Table 3.18 (1/5)

Status of Meteorological Instrument in PAGASA

Name of Instrument	Air Temperature 1 Ordinary thermometer 2 Max./Min. thermometers 3 Thermograph			Atmospheric Pressure 1 Mercurial barometer 2 Aneroid barometer 3 Barograph			Wind 1 Wind vane 2 Anemometer (Anemograph) 3 Wind Mill Anemometer			Humidity 1 Psychrometer 2 Hair hygrometer		Precipitation 1 Rain gauge 2 Tilting bucket raingauge		Duration of Sunshine 1 Cambell-Stokes Recorder 2 Jordan Sunshine Recorder Solar Radiation 1 Eppley Pyranometer 2 Robitch Pyranometer	Special Observation Upper: Upper-air Observation Radar: Weather Radar Observation
Basco	1 USWB	2 USWB	3 USWB	1 JAPAN SUZUKI		3 USA BELFORT		2 JAPAN OTA	3 JAPAN ISUZU	1 USWB		1 LOCAL 8 in. Std.	2 USWB	1 LONDON	Upper
Vigan	1 USWB	2 USWB		1 JAPAN SUZUKI		3 USWB		2 JAPAN		1 USWB		1 USWB		NONE	NONE
Laoag	1 USWB	2 USWB	3 JAPAN TAMAYA '73	1 JAPAN SUZUKI	2 USWB	3 CACELLA & FRIEZ	1 JAPAN KOSHIN			1 KHALSICO '82		1 LOCAL 8 in. Std.	2 JAPAN OTA	1 USWB	Upper
Aparri Rad.				1 JAPAN KSF	2 USWB	3 USWB		2 USWB		1 USWB			2 JAPAN OTA '73	NONE	Radar
Aparri	1 USWB	2 USWB		1 USWB	2 USA BELFORT		1 USWB			1 USWB		1 JAPAN OTA '73	2 USWB	NONE	NONE
Tuguegarao			3 JAPAN OTA '73	1 USWB		3 USA BELFORT	1 USWB	2 JAPAN		1 USWB		1 JAPAN OTA '73	2 JAPAN OTA '73	NONE	NONE
Baguio Rad.														NONE	Radar
Iba	1 USWB	2 USWB		1 JAPAN		3 JAPAN OTA	1 USWB	2 JAPAN		1 USWB		1 LOCAL 8 in. Std.	2 JAPAN OTA '73	NONE	NONE
Dagupan	1 USWB	2 USWB	3 JAPAN OTA '73	1 JAPAN OTA '73		3 JAPAN '73	1 JAPAN			1 JAPAN		1 LOCAL 8 in. Std.'73	2 JAPAN OTA '73	NONE	NONE
Baguio	1 USWB	2 USWB	3 ENGLAND	1 USWB		3 USWB		2 JAPAN OTA		1 JAPAN KHALSICO		1 LOCAL 8 in. Std.	2 JAPAN OTA '73	1 USWB	Upper
Cabanatuan	1 USWB	2 USWB	3 JAPAN OTA	1 USWB		3 USA BELFORT	1 JAPAN OTA S45			1 USWB		1 JAPAN OTA '73	2 USWB	1 USWB	NONE
Balar	1 USWB	2 USWB		1 JAPAN SUZUKI		3 USA BELFORT	1 USWB			1 USWB			2 JAPAN OTA '73	NONE	NONE
Basco Rad.														NONE	Racar
Casigran															
Port Area	1 USWB	2 USWB	3 USWB		2 USWB			2 USWB		1 USWB	2 USWB	1 USWB	2 USWB	NONE	NONE
Tayabas	1 USWB '74	2 WEKSLER '73	3 BARCON	1 JAPAN '74	2 FAURA '63	3 JAPAN '73	1 USA BELFORT			1 USWB '74		1 LOCAL 8 in. Std. '70	2 JAPAN OTA '64	NONE	NONE
Sangley		2 USWB		1 ——	2 JAPAN OTA	2 ——	1 JAPAN KOSHIN		3 JAPAN OTA			1 JAPAN OTA	2 JAPAN OTA	NONE	NONE

Table 3.18 (2/5)

Status of Meteorological Instrument in PAGASA

Name of Instrument	Air Temperature 1 Ordinary thermometer 2 Max./Min. thermometers 3 Thermograph	Atmospheric Pressure 1 Mercurial barometer 2 Aneroid barometer 3 Barograph	Wind 1 Wind vane 2 Anemometer (Anemograph) 3 Wind Mill Anemometer	Humidity 1 Psychrometer 2 Hair hygrometer	Precipitation 1 Rain gauge 2 Tilting bucket raingauge	Duration of Sunshine 1 Cambell-Stokes Recorder 2 Jordan Sunshine Recorder Solar Radiation 1 Eppley Pyranometer 2 Robitch Pyranometer	Special Observation Upper: Upper-air Observation Radar: Weather Radar Observation
MIA	M733 Micro Computer, USA	1 Fortin; 2 NEW-JARSY; 3 BALTI-MORE	M733 Micro Computer, USA	M733 Micro Computer, USA	1 LOCAL 8 in. Std.; 2 JAPAN OTA '73	NONE	NONE
Science Garden	3 JAPAN '67	1 JAPAN; 2 JAPAN; 3 USA	1 USWB; 2 USWB; 3 USWB	1 USWB	1 JAPAN; 2 JAPAN	1 USWB; 2 USWB	
Calapan	2 USWB	1 WBZ; 3 JAPAN OTA '73	3 USA BELFORT (W/D DEFECT)	1 USWB	1 LOCAL 8 in. Std.; 2 JAPAN OTA '73	1 LONDON (CASELLA)	NONE
Ambulong	2 USWB	1 USWB (DEFECTIVE); 3 JAPAN OTA (DEFECTIVE)	DIGITAL KAHAL 1982	1 USWB; 2 USWB	1 LOCAL 8 in. Std.; 2 JAPAN OTA	1 USWB	NONE
Infanta	2 USWB	1 JAPAN SUZUKI; 3 BENDX FREEX	1 USA BELFORT			NONE	NONE
Alabat	2 USWB; 3 JAPAN OTA '73	1 USWB; 3 USA BELFORT	1 JAPAN KOSHIN	1 ——	1 LOCAL 8 in. Std.; 2 JAPAN OTA	NONE	NONE
San Francisco	1 USWB; 3 USWB	1 USWB; 2 USWB	NONE	1 ——	1 LOCAL 8 in. Std.; 2 JAPAN OTA	NONE	NONE
Daet Rad.	1 USA WEKSLER; 3 JAPAN OTA '73	1 JAPAN SUZUKI; 3 USA BELFORT	2 JAPAN NAKAASA (DEFECT.)	1 JAPAN OTA	2 JAPAN OTA	NONE	Radar
Legaspi	1 USWB; 2 USWB; 3 JAPAN OTA '73	1 JAPAN SUZUKI '73	1 USWB; 2 USWB; 3 USWB	1 USWB	1 JAPAN OTA; USWB	NONE	Upper
Virac	1 USWB; 2 USWB; 3 JAPAN OTA '73	1 JAPAN; 3 JAPAN OTA '73	1 USWB; 2 USWB	1 USWB; 2 USWB	1 JAPAN '69	1 KALSICO	NONE
Virac Rad.	1 USWB; 2 USWB	1 JAPAN	1 USWB; 2 USWB	1 USWB; 2 USWB	1 JAPAN OTA (DEFECT.)	NONE	Radar
Zamboanga	1 USWB; 2 USWB; 3 USA FRIEZ	1 JAPAN SUZUKI; 2 USWB; 3 JAPAN OTA	2 JAPAN ISUZU	1 USWB	1 LOCAL 8 in. Std.; 2 JAPAN OTA	1 LONDON (CASELLA)	Upper
Davao	1 JAPAN OTA; 2 JAPAN OTA; 3 JAPAN OTA	1 JAPAN SUZUKI; 3 USA BELFORT	3 JAPAN OTA (DEFECT.)	1 JAPAN OTA	1 LOCAL 8 in. Std.; 2 JAPAN OTA (DEFECT.)	1 LONDON (CASELLA); 1 EPPLEY (no chart)	Upper
Guiuan	1 USWB; 2 USWB; 3 USWB	1 JAPAN SUZUKI; 3 USA BELFORT	1 WEATHER TROPICS '84 (DEFECT.)	1 USWB	1 LOCAL 8 in. Std.; 2 JAPAN OTA	NONE	Radar
Tacloban	1 USWB; 2 USWB	1 USWB; 2 FAURA; 3 USA BELFORT	2 USA BELFORT (DEFECT.); 3 JAPAN OTA	1 USWB	1 JAPAN OTA; 2 JAPAN OTA	NONE	NONE
Sanjose Mindoro	1 USWB; 2 USWB; 3 ENGLAND	1 BOARD; 3 USA BELFORT	2 INTB (DEFECT.); 3 JAPAN KOSHIN	1 USWB	1 LOCAL 8 in. Std.; 2 JAPAN OTA '73	NONE	NONE
Puerto Princesa	2 USWB; 3 JAPAN OTA	1 USWB; 3 USA BELFORT	2 JAPAN OTA	1 USA WHIRLING	1 LOCAL 8 in. Std.; 2 JAPAN OTA	NONE	Upper

Table 3.18 (3/5)

Status of Meteorological Instrument in PAGASA

Name of Instrument	Air Temperature 1 Ordinary thermometer 2 Max./Min. thermometers 3 Thermograph			Atmospheric Pressure 1 Mercurial barometer 2 Aneroid barometer 3 Barograph			Wind 1 Wind vane 2 Anemometer (Anemograph) 3 Wind Mill Anemometer			Humidity 1 Psychrometer 2 Hair hygrometer		Precipitation 1 Rain gauge 2 Tilting bucket raingauge		Duration of Sunshine 1 Cambell-Stokes Recorder 2 Jordan Sunshine Recorder Soler Radiation 1 Eppley Pyranometer 2 Robitch Pyranometer	Special Observation Upper: Upper-air Observation Radar: Weather Radar Observation
Iloilo															
Masbate	1 USWB	2 USWB	3 USWB	1 JAPAN SUZUKI	2 ——	3 USA BELFORT	1 WEATHER TROPICS		3 ——	1 USWB		1 LOCAL 8 in. Std.	2 ——	1 KHALSI * Integral Digital Co. Printer USA	NONE
Macten Rad.	NONE			NONE			NONE			NONE		NONE		NONE	Radar Upper
Macten	1 USWB	2 USWB	3 USA BELFORT	1 JAPAN SUZUKI	2 JAPAN NIHON KISHO SOKKI	3 USA BELFORT (DEFECT.)	1 WEATHER TROPICS	2 JAPAN ISUZU		1 USWB	2 USWB	1 USWB	2 JAPAN OTA (DEFECT.)	NONE	NONE
General Santos	1 USWB	2 USWB		1 JAPAN SUZUKI		3 USWB (DEFECT.)	1 JAPAN OTA '73			NONE		1 LOCAL 8 in. Std.	2 JAPAN OTA (DEFECT.)	NONE	NONE
Cotarman	1 USWB '74	2 USWB '74		1 JAPAN SUZUKI '81		BELFORT '78 3 OTA '83 CASELLA '78	1 JAPAN OTA	2 JAPAN OTA		1 USWB '74		1 LOCAL 8 in. Std.	2 JAPAN OTA	NONE	NONE
Lumbia	1 USWB	2 USWB	3 JAPAN OTA	1 JAPAN SUZUKI	2 JAPAN NIHON KISHO SOKKI	3 USA FRIEZ	1 WEATHER TROPICS			1 USWB		1 LOCAL 6 in.	2 JAPAN OTA	1 LONDON (CASELLA)	NONE
Masin	1 USWB	2 USWB	3 JAPAN OTA '73	1 USWB	2 JAPAN	3 USWB	1 USWB			1 USWB		1 JAPAN OTA '73		NONE	NONE
Catbalogan	1 USWB	2 USWB		1 USA GREED	2 FAURA	3 CASELLA	1 USA	2 USA FRIEZ		1 USWB	2 USWB	1 USWB LOCAL	2 JAPAN OTA '73	NONE	NONE
Puerto Princesa	* SEISMOLOGICAL			o HELICORDER/RV-301 o HELIDYNE GEOTECH CALIBRATION CONTROL/CC-210 o HELICORDER AMPLIFIER/AR-311											
Roxas	1 USWB		3 USA BELFOR	1 JAPAN SUZUKI		3 JAPAN OTA		2 USA BELFORT		1 USWB		1 LOCAL 8 in. Std.	2 JAPAN OTA (DEFECT.)	1 ——	NONE
Tagbilaran	1 USWB	2 USWB	3 JAPAN OTA '73	1 JAPAN SUZUKI '73		3 USA FRIEZ	1 JAPAN OTA '73			1 USWB		1 LOCAL 8 in. Std.	2 JAPAN	NONE	NONE
Cuyo	1 USWB	2 USWB	3 CASELLA	1 ——	2 FAURA	3 JAPAN OTA '81 USA FRIEZ	1 JAPAN KOSHIN (DEFECT.)	2 USWB '82 (WIND RECORD)		1 USWB (BROKEN)		1 USWB '45	2 JAPAN OTA '73	NONE	Upper
Dumaguete	1 USWB '73	2 USWB '73	3 JAPAN '77	1 JAPAN '74	2 FAURA '63	3 USWB '51	1 WEATHER TROPICS			1 RATOR '51		1 LOCAL 8 in. Std.	2 JAPAN '64	1 LONDON (CASELLA) '80	NONE
Cagayan de Oro		2 USWB	3 USWB	1 USWB	2 FAURA (BROKEN)	3 USA BELFORT	(BROKEN)			1 ——		1 ——	2 ——	NONE	NONE
Coron	1 USWB	USWB '49 2 (NOT USABLE)	3 USWB '49	1 —— '75 USWB '49	2 FAURA '72	3 USWB '49	NONE			NONE		1 LOCAL 8 in. Std. '73	2 —— '70	NONE	NONE

Table 3.18 (4/5)

Status of Meteorological Radar in PAGASA

Site	Type	Inspection Remarks	Date Manufactured	Status as of 01 March 1984
BASCO	RAYTHEON WSR-57M UPGRADED TO WSR-77		July 1979	Not operational. Trigger circuit defective.
APARRI	TOSHIBA TW11634			Operational
BAGUIO	RAYTHEON WSR-57M			Operational
BALER	RAYTHEON WSR-77		July 1979	Operational
DAET	RAYTHEON WSR-57M UPGRADED TO WSR-77			Operational
VIRAC	RAYTHEON WSR-77		July 1979	Operational
MACTAN	RAYTHEON WSR-57M UPGRADED TO WSR-77			Under maintenance.
GUIUAN	RAYTHEON WSR-77		July 1979	On site delivery of equipment and installation in progress.
BUSUANGA	RAYTHEON WSR-77		July 1979	System installation in progress.
TANAY	RAYTHEON WSR-77M		July 1979	Radar building under construction.

Table 3.18 (5/5)

Status of Meteorological Upper-air Instruments in PAGASA

Site	Type	Inspection Remarks	Date Manufactured	Status as of 01 March 1984
LAOAG	RS : Micro-cora (Vaisala) RW : 〃 Pibal: Theodolite (W.Knight)		—— —— 1982	Operational Operational Operational
MACTAN RADAR	RS : AR16 (Vaisala) RW : RT18 (〃) Pibal: Theodolite (W.Knight)		1974 1970 ——	Operational Operational Operational
ZAMBOANGA	RS : AR16 RW : RT16 Pibal: Theodolite (W.Knight)		1974 1963 ——	Operational Operational Operational
LEGASPI	RW : RT18 Pibal: Theodolite (W.Knight)		1970 ——	Non-Operational Operational
PTO. PRINCESA	RW : RT18 Pibal: Theodolite (W.Knight)		1970 ——	Operational Operational
DAVAO	RW : WFR100 (EEC) Pibal: Theodolite (W.Knight)		1978 1978	Operational Operational
BASCO	Pibal: Theodolite (W.Knight)		——	Operational
BAGUIO	Pibal: Theodolite (W.Knight)		——	Operational
CUYO	Pibal: Theodolite (W.Knight)		——	Non-Operational

Table 5.1 Design of Multiplex Radio Link

Span	Distance	Main Antenna (required min. ant. height) & Sub Antenna	Model of Equipment	S/N at Standard Condition	S/N at Fading Condition (99.95%)	Figure Number of Terrain Profile	Table Number of Data Sheet
TANAY - GAPAS	132.4 km	6.0mφ GP (13.7m) - 4.2mφ GP (22m)	PM24-800-70 FD	63.9 dB	40.4 dB	A.1 (1/19)	A.2 (1/20)
GAPAS - NAGA	90.5 km	6.0mφ GP (22m) - 6.0mφ GP (27.8m)	PM24-800-70 FD	59.9 dB	36.4 dB	A.1 (2/19)	A.2 (2/20)
NAGA - MALABOG	74.2 km	3.0mφ GP (22.85m) - 3.0mφ GP (22m)	PM24-800-70 FD	64.5 dB	41.0 dB	A.1 (3/19)	A.2 (3/20)
MALABOG - BALOD	130.5 km	10mφ GP (15m) - 6.0mφ GP (21.3m) 6.0mφ GP 4.2mφ GP	PM12-800-70 SD	61.5 dB	39.0 dB	A.1 (4/19)	A.2 (4/20)
BALOD - TINAMBACAN	25.7+20.0km	4.0mφ PP - 4.0mφ PP x 2 - 4.0mφ PP (40.9m) (15m) (10m)	FM60-6700-1	61.8 dB	46.2 dB	A.1 (5/19) A.1 (6/19)	A.2 (5/20)
TINAMBACAN - DANAO	183.9 km	10mφ GP (10m) - 10mφ GP (15.3m) 6.0mφ GP 6.0mφ GP	PM12-800-70 SD	59.0 dB	36.5 dB	A.1 (7/19)	A.2 (6/20)
DANAO - MALASAG	239.3 km	6.0mφ GP (15.3m) - 6.0mφ GP (10m) 4.2mφ GP 4.2mφ GP	PM6-800-70 SD	58.0 dB	35.5 dB	A.1 (8/19)	A.2 (7/20)
MALABOG - LEGASPI	7.0 km	12 ele YAGI (20m) - 12 ele YAGI (20m)	PM12-800-5	62.5 dB	55.1 dB	A.1 (9/19)	A.2 (8/20)
BALOD - CATARMAN	2.9 km	12 ele YAGI (30m) - 12 ele YAGI (20m)	PM6-800-5	75.5 dB	68.9 dB	A.1 (10/19)	A.2 (9/20)
DANAO - MACTAN RADAR	20.5 km	1.8mφ GP (20m) - 3.0mφ GP (20m)	PM12-800-5	63.7 dB	53.6 dB	A.1 (11/19)	A.2 (10/20)
MALASAG - CAGAYAN DE ORO	10 km (presumed)	12 ele YAGI (10m) - 12 ele YAGI (20m)	PM6-800-5	66.5 dB	58.5 dB	-	A.2 (11/20)
SCIENCE GARDEN - PFC	1.4 km	12 ele YAGI (50m) - 12 ele YAGI (-)	FM60-800-05 (5W + ATT 10dB)	69.1 dB	62.8 dB	-	

Table 5-2 (1/2)

List of Improved Observation Instruments

Items / Name of Station	Propeller and Vane Type Wind Sensor & Recorder	Tilting Bucket Type Rain Gauge Recorder	Psychrometer	Fortin Barometer
BASCO	○	○	○	○
APARRI	○	○	○	○
LAOAG	○	○	○	○
TUGUEGARAO	○	○	○	○
MUÑOZ		○	○	
SCIENCE GARDEN	○	○	○	○
DAET	○	○	○	○
CALAPAN	○	○	○	○
LEGASPI	○	○	○	○
ILOILO	○	○	○	○
CAGAYAN DE ORO	○	○	○	○
MACTAN	○	○	○	○
DAVAO	○	○	○	○
HINATUAN	○	○	○	○
ZAMBOANGA	○			○
CUYO	○			○
PTO PRINCESA		○	○	○
TACLOBAN	○	○	○	○
BALER	○	○	○	○
DAGUPAN	○	○	○	○
CASIGURAN	○	○	○	○
ALABAT	○	○	○	○
MALAYBALAY	○	○	○	
IBA	○	○	○	○
SURIGAO	○	○	○	○
TOTAL	23	23	23	23

Table 5.2 (2/2)

List of Additional Meteorological Observation Instruments

Items / Name of Station	Pyranometer	Items / Name of Station	Pyranometer
BASCO	○	SAN JOSE MINDORO	○
CASIGURAN	○	CATBALOGAN	○
IBA	○	SURIGAO	○
INFANTA	○	HINATUAN	○
DAET	○	TUGUEGARAO	○
MORONG	○	ILOILO	○
SAN FRANCISCO	○	PTO. PRINCESA	○
ROMBLON	○	Total	15

Table 5.3

List of Improved Meteorological Observation Instruments

Name of Instrument	Specification	Accuracy
Propeller and Vane Type Wind Sensor & Recorder	FF3R-13 LRT-100	Speed < 0.5 m/s Direction ±5°
Tilting Bucket Type Rain Gauge & Recorder	LRT-100 1 Pulse; 0.5 mm	±3 %
Fortin Barometer	PM-2M 10-A	<0.2 mm
Psychrometer	HP-2 SY H-5B	0.1°C
Pyranometer	MS-42	0.01 KW/m^2

Table 6.1

Training Course

Name of course	Place	Duration	Number of people	Remarks
Mini computer (Soft)	Outside In PAGASA	1 year 6 months	} 4	
Mini computer (Hard)	Outside In PAGASA	6 months 3 months	} 5	
Tele-communication (Operation)	In PAGASA	1 month	70	Weather station 62 persons PFC 8 persons
Tele-communication (OH multiplex)	Outside In PAGASA	1 month 6 months	10 30	
	Outside In PAGASA	1 month 2 months	10 30	
Tele-communication (VHF)	Outside In PAGASA	10 days 1 month	} 10	two times
Tele-communication (HF)	Outside In PAGASA	10 days 1 month	} 10	
Meteorological Observations	Outside In PAGASA	1 month 2 month	5 10	

Table 6.2

Personnel Necessary for Operation and Maintenance

	Station	Number of personnel	Remarks
Operation	PFC	13	3 men x 4 group & chief 1
	DCC TUGUEGARAO	9	2 men x 4 group & chief 1
	DCC MACTAN Radar	9	"
	DCC CAGAYAN DE ORO	9	"
	SCIENCE GARDEN	9	
	Other station	5	(Hold the additional of observation)
Maintenance	PFC	3	Day time work
	DCC (3 stations)	each 1	
	DRS CARMEN ROSALES	1	
	DRS TANAY	0	
	DRS LEGASPI	1	
	SCIENCE GARDEN	1	
Repairs	DILIMAN	5	Day time work

Table 8.3 Derivation of Benefit Less Cost of Alternative Plan 1 (at Discount Rate of 10%)

(Unit: ₱10^6)

No.	Year	Costs			Total Benefits
		Capital Cost & Replacement Cost	O&M Cost	Total Cost	
1.	1986	130.0	0	130.0	0
2.	1987	112.0	0	112.0	0
3.	1988	64.0	3.9	67.9	46.0
4.	1989	0	6.2	6.2	137.0
5.	1990	0	6.2	6.2	202.0
6.	1991	0	6.2	6.2	266.0
7.	1992	0	6.2	6.2	331.0
8.	1993	0	6.2	6.2	395.0
9.	1994	0	6.2	6.2	459.0
10.	1995	0	6.2	6.2	524.0
11.	1996	0	6.2	6.2	588.0
12.	1997	0	6.2	6.2	653.0
13.	1998	199.0	6.2	205.2	717.0
14.	1999	0	6.2	6.2	781.0
15.	2000	0	6.2	6.2	847.0
16.	2001	0	6.2	6.2	856.0
17.	2002	0	6.2	6.2	865.0
18.	2003	0	6,2	6.2	874.0
19.	2004	0	6.2	6.2	883.0
20.	2005	0	6.2	6.2	893.0
21.	2006	0	6.2	6.2	902.0
22.	2007	0	6.2	6.2	911.0
23.	2008	199.0	6.2	205.2	920.0
24.	2009	0	6.2	6.2	930.0
25.	2010	0	6.2	6.2	939.0
26.	2011	0	6.2	6.2	948.0
27.	2012	0	6.2	6.2	958.0
28.	2013	0	6.2	6.2	967.0
29.	2014	0	6.2	6.2	976.0
30.	2015	0	6.2	6.2	986.0
31.	2016	0	6.2	6.2	995.0
32.	2017	0	6.2	6.2	1,005.0
33.	2018	0	6.2	6.2	1,014.0
		704.0	189.9	893.9	22,905.0

B-C (10%) = ₱4,042 x 10^6

Table 8.4 Derivation of Benefit Less Cost of Alternative Plan 2 (at Discount Rate of 10%)

(Unit: ₱10^6)

No.	Year	Costs			Total Benefits
		Capital Cost & Replacement Cost	O&M Cost	Total Cost	
1.	1986	121.0		121.0	0
2.	1987	139.0		139.0	0
3.	1988	46.0	0.8	46.8	9.0
4.	1989	0	6.2	6.2	137.0
5.	1990	0	6.2	6.2	202.0
6.	1991	0	6.2	6.2	266.0
7.	1992	0	6.2	6.2	331.0
8.	1993	0	6.2	6.2	395.0
9.	1994	0	6.2	6.2	459.0
10.	1995	0	6.2	6.2	524.0
11.	1996	0	6.2	6.2	588.0
12.	1997	0	6.2	6.2	653.0
13.	1998	199.0	6.2	205.2	717.0
14.	1999	0	6.2	6.2	781.0
15.	2000	0	6.2	6.2	847.0
16.	2001	0	6.2	6.2	856.0
17.	2002	0	6.2	6.2	865.0
18.	2003	0	6.2	6.2	874.0
19.	2004	0	6.2	6.2	883.0
20.	2005	0	6.2	6.2	893.0
21.	2006	0	6.2	6.2	902.0
22.	2007	0	6.2	6.2	911.0
23.	2008	199.0	6.2	205.2	920.0
24.	2009	0	6.2	6.2	930.0
25.	2010	0	6.2	6.2	939.0
26.	2011	0	6.2	6.2	948.0
27.	2012	0	6.2	6.2	958.0
28.	2013	0	6.2	6.2	967.0
29.	2014	0	6.2	6.2	976.0
30.	2015	0	6.2	6.2	986.0
31.	2016	0	6.2	6.2	995.0
32.	2017	0	6.2	6.2	1,005.0
33.	2018	0	6.2	6.2	1,014.0
		704.0	186.8	890.8	22,868.0

B-C (10%) = ₱4,013 x 10^6

Table 9.1 Historical Typhoon Damages, per Capita GDP and Population Density from 1970 to 1983

Year	Typhoon Damages (Current price $P10^6$)	Consumer Price Index	Typhoon Damages (const price June, 1984)	GDP (current price $P10^6$)	GDP Deflator	GDP (const price $P10^6$ June, 1984)	Per Capita GDP (const price, June 1984, Peso)	National Population (10^3)	Population Density (person/km^2)
1970	500.6	13.6	3,680	42,448	21.1	201,175	5,484	36,684	122
1971	40.3	15.6	258	50,120	23.6	212,372	5,609	37,862	126
1972	178.3	17.2	1,037	56,075	25.2	222,520	5,718	38,914	129
1973	250.4	19.6	1,278	71,786	29.6	242,520	6,064	39,995	133
1974	365.1	26.1	1,399	99,638	38.9	256,139	6,231	41,106	137
1975	18.9	28.2	67	114,603	42.0	272,864	6,486	42,070	140
1976	724.8	30.0	2,416	133,928	46.0	291,148	6,708	43,406	144
1977	335.1	32.4	1,034	155,631	49.5	314,406	7,052	44,584	148
1978	1,575.2	34.8	4,526	178,603	54.2	329,526	7,196	45,794	152
1979	417.2	41.4	1,008	220,477	62.7	351,638	7,476	47,037	156
1980	1,417.7	48.8	2,905	266,008	72.1	368,043	7,652	48,098	160
1981	1,419.0	55.3	2,566	305,270	79.7	383,024	7,733	49,530	165
1982	1,650.5	61.3	2,692	340,360	85.8	396,690	7,818	50,740	169
1983	522.1	68.0	768	380,820	95.0	400,863	7,715	51,960	173
1984		100.0			100.0				

Source: International Financial Statistics, 1983 Philippine Statistical Yearbook

Table 9.2 Projection of Future Typhoon Damage under "Without Project" Condition and Derivation of Mitigatable Typhoon Damage

No.	Year	Population (10^3)	Population Density (persons/km^2)	GDP (Const.price June, 1984) (₱10^6)	Per Capita GDP (Peso)	Typhoon Damage (Const.price June, 1984) (₱10^6)	Mitigatable Typhoon Damage (₱10^6)
1.	1986	55,576	185.3	461,909	8,311	4,074	0
2.	1987	56,761	189.2	478,630	8,431	4,136	0
3.	1988	57,927	193.1	495,350	8,551	4,199	420
4.	1989	59,070	196.9	512,140	8,670	4,260	790
5.	1990	60,185	200.6	528,862	8,787	4,320	1,160
6.	91	61,275	204.3	545,582	8,904	4,380	1,530
7.	92	62,344	207.8	562,302	9,019	4,347	1,900
8.	93	63,390	211.3	579,024	9,134	4,494	2,270
9.	94	64,408	214.7	595,744	9,250	4,550	2,640
10.	95	65,397	218.0	612,466	9,365	4,605	3,010
11.	96	66,358	221.2	629,186	9,482	4,659	3,380
12.	97	67,288	224.3	645,908	9,599	4,712	3,750
13.	98	68,187	227.3	662,628	9,718	4,764	4,120
14.	99	69,054	230.2	679,348	9,838	4,815	4,490
15.	2000	69,885	233.0	696,070	9,960	4,865	4,865
16.	01	70,933	236.4	712,790	10,049	4,918	4,918
17.	02	71,997	240.1	729,512	10,133	4,973	4,973
18.	03	73,077	243.6	746,232	10,212	5,025	5,025
19.	04	74,173	247.2	762,952	10,286	5,077	5,077
20.	05	75,285	251.0	779,674	10,356	5,131	5,131
21.	06	76,415	254.7	796,394	10,422	5,183	5,183
22.	07	77,562	258.5	813,144	10,483	5,236	5,236
23.	08	78,725	262.4	829,838	10,541	5,289	5,289
24.	09	79,906	266.4	846,558	10,594	5,343	5,343
25.	10	81,104	270.3	863,278	10,644	5,395	5,395
26.	11	82,321	274.4	879,998	10,690	5,449	5,449
27.	12	83,556	278.5	896,718	10,732	5,503	5,503
28.	13	84,809	282.7	913,442	10,771	5,557	5,557
29.	14	86,081	286.9	930,162	10,806	5,610	5,610
30.	15	87,372	291.2	946,882	10,837	5,664	5,664
31.	16	88,683	295.6	963,602	10,866	5,719	5,719
32.	17	90,013	300.0	980,322	10,891	5,774	5,774
33.	18	91,364	304.5	997,046	10,913	5,829	5,829

Table 9.3 Derivation of Typhoon Damage Mitigation Ratio to Equalize the Benefit of the Project to the Cost of the Projec (For Plan 1)

(Unit: ₱10^6)

No.	Year	Costs			Total Benefit
		Capital Cost & Replacement Cost	O&M Cost	Total Cost	
1.	1986	130.0	-	130.0	-
2.	87	112.0	-	112.0	-
3.	88	64.0	3.9	67.9	420.0
4.	89	0	6.2	6.2	790.0
5.	90	0	6.2	6.2	1,160.0
6.	91	0	6.2	6.2	1,530.0
7.	92	0	6.2	6.2	1,900.0
8.	93	0	6.2	6.2	2,270.0
9.	94	0	6.2	6.2	2,640.0
10.	95	0	6.2	6.2	3,010.0
11.	96	0	6.2	6.2	3,380.0
12.	97	0	6.2	6.2	3,750.0
13.	98	199.0	6.2	205.2	4,120.0
14.	99	0	6.2	6.2	4,490.0
15.	2000	0	6.2	6.2	4,865.0
16.	01	0	6.2	6.2	4,918.0
17.	02	0	6.2	6.2	4,973.0
18.	03	0	6.2	6.2	5,025.0
19.	04	0	6.2	6.2	5,077.0
20.	05	0	6.2	6.2	5,131.0
21.	06	0	6.2	6.2	5,183.0
22.	07	0	6.2	6.2	5,236.0
23.	08	199.0	6.2	205.2	5,289.0
24.	09	0	6.2	6.2	5,343.0
25.	10	0	6.2	6.2	5,395.0
26.	11	0	6.2	6.2	5,449.0
27.	12	0	6.2	6.2	5,503.0
28.	13	0	6.2	6.2	5,557.0
29.	14	0	6.2	6.2	5,610.0
30.	15	0	6.2	6.2	5,664.0
31.	16	0	6.2	6.2	5,719.0
32.	17	0	6.2	6.2	5,774.0
33.	18	0	6.2	6.2	5,829.0
		704.0	189.9	893.9	131,000.0

Present Worth of Cost = Present Worth of Benefit x X%

$$X = \frac{424.1}{25,257.6} = 1.68\% \text{ (Discount Rate = 10\%)}$$

Table 9.4 Derivation of EIRR based on Mitigation Ratio of 5% (For Plan 1)

(Unit: ₱10^6)

NO	Year	Costs		Total Cost	Total Benefits	Benefit Less Cost
		Capital Cost & Replacement Cost	O&M Cost			
1	1986	130.0	0	130.0	0	-130.0
2	1987	112.0	0	112.0	0	-112.0
3	1988	64.0	3.9	67.9	132.0	64.1
4	1989	0	6.2	6.2	213.0	206.8
5	1990	0	6.2	6.2	216.0	209.8
6	1991	0	6.2	6.2	219.0	212.8
7	1992	0	6.2	6.2	222.0	215.8
8	1993	0	6.2	6.2	225.0	218.8
9	1994	0	6.2	6.2	228.0	221.8
10	1995	0	6.2	6.2	230.0	223.8
11	1996	0	6.2	6.2	233.0	226.8
12	1997	0	6.2	6.2	236.0	229.8
13	1998	199.0	6.2	205.2	238.0	32.8
14	1999	0	6.2	6.2	241.0	234.8
15	2000	0	6.2	6.2	243.0	236.8
16	2001	0	6.2	6.2	246.0	239.8
17	2002	0	6.2	6.2	249.0	242.8
18	2003	0	6.2	6.2	251.0	244.8
19	2004	0	6.2	6.2	254.0	247.8
20	2005	0	6.2	6.2	257.0	250.8
21	2006	0	6.2	6.2	259.0	252.8
22	2007	0	6.2	6.2	262.0	255.8
23	2008	199.0	6.2	205.2	264.0	58.8
24	2009	0	6.2	6.2	267.0	260.8
25	2010	0	6.2	6.2	270.0	263.8
26	2011	0	6.2	6.2	272.0	265.8
27	2012	0	6.2	6.2	275.0	268.8
28	2013	0	6.2	6.2	278.0	271.8
29	2014	0	6.2	6.2	281.0	274.8
30	2015	0	6.2	6.2	283.0	276.8
31	2016	0	6.2	6.2	286.0	279.8
32	2017	0	6.2	6.2	289.0	282.8
33	2018	0	6.2	6.2	291.0	284.8
		704.0	189.9	893.9	7,710.0	6,816.1

EIRR = 51.9%