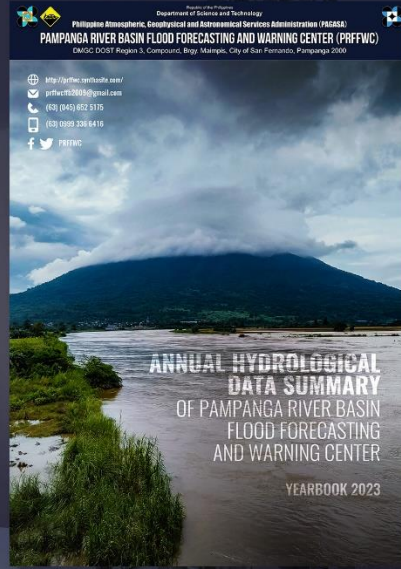
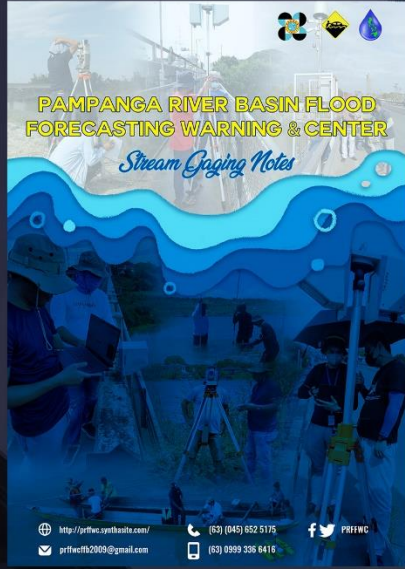




Reference Manual No. 2 for Pampanga River Basin Flood Forecasting & Warning Center



Flood Forecaster / Operational Hydrologist (& Hydro Technician)
Guide in the preparation and issuance of Flood Advisories & Flood
Bulletins (with relevant information & other related activities);
Flood Watch Operational activities



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PRFFWC



**Reference Manual No. 2 for the Operational Activities of the
PAMPANGA RIVER BASIN FLOOD FORECASTING and WARNING
CENTER (PRBFFWC)**

Flood Forecaster / Operational Hydrologist (& Hydro Technician) Guide in the preparation and issuance of Flood Advisories & Flood Bulletins (with relevant information & other related activities); Flood Watch Operational activities

(Updated / revised: September 2024)

Acronyms & Abbreviations:

- CL – Central Luzon
- CSFP – City of San Fernando, Pampanga
- DRRM – Disaster Risk Reduction and Management
- DRRMO – Disaster Risk Reduction & Management Office; L / C / M / P / R DRRMO – Local / City / Municipal / Provincial / Regional Disaster Risk Reduction & Management Office
- D/S - downstream
- D/T - downtime
- FA – Flood Advisory
- FB – Flood Bulletin
- FFWS – Flood Forecasting & Warning System / FFW – Flood Forecasting & Warning
- FM – Flood Marker
- FW – Flood Watch (status)
- FWL - flood warning water level
- HMD – Hydro-Meteorology Division
- HMTS – Hydromet Telecommunications Section
- HMDAS – Hydromet Data Application Section
- LB – Left Bank
- LGU – Local Government Unit
- MGB – Mines & Geosciences Bureau
- NCR-PRSD – National Capital Region – PAGASA Regional Services Division
- NGO – Non-Governmental Organization
- NE Monsoon – Northeast Monsoon (or Amihan)
- NFW – non-Flood Watch (status)
- OCD – Office of Civil Defense
- PAR – Philippine Area of Responsibility
- PRB – Pampanga River Basin
- PRBFFWC / PRFFWC – Pampanga River Basin Flood Forecasting & Warning Center / Pampanga River Flood Forecasting & Warning Center
- PAGASA – Philippine Atmospheric, Geophysical and Astronomical Services Administration
- RB – Right Bank
- RR – Rainfall
- SG or S.G. – Staff Gauge
- STS – Severe Tropical Storm
- STy – Super Typhoon
- SW Monsoon – Southwest Monsoon (or Habagat)
- TC – Tropical Cyclone
- TCWS – Tropical Cyclone Warning Signal
- TD – Tropical Depression
- TS – Tropical Storm
- Ty - Typhoon
- U/S - upstream
- WL – Water Level
- WMO – World Meteorological Organization
- Wx or wx – weather

Table of Contents:

	Overview	1
1.0	Non-Flood Watch Status Operational Activities	2
2.0	Flood Watch Status	4
3.0	Flood Warning Water Levels	8
4.0	Flood Situation Messages	8
5.0	Comparison of some river stages from past events for reference purposes	11
6.0	Issuance of FA / FB	12
	6.1 Conditions for the issuance of Flood Advisory (FA)	14
	6.2 Conditions for the issuance of Flood Bulletin (FB)	15
	6.3 Conditions for the issuance of Intermediate FB and amended FA/FB	16
	6.4 When to issue FA/FB, intermediate FB, amended FA/FB	16
	6.5 When to terminate FA/FB	17
	6.6 Other Possibilities / actions to consider	18
	6.7 Checklist for FA & FB Document before dissemination / some TIPS	18
7.0	Validating flood forecast information	19
8.0	River sections and area covered	20
9.0	(Initial) River systems / Areas in the FA or FB document	23
10.0	Estimated Lead time / other forecasting issues	23
11.0	Various Station situations during flood events in pictures	27
12.0	Downtime (D/T) / System breakdown / Emergency situations / etc.	30
13.0	Protocol on flood info dissemination	31
14.0	Center activities / conditions during FW	33
15.0	Operations during FW	34
16.0	Ways Forward: Improvement Plans in Flood Warning Information	35
17.0	List of Flood-Prone areas per province within the PRB	36

Overview

Flood models are tools used to help flood forecaster / hydrologist make a flood forecasts, however, some limitations come into play since each flood event is always different from the other mainly because meteorological / hydrological conditions are precisely different. Observed data and present basin situations are added factors that are more important when doing flood analyses. But one thing that makes an effective and a skillful basin flood forecaster is having a “sound” knowledge of the basin area of concern. It is imperative that hydrologist / basin flood forecaster should be quite familiar and accustomed with the regular flood regime as well as basin characteristics of the basin. This is basically the premise and the practical reason why such reference manuals were developed for the PRBFFWC. This reference manual number 2 complements the first one as a main guide for PRB hydrologists / flood forecasters.

This reference manual is exclusively and specifically intended for the flood forecasters / hydrologists including the hydro technicians of the Pampanga River Basin Flood Forecasting & Warning Center. It serves as a guide (and a tool) to operational PRBFFWC hydrologists / flood forecasters in formulating flood information, e.g., Flood Advisories (FAs) and the Flood Bulletins (FBs), during times of imminent flooding in the PRB. It contains specific operational activities, moreover some guidelines and other relevant materials in the preparation of these flood information. It also includes some activities for the hydro technicians (“hydro techs”) being a support group assisting center personnel in the preparation and, most importantly, in the dissemination of flood information. Included further are other relevant basin information and materials that may serve as tools in complementing the flood information.

The contents presented in this manual were based on many operational flood event activities that the PRBFFWC personnel have experienced since transferring to its home center in CSFP in March 2009; and during the course of such period, only a general set of standard operating procedure are worked-out mainly because of the following reasons:

- Flood events vary from one event to another due to the fact that meteorological and hydrological conditions are not the same with every event; spatial and temporal distribution of rainfall is highly variable in the PRB considering a relatively big basin area of 10,434 km²;
- Rainfall and water level monitoring station distribution is rather sparse – rainfall station is 1 for every 615 km²; water level station is at 1 for every 1,045 km²
- The dynamic condition in the basin, i.e., Pasac-Guagua river sub-basin, is still affected mainly by “lahar” flows during some intense rainfall events and construction of flood mitigating structures are still on-going and continuously being undertaken in the area; Main Pampanga River bed / channel particularly at the lower sections of the basin remain affected by heavy siltation and / or sedimentation;
- And many other factors, directly or indirectly, that are mostly uncontrolled.

Again, as what has been mentioned in Reference Manual No. 1, *in a rather realistic but quite sad situation, it is likely that these reports (Reference Manuals No. 1 & 2) may not have any chance of being read nor browsed at all by most of the PRBFFWC personnel, which is actually the main focused of these manuals, as almost all of them remain passive and not at all responsive in their attitude towards the river basin center’s thrust and agenda in its area of concern.*

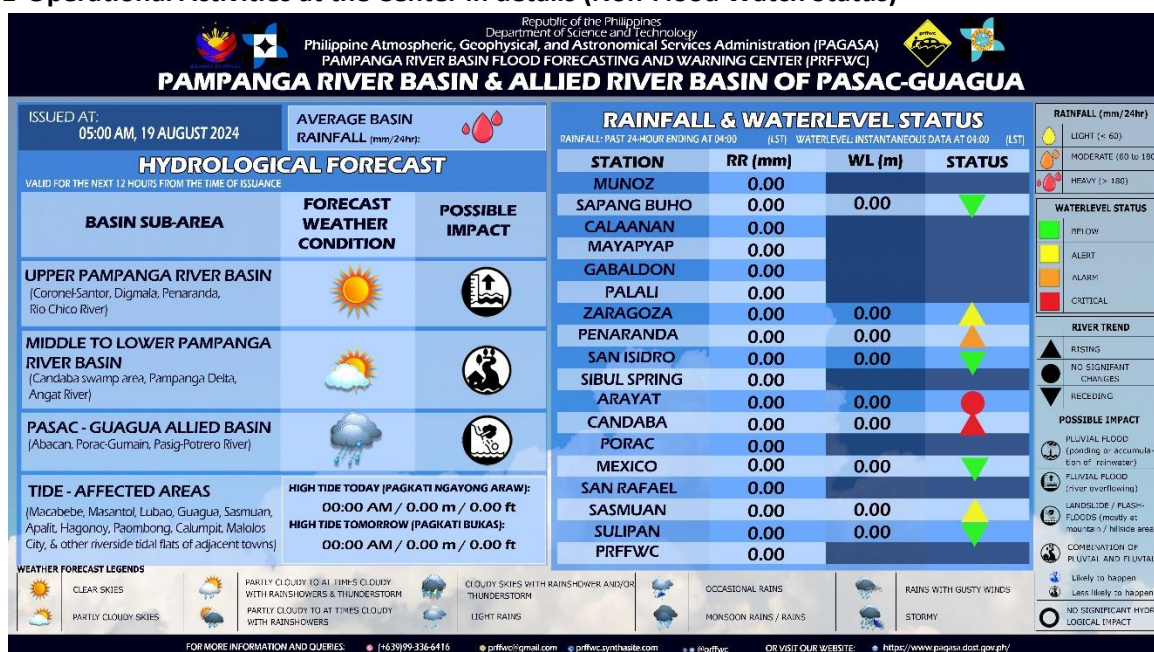
PRBFFWC, September 2024

1. Non-Flood Watch Status Operational Activities

Non-flood watch status in the Flood Forecasting & Warning Center is often referred to as the “peace time” status. It is during such situation that the updating of hydrological forecast and uploading of the status of RR & WL of the PRBFFW system covering the PRB are carried-out on a daily basis. Some of the main operational activities during the non-Flood Watch status in the PRBFFWC are as follows:

- The past 24-hour rainfall and instantaneous water level reading observed at 4:00 am at all the PRBFFWC monitored stations in the basin are updated & uploaded in the river basin center’s website on or before 5:00 am daily;
- The status of the basin RR & WL of the PRBFFW system are once again updated and uploaded in the river basin center’s website on or before 5:00 pm daily; If there is a significant change in the basin’s hydrological situation then the hydrological forecast is also updated;
- Encoding of telemetry data, rainfall and water level of all stations whenever necessary, into the center’s customized database;
- The conduct of other regular operational activities that are mostly related to field activities such as quarterly maintenance of telemetry system, stream gaging, information & education campaigns, meetings, and the like.

1.1 Operational Activities at the Center in details (Non-Flood Watch Status)

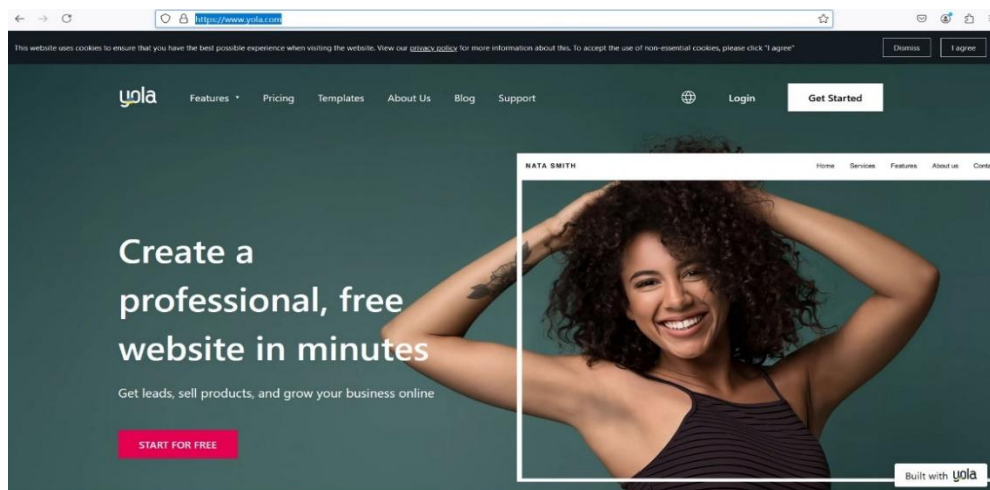


Above figure is the latest infographic Hydrological Forecast output of the PRBFFWC which can be updated using a Photoshop auto suite.

- Daily before 5:00 am, the shift duty shall check the latest 24-hr public weather forecast (issued at 4:00 am) at the PAGASA website and establish the expected weather condition that will prevail generally over the PRB by taking a look at the synopsis and the forecast paragraph; other points of reference is the Regional Forecast site of the NCR-PRSD for selected provinces, e.g., Tarlac, Nueva Ecija, Bulacan, Pampanga (<https://www.pagasa.dost.gov.ph/regional-forecast/ncrpsd>); Other means that will help in formulating the hydrological forecast for the basin are the latest satellite

and radar images, a check and browse of other weather-related links for updates (see weather links in the PRBFFWC website.)

- Formulation of hydrological forecast will take into consideration the previous basin condition (past 24-hr rainfall at each station and the WL trends and its assessment status); the previous basin condition will then be merged with the weather forecast issued by the Weather Division (WD) to come-up with the hydrological forecast for the basin which is divided generally into 3 areas – Upper PRB, Middle to Lower PRB, and the Pasac-Guagua Allied Sub-Basin; other information to be considered includes time of occurrence of high tide and its height (check the high tide excel file in the PRBFFWC Hydro-forecast page) and the likely impacts within the 3 areas of concerns.
- At few minutes past 4:00am, after all the observations have been collated from the center’s supervising terminal, fill-up the “uploading” form for the past 24-hour rainfall observations (from the supervisory terminal go to Rainfall / Table) for each stations from the 24-hour rainfall column, and likewise the instantaneous 4:00am WL readings (go to Water Level / Map) at all stations;
- Updating of the Hydrological Forecast is done by Photoshop auto fill-up suite that should be introduced first to newly assigned shift hydro forecaster/s of the PRBFFWC;
- Site updating: Open the center’s website through “yola” (<https://www.yola.com/>), login, and enter the password and proceed to “site builder”; update the hydrological forecast page by updating and uploading the data collected in steps 2 and 3 in the status of rainfall and water level page, and other items within the site as per instructions by center forecasters (see figure below for the yola website login screenshot).



- Always save the webpage after every updating / uploading operations; then publish the website and finally do not forget to log-out (**important: do not leave the website open after updating and uploading procedures has been made;**)
- Finally, to verify if the website has been updated, always check by going directly to the site: <http://prffwc.synthasite.com/>, or through the PAGASA website by going to Floods / Basin Hydrological Forecast / Pampanga River Basin...). In case the contents of the website have not yet been changed, refresh the page after several minutes by pressing F5 or manually refreshing the page as per browser steps;
- When changes have already been effected, open hydrological forecast page and press “Print Screen / Sys Rq” button (may vary depending on the computer you are using); open “Paint” and paste

“hydrological forecast” page either by right button clicking the mouse and click paste or simply pressing “Ctrl” and “V” buttons simultaneously; do necessary cropping of picture. Save with appropriate name, say “hydro-4cast-day-month-year”, e.g. “hydro-4cast-25-jul-2015” or any simple file name (e.g. “1” or “2”) that can be easily recovered when uploading and sharing in the center’s social media accounts – Facebook (FB) and Twitter (X), viber, and via email;

- Open Facebook (FB) using the center’s account and upload hydro forecast picture. Similarly, upload to “Twitter” and “Viber” using the center’s account and do the same. Always “log out” after uploading in both social media accounts. Finally, share the hydro forecast for the day via email to the following recipients: OCD-3 (r3.drmmc.oed@gmail.com) and the HMD.FFWS (hmd.ffws@gmail.com);
- The updated / uploaded hydro forecast is also saved directly in the FB page for possible back tracking reference. (the figure just below is a screenshot of the main page of the PRBFFWC)

Center Location: DOST-Region 3 Compound, Barangay Maimpis, San Fernando, Pampanga 2000, Philippines

e-mail: prffwcfb2009@gmail.com

Links:

Bulacan PDMO: <https://bulacan.gov.ph/government/offices/pdrrmo/>
 PAGASA (Weather Bureau): <https://www.pagasa.dost.gov.ph/>
 Weather Links: <http://weatherlinks2009.yolasite.com/wx-links.php>

2. Flood Watch status

Flood Watch status refers basically to a center’s operational condition with regards to any one or a combination of the following scenarios:

- A TC is headed towards or will pass close / adjacent to the PRB, which is likely to bring significant rainfall in any part of the basin, lead time of 24 or 48 hours; and possibly that such condition will require an immediate issuance of FA for awareness and preparedness activities directed to local DRRMOs and communities within the basin;
- The TC forecast favors a track towards CL or the “cone of uncertainty” shows direct or partly or a near/adjacent pass over CL;
- River stage observed at any of the stream gauging stations is about to reach or has reached respective alert and / or alarm levels (in some instances) even if there’s no TC present but another weather system is present, e.g., Habagat, Amihan, easterlies;
- There is a significant rainfall observed on most of the telemetry stations for several hours to almost a day and rains are forecasted to continue further, or in such case if there is a lingering weather disturbance, e.g. monsoon, affecting or partly affecting the PRB;
- Presence of other weather systems or tropical disturbances other than a TC such as monsoons, ITCZ, fronts, easterlies, etc. that are forecasted to affect or is already affecting the PRB and that

river situations are rising close to alert levels and most of the stations are registering rains for several hours to almost a day with an increasing trend in river stage at any of the stream gauging stations in at least during the past 12 hours;

- Pantabangan and/or Angat dams have started releasing reservoir water level and condition number 2 exists; otherwise a joint forecasters' discussion shall take place to assess and analyze basin situation;
- When the shift duty, upon discussions with the other center personnel, have determined a need for a flood watch status to be in effect as what the situation calls for based on existing PRB conditions other than those mentioned above:

Situations for a forecasters' discussion:

- There are instances that a gauging station is about to reach alert level but general basin conditions are still "relatively" dry (or coming from a dry condition) as per prior hydrological situations, based on "antecedent rainfall". In such case, forecasters will first have to discuss and assess the situation whether to go on flood watch status or hold for the moment but do intensive monitoring until such time that a definite effect on the basin is manifested; forecasters' agreement has been reached to cause for a commencement of flood watch phase and the eventual issuance of a flood information;
 - Only the Candaba gauging station is above alert level, it is possible to hold (no actions yet) the flood watch status momentarily until such time that a definite weather system (monsoon, tropical cyclone, etc.) is likely to continue and expected to affect the basin;
 - Other unusual situations that may require duty forecasters' intuitions, "gut feelings" and that brainstorming / discussions with fellow hydrologists / forecasters has been made to agree whether to go on flood watch or to hold (status quo) for the moment.
- Any other basin situation such that imminent flooding or overflowing of the main river and/or major tributaries is likely to occur (time period is subjective) in consideration with the present hydrological conditions of the basin.

PAMPANGA RIVER BASIN ASSESSMENT LEVELS (meters) as Oct 2022

color code	YELLOW	ORANGE	RED
STATION	ALERT	ALARM	CRITICAL
Sapang Buho	3.70	4.50	6.50
Mayapyap			
Zaragoza	3.00	4.00	5.00
Penaranda	2.50 **	3.50 **	4.50 **
San Isidro	5.00	6.00	8.00
Arayat	5.00	6.00	8.50
Candaba	3.50	4.50	5.00
Mexico	2.00 **	2.50 **	3.50 **
Sasmuan			3.00
Sulipan	2.60	3.20	3.80

** Initial value (for validation)

** Based on past observations from various flood events (for validation / updating if necessary)

RAINFALL RATE (mm/time)

Rainfall Intensity	mm/hr	mm/12 hrs	mm/24 hrs
LIGHT	< 2.5	< 30	< 60
MODERATE	2.5 - 7.5	30-90	60 - 180
HEAVY	> 7.5	> 90	> 180

RIVER RATE (AVERAGE) in meters

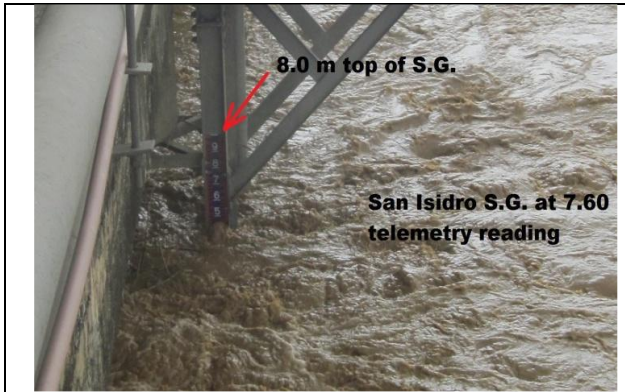
PERIOD	SLOW	GRADUAL	RAPID
1-hour	< 0.3	0.3 - 1.0	> 1.0
3-hour	< 0.6	0.6 - 1.4	> 1.4
6-hour	< 0.9	0.9 - 1.9	> 1.9
12-hour	< 1.6	1.6 - 2.9	> 2.9
24-hour	< 3.0	3.0 - 5.0	> 5.0

Heavy RR warning levels

Yellow: 7.5-15mm / hour (heavy) observed in 1 hour expected to continue in the next 3 hours	Orange: 15-30mm / hour (intense) has fallen and or expected to fall / if continuous RR for the past 3 hours is more than 45-65mm & most likely to continue in the next 3 hours.	More than 30mm (torrential) within 1 hour has fallen or expected to fall / if continuous RR for the past 3 hours is more than 65mm & most likely to continue in the next 3 hours
Flooding is possible	Flooding is Threatening	Serious flooding expected in low-lying areas

Pictures of station's S.G. (some with equivalent Telemetry reading)

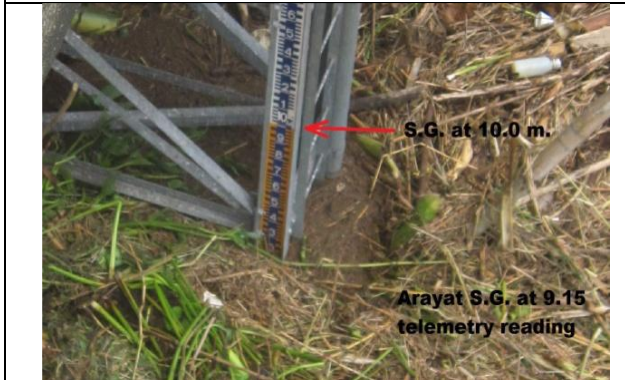
 <p>Sapang Buho S.G. at 0.03 telemetry setting (March 2009)</p>	 <p>Mayapyap S.G. (Aug. 19, 2010)</p>
<p>Sapang Buho SG: Picture taken on Mar. 24, 2009 (No adjustments needed at the time when picture was taken)</p>	<p>Mayapyap SG: Picture taken on Aug. 19, 2010 (River stage is way below "0" S.G. reading)</p>
 <p>Zaragoza S.G. at 3.15 telemetry reading (Aug. 23, 2016)</p>	 <p>Peñaranda S.G. (March 23, 2009)</p>
<p>Zaragoza WL: Picture taken on Aug. 23, 2016 (telemetry reading not tied-up with S.G.)</p>	<p>Peñaranda SG: Picture taken on Mar. 23, 2009 (River stage is way below "0" S.G. reading)</p>



San Isidro WL: Picture taken on Oct. 19, 2015



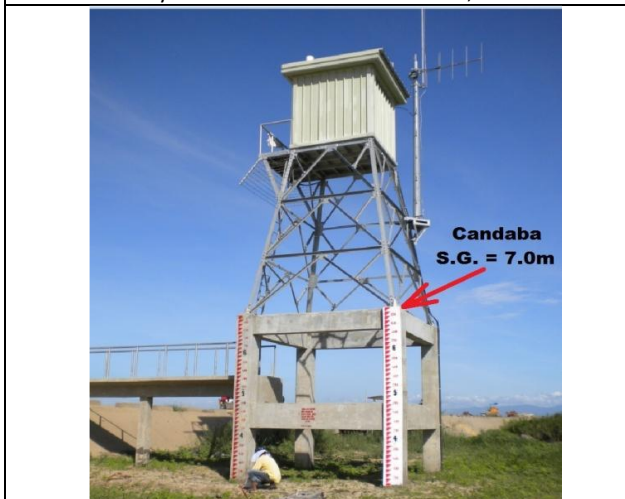
Arayat WL: Picture taken on Aug. 18, 2016



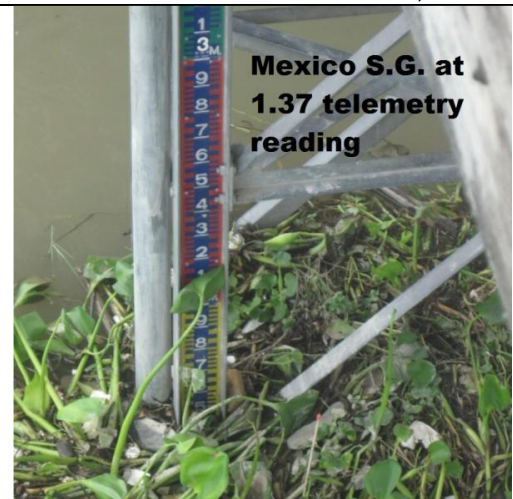
Arayat SG: Picture taken on Oct. 19, 2015



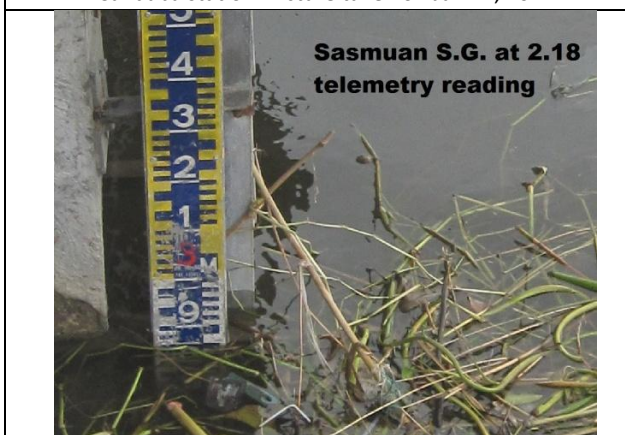
Candaba SG: Picture taken on Mar. 24, 2009



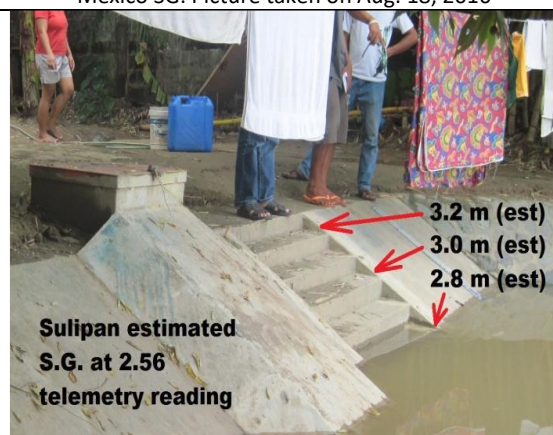
Candaba station: Picture taken on Jul. 12, 2011



Mexico SG: Picture taken on Aug. 18, 2016



Sasmuan SG: Picture taken on Aug. 19, 2016 (telemetry reading not tied-up with S.G.)



Sulipan SG: Picture taken on Aug. 19, 2016

3. Flood Warning Water Levels

Water level gages (staff gages) in the river/lake/swamp are normally utilized as reference markers to warn the people in flood prone areas and on the severity of flood. These are known as flood warning water levels (FWWLs) or assessment levels which are the water level equivalent to the specified percentage of the river channel / lake / swamp capacity. Table AA below gives the definitions and the respective operational and forecast significance of these FWWLs.

Referred to the FWWLs at each gauging station, the severity of forecasted hydrograph or trend of the progressive change in water level is assessed and determined what flood message is going to be effected in the basin flood bulletin for warning.

Table AA. Flood Assessment Levels

Alert Level	The water level at the gauging station when the channel reach / lake / swamp of which the station is representing is estimated to be at 40% full on the average.
Alarm Level	The water level at the gauging station when the channel reach / lake / swamp of which the station is representing is estimated to be at 60% full on the average.
Critical Level	The water level at the gauging station when a certain section of the channel reach / lake / swamp of which the station is representing is estimated to be at 100% full (at bankfull capacity).

The above assessment levels, like for Alert WL, can be adjusted from 40% to 50% of channel capacity as the case may be if that WL limit at that level is more than 50% of the time period of the year, meaning that this WL is still normal for that channel section. Subsequently, Alarm WL, can also be adjusted relative to the adjustments made for the Alert WL limits.

4. Flood Situation Messages

Flood situation messages are used to describe the possible severity of the (real-time) hydrological condition and forecast in the flood bulletin as shown in Table BB. Describing the flooding situation for a forecasted area/s to be affected would not always be the same for all events as to its extent and magnitude of flood due to several reasons, e.g., topography and the spatial and temporal distributions of rainfall.

Based on the expected hydrological situation/s, affected area/s shall be enumerated in the flood bulletin under any one of the flood situation messages, i.e., (a) FLOODING IS POSSIBLE; (b) FLOODING IS THREATENING; (c) FLOODING (is expected) TO OCCUR; and (d) FLOODING (is expected) TO PERSIST.

Some common terminologies / words that can be used in the FA / FB

- **Peak** – reach the highest point, either of a specified value or at a specified time (alternative synonyms: crest, top; or if “peaked” then “crested”, “topped”)
- **Level off** – to approach or reach a steady state (rate, volume or amount); stabilize. (alternative synonyms: remain the same, settle; or if “levelled off” then “remained the same”, “settled”)

- **Increase** – going up (alternative synonyms: rise, ascend, climb; or if “increasing” then “rising”, “ascending”, “climbing”)
- **Decrease** – going down (alternative synonyms: fall, descend, drop; or if “decreasing” then “falling”, “descending”, “dropping”)
- **Relatively** – in relation, comparison
- **Subside** - (of water) go down to a lower or the normal level
- **Diminish** - make or become less
- **Possible** – has the potential (alternative synonyms and more appropriate to use: **likely**)
- **Adjacent** – next to or adjoining
- **Overtop** – exceed in height (alternative synonyms: burst, spread out or spread over, spill out or spill-over, exceed, etc.)
- **Persist** – continue to exist; be prolonged.
- **A new rise of WL** - another term to use in case a recession has already been mentioned but the WL at a station has manifested a rising trend once again (another term is “revert”)

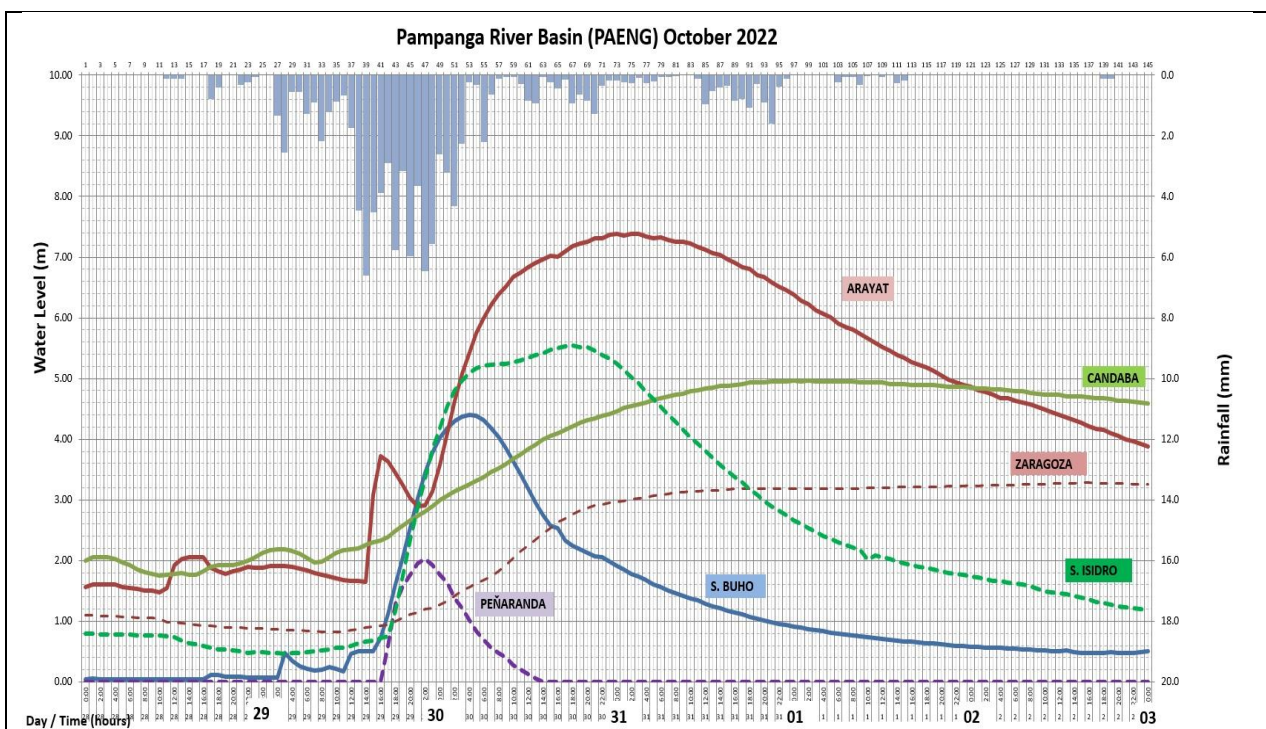
Table BB. Flood Situation Messages for Flood Bulletin

Flood Forecaster Message	Concerned Public
Flooding is Possible: when the expected rise of water level at the station exceeds the Alert Level within the next 12-24 hours; or when the observed station water level and the expected water level within the following 12-24 hours, are between level 4 and level 6 (40% and 60%).	This message mainly suggests AWARENESS within the following 12-24 hour period.
Flooding is Threatening: when the expected rise of water level at the station exceeds the Alarm Level within the next 24 hours or less; or when the station observed water level and the expected water level within the following 24 hours or less are between level 6 and level 10 (60% to 100%).	This message suggests PREPAREDNESS within the following 24 hours or less.
Flooding is Expected to Occur / Flooding to Occur: when the expected rise of water level at the station exceeds the Critical Level within the next 24 hours or less. Flooding is Expected to Persist / Flooding to Persist: when the of water level at the station and the expected water level within the following 24 hours or less will remain at Critical Level / or when WL has receded Critical Level and remnants of flooding remains in the area.	This message suggests (proactive) RESPONSE before or within the following 24 hours or less.
Flooding is no Longer Possible: when the observed water level at the station is below the Critical Level and is continuously receding and no (immediate) significant rise is expected. Normally this message is followed by a “(A FINAL MESSAGE)” for the said forecasting point.	These messages are non-critical information but more of an informative statement to concerned communities of a downgraded flood situation. (Last 3 statements are usually
Flooding is no Longer Threatening: when the observed water level at the station is below the Critical Level and is generally receding and no immediate significant rise is expected.	
Flooding is no Longer Expected to Occur: when the observed water level at the station is below the Critical Level and is generally receding and immediate significant rise is no longer expected.	

Flooding is no Longer Expected to Persist: when the observed water level at the station is above the Critical Level and is generally receding and no immediate significant rise is expected.

not used in the FB at all)

There may be instances when the river status of the water level at the station has already reached critical level and that the appropriate message “Flooding is expected to occur / Flooding to Occur” has not yet been issued prior to this. In such case, one can re-phrase the message to “Flooding has occurred / Flooding occurred” and followed by the message “and will Persist” to recover in the flood issuance episode. More appropriately, an intermediate FB should have been issued before a critical level status and also before flooding situation would have been a preferred action rather than doing the said mentioned statement. **Always think of continuity of the flood episode and consistency in the rise, peak and recession of WL.**



The above figure shows the responses of the hydrographs at various stations of PRBFFWC during the event “Paeng” in October 2022. It is very evident that the basin rainfall (hyetograph at the top axis) caused the eventual rise of the WL at the various stations, As the rainfall diminishes as the period progresses, the WL reacted in various fashion such as reaching a peak and then eventually receding in a very slow manner as in the red curve (Arayat); WL rose and levelled-off and then reverted in another rise as with the green curve (San Isidro); and a lengthy levelling-off as reflected by the dark green curve (Candaba WL); there is also a brief rise, a peak and an immediate recession as in the case of the purple curve (Peñaranda).

5. Comparison of some river stages from past events for reference purposes

Table A1 Peak WL registered in the respective telemetry station points of the PRBFFWC for various flood events that affected the PRB

Event	Sapang Buho	Mayapayap	Zaragoza	Peñaranda	San Isidro	Arayat	Candaba	Sulipan	Mexico	Sasmuan	Remarks (maximum period basin RR)
Ty Kadiang (Sept-Oct 1993)	6.30 (SG)	6.18 (SG)	15.9 (SG)		7.65 (SG)	9.81 (SG)	7.6 (SG)	4.91 (SG)			
Ty Loleng (Oct 1998)	7.15 (est)	6.50 (est)	15.76		7.38	9.47	6.62	4.87			2-day event basin RR: 131 mm
TD Winnie-Ty Yoyong (Nov-Dec 2004)	7.60 (est)	7.18	13.63		7.16 (est)	9.42 (est)	6.96	3.97			1-day event basin RR: 77 mm
Ty Marce-SW (Aug 2004)	5.45	5.06	15.39		6.70	10.03	7.38	4.39		2.06 (est)	2-day event basin RR: 114 mm
TS Ondoy (Sept 2009)	3.38	1.72	14.14	3.93	3.89	8.35	6.40	3.29	2.81	3.03	2-day event basin RR: 72 mm
Ty Pepeng (Oct 2009)	6.29	5.46	15.68	2.79	6.46	9.66	7.02	4.03	4.03	2.73	2-day event basin RR: 53 mm
TS Falcon-SW (June 2011)	3.47	2.57	14.88	2.56	4.08	8.37	6.24	2.80	2.72	3.22	
Ty Pedring (Sept-Oct 2011)	7.17	6.86	15.40	6.01	7.75	10.6 (FM)	7.62	4.85	3.30	3.09	2-day event basin RR: 146 mm
SW of August 2012	1.67	0.6	4.64	1.68	3.29	9.24	6.93	3.17	3.46	3.17	2-day event basin RR: 97 mm
TS Maring-SW (Aug 2013)	1.36		4.31	1.08	1.46	8.39	6.30	3.26	2.61	3.06	
Ty Lando** (Oct 2015)	8.08	7.30 (FM)	4.19	7.72	8.23	10.03	7.13	4.29	1.57	2.00	2-day event basin RR: 112 mm
Ty Nona / Frontal System (Dec 2015)	6.84		5.22	5.72	7.80	9.98	6.94	4.13	1.62	2.13	2-day event basin RR: 142 mm
Ty Ulysses (Nov 2020)	5.89		3.67	4.02		8.81	6.34	3.99	2.27	2.83	2-day event basin RR: 70 mm
Ty Karding (Sept 2022)	4.94		3.67	5.30	8.32	8.26	6.03	3.52		3.48	2-day event basin RR: 52 mm
SW Monsoon – TCs Egay-Falcon (Jul-Aug 2023)	1.87		4.59	0.76	5.34	8.43	6.66	3.95			2-day event basin RR: 152 mm

Notes: ** - based on a 10-minute telemetry observation (logger);

blue shaded events are associated with enhanced SW monsoon;

blanks indicate station either did not yet exist or station's telemetry system was down during the event;

light orange shaded values +10.213 for MSL;

light green shaded values – adjusted telemetry reading due to a change of type of WL sensor;

(FM) – levels were based on available flood marks only;

(SG) – as per staff gage reading.

Figure below shows a sample of the old FB format issued during the event Typhoon Lando (Oct. 2015)

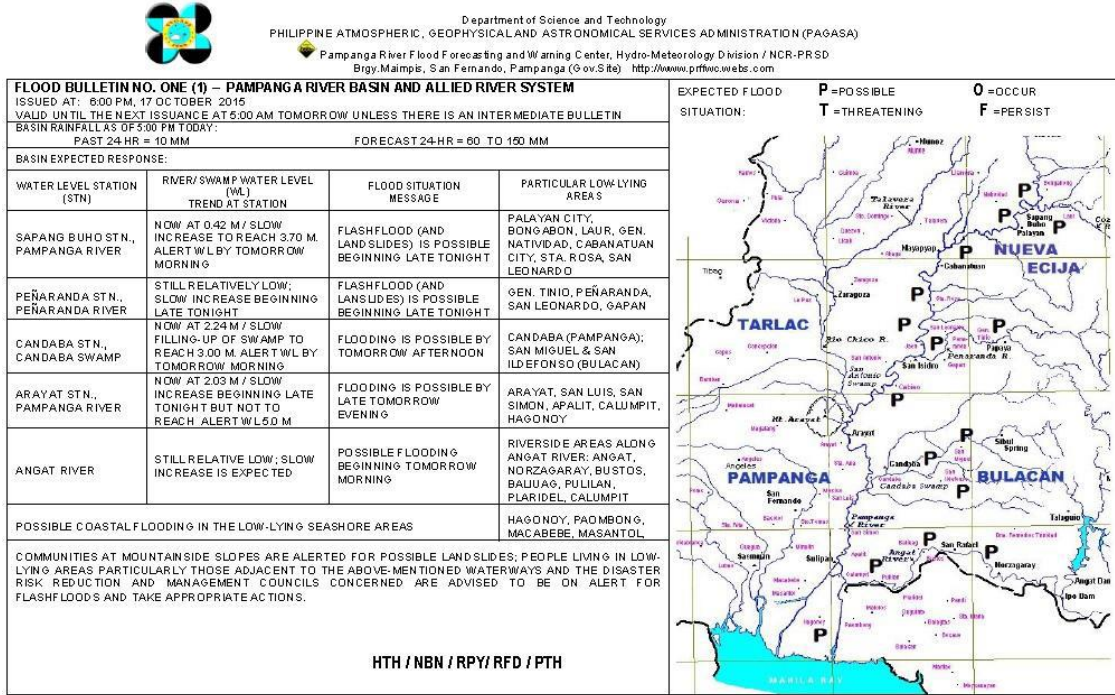
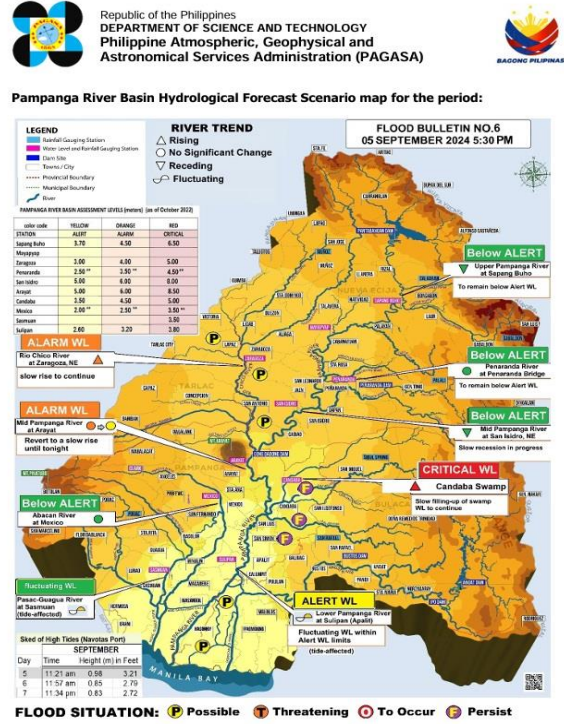
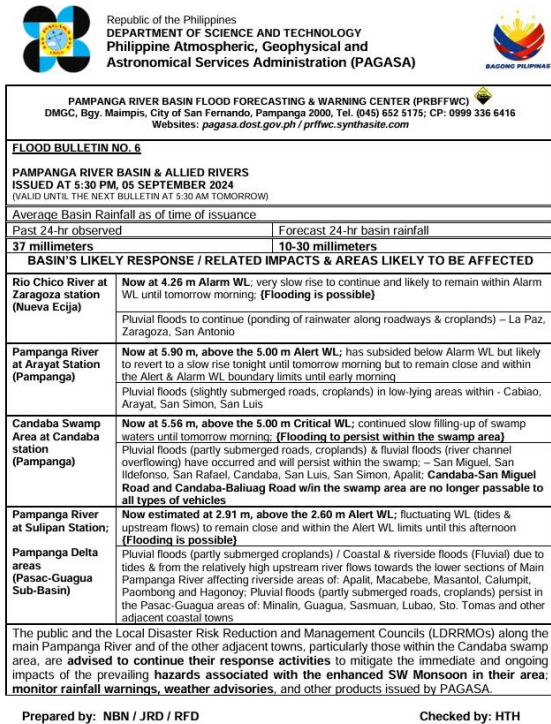
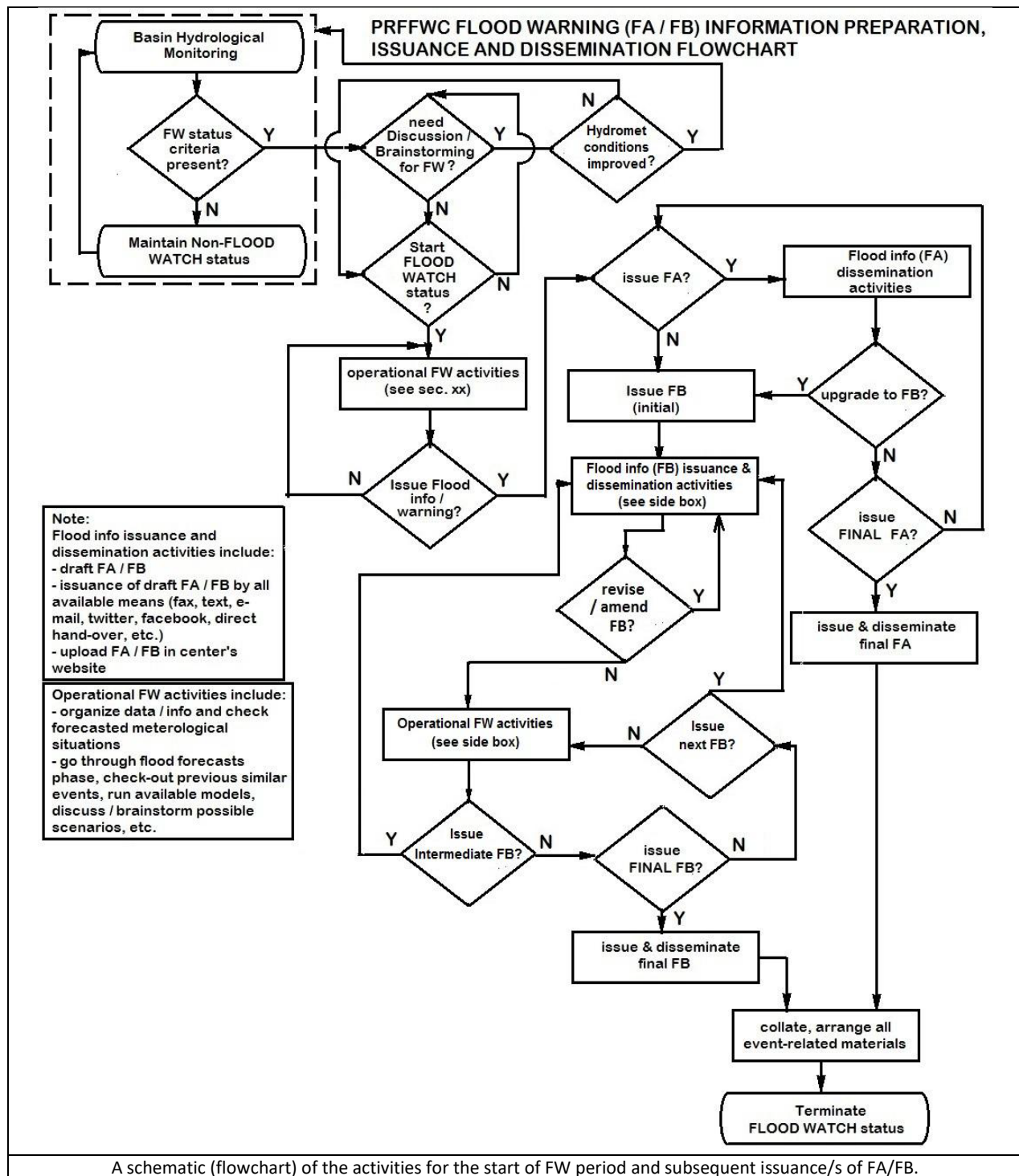


Figure below is the latest format of FB issued during the event TC Enteng (Sept. 2024); Note the differences between the two formats of Flood Bulletins.



6.1 Conditions for the issuance of Flood Advisory (FA)

- When HMD (FFWS) issues GFA for Region 3 area with specific to the following provinces – Aurora, Bataan and/or Zambales, then try to qualify if part of the basin is affected or will be affected otherwise one may opt not to issue an FA;
- A TC coming from the east (Pacific) is (fast) approaching towards the country and it is posed towards Region 3 / CL area (in at least 24 to 48-hour time period) with a big certainty / probability (cone of uncertainty will come close or will cross CL; also check for forecast tracks from other wx agencies such as JMA, JTWC, etc.) that it will cross or pass close to the CL area (always check the TC forecast of the Weather Division’s TC bulletin);
- When TCWS has been issued / raised in any part of the PRB, particularly NE, Pampanga, Bulacan, Tarlac; or other immediate adjacent areas such as Aurora, Bataan, Zambales, Rizal, Quezon, Metro Manila, Nueva Vizcaya, Pangasinan, etc.;
- When there is a need to make people be aware of sudden changes in the river stages particularly a rapid rise or localized river increases that may have impact somehow in the main Pampanga River’s flow or something to that effect within at least 24 hrs.
- When heavy RR warning color-coded information, yellow, orange or red warning has been raised or continuously raised in any of following provinces NE, Pampanga, Tarlac, and Bulacan; or any adjacent provinces such Zambales, Bataan or Aurora;
- SW monsoon affecting the western side of PRB
 - a. for several days and WL at several stream gauging stations are close to their respective alert levels, with trends to reach the respective levels in at least 12-24 hours;
 - b. or a continued slow increase of WL observed in several stream gauging sites for the past 6 hours or more;
- “Gut feeling” or intuitions dictates that something significant in relation to present RR-WL within the basin will occur as per on-going / existing conditions; or model runs suggests a rising trend in WLs (as per model output)
- Or simply there is a need to make people / community be aware of any of the possible situations:
 - c. that there is an existing tropical disturbance;
 - d. possibility of an immediate river flood, particularly flash flood in nature affecting small streams or at mountainside areas;
 - e. landslides and debris flow that may affect mountainside areas / communities;
 - f. a combination of any of the above possible situations.
- ***Remember to always be consistent with statements taking note of the continuity / flow of the possible flood episode.***



6.2 Conditions for the issuance of Flood Bulletin (FB)

- A TC is fast approaching (in at least or less than 24-hour time period) towards the CL area with a high certainty / probability of crossing or will pass closely to PRB (Regular checks of TC bulletins or in particular the TC forecasts);
- A tropical disturbance is close or adjacent of the PRB and a run of the available models have indicated a rise in river WLs;
- A tropical disturbance (TC, Monsoons, etc.) exists and several stream gauging stations are already close to their alert levels; or have surpassed alert levels;

- Continuous rains (light to moderate, moderate to (occasionally) heavy, or 7.5 mm or more for several hours) recorded in many of the RR stations within PRB during the past 12 or more hours with an increasing trend in river stages at most of the stream gauging sites are already being manifested;
- Forecasters' discussions / brainstorming have agreed to issue FB based on the present basin situation;
- Other possible instances:
 - a. When Candaba WL has exceeded 4.5-meter Alarm WL (an FA may have been issued prior to this) and other WL stations are showing an increasing trend above alert levels
 - b. Any station (except Candaba & Zaragoza) has reached respective alert levels
 - c. Almost simultaneous rapid rise of WL at both Sapang Buho, Mayapyap and Peñaranda
 - d. "Gut" feeling or intuitions dictates that something significant in relation to RR-WL within the basin will occur based on pre and on-going basin hydrometeorological conditions

6.3 Conditions for the issuance of Intermediate FB and amended FA/FB

- Intermediate FB is issued when abrupt significant changes in the PRB hydrological conditions have occurred such that there is a need to immediately update or upgrade warning messages / statements; further deterioration of basin conditions are currently occurring and needs to be emphasized and addressed immediately through an intermediate issuance;
- Amended FA/FB is done when there is a need to correct / change statement/s, observed value/s, location, date and time issuance errors, etc.

6.4 When to issue FA/FB, intermediate FB, amended FA/FB

- FA and FB can be initialized at any time of the day (*preferably between 4:00 am to 5:30 pm*). Issuances during night time should be avoided but if PRB conditions are fast deteriorating then never hesitate to issue the said flood information at once.
- FB is issued and updated daily (every 12 hours) at **5:30 am** and **5:30 pm** until the final issuance when PRB conditions warrants the issuance of a final flood info;
- Intermediate FB are normally issued at **11:00 am** or **2:00 pm**, however when basin conditions are significantly deteriorating such that there is a need to inform immediately and make the community be aware of the changes, then an intermediate FB can be issued **at any time deemed appropriate**;
- FA is normally updated on a 12 hr. period except after its initial issuance, i.e. if initial was issued at 8:00 am then the next FA should be issued at 5:30 pm of the same day;
- Amended FA/FB should be issued immediately upon discovery of errors or there is a need to change statement/s etc. from the recently issued FA/FB.
- **Important note: Issuance as to time (e.g. 5:30 am or 5:30p m) should be done with a limited delay of time not exceeding 15 minutes especially for FB! Therefore, whether we like it or not, final draft FB should at least be finished not later than 5:20 am or 5:20 pm or whatever time is indicated in the issuance and should be disseminated immediately afterwards. As much as possible FA and FB should be issued 5-10 minutes before time of indicated issuance of the flood information.**

Issuance of	FA	Frequency (Validity) / Updated	FB	Frequency (Validity) / Updated
Initial	Any time as deemed appropriate (but preferably between 4am to 5pm of the day)	24-hour validity / every 12-hrs updating	Any time as deemed appropriate (but preferably between 4am to 5pm of the day)	Next issuance should be on the next regular issuance unless an intermediate issuance is necessary
Regular	5:30 am or adjusted to follow initial time of issuance after 12-hrs.	Every 12-hrs updating	5:30 am and 5:30 pm	Every 12-hrs updating
Intermediate	Normally not issued but only on crucial situations / cases		Any time as need arises	Valid until next regular issuance
Amended	Any time when necessary / as deemed appropriate		Any time when necessary	Valid until next regular issuance
Final	At the next time of issuance as deemed appropriate	No validity period when issued	At regular issuance time of either 5:30am or 5:30pm	No validity period when issued

Note: There is a plan to issue regular 6-hourly FBs (5am, 11 am, 5pm & 11pm) as a way forward activity.

6.5 When to terminate FA/FB

- If FA was issued for the whole duration of the event – can be terminated at next time of issuance as long as significant RR to cause WL to rise is no longer expected over the basin.
- FB can be terminated once river level stage at almost all stream gauging stations are on a receding trend and satisfying any or combination of the following conditions:
 - a. Water Levels at stream gauging stations are below their respective critical levels and are close to passing below their alarm levels;
 - b. Candaba swamp level, though still above its 5.0-meter critical level has indicated a very slow recession (for at least past 3 to 6 hours already) and significant RR are no longer expected;
 - c. The tropical disturbance has already crossed and exited landmass; a final TC Bulletin, if a TC is being monitored, has been issued by the Weather Division and that improving weather conditions has (already) been stated somehow in the weather forecast information;
 - d. Satellite/radar images shows clearing skies over the whole country, particularly over CL and its surrounding areas, and that all stream gauging stations' WLs are receding and already way below their respective critical levels with the exception of Candaba station (but should have shown a receding trend for the past 6-12 hours);
- A discussion between forecasters arriving at a unified consensus to terminate the FW status through a final issuance of FA/FB regardless of the present PRB WL conditions and with consideration of the above mentioned situations, etc.

6.6 Other Possibilities / actions to consider

- FA issuance can be decided by shift duty personnel (if alone) and / or discuss / brainstorm with other center personnel when confronted with such situation;
- Decision to go into a FW status should be relayed to other center personnel in case a single person is on shift duty;
- FA can be issued prior to an FB;
- FA can be issued daily for several days as per basin condition and may not readily require an upgrade to FB;
- FB can be issued immediately even without going through the issuance of an initial FA;
- FB can (still) be issued even if only one WL station is in critical level and flooding is imminent;
- An intervening (intermediate) FB is issued when the rainfall (intensity and / or coverage) forecasted within the validity period of the issued FB was underestimated and a significant change is likely to occur; no need for an intermediate if overestimated;
- Consider observed data from AWS (automatic weather station) e.g., wind direction, pressure, temperature, etc., for incorporation in the analyses of your FB (there is no AWS at the center at the moment)
- ***Consider effects of high tide in the formulation of FB especially when this will coincide with the arrival of the flood wave at the downstream sections;***
- ***A final FA/FB has no validity period;***
- The shift duty, in times of emerging and imminent sudden flood situations, can decide whether to issue FB as per existing conditions within and around the PRB.

6.7 Checklist for FA & FB Document before dissemination / some TIPS:

Items that need to be checked while preparing and before disseminating FA and FB:

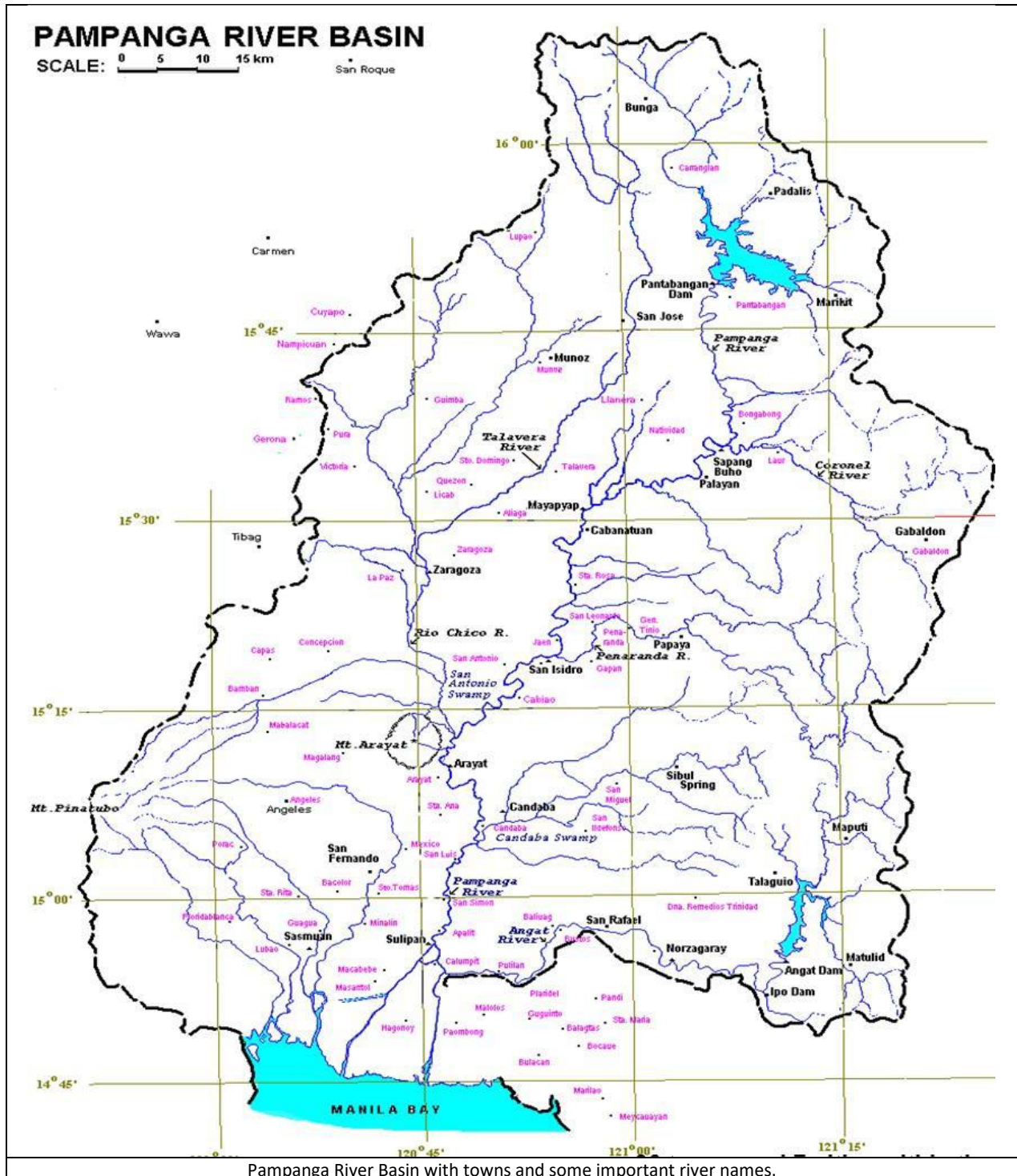
- Check river basin name;
- Check Flood Advisory or Bulletin number (important), etc.
- Check appropriate issuance time, specifically A.M. or P.M., and the Date/s; note if issuance (for amendment or intermediate) is exactly on 12 noon, make sure that your time should be in the order of say: 12:01 PM or 11:59 AM or 12:00 NOON whichever is appropriate or more convenient.
- Check for issuance validity period, specifically A.M. or P.M. / TODAY OR TOMORROW;
- Check spelling, tenses; and typo errors;
 - **FA / FB BODY Proper:**
- Previous rainfall occurrence in the basin (optional);
- Forecasted rainfall (note that if it's a final FA or FB, **value should be relatively lesser than the past observed rainfall**);
- Check the river names
- Check for appropriate flood status (OUTLOOK, ALERT, ALARM, AND CRITICAL LEVELS);
- Check for the affected places names... towns, province, etc., note that towns should correspond properly with the river adjacent to it (refer to map and if ever the town is adjacent, check whether there are flood mitigating structures that are protecting said town/s);
- Check for appropriate actions to be undertaken (ADVISED, STILL ADVISED, STRONGLY ADVISED, etc.) and note when you need to use them (e.g. if the message is "flooding to occur" then "strongly advised" should be used; if final flood info is issued better use "still advised")
- Forecaster's initials (check for appropriate initials as per duty schedule)

- Check for consistencies in RR in the final issuance – **forecast RR should be lower than previous RR** (see number 7) to effect a final issuance of FA / FB;
- When describing river regime, avoid a statement of a decreasing or falling stage without going through a peak or level-off from the previous bulletin. The sequence should be rising / increasing then “to peak” or “to level-off” or “has peaked” (if it has occurred already before issuance of next FB), and finally receding / decreasing. **BE CONSISTENT!**
- Never put “no significant increase in river stage” if you’re going to mention DRRMCs are advised to be on alert... or something to that effect.
- Whenever possible, avoid the use of the word “**EXPECTED**” in the flood information in FA and FB. It is better to say what is to be expected outright (e.g. rather than “flooding is expected” better say “flooding will occur starting tonight”, etc.)
- Always bear in mind the FB statements on WL trending and RR consistencies; no abrupt changes otherwise issue an intermediate bulletin if WL trend is rising. (e.g. when you mentioned “slowly rising” in the previous bulletin for a certain station, it should go into a “peak” or a “level-off” statement before a statement of “slow recession”) – (see number 14)
- In some special cases, you can improvise / change the format in the FA or FB to go well with the appropriate situation of the basin.
- When in doubt always have a second opinion and / or discussion / brainstorming with other center personnel
- ***It is always better to check the final draft before printing rather than going into the issuance of an amended FA or FB.***

7. Validating flood forecast information

Set of standard levels used in Flood Forecasting as basis for forecast efficiency:

Time		Magnitude (river flood stage)	
For peak / critical WL difference	% accuracy	For peak / critical WL difference	% accuracy
0	100 %	0	100 %
+/- 3 hours	95 %	+/- (1 - 10 cm)	95 %
+/- 6 hours	90 %	+/- (11 - 20 cm)	90 %
+/- 9 hours	85 %	+/- (21 - 30 cm)	85 %
+/- 12 hours	80 %	+/- (31 - 40 cm)	80 %
		+/- (41 – 50 cm)	75 %

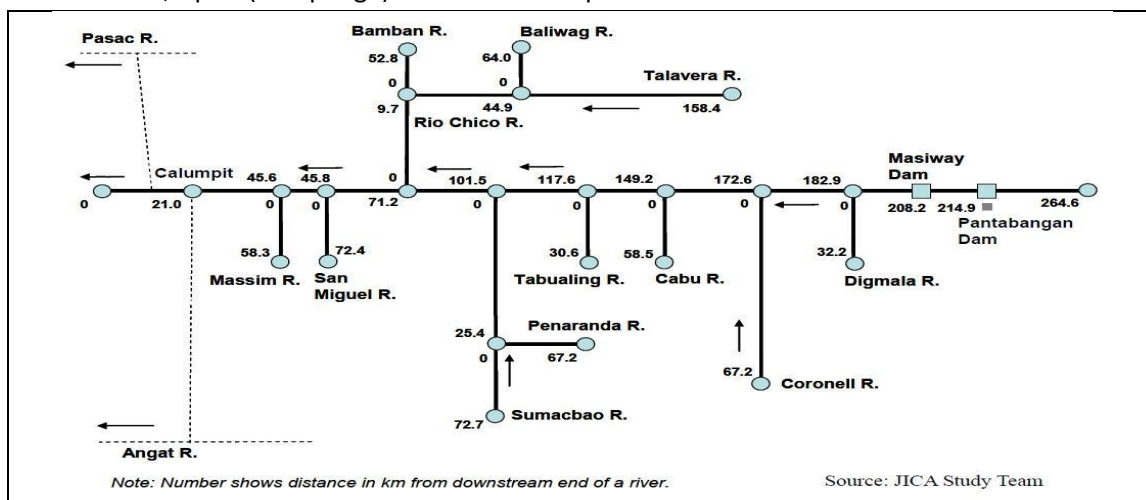


8. River sections and area covered

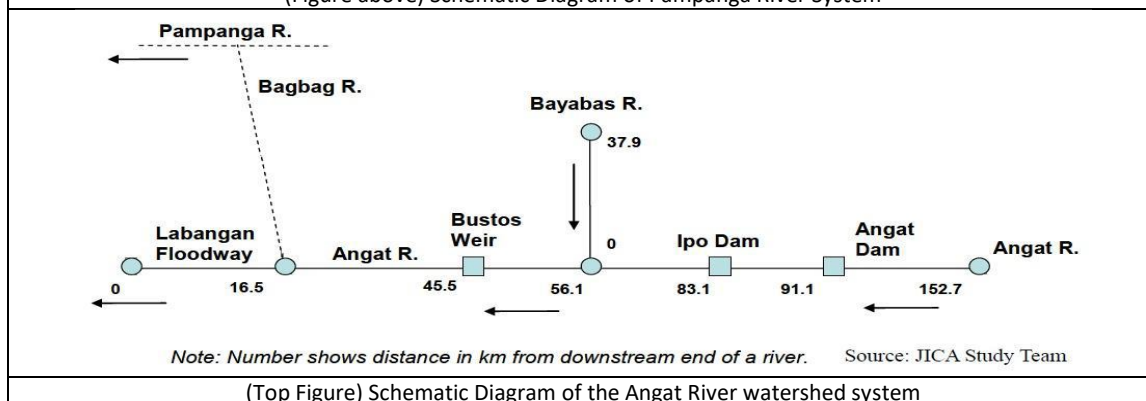
- Upper main Pampanga River:
 - includes the tributaries of Coronel-Santor Rivers (Gabaldon, Laur and Palayan City);
 - Digmala River (Bongabon and Palayan City), Nabao, Cabu and Murcon Rivers (Palayan and Cabanatuan Cities);
 - From the East flowing towards Main Pampanga River are Minatula River (between Cabanatuan City and Sta. Rosa) and Tabuating River (between Sta. Rosa and San Leonardo); Peñaranda River (Gen, Tinio, Peñaranda, San Leonardo and Gapan City) and a lot of other small streams.

- Western / Northwest side of the basin:
 - Talavera (San Jose City, Talavera, Sto. Domingo, Quezon, Aliaga, Zaragoza)
 - Ilog de Baliwag (Muñoz, Licab)
 - Benatuan River (Guimba, Victoria, Licab)
 - Bamban River: Tarlac area – Bamban, Capas (partly), Concepcion (partly Magalang, Pampanga), La Paz and partly Tarlac city
 - Rio Chico River: Covers the towns along these rivers such as Muñoz, Talavera, Quezon, Licab, Guimba, Aliaga, Sto. Domingo, Zaragoza; Tarlac area – La Paz
 - San Antonio swamp (about 100 km² area)
- Middle main Pampanga River:
 - Referring to the towns of Jaen, San Isidro, San Antonio, Cabiao (all in Nueva Ecija), Arayat, Candaba, San Luis, and San Simon (all in Pampanga) **NOTE: DO NOT INCLUDE STA. ANA** town as this is protected by the Set-Back Levee and falls in the Pasac-Guagua Sub-basin side.
- Lower main Pampanga River:
 - Referring to towns within the Pampanga Delta area in PRB: Apalit, Macabebe, and Masantol (Pampanga); Calumpit, partly Malolos, Hagonoy, and Paombong (Bulacan)

Candaba swamp is situated in the plains just downstream of Mount Arayat (est. elev. 1,075 meters) on the left bank of the Pampanga River channel. it encompasses the areas, either partly or wholly, the towns of San Miguel (lower part), San Ildefonso, Pulilan, Baliuag, Calumpit and Plaridel (Bulacan), Cabiao (Nueva Ecija), Candaba (whole area), San Luis, San Simon, Apalit(Pampanga). Candaba swamp area: about 220 km².



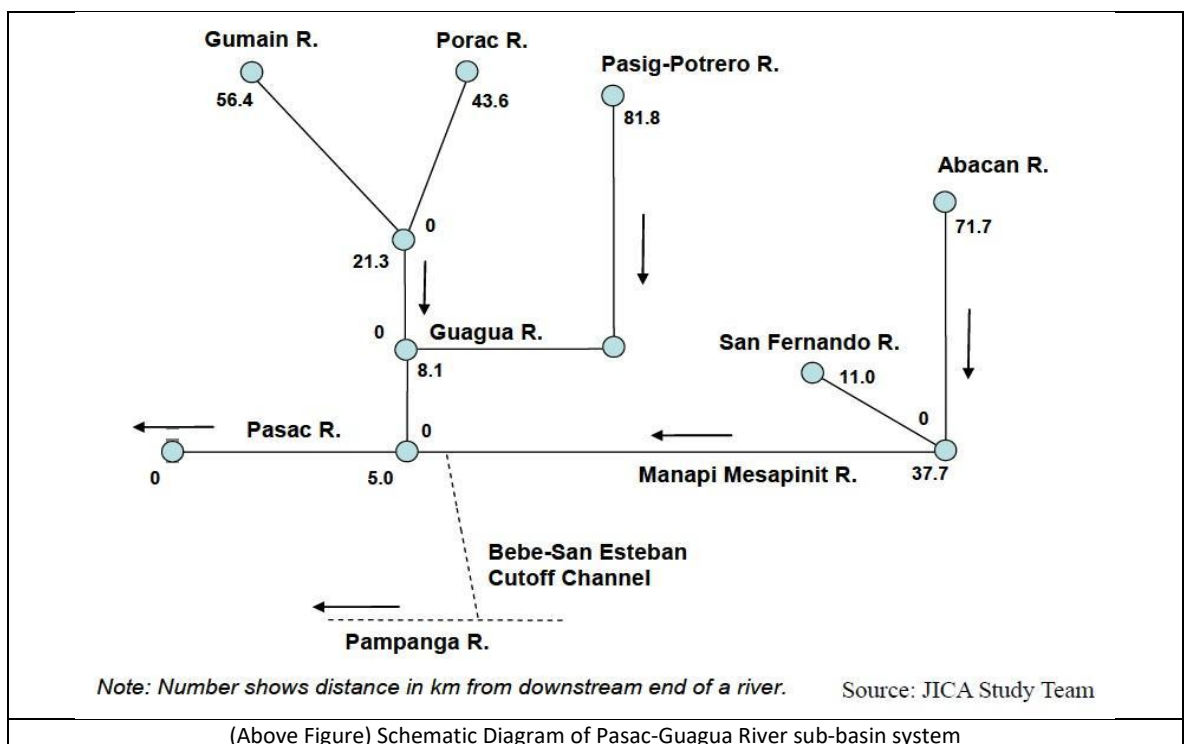
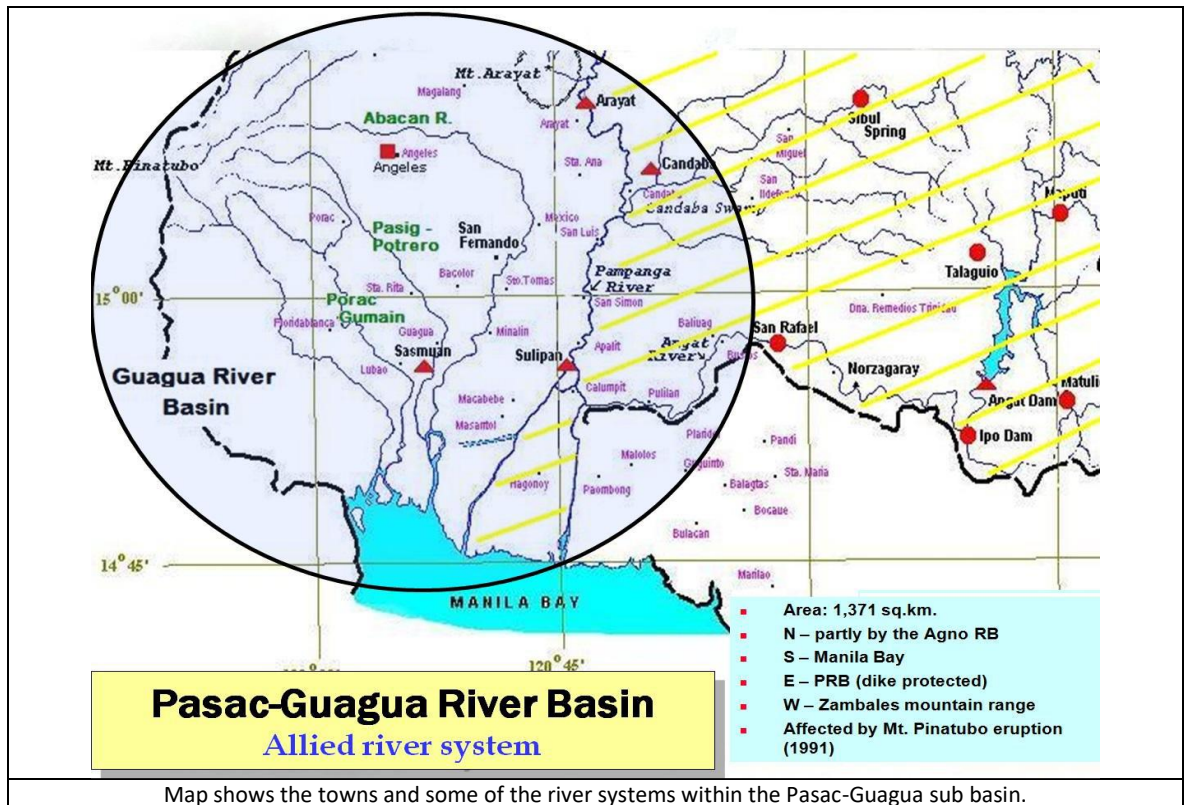
(Figure above) Schematic Diagram of Pampanga River System



(Top Figure) Schematic Diagram of the Angat River watershed system

- Angat River system: Norzagaray, Angat, Bustos, Baliuag, San Rafael, Pulilan, Plaridel, Calumpit, Hagonoy, and Paombong (Labangan Channel)

- Pasac-Guagua River system includes:
 - Abacan River: Angeles, Mexico, Sto. Tomas, Minalin, San Fernando
 - Pasig-Potrero: Sta. Rita, Bacolor, Guagua, Sasmuan
 - Porac-Gumain: Porac, Floridablanca, Guagua, Lubao, Sasmuan
 - Other areas affected mainly by ponding: Sta. Ana, Magalang, San Simon (Sub-Basin E & NNW sides)



9. (Initial) River systems / Areas in the FA or FB document

- **Condition 1: a TC coming from the east of the basin; eastern part of the basin will be affected**
 - Upper Main Pampanga River
 - Coronel River or Coronel-Santor River - Gabaldon, Laur and Palayan City
 - Digmala River - Bongabon and Palayan City
 - Cabu Creek - Palayan City and Cabanatuan City
 - Minatula and Tabuating Rivers - Sta. Rosa and San Leonardo
 - Peñaranda River (Sumacbao and Chico Rivers) – Gen Tinio, Peñaranda, San Leonardo, Gapan)
 - San Miguel, Bulu, Garlang, Madlum and Maasim Rivers – San Miguel, San Ildefonso, Candaba swamp area)
 - Angat River - Directly for riverside Barangays of Norzagaray, Angat, Bustos, Baliwag, San Rafael, Plaridel, Pulilan; indirectly for Calumpit, Paombong and Hagonoy
- **Condition 2: a tropical disturbance is affecting / will affect the east - southeast part of the basin**
 - Peñaranda River (Sumacbao and Chico Rivers) – Gen Tinio, Peñaranda, San Leonardo, Gapan)
 - San Miguel, Bulu, Garlang, and Maasim Rivers – San Miguel, San Ildefonso, Candaba swamp area)
 - Candaba swamp area - Candaba, San Luis, San Simon, Pulilan and Calumpit
 - Angat River - Directly for riverside Barangays of Norzagaray, Angat, Bustos, Baliwag, San Rafael, Plaridel and Pulilan; indirectly for Calumpit, Paombong and Hagonoy
 - Middle and lower Main Pampanga River
- **Condition 3: SW Monsoon affecting the west / southwest part of the basin**
 - Rio Chico River (Ilog de Baliwag, Benatuan River) – Guimba, Licab, La Paz, Zaragoza
 - Bamban River – Bamban, Concepcion, San Antonio
 - Middle Main Pampanga River - San Isidro, Jaen, San Antonio, Cabiao, Arayat, Candaba, San Luis, San Simon, Apalit
 - Lower Main Pampanga River – Apalit, Calumpit, Pulilan, Hagonoy, Paombong, Macabebe, Masantol
 - Pasac-Guagua River system (Abacan, Porac-Gumain and Pasig-Potrero Rivers) – Angeles, Mexico, Sta. Ana, San Fernando, Bacolor, Minalin, Floridablanca, Sta. Rita, Guagua, Lubao, Sasmuan
- **Condition 4: a tropical disturbance affecting / will affect the northwest part of the basin**
 - Rio Chico River (Ilog Baliwag, Benatuan and Talavera Rivers)
 - Middle Main Pampanga River

10. Estimated Lead time / other forecasting issues

An important aspect in working-out forecast, aside from running available models using estimated input rainfall/rainfall intensities, is having an idea of the flood travel time/s between stream gauging stations. ***However, flood travel time will vary from event to event depending on the present / occurring hydrological condition/s – spatial and temporal distribution of rainfall and the existing or instantaneous river status at that period and previous river episodes.***

A. Angat Dam Flood Propagation Time (Angat Dam to the following stations)

Location	Distance from Dam	Propagation Time (est.)	Remarks
Padling		2 hrs. 16 mins. (2.2 hrs)	Norzagaray
Matictic	28 kms	2 hrs. 30 mins. (2.5 hrs)	Norzagaray
Angat		3 hrs. 14 mins. (3.2 hrs)	
Binagbag		3 hrs. 44 mins. (3.7 hrs)	Angat
Maronquillo		4 hrs. 14 mins. (4.2 hrs)	Angat
Donacion		4 hrs. 49 mins. (4.8 hrs)	Angat
San Rafael		5 hrs. 14 mins. (5.2 hrs)	
Bustos	46 kms	5 hrs. 40 mins. (5.7 hrs)	
Sabang		5 hrs. 53 mins. (5.9 hrs)	
Baliuag		6 hrs. 5 mins. (6.1 hrs)	
Sta. Barbara		6 hrs. 27 mins. (6.4 hrs)	Baliuag
Bintog		7 hrs. 12 mins. (7.2 hrs)	Plaride
Plaridel	62 kms	8 hrs. 20 mins. (8.3 hrs)	
Pulilan		8 hrs. 47 mins. (8.8 hrs)	
Tibag		9 hrs.	Angat R. NLEX bridge

B. Pantabangan Dam Flood Propagation Time (from spillway of Masiway Re-Regulating Dam down to critical flood-prone areas)

Location	Distance from Dam	Propagation Time (est.)	Remarks
Rizal	11.0 kms	2 hrs. 42 mins. (2.7 hrs)	
Sapang Buho	33.2 kms	5 hrs. 12 mins. (5.2 hrs)	Palayan City
Cabanatuan City	70.0 kms	7 hrs. 12 mins. (7.2 hrs)	
Sta. Rosa	82.0 kms	9 hrs. 6 mins. (9.1 hrs)	
San Isidro	101.98 kms	10 hrs. 6 mins. (10.1 hrs)	

C. PRB Flood Travel Time during Ty. Pedring (October 2011) * and Ty. Lando (October 2015) **

System	From	To	Distance (kms)	Travel Time (hrs.)*	Travel Time (hrs.)**	Other events
Pampanga River System	Masiway Dam	Sapang Buho	36.0	2.0 to 3.0		
	Sapang Buho	Mayapyap	33.5	5.0 to 6.0		
	Sapang Buho	San Isidro	71.5		14	10-12 hrs
	Mayapyap	San Isidro	38.0	9.0		
	Peñaranda	San Isidro	23.0	12.0	9.5 to 10	6-8 hrs
	San Isidro	Cabiao Floodway	23.0	5.0		
	Cabiao Floodway	Arayat	10.5	4.0		
	Arayat	Candaba Viaduct	21.0	6.0		
	Candaba Viaduct	Sulipan	1.0	48.0 (too long)	Between 16 to 24 hrs	
Coronel River	Coronel up	Sapang Buho	23.0	1.0		
Cabiao Floodway	Cabiao Floodway	Candaba area	14.0	6.0		
Angat River System	Ipo Dam	Bustos Dam	37.3	4.0		
	Bustos Dam	Angat-Bagbag Confluence	28.6	5.0		

The overall flood lag time of Pampanga River from upstream point to its downstream point (at the mouth) ranges from about 1.5 to 2 days in general.

Note: Flood Time from Ty. "Pedring" was based on the JICA-NK project completion report "The Strengthening of Flood Forecasting & Warning System for Dam Operations: Volume 1 Main Report, November 2012.

D. Some notes to consider on flood issues within the basin

Area / Place	Situations	Remarks
Cabiao Floodway	Pampanga R. to overflow the floodway at an estimated Arayat telemetry reading between 8.3 - 8.9 m. (est)	Should be validated on a regular basis (during flood events)
Bgy. Candating (Arayat)	Flooding starts to affect riverside areas (outside the Arayat-Cabiao ring levee at around 8.0 – 8.6 m. (est) Arayat telemetry reading	Should be validated on a regular basis (during flood events)
Candaba station	Candaba telemetry reading of about 5.0 m (est), bridge adjacent to the station is already almost at level with floodwaters	At 5.3 m, Candaba-San Miguel Road in Paralaya (Dukma) & Candaba-Baliuag Road in Bgy. San Agustin are already submerged in floodwaters
Bgy. Buas, Candaba	Riverside areas at this barangay gets flooded at Arayat telemetry reading of 8.5 – 8.7 m (est)	For validation
Bgy. San Agustin, Candaba	Flooding at the area starts at around 5.0 – 5.2 m (est) Candaba telemetry reading	Should be validated on a regular basis (during flood events)
Bgy. Bulusan – Bgy. Sta. Lucia	Pampanga River overflows over a portion of the Calumpit-Hagonoy road along Bgy. Bulusan-Bgy Sta. Lucia in Calumpit at a telemetry reading between 3.15 to 3.30 meters (est) at Sulipan telemetry station	Possible adjustment of assessment levels – Critical to 3.3 m. for Calumpit area
Arayat affected by Zaragoza (Rio Chico flow)	WL at Arayat gets to recede very slowly (almost steady) with a Zaragoza telemetry reading maintaining at 2.5 – 3.0 m (est) (take note of the Karen-Lawin event – Oct 2016)	
Sulipan station	Base of the station housing started to get flooded at a telemetry and / or S.G. reading of more than 3.2 m. (est)	
Calumpit-Hagonoy Road at Bgy. Bulusan - Calizon	Overflow on the said road when Sulipan station reach a reading (Tel or S.G.) of 3.10 to 3.2 m. (est)	

E. Estimated Rainfall reaction time to succeeding downstream station

Rainfall Station	Reacting WL station	Estimated Response Time	Notes / Updates
Gabaldon	Sapang Buho	around 7 hrs.	For validation
Palali	Peñaranda	around 5 hrs.	4 to 5 hrs.
Calaanan	Sapang Buho	around 8 hrs.	For validation
Sapang Buho	Cabanatuan area		
Muñoz	Zaragoza	10 to 15 hours (?)	For validation
Sibul Spring	Candaba	10 hours (?)	For validation
San Rafael	Sulipan		
Porac	Sasmuan (?)		
Mexico	San Fernando area		

Note: Reaction time may vary from flood event to event; the abovementioned times are for guidance only; further validation should be made for such estimates.

FLOOD MITIGATION EFFECTS OF CANDABA SWAMP

Past Floods

Maximum flood discharge in the Pampanga River Basin from the beginning of flow discharge observations in 1960 occurred with the May 1976 monsoon related flood. The remarkable floods in the last decade occurred in Oct. 1993 and Oct. 1998, each of which related to typhoons. These floods were observed at two points Arayat and Sulipan.

TABLE-1 Features of Past Floods in Pampanga River

Flood		May 1976	Oct. 1993	Oct. 1998
Catchment Area (km ²)	Arayat	5,642	5,642	5,642
	Sulipan	7,121	7,121	7,121
Peak Discharge (m ³ /s)	Arayat	2,780	3,300	2,747
	Sulipan	2,490	1,992	1,530
Flood Frequency (year)	Arayat	10	15	10
	Sulipan	15	10	5
Duration of Precipitation (hr)	Arayat	150	104	63
	Sulipan	187	104	64
Lead Time (hr)	Arayat	67	42	43
	Sulipan	105	88	81
Precipitation Depth (mm)	Arayat	685.1	355.7	277.3
	Sulipan	705.3	339.6	268.4
Run-off Depth (mm)	Arayat	394.9	282.2	223.7
	Sulipan	320.7	114.5	72.6
Run-off Ratio	Arayat	0.576	0.793	0.807

TABLE-1 shows lead time of May 1976 flood was longer than that of Oct. 1993 flood and of Oct. 1998 flood and Run-off Ratio of May 1976 was smaller than that of Oct. 1993 flood and of Oct. 1998 flood. From the field survey result and hydrological data, the causes of which are as follow:

- 1) Duration of precipitation of May 1976 flood was longer than that of Oct. 1993 flood and of Oct. 1998 flood by typhoon since May 1976 flood was caused by monsoon rainfall.
- 2) Diversion discharge from Flood Way located in upstream of Arayat to the Candaba Swamp reduced since discharge capacity of the Flood Way have been declined, due to sedimentation.
- 3) Water retention capacity in upper and middle basin areas have deteriorated due to mountain devastation in upper basin and agricultural development in middle basin.
- 4) Soil saturation in watershed of May 1976 flood is lower than that of Oct. 1993 flood and of Oct. 1998 flood since May 1976 flood occurred on the early days of rainy season. In contrast, Oct. 1993 flood and Oct. 1998 flood occurred on the last days of rainy season.

Reference: Flood Mitigation Effects and Sedimentation Function of Candaba Swamp within Pampanga River Basin in the Republic of the Philippines by N. Yamashita, et.al. (Nov. 2005)

11. Various Station situations during flood events in pictures



Sapang Buho station with arrow (background) pointing to the estimated extent of floodwaters at 8.08 m. telemetry reading.



View of Gen. Luna Bridge (Mayapyap station) in Cabanatuan; Sapang Buho peaked at 6.84 m. telemetry reading during that event – effects of Ty. Nona (Dec2015)



Downstream, RB view (station side) of the Pampanga River at San Isidro station at a S.G. reading of 7.4 meters (estimated)



The LB side of Pampanga River at San Isidro station (S.G. of 7.4 m.); houses on this side are already halfway submerged.



Flooded road leading to the Poblacion area of Jaen Municipality at a San Isidro S.G. reading of 7.4 meters (estimated)



Rio Chico River at Zaragoza station at a S.G. reading of 3.9 meters (estimated); Still no flooded areas yet.



Downstream view of the Pampanga River at Arayat station at a S.G. reading of around 9.1 meters (estimated); Bgy. Candating on the LB of the river starts to get flooded at around 8.3-8.5 meters reading.



Upstream view of the Pampanga River at Arayat station at a S.G. reading of 9.62 meters (estimated); on the right side of the picture (LB side of the river) is the old telemetry station.



The Cabiao Floodway situation at an Arayat S.G. reading of 9.6 meters (estimated); Cabiao Floodway gets overflowed at an estimated Arayat S.G. reading of 8.6-8.8 meters (still for validation).



Downstream view of the Cong Dadong Irrigation Dam at Arayat S.G. reading of almost 10.0 meters (estimated)



The bridge adjacent to the Candaba station at 4.20 meters' telemetry reading. Note that at around 5.0 meters water is almost above the bridge's floor



The road along Candaba station at a telemetry reading of 5.62 meters.



Bgy. San Agustin, Candaba at a station S.G. reading of 5.62 meters; area gets flooded starting at around 5-5.20 m. (estimated)



Mexico Station at 0.90 S.G. reading

Mexico station: River has already overflowed the old bridge's floor at upstream of the station at a telemetry reading of 0.90 m.



Sulipan station: Basketball court beside the station with flood level height at a station's S.G. reading of 4.5 m (estimated)



Flooding at lower Candaba area along NLEX-Viaduct at a Candaba telemetry reading of 7.07 m & Sulipan telemetry reading of 4.19 m (or S.G. reading of 4.33 m., estimated); Candaba had already peaked 5-6 hrs before & higher by 0.06 meters only.



Pampanga River at NLEX-Apalit Bridge; Sulipan S.G. reading at 2.25 meters (estimated); Boat ferry landing platform starts to get flooded between S.G. of 2.65-2.85 meters (estimated) at Sulipan stn.



Pampanga River overflows over a portion of the Calumpit-Hagonoy road along Bgy. Bulusan-Bgy Sta. Lucia in Calumpit at a telemetry reading between 3.15 to 3.30 meters (estimated) at Sulipan telemetry station



The Sulipan RR-WL telemetry station which was already surrounded by floodwaters at around 1300H of July 31, 2023, TC Egay-Falcon event (photo taken by Ms. W. Flores)



flooded Candaba - San Miguel Road taken on Aug 04, 2023 (TC Egay-Falcon event) (photo provided by Candaba MDRRMO)



Candaba - San Miguel Road showing the NE approach (San Miguel side) of the bridge still submerged by floodwaters; August 04, 2023 (photos courtesy of Candaba MDRRMO)

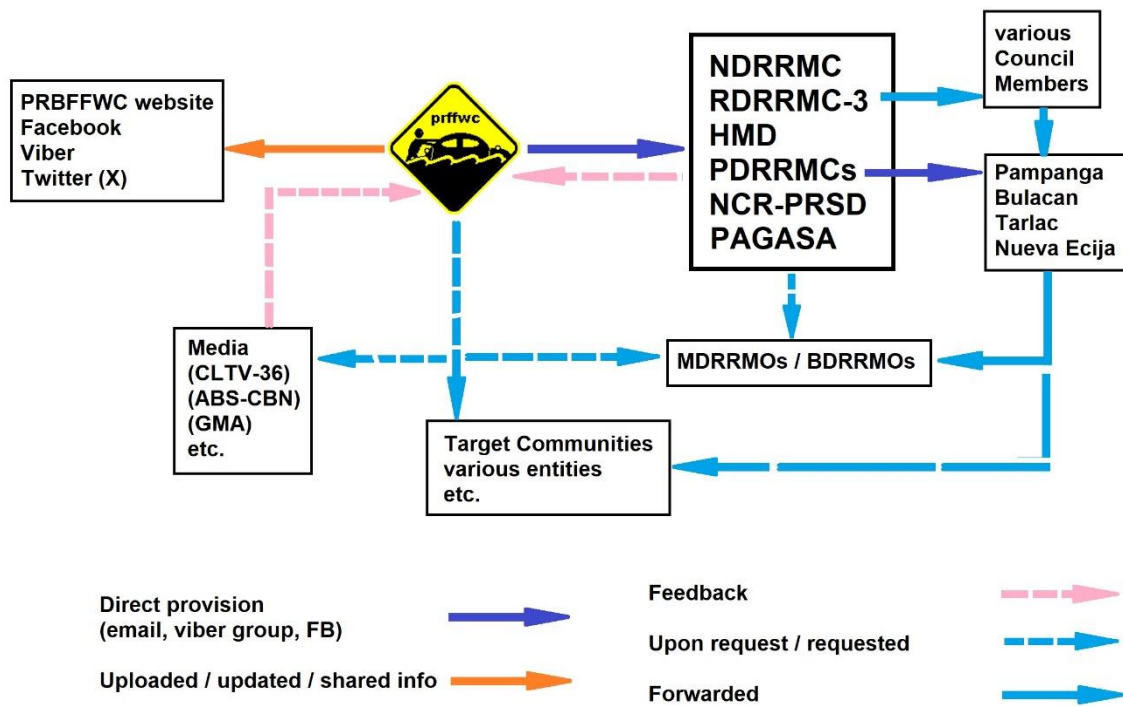
12. Downtime (D/T) / System breakdown / Emergency situations / etc.

Issuance of flood information, e.g. FA and FB, are highly dependent on the availability of data received mainly from the monitoring stations as well as from other sources. D/T or breakdown of monitoring system cannot be avoided totally. A back-up system or a contingency action plan should be on hand in the event of a worst case scenario such as either system breakdown or data transmission D/T. The following immediate activities should be carried-out during unexpected system downtimes:

- *Report the problem immediately to HMD-HMTS as they may be able to immediately resolve the problem. (call HMTSS, or use VOIP if it is still functioning) – you may course info first to NCR-PRSD (info for WSC) for possible follow-up action to HMD;*
- Immediate dispatch (at the soonest possible time) of the center’s service vehicle to the following stations for manual observation of water level:
 - Mexico station for Pasac-Guagua river sub-basin
 - Candaba station for Candaba swamp area
 - Arayat & Sulipan stations for Lower Main Pampanga River
 - Check on Cabiao Floodway for possible overflow
 - San Isidro station for Middle Main Pampanga River
- When necessary, the service vehicle should continue roving around the abovementioned stations from time-to-time and if possible at other stations for continuous feed of info / data.
- Call PAGASA Synop stations and other DRRM agencies with monitoring equipment for RR (rain gauge) and within PRB; note that the list is up to September 2024 as per available present link but contact number may significantly change without prior notice:
 - Muñoz Synop station: 0910 825 0266 (CMO Roger Manuel)
 - Clark Synop: (045) 5992888 loc. 612 (?); 0917 177 3335 (CMO Rizza Gerente)
 - San Idefonso Synop: 0908 596 7687 (Justin (?))
 - Hda. Luisita Agromet: 0921 405 9983 (CMO Eufronio Garcia, Jr.)
 - Sulipan Telemetry: 0981 463 9919 (?) (Daniel Flores)
 - Bulacan PDRRMO: (044) 7949853; 0923 849 3012 (Raul Agustin)
 - NE PDRRMO: 0916 775 3788 (Michael Calma) (can be qualitative information as to RR generally in the area)
 - Pampanga PDRRMO: 0916 779 0021 (Francis Alingcastre)
 - Tarlac PDRRMO: 0916 492 5545 (?) (Marvin Guiang)
 - Possible other sources . . .
- For PAGASA synop stations, in case a failure of cell phone communication, please call Arman Griarte for updated link with stations within the PRB (0919 575 0768)
- Call other possible MDRRMO links at upstream areas that can provide qualitative / descriptive info as to river levels, rainfall conditions, etc. (see possible list below)

Note: the above contact persons should be updated if there are changes in their present DRRMO center; contact names / numbers are only good as to the suggested date corresponding to their names

13. Protocol on flood info dissemination



Above is the schematic flow diagram of flood information dissemination as of September 2024.

The dissemination protocol starts with the immediate provision of FA or FB mainly by e-mail and / or through Viber groups / FB accounts as follows (updated as of September 2024); Below are some of the immediate and available contact details of flood info stakeholders:

Recipient	Tel / Fax / CP / VOIP (as of July 2015)	E-mail	Notes / Updates
NDRRMC Main office		ndrrmoc@ocd.gov.ph	
RDRRMC-3 / OCD-3	(045) 4550033 / 4551526 (?)	r3.rdrmmc.ocd@gmail.com	
HMD / FFWS	VOIP Fax 1097, 1098, 1099	hmd.ffws@gmail.com	VOIP if Fax is available
NCR-PRSD	(632) 4331456 (?)	ncrprsd.pagasa@gmail.com	
NE PDRRMO	(044) 9405760 / 6004739 (?)	pdrmonuevaecija@gmail.com	
Pampanga PDRRMO	(045) 4353211 / 4550278 (?)	pdrmo_pampanga@yahoo.com	
Bulacan PDRRMO	(044) 7499853 / 7910853 (?)	bulacan_rescue@yahoo.com	
Tarlac PDRRMO	(045) 6280586 (?)	pdrmmctarlac@yahoo.com	
DILG-3	(045) 4553208 (?)	med.dilgr3@gmail.com / dilgr3.med@gmail.com	
Guagua MDRRMO		r3.pam.mdrmm.guagua@gmail.com	
MGB-3	09278788805 (c/o Noel Lacadin)	mgbr3_geology@yahoo.com.ph	
Cabanatuan CDRRMO	09165165827 (Guilliene Garcia)	cabanatuandrrmc@yahoo.com.ph	
PIA-3	(045) 9632175 (?)	piacentralluzon@gmail.com / carlodatu@gmail.com	
Calumpit MDRRMC	09179617475 (JP Adriano)	mdrrmc_calumpit@yahoo.com.ph	

Inquirer (Tonette Orejas)	09175109425	tonetteorejas@yahoo.com	
DSWD-3		dmciu.fo3@dswd.gov.ph / fo3@dswd.gov.ph	
CSF CDRRMO		cdrmo.csfp@gmail.com	
Sta. Rosa DRRMO		lgu.starosa@yahoo.com	
San Leonardo	09502868164 (Edhel Talplacido)	sanleonardodrrmo@gmail.com	
Palayan DRRMO	09291802214 (Bong Hilado)	bhilado1968@yahoo.com / r3.ne.cdrrm.palayan.official@gmail.com	
Bongabon MDRRMO	09431336755 (John Ryan Ong)	drmobongabon@gmail.com / jryanong27@yahoo.com	
Pantabangan FFWSDO		panta_iffwsdo@yahoo.com	
Norzagaray MDRRMC		norzagarayrescue2015@gmail.com	
DOH-3 (HEMS)		hems_chd3@yahoo.com	
San Simon MDRRMO	09088958632 (Angelica Quiambao)	r3.pam.mdrmm.sansimon@gmail.com	
Gabalton MDRRMO	09482365257 (El Cielo Jintalan)	gabaldonmdrrmo@yahoo.com	
Macabebe MDRRMO	09178822375 (Jomel Cruz)	macabebe1575@yahoo.com.ph / mpdcmacabebe@yahoo.com	
Malolos CDRRMC	09324224002 (Pia San Pedro)	cityofmalolos.drrmo@gmail.com	
San Luis MDRRMO	09489938163 (Robert Sagum)	r3.pam.mdrmm.sanluis@gmail.com	
Candaba MDRRMO	09151106306 (Galen Gumabon)	r3.pam.mdrmm.candaba@gmail.com	
Zaragoza MDRRMO	09059742731 (Joseph Pingol)	ldrrmozaragoza@gmail.com	
San Miguel MDRRMO	09178736659 (Den Pablo_)	sanmiguel.mdrmmo2016@gmail.com	
Angeles City DRRMO	09321211489 (Gerry Calimoso)	acdrrmo@yahoo.com.ph	
San Idefonso MDRRMO	09334405960 (Jet Guzman)	drmmo_si@yahoo.com	
Cabiao MDRRMO	09230855294 (Dina Parungao)	mdrrmo_cabiao_09@yahoo.com	
Hagonoy MDRRMO	09225056990 (Rene Crisostomo)		
Apalit MDRRMO	09175101071 (Cesar Carlos)	cesarcarlos135@gmail.com	
Masantol MDRRMO	09061893021 (Paul Vincent Magat)	r3.pam.mdrmm.masantol@gmail.com	
Arayat MDRRMO	09988693927 (Jeffrey Venzon)	r3.pam.mdrmm.arayat@gmail.com	
Gen Tinio MDRRMO	09061148760 (Fe Manabat)	r3.ne.mdrmm.gentinio@gmail.com	

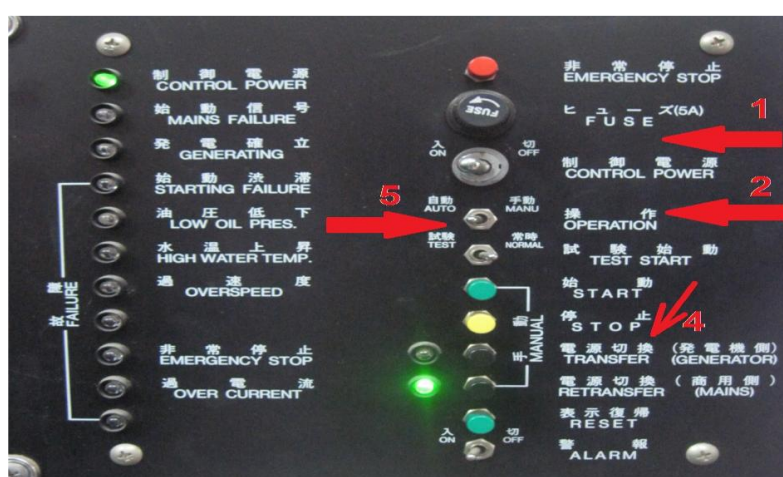
The list above will be updated as the need arises; other recipients not included in the list are automatically being accommodated by the RDRRMC-3 through email batch sharing; additional recipients will be included in the list whenever necessary.

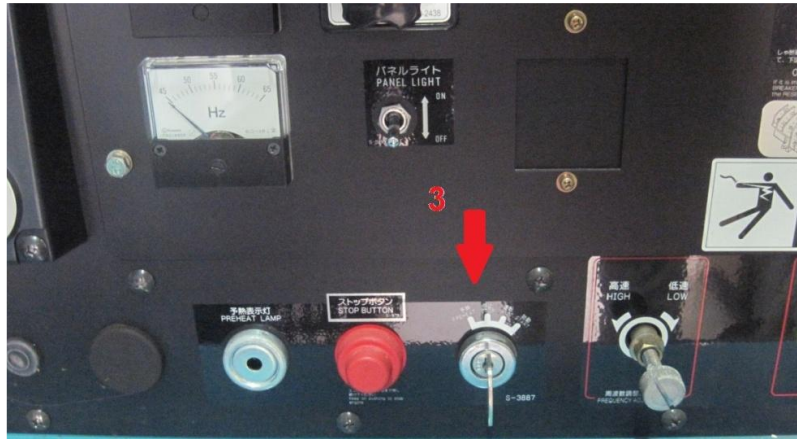
Take Note: If it's possible, try to inform Cabanatuan CDRRMO if significant rains of 20mm or more for 3 hours have been observed collectively at Calaanan, Gabaldon, and Sapang Buho stations.

Important: to ensure that information was received at the recipient end, name, feedback and reception of sent information should be taken; or every time a message has been faxed (if this platform was used), get and write the name of the recipient and the time of transmission of the message in the center's appropriate logbook. Otherwise, if no response from the other end was established or there are other problems encountered, write down a remark into the logbook as well.

14. Center activities / conditions during FW

- Duty shift personnel shall inform all other personnel of PRBFFWC when FW is already in effect;
- Duty shift personnel should know the present weather situation, TC forecasts, TCWS, high tide, etc.;
- **Center duty during FW should be at least 3 personnel (1 flood forecaster present, a hydro tech, and a telemetry technician);**
- Hydro tech/s shall be responsible for the collection / encoding of RR-WL data in the center's supervisory data suite (excel file);
- Forecaster and/or hydro tech shall run the model (if available);
- **While it is the hydro forecaster's duty to come-out with the statements in the FA or FB, all center personnel should at least be able to know how to prepare, upload and disseminate (including the manual start-up of generator, etc.) FA/FB in cases of "unavoidable" emergency situations;**
- The duty forecaster shall be the lead spokesperson during times of media interview; however, all personnel on duty should also be able to provide media interviews in case there are several simultaneous interviews (phone, live, etc.) to be handled; hence, all duty personnel should know and understand the present basin and weather situations on hand, etc.;
- **Manual start-up of Generator Set in case there is failure of commercial power:**
 - Located inside the Gen set building which is adjacent to the transmission tower: (1) Switch "Control Power" to ON position (at normal condition, this is already set as is); (2) toggle Operation switch to Manual; Press the start switch. If Gen set does not start then... (3) Key start the generator; Press "Transfer" switch in the Main Panel; When Generator is already running, toggle the operation switch in the main panel back to "Auto" to transfer automatically when commercial power returns. (check with the duty technician for actual operation; it is best to do a drill of the manual start-up prior to a flood event or at least once or twice a year).






- Although the duty forecaster shall be responsible doing the presentation and in attending the PDRA (Pre-Disaster Risk Assessment) which is usually called for by the OCD-3, nonetheless all center personnel should be able to do this as well in times of necessity or in dire situations; therefore, duty personnel's knowledge of the present & forecast weather situation is a must;
- Exiting shift duty personnel shall relay to incoming shift duty personnel the status and present situations on hand;
- ***Hydro forecasts in the center's website shall continue to be updated even when there's FA/FB issuance; hydro forecasts and FA/FB should coincide with one another in their messages but not necessarily having the same contents.***

15. Operations during FW

- FW shall start with a check (validation) and encoding of RR-WL into the center's supervisory; data suite and / or the immediate issuance of FA or FB at any time of the day as per PRB WL-RR assessment conditions;
- Disseminate FA/FB as per protocol on flood info dissemination (refer to section 13)
- Upload the FA/FB in the center's website;
- Uploading of the image of the FA/FB is also done on the center's social media accounts Facebook and Twitter (X); Facebook account; shared in Viber group or whatever is presently provided;
- Once FA/FB have been disseminated and uploaded, hydro tech shall continue to encode on at least 3 or 6 hourly basis (if possible) the real-time RR-WL in the center's supervisory terminal data set (excel file) to be handed or provided (via email) to the duty flood forecaster / hydrologist;
- Hydro technicians shall also update and upload every 3 or 6 hours during FW (can be neglected unless there is a request or a continued need for it) in the center's Facebook and Twitter (X) accounts the past 3 or 6-hour basin rainfall and WL of all stations. (see sample below); At the moment, this activity has been put on hold until there is a unanimous consensus from the PRBFFWC personnel to agree to continue this activity;

PAMPANGA RIVER BASIN				
Rainfall and Water Level Status		Year:		prffwc
Time Update:	11:00PM	Date:		2016
				17-Aug
Hourly Basin Rainfall (mm)		0.10	0.10	0.00
Water Levels		9:00 PM	10:00 PM	11:00 PM
Station	River	(meters)	(meters)	(meters)
Sapang Buho	Pampanga R.	0.85	0.86	0.87
Mayapyap	Pampanga R.	xx	XX	XX
Zaragoza	Rio Chico	2.44	2.42	2.39
Peñaranda	Peñaranda	0.32	0.32	0.33
San Isidro	Pampanga R.	0.06	0.05	0.03
Arayat	Pampanga R.	6.76	6.76	6.78
Candaba	Candaba Swamp	5.51	5.52	5.53
Mexico	Abacan	1.44	1.44	1.43
Sasmuan	Pasac-Guagua	2.14	1.97	2.14
Sulipan	Pampanga R.	2.37	2.37	2.38

- Once FW has been terminated, hydro tech shall collect all hardcopies (FA / FB), including TCBs, and other related materials for compilation purposes.

16. Ways Forward: Improvement Plans in Flood Warning Information

Color-coded warning levels			
Color	Range of flood level	Time frame (before occurring)	Flood estimated duration
Yellow	Less than 0.5 meters	in at least 12 to 24 hours	Hours to day/s
Orange	0.3 to 0.8 meters	- do -	Days to week/s
Red	0.5 to more than 1.0 m	- do -	Weeks to several weeks

Note: overlapping flood levels was purposely done to cover the general flood depth in a municipal setting inasmuch as depth conditions in the area may vary widely in such a short distance.

- To incorporate "Google CAP (Common Alerting Protocol)" in the formulation and preparation of FA/FB (manual of procedures to be develop if ever there is a need); this activity has been put on hold as there is a need to update the "Google CAP" format for the PRBFFWC; may no longer be feasible to do this for the center unless there is a move to update / upgrade the said system;
- Possible "Filipino" translated FAs / FBs;
- Issuance every 6-hours for FBs, e.g. 5am, 11am, 5pm, & 11pm;
- Enhancement of social media accounts (FB & Twitter) with 3-hourly updates of PRB RR & WL;
- More focused on areas flooded up to barangay level / flood depth forecasts;
- A stakeholder meeting to discuss on how they are taking the info / handling of the FA / FB issuances and how it can be improve to suit their level of understanding; this should be done on a regular basis if possible.

17. List of Flood-Prone areas per province within the PRB**BARANGAYS ALONG WATERWAYS WITHIN THE PROVINCE OF PAMPANGA****PAMPANGA RIVER**

River Portion	City/ Municipality	Number of Barangays Affected	Barangays	Number of Affected Families
From Nueva Ecija and Tarlac	Arayat	9	BATASAN CANDATING (flooding starts at around 8.3-8.5m reading at Arayat stn.) CUPANG, MATAMO, MESULO, PARALAYA, SAN AGUSTIN NORTE, SAN AGUSTIN SUR, SAN NICOLAS	1,984
From Bulacan and Nueva Ecija	Apalit	12	BALUCUC, CALANTIPE, COLGANTE, CANSINALA, CAPALANGAN, PALIGUI, SAMPALOC, SAN JUAN, SAN VICENTE, SUCAD, SULIPAN, TABUYUC	6,410

River Portion	City/ Municipality	Number of Barangays Affected	Barangays	Number of Affected Individuals
From Nueva Ecija and from the eastern side area (Bulacan)	Candaba	33	BAHAY PARE, BAMBANG, BARANGCA, BARIT, BUAS, CUAYAN, BUGTONG, ALAYAP, DULONG ILOG, GULAP, LANANG, LOURDES, MAGUMBALI, MANDASIG, MANDILI, MANGGA, MAPANIQUI, PALIGUI, PANGCLARA, PANSINAO, PARALAYA, PASIG, PESCADORES, PULONG GUBAT, PULONG PALAZAN, SALAPUNGAN, SAN AGUSTIN (lowest area in the town; flooding starts at 5.2-5.5m reading at Candaba stn.) STO. ROSARIO, TAGULOD, TALANG, TENEJERO, VIZAL SAN PABLO, VIZAL, STO. CRISTO, VIZAL STO. NINO	5,410

River Portion	City/ Municipality	Number of Barangays Affected	Barangays	Number of Affected Individuals
From Bulacan and Nueva Ecija	Macabebe	25	BATASAN, CADUANG TETE, CANDELARIA, CASTULI, CONSUELO, DALAYAP, MATAGUITI, SAN ESTEBAN, SAN FRANCISCO, SAN GABRIEL, SAN ISIDRO, SAN JOSE, SAN JUAN, SAN RAFAEL, SAN ROQUE, SAN VICENTE, SAPLAD DAVID, STA. CRUZ, STA. LUTGARDA, STA. MARIA, STA. RITA, STO. NINO, STO. ROSARIO, TACASAN, TELACAN	2,658

River Portion	City/ Municipality	Number of Barangays Affected	Barangays	Number of Affected Individuals
From Bulacan and Nueva Ecija	Masantol	26	ALAU LI, BAGANG, BALIBAGO, BEBE ANAC, BEBE MATUA, BULACUS, CAMBASI, MALAULI, NIGUI, PALIMPE, PUTI, SAGRADA, SAN AGUSTIN, CAINGIN, SAN ISIDRO ANAC, SAN ISIDRO MATUA, SAN NICOLAS, SAPANG CAWAYAN, SAN PEDRO,	1,702

			STA. CRUZ, STA. LUCIA ANAC, STA. LUCIA MATUA, STA. LUCIA PAGUIBA, STA. LUCIA WAKAS, STA. MONICA, STO. NINO, SUA	
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River Portion	City/ Municipality	Number of Barangays Affected	Barangays	Number of Affected Individuals
From Bulacan and Nueva Ecija	San Luis	17	SAN AGUSTIN, SAN CARLOS, SAN ISIDRO, SAN JOSE, SAN JUAN, SAN NICOLAS, SAN ROQUE, SAN SEBASTIAN, STA. CATALINA, STA. CRUZ PAMBILOG, STA. CRUZ POBLACION, STA. LUCIA, STA. MONICA, STA. RITA, STO. NINO, STO. ROSARIO, STO. TOMAS	7,102
	San Simon	14	CONCEPCION, DELA PAZ, SAN AGUSTIN, SAN ISIDRO, SAN JOSE, SAN JUAN, SAN MIGUEL, SAN NICOLAS, SAN PABLO LIBUTAD, SAN PABLO PROPIO, SAN PEDRO, STA. CRUZ, STA. MONICA, STO. NINO	4,318

WATERS coming from the Eastern Slopes of Mt. Pinatubo (including CLARKFIELD, ANGELES)

River Portion	City/ Municipality	Number of Barangays Affected	Barangays	Number of Affected Families
Sapang Balen	Magalang	4	BALITUCAN, SAN ROQUE, STA. MARIA, TURU	238
	Mabalacat	3	MANGALIT, POBLACION, STA. INES	733
Quitangil River		7	BUNDAGUL, MABIGA, MADAPDAP, PARALAYUNAN, SAN FRANCISCO, STA. MARIA, STO. ROSARIO	

WATERS COMING FROM PORAC AND STA. RITA

River Portion	City/ Municipality	Number of Barangays Affected	Barangays	Number of Affected Families
Sapang Maragul	Guagua	7	SAN AGUSTIN, SAN JUAN BAUTISTA, SAN JUAN NEPOMUCENO, SAN MIGUEL, STA. INES, STA. URSULA, SAN NICOLAS 2ND	5,513
Guagua Pasak River		13	BANCAL, PLAZA BURGOS, SAN ISIDRO, SAN JOSE, SAN MATIAS, SAN NICOLAS 1 ST , SAN PABLO, SAN PEDRO, SAN RAFAEL, SAN ROQUE, STA. FILOMENA, STO. CRISTO, STO. NINO	

WATERS COMING FROM PORAC GUMAIN RIVER

River Portion	City/ Municipality	Number of Barangays Affected	Barangays	Number of Affected Families
Sapang Maragul	Sta. Rita	7	SAN AGUSTIN, SAN ISIDRO, SAN JOSE, SAN JUAN, SAN MATIAS, SAN VICENTE, STA. MONICA	1,303

WATERS COMING FROM ABACAN RIVER (ANGELES area)

River Portion	City/ Municipality	Number of Barangays Affected	Barangays	Number of Affected Families
Inumang Baka	Sta. Ana	6	SAN BARTOLOME, SAN ISIDRO, SAN JOAQUIN, SAN JUAN, SAN PEDRO, SANTIAGO	1,924
		3	SAN AGUSTIN, SAN ROQUE, SAN ROSARIO	
Matubig Creek	Mexico	6	SAN ANTONIO, SAN JUAN, SAN JOSE MATULID, SAN LORENZO, SAN PABLO, SAN PATRICIO	1,271

WATERS COMING FROM MT. PINATUBO (RAINS)

River Portion	City/ Municipality	Number of Barangays Affected	Barangays	Number of Affected Families
-	Sto. Tomas	7	MORAS DELA PAZ, POBLACION, SAN BARTOLOME, SAN MATIAS, SAN VICENTE, STO. NINO, STO. ROSARIO PAU	1,079
Porac Gumain	Porac	6	CANGATBA, JALONG, PIO, PLANAS, POBLACION, HACIENDA DOLORES	301

WATERS COMING FROM GUGU (DIKE breached)

River Portion	City/ Municipality	Number of Barangays Affected	Barangays	Number of Affected Families
-	Minalin	8	BULAC, SAN FRANCISCO I, SAN FRANCISCO II, SAN NICOLAS, SAN PEDRO, STA. CATALINA, STA. RITA, STO. ROSARIO	4,839
Coastal		3	MANIANGO, DAWE, SAPLAD	
Gugu	Bacolor	8	CABALANTIAN, MALIWALU, MESALIPIT, SAN ANTONIO, SAN ISIDRO, SAN VICENTE, TALBA, TINAJERO	1,351
		2	CABETICAN, STA. BARBARA	
Pasig Potrero	CSFP	4	PANDARAS, SAN NICOLAS, SAN PEDRO, STA. LUCIA	4,985

WATERS COMING FROM PORAC RIVER

River Portion	City/ Municipality	Number of Barangays Affected	Barangays	Number of Affected Families
Porac Gumain	Lubao	7	REMEDIOS, SAN JOSE GUMI, SAN PABLO 2 ND , STA. CATALINA, STA. CRUZ, STA. RITA, STA. TEREZA 1ST	6,048
Coastal		3	BANCAL PUGAD, BANCAL SINUBLI, STA. TEREZA 2ND	
Porac River	Floridablanca	6	BENEDICTO, CALANTAS, DEL CARMEN, MABICAL, SOLIB, VALDEZ	241
Caulaman River		4	CARMENCITA, DAMPE, STO. ROSARIO, BODEGA	
Gumain River		2	SAN PEDRO, GUTAD	

Coastal	Sasmuan	5	BATANG 1 ST , BATANG 2 ND , MABUANBUAN, MALUSAC, SEBITANAN	2,548
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Source: PDRRMO-Pampanga (as of December 2015)

FLOOD-PRONE BARANGAYS IN THE PROVINCE OF BULACAN (Within PRB)

Municipality/City	Low to Moderate Areas with less than 1 meter flood height. These are usually inundated during prolonged and extensive heavy rainfall or extreme weather condition	High Areas with greater than 1 meter flood height. These areas are usually flooded for several hours during heavy rains; include landforms of topographic lows such as active river channels, abandoned river channels and areas along river banks; also prone to flashfloods.	Total Land Area (An indicative estimate of land area affected in hectares)
Angat	Paltok, Pulong Yantok, Banaban, portions Sulucan, Marungko, Nugan 2,658 has.	Donacion, Laog, Sto. Cristo, San Roque, Sta Cruz, Binagbag, Niugan, Taboc, river portions of Binagbag, Baybay 1,254 has.	3,912
Baliwag	Tarcan Concepcion, Vigen de las Flores, Sto Cristo, Bagong Nayon, Subic, San Jose, Paitan 1,707 has	Makinabang, Matang Tubig, Sta Barbara, Tiaong, Calantipay, Catulinan, Pinagbarilan, Pagala, Tangos, Poblacion, Tibag, Tilapayang, Barangka, Sto Nino, Sullivan, Piel, San Roque, Hinukay 3,022 has	4,729
Bustos	Poblacion, Cambaog, Bonga Mayor, Malawak, Catacte 2,153 has.	Tanawan, Bonga Menor, Tibagan, Malamig, Liciada, Buwisan, Camachilihan, Talampas, San Pedro 1,568 has	3,721
Calumpit	Iba O' Este, Buguion, Iba Este, Corazon, Sergio Bayan, Calumpang, Longos 1,360 has.	All other remaining Barangays (San Miguel, Meysulao, Frances, Gatbuca, Sapang Bayan, Pungo, Sucol, Poblacion, Calizon, Balungao, Bulusan, Sto, Nino, Caniogan, Gugo, Palimbang, San Marcos, Sta. Lucia, Balite, Buguion, Pio Cuzcosa, San Jose, Meyto, Panducot) 3,410 has.	4,770
Hagonoy	Iba-Ibayo, Iba and San Pedro (MGB report)	San Agustin, San Isidro, San Juan, Palapat, San Sebastian, Carillo, Sto. Nino (Pob.), Abulalas and Sta. Elena, San Miguel, Tampok, San Pablo, Sagrada, San Nicolas, Mercado, Pugad, San Jose, San Pascual, San Roque, Sta. Cruz, Sta. Monica, Sto. Rosario and Tibaguin (MGB report)	9,317
Malolos City	Look 1, Lugam, Longos, Bulihan, Anilao, Canalate, San Juan, Dakila, Balite.Taal, Santor, San Pablo, Bagong Bayan, Ligas, Sumapang Bata, Bungahan, Guinhawa, Mojon, Sumapang Matanda, Pinagbakahan, Santisima Trinidad, Tikay, Niugan, Cofradia, Mabolo, Caniogan Sto Rosario, San Agustin, Sto Cirsto 3,749 has.	Panasahan, Calero, Matimbo, Mambog, Bangkal, Babatnin, Masile, Namayan, Caliligawan, Pamarawan, Santiago, Liang, San Gabriel, Catmon, Balayang, Bagna, Atlog, Liang 3,335 has.	7,804

Norzaragay	Minuyan, Bigte, Pinagtulayan, Partida 1,255	Poblacion, Matictic 985 has	2,240
Paombong	Kapitangan, San Vicente and Poblacion; Sto. Rosario, Malumot, San Isidro 1 st , and San Isidro 2 nd (MGB Report)	San Roque, Pinalagdan, Sto. Nino, San Jose, Sta. Cruz, Binakod, Masukol (River systems with history of overflowing: Labangan channel, San Isidro-Sto. Nino River, Paombong River and Ilog Gusi) (MGB Report)	4,600
Plaridel	Rueda, Lagundi, Dampal, Sto Nino, Lalangan, Poblacion, Agnaya, Banga 1-11, Tabang, Buliham Bintog, Parulan, Culianin 2,284 has.	San Jose, Lumang Bayan, Bagong Silang, Sta Ines, Sipat 1,198 has	3,682
Pulilan	Poblacion, Tinajero, Balatong A, Penabatan, Balatong B, Sta. Peregrina, DAmpol 2 nd A, Tibag, Dampo 1 st , Lumbac, Paltao, Cut-cot, Sto. Cristo, Taal and Longos (MGB Report).	Inaon, Dulong Malabon, Dampol 2 nd B, and Tabon – proximity to Candaba swamp (MGB Report)	3,880
San Ildefonso	Calawitan, Pulong Tamo, Telepatio, Malipampang, Maasim, Sapang Putik, Palapala, Pinaod, Poblacion, Sapang Putal, Lapanit, Matas na Parang, Sta Catalina, Bata- Matanda, Bubulong Malaki, Umpucan, Anyatam, Matimbubong, Sumandig (5,983 has.)	Makapilapil, Garlang, Nabaong Garlang, Calasag, San Juan, Upig 2,312 has.	8,295
San Miguel	Maligaya, Bardias, Lambakin, Partida, Tartaro, Sta. Ines, Balaong, Masalipit, Sta. Lucia, Baritan, Bulualto, Bantog, King Kabaya, Pinambaran, Sapang, Cambio, Saccalan, Bagong Pagasa, Balite, San Agustin, Batasan Bata, Paliwasan, Biclát, Magmarale, Tibagan, Labne, San Vicente, Poblacion, San Juan 13,385 has.	Buga, Ilog-Bulo, Salacot, Bagong Silang, Mandile, Batasang Matanda, Tigpalas, Buliran, Camias, San Jose 3,504 has.	16,889
San Rafael (source: MDRRMO-San Rafael – Mr. Louie Rodriguez)	Affected by Angat River: Pulo, Maronquillo, Talaksan, Libis, Poblacion, Lico, Pantubig, Caingin, Tambubong	Affected by Maasim River: Salapungan, Pasong Bangkal, Pasong Callos, Diliman , Maasim , Dagat-Dagatan, Pulong Bayabas , Pansumaloc (highlighted barangays are at high-risk to floods)	

Source: PPDO, Provincial Government of Bulacan and partly from MGB-3 report (2012?)

AFFECTED MUNICIPALITY/BARANGAYS IN BULACAN RELEASING OF RESERVOIR OF ANGAT /IPO /BUSTOS DAMS							
NO.	MUNICIPALITY	NO.	BARANGAY	AFFECTED		EVACUATED	
				FAMILIES	PERSON	FAMILIES	PERSON
1	NORZAGARAY	1	MATICITIC	400	2000	80	315
		2	PINAGTULAYAN	50	250		
		3	MINUYAN	250	1250		
		4	BIGTE	250	1250		
		5	POBLACION	500	2500		

				1,450	7,250	80	315
2	ANGAT	1	STA. CRUZ	25	95		
		2	STO. CRISTO	46	210		
				71	305		
3	BUSTOS	1	CAMBAOG	200	1000	100	500
		2	TIBAGAN	53	265		
		3	CAMACHILIHAN	50	300	50	300
		4	TANAWAN	60	300	60	360
		5	MALAWAK	79	395	50	250
		6	TALAMPAS	550	2550	92	552
		7	BONGA MENOR	350	1750	59	354
		8	BONGA MAYOR	380	1825	50	300
		9	SAN PEDRO	250	1250	200	1000
		10	POBLACION	1,118	5,515		
				3,090	15,150	661	3,616
4	BALIUAG	1	TIAONG	295	2324	100	450
		2	SAN JOSE	250	1150	200	950
		3	SABANG	257	1239	65	300
		4	POBLACION	1965	9639	786	3890
		5	STA. BARBARA	260	1347	45	210
		6	PAITAN	150	753	55	245
		7	MAKINABANG	267	1253		
		8	PAGALA	49	245		
		9	TIBAG	1500	6500	285	1125
				4,993	24,450	1,536	7,170
5	PLARIDEL	1	BANGA 1ST	70	350	10	50
		2	PARULAN	50	250		
		3	RUEDA	20	100		
		4	LUMANG BAYAN	30	150		
		5	SAN JOSE	24	120		
		6	BANGA 2ND	40	233	39	180
		7	BINTOG	17	85		
		8	CULIANIN	30	150		
		9	POBLACION	30	150		
		10	SIPAT	15	75		
		11	DAMPOL	5	25		
				331	1,688	49	230
6	PULILAN	1	STO. CRISTO	500	2250	100	500
		2	TIBAG	200	859	12	45
		3	LUMBAK	20	57		
		4	PALTAO	250	1150	60	287
				970	4,316	172	832
7	SAN RAFAEL	1	SALAPUNGAN	120	600	25	150
		2	PULONG BAYABAS	315	1890		
				435	2,490	25	150

TOTAL	38	BARANGAYS	11,340	55,649	2,523	12,313	
San Rafael Barangays		Pulo					
(affected by Angat R.		Maronquillo					
as per MDRRMO San		Talaksan					
Rafael report – Mr.		Libis					
Louie Rodriguez)		Poblacion					
		Lico					
		Pantubig					
		Caingin					
		Tambubong					
AFFECTED MUNICIPALITY/BARANGAY							
RELEASING OF ANGAT /IPO /BUSTOS DAMS							
NO.	MUNICIPALITY	NO.	BARANGAY	AFFECTED		EVACUATED	
				FAMILIES	PERSON	FAMILIES	PERSON
8	CALUMPIT	1	SAPANG BAYAN	758	3,790	116	570
		2	MEYSULAO	1,210	6,050		
		3	SAN MIGUEL	1,480	7,400		
		4	STA. LUCIA	748	3,740		
		5	SAN JOSE	1,320	6,600		
		6	BULUSAN	741	3,705		
		7	CALIZON	498	2,490	173	554
		8	FRANCES	1,575	7,875		
		9	MEYTO	852	4,260		
		10	PANDUKOT	782	3,910		
		11	GUGO	480	2,400		
		12	BALUNGAO	1,320	6,600		
		13	GATBUKA	1,505	7,525		
				13,269	66,345	289	1,124
9	PAOMBONG	1	KAPITANGAN	636	1,908		
		2	PINALAGDAN	494	1,976		
		3	STO. ROSARIO	1,440	5,760		
		4	SAN VICENTE	540	2,160	35	140
		5	SAN JOSE	1,095	3,285		
		6	MALUMOT	463	1,389		
		7	POBLACION	112	448	41	164
		8	SAN ROQUE	805	2,415	45	180
		9	SAN ISIDRO 1	575	2,300		
		10	SAN ISIDRO 2	1,782	5,346		
				7,942	26,987	121	484
10	HAGONOY	1	CARILLO	539	2,595		
		2	ABULALAS	1,500	6,650	25	120
		3	SAN PEDRO	1,250	6,125	145	650
		4	STA. ELENA	1,481	7,245		
		5	PUGAD	580	2,750		
		6	TIBAGUIN	900	4,250		
		7	TAMPOK	860	3,500	50	150

		8	STA. MONICA	2,411	11,150		
		9	SAN MIGUEL	1,741	8,570	34	152
		10	SAN SEBASTIAN	2,420	11,250		
		11	STO. NINO(POB)	980	4,795	16	60
		12	MERCADO	1,800	9,000	75	275
		13	SAN JOSE	1,317	6,285		
		14	STO. ROSARIO	1,456	6,280		
		15	SAN PASCUAL	1,857	9,125		
		16	SAN ROQUE	1,348	6,325		
		17	STA. CRUZ	1,139	5,465		
		18	SAN NICOLAS	1,280	6,540		
		19	SAGRADA	2,207	10,125		
		20	SAN AGUSTIN	2,512	11,560		
TOTAL		43	BARANGAYS	29,578	139,585	345	1,407
GRAND TOTAL		81	BARANGAYS	40,918	195,234	2,868	13,720

Source: Bulacan-PDRRMO

FLOOD-PRONE BARANGAYS WITHIN THE PROVINCE OF NUEVA ECIJA (Within PRB)

Town / City	Low susceptibility	Moderate susceptibility	High susceptibility
Aliaga	Magsaysay, Santiago, San Felipe (Bata), Umangan, San Eustacio, Sto. Tomas, Macabucod, San Pablo (Matanda), Poblacion Centro, Poblacion West	Sto. Rosario, Bucot, San Pablo Bata, Poblacion East I and II, Poblacion West III, San Carlos, Betes, PAntok and Sunson	Sta. Monica, San Juan, San Felipe Matanda, San Emilliano, La Purisima
Bongabon	Magtanggol Palomaria, Sinipit, Olivete	Antipolo, Makabaklay, Pesa, Tugatog, Larcon, Cruz and Santor	Vega, Ariendo and Lusok; Labi, Curva and Caingin
Cabanatuan City	San Fernando Sur, San Vicente, Sta. Rita, Bagong Silang, Entablado, Santa Isabel, Concepcion, San Carlos, San Gregorio, Sinipit, Bagong Sikat, Santa Ines, San Roque, San Antonio, Maligaya, San Fernando Norte, Bagong Buhay, Polilio, San Juan South (Pob), Natividad North (Pob), Aduas		
Carranglan	T.L. Padilla, F.C. Otic, Bunga and Putlan	D.L. Maglantoc, G.S. Rosario, R.A. Padilla, San Agustin, Puncan and Bantug	Bantug and Gen, Luna
Gabaldon	Susceptible to landslides and flash flooding: Cuyapa, Pinamalisán, Sawmill, Calabasa, Macasandal, Malinao, Pantoc, South Poblacion, Tagumpay, Bagong Sikat, Bagting, Bantug, Bitulog – north Poblacion, (not susceptible to landslides: Bugnan, Camachile and Ligaya)		
Gapan city	Mangino	Mangino, Parcutela, Marelo, San Roque, Malimba, Sto. Cristo Sur and Norte, Bayanihan, San Nicolas, Pambuan, San Lorenzo, San Vicente, Sta. Cruz, Maburak, Mabuga, Putting Tubig, Bungo, Mahipon, Kapalangan, Bulak, Sto. Nino, and Balante; high susceptibility - Makabaklay	
Gen. M. Natividad	Pinahan, Platero, Natividad, Magasawang Sampaloc, Balangkare Norte and Sur, Manarog, Talabutab Norte, Belen and Poblacion	Sapang Bato, Kabuluan, Mataas na Kahoy, Burol, Balaring, Pulong Singkamas, Picaleon, Panacsac, Talabutab Sur and Bravo	
Gen. Tinio	Nazareth, San Pedro, Sampaguita and Pulong Matong	Concepcion, Pias, Rio Chico, Bago and Padolina, Poblacion East, Poblacion Centro and Poblacion West	
Guimba	Tampac I, II and III, Sta Cruz, San Bernardino, Caballero, Triala, Consuelo, San Roque, Manggang Marikit, San Rafael, Naglabrahan, Cardinal, Magpandayan, Catimon and Banitan	Bagong Barrio, Pasong Inchic, Casongsong, Guiset, San Andres, Camiling, Cabanuan, Lamorito, Maybubon, San Agustin, Magpandayan, Balingog East, Bantug and Sto. Cristo	Culong, Cwayan Bugtong, Narvacan I, Macamias, Ayos Lomboy, San Miguel, Galvan, Yuzon, Agcano, Partida I, Macacatuit and Saranay, Pacac, Bacayao, Balbalino, San Marcelino, Saint John (Pob), Macapabellag, Sta. Ana, Faigal, Sinulatan, Sta.

			Lucia, Bulakid, Escano, Manacsac, Balingog West, Subol and Maturanoc; Cavite, Caingin-Tabing Ilog, Calem, Partida II, Lennec, Narvacan II and Sta. Veronica
Laur	Poblacion I, II, III, San Felipe, San Juan, Pintol, Pantoc, Bayug, San Isidro and San Fernando	Pinagbayana	Pacarso, Kamuning, Panaulo, Betania, San Antonio and Sitio Panganulong
Licab	San Casimiro, Sta. maria and San Jose	Poblacion, Poblacion Norte, San Juan, Tabing Ilog, Linao, Villarosa and San Cristobal; Aquino	
Llanera	Gomez, Florida, Blanca, Villa Veniegas, Sta. Barbara, Ligaya, San Nicolas, Caridad Norte, Casile, Gen. Luna, Murcon, Gen. Ricarte, Mabini, Inanama, A. Bonifacio Sur & Norte, Victoria, Bagumbayan and Plaridel	Caridad Sur, San Felipe, San Vicente and Basque	
Lupao	Tienzo	Arimal Creek, Panabcan River, Agupalo River, Balibago Creek, Alimutong Creek, Macanawed River	
Science City of Muñoz	Bantug, Cabisuculan, Calabalabaan, Calisitan, Curva, Gabaldon, Labney, Licaong, Linglingay, Magtanggol, Maligaya, Mangandingay, Maragol, Mapangpang, Naglabrahan, Poblacion East, South and West, Rang-ayan, Rizal, Sn Andres, Villa Quizon, Villa Isla and Villa Nati	Balante, Bical, Palusapis, Poblacion North, San Antonio, San Felipe and Sapang Cauayan	Bagong Sikat, Catalanacan, Franza and Matingkis
Palayan City	Barangays with susceptibility to flooding are influenced by the Pampanga River and the Creeks that traverses these barangays.		
Pantabangan		Ganduz and Cadaclan	
Peñaranda	San Mariano, Poblacion I & II	Callos, San Josef, Sinasajan, Las Pinas, Sto. Tomas, Poblacion 3 & 4, Sta. Lucia, Sta. Monica, San Antonio, San Nicolas 1 st & 2 nd , Sto. Tomas and San Pedro, Batang 1 st & 2 nd , Mabuanbuan, Sebitanan and Malusak	
Quezon	Sto. Tomas, Feria, San Miguel, San Manuel, and Doña Lucia	Bertese, Sta. rita, Sta. Clara, Bgy. I, II (Poblacion), Dulong Bayan and San Andres I	Pulong Bahay, Sto. Cristo and San Andres II
Rizal	Portal, Balasing, Del Pilar, Aglipay, Bicos, Maligaya, Agbannawag, Pagasa, Paco Roman, Cabucbucan, Canaan East & West, Gen. Luna, Casilagan, Villa Paraiso, Villa Labrador	Estrella / Subdivision, Calaocan, San Gregorio, San Esteban, Cabucbucan, Macapsing, Canaan East and Gen. Luna	
San Jose City	Sto. Nino 3 rd & 2 nd , Manikla, Tayabo, Malasin, Porais, Villa Joson, San Juan, Villa Marina, Kaliwanagan, Culaylay, Palestina, Pinili, Bagong Sikat, Kamanagsakan, Calaocan, Sibut, San Agustin, Abar 1 st , Sto. Tomas, Rafel Rueda, Crisanto Sanchez, Canuto Ramos, Raymundo Eugenio, F.E. Marcos	Tulat, Dizol, Abar 2 nd , and Caanawan	Sto. Nino 1 st , Kita-Kita, Tabulak, Parang Mangga, A. Pascual and San Mauricio
San Leonardo	Nazareth, San Pedro, Sampaguita and Pulong Matong	Pias, Rio Chico, Bago and Padolina	Poblacion East, Centro and West
Sta. Rosa	Mapalad, Malacanang, Liwayway, Tagpos, Soledad, Rajal Centro, Norte, & Sur, Inspector, Sto. Rosario	San Isidro, San Pedro, San Joseph, Maliolio, Sta. Teresita, Zamora, Gomez, San Mariano, Luna, Valenzuela, Mabini, Aguinaldo, Burgos, Tramo and Cojuangco, Sapsap, Rizal, Del Pilar, San Gregorio	La Fuente, Lourdes, Isla and Berang
Sto. Domingo	Hulo and Sto. Rosario	Concepcion, Maligaya, Dolores, San Agustin, San Fabian, Mabini	

Talavera	San Pascual, Lomboy, Campos, Burnay, Valle, Calipahan, Andal Alino, Esguerra, Marcos, Mamandil, Bantug, Dinarayat, Bacal I, II & III, Matingkis, Baluga, San Miguelna Munti, Sicsican Matanda, Casuluca Este, Tabacao, Bsang Hamog, Pantoc Bulac, Tagaytay, Cabubulaunan, Caputian, Mabuhay, Collado, Kinalanguyan, Sibul, Butong na Buli, Dimasalang Norte & Sur, Bantug Hacienda, Gulod, Sampaloc, Paludpod, San Ricardo, Bagong Sikat, Homestead I & II, Pinagpanaan	Pulong San Miguel, Maestrang Kikay, La Torre, Caaminaplhan and Pula, Matias, Poblacion Sur, Pulong San Miguel, Bulac	Bagong Silang, Pagasa, Minabuyok
Talugtog	Saverona, Fronda, Villa Rosenda, Villa Boado and Mayamot II	Nangabulan, Cinense, Tandoc, Mayamot and Baybayabas	
Zaragoza		San Vicente, Carmen, Pantoc, Concepcion, San Isidro, Sta. Cruz and San Rafael; Sta. Lucia Young and Old, Del Pilar, Sto. Rosario Young and Old, Macarse, Mayamot, Valeriana, Batitang, Manaol, H. Romero and Gen. Luna	

Source: MGB-3 Geohazard Assessment Report (2012?)

FLOOD-PRONE BARANGAYS IN THE PROVINCE OF TARLAC (Within PRB)

Town / City	Low susceptibility	Moderate susceptibility	High susceptibility
Bamban	Anupul, Banaba, Bancu, Dela Cruz, La Paz, Lourdes, Malonzo, San Nicolas, Sto. Nino, San Vicente, San Pedro, San Rafael, San Roque and Virgen delos Remedios	Culubasa, San Nicolas	Lahar affected areas: Dela Cruz, La Paz, San Vicente, Banaba, Culubasa, Virgen delos Remedios, San Pedro and Malonzo
Capas	Aranguen, Cubcub, Cutcut 1 st & 2 nd , Dolores, Estrada, Lawy, Manga, Manlapig, Sta. Rita, Sto. Domingo 2 nd , Sto. Rosario, Talaga and Cristo Rey	Bueno, O'Donnell, Sta. Lucia, Sto. Domingo 1 st , Maruglu and Sta. Juliana	
Concepcion	Calius Gueco, Corazon de Jesus, Dutung Matas/Jetmin, Mabilog, Panalicsican, Pitabunan, San Agustin/Murcia, San Bartolome, San Nicolas, Balas, Sta. Cruz and Talimundoc/San Miguel	Caluluan, Parang, Parulung, San Antonio, San Francisco, San Juan Santiago, San Vicente, Sta. Maria, St. Rosa, Sto. Nino and Sto. Rosario/Magunting	Minane, Pando, San Isidro, Sta. Rita, Sto. Cristo and Tinang; Balutu, Café, Castillo, Culatingan, Dungan, Lilibingan, Magao, Malupa, San Jose, San Martin, San Nicolas/Poblacion, Sta. Monic and Talimundoc Marimla
La Paz		Mayang, Kapanikian, Matayumtayum, Caramutan, Laungcupang, Dumarais, Sierra, Motrico and Camillas	La mPurisima, Macalong (New and Old), Lara, San Roque, Rizal, Balanoy, Caut, Bantog, Paludpud, San Isidro and Guevarra
Tarlac City	Big portion of the city falls within the Agno River Basin; parts within the PRB are normally affected by ponding of rainwater and are mostly agricultural farms		
Victoria	Baculong, Balbaloto, Calibungan, Lalapac, Maluid, San Andres, San Jacinto, Sta. Lucia	Balayang, Masalasa, San Agustin, San Francisco, San Gavino, San Vicente	Bantog, Cabaluan, Cruz, Mangolago, San Fernando, Sta. Barbara

Source: MGB-3 Geohazard Assessment Report (2012?)

MGB NOTE: It should be noted that these susceptibility ratings were arrived at as per latest field assessment done on certain dates. However, the rating could significantly change (e.g. from a low to moderate, and moderate to high, etc.) based on the present and historical accounts of the flood susceptibility in the municipality / city. MGB constantly recommends strict and continuous monitoring of these areas, continuing information and education campaigns on DRR and the strengthening of DRRMCs.

STORM SURGE PRONE BARANGAYS IN THE PROVINCES OF PAMPANGA & BULACAN (Within PRB)

Pampanga Towns	Barangays
Lubao	Sta. Teresa 2 nd , Bancal Sinubli, Bancal Pugad, Pamugsuc
Sasmuan	San Antonio, Malusac, Mabuanbuan, Batang 1 st & 2 nd , Sabitanan
Macabebe	Dalayap/Sua, San Esteban
Masantol	Bulacus, San Pedro, Nigui, Malauli, Balibago, Sapang Kawayan
Bulacan Towns	Barangays
Hagonoy	Tibaguin, Pugad
Paombong	Sta. Cuz, Masucol, Binakod
Malolos	Babatnin, Pamarawan, Masile, Namayan, Kaliligawan

Source: Post-Storm Surge Report (Ty. Glenda, July 2014) by N.B.Nimes

