

Case Study: InaSAFE during Jakarta's Flood in 2014

Background

Jakarta is a city that experiences seasonal flood almost every year sometimes between December and February due to high rainfall. Geographically, Jakarta is a lowland estuary of a number of rivers across West Java. The drainages in Jakarta are in poor conditions, which, combined with the city's location, contribute to flood across the city on rainy season.

During such difficult circumstances, both public and government officials need information, which is easy to access and understand, about the areas that are affected by flood. Data needs to be presented in an informative format such as using maps and final numbers instead of raw tabular data to help people and government to make decision and coping with flood. Maps help the Jakarta Disaster Management Agency (BPBD DKI Jakarta), and other stakeholders that attempt to help, to target the right areas according to needs. This is especially crucial for logistics distribution and in evacuating disaster-affected populations.

Recognizing such critical role of maps in disaster, the Australia-Indonesia Facility for Disaster Reduction (AIFDR) funded HOT with the main task to assist BPBD DKI Jakarta to map the Jakarta flooding in 2014. Two GIS Specialists from HOT were assigned to work at Pusdalops BPBD DKI Jakarta every day for two months, to produce flood maps based on reports from Sub-villages affected by flood.



Figure 1: Flood mapping activity at Pusdalops BPBD DKI Jakarta

Implementation

The flood maps were developed using free and open source software, such as QGIS 2.0. The workflow went as followed:

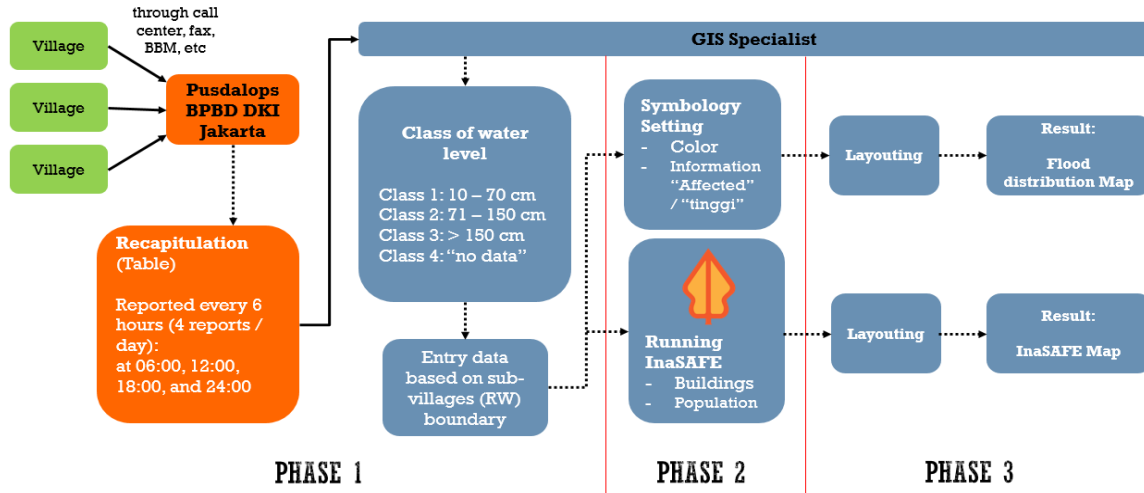


Figure 2: Workflow for Jakarta flood mapping 2014

Phase 1:

Each village representative, which sub village (RW) was affected by flood, reported to Pusdalops BPBD DKI Jakarta through call center, fax, or BlackBerry Messenger (BBM). The report contained information about the height and spread of inundation. Pusdalops staff then summarized all of the reports into a recapitulation table. This table is submitted to the head of Pusdalops and the Jakarta Governor every 6 hours. In total, there are 4 reports each day -- at 6:00, 12:00, 18:00 and 00:00.

LAPORAN BANJIR													
KAMIS, 24/01/2014													
S.D. Pukul.06.00 WIB													
Kel.	KETINGGIAN	JUMLAH TERDAMPAK						PENGUNGSI (JIWA)	KORBAN MENINGGAL		LOKASI PENGUNGSI		
		Kec	Kel	RW	RT	KK	JIWA		Jml.	Ket.			
JAKARTA TIMUR													
KECAMATAN JATINEGARA													
		1									17	LOKASI	
Kel. Kampung Melayu	30 - 300 cm		1	8	68	2308	7698	7713					
Rw. 01 6 Rt	30 - 300 cm			1	6	142	419	963	1	Hidayat (35)		Sudinkes Jaktim	
Rw. 02 11 Rt	30 - 300 cm			1	11	1002	2921	185		warga		Masjid Attawabin	
Rw. 03 2 Rt	30 - 300 cm			1	2	75	158	312		Rt.08/12		RS. Hermina	
Rw. 04 Rt. 1,2,3,4,5,6,11,12,13,14	0 cm			1	10	-	-	531		sakit		Gereja Konoimia	
Rw. 05 4 Rt	30 - 300 cm			1	4	93	269	200	1	Zulfikar (22)		Kantor Lurah Cawang	
Rw. 06 1 Rt	30 - 300 cm			1	1	30	76	363		Warga Rt. 11/01		SDN 01 Kmp. Melayu	
Rw. 07 10 Rt	30 - 300 cm			1	18	445	1771	117		Kel. Cipinang		SMP. 26	
Rw. 08 12 Rt	30 - 300 cm			1	16	521	2084	566		Besar Utara		GOR Otista	
								86		terbawa		Pos RW 03	
								75		Arus		Mushollah Khairul Anam	
								370	1	H. Masri (76)		SDN 02 Balimester	
								3561		Warga		Jl. Jatinegara Barat	
								120		Rt. 06/06		Madrasah Baitul Khoir	
								85		kel. Bidara Cina		Masjid jami ithihadul	
								35				Pos RW 07	
								41				Masjid Ruhul Islam	
								103				Ex bengkel Trimatra	
Kel. Bidara Cina													
	20 - 300 cm		1	13	99	4736	16563	5955	1	(jul 17 th Laki2		20	LOKASI
Rw. 01 Rt. 09,11	50-250 cm			1	3	200	215	201		Terbawa Arus		1	Kantor Pos Rw 01
Rw. 02 14 Rt	50-200 cm			1	14	656	2226	250		Banjir		1	Kantor Pos Rw 02
Rw. 03 12 Rt	20-200 cm			1	10	544	1873	407				1	Kantor Pos Rw 03
Rw. 04 Rt. 09, 10	50-200 cm			1	2	50	152	160	1	Tio Hoklim		1	Kantor Pos Rw 04
Rw. 05 Rt. 06,07	100-200 cm			1	2	103	322	250		Alias Abd Aziz		2	Mushola Raudatul Ibad, Lap. Tenis
Rw. 06 7 Rt	60-200 cm			1	7	283	850	465		42 th. tennisslam		2	Puskesmas. Gereja Penabur AC

Figure 3: Recapitulation table produced every six hours by Pusdalops BPBD DKI Jakarta

The Recapitulation table was also sent to GIS specialists, who would process them into a map. The flood stage is divided into four classes based on its height: Class 1 (10-70 cm), Class 2 (71 - 150 cm), Class 3 (> 150 cm) and Class 4 (No data). "No data" in Class 4 means that the area is affected, but information concerning the flood stage is not available yet.

Once the data was collected, the team filled them in to QGIS 2.0. The affected area was overlaid on top of RW boundary data from OSM. The team added "*terdampak*" (affected) and "*ketinggian*" (inundation level) column to the attribute table. RWs affected by flood were marked "1" on the *terdampak* column, while the *ketinggian* column is numbered according to the class of water level.

Phase 2:

At this phase, the process is divided into two steps:

1. Flood distribution map:

Once the data entry process was completed, the team added a number of symbolism to illustrate relevant information regarding the flood such as the flood distribution and inundation level.

2. InaSAFE map:

InaSAFE needs the hazard data (flood prone) and exposure data (building and population) to run and calculate the impact estimation. The team do not need to put additional symbolism because they will be symbolized automatically as the information was processed.

Phase 3:

Phase 3 covered layout process, in which the maps were customized for printing and distribution. The flood distribution map and InaSAFE map were designed with the same layout using QGIS Map Composer, while the legend section was adjusted with the information that were shown on the map.

Results

The collaboration between HOT and BPBD DKI Jakarta has resulted to the provision of highly detailed and accurate flood maps for the period of 12 January to 10 February 2014. These maps show the inundation level in affected areas. In addition, BPBD was also provided with InaSAFE maps with additional visualization of the number of buildings (mainly public facilities) that were affected by the flood and the estimated number of internally displaced people (IDPs). Such maps that were published on daily basis were proved to be useful for a number of stakeholders.

Daily maps proved to be highly useful for official decision-making and aid distribution. Flood distribution maps were used to report to the head of Pusdalops BPBD DKI Jakarta and the Governor of Jakarta each day. By using the map, BPBD could find out the location of areas with the highest inundation level and areas that were inundated for days. BPBD put those areas as the priority area to receive aid rapidly. An example of high priority area was Kampung Pulo, a village located in one of Ciliwung (river) meanders.

As the maps were published for public, other stakeholders that were also benefitting from these maps are volunteers and journalists. Volunteers could access the maps on BPBD DKI Jakarta's website to get information concerning the location and number of people affected to organize and ensure effective aid distribution. Journalists preferred to come to get other detail information to support their reports and ensure that the report is accurate. Such publication concerning flood distribution also helped people in Jakarta in general to cope with flood, including enable them to avoid passing inundated areas.

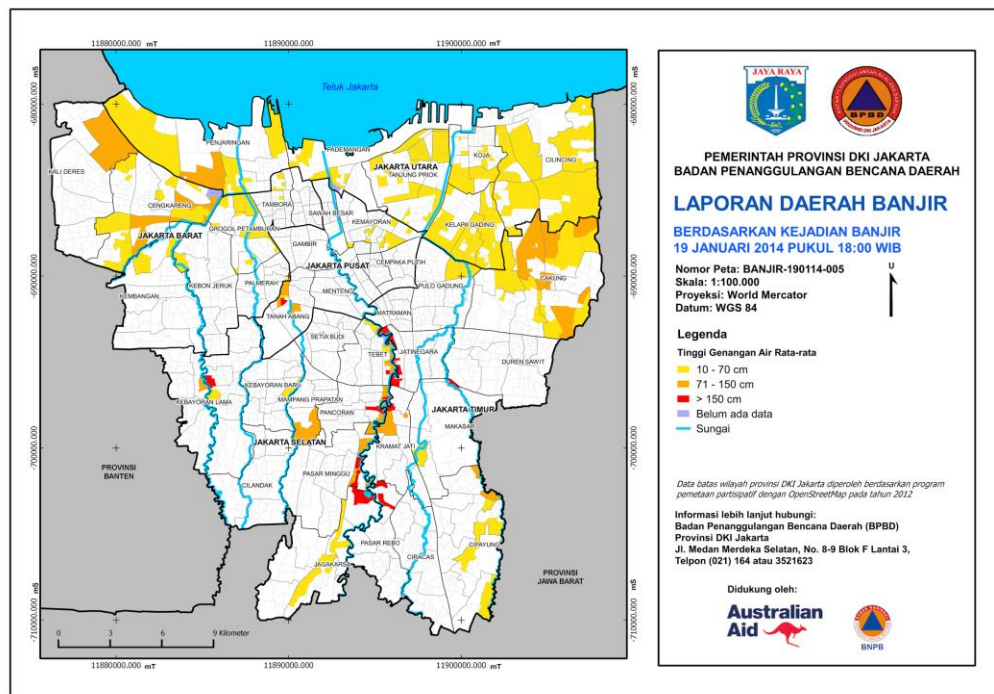


Figure 4. Flood distribution map

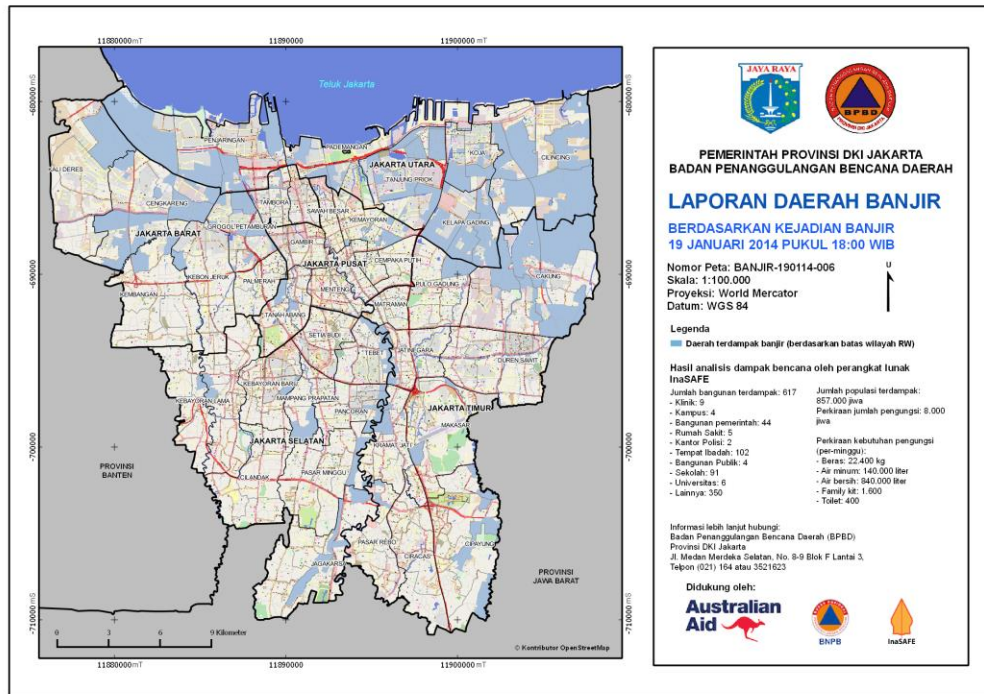


Figure 5. Map of buildings and population affected by the flood based on the InaSAFE calculation.

Lessons learned

The publication of flood maps in BPBD DKI Jakarta's website was a really good step to help people in Jakarta to know the condition of the city when flood strikes. However, in order for InaSAFE to function optimally, two things need to be improved.

- InaSAFE needs to improve its infrastructure data in terms of its completeness. InaSAFE, which was built based on OSM data, only has limited data of public facilities such as schools, places of worship, hospitals, government offices, and so on. In 2012 a Jakarta mapping project to map public facilities using OSM was conducted. Although this project had successfully mapped the majority of the public facilities in Jakarta, the total number of buildings, including the house building is still invalid due to a number of other buildings that have not been mapped.
- InaSAFE needs to increase the detail of its geographical coverage from the current lowest analyses unit at RW (sub-sub village) level to RT level (a unit which consists of around 20 houses) or less. RW level is still considered too large to describe the area that is affected by flood. Increasing the detail of its geographical coverage would increase the validity of the information about the scope of the affected area, especially when the flood affected only parts of the RW.