DETERMINATION OF EMERGENCY STATUS FOR LAHAR IN MOUNT MERAPI AREA

Experimental Station for Sabo (Balai Sabo)
Research Center for Water Resource
Ministry of Public Works and Housing

BACKGROUND

Yogyakarta Governor Regulation No. 11 Year 2013 (*Pergub DIY No. 11 Tahun 2013*) → **Guidelines for potential Disaster Status**

Technical criterias of lahar hazard emergency status have not been established yet. Past studies on this emergency status were carried out based on the rainfall critical line parameter.

How about water level criteria?
A comparison study and/or a combination study using water level criteria and rainfall critical line will provide better emergency status with high accuracy.

Standard operation procedures on lahar monitoring is one of Balai Sabo duties.

Aim → To obtain technical criterias for determining the lahar hazard emergency status.

e.g.: Normal lahar, Alert 1 lahar, Alert 2 lahar, and Alert 3 lahar.

Output

Emergency status of lahar disaster in mount merapi area.

Component Outputs:

1) Critical Rainfall
2) Relationship between Rainfall and Rainfall volume
3) Water level calibration
4) Lahar hazard-prone map

References

Critical Rainfall

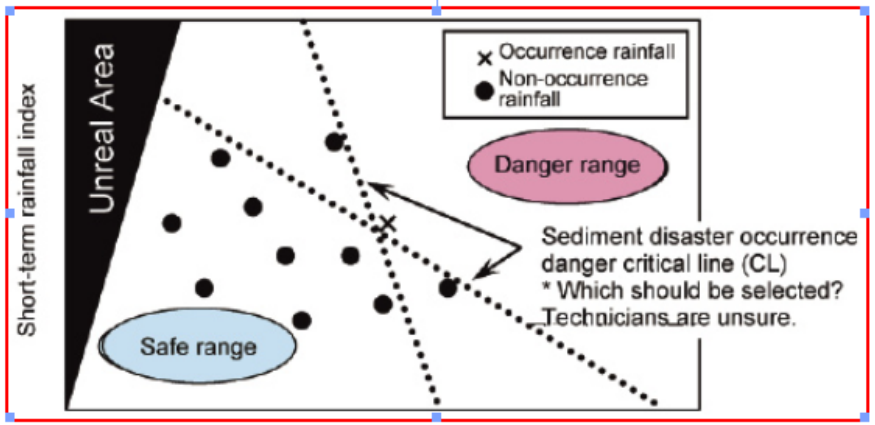


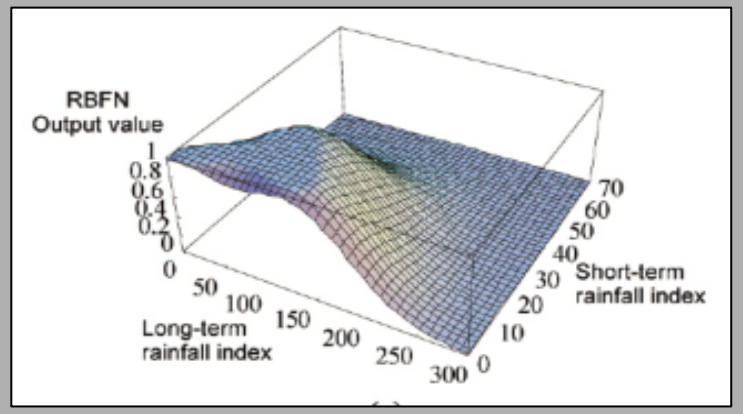
Figure 2 Example of Uncertainty when Setting by the Conventional Method

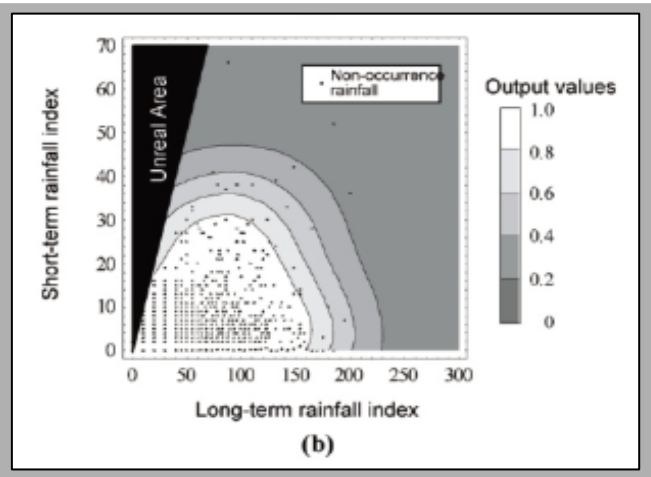
Disadvantages:

- Critical line boundary is usually a straight line
- It requires accurate rainfall data and the length of the lahar events
- The critical line threshold can be different from one and another, it is based on the engineering judgment by the researchers.

OSANAI dan NORO, 2008

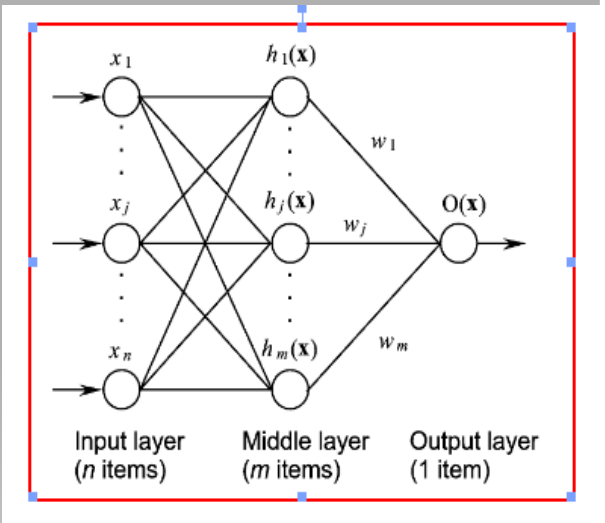
Conventional Method





Critical Rainfall

Radial Basis Function Network (RBFN) Concept



Advantages:

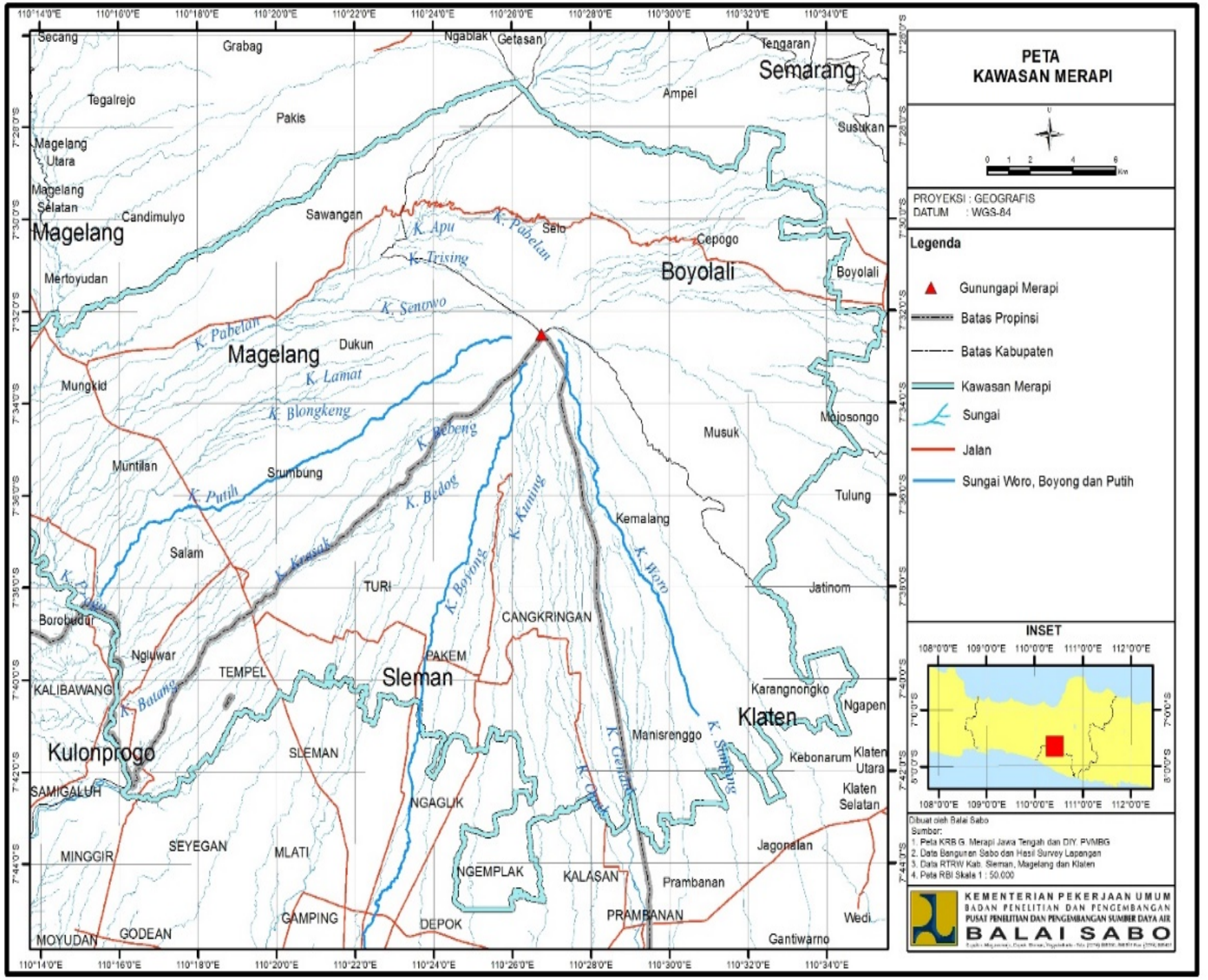
- Critical line can be made using less observational data.
- The result is a fix line although it is analyzed by different people. This method is a statistical method using neural network principle.

OSANAI dan NORO, 2008

RBFN Method

Research Site

- USER
  Regional Disaster Management Authority (BPBD) in Merapi Areas (DIY, Klaten, Magelang)



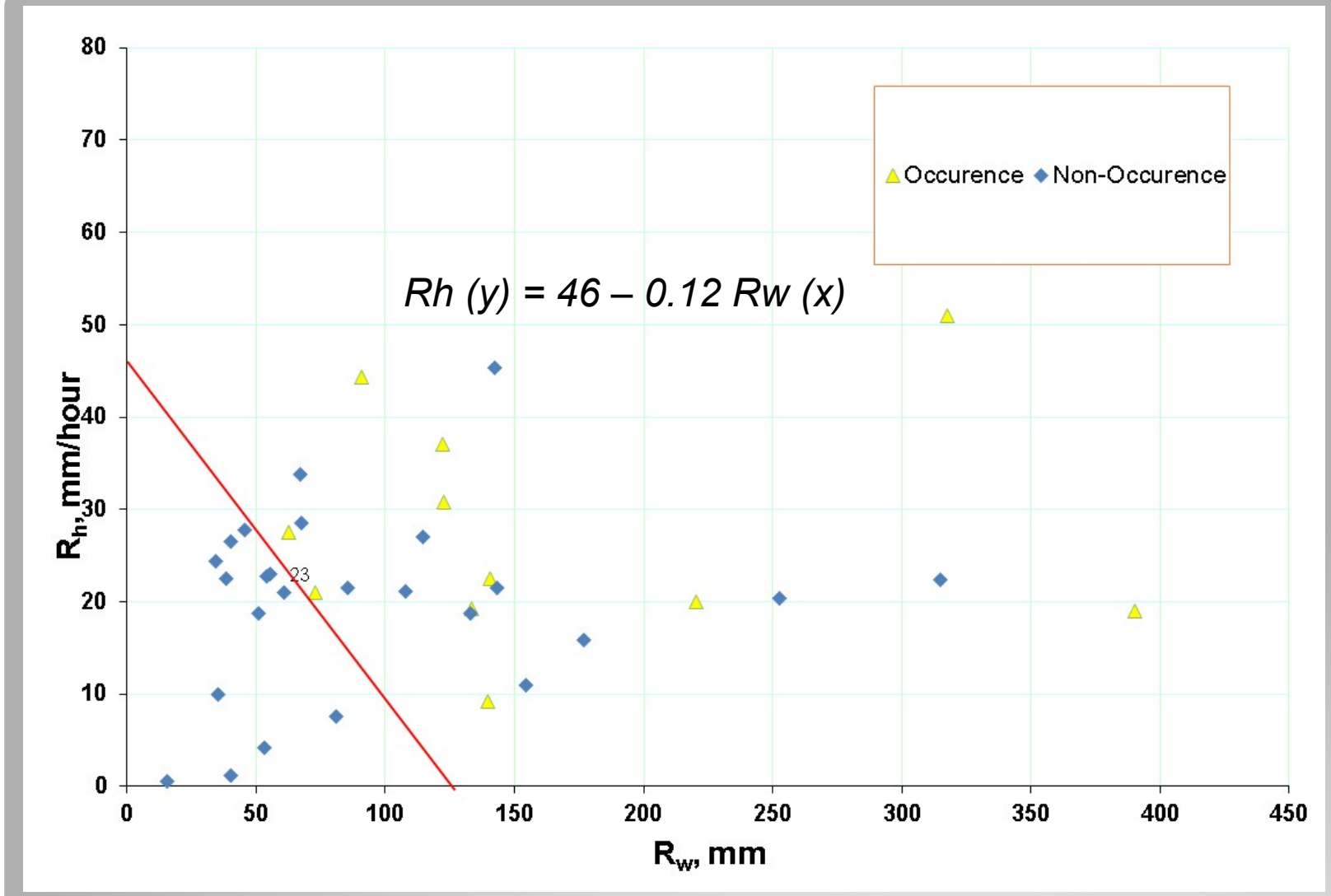
RESULTS

Occurences of Lahar in Putih River

- During 1985-1993 : 18 Occurences.
- From November 2010 to May 2011 : 43 Occurences.

Problems:

- No Historical water level and discharge data monitoring.
- No rainfall data in Maron Stasiun after 2010 Merapi Eruption.

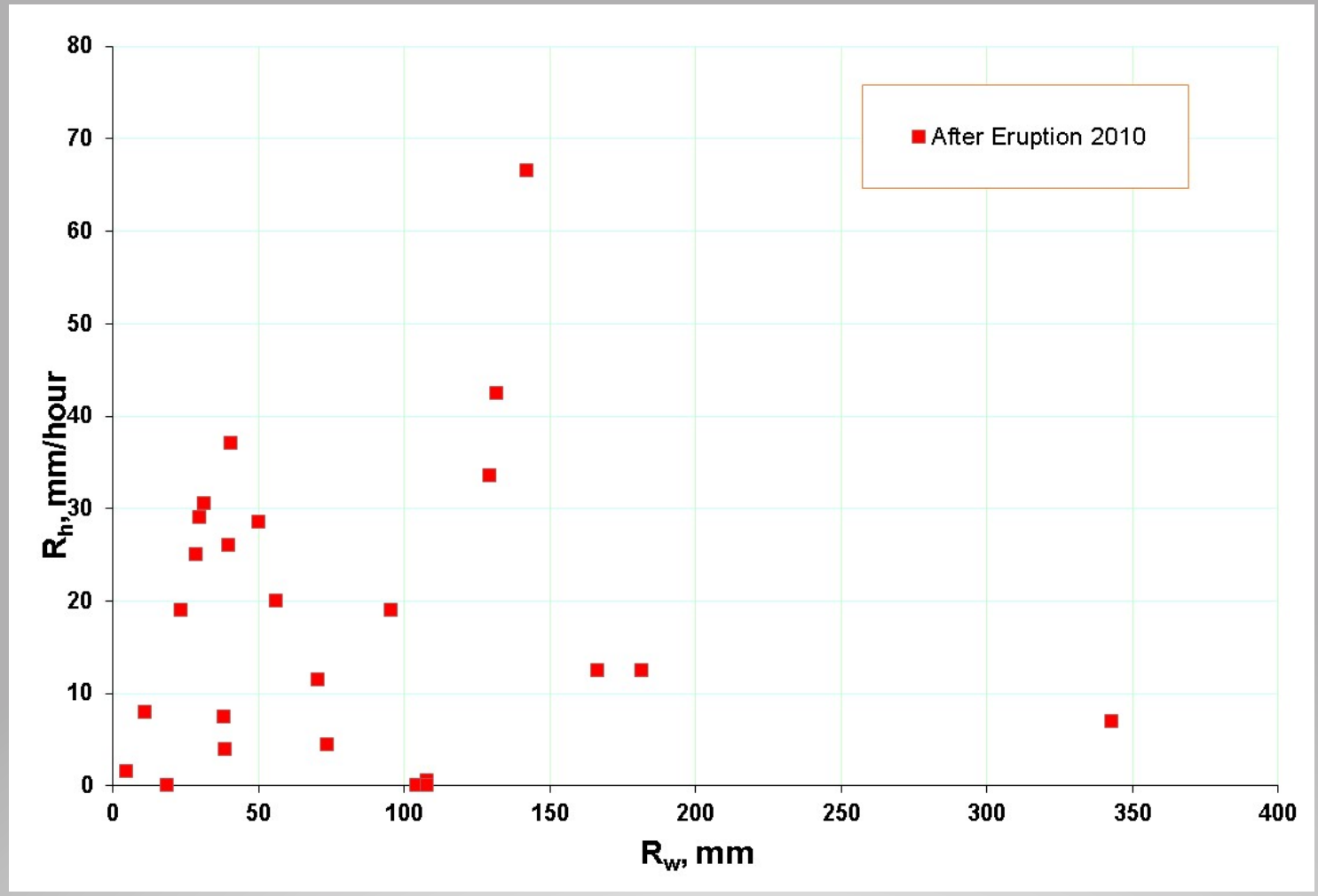


Conventional Method

Critical Rainfall line in Putih River

- Effective Rainfall : 9,2 mm/hour – 51 mm/hour
- Working Rainfall : 62,53 mm – 390,26 mm
- Cumulative Rainfall : 87 mm – 461,80 mm

Critical Rainfall Variation



Critical Rainfall in Putih River

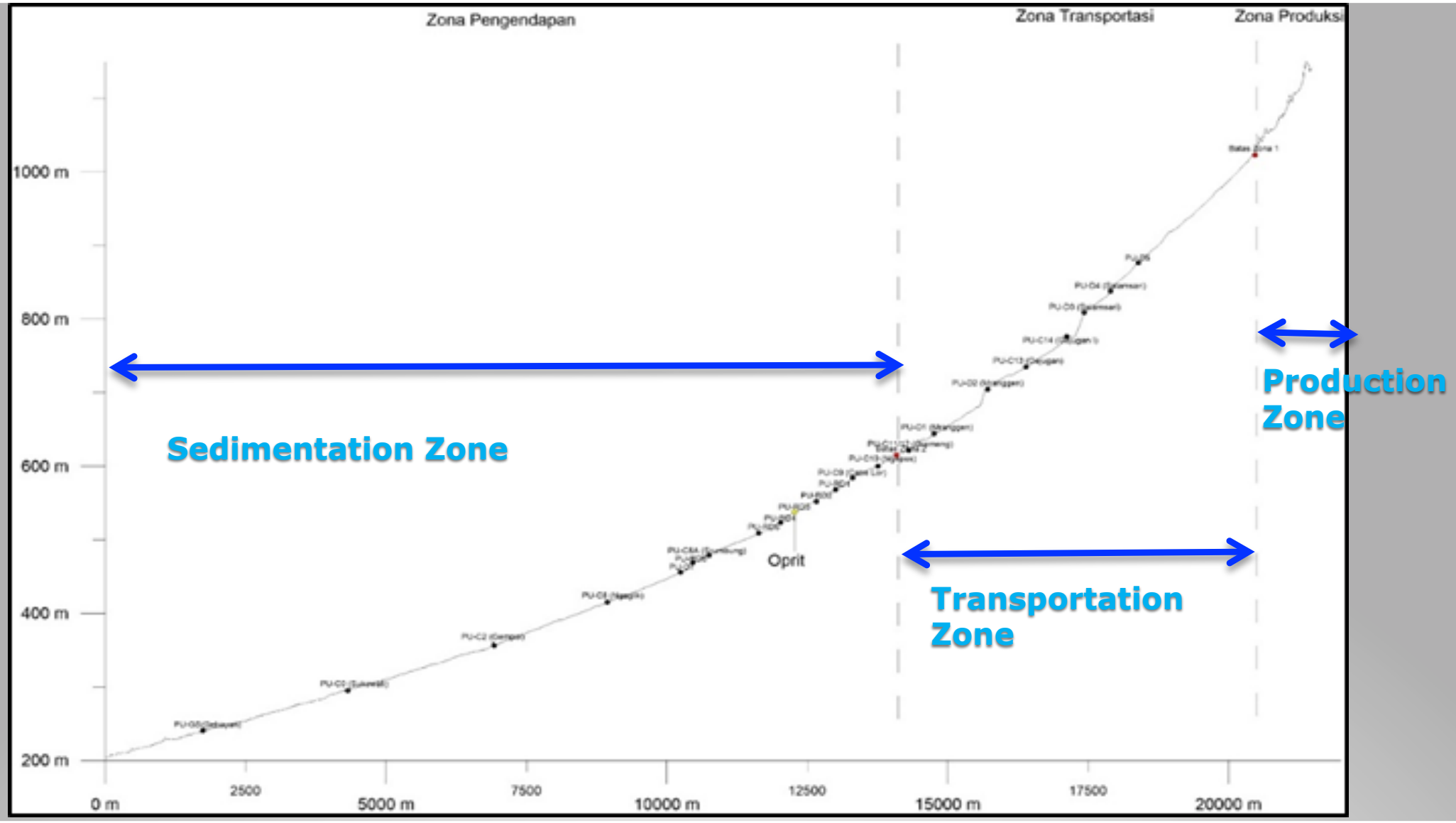
Before 2010 Eruption:

- Using Maron rainfall station
- Maron is located in Production Zone
- Elevation: 960 m MSL

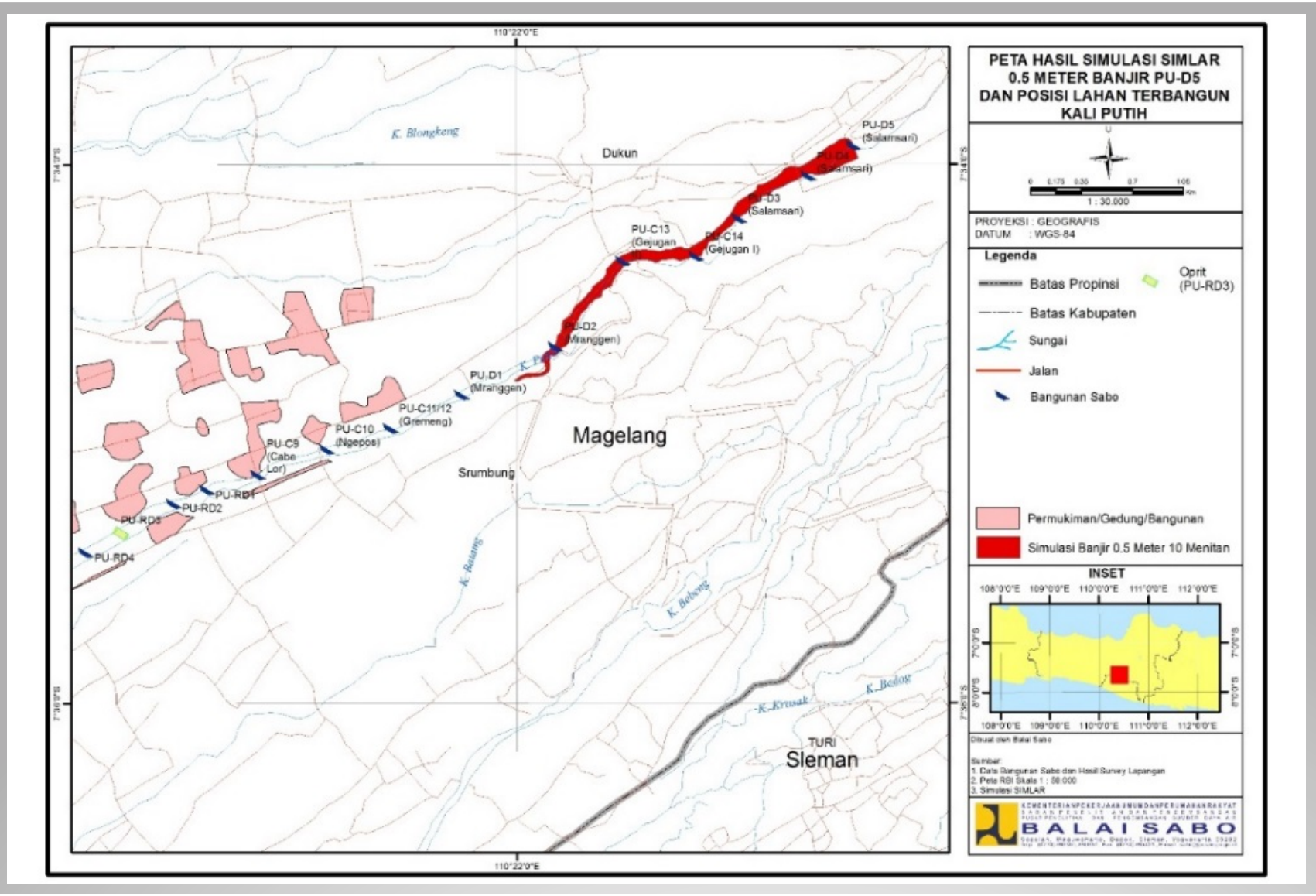
After 2010 Eruption

- Using Ngepos rainfall station
- Ngepos is located in Transportation Zone
- Elevation 631: m MSL
- Distance from Maron is 4.87 km

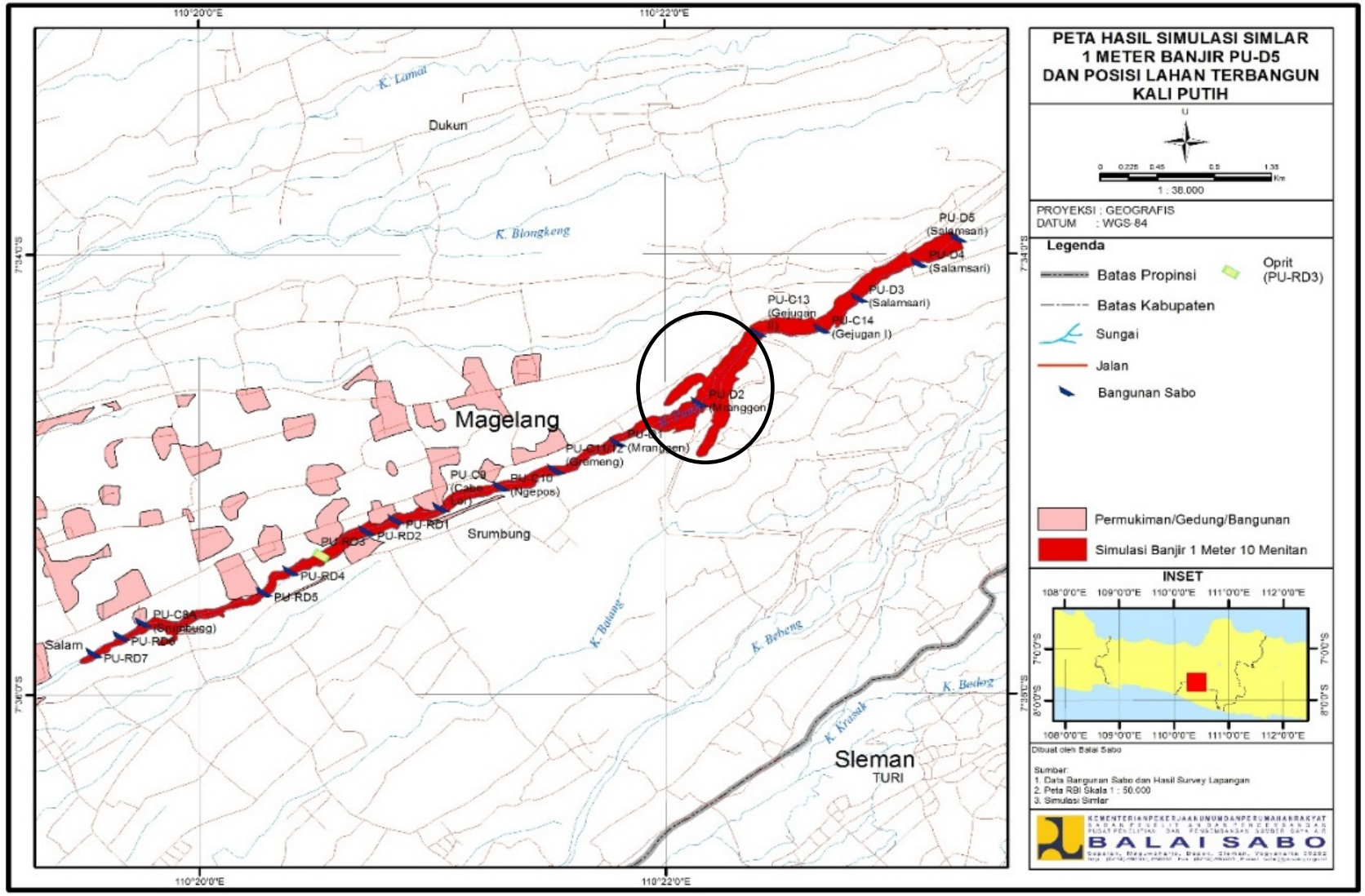
Location of Rainfall Gauges in Putih River



Zone Determination



SIMLAR Simulation



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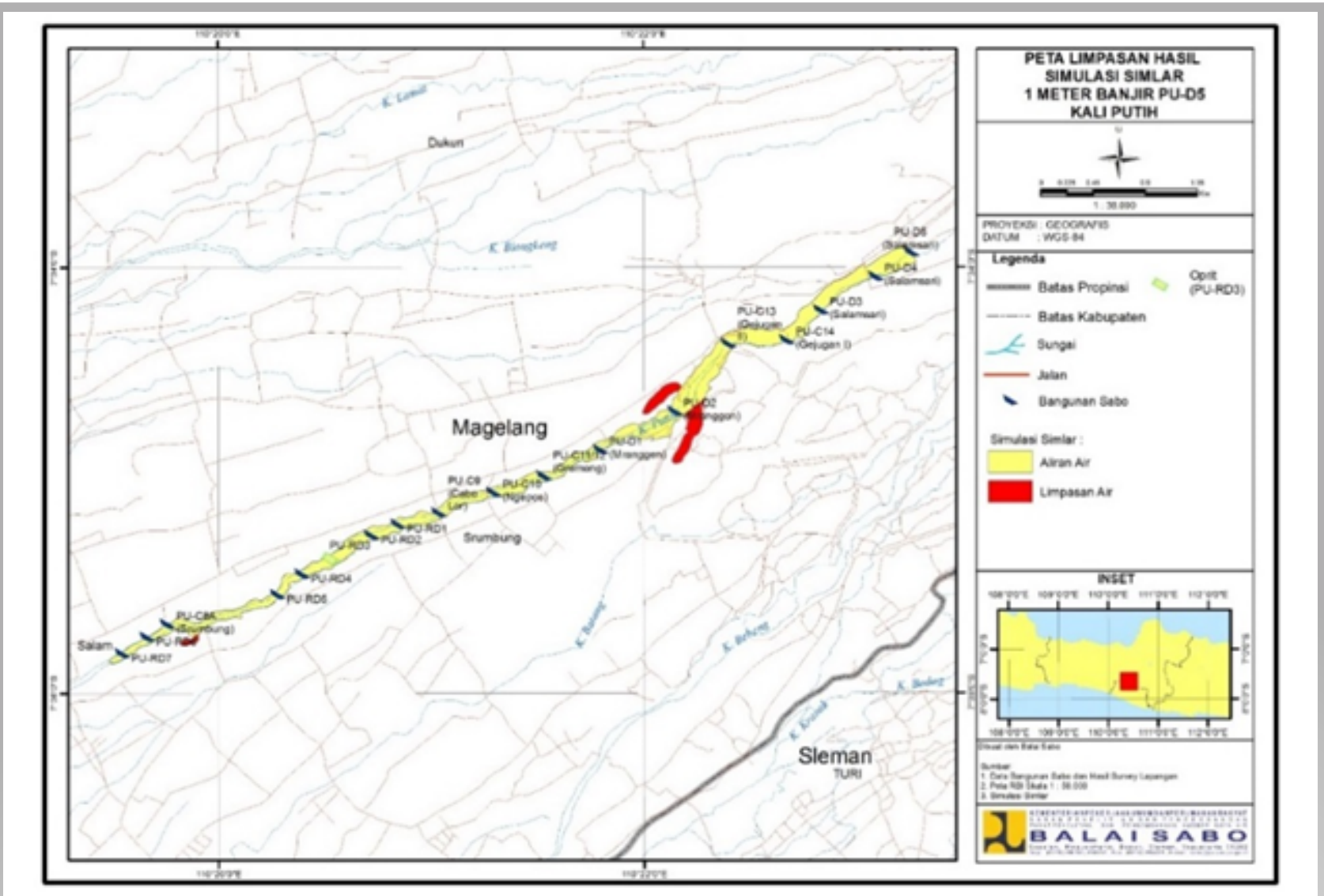
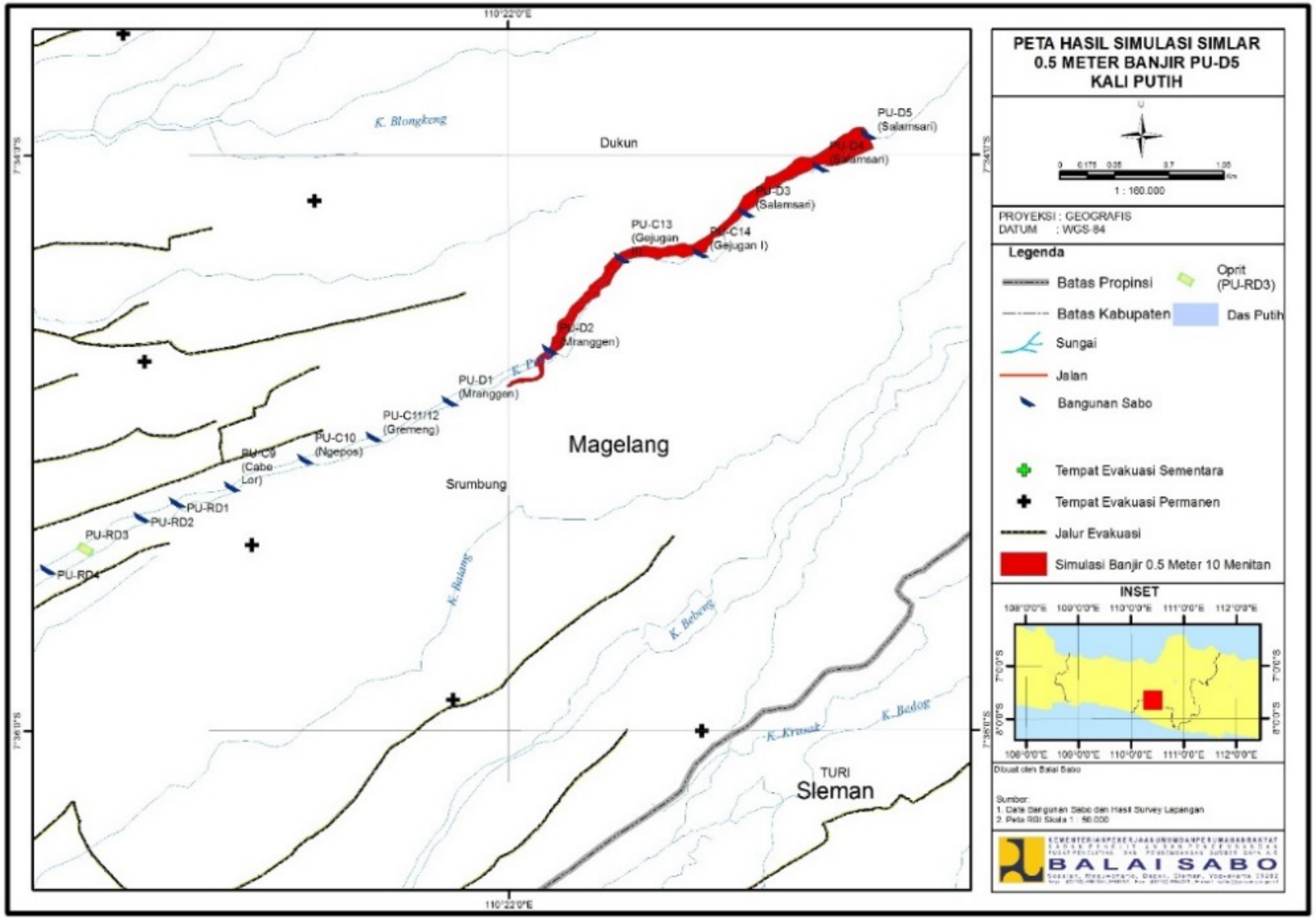


SIMLAR Simulation



Evacuation Area and Route

Water Level (Meter)	Level	Lahar Status	Parameters	Local Lahar Conditions	Responses
0-0.1	0	Normal	- The weather is sunny/No rain/No clouds. - Normal water level.	Relatively very small or normal.	Normal Activity
0,2-0.4	1	Alert Lahar 1	- Cloudy in the upstream or starting to rain. - There are some known-material deposits that may fall.	- Flow velocity above normal. - Flow is clear or slightly muddy.	- Initial coordination between BPBD and relevant agencies. - People who are in lahar-prone areas can do daily activities with increase of the awareness and preparedness for evacuation. - Miners who work in the river should be in alertness.
0,5-1	2	Alert Lahar 2	- Heavy rain in the upstream. - Lahar in the upstream is starting to move. - The critical rainfall has passed the yellow line on the lahar early warning System. Note: The yellow line means "*warning*".	- Flow velocity above normal . - Muddy flow. - There may be twig/garbage, wood, and the building material from upstream.	- BPBDs make coordination with potential disaster monitoring agency which is authorized to monitor the development of weather forecasting and the development of potential disaster that may occur. - People who are in Lahar-prone areas are ready for evacuation at any time if there is an order from the local government and/or the district/city. - Local Government, organizing disaster management agencies from district/municipality, and community can contribute to continuously monitor the locations, which have high disaster potential.
> 1	3	Alert Lahar 3	- Heavy rain in the upstream . - Lahar moves quickly. - The critical rainfall has passed the pink colour and red. Note: a. The pink line means "Evacuation". b. The red line means "Alert".	- Flow moves very fast. - Dense muddy flow. - Flow caries sand mixed with gravel/rock.	Declare Emergency Status: - BPBDs/relevant agencies from District/City quickly assess the impact of disasters. - BPBD/relevant agencies from District/City conduct emergency response in the disaster area. - BPBD/relevant agencies from District/City localize and map the lahar–prone areas. - People are not allowed staying in the areas affected by lahar without the supervision of the SAR team, until the situation is declared safe. - BPBDs/relevant agencies from District/City constantly monitor the weather forecasts and the outcoming disaster.

Proposed Lahar Status in Mount Merapi

Thank you
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