

Town Hall Meeting on Individual and Family Disaster Preparedness

Tuesday, 28 May 2013, Auditorium Zones B & C, Asian Development Bank, Mandaluyong City



Preparedness measures for impacts of tropical cyclones and flooding



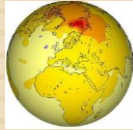
Aporn Meteorological Radar Tower Building



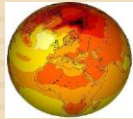
Susan R. Espinueva, Ph. D.
Chief, Hydrometeorology Division, PAGASA-DOST



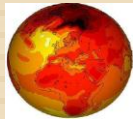
OUTLINE OF PRESENTATION



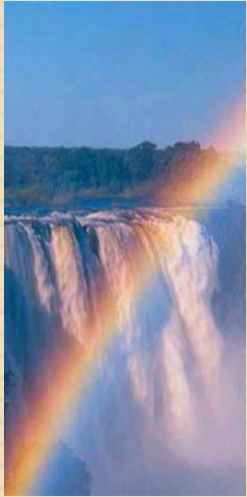
Introduction: Understanding the hazards



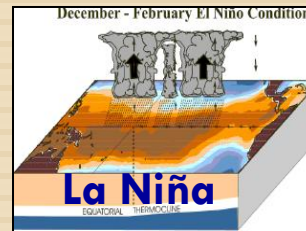
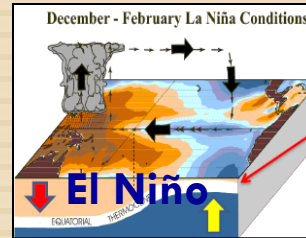
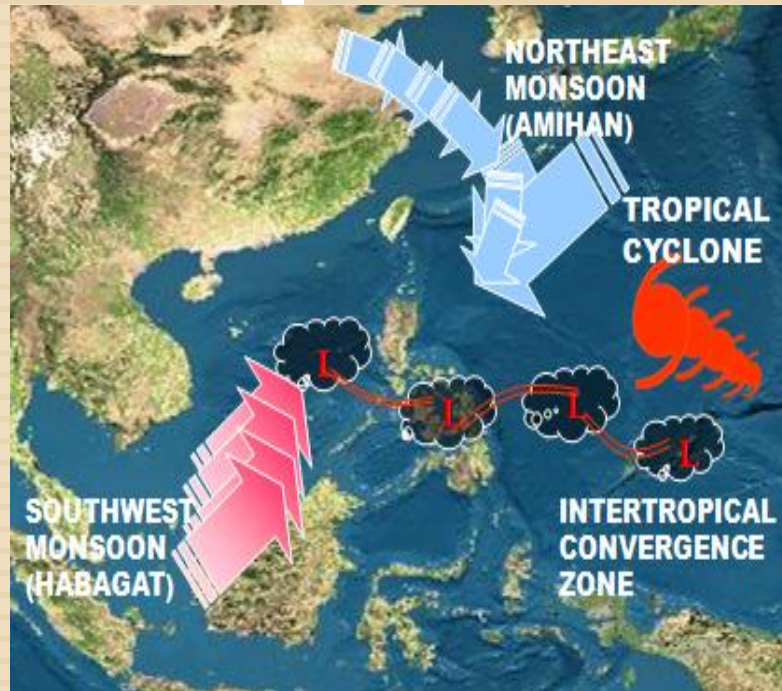
Impacts of tropical cyclones & flooding



Preparedness measures



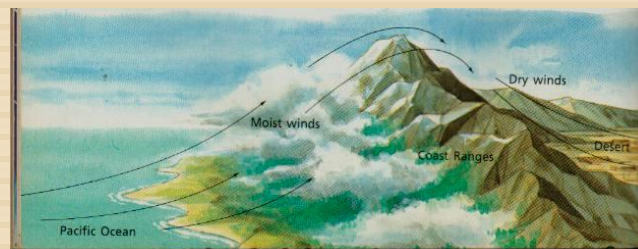
Introduction



- Semi-permanent cyclones & anti-cyclones
- Air streams – SW & NE monsoon
- Ocean currents
- Linear systems – ITCZ, cold front, easterly wave
- Tropical cyclones
- ENSO phenomena (El Niño & La Niña)

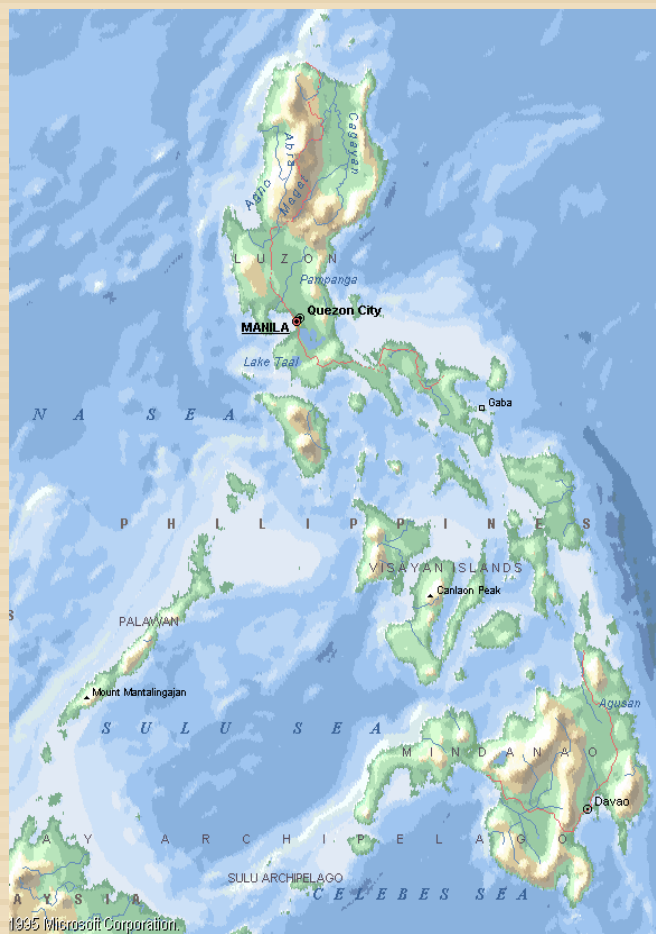


Climatic controls that influence Philippine climate.

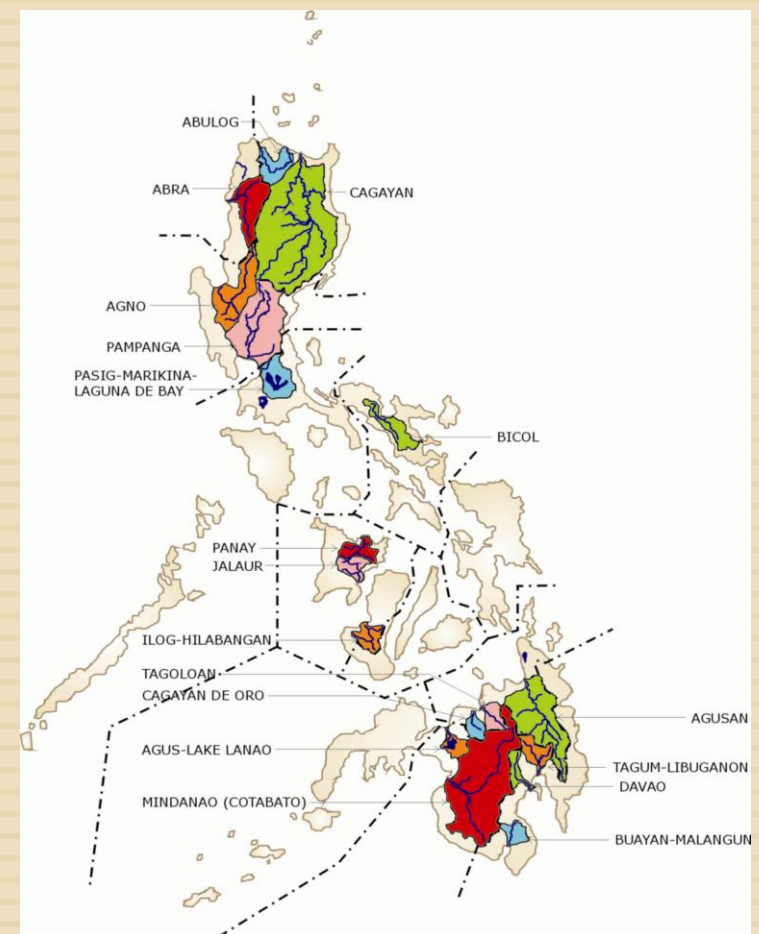


- Geography & topography

Introduction



Topographic map



Major river basins



- **Average annual rainfall:**
 - 2,400 mm (50% comes from Tropical Cyclones)

- **Land area: 300,000 sq. km.**
- **The Philippines has**
 - 421 principal river basins
 - 18 are major river basins

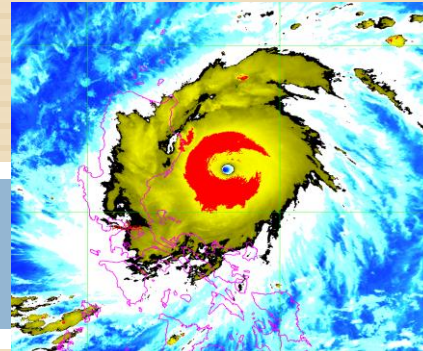
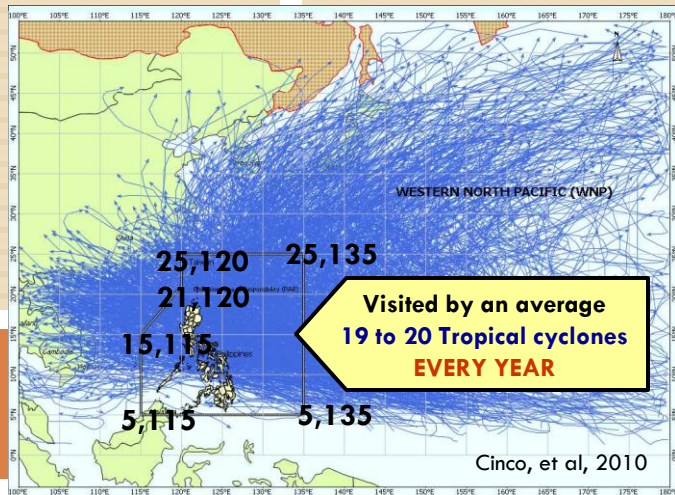
1. Understanding the hazards



What is a tropical cyclone?

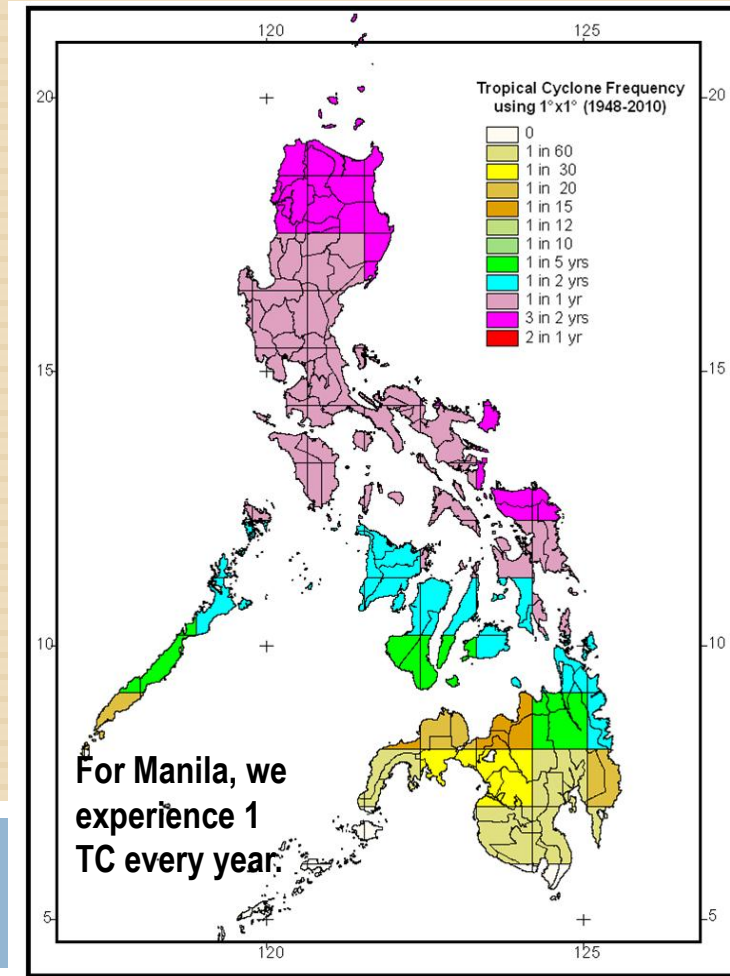
A tropical cyclone is classified based on its wind strength:

- Tropical Depression (TD) - **45 to 63 KPH**
- Tropical Storm (TS) - **64 to 118 KPH**
- Typhoon (TY) - **greater than 118 KPH**



From 1948 to 2010: 1228 tropical cyclones have crossed the Philippine Area of Responsibility (PAR).

- Wind speed ranges from 40 KPH to about 300 KPH.
- Diameter ranges from 300 to 1,000 kms.



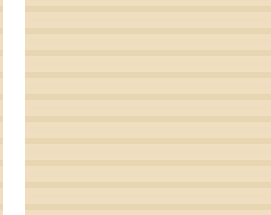
Tropical Cyclone Frequency using 1°x1° (1948-2010)



Hazards associated with tropical cyclones



✓ **Strong Winds**



✓ **Tornadoes**



✓ **Storm Surges**



✓ **Flashfloods/Floods**



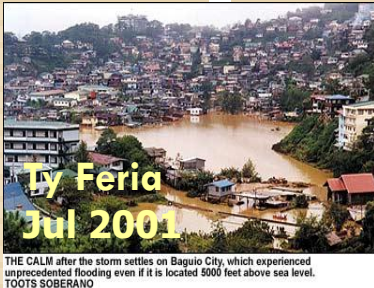
✓ **Landslides/Mudflows**



2. Impacts of tropical cyclones & flooding



IMPACTS of Weather Phenomena in the PH



1970-2010:

Affected families – 26,978,106

Affected persons – 136,543,259

Casualties – 23,892

Cost of Damages:

Agriculture: PhP178.39 billion

Infrastructure: PhP 76.77 billion

Private properties: PhP 10.29 billion

Total cost of damages: PhP265.5 billion

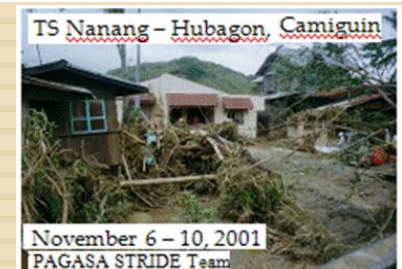
Source: Office of Civil Defense



**Dingalan,
Aurora,
Dec. 2004**



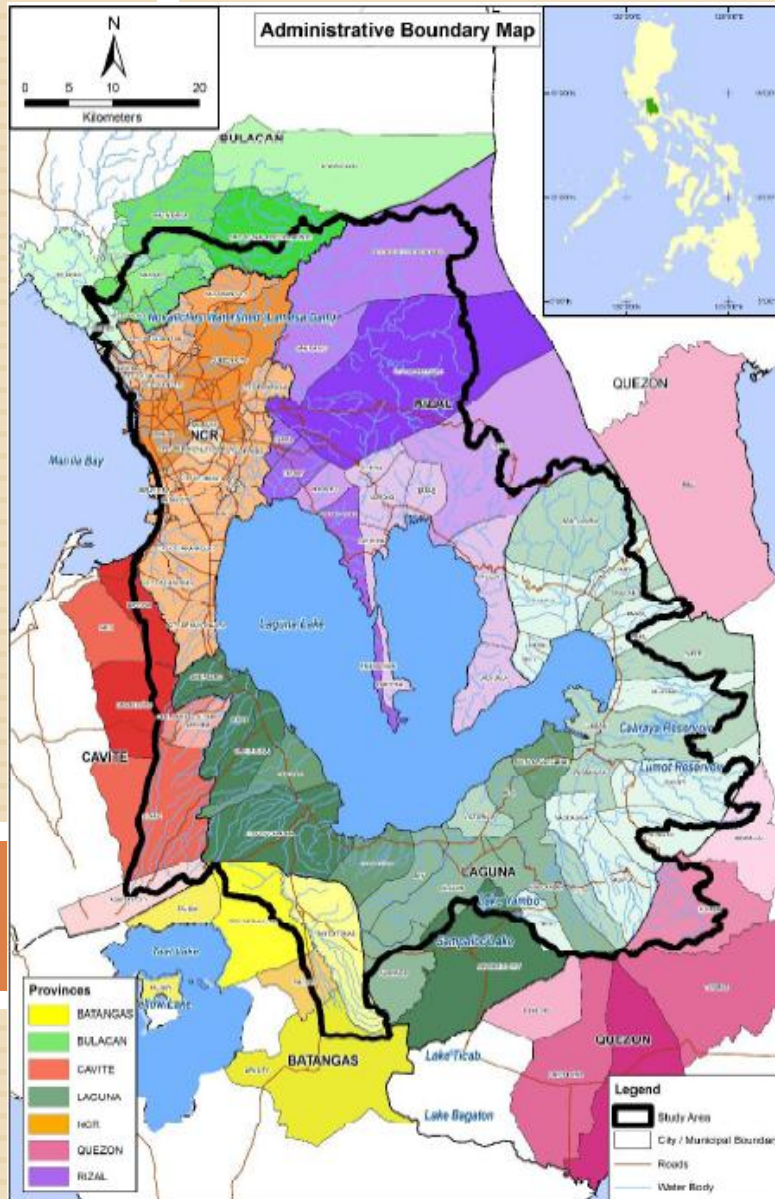
**Dec. 2003, Brgy. Pinutan,
San Ricardo,
Panaon Island,
Southern Leyte.**



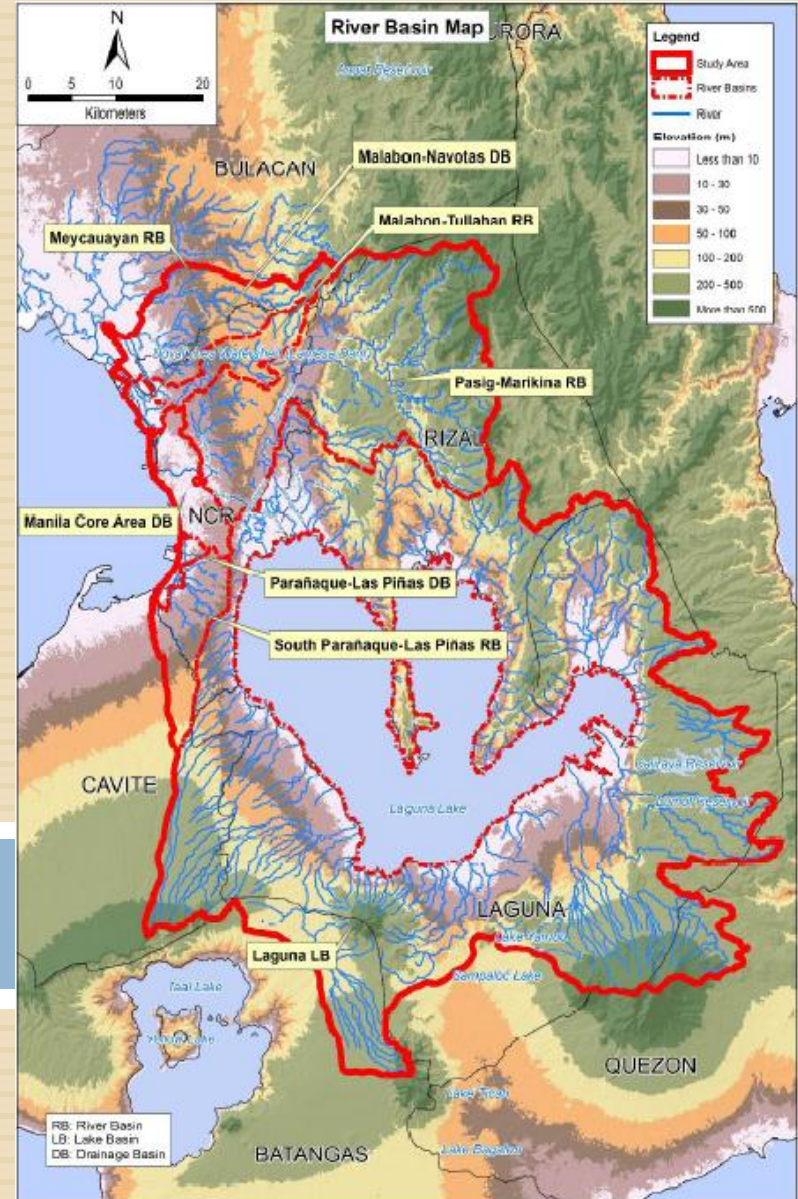
2. Impacts of tropical cyclones & flooding



Map of Greater Metro Manila

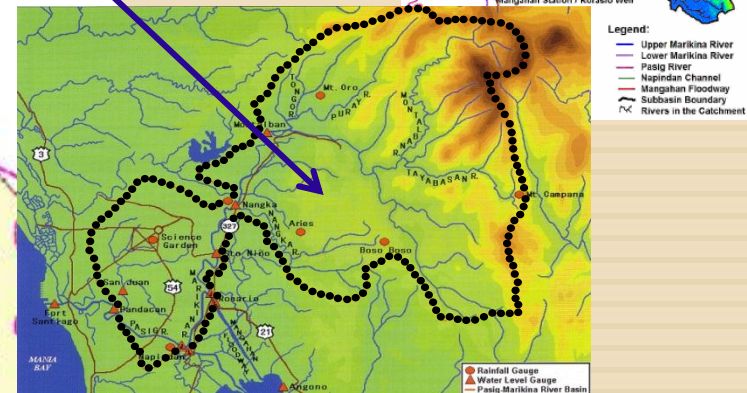
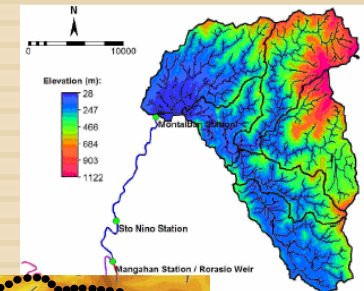
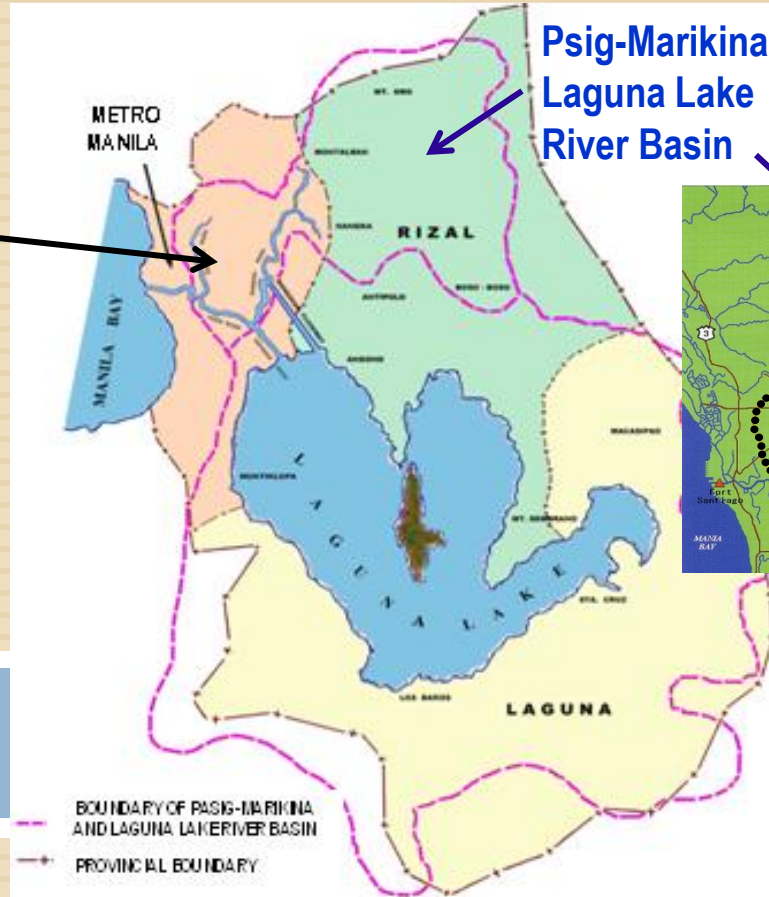


Administration Areas in GMMA



River Basins, Lake Basin, and Drainage Basins in GMMA

Effective Flood Control Operation System (EFCOS) of the Pasig-Marikina- Laguna Lake Complex



Main river:

Marikina & Pasig

Tributaries:

Nangka river in San Mateo,

San Juan river

Napindan river

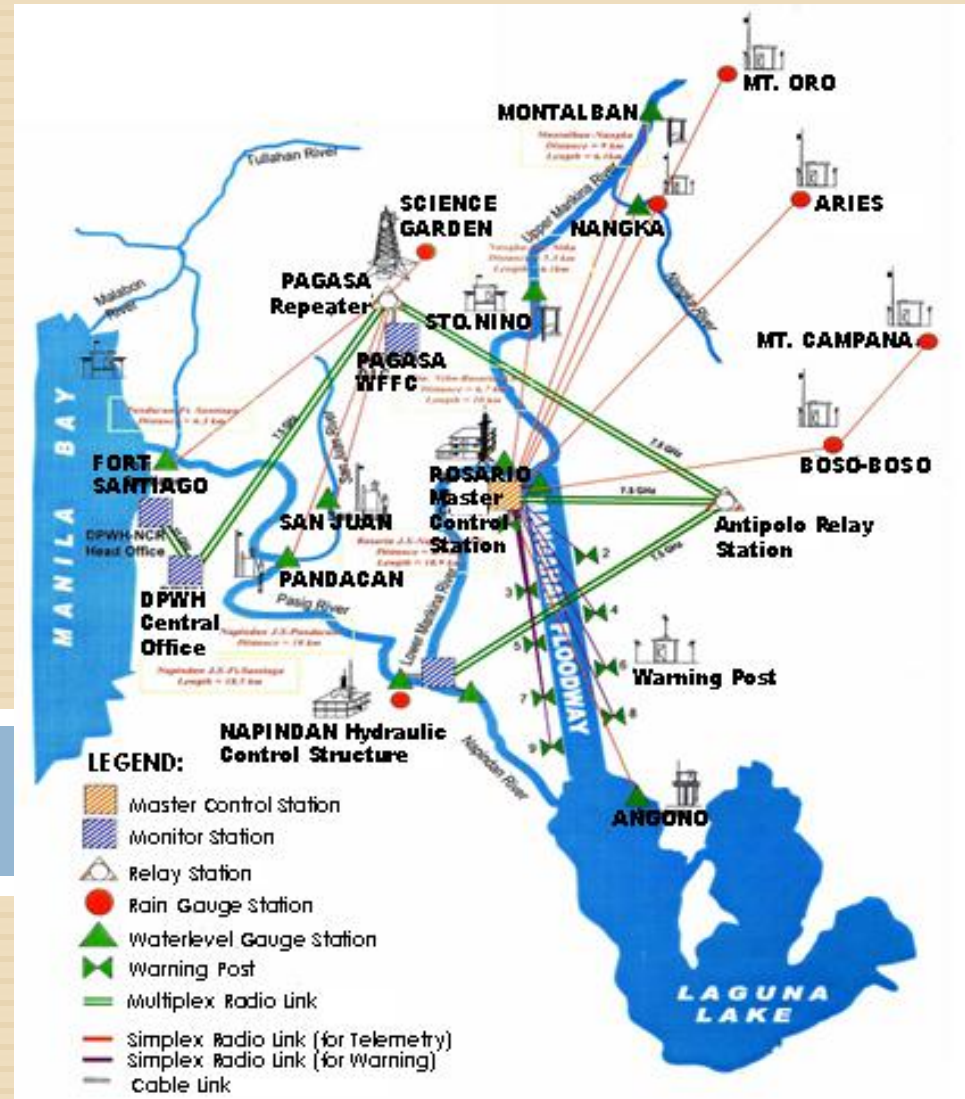


Political subdivisions

Effective Flood Control Operation System (EFCOS) of the Pasig-Marikina- Laguna Lake Complex

Originally, EFCOS was under DPWH but in 2003, after its expansion by JICA, it was turned over to MMDA.

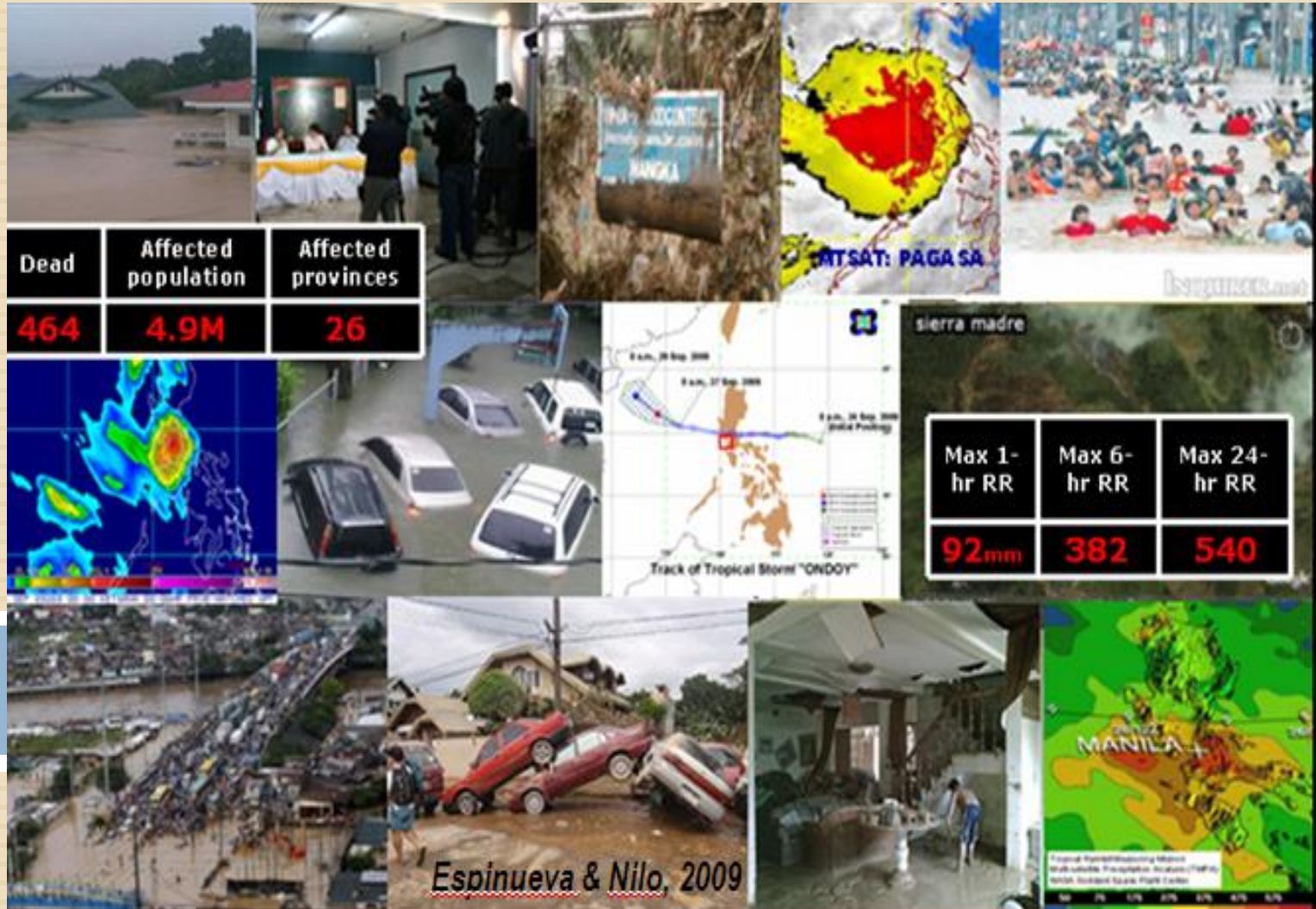
Operation of EFCOS – The forecast flood in the Upper Marikina river will be the basis to operate the Rosario weir & divert flow to Laguna Lake thru the Manggahan Floodway.



PAGASA & DPWH act as monitoring agencies.

When flood in Pasig river subsides, temporary detained water from Laguna Lake will be discharged to Manila Bay thru the Napindan Channel.

Impacts of flooding due to passage of TS Ondoy (Sep 26, 2009) in Greater Metro Manila

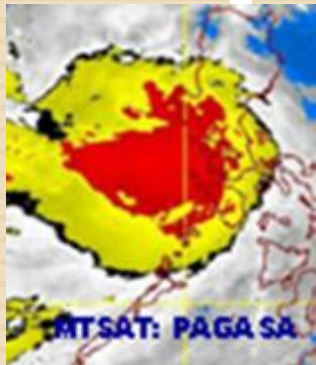


Signatures of a Flood Disaster

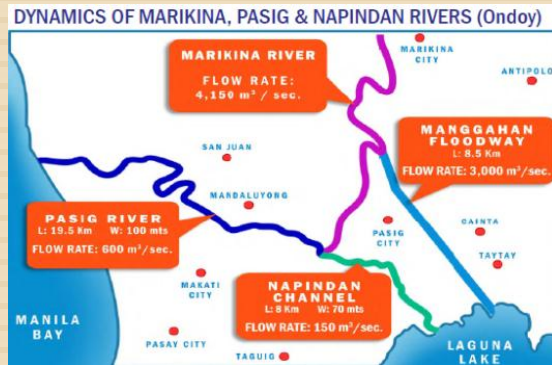


Flash Flood in Metro Manila due to TS Ondoy

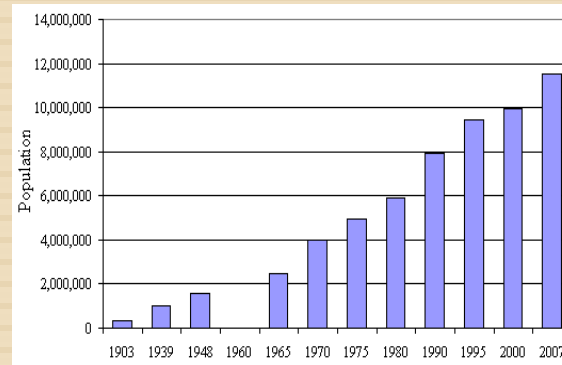
In 2003, Bankoff described in depth that Metro Manila's vulnerability to flooding has evolved as a result of the degree of interplay between climate, topography, resource use, and culture over time. The flood due to TS Ondoy in Sep 2009 proved it.



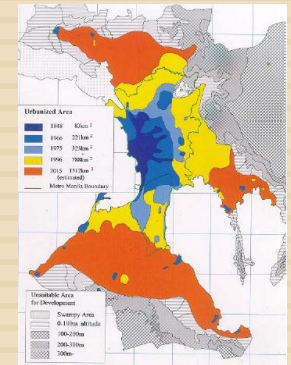
Intense rainfall



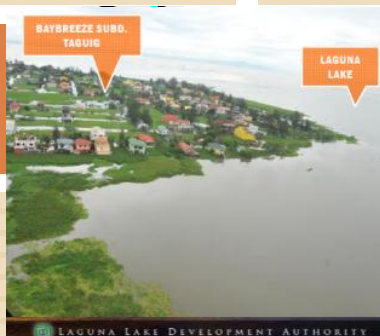
Insufficient carrying capacities



High/dense population



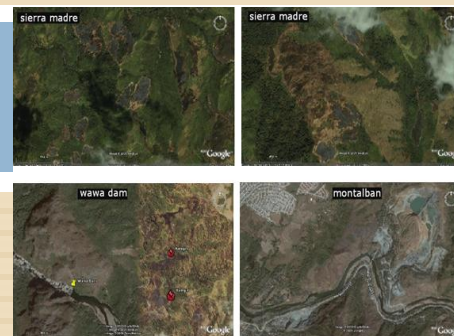
High urbanization level



Unabated/rampant development



Deforestation



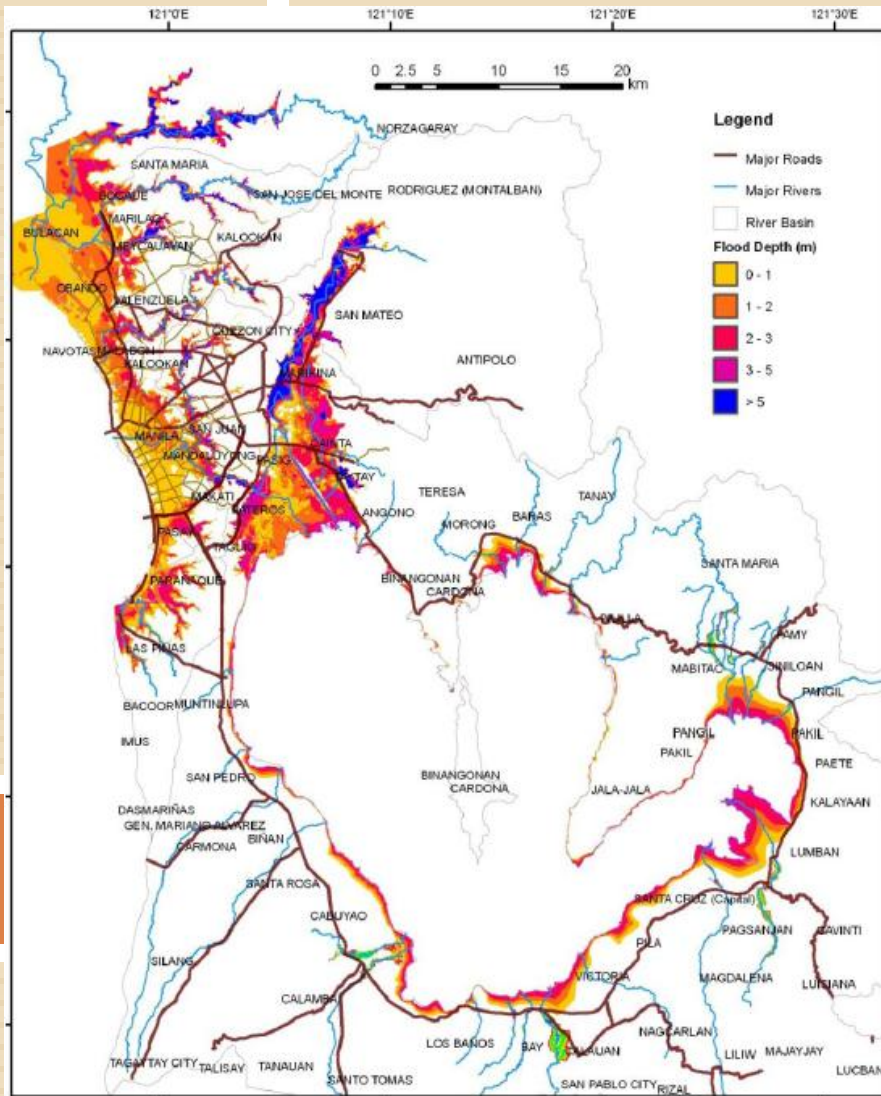
Insufficient warnings



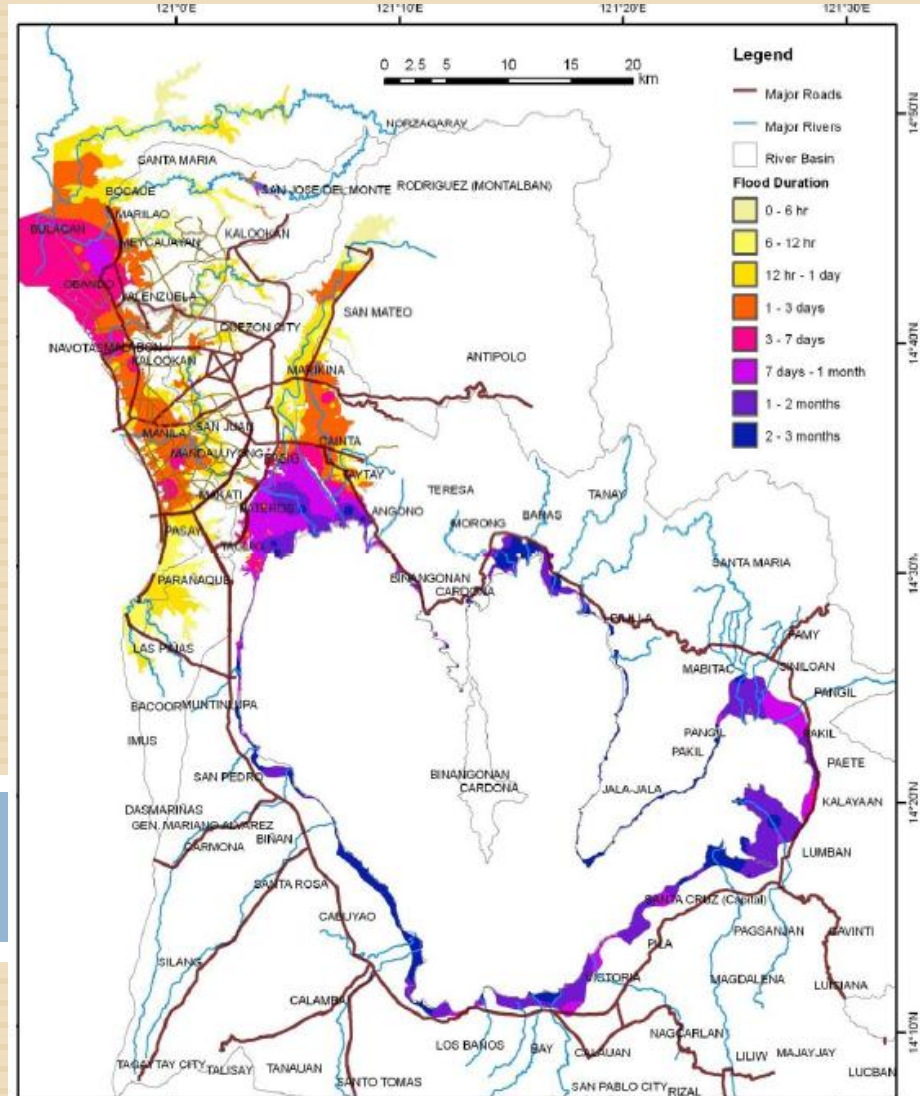
Informal settlers



Flood depth and duration maps of GMMA due to passage of TS Ondoy in 2009

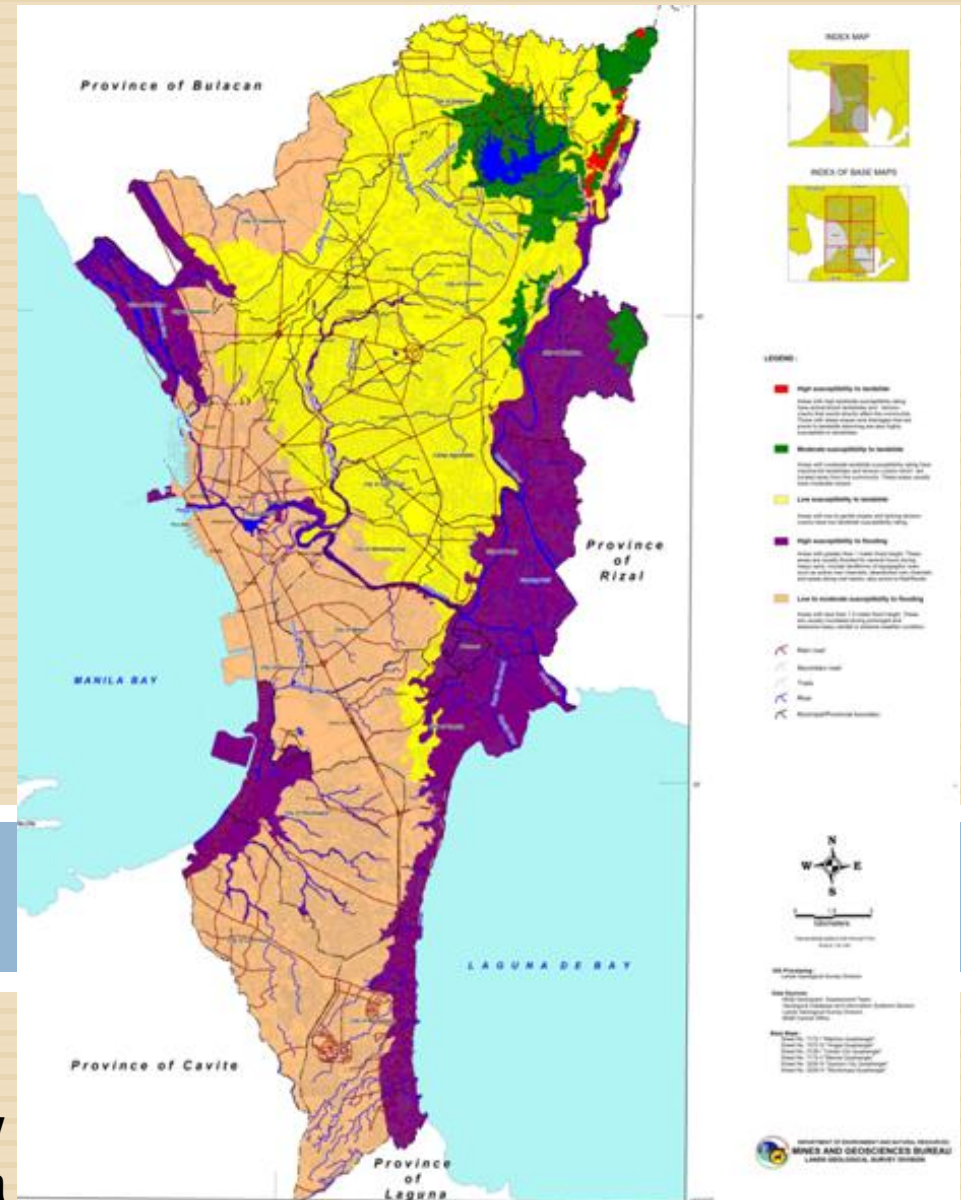
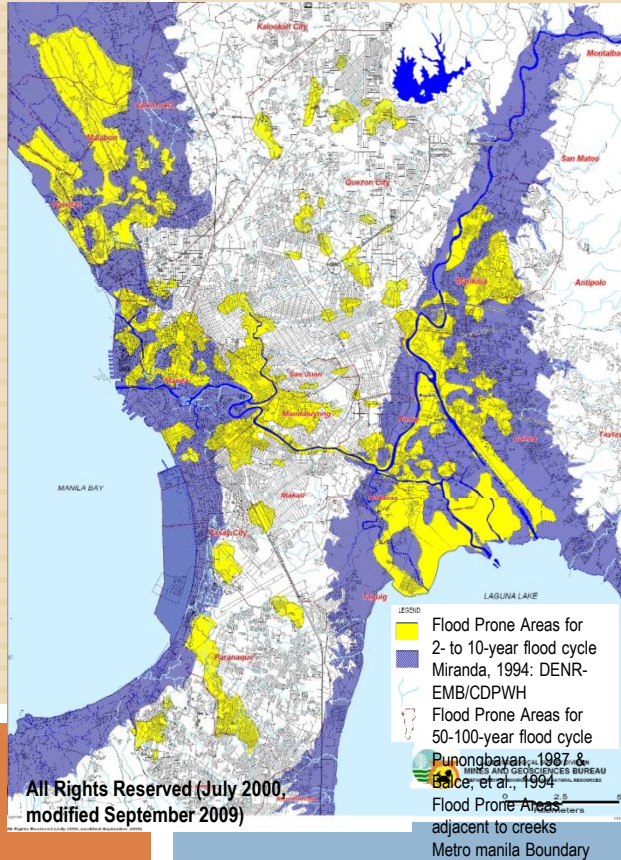


Flood Depth Map of Ondoy Flood in 2009



Flood Duration Map of Ondoy Flood in 2009

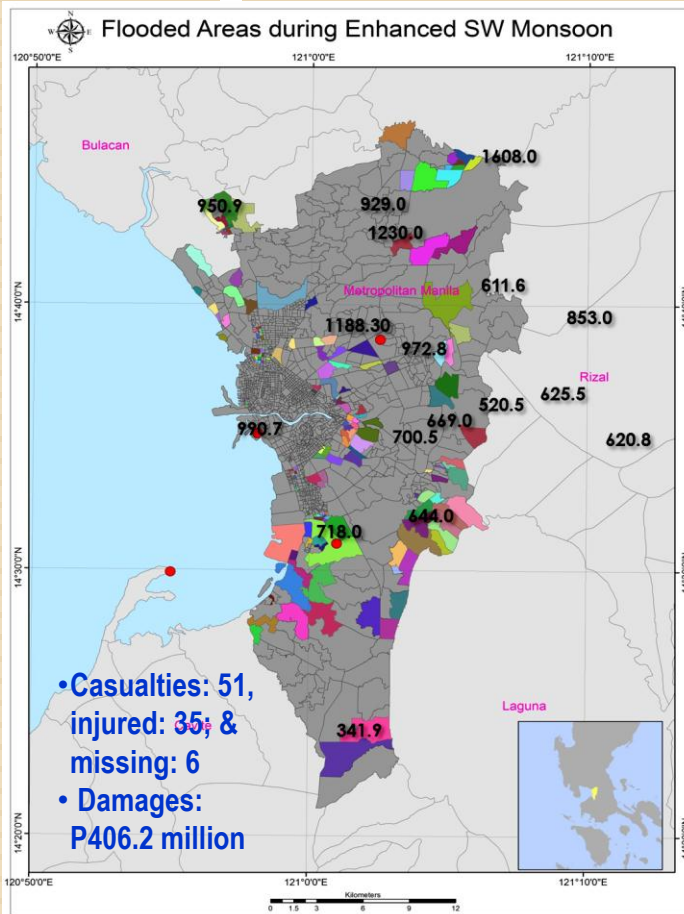
Landslide & Flood hazard Map of Metro Manila after Ondoy



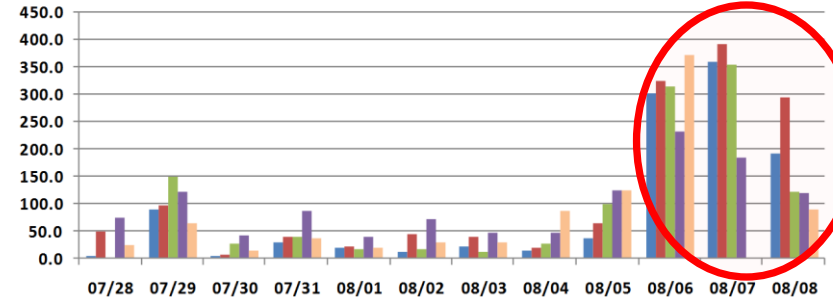
Landslide and Flood Susceptibility Map of Metro Manila



Impacts of Habagat



Daily Rainfall for selected stations
July 28- August 8, 2012



Date	Rainfall (mm)	% Monthly Normal Rainfall	TC in PAR	Remarks
26 Sep 2009	455.0	90.24%	TS Ondoy (Sep 24-27)	TS crossed C. Luzon
7 Aug 2012	391.4	77.62%	No TC	TS Haikui far N near China
7 Jun 1967	334.5	66.34%	No TC	TY Billie @ S of Japan
6 Aug 2012	323.4	64.14%	No TC	TS Haikui far N near China
8 Aug 2012	292.6	58.03%	No TC	TS Haikui over China
2 Sep 1970	276.5	54.84%	TS Norming (Sep 2-8)	TS @ NE of Luzon to Taiwan
4 Sep 2000	267.0	52.96%	TS Maring (Sep 2-8)	TS @ E-NE-W of Luzon

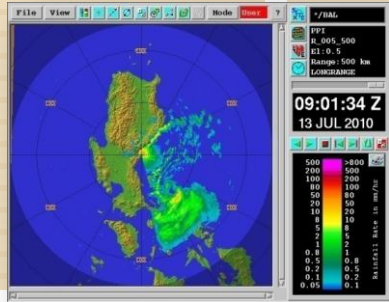
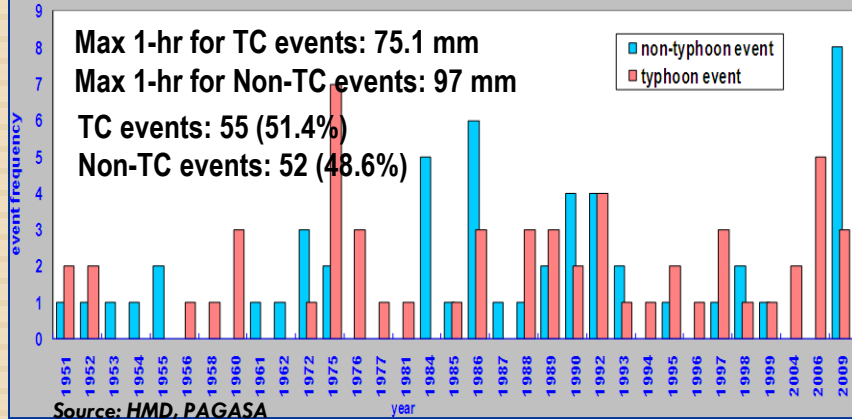


Duration of continuous rainfall:
July 16 – Aug 8 = 24 days



Rainfall & Thunderstorm Warning System for Metro Manila

Metro Manila Flood Event



Innovations in PAGASA's Warning Services

1. Rainfall Warning System – launched: on 10 Jun 2012
2. Thunderstorm Warning System

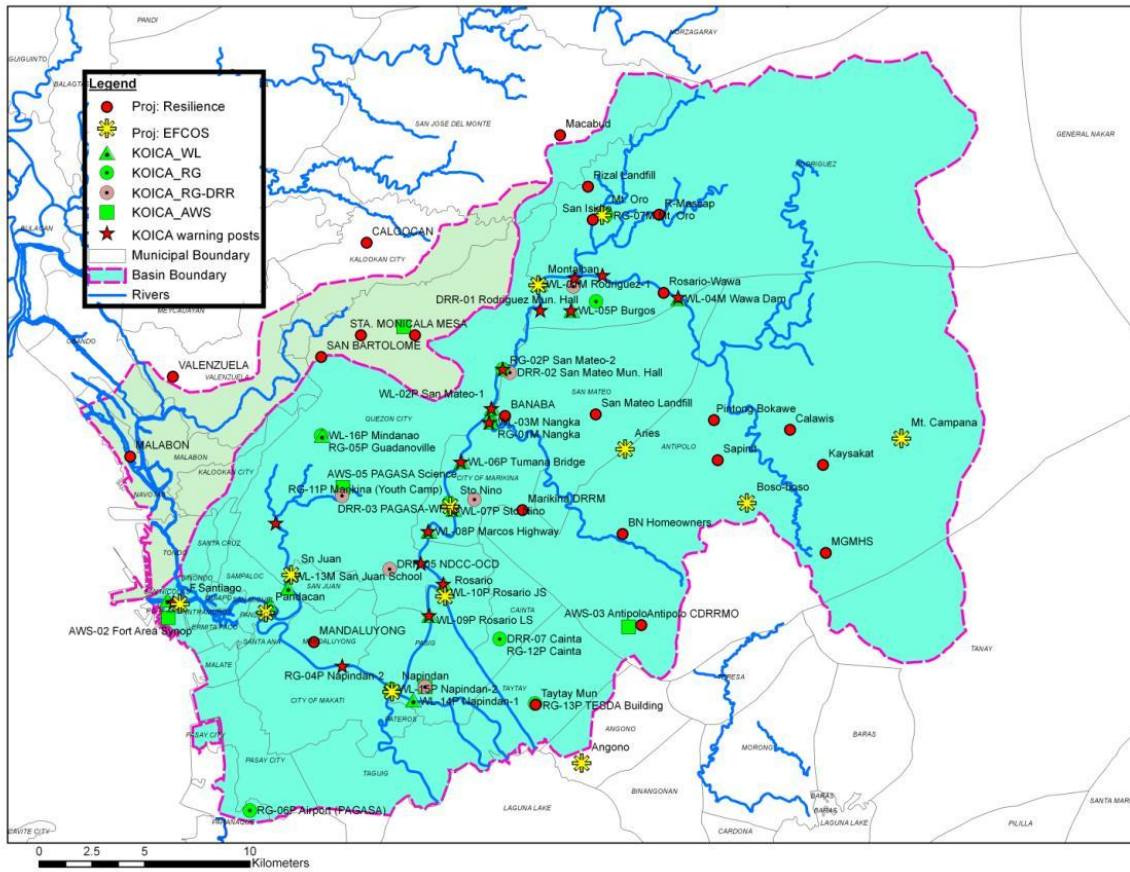
Rainfall Warning System

RAINFALL VALUES (mm)	MEANING	WARNING
Rainfall of 7.5 to 15 mm per hour is expected to fall and most likely to continue for the next 3 hours.	Community AWARENESS FLOODING is POSSIBLE in low lying areas and near river channels.	Advisory
Rainfall of more than 15mm up to 30mm in 1 hour was observed & most likely to continue or rainfall for the past 3 hours is more than 45mm to 65mm	Community PREPAREDNESS FLOODING is THREATENING in low lying areas and near river channels	Alert
Rainfall of more than 30mm in 1 hour was observed & most likely to continue or rainfall for the past 3 hours is more than 65mm.	Community RESPONSE SERIOUS FLOODING is EXPECTED Take necessary precautionary measures	Emergency

Thunderstorm Warning System

WARNING	MEANING	DISSEMINATION
Information 	Thunderstorm is <i>less likely</i> to develop in the Metro Manila area	This will be disseminated thru website
Watch 	Thunderstorm formation is <i>likely</i> within the next twelve (12) hours. This is more general than a warning.	This will be disseminated thru SMS, Twitter, website and fax
Warning 	Thunderstorm is <i>threatening a specific area(s)</i> within the next 2 hours. Updates will be issued as frequent as necessary	This will be disseminated thru SMS, Twitter, website and fax

Integrated Flood Warning System for Metro Manila



Integrated Network & Warning System

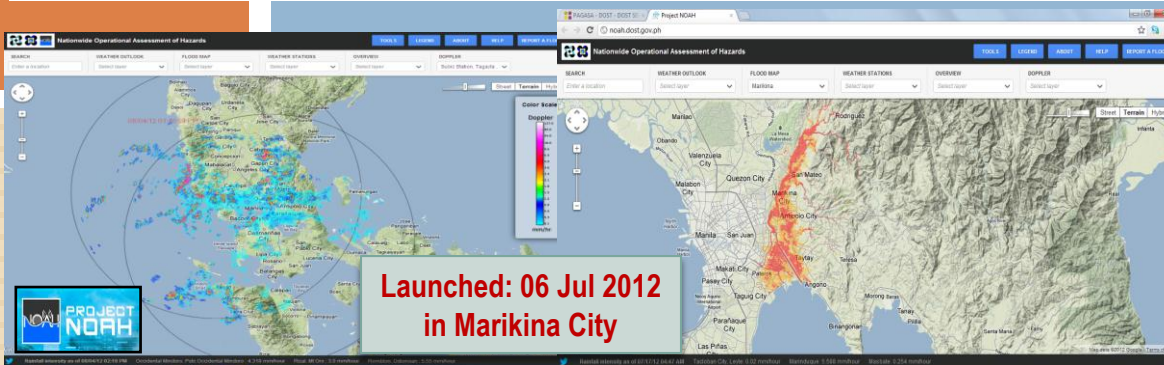
EFCOS (JICA) - MMDA

KOICA - PAGASA

CIDA - PAGASA

Facilities:

- Rainfall stations (10 KOICA; 6 EFCOS; 22 CIDA)
- Water level stations (10 KOICA; 1 CIDA; -- EFCOS)
- Automatic Weather Station (AWS): 4 – KOICA
- Warning Stations (20 along Pasig-Marikina – KOICA; 4 along Manggahan Floodway – EFCOS)

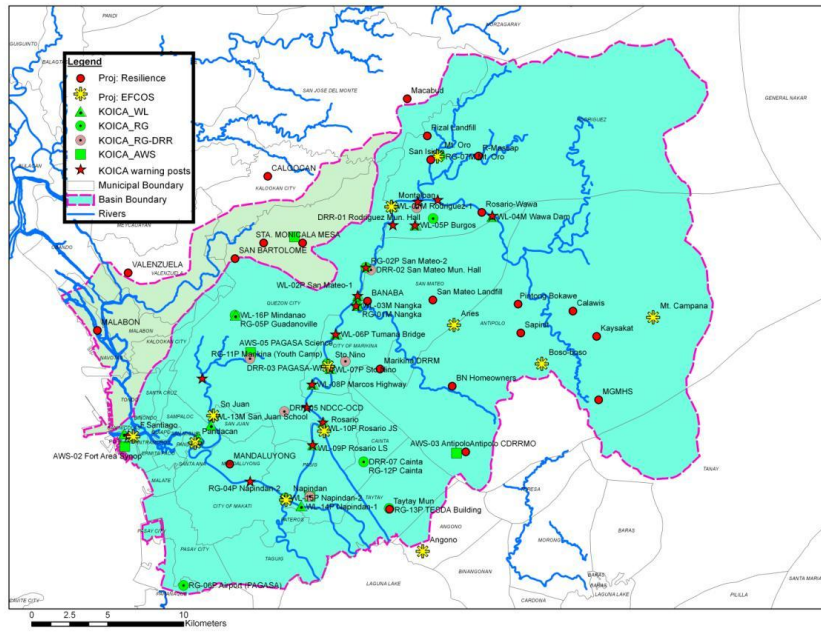


Real-time access of Radar data, AWS, Rainfall & Water Level Data & Rainfall Forecasts





EWS for flood – carried out on a river basin approach.



Threshold for Flood Warnings:

1. Rainfall intensities

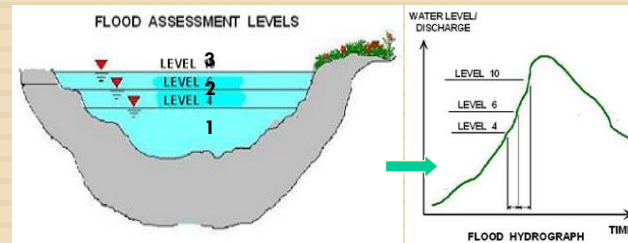
Rainfall Values	Meaning	Flood Warning
Rainfall observation of 5 to 9 mm per hour	Awareness	READY
Rainfall observation 10 to 19 mm/hour	Preparedness	GET SET
Rainfall observation of 20 mm/hour or more	Response	GO

Threshold for Flood Warnings:

2. Assessment Water Levels

	Actual Water Level (m)	Meaning	Flood Warning
Alert	22.40 m	Awareness	READY
Alarm	23.00 m	Preparedness	GET SET
Critical	23.60 m	Response	GO

Station Name	Gauge Datum	Assessment Levels		
		Alert	Alarm	Critical
1. Burgos	25.00	22.40	23.00	23.60
2. San Mateo	27.41	16.50	17.50	18.50
3. Mindanao	28.00	28.00	29.00	30.00
4. Tumana	27.73	16.00	17.00	18.00
5. Sto. Niño	24.73	15.00	16.00	17.00
6. Marcos Highway	22.60	13.50	14.50	15.50
7. Rosario L.S.	21.50	12.50	13.20	13.80
8. Rosario J.S.	12.50	12.50	13.20	13.80
9. Napindan I	12.00	10.90	11.90	12.90
10. Napindan II	15.56	10.90	11.90	12.90



Note:

Values are arbitrary and will be modified when sufficient data becomes available.

3. Preparedness measures



Typical tropical cyclone damage

4



Widespread damage to infrastructure and agriculture.

3



Heavy damage to agriculture; Some large trees uprooted; Majority of nipa and cogon houses unroofed or destroyed, considerable damage to structures of light to medium construction; Moderate to heavy disruption of electrical power and communication services; Travel by land, sea and air is dangerous.

2



Moderate damage to agriculture; Rice and corn adversely affected; Few large trees uprooted; Large number of nipa and cogon houses partially or totally unroofed; Travel by land, sea and air is dangerous.

1



Rice in flowering stage may suffer significant damage. Some nipa and cogon houses may be partially unroofed. Sea travel of small sea crafts and fishing boats is risky.



3. Preparedness measures

Public Storm Warning Signal Number 1

A tropical cyclone may threaten or affect the locality.

Winds of not more than 60 KPH may be expected in at least 36 hours.



Potential Impacts



- Twigs and branches of small trees may be broken.
- Some banana plants may tilt or land flat on the ground.
- Rice in flowering stage may suffer significant damage.
- Some houses of very light materials (nipa and cogon) houses may be partially unroofed.
- Very light or no damage at all may be sustained by exposed communities.

What to do?



- Listen to your radio for more information about the weather disturbance.
- Check the capacity of the house to withstand strong winds and strengthen the house if necessary.
- Prepare flashlights, batteries, matches, kerosene lamps or candles and charcoal in anticipation of power failure.
- Listen to the latest **PAGASA's Severe Weather Bulletin issued by every 6 hours.** In the meantime, business may be carried out as usual except when flood occurs
- Disaster preparedness plan is activated to alert status.

3. Preparedness measures

Public Storm Warning Signal Number 2

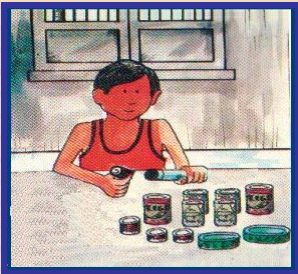
A moderate tropical cyclone may affect the locality.

Winds of not more than 61 to 100 KPH may be expected in at least 24 hours.

Potential Impacts

- Some coconut trees maybe tilted with few others broken.
- Few big trees maybe uprooted.
- Many banana plants maybe downed.
- Rice and corn maybe adversely affected.
- Large number of nipa and cogon houses maybe partially or totally unroofed.
- Some old galvanized iron roofing maybe peeled off.
- Light to moderate damage to the exposed communities.

What to do?



- Special attention should be given to the **latest position, the direction and speed of movement** as it may intensify and move towards the locality.
- The general public, especially people traveling by sea and air are cautioned to avoid unnecessary risks.
- Secure properties before the signal are upgraded.
- Board up windows or put storm shutters in place and securely fastened.
- Stay at home.
- **Disaster preparedness agencies must alert their communities.**



3. Preparedness measures

Public Storm Warning Signal Number 3

A strong tropical will affect the locality.

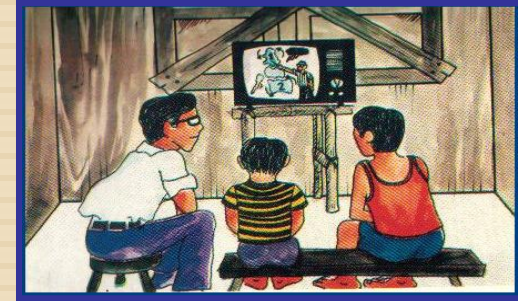
Winds of 101 to 180 KPH may be expected in at least 18 hours.

Potential Impacts

- Many coconut trees may be broken or destroyed.
- Almost all banana plants may be downed and a large number of trees may be uprooted.
- Majority of nipa and cogon houses may be unroofed or destroyed and considerable damage to structures of light to medium construction.
- Widespread disruption of electrical power and communication services.
- Moderate to heavy damage may be experienced in the industrial sectors.



What to do?



- Keep your radio on and listen to the latest news about typhoon.
- Everybody is advised to **stay indoors**.
- People are advised to stay in strong buildings.
- Evacuate from low-lying areas.
- Stay away from coastal areas and riverbanks.
- Watch out for the passage of the “Eye Wall” and the “Eye” of the typhoon.
- **Disaster preparedness and response agencies are in action with appropriate response to actual emergency.**



3. Preparedness measures

Public Storm Warning Signal Number 4

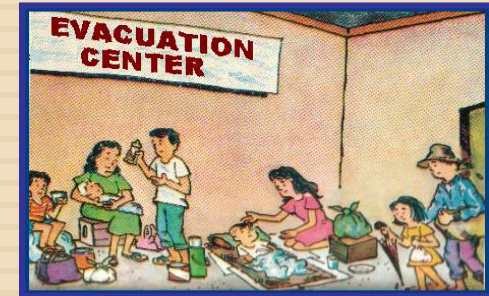
A very strong tropical cyclone will affect the locality.

Very strong winds of more than 180 KPH may be expected in at least 12 hours.

Potential Impacts

- Coconut plantations may suffer extensive damage.
- Many large trees may be uprooted.
- Most residential and institutional buildings of mixed construction material may be severely damaged.
- Electrical power distribution and communication services may be severely disrupted.
- Damage to affected communities can be very heavy.

What to do?



- The situation is potentially very destructive to the community.
- Stay in safe houses or evacuation centers !!!
- All travels and outdoor activities should be cancelled.
- Generally, damage to affected communities can be very heavy.
- The National Disaster Risk Reduction Office and other disaster response organizations are now fully responding to emergencies and in full readiness to immediately respond to possible calamity.



FLOOD SAFETY RULES

BEFORE THE FLOOD:

- Find out how often your location is likely to be flooded.
- Know the flood warning system in your community and be sure your family knows it.
- Keep informed of daily weather condition.
- Designate an evacuation area for the family and livestock.
- Assign family members instructions and responsibilities according to an evacuation plan.
- Keep a stock of food which requires little cooking and refrigeration; electric power may be interrupted.
- Keep a transistorized radio and flashlight with spare batteries, emergency cooking equipment, candies, matches and first aid kit handy in case of emergency.
- Store supplies and other household effects above expected flood water level. Securely anchor weak dwellings and items



FLOOD SAFETY RULES

WHEN WARNED OF FLOOD:

- Watch for rapidly rising flood waters.
- Listen to your radio for emergency instructions.
- If you find it necessary to evacuate, move to a safe area before access is cut off by flood waters.
- Store drinking water in containers, water service may be interrupted.
- Move household belongings to upper levels.
- Get livestock to higher grounds.
- Turn off electricity at the main switch in the building before evacuating and also lock your house.



FLOOD SAFETY RULES

DURING THE FLOOD:

- Avoid areas subject to sudden flooding.
- Do not attempt to cross rivers or flowing streams where water is above the knee.
- Beware of water-covered roads and bridges.
- Avoid unnecessary exposure to the elements.
- Do not go swimming or boating in swollen rivers.
- Eat only well-cooked food. Protect leftovers against contamination.
- Drink clean or preferably boiled water **ONLY**.

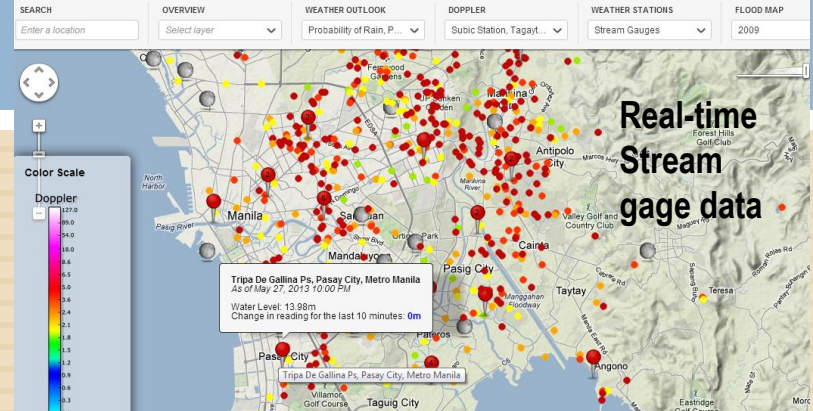
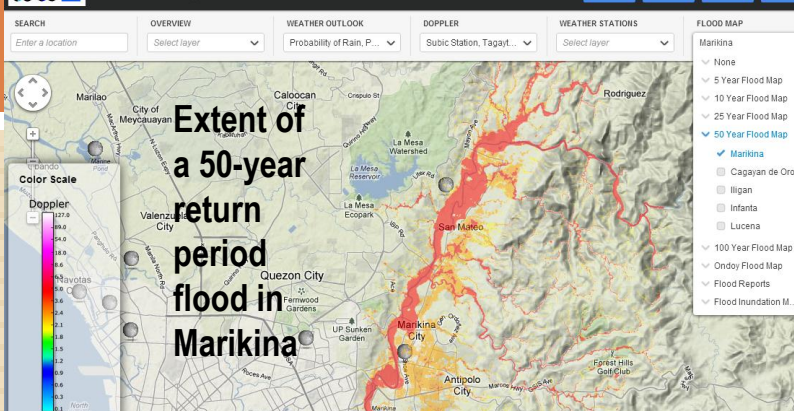
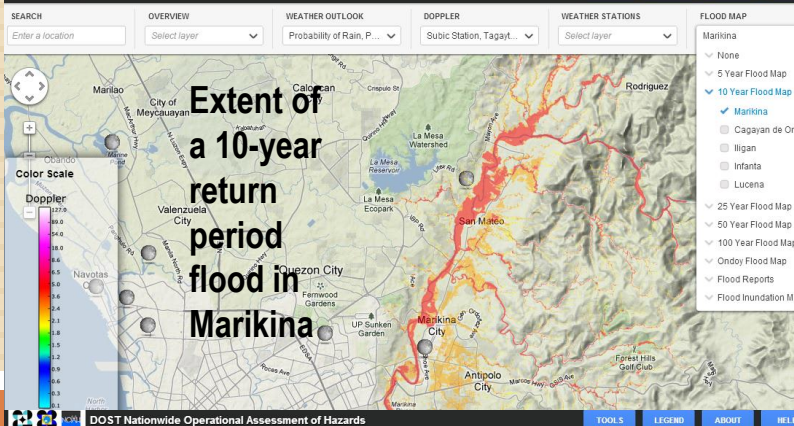
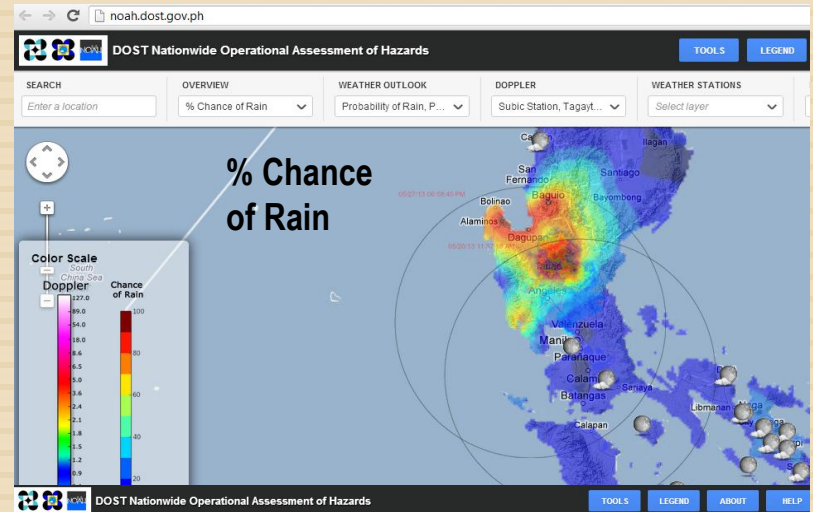
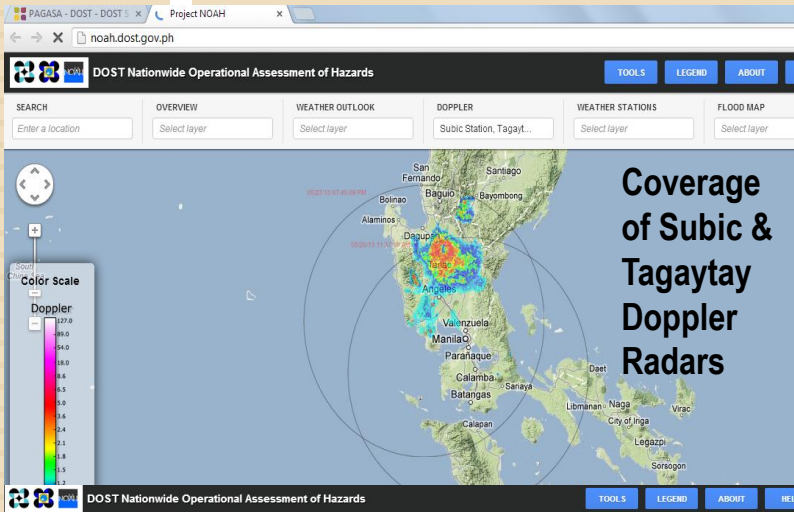


FLOOD SAFETY RULES

AFTER THE FLOOD:

- Re-enter the dwellings with caution using flashlights, not lanterns or torches.
- Flammables may be inside. Be alert for fire hazards like broken wires.
- Do not eat food and drink water until they have been checked for flood water contamination.
- Report broken utility lines (electricity, water, gas and telephone) to appropriate agencies authorities.
- Do not turn on the main switch or use appliances and other equipment until they have been checked by a competent electrician.
- Consult health authorities for immunization requirements.
- Do not go in disaster areas. Your presence might hamper rescue and other emergency operations.







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Thank you for your attention.

*The source of man's unhappiness is his
ignorance of Nature.*

- Paul Henry Thiry d'Holbach