

FLASH FLOOD FORECASTING AND WARNING IN MALAYSIA

Malaysia
Truly Asia

**SOUTHEASTERN ASIA – OCEANIA FFGS INITIAL MEETING
JAKARTA, INDONESIA
2 FEBRUARY 2016**



Contents

- Overview of Flash Flood Scenario in Malaysia
 - Role of Agencies in Flood Forecast and Warning
 - Flash Flood Forecast and Warning System in Malaysia
 - Challenge and Way Forward
-



OVERVIEW OF FLASH FLOOD SCENARIO IN MALAYSIA



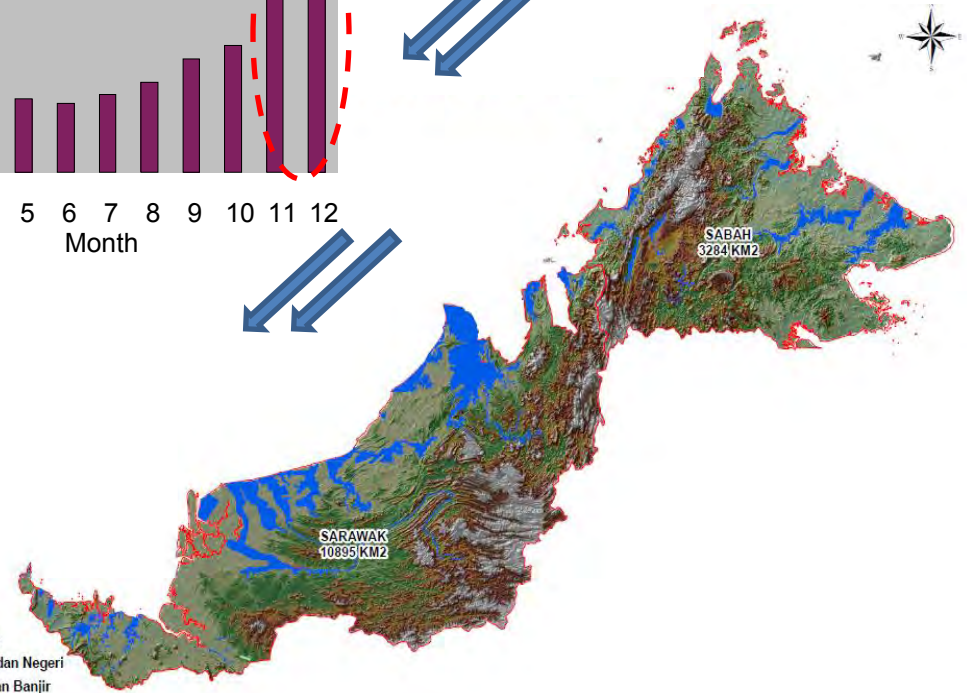
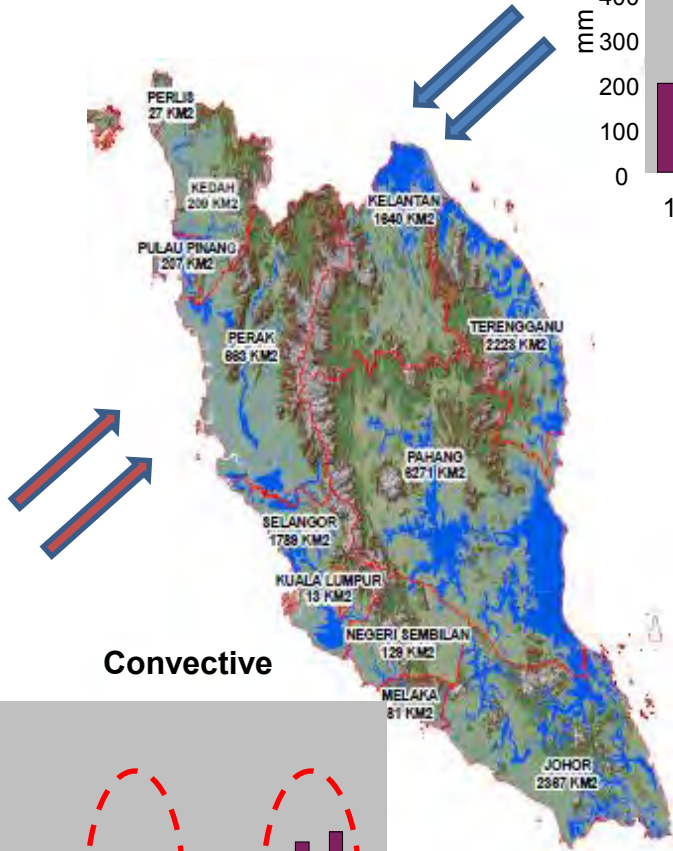
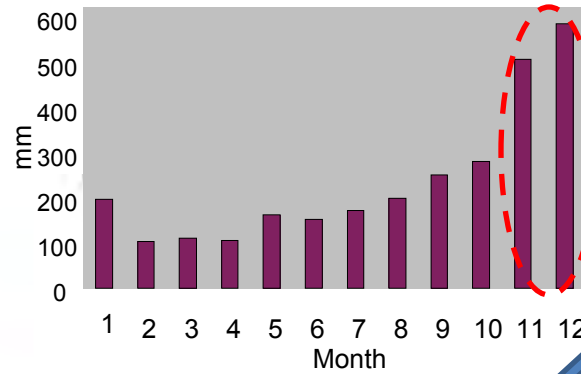
Impacts of Flood in Malaysia

Annual Rainfall

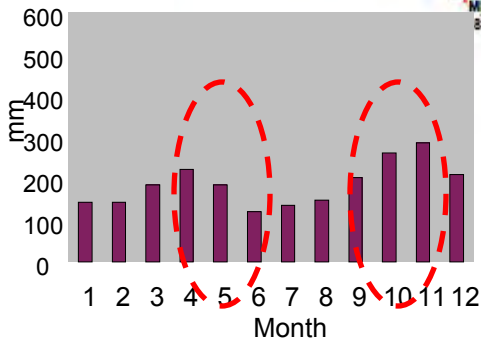
West Coast : 2000 - 2500mm

East Coast : 2500 - 3500mm

Monsoon



Convective



PETUNJUK
 Sempadan Negeri
 Kawasan Banjir

10.1% (33,298 km-sq persegi)

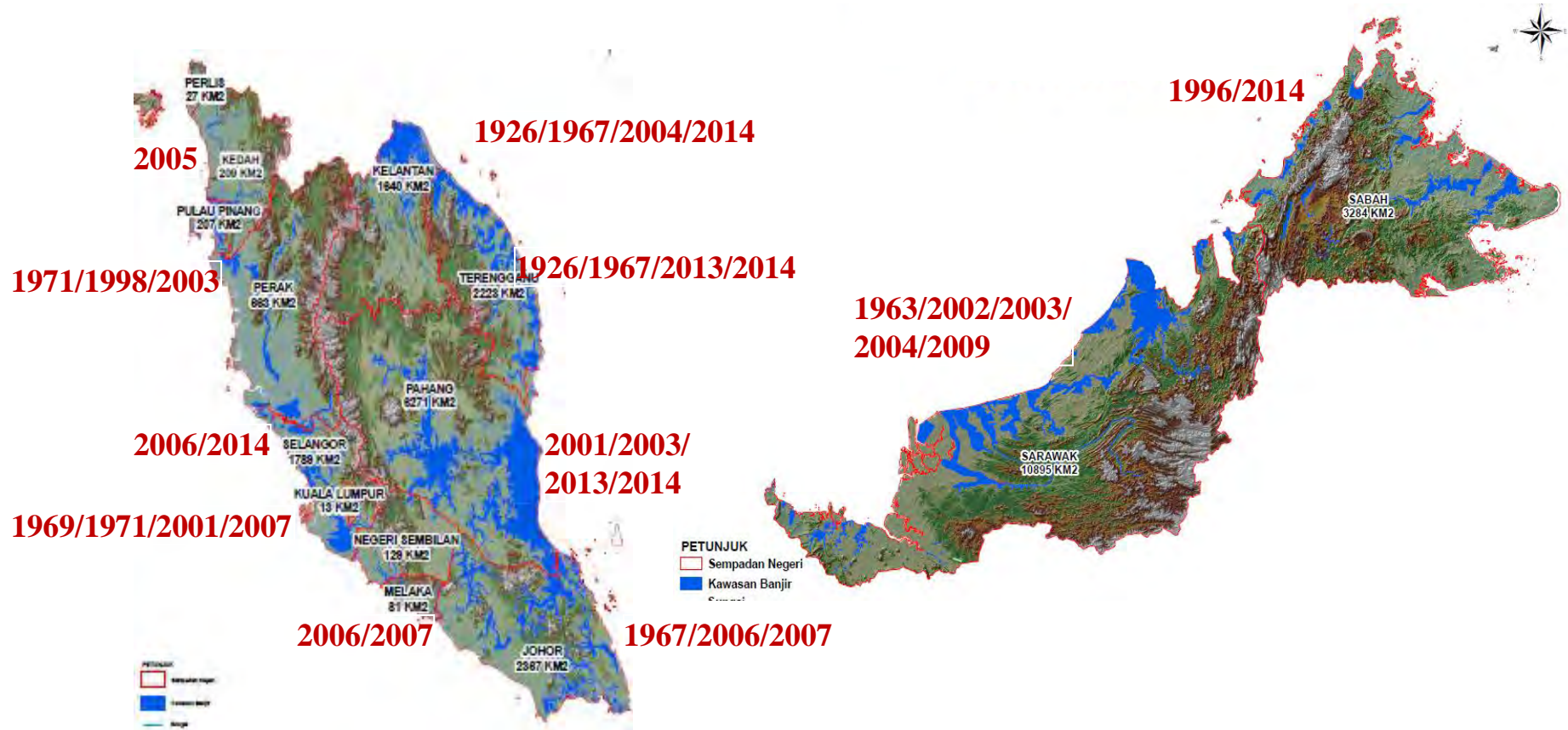
5.67 mil population

RM 1 Bil loss per year

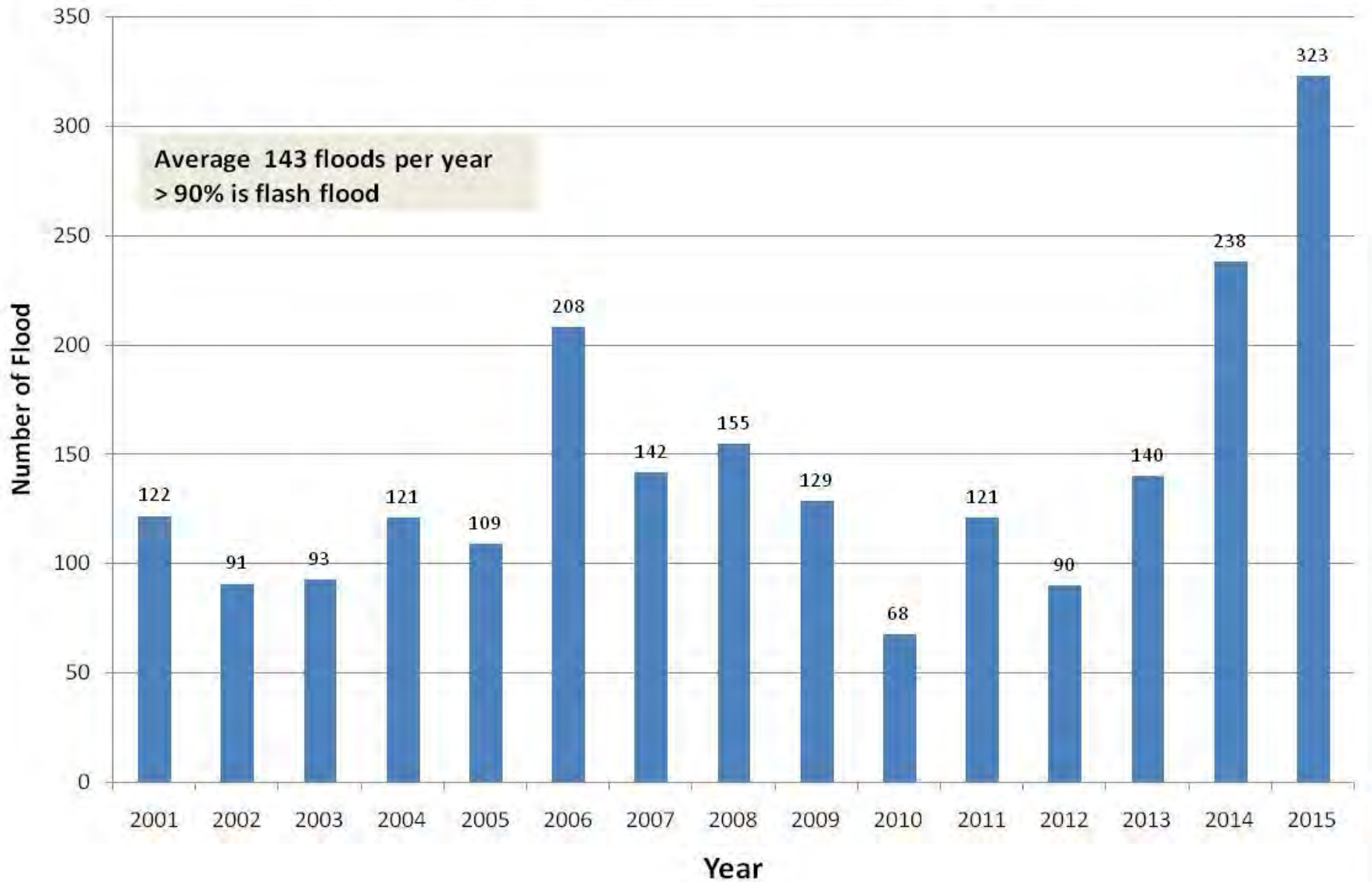


Impacts of Flash Flood in Malaysia

- ✓ Flash Flood ; 102 location nationwide
- ✓ Required RM 9.1 billion to overcome



Flood Records Between 2001 - 2015 in Malaysia



1926

Monsoon Flood in Kota Bharu, Kelantan



Flood pictures in kota Bharu, Disember 1926; British Officer (Left) Mr. Ferrier, Dr. Taylor, Mr. Kemp And Mr. Worham) Source: Facebook Persatuan Pencinta Sejarah Kelantan (2014)



1967

Monsoon Flood in Kuala Kangsar (Jan.1967)



1971

Losses : > RM200mil
No. of Casualties : 61



1996

Sg.Pampang at Keningau (26 Dec 1996)

(Mudflow / Debris flow)



1998

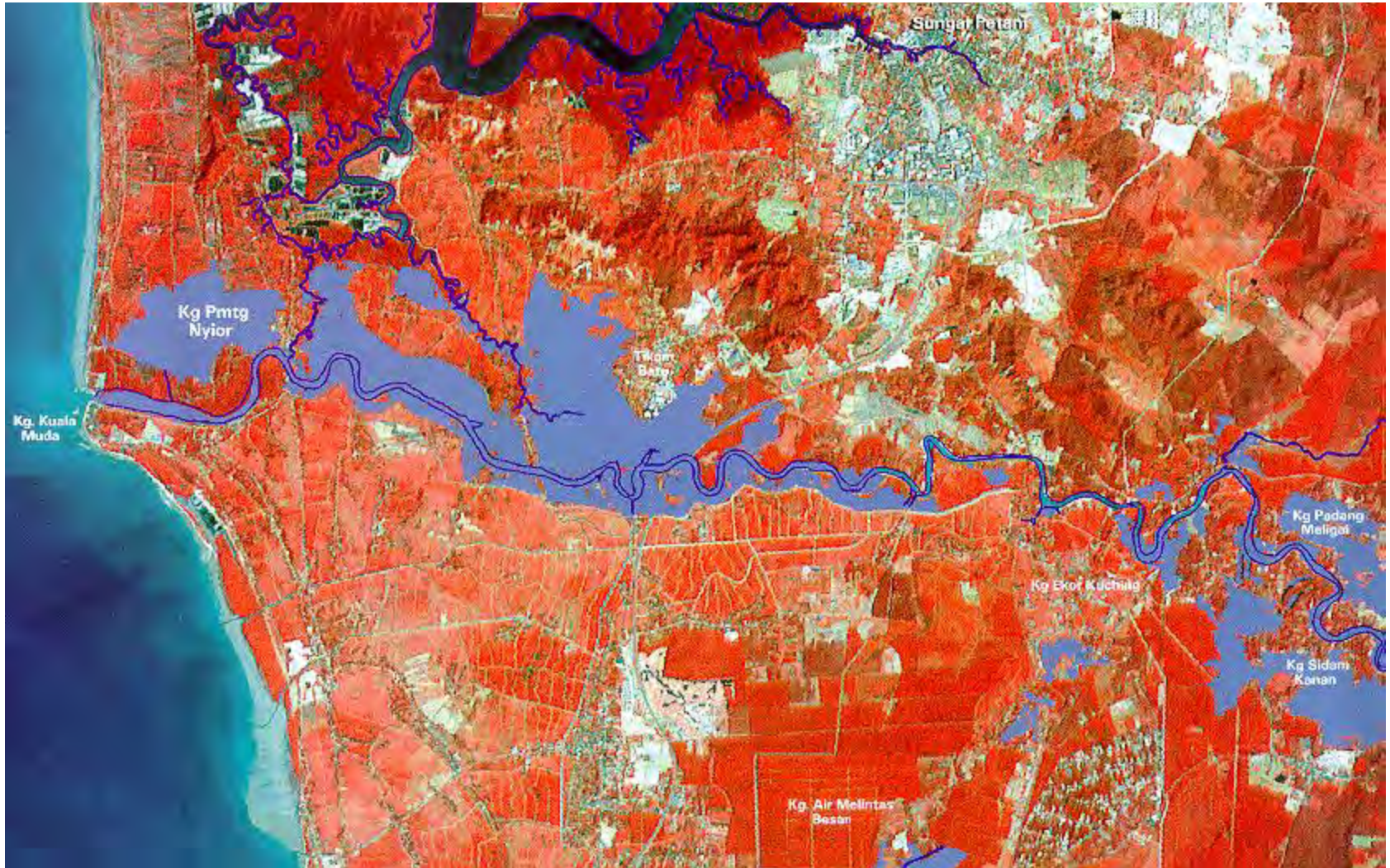


LANDSLIDE IN PENANG (28 NOV.1998)



1998

Sg. Muda - Flooded areas in 1998



2000 Flash Flood in Taman Sri Muda, Selangor



2000



Highway Flooding at Batu Tiga (5 Jan. 2000) Jan 2000



2003

High intensity and short duration rainfall - URBAN

KL hit by floods

Three-hour downpour causes havoc in city

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Hundreds of cars were damaged when underground car parks were turned into giant pools as police reported that several people were also injured in various accidents due to the havoc.

The three-hour rain that brought much relief from the heat started at 4pm and within 30 minutes became a heavy downpour trapping the hundreds of thousands as they tried to make their way home from work.

Even the Sentul Fire Station fell victim to flood waters and all the engines had to be parked outside as the water level in the building was chest-high at the peak.

City Mayor Datuk Shaid Mohd Taufik had to take to a motor-cycle to get to visit the various affected places.

City Hall's 24-hour monitoring centre also reported flooding at the nearby areas of Dataran Merdeka, Masjid Jamek, St. Mary's Cathedral and parts of Jalan Sultan Ismail.

The low-lying areas of Kampung Baru,



TO THE RESCUE: Emergency workers manoeuvring past a car that stalled at the Jalan Tun Perak and Jalan Melaka intersection yesterday while getting to those stranded following a three-hour downpour.

● TURN TO PAGE 3



2003

High intensity and short duration rainfall - URBAN

10 June 2003 Flood



2003



Dataran Merdeka - June 2003



SeberangPerai, P.Pinang- October 2003



Kuantan, Pahang - December 2003



Kuah, Langkawi September 2003



Johor Bahru - Mac 2004



Ilanda banjir hingga menyebabkan kebanyakan jalan utama di bandar itu terpaksa ditutup semalam. Gambar kiri menunjukkan petugas lepasa hospital itu turut dimaki air, semalam.

Kota Bharu, Kelantan- Disember 2004

Close call for two teens in flash flood

KUALA LUMPUR: Two schoolboys nearly drowned when they were trapped inside a tunnel along the banks of Sungai Klang, near the PONS flat in Kampung Baru yesterday.

Mohd Ali Ali, 17, and Mohd Nor Harun, 16, from Taman Keramat were fishing at the river when a heavy downpour which began about 5pm, forced them to take shelter in the tunnel.

However, as the downpour caused the river waters to rise, the boys found themselves trapped in the tunnel.

The strong currents did not permit them to swim to safety and the two boys shouted to attract attention from passers-by from across the banks.

Passers-by alerted the Civil Defence Unit which dispatched a team to rescue them.

Using ropes, the 12-man team pulled the boys to safety before they were treated for shock and cold.

The downpour wreaked havoc in the city, causing flash floods, traffic congestion and trees to be uprooted.

It also caused flash floods at a squatter settlement in Sungai Buloh.

Fifteen houses at the settlement were almost submerged, with two families rescued by firemen after they were trapped in their dwellings.

Traffic at Jalan Sungai Buloh came to a standstill when several cars knocked into one another after flash floods hit the area.

Traffic came to a halt after the pile-up in Jalan Sungai Buloh

The Malay Mail July 17

Sg Buluh – July 2005

4 Selasa 20 Desember 2005 NASIONAL

Ush Mohd Fuzl Razali, Zulhili Jamahudin, Ismail Mar, Kanan Mahomud, Saiful Mohd Ali, Wia Hassan Bakar, Mansorah Abu Bakar, Jafar Ali Abd Rahim, Nizam Ahmad, Nuris Syah, Fatai Zaimudin, Radziffi Mohd Razali, Saipon Shahrudin, Nurawajja Ghazir, Harun Bahik, Kabilah Kertin, Ruhana Mohd Nuzri, Remy Suberani, Sukarni Shamsuddin, Harun Osman, Nurhayati Abidin, Mohamadul Lohak, Noor Nohidah dan Ahmad Chu Doh.

● Gambar: Shahrudin Md Nuzri, Rudi Ahmad, Izzan Mahidin, Ahmad Azzul dan Mohamadul Lohak.

BERLAIN KADAH
 - Bantuan
 Pertolongan
 Keluarga dan
 Masyarakat
 (PKM) Kedah
 telah mengumpul
 barang-barang
 keperluan untuk
 membantu orang-orang
 yang terdampak
 banjir di Perlis dan
 Kedah.
 Sulhan Ahmad

RAJAH PERILAH LAIN: Penderita di Taman Sari Bekas di Kangar menggunakan perahu untuk bergerak ke sekolah tempat.

SARUNG CECIL: Mak Noh Binti, menggunakan sarung sebagai selendang selip.

Perlis/Nothen Kedah – December 2005





Besut, Terengganu - February 2006



Shah Alam, Selangor - February 2006



Johor - December/January 2006



Melaka - December 2006



2006

Johor, 27 Dec 2006



JOHOR: Volunteers from Mercy getting some assistance from army personnel to send medicine, clothes, food and other items to flood relief centres in Kota Tinggi using boats as some areas are inaccessible through the roads on Dec 27, 2006. NST pix by Ahmad Othman.



JOHOR: Mahat Haron, 51, (in the foreground) taking a dip in the floodwaters with his family members. When the picture was taken, the water measured at 4m deep. NST pix by Fathil Asri.



KUANTAN: Residents of Taman Pelangkah in Pekan, Pahang evacuating their homes on Dec 26, 2006 as floodwaters keep rising in the area. NST pix by Ilham Nusa.



JOHOR: Sin Soon Huat of Kampung Parit Warijo in Batu Pahat resorted to setting up a barrier of sand bags at his home to keep floodwaters out. NST pix by Fathil Asri.



JOHOR: Teacher Rosli Md Din, 40, (right) wading through the floodwaters in Kampung Dalam Sungai Kenanga, Batu Pahat, with bunches of cassava for his



JOHOR: Faizal Salleh, 31, doing his part in discarding pieces of wood which ended up inside the padi field in Kampung Kesang Gate, Muar as a result of the overflowing Sungai Kesang on Dec 24, 2006. NST pix by Rosdan Wahid.



JOHOR: Volunteers keep on sending food supplies to victims stranded in Kampung Batu Badak in Segamat on Dec 24, 2006, even at night. NST pix by Shahrul M.



JOHOR: This family resolved to wade through the floodwaters which have resulted in the closure of Jalan Segamat-Muar in Kampung Rawang and Pantai Layang in Muar. NST pix by Rosdan Wahid.



2007

Johor, 15 Jan 2007



All flooded: An aerial view showing the level of flooding in Kota Tinggi town yesterday. - 15 January, 2007



People carrying their belongings walk through flood waters in Kota Tinggi after heavy rainfall over the past two days caused a return of the dreaded floods. - 13 January, 2007



Novel idea: A family using a water tank and a tyre tube as a mode of transport in Kota Tinggi yesterday. - 15 January, 2007



People carrying their belongings from their shops in the town centre walk through flood waters to return home in Kota Tinggi after heavy rainfall over the past two days caused a return of the dreaded floods. - 13 January, 2007



Water, water everywhere: An aerial view of a housing estate in Kota Tinggi town at 9am yesterday. ? Courtesy of Oong Boon See - 14 January, 2007



2007

Kuala Lumpur, 10 Jun 2007



2013

Cameron Highlands 23 Oct 2013



Chang Lih Kong Facebook pic



2013

KUANTAN, PAHANG; 4 DEC 2013



Stesen TNB Jalan By-Pass



Stesen Aras Air Jalan By-Pass



Sg. Isap Damai



2013

KUANTAN, PAHANG; 4 DEC 2013



2013

KEMAMAN, TERENGGANU; 4 DEC 2013



2014

Flash Floods in 2014



Merlimau, Melaka
15 Ogos 2014



Seberang Jaya
24 September 2014

Kg Sethu,
Seberang Perai Selatan,
5 Okt 2014



2014

Flash Floods in 2014



Pusat Bandar KL,
1 Okt 2014



Kota Kinabalu
7 Okt 2014



Kg Teroi, Yan, Kedah
5 Okt 2014



2014 Flood in Kelantan, Dec 2014



SK Manek Urai



Kuala Krai



Muara Sg Kelantan



Kuala Krai



Lata Rek



Gua Musang



Kuala Tahan



2015

Flash Flood, 2015

Kuala Lumpur 12/11/2015



Kuala Lumpur

Selangor



Kawasan Perumahan Seri Alam, Saujana Utama



Selangor



ROLE OF AGENCIES ON FLOOD SCENARIO IN MALAYSIA

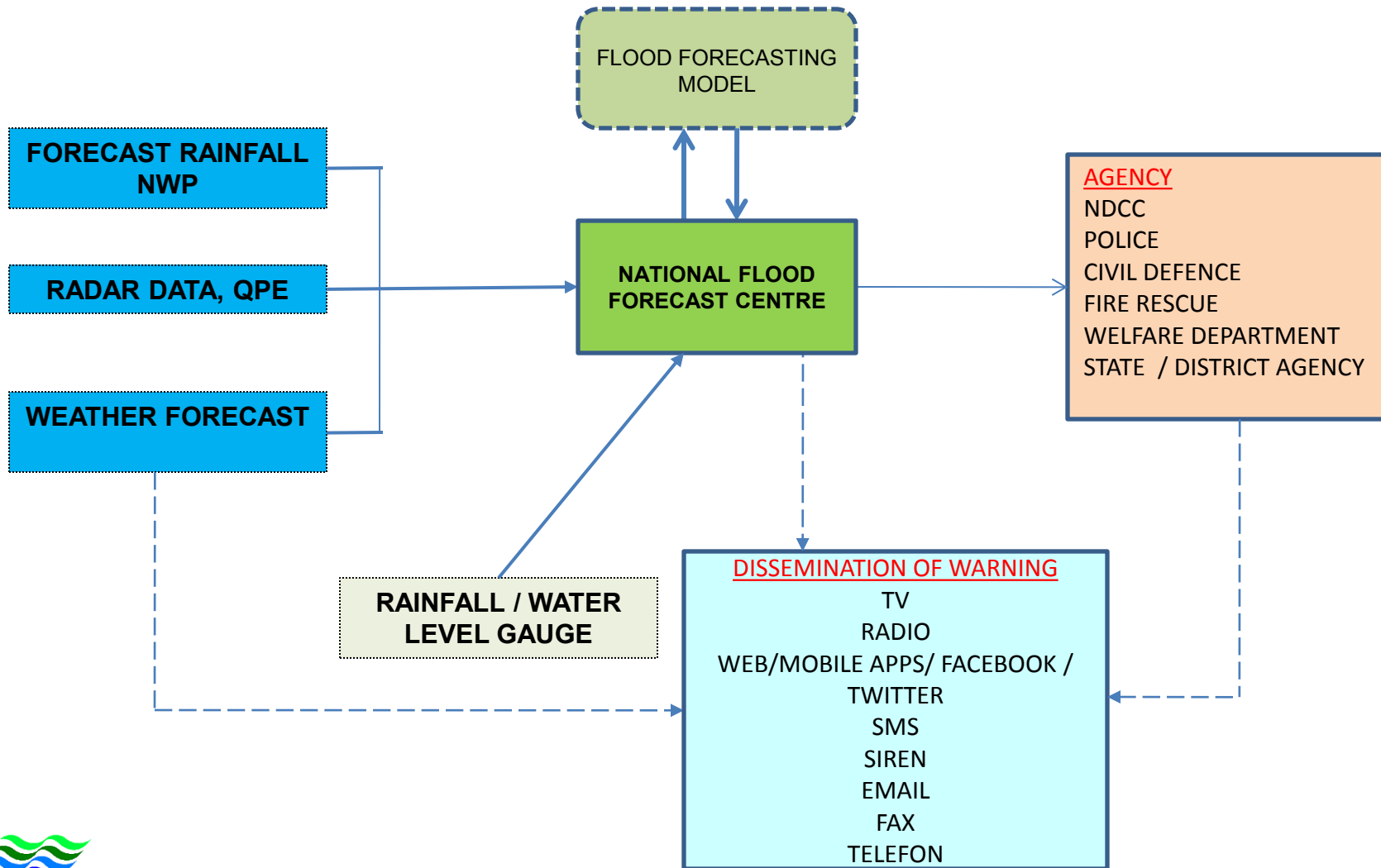


ROLE OF AGENCIES IN FLOOD FORECAST AND WARNING DISSEMINATION

METMALAYSIA

DID

NDMA



ROLE OF AGENCIES IN FLOOD FORECAST AND WARNING DISSEMINATION

METMALAYSIA

- To produce rainfall forecast, qpf
- To produce rainfall estimate using radar
- To provide sea level forecast
- To provide weather forecast (long-term/short term)
- To provide weather conditions and alerting mechanism
- To disseminate the forecast information to relevant agencies and public

DID

- To produce flood forecast (long-term/short-term)
- To collect and provide flood prone area information
- To provide rainfall and flood information
- To provide flood conditions and alerting mechanism
- To disseminate the forecast information to relevant agencies and public
- To establish flood mitigation programme

NDMA

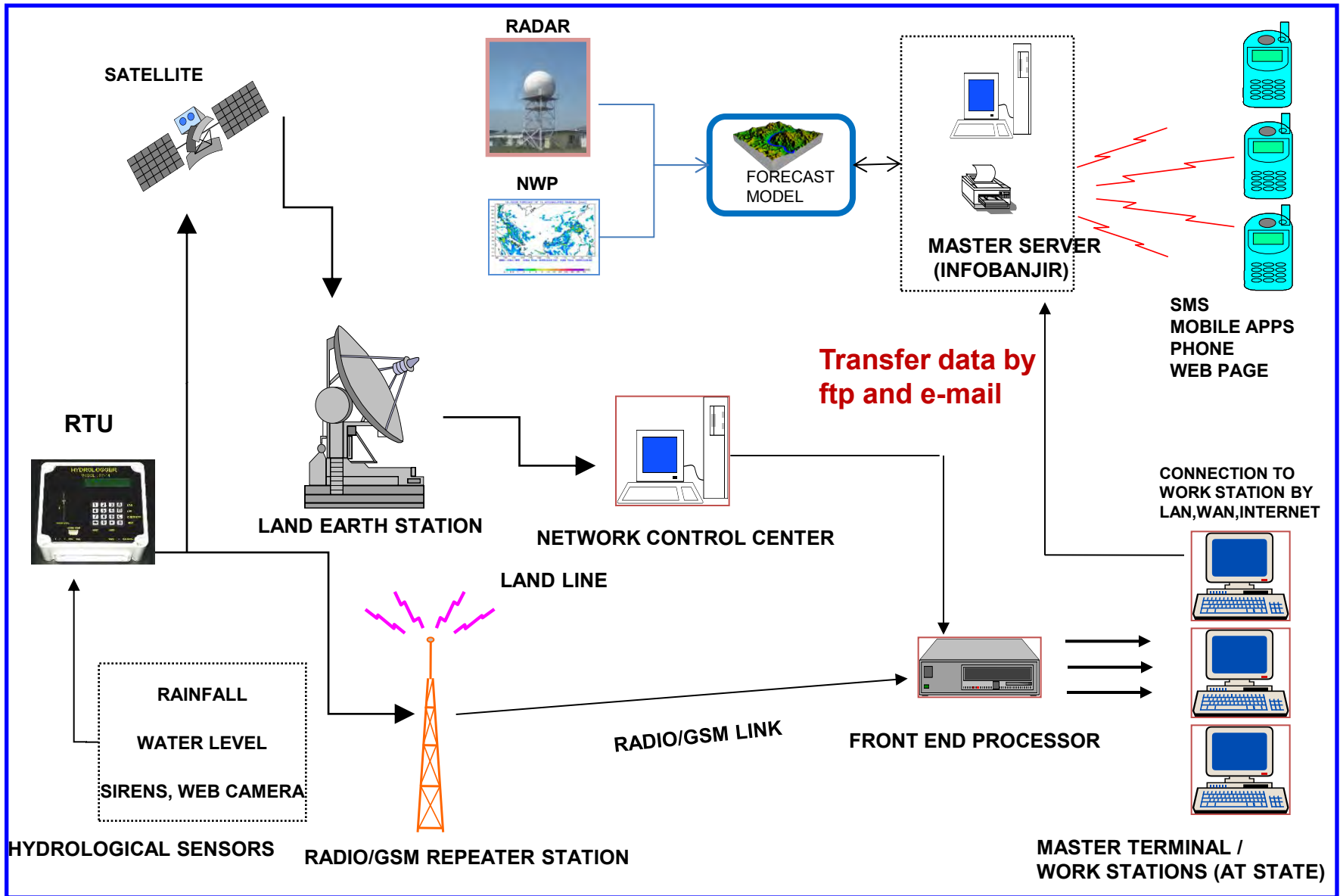
- To manage and lead all agencies in flood disaster
- To collect and disseminate the information from various agencies
- To determine and declare flood condition
- To lead all rescue and recovery programme
- To establish flood disaster management and action plan



FLASH FLOOD FORECASTING AND WARNING SYSTEM



System Architecture for Data Collection and Dissemination



Hydrological Stations Inventory

No.	State	Telemetry Stations (2000 – 2014)			
		Rainfall	Water Level	Combine	Total
1.	Perlis	3	1	7	11
2.	Kedah	6	2	42	50
3.	Pulau Pinang	5	4	8	17
4.	Perak	19	2	23	44
5.	Selangor	17	0	51	68
6.	WP KL	14	6	5	25
7.	Negeri Sembilan	15	13	9	37
8.	Melaka	0	0	8	8
9.	Johor	28	6	32	66
10.	Pahang	14	2	25	41
11.	Terengganu	8	1	17	26
12.	Kelantan	10	1	14	25
13.	Sabah	16	5	44	65
14.	Sarawak	19	30	34	83
	Total	174	73	319	566

Rainfall: 493 Water Level: 392

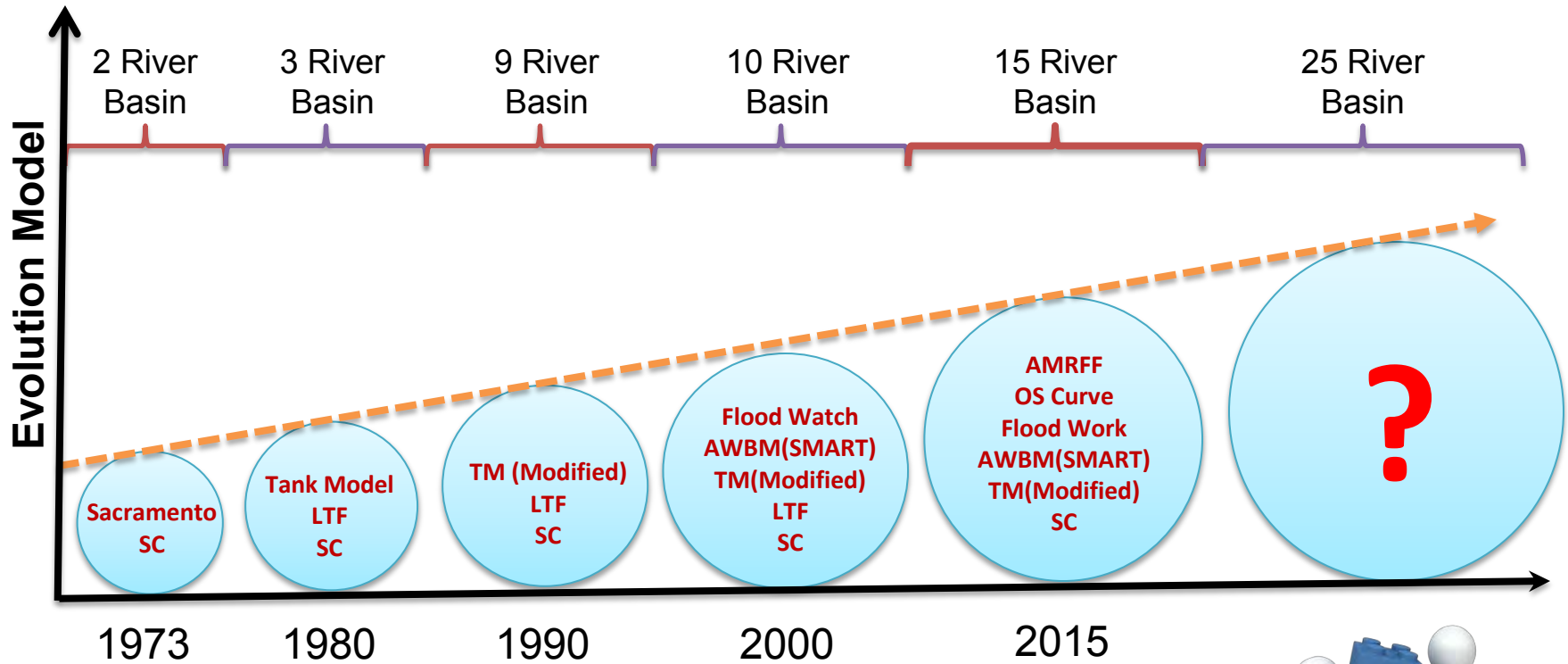


Evolution of Flood Forecasting Model - After 1971

- **Sacramento Model (1973)**
- **Stage Correlation / Regression (1974 to date)**
- **Sugawara's Tank Model (1981 to date)**
- **Linear Transfer Function Model (1986)**
- **Flash-Flood Forecasting Model (1979 - 1985)**
- **Hydrodynamic Models (2001 to 2010)**
- **Hydrologic + Hydrodynamic + QPF (2010- to date)**



EVOLUTION MODEL (1973 – 2015)



Flood Warning Dissemination System

Through

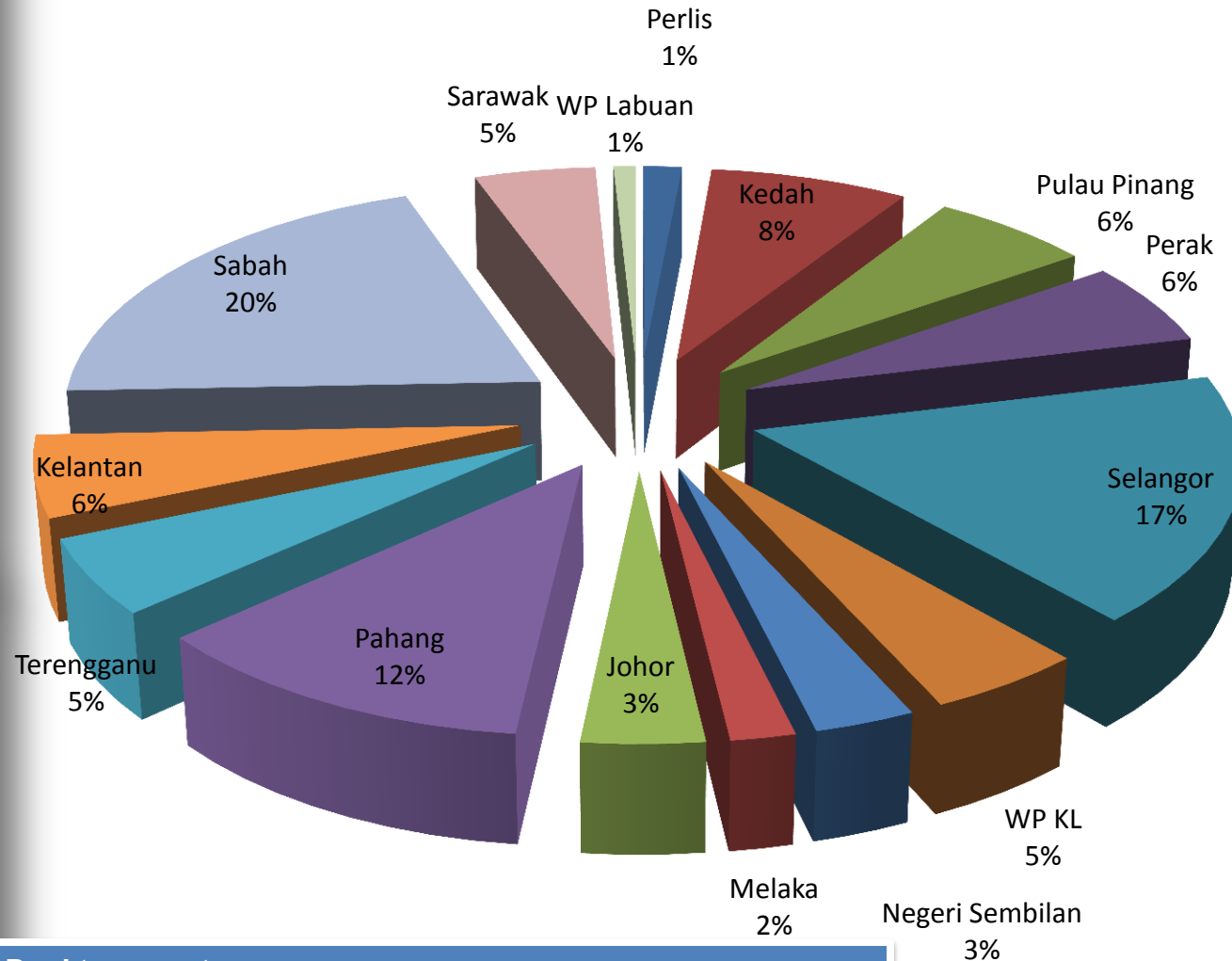
Siren

www.publicinfobanjir.water.gov.my

www.facebook.com/pages/PublicInfoBanjir



Siren Station (472 unit)

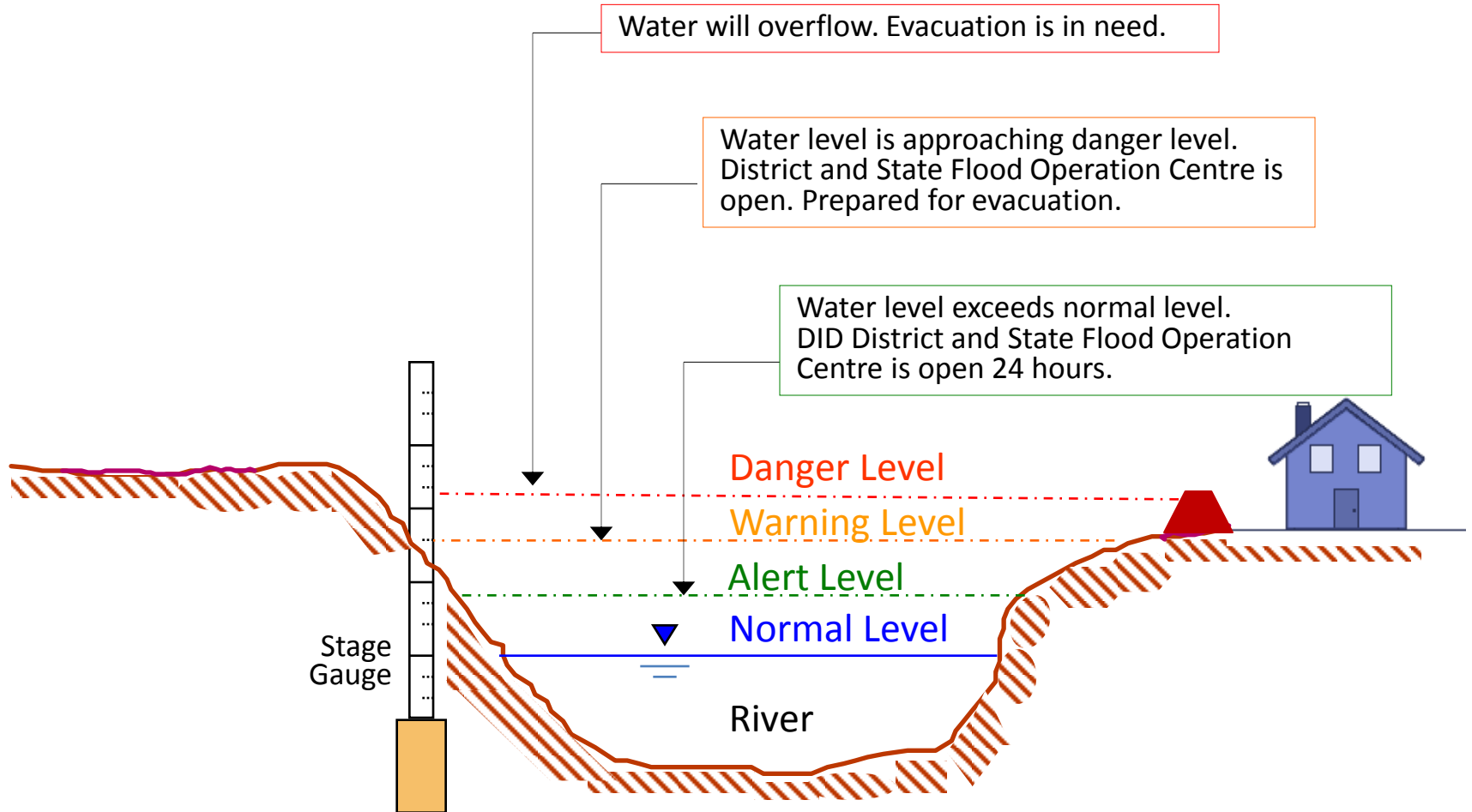


Dual tone system:-

First siren – when WL reach warning level

Second siren – when WL exceed danger level

Water Level Classification at Flood Warning Centre



Homepage for the public - 'Infobanjir Awam'

<http://publicinfobanjir.water.gov.my>

The screenshot shows the homepage of the 'Public Infobanjir' website, managed by the Malaysian Water Services Department (Jabatan Pengairan dan Saliran Malaysia). The page features a navigation menu on the left, a central map of Malaysia, and several informational panels on the right. Callout boxes highlight the following features:

- Links and current flood reports:** A sidebar menu on the left with options like 'PEREMPATAN BANJIR', 'BILIK GERAKAN BANJIR', 'STATUS BERCAHA BANJIR', and 'INFOBANJIR'.
- Real time graphic:** A map of Malaysia showing flood-prone areas and water levels.
- Latest information:** A section titled 'PERGUMUMAN TERKINI' with the latest update: '2. Operasi Pemantaun Banjir 2011/2012'.
- Rainfall intensity isohyet:** A section titled 'KEPADATAN HUJAN' showing rainfall intensity maps for the period 23-09-2011.
- Detail information:** A table listing flood status for various regions (Negeri) and river stations (Sungai).

Kawasan	Status Paras Air Sungai
Negeri:Perak Sg. Bekoh di Bekoh, masa: 23/09/2011 - 15:00	Bahaya: Air sungai telah melebihi paras bahaya. Kawasan sekitar dikuatiri dinaiki air. Penduduk di kawasan sekitar diminta berjaga-jaga. Paras Air: 33.13 (m) [Graf Aras Sungai] [Peta lokasi]
Negeri:Wilayah Kuala Lumpur Sg. Kelang di Emp. Genting Kelang, masa: 23/09/2011 - 15:45	Amaran: Air sungai telah melebihi paras amaran. Penduduk di kawasan sekitar diminta berjaga-jaga. Paras Air: 96.21 (m) [Graf Aras Sungai] [Peta lokasi]
Negeri:N.Sembilan Sg. Linggi di Kg. Mantau, masa: 23/09/2011 - 15:00	Amaran: Air sungai telah melebihi paras amaran. Penduduk di kawasan sekitar diminta berjaga-jaga. Paras Air: 34.66 (m) [Graf Aras Sungai] [Peta lokasi]
Negeri:Sabah Sg. Kuamut di UluKuamut, masa: 23/09/2011 - 08:00	Amaran: Air sungai telah melebihi paras amaran. Penduduk di kawasan sekitar diminta berjaga-jaga. Paras Air: 34.66 (m) [Graf Aras Sungai] [Peta lokasi]
- Social network:** A section titled 'KEMUDAHAN LAIN' with icons for Facebook, Twitter, and RSS.
- Administrator:** A login section for 'JPS Personal' with fields for ID, Name, and Password, and buttons for 'Daftar Masuk' and 'Reset'.
- Link to web camera:** A section titled 'KAMERA BANJIR' with a 'Pautan Kamera' link.
- Complaints:** A section titled 'JPS Careline' with the contact number '1300 80 1010'.

FLASH FLOOD FORECAST SYSTEM FOR KUALA LUMPUR



KL hit by floods

Three-hour downpour causes havoc in city

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The low-lying areas of Kampung Baru.

● **TURN TO PAGE 3**

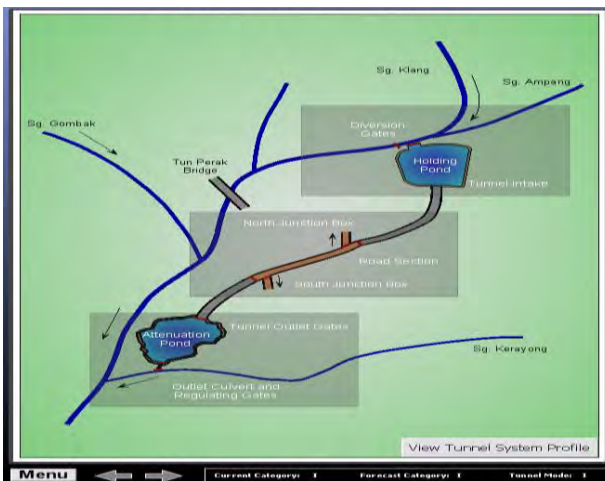
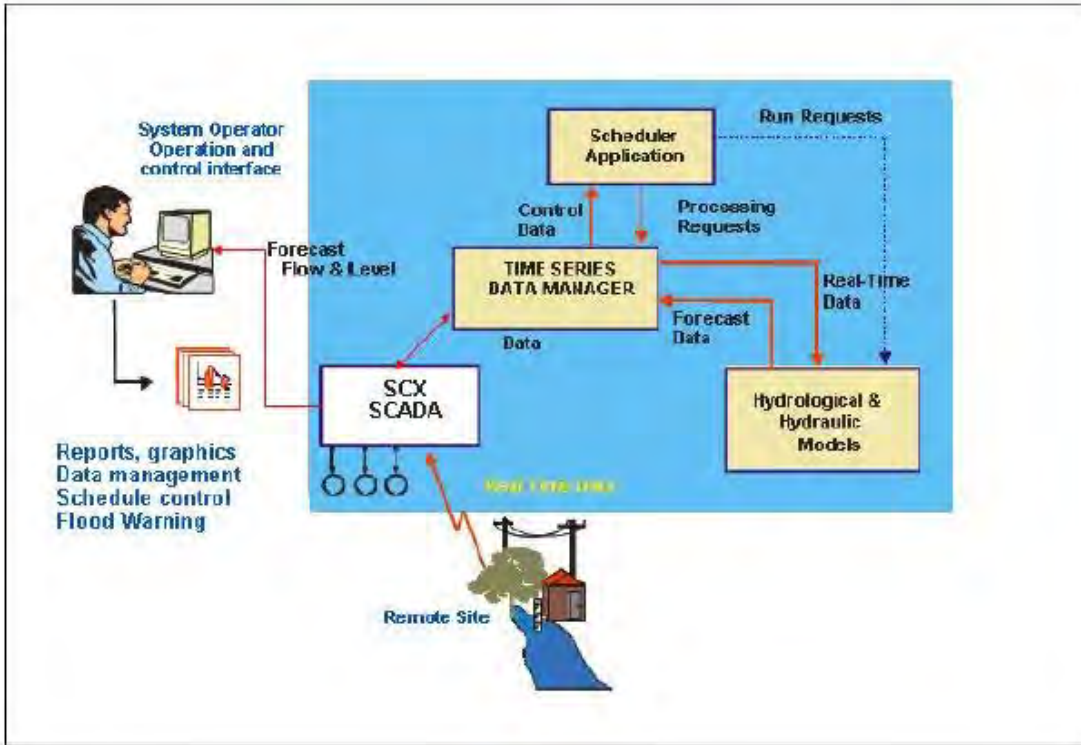


TO THE RESCUE: Emergency workers manoeuvring past a car that stalled at the Jalan Tun Perak and Jalan Melaka intersection yesterday while getting to those stranded following a three-hour downpour.

2003



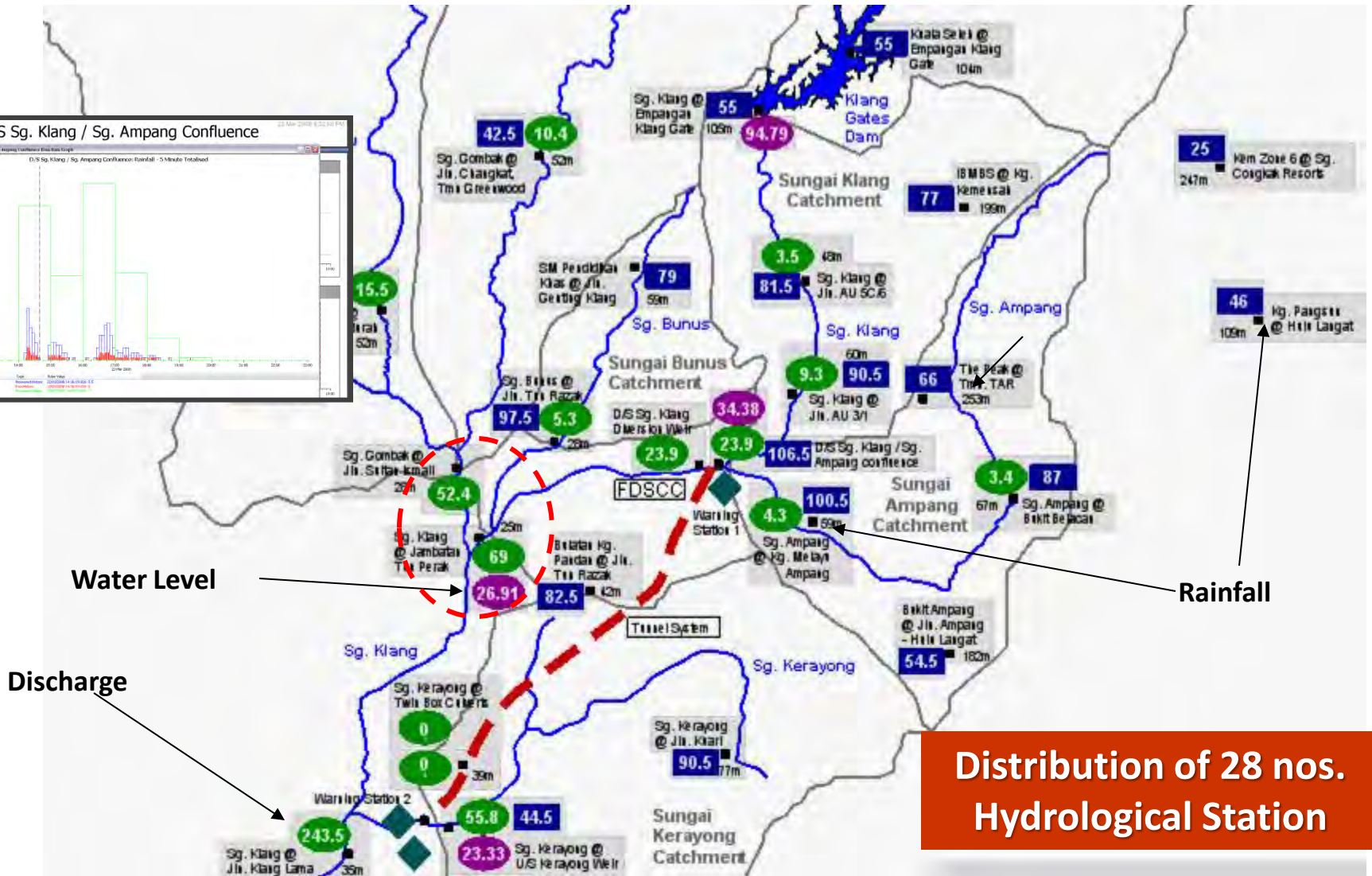
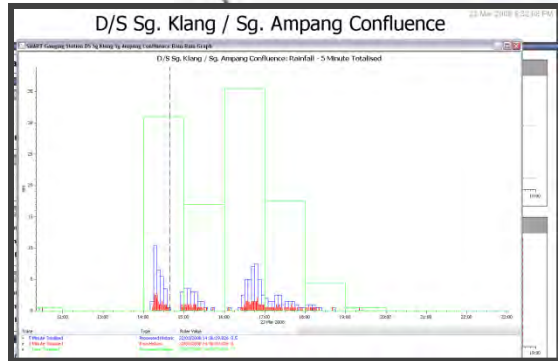
FLOOD DETECTION SYSTEM FOR SMART TUNNEL



Inner Tunnel Diameter: 11.8m
Stormwater Tunnel : 9.7 km



FDS Operations



Catchment Monitoring System



FDS Operations

FDS SMART OPERATIONS MANAGEMENT

22-Mar-2008 6:06:50 PM

CRITICAL SYSTEM STATUS

Catchment Sites: **ONLINE**

Operation Sites: **ONLINE**

VHF Repeater: **ONLINE**

TMCS INTERFACE

Filling Status: **READY**

Dewatering Status: **READY**

SCADA OPERATING MODES

Holding Pond: **MAN / AUTO**

Attenuation Pond: **MANUAL**

OPERATING ALARMS

HP Auto Ready: **ALARM**

AP Auto Ready: **ALARM**

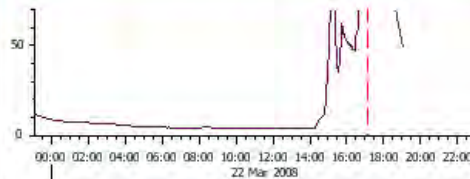
Gate Status: **ALARM**

L8 Pump Status: **ALARM**

FORECAST FLOW @ L4 GATES

15 mins **98.7 m³/s** 30 mins **98.8 m³/s** 60 mins **73.8 m³/s**

STORM CATEGORY II



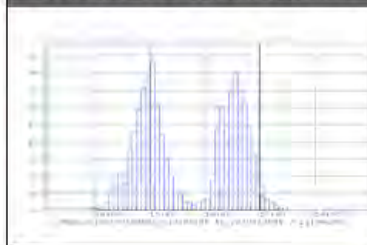
CRITICAL SITE LEVEL / FLOW

	Level	Flow	
UIS L4 Gates:	36.86 mLSD	204.41 m³/s	
D/S L4 Gates:	34.92 mLSD		
D/S Diversion:	35.26 mLSD	81.89 m³/s	
Holding Pond:	34.58 mLSD		
Upstream NJB:	15.50 mLSD		
Downstream SJB:	10.63 mLSD		
L8 Tunnel Outfall:	4.06 mLSD		
Attenuation Pond:	21.50 mLSD		
Tun Perak:	28.53 mLSD	177.47 m³/s	
UIS Sg. Kerayong:	23.43 mLSD	92.61 m³/s	

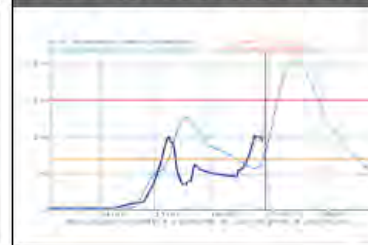
TUNNEL OPERATING MODE



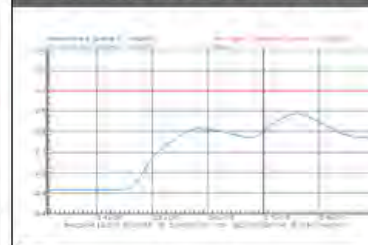
AVERAGE RAINFALL



D/S DIVERSION FLOW



TUN PERAK LEVEL



Menu



Current Category: III

Forecast Category: III

Tunnel Mode: III



FDS Operations

Operational Modes of the Smart Tunnel

Flow (cumec)	Operational Mode	Flow Thru' Lower Drain	Traffic Evacuation	Flow Thru' Traffic Tunnel	Mode
< 70	Mode I: No Storm Klang River, Berembang Holding Pond, Lower Drain, Traffic Tunnel, Desa Attenuation Pond, Kerayong River	✗	✗	✗	1
70-150	Mode II: Moderate Storm Water level rises in Berembang Holding Pond and Desa Attenuation Pond. Section A-A and B-B shown.	✓	✗	✗	2
> 150	Mode III: Major Storm Water level rises significantly. Upper Deck and Lower Deck shown. Traffic evacuation = 1 hour.	✓	✓	✗	3
> 150 prolong	Mode IV: Prolonged Major Storm Water level rises to maximum. Lower drain = 70 m ³ /s.	✓	✓	✓	4

Total Storage Capacity

3 million cubic meters at 3 main components

Holding Pond	Northem Section	Motorway Tunnel (8%)	Southern Section	Attenuation Pond	Total
600,000m ³		250,000m ³		1,400,000m ³	3,000,000m ³
		750,000m ³			



FDS Operations



Inflow to Holding Pond at L5



High Water Level at Tunnel Intake
at 5.11pm

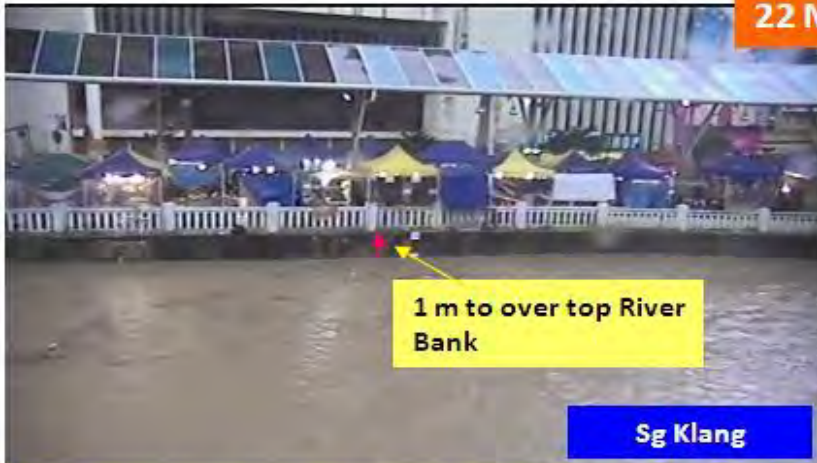


Pond water level rise rapidly

High Water Level at Tunnel Intake
at 6.03 pm

Snap Shots Showing how the SMART has saved the day

22 March 2008



1 m to over top River Bank

Sg Klang

High Water Level at Masjid Jamek LRT Station
at 5.35pm



Sg Gombak

Sg Klang

High Water Level at Sg. Gombak/ Sg. Klang Confluence
at 5.40pm

Events Statistics

(July 2007 - 12th January 2016)

YEAR	MODE 2	MODE 3	MODE 4	TOTAL
2007	13	2	0	15
2008	30	21	1*	52
2009	20	13	0	33
2010	11	14	0	25
2011	21	19	1**	41
2012	25	8	3***	36
2013	21	2	0	23
2014	25	2	0	12
2015	18	0	0	12
2016	2	0	0	2
TOTAL	186	81	5	272

* Mode 4 on the 4th September, 2008

** Mode 4 on the 21st May, 2011

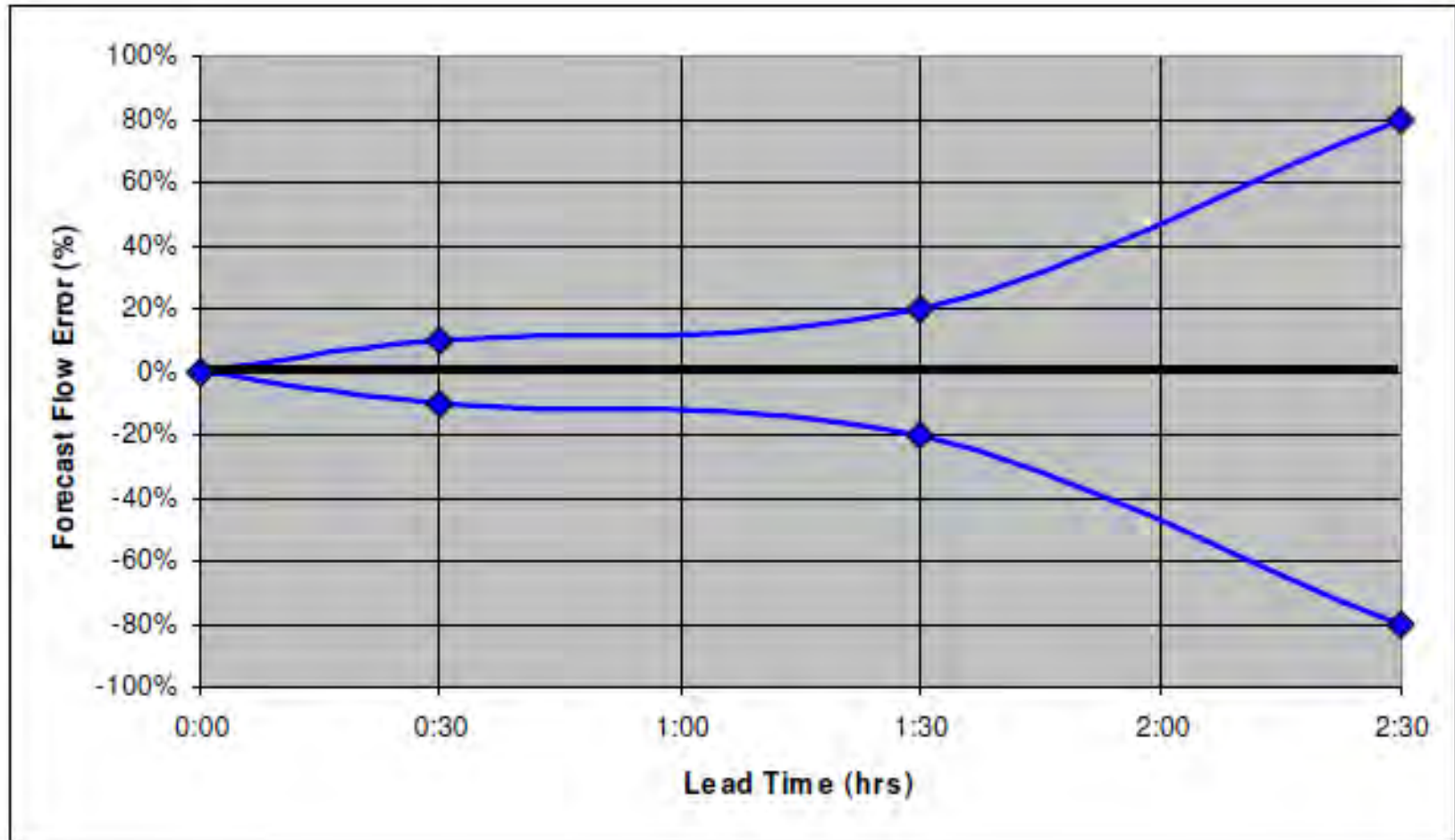
***Mode 4 on the 26th November, 2012

***Mode 4 on the 7th March, 2012

***Mode 4 on the 2nd May, 2012



FLOOD DETECTION SYSTEM FOR SMART TUNNEL



FLASH FLOOD FORECAST SYSTEM FOR SHAH ALAM



• Paling buruk dalam tempoh 10 tahun • 1,240 penduduk dipindah

Shah Alam banjir besar



DITENGGELAMI AIR... Beginilah keadaan di beberapa kawasan termasuk sekitar Stadium Shah Alam, Selangor yang dilanda banjir kilat ekoran hujan lebat awal pagi semalam.

Oleh FAUZIAH AROF dan ZAINI RABAN

SHAH ALAM 26 Feb. - Ribuan penduduk Shah Alam hari ini panik dan kelam kabut apabila beberapa kawasan di bandar raya terancang itu dilanda banjir yang dianggap paling buruk dalam tempoh 10 tahun. Banjir berkenaan yang bermula kira-kira

pukul 5 pagi itu menenggelamkan lebih 4,000 rumah dan menyebabkan beberapa laluan lebuh raya terpaksa ditutup untuk semua jenis kenderaan.

• Lagi berita, gambar - Muka 5, 6, 7

Seramai 1,240 penduduk dari 260 keluarga telah dipindahkan ke tempat selamat.

Kawasan yang paling teruk ialah Kampung Kebun Bunga di Batu Tiga apabila lebih 50 buah rumah di perkampungan tersebut ditenggelami air setinggi enam meter.

Selain itu, kawasan taman perumahan Taman Tun Dr. Ismail (TTDI) Jaya juga terjejas teruk apabila semua rumah di kawasan itu ditenggelami air setinggi kira-kira 1.6 meter. Banjir berkenaan turut melanda kawasan

Seksyen 13 Shah Alam yang menempatkan kawasan perumahan, pasar raya Giant, Makro serta menenggelami kawasan tempat letak kereta Stadium Shah Alam dan kawasan padang bola sepaknya.

Antara kawasan yang terbitab ialah Kampung Landasan di Kampung Melayu Subang

■ Lihat muka 2

CHAOS in Shah Alam

RESCUE EFFORTS: Firemen pass a submerged car while evacuating residents of Kampung Kebun Bunga during the floods. - NST picture by Mustafa Kamal



■ By V. Shankar Ganesh

SHAH ALAM, Sun - Unusually heavy rain made worse by a weather tide resulted in one of the worst floods to hit the city early today. Waters rose so rapidly in the pre-dawn hours that more than 2,000 people had to be taken to their homes with just the clothes on their backs while several cars, many of them brand-new models in a Proton dealer's yard, were submerged.

Sections of the Federal Highway and the New Klang Valley Expressway had to be closed to traffic.

The three affected areas were Kampung Kebun Bunga and Taman Mawar in Batu Tiga, Taman Tun Dr. Ismail and Kampung Melayu Subang near the Sultan Abdul Aziz Shah airport.

KTM commuter services were also disrupted as the Batu Tiga station was flooded, the stretches at Km9.2 of the NKVE and Km15 of the Federal Highway were closed to all vehicles since morning as they were under one metre of water, reports said.

The NKVE service between Subang and Shah Raja was closed at 4.35am while the Federal Highway was closed at 5.55am. This caused a



NOT TAKING CHANCES: Vehicles making U-turns before the Batu Tiga Toll Plaza to avoid the fast floods.

major jam as traffic was backed up for several kilometres. Many were even turning back as PLTS officials opened U-turns for the stranded motorists. The NKVE was reopened at 2.30pm while the Federal Highway was reopened at 1.30pm. He said the toll plaza in Shah Alam, Batu Tiga and Bakti Raja were also closed in the morning. KTM said its commuter services from Sentral to Port Klang terminated at the Subang Jaya station and

trains returned to Sentral, while the service from Port Klang to Sentral remained at the Shah Alam station and turned back. However, all train services resumed at 2.05pm after waters receded.

Minister Besar Datuk Seri Dr. Mah Mohd Khalid Yusoff, who visited the affected areas at 5pm, upon his return from Seremban, said they had anticipated such a problem to occur and had last week approved RM10 million for flood mitigation works.

He said construction of a canal between Sungai Klang and Sungai Langat to drain out excess water during floods would begin soon.

Dr. Shah expressed disappointment that the flood warning system in the area was not working well. He said the State Government would consider compensating the affected residents through relief in assessment charges.

In Kampung Kebun Bunga in Batu Tiga, about 800 families fled their homes after the Sungai Damansara, which flows behind their homes, overflowed and a section of the land gave way.

Fire and Rescue Department and Civil Defence personnel arrived at the village with fire boats and managed to evacuate the villagers.

Senior Assistant Superintendent Borhan Madun from the Shah Alam Fire station said many of the vil-

lagers were sitting on their roofs, awaiting rescue as the waters had risen rapidly.

"Many were trapped in their homes and in some places, it rose to the ceiling. However, there were no casualties."

According to the villagers, the waters rose to about six metres in some places.

Among those badly affected by the flood was a Proton dealer. He said there were about 60 brand-new and unregistered cars in the yard when the waters rose.

"My workers could only push 30 cars out but the rest are all in the water now. The models include Perodua, Myvi and Wira."

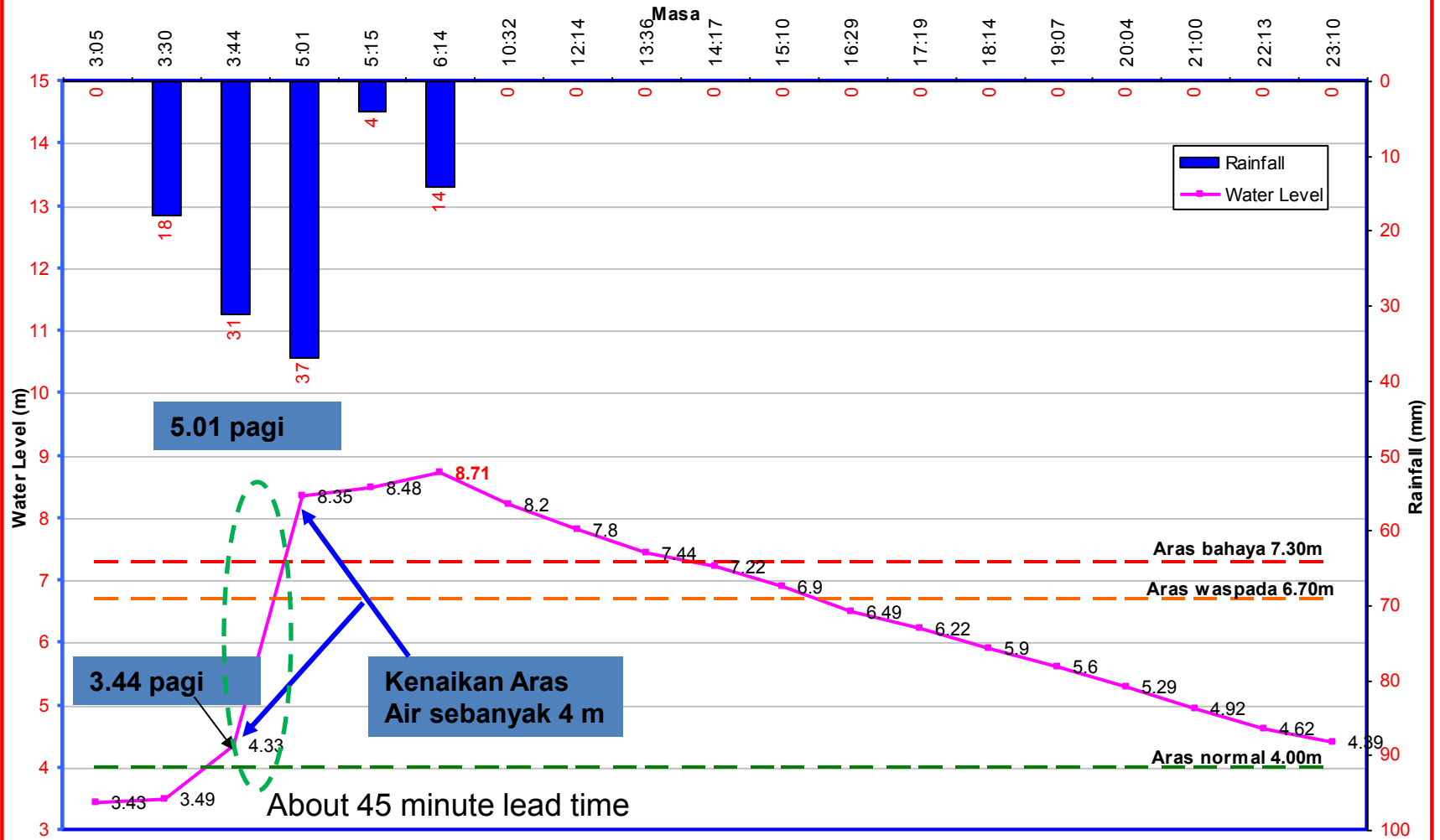
Batu Tiga State assemblyman Datuk Subhan Selamat said about 1,200 people were evacuated from the village and had been housed in three nearby community school centres.

In TTDI, more than 1,000 homes were affected and 150 people were evacuated to a nearby mosque as many opted to remain on the first floors of their homes. Electricity has been cut off and will be restored tomorrow. Welfare Department officials were present at all the evacuation centres to monitor the situation.

2006



Sungai Damansara di TTDI Jaya (26/2/2006)



FLASH FLOOD SMS ALERT SYSTEM

smsBanjir



SMS alert plan mulled

More flood warning sirens to be set up

By SA'ODAH ELIAS
Odae@thestar.com.my

KUALA LUMPUR: The Drainage and Irrigation Department (DID) is looking into the possibility of using SMS to alert residents in Shah Alam's low-lying areas of possible flooding.

The department will also set up more warning sirens in flood-prone areas such as Taman TTDI Jaya, Kampung Kebun Bunga and Batu Tiga, which were badly hit during the Feb 26 floods, said its director-general Datuk Keizrul Abdullah.

The people have also been told to brace themselves for another major flood if the Sungai Damansara catchment area were to experience heavy rainfall similar to that two weeks ago.

Keizrul said the SMS system was already available for department officers to receive automatic updates on their mobile phones once rainfall exceeded a certain level.

"We are looking into how we can extend a similar service to people in the affected areas so that they can take measures to protect their properties," he added.

He said the delay in carrying out flood mitigation pro-



Keizrul: 'We will strengthen the walls of the Kota Damansara retention pond'

grammes – such as dredging Sungai Damansara, fortifying its bunds and increasing the height of its banks – was due to the process of appointing contractors through open tender, which would take around two months even on a fast-track basis.

"We will also strengthen the walls of the Kota Damansara retention pond which collapsed on Feb 26 and increase its storage capacity," he said.

However, he pointed out that these were only short-term measures as the problem faced

by the people was due to the over-development around the Sungai Damansara catchment area.

The river could not even be widened as most of its reserve had been developed.

"The massive development upstream of Sungai Damansara, Sungai Pencala and Sungai Air Kuning – particularly the Bukit Cerakah and Kota Damansara projects – is causing heavy siltation in the river," he said.

"Once you have an area heavily developed, the water runoff not only more than double in volume during heavy rain but also in speed.

"The Sungai Damansara catchment area is almost fully developed, except for two green lungs at Taman Pertanian Bukit Cerakah and Taman Botani near Sungai Buloh.

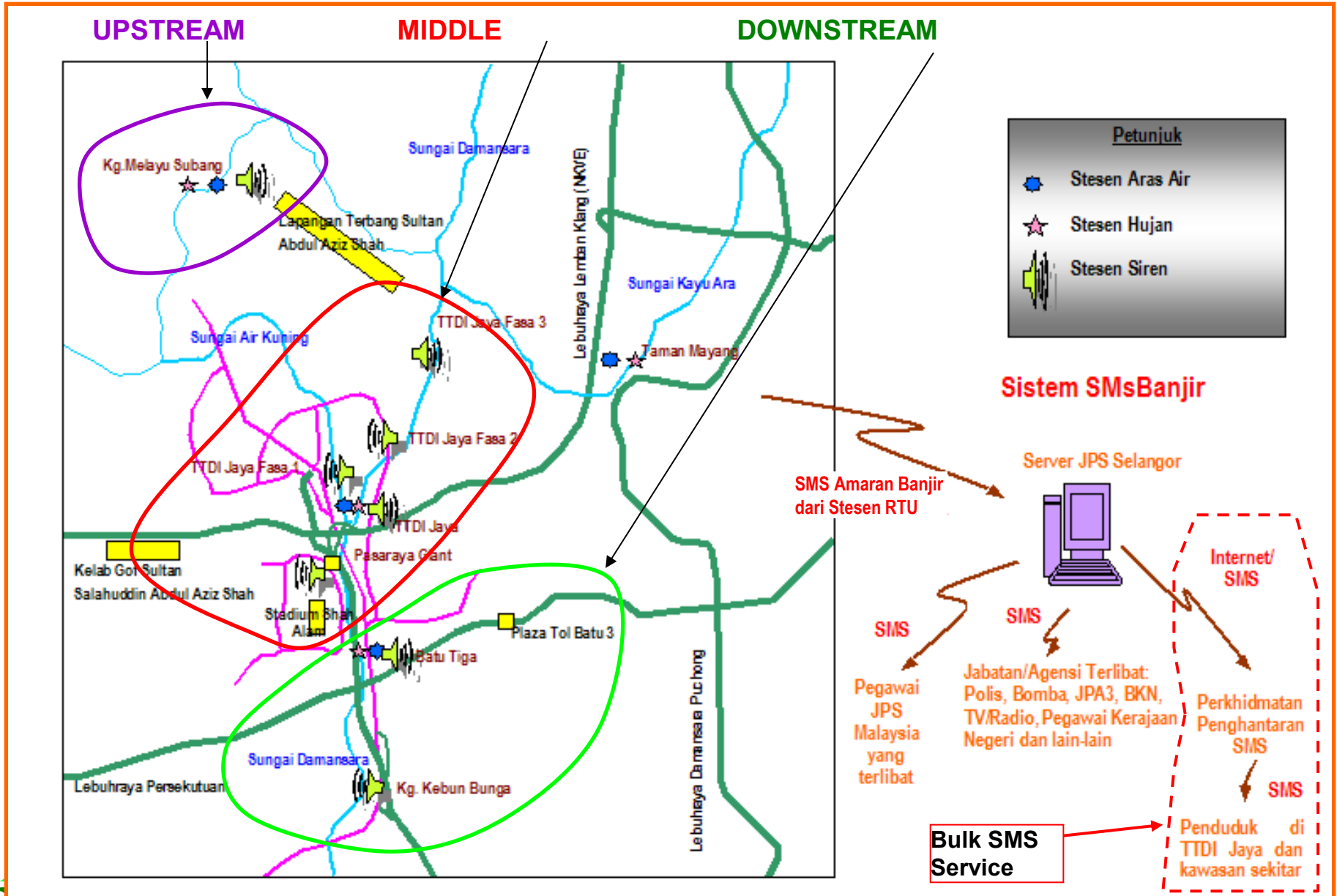
"Because of that, we have already drawn up a master plan for the whole Sungai Damansara basin to protect the low-lying areas. The projects will only take place in the Ninth Malaysia Plan," he added.

Last week, Selangor Menteri Besar Datuk Seri Dr Mohamad Khir Toyo criticised the department for its delay in implementing flood mitigation projects along Sungai Damansara.

Warning ! Sg. Damansara is at warning condition. Flood will be occur at TTDI Jaya and surrounding area. Please alert and take necessity action.



SIREN AND HYDROLOGICAL STATIONS IN TTDI JAYA



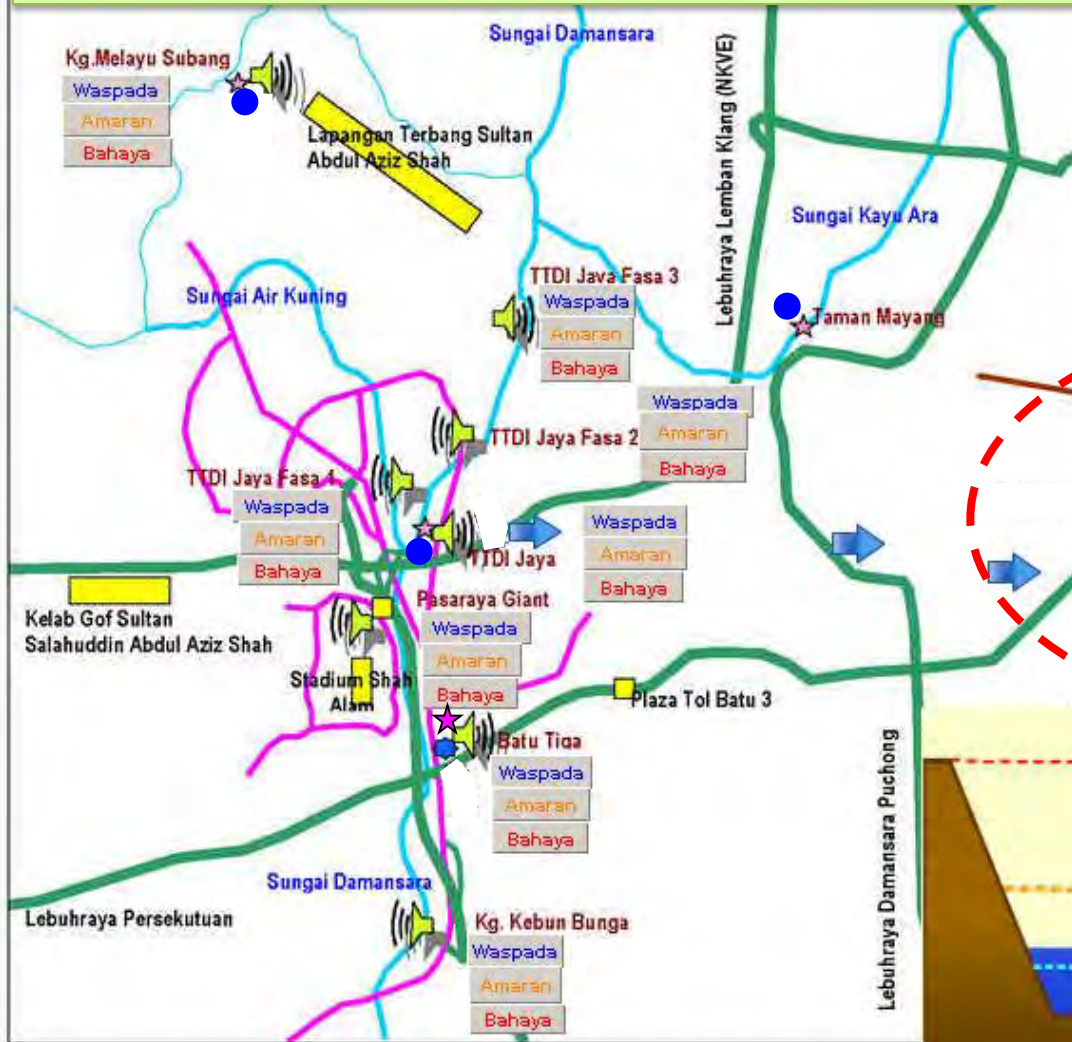
SMS ALERT TRIGGER CRITERIA

1. Alert : 2 rainfall station > 40mm in 1 hr
2. Warning : Water level > warning level Aras air
3. Danger : Water level > Danger level

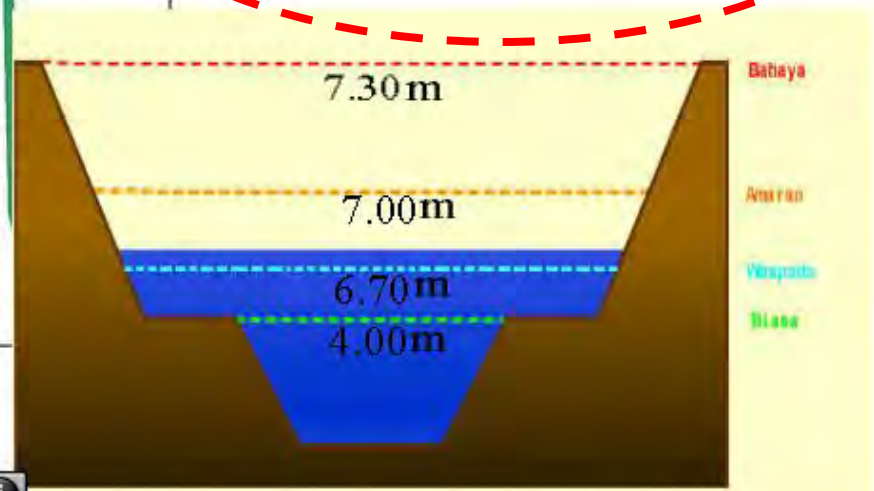
Category	Types of Warning		SMS
	Siren	SMS	
Alert	Yes (1 Tone Sound)	Yes	Alert! Sg. Damansara is at alert level. Flood possibly occur if rainfall continue.
Warning	Yes (2 Tone Sound)	Yes	Warning ! Sg. Damansara is at warning condition. Flood will be occur at TTDI Jaya and surrounding area. Please alert and take necessity action.
Danger	Yes (2 Tone Sound)	Yes	Danger! Flood was occurred in TTDI Jaya and surrounding area. Advise to evacuate and take necessity action.



FLASH FLOOD MODEL IN SHAH ALAM



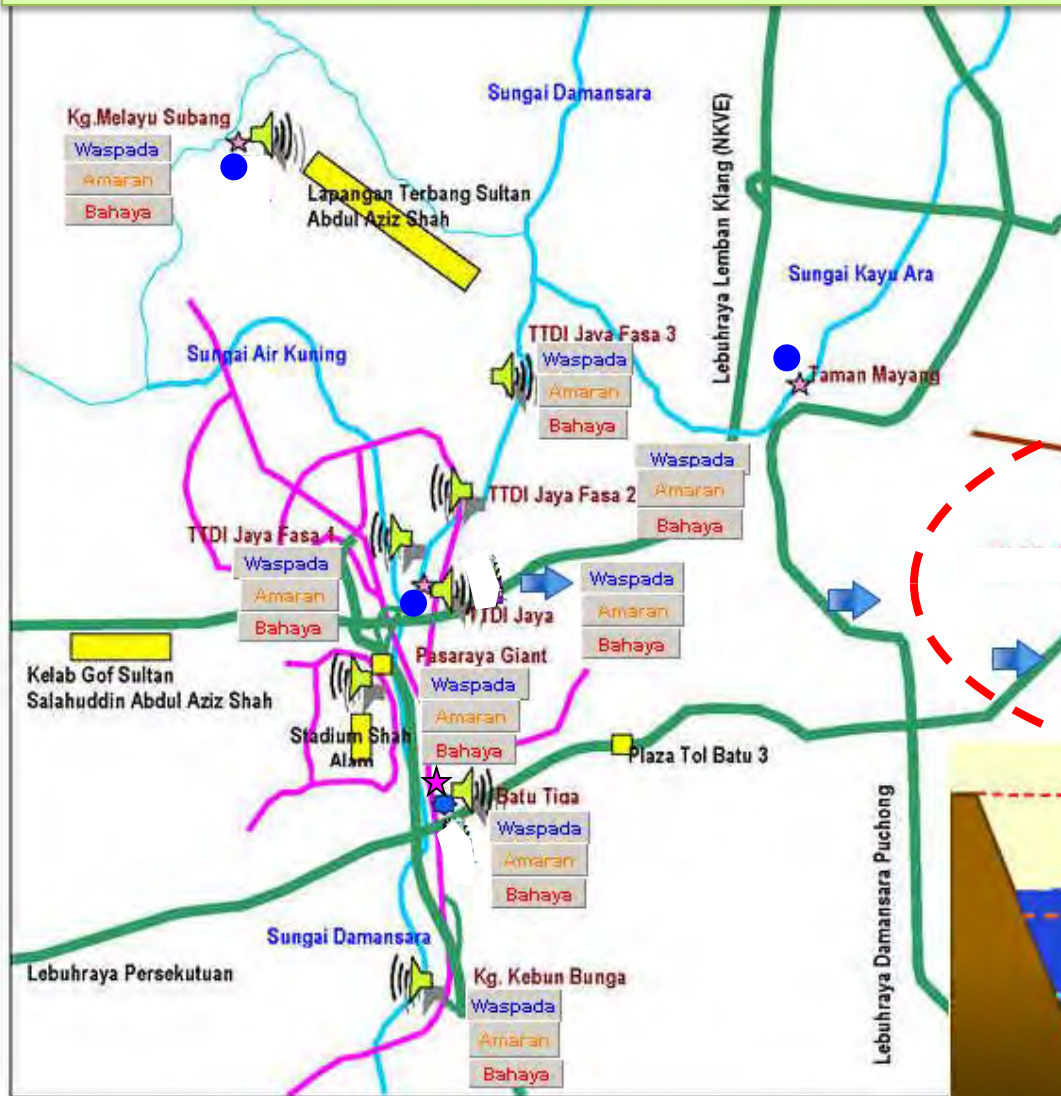
Waspada! Sg. Damansara di tahap waspada. Kemungkinan banjir akan berlaku jika hujan lebat berterusan.



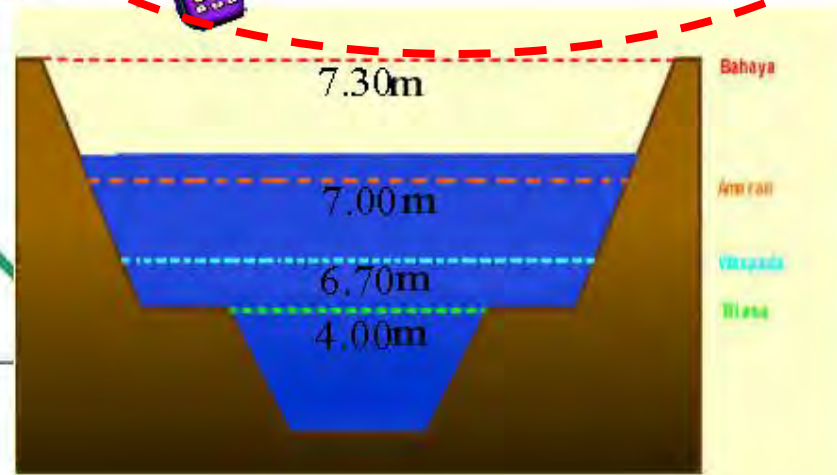
LOKASI STESEN HUJAN, ARAS AIR DAN SIREN DI TTDI JAYA, SHAH ALAM DAN KAWASAN SEKITAR



FLASH FLOOD MODEL IN SHAH ALAM



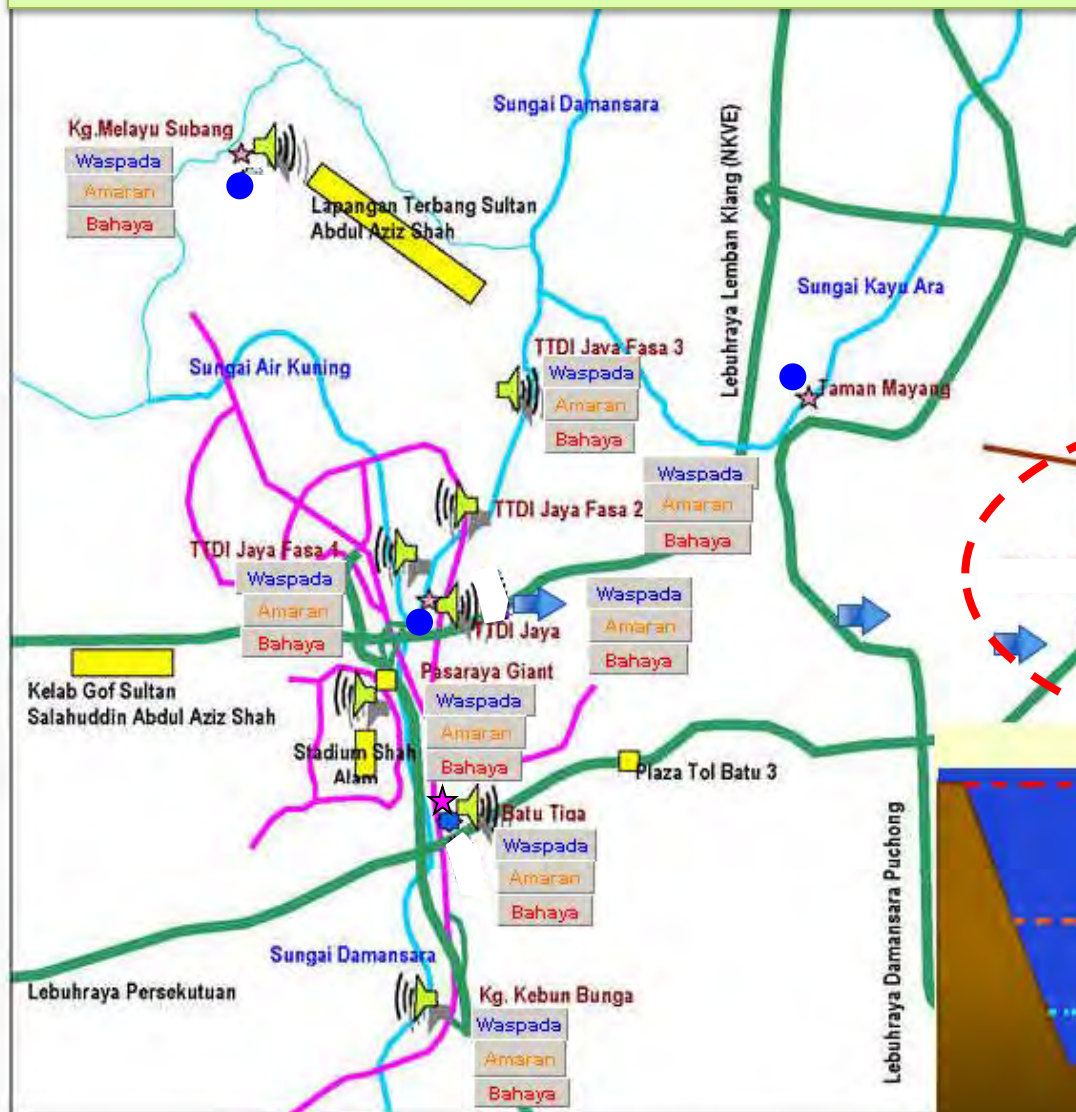
Amaran! Sg. Damansara di tahap amaran. Kemungkinan besar banjir akan berlaku di TTDI Jaya dan kawasan sekitar. Bersedia untuk mengambil tindakan sewajarnya.



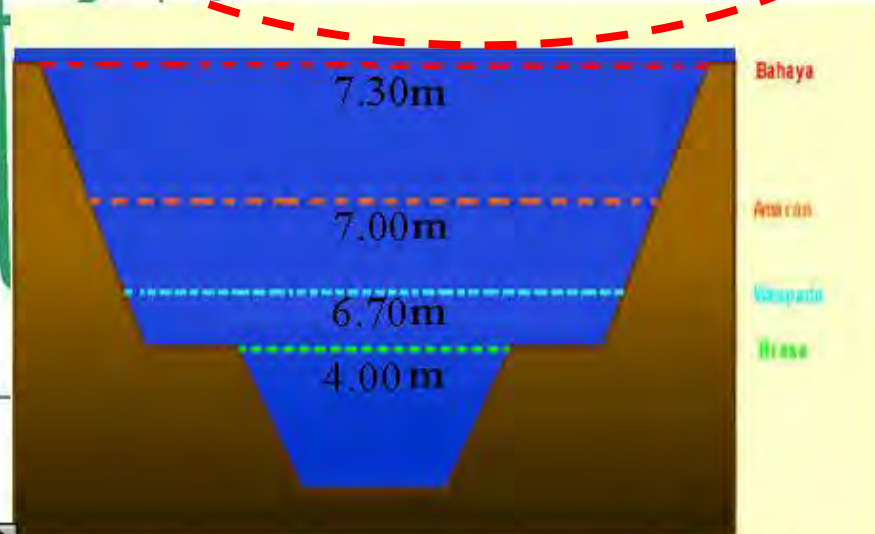
LOKASI STESEN HUJAN, ARAS AIR DAN SIREN DI TTDI JAYA, SHAH ALAM DAN KAWASAN SEKITAR



FLASH FLOOD MODEL IN SHAH ALAM



Bahaya! Banjir telah tiba di TTDI Jaya dan kawasan sekitarnya. Dinasihatkan segera berpindah dan ambil tindakan sewajarnya.



LOKASI STESEN HUJAN, ARAS AIR DAN SIREN DI TTDI JAYA, SHAH ALAM DAN KAWASAN SEKITAR

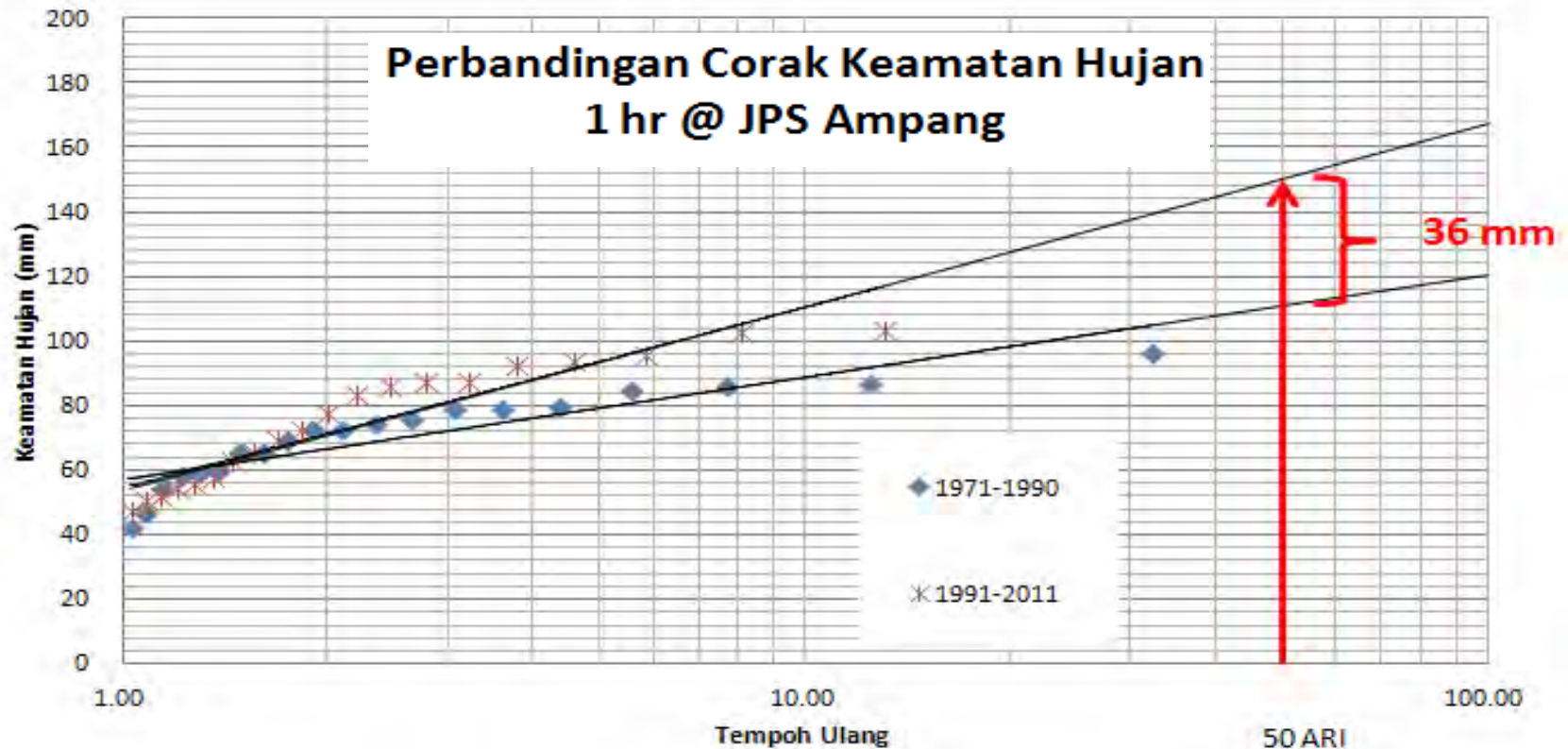


CHALLENGES AND WAY FORWARD



TIMELINESS

- Changes in rainfall pattern such as high intensity rainfall for a shorter period of time which increase the probability of flash flood.



VERY SHORT LEAD TIME

KAJANG,	12/11/2014,	13:00,	22.32,	94,	0,
KAJANG,	12/11/2014,	13:15,	22.32,	94,	0,
KAJANG,	12/11/2014,	13:30,	22.33,	94,	0,
KAJANG,	12/11/2014,	13:45,	22.33,	94,	0,
KAJANG,	12/11/2014,	14:00,	22.34,	94,	0,
KAJANG,	12/11/2014,	14:15,	22.34,	94,	0,
KAJANG,	12/11/2014,	14:30,	22.37,	97,	2,
KAJANG,	12/11/2014,	14:45,	22.37,	101,	6,
KAJANG,	12/11/2014,	15:00,	22.89,	117,	22,
KAJANG,	12/11/2014,	15:15,	23.74,	133,	38,
KAJANG,	12/11/2014,	15:30,	24.61,	134,	40,
KAJANG,	12/11/2014,	15:45,	25.03,	134,	40,
KAJANG,	12/11/2014,	16:00,	25.06,	134,	40,

} 36 mm
in 45 min



Flood in
Kajang Town



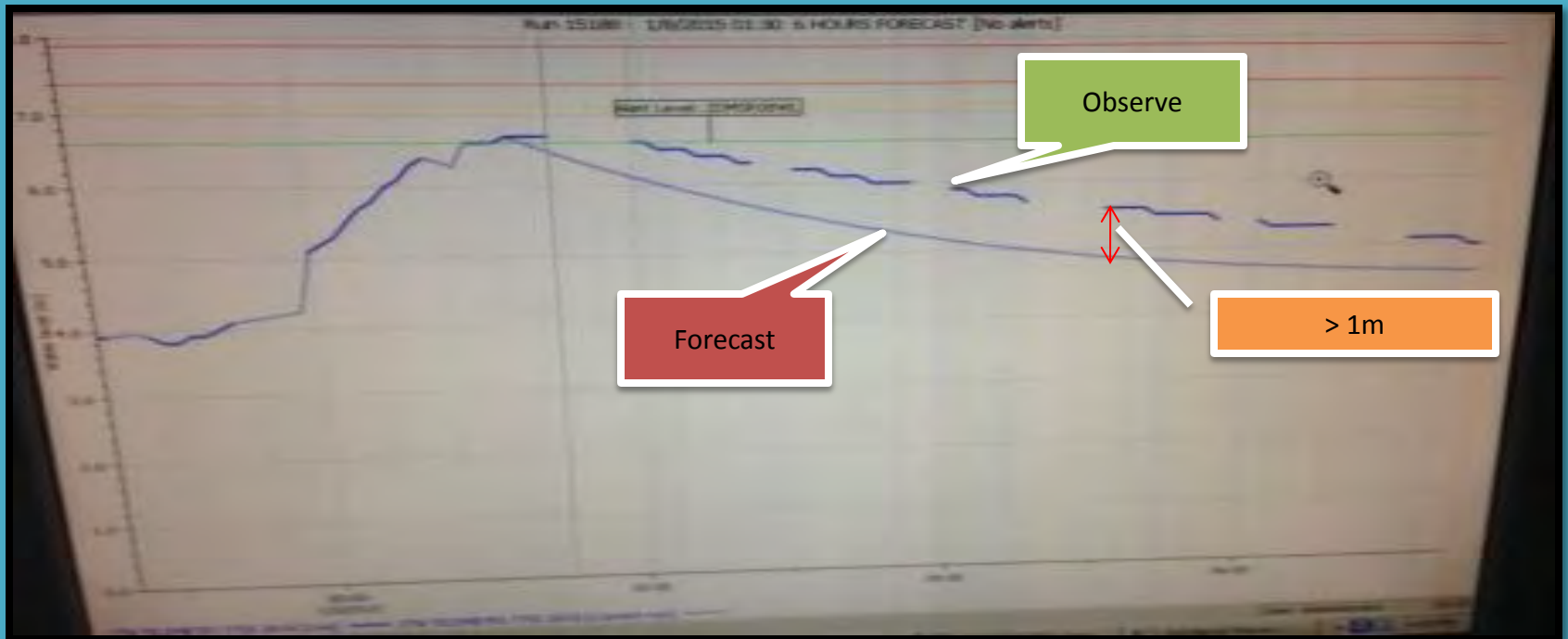
FORECAST ACCURACY

Current

Way Forward

Flood forecast error $> \pm 1.0$ metre

Flood forecast error $< \pm 0.5$ meter



Manpower and Expertise

- Require 24-hour operational flood forecast and warning
- Require enough manpower with sufficient knowledge and skill



Allocation and Budget

- Not enough allocation for development, maintenance and operational cost
- Allocation for proper and continuous training on forecasting



Way Forward

- Enhanced the flash flood forecasting and warning system via latest technology at flood risk area
- Strengthen the flood forecast officer by improving the knowledge and skills
- Strengthen the cross-department cooperation i.e. DID, MetMalaysia, ARSM, Universities, NDMA
- To obtain the allocation for development, operation and maintenance of the flood forecasting system via internal or external budget source



A dynamic background featuring a blue water splash with numerous bubbles of varying sizes. The splash is centered horizontally and extends across the width of the image. The bubbles are rendered with realistic highlights and shadows, giving them a three-dimensional appearance. The overall color palette is a gradient of light to medium blue.

THANK YOU

