
MALAYSIA
WATER RESOURCES
MANAGEMENT
FORUM 2014
Department of Irrigation and Drainage Sabah
Wally H

CHALLENGES IN MANAGING FLOOD IN SABAH

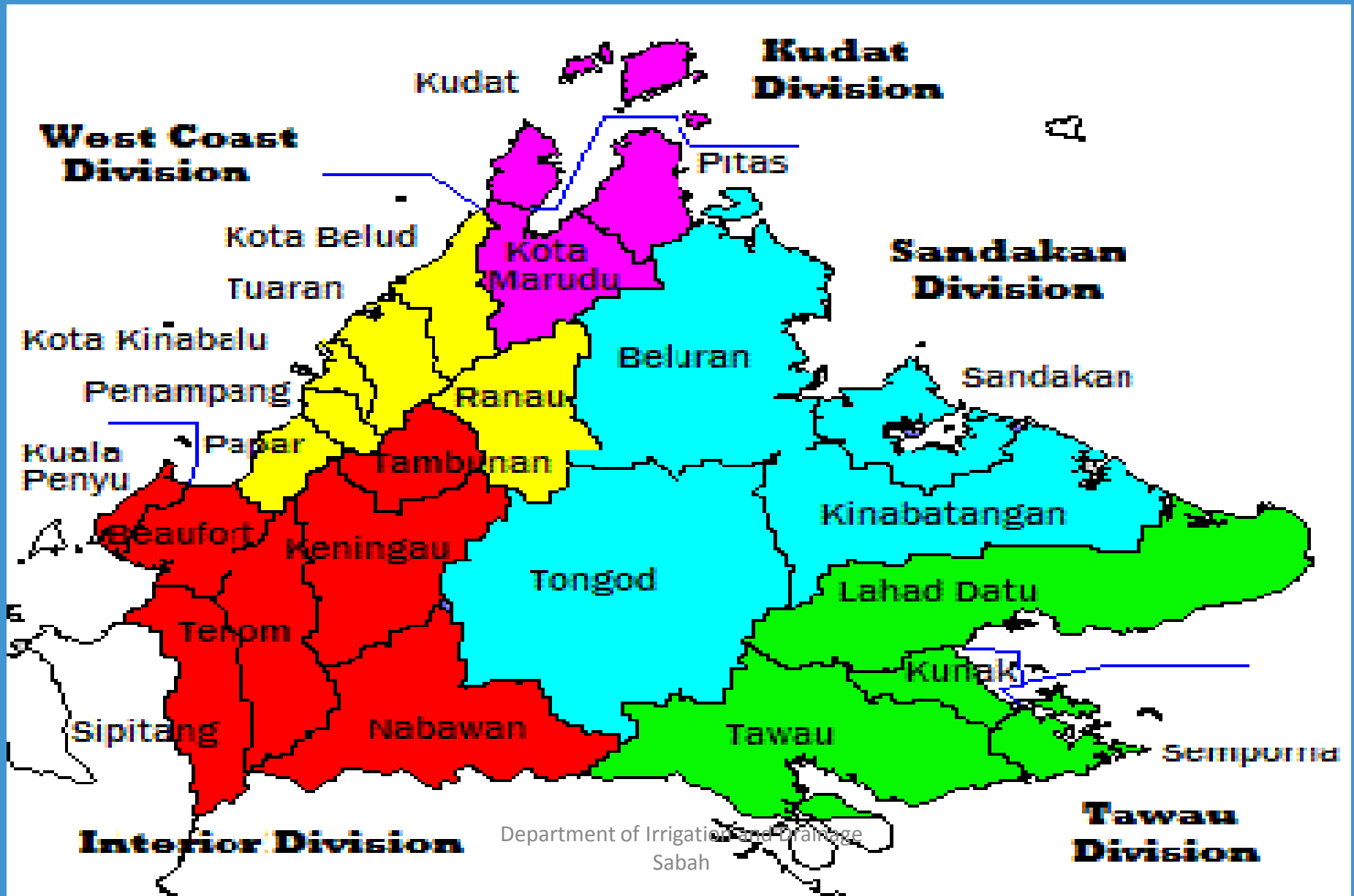
By
Waily Harim
Department of Irrigation and Drainage
Sabah

PRESENTATION OUTLINE

- INTRODUCTION TO SABAH
- BACKGROUND – TOPOGRAPHY & CLIMATE
- FLOOD EVENTS AND CAUSES OF FLOODING
- FLOOD MITIGATION STUDY BY DID
- FLOOD MITIGATION CASE STUDY – MOYOG
- CHALLENGES & WAY FORWARD
- CONCLUSIONS

INTRODUCTION TO SABAH

INTRODUCTION TO SABAH



INTRODUCTION TO SABAH

Mount Kinabalu Golf Club

Mount Kinabalu

|Canon PowerShot G11|ISO 80|F4|1/250s|6.1mm|

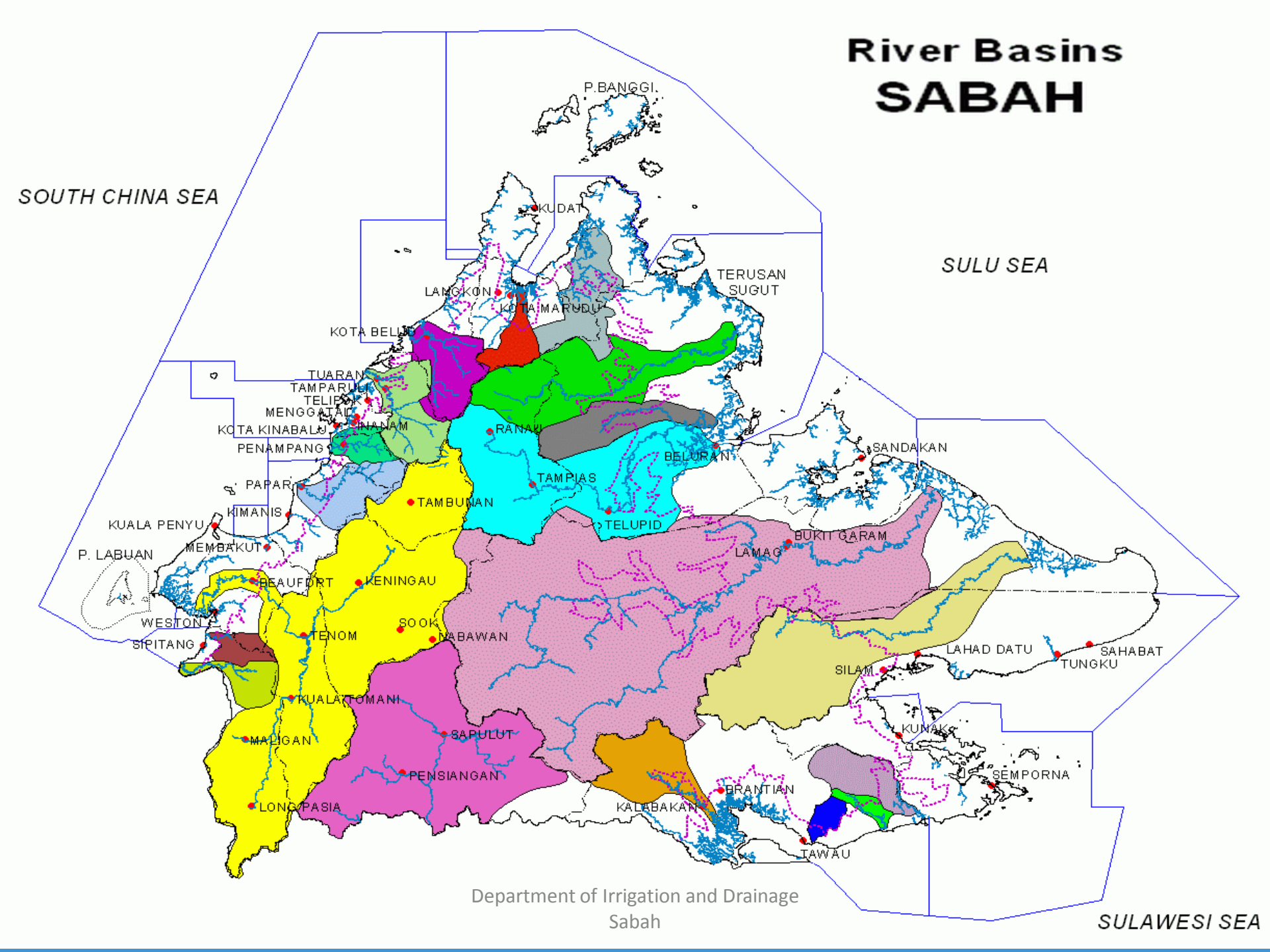
Fish Massage - Kg Luanti, Ranau

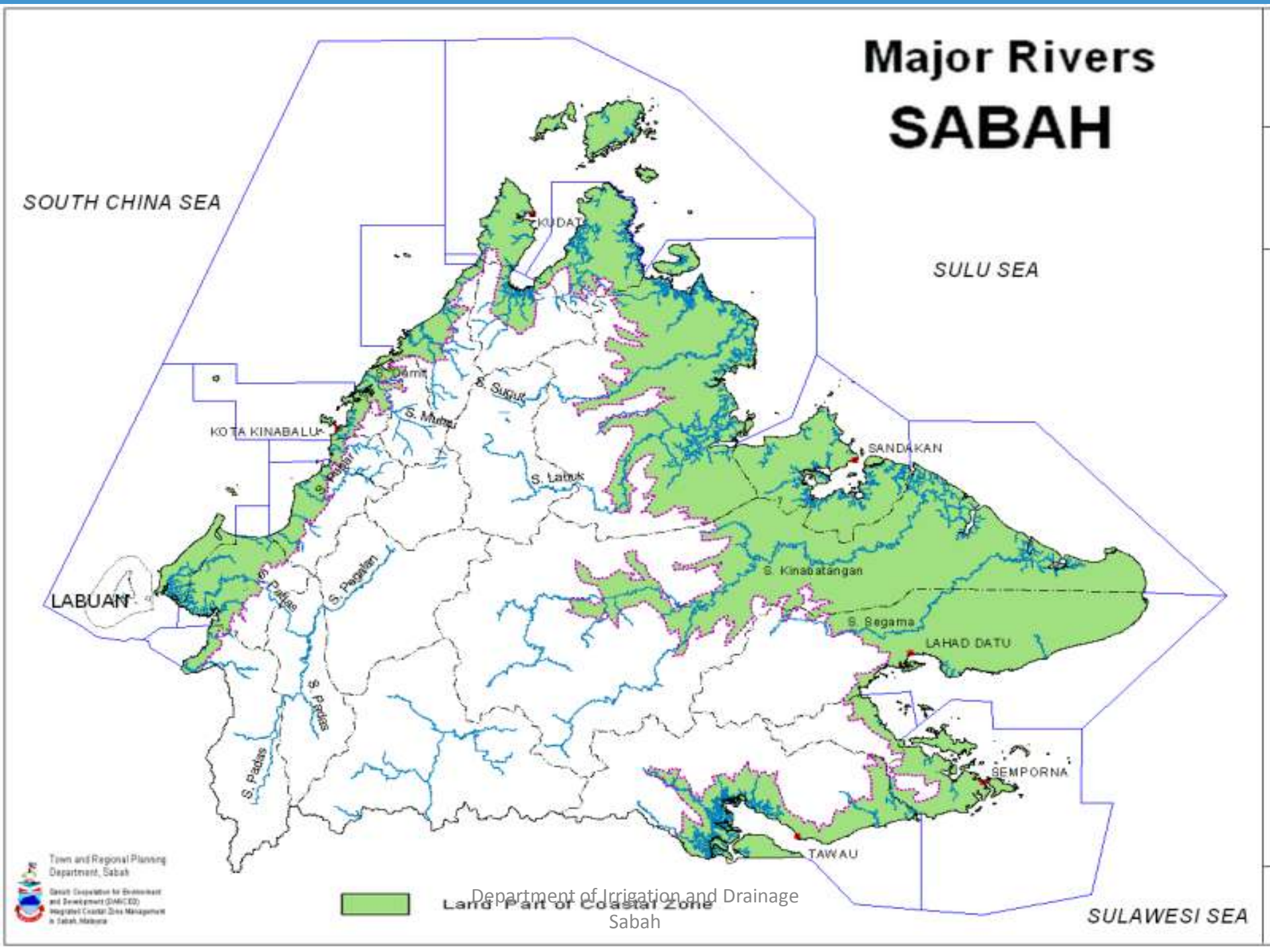
Tambunan @ Switzerland of The East

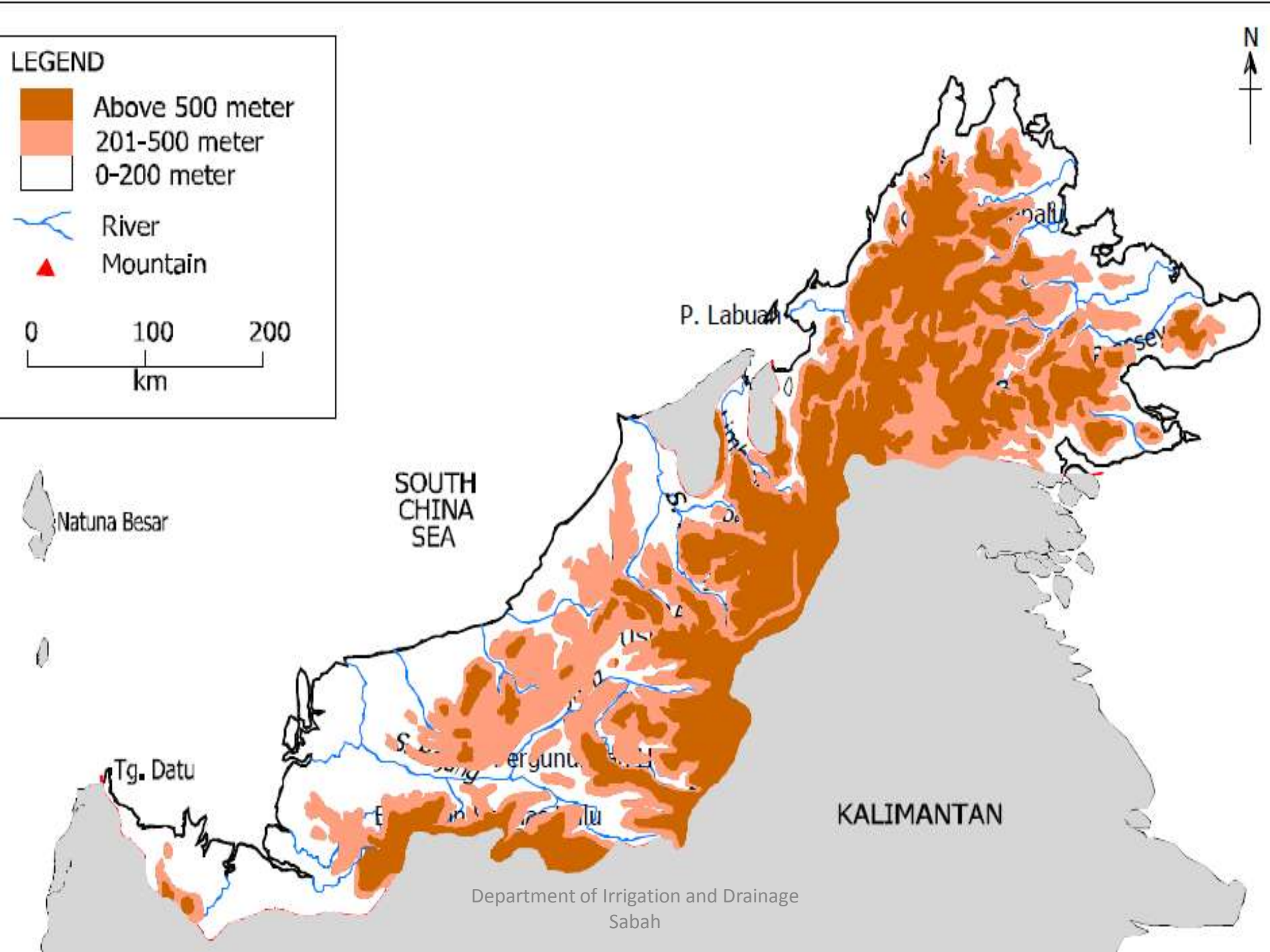
Island - Semporna

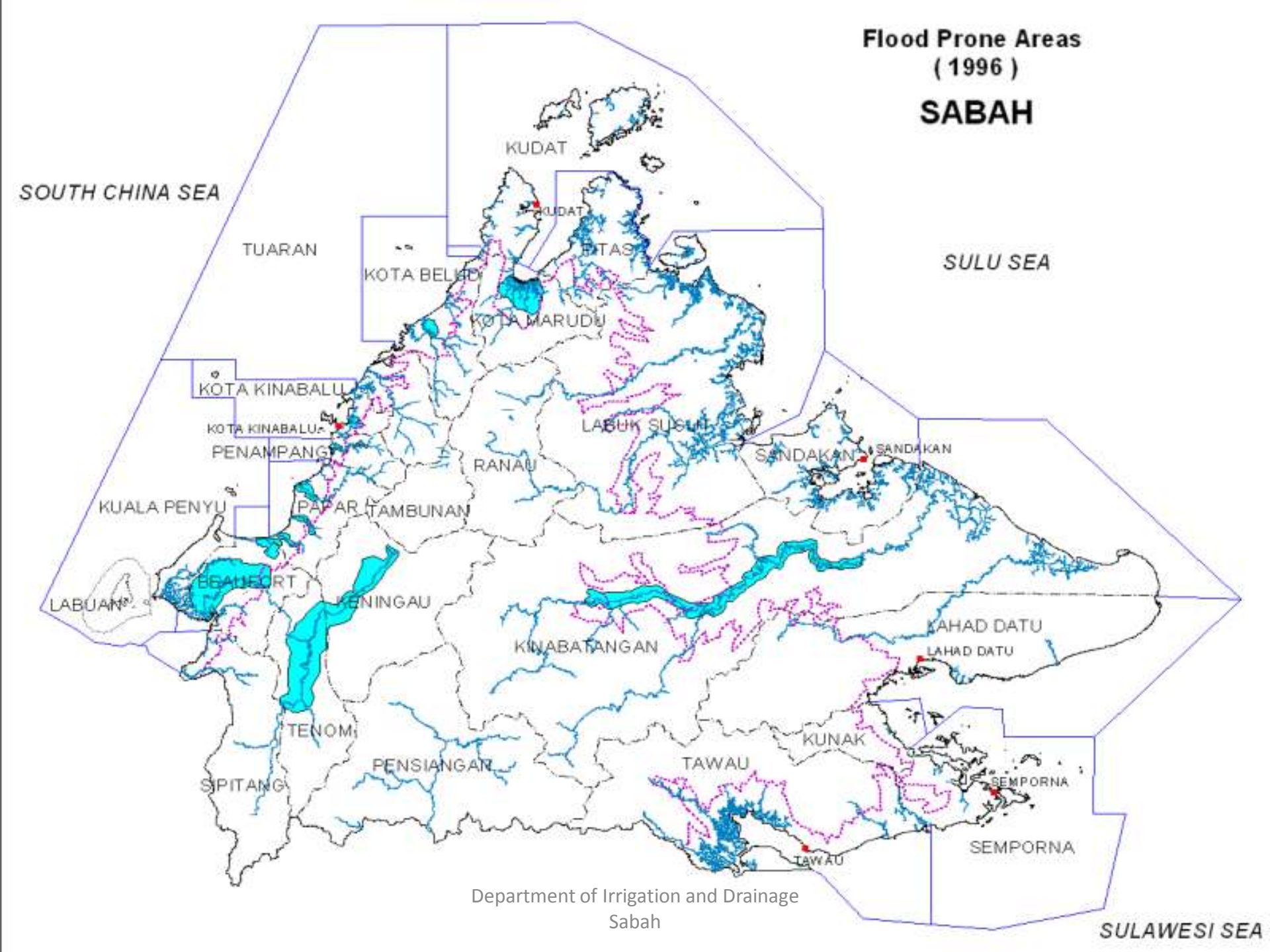
Bohey Dulang

BACKGROUND
TOPOGRAPHY & CLIMATE


River Basins
SABAH
SOUTH CHINA SEA
SULU SEA
SULAWESI SEA
P.BANGGI
KUDAT
TERUSAN
SUGUT
LANGKON
KOTA MARUDU
KOTA BELUD
TUARAN
TAMPARULI
TELIPOK
MENGGATAL
KOTA KINABALU
INANAM
PENAMPANG
PAPAR
KIMANIS
KUALA PENYU
MEMBAKUT
P. LABUAN
BEAUFORT
KENINGAU
WESTON
SIPITANG
TENOM
SOOK
NABAWAN
KUALA TOMANI
MALIGAN
SAPULUT
PENSIANGAN
LONG PASIA
RANAU
TAMPIAS
TAMBUNAN
TELUPID
BELURAN
SANDAKAN
BUKIT GARAM
LAMAG
LAHAD DATU
SAHABAT
TUNGKU
SILAM
KUNAK
SEMPORNA
BRANTIAN
KALABAKAN
TAWAU

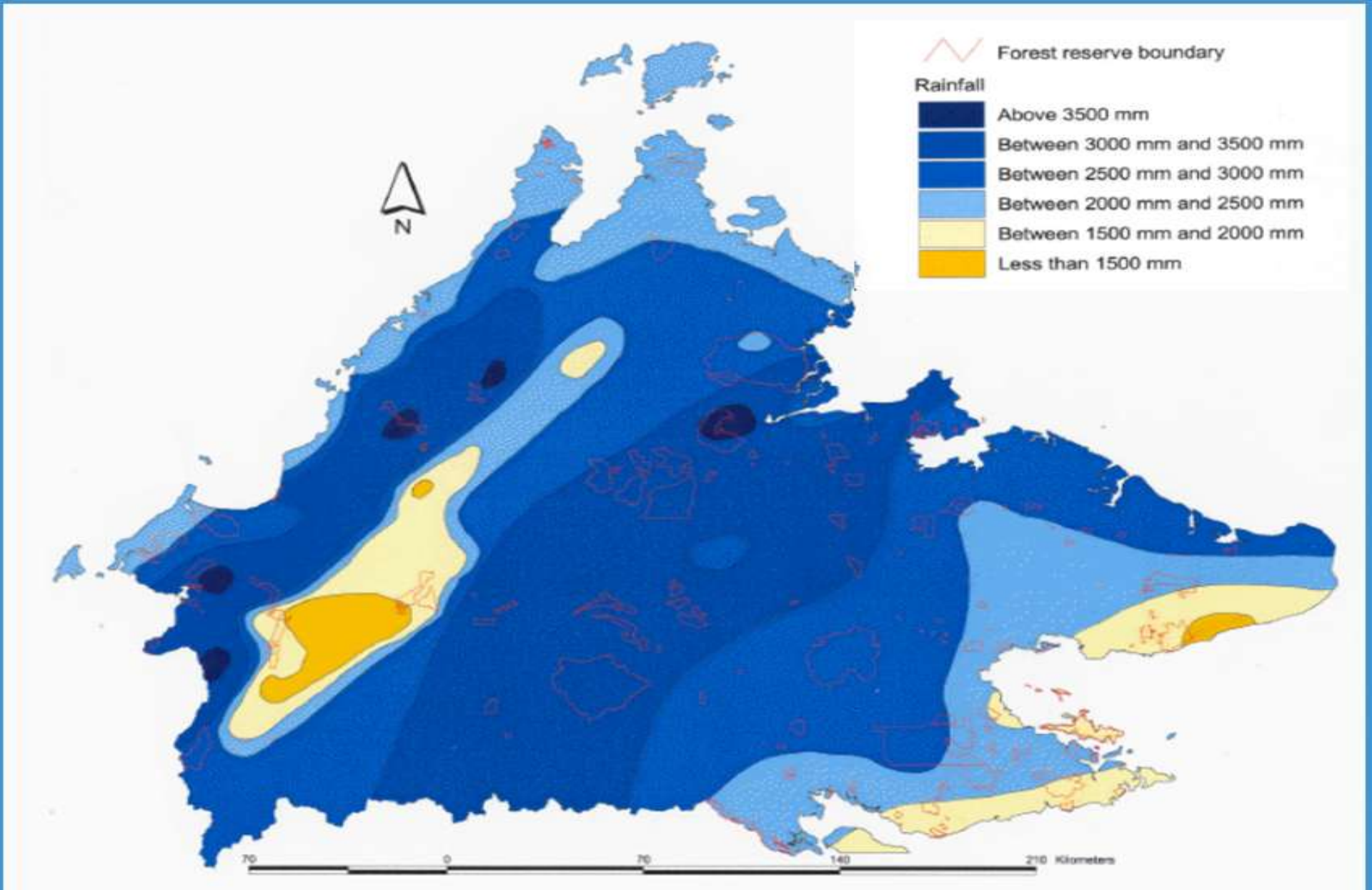

Major Rivers
SABAH
SOUTH CHINA SEA
SULU SEA
SULAWESI SEA
KUDAT
KOTA KINABALU
SANDAKAN
LABUAN
LAHAD DATU
SEMPORNA
TAWAU
S. Sugut
S. Labuk
S. Kinabatangan
S. Segama
S. Padas
S. Pegalan
Land Part of Coastal Zone
Town and Regional Planning Department, Sabah


LEGEND
Above 500 meter
201-500 meter
0-200 meter
River
Mountain
0
100
200
km
N
P. Labuan
SOUTH
CHINA
SEA
Natuna Besar
Tg. Datu
KALIMANTAN



Department of Irrigation and Drainage
Sabah

RAINFALL DISTRIBUTION



Annual Average Rainfall

Peninsular Malaysia	2,500 mm
Sabah	3,000 mm
Sarawak	3,500 mm

MAJOR FLOOD EVENTS SABAH

- Flooding is a regular occurrence in Sabah and affects virtually every district .
- The severity of flooding varies from year to year, and also from river basin to river basin.
- Several major floods have been experienced in the last few decades & the most recent major floods are:-

  15 Jan 2014 - Padas Catchment i.e. Tambunan-Keningau-Tenom, Beaufort.

  26 Dis 2006 - Sabah was hit by one of the worst tropical storm known as Tropical Storm Greg

Published: Wednesday January 15, 2014 MYT 4:35:00 PM
Updated: Wednesday January 15, 2014 MYT 5:47:09 PM

Flash floods hit five districts in Sabah

BY RUBEN SARIO

Beaufort hit by worst floods in three decades – MP Azizah

16 FEB 2014 12:21AM

FILE Floods hit Beaufort on Thursday Feb 13.

BEAUFORT, Feb 14–Beaufort has been hit by the worst case of flooding since 1981, according to Beaufort Member of Parliament Datuk Azizah Mohd Dun.

BEAUFORT TOWN

Sabah floods: More than 4,000 victims in relief centres

15 FEB 2014 07:35PM

Floods in Beaufort

KOTA KINABALU, Feb 15 — A total of 4,512 flood victims have been evacuated to 22 relief centres in Beaufort and Tenom.

There are 2,549 victims from 500 families housed at 17 centres in Tenom while Beaufort's five centres are sheltering 1,963 victims comprised of 613 families.

Published: Friday February 14, 2014 MYT 1:28:00 PM
Updated: Friday February 14, 2014 MYT 8:41:14 PM

Sabah flood situation worsens after persistent rain

BY RUBEN SARIO

Beaufort flooded.

TENOM TOWN

Daily Express
INDEPENDENT NATIONAL NEWSPAPER OF EAST MALAYSIA
SUNDAY

PPH 8/12/2012 (031085) Vol. 44 Kota Kinabalu, Sunday, February 16, 2014 RM1.20 Established 1963

The school that is almost totally submerged in Beaufort.

Top: How the water gushes out when the gate is opened.

Right: Logging debris at the intake point.

Over 4,500 moved to 22 relief centres

KOTA KINABALU: A total of 4,512 flood victims have been evacuated to 22 relief centres in Beaufort and Tenom. There are 2,549 victims [illegible] families housed at 17

It was learnt that his friends including his 70-year-old grandmother who saw the incident tried to rescue the boy but failed.

State Education Director Datuk Jame Alip who extended condolences to the [illegible]

Some 4,000 students unable to continue classes in 3 districts

Jason Santos and Larrisa Lumandan

KOTA KINABALU: A pre-school in Beaufort is on the verge of being totally submerged while some 4,000 students in three districts – Beaufort, Tenom and Keningau – are affected as 36 schools remain closed indefinitely in the third flood crisis to hit Sabah in two months.

Education Department Director Datuk Jame Alip said Beaufort was the worst hit with 19 schools affected, while Tenom 15 schools.

"Beaufort remains flooded and roads have become inaccessible. Our Education Officers from Kuala Penyu and Tenom are now blocked from coming to the city due to the situation," he said.

Flooding partly due to opening diversion gate?

Mail Matthew and Uhim Wong

TENOM: The current worst flooding in the district and Beaufort since 1981 and Storm Greg in 1996 is forcing personnel at the Pangi Hydroelectric Power Station to work doubly hard.

They not only have to monitor the water level all the time but also prevent debris from logging operations upstream entering the turbine tunnel and affecting power supply.

Some callers told Daily Express they suspected the severity of the flooding in Beaufort was due to the opening of the diversion gate.

According to sources, power supply was unstable due to the unusual water flow, as the dam had to relieve the water.

Last year, the Sabah Electricity Sdn Bhd (SESB) Senior General Manager (Asset Management) Ahmad Fuad Md Kasim said that erratic weather at that time had resulted in the Pangi Hydro power station unable to generate in full or the capacity

is also the district's Disaster Committee Chairman, said rescue operations and food distribution has gone as planned.

The rescue operation was jointly conducted with the Police Air Unit which gave early assistance by distributing food to seven evacuation centres, he said, when met at one of the centres at Dewan Datuk Seri Panglima Anstrom. Also present was Melalap Assemblyman Datuk Radin Malleh.

Madiem said Tenom MP Datuk Raime Unggi donated fire boats and engines to the district's Fire and Rescue Department to assist in the operations. The Sabah Red Crescent Association donated mattresses while the Police Family Association assisted in providing food for the victims at the

Tambunan

Five schools in Sabah still closed

BY MUGUNTAN VANAR

Waist deep: SK St Catherine in Inanam at the outskirts of Kota Kinabalu was under about a metre of water at the height of the flooding.

KOTA KINABALU: Five out of 12 primary schools hit by flash floods have remained closed as state Education Department officials assess the damage.


Flooding caused by tropical storm
Greg Penampang, Sabah 26 Dec. 1996

Tropical Storm Greg.

SG PAMPANG, KENINGAU

SG PAMPANG, KENINGAU

KENINGAU, 29 DIS 1996 – Jumlah mayat yang terkorban dalam Tragedi Ribut di Sabah meningkat apabila pihak tentera dan orang awam menemui beberapa lagi mayat. Seorang pemuda yang kehilangan ahli keluarga cuba mengenal pasti salah satu mayat yang dikeluarkan di kampung Limbawan, Sabah.

- The big flood that hit majority of district in Sabah was basically a natural event where the river burst its banks and the floodplain was inundated as a result of exceptionally high and long periods of rainfall. While nature like storm and flood must take its course, men are in full control of their own actions.
- In this regard, cognisance of impacts of developments and activities on drainage and flood behaviour must be taken whereas those are now inhibating in the floodplains must understand the risks that they are constantly subject to and learn how to live with them.

The main causes of flooding

- increased runoff rates due to the urbanisation;
- loss of flood storage – development in flood plains and drainage corridors
- inadequate drainage systems
- constriction at bridges
- undersized culverts
- siltation in waterway channels from indiscriminate land clearing operations
- localised continuous heavy rainfall
- tidal backwater effect
- inadequate river capacity

Flood Protection Works

- Some of the flood protection works that have been carried out in Sabah include structural and non-structural measures.
- Structural measures include re-aligning or diversion of channels, and concretisation of channels. The non-structural flood protection measures involve installation of flood forecasting and warning systems and development control measures.
- Flood protection work are carried mainly to alleviate or mitigate flooding by means of improvement of drainage in flood prone areas.

FLOOD MITIGATION STUDIES

- Since 2006, a number of river basin studies/drainage master plan have been carried out for rivers where major flood problems exist.
- To date, at least 9 studies have been completed

	SENARAI KAJIAN PELAN INDUK TEBATAN BANJIR / SALIRAN	
Bil	**Nama Kajian/Pelan Induk**	**Kos Kajian/Penyediaan Pelan**
1	Tebatan Banjir Lembangan Sg Padas	1,500,000.00
2	Preparation of stormwater management - drainage master plan study & detailed design of drainage improvement works for the district of Sandakan	1,454,132.00
3	Preparation of stormwater management, drainage master plan study & detailed design of drainage improvement works for the district of Tenom	1,649,013.00
4	Tebatan Banjir Lembangan Sg Moyog	2,500,000.00
5	Preparation of stormwater management, drainage master plan & drainage improvement works for Papar	1,641,481.00
6	Preparation of stormwater management, drainage master plan study & detailed design of drainage improvement works for the district of Kota Marudu	2,645,872.00
7	Saliran Bandar Putatan	1,239,999.50
8	Tebatan Banjir Lembangan Sg. Pancuran	1,500,000.00
9	Kajian Pelan Induk Tebatan Banjir Daerah Pitas	1,829,888.00
10	Rekabentuk Terperinci RTB Lembangan Sg. Moyog (Fasa 1)	4,108,290.00
Jumlah Keseluruhan		15,960,385.50

FLOOD MITIGATION STUDIES

- 9 nine plans were completed, one of which already have detailed design, which also means that there are physical projects recommended by the study are available for implementation.
- The State faced tough challenges to fund all projects that have been planned. The estimated total cost is RM1.765 billion.
- This amount reflects the tremendous financial needs and far beyond the financial capacity of the Government .

KERAJAAN MALAYSIA

LAPORAN AKHIR

KPI YB Menteri Sumber Asli dan Alam Sekitar, Tahun 2013

Melaksana Kajian Komprehensif Penyelesaian Jangka Panjang Dalam Memerangi Banjir Kilat

"Conduct a Comprehensive Study on Long Term Solution in Combating Flash Floods"

KEMENTERIAN SUMBER ASLI DAN ALAM SEKITAR

JABATAN PENGAIRAN DAN SALIRAN, MALAYSIA

DID needs RM1959 million to reduce flooding

- This study involve 3 major Town – Kota Kinabalu, Tawau & Sandakan

Total cost

- Kota Kinabalu - RM1,280 million
- Sandakan – RM 64 Million
- Tawau – RM580 million

FLOOD MITIGATION CASE STUDY – MOYOG

Case Study

JABATAN PENGAIRAN DAN SALIRAN
MALAYSIA

MASTER PLAN STUDY FOR MOYOG RIVER BASIN FLOOD MITIGATION PROJECT, SABAH

Executive Summary

August 2011

Master Plan Study for Moyog River Basin Flood Mitigation Project, Sabah

09 Jun 2014

Wedge Hong – Jurutera Saba Perunding

Case Study
Overview of the Presentation

1. Description of the Moyog Floodplain
2. Flooding in Moyog Floodplain
3. Challenges of Flood Management
4. Past and current practices of managing floods
5. Moyog Master Plan
6. Structural measures
7. Flood hazard mapping
8. Land Use control
9. Development control
10. Action Plan

Two Common Types of Urban Flooding in Sabah

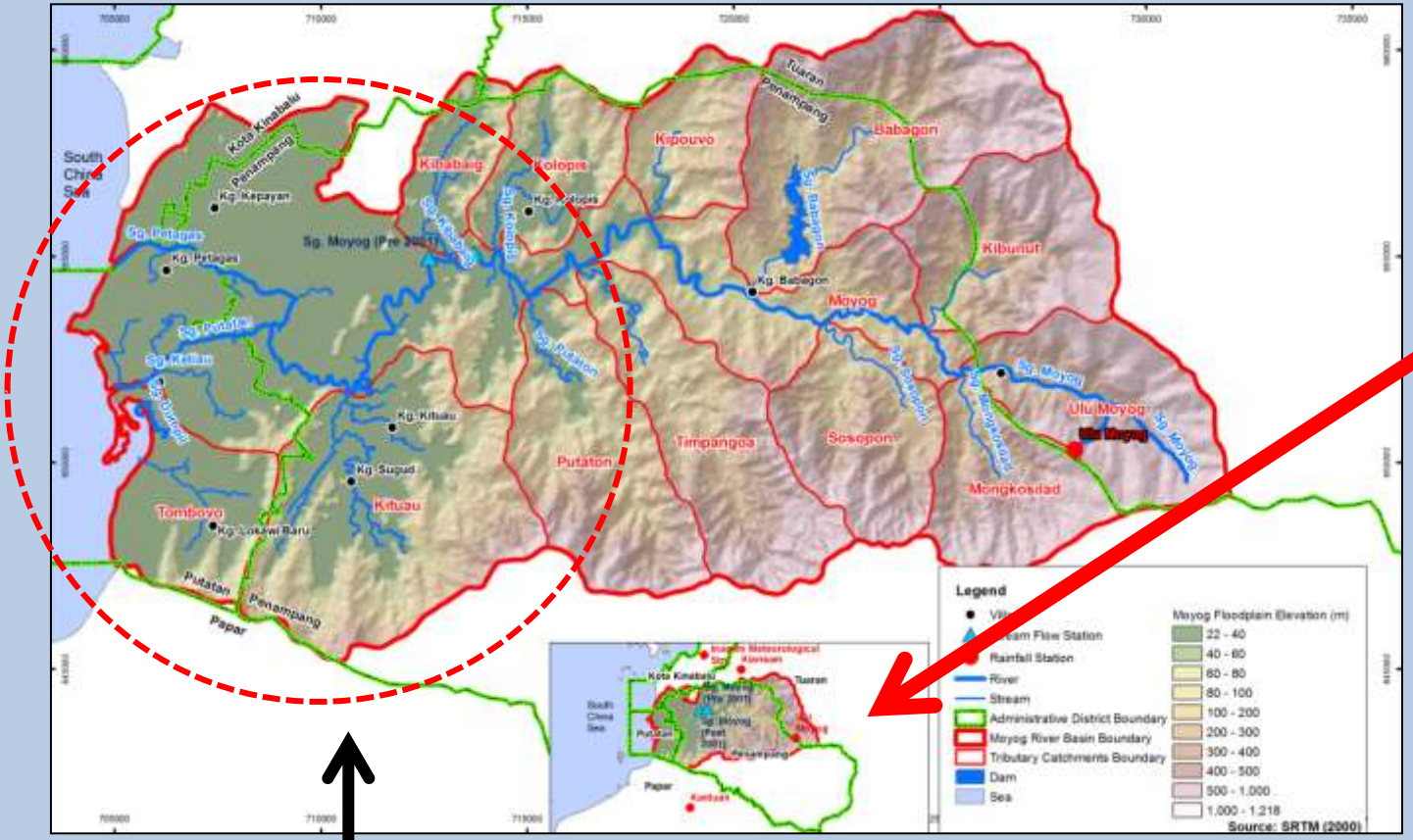
Local Drainage Flooding

- improve drainage
- provide culverts
- provide detention ponds
- maintenance

River Flooding

- river enlargement or re-alignment
- levee
- flood dam
- floodplain land use and development control
- flood warning and evacuation

Study Area: Moyog Catchment and Floodplain

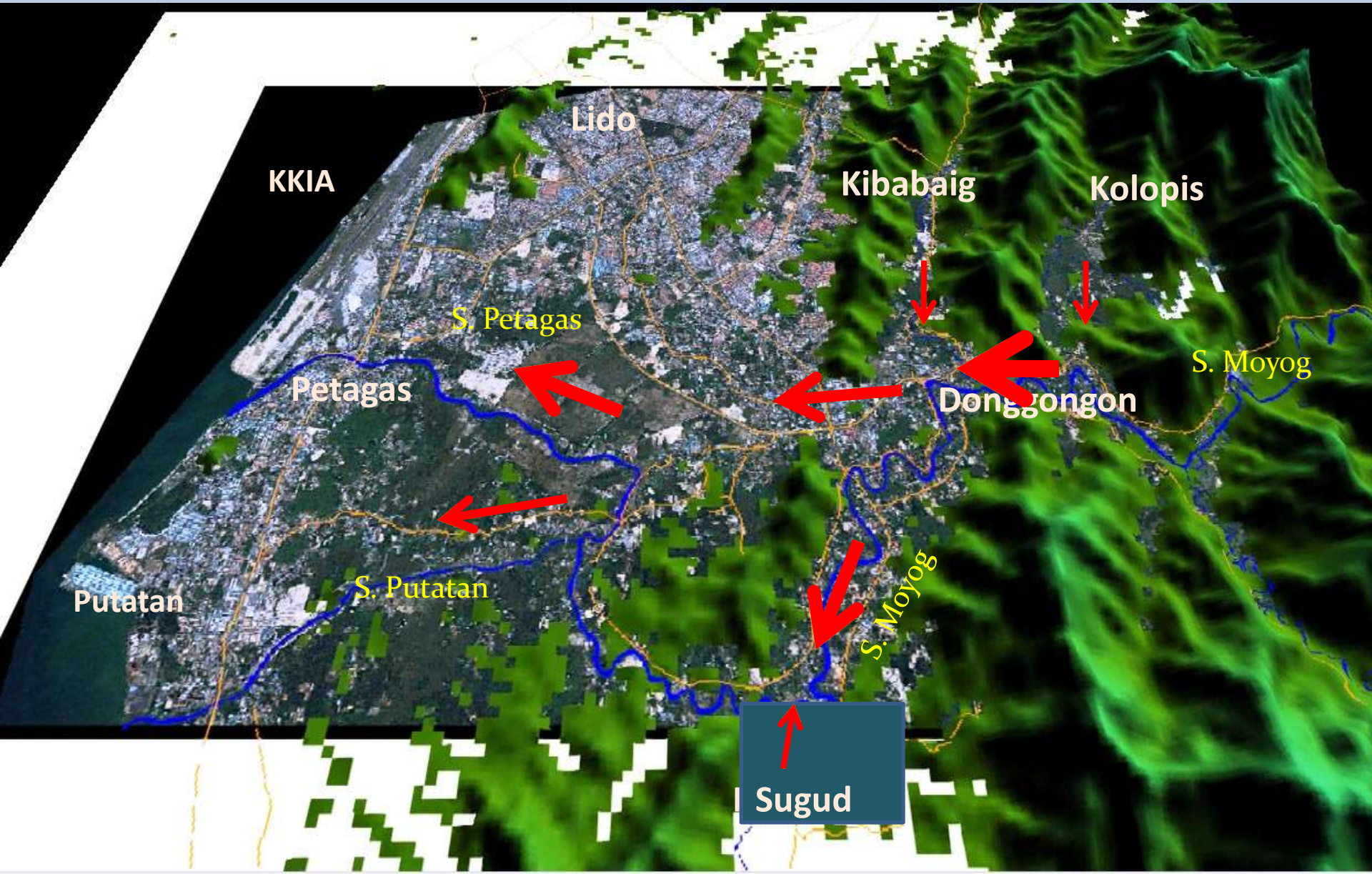


Sabah

- Catchment: 295 km2

Moyog floodplain

Settling on floodplain has enormous advantages… at the same times poses a lot of risk

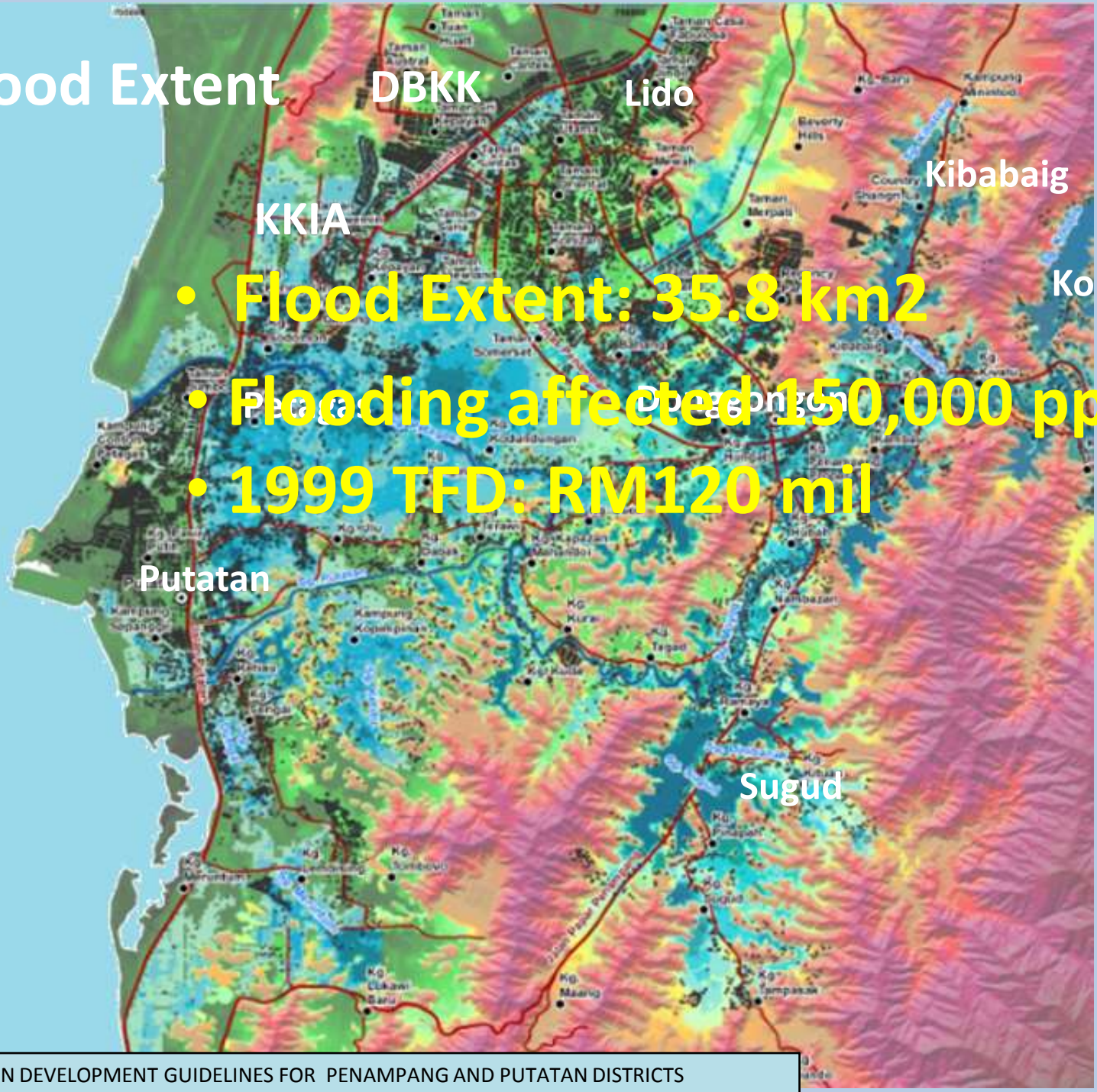


Major Flood on 6 January 1999

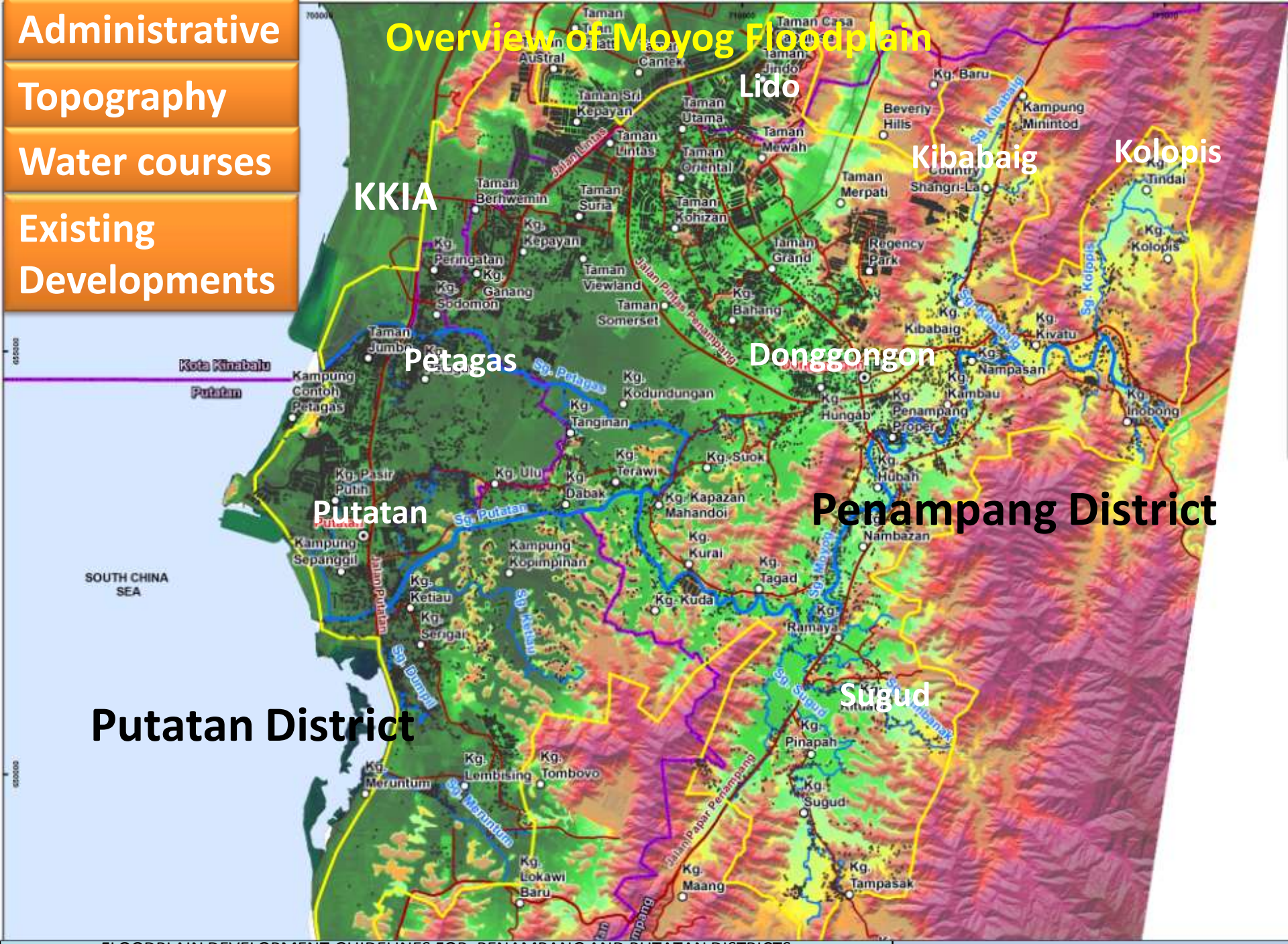
Donggongon today

Donggongon on 6 January 1999

1999 Flood Extent

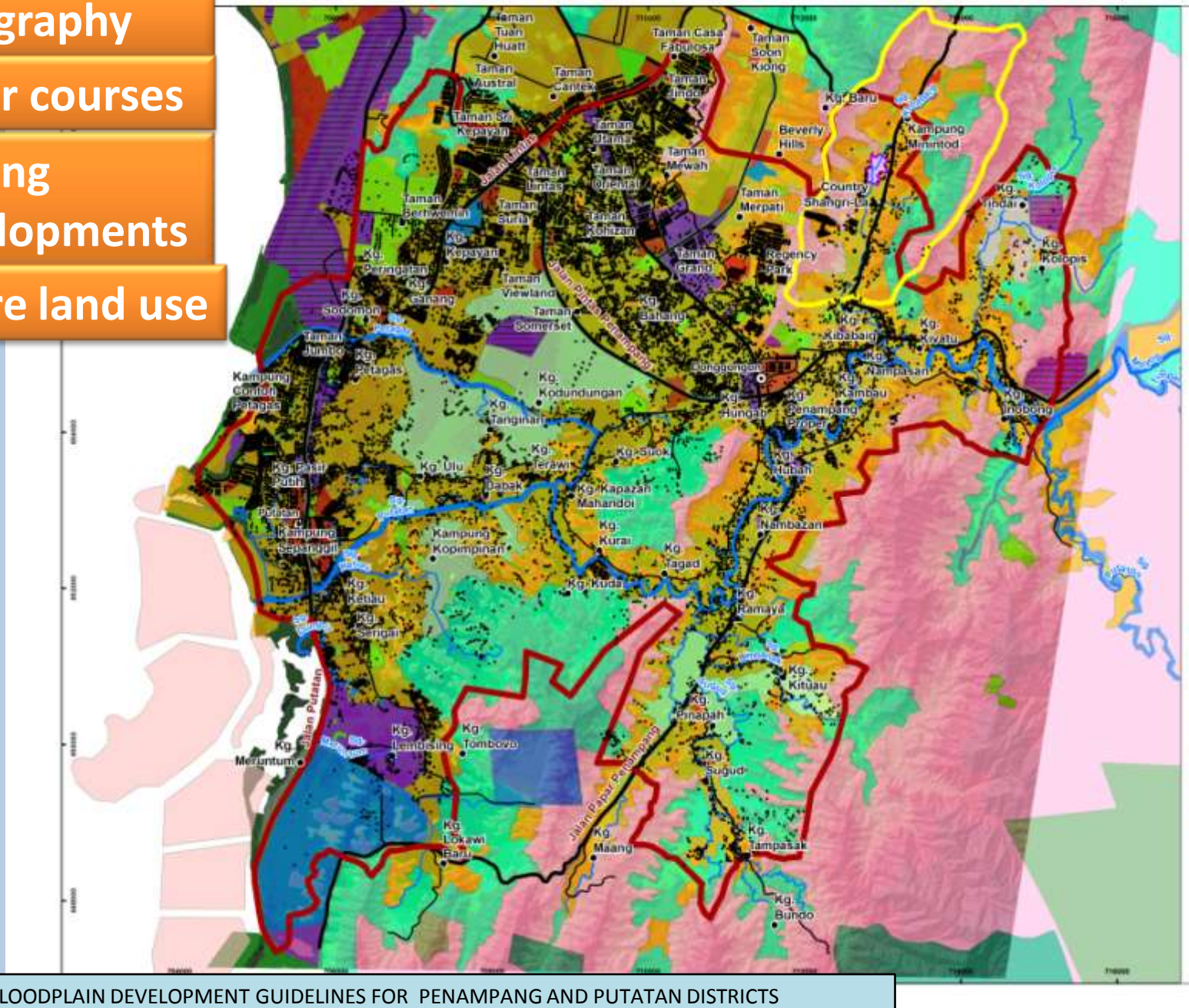


- Flood Extent: 35.8 km2
- Flooding affected 150,000 pp
- 1999 TFD: RM120 mil


Administrative
Topography
Water courses
Existing Developments
Overview of Moyog Floodplain
KKIA
Lido
Kibabaig
Kolopis
Petagas
Donggongon
Penampang District
Putatan
Putatan District
Sugud
Kota Kinabalu
Putatan
SOUTH CHINA SEA
Taman Austral
Taman Cantek
Taman Jindo
Taman Sri Kepayan
Taman Utama
Taman Mewah
Taman Lintas
Taman Oriental
Taman Berhwemin
Taman Suria
Taman Kohizan
Taman Merpati
Taman Grand
Taman Viewland
Taman Somerset
Regency Park
Beverly Hills
Country Shangri-La
Kg. Baru
Kampung Minintod
Kg. Tindai
Kg. Kolopis
Kg. Kepayan
Kg. Peringatan
Kg. Ganang
Kg. Sodomon
Kg. Bahang
Kg. Kivatu
Kg. Nampasan
Kg. Kambau
Kg. Hungab
Kg. Penampang Proper
Kg. Inobong
Kg. Kodundungan
Kg. Tanginan
Kg. Terawi
Kg. Suok
Kg. Hubah
Kg. Kapazan Mahandoi
Kg. Nambazan
Kg. Kurai
Kg. Tagad
Kg. Kuda
Kg. Ramaya
Kg. Pinapah
Kg. Sugud
Kg. Maang
Kg. Tampasak
Kg. Pasir Putih
Kg. Ulu
Kg. Dabak
Kampung Sepanggil
Kampung Kopimpinan
Kg. Ketiau
Kg. Sengai
Kg. Meruntum
Kg. Lembising
Kg. Tombovo
Kg. Lokawi Baru
Kampung Contoh Petagas
Sg. Petagas
Sg. Putatan
Sg. Moyog
Sg. Ketiau
Sg. Bumpul
Sg. Meruntum
Sg. Sugud
Jalan Putatan
Jalan Papar Penampang
Jalan Pintas Penampang

Overview of Moyog Floodplain

- Administrative
- Topography
- Water courses
- Existing Developments
- Future land use



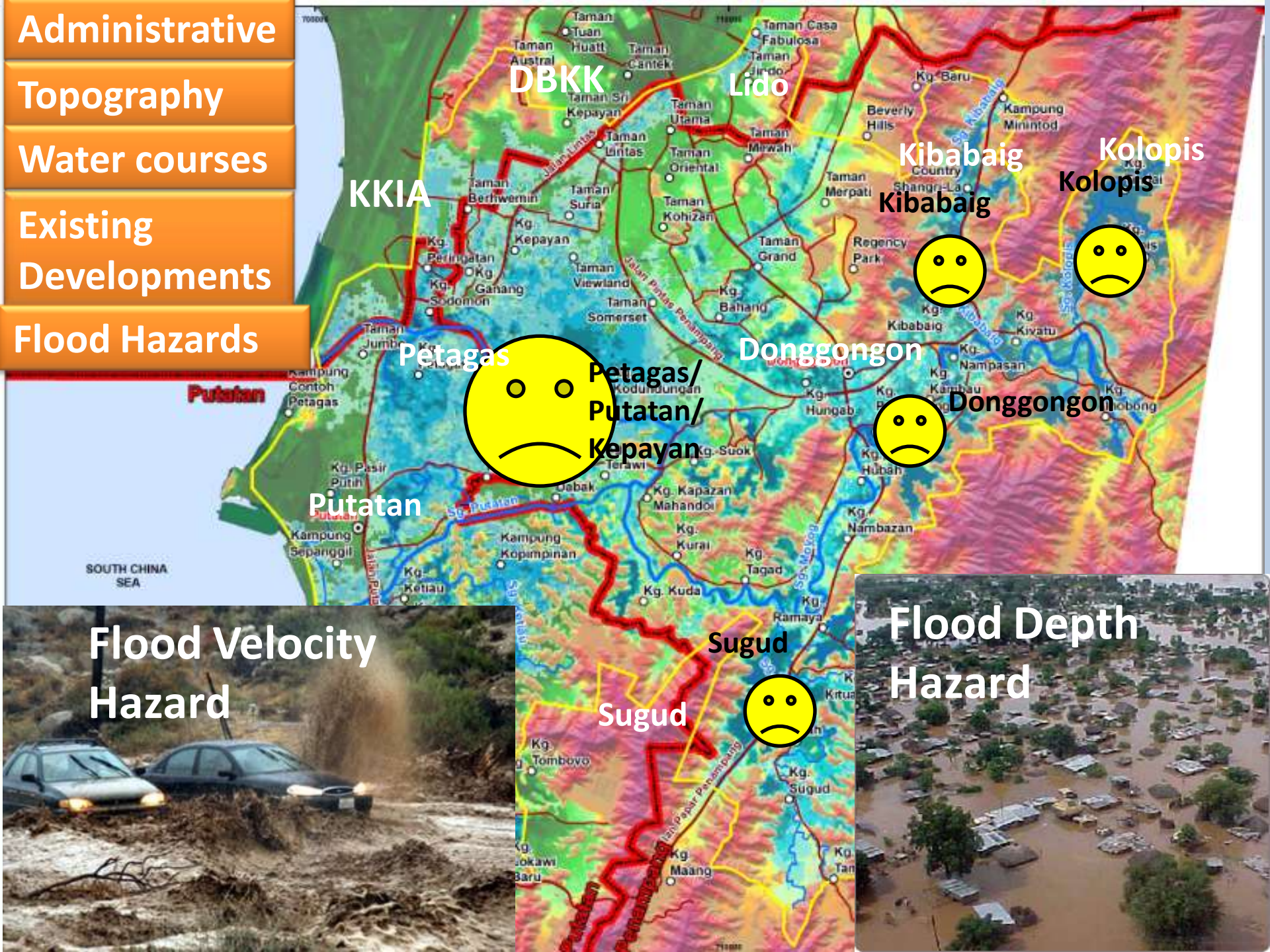
Administrative

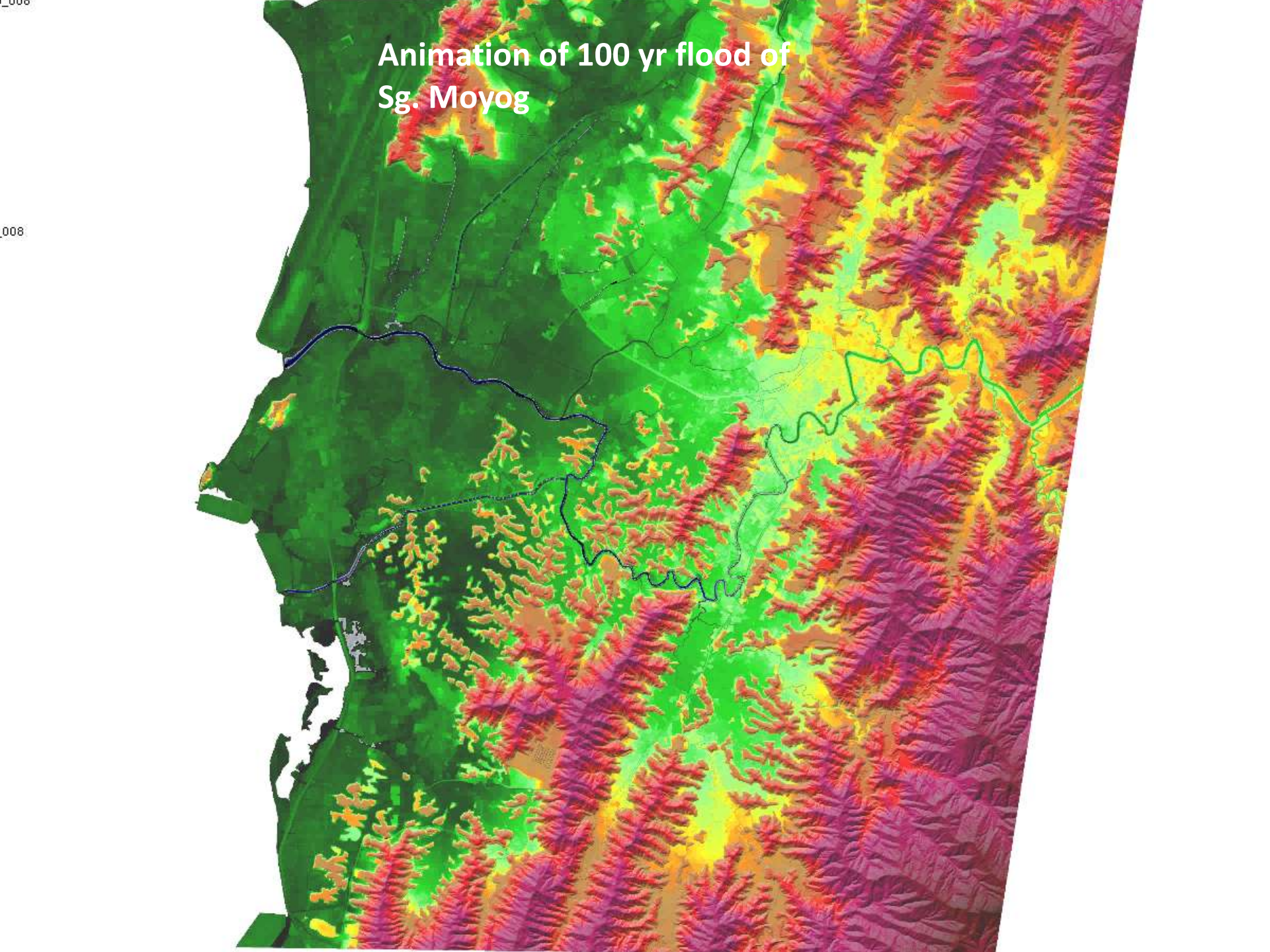
Topography

Water courses

Existing Developments

Flood Hazards




Animation of 100 yr flood of
Sg. Moyog

1999 flood level at Kg. Kibabaig


1999 flood level at Kg.Kibabaig


1999 flood level at Donggongon
Penamapang

1999 flood level at Putatan

Challenges of Flood Management

1. Rapid Urbanization: new developments and roads

2. Floodplain and catchment degradation

3. Climate change

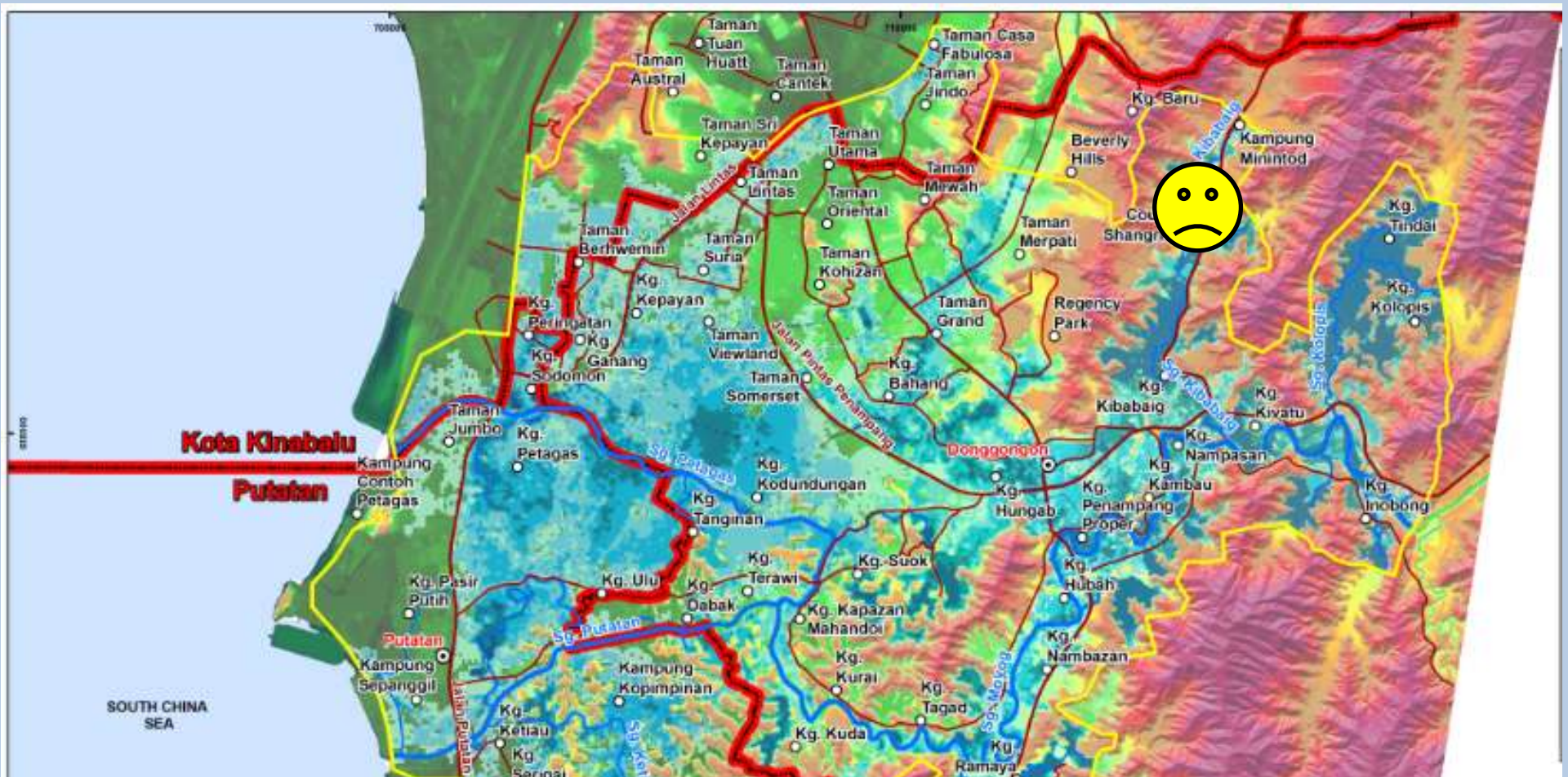
4. Balance between developments and flooding

Practices in Managing Floods in Malaysia

- **Before 2000**

  Urban Drainage Design Standards and Procedures for Peninsular Malaysia by DID in 1975.

  - Rapid discharge

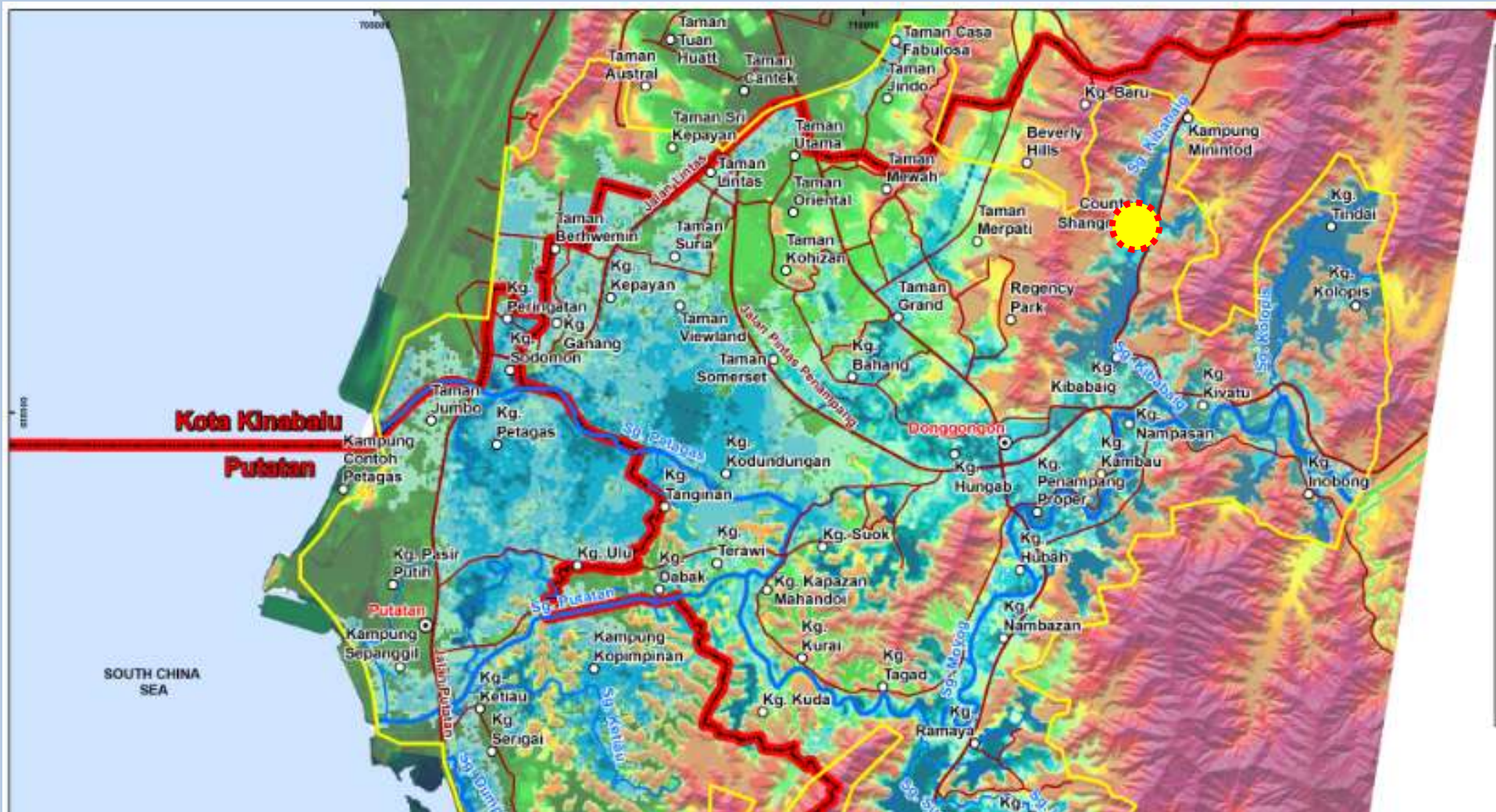


Practices in Managing Floods in Malaysia

- **After 2000**

  Urban Stormwater Management Manual for Malaysia by DID 2000

  - On-site detention

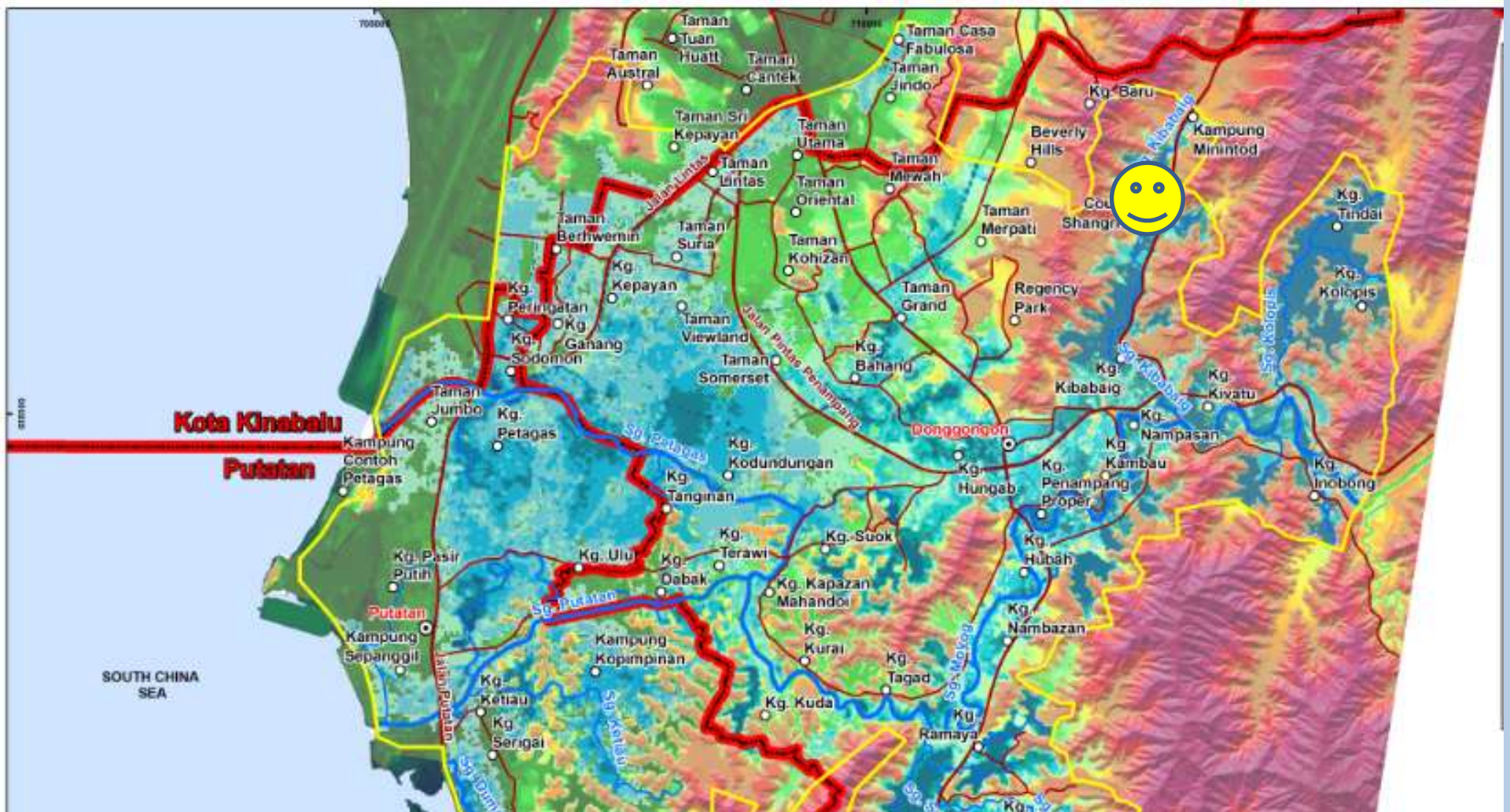


Practices in Managing Floods in Malaysia

- **Sabah 1998**

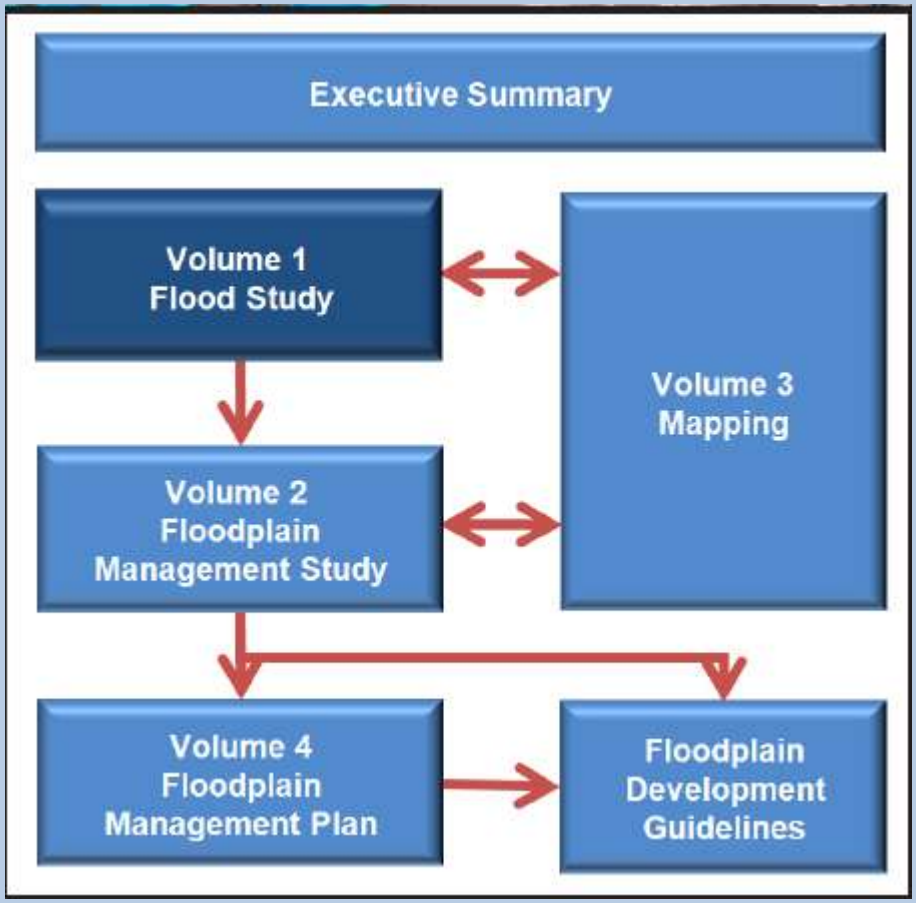
  Water Resources Enactment 1998

  - Floodplain Management (land use and development control)
  - NSW Australia Floodplain Development Manual



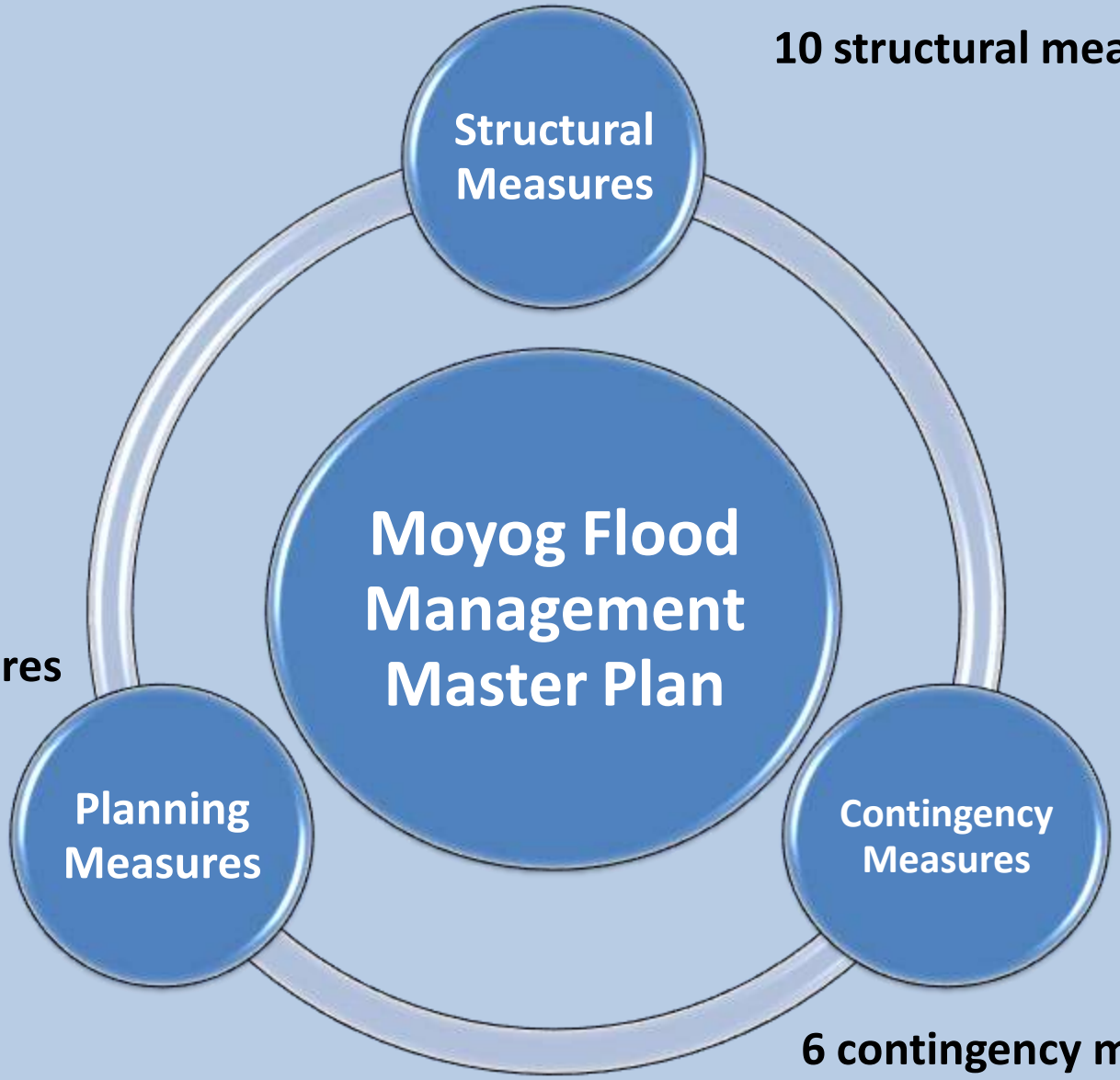
Moyog Master Plan Study

- The study was completed in August 2011
- The study includes the following reports:



Moyog Master Plan Study

10 structural measures



13 planning measures

6 contingency measures

Moyog Master Plan Study

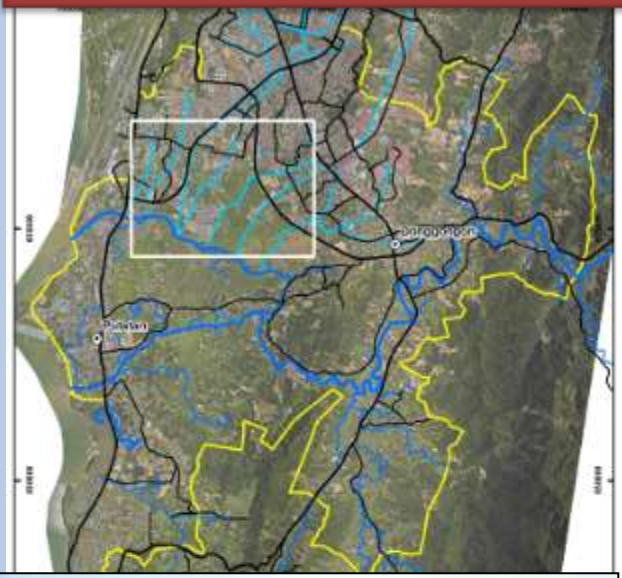
S1	Kolopis Valley Flood Storage
S2	Donggongon Levee Scheme
S3	**Monsoon Drain Floodgates and Kg. Kepayan Levee**
S4	**Moyog Diversion Channel**
S5	**Kibabaig Floodway and Floodgates**
S6	'Kurai Narrows' River Improvement
S7	**Sg. Petagas Bridge Improvement**
S8	**Sg. Petagas River Mouth Dredging**
S9	**Lower Petagas Drainage Improvement**
S10	**Sg. Putatan Bridge Improvement**
S11	**Sg. Putatan Channel Improvements**
S12	**Lower Putatan Drainage Improvement**
S13	**Lowering/Removal of Kasigui Weir**

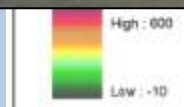
1. Structural Measures

Moyog Master Plan Study

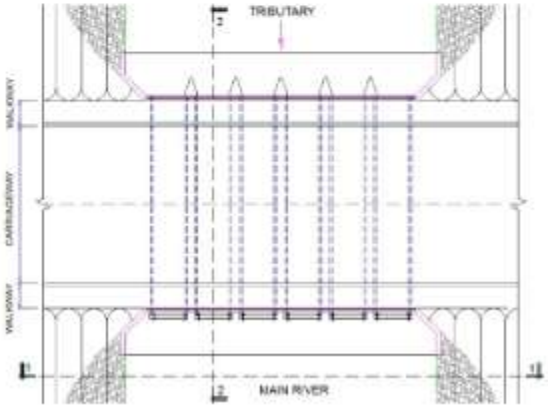
1. Structural Measures

Measure S3b – Monsoon Drain, Floodgates and Levee at Kg. Kepayan Schematic Layout

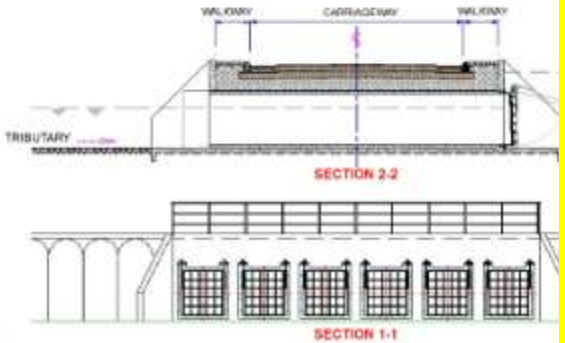




Total estimated cost RM21 million



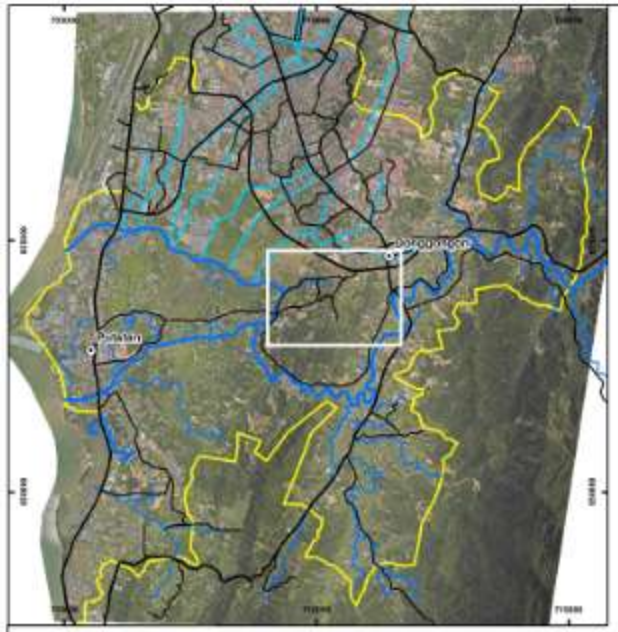
TYPICAL FLAP GATE

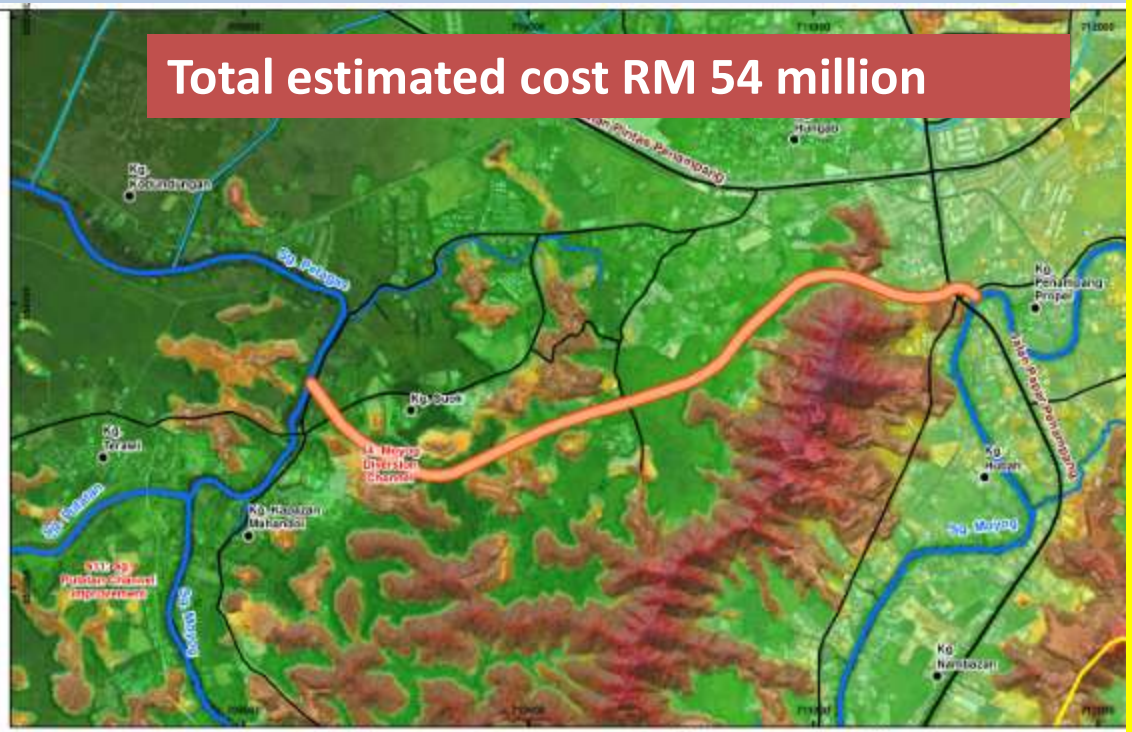


Source: ORTHO

1. Structural Measures

Measure S4 – Moyog Diversion Channel
Schematic Layout

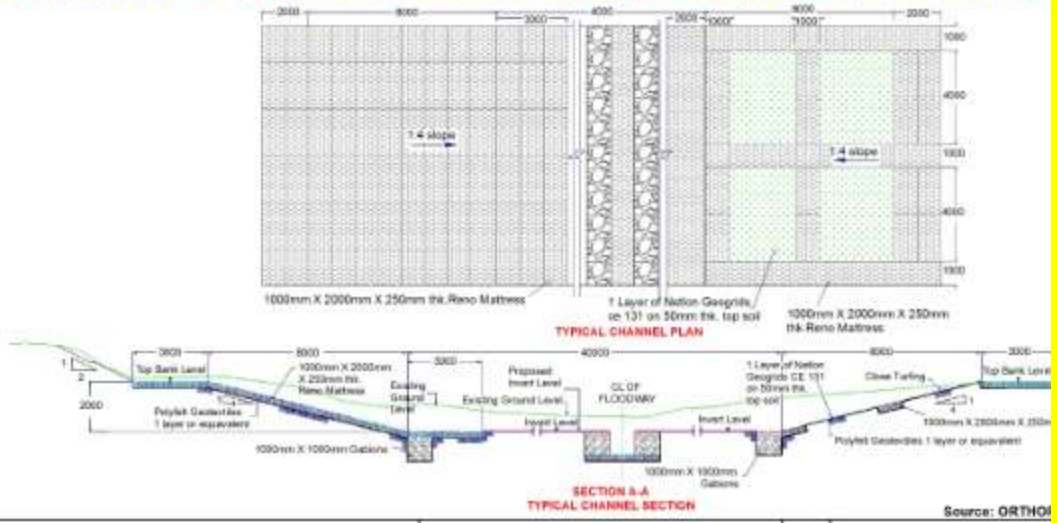




Total estimated cost RM 54 million

Legend
- Village
- Town
- S4: Moyog Diversion Channel
- Main Road
- Minor Road
- River
- Stream
- Monsoon Drain
- Study Area

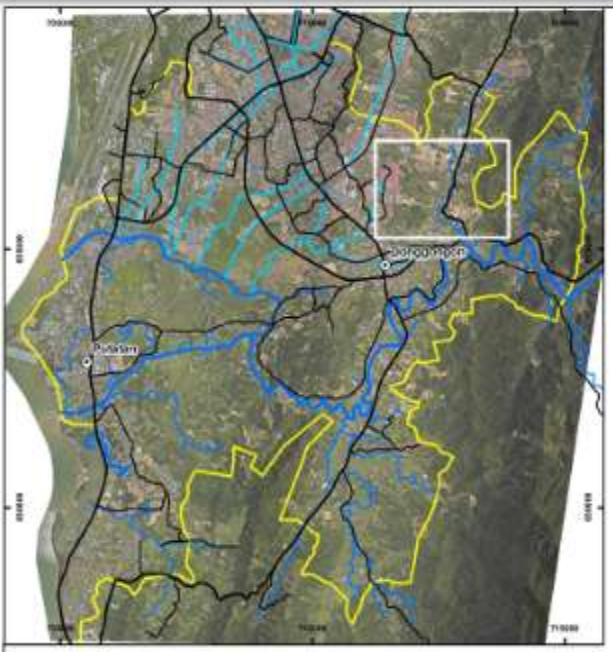
Elevation (m)
- High : 600
- Low : -10

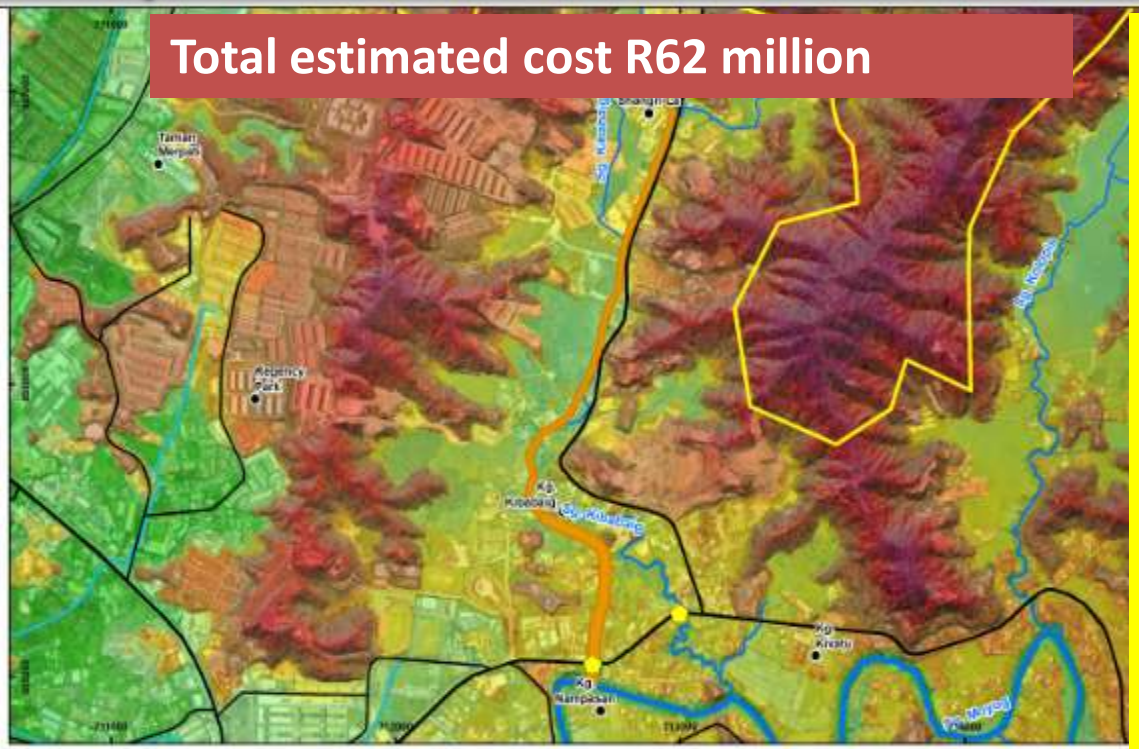


1. Structural Measures

Measure S5 – Kibabaig Floodway and Floodgates
Impact Assessment

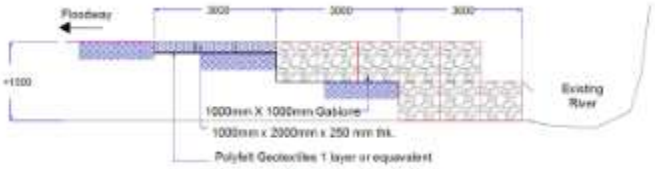
Total estimated cost R62 million



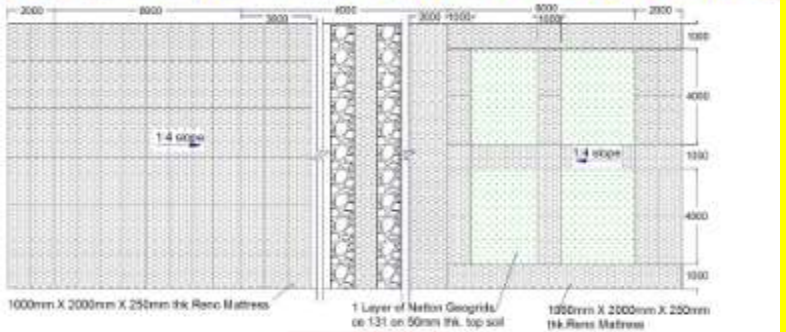


Legend
- Village
- Town
- S5: Kibabaig Floodgates
- Main Road
- Minor Road
- River
- Stream
- Monsoon Drain
- S5: Kibabaig Floodway
- Study Area

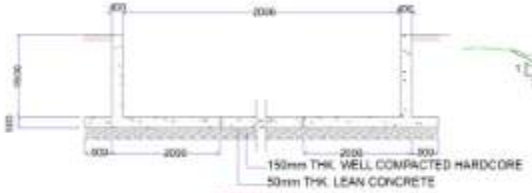
Elevation (m)
High : 600
Low : -10



DETAIL '1'
TYPICAL DETAIL OF 1.50M HEAD WALL



TYPICAL FLOODWAY PLAN



SECTION A-A
TYPICAL 20.00 M WIDE MONSOON DRAIN

SECTION B-B
TYPICAL FLOODWAY SECTION

Source: ORTHOP

1. Structural Measures

Moyog Master Plan Study

P1	Floodplain Management Area
P2	**Flood Hazard Maps**
P3	Planning For Climate Change
P4	Flood Planning Levels
P5	River Reserves
P6	**Floodplain Development Guidelines**
P7	Review of Local Planning Documents
P8	Flood Impact Assessment
P9	Reassessment of Proposed Works
P10	Property Acquisition
P11	Building Controls
P12	Flood Proofing Measures
P13	Floodplain Management Plan Review

2. Planning Measures

Moyog Master Plan Study

C1	Additional Rainfall and Streamflow Gauges
C2	Flood Warning System
C3	Evacuation Management Plan
C4	Community Awareness and Preparation
C5	Flood Monitoring Program
C6	Moyog Community Flood Watch

3. Contingency Measures

Why Development Guidelines and Land Use Control?

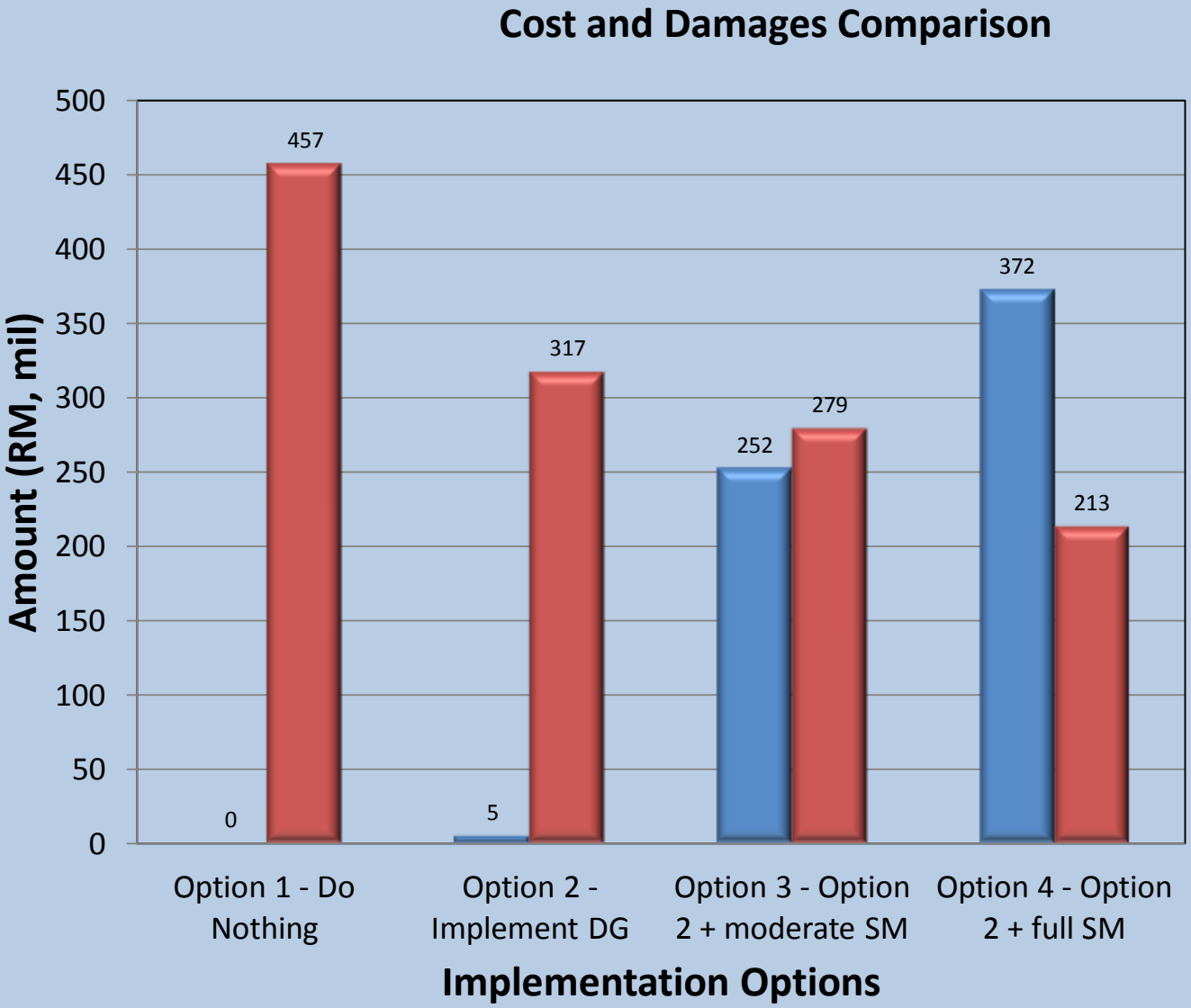
a. It is the most cost effective option

b. Least impact on water quality and quantity

c. River basin approach and sustainable

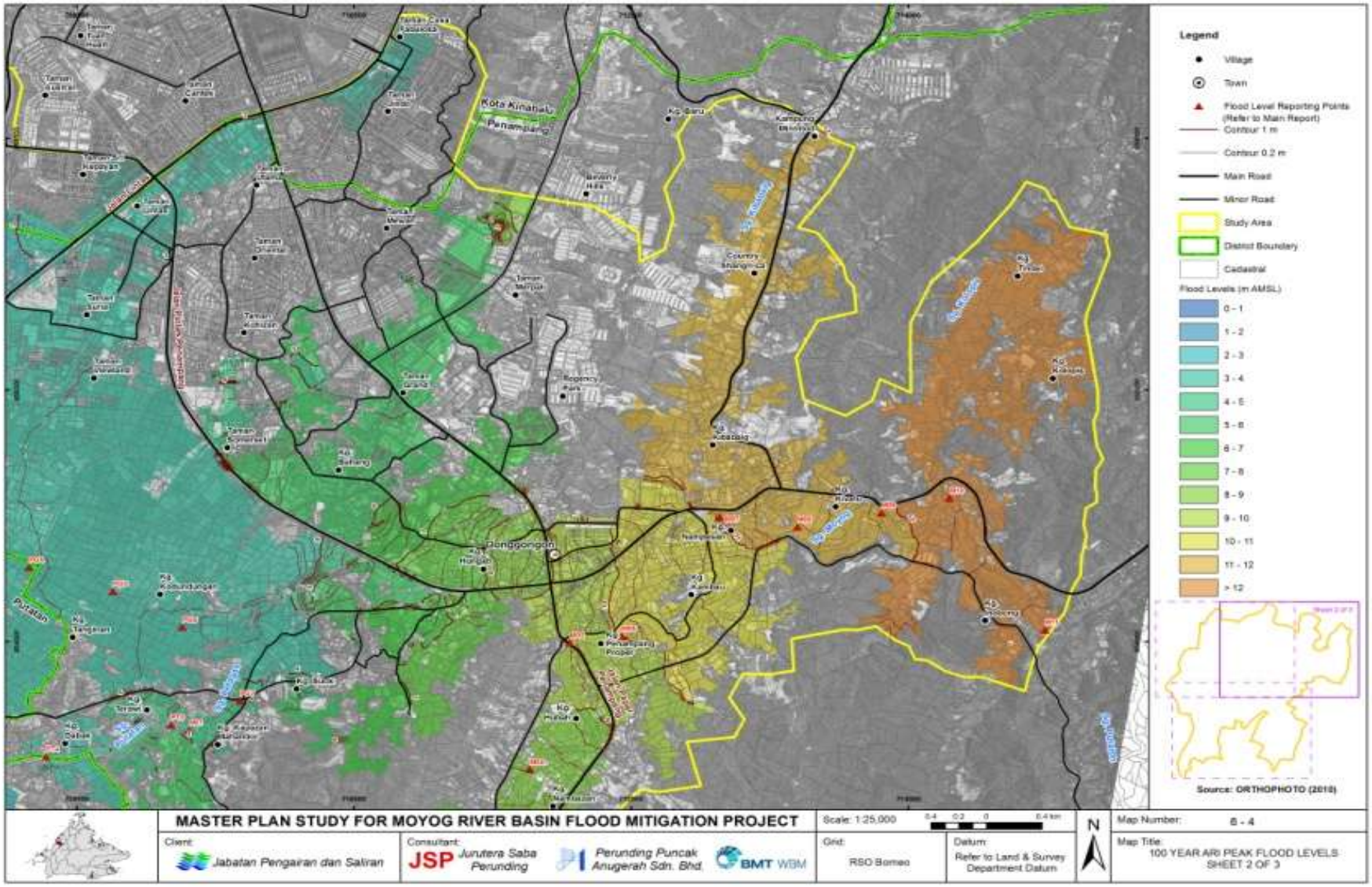
d. Simple and clear tool to plan and process development application in the floodplain

Why Development Guidelines and Land Use Control?

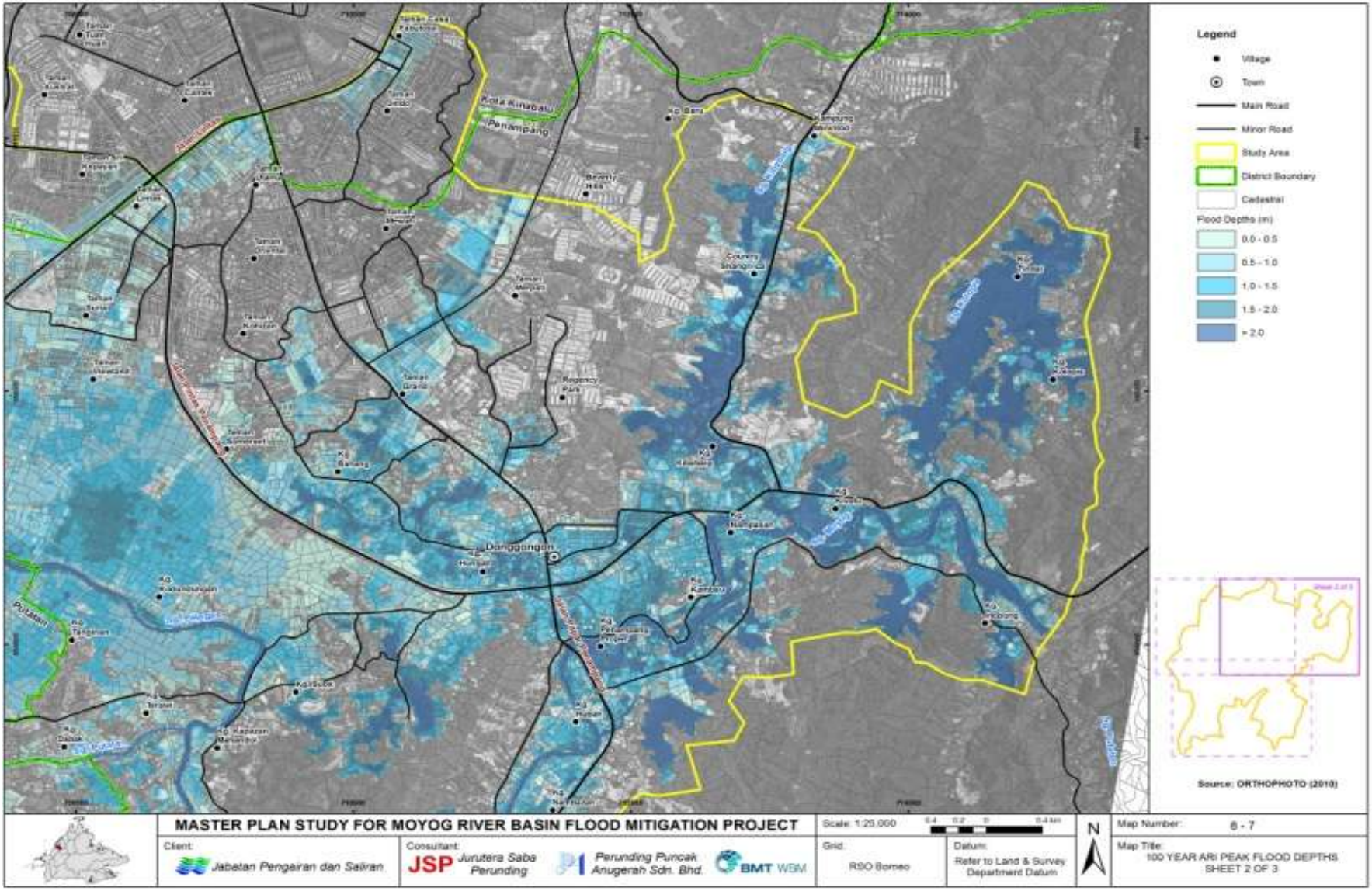


Δ Cost	Δ Damages
5	140
247	38
120	66

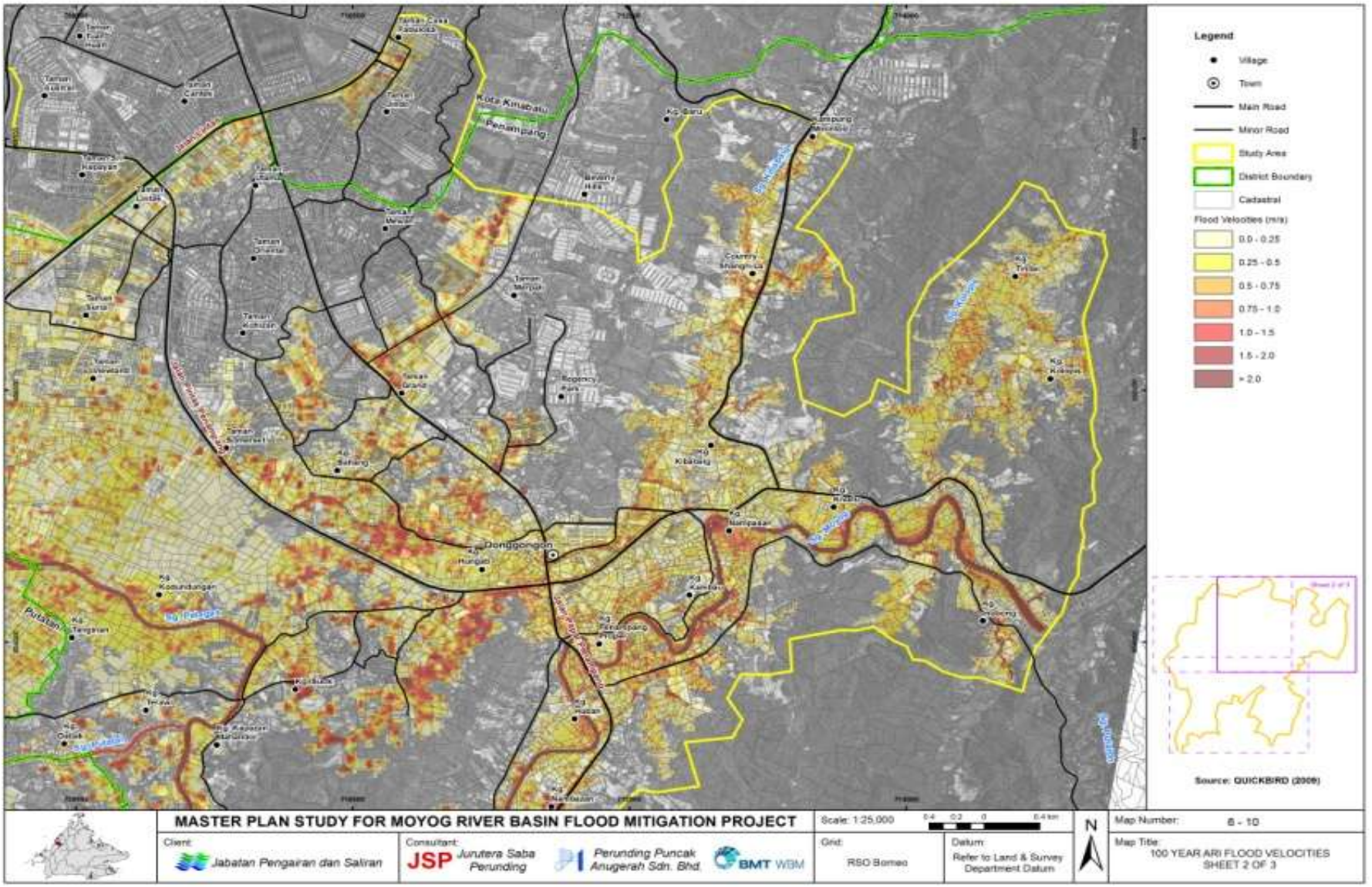
Flood Mapping #1: Flood Level Mapping



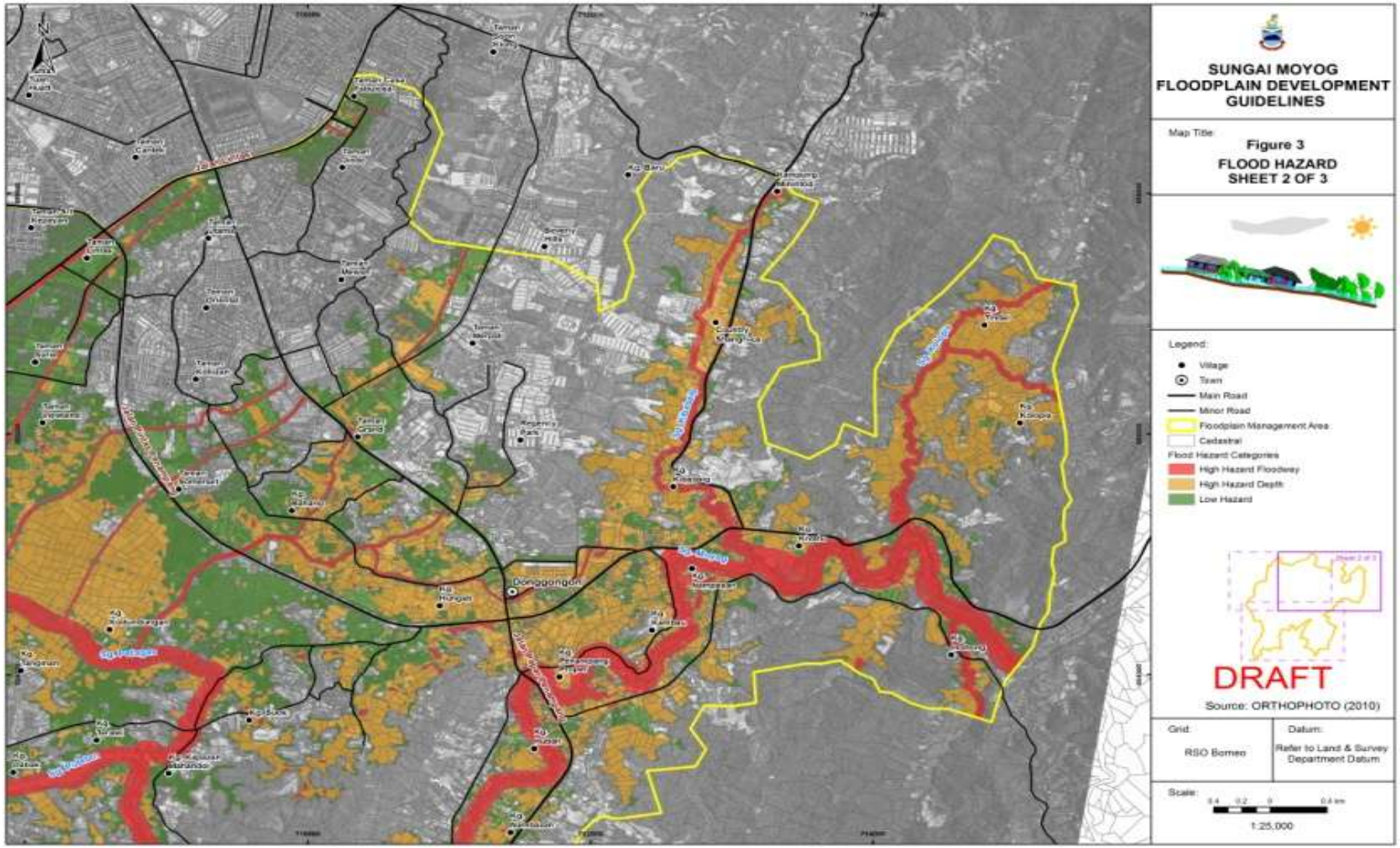
Flood Mapping #2: Flood Depth Mapping



Flood Mapping #3: Flow Velocity Mapping



Flood Mapping #4: Flood Hazard Planning



Flood Hazard Mapping

Define Hazard Categories for Flood Hazard Mapping

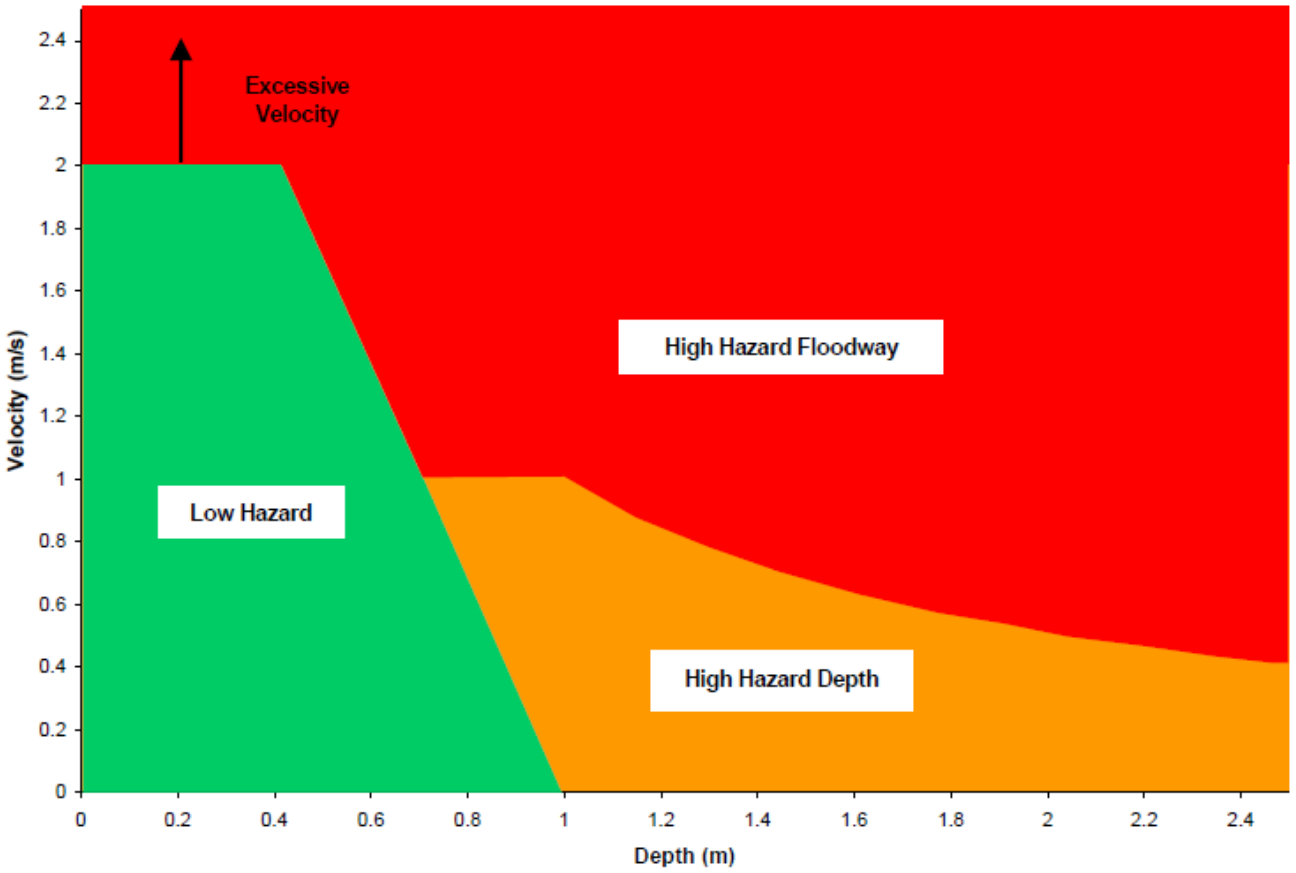


Figure 1 Flood Hazard Categorisation

Toowoomba flood 2011 Au

Flood Hazard Mapping and Land Use Planning

High hazard depth

High hazard floodway

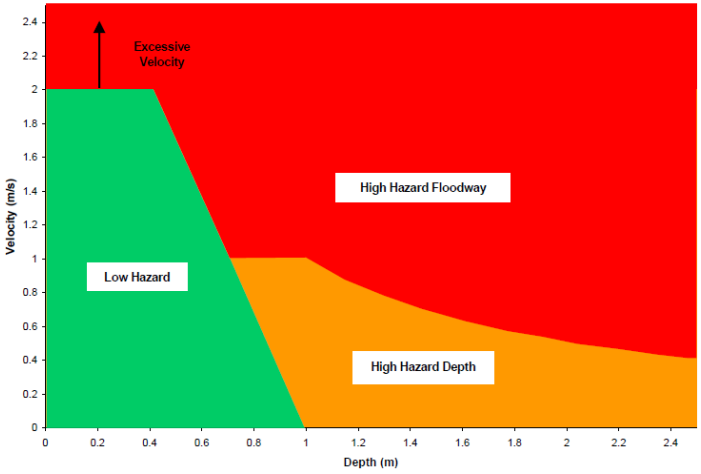


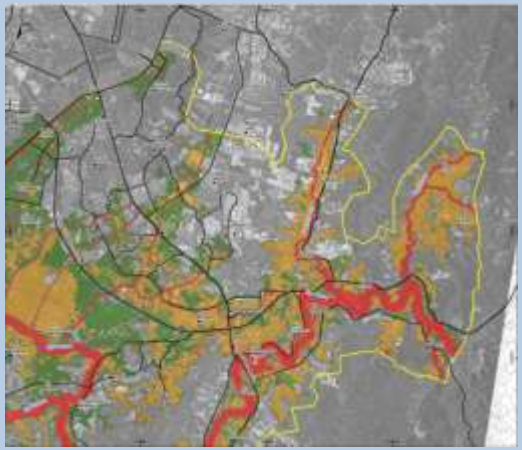
Figure 1 Flood Hazard Categorisation

Flood Hazard Mapping and Land Use Planning

Engineer

Hydraulic and Hazard Categories
- High Hazard Floodway
- High Hazard Depth
- Low Hazard

(JPS)



Integrate

Socio-economic
Environmental
Financial
Considerations &
Technical Analysis

Land Use Planner

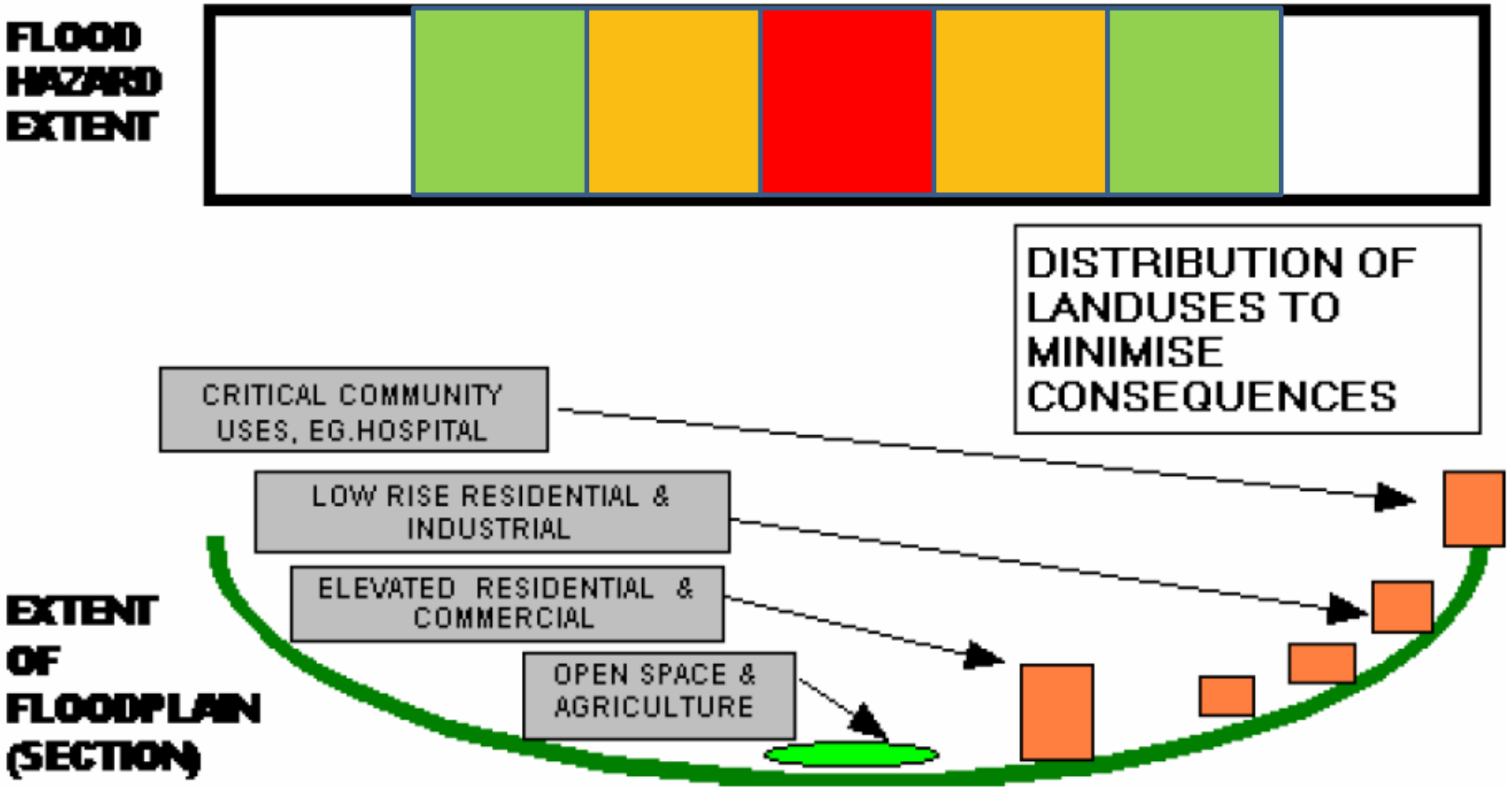
Land Use Categories
- Residential
- Commercial
- Industrial
- Open Space
- Special Use…

(T&RPD, Councils, JKR and others)

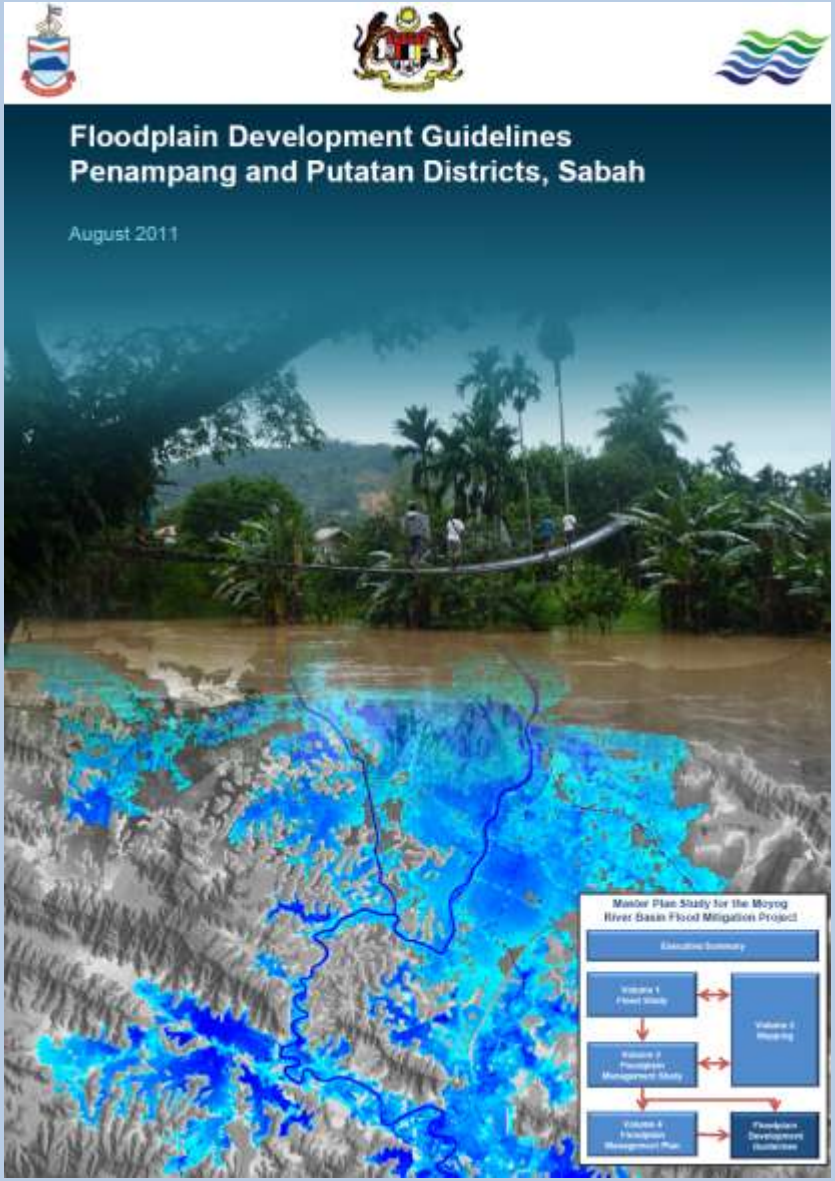
District Land Use Plans & Local Plans

Flood Hazard Mapping and Land Use Planning

Considerations for Distributing Land Uses for Urban Planning



Proposed Guidelines for Development Control



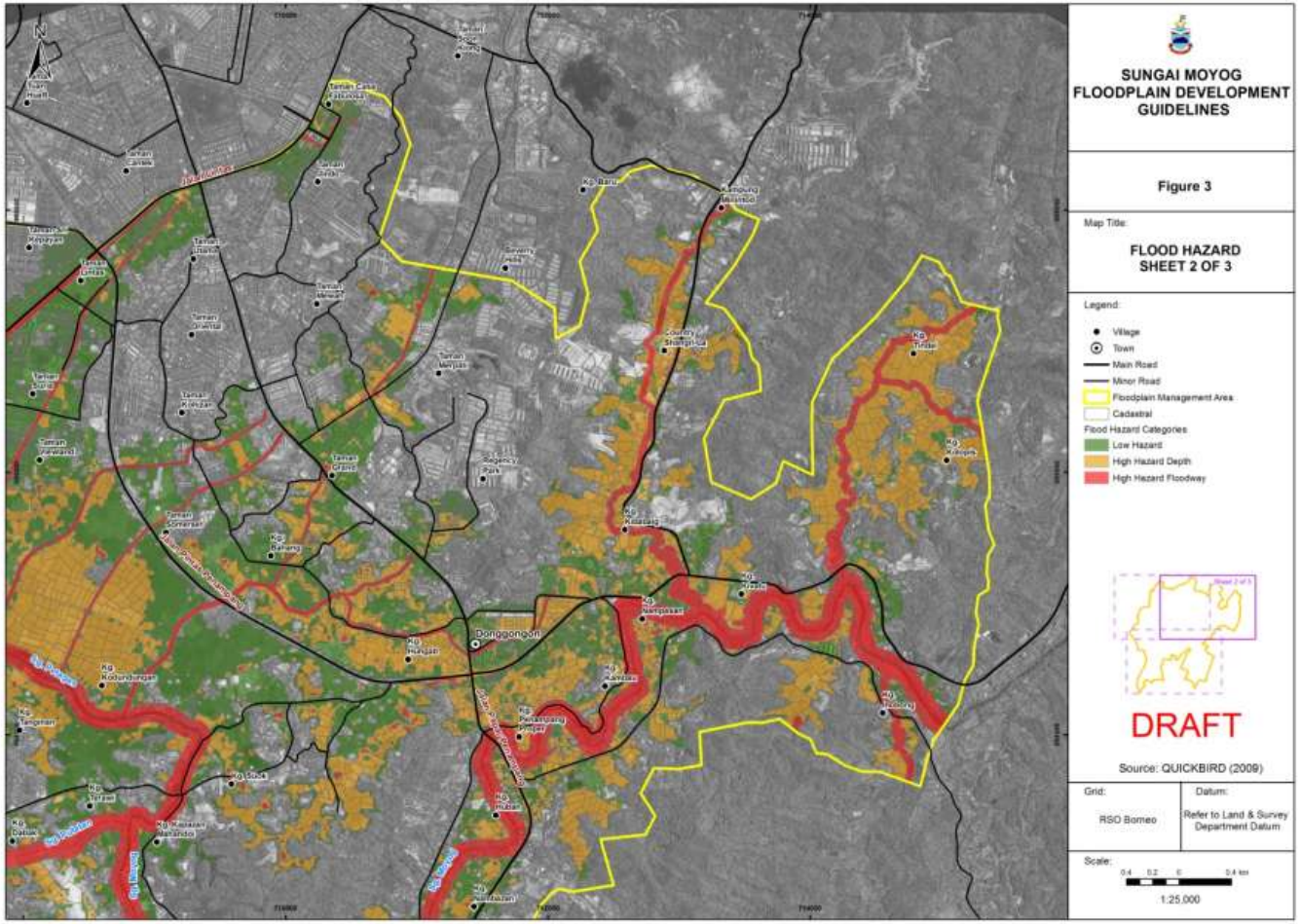
4 Steps Assessment Process

Any proposed development MUST NOT:

1. **Be located in a 'High Hazard Floodway' area**
2. **Be lower than the 100 year flood level**
3. **Cause impacts on surrounding land**
4. **Be within a River Reserve**

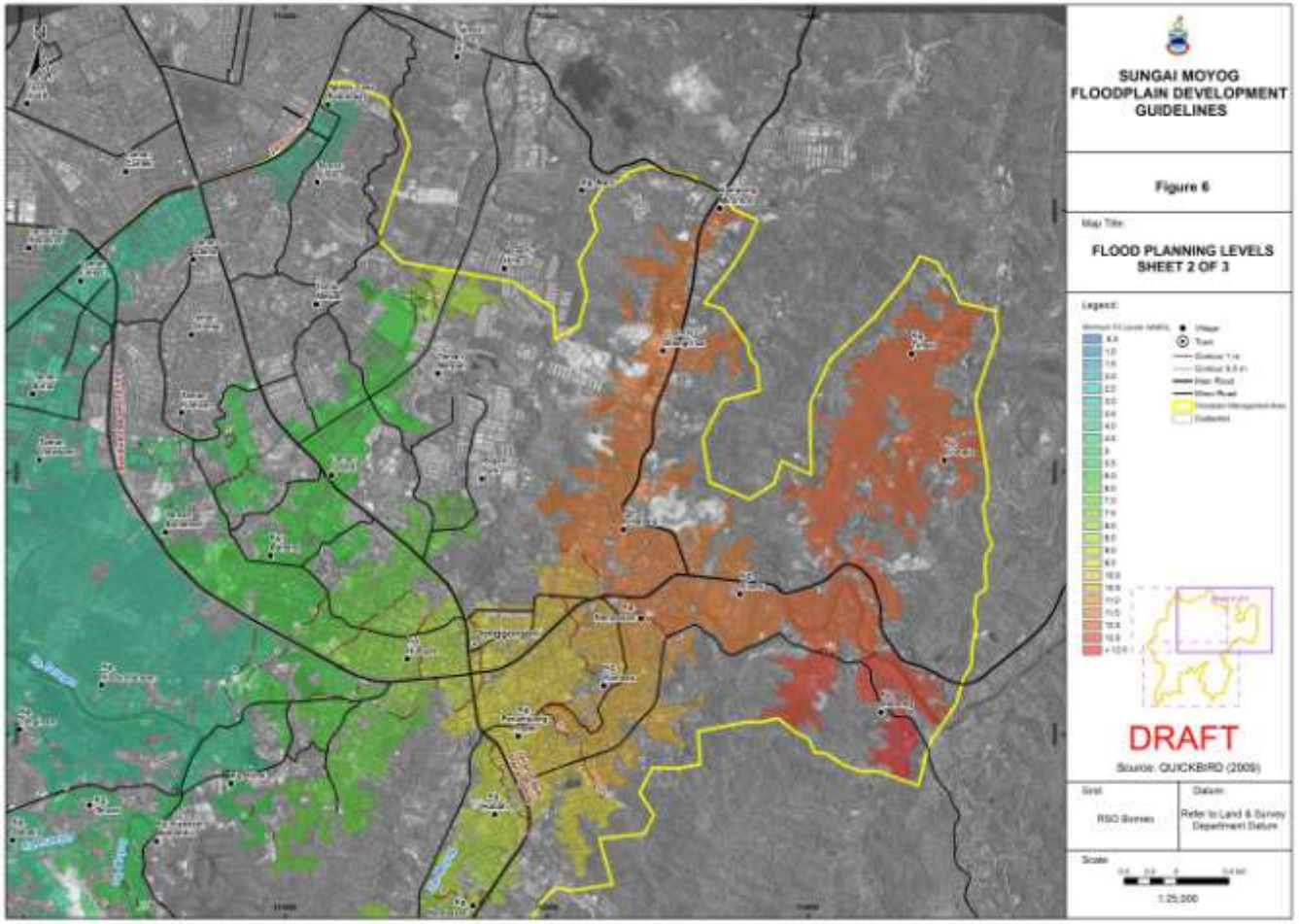
Proposed Guidelines for Development Control

1. **Flood Compatible Development – Flood Hazard**
2. Flood Planning Levels
3. Flood Impacts
4. River Reserves



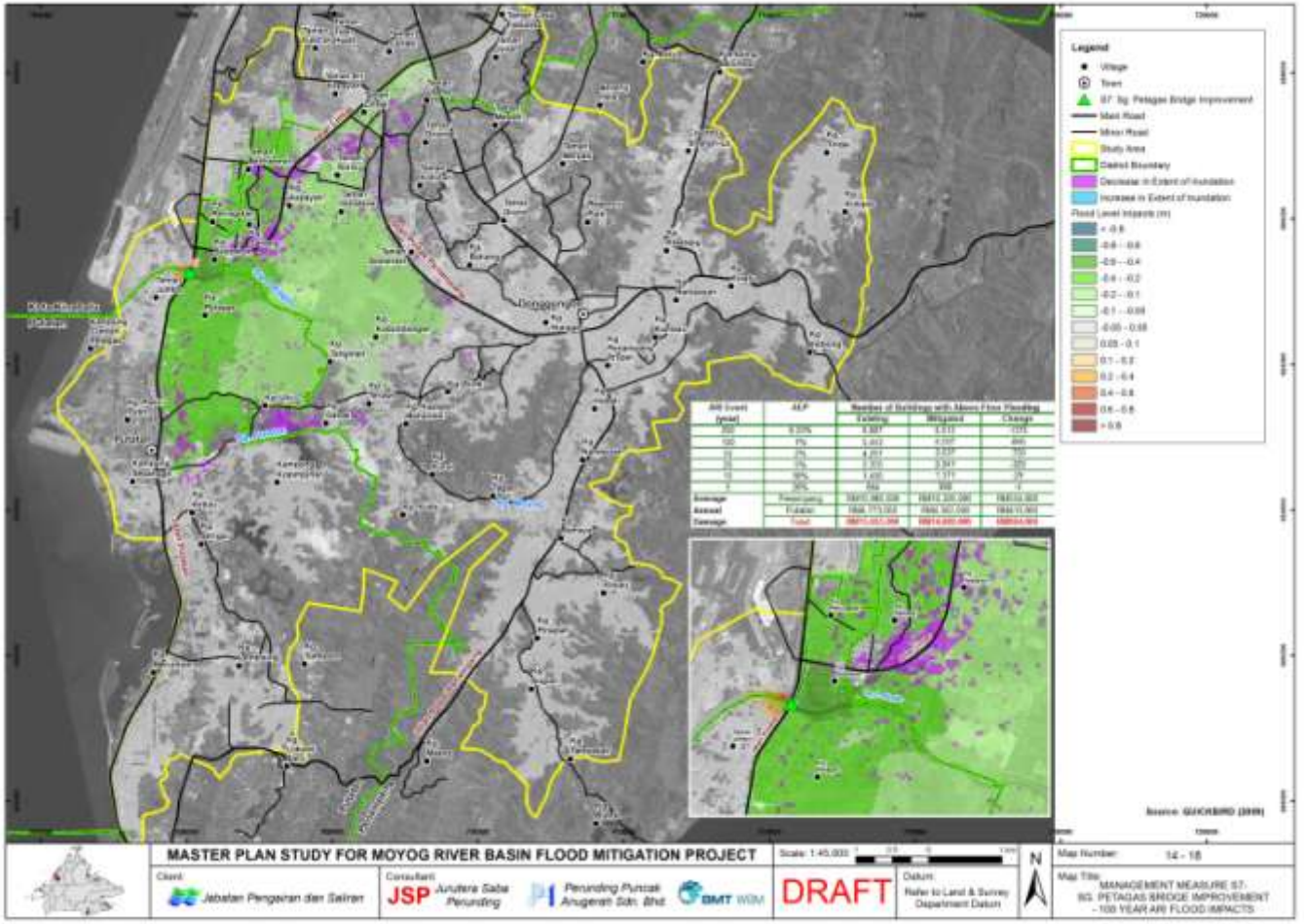
Proposed Guidelines for Development Control

1. Flood Compatible Development – Flood Hazard
2. **Flood Planning Levels**
3. Flood Impacts
4. River Reserves



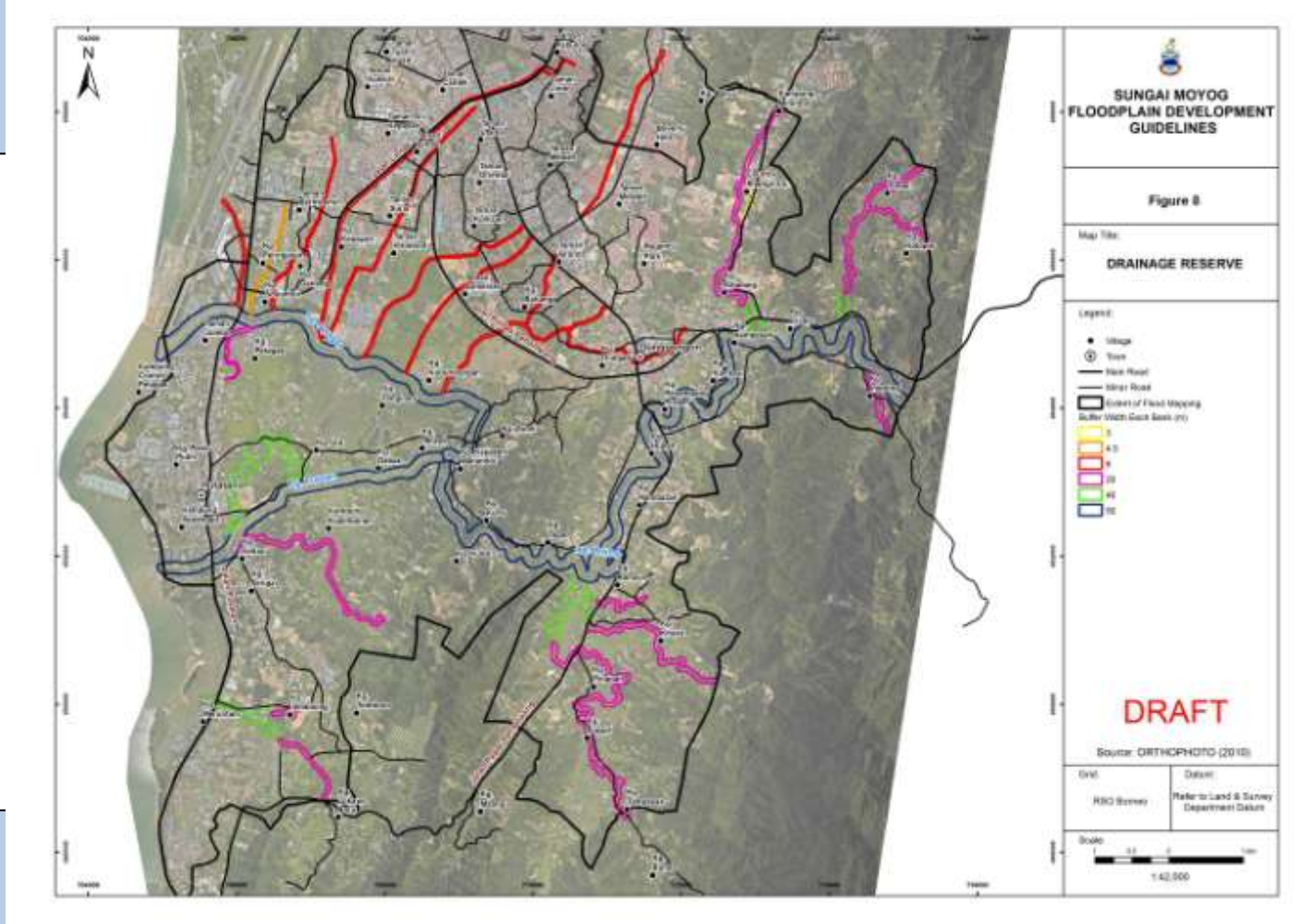
6. Proposed Guidelines for Development Control

1. Flood Compatible Development – Flood Hazard
2. Flood Planning Levels
3. **Flood Impacts**
4. River Reserves



Proposed Guidelines for Development Control

1. Flood Compatible Development – Flood Hazard
2. Flood Planning Levels
3. Flood Impacts
4. **River Reserves**



Proposed Guidelines for Development Control

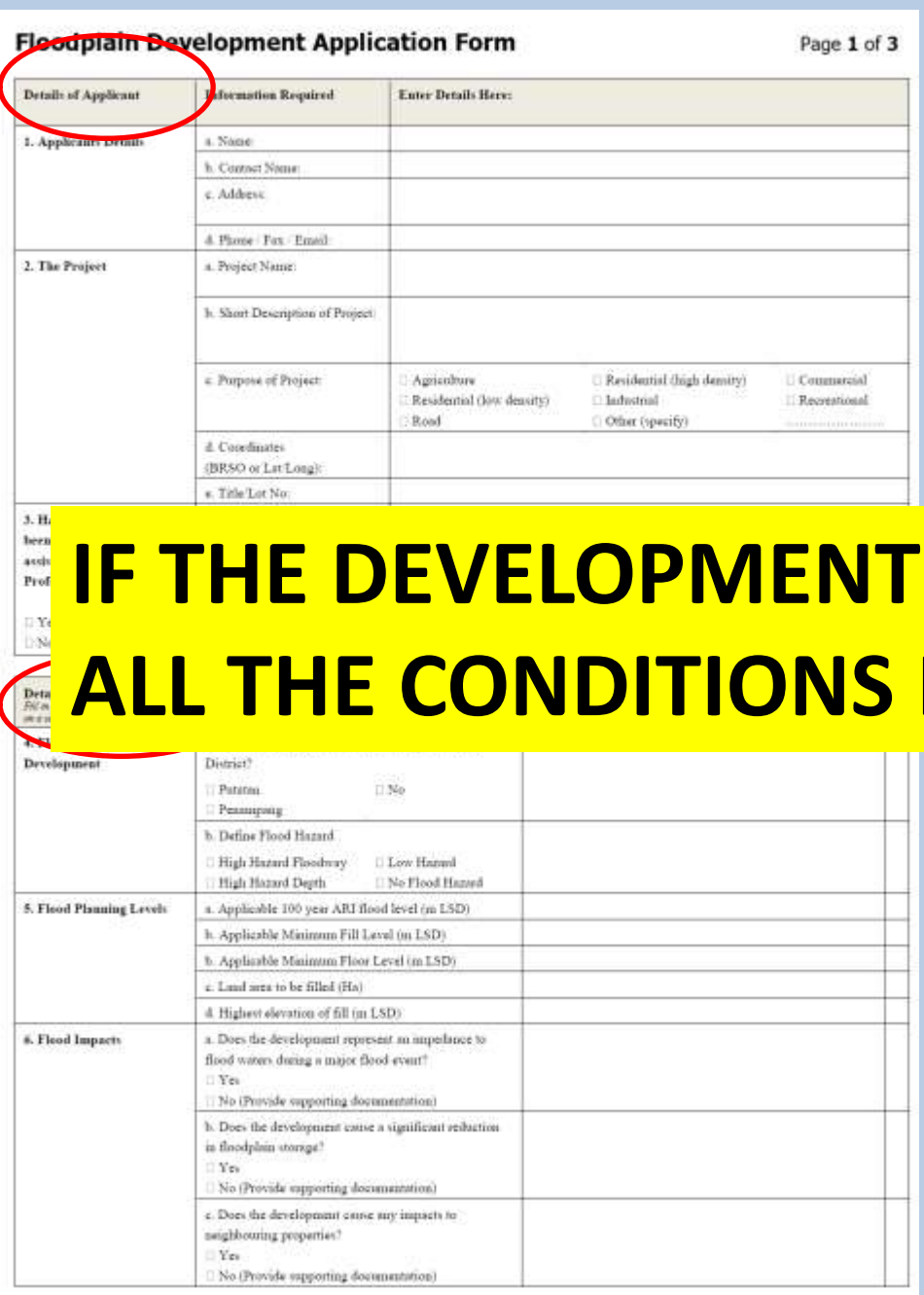
1. Flood Compatible Development – Flood Hazard
2. Flood Planning Levels
3. Flood Impacts
4. **River Reserves**

Table 2 Drainage Reserves

Width between River Banks*	Width of Reserve beyond each River Bank
more than 40m	at least 50m
between 20m and 40m	at least 40m
between 3m and 20m	at least 20m
less than 3m	at least 5m

* river banks are defined from the top of the bank, or levee if present.

Floodplain Development application Forms



Floodplain Development Application Form Page 1 of 3

Details of Applicant	Information Required	Enter Details Here:
1. Applicant's Details	a. Name:	
	b. Contact Name:	
	c. Address:	
	d. Phone / Fax / Email:	
2. The Project	a. Project Name:	
	b. Short Description of Project:	
	c. Purpose of Project:	☐ Agriculture ☐ Residential (high density) ☐ Commercial ☐ Residential (low density) ☐ Industrial ☐ Recreational ☐ Road ☐ Other (specify) .....
	d. Coordinates (BRSO or Lat/Long):	
	e. Title/Lot No:	

IF THE DEVELOPMENT APPLICATION FULFILLS ALL THE CONDITIONS IT SHALL BE ENDORSED

Floodplain Development Application Form Page 2 of 3

Details of Proposed Works *Fill in required information. Continue on a separate page if necessary*	Information Required *Refer to relevant Sections in the Floodplain Development Policy for guidance*	Enter Details Here: *Tick if additional information attached*	✓
	d. Does the development cause any social, water quality and/or environmental impacts? ☐ Yes ☐ No (Provide supporting documentation)		
	e. Describe any mitigation works proposed as part of the development		
7. Drainage Reserves	a. Name of nearest waterway		
	b. Distance to waterway (m)		
	c. Does development encroach upon Drainage Reserve? ☐ Yes ☐ No		
8. Special Considerations	a. Are further special considerations required?		

c.	Topographic survey plan
d.	Earthwork plan
e.	Flood and drainage study report
f.	Engineering Drawings
g.	Technical Specifications
h.	Construction Standards
i.	Special Considerations / Compliance to other plans
j.	Other:

Development	District? ☐ Pututau ☐ No ☐ Penunpung	
	b. Define Flood Hazard ☐ High Hazard Floodway ☐ Low Hazard ☐ High Hazard Depth ☐ No Flood Hazard	
5. Flood Planning Levels	a. Applicable 100 year ARI flood level (m LSD)	
	b. Applicable Minimum Fill Level (m LSD)	
	b. Applicable Maximum Floor Level (m LSD)	
	c. Land area to be filled (Ha)	
	d. Highest elevation of fill (m LSD)	
6. Flood Impacts	a. Does the development represent an impedance to flood waters during a major flood event? ☐ Yes ☐ No (Provide supporting documentation)	
	b. Does the development cause a significant reduction in floodplain storage? ☐ Yes ☐ No (Provide supporting documentation)	
	c. Does the development cause any impacts to neighbouring properties? ☐ Yes ☐ No (Provide supporting documentation)	

10. CC List of Authorities

Other relevant approvals authorities to be consulted are listed here

	Name of Authority	Contact Name	Position
a.			
b.			
c.			
d.			
e.			
f.			

CHALLENGES & WAY FORWARD

- DID is the main department that has been entrusted directly in the affairs of flood mitigation. However, land use planning, urban design, infrastructure projects, traffic management, waste collection and disposal, enforcement and environmental control in urban areas is the authority and responsibility of the local authorities.
- So far, there is not a standing committee to ensure that the planning and actions related to the integrated management of stormwater amongst the various technical agencies and local authorities.

CHALLENGES & WAY FORWARD

- This condition can cause the parties involved have different priorities and therefore carry their roles in "in silos" without or with minimal coordination resulting in objective to address flooding in urban areas cannot be solved effectively.

CHALLENGES & WAY FORWARD

- **Identify Flood Management Committee members and stakeholders e.g in DBKK Flood Prevention Committee**
- **Roles and responsibilities**
- **Coordination – local authority and other agencies**
- **Community Consultation – make report available to public**
- **Monitor and enforcement**

CONCLUSIONS

- **Promote Integrated Flood Management for all the river basins in Sabah**

- **Promote Flood Hazard Mapping, Land Use Planning Control and Development Control Guidelines for urban development**

Department of Irrigation and Drainage
Sabah

The End