	82.	19.	38.	8.	78.	14.	21.	14.	8.	33.	67.	148.
1967	154.	28.	20.	19.	9.	34.	77.	88.	19.	170.	-1.	165.
1968	93.	74.	67.	47.	50.	67.	40.	138.	120.	79.	93.	62.
1969	41.	14.	13.	9.	5.	21.	65.	28.	46.	61.	121.	148.
1970	73.	21.	35.	21.	23.	14.	9.	26.	51.	222.	297.	173.
1971	60.	46.	38.	3.	6.	10.	79.	35.	26.	113.	132.	205.
1972	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.
1973	22.	14.	8.	6.	5.	8.	63.	36.	23.	131.	340.	254.
1974	92.	19.	9.	11.	9.	7.	-1.	-1.	-1.	-1.	-1.	-1.
1975	-1.	-1.	-1.	-1.	-1.	-1.	7.	7.	7.	9.	15.	46.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID : 4-2-020-NW-225
NAME OF STATION : LARION TUGUEGARAO

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAN	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1976	21.	7.	6.	5.	35.	13.	11.	-1.	-1.	22.	105.	-1.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID	: 4-2-044-NW-244		
NAME OF STATION	: PANGAL ECHAGUE	NAME OF RIVER SYSTEM	: CAGAYAN
NAME OF PROVINCE	: ISABELA	NAME OF RIVER	: CAGAYAN
CATCHMENT AREA (SQ.KMS.)	: 4244.0	WATER RESOURCES REGION	: II
LATITUDE	: N 16-36-12	RECORD PERIOD (YEARS)	: 16 (1959-1974)
LONGITUDE	: E 121-40-25	RECORD NUMBER	: 30
FILING TYPE	: EXISTING FILE, NEW ADDRESS		

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1959	137.	123.	282.	73.	57.	25.	39.	109.	140.	108.	900.	439.
1960	382.	587.	206.	114.	82.	177.	170.	372.	270.	725.	254.	288.
1961	221.	132.	164.	58.	117.	87.	239.	171.	203.	355.	563.	474.
1962	230.	145.	108.	135.	87.	60.	239.	339.	283.	314.	710.	427.
1963	230.	219.	98.	60.	24.	239.	221.	592.	345.	202.	131.	556.
1964	32.	26.	25.	23.	32.	44.	38.	78.	98.	70.	182.	160.
1965	467.	222.	126.	87.	65.	79.	319.	192.	384.	228.	350.	282.
1966	190.	148.	105.	67.	563.	219.	223.	295.	209.	115.	874.	827.
1967	525.	174.	124.	174.	56.	91.	105.	368.	402.	644.	1002.	505.
1968	310.	128.	103.	50.	55.	130.	126.	225.	276.	209.	268.	164.
1969	91.	52.	34.	25.	34.	24.	102.	140.	228.	154.	362.	486.
1970	253.	121.	67.	66.	46.	121.	86.	178.	601.	1203.	1053.	819.
1971	276.	212.	463.	175.	302.	523.	505.	78.	214.	873.	1243.	532.
1972	445.	239.	118.	120.	120.	107.	610.	280.	319.	131.	336.	337.
1973	54.	46.	33.	28.	19.	21.	37.	63.	55.	515.	546.	237.
1974	132.	69.	80.	63.	46.	53.	-1.	-1.	-1.	-1.	-1.	-1.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID	: 4-2-055-NW-		
NAME OF STATION	: DATO PAYOMBONG	NAME OF RIVER SYSTEM	: CAGAYAN
NAME OF PROVINCE	: NUEVA VIZCAYA	NAME OF RIVER	: MAGAT
CATCHMENT AREA (SQ.KMS.)	: 1784.0	WATER RESOURCES REGION	: II
LATITUDE	: N 16-25-54	RECORD PERIOD (YEARS)	: 14 (1959-1972)
LONGITUDE	: E 121-07-00	RECORD NUMBER	: 33
FILING TYPE	: EXISTING FILE, NEW ADDRESS		

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAN	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1959	13.	10.	31.	16.	23.	13.	16.	43.	76.	65.	116.	88.
1960	56.	89.	48.	36.	32.	63.	88.	259.	200.	206.	44.	27.
1961	23.	16.	24.	16.	22.	41.	129.	91.	118.	138.	57.	28.
1962	23.	17.	-1.	-1.	43.	60.	184.	102.	207.	39.	108.	31.
1963	12.	16.	9.	6.	7.	90.	96.	144.	170.	82.	60.	57.
1964	32.	26.	-1.	23.	32.	44.	38.	78.	98.	70.	182.	161.
1965	87.	75.	30.	28.	29.	31.	66.	36.	65.	69.	58.	59.
1966	30.	19.	12.	6.	148.	138.	118.	138.	112.	28.	171.	435.
1967	221.	146.	127.	149.	118.	194.	72.	175.	212.	113.	115.	50.
1968	42.	29.	27.	7.	20.	24.	49.	160.	258.	183.	54.	33.
1969	77.	7.	4.	7.	15.	16.	17.	7.	17.	90.	12.	22.
1970	40.	9.	5.	3.	2.	125.	84.	118.	107.	38.	45.	39.
1971	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.
1972	29.	23.	23.	15.	28.	43.	213.	205.	108.	33.	39.	24.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID	: 4-2-063-NP-		
NAME OF STATION	: BASAO	NAME OF RIVER SYSTEM	: CAGAYAN
NAME OF PROVINCE	: MOUNTAIN PROVINCE	NAME OF RIVER	: CHICO
CATCHMENT AREA (SQ.KMS.)	: 874.0	WATER RESOURCES REGION	: II
LATITUDE	: N 17-14-18	RECORD PERIOD (YEARS)	: 50 (1901-1950)
LONGITUDE	: E 121-07-21	RECORD NUMBER	: 36
FILING TYPE	: EXISTING FILE, NEW ADDRESS		

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1901	21.	9.	10.	26.	47.	79.	155.	37.	93.	60.	50.	28.
1902	17.	6.	4.	5.	91.	72.	42.	42.	52.	24.	91.	26.
1903	25.	34.	14.	20.	24.	66.	114.	78.	63.	116.	54.	119.
1904	27.	7.	14.	13.	8.	107.	42.	85.	34.	78.	32.	36.
1905	20.	12.	6.	12.	55.	141.	177.	42.	75.	15.	48.	22.
1906	19.	9.	18.	10.	89.	33.	216.	193.	195.	82.	45.	17.
1907	14.	13.	5.	31.	98.	84.	146.	53.	50.	39.	102.	28.
1908	17.	26.	9.	17.	19.	138.	116.	148.	104.	50.	56.	18.
1909	20.	17.	7.	19.	62.	107.	74.	63.	35.	89.	71.	30.
1910	19.	11.	6.	7.	18.	71.	170.	95.	20.	22.	40.	12.
1911	23.	11.	9.	13.	10.	50.	59.	103.	90.	27.	63.	31.
1912	24.	9.	12.	9.	105.	54.	80.	160.	120.	152.	68.	21.
1913	16.	17.	15.	23.	17.	66.	78.	68.	163.	98.	123.	72.
1914	24.	10.	13.	37.	51.	55.	117.	199.	98.	31.	34.	25.
1915	41.	10.	13.	28.	50.	82.	139.	104.	53.	46.	88.	41.
1916	41.	21.	11.	12.	176.	26.	110.	75.	58.	211.	76.	52.
1917	15.	11.	13.	13.	28.	77.	62.	167.	39.	36.	84.	25.
1918	28.	14.	14.	22.	48.	51.	38.	129.	76.	49.	165.	56.
1919	21.	13.	17.	12.	30.	167.	190.	113.	48.	49.	18.	34.
1920	19.	13.	5.	12.	88.	46.	111.	112.	12.	94.	130.	58.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID : 4-2-063-NP-
NAME OF STATION : PASAO

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAN	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1921	7.	5.	6.	16.	34.	68.	70.	75.	59.	60.	36.	23.
1922	20.	9.	3.	23.	7.	72.	174.	119.	86.	36.	19.	30.
1923	14.	19.	5.	17.	87.	62.	97.	28.	149.	46.	93.	19.
1924	31.	9.	4.	15.	77.	80.	223.	130.	21.	110.	81.	43.
1925	9.	10.	7.	16.	17.	56.	93.	114.	30.	58.	29.	33.
1926	17.	16.	10.	12.	23.	83.	62.	49.	40.	53.	97.	14.
1927	14.	11.	15.	8.	130.	185.	124.	214.	136.	34.	30.	12.
1928	22.	7.	12.	10.	60.	83.	182.	75.	72.	33.	126.	24.
1929	38.	20.	8.	14.	11.	65.	29.	208.	131.	35.	153.	51.
1930	31.	22.	9.	13.	94.	112.	27.	39.	94.	138.	38.	72.
1931	28.	9.	12.	8.	45.	76.	148.	44.	100.	78.	55.	33.
1932	24.	11.	14.	25.	41.	88.	172.	69.	79.	32.	61.	52.
1933	18.	25.	17.	35.	115.	52.	36.	149.	87.	59.	195.	64.
1934	14.	11.	8.	7.	60.	159.	66.	97.	117.	42.	82.	10.
1935	25.	15.	15.	18.	37.	200.	233.	84.	39.	132.	34.	39.
1936	12.	15.	14.	9.	72.	230.	123.	78.	72.	19.	29.	63.
1937	72.	17.	8.	53.	54.	32.	86.	70.	57.	149.	178.	61.
1938	8.	13.	17.	16.	66.	21.	60.	55.	42.	18.	77.	22.
1939	21.	7.	8.	32.	76.	74.	94.	103.	189.	46.	49.	21.
1940	18.	12.	16.	16.	37.	148.	184.	65.	139.	69.	33.	26.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID : 4-2-063-NP-
NAME OF STATION : BASAO

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAN	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1941	10.	10.	4.	13.	86.	44.	65.	54.	28.	83.	22.	18.
1942	17.	10.	3.	9.	17.	84.	32.	92.	34.	42.	29.	20.
1943	13.	13.	9.	15.	9.	66.	74.	105.	324.	84.	71.	50.
1944	36.	18.	12.	17.	55.	29.	120.	123.	115.	76.	37.	70.
1945	17.	11.	14.	9.	84.	42.	113.	100.	132.	182.	106.	27.
1946	10.	9.	5.	10.	19.	38.	97.	118.	28.	50.	24.	30.
1947	20.	10.	4.	23.	9.	32.	72.	153.	75.	48.	77.	18.
1948	10.	16.	12.	12.	35.	102.	37.	74.	81.	32.	17.	18.
1949	17.	18.	6.	18.	32.	57.	117.	63.	168.	128.	79.	15.
1950	29.	17.	7.	4.	29.	53.	51.	39.	26.	10.	167.	80.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID	: 4-3-009-NW-326		
NAME OF STATION	: BALUARTE CARRANGLAN	NAME OF RIVER SYSTEM	: CARRANGLAN
NAME OF PROVINCE	: NUEVA ECIJA	NAME OF RIVER	: CARRANGLAN
CATCHMENT AREA (SQ.KMS.)	: 258.0	WATER RESOURCES REGION	: III
LATITUDE	: N 15-58-00	RECORD PERIOD (YEARS)	: 18 (1958-1975)
LONGITUDE	: E 121-03-14	RECORD NUMBER	: 44
FILING TYPE	: EXISTING FILE, NEW ADDRESS		

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1958	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	3.
1959	2.	1.	1.	1.	2.	1.	3.	11.	12.	9.	55.	5.
1960	3.	2.	2.	1.	2.	12.	7.	52.	21.	40.	3.	3.
1961	2.	1.	1.	1.	2.	8.	71.	23.	17.	18.	5.	3.
1962	2.	1.	1.	1.	1.	2.	41.	11.	24.	14.	5.	3.
1963	2.	1.	1.	1.	1.	16.	15.	26.	46.	12.	5.	5.
1964	1.	1.	1.	1.	1.	5.	8.	32.	20.	22.	16.	12.
1965	4.	2.	2.	2.	4.	7.	62.	11.	27.	12.	6.	3.
1966	2.	1.	1.	1.	18.	4.	3.	5.	8.	4.	7.	7.
1967	4.	2.	2.	2.	1.	20.	17.	27.	33.	24.	13.	5.
1968	2.	2.	1.	1.	1.	2.	6.	23.	32.	10.	1.	2.
1969	1.	1.	1.	1.	1.	3.	15.	35.	17.	7.	3.	3.
1970	2.	1.	1.	1.	1.	12.	10.	16.	23.	17.	7.	5.
1971	2.	1.	1.	1.	3.	8.	17.	22.	22.	17.	10.	5.
1972	2.	1.	1.	1.	3.	7.	17.	20.	21.	16.	10.	4.
1973	1.	1.	0.	0.	-1.	-1.	2.	2.	4.	5.	6.	5.
1974	4.	3.	2.	1.	1.	4.	4.	6.	3.	6.	5.	2.
1975	2.	1.	1.	0.	0.	0.	4.	5.	7.	-1.	-1.	-1.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID	: 4-3-017-NW-325		
NAME OF STATION	: GUISGUIS STA CRUZ	NAME OF RIVER SYSTEM	: NAYOM
NAME OF PROVINCE	: ZAMBALES	NAME OF RIVER	: NAYOM
CATCHMENT AREA (SQ.KMS.)	: 128.0	WATER RESOURCES REGION	: III
LATITUDE	: N 15-48-31	RECORD PERIOD (YEARS)	: 23 (1955-1977)
LONGITUDE	: E 119-58-48	RECORD NUMBER	: 51
FILING TYPE	: EXISTING FILE, NEW ADDRESS		

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1955	-1.	-1.	-1.	-1.	-1.	-1.	-1.	6.	10.	6.	3.	1.
1956	1.	1.	1.	1.	2.	2.	4.	13.	58.	6.	7.	4.
1957	3.	2.	2.	2.	1.	2.	56.	18.	11.	5.	2.	1.
1958	1.	1.	1.	1.	1.	9.	26.	14.	18.	11.	3.	2.
1959	2.	1.	1.	1.	2.	3.	3.	6.	11.	3.	2.	2.
1960	1.	1.	1.	1.	1.	2.	2.	31.	18.	13.	4.	3.
1961	2.	2.	1.	1.	1.	7.	16.	12.	20.	14.	5.	3.
1962	2.	1.	1.	1.	1.	2.	28.	13.	17.	7.	3.	2.
1963	1.	1.	1.	1.	1.	9.	10.	10.	19.	8.	3.	2.
1964	1.	1.	1.	1.	1.	6.	7.	27.	16.	19.	6.	5.
1965	3.	2.	2.	2.	4.	12.	18.	14.	12.	6.	3.	2.
1966	1.	1.	1.	1.	4.	5.	9.	9.	35.	7.	6.	5.
1967	2.	1.	1.	1.	1.	10.	13.	21.	10.	16.	6.	3.
1968	4.	7.	2.	2.	2.	3.	5.	51.	20.	-1.	4.	3.
1969	2.	1.	1.	1.	2.	9.	40.	-1.	14.	8.	4.	2.
1970	2.	-1.	-1.	1.	3.	6.	11.	20.	32.	12.	6.	5.
1971	1.	1.	1.	1.	1.	1.	3.	15.	3.	12.	19.	5.
1972	1.	1.	1.	0.	1.	2.	60.	13.	1.	1.	1.	1.
1973	1.	-1.	-1.	1.	1.	2.	2.	19.	24.	16.	12.	11.
1974	1.	1.	1.	1.	1.	1.	3.	31.	1.	31.	6.	1.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID : 4-3-017-NW-325
NAME OF STATION : GUISGUIS STA CRUZ

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAN	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1975	11.	10.	7.	8.	9.	8.	9.	18.	13.	10.	5.	3.
1976	2.	1.	1.	1.	21.	13.	20.	20.	27.	11.	9.	7.
1977	5.	5.	4.	4.	5.	11.	12.	13.	55.	12.	12.	8.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID	: 4-3-052-NW-361		
NAME OF STATION	: STA INES SAN MIGUEL	NAME OF RIVER SYSTEM	: PAMPANGA
NAME OF PROVINCE	: BULACAN	NAME OF RIVER	: BALAONG
CATCHMENT AREA (SQ.KMS.)	: 204.0	WATER RESOURCES REGION	: III
LATITUDE	: N 15-09-15	RECORD PERIOD (YEARS)	: 23 (1956-1978)
LONGITUDE	: E 121-04-12	RECORD NUMBER	: 77
FILING TYPE	: EXISTING FILE, NEW ADDRESS		

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1956	1.	1.	1.	1.	2.	1.	3.	10.	25.	10.	10.	12.
1957	2.	1.	1.	1.	1.	4.	20.	25.	17.	14.	13.	1.
1958	1.	1.	1.	1.	1.	3.	4.	5.	32.	12.	4.	1.
1959	1.	1.	1.	1.	1.	1.	2.	24.	13.	4.	6.	2.
1960	2.	1.	1.	1.	1.	7.	3.	27.	17.	16.	2.	1.
1961	1.	1.	1.	1.	1.	4.	11.	27.	43.	10.	5.	2.
1962	2.	1.	1.	1.	1.	4.	60.	8.	15.	4.	5.	2.
1963	1.	1.	1.	1.	1.	26.	7.	25.	44.	6.	2.	3.
1964	1.	1.	1.	1.	1.	22.	12.	16.	9.	10.	30.	9.
1965	1.	1.	1.	1.	1.	1.	11.	7.	5.	3.	3.	1.
1966	1.	1.	1.	1.	16.	3.	8.	12.	11.	2.	18.	8.
1967	1.	1.	1.	1.	1.	11.	2.	9.	2.	2.	5.	1.
1968	1.	1.	1.	1.	1.	1.	2.	10.	10.	8.	2.	2.
1969	1.	1.	1.	1.	0.	1.	4.	7.	17.	9.	4.	1.
1970	1.	1.	1.	0.	1.	2.	2.	5.	17.	20.	5.	2.
1971	1.	1.	1.	1.	3.	11.	17.	9.	10.	15.	11.	12.
1972	1.	1.	1.	1.	2.	5.	18.	17.	19.	9.	8.	4.
1973	1.	1.	-1.	-1.	1.	1.	8.	12.	9.	20.	11.	10.
1974	9.	7.	6.	-1.	-1.	-1.	3.	10.	9.	12.	12.	11.
1975	9.	8.	7.	6.	4.	4.	13.	13.	-1.	-1.	-1.	-1.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID : 4-3-052-NW-361
NAME OF STATION : STA INES SAN MIGUEL

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAN	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1976	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.
1977	1.	1.	1.	1.	1.	1.	7.	38.	4.	1.	8.	1.
1978	1.	1.	1.	1.	1.	4.	8.	41.	70.	156.	22.	4.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID	: 4-3-093-NP-		
NAME OF STATION	: AMBUKLAO HE PLANT	NAME OF RIVER SYSTEM	: AGNO
NAME OF PROVINCE	: BENGUET	NAME OF RIVER	: AGNO
CATCHMENT AREA (SQ.KMS.)	: 690.0	WATER RESOURCES REGION	: III
LATITUDE	: N 16-28-42	RECORD PERIOD (YEARS)	: 17 (1968-1984)
LONGITUDE	: E 120-44-45	RECORD NUMBER	: 94
FILING TYPE	: EXISTING FILE, NEW ADDRESS		

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1968	11.	6.	3.	1.	7.	15.	89.	188.	273.	89.	17.	9.
1969	6.	4.	2.	3.	12.	21.	114.	122.	74.	56.	21.	16.
1970	11.	5.	5.	6.	11.	45.	32.	64.	110.	93.	48.	48.
1971	14.	11.	11.	4.	9.	36.	132.	144.	61.	143.	39.	32.
1972	21.	11.	10.	8.	27.	40.	476.	241.	77.	30.	20.	11.
1973	6.	3.	2.	4.	15.	18.	29.	51.	54.	112.	34.	18.
1974	12.	8.	6.	7.	6.	62.	36.	167.	68.	258.	167.	50.
1975	23.	13.	9.	7.	18.	22.	19.	94.	66.	46.	22.	19.
1976	15.	7.	5.	1.	105.	144.	160.	63.	62.	39.	16.	32.
1977	11.	2.	5.	5.	7.	9.	46.	62.	125.	35.	31.	14.
1978	9.	5.	6.	9.	5.	20.	36.	166.	152.	117.	53.	22.
1979	10.	8.	9.	7.	17.	28.	44.	73.	42.	47.	19.	13.
1980	7.	5.	8.	5.	14.	9.	89.	50.	87.	46.	158.	20.
1981	10.	5.	5.	7.	14.	59.	75.	98.	74.	42.	62.	25.
1982	9.	6.	7.	10.	4.	9.	63.	88.	63.	51.	22.	14.
1983	13.	8.	5.	2.	1.	4.	11.	68.	27.	36.	16.	6.
1984	5.	2.	5.	6.	23.	26.	39.	195.	93.	38.	27.	12.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID	: 4-4-001-NW-3118		
NAME OF STATION	: DIAMMAN MA AURORA	NAME OF RIVER SYSTEM	: CABATANGAN
NAME OF PROVINCE	: QUEZON	NAME OF RIVER	: CABATANGAN
CATCHMENT AREA (SQ.KMS.)	: 242.0	WATER RESOURCES REGION	: IV
LATITUDE	: N 15-44-09	RECORD PERIOD (YEARS)	: 19 (1955-1973)
LONGITUDE	: E 121-24-48	RECORD NUMBER	: 131
FILING TYPE	: EXISTING FILE, NEW ADDRESS		

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1955	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	13.	11.
1956	8.	10.	20.	21.	14.	9.	8.	15.	15.	46.	60.	35.
1957	18.	8.	3.	3.	2.	4.	8.	7.	8.	12.	44.	7.
1958	7.	7.	7.	2.	2.	3.	1.	7.	8.	11.	10.	7.
1959	6.	5.	12.	4.	4.	3.	3.	4.	4.	7.	24.	20.
1960	15.	13.	9.	8.	7.	10.	7.	40.	15.	28.	15.	12.
1961	14.	12.	10.	9.	19.	12.	26.	15.	15.	14.	13.	10.
1962	12.	10.	11.	9.	8.	7.	25.	11.	38.	11.	28.	18.
1963	14.	19.	12.	10.	10.	19.	24.	28.	36.	23.	18.	30.
1964	25.	23.	18.	23.	16.	21.	47.	32.	27.	28.	45.	63.
1965	13.	5.	2.	2.	20.	2.	16.	12.	14.	11.	18.	10.
1966	11.	6.	3.	3.	42.	5.	23.	20.	25.	19.	63.	19.
1967	11.	11.	9.	8.	7.	9.	14.	23.	17.	17.	43.	12.
1968	12.	10.	11.	9.	6.	6.	11.	11.	19.	17.	14.	12.
1969	11.	7.	5.	5.	3.	4.	6.	6.	15.	16.	16.	13.
1970	11.	8.	6.	10.	9.	10.	11.	11.	18.	-1.	61.	10.
1971	3.	3.	6.	5.	23.	30.	15.	15.	14.	27.	76.	100.
1972	78.	43.	22.	26.	25.	34.	95.	75.	23.	-1.	-1.	-1.
1973	3.	4.	3.	3.	3.	10.	5.	4.	8.	-1.	-1.	-1.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID	: 4-4-003-NW-430		
NAME OF STATION	: BANUGAO INFANTA	NAME OF RIVER SYSTEM	: AGUS
NAME OF PROVINCE	: QUEZON	NAME OF RIVER	: AGOS
CATCHMENT AREA (SQ.KMS.)	: 879.0	WATER RESOURCES REGION	: IV
LATITUDE	: N 14-45-15	RECORD PERIOD (YEARS)	: 28 (1950-1977)
LONGITUDE	: E 121-36-45	RECORD NUMBER	: 133
FILING TYPE	: EXISTING FILE, NEW ADDRESS		

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1950	237.	119.	135.	56.	31.	30.	60.	73.	55.	211.	217.	275.
1951	198.	118.	44.	37.	94.	49.	54.	163.	68.	81.	406.	386.
1952	240.	135.	50.	47.	33.	55.	50.	158.	108.	435.	110.	297.
1953	180.	188.	55.	56.	28.	56.	34.	107.	49.	182.	190.	410.
1954	161.	106.	184.	45.	32.	27.	33.	45.	51.	63.	124.	415.
1955	334.	74.	47.	50.	32.	65.	56.	37.	72.	160.	283.	192.
1956	163.	118.	151.	173.	76.	76.	98.	100.	154.	261.	276.	550.
1957	254.	80.	41.	31.	22.	24.	40.	82.	62.	89.	106.	74.
1958	146.	79.	73.	86.	78.	74.	91.	66.	90.	204.	191.	69.
1959	141.	92.	137.	34.	21.	26.	42.	60.	70.	86.	221.	-1.
1960	154.	183.	55.	47.	70.	88.	77.	239.	140.	248.	190.	192.
1961	196.	155.	119.	77.	101.	76.	65.	61.	112.	198.	290.	118.
1962	167.	133.	78.	77.	35.	35.	99.	79.	203.	113.	207.	186.
1963	148.	162.	81.	70.	25.	48.	62.	104.	143.	113.	107.	193.
1964	154.	152.	126.	80.	45.	66.	96.	114.	116.	120.	316.	298.
1965	194.	114.	71.	31.	27.	27.	68.	58.	73.	144.	224.	307.
1966	101.	76.	30.	21.	74.	32.	34.	37.	84.	196.	284.	261.
1967	202.	77.	74.	56.	45.	65.	51.	106.	79.	64.	223.	183.
1968	150.	150.	149.	98.	33.	29.	49.	91.	94.	128.	132.	79.
1969	82.	35.	43.	27.	16.	13.	37.	58.	69.	70.	112.	301.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID : 4-4-003-NW-430
NAME OF STATION : BANUGAO INFANTA

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAN	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1970	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.
1971	161.	117.	87.	58.	49.	54.	65.	86.	91.	158.	221.	254.
1972	158.	114.	85.	57.	48.	54.	70.	88.	91.	155.	220.	252.
1973	70.	77.	37.	30.	30.	41.	44.	32.	38.	148.	229.	366.
1974	160.	87.	64.	22.	65.	-1.	-1.	-1.	-1.	-1.	-1.	-1.
1975	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.
1976	-1.	-1.	-1.	18.	-1.	68.	65.	72.	76.	71.	249.	190.
1977	175.	159.	913.	37.	31.	22.	80.	65.	97.	75.	230.	101.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID	: 4-4-021-NW-416		
NAME OF STATION	: MAGDALENA BUKAL	NAME OF RIVER SYSTEM	: LAGUNA
NAME OF PROVINCE	: LAGUNA	NAME OF RIVER	: BALANAC (UPPER)
CATCHMENT AREA (SQ.KMS.)	: 116.0	WATER RESOURCES REGION	: IV
LATITUDE	: N 14-12-24	RECORD PERIOD (YEARS)	: 16 (1963-1978)
LONGITUDE	: E 121-26-33	RECORD NUMBER	: 139
FILING TYPE	: EXISTING FILE, NEW ADDRESS		

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1963	8.	10.	6.	7.	6.	6.	6.	17.	17.	8.	8.	15.
1964	14.	11.	10.	9.	8.	14.	13.	11.	11.	11.	16.	11.
1965	7.	6.	13.	10.	9.	8.	11.	11.	10.	12.	13.	12.
1966	7.	5.	5.	5.	11.	4.	6.	4.	4.	5.	17.	12.
1967	13.	12.	11.	8.	5.	7.	5.	9.	11.	12.	19.	10.
1968	7.	5.	4.	4.	4.	6.	4.	4.	6.	10.	8.	6.
1969	4.	4.	3.	3.	2.	4.	7.	5.	6.	8.	8.	18.
1970	11.	7.	6.	5.	3.	4.	6.	5.	10.	28.	29.	16.
1971	8.	7.	7.	6.	6.	6.	7.	8.	11.	11.	16.	13.
1972	9.	7.	7.	6.	6.	6.	7.	8.	11.	11.	16.	13.
1973	9.	7.	7.	6.	6.	6.	7.	8.	11.	12.	16.	13.
1974	9.	7.	7.	7.	5.	6.	7.	8.	10.	12.	15.	13.
1975	9.	7.	7.	7.	5.	6.	7.	8.	10.	11.	15.	13.
1976	9.	7.	7.	7.	5.	6.	8.	9.	10.	11.	15.	13.
1977	9.	7.	7.	7.	6.	6.	8.	9.	10.	11.	15.	13.
1978	9.	7.	7.	7.	6.	6.	8.	9.	10.	11.	15.	14.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID	: 4-4-025-NW-417		
NAME OF STATION	: CALUMPANG LILIW	NAME OF RIVER SYSTEM	: LAGUNA LAKE
NAME OF PROVINCE	: LAGUNA	NAME OF RIVER	: STA CRUZ
CATCHMENT AREA (SQ.KMS.)	: 103.0	WATER RESOURCES REGION	: IV
LATITUDE	: N 14-11-55	RECORD PERIOD (YEARS)	: 25 (1950-1974)
LONGITUDE	: E 121-26-30	RECORD NUMBER	: 142
FILING TYPE	: EXISTING FILE, NEW ADDRESS		

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1950	9.	7.	6.	5.	3.	4.	4.	4.	5.	6.	6.	5.
1951	5.	4.	3.	7.	5.	4.	3.	5.	8.	5.	6.	8.
1952	6.	5.	4.	3.	4.	4.	3.	8.	6.	16.	10.	10.
1953	7.	6.	6.	5.	5.	6.	6.	7.	5.	8.	9.	11.
1954	8.	5.	5.	4.	3.	3.	4.	4.	5.	4.	5.	6.
1955	9.	5.	4.	4.	4.	3.	3.	4.	4.	5.	10.	7.
1956	5.	4.	4.	4.	4.	5.	9.	7.	14.	8.	13.	16.
1957	21.	18.	14.	11.	9.	10.	10.	11.	9.	6.	1.	1.
1958	2.	3.	3.	3.	3.	5.	4.	5.	6.	8.	6.	3.
1959	1.	3.	2.	-1.	-1.	-1.	1.	3.	1.	1.	9.	7.
1960	11.	12.	10.	6.	5.	7.	7.	8.	9.	12.	6.	4.
1961	2.	1.	2.	1.	1.	1.	2.	3.	6.	5.	6.	5.
1962	2.	2.	1.	1.	1.	1.	5.	4.	8.	3.	4.	3.
1963	2.	1.	0.	1.	0.	1.	1.	4.	7.	4.	2.	2.
1964	1.	2.	1.	1.	1.	2.	3.	3.	4.	6.	11.	12.
1965	7.	3.	2.	1.	1.	1.	2.	2.	3.	3.	2.	4.
1966	2.	1.	1.	1.	2.	2.	1.	1.	2.	2.	5.	7.
1967	5.	3.	2.	2.	1.	2.	1.	2.	2.	2.	4.	2.
1968	2.	2.	0.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1969	1.	0.	0.	1.	0.	1.	1.	1.	1.	2.	1.	5.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID : 4-4-G25-NW-417
NAME OF STATION : CALUMPANG LILIW

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1970	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.
1971	5.	3.	2.	1.	3.	6.	7.	2.	1.	8.	6.	14.
1972	9.	3.	2.	1.	1.	3.	9.	7.	7.	5.	9.	7.
1973	2.	1.	1.	1.	1.	2.	1.	1.	2.	5.	10.	12.
1974	9.	7.	4.	2.	2.	2.	2.	4.	1.	4.	-1.	-1.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID	: 4-5-001-NW-501		
NAME OF STATION	: MATOGDON LABO	NAME OF RIVER SYSTEM	: LABO
NAME OF PROVINCE	: CAMARINES NORTE	NAME OF RIVER	: MATOGDON
CATCHMENT AREA (SQ.KMS.)	: 28.0	WATER RESOURCES REGION	: V
LATITUDE	: N 14-08-53	RECORD PERIOD (YEARS)	: 29 (1950-1978)
LONGITUDE	: E 122-50-18	RECORD NUMBER	: 98
FILING TYPE	: EXISTING FILE, NEW ADDRESS		

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1950	-1.	7.	7.	3.	2.	1.	1.	1.	2.	3.	6.	6.
1951	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	5.	-1.	8.
1952	8.	6.	4.	2.	2.	2.	1.	2.	2.	-1.	-1.	-1.
1953	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	2.	1.	2.	5.
1954	5.	4.	3.	2.	2.	1.	1.	3.	1.	3.	5.	8.
1955	11.	6.	4.	3.	3.	3.	3.	2.	2.	3.	7.	5.
1956	3.	4.	5.	5.	3.	2.	2.	2.	2.	3.	8.	17.
1957	10.	5.	2.	3.	1.	1.	2.	3.	2.	4.	11.	4.
1958	6.	3.	2.	2.	2.	1.	1.	1.	1.	13.	7.	9.
1959	7.	5.	5.	4.	3.	4.	2.	2.	2.	4.	4.	5.
1960	7.	11.	2.	2.	2.	1.	2.	1.	3.	5.	4.	6.
1961	5.	2.	3.	2.	2.	3.	1.	3.	4.	4.	5.	6.
1962	5.	3.	3.	9.	7.	1.	3.	1.	2.	2.	4.	6.
1963	6.	5.	3.	2.	1.	4.	2.	3.	3.	4.	4.	7.
1964	5.	5.	2.	1.	1.	1.	3.	2.	5.	6.	10.	5.
1965	5.	5.	5.	4.	3.	1.	1.	2.	2.	4.	4.	3.
1966	6.	3.	3.	2.	2.	1.	2.	2.	1.	2.	2.	7.
1967	8.	4.	4.	2.	2.	1.	1.	2.	3.	2.	7.	2.
1968	8.	4.	5.	2.	1.	1.	1.	1.	1.	1.	1.	-1.
1969	-1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	0.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID : 4-5-001-NW-501
NAME OF STATION : MATOGDON LABO

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAN	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1970	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.
1971	4.	5.	5.	3.	4.	5.	2.	1.	1.	2.	2.	3.
1972	2.	1.	2.	3.	2.	1.	1.	1.	1.	1.	3.	4.
1973	4.	2.	1.	2.	1.	2.	3.	3.	3.	-1.	-1.	-1.
1974	-1.	-1.	-1.	-1.	2.	1.	1.	1.	-1.	-1.	-1.	-1.
1975	-1.	1.	1.	1.	1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.
1976	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	-1.	2.	3.
1977	3.	3.	2.	2.	1.	1.	2.	1.	0.	-1.	-1.	-1.
1978	2.	1.	1.	1.	1.	1.	1.	1.	-1.	-1.	-1.	-1.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID	: 4-5-039-NW-529		
NAME OF STATION	: BIRONGSURAN LIGAO	NAME OF RIVER SYSTEM	: BICOL
NAME OF PROVINCE	: ALBAY	NAME OF RIVER	: CABILOGAN
CATCHMENT AREA (SQ.KMS.)	: 164.0	WATER RESOURCES REGION	: V
LATITUDE	: N 13-14-00	RECORD PERIOD (YEARS)	: 23 (1956-1978)
LONGITUDE	: E 123-31-30	RECORD NUMBER	: 128
FILING TYPE	: EXISTING FILE, NEW ADDRESS		

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1956	-1.	-1.	-1.	-1.	9.	8.	10.	11.	13.	11.	12.	23.
1957	43.	9.	11.	12.	7.	10.	14.	15.	12.	15.	21.	10.
1958	10.	6.	6.	7.	5.	6.	8.	8.	10.	32.	24.	10.
1959	9.	10.	8.	7.	7.	4.	9.	12.	10.	14.	18.	15.
1960	16.	11.	9.	21.	14.	17.	10.	13.	10.	9.	10.	12.
1961	10.	9.	9.	9.	9.	9.	9.	10.	17.	8.	7.	10.
1962	6.	6.	6.	7.	18.	9.	14.	13.	15.	11.	15.	9.
1963	7.	6.	6.	6.	5.	15.	15.	18.	17.	12.	11.	8.
1964	9.	9.	9.	9.	8.	9.	6.	7.	9.	20.	11.	20.
1965	12.	9.	6.	6.	5.	7.	14.	10.	14.	10.	8.	9.
1966	12.	8.	7.	8.	7.	7.	8.	27.	13.	9.	13.	27.
1967	19.	12.	11.	8.	6.	10.	13.	11.	13.	14.	-1.	-1.
1968	-1.	-1.	-1.	-1.	12.	10.	13.	-1.	-1.	-1.	5.	8.
1969	-1.	3.	2.	3.	6.	8.	10.	7.	9.	-1.	-1.	4.
1970	4.	3.	2.	-1.	-1.	7.	-1.	11.	-1.	9.	-1.	-1.
1971	2.	5.	5.	4.	-1.	-1.	13.	-1.	8.	14.	10.	22.
1972	12.	8.	7.	8.	9.	10.	11.	11.	13.	14.	14.	14.
1973	-1.	6.	8.	9.	8.	10.	22.	37.	7.	9.	38.	63.
1974	15.	18.	-1.	-1.	-1.	13.	20.	11.	15.	25.	25.	29.
1975	-1.	-1.	5.	-1.	5.	14.	21.	20.	23.	15.	3.	35.

NOTE : -1 MEANS DATA NOT AVAILABLE

MONTHLY STREAMFLOW DATA

GAGE ID : 4-5-039-NW-529
NAME OF STATION : BIGONGSURAN LIGAO

UNIT : CMS

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1976	12.	5.	7.	3.	14.	16.	8.	14.	-1.	7.	20.	21.
1977	9.	12.	3.	9.	11.	10.	29.	19.	25.	12.	23.	14.
1978	12.	11.	14.	11.	15.	23.	-1.	-1.	-1.	35.	6.	9.

NOTE : -1 MEANS DATA NOT AVAILABLE

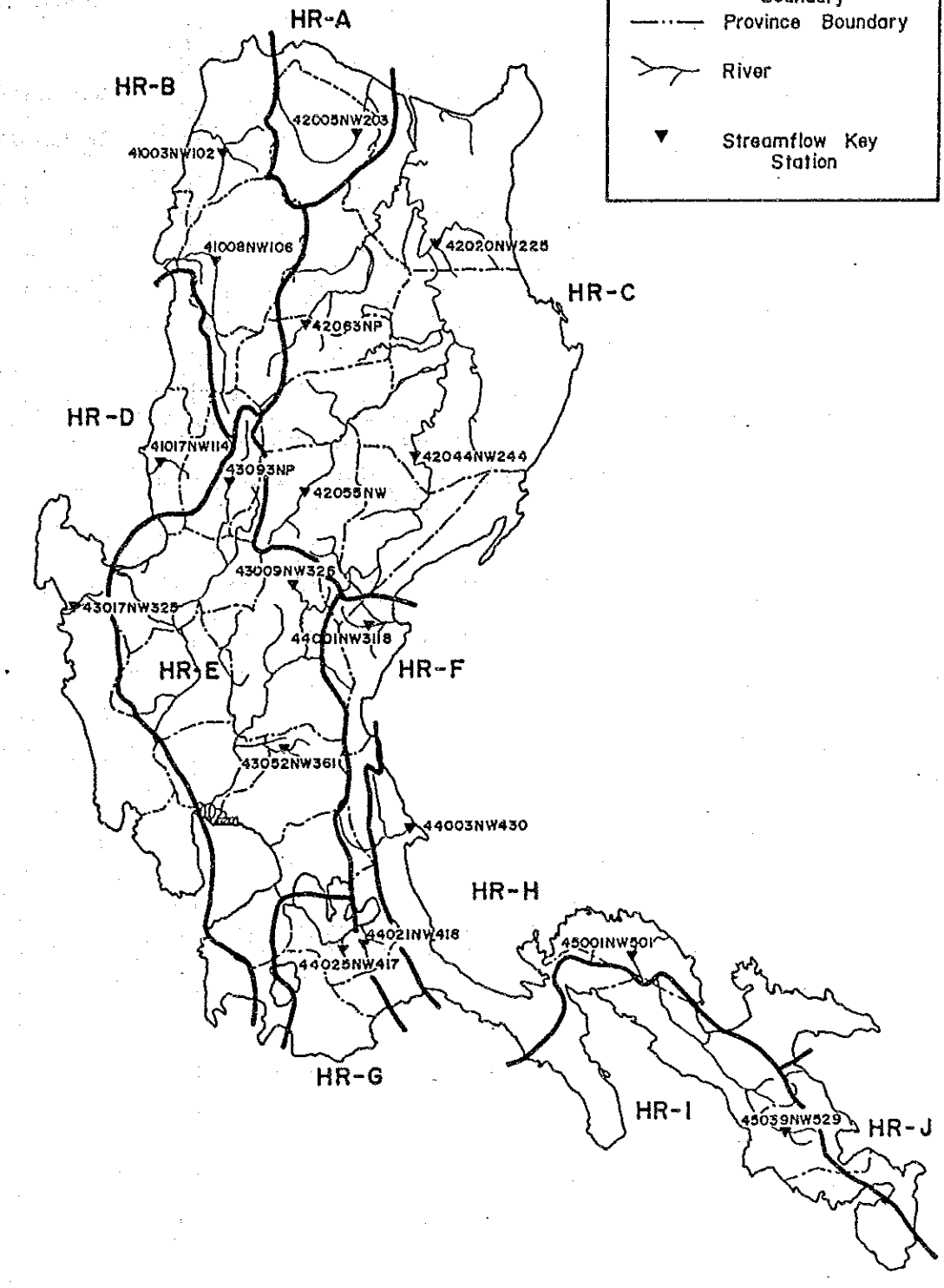
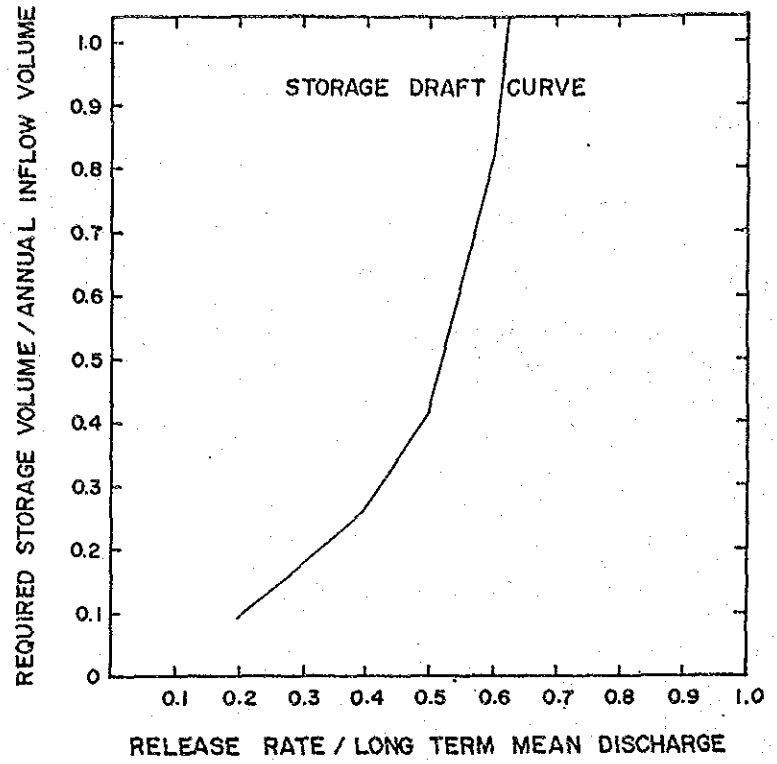


Fig. 1 LOCATION MAP OF STREAMFLOW KEY STATIONS



NAME OF STREAM GAUGE

BANGAY. DINGRAS

GAUGE I.D. NUMBER

41003NW102

HYDROLOGICAL REGION

8

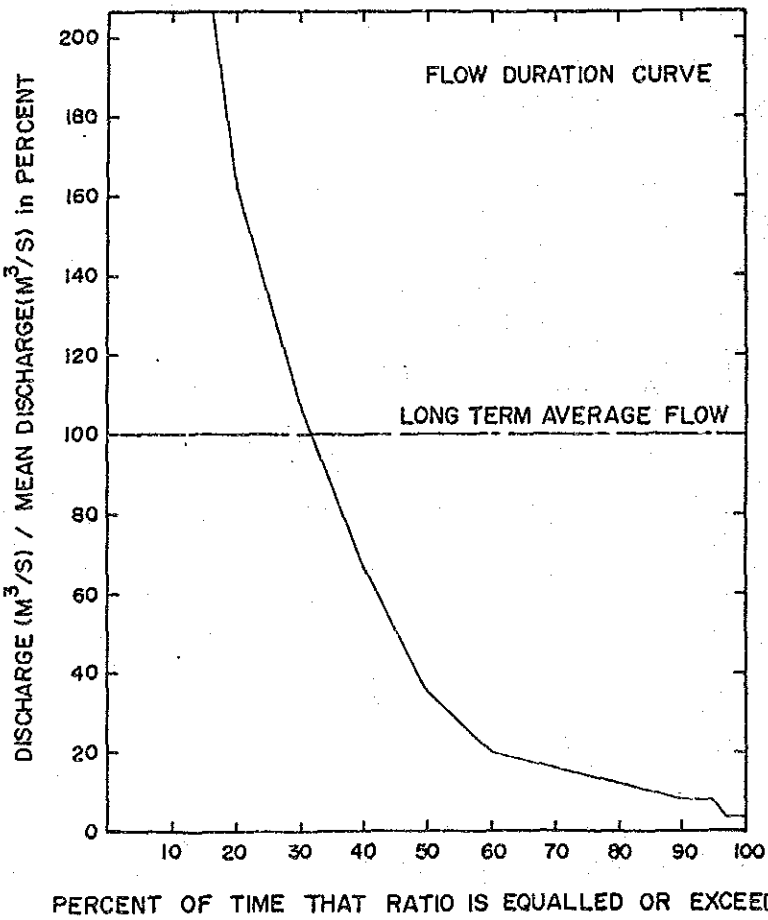
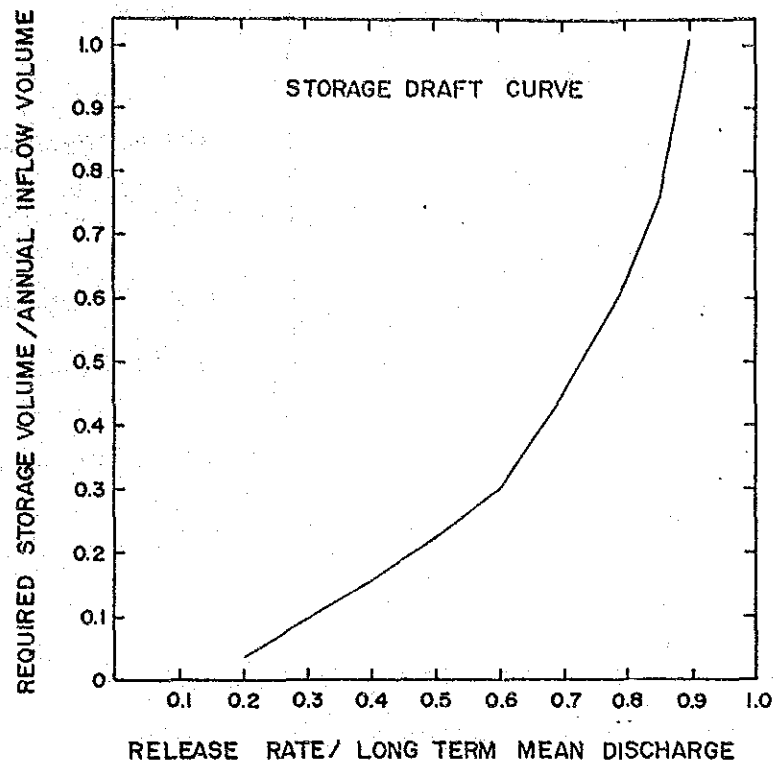


Fig. 2 DIMENSIONLESS STORAGE DRAFT & FLOW DURATION CURVES



NAME OF STREAM GAUGE

BUNMAGCAT TAYUM

GAUGE I.D. NUMBER

41008NW106

HYDROLOGICAL REGION

B

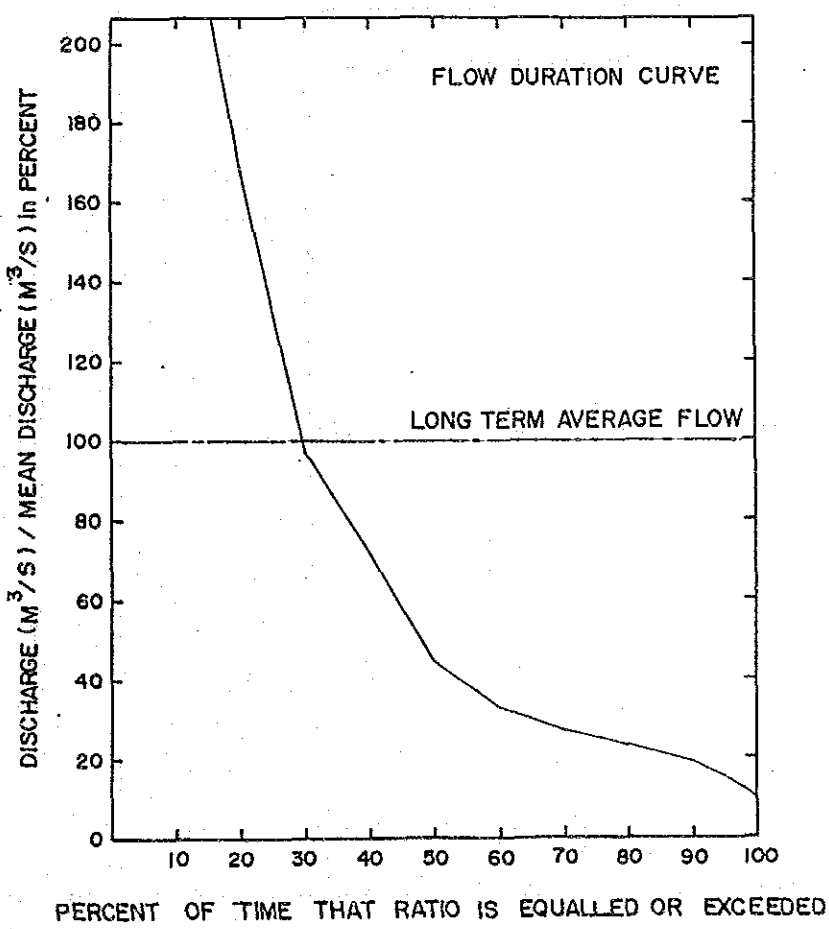
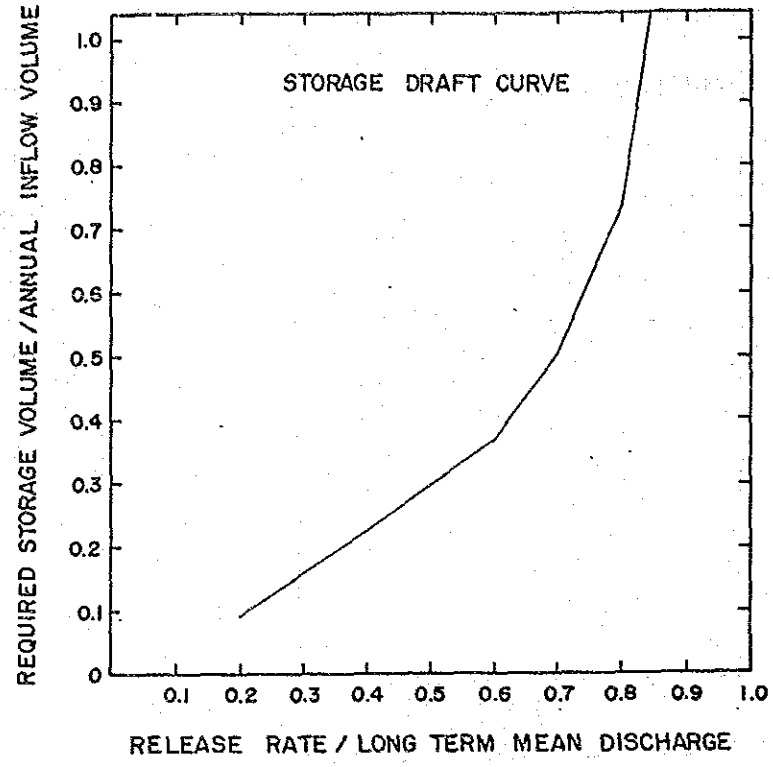


Fig. 3 DIMENSIONLESS STORAGE DRAFT & FLOW DURATION CURVES



NAME OF STREAM GAUGE

MAMAT-ING NAGUIALIAN

GAUGE I.D. NUMBER

41017NW114

HYDROLOGICAL REGION

D

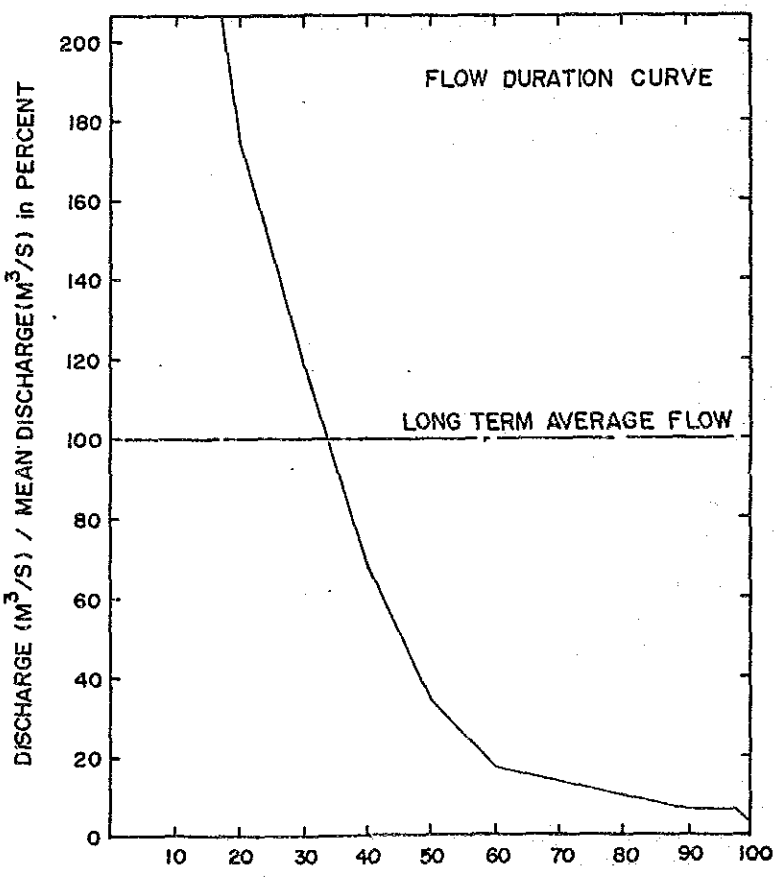
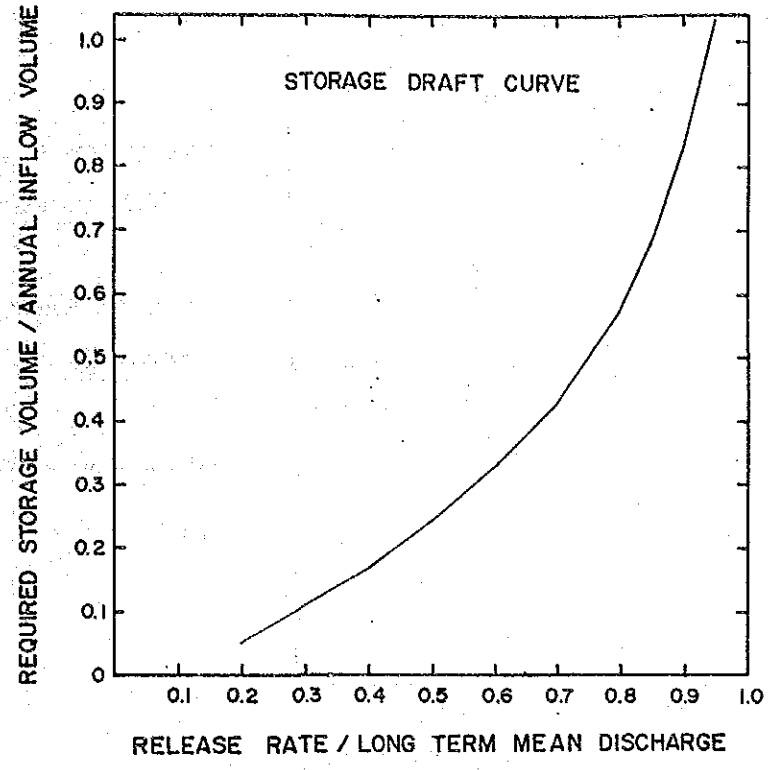


Fig. 4 DIMENSIONLESS STORAGE DRAFT & FLOW DURATION CURVES



NAME OF STREAM GAUGE

ATOK PUDTOL

GAUGE I.D. NUMBER

42005NW203

HYDROLOGICAL REGION

A

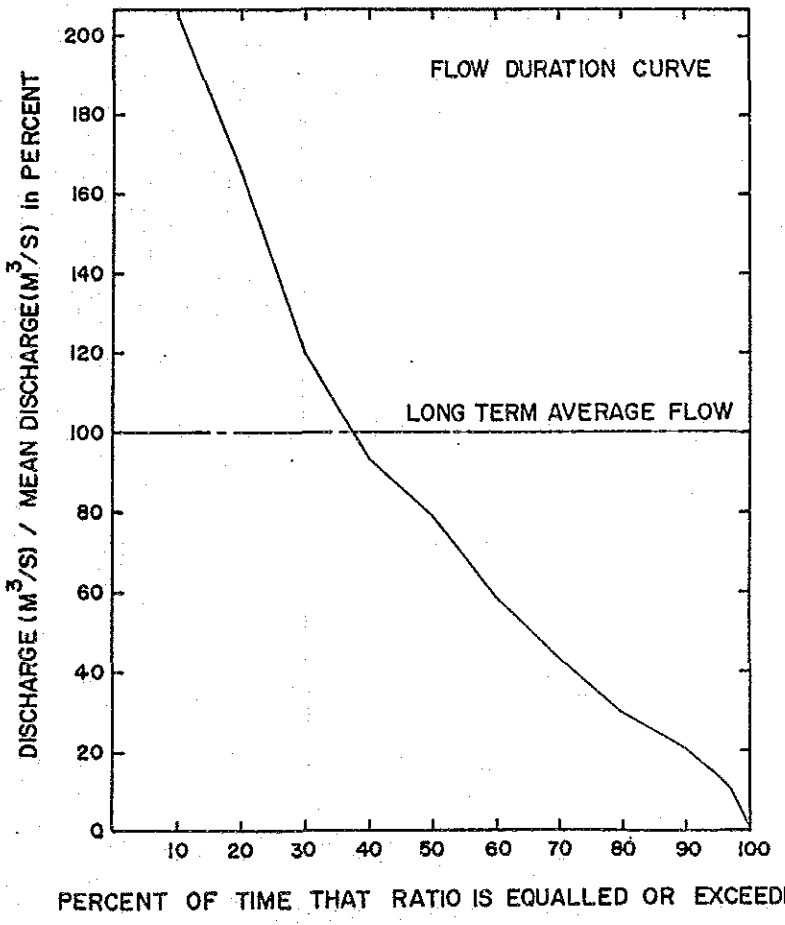
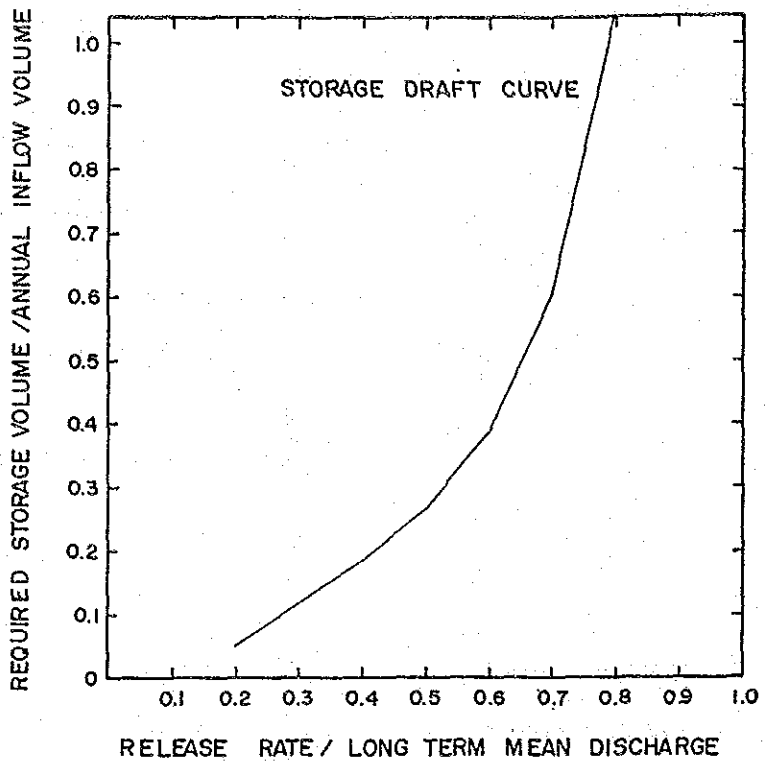


Fig. 5 DIMENSIONLESS STORAGE DRAFT & FLOW DURATION CURVES



NAME OF STREAM GAUGE

LARION TUGUEGARAO

GAUGE I.D. NUMBER

42020NW225

HYDROLOGICAL REGION

C

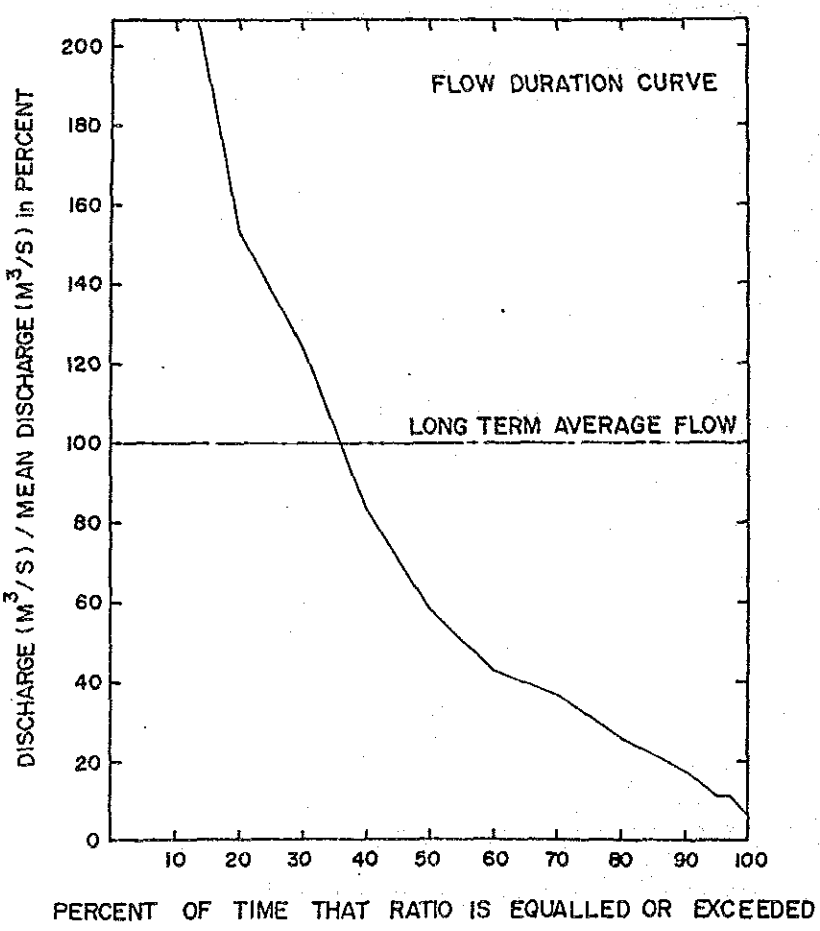
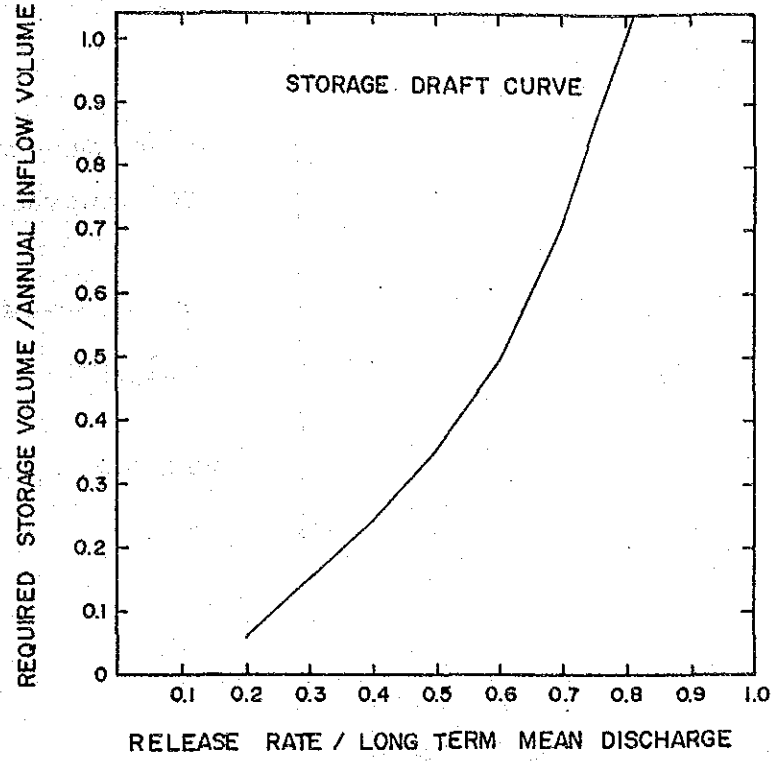


Fig. 6 DIMENSIONLESS STORAGE DRAFT & FLOW DURATION CURVES



NAME OF STREAM GAUGE

PANGAL ECHAGUE

GAUGE I.D. NUMBER

42044NW244

HYDROLOGICAL REGION

C

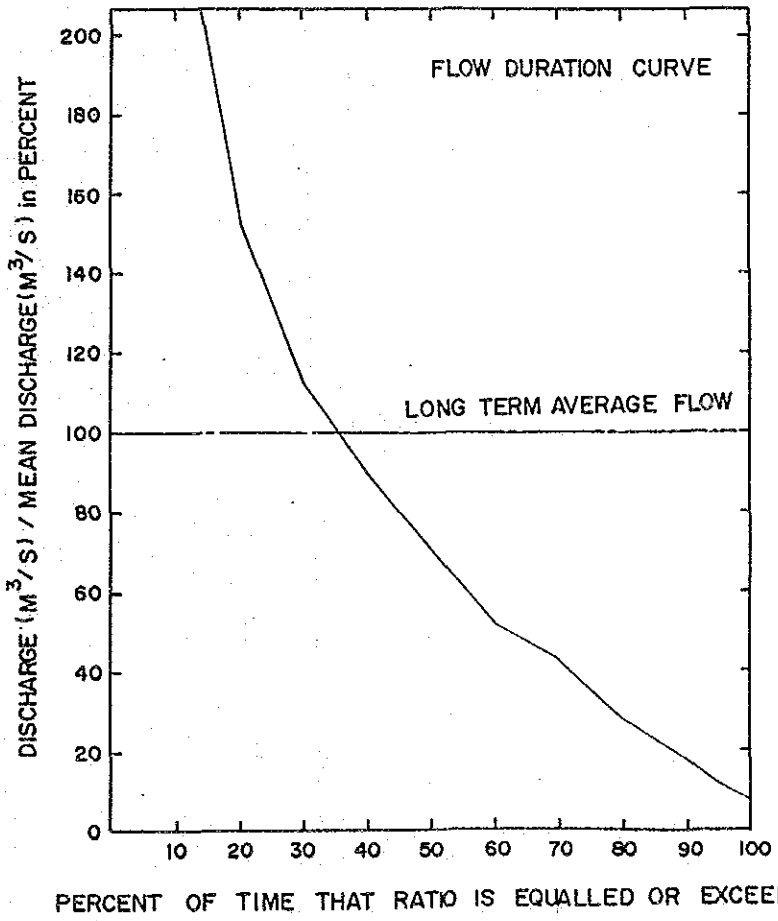
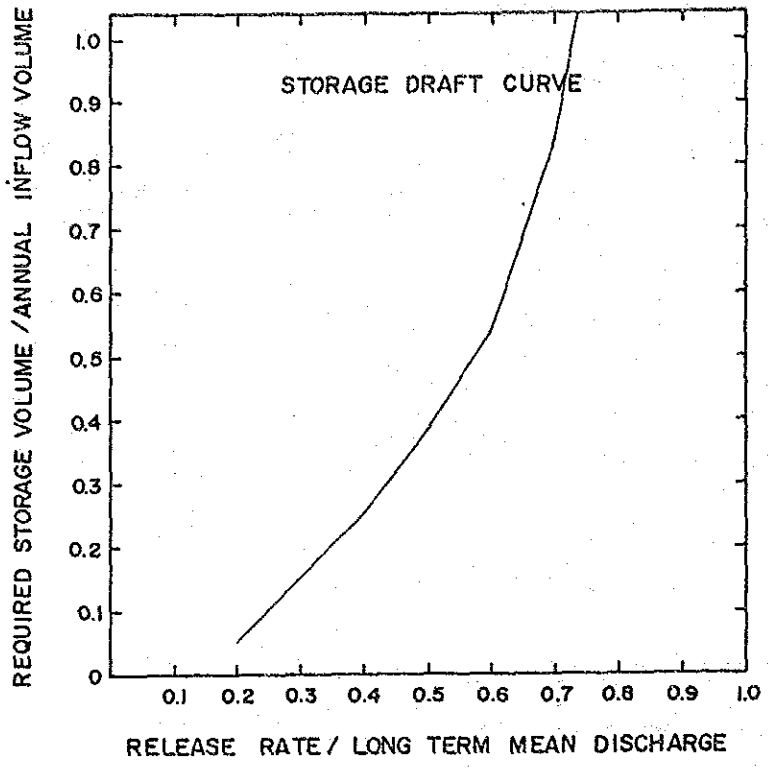


Fig. 7 DIMENSIONLESS STORAGE DRAFT & FLOW DURATION CURVES



NAME OF STREAM GAUGE

BATO BAYOMBONG

GAUGE I.D. NUMBER

42055NW

HYDROLOGICAL REGION

C

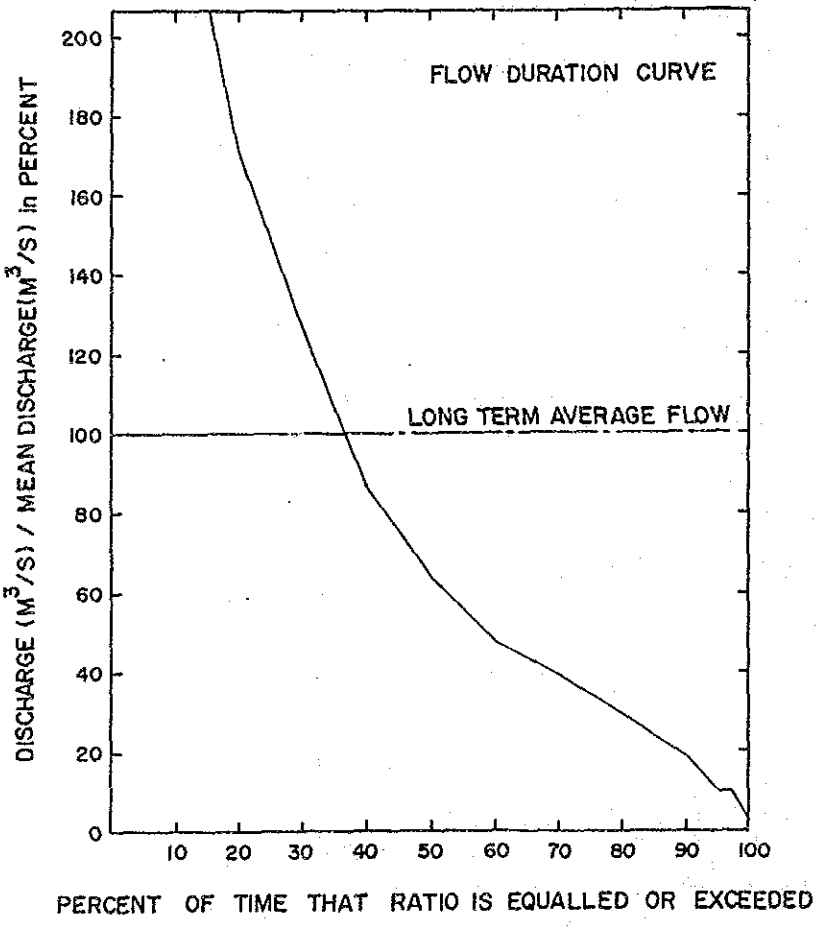
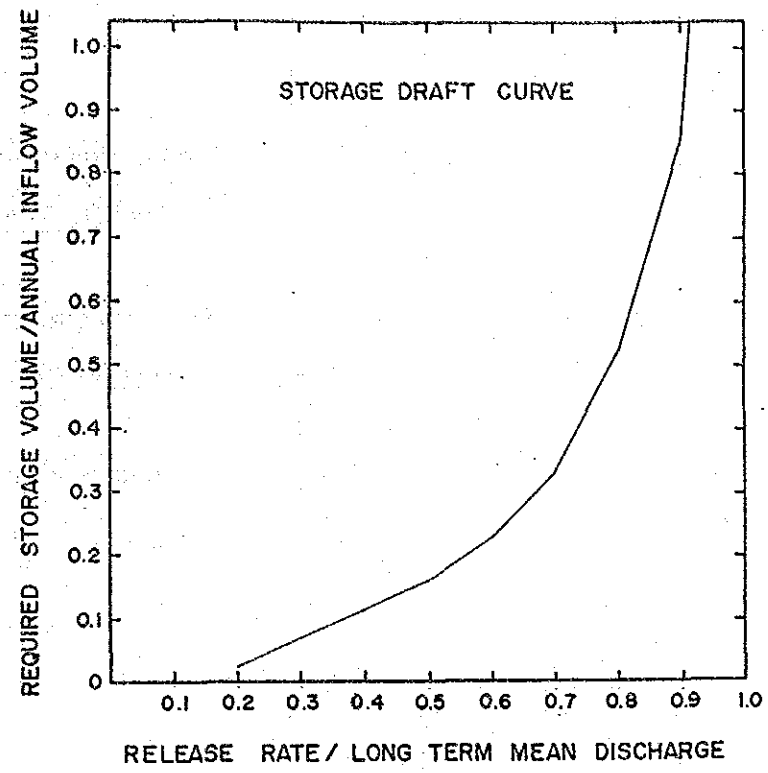


Fig. 8 DIMENSIONLESS STORAGE DRAFT & FLOW DURATION CURVES



NAME OF STREAM GAUGE

BASAO

GAUGE I.D. NUMBER

42063NP

HYDROLOGICAL REGION

C

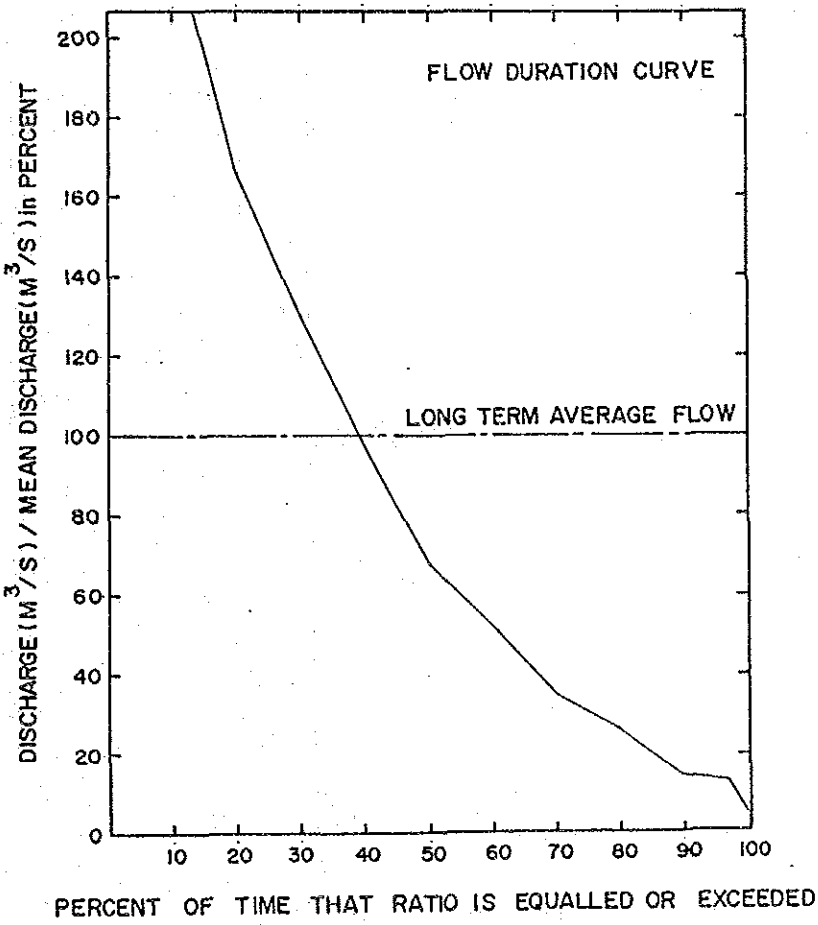
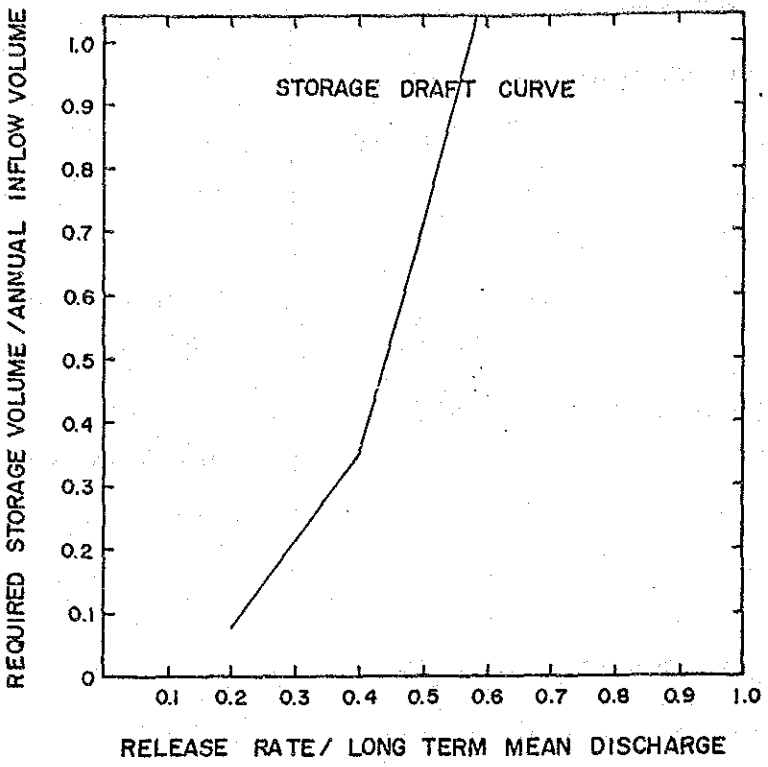


Fig. 9 DIMENSIONLESS STORAGE DRAFT & FLOW DURATION CURVES



NAME OF STREAM GAUGE

BALUARTE CARRANGLAN

GAUGE I.D. NUMBER

43009NW326

HYDROLOGICAL REGION

E

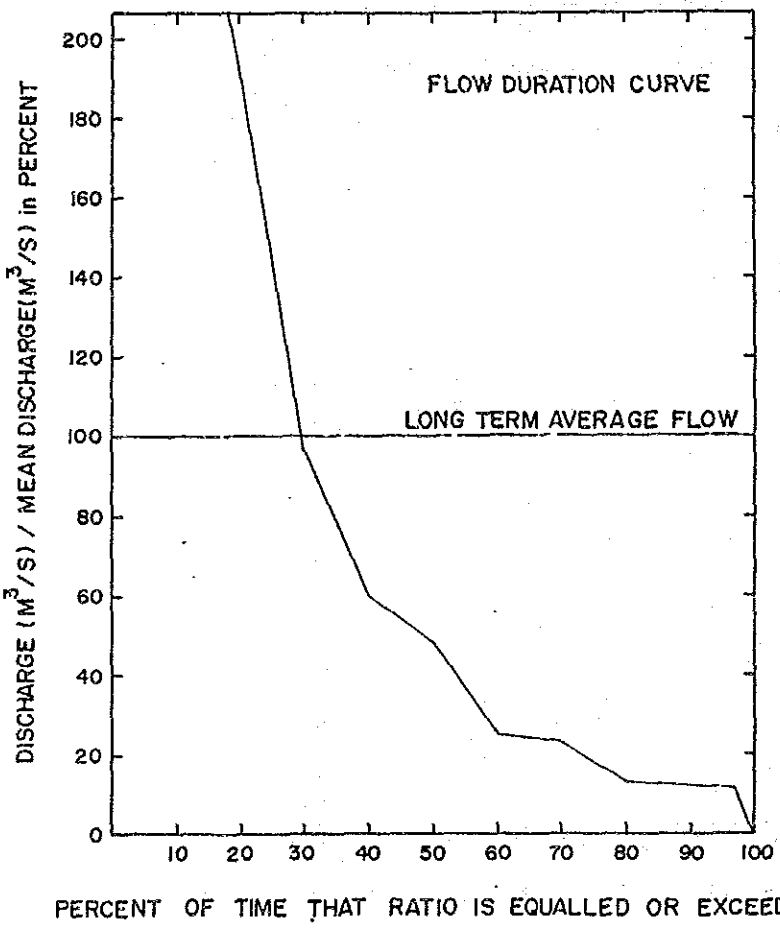
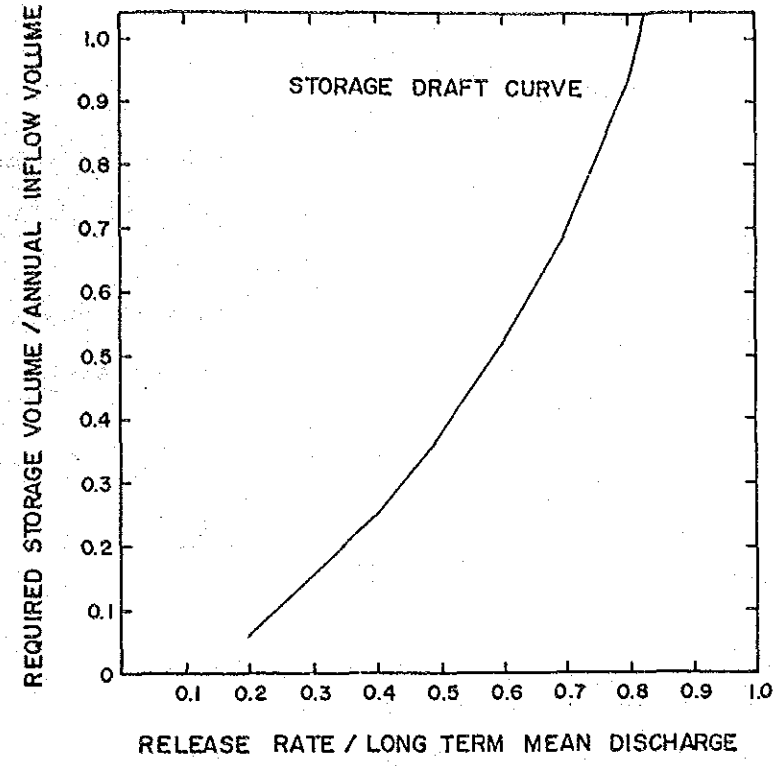


Fig. 10 DIMENSIONLESS STORAGE DRAFT & FLOW DURATION CURVES



NAME OF STREAM GAUGE

GUISGUIS STA. CRUZ

GAUGE I.D. NUMBER

43017NW325

HYDROLOGICAL REGION

D

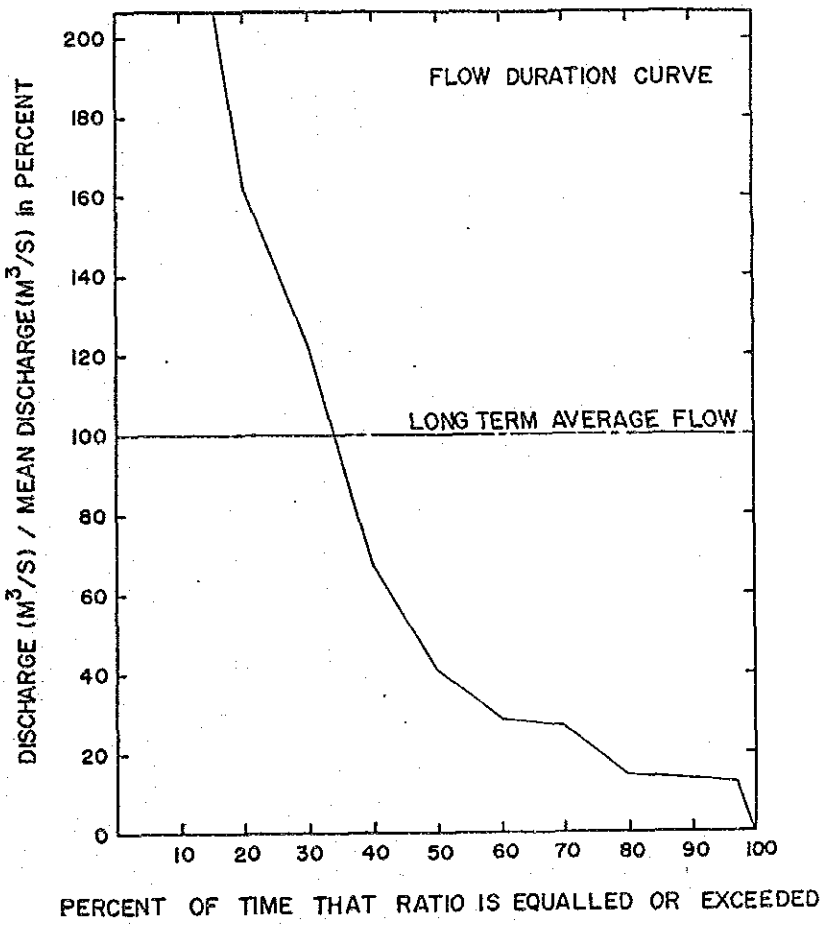
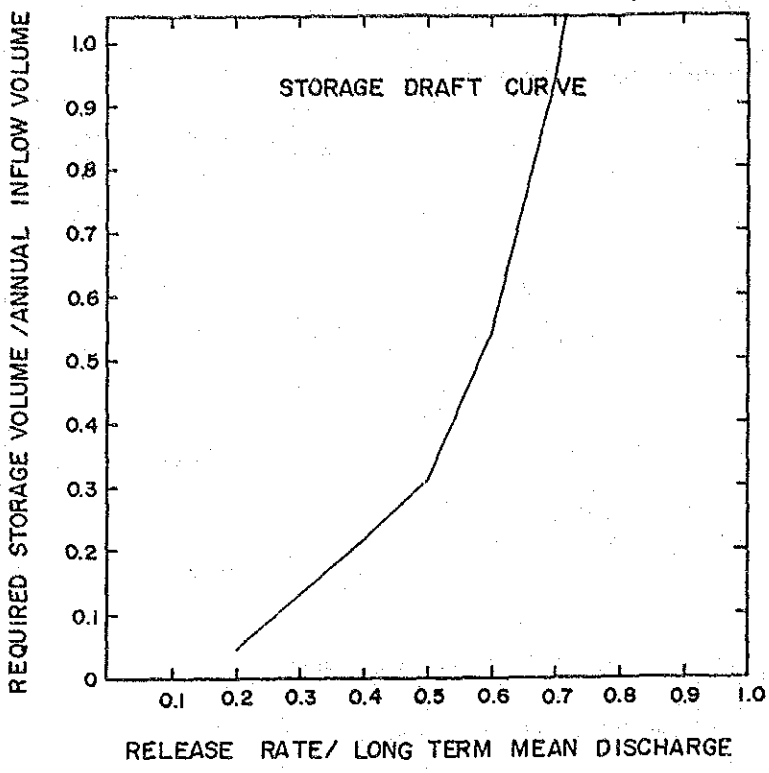


Fig. 11 DIMENSIONLESS STORAGE DRAFT & FLOW DURATION CURVES



NAME OF STREAM GAUGE

STA. INES SAN MIGUEL

GAUGE I.D. NUMBER

43052NW361

HYDROLOGICAL REGION

E

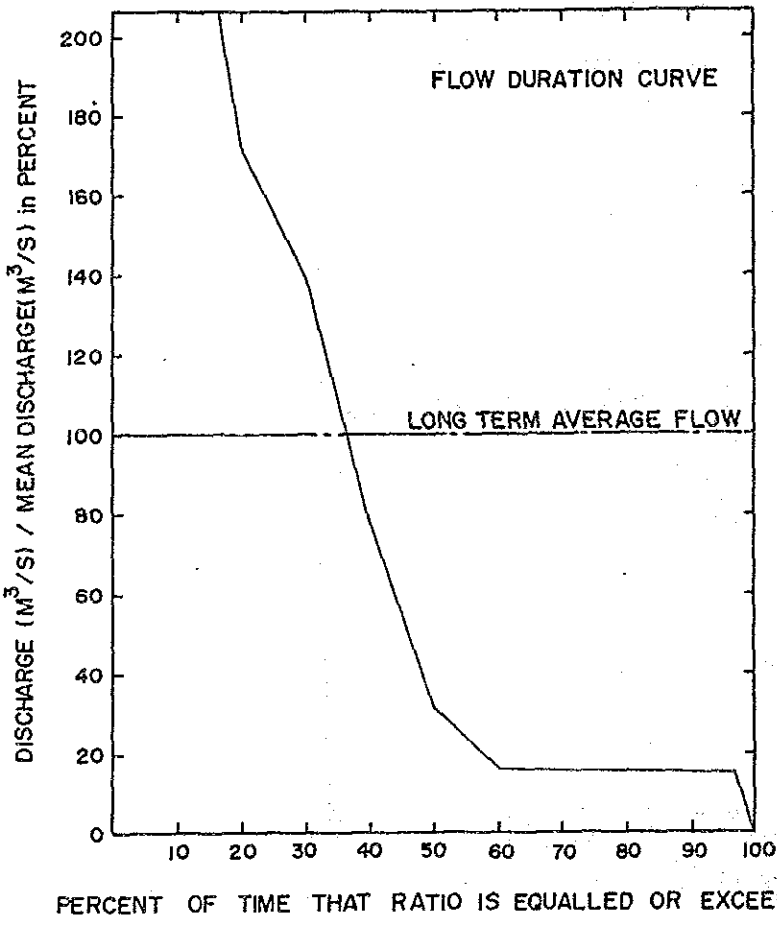
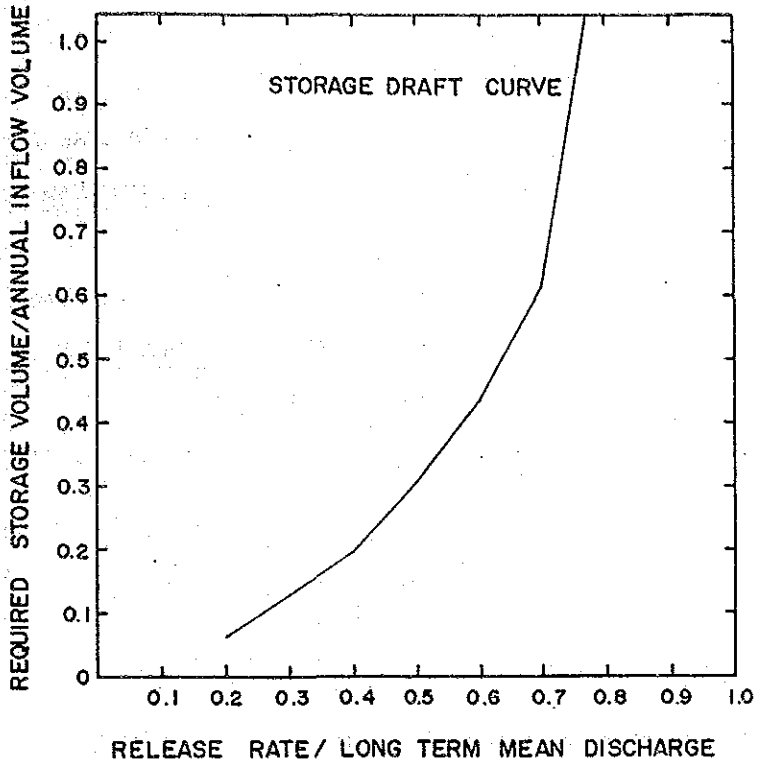


Fig. 12 DIMENSIONLESS STORAGE DRAFT & FLOW DURATION CURVES



NAME OF STREAM GAUGE

AMBUKLAO HE PLANT

GAUGE I.D. NUMBER

43093NP

HYDROLOGICAL REGION

E

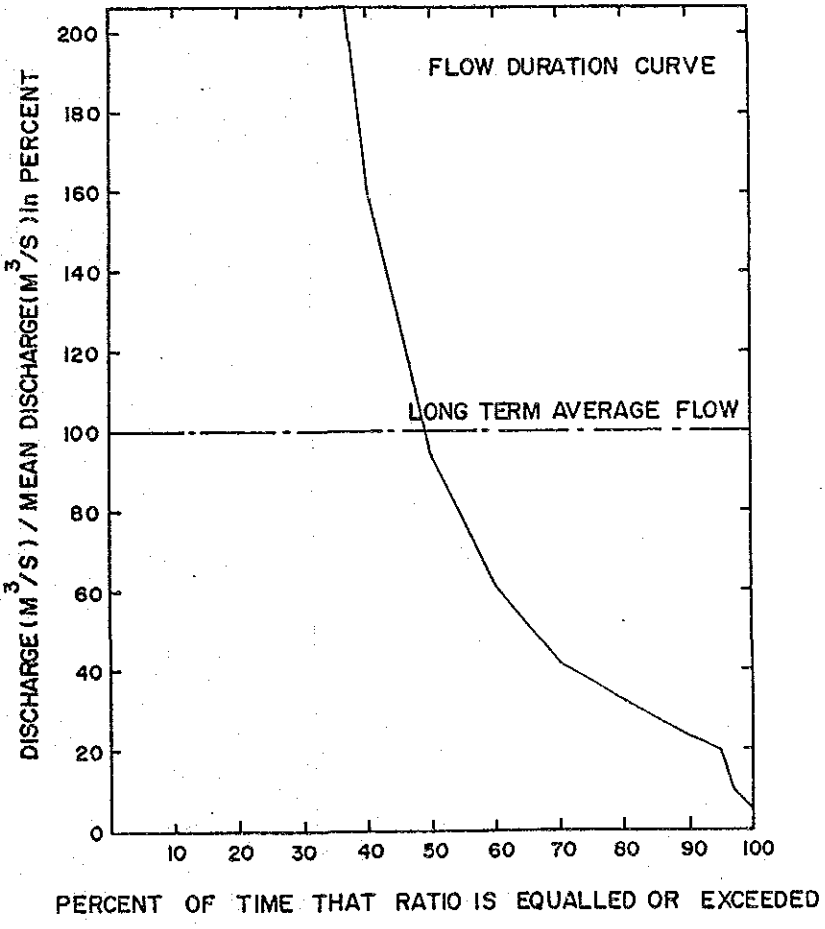
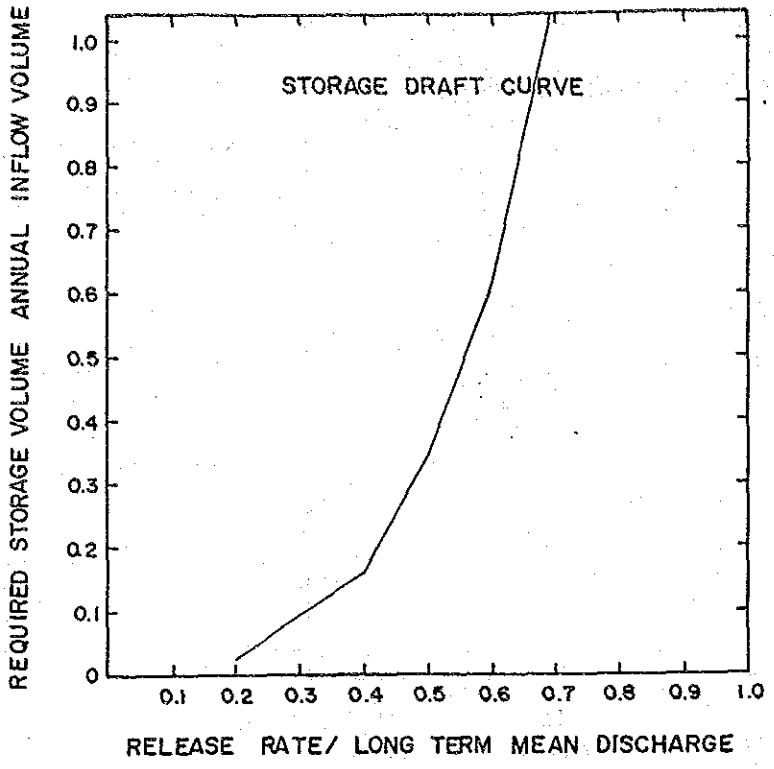


Fig. 13 DIMENSIONLESS STORAGE DRAFT & FLOW DURATION CURVES



NAME OF STREAM GAUGE

DIAMMAN Ma. AURORA

GAUGE I.D. NUMBER

4400INW3118

HYDROLOGICAL REGION

F

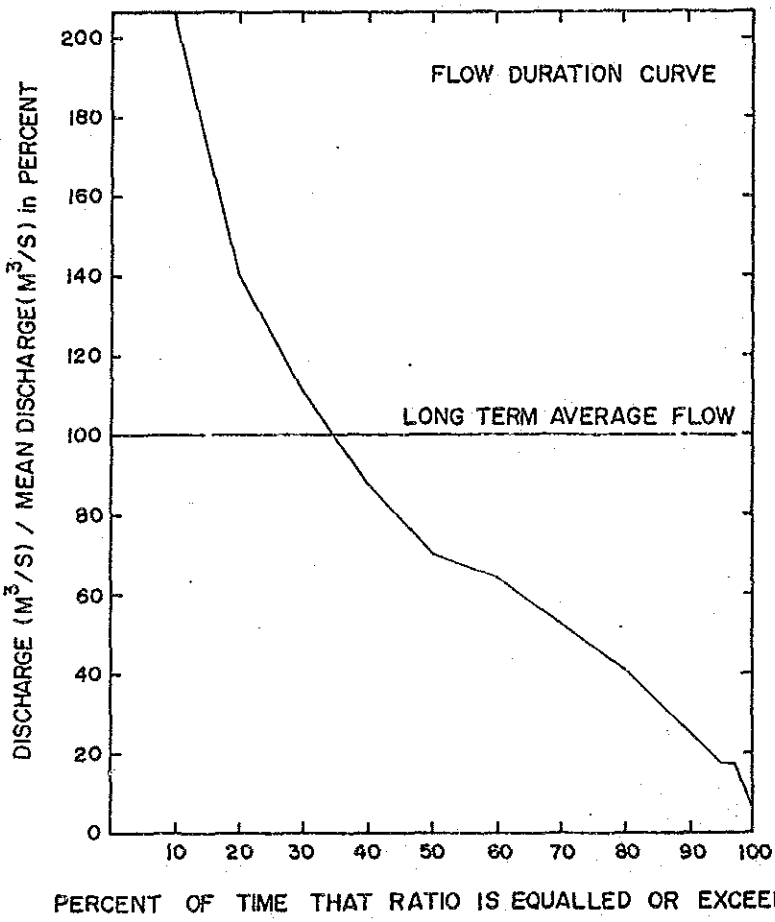
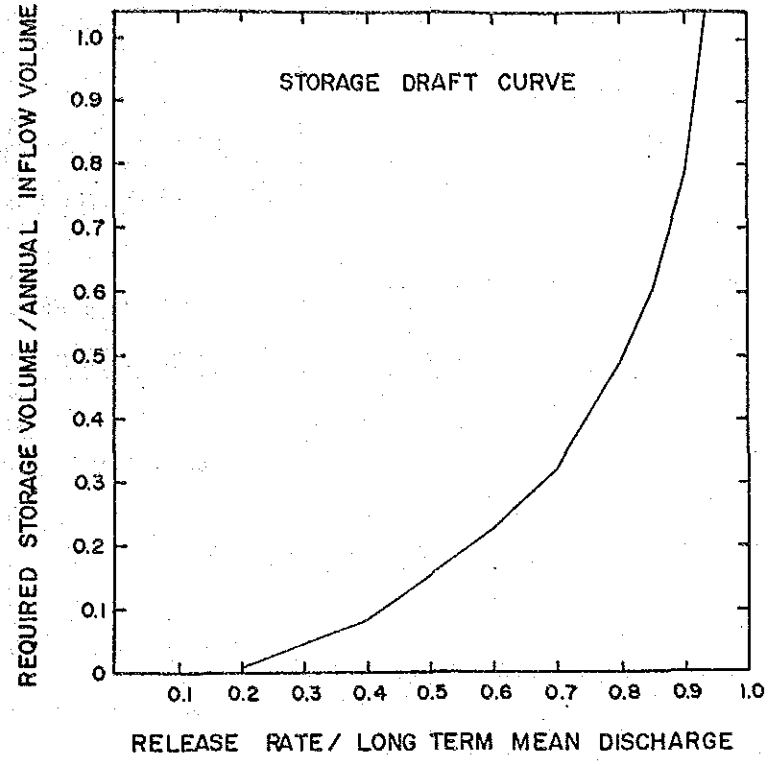


Fig. 14 DIMENSIONLESS STORAGE DRAFT & FLOW DURATION CURVES



NAME OF STREAM GAUGE

BANUGAO INFANTA

GAUGE I.D. NUMBER

44003NW430

HYDROLOGICAL REGION

H

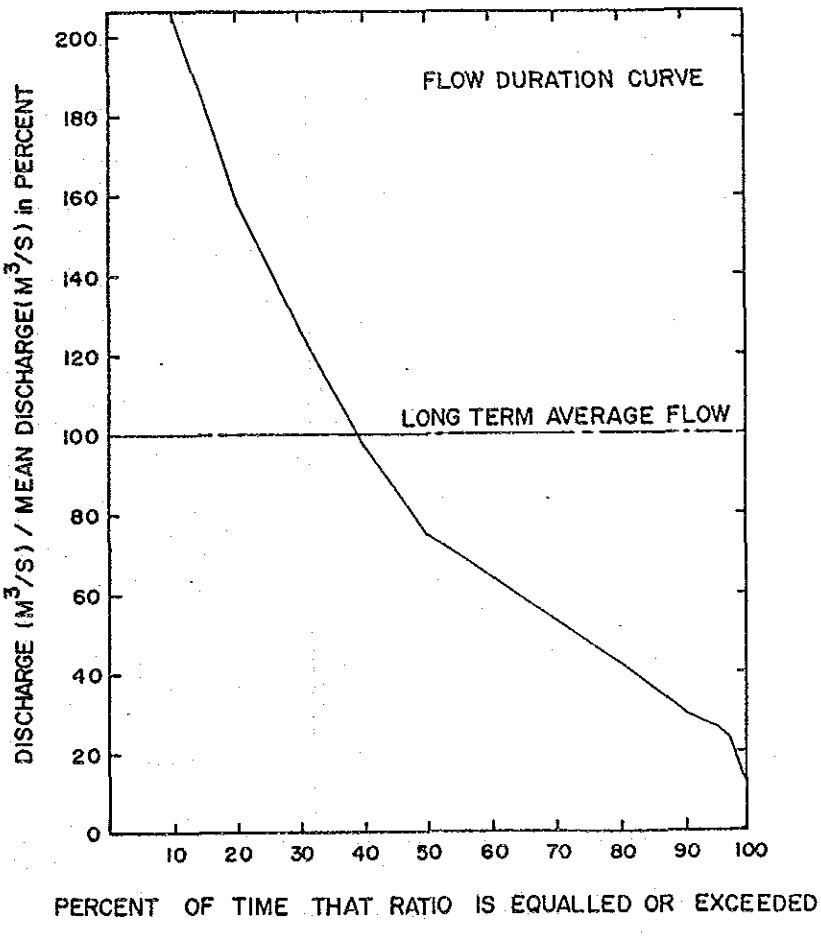
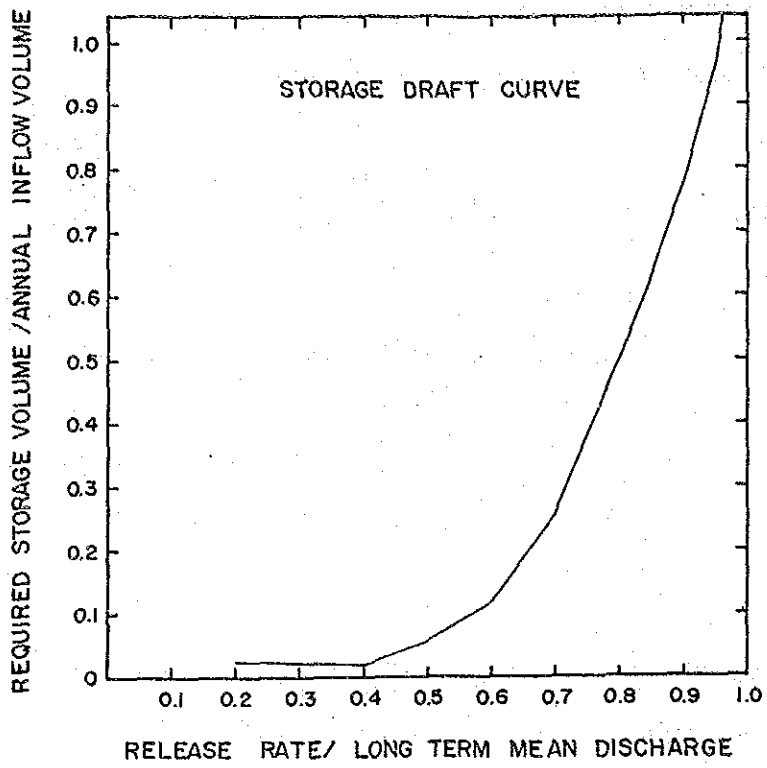


Fig. 15 DIMENSIONLESS STORAGE DRAFT & FLOW DURATION CURVES



NAME OF STREAM GAUGE

MAGDALENA BUKAL

GAUGE I.D. NUMBER

4402INW418

HYDROLOGICAL REGION

F

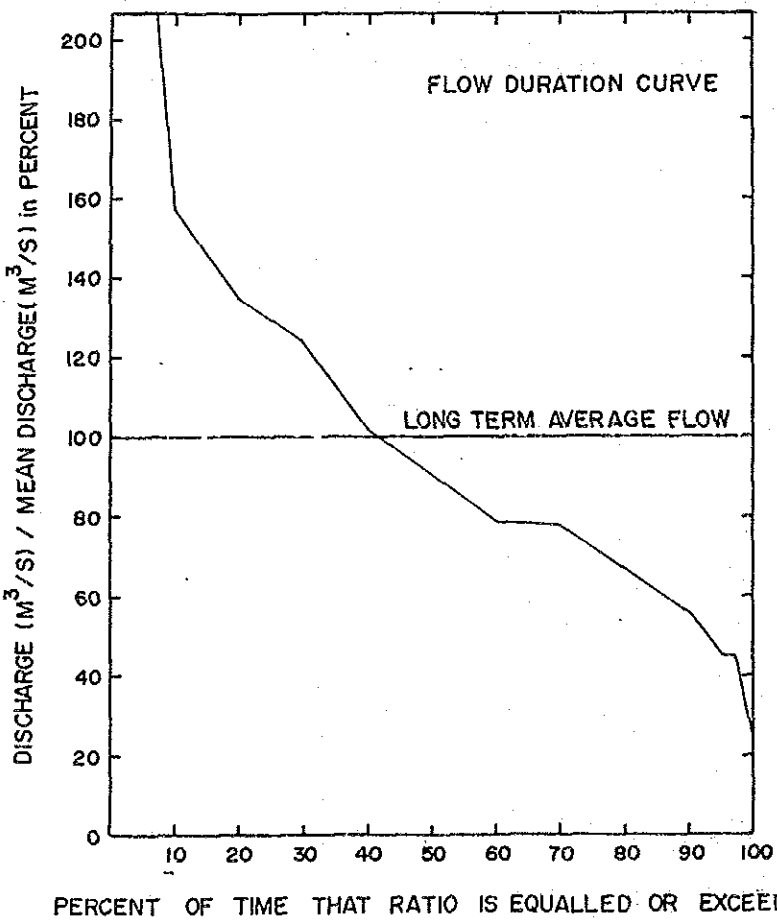
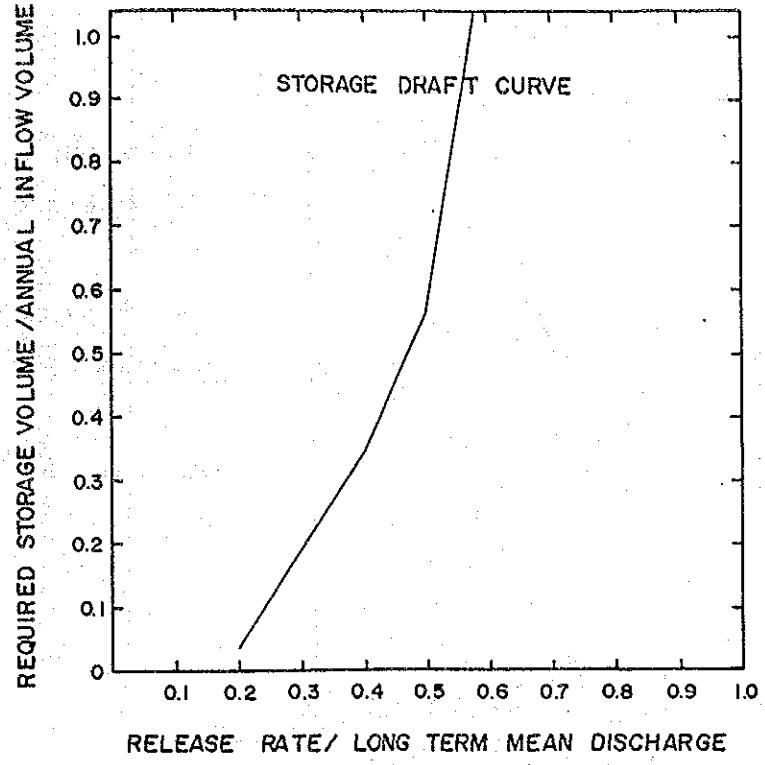


Fig. 16 DIMENSIONLESS STORAGE DRAFT & FLOW DURATION CURVES



NAME OF STREAM GAUGE

CALUMPANG LILIW

GAUGE I.D. NUMBER

44025NW417

HYDROLOGICAL REGION

G

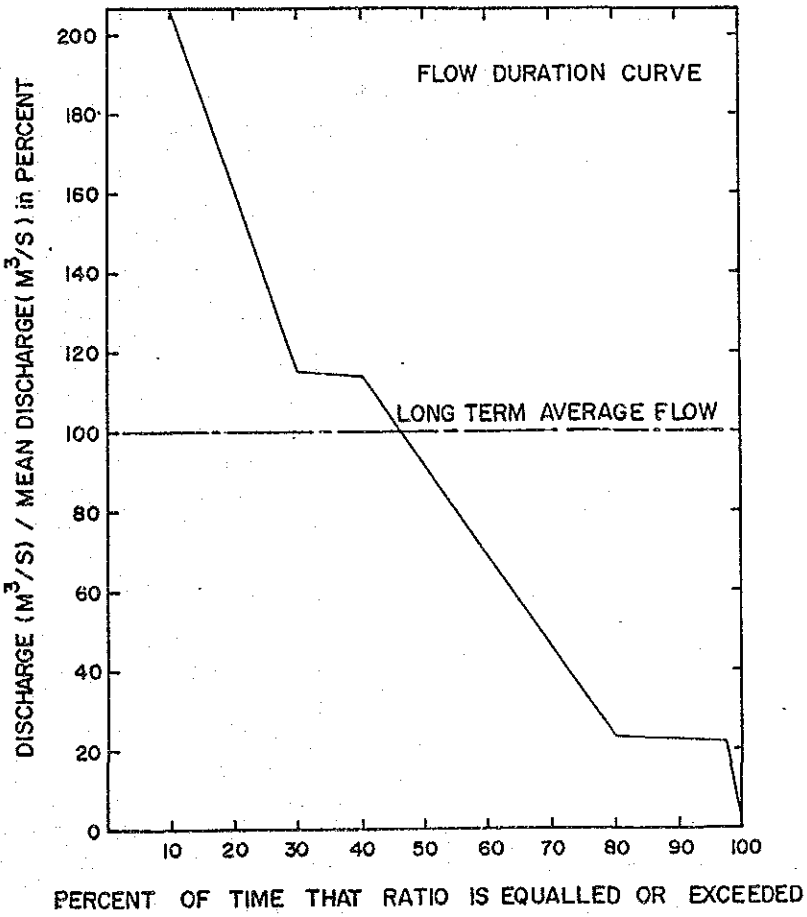
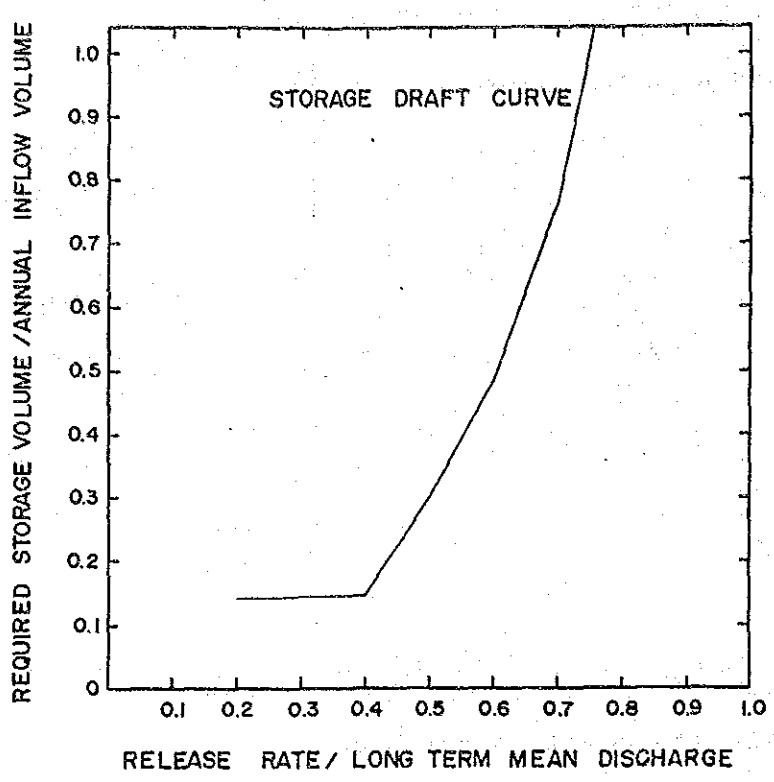


Fig. 17 DIMENSIONLESS STORAGE DRAFT & FLOW DURATION CURVES



NAME OF STREAM GAUGE

MATOGDON LABO

GAUGE I.D. NUMBER

45001NW501

HYDROLOGICAL REGION

H

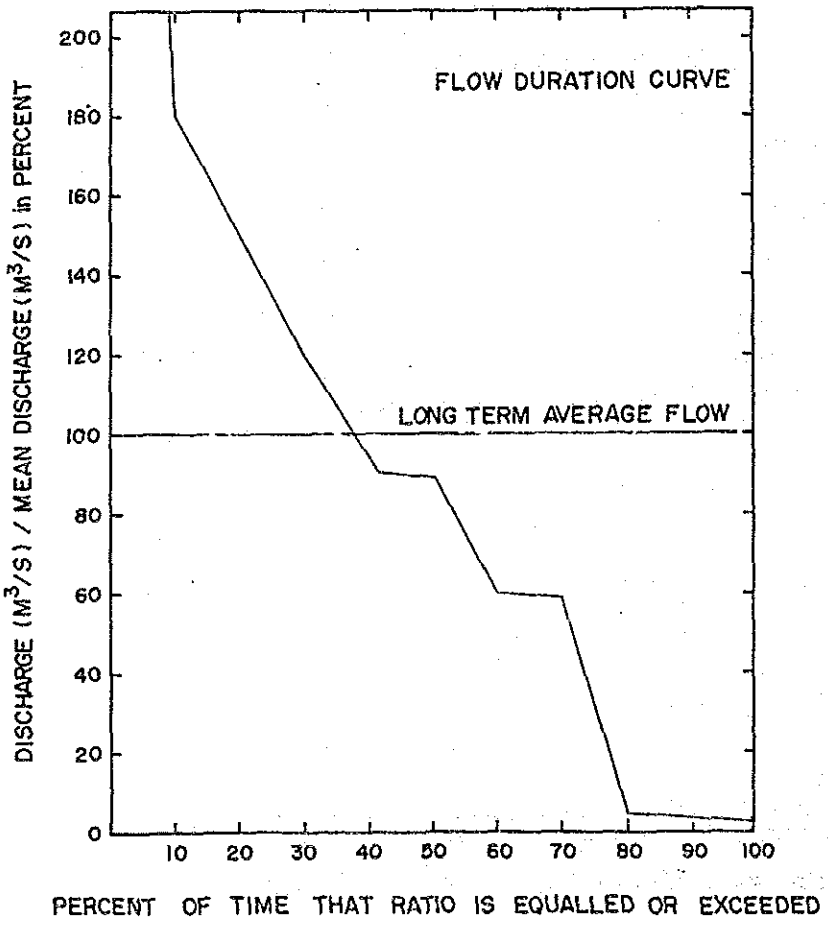
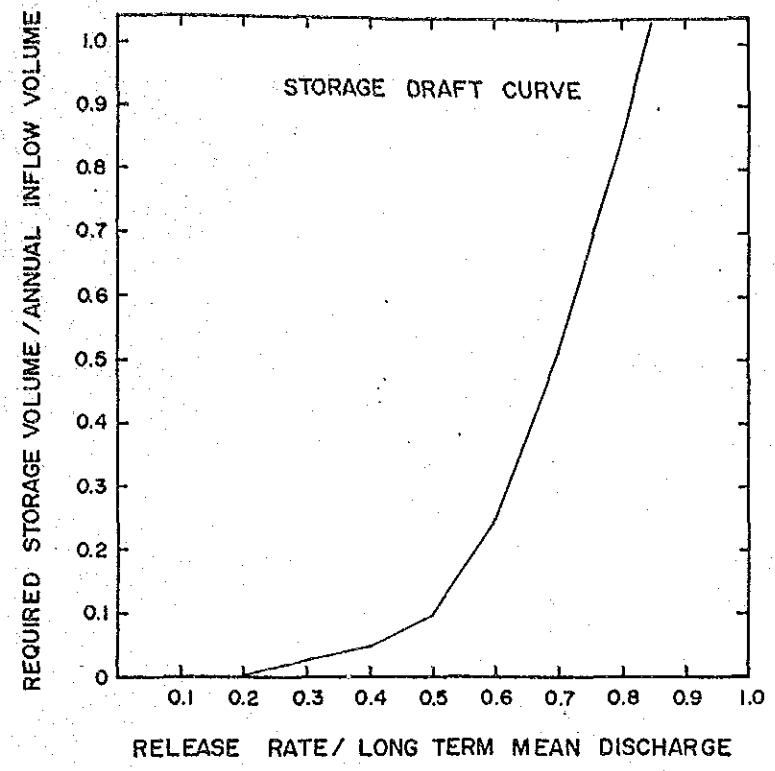


Fig. 18 DIMENSIONLESS STORAGE DRAFT & FLOW DURATION CURVES



NAME OF STREAM GAUGE

BIBONGSURAN LIGAO

GAUGE I.D. NUMBER

45039NW529

HYDROLOGICAL REGION

I

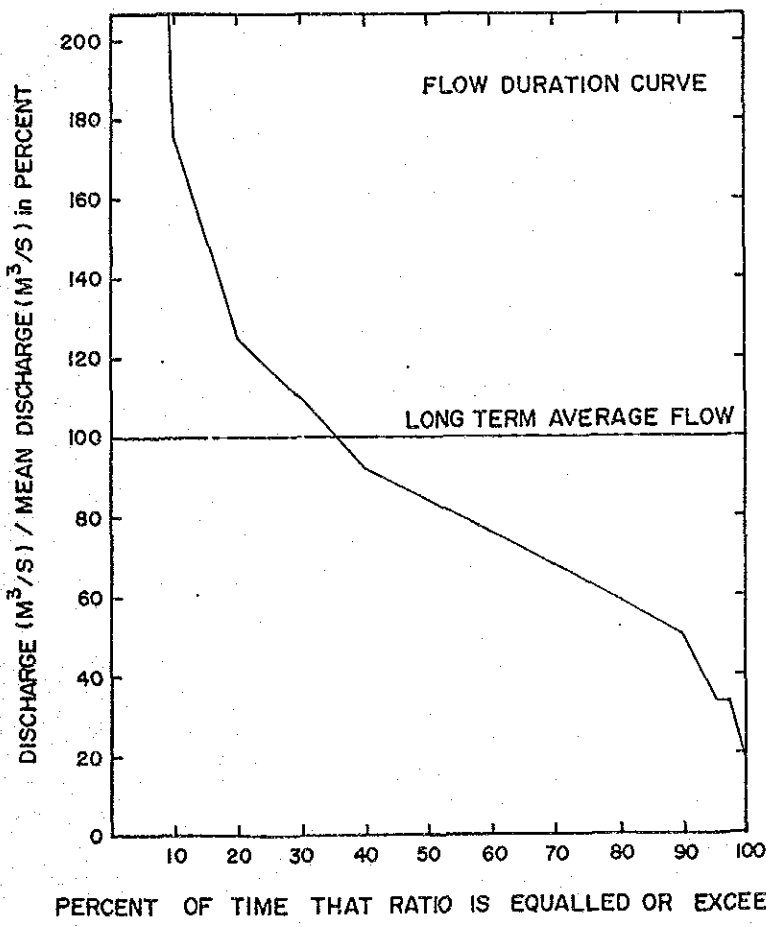


Fig. 19 DIMENSIONLESS STORAGE DRAFT & FLOW DURATION CURVES

GEOLOGY

GEOLOGY

CONTENTS

Naguilian (1-3-0-2)

Naguilian scheme is proposed as a run-of-river type, consisting of about 6 m height and 68 m width concrete intake weir on the Trinidad river. Approximately 297 m head is taken with about 9 km long water way tunnel, through right bank of the Trinidad river.

Intake weir of Naguilian scheme is located at 500 m downstream of confluence of the Trinidad and Payung rivers where is situated at 12 km north-northeast of Baguio city and about 7 km north of Trinidad city. The intake weir site is not easily accessible from Trinidad city due to rough road along the Trinidad river and steeply graded river valley.

Power house site is located at the right bank of Trinidad river about 9.5 km downstream of intake weir site. According to the existing geological map, the proposed site is composed of same geological condition to that of Amburayan site, that is, late Miocene to Pliocene sedimentary rocks and early to middle Miocene sedimentary rocks intruded by Neogene quartz diorite.

Both abutments of intake weir site form gorge which is underlain by limestone. The fresh limestone exposed at from toe of abutments to mark of the high flood level without vegetation and weathered soil. There are some pine trees grew on direct from limestone joints at higher than flood level. The very large limestone rock fall and huge limestone boulder are deposited on riverbed, and riverbed are studded with some diorite or agglomerateic boulders and gravels.

The volcanic flow in distributed at right bank side between intake weir site and confluence, and also talus debris and rock slides are occurred at both river sides.

And higher elevation of abutments are stable covered with residual soil. The cavernous limestone is distributed along the Trinidad river from intake weir site to downstream, therefore special foundation treatment is necessary for intake weir and tunnel inlet.

About 2 km from intake weir, limestone changes to the alternating beds of sandstone and conglomerate, that is, water way tunnel will pass through the late Miocene to Pliocene limestone, and early to middle Miocene sandstone and conglomerate.

The section of the sandstone will require supporting works. Furthermore, the tunnel is to traverse the cavernous limestone zone near the inlet area, consequently ground water leakage into the tunnel is possible to happen in the limestone area.

The geology of power house site will be underlain by the hard to rather hard alternating beds of sandstone and conglomerate. The regulating reservoir area is chiefly underlain by coralline limestone. Obviously water leakage from reservoir to outside is possible to happen in the cavernous limestone zone.

The most suitable concrete aggregate is located at riverbed within 1 km from intake weir site which is underlain by limestone, very large rock fall and huge boulder.

Luya (1-10-0-1)

Luya scheme is proposed as a run-of-river type, consisting of about 14 m height and 45 m width intake concrete weir on the Amburayan river, 1 km downstream from power house of Amburayan scheme.

Approximately 123 m head is taken with about 7 km long water way tunnel from intake weir to power house, through right bank of the Amburayan river.

Regional geology almost same as Amburayan scheme, that is middle Miocene sedimentary rocks which is probably equivalent to Zigzag series and Quaternary volcanics of andesitic to dacitic composition.

The Amburayan river forms gorge at the intake weir. Geologic structure of this area is controlled by NS trending. The geology of intake weir site is probably underlain by hard compacted conglomerate, sandstone and shale of middle Miocene. These rocks may be slightly weathered with some cracks. There are no major faults to effect the stability at the intake weir site.

Rock quality of water way tunnel route and proposed power house site is also generally fresh and compacted which is underlain by a sequence of middle Miocene conglomerate-sandstone-shale. It seems to have enough strength for tunneling and for power house foundation.

Regulation reservoir area is underlain by conglomerate-sandstone-shale which is covered with river deposits and talus deposits. There is no evidence of water leakage and landslide, then there is no special problem of hydrologically and slope stability.

The suitable quarry site for concrete aggregate is located at 1 km south-east of damsite which underlain by hand conglomerate and sandstone. Sand materials can be expected within 2 km from weir site on the Amburayan river flood plain.

Bakum (1-10-0-2)

Bakum scheme is located on the Bakum river at about 2 km north-east of barrio Bakum in northern part of Benguet Province. The Bakum river is a tributary of the Amburayan river. the junction of the Bakum and Amburayan rivers is located at about 27 km downstream from intake weir site in the western part of Luzon Central Cordillera.

The Bakum scheme is proposed as a run-of-river type. Intake weir site is located at 3 km south of Mt. Tungtayan (1800 m). Inlet site is located at left bank of the Bakum river. An approximately

210 m head is taken with 5 km long water way tunnel. The location of power house is about 4 km west of Mt. Tungtayan.

According to the existing geological map, regional geology of this area is underlain by Nl Formation and UV Formation, both formations are contacting by fault each other.

Nl Formation is underlain by Miocene well bedded clastic sedimentary rocks which is probably equivalent to Zigzag Formation. UV Formation is underlain by Cretaceous to Paleogene metamorphosed basalt and andesite which is probably equivalent to Pugo Formation.

Intake concrete weir is proposed as 6 m in height, and 50 m in width. The topographic feature of the intake site is composed of very steep mountain slope and deep canyon.

The slopes of valley form V-shaped canyon. Both abutments are covered with residual soil which are several meters in thickness. Some boulders and cobbles are deposited on riverbed.

Bed rock of intake weir is possibly underlain by well bedded clastic sedimentary rocks which are conglomerate, sandstone and wackes. These rocks are to be well indurated and compacted with low permeability. The water way tunnel is through left bank of the Bakum river.

The overburden of tunnel route has enough thickness for tunnel excavation. Generally, excavation conditions is fairly good without support. Geology of tunnel route is probably composed of well indurated conglomerate, sandstone and wackes, but some parts where several geologic lineaments pass, will require full support.

The power house is located at left bank on the Bakum river. Bed rock is probably underlain by conglomerate, sandstone and wackes of Miocene. No major fault is found at the site. Several meters thickness talus deposits and terrace deposits overlies the bed rock.

Regulating reservoir area is almost similar to floor of the flood area, and then water leakage may be remote.

The most suitable quarry site for concrete aggregate is located at 1 km east of intake weir site which is possibly underlain by Miocene conglomerate and sandstone.

Sources of materials is remote from intake weir. The proposed borrow area of sand and gravel is located about 10 km downstream of intake weir and 5-6 km downstream of power house.

Amburayan (1-10-1-4)

Amburayan scheme is proposed as a run-of-river type, consisting of about 6 m height and 62.5 m width intake concrete weir on the Nabuang river.

Approximately 195 m head is taken with 13 km long water way tunnel from two intake weirs to power house, through right bank of the Nabuang river. The main intake weir site is located at 500 m upstream from the Baguio-Kibungan road suspension bridge which is over the Nabuang river, a tributary of the Amburayan river.

The additional sub-weirs are located on another tributary of the Amburayan river at about 9 km north-northeast of main intake weir and 4.5 km northeast of power house site.

The water of sub-weir will be convened by tunnel and joins at about 7 km point of main water way tunnel route from inlet site. The power house site is to be located at right bank of the Nabuang river at about 9 km downstream of main intake site.

According to the geological map of the Benguet province in scale of 1/250,000 (BMG, September 1974) the proposed scheme site consists of late Miocene to Pliocene sedimentary rocks which is probably equivalent to Klondyke or Rosario Formation, early to middle Miocene sedimentary rocks which is probably equivalent to

zigzag series intruded by Neogene quartz diorite, and Quarternary volcanics of andesitic to dacitic composition. The Nabuang river forms gorge at the intake weir site, downstream of this point, both river sides form wide and shallow V-shaped canyon.

The geology of main intake weir site is underlain by the coral limestone. Immediately downstream of weir site consists of volcanic conglomerate and limestone. One small tributary is located at immediately downstream of the bridge on left bank. River deposits are not well sorted, they are composed of huge boulder, gravel and silty sand. At the main intake weir, limestone which is porous, strongly to moderately weathered underlie, and also many caves are developed.

From above reason, main intake site seems to be very high permeability. The treatment work of intake weir will be accompanied with many difficulties and high cost. The joints of limestone is developed parallel to the bedding and also vertically, but coralline limestone at the left bank of intake weir site is rather solid than right bank side, even so small scale caves and solution trace are found. The bedding of limestone is shown about N 20° E/25-75° east.

Between the intake weir site and suspension bridge at the right bank, there is underlain by debris and rock fall of volcanic conglomerate, but it is very hard and solid at under the bridge site. On the other hand, at left bank volcanic conglomerate is located at downstream of bridge, it is occupied about 100 m in width along the river and after that limestone is exposed at riverbed again.

The regulating reservoir is underlain by limestone and volcanic talus, therefore it is necessary that some special treatment to protect the leakage. Sedimentation of reservoir is almost no effect to that regulating reservoir.

The geology of sub intake weir site is probably underlain by hard compacted conglomerate, sandstone and shale of early to

middle Miocene. These rocks may be locally weathered and watertightness of bed rock is to be good except fractured zone. There are no major faults to effect the stability at the sub intake weir site.

Rock quality of water way tunnel route is estimated to be generally fresh and compacted which is underlain by a sequence of early to middle Miocene conglomerate-sandstone-shale at outlet site, limestone with interbedded conglomerate of late Miocene to Pliocene, and dacite of Quarternary volcanics at inlet site. However, the inlet area of water way tunnel is estimated to be cavernous or fractured jointed limestone, and then this area may be required special treatment for water leakage.

Proposed power house site is assumed to be underlain by a sequence of fresh and hard conglomerate-sandstone-shale of middle Miocene, covered with talus deposits and some residual soil. It seems to have enough strength for power house foundation.

At regulating reservoir of main intake weir, fracture and pervious faulted zone are situated on right bank. And also many rock debris and talus are deposited on both riversides due to unstable of valley slopes. Some stable and water-proof treatment works are required.

The suitable concrete aggregate is located at within 2 km upstream on the riverbed of main intake weir site which underlain by indurated limestone and diorite boulders. Proposed sand and gravel borrow area is located within 2 km from damsite.

Banaoang (1-22-0-1)

Banaoang scheme is proposed as dam and reservoir type, comprising construction of approximately 76 m high rockfill dam on the Abra river.

The proposed damsite is situated at the north-south trending Vigan Gap, 22 km upstream from estuary of the Abra river and immediately upstream of the bridge of national road route 3.

The width of the bridge is about 300 m and water depth is several meters, but immediately downstream of the bridge, broad plain is extend toward to the sea coast along the Abra river. The riverbed is lying at an elevation of 20 m above sea level.

According to the existing geological map, basement rock of damsite is underlain by Cretaceous to Paleogene rocks. These rocks consists of diorite, metavolcanics, andesite, shale and wacke sandstone.

Diorite is located at both abutments of dam axis, metavolcanics is mainly located at downstream of dam axis, and a series of alternating andesite, shale and wacke sandstone is located at immediately upstream of dam axis.

The Abra river meanders at 1 km upstream from the bridge, and the river floor is covered with thick sandy gravel and boulder with silt.

The lower river terrace of right bank is covered with silty clay. The thickness of the terrace may be between 2-4 m. At the several places of the right bank slope, the blocky debris is deposited, but the toe of very steep slopes on both abutments are exposed of basement rock and free from debris. The Gap slopes of high elevation are covered with forest.

The general trend of the tectonic structure of proposed scheme is north-south oriented. The northeasterly trending major fault system is recognized immediately west of Vigan Gap.

At the damsite, fresh diorite is only exposed at the left bank axis from riverbed up to the height of about 50 m. The diorite of right bank side is moderately to strongly weathered, thick dioritic stony to blocky talus is deposited at the steep parts of gully of right

abutment and also some rocks have been altered into clay and some debris remain in residual soil.

The dark gray color andesite at damsite is mainly massive showing block or slab jointing with a spacing of 1 to 100 cm. The brittle shale sequence consists of several cm to 10 cm platy structures which is exposed at east of andesitic rocks of damsite.

So that, the basement rock of damsite is generally sound and weathered partly. At the right abutment talus deposits and weathered diorite have to be excavated to at least 5-10 m in depth.

The permeability of bed rock on dam axis may be low to impermeable, however upstream side of damsite could be high to medium permeability due to intensive joints. In order to prevent leakage through the jointed and faulted zone of the dam foundation and abutments, grouting of subsurface is required.

The basement rock of power house site is underlain by stiff compacted metavolcanics. There is no serious geotechnical problem.

The reservoir area of about 284.4 km^2, extends towards eastward from damsite, within flat and broad meandering valley. In the reservoir area several typical cuesta is found near damsite. Sliding of rock way occur in the area because an existing landslide was observed on cuesta zone.

The reservoir basin is formed by wackes and shale with dacite and andesitic flows of Paleocene-Eocene rocks. The permeability and ground water condition of reservoir area is probably watertight, because hydrogeologically, thick impervious residual soil and high ground water level is expected in the flood plain of meandering valley.

The suitable rock quarry site is proposed at rocky hill 3 km upstream left river bank of the Abra river from damsite. The bed rock of hill is underlain by diorite or andesite. Fine aggregate and sand materials expected to riverbed sediments on the flood plain

within 3 km from damsite. The proposed borrow area for earth materials is located at the lower terrace deposits of right bank 1.5 km upstream of damsite.

Supo (1-22-0-5)

Supo scheme is proposed in middle reach of the Abra river at the boundary of Abra and Ilocos Sur Province, about 90 km upstream from Banaoang site and also this site is located around 25 km southeast of San Esteban NPC substation.

The Abra river winds towards north through the boundary of Luzon Central Cordillera and Ilocos Range. At the damsite the Abra river flows to west and forms V-shaped valley.

According to the existing geologic map, proposed scheme site is underlain by largely metavolcanics of Cretaceous to Paleogene as spilites and basalt, and lower Miocene sedimentary rocks. Several inferred faults occur along the Abra river. Structurally, major faults occur 500m upstream of damsite.

This scheme is proposed as rockfill dam and reservoir type and dam height of about 138 m has been considered. Both abutments are covered with residual soil of medium thickness. River gradation is almost flat slope then riverbed is filled with very thick sand and gravel.

Bed rock of damsite is probably underlain by hard and very sound metavolcanics with some fractured zone due to effective of fault. Surface about 5-10 m in depth may be weathered.

Power house is located at left bank of the Abra river, bed rock is underlain by metavolcanics which may be hard to very hard, and is covered several meters thickness of talus deposits. Then it will require no special foundation treatment. Reservoir area of Supo dam is about 37.2 km^2 at crest elevation of 320 m.

Major faults (trend N10°E) occur along the left bank of the Abra river and other several assumed faults occur along the right bank.

Reservoir area is underlain by lower Miocene sedimentary rock and Cretaceous-Paleogene metavolcanics. Reservoir area will be watertight except fractured fault zone. Slope stability is expected to be good, except some sliding soils and rocks after impounding.

Rock material will be supplied from the hard to very hard metavolcanics rock at 3.5 km south of damsite on right bank of the Abra river. Sand and gravel materials are expected within the Abra river immediately upstream of damsite. Earth material may be collected from the weathered zone of the lower Miocene sedimentary rocks.

Eteb (1-22-0-6)

Eteb scheme is proposed on the Abra river about 12 km upstream from Supo damsite. It is 1.5 km upstream of the confluence of the Abra and Ditong rivers, and 1 km downstream of barrio Eteb.

Proposed scheme is located at Ilocos Sur Province east side of Ilocos Range and west margin of Luzon Central Cordillera mountains. The alluvial flood plain of damsite is about 60 m wide and the abutment have moderate to steep slopes. However, the Abra river has enlarged its alluvial flood plain from upstream of barrio Eteb, and then mountain flanks have become gentle slopes.

Regional geology at the site is almost same to that of Supo scheme. Structure pattern is N-S, specially major fault running along the left bank of the Abra river. Proposed scheme site is probably underlain by metamorphosed andesite and basalt of Cretaceous to Paleogene and conglomerate, wackes and shale of lower Miocene.

Eteb dam is proposed as rockfill type, and dam height of about 118m has been considered. Bed rock of damsite is underlain by probably hard to very hard compacted sound metavolcanics with some fractured zone due to effect of fault at right abutment. Permeability is generally low except partial fractured zone. Rock strength is estimated to be enough for dam foundation except strongly fractured zone.

Power house is to be located at right bank of the Abra river. Bed rock is underlain by hard to very hard and slightly weathered metavolcanics covered with talus deposits.

Reservoir area is possibly underlain by metavolcanics and calstic sedimentary rocks which have enough watertightness except strongly fractured area. Reservoir area is surrounded by faults and fractured zone. Slope will generally be stable. However some area is not stable. Very large scale of debris flow is seen about 2 km upstream of damsite at left bank of the Abra river.

Construction materials can be expected in surrounding area with good quality and quantity. Rock materials will be collected from steep mountains ridges of metamorphosed basalt and andesite at 2 km east of damsite. Sand and gravel materials can be expected 1-3 km upstream of the Abra river flood plain. Earth materials will be supplied from residual soil of clastic sedimentary rocks which develop in gently sloped hilly area of 3.5 km south east of damsite.

Abra (1-22-0-10)

Abra scheme is located at upstream of the Abra river in most northern part of Benguet Province, which is situated in the Luzon Central Cordillera zone.

Intake weir site is located at 5 km southwest of the Mankayan Mining. This scheme is proposed as run-of-river type. Power house is to be located at right bank of the Abra river 8.5 km downstream

from intake site, and both sites are connected by water way tunnel of about 6 km long.

Proposed scheme area is located in Luzon Central Cordillera Range which rises up to 2000 m above sea level. The general geology of this area is similar to that of Agno-1 scheme. Geologic structural direction is south and north, and large scale fault is running along the Bacarus river.

According to the geological map, basement rock is underlain by metavolcanics of Cretaceous to Paleogene intruded by Neogene quarts diorite or granodiorite. And early to middle sedimentary rocks contact to intrusive rocks by fault. The geologic contact of quartz diorite and metavolcanics occur almost left bank of the Abra river. These are unconformably contact. Major structrues of the scheme are arranged at right bank side, where quartz diorite zone is seen.

Intake weir site is to be located at V-shaped valley, and residual soil of abutments is probably rather thick at higher part of both abutments. At riverbed, exposed bed rock are covered with some boulders and cobbles. Bed rocks is probably underlain by quartz diorite or granodiorite. Rock quality is estimated to be hard to very hard compacted. Permeability at the site may be very low except deeply weathered zone.

Waterway is in quartz diorite or granodiorite. Rock quality is probably hard to very hard indurated. Overburden is mostly enough thickness for tunneling except some points crossing small gully. Rock quality is probably hard to very hard, indurated and compacted. Rock is affected by fault at the outlet site.

Power house is to be located at right bank side which area is geologic contact zone of quartz diorite (Intrusive rock) and metavolcanics. Probably power house site is underlain by the intrusive rocks. These bed rocks are covered by thin residual soil and some talus deposits. Bed rock has enough strength to build power house.

The area of regulating reservoir is quite small and limited, so that no special problem is expected.

Concrete aggregate is expected to Cretaceous-Paleogene metavolcanics at 2 km northeast of damsite and sand material to be taken from 4-6 km downstream of power house.

Sisiritan (2-6-0-1)

Sisiritan scheme is proposed as a dam and reservoir type. Construction of approximately 112 m high rockfill dam is planned on the Abulog river. The proposed damsite is about 150 m wide U shaped valley on elevation 10m above sea level at riverbed.

The Sisiritan scheme is situated at 35 km upstream of estuary of the Abulog river, about 5 km downstream of confluence of the Abulog river and the Tauit river, in Kalinga Apayao Province.

According to the observation of aerial photographs and topographic maps, the Abulog river is very wide which is being vigorously variation of riverbed at upstream of damsite. A broad flat basin was formed between the Abulog river and the Tauit river.

The existing geological maps show the scheme site to be formed Miocene N2 Formation (probably equivalent to Cabangan Formation and Callao Formation) and Ibulao limestone.

The left abutment would be the Cabangan sandstone and contains some intercalated siltstone and claystone. Right bank abutment is probably formed of pervious limestone, which unconformably covers the clastic sedimentary rocks. Ibulao limestone is to form the deep and marrow canyon along the Abulog river 13 km upstream from damsite.

According to the aerial photographs and existing geological maps, major limeaments in the study area have generally north-south trend. one major and one minor fault systems were

recognized, namely, the Gened fault and unknown fault south of barrio Bubulayan.

The Gened fault is traceable for a distance of 9 km north-northeast ward and passes through the Abulug river canyon at the limestone area. The unknown fault strikes N45°E, dipping steeply, occur along the right bank of the TAuit river. The fault line is traceable for a distance of 5 km on the aerial photographs.

The riverbed is covered with thick sand and gravels. The right abutment of limestone area is covered with thick and dense forest. The left abutment of sandstone area is formed by steep cliff.

The foundation of the dam center core will be founded on slightly weathered sandstone and porous limestone. The depth of core trench depends on the thickness of the river deposits and weathered rock. The slightly weathered permeable zone underneath the riverbed and at both abutments will require some cement grouting to seal open fractures.

The power house is located immediately downstream of damsite on left bank of river where underlying sandstone covered with some residual soil.

Diversion tunnel will be excavated in the limestone zone on the right abutment without full support. Natural caves and water seepage course must be controlled by cement grout.

A quarry area to work fresh hard limestone, suitable for rockfill, could be exploited in the reservoir area 7 km southwest of damsite. The river and terrace deposits are probably very thick. It will be suitable for sand material of dam construction. Sandstone and claystone, probably suitable for earth material, will be exploited at residual soil deposits in the reservoir area within 2.5 km southwest from damsite.

Reservoir area is about 72.2 km^2 and which is submerged not only the wide alluvial plain also the Gadeng fault and limestone canyon.

The presence of thick calstic limestone cliff and the Gadeng faults in the canyon area indicates the possibility of the high permeability. As the depth of impounding water would be great, there is a risk of excessive leakage or seepage on the upstream of the limestone canyon. Some slides may occur at along the Tauit river after impounding, because the right bank of Tauit river is fourmed by deeply weathered faulted escarpments. Judgeing from such geological conditions, it is not recommendable to plan the scheme here.

Bubulayan (2-6-0-2)

Bubulayan scheme is situated at the wide gorge on the Abulog river about 13 km upstream of Sisiritan damsite in the northern part of Kalinga Apayao Province.

A dam height of about 183 m has been considered at this site. The Abulog river is meandering in the alluvial plain from 1 to 10 km downstream of the dam axis. The riverbed is about 70-80 m wide and the abutments have steep slope up to 200 m in elevation.

The project area is situated on the north-eastern margin of Luzon Central Cordillera. The area lies in the Cretaceous to Miocene Formation. These formations consist of thick extensive basaltics pyroclastic rocks and lava flows of Cretaceous-Paleogene Caraballo Group, and early Miocene limestone and clastic sedimentary rocks.

The Gened fault trend NNE lie in the limestone area 4 km upstream of damsite along the Abulog river valley within reservoir area.

The existing geological maps show the damsite to be formed of Ibulao limestone. These beds unconformably underlie sandstone and

siltstone of Cabagan Formation, which outcroppings surrounded alluvial flood plain between Bubulayan damsite and Sisiritan damsite.

The aerial photographs show prominent north-south trending large fault, namely Gened fault which controls the structure of the Bubulayan scheme.

According to the aerial photographs interpretations, bed rock is only exposed at the both banks of the Abulog river up to the high flood water level but further up hills are covered with dense forest.

The damsite is formed of slightly weathered hard and indurated limestone. However, the limestone can be expected to be pervious through well defined, interconnecting open joints and fractured fissures particularly at immediately upstream of damsite where it would be faulted.

And then, big amount of leakage and extensive cement grouting at damsite can be considered necessary. Therefore, this damsite is not recommendable from such poor geological conditions.

Bulu (2-6-0-3)

The Bulu scheme is proposed as a dam and reservoir type. Construction of about 160 m high rockfill dam is planned on the Abulog river about 15 km upstream of the Bubulayan damsite.

The width of riverbed is about 60-100 m . The flood plain of river can be expected to vary from sand to gravel layers and 20 to 30 m in thickness. The both abutments of damsite show steep slopes.

The aerial photographs of this area show prominent generally north-south trend geologic structures and several east-west trend geologic lineaments.

Several faults are inferred to across at a right angle to the Abulog river. Three major faults were recognized, namely, the Bulubatuan fault immediately east of damsite, Magapta fault 2.5 km west of damsite, and Kabugao fault 1 km west of Magapta fault.

Bulubatuan fault strikes N6°W and dipping 71°SW across the immediately downstream of damsite. Magapta fault trends northwesterly and intersects the Abulog river three times. Kabugao fault has kerencols and kerenbats which is 39 km in length. Due to the Gened Feasibility Study Report (1979), Kabugao fault is to be active.

The existing geological maps show the scheme area to be formed of andesitic rocks of Eocene Licuan Formation intruded by diorite in the Miocene age.

The left abutment of Bulu damsite is probably composed of diorite, whereas the right abutment is Eocene andesite.

Both abutments have many broken closely-spaced joints and may be expected to have moderately to high permeability. The bed rock at the left abutment is intensely loosened, due to influence of Bulubatuan fault and minor fault across the dam axis at the right abutment. Special treatment for dam foundation such as curtain grout and consolidation grout will be required.

The reservoir area of about 97.4 km^2 extends along the Abra river and the Binuan river. The steep valley slopes are generally covered with forest or bush, but several sliding topographic slope are found by aerial photographs interpretation.

The bed rocks of slope of river banks, are exposed up to the high flood water level. The reservoir area is generally estimated to be low permeability, because it is formed by diorite and andesite. However many fractured faults exist crossing the Abulog river and along the Binuan river. Therefore the water leakage through these fractured faults are expected. Many minor slides may occur at

vicinity of fractured faults zone after impounding. Slopes covered with bush will deliver fine materials sedimentation to the reservoir.

The power house is proposed at the downstream dam toe of right bank side where underlying andesitic rocks covered with alluvium and residual soil. The degree of fracturing is intense due to influence of faulting action.

The most suitable location for construction materials is the diorite rock 2.5 km south west of damsite. The borrow area of sand and gravel occur on the flood plain which is about 2 to 8 km upstream from damsite. Core materials will be supplied from the residual soil of diorite which develops in gentle topographic area.

Nababalayan (2-6-1-4)

Nababalayan scheme is proposed as dam and reservoir type. Approximately 161 m high rockfill dam is planned on the Abulog river in the Luzon Central Cordillera.

The proposed damsite is situated on the narrow steep V-shaped valley of the Apayao river about 14 km upstream of Bulu damsite.

The running direction of Apayao river is shifted from north-south to west-east direction at the confluence of Apayao river and unnamed big tributary about 6 km upstream of damsite.

The riverbed is covered with thick sand, gravels, cobbles and boulders. Both abutments are covered with largely grassland and some forest occupied at steep slope. The riverbed of damsite lying at an elevation of around 101 m above sea level is about 130 m wide.

Geologic structure in this area trend generally northwest to southeast direction. The Kabugao fault is traceable along the Apayao river apart 2 km east for a distance 39 km. Named faults are as described for the Bulu scheme.

The existing geological maps show the proposed scheme site to be formed andesite, quartz-diorite, dacite, agglomerate which are belong to Eocene and Oligocene.

The proposed damsite is probably situated in the zone of Eocene Licuan Formation II. Geological interpretation of aerial photograph indicates on lineament of northwesterly orientation through left abutment of damsite which may possibly be fault. The licuan Formation II exposed along the Apayao river is composed of andesitic rock. It is probably hard to rather hard slightly weathered, and well jointed partially, strongly fractured.

The fractured and loosened permeable zone is estimated at a certain depth below surface at both abutments and underneath the riverbed. The permeable zone must be sealed by grouting at the base of dam center core.

Power house near barrio Nangsimbo on the lift bank of the Apayao river are laid on the hard to rather hard andesite which covered with river terrace deposits. One inferred fault runs parallel to the river through power house site, but probably no serious problems are envisaged for the power house.

Reservoir area of about 42.6 km^2 seems to be underlain by andesite and quartz diorite. Seepage is to be expected at the several fractured zones and faults. There is strong fractured zone and landslide configuration at 2-6 km upstream of the damsite. It is expected land slide and rock fall will occur at scarsely vegatated slope after impounding.

The suitable construction materials are located at the andesitic rock hill 2 km northwest and rock fall in the river floor within 5 km from damsite. The most suitable location for sand and gravel is the river and terrace deposits within 2 km from damsite. Residual soil of andesitic rock suitable for earth material could be obtained at 1 km southeast of damsite.

Dibagat (2-6-1-5)

The Dibagat scheme is proposed as rockfill dam and reservoir type, and dam height of about 207 m have been considered at this site. The proposed site is situated on the Apayao river about 26 km upstream of the Nababalayan damsite in the Kalinga-Apayao Province.

Regional geology at the site is almost similar to that of Nababalayan scheme. The existing geological maps and aerial photographs show the damsite is underlain by dacite of Oligocene, andesite of Eocene Licuan-II Formation.
The Dibagat damsite is located at the V-shaped valley with thick river deposits on the sharp bend of the Apayao river. The right abutment consists of dacite, whereas the left abutment consists of dacite and Eocene andesite.

These rocks consists of probably hard to rather hard quality with some joints and cracks and exposes at the toe of abutment up to the high flood water level along the river.

The slope of right bank is almost bare except at the lower elevations. The left abutment is still forested. The steep slopes of right abutment are nearly free from any debris and stable. However, there is a deep eroded gully at downstream side of left bank which delivers talus deposits to the Apayao river.

Geological interpretation of aerial photograph indicates faulted lineament of northeasterly orientation at behind of right abutment, and it is traceable for a distance of 6 km reach to Kabugao active fault.

One big scale land slide configuration is found at the right bank of Apayao river from 3 km downstream of damsite and its washout almost occupied the flood plain of the Apayao river, due to effect of faulting zone. Both abutments of damsite are stable and suitable for construction of rockfill dam without special foundation treatment.

Power house is located at right bank side where slightly weathered hard to rather hard dacite crop out on river side. No serious problems are seen geotechnically.

Reservoir area of about 44.4 km^2 is underlain by Eocene andesite, Oligocene dacite, Miocene andesite and intrusive diorite of Miocene.

The reservoir slopes are steep and almost sparsely vegetated, they appear to be much sedimentation. Several faults are recognized within reservoir area. Seepage is to be expected from these fault zone, however a large portion of the reservoir area is impervious.

The suitable location for construction materials are rock fall within river flood plain and the fresh and hard dacitic rocks of left abutment at 1 km upstream from damsite. The most suitable location for sand and gravel is the river and terrace deposits within 4-9 km downstream from damsite. Residual soil of quartz-diorite suitable for earth material could be obtained at 3.5 km south-west of damsite.

Agbulu (2-6-1-6)

The Agbulu scheme is proposed as about 180 m high concrete gravity dam and reservoir type.

The proposed damsite is situated on the Apayao river about 8 km upstream of Dibagat damsite and 1.5 km downstream from the confluence of the Tabayagan and Apayao rivers in the Kalinga Apayao Province.

The Apayao river runs in a deeply cut canyon V-shaped, and left abutment of damsite is formed of thin ridge covered with bush. The Logunao river joins the Apayao river at immediately downstream of left abutment. The riverbed of damsite lying at an

elevation of around 185 m above sea level is about 40 m wide, covered with thick river deposits.

Regional geology of this scheme is almost similar to that of Nababalayan scheme. The existing geological maps and aerial photographs show the scheme site to be formed of andesite of Miocene mabace Formation, dacite of Oligocene Tineg Formation, andesite of Eocene Licuan Formation-II and diorite of Miocene plutonic rock.

Geological interpretation of aerial photograph indicates one short lineament of west-northwestly orientation through immediately downstream of damsite. This lineament may be connected with big slide scars which is located at left bank side of the river.

The damsite geology is underlain by probably hard to very hard sound Miocene andesite. High permeability zone is expected at shallow part of subsurface rock, because intensely jointed andesite outcrops on lower part of both abutments. There is no serious problem on dam foundation, however medium scale curtain and consolidation grout and rather deep excavation are necessary.

Power house site is proposed at left bank of the Apayao river immediately upstream of the confluence of the Apayao and Lagunao rivers. Proposed power house site is also underlain by sound Miocene andesite covered with residual soil.

Reservoir area is about 37.7 km^2. In general the reservoir would be underlain by Miocene andesite and intruded sand and gravel. The higher elevation of reservoir slope are covered with sparsely vegetated and grass land. It would be happened rock slides or soil slips after impounding and probably rate of silting in the reservoir is rather high value. The seepage problem of reservoir area would be remote except fractured zone.

The most suitable location for concrete aggregate materials is to be fresh Eocene andesite mountain within 5 km downstream from

damsite. Borrow area of sand and gravel is proposed at flood plain 1 to 3 km upstream from damsite.

Apayao (2-6-1-8)

Apayao scheme is proposed as a run-of-river type, comprising 6 m high intake weir, 8295 m water way tunnel and power house. Intake weir is situated on the Apayao river about 36 km upstream of Agbulu scheme and 4 km north-northeast of Mt. Magsingit (1175 m). Approximately 100 m of head is taken with about 8 km long tunnel.

According to the existing geological maps, regional geology consists of metaphorised spilites and basalt (Cretaceous-Paleogene) intruded quartz diorite and diorite which belongs to be Neogene. Limestone (probably equivalents to No. 2 Formation) overlies on these metavolcanics.

Geologic structures trend approximately south to east or northeast to southwest. Anticline axis is located about 3 km east of intake site, and also sycline axis is located west side.

Intake weir site which is formed V-shaped valley by quartz-diorite and diorite is situated about 5 km downstream barrio Slongsang. Quartz-diorite intrudes into metavolcanics. One fault occurs apart 1 km to southeast of weir site. Basement rock of intake weir site is hard and indurated, however, shallow part is to be weathered and highly permeable. Both abutments have rather thick weathered zone at high elevation. Riverbed covered with boulder and gravel forms rapid. There is no geologic hazards for the weir foundation.

Power house is proposed at an altitude of 300m on left bank of the Apayao river 1 km downstream from confluence of the Apayao and the Aoan rivers. This site is probably underlain by very hard spilite and basalt covered with terrace deposits. The Apayao river

bends at this point. Water way tunnel of about 8 km long connects intake weir site and power house site.

Inlet site of water way tunnel is underlain by quartz diorite, and outlet site is underlain by metavolcanics rocks. Both rocks are hard and enough strength to excavation work. However, middle part of water way tunnel passes underneath deeply cut on the slope very thin overburden, and also intersects diagonally the fault which is probably fractured. There, full support will be necessary for tunnel excavation.

The suitable location for rock materials is the quartz diorite mountain area from 1.5 km south of damsite. Borrow area of sand and gravel is proposed at around 5 km upstream riverbed from intake weir.

Basao (2-8-3-3)

The Basao scheme is proposed as a dam and reservoir type. Construction of rockfill type dam, approximately 177 m high and 856 m long at the crest is planned on the Chico river about 38 km downstream of Bontoc and near barrio Basaso. The Chico river basin is located on the center part of Luzon Central Cordillera which is underlain by Cretaceous to Paleocene metavolcanics. Major fold and fault trends in this area generally trend northeast to southeast.

According to geological map of the Northeast Luzon (JICA-MMAJ, Aug. 1981) the proposed site consists of basalt and agglomerate of Miocene Licuan Formation. Fault zones and small shear planes occur frequently in the area of both valley flanks. The proposed damsite is situated at 5 km downstream from confluence of the Chico river and the Makilo Creek at 2 km northeast of barrio Basao. The proposed dam axis is located at 400 m upstream from the Chico No. 3 site. According to the Pre-Feasibility study (1973, Lahmeyer International), the damsite area is composed of hard and indurated rock.

The Chico river forms a deep V-shape valley around the damsite. Bed rock of damsite is underlain by massive basalt which is hard to very hard and loosened in the upper layer of the slope. Slides will occur at where the slope is oversteep. In the riverbed, there are 4 to 6m thick layer of sandy grave, rock fall and huge block rock. Terrace deposits exist mainly lower part of both abutments which are composed of sandy gravel and boulder. Small scale loamy slope deposits occur on the right abutment slope of downstream site. The permeability of both dam abutments are probably rather high due to wide distribution of rather deeper loosened rock. Therefore large volume of grouting is to be required.

Power house site is proposed at right bank of the Chico river immediately upstream of the confluence of the Chico river and small creek. The site is probably underlain by hard basaltic agglomerate covered with thick terrace deposits and stony loam. Therefore large volume of excavation is to be required. These deposits, similar to the recent river deposits are distributed at various height of downstream of damsite. Probably basementrock is locally sheared by the fault.

Reservoir area is about 5.4 km^2 in case of dam crest elevation is 672 m, and is underlain by basalt and agglomerate of Miocene Licuan Formation. Most upstream of the reservoir is reached to power house site of Sadanga scheme.

Basao reservoir seems to be watertight and stable except vicinity of assumed fault at the right bank of the Chico river. Locally several rock slidings will happen after impounding.

The most suitable rock material is located at 700 m west of damsite which is composed of fresh and hard basalt and agglomerate. Proposed sand and gravel borrow area is the flood plain and river terrace of the Chico river which is situated at 1-2 km downstream from damsite. Earth materials is expected to residual soil of basalt and agglomerate which is located at 3.5 km southwest of damsite.

Chico-1R (2-8-3-4)

Chico-1R scheme is proposed in the Chico river basin as a run-of-river type, consists of 7 m high concrete intake weir, 3 km long water way tunnel and power house, with a head of 60 m between headwater and tailwater.

Intake weir (El. 617 m) is situated at 300 m downstream from confluence of the Chico river and the Malanas creek. The water way tunnel route is situated at right bank of the Chico river. The power house is situated at about 500 m southwest of barrio Bugnay.

The Chico river basin is located on the center part of Luzon Central Cordillera which is underlain by Cretaceous to Paleogene metavolcanics, where major fold and fault trends in this area generally trend northeast to southwest.

According to Geological Map of the Northwestern Luzon in scale of 1/250,000 (JICA-MMAJ, Sep. 1981), the proposed scheme site consists of basalt and conglomerate of Miocene Licuan Formation.

The Chico river which is covered with talus deposits at the toe of the valley slopes forms V-shaped valley around the intake weir site. The Chico-1R intake weir site would be underlain by hard to very hard basalt and agglomerate and locally slightly to moderately weathered. Therefore, no special treatment of dam foundation is required.

The regulation reservoir of intake weir is underlain by basalt and agglomerate of Eocene, which are estimated to be impervious. Minor permeable zone may exist only at fractured fault zone.

Landslide scars are scarce so that reservoir slopes are to be stable. The water way tunnel route would be driven through hard and sound basalt and agglomerate of Eocene Licuan Formation. The fault trend northeast to southwest exist parallel to the tunnel route apart about 2 km. Special excavation conditions are not to be

expected, except intensely fractured rock zone where full support must be considered.

The power house for Chico-1R will be founded on fresh sound Miocene basalt and agglomerate. No serious geologic hazards are estimated for the power house foundation.

The most suitable concrete aggregate is located at 1.5 km northeast of intake weir site which is probably composed of fresh and hard basalt agglomerate. Proposed sand and gravel borrow area is situated at 5-8 km upstream within flood plain and river terrace of the Chico river.

Sadanga (2-8-3-5)

Sadanga scheme is proposed as a rockfill dam and reservoir type on the Chico river. The proposed dam has a height of approximately 228 m and a crest length of about 463 m.

Proposed scheme is located on the Chico river at 16 km downstream of Bontoc (capital city of Mt. Province) in the Luzon Central Cordillera.

Regional geology of this scheme is similar to that of Chico-1R scheme, that is, Cretaceous to Paleogene metavolcanics and Neogene intrusive rocks.

The existing geological maps show the scheme site is largely formed of Eocene Licuan Formation and intruded by Neogene granodiorite and dacitic to andesitic Quaternary volcanics vicinity of Bontoc. Several faults exist in the scheme site with general trend of northeast to southwest.

According to the geological map of Sadanga in scale of 1/5000 (NPC-Lahmeyer International; Chico river feasibility study report, 1973), proposed damsite is underlain by fresh slightly jointed basalt

and agglomerate. One N-S trend wide fractured fault zone appears on left bank of the Chico river at 500 m west of damsite.

At the damsite the Chico river flows southeast to northwest in a V-shaped valley. There is scarely deposits on the riverbed. The slope of dam abutments is covered with thin residual soil or talus deposits. Weathering of the bed rock is very thin at right abutment. At the left abutment weathered zone is rather thick and locally reaches to 10 m in depth.

Considering the geotechnical and topographical condition at the damsite, concrete gravity dam would be suitable. Because, foundation rock would consists of fresh and hard sound basalt and agglomerate, and may be expected as watertight.

Power house site is proposed at right bank on a sequence of hard and sheet jointed basalt and conglomerate which is covered with residual soil and talus. No serious geological problem is seen.

Reservoir area of about 13.5 km^2 is underlain by agglomerate and basalt of Miocene Licuan Formation. Upper reservoir is to reach to barrio Tucucon about 4 km downstream of Bontoc. Sadanga reservoir seems to be watertight and stable except vicinity of assumed fault at the right bank of the Chico river, where several slidings will happen after impounding.

Quarry site producing crushed rock from fresh and indurated basalt and agglomerate, would be located at 3 km south of the damsite. Sand gravel, suitable for rock fill filter, would be located in the riverbed within 2 km of the damsite. Earth materials is expected to residual soil of basalt and agglomerate which is located at 3.5 km southeast of damsite.

Chico-2R (2-8-3-6)

Chico-2R scheme is proposed as a run-of-river type. Construction of about 6 m high and 74 m width concrete intake weir is planned on the Chico river. Approximately 115 m head is taken with 6 km long water way tunnel, through left bank of the Chico river.

The proposed intake site (El. 773 m) is located at 400 m upstream from barrio Tucuan where is confluence of the Tahibin and the Chico rivers in the Mt. Province. The power house is located at about 3.5 km downstream of confluence of the Bituagan creek and the Chico river.

According to geological map of the Northwestern Luzon in scale of 1/250,000 (JICA-MMAJ, Sep. 1981), the proposed scheme is in the Eocene Licuan Formation in LUzon Central Cordillera.

Intake weir site is covered with thin residual soil and some talus deposits. River deposits are found at limited area and its thickness is unknown. Bed rock of intake weir site is to be underlain by hard to very hard basalt and agglomerate. These rocks are locally weathered and jointed. Watertightness of bed rock is to be generally good except fractured and weathered zone. There are no major faults to affect the stability of the intake weir.

Rock quality of water way tunnel route which is underlain by basalt and agglomerate, is probably fresh and compacted. However in the outlet area of water tunnel, full supporting works will be required, as the rock is fractured and brittled due to fault.

Power house site is proposed at left bank of the Chico river near Bagwang Gate House. Hard but fractured basalt and agglomerate of Eocene may exist at the power house site. It is assumed some special treatment for power house foundation is necessary on the basement rock.

Regulating reservoir area has no major fractured faults, and also flanks of reservoir area is stable. Therefore, there is no problem geotechnically and hydrologically.

The most suitable concrete aggregate is located at within 2 km east from intake weir site which is underlain by fresh indurated basalt. Proposed sand and gravel borrow area is located at on the flood plain of Bontoc, 4-6 km upstream from damsite.

Chico-3R (2-8-3-7)

Chico-3R is proposed as a run-of-river type, consisting of about 6 m high and 79 m width concrete intake weir at 2 km downstream of Bontoc in Mt. Province. Approximately 78 m head is taken with 4 km long water tunnel, through right bank of the Chico river.

Power house is proposed at immediately west side of confluence of the Chico and Talubin rivers which is located at 500m east of intake weir site of Chico-2R scheme.

Regional geology is similar to that of Sadanga scheme. Bed rock of this scheme is underlain by Eocene Licuan Formation which have been intruded by Neogene Grano diorite and quaternary volcanics.

Bed rock of intake weir is inferred to be underlain by very hard intrusive granodiorite and locally slightly weathered. Toe of both abutments of intake weir site is covered with talus deposits, and at upper part of abutments is underlain by rather thick residual soil. Riverbed is filled with big boulder and sand, the thickness of these sediments is unknown.

Watertightness of regulating reservoir may be generally good except fractured and weathered zone.

The water way tunnel passes two kinds of rocks. Former is grano-diorite which is situated within 700 m from intake weir, and the other area is occupied by basalt and agglomerate of Eocene Licuan Formation.

Tunnel supporting is minimized except geologic contact due to indurated and fresh rock quality, and also overburden is enough thickness for tunnel excavation.

Bed rock of power house site seems to be underlain by hard to very hard and slightly weathered basalt or agglomerate which is covered with thin residual soil and talus deposits. No special foundation treatment is required.

The floor of regulating reservoir is probably underlain by grano-diorite covered by thick flood plain and reservoir slope to be appeared stable. Then, no special treatment is needed.

The quarry site for concrete coarse aggregate is proposed at within 2.5 km east of from intake weir site. Fine aggregate consisting of sand and gravel is also expected to be obtained within 1 km upstream from damsite within flood plain of the Chico river.

Chico-4R (2-8-3-8)

The Chico-4R scheme is proposed as a run-of-river type. About 6 m high and 71 m width concrete intake weir is planned on the Chico river at barrio Gonogon 14 km upstream from Bontoc, capital city of Mt. Province, in the Luzon Central Cordillera.

The water way tunnel passes from the right bank of the Chico river to the left bank of the Gufyon river. About 75 m head is taken with 6.6 km long straight water way tunnel. The power house site is located at left bank of the Gufyon river, 1.5 km upstream of junction of the Gufyon and the Chico rivers.

Regional geology is almost same to that of Sadanga scheme, that is, basalt and andesite of Eocene Licuan Formation, dacite of Oligocene Tineg Formation and granodiorite which is intrusive the Licuan and Tineg Formation. Geologic structure of this area is controlled by NS trending.

Topographically, intake weir site is open V-shaped and abutment is covered with rocky residual soil and loamy slope talus. Riverbed is composed of exposed bed rock with covered by small amounts of sand and gravel. Bed rock of intake weir site is underlain by dacitic rock of Tineg Formation at left bank and riverbed, and basaltic or andesitic rock of Licuan Formation occurred at right bank.

The geologic contact of both formation is near intake site at right river bank of the Chico river. Rock quality of bed rock is probably hard and enough strength for construction of concrete weir except geologic contact zone. Therefore, there is no special treatment needed.

Water way tunnel extends from weir site to northeast direction. The bed rock at inlet area and the most part of tunnel route is underlain by fresh and compacted basalt and agglomerate. The last 1 km of tunnel route is underlain by grano-diorite. Geologic structurally, assumed fault diagonally intersect the tunnel at 2.5 km point from outlet. This area is necessary to full support during the excavation of tunnel.

The power house is located at left bank site of the Gufyon river which is probably underlain by hard grano-diorite covered with residual soil and talus deposits and partly weathered. There is no special treatment necessary.

Regulation reservoir area is underlain by dacitic pyroclastic flow and lava which is covered with river deposits, terrace deposits and talus deposits. Permeability of bed rock is low and watertight. No major fault passes within the regulation reservoir. The regulation reservoir slopes are assumed to be stable due to no evidence of land slides.

The quarry site for concrete aggregate is proposed at 1 km east of damsite which is composed of fresh and indurated basalt, andesite and agglomerate of Eocene Licuan Formation. Excavation cuttings is also expected to be from tunnel. Fine aggregate is also expected to