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Post-Flood Investigation Report
Pampanga River Basin Floods due to Tropical Depression
Winnie and Typhoon Yoyong
(November 28 – December 04, 2004)



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Pampanga River Basin Floods due to Tropical Depression Winnie and Typhoon Yoyong (Nov 28 – Dec 04, 2004)

Summary

Barely a week after flash floods swept through several towns in the province of Nueva Ecija brought about by Tropical Depression Violeta, widespread flooding as a result of Tropical Depression Winnie (Nov. 28 - 30, 2004) and Typhoon Yoyong (Nov. 30 – Dec. 04, 2004) devastated once again the said province as well as major areas of the provinces of Bulacan and Pampanga.

Extraordinary flood magnitudes in the province of Nueva Ecija were experienced, making this one of the worst recorded flood disaster for the province. The two disturbances left 19 people dead, 10 others injured, and several reported missing plus an estimated (about ₱ 600 M) millions of pesos in damages to properties in both private and public sectors within the Pampanga river basin.

Inundation, as a result of the two disturbances, within the basin area can be attributed to some interrelated factors – the extensive rains on November 29 and December 2 over the basin area; heavy rains prevailing on the eastern portions of the basin, the upstream sections of Pampanga River, that started late afternoon of the 29th till the morning of the 30th of November, and early evening of the 2nd December till just after midnight; and the already saturated condition of the basin, having been drenched by T.D. Violeta hardly a week ago.

Pampanga River overflowed its banks from Cabanatuan down to Cabiao, Nueva Ecija, from Arayat to Apalit in Pampanga, and from Calumpit to the Hagunoy-Paombong area in Bulacan. Similarly, tributaries to the main Pampanga River such as Coronel, Minatula, Tabuating, Tambo and Peñaranda Rivers, mostly from the western slopes of the Sierra Madre mountain range, overflowed their banks at several points that eventually started the widespread inundation over the province of Nueva Ecija. Likewise, Angat River caused flooding at several points along its channel from Norzagaray to Pulilan in Bulacan.

The impact brought about by the weather disturbances Winnie and Yoyong to the country became a disaster-highlight for the year 2004, proving to be a major disaster year compared to other previous disaster years for the Philippines in terms of loss in lives and damage to both public and private properties.

1.0 Background

The Philippines is a country that has suffered the greatest number of disasters in the last century. Out of the damages caused by disasters, the flood damage occupies a large part of the country's total dent amounting to about 5 Billion pesos (Philippine) annually (1982 figures).

The Pampanga River is one of the two major river systems draining the Central Luzon plain, which is, oftentimes, referred to as the rice granary of the Philippines. The area, sad to say, suffers considerable flood damage almost every year.

The floods of August 1960, July 1962, and May 1966 are several of the destructive floods that affected the Pampanga River Basin. However, the flood that occurred in Central Luzon in July 1972 was considered as one of the most disastrous of the Philippine floods in living memory. It inflicted a total damage of about \$300 Million (US) in Central Luzon area particularly in the Pampanga River Basin. It was in the light of these sad experiences that authorities saw the need for a non-structural measure of mitigating flood loss and damages: a Flood Forecasting and Warning in the major river basins.

In 1973, a pilot Flood Forecasting and Warning System (FFWS) for Pampanga River Basin was established through technical cooperation between the Philippines and Japan Governments, taking into account the action program decided upon by the ECAFE/WMO Typhoon Committee. This FFWS proved effective during subsequent major floods that led to the establishment of a similar system covering Agno, Bicol and Cagayan River Basins in 1982.

Similar to the FFWS in the 4 major river basins in Luzon, Flood Forecasting & Warning System for Dam Operations (FFWSDO) in 3 of these basins (Pampanga, Agno, & Cagayan) was conceived and finally started in 1983. This was in the light of the unprecedented flooding due to the release of impounded water by Angat Dam in Bulacan in 1978, again within the Pampanga River Basin, which caused destruction and death downstream of the dam.

2.0 Physiographical Factor¹ - The Pampanga River Basin

The basin is the 4th largest basin in the Philippines and covers an aggregate area of 10,550 km² (includes the allied basin of Guagua River). It encompasses the provinces of Nueva Ecija (almost whole province), part of Bulacan and Pampanga,

¹ Major parts of this section were lifted directly from the Pampanga River Basin Post-Flood Investigation reports of the SW Monsoon event of August 1999 and T.Ditang & Edeng event of July 2000.

and portions of Tarlac. The main Pampanga River is about 260 kilometers in length (Figure 1.0).

The basin is drained through the Pampanga River and via the Labangan Channel into the Manila Bay. Several tributaries support the main river, the principal ones of which are the Peñaranda and the Coronel-Santor Rivers on the eastern side of the basin and the Rio Chico River from the northwest side. The Angat River joins the Pampanga River at Calumpit in Bulacan via the Bagbag River. The Labangan channel, on the other hand, acts as a cut-off channel for the Angat River into Manila Bay. Somewhere between the middle and lower portion of the basin stands the Mount Arayat, standing some 1,026 meters in elevation. Adjacent just on the eastern side, at the left bank of the Pampanga River, is the Candaba swamp, covering an area of some 300 km² absorbing most of the flood flows coming from the eastern sections of the basin (western slopes of the Sierra Madre mountain range) and the overflowing of the Pampanga River via the Cabiao Floodway. This area acts as a detention basin and is submerged during the rainy season but is relatively dry during summer. At the lower sections of the basin, where the Pampanga delta lies, the Pampanga River system form a network of sluggish, tidal flats and canals, which eventually find their way to Manila Bay. The main river has a relatively low-gradient riverbed channel particularly at the middle and lower sections, other than being below the mean sea level elevation.

The basin experiences, on an average, at least one flooding in a year. The dry season generally occurs from December to May, and wet the rest of the year. The wettest months are from July to September. The frequency of tropical cyclone passage over the basin area is about 4 to 5 in a year, on an average.

The allied basin of Guagua River was not significantly affected during the passage of T.D. Winnie and Typhoon Yoyong. There were no reported floodings within the area.

The overall flat topography and the rapidly developing and agriculturally productive flood plain of the Pampanga River Basin make it very vulnerable to floods during intense and prolonged rainfall. The land subject to flooding within the Pampanga River Basin is about 2,200 km², and about 225 km² for the allied basin of Guagua River. About 45 municipalities are either directly or partly affected in the 4 major provinces encompassed by the whole basin system.

3.0 The Pampanga River Basin Flood Forecasting & Warning System

The PRFFWS has a total of 14 telemetered rainfall (RR) stations namely: Gabaldon, Sapang Buho, Mayapyap, Munoz, San Isidro, Arayat, Candaba, Zaragoza, Papaya, Sibul Springs, San Rafael, Ipo Dam, Sulipan and Sasmuan which is in Guagua River Basin; and 7 telemetered water level (WL) stations: Sapang Buho,

Mayapyap, San Isidro, Zaragoza, Arayat, Candaba and Sulipan (refer back to Figure 1.0). A set of repeater stations are put into place to handle data transmission up to the terminal telemetry station serving as the nerve center of data collection located at the WFFC compound in Diliman, Quezon City.

Within the two basin systems (Pampanga and Guagua) are 2 synoptic stations; Angeles and Cabanatuan stations. An agrometeorological station also exists in Munoz, Nueva Ecija.

A standard rain gage observation in the Municipality of Guagua was set-up just a few years back, through a community-based flood management program of the office and the town, and manual observation is undertaken during times of inclement weather.

4.0 Meteorological Factor

Tropical Depression Winnie (November 28-30, 2004) started as an active low pressure area east of Visayas in the afternoon of November 27. By morning of the following day, it had intensified into a tropical depression with strongest sustained winds of 45 kph, moving at 15 kph westwards towards eastern Samar (Figure 2.0).

It made landfall late afternoon of November 28 just north of Borongan, Eastern Samar still bearing maximum winds of 45 kph near its center. It, eventually, slowed down upon hitting land. It then cut across through Bicol and Southern Tagalog Provinces on a west northwest direction by morning of November 29. T.D. Winnie, had slightly gained strength to 55 kph winds as it passed through Albay Gulf and Legaspi area. By late evening of the 29th, over Lucena City, Winnie maintained its maximum winds at 55 kph moving westward at 15 kph. Almost 12 hours later, made a west southwest movement towards the Mindoro-Palawan area. On the morning of November 30, T.D. Winnie weakened into an active low pressure area off the coast west southwest of Batangas City but never regained strength and, in the end, dissipated.

Although T.D. Winnie coursed through the Bicol and Southern Tagalog Provinces, its rainfall effects were mostly felt along the eastern sections of the Aurora-Quezon Provinces. Flash floods and landslides devastated the area making it the worst disaster for the country for the year 2004. Widespread flooding over the eastern block of Nueva Ecija, portions of Pampanga particularly the Candaba swamp area, and several towns of Bulacan were experienced as a result of the heavy rains spawned by the disturbance over the western slopes of the Sierra Madre mountain range.

While Winnie was still on the verge of dissipating on the morning of November 30, 2004, Tropical Storm Yoyong (Nanmadol, 0427, November 30 to

December 04, 2004) had developed over Caroline Islands less than 2,000 kms east southeast of Visayas with maximum winds of 85 kph near the center and gustiness of up to 100 kph, moving west northwest at 19 kph (Figure 3.0). By early morning of the next day, Yoyong, now at typhoon stage with gustiness of up to 185 kph, had entered the PAR moving west northwest at 35 kph. By afternoon of December 01, Yoyong had gained strength and now dubbed as a "Super Typhoon" with strongest sustained winds of 175 kph near the center and gustiness of up to 210 kph increasing its threat towards the eastern Luzon area.

Imminent to hit land, Yoyong was expected to make landfall on the evening of December 02 at the Aurora-Isabela area, now packing maximum sustained winds of 185 kph and 220 kph of gustiness. Public Storm Warning Signal (PSWS) #4 was issued over Camarines Norte, Catanduanes, Northern Quezon, Polillo Island, Aurora, Quirino and Isabela. In time, upon hitting land at the said stretch, the disturbance weakened to 120 kph wind force and 150 kph gustiness in such a short period. On the early morning of December 03, Yoyong was now over at the South China Sea, still maintaining the 120 kph wind force and the 150 kph gustiness. By afternoon of the same day, it was already more than 200 kms west northwest of Laoag City and was later downgraded to a tropical storm moving at a north northwest direction. The next day, December 04, it accelerated and shifted course towards the western Taiwan area, and with that ended its stint over the PAR.

Typhoon Yoyong, with its considerable moderate to occasionally heavy downpour on the evening of December 02, caused similar catastrophic effects over the Aurora province. Its effect over the Pampanga River Basin simply prolonged the already flooded eastern and central Nueva Ecija area, portions of Pampanga particularly the Candaba swamp area, and several towns of Bulacan.

5.0 Hydrometeorological Factor

5.1 Status of Stations during the two events

T.D. Winnie: There were no telemetered data from all stations some four days (starting 1600H, November 26, 2004) prior to Winnie's rainfall brunt. Telemetry system was practically down. The PRFFWC was caught "flat-footed" at the beginning of Winnie, owing to the unsure basin condition due to unavailability of telemetered data. Data came back before noon of November 30. Still, after the system's restoration, no data was received from the San Isidro and Sapang Buho Telemetered WL station.

T. Yoyong: Telemetered real-time data was available throughout the event except for several RR data breaks for Arayat during that time. Real-time water level data for Sapang Buho and San Isidro remained totally out. No major problems were encountered during that period considering some few non-reporting stations.

5.2 Rainfall Aspect

Table 1.0 Rainfall Intensity Classification (mm)

Category	1 hour	3 hours	6 hours	12 hours	24 hours
Light	< 2.5	< 7.5	< 15	< 30	< 60
Moderate	2.5 – 7.5	7.5 – 22.5	15 – 45	30 - 90	60 – 180
Heavy	> 7.5	> 22.5	> 45	> 90	> 180

Missing telemetered Rainfall data were reconciled from available pluviographs from the rainfall recorders in the stations.

T.D. Winnie's rainfall regime over the basin was basically concentrated in less than a day of continuous heavy downpour, which started in the afternoon of the 29th till the morning of the 30th November 2004. The almost basin wide heavy rains began 1 to 2 hours before midnight of the 29th.

Heavy rains for about 18 hours were recorded over Gabaldon, between 1800H of the 29th to 1100H of the 30th. Several hours of heavy rainfall was the main reason for the landslides and flash flooding over the town of Gabaldon. On the other hand, about 9 hours of continuous heavy rains prevailed over Sapang Buho and Papaya stations while the rest of the stations have about 5 to 6 hours of continuous heavy rains. The rains over and at upstream of the Papaya station caused flash flooding at the Gapan-San Leonardo stretch adjacent to the Dona Josefa Bridge over the Peñaranda River. A prelude of a few hours of light to moderate intensity rains mostly at the eastern portions of the basin signified the start of T.D. Winnie's onslaught of the area.

Typhoon Yoyong's rainfall was a lot less than that of T.D. Winnie. However, the rains brought by Yoyong further aggravated the already flooded areas of the basin. Similar to Winnie, Yoyong's rains started early afternoon of the 2nd of December 2004, then peaking before midnight of the same day. By dawn of the following day, rains became light and eventually ceased a few hours before noontime. Gabaldon had about 7 hours of continuous heavy rains. Ipo had some 6 hours while the rest from 2 to 4 hours. Yoyong dealt the Gapan-San Leonardo stretch at the Dona Josefa Bridge over Peñaranda River its 3rd flash flood in a span of about 10 days.

The 24-hour isohyetal maps for November 29, 30 and December 03 (Figures 4.0 to 4.2) clearly shows distribution of rainfall for the two events. The eastern sections of the basin received the brunt of the rainfall for both the two events. The maps further shows that the maximum rainfall values recorded were received over the province of Nueva Ecija and eastern Bulacan. This, obviously, shows why flash floodings were reported at these parts.

Table 2.0 Available 24-hr Rainfall Totals of various stations within and around the Pampanga River Basin during passage of T.D. Winnie and Typhoon Yoyong

Stations	November 2004		December 2004	
	29th	30th	1st	2nd
San Roque	53	5	0	49
Sta. Barbara		51	0	47
Carmen	54	3	0	67
Wawa	55	0	0	66
Tibag	116	9	0	53
Bunga				
Padalis				
Marikit			0	101
Pantabangan Dam			0	108
CLSU, Munoz	136.4	3.6	0	81.0
Cabanatuan	157.8	3.8	T	86.3
Angeles	93	1.8	0	20.5
Subic	66.6	0	0	26.4
Maputi				
Talaguio	299	18	1	241
Matulid				
Angat Dam	246	16	1	116
Norzagaray				
Munoz Telemetering	137	3	0	62
Gabalton	449	64	0	203
Sapang Buho	246	5	0	91
Mayapyap	151	0	0	53
Zaragoza	115	1	0	69
Papaya	286	12	0	90
San Isidro	154	2	0	70
Arayat	176	1	0	46
Sibul Springs	227	3	0	80
Ipo Dam	158	9	0	121
San Rafael		2	0	36
Candaba	148	1	0	27
Sulipan	113	2	0	21
Sasmuan	110	1	0	33

Blank means no data recorded / received

6.0 Basin Hydrological Factor

6.1 River Heights and Basin Situation during the Event

River stages prior to T.D. Winnie were relatively low, although, river water level data were not available 4 days prior to the event. As per area survey made on November 30, the day after T.D. Winnie's rainfall impact, there were no river stages above their respective alert levels.

More than two days separated T.D. Winnie and Typhoon Yoyong. Two peaks were observed at Mayapyap, Arayat, Zaragoza and Candaba gaging stations representing the two events. Sapang Buho, being out of order during that time, can only register the maximum stage reached based on flood marks at the staff gages. It can only be deduced from observer's report that the flood mark (highest) was due to Winnie. San Isidro, on the other hand, revealed one peak, that is, just after Winnie's widespread rains over the eastern block of Nueva Ecija. Available observations from the DPWH gage keeper's note at the site are relatively doubtful. In Sulipan, because of the lag time of floodwaters, somehow showed a continuous increasing trend and separation of flood events were no longer possible. Peak of floodwaters at the station came after Yoyong, about two days later.

Post-flood survey of areas along Peñaranda River, at Doña Josefa Bridge between Cabiao and San Leonardo, reported experiencing three flash floodings – from T.D. Violeta (about a week before), T.D. Winnie, and Typhoon Yoyong. The first flash flood was the highest but the second took a lot longer to subside. The third was a lot lesser in both flood time and magnitude. Hyetographs and hydrographs of rainfall and water level telemetering stations are shown in Figures 5.0 to 5.14.

Table 3.0 Time/Date Station's Flood Assessment Gage Heights were attained during Tropical Depression Winnie

Station Point	(Alert Level) Time & Day attained	(Alarm Level) Time & Day attained	(Critical Level) Time & Day attained	Remarks
Sapang Buho	(3.7 m) attained	(4.5 m) attained	(6.5 m) attained	Estimated peak of 7.60 m (57.794 m. AMSL) based on flood marks attained before noontime of Nov.30
Mayapyap	(3.0 m) attained at around 0500H, Nov 30	(3.5 m) attained at around 0700H, Nov 30	(4.5 m) between 0800H-0900H of Nov 30	Peak WL recorded was at 7.18 m (32.536 m. AMSL) attained at around 1300H, of Nov 30.
San Isidro	(3.2 m) already attained prior to event	(4.5 m) about 1800H of Nov 29	(6.0 m) between 0800H-0900H Nov 30	Est. peak water level of 7.16 m. (16.393 m. AMSL) attained at around 1700H, Nov 30. Data were based

				on DPWH gage keeper's available observations.
Zaragoza	(11.0 m) around 0600H of Nov 30	(12.5 m) before midnight of Nov 30	(14.5 m) not attained	Recorded peak gage height of 13.63 m (13.965 m. AMSL) attained at about 0100H, Dec 02
Arayat	(5.0 m) No data available	(6.0 m) Believed to have been attained before noon of Nov 30	(8.5m) 1600H of Nov 30	Peak of 9.42 m (9.502 m AMSL) based on flood marks attained around 0200H, Dec 02
Candaba		(4.5 m) 1400H of Nov 30	(5.0 m) between 1700H-1800H, Nov 30	Recorded Peak of 6.96 m (6.803 m AMSL) attained at around 1000H of Dec 02
Sulipan	(3.6 m) around 1500H, Dec 02	(4.2 m) not attained	(5.0 m) not attained	A slow rise of river stage observed until it peaked after passage of typhoon Yoyong.
Sasmuan				No recorded river overflowing during the event

Table 3.1 Time/Date Station's Flood Assessment Gage Heights were attained during Typhoon Yoyong

Station Point	(Alert Level) Time & Day attained	(Alarm Level) Time & Day attained	(Critical Level) Time & Day attained	Remarks
Sapang Buho	(3.7 m) definitely attained	(4.5 m) possibly attained	(6.5 m) may not have been attained	Estimated peak did not exceed the peak attained during T.D. Winnie
Mayapyap	(3.0 m) between 0300H-0400H, Dec 03	(3.5 m) between 0400H-0500H, Dec 03	(4.5 m) between 0500H-0600H of Dec 03	Peak WL recorded was at 5.19 m (30.546 m. AMSL) attained at around 0800H, of Dec 03.
San Isidro	(3.2 m) may have been attained prior to event	(4.5 m) doubtful DPWH gage keeper report	(6.0 m) doubtful DPWH gage keeper report	As per reports of DPWH gage keeper, river stage was physically receding since it peaked after T.D. Winnie, Nov 30.
Zaragoza	(11.0 m) already attained prior to the event	(12.5 m) already attained prior to the event	(14.5 m) not attained	Recorded peak gage height of 14.42 m (14.755 m. AMSL) attained at about 1800H, Dec 04

Arayat	(5.0 m) already attained prior to the event	(6.0 m) already attained prior to the event	(8.5m) already attained prior to the event	Peak of 9.29 m (9,372 m AMSL) attained at around 0500H, Dec 04
Cardaba		(4.5 m) already attained prior to the event	(5.0 m) already attained prior to the event	Recorded Peak of 7.15 m (6.993 m AMSL) attained at around 0600H of Dec 04
Sulipan	(3.6 m) already attained prior to the event	(4.2 m) not attained	(5.0 m) not attained	Peak gage height at 3.97 m (3.908 m AMSL) attained 1700H, Dec 03
Sasmuan				No recorded river overflowing during the event

Note: All elevation of gage heights (in MSL) were based on survey of elevation of zero "0" of gage at various streamgaging stations undertaken on November 1996.

The high and lows of the tides at Manila Bay may have somehow affected the recession of floodwaters at the mouth of Pampanga River. Also, there were no reports of storm surges along Manila Bay.

6.2 Streamflow

There were no actual river velocity measurements undertaken during the flooding event, particularly at the time of peak flows. Measurements of river velocities were carried out on December 06, 2005, when river stages were already receding, at two streamgaging stations – Arayat and Apalit in Pampanga.

Main Pampanga River at a gage height of 7.90 m at Arayat streamgaging station registered a discharge equivalent to 1,208 cumecs corresponding to a river cross-section area of 1,167 m² and an average velocity of about 1 m/sec.

Pampanga River at Apalit streamgaging station, along the North Luzon Expressway (NLEX) and for a gage height reading of 3.36 m, the equivalent discharge is 1,385 cumecs. This corresponds to a river cross-section of 1,053 m and an average velocity of 1.4 m/sec.

6.3 Major Hydraulic Structures and Dam Releases

The two main hydraulic structures within Pampanga River Basin are Pantabangan and Angat Dams. Pantabangan Dam, located upstream of the upper main Pampanga River operates as a hydropower and an irrigation dam. The Angat Dam, on the other hand, is located on the eastern portion of the lower main Pampanga River and drains through the Angat River and via the Ipo Dam and

operates as a hydropower plant. Ipo Dam, which supports and partly regulates releases coming from the Angat Dam, is situated about to 7 kilometers downstream of the latter. Ipo serves as an active reservoir for water supply requirement of Metro Manila. It is not an impounding reservoir but as a diversion dam and relatively a lot smaller, about 6 km², than the other two dam structures.

During the passage of T.D. Winnie and T. Yoyong, both Angat and Ipo Dams released water via their spillways. Pantabangan Dam, on the other hand, has yet to release dam water through its spillway since its construction in 1974.

Ipo Dam is primarily a diversion dam. It diverts water from the Angat and Ipo Rivers into tunnels that lead to La Mesa reservoir and Balara filtration plant. Only a small impounding reservoir of around 7.5 million m³ compared to Angat Dam which has a reservoir capacity of 850 million m³. If the impounded water exceeds this volume, water starts to overflow the radial gates. The Dam has to maintain a reservoir elevation of between 100.0 to 100.5 meter (AMSL) levels to be able to provide water to Metro Manila.

Ipo Dam first started releasing reservoir water on the evening (around 2025H) of the 29th of November. Considering a smaller watershed area of about 6 km², Ipo Dam had to release water much earlier following the continuous moderate to heavy rains over the watershed that started about 5 to 6 hours earlier in the afternoon of November 29. Release of reservoir water continued for the next 4 days later with peak discharges reaching up to more than 2,000 cumecs on the third day of releases. The accumulated total releases during the whole period amounted to 321.09 MCM of water, more than 40 times of Ipo Dam's capacity and nearly 40% of Angat Dam's reservoir. Ipo Dam releases ceased at about noontime (1200H) of December 03 after reservoir elevation fell just below 100.0 meter (AMSL) mark

Table 4.0 Ipo Dam Daily Releases and Maximum Discharge

Day (Year 2004)	Total Spilled Water (MCM) at Ipo Dam* for the day	Maximum Recorded Discharge for the day (m ³ /s)
November 29	7.46	959.9
November 30	27.60	1055.50
December 01	135.33	2094.10
December 02	104.77	1867.00
December 03	45.93	1477.30

* Reported Dam release data from Ipo Dam Reservoir Plant

Angat Dam started its reservoir releases via its spillway at about 1400H of November 30 upon reaching a reservoir elevation of 216.81 meters (AMSL). This was after heavy rains were dumped over the watershed the night before. Reservoir spilling continued for the next 3 days, even past after Yoyong's passage, until it ceased noontime of December 03, at a reservoir elevation of 213.52 meters (AMSL).

Table 4.1 Angat Dam Summary of Daily Operations

Day (2004)	Inflow (MCM)	Turbine (MCM)	Spillway outflow (MCM)	Max Q via spillway (m ³ /s)
Nov 29	99.07	2.53	0	0
Nov 30	103.80	5.74	24.08	912
Dec 01	59.02	6.00	120.50	1,896
Dec 02	77.22	7.66	90.17	1,438
Dec 03	64.66	11.14	32.38	1,234
Dec 04	19.29	12.22	0	0

The accumulated total water released by Angat Dam for the whole period reached 267.13 MCM, which is much less compared to the total inflow of 416.06 MCM. Obviously, releases for the Angat Dam are much lesser than for Ipo Dam considering a relatively bigger reservoir and a catchment area. Furthermore, reservoir releases from Angat's spillway are coursed through Ipo, therefore, requiring much greater releases from the latter.

Cross-section of Angat River at Bgy. Maticlic, Norzagaray, Bulacan can only handle a discharge capacity rate of 770 m³/s as per hydrographic survey (1997) and as determined by hydraulic calculation at that section. The total cross-sectional area at this part is 683 m² with a river width of 172 meters.

The dam releases by Ipo Dam contributed quite significantly to the flooding along Angat River, particularly the riverside areas of Norzagaray, Angat, Bustos, San Rafael, Baliaug, Pulilan and Plaridel. Likewise, dam releases considerably affected the towns of Calumpit, Hagonoy and Paombong by further aggravating the inundation along the Pampanga River and Labangan channel. Ipo Dam has yet to be a part and a coordinating member of the FFWSO for the Angat Dam System.

Ipo and Angat Dams reservoir operations during the said events are shown in Figures 6.0 and 6.1.

6.4 Areas Flooded

A list of areas inundated within the basin during the event is presented in Table 5.0. Flood depths were taken from reports gathered by the respective Provincial Disaster Coordinating Councils (PDCC's) of Nueva Ecija, Pampanga and Bulacan.

The approximate flooding map (Figure 7.0) of the basin shows the extent of inundation within the basin. Likewise, maps showing the flow of floodwaters during the event are presented in Figures 7.1 to 7.7.

7.0 Flood Forecasting and Warning activities

The initial flood bulletin (FB #1) was issued 0600H of November 30 following reports of flash flooding at the upper main Pampanga River including the tributaries of Coronel, Tabuatling, Minatula, Tambo and Peñaranda Rivers. Flood forecasting and warning is definitely not suited for flash floods because there is little or no time at all for preparation and evacuation.

A total of 12 flood bulletins were issued throughout the whole period of the two flood events – Winnie and Yoyong. Significantly, an addendum to flood bulletin no.6 (FB #6 issued on 0400H, Nov 02), which is flood bulletin no.6-A (Additional report), was issued in anticipation of the possible flash flooding that is highly probable to be generated by Typhoon Yoyong.

Final flood bulletin (no. 12) was issued on December 05 at around 0500H after all forecasting river points were showing signs of complete recession and no tropical disturbance is likely to affect the basin within the next 24 hours.

There were no General Flood Advisories issued for the Guagua sub-basin at that time. The area was totally not affected during that time.

The issuance of flood bulletins for Pampanga River was somehow late during Winnie. Telemetered data were not available almost 4 days prior to the disturbance. Flood warnings to the province of Nueva Ecija were not given on time, however, on the lighter side of the matter, anticipated flood warnings thru the bulletins issued were 1 to 2 days ahead for the Bulacan province. In fact, PAGASA, through the FFB's field center - PRFFWC, was cited with a certificate of recognition and appreciation for its timely flood warnings in the major flood prone areas within the province.

8.0 Damages (Region III)

The effects of both Winnie and Yoyong can be gleaned from the Regional Disaster, Office of Civil Defense Region 3 (RD-OCD-3) damage report. The flooding as a result of Winnie affected 3 provinces, Aurora, Bulacan and Nueva Ecija. On the other hand, 7 provinces were affected by Yoyong, Aurora, Bataan, Bulacan, Pampanga, Tarlac, Zambales and Nueva Ecija. However, because of the spatial and temporal proximity of the two disturbances, it is quite possible that Winnie could have add-up to Yoyong's wider area and bigger damage total.

8.1 Tropical Depression Winnie

The following is the terminal damage report on Winnie as reported by RD-OCD-3 as of 16 December 2004.

Province	Numbers Affected				Evacuated	
	Municipalities	Barangays	Families	Persons	Families	Persons
Aurora	6	38	11,181	58,599	2,930	13,185
Bulacan	14	109	15,773	88,036	1,303	7,476
N. Ecija	17	232	56,891	266,003	4,443	20,786
Total	37	379	83,845	412,638	8,676	41,447

Province	Damaged House		Casualties			Total Estimated Damaged in Millions of Pesos
	Totally	Partially	Dead	Injured	Missing	
Aurora	1,197	1,609	165	67	3	25.55 *
Bulacan	79	173	7	8	-	9.56 **
N. Ecija	558	871	9	2	91	1.22 ***
Total	1,834	2,653	181	77	94	36.33

* Includes damaged on school buildings, books & equipment; Infrastructure and Agriculture (Fisheries & Livestock) / ** Damage report on school buildings, books & equipment / *** Damage report on Infra & Agriculture (Fisheries & Livestock)

8.2 Typhoon Yoyong

The following is damage report on Yoyong as reported by RD-OCD-3 as of 08 December 2004.

Province	Numbers Affected				Evacuated	
	Municipalities	Barangays	Families	Persons	Families	Persons
Aurora	8	110	13,844	68,590	1,464	7,320
Bataan	4	25	2,764	13,782	-	-
Bulacan	19	189	61,974	305,478	2,793	13,965
N.Ecija	7	9	124	620	124	620
Pampanga	1	7	4,200	18,400	452	2,343
Tarlac	4	9	363	1,577	296	1,285
Zambales	3	3	41	220	-	-
Total	46	352	83,310	408,577	7,503	37,403

Province	Damaged House		Casualties			Total Estimated Damaged in Millions of Pesos
	Total	Partially	Dead	Injured	Missing	
Aurora	1,334	2,375	-	22	-	80.784*
Bataan	3	-	-	-	-	5.0**
Bulacan	84	162	3	-	-	261.28***
Zambales	1	10	-	-	-	-
Pampanga	-	-	-	-	-	88.974^
N. Ecija	-	-	-	-	-	9.5**
Total	1,422	2,551				445.538

* No crop damage included / ** Infra damage only / *** No damage on livestock & fisheries reported

^ Agriculture damage only

9.0 Highlights during the event

The following day-to-day significant developments during the event were based from actual observations, reports and from the post-flood survey made; quite clear enough to describe the flood regime during the Winnie-Yoyong Event.

- Day 1 (Monday, November 29, 2004) – Moderate rains mostly over the eastern sections of the basin started late afternoon on that day becoming heavy as midnight came close. By midnight, almost all stations over the basin were registering moderate to heavy rainfall intensities.

Ipo Dam started releasing reservoir water at around 2025H.

- Day 2 (Tuesday, November 30, 2004) – Moderate to heavy rains still continued over the basin in the early hours of the day. Several hours later, rains had almost ceased at the lower-half of the basin. Still heavy rains continued at the upstream reaches and upper sections of the basin until completely clearing out just after noontime. Peñaranda River overflowed its banks at several points from Gen. Tinio to Gapan. At around 0200H-0300H of the morning, the riverside barangays along Peñaranda River between Gapan and San Leonardo, particularly adjacent to the Doña Josefa Bridge, were affected by flash floods following the heavy downpour. Likewise, flash floods due to overflowing of tributaries Coronel, Dupinga, Bugnan and Tablong Rivers, and the Digmala River rampaged thru the towns of Gabaldon, and Laur, and Bongabon, respectively.

Initial Flood Bulletin (FB#1) was issued at 0600H following reports of the flash flooding at the upper main Pampanga River including the tributaries of Coronel, Tabuating, Minatula, Tambo and Peñaranda Rivers.

Around 1000H, Pampanga River overflowed its banks towards the Cabiao Floodway cutting-off the GSO (Gapan-San Fernando-Olongapo) Road between Bgys. San Vicente and Concepcion in Cabiao, Nueva Ecija. Arayat station registered an estimated gage height of 8.1 meters at about the same time.

By noontime, Pampanga River overflowed its banks at Bgy. San Mariano in San Antonio, and at the riverside portions of the towns of Sta. Rosa, San Leonardo, Gapan, San Isidro, Cabiao and Cabanatuan City, all in Nueva Ecija. Floodwaters swelled further by nighttime.

Angat Dam started its reservoir spilling at around 1400H that day.

- Day 3 (Wednesday, December 01, 2004) – Rains have completely stopped. Floodwaters have now engulfed a large stretch of the riverside areas along the Pampanga River from Cabanatuan to Arayat. Just before dusk, floodwaters were now slowly receding at most of the affected areas within Nueva Ecija. Candaba

swamp, on the other hand, maintained its slow fill-up. Floodwaters along the GSO road in Cabaio have, likewise, receded.

- Day 4 (Thursday, December 02, 2004) – Around 0800H-0900H, floodwaters started overflowing at Barangay Callizon in Calumpit, Bulacan. This was the start of flooding in the areas of Calumpit, Hagonoy and Paombong. Prior to the flooding at the said 3 towns, similar situations have already occurred at riverside areas downstream of Arayat station, particularly along the stretch of San Luis, San Simon and Apalit towns.

Rains as spawned by Typhoon Yoyong have started early evening of the day until a few hours after midnight.

- Day 5 (Friday, December 03, 2004) – Flash floods once again charged through the riverside barangays along the Peñaranda River between Gapan and San Leonardo. This was the third time in just 2 weeks. But unlike the previous two, this was a bit milder. Likewise, flash floods again affected the upstream towns of Gabaldon, Laur and Bongabon. Rains have ceased just before daylight.

Cabaio floodway went underwater once again following the flash floods that affected Gapan and San Leonardo.

The flood prone areas at the lower sections of the main Pampanga River were now being inundated from overflowing of Pampanga and Angat Rivers and overflowing of the Candaba swamp.

- Day 6 (Saturday, December 04, 2004) – Completely no more rains. Rather slow recessions of floodwaters were now in effect in almost all affected areas from middle to lower main Pampanga River. Floodwaters at the Cabaio floodway have now totally subsided.
- Day 7 (Sunday, December 05, 2004) – Although a big area still remains underwater, flood forecasting and warning activities of the PRFFWC were now called-off following forecasts of improving weather conditions over the basin. Final Flood Bulletin (FB #12) ended the Center's flood watch operations.

10.0 Recommendations

The Winnie-Yoyong flood event is considered a major disaster for the Pampanga River Basin, particularly the province of Nueva Ecija, for the year 2004. The following recommendations, most of which have been recommended before, are offered following the hydrological analyses, post-flood survey and investigations undertaken within the Basin during and days after the flood event.

A. Short Term:

(1) Extensive programs on Public Information Drive (PID) within the basin particularly at flood-prone areas focusing on the flood hazards, disaster preparedness, environmental protection awareness, weather and flood information interpretation, etc. The programs are to be coordinated with various concerned regional and local government (RDCC, PDCC, MDCC, etc.) and non-government agencies.

(2) Establish a community-based flood management programs between FFB and municipalities and/or province concerned. This is to facilitate efficient reporting of observed data and in return the response or actions to be undertaken within the areas involved.

At present, this program is being introduced at 3 towns of Bulacan through coordination with the provincial disaster coordinating council of Bulacan. The program involves setting-up of manual rain gages, staff gages and flood markers within the target areas. Volunteer observers will be used to report observed data from these gages to FFB. On the other hand, FFB will provide flood advisories based on the data supplied from these observation points.

(3) Introduce a flash flood alert system at areas that are prone to such type of flooding. A network of rainfall stations at strategic points at the mountain ranges of Sierra Madre and water level observation points at the immediate low end slopes of the mountains as well as river observation points at upstream sections of primary rivers are some of the possible actions that can be adopted for a flash flood alert system.

(4) Incessant familiarization and physical re-survey of the basin area, especially the Guagua River system, to continually familiarize basin forecasters and hydrologists of the ever-changing basin features particularly the river system and present structural works.

(5) Hiring of part-time observers at forecasts points (streamgaging stations) thru IPP (Individual Project Proposals) to support and as a back-up for telemetry data. This is to ensure a checkof water level data during times of failure of transmission at forecast points. Observers will only be utilized during flood events and shall be provided with communication links (dedicated) for data reporting purposes.

(6) Regular maintenance of all telemetering RR and WL stations, their equipment, and the stations' housing. Physical maintenance of station, particularly cleaning of water level intake pipes (declogging and desilting works) and wells prior to rainy season.

(7) Establish an FFWSDO with Ipo Dam in coordination with NPC's Angat Dam.

(8) While there were still no reported discharges from the Pantabangan Dam to date, it is important for future flooding that coordination on the monitoring of the status and condition of the said dam catchment be maintained. In this regard, there should be a continued joint-agency monitoring activity focused on updating the status of FFWSDO Warning Equipment not only for the said dam but for Angat Dam as well.

(9) Develop and improve a system for information exchange (inter-agency) with other government and non-government entities within the basin concerned. It will be beneficial to pursue activities aimed at an inter-agency Flood Watch Hotline during major flood events among the agencies of the LGU's, OCD, PDCC, DSWD, DPWH, NPC, NIA, DENR, etc. A hotline or dedicated communication link could be a venue for exchanging information on forecast, actual flooding conditions during flood events aimed at better disaster responses.

(10) Upgrade of on-line basin and flood information system through the web/internet services. Possible integration of daily update of water level at the various streamgaging stations within the basin.

(11) A need to augment the personnel of the center (PRFFWC) for floodwatch operations. With 2 hydrologist and 3 hydrological aides at present situation, the shift rotation would be quite exhausting for about a week's floodwatch operation. On the immediate, staff from the FFWS could be temporarily detailed to the center during floodwatch operations.

B. Medium / Long Term:

(1) Continued improvement and development of simple hydrologic models incorporating advanced mapping methods such as Geographic Information System (GIS) and others. Emphasis should be placed on antecedent meteorological and hydrological conditions, flash-flood guidance indices, and instantaneous rainfall rates as determined from satellites or radar images.

(2) Establishment of auxiliary stations at strategic locations within the basin to supplement rainfall and water level observation points for better flood forecasts and flood modellings.

(3) Total rehabilitation of the telemetry system of the Pampanga River Basin in order to have reliable real-time rainfall and water level data. Rehabilitation should include the installation of additional telemetered stations in strategic locations, particularly in the Guagua River system whose catchment, at the moment, has only one telemetered RR station.

(4) The need for a field service vehicle and additional equipment with the aim of improving the present FFW system of the center, enhancing the mobility of flood forecasting personnel during flood events, facilitating post-flood field investigation surveys and for supplemental data on rivers not covered by the present system.

References

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2. Design Report – Hydrological & Hydraulic Calculation for FFWSO Project. NK, CTIE & BASIC Team. June 1987.
3. Water and Floods: A Look at Philippine Rivers and Flood Mitigation Efforts. DPWH-JICA-PKII. March 2004.
4. Encarnacion, R. P. and Hernando, H. T., "Post-Flood Investigation Report – Widespread Flooding in Pampanga River Basin due to the Influence of Typhoons Ditang and Edeng (July 2000)". PRFFWC, Flood Forecasting Branch, PAGASA, DOST. September 2000.
5. Terminal Report re: Winnie and Partial Summary Report re: Yoyong as prepared by RD-OCD-3 for the Chairman of RDCC 3, December 2004.

B: Resource Persons:

1. Personnel and Staff of the Pampanga Provincial Disaster Coordinating Center, San Fernando, Pampanga.
2. Mr. Rodolfo Santos, Provincial Disaster Coordinating Officer, Bulacan Provincial Disaster Coordinating Office, Malolos, Bulacan
3. Raul Agustin, Bulacan Provincial Disaster Coordinating Office, Bulacan
4. Lorenzo W. Burgos, Executive Officer, PDCC; Chief, Provincial Disaster Management Center, Office of Civil Defense, Province of Nueva Ecija.
5. Elsa P. Pantino, Municipal Planning & Development Coordinator, Municipality of Guagua, Pampanga
6. Carmelito P. Calimbas, Chief, GMS-PAGASA
7. Personnel and Staff of PAGASA Cabanatuan Synoptic Station, Cabanatuan City, Nueva Ecija
8. Herminigildo M. Medrano, Head, Ipo Headwork's and Conveyances, Ipo Dam, MWC
9. Mario C. N. Resurreccion, Manager, Common Purpose Facilities, Manila Water
10. Leonida S. Santos, Weather Specialist II, FFB, PAGASA
11. Lourdes Elipane, DPWH gagekeeper, San Isidro, Nueva Ecija
12. Personnel & Staff of Pampanga River Basin Flood Forecasting & Warning Center (PRFFWC), PAGASA

Table 5.0 Affected Areas - T.D.Winnie and Typhoon Yoyong (November 2004)					
Pampanga River Basin (PRB) and Guagua River Basin (GRB) Areas					
Barangay	Estimated Flood Depth (m)	Remarks	Barangay	Estimated Flood Depth (m)	Remarks
Province of Pampanga					
1. Municipality of Candaba (14 Barangays)					
Pasig	1.6-2m		Mandasig	1-1.3m	
Paralaya	1-1.3m		Buas	1-1.3m	
Bambang	1-1.3m		San Agustin	2.5-3m	
Gulap	1.3-1.6m		Sto. Rosario	2.2-2.5m	
Lanang	1-1.3m		Pansinao	1-1.3m	
Cuayan Bugtong	1-1.3m		Tagulud	1-1.3m	
Barangca	0.3-0.6m		Mapaniqui	0.3-0.6m	
2. Municipality of Arayat (3 Barangays)					
Candating	0.6-1.3m		San Mateo	0.6-1.3m	
Mapalad	0.3m				
3. Municipality of San Simon (6 Barangays)					
San Jose	1-1.3m		San Juan	2-2.2m	
San Pedro	2-2.2m		Sta Cruz	1.6-2m	
San Miguel	1.6-2m		San Nicolas	1.6-2m	
4. Municipality of San Luis (15 Barangays)					
San Juan	1.6-2.2m		Sta. Monica	1.6m	
San Agustin	1.3-1.6m		Sta. Cruz(Pambilog)	1.6-2.2m	
Sta Catalina	1.6-2.2m		San Nicolas	1.6-2.2m	
Sta. Rita	1.6-2m		Sta Cruz(Poblacion)	1.3m	
Sto Tomas	1m		San Isidro	1.6m	
Sta. Lucia	1m		San Sebastian	2.2m	
San Carlos	1m		San Roque	1m	
Sto. Rosario	1m				
5. Municipality of Apalit (7 Barangays)					
San Juan	0.3m		Capalangan	0.4-0.6m	
Sulipan	0.5-0.6m		Tabuyuc	0.3m	
Sucad	0.3-0.4m		Cansinale	0.3-0.6m	
San Vicente	0.3m				
6. Municipality of Masantol (7 Barangays)					
Bebe Anac	0.3-0.6m		Bebe Matua	0.3-0.6m	
Canbasi	0.3-0.6m		Puti	0.3-0.6m	
San Isidro	0.3-0.6m		Sta Cruz	0.3-0.6m	
Sagrada	0.3-0.6m				
7. Municipality of Macabebe (3 Barangays)					
Sitio Bitas Batasan	0.3-0.6m		Sta. Rita	0.2m	
San Rafael	0.2m				
Province of Bulacan (Areas within the basin and affected by Pampanga & Angat Rivers)					
1. Municipality of Malolos (4 Barangays)					
Atlag			Calero		
Bagna			Sto. Rosario		
2. Municipality of Hagonoy (26 Barangays)					
Abulalias	0.3-0.6m		San Nicolas	0.3-0.3m	
Carillo	0.3-1m		San Pablo	0.3-1.2m	
Iba	0.3-1m		San Pascual	0.3-0.3m	
Iba-Ibayo	0.3-1m		San Pedro	0.3-1m	
Mercado	0.3-0.6m		San Roque	0.3-0.3m	
Palapat	0.3-1m		San Sebastian	0.3-1m	
Pugad	0.3-1m		Sta. Cruz	0.3-0.6m	
Sagrada Familia	0.3-1m		Sta. Elena	0.3-0.6m	
San Agustin	0.3-1.6m		Sta. Monica	0.3-1.2m	
San Isidro	0.3-1m		Sto. Nino (Pob.)	0.3-0.6m	
San Jose	0.3-1m		Sto. Rosario	0.3-0.6m	

Table 5.0 Affected Areas - T.D. Winnie and Typhoon Yoyong (November 2004)					
Pampanga River Basin (PRB) and Guagua River Basin (GRB) Areas					
Barangay	Estimated Flood Depth (m)	Remarks	Barangay	Estimated Flood Depth (m)	Remarks
San Juan	0.3-1.3m		Tampok	0.3-1.3m	
San Miguel	0.3-1.3m		Tibaguin	0.3-1m	
3. Municipality of San Ildefonso (14 Barangays)					
Antayam	0.3-0.6m		Makapilapil	0.3-0.6m	
Bubulong Malaki	0.3-1m		Nabaong Garlang	0.3-0.6m	
Calasag	0.3-0.6m		Pasong Bakal	0.3-0.6m	
Calawit	0.3-1m		Pulong Tamo	0.3-0.6m	
Garlang	0.3-0.6m		Sumandig	0.3-0.6m	
Lapnit	0.3-0.6m		Telepatic	0.3-0.6m	
Maasim	0.3-0.6m		Upig		
4. Municipality of San Miguel (35 Barangays)					
Bagong Pag-asa	0.3-0.6m		Poblacion	0.3-0.6m	
Bagong Silang	0.3-0.6m		Pulong Duhat	0.3-0.6m	
Balite	0.3-0.6m		Sacdalan	0.3-1m	
Bantog	0.3-0.6m		Salacot	0.3-1m	
Bardias	0.3-1.3m		Salangan	0.6-1.6m	
Batasan Bata	0.3-0.6m		San Agustin	0.3-0.3m	
Batasan Matanda	0.3-0.6m		San Jose	0.3-1m	
Buga	0.3-1.0m		San Juan	0.6-1.3m	
Buliran	0.3-0.6m		San Vicente	0.3-0.6m	
Bulualto	0.3-0.6m		Sapang	0.3-1m	
Cambio	0.3-0.6m		Sibul	0.3-0.6m	
Camias	0.3-1.3m		Sta. Lucia	0.3-0.6m	
Ilog-Bulo	0.3-0.6m		Sta. Rita Bata	0.3-0.6m	
Labne	0.3-0.6m		Sta. Rita Matanda	0.3-0.6m	
Mandile	0.6-2.2m		Tartaro	0.3-0.6m	
Masalpit	0.3-0.6m		Tibagan	0.3-1m	
Partida	0.3-1m		Tigpelas	0.3-0.6m	
Pinambaran	0.3-1.6m				
5. Municipality of Calumpit (27 Barangays)					
Balite	0.3-1.6m		Palimbang	2-2.2m	
Balungao	0.3-1m		Panducot	0.3-0.6m	
Bulusan	0.3-0.6m		Pio Cruzcosa	0.3-1.6m	
Calizon	1-1.6m		Poblacion	0.3-1m	
Caniogan	0.6-2.2m		Pungo	1-1.3m	
Corazon	0.6-1m		San Jose	1-1.6m	
Frances	1-1.6m		San Marcos	0.3-2m	
Gatbuca	1-2m		San Miguel	1-1.6m	
Gugo	1-2m		Sapang Bayan	0.3-3m	
Iba Este	1.3-2m		Sergio Bayan	0.3-2m	
Iba O' Este	1-2m		Sta. Lucia	0.3-1m	
Longos			Sto. Nino	0.3-0.6m	
Calumpit Center	1.3-3m		F. Mendoza E/S	0.3-3m	
Meysulao	1-1.6m		Sucol	0.3-1.6m	
Meyto	0.3-0.6m				
6. Municipality of Paombong (3 Barangays)					
Pinalagdan					
San Isidro 1st	0.3-0.3m				
Sto. Rosario					
7. Municipality of Bustos (8 Barangays)					
Bonga Mayor	0.3-0.6m		San Pedro	0.3-1m	
Bonga Menor	0.3-1m		Talampas	0.3-1m	
Cambaog	0.3-1m		Tanawan	0.3-1m	
Poblacion	0.3-1m		Tibagan	0.3-1m	

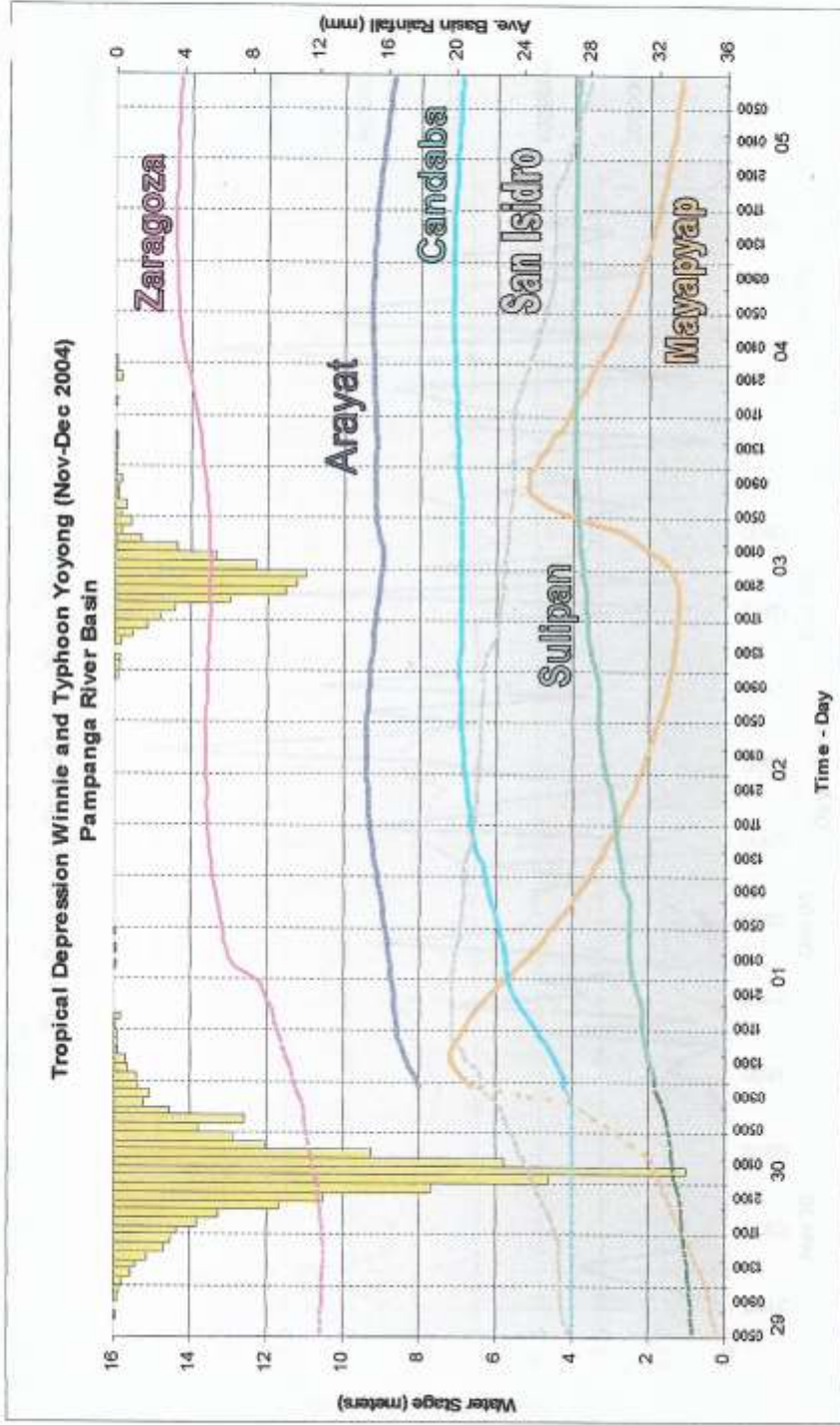


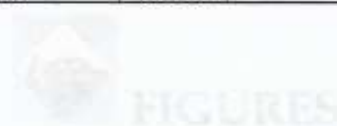
Figure 5.14 Basin Hyetograph and Hydrographs at various gaging stations (November 29-December 05, 2004)

Table 5.0 Affected Areas - T.D.Winnie and Typhoon Yoyong (November 2004)					
Pampanga River Basin (PRB) and Guagua River Basin (GRB) Areas					
Barangay	Estimated Flood Depth (m)	Remarks	Barangay	Estimated Flood Depth (m)	Remarks
8. Municipality of Pullan (6 Barangays)					
Dulong Malabon	0.3-0.6m		Paltao	0.3-0.3m	
Inaon	0.3-0.6m		Poblacion		
Lumbac	0.3-0.3m		Sto. Cristo	0.3-1.3m	
9. Municipality of Angat (4 Barangays)					
Baraban	0.3-0.6m		Sto. Cristo	0.3-0.6m	
Niugan	0.3-1m		Sulucan	0.3-1.3m	
10. Municipality of Baliuag (7 Barangays)					
Pagala			Sta. Barbara		
Poblacion	0.3-0.6m		Tiaong	0.3-1m	
Sabang	0.3-1m		Tibag	0.3-1m	
San Jose	0.3-1m				
11. Municipality of Norzagaray (5 Barangays)					
Bigte	0.3-1m		Poblacion	0.3-1.6m	
Meticlic	0.3-1m		San Mateo	0.3-1.6m	
Minuyan	0.3-1.6m				
12. Municipality of Plaridel (5 Barangays)					
Banga 1st	0.3-1.6m		Parulan	0.3-1m	
Banga 2nd	0.3-1.6m		Sipat		
Culianin	0.3-0.6m				
13. Municipality of San Rafael (3 Barangays)					
Dagat-Dagatan	0.3-0.6m		Pulong Bayabas	0.3-0.6m	
Maasim	0.3-0.6m				
Province of Nueva Ecija					
1.Cabanatuan City (64 Barangay)					
Valdefuente	2-2.2m		Valle Cruz		
Cabu Bana			Sumacab Sur		
San Isidro			Samon		
Bagong sikat			Bitas		
Caudillo			Balite		
Imelda			Barlis		
MS Garcia			Palagay		
Matadero			Pollito		
Pagas			Talipapa		
Aduas Sur			Nabao		
Isla			Cinco-cinco		
Aduas Norte			Ibabac Bana		
Rizdeliz			Caalibangbangan		
Communal			Bantug Norte		
San Juan -			Sanbermicristi		
Acfa			Zulueta		
San Roque Sur			Sumacab Este		
Sumacab Norte			San Josef Sur		
Bonifacio			San Josef Norte		
Sta Arcadia			Mabini HOMESITE		
DS Garcia			Villa Ofelia		
Dicarna			Barrera		
Calawagan			Caridad		
Bitas			Vijandre		
Daan Sanle			Cruz roja		
Aduas Centro			Lagare		
Mayapyap Norte			Mayapyap Sur		
Obrero			Lourdes		
Sto. Nino			Pamaldan		

Table 5.0 Affected Areas - T.D.Winnie and Typhoon Yoyong (November 2004)					
Pampanga River Basin (PRB) and Guagua River Basin (GRB) Areas					
Barangay	Estimated Flood Depth (m)	Remarks	Barangay	Estimated Flood Depth (m)	Remarks
H. Concepcion			Buliran		
Sangitan Este			Sangitan West		
Bangad			Bakero		
Bantug Bulalo					
2. Municipality of Palayan City (22 Barangays)					
Brgy. Popolon	2-2.5m		Pinattakan		
Sapang Buho			Mansnac		
Marcos Village			Mapaet		
Singalat			Aulo		
Imelda Valley			Militar		
Atate			Maligaya		
Caballero			Bagong Buhay		
Ganaderia			Dona Josefa		
Santolan			Bacao		
Malate			Palale		
Caimito			Langka		
3. Municipality of San Isidro (5 Barangays)					
Malapit	1-1.6m		Tabon		
Calaba			Politio		
Pulo					
4. Municipality of San Antonio (11 Barangays)					
Tikiw			Buliran		
Mangat			Hulo		
Sto. Cristo			Sta. Cruz		
Luyos			Papaya		
Lawang Kupang			San Francisco		
San Mariano					
5. Municipality of Aliaga (3 Barangays)					
Sta. Ines			San Antonio		
Bucot					
6. Municipality of Gen. Tinio (7 Barangays)					
Pias	1.3-2.5m		Padolina		
Poblacion East			Otso		
Poblacion West			Onse		
Rio Chico					
7. Municipality of Gabaldon (16 Barangays)					
Bagong Sikat	1.6-2.5m		Bantug		
Tagumpay			Bugnan		
Cuyapa			Ligaya		
Macasandal			Malinao		
South Poblacion			Pantoc		
Sawmill			Calabasa		
North Poblacion			Bagting		
Carnachile			Pinamalsan		
8. Municipality of Gen. Natividad (10 Barangays)					
Sitio Lubog, Bravo	1.3-1.6m		Picalen		
Pinahan			Mataas na Kahoy		
Sapang Bato			Poblacion		
Platero			Belen		
Tal. Sur			Buroi		
9. Municipality of Penaranda (9 Barangays)					
Sto. Tomas			Poblacion 1		
Callos			Poblacion 11		
Sinisajan			Poblacion 111		

Table 5.0 Affected Areas - T.D.Winnie and Typhoon Yoyong (November 2004)					
Pampanga River Basin (PRB) and Guagua River Basin (GRB) Areas					
Barangay	Estimated Flood Depth (m)	Remarks	Barangay	Estimated Flood Depth (m)	Remarks
Las Pinas			Poblacion 1V		
San Josef					
10. Municipality of Zaragoza (2 Barangays)					
Batitang			Manaoi		
11. Municipality of Cabiao (20 Barangays)					
Bagong Sikat			San Fernando Sur		
Sta. Isabel			San Juan South		
Polillo			Natividad South		
San Carlos			Palasinan		
Bagong Silang			Sta Ines		
Concepcion			Entablado		
Sta. Rita			Natividad North		
San Vicente			San Antonio		
San Roque			San Fernando Norte		
San Gregorio			Pantalan		
12. Municipality of Sta. Rosa (8 Barangays)					
Isla			Sto Rosario		
La Fuente			Maliolio		
Zamora			Sapsap		
San Pedro			Soledad		
13. Municipality of Jaen (10 Barangays)					
Niyugan			San Jose		
Nabac			Lambakin		
Langla			San Roque		
Imelda			Magsalisi		
Panacpecan			Dampulan		
14. Municipality of San Leonardo (15 Barangays)					
Castellano			Burgos		
Nieves			Mallorca		
Tabuating			San Bartolome		
San Antonio			Rizal		
Magpapalayok			Adorable		
Tagumpay			Diversion		
San Roque			Mambangnan		
Bonifacio					
15. Municipality of Laur (16 Barangays)					
Betania	1.3-1.6m		Siclong		
San Antonio			Brgy. 1		
San Juan			Brgy. 11		
San Felipe			Brgy. 111		
San Vicente			Brgy. 1V		
San Fernando			Nauzon		
Pinagbayaran			Sagana		
San Isidro			Canantong		
16. Municipality of Bongabon (15 Barangays)					
Lusok	1.6-2.5m		Kaingin		
Bantug			Ariendo		
Vega			Mantile		
Palomaria			sinipit		
Magtanggol			San Roque		
Calaanan			Tulay na Bato		
Sampalukan			Sapang Buho		
Labi					
17. Municipality of Gapan City (5 Barangays)					

Table 5.0 Affected Areas - T.D.Winnie and Typhoon Yoyong (November 2004)					
Pampanga River Basin (PRB) and Guagua River Basin (GRB) Areas					
Barangay	Estimated Flood Depth (m)	Remarks	Barangay	Estimated Flood Depth (m)	Remarks
Pambuan			Riverside		
San Vicent			San Nicolas		
San Lorenzo					
18. Municipality of Rizal (14 Barangays)					
Agbannawag		Bagong Silang	San Gregorio		
Bagong Sikat		Bagong Lipunan	Pob. Norte		
Bicos		Kaisiwan	Cabucbucan		
Calaocan Dist(Riverside)		Purok 4	Villa Paraiso		
Estrella (Proper)		Purok 2	Villa Labrador		
Macapsing			Gen. Luna		
San Esteban			Casilagan		
Province of Tarlac (Areas within the Basin)					
1. Municipality of Bamban					
Poblacion	0.3 - 0.5		Anupul	0.3 - 0.5	
2. Municipality of Capas					
Bueno					
Sta. Lucia					
Kalangitan		5 Sitios			
3. Municipality of Concepcion					
Sta. Monica	1.0 - 1.2		Sta. Rita		
San Jose	0.3 - 0.5		Minane		
San Francisco			Castillo		
Sto. Nino			Tal. Marimla		
Caluluan			Calius Gueco		
Culatingan			Café		
4. Municipality of La Paz					
Bantog Caricutan	1.0 - 1.2		San Isidro		
Balanoy			Guevarra		
Paludpod			Matayumtayum		
Caut			Laoangcupang		
Bantog			Rizal		
Mayang			Lomboy		
Kapanikian			Cornillas		
Sierra			Dumarais		
Lara			La Purisima		
Macalong			San Roque		
Caramutan					
5. Municipality of Victoria					
Canarem	0.3 - 0.6				
6. Municipality of Pura (Portions are out of basin area)					
Balite	0.3 - 0.6	sfc. Run-offs	Maungib	0.3 - 0.6	
Buenavista	0.3 - 0.6		Naya	0.3 - 0.6	
Cadanglaan	0.3 - 0.6		Nilasin 1st	0.3 - 0.6	
Estipona	0.3 - 0.6		Nilasin 2nd	0.3 - 0.6	
Lineo	0.3 - 0.6		Poblacion 1	0.3 - 0.6	
Maasin	0.3 - 0.6		Poblacion 2	0.3 - 0.6	
Matindog	0.3 - 0.6		Poblacion 3	0.3 - 0.6	



PAMPANSA RIVER CATCH



FIGURES



Figure 1.0. The Pampanga River Basin including the allied basin of Guagua River.



Figure 2.0. Track of Tropical Depression Winnie.

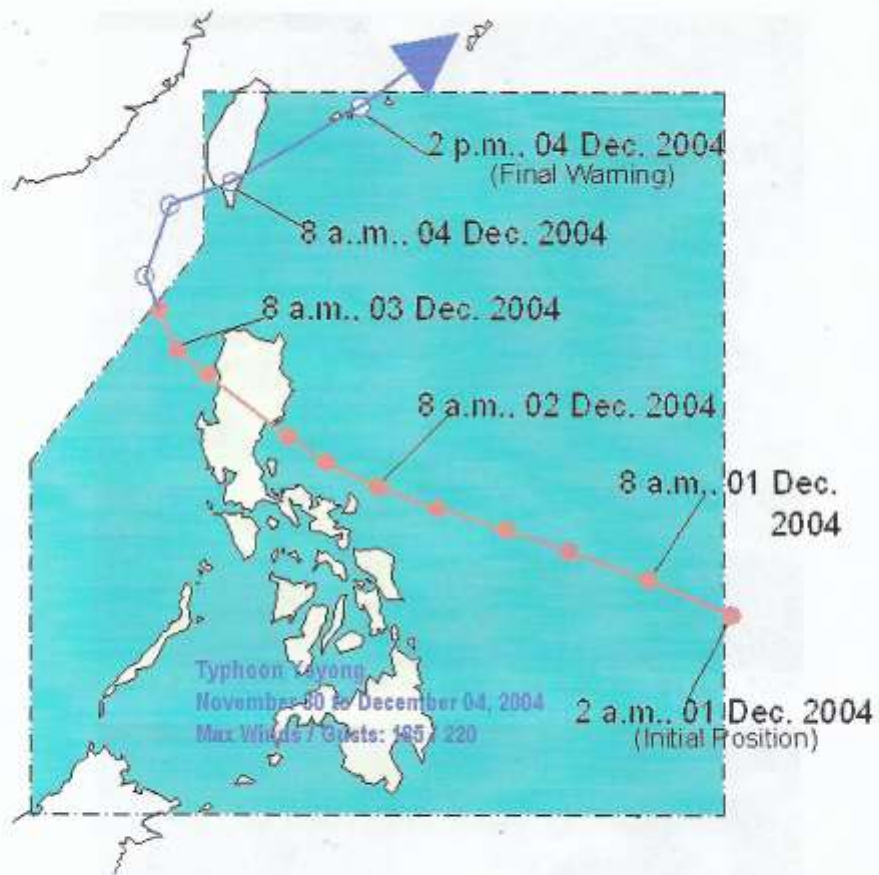


Figure 3.0. Track of Typhoon Yoyong.

Figure 3.1. Relative tracks of Typhoon Yoyong and the approaching Typhoon Yoyong as of Dec 1, 2004.

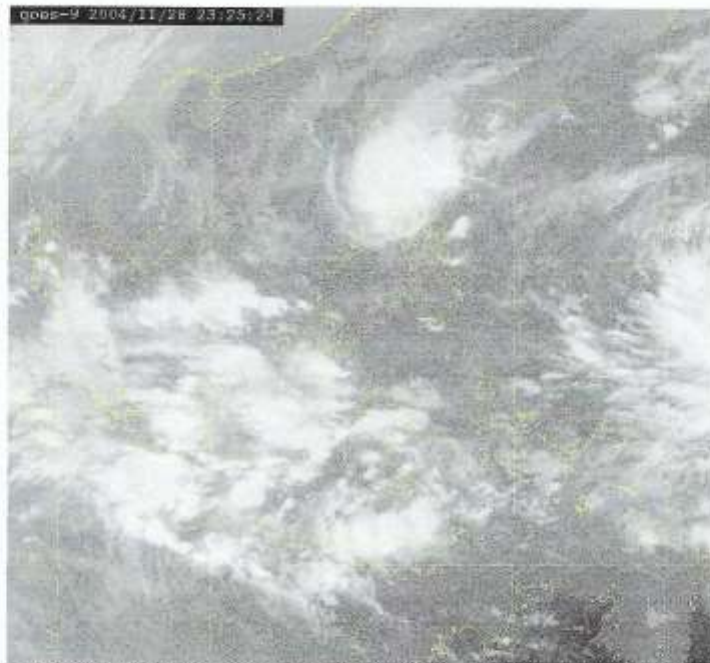


Figure 3.1 Satellite Image of T.D.Winnie as of 0000H, 29 Nov. 2004.

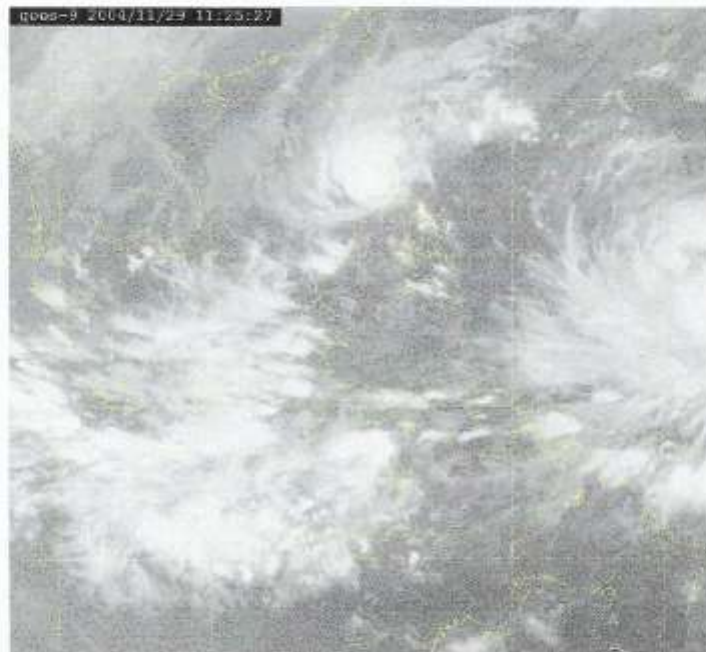


Figure 3.2 Satellite Image of T.D.Winnie and the approaching Typhoon Yoyong as of 1200H, 29 Nov. 2004.

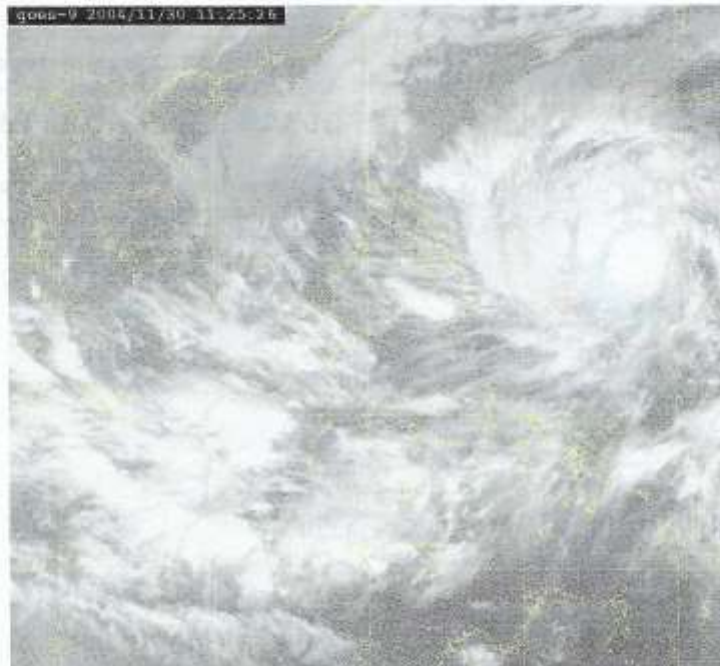


Figure 3.3 Satellite Image of Typhoon Yoyong as of 0000H, 01 Dec 2004.

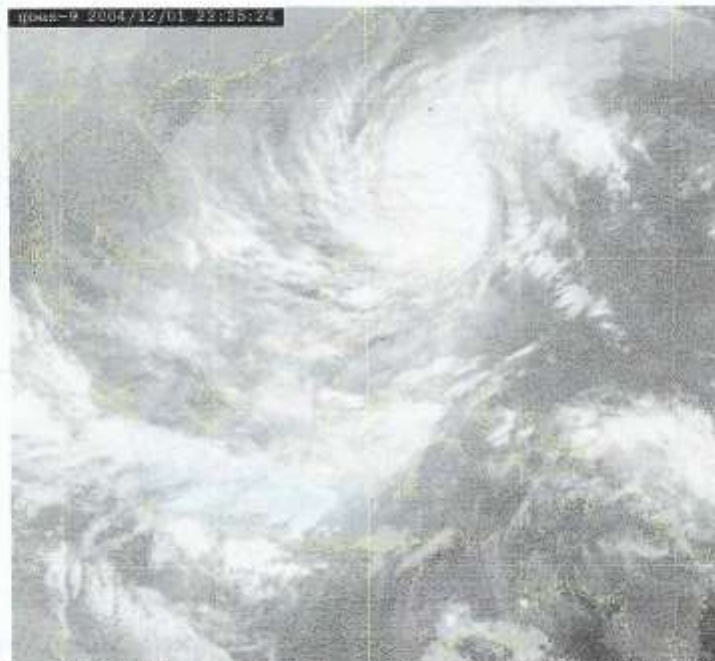


Figure 3.4 Satellite Image of Typhoon Yoyong as of 0000H, 02 Dec 2004.

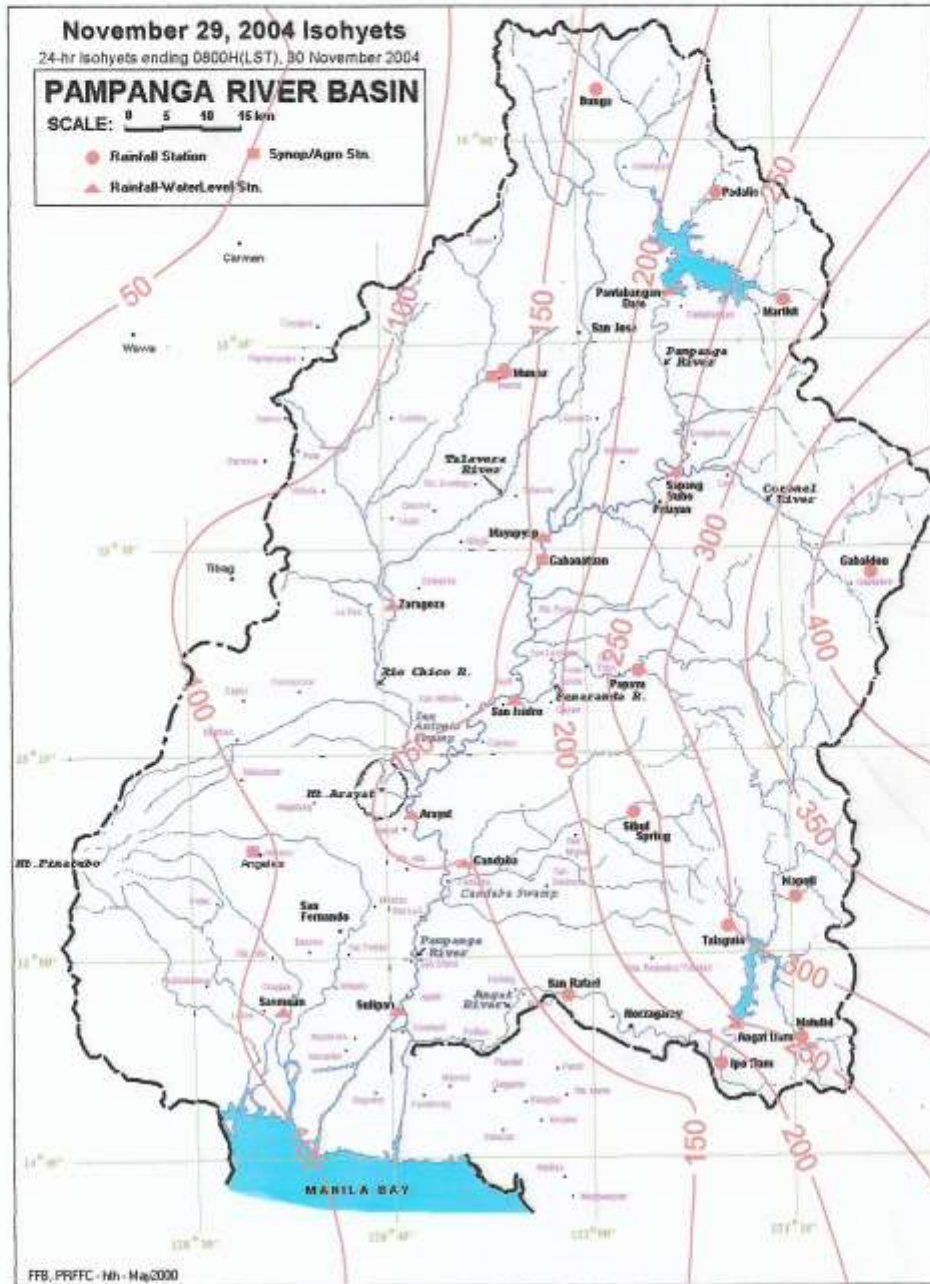


Figure 4.0 24-hour Isohyets ending at 0800H, November 30, 2004 (T.D. Winnie)

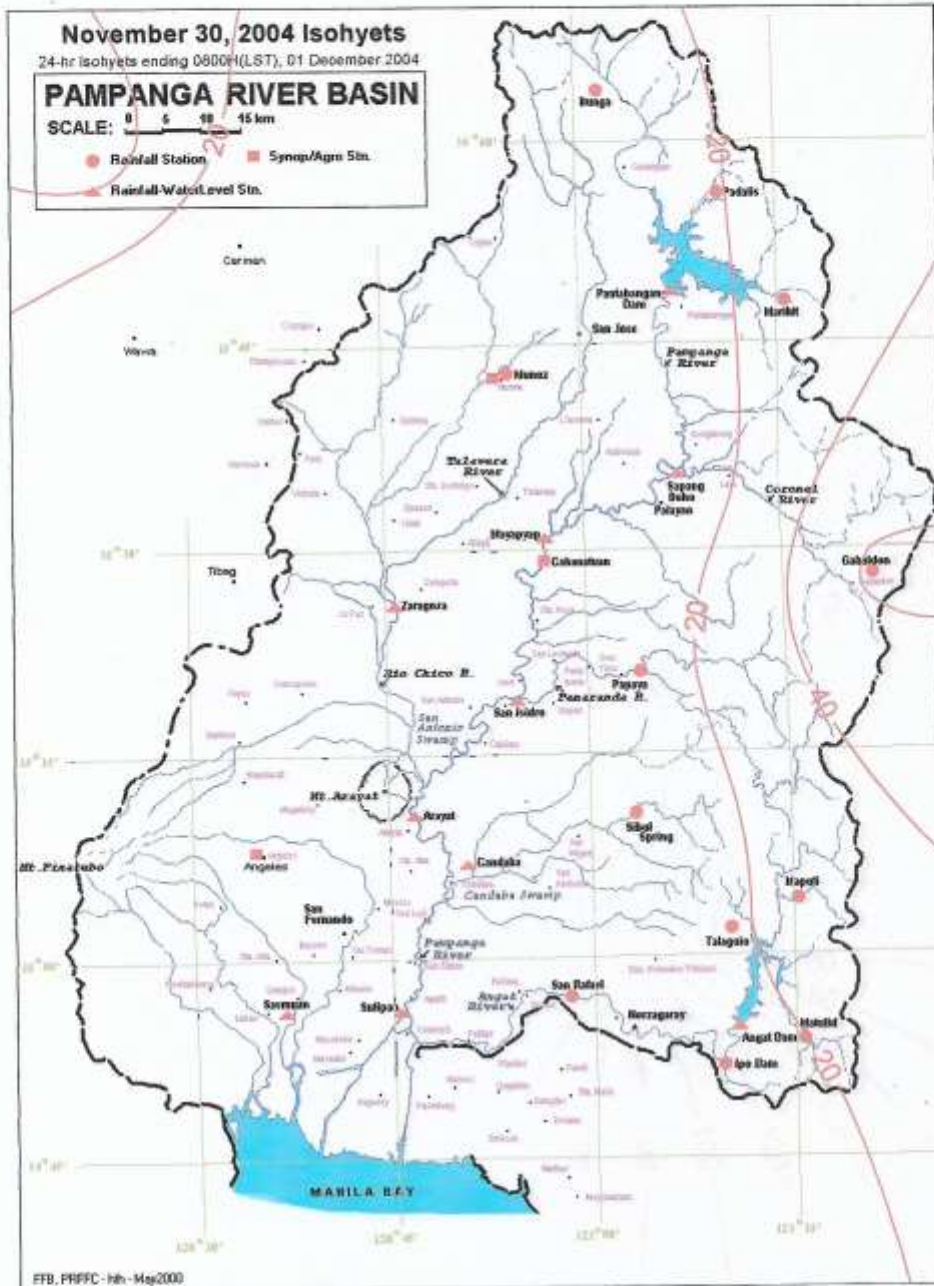


Figure 4.1 24-hour Isohyets ending at 0800H, 01 December 2004.

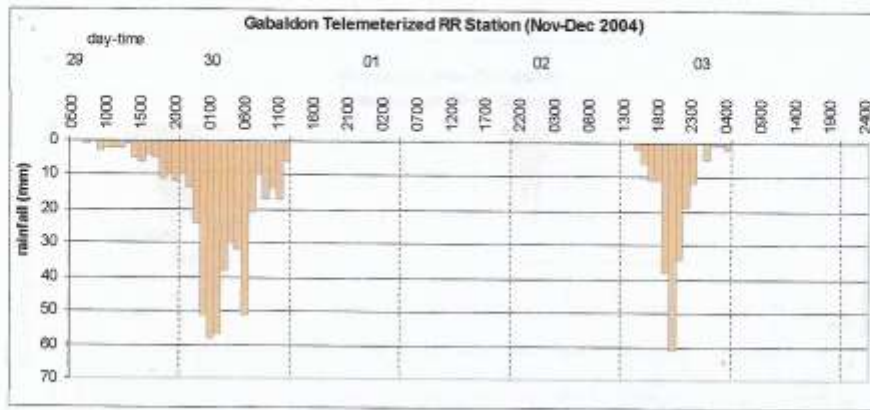


Figure 5.0 Gabaldon Telemetered Station Hyetograph

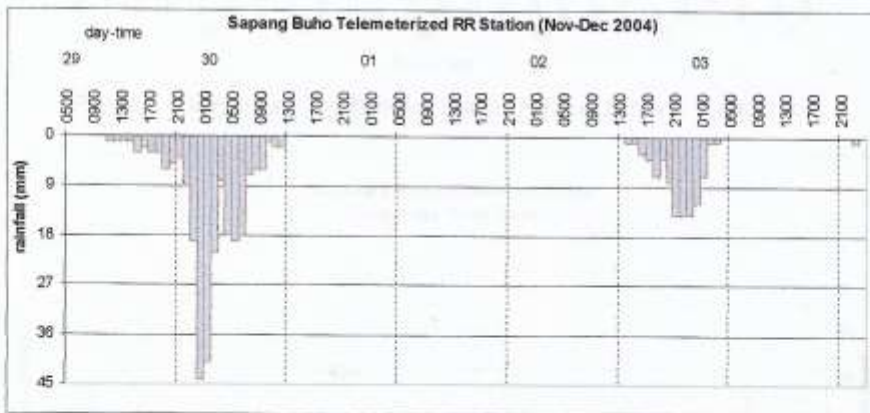


Figure 5.1 Sapang Buho Telemetered Station Hyetograph

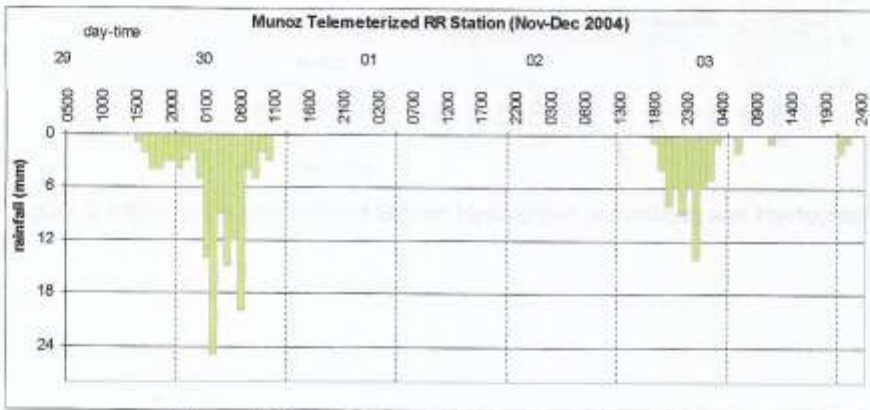


Figure 5.2 Muñoz Telemetered Station Hyetograph

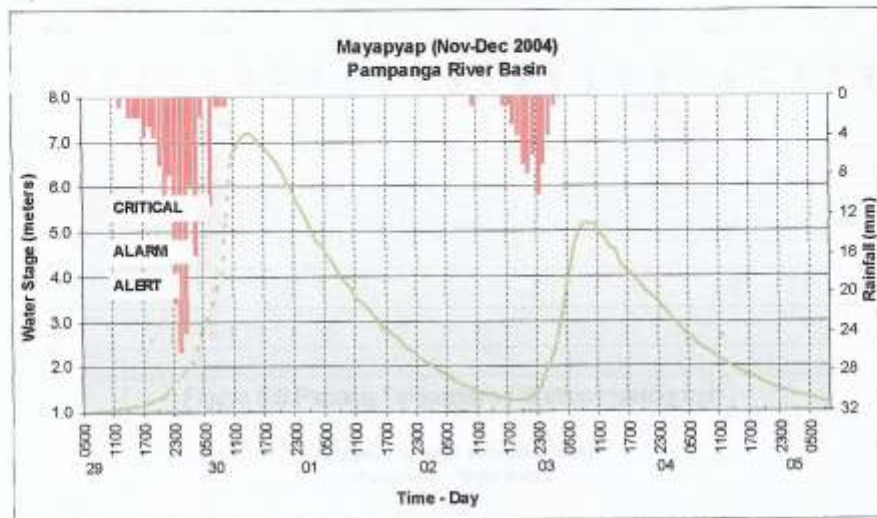


Figure 5.3 Mayapyap Telemetered Station Hydrograph and Hyetograph

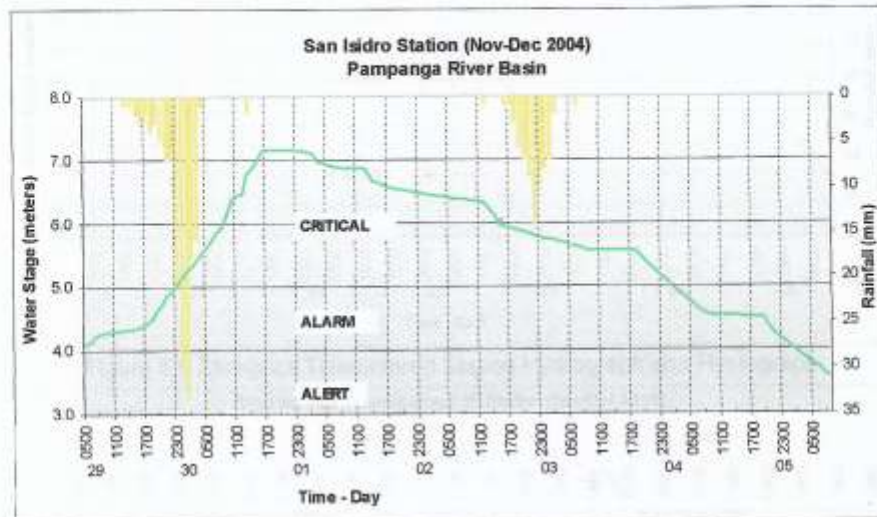


Figure 5.4 San Isidro Telemetered Station Hydrograph (estimated) and Hyetograph

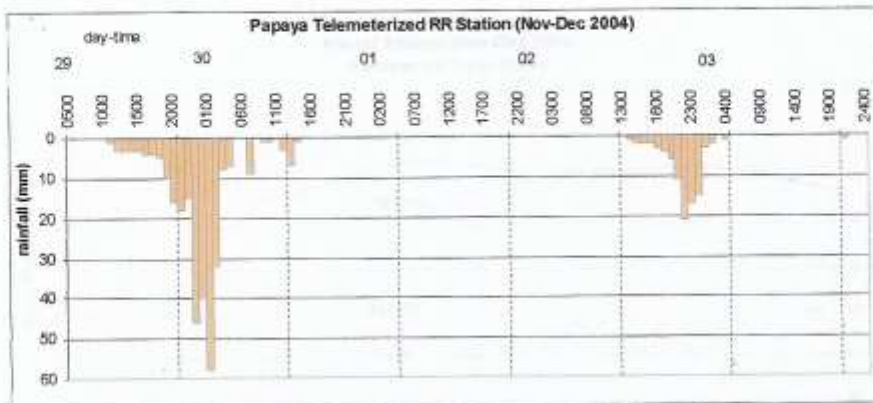


Figure 5.5 Papaya Telemetered Station Hyetograph

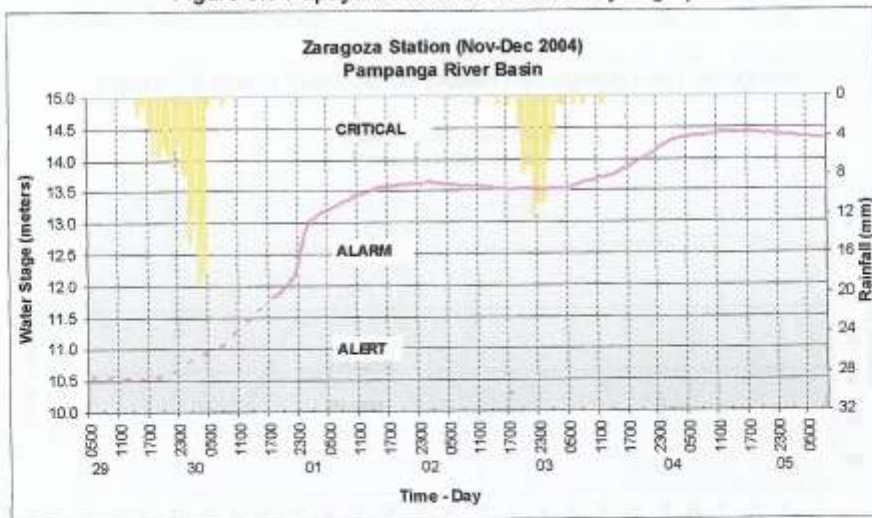


Figure 5.6 Zaragoza Telemetered Station Hydrograph and Hyetograph

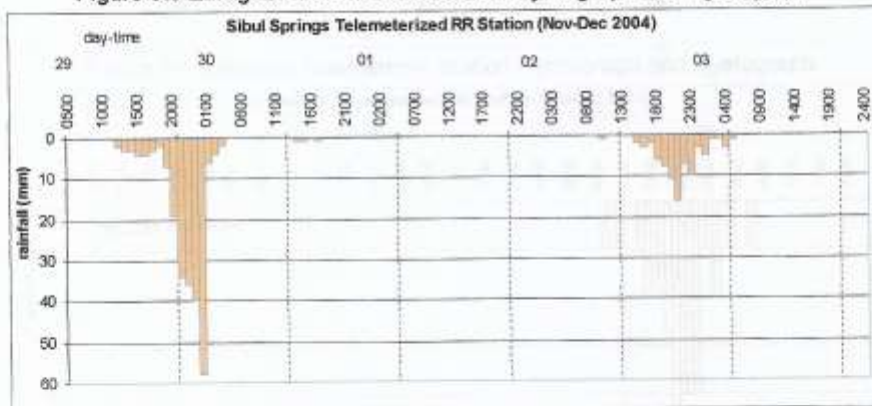


Figure 5.7 Sibul Springs Telemetered Station Hyetograph

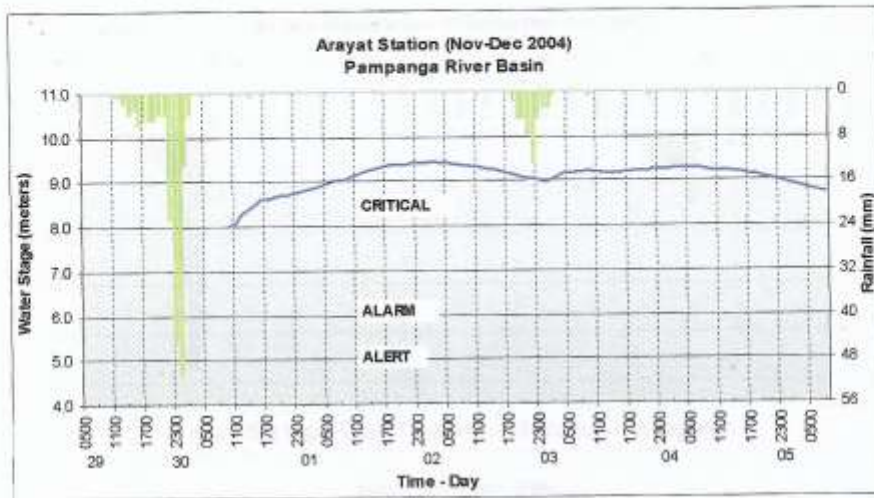


Figure 5.8 Arayat Telemetered Station Hydrograph and Hyetograph

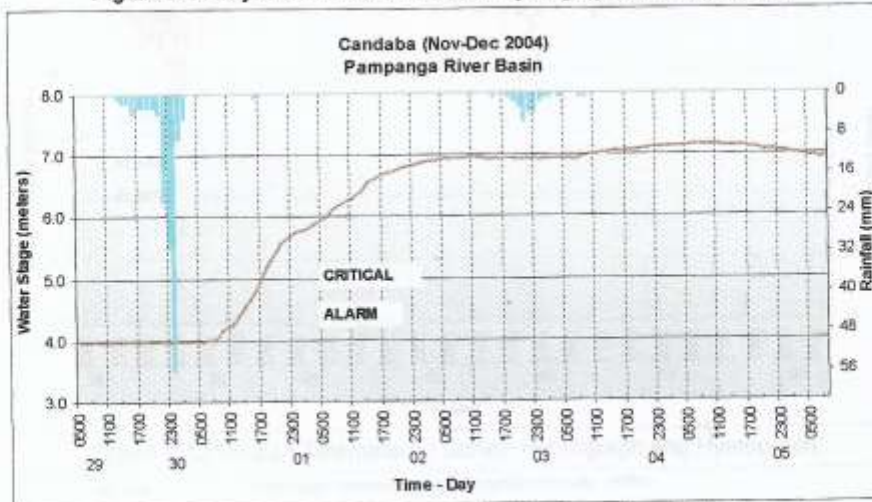


Figure 5.9 Candaba Telemetered Station Hydrograph and Hyetograph

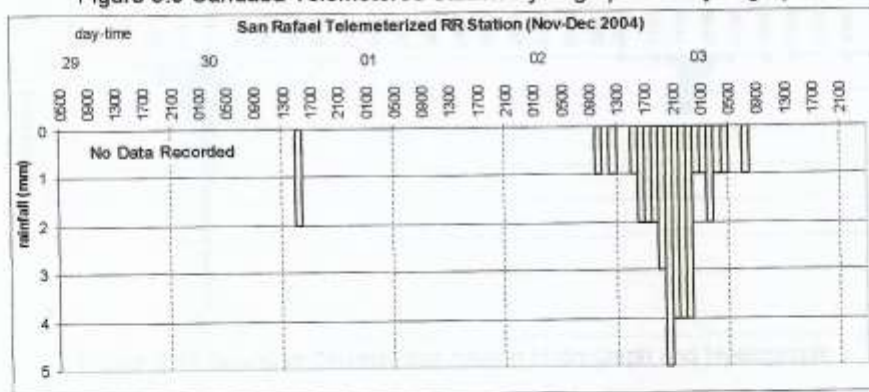


Figure 5.10 San Rafael Telemetered Station Hyetograph

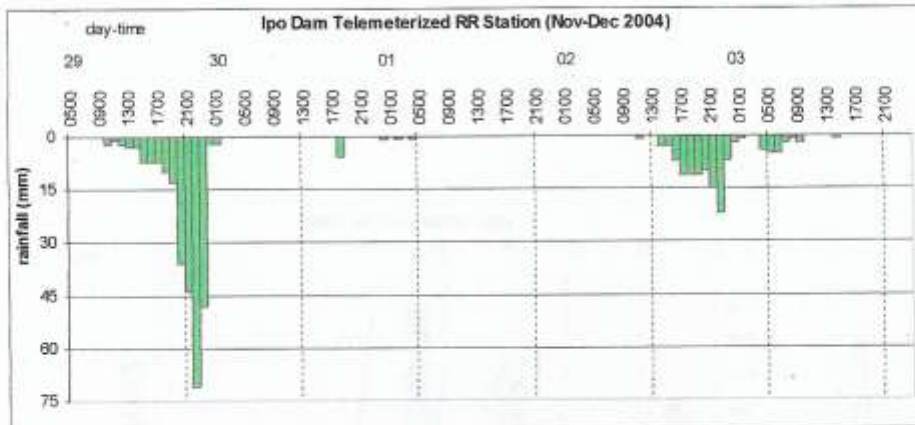


Figure 5.11 Ipo Dam Telemetered Station Hyetograph

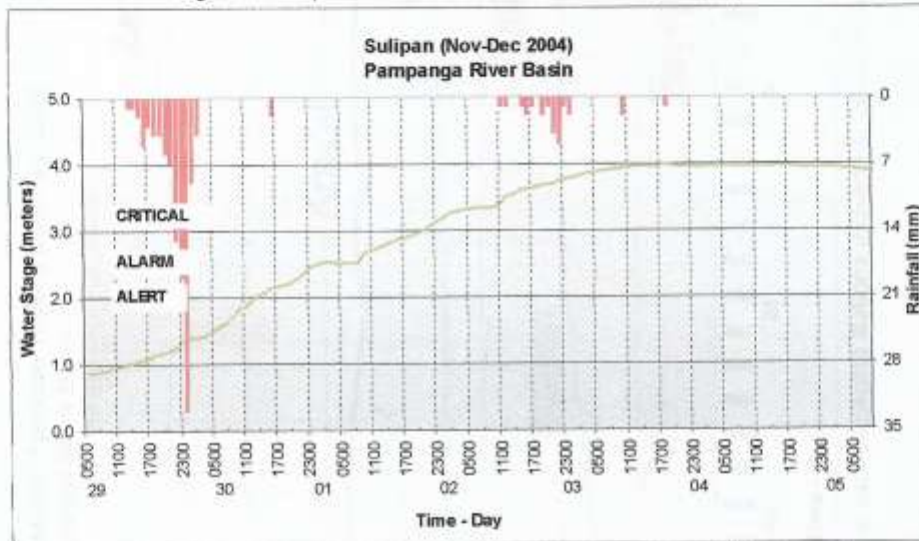


Figure 5.12 Sulipan Telemetered Station Hydrograph and Hyetograph

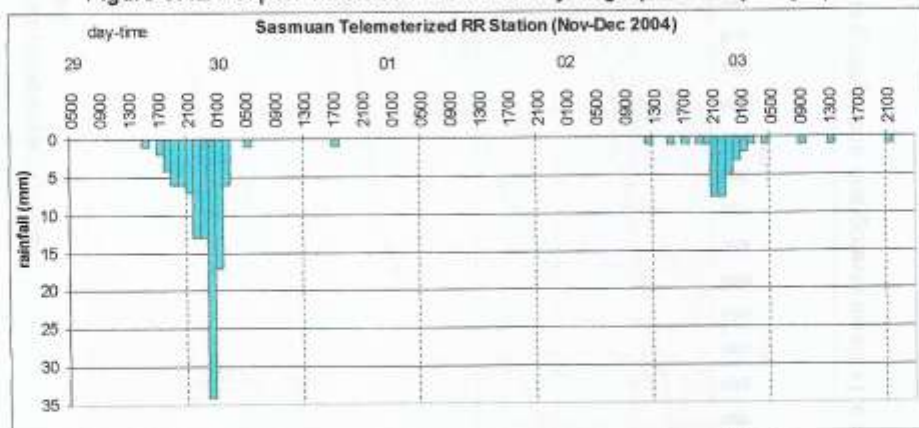


Figure 5.13 Sasmuan Telemetered Station Hydrograph and Hyetograph



**Telemetered Rainfall and Water
Level Data for Pampanga River Basin
November 29 to December 05, 2004**

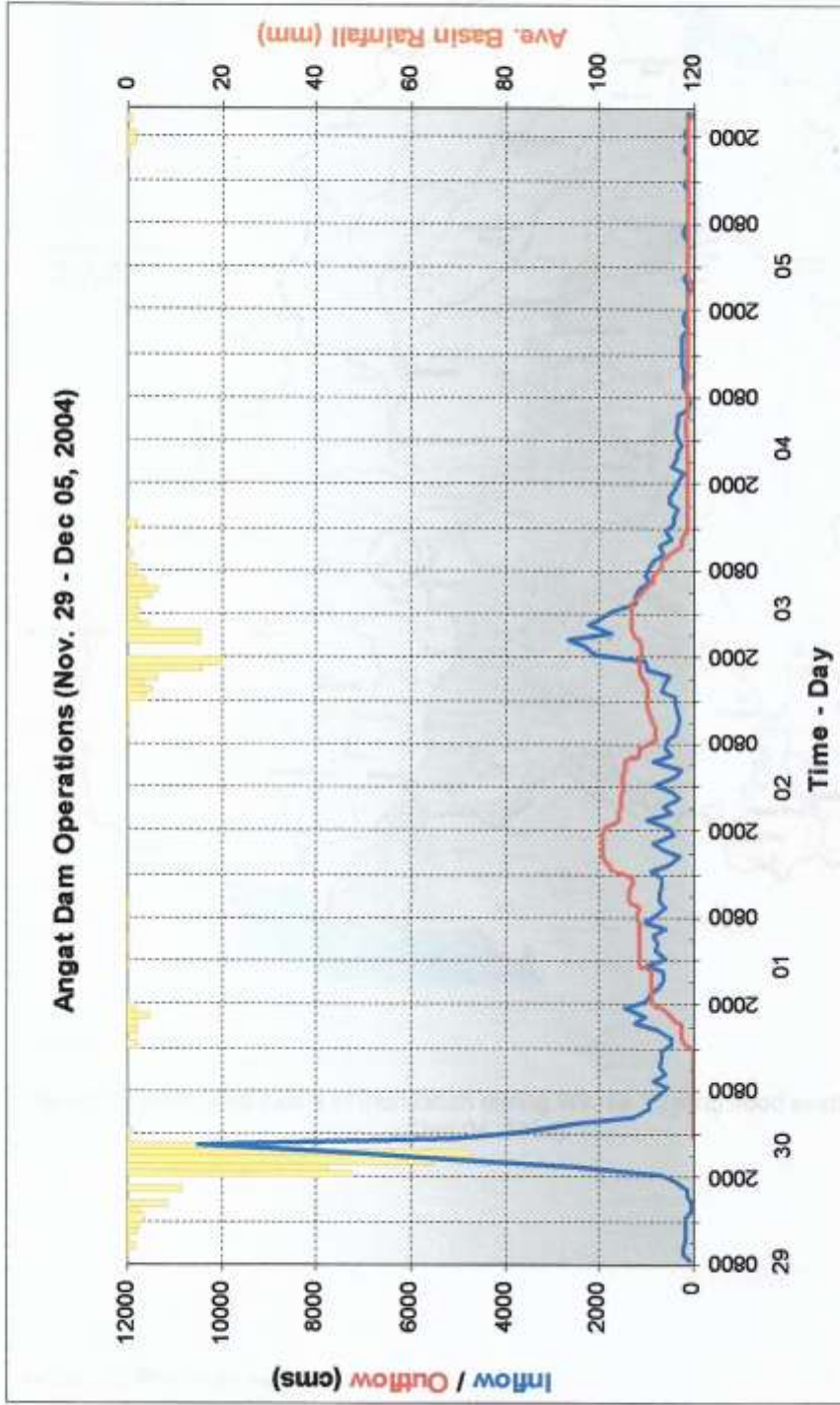


Figure 6.1 Angat Dam Reservoir Operations, Nov. 29 to Dec. 03, 2004(Passage of T.D. Winnie and T. Yoyong)

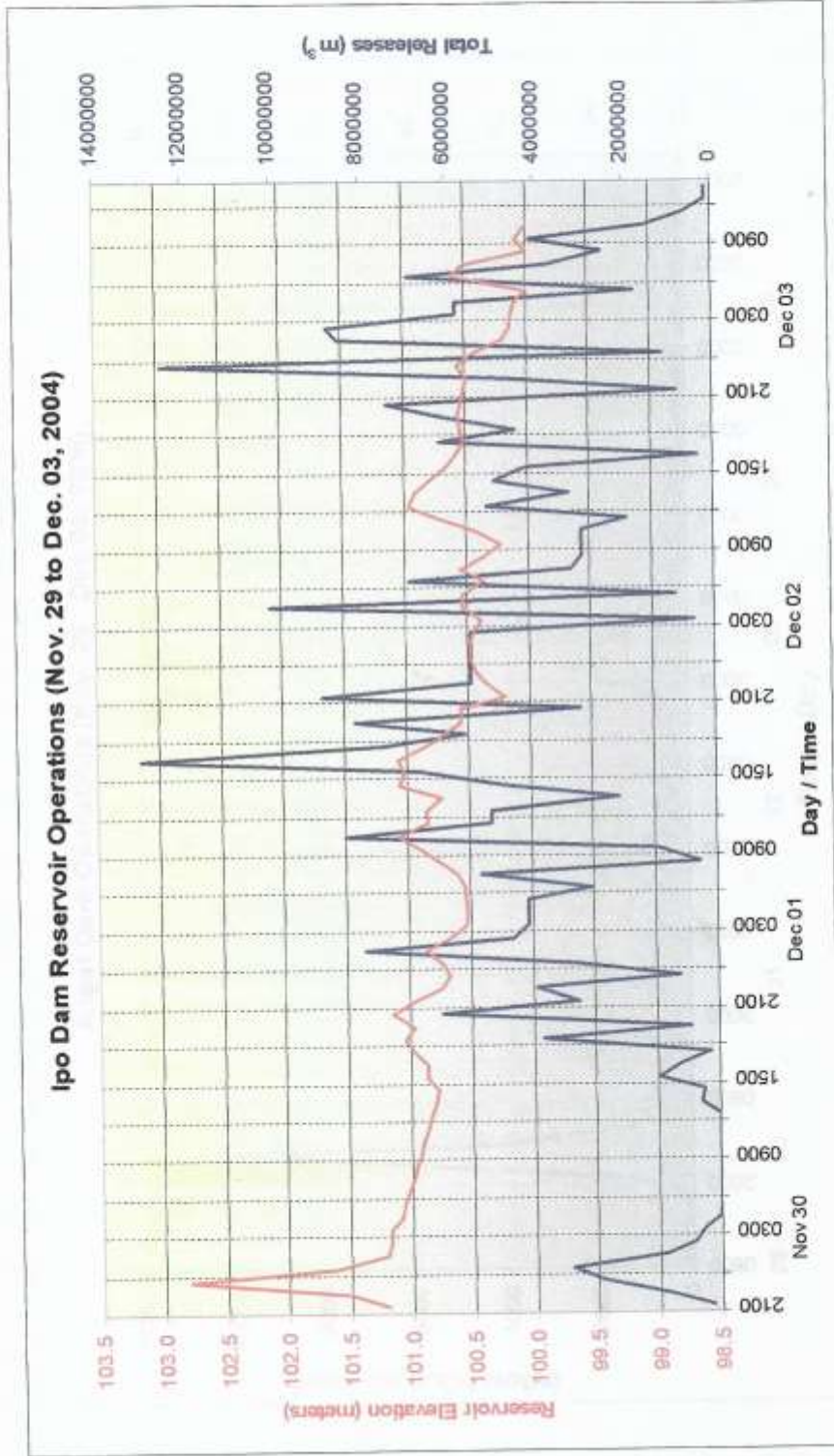
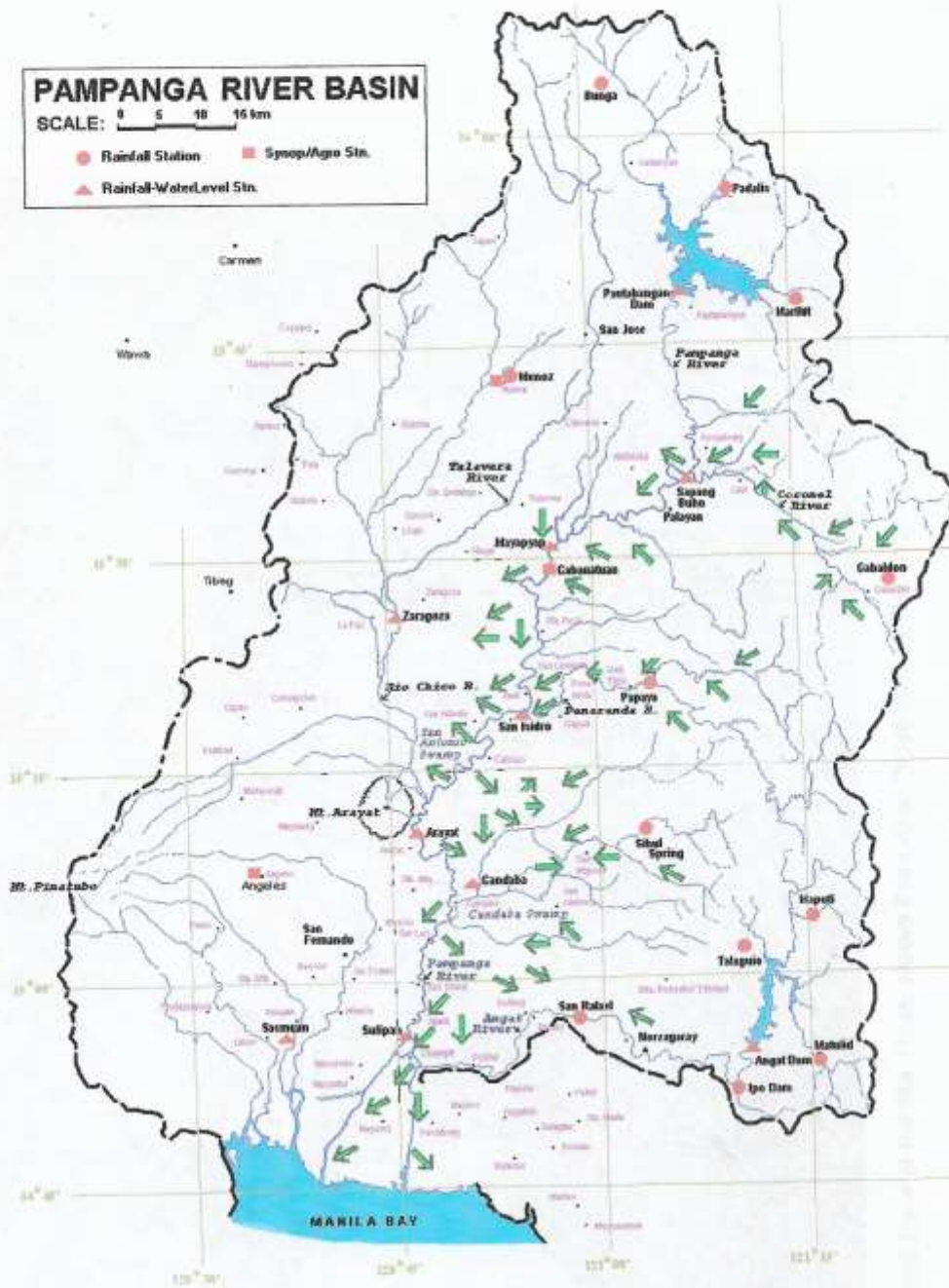


Figure 6.0 Ipo Dam Reservoir Operations, Nov. 29 to Dec. 03, 2004 (Passage of T.D. Winnie and T. Yoyong)



Figure 7.0 Estimated extent of inundation during Winnie-Yoyong flood event (Nov 30- Dec 04, 2004)



FFB, PRFFC - Hh - May2000

Figure 7.1 Flood flows during Winnie-Yoyong disturbances (Nov 30-Dec 04, 2004).

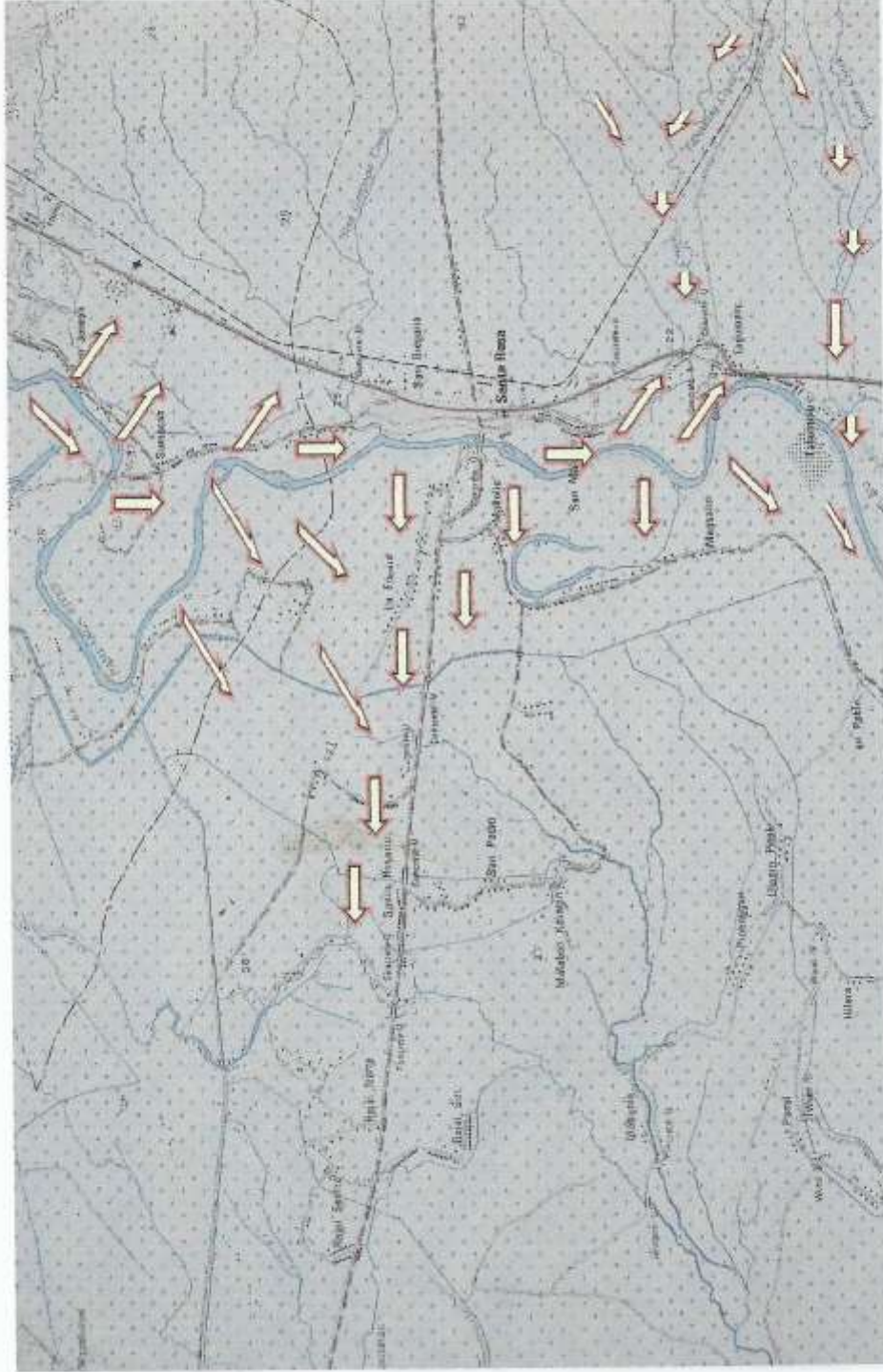


Figure 7.2 Flood flows at the Sta. Rosa, Nueva Ecija Area (November 30-December 02, 2004)

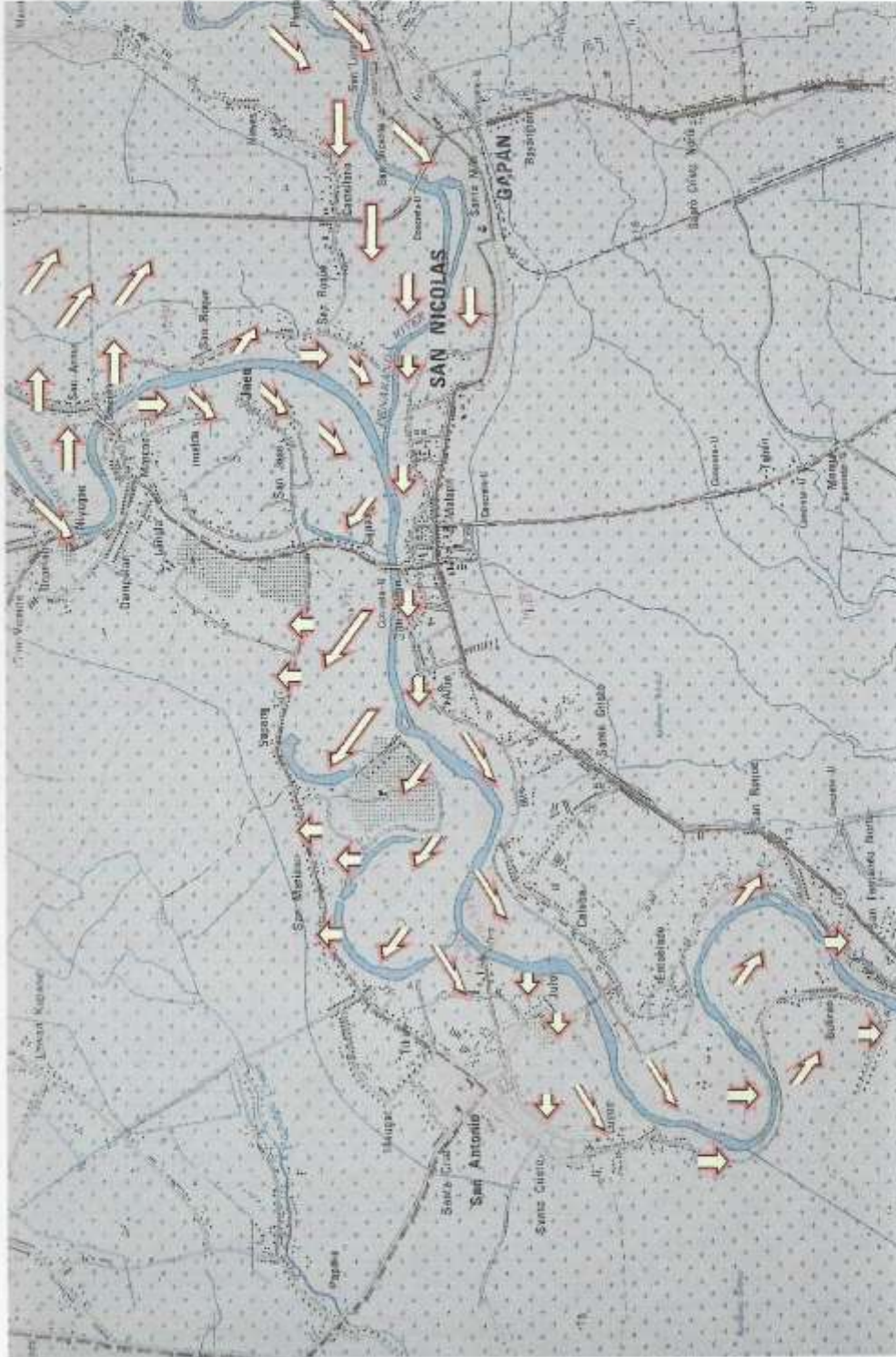


Figure 7.3 Flood flows at Gapan-Jaen-San Antonio-San Isidro, Nueva Ecija area (November 30-December 02, 2004).

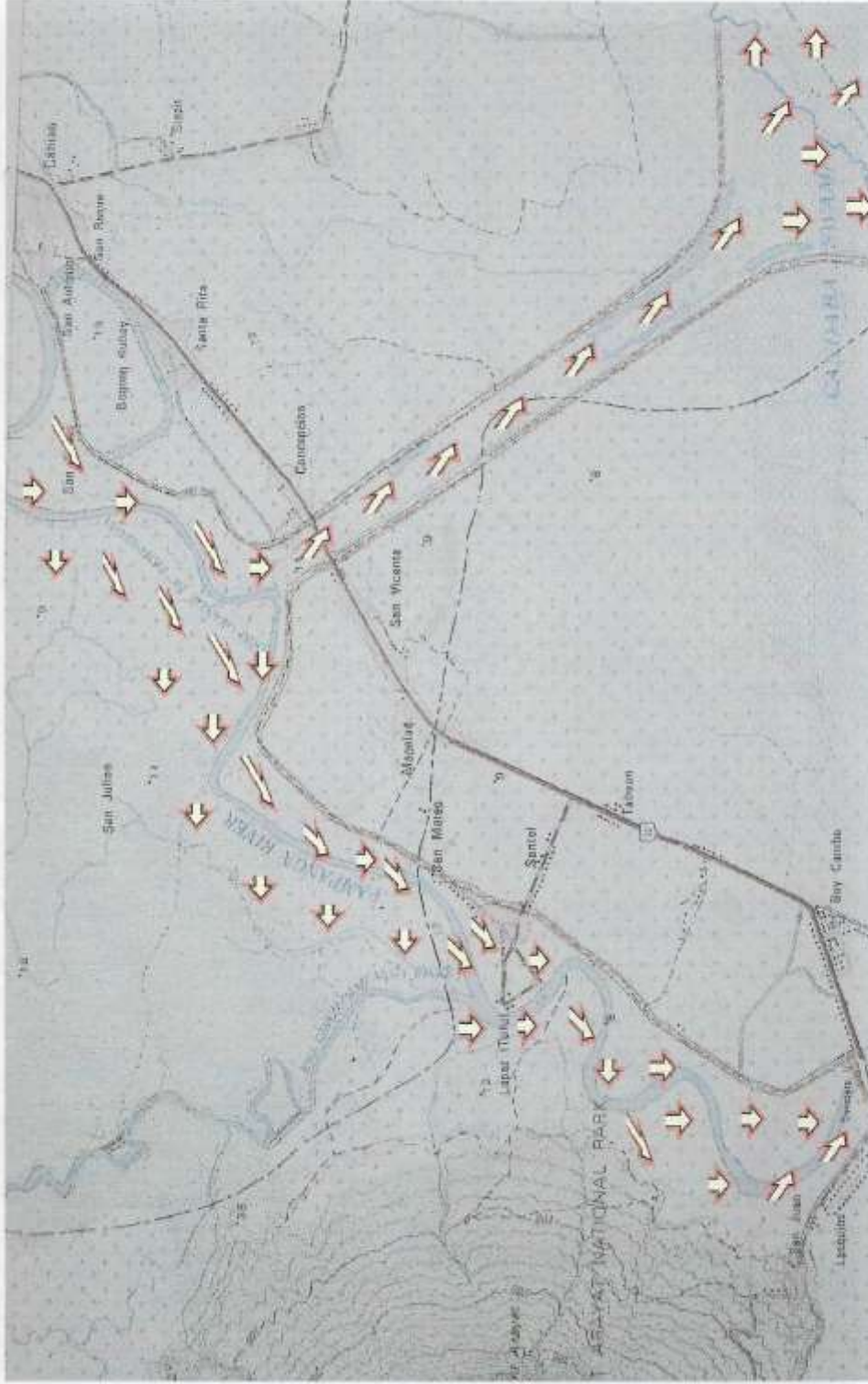


Figure 7.4 Flood flows at the Cabiao Floodway Area, Nueva Ecija (November 30-December 03, 2004).

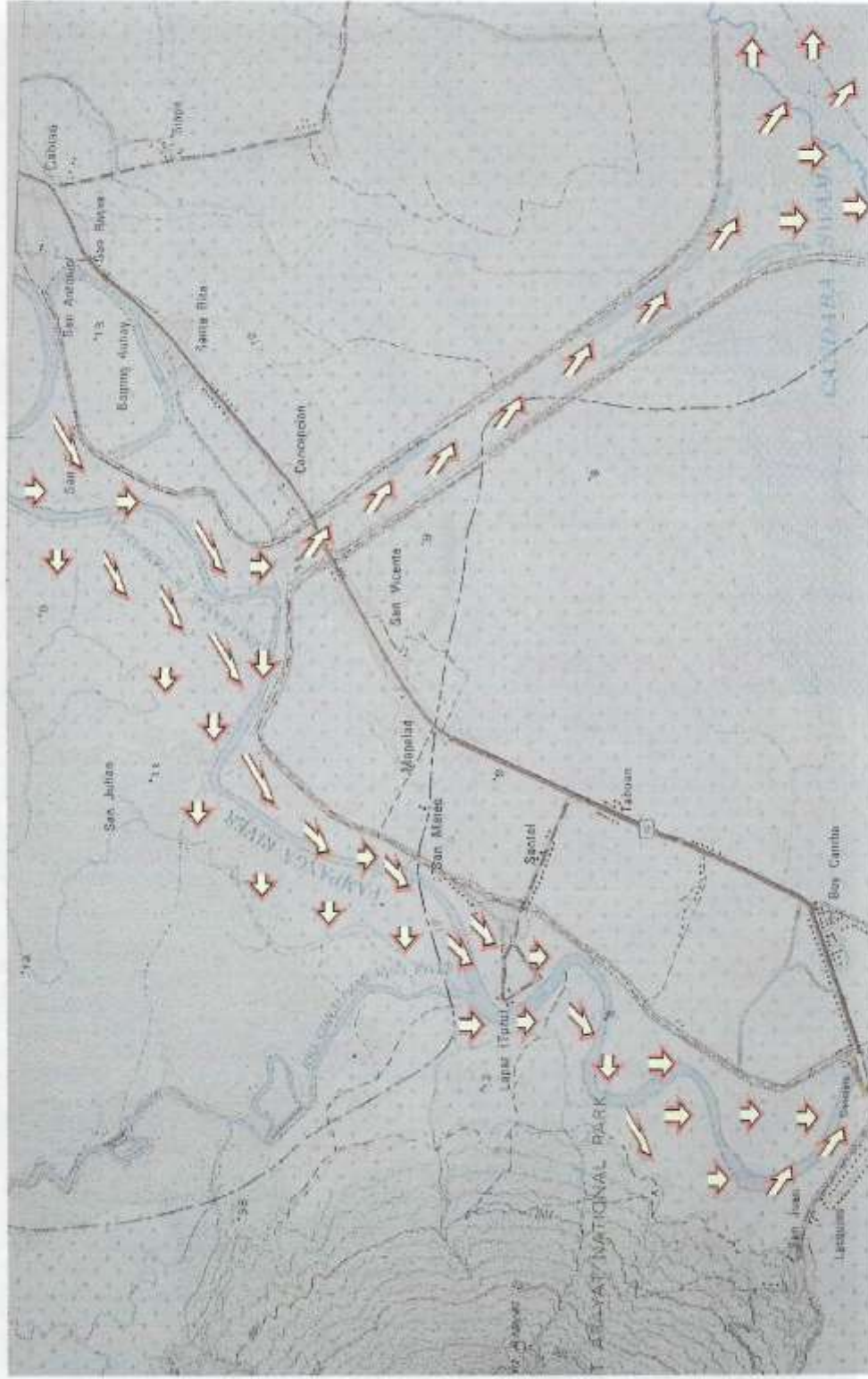


Figure 7.4 Flood flows at the Cabaio Floodway Area, Nueva Ecija (November 30-December 03, 2004).

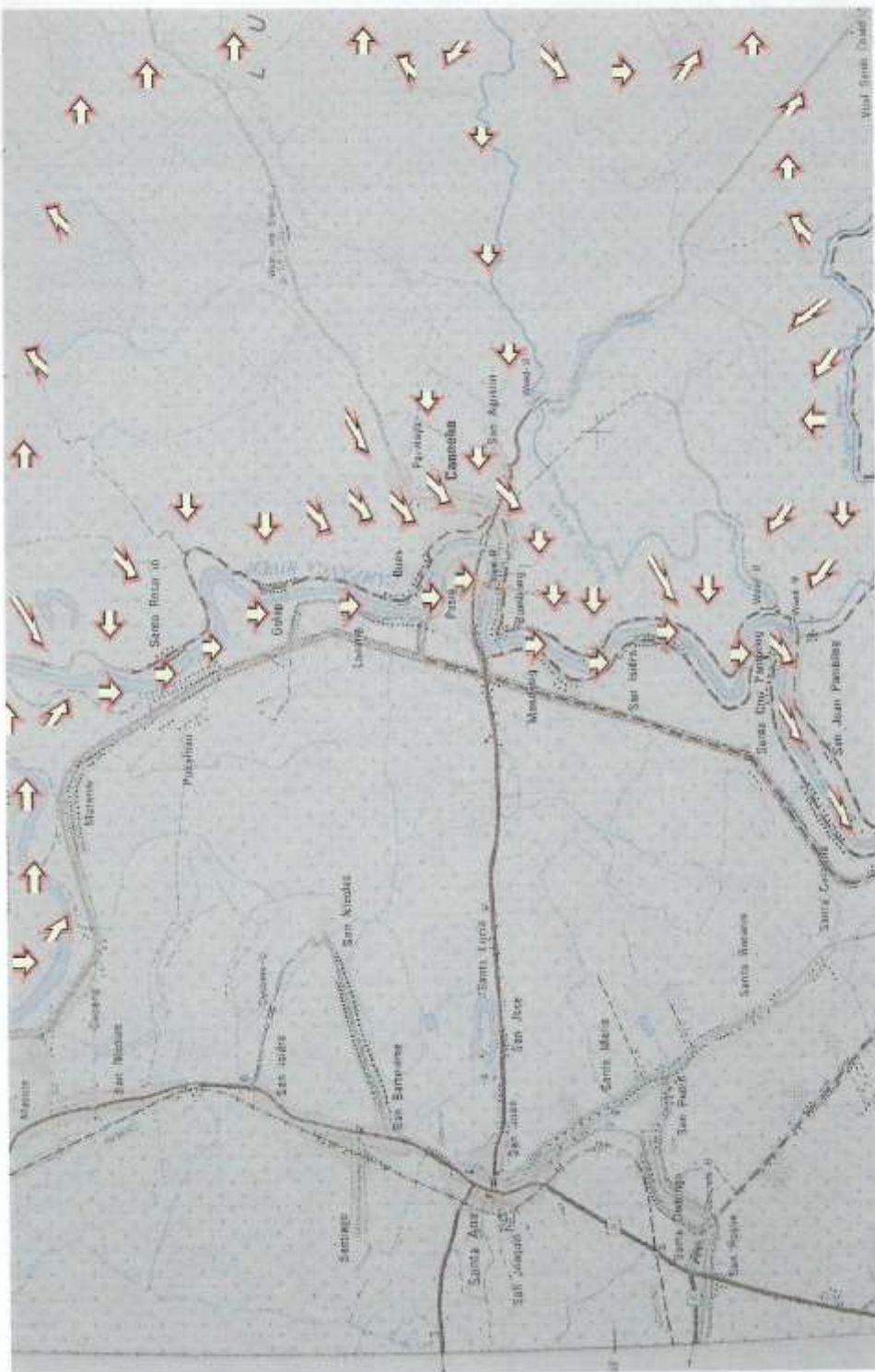


Figure 7.5 Flood flows at the Candaba Swamp Area, Pampanga (November 30-December 04, 2004).

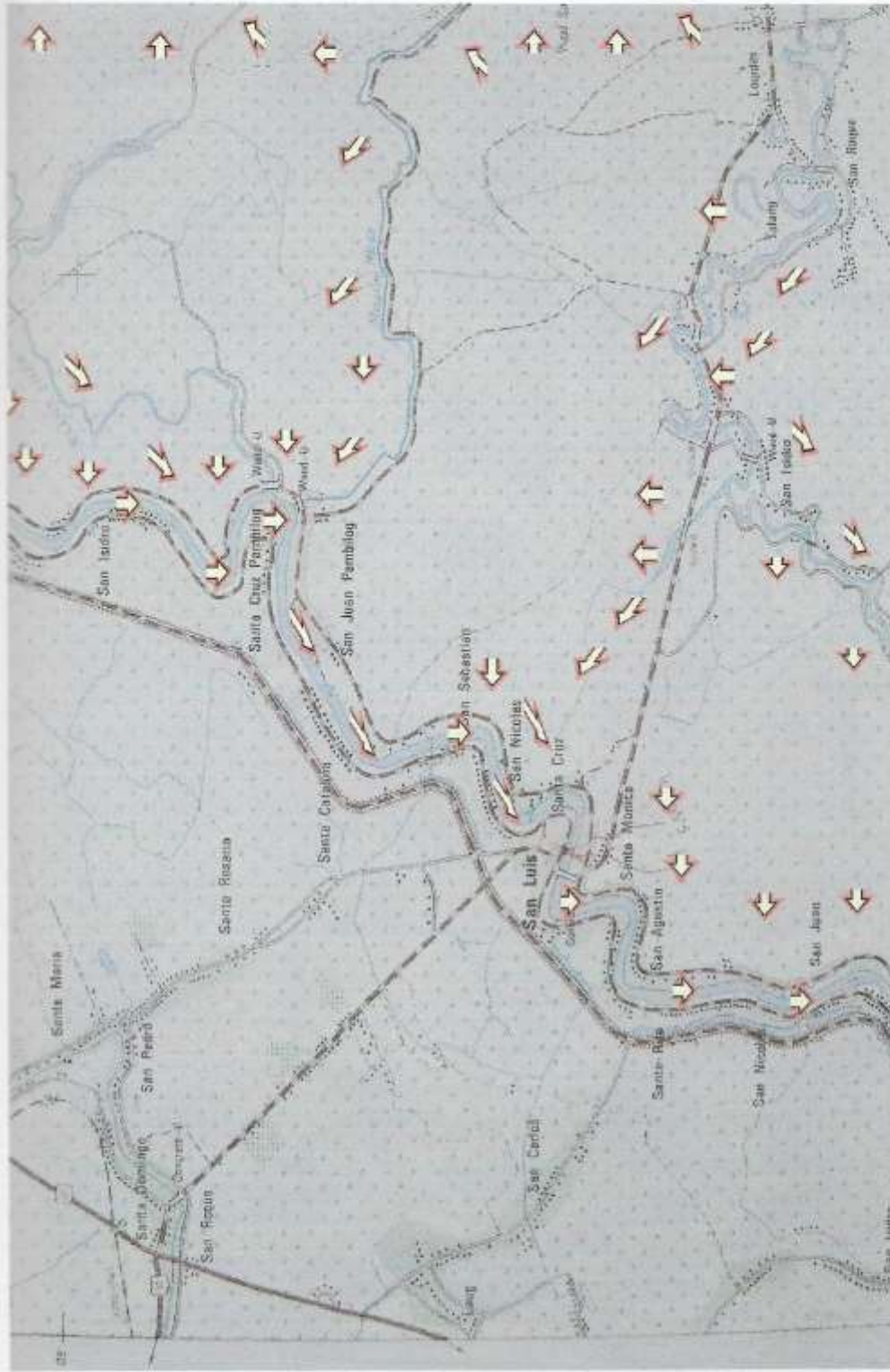


Figure 7.6 Flood flows at the San Luis-Middle Candaba Swamp Area, Pampanga (November 30-December 04, 2004).



Figure 7.7 Flood flows at the Lower Candaba Swamp Area, Pampanga-Bulacan Province (November 30-December 04, 2004).



Fig. 10. [Faded text describing the photograph, likely a road or landscape view.]



Fig. 11. [Faded text describing the photograph, likely a road or landscape view.]



Fig. 12. [Faded text describing the photograph, likely a road or landscape view.]



Fig. 13. [Faded text describing the photograph, likely a road or landscape view.]



Fig. 14. [Faded text describing the photograph, likely a road or landscape view.]



Fig. 15. [Faded text describing the photograph, likely a road or landscape view.]



PHOTOGRAPHS



Pic. 1.0 The already swelled-up Angat River at Pulilan taken on the morning of November. 30, 2004



Pic 2.0 Pampanga River at San Agustin, Arayat a few minutes before overflowing was reported at the Cabiao floodway.



Pic 2.1 Maximum river stage of 9.42 m was attained at Arayat station just after noontime of Dec 02, 2004.



Pic 3.0 Pampanga River overflowed the Cabiao floodway at around 1000H of November 30, 2004.



Pic 3.1 Barangay San Vicente in Cabiao, N.E. after Pampanga River overflowed the Cabiao floodway.



Pic3.2 The same barangay on the left after floodwaters had subsided.



Pic 3.3 The totally submerged GSO road at the Cabiao floodway on the morning of November 30, 2004



Pic 3.4 The GSO road several days after the flood event.



Pic 3.5 Trucks coming from the north end of the floodway trying to cross the submerged GSO road.



Pic 3.6 About 300 meters of 0.5 m deep of floodwaters covered a stretch of the GSO road in Cabiao, Nueva Ecija.



Pic 4.0 Approximately 2.0 m of floodwaters was attained in Barangay Magpapalayok, San Leonardo, Nueva Ecija.



Pic 4.1 A still flooded Bgy. Magpapalayok in San Leonardo, N.E. The area suffered almost 3 floodings for the year 2004.



Pic. 5.0 Maximum flood depth of about 1.3 m attained in Barangay San Anton, San Leonardo, Nueva Ecija.



Pic 5.1 A scoured right shoulder of the San Leonardo - Jaen road which was 0.5 m underwater bet. Nov 30 to Dec 02, 2004.



Pic 6.0 The Gabaldon - Laur road in Bato Ferry, Laur, N.E. was washed-out as a result of the overflowing of Coronel River.



Pic 7.0 The Palayan - Natividad road in Bgy. Atate, Palayan went about 0.5 m. underwater at the height of T.D.Winnie.



Pic 8.0 Almost 0.5 m of floodwaters at Bgy. Kamuning, Laur, N.E. being pointed out by residents of the area.



Pic 9.0 Floodwaters almost reached the flooring of Cabanatuan Synoptic station at the compound of Cabanatuan City Hall.



Pic. 10.0 Pampanga River overflowed its banks and slowly creeping towards Bgy. Sto. Rosario, Sta. Rosa, N.E. (Nov.30, 2005)



Pic 10.1 The same area on the left a month after the flooding.



Pic 10.2 Water Lilies replaced the flooded rice fields in Bgy. Sto. Rosario, Sta. Rosa, N.E. (Photo as of 1430 Nov. 30, 2005)



Pic 11.0 Flashfloods rampaged through Gabaldon town. A lot of the roads were eroded and washed-out.



Pic 12.0 Maximum river stage attained at Sapang Buho telemetry station reached up to the third sensing pole.



Pic 13.0 Scoured embankments along the Minatula River, between Sta. Rosa and Cabanatuan, N.E.



Pic. 14.0 Maximum flood level attained at Bgy. Paralaya, Candaba was 15 cm. below that attained during Marce.



Pic 14.1 Maximum flood height attained at Candaba station reached 7.15 m



Pic 15.0 More than a meter of floodwaters from Chico River overflowed this bridge in Bgy. Papaya, Gen. Tinio, N.E.



Pic 16.0 Floodwaters scoured the right shoulder of Zaragoza - San Antonio road at Bgy. San Francisco, San Antonio, N.E.



Pic 17.0 Ravaged houses due to flash floods at Bgy. Castellano, San Leonardo, N.E.



Pic 17.1 Bgy. Castellano in San Leonardo, N.E. affected by 3 flash floods in about 2 weeks.



Pic 18.0 Eroded embankment as a result of flash floods along the San Miguel River near Poblacion of San Miguel in Bulacan.



Pic 19.0 Debris brought about by floodwaters along Pampanga River at Jaen - San Isidro Bridge.



Pic 20.0 A still flooded Baliuag - San Luis Road (within Candaba swamp) in San Luis, Pampanga (Dec 06, 2005)



Pic 20.1 Eroded shoulder along the Baliuag - San Luis road that went underwater during Winnie & Yoyong.



Pic 20.2 Still flooded streets in Bgy. Sta. Monica, San Luis, Pampanga (Dec. 06, 2005).



Pic 20.3 Maximum floodwaters of more than 1.0 m recorded in Bgy. Sta. Monica, San Luis, Pampanga.



Pic. 20.4 Bgy. Sta. Monica in San Luis, Pampanga remained under floodwaters for several days after the passage of T.Yoyong.



Pic 20.5 San Luis, Pampanga went underwater as a result of the overflowing of Pampanga River and Candaba Swamp.



Pic 21.0 The start of flooding in San Antonio, Nueva Ecija started at around noontime of Nov. 30, 2005.



Pic 21.1 Flooding in San Antonio, Nueva Ecija was a result of the overflowing of Pampanga river.



Pic 21.2 Bgy. San Mariano, San Antonio, N.E. was one of the hardest hit during the passage Winnie and Yoyong.



Pic 21.3 Floodwaters in San Mariano, San Antonio, N.E. went from 0.5 to 1.0 meters in depth.



Pic. 21.4 The San Antonio - Jaen road junction went impassable at the height of T.D. Winnie (taken Nov. 30, 2004)



Pic 21.5 The same area on the left a week after the passage of disturbances Winnie and Yoyong.



Pic 22.0 Pampanga River overflowed towards the town of Calumpit and Hagonoy in Bgy. Calizon, Calumpit in Bulacan.



Pic 22.1 Maximum flood height registered at Bgy. Calizon in Calumpit, Bulacan reached up to a meter in depth.



Pic 23.0 About a meter of floodwaters was observed in Bgy. Sulipan, Apalit in Pampanga.



Pic 23.1 A reading of 4.18 m based on flood marks was registered in Sulipan station in Apalit, Pampanga.



Department of the Interior
Bureau of Reclamation
1900 L Street, N.W.
Washington, D.C. 20540



REGISTRATION NO. 170002
FLOOD CONTROL DISTRICT NO. 1
1900 L Street, N.W., Washington, D.C. 20540

PLANNING-BUDGET DISTRICT

1900 L Street, N.W., Washington, D.C. 20540
PLANNING-BUDGET DISTRICT NO. 1

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FLOOD BULLETINS

PLANNING-BUDGET DISTRICT NO. 1



Republic of the Philippines
Department of Science and Technology
**PHILIPPINE ATMOSPHERIC, GEOPHYSICAL AND
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**FLOOD FORECASTING BRANCH
PAMPANGA RIVER FLOOD FORECASTING AND WARNING CENTER**

WFCC, BIR Road, Quezon City 1100 Tel. No. 928-27-54/926-50-60 Fax. 929-40-65
Webpage: <http://www.pampangariverbasin.mainpage.net>

**PAMPANGA RIVER BASIN
FLOOD BULLETIN No. 1**

Issued at 6:00 AM Tuesday November 30, 2004
(Valid Until the next issuance at 4:00 PM today)

**MODERATE RAINS OVER THE BASIN DURING THE PAST 24 HOURS.
SCATTERED RAINSHOWERS EXPECTED WITHIN THE NEXT 12 HOURS.**

EXPECTED HYDROLOGICAL RESPONSE:

1. MIDDLE MAIN PAMPANGA RIVER IN GRADUAL RISE.
FLOODING IS NOW PERSISTING IN THE LOW-LYING AREAS OF GAPAN, STA. ROSA, SAN LEONARDO, SAN ISIDRO, JAEN, AND CABANATUAN CITY.
FLOODING IS NOW THREATENING AND EXPECTED TO OCCUR IN THE LOW-LYING RIVERSIDE AREAS OF CABIAO, ARAYAT, SAN LUIS AND SAN SIMON.
2. SLOW RISE OF THE LOWER MAIN PAMPANGA RIVER.
FLOODING IS NOW THREATENING THE LOW-LYING RIVERSIDE AREAS OF APALIT, CALUMPIT, HAGONoy AND PAOMBONG.
3. CONTINUED FILLING-UP OF THE CANDABA SWAMP AREA.
FLOODING IS EXPECTED TO OCCUR IN THE SURROUNDING LOW-LYING AREAS OF CANDABA SWAMP.

RESIDENTS AND THE DISASTER COORDINATING COUNCILS CONCERNED ARE ADVISED TO TAKE APPROPRIATE ACTIONS.

Prepared By:

**HTH / LSF
PRFFWC**

Noted By:

**Rosa T. Perez, Ph. D.
OIC, FFB**



Republic of the Philippines
Department of Science and Technology
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**PAMPANGA RIVER BASIN
FLOOD BULLETIN No. 2 (INTERMEDIATE)
Issued at 1:00 PM Tuesday November 30, 2004
(Valid Until the next issuance at 4:00 PM today)**

MODERATE RAINS OVER THE BASIN DURING THE PAST 30 HOURS.
SCATTERED RAINSHOWERS EXPECTED WITHIN THE NEXT 12 HOURS.

HYDROLOGICAL RESPONSE:

1. UPPER MAIN PAMPANGA RIVER AT MAYAPYAP STATION ABOVE CRITICAL LEVEL AS WELL AS ITS TRIBUTARIES.
FLOODING WILL PERSIST IN THE LOW-LYING AREAS OF BONGABON, PALAYAN CITY & GABALDON.
2. MIDDLE MAIN PAMPANGA RIVER IN GRADUAL RISE.
FLOODING WILL PERSIST IN THE LOW-LYING AREAS OF GAPAN, GEN. TINIO, STA. ROSA, SAN ISIDRO, SAN ANTONIO, JAEN, CABANATUAN CITY, CABIAO, ARAYAT, ZARAGOZA, SAN LUIS AND SAN SIMON.
3. GRADUAL RISE OF THE LOWER MAIN PAMPANGA RIVER.
FLOODING WILL PERSIST IN THE LOW-LYING RIVERSIDE AREAS OF APALIT, CALUMPIT, HAGONoy AND PAOMBONG.
4. CONTINUED FILLING-UP OF THE CANDABA SWAMP AREA.
FLOODING WILL PERSIST IN THE SURROUNDING LOW-LYING AREAS OF CANDABA SWAMP.

RESIDENTS AND THE DISASTER COORDINATING COUNCILS CONCERNED ARE ADVISED TO TAKE APPROPRIATE ACTIONS.

Prepared By:

MJB / TPS / SRE / SFP

Noted By:

**Rosa T. Perez, Ph. D.
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**PAMPANGA RIVER BASIN
FLOOD BULLETIN No. 3
Issued at 4:00 PM Tuesday November 30, 2004
(Valid Until the next issuance at 4:00 AM tomorrow)**

MODERATE RAINS OVER THE BASIN DURING THE PAST 33 HOURS.
SCATTERED RAINSHOWERS EXPECTED WITHIN THE NEXT 12 HOURS.

HYDROLOGICAL RESPONSE:

1. UPPER MAIN PAMPANGA RIVER AT MAYAPYAP STATION ABOVE CRITICAL LEVEL AS WELL AS ITS TRIBUTARIES.
FLOODING WILL PERSIST IN THE LOW-LYING AREAS OF BONGABON, PALAYAN CITY & GABALDON.
2. MIDDLE MAIN PAMPANGA RIVER AND TRIBUTARY RIO CHICO IN GRADUAL RISE BEGINNING THIS AFTERNOON.
FLOODING WILL PERSIST IN THE LOW-LYING AREAS OF GAPAN, GEN. TINIO, STA. ROSA, SAN LEONARDO, SAN ISIDRO, SAN ANTONIO, JAEN, CABANATUAN CITY, CABIAO, ARAYAT, ZARAGOZA, SAN LUIS AND SAN SIMON.
3. GRADUAL RISE OF THE LOWER MAIN PAMPANGA RIVER.
FLOODING WILL PERSIST IN THE LOW-LYING RIVERSIDE AREAS OF APALIT, CALUMPIT, HAGONoy AND PAOMBONG.
4. CONTINUED FILLING-UP OF THE CANDABA SWAMP AREA.
FLOODING WILL PERSIST IN THE SURROUNDING LOW-LYING AREAS OF CANDABA SWAMP.

RESIDENTS AND THE DISASTER COORDINATING COUNCILS CONCERNED ARE ADVISED TO TAKE APPROPRIATE ACTIONS.

Prepared By:

MJB / TPS / SRE / SFP

Noted By:

**Rosa T. Perez, Ph. D.
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Webpage: <http://www.pampangariverbasin.mainpage.net>

**PAMPANGA RIVER BASIN
FLOOD BULLETIN No. 4**

Issued at 4:00 AM Wednesday December 01, 2004

(Valid Until the next issuance at 4:00 PM today)

AVERAGE BASIN RAINFALL:

PAST 12 HOURS ENDING AT 4 AM = LESS THAN 5 mm

FORECAST FOR THE NEXT 12 HOURS = LESS THAN 5 mm

HYDROLOGICAL RESPONSE:

1. UPPER MAIN PAMPANGA RIVER IS NOW IN CONTINUED GRADUAL RECESSION.

FLOODING WILL STILL REMAIN IN THE RELATIVELY LOW-LYING AREAS OF LAUR, BONGABON AND PALAYAN CITY.

2. CONTINUED SLOW RISE OF THE MIDDLE MAIN PAMPANGA RIVER AND TRIBUTARY RIO CHICO RIVER.

FLOODING WILL REMAIN IN THE LOW-LYING AREAS OF CABANATUAN CITY, GAPAN, STA. ROSA, SAN LEONARDO, SAN ISIDRO, SAN ANTONIO, JAEN, CABIAO, ZARAGOZA, ARAYAT, SAN LUIS AND SAN SIMON.

3. A SLOW RISE OF THE LOWER MAIN PAMPANGA RIVER.

FLOODING WILL PERSIST IN THE LOW-LYING RIVERSIDE AREAS OF APALIT, PULILAN, CALUMPIT, HAGONOY AND PAOMBONG.

4. CONTINUED FILLING-UP OF CANDABA SWAMP AREA.

FLOODING WILL PERSIST IN THE SURROUNDING LOW-LYING AREAS OF CANDABA SWAMP.

RESIDENTS AND THE DISASTER COORDINATING COUNCILS CONCERNED ARE ADVISED TO CONTINUE TO TAKE APPROPRIATE ACTIONS.

Prepared By:

HTH / FLM

Noted By:

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**PAMPANGA RIVER BASIN
FLOOD BULLETIN No. 5**

Issued at 4:00 PM Wednesday December 01, 2004
(Valid Until the next issuance at 4:00 AM tomorrow)

AVERAGE BASIN RAINFALL:

PAST 24 HOURS ENDING AT 4 PM = LESS THAN 5 mm

FORECAST FOR THE NEXT 12 HOURS = LESS THAN 10 mm

HYDROLOGICAL RESPONSE:

1. UPPER MAIN PAMPANGA RIVER IS NOW IN CONTINUED GRADUAL RECESSION.

FLOODING STILL TO REMAIN IN THE RELATIVELY LOW-LYING AREAS OF LAUR, BONGABON AND PALAYAN CITY.

2. CONTINUED SLOW RISE OF THE MIDDLE MAIN PAMPANGA RIVER AND TRIBUTARY RIO CHICO RIVER.

FLOODING WILL REMAIN IN THE LOW-LYING AREAS OF CABANATUAN CITY, GAPAN, STA. ROSA, SAN LEONARDO, SAN ISIDRO, SAN ANTONIO, JAEN, CABIAO, ZARAGOZA, ARAYAT, SAN LUIS AND SAN SIMON.

3. A SLOW RISE OF THE LOWER MAIN PAMPANGA RIVER.

FLOODING WILL PERSIST IN THE LOW-LYING RIVERSIDE AREAS OF APALIT, PULILAN, CALUMPIT, HAGONoy AND PAOMBONG.

4. CONTINUED FILLING-UP OF CANDABA SWAMP AREA.

FLOODING WILL PERSIST IN THE SURROUNDING LOW-LYING AREAS OF CANDABA SWAMP.

RESIDENTS AND THE DISASTER COORDINATING COUNCILS CONCERNED ARE ADVISED TO CONTINUE TO TAKE APPROPRIATE ACTIONS.

Prepared By:

APT / SFP
Duty Hydrologists

Noted By:

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**PAMPANGA RIVER BASIN
FLOOD BULLETIN No. 6**

Issued at 4:00 AM Thursday December 02, 2004
(Valid Until the next issuance at 4:00 PM today)

AVERAGE BASIN RAINFALL:

PAST 36 HOURS ENDING AT 4 AM = LESS THAN 5 mm (NO RAINS RECORDED
DURING THE LAST 12 HOURS)

FORECAST FOR THE NEXT 12 HOURS = LESS THAN 10 mm

HYDROLOGICAL RESPONSE:

1. UPPER MAIN PAMPANGA RIVER STILL IN CONTINUED RECESSION.
FLOODING WILL STILL REMAIN IN THE RELATIVELY LOW ELEVATED AREAS
OF LAUR, BONGABON AND PALAYAN CITY.
2. MIDDLE MAIN PAMPANGA RIVER HAD REACHED ITS PEAK AND A SLOW
RECESSION IS NOW IN EFFECT. TRIBUTARY RIO CHICO RIVER IS,
LIKEWISE, SLOWLY RECEDING.
FLOODING WILL STILL REMAIN IN THE LOW-LYING AREAS OF CABANATUAN
CITY, GAPAN, STA. ROSA, SAN LEONARDO, SAN ISIDRO, SAN ANTONIO,
JAEN, CABIAO, ZARAGOZA, ARAYAT, SAN LUIS AND SAN SIMON.
3. CONTINUED SLOW RISE OF THE LOWER MAIN PAMPANGA RIVER.
FLOODING WILL CONTINUE TO PERSIST IN THE LOW-LYING RIVERSIDE
AREAS OF APALIT, PULILAN, CALUMPIT, HAGONoy AND PAOMBONG.
4. CONTINUED FILLING-UP OF CANDABA SWAMP AREA.
FLOODING WILL CONTINUE TO PERSIST IN THE SURROUNDING LOW-LYING
AREAS OF CANDABA SWAMP.

RESIDENTS AND THE DISASTER COORDINATING COUNCILS CONCERNED ARE
ADVISED TO CONTINUE TO TAKE APPROPRIATE ACTIONS.

Prepared By:

HTH / FLM
Duty Hydrologists

Noted By:

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PAMPANGA RIVER BASIN

FLOOD BULLETIN No. 6-A (Additional Report)

Issued at 6:00 AM Thursday December 02, 2004

(Valid Until the next issuance at 4:00 PM today)

AVERAGE BASIN RAINFALL:

PAST 37 HOURS ENDING AT 5 AM = LESS THAN 5 mm (NO RAINS RECORDED

DURING THE LAST 12 HOURS)

FORECAST FOR THE NEXT 12 HOURS = MORE THAN 50 mm

HYDROLOGICAL RESPONSE:

1. UPPER MAIN PAMPANGA RIVER STILL IN CONTINUED RECESSION. HOWEVER, FLASH FLOODING IN THE UPPER REACHES OF THE BASIN IN THE SIERRA MADRE MOUNTAIN RANGE (WESTERN PORTIONS) IS EXPECTED TO OCCUR DUE TO THE ENTRY OF TYPHOON YOYONG. GRADUAL TO RAPID INCREASE OF WATER LEVEL OF THE UPPER MAIN PAMPANGA RIVER IS EXPECTED TODAY.

FLASH FLOODING EXPECTED TO OCCUR IN THE AREAS OF RIZAL, GABALDON, LAUR, BONGABON, GEN. NATIVIDAD AND PALAYAN CITY.

2. POSSIBLE GRADUAL TO RAPID INCREASE OF TRIBUTARIES CABU, MINATULA, TABUATING, PENARANDA, BULU, SAN MIGUEL, AND MAASIM RIVERS.

FLASH FLOODING LIKELY TO OCCUR IN THE AREAS OF GEN TINIO, GAPAN, PENARANDA, SAN MIGUEL, SAN ILDEFONSO, DONA REMEDIOS TRINIDAD AND SAN RAFAEL.

FLOODING WILL CONTINUE TO OCCUR IN THE LOW-LYING AREAS OF CABANATUAN CITY, GAPAN, STA. ROSA, SAN LEONARDO, SAN ISIDRO, SAN ANTONIO, JAEN, CABIAO, ZARAGOZA, ARAYAT, SAN LUIS AND SAN SIMON.

3. CONTINUED SLOW RISE OF THE LOWER MAIN PAMPANGA RIVER.

FLOODING WILL CONTINUE TO PERSIST IN THE LOW-LYING RIVERSIDE AREAS OF APALIT, PULILAN, CALUMPIT, HAGONoy AND PAOMBONG.

4. CONTINUED FILLING-UP OF CANDABA SWAMP AREA.

FLOODING WILL CONTINUE TO PERSIST IN THE SURROUNDING LOW-LYING AREAS OF CANDABA SWAMP.

RESIDENTS AND THE DISASTER COORDINATING COUNCILS CONCERNED ARE ADVISED TO CONTINUE TO TAKE APPROPRIATE ACTIONS.

Prepared By:

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Noted By:

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PAMPANGA RIVER BASIN

FLOOD BULLETIN No. 7

Issued at 4:00 PM Thursday December 02, 2004

(Valid Until the next issuance at 4:00 AM tomorrow)

AVERAGE BASIN RAINFALL:

PAST 48 HOURS ENDING AT 4 PM = LESS THAN 5

FORECAST FOR THE NEXT 12 HOURS = MORE THAN 50 mm

EXPECTED HYDROLOGICAL RESPONSE:

1. UPPER MAIN PAMPANGA RIVER STILL IN CONTINUED RECESSION. FLASH FLOODING IN THE UPPER REACHES OF THE BASIN IN THE SIERRA MADRE MOUNTAIN RANGE (WESTERN PORTIONS), PARTICULARLY TRIBUTARIES CORONEL, SANTOR, AND DIGMALA RIVERS IS EXPECTED TO OCCUR. GRADUAL INCREASE OF THE UPPER MAIN PAMPANGA RIVER IS LIKELY EXPECTED.

FLASH FLOODING EXPECTED TO OCCUR IN THE AREAS OF CARRANGLAN, SAN JOSE CITY, RIZAL, GABALDON, LAUR, BONGABON, GEN. NATIVIDAD AND PALAYAN CITY.

2. MIDDLE MAIN PAMPANGA RIVER IS STILL SLOWLY RECEDING; HOWEVER, SLOW TO GRADUAL INCREASE IS EXPECTED TONIGHT. POSSIBLE GRADUAL TO RAPID INCREASE OF TRIBUTARIES CABU, MINATULA, TABUATING, PENARANDA, BULU, SAN MIGUEL, MAASIM RIVERS AND OTHER STREAMS FROM SIERRA MADRE MOUNTAINS.

FLASH FLOODING LIKELY TO OCCUR IN THE AREAS OF GEN TINIO, GAPAN, PENARANDA, SAN MIGUEL, SAN ILDEFONSO, DONA REMEDIOS TRINIDAD AND SAN RAFAEL.

FLOODING STILL TO CONTINUE TO OCCUR IN THE LOW-LYING AREAS OF CABANATUAN CITY, GAPAN, STA. ROSA, SAN LEONARDO, SAN ISIDRO, SAN ANTONIO, JAEN, CABIAO, ZARAGOZA, ARAYAT, SAN LUIS AND SAN SIMON.

3. CONTINUED SLOW RISE OF THE LOWER MAIN PAMPANGA RIVER. FLOODING WILL CONTINUE TO PERSIST IN THE LOW-LYING RIVERSIDE AREAS OF APALIT, PULILAN, CALUMPIT, HAGONoy AND PAOMBONG. FLOODING WILL CONTINUE TO PERSIST IN THE LOW-LYING RIVERSIDE AREAS ALONG ANGAT RIVER PARTICULARLY NORZAGARAY, ANGAT, BUSTOS, AND BALIUAG.

4. CONTINUED FILLING-UP OF CANDABA SWAMP AREA. FLOODING WILL CONTINUE TO PERSIST IN THE SURROUNDING LOW-LYING AREAS OF CANDABA SWAMP.

RESIDENTS AND THE DISASTER COORDINATING COUNCILS CONCERNED ARE ADVISED TO CONTINUE TO TAKE APPROPRIATE ACTIONS.

Prepared By:

Noted By:

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PAMPANGA RIVER BASIN

FLOOD BULLETIN No. 8

Issued at 4:00 AM Friday December 03, 2004

(Valid Until the next issuance at 4:00 PM today)

AVERAGE BASIN RAINFALL:

PAST 18 HOURS ENDING AT 3 AM = 66mm

FORECAST FOR THE NEXT 12 HOURS = MORE THAN 5mm

EXPECTED HYDROLOGICAL RESPONSE:

1. GRADUAL RISE OF UPPER MAIN PAMPANGA RIVER.

FLOODING IS EXPECTED TO OCCUR IN THE AREAS OF CARRANGLAN, SAN JOSE CITY, RIZAL, GABALDON, LAUR, BONGABON, GEN. NATIVIDAD AND PALAYAN CITY.

2. MIDDLE MAIN PAMPANGA RIVER AND TRIBUTARIES CABU, MINATULA, TABUATING, PENARANDA, BULU, SAN MIGUEL, MAASIM RIVERS AND OTHER STREAMS FROM SIERRA MADRE MOUNTAINS WILL GRADUALLY RISE.

FLOODING STILL TO CONTINUE IN THE LOW-LYING AREAS OF CABANATUAN CITY, GAPAN, STA. ROSA, SAN LEONARDO, SAN ISIDRO, SAN ANTONIO, JAEN, CABIAO, ZARAGOZA, ARAYAT, SAN LUIS AND SAN SIMON. FLOODING IS LIKELY TO OCCUR IN THE LOW-LYING AREAS OF GEN. TINIO, PEÑARANDA, SAN RAFAEL AND SAN MIGUEL.

3. CONTINUED SLOW RISE OF THE LOWER MAIN PAMPANGA RIVER.

FLOODING WILL CONTINUE TO PERSIST IN THE LOW-LYING RIVERSIDE AREAS OF APALIT, PULILAN, CALUMPIT, HAGONoy AND PAOMBONG.

FLOODING WILL CONTINUE TO PERSIST IN THE LOW-LYING AREAS ALONG ANGAT RIVER PARTICULARLY NORZAGARAY, ANGAT, BUSTOS, AND BALIUAG.

4. CONTINUED FILLING-UP OF CANDABA SWAMP AREA.

FLOODING WILL CONTINUE TO PERSIST IN THE SURROUNDING LOW-LYING AREAS OF CANDABA SWAMP.

RESIDENTS AND THE DISASTER COORDINATING COUNCILS CONCERNED ARE ADVISED TO CONTINUE TO TAKE APPROPRIATE ACTIONS.

Prepared By:

**SFPJ / FLM
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Noted By:

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**PAMPANGA RIVER BASIN
FLOOD BULLETIN No. 9**

Issued at 4:00 PM Friday December 03, 2004

(Valid Until the next issuance at 4:00 AM tomorrow)

AVERAGE BASIN RAINFALL:

PAST 30 HOURS ENDING AT 4 AM = 69mm

FORECAST FOR THE NEXT 12 HOURS = LESS THAN 10mm

EXPECTED HYDROLOGICAL RESPONSE:

1. UPPER MAIN PAMPANGA RIVER HAD REACHED ITS PEAK AND A SLOW RECESSION IS NOW IN EFFECT.

FLOODING WILL STILL REMAIN IN THE RELATIVELY LOW AREAS OF GABALDON, LAUR, BONGABON AND PALAYAN CITY.

2. SLOW RISE OF THE MIDDLE MAIN PAMPANGA RIVER AND TRIBUTARY RIO CHICO RIVER. STREAMS FROM THE WESTERN SLOPES OF THE SIERRA MADRE MOUNTAINS HAVE GRADUALLY SUBSIDED.

FLOODING STILL TO CONTINUE IN THE LOW-LYING AREAS OF CABANATUAN CITY, STA. ROSA, SAN LEONARDO, GAPAN, SAN ISIDRO, SAN ANTONIO, JAEN, CABIAO, ZARAGOZA, SAN MIGUEL, ARAYAT, SAN LUIS AND SAN SIMON.

3. LOWER MAIN PAMPANGA RIVER TO RISE FURTHER.

FLOODING WILL CONTINUE TO PERSIST IN THE LOW-LYING RIVERSIDE AREAS OF APALIT, PULILAN, CALUMPIT, HAGONoy AND PAOMBONG. FLOODING WILL STILL REMAIN IN THE LOW-LYING AREAS ALONG ANGAT RIVER PARTICULARLY NORZAGARAY, ANGAT, BUSTOS, AND BALIUAG.

4. CONTINUED SLOW FILLING-UP OF CANDABA SWAMP AREA.

FLOODING WILL CONTINUE TO PERSIST IN THE SURROUNDING LOW-LYING AREAS OF CANDABA SWAMP.

RESIDENTS AND THE DISASTER COORDINATING COUNCILS CONCERNED ARE ADVISED TO CONTINUE TO TAKE APPROPRIATE ACTIONS.

Prepared By:

APT/ HTH / LSF
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**PAMPANGA RIVER BASIN
FLOOD BULLETIN No. 10
Issued at 4:00 AM Saturday December 04, 2004
(Valid Until the next issuance at 4:00 PM today)**

**AVERAGE BASIN RAINFALL:
PAST 42 HOURS ENDING AT 3 AM = 70mm
FORECAST FOR THE NEXT 12 HOURS = LESS THAN 10mm**

EXPECTED HYDROLOGICAL RESPONSE:

1. SLOW RECESSION OF THE UPPER MAIN PAMPANGA RIVER.
FLOODING IS EXPECTED TO SUBSIDE IN THE AREAS OF GABALDON, LAUR,
BONGABON AND PALAYAN CITY.
2. SLOW RISE OF THE MIDDLE MAIN PAMPANGA RIVER AND TRIBUTARY
RIO CHICO RIVER.
FLOODING IS EXPECTED TO PERSIST IN THE LOW-LYING AREAS OF
CABANATUAN CITY, STA. ROSA, SAN LEONARDO, GAPAN, SAN ISIDRO, SAN
ANTONIO, JAEN, CABIAO, ZARAGOZA, SAN MIGUEL, ARAYAT, SAN LUIS AND
SAN SIMON.
3. LOWER MAIN PAMPANGA RIVER IS EXPECTED TO RECEDE SLOWLY.
FLOODING IS EXPECTED TO SUBSIDE IN THE AREAS OF APALIT, PULILAN,
CALUMPIT, HAGONOY AND PAOMBONG.
FLOODING IS EXPECTED TO SUBSIDE IN AREAS ALONG ANGAT RIVER
PARTICULARLY NORZAGARAY, ANGAT, BUSTOS, CALUMPIT AND BALIUAG.
4. CONTINUED SLOW FILLING-UP OF CANDABA SWAMP AREA.
FLOODING WILL CONTINUE TO PERSIST IN THE SURROUNDING LOW-LYING
AREAS OF CANDABA SWAMP.

RESIDENTS AND THE DISASTER COORDINATING COUNCILS CONCERNED ARE
STILL ADVISED TO CONTINUE TAKING APPROPRIATE ACTIONS.

Prepared By:

**SFP / FLM
Duty Hydrologists**

Noted By:

**Rosa T. Perez, Ph. D.
OIC, FFB**



Republic of the Philippines
Department of Science and Technology
**PHILIPPINE ATMOSPHERIC, GEOPHYSICAL AND
ASTRONOMICAL SERVICES ADMINISTRATION (PAGASA)**



**FLOOD FORECASTING BRANCH
PAMPANGA RIVER FLOOD FORECASTING AND WARNING CENTER**

WFCC, BIR Road, Quezon City 1100 Tel. No. 928-27-54/926-50-60 Fax: 929-40-85
Webpage: <http://www.pampangariverbasin.mainpage.net>

PAMPANGA RIVER BASIN

FLOOD BULLETIN No. 11

Issued at 4:00 PM Saturday December 04, 2004

(Valid until the next issuance at 4:00 AM tomorrow)

AVERAGE BASIN RAINFALL:

PAST 54 HOURS ENDING AT 4 AM = 70mm

FORECAST FOR THE NEXT 12 HOURS = LESS THAN 5mm

EXPECTED HYDROLOGICAL RESPONSE:

1. UPPER MAIN PAMPANGA RIVER TO RECEDE FURTHER.
FLOODING TO SUBSIDE FURTHER IN THE AREAS OF GABALDON, LAUR, BONGABON AND PALAYAN CITY.
2. MIDDLE MAIN PAMPANGA RIVER AND TRIBUTARY RIO CHICO RIVER HAVE BOTH REACHED THEIR PEAKS. RELATIVELY SLOW RECESSION IS NOW IN EFFECT.
FLOODING TO SUBSIDE IN THE LOW-LYING AREAS OF CABANATUAN CITY, STA. ROSA, SAN LEONARDO, GAPAN, SAN ISIDRO, ZARAGOZA, SAN ANTONIO AND JAEN.
FLOODING WILL CONTINUE TO REMAIN IN THE LOW-LYING AREAS OF CABIAO, SAN MIGUEL, ARAYAT, SAN LUIS AND SAN SIMON.
3. LOWER MAIN PAMPANGA RIVER HAD LEVELLED-OFF AND A VERY SLOW RECESSION IS NOW IN PROGRESS.
FLOODING WILL CONTINUE TO REMAIN IN THE AREAS OF APALIT, PULILAN, CALUMPIT, HAGONOY AND PAOMBONG.
FLOODING TO SUBSIDE FURTHER IN AREAS ALONG ANGAT RIVER PARTICULARLY NORZAGARAY, ANGAT, BUSTOS, CALUMPIT AND BALIUAG.
4. WATER LEVEL OF CANDABA SWAMP HAD LEVELLED-OFF. SLOW RECESSION IS IN PROGRESS.
FLOODING WILL CONTINUE TO REMAIN IN THE SURROUNDING LOW-LYING AREAS OF CANDABA SWAMP.

RESIDENTS AND THE DISASTER COORDINATING COUNCILS CONCERNED ARE STILL ADVISED TO CONTINUE TO TAKE APPROPRIATE ACTIONS.

Prepared By:

HTH / LSF
Duty Hydrologists

Noted By:

Rosa T. Perez, Ph. D.
OIC, FFB



Republic of the Philippines
Department of Science and Technology
**PHILIPPINE ATMOSPHERIC, GEOPHYSICAL AND
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**PAMPANGA RIVER BASIN
FLOOD BULLETIN No. 12 (FINAL)
Issued at 4:00 AM Sunday December 05, 2004
(Valid for the next 24-hour period)**

AVERAGE BASIN RAINFALL:
PAST 66 HOURS ENDING AT 4 AM = 70mm (NO RAINS RECORDED IN THE PAST
20 HOURS)
FORECAST FOR THE NEXT 12 HOURS = LESS THAN 5mm

EXPECTED HYDROLOGICAL RESPONSE:

1. UPPER MAIN PAMPANGA RIVER TO RECEDE FURTHER.
FLOODING HAS SUBSIDED IN THE AREAS OF GABALDON, LAUR,
BONGABON AND PALAYAN CITY.
2. ALTHOUGH STILL RELATIVELY HIGH, MIDDLE MAIN PAMPANGA RIVER
AND TRIBUTARY RIO CHICO RIVERS ARE IN CONTINUED SLOW
RECESSION.
FLOODING TO SUBSIDE FURTHER IN THE LOW-LYING AREAS OF
CABANATUAN CITY, STA. ROSA, SAN LEONARDO, GAPAN, SAN ISIDRO,
ZARAGOZA, SAN ANTONIO, JAEN AND SAN MIGUEL.
FLOODING STILL TO REMAIN FOR A FEW DAYS IN THE LOW-LYING AREAS
OF CABIAO ARAYAT, SAN LUIS AND SAN SIMON.
3. A CONTINUED SLOW RECESSION OF THE LOWER MAIN PAMPANGA
RIVER.
FLOODING WILL STILL REMAIN FOR A FEW DAYS IN THE AREAS OF APALIT,
PULILAN, CALUMPIT, HAGONOY AND PAOMBONG.
FLOODING HAS SUBSIDED IN AREAS ALONG ANGAT RIVER PARTICULARLY
NORZAGARAY, ANGAT, BUSTOS, CALUMPIT AND BALIUAG.
4. WATER LEVEL OF CANDABA SWAMP IN A VERY SLOW RECESSION.
FLOODING WILL REMAIN FOR SEVERAL DAYS IN THE SURROUNDING LOW-
LYING AREAS OF CANDABA SWAMP.

RESIDENTS AND THE DISASTER COORDINATING COUNCILS CONCERNED ARE
STILL ADVISED TO TAKE APPROPRIATE ACTIONS.

Prepared By:

HTH
Duty Hydrologists

Noted By:

Rosa T. Perez, Ph. D.
OIC, FFB

PAMPANGA RIVER BASIN

Telemeterized Rainfall and Water Level Data

Year: 2004		Rainfall Stations														Water Level Stations								
Mo.:	Nov	Munoz	Sapang Buho	Mayapyap	Gabalton	Zaragoza	Papaya	San Isidro	Arayat	Candaba	Sibul Spring	Sasmuan	Sulipan	Ipo Dam	San Rafael	Sapang Buho	Mayapyap	Zaragoza	San Isidro	Arayat	Candaba	Sexmoan	Sulipan	
Day	Time (0000)																							
28	10																							
28	11																							
28	12																							
28	13																							
28	14																							
28	15																							
28	16																							
28	17																							
28	18																							
28	19																							
28	20																							
28	21																							
28	22																							
28	23																							
29	00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	err	0.01	10.60	3.80		3.98		0.83	
29	01	0	0	0	0	0	0	0	0	0	0	0	0	0	1	err	0.03	10.59	3.85		3.98		0.83	
29	02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	err	0.09	10.59	3.94		3.98		0.84	
29	03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	err	0.10	10.59	4.00		3.98		0.94	
29	04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	err	0.14	10.58	4.04		3.98		0.85	
29	05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	err	0.20	10.58	4.10		3.98		0.86	
29	06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	err	0.26	10.58	4.14		3.98		0.87	
29	07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	err	0.32	10.58	4.24		3.98		0.88	
29	08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	err	0.37	10.57	4.29		3.98		0.89	
29	09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	err	0.40	10.57	4.28		3.98		0.90	
29	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	err	0.44	10.56	4.29		3.98		0.93	
29	11	0	1	0	0	0	0	0	0	0	0	0	0	0	0	err	0.52	10.55	4.30		3.98		0.95	

PAMPANGA RIVER BASIN

Telemeterized Rainfall and Water Level Data

Year:	PAMPANGA RIVER BASIN														Water Level Stations							
2004	Telemeterized Rainfall and Water Level Data														Water Level Stations							
Mo.: Nov	Rainfall Stations														Water Level Stations							
Day	Munoz	Sapang Buho	Mayapyap	Gabalдон	Zaragoza	Papaya	San Isidro	Arayat	Candaba	Sibul Spring	Sasmuan	Sulpan	Ipo Dam	San Rafael	Sapang Buho	Mayapyap	Zaragoza	San Isidro	Arayat	Candaba	Sexmoan	Sulpan
29 12	0	1	1	2	0	3	0	1	0	2	0	0	2	err		0.80	10.54	4.31		3.98		0.98
29 13	0	1	0	1	0	3	1	2	1	3	0	1	3	err		0.88	10.53	4.32		3.98		1.00
29 14	0	1	2	5	0	3	1	4	2	3	0	1	3	err		0.82	10.53	4.33		3.98		1.03
29 15	1	3	2	6	2	3	2	3	2	4	1	2	7	err		0.90	10.53	4.35		3.98		1.05
29 16	2	2	2	4	1	4	3	6	4	4	0	5	7	err		1.00	10.53	4.36		3.98		1.07
29 17	4	3	4	5	3	4	2	5	3	3	2	3	7	err		1.10	10.54	4.41		3.98		1.10
29 18	4	3	3	11	6	5	4	5	3	2	4	4	10	err		1.20	10.65	4.51		3.98		1.12
29 19	3	6	4	10	6	10	3	5	3	7	6	4	13	err		1.30	10.66	4.61		3.98		1.14
29 20	3	5	7	12	5	16	5	4	3	19	8	6	36	err		1.40	10.61	4.71		3.96		1.17
29 21	4	4	11	10	6	18	7	4	4	34	7	7	44	err		1.50	10.62	4.86		3.98		1.19
29 22	3	9	8	14	7	15	7	23	22	36	13	15	71	err		1.60	10.64	4.92		3.98		1.25
29 23	2	19	21	24	5	46	21	45	31	40	13	19	48	err		1.70	10.70	5.02		3.98		1.31
30 00	5	44	26	51	8	40	30	51	58	58	34	33	2	err		1.80	10.75	5.12		3.98		1.37
30 01	14	41	24	58	15	58	33	13	9	6	17	9	2	err		1.90	10.81	5.23		3.98		1.38
30 02	25	21	0	57	12	32	18	4	5	4	6	4	0	err		2.00	10.85	5.33		3.98		1.39
30 03	9	8	16	38	18	8	16	0	0	2	0	0	0	err		2.33	10.89	5.43		3.98		1.40
30 04	15	18	2	30	18	7	1	0	0	0	0	0	0	err		2.67	10.93	5.53		3.98		1.45
30 05	12	19	0	32	1	0	0	0	0	0	1	0	0	err		3.00	10.96	5.63		3.98		1.49
30 06	20	18	11	51	0	0	0	0	0	0	0	0	0	err		3.33	11.00	5.74		3.98		1.54
30 07	4	7	1	21	0	9	0	0	0	0	0	0	0	err		3.67	11.04	5.84		3.99		1.58
30 08	5	6	1	10	1	0	0	0	0	0	0	0	0	err		4.00	11.08	5.94		4.00		1.66
30 09	2	6	1	17	0	1	0	0	0	0	0	0	0	err		5.33	11.15	6.18		4.10		1.74
30 10	3	1	0	14	0	1	0	0	0	0	0	0	0	err		6.65	11.23	6.36		4.20		1.82
30 11	0	2	0	17	0	0	0	0	0	0	0	0	0	err		6.86	11.30	6.44		4.22		1.84
30 12	0	2	0	6	0	3	0	0	0	0	0	0	0	err		7.07	11.38	6.46		4.33		1.93
30 13	0	0	0	0	0	7	2	0	0	0	0	0	0	err		7.18	11.45	6.76		4.44		2.00
30 14	0	0	0	0	0	1	0	1	0	1	0	0	0	err		7.18	11.52	6.86		4.56		2.05

Year:		PAMPANGA RIVER BASIN														MADRID							
2004		Telemeterized Rainfall and Water Level Data														MADRID							
Mo.:	Dec	Rainfall Stations										Water Level Stations					MADRID						
Day	Time (0000)	Munoz	Sapang Buho	Mayapyap	Gabaldon	Zaragoza	Papaya	San Isidro	Arayat	Candaba	Sibul Spring	Sasmuan	Sulipan	Ipo Dam	San Rafael	Sapang Buho	Mayapyap	Zaragoza	San Isidro	Arayat	Candaba	Sexmoan	Sulipan
1	09	0	0	0	0	0	0	0	0	0	0	0	0	0	0		3.80	13.36	6.86	9.05	6.20		2.64
1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0		3.63	13.42	6.86	9.10	6.25		2.67
1	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0		3.49	13.45	6.86	9.12	6.30		2.70
1	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0		3.39	13.46	6.86	9.18	6.35		2.73
1	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0		3.25	13.49	6.76	9.22	6.45		2.77
1	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0		3.13	13.52	6.68	9.25	6.55		2.80
1	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0		3.01	13.55	6.82	9.27	6.59		2.83
1	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0		2.81	13.56	6.59	9.30	6.63		2.86
1	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0		2.79	13.57	6.56	9.33	6.67		2.88
1	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0		2.68	13.58	6.55	9.36	6.70		2.91
1	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0		2.58	13.60	6.53	9.36	6.73		2.94
1	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0		2.48	13.59	6.52	9.38	6.76		2.97
1	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0		2.36	13.59	6.50	9.38	6.79		3.02
1	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0		2.30	13.61	6.48	9.41	6.81		3.09
1	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0		2.19	13.60	6.47	9.41	6.83		3.14
2	00	0	0	0	0	0	0	0	0	0	0	0	0	0	0		2.11	13.61	6.46	9.40	6.85		3.18
2	01	0	0	0	0	0	0	0	0	0	0	0	0	0	0		2.04	13.63	6.44	9.40	6.87		3.23
2	02	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1.97	13.61	6.43	9.42	6.89		3.27
2	03	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1.89	13.62	6.42	9.40	6.90		3.29
2	04	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1.83	13.60	6.41	9.40	6.92		3.30
2	05	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1.75	13.60	6.39	9.40	6.93		3.31
2	06	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1.68	13.60	6.38	9.37	6.94		3.32
2	07	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1.61	13.58	6.37	9.36	6.95		3.32
2	08	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1.55	13.58	6.36	9.35	6.95		3.32
2	09	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1.51	13.58	6.35	9.33	6.95		3.33
2	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1.46	13.57	6.34	9.31	6.96		3.35
2	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1.41	13.57	6.32	9.30	6.96		3.41

Year		PAMPANGA RIVER BASIN																					
2004		Telemeterized Rainfall and Water Level Data																					
Mo.:	Dec	Rainfall Stations															Water Level Stations						
Day	Time (0000)	Munoz	Sapang Buho	Mayapyap	Gabalidon	Zaragoza	Papaya	San Isidro	Arayat	Candaba	Sibul Spring	Sasmuan	Sulipan	Ipo Dam	San Rafael	Sapang Buho	Mayapyap	Zaragoza	San Isidro	Arayat	Candaba	Sexmoan	Sulipan
2	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.38	13.55	6.31	9.29	6.96		3.49
2	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.37	13.56	6.19	9.24	6.95		3.52
2	14	0	1	0	0	0	0	0	0	0	0	0	0	3	0	0	1.33	13.54	6.08	9.24	6.95		3.57
2	15	0	1	0	2	1	0	0	0	1	2	1	1	3	1	0	1.28	13.54	5.96	9.22	6.94		3.60
2	16	0	3	1	1	6	0	0	0	0	3	0	2	7	2	0	1.28	13.54	5.94	9.19	6.93		3.61
2	17	0	4	1	1	11	1	0	0	0	2	1	1	11	2	0	1.23	13.51	5.91	9.17	6.94		3.63
2	18	1	7	3	3	11	0	0	2	1	6	0	0	11	2	0	1.24	13.50	5.90	9.14	6.94		3.65
2	19	4	4	4	38	3	4	6	5	2	8	1	2	11	3	0	1.24	13.52	5.86	9.11	6.93		3.67
2	20	8	8	7	61	8	6	7	5	3	11	1	1	10	5	0	1.24	13.52	5.84	9.08	6.93		3.68
2	21	6	14	8	34	7	11	9	8	6	16	8	4	15	4	0	1.29	13.52	5.82	9.06	6.93		3.70
2	22	9	14	6	19	12	21	14	13	4	7	8	5	22	4	0	1.37	13.51	5.79	9.03	6.93		3.73
2	23	6	14	10	12	11	17	10	5	4	10	5	1	7	4	0	1.50	13.50	5.77	9.00	6.94		3.76
3	00	14	12	7	0	11	15	8	3	2	3	3	2	2	1	0	1.75	13.51	5.75	9.00	6.92		3.79
3	01	6	7	4	4	5	3	7	3	1	5	2	0	1	1	0	2.07	13.52	5.74	8.99	6.93		3.81
3	02	5	1	1	1	4	2	2	1	1	1	1	0	0	2	0	2.38	13.52	5.72	9.04	6.94		3.83
3	03	1	1	0	1	1	0	0	0	0	1	0	0	0	1	0	2.77	13.53	5.70	9.10	6.95		3.84
3	04	0	0	0	2	1	1	0	0	1	3	1	0	4	1	0	3.44	13.52	5.68	9.15	6.95		3.86
3	05	0	0	0	0	0	0	0	0	0	1	0	0	5	0	0	4.18	13.54	5.64	9.16	6.93		3.87
3	06	2	0	0	0	1	0	1	0	0	0	0	0	5	0	0	4.67	13.57	5.62	9.17	6.93		3.89
3	07	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	5.03	13.59	5.60	9.19	6.92		3.89
3	08	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	5.19	13.63	5.56	9.20	6.97		3.91
3	09	0	0	0	0	0	0	0	1	1	0	1	0	2	0	0	5.15	13.63	5.56	9.21	6.98		3.92
3	10	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	5.15	13.66	5.56	9.19	7.01		3.94
3	11	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.95	13.70	5.56	9.18	7.01		3.94
3	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.84	13.70	5.56	9.18	7.03		3.96
3	13	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	4.64	13.73	5.56	9.17	7.04		3.96
3	14	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	4.57	13.76	5.56	9.16	7.04		3.96

PAMPANGA RIVER BASIN

Telemeterized Rainfall and Water Level Data

HYDREC

Jan 09

Year:	2004		Rainfall Stations																Water Level Stations					
Mo.:	Dec	Dec	Munoz	Sapang Buho	Mayapyap	Gabalton	Zaragoza	Papaya	San Isidro	Arayat	Candaba	Sibul Spring	Sasmuan	Sulipan	Ipo Dam	San Rafael	Sapang Buho	Mayapyap	Zaragoza	San Isidro	Arayat	Candaba	Sexmoan	Sulipan
3	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.31	13.80	5.56	9.17	7.05		3.96
3	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.16	13.84	5.56	9.19	7.05		3.96
3	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.07	13.87	5.56	9.20	7.06		3.97
3	18	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3.94	13.92	5.54	9.21	7.07		3.97
3	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.81	13.96	5.48	9.22	7.08		3.97
3	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.67	14.01	5.35	9.22	7.09		3.96
3	21	2	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	3.56	14.05	5.28	9.23	7.10		3.95
3	22	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.48	14.09	5.21	9.24	7.11		3.95
3	23	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.36	14.16	5.14	9.25	7.11		3.95
4	00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.21	14.20	5.07	9.25	7.12		3.94
4	01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.07	14.26	5.00	9.26	7.13		3.95
4	02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.95	14.29	4.92	9.27	7.13		3.95
4	03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.83	14.31	4.84	9.28	7.13		3.95
4	04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.71	14.33	4.78	9.28	7.14		3.95
4	05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.61	14.34	4.71	9.29	7.14		3.95
4	06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.51	14.36	4.64	9.28	7.15		3.96
4	07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.43	14.37	4.58	9.29	7.15		3.95
4	08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.36	14.37	4.54	9.28	7.15		3.95
4	09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.28	14.38	4.52	9.23	7.15		3.95
4	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.20	14.39	4.52	9.23	7.15		3.95
4	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.12	14.40	4.52	9.22	7.15		3.95
4	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.03	14.42	4.52	9.22	7.14		3.95
4	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.97	14.41	4.52	9.21	7.14		3.95
4	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.92	14.41	4.52	9.19	7.14		3.95
4	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.86	14.41	4.51	9.18	7.14		3.95
4	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.79	14.41	4.51	9.16	7.13		3.95
4	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.75	14.42	4.51	9.14	7.12		3.95

Comparison of 2004 Flood Event River Peaks

Table 6.2 Comparison of Peaks - 2004 Floods (meters)

Station	T. Marce	T.D. Violeta	T.D. Winnie	T. Yoyong
Sapang Buho	5.45		7.60	
Mayapyap	5.06	4.59	7.18	5.19
San Isidro	6.70	4.30	7.16	
Zaragoza	15.39	11.38	13.63	14.42
Arayat	10.03	8.15	9.42	9.29
Candaba	7.38	5.05	6.96	7.15
Sulipan	4.39	2.01		3.97

Red values are the maximum for the 4 events.

The preceding table compares the peaks attained during the four flood events that affected the Pampanga River Basin in year 2004. The physical differences in peaks between events can be attributed to some of the following reasons:

- T. Marce, as a disturbance, did not hit land but rather enhanced the Southwest Monsoon, which happens to be the prevailing weather system at that time, and practically affected the basin coming from the western side; the rest of the disturbances came in from the eastern side of the basin.
- During Marce, the worst affected areas within the basin were the Pampanga and Bulacan areas while for the other three, it was Nueva Ecija first and then portions of Pampanga and Bulacan;
- Flash floods affected the immediate areas at the downside of the Sierra Madre Mountains for Violeta, Winnie and Yoyong. Floodwaters were then absorbed by the middle and lower sections of the basin, hence, lower peaks at the lower main Pampanga River as compared to T. Marce. On the other hand, higher peaks were registered by the three Violet, Winnie and Yoyong, in the upper main Pampanga River than that for Marce.
- The latter 3 disturbances (Violeta, Winnie and Yoyong) have rainfall durations lasting for about a day and concentrated mainly on the eastern sections of the basin (a classic case of upstream to downstream flood regime); for Marce, rainfall was fairly distributed throughout the basin with greater concentrations on the southwest portions of the basin and lasting from 2 to 3 days (typical southwest monsoon effect over the basin)

Typhoon Marce's have record-breaking flood magnitudes at Arayat and Candaba stations, whilst for Tropical Depression Winnie, record peaks at Sapang Buho and Mayapyap were registered during the last several years of data of flood events within the basin.