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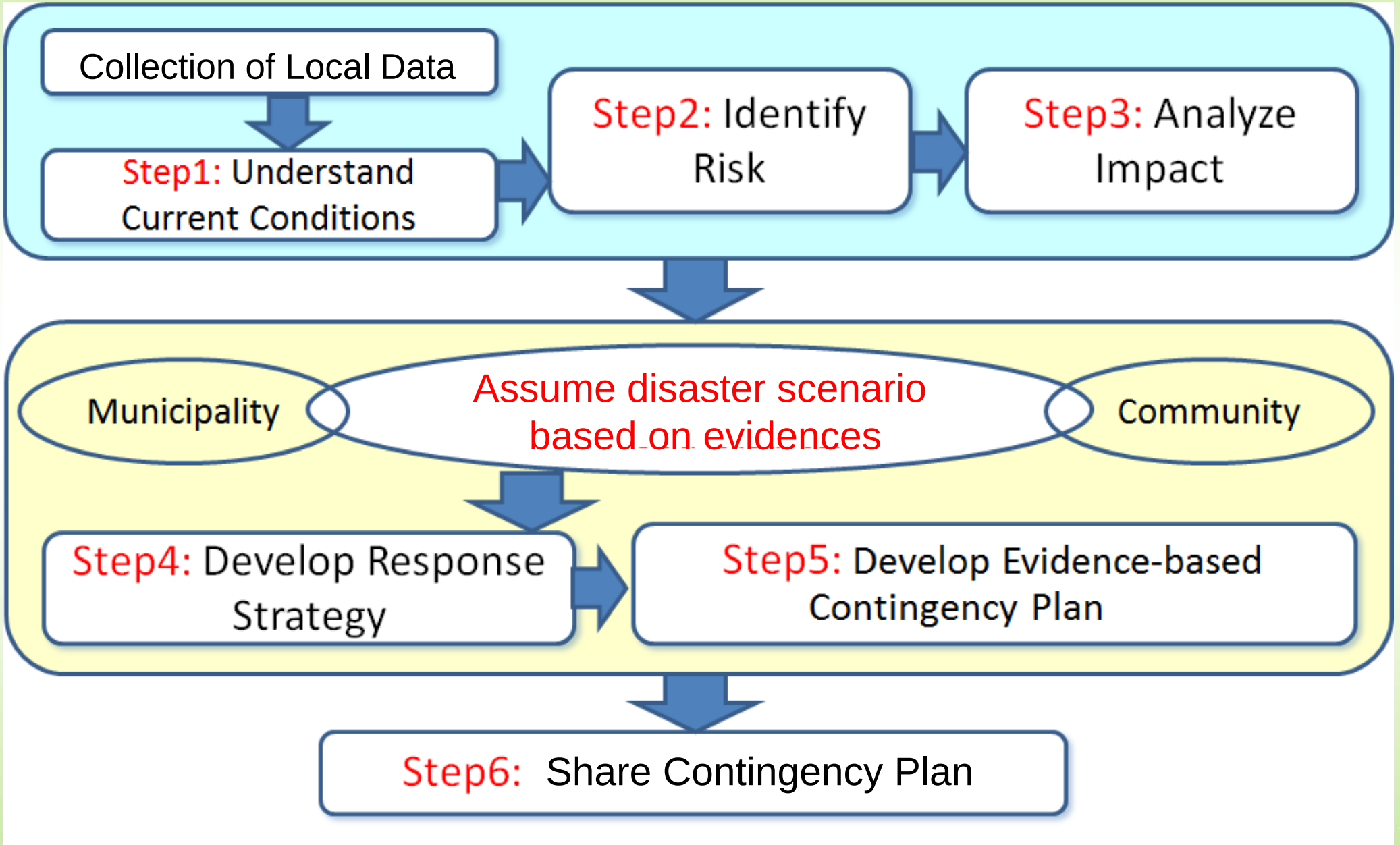
Proposal of Evidence-based Flood Contingency Planning

M. OHARA, N. NAGUMO, B. B. SHRESTHA and H.SAWANO
International Centre for Water Hazard
and Risk Management (ICHARM),
Under the auspices of UNESCO

Public Works Research Institute (PWRI)

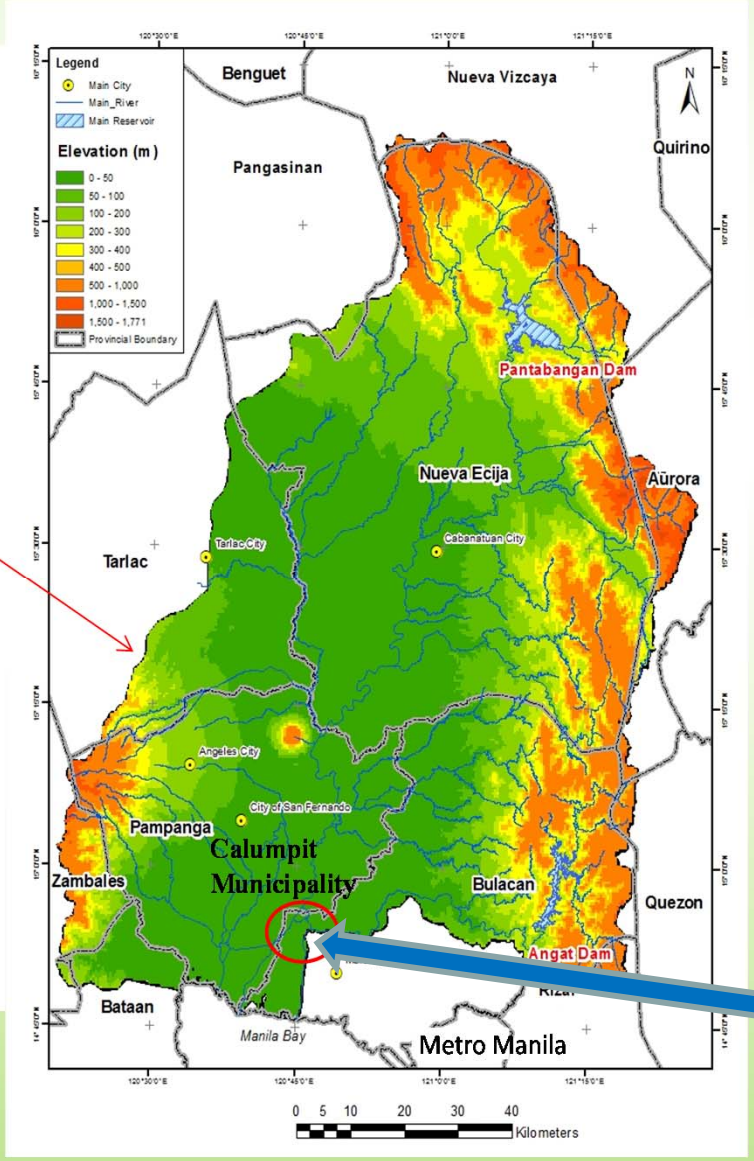
Proposal of Evidence-based Contingency Planning



Reference: ISO22301 Societal Security
– Business continuity management systems –.

Objectives and Case Study Area

This study proposes/verifies a method of evidence-based flood contingency planning with community involvement.

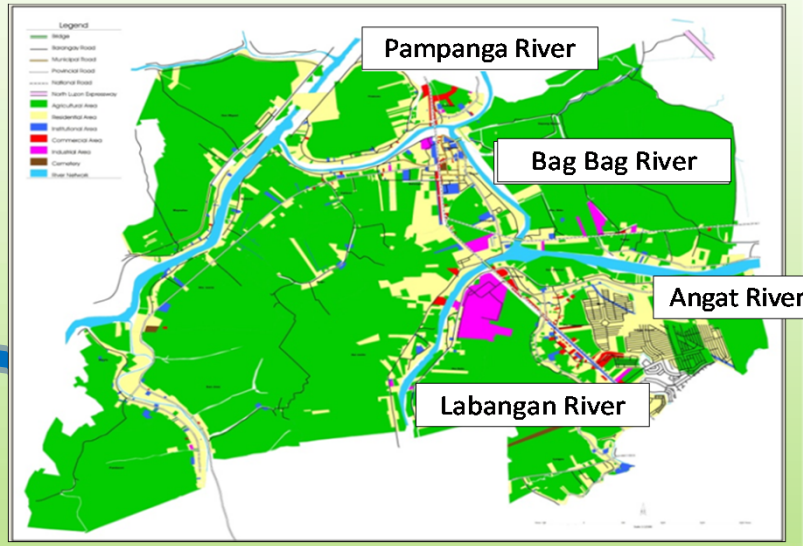


Pampanga River Basin:

Catchment Area: 10,434 km^2
River Length: 260 km
Average annual rainfall:
2155 mm/year

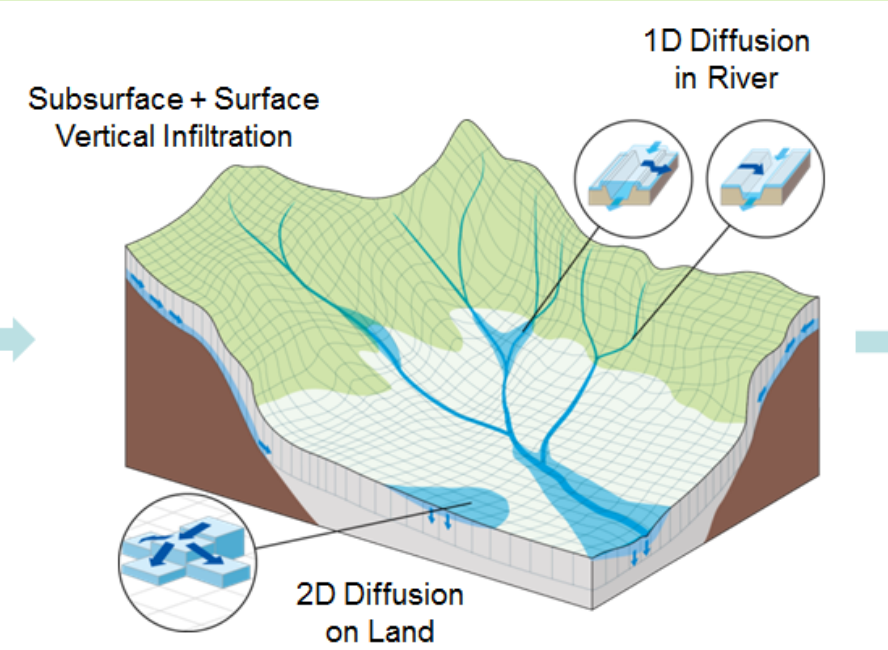
Calumpit Municipality:

Population: 112,007
Households: 22,402
Area: 5,625 ha

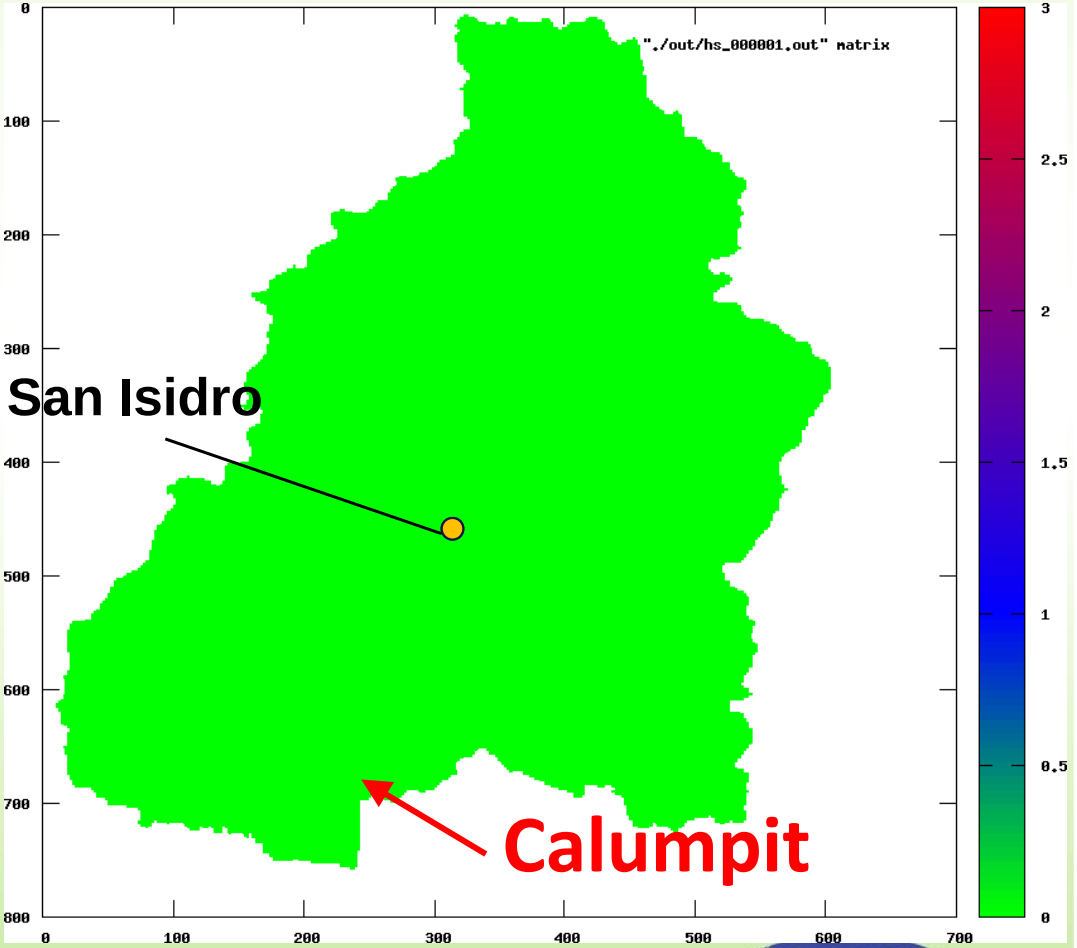


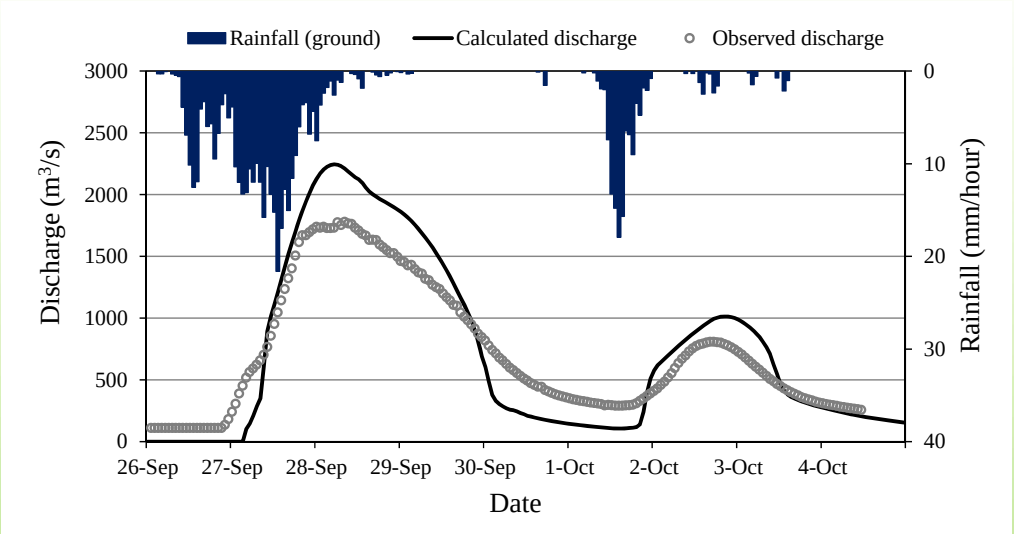
Step2: Identify Risk

Hazard Assessment by Rainfall-Runoff-Inundation (RRI) Model



Simulation for 2011 Flood (Typhoons Pedring and Quiel) from 26 Sep to 4 Oct,





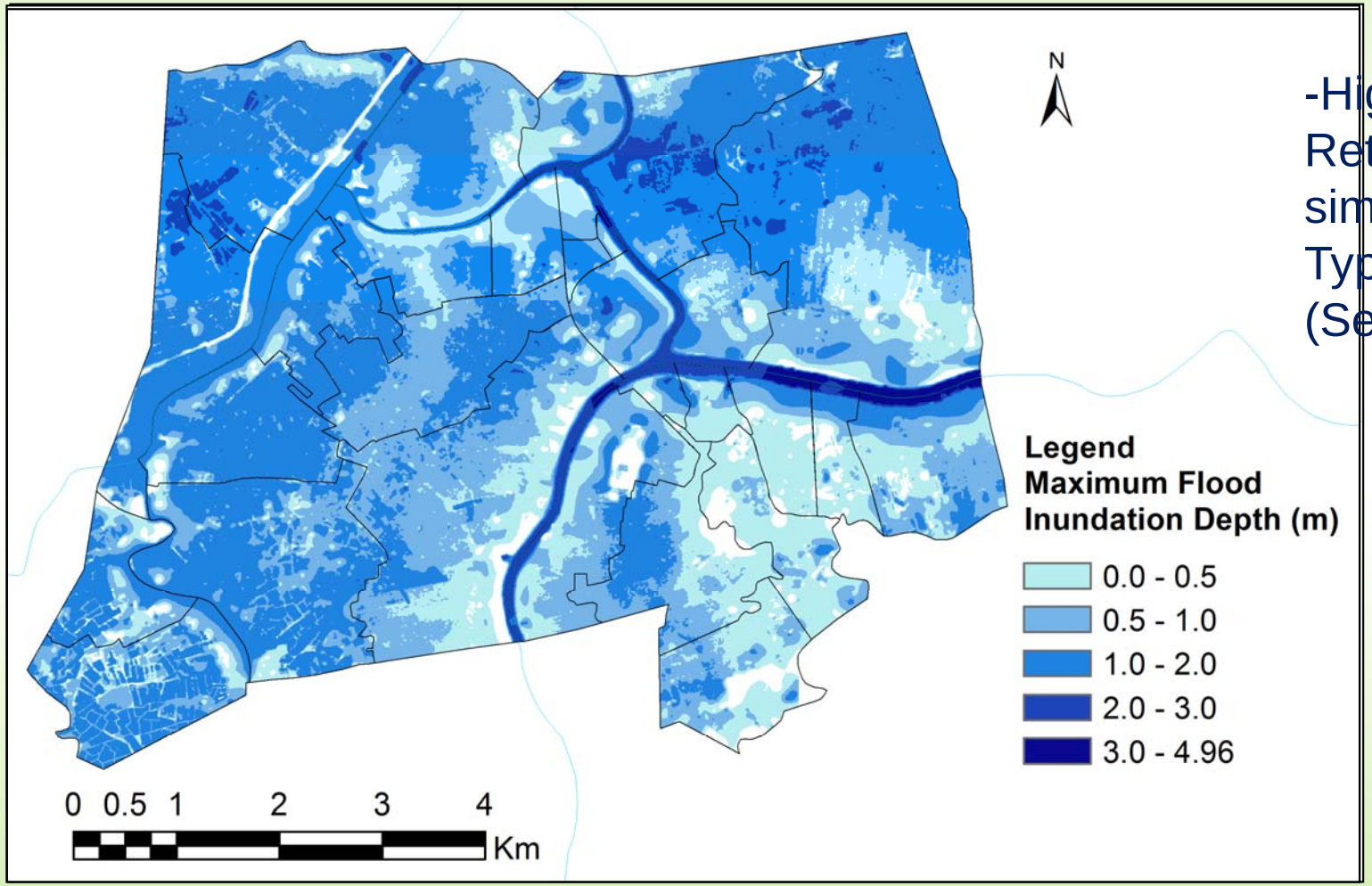
Comparison of calculated and observed discharge at San Isidro Station

http://www.icharm.go.jp

Step2: Identify Risk

Hazard Assessment by Rainfall-Runoff-Inundation (RRI) Model

Extreme Flood (100-year Return Period)



-High Flood (30-year Return Period) is similar to flood event of Typhoon Pedring (September 2011).

Interferometric Synthetic Aperture Radar (IfSAR) DEM Data provided by National Mapping and Resource Information Authority (NAMRIA), Philippines, was used in the calculation (grid size/ 5m).

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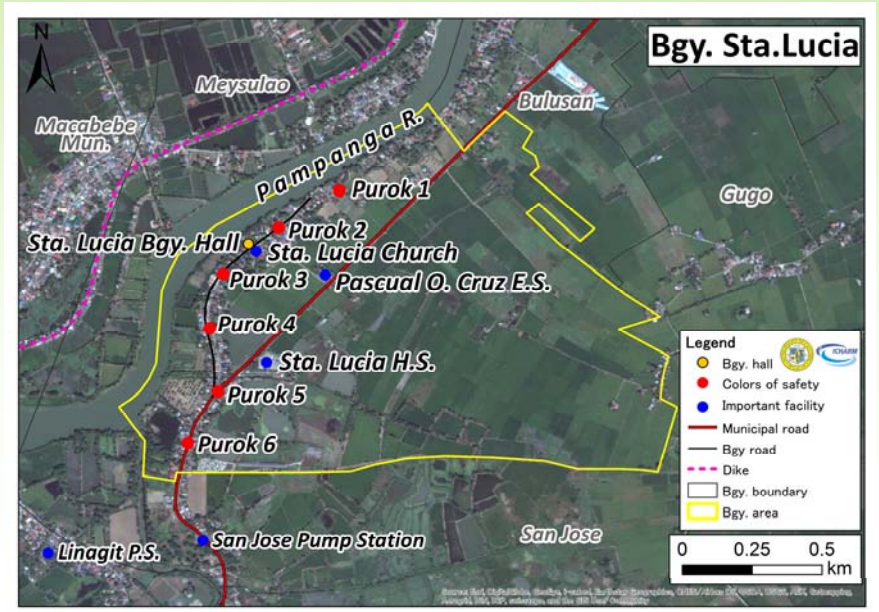
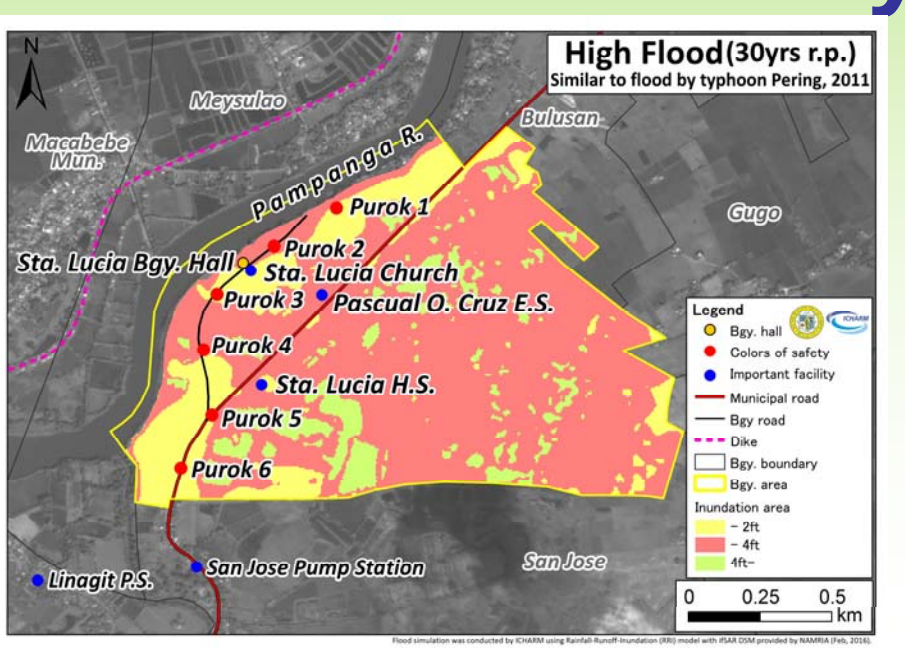
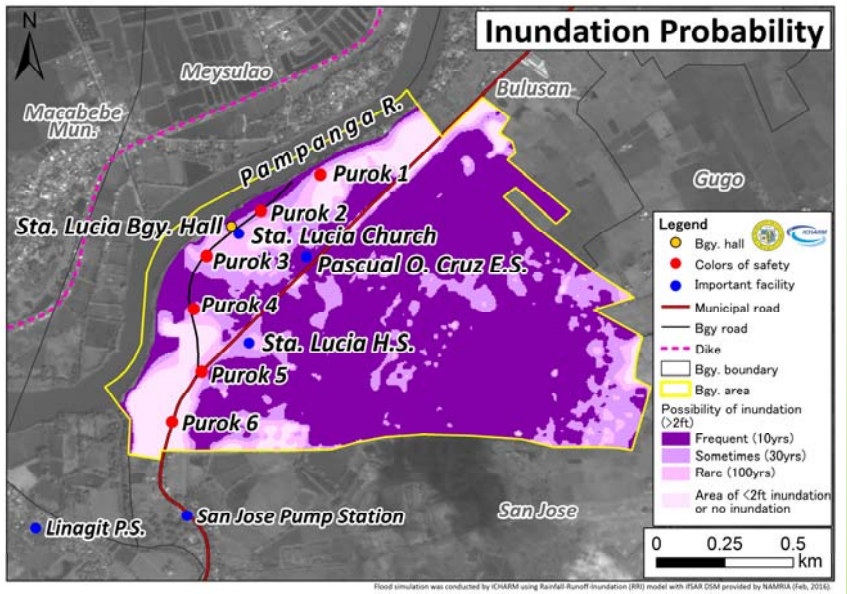
Tools for identifying risk for community



Resource Map



Inundation Map



Inundation Probability Map

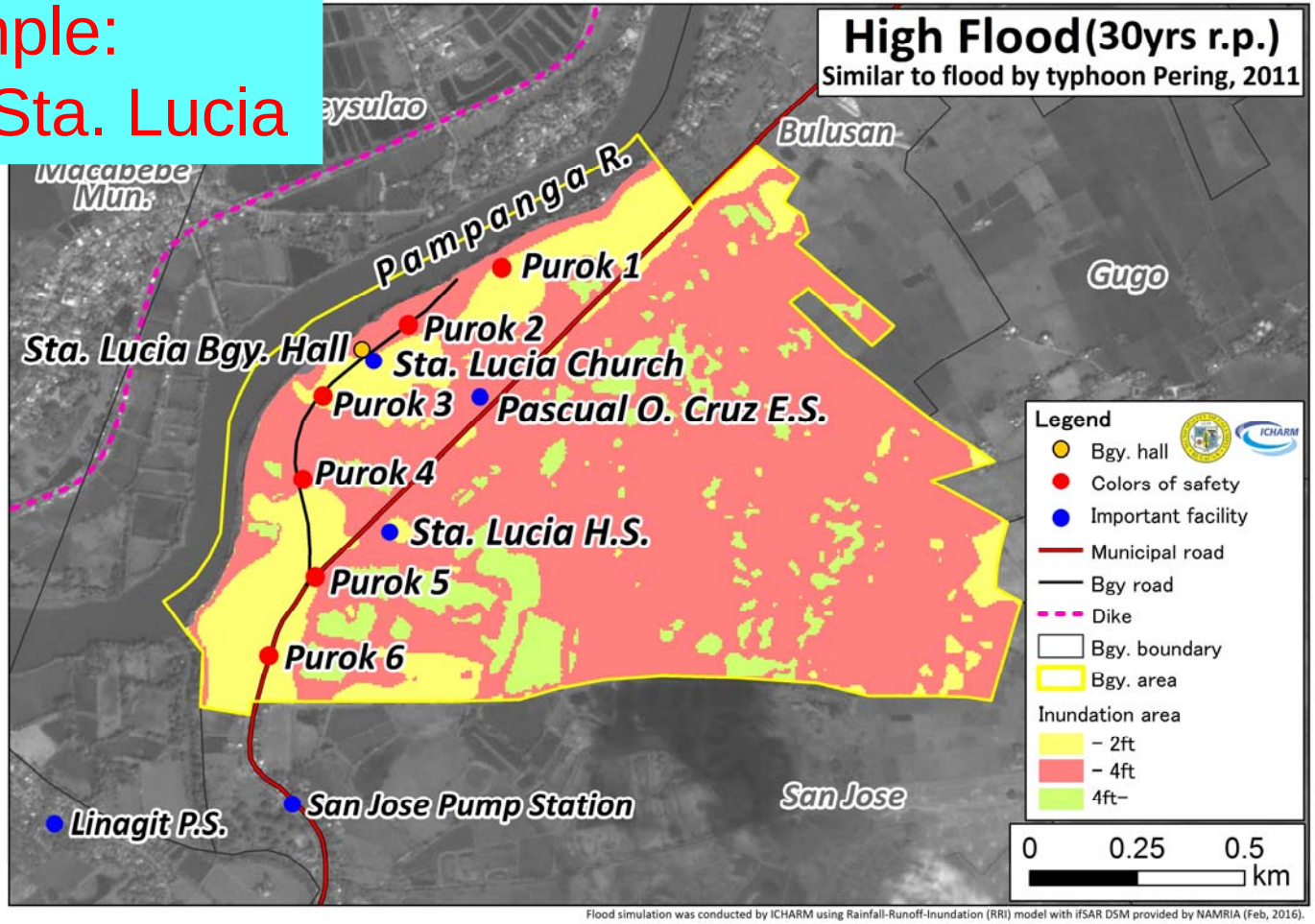
Colors of Safety	Flood Case	<Legend>	less than 2ft (<0.3048m)	less than 4ft (<1.2192 m)	more than 4ft (>1.2192m)	Inundation depth (m)															
		Day1		Day2		Day3		Day4		Day5		Day6		Day7		Day8		Day9		Day10	
Purok 1	Ordinary flood (10yrs return period)	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.32	0.34	0.32	0.28	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	High flood (30yrs return period)	0.00	0.00	0.00	0.00	0.00	0.15	0.33	0.40	0.43	0.45	0.45	0.44	0.43	0.40	0.33	0.25	0.13	0.00	0.00	0.00
	Extreme flood (100yrs return period)	0.00	0.00	0.00	0.00	0.00	0.26	0.42	0.58	0.65	0.70	0.74	0.76	0.76	0.73	0.69	0.62	0.52	0.42	0.38	0.33
	2011 Pedring and Quiel	0.00	0.00	0.00	0.00	0.00	0.15	0.32	0.40	0.43	0.44	0.44	0.44	0.43	0.42	0.43	0.44	0.45	0.43	0.42	0.39
Purok 2	Ordinary flood (10yrs return period)	0.00	0.00	0.00	0.00	0.00	0.24	0.44	0.53	0.56	0.50	0.37	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	High flood (30yrs return period)	0.00	0.00	0.00	0.00	0.00	0.36	0.55	0.70	0.76	0.78	0.78	0.76	0.73	0.67	0.51	0.29	0.13	0.00	0.00	0.00
	Extreme flood (100yrs return period)	0.00	0.00	0.00	0.00	0.00	0.45	0.74	0.91	0.99	1.04	1.08	1.10	1.09	1.05	1.01	0.87	0.82	0.67	0.58	0.46
	2011 Pedring and Quiel	0.00	0.00	0.00	0.00	0.00	0.36	0.54	0.69	0.75	0.77	0.77	0.75	0.73	0.72	0.75	0.77	0.77	0.74	0.70	0.64
Barangay hall	Ordinary flood (10yrs return period)	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.54	0.56	0.55	0.51	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	High flood (30yrs return period)	0.00	0.00	0.00	0.00	0.00	0.22	0.55	0.63	0.66	0.67	0.67	0.67	0.65	0.63	0.56	0.47	0.35	0.00	0.00	0.00
	Extreme flood (100yrs return period)	0.00	0.00	0.00	0.00	0.22	0.48	0.64	0.77	0.84	0.90	0.94	0.96	0.96	0.94	0.89	0.82	0.72	0.65	0.60	0.56
	2011 Pedring and Quiel	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.62	0.65	0.66	0.67	0.66	0.65	0.65	0.66	0.67	0.67	0.66	0.64	0.62

Time-series Inundation Chart

Inundation map for Barangay (Community)

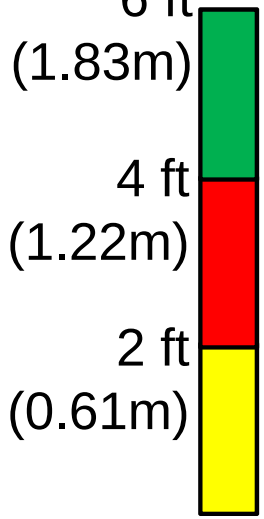
Inundation map using the Colors of Safety
High Flood (30 Years Flood)

Example:
Bgy. Sta. Lucia



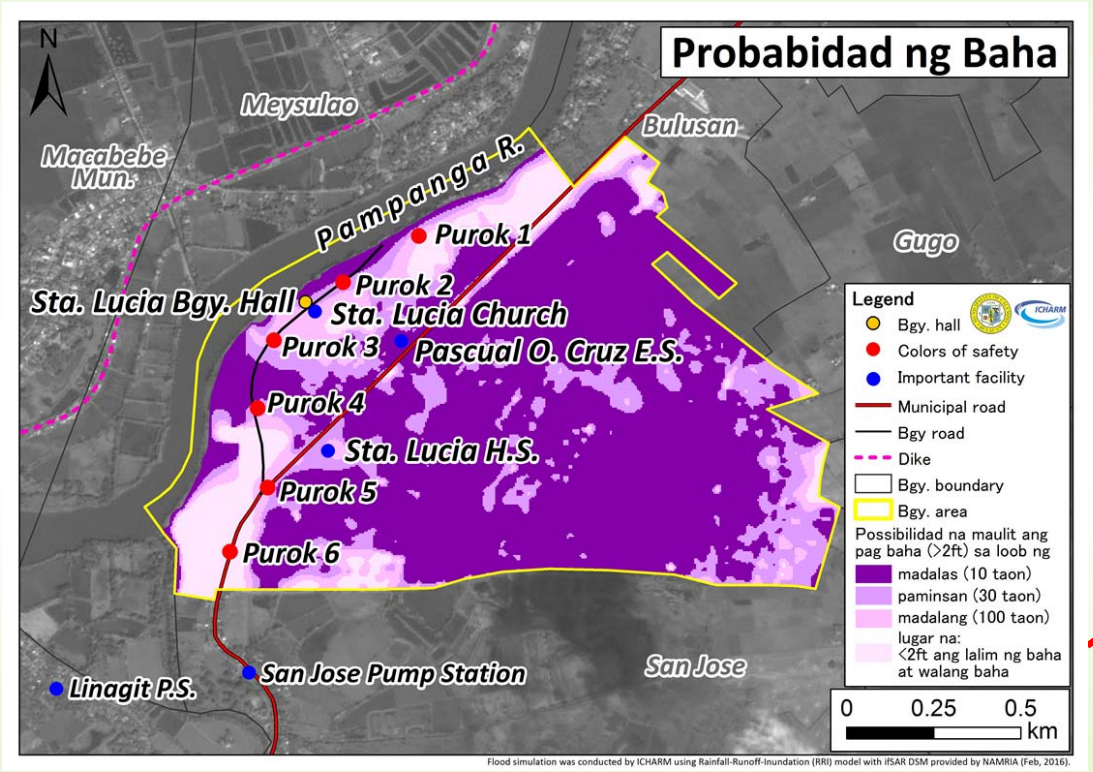
-193 electric poles are colored with " Yellow, Red, Green" to provide guidance for evacuation.

Community Warning System Using Electric Poles



Inundation Probability Map

This map shows the probability of inundation that exceeds more than 2ft (0.61m). Dark Purple area is the most frequently inundated by “Ordinary Flood” (10years flood).



Example:
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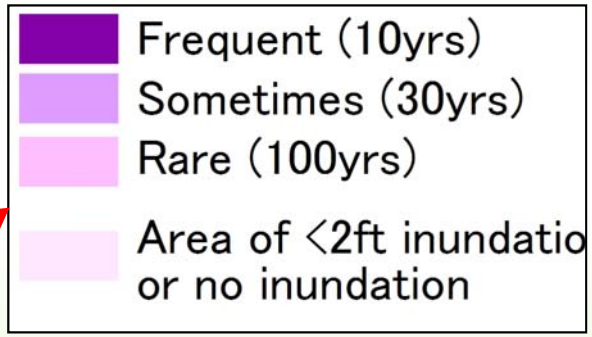

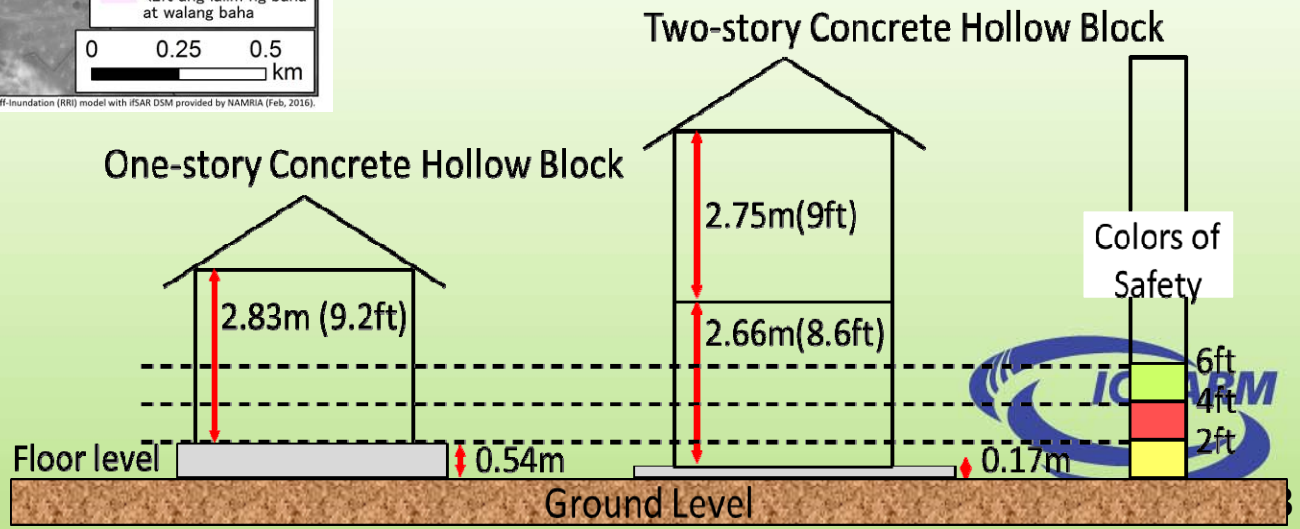

Time Series Inundation Chart

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The flood inundation depth calculated by RRI model at the location of color of safety pole is presented in the table at 12hrs interval in each day. The colors of the water depth are based on color of safety markers.

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Step3: Analyze Impact

Joint Work with Two Barangays (Communities)

Interpreters: PAGASA Staff

What will happen during three types of floods?

Based on workshops at **Bgy. Bulusan** and **Bgy. Sta. Lucia** in 2015 and 2016

Flood Scale / Component	Ordinary Flood	High Flood	Extreme Flood
Information Communication		**-No battery charge for telephone/mobile phone** -Lack of information about inundation /damage situation.	
Evacuation		-Fast speed of rising water during inundation. **-Evacuation center doesn't have enough capacity.**	
Housing	-Only non-elevated houses get flooded.	-Difficulty in cleaning houses	-Difficulty in cleaning houses **-Need of more construction materials for repairing houses.**
Water, Food, Relief Goods	-No/less water supply. -No electricity.	**-No water supply, no electricity** -Delay of relief goods -Relief goods get wet. -Need of portable restroom	
Medical Treatment		-Need of medical mission, providing medicines for leptospirosis, fever etc.	
Transportation		**-Difficult to go to center area** because access road to the elevated road are inundated.	
Others		-Damage of Rice field -Delay in education in school	

Step4: Develop Response Strategy

Write opinion on post-it

Discussion with MDRRMO and barangay people

Share opinions with participants

Result (Barangay Sta. Lucia)

What We Do/Improve?

Based on workshops at **Bgy. Bulusan** and **Bgy. Sta. Lucia** in 2016

Time / Key Component	Before Flood	During Flood	After Flood
Information Communication	-Communicate with MDRRMO(Municipal Disaster Risk Reduction and Management Office)	-Inform water level at "Colors of safety" regularly to the Municipality (MDRRMO). -Keep communication with outside of the Barangay by using generator for charging battery for mobile phone. -Inform obtained information to Barangay people.	-Identify water level, duration, source of flooding.
Evacuation	-Make residents evacuate quickly to safer place -Quantify vulnerable individuals /families	-Make residents evacuate quickly to safer place -Quantify affected individuals /families	
Housing			-Support residents to clean houses for getting back to normal life quickly.
Water, Food, Relief Goods		-Get/provide relief goods and keep them dry.	
Medical Treatment		-Save children and elder people	
Transportation		-Use Bangka	

What We Do/Improve?

Based on workshops at **Bgy. Bulusan** and **Bgy. Sta. Lucia** in 2016

Time / Key Component	Before Flood	During Flood	After Flood
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Evacuation			
Housing			s to for to y.
Water, Food, Goods			
Medical Treatment			
Transportation		-Use Bangka	

Response Strategy

- Inform water level at "Colors of Safety" regularly to the MDRRMO.
- Make residents evacuate quickly to safer place.
- Get/provide relief goods and keep them dry.
- Save children and elder people.
- Support residents to get back to normal life quickly.

Step5: Develop Contingency Plan

Example of the developed flood contingency plan

Category	Contents
1.Message	-Message from Barangay Leader
2.Basic Information	-Barangay Profile (Population etc.)
3.Risk Identification	-Past flood -Inundation maps -Time series Inundation chart -Number of vulnerable people -Impact due to three floods
4.Contingency Plan	-Organization chart -Resource map -List of equipment -Response strategy -Sectoral Plan -Annual activity plan

Step6: Share the Plan

Final Workshop at Municipality on Feb. 17, 2016

Republic of the Philippines
Province of Bulacan
Municipality of Calumpit

OFFICE OF THE MUNICIPAL MAYOR

CERTIFICATE OF APPRECIATION

presented to

INTERNATIONAL CENTRE FOR WATER HAZARD AND RISK MANAGEMENT (ICHARM), under the auspices of UNESCO, PUBLIC WORKS RESEARCH INSTITUTE (PWRI), JAPAN

in grateful recognition of your efforts in conducting a research project for flood risk assessment and pre-disaster recovery planning within the Municipality of Calumpit which resulted to increased awareness and preparedness of our barangays on disaster risk management.

We are truly grateful for your support and commitment.

Given this 18th day of February, 2016, coinciding with the Workshop on Evidence-based Flood Contingency Planning held in Lasent Hotel, Quezon City, Philippines.

HON. JESSIE P. DE JESUS, DMD
MUNICIPAL MAYOR

ICHARM received “Certificate of appreciation” from the Mayor of Calumpit Municipality for this activity.

Final Workshop at Metro Manila on Feb. 18, 2016

Conclusions

- This study proposed an effective method to implement evidence-based flood contingency planning.
- The proposed method was successfully applied to one of flood prone communities in Pampanga River basin in the Philippines.
- This method needs to be applied to different flood-prone communities for further verification of the method.
- For sustainable implementation of this method, technical and administrative cooperation between national and local governments should be ensured.

Sep 2016

Thank you very much !!