FLOOD and Mud & Debris flow Hazard mapping and Implementation

NAKTAE PAITOON

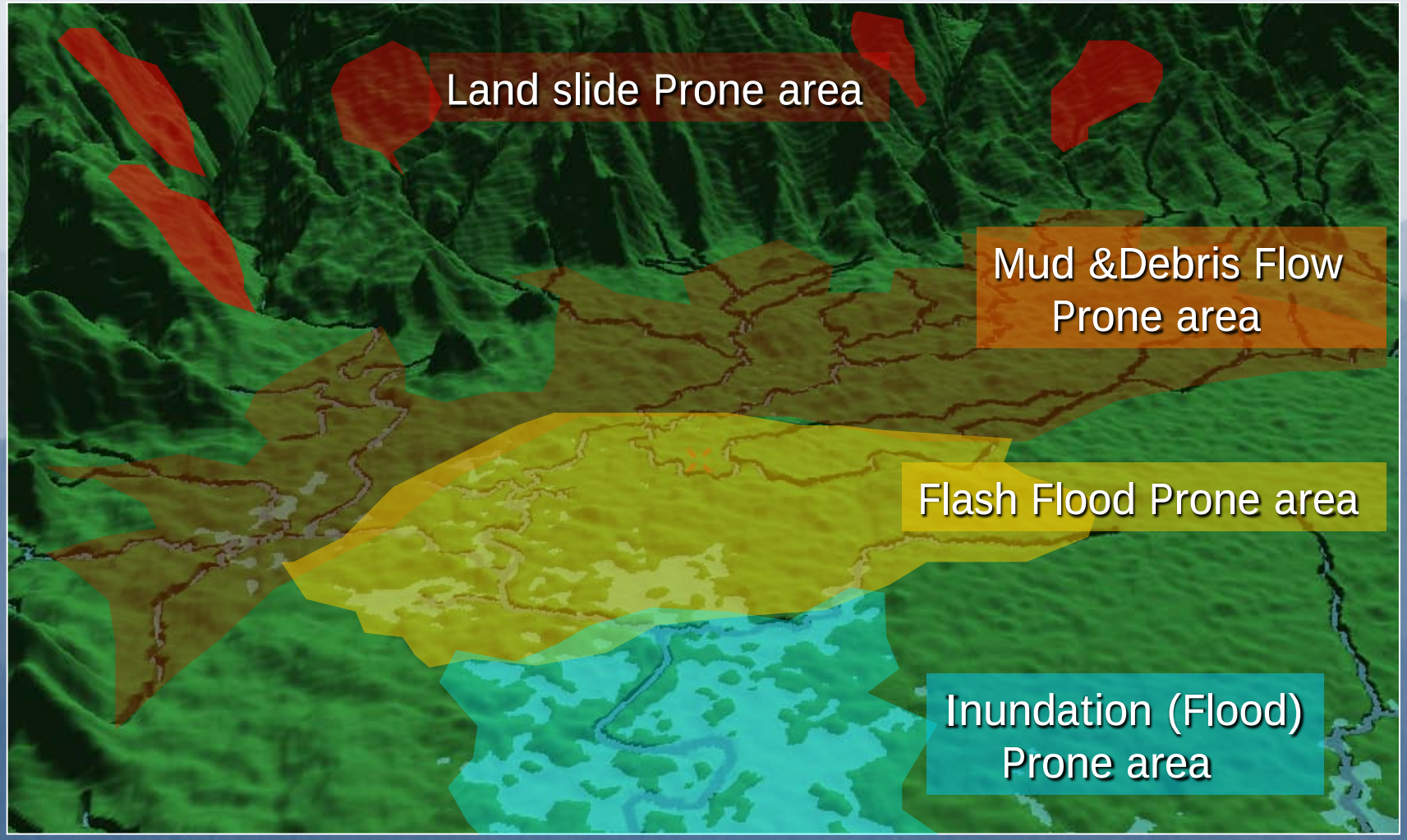
Director of Safety Standard division

Disaster Prevention Measure Bureau

Department of Disaster Prevention and Mitigation

THAILAND

Series of Hydrological Hazard Prone Area



- INTRODUCTION

Factor of Flood Hazard Mapp

- Hydrology (Rainfall, Surface &Direct runoff, Evaporation, Inspiration, Infiltration, etc.)
- Geology (Soil & Rock Type and Depth)
- Geography (Watershed area, Slope, Aspect, Land used, Land cover, etc.)

Recently method of Flood Hazard Mapping in Thailand

1. Hydrological methodology
2. GIS layer analysis

1. Hydrological methodology (Flood Simulation)

- Insufficient Hydrological Data
- Small area implementation
- Expensive cost of data collection
- Making by the specialist

GIS layer analysis (Weight Index Method)

- Statistical assessment method by superposition of several weighted geo-information layers e.g.

-easy to understand

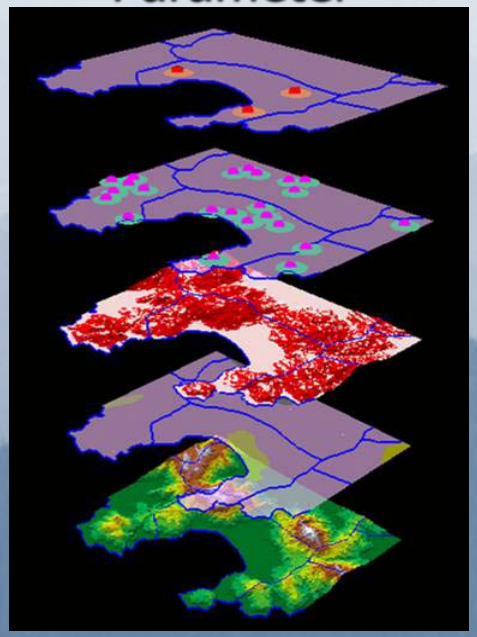
-effective to assess the in-situ stability

-unsuitable to assess the disaster prone area coursed by flash flood&debris flow

- GIS Analysis Technique (**Overlaying technique**)

Weight Index Method

Parameter



Same Position

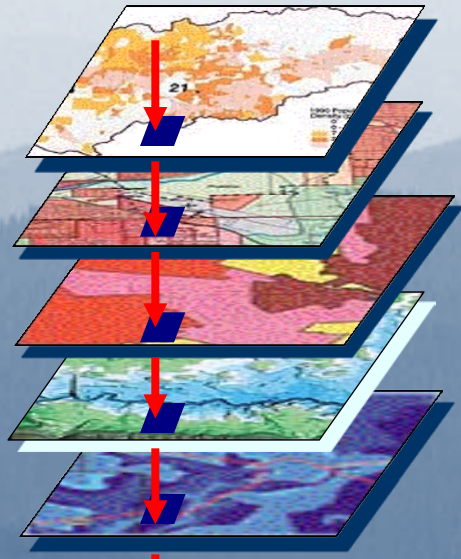
Average rainfall

Slope

Soil type

Slope Stability

Land used & land Cover etc.



Analysis

Overlaying

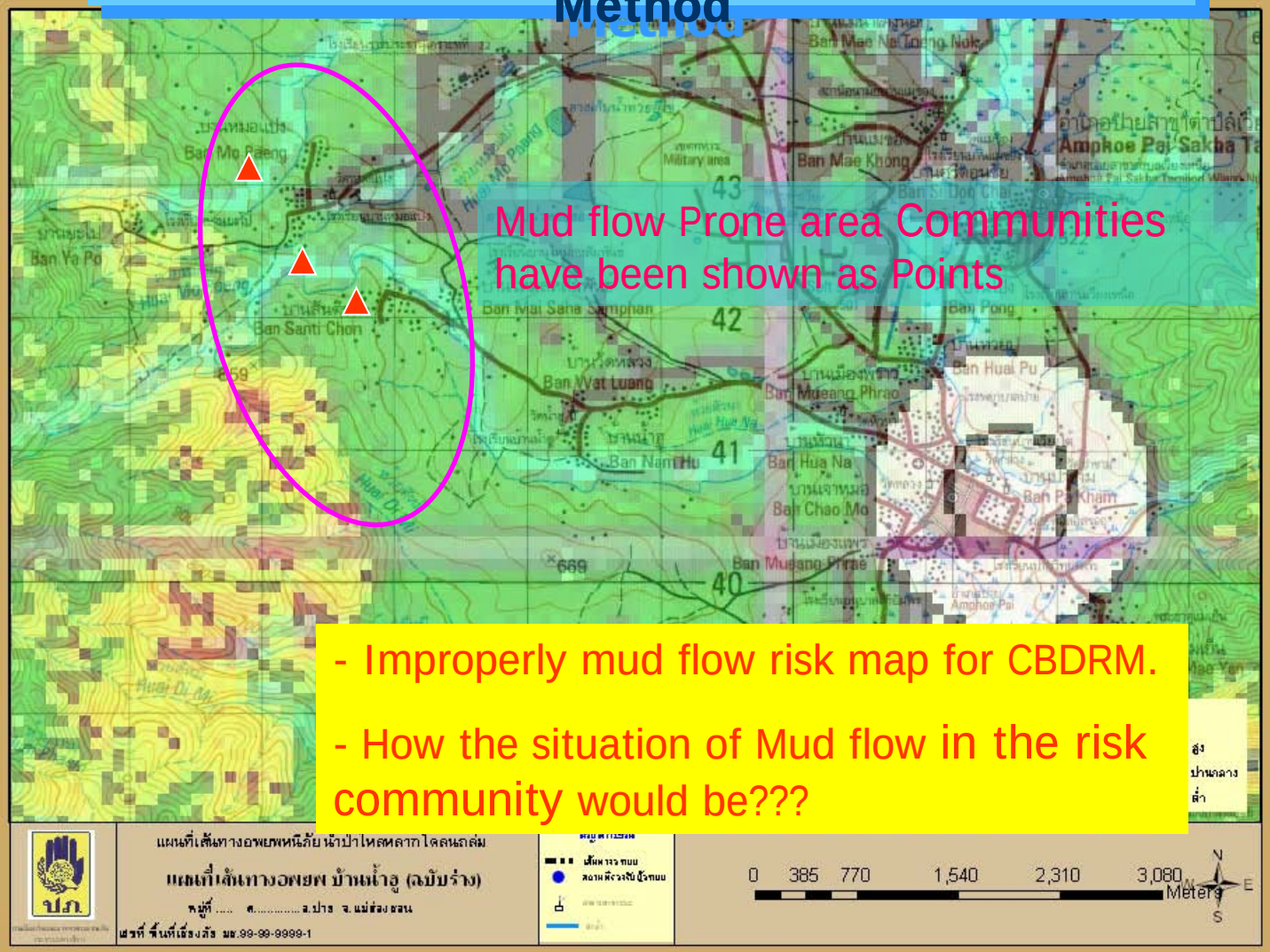
Weight Index

M = M W + M W + ... MnWn

Hazard Map

- GIS Analysis Technique (**Overlaying technique**)

Out put of Weight Index Method



New GIS Analysis Technique

For

Flood & Mud flow Hazard mapping

in Thailand

focused on the scientific character

Flood and Mud & Debris flow Hazard Mapping

- Requested Output
  - Because the Hazard Map should cover whole area of Thailand, it must be evenly prepared regardless the available data
  - The Hazard Map is not required the high accuracy but necessary to be not far from the actual historical data
  - The Hazard Map should be a base map for the Community Level Hazard Map
  - The Hazard Map should show the risk area of residential area

Flood and Mud & Debris flow Hazard Mapping

Criterion of Methodology

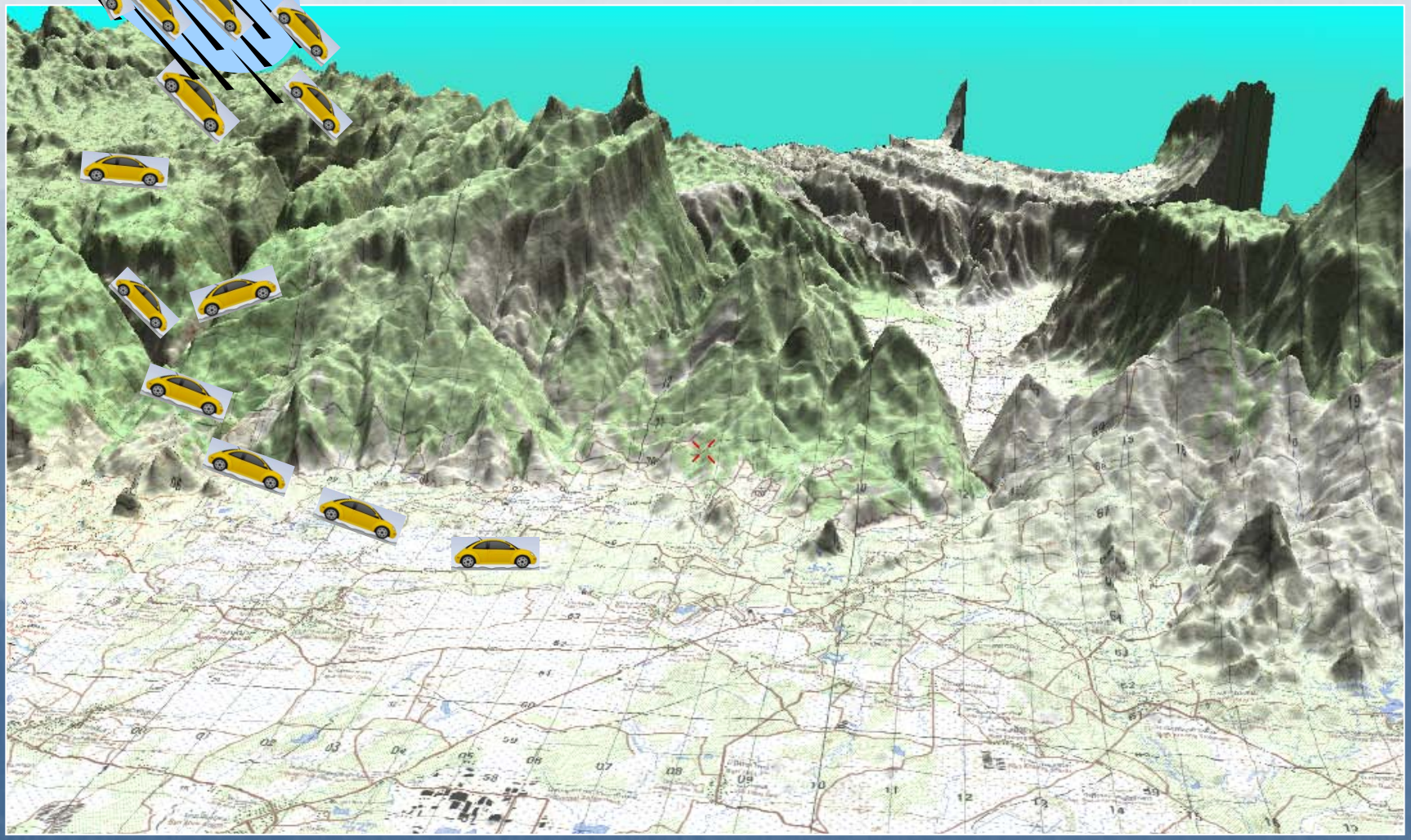
- Mud & Debris flow must occur during flash flood event
- More Easier water flowing into the area, More potential risk of mud& debris flow.
- For economy and lacking data problem solution,
  - -The less of data would be used in the model.
  - -The model would be generalized, and not so high technology.
- The potential risk map would have enough scale for community levels.

- GIS Analysis Technique

Spatial Analysis

Cost Path Distance Analysis

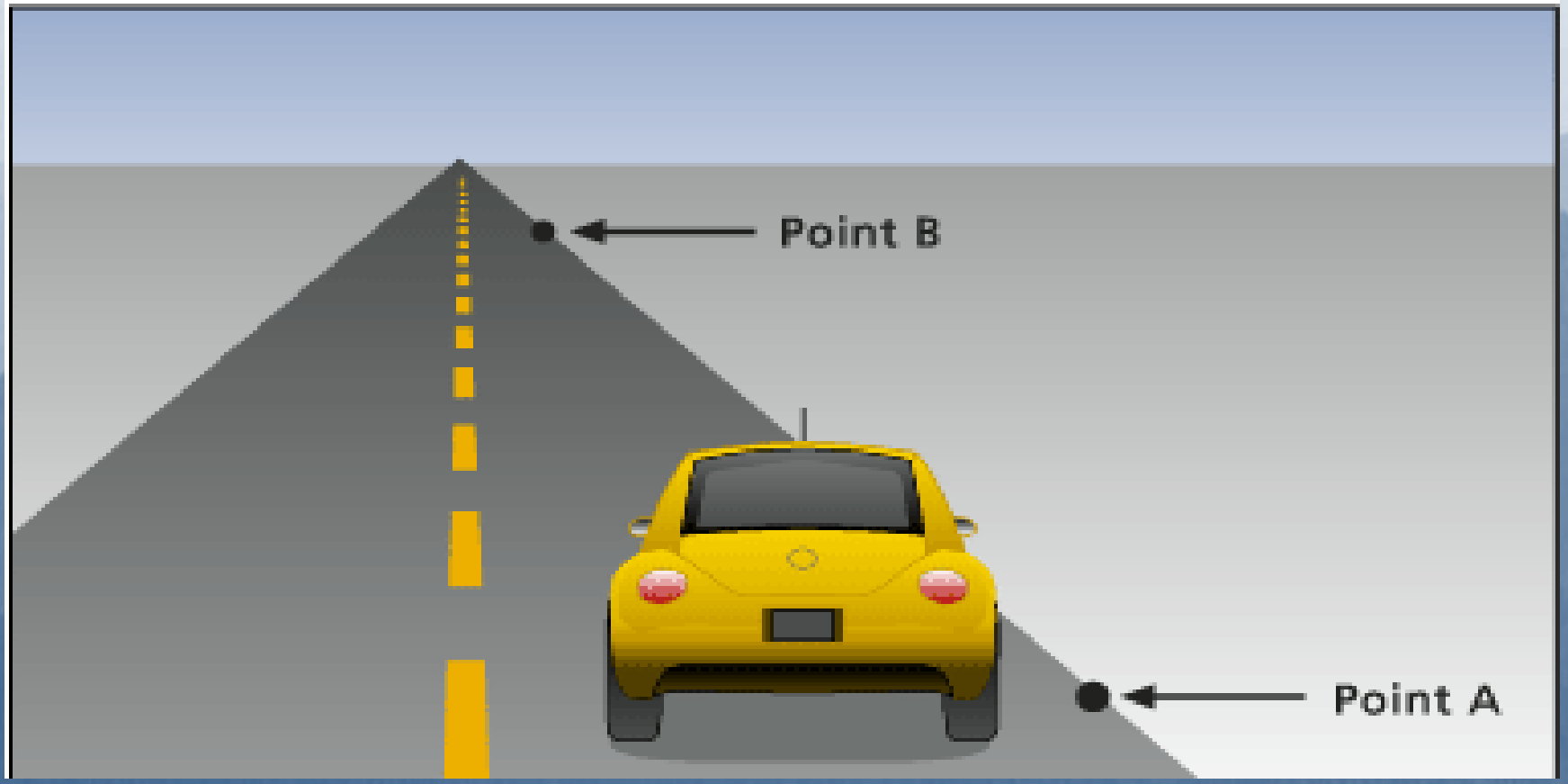
The moving of water on the surface



- GIS Analysis Technique (**Spatial Analysis**)

Cost Path Distance Principle

Cost of Fuel used for traveling from A to B



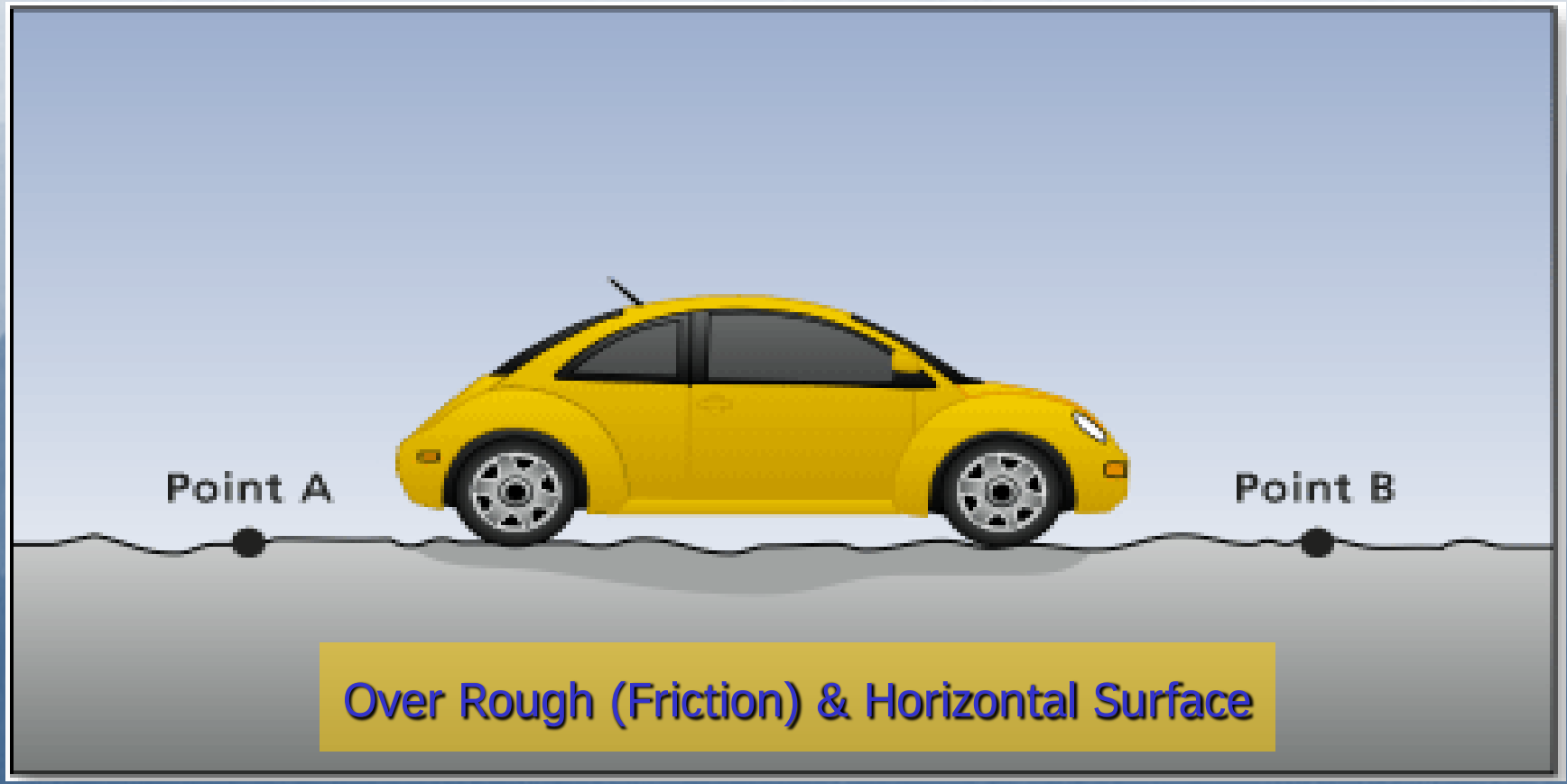
Over Smooth & Horizontal Surface

Fuel used = D

- GIS Analysis Technique (**Spatial Analysis**)

Cost Path Distance Principle

Cost of Fuel used for traveling from A to B

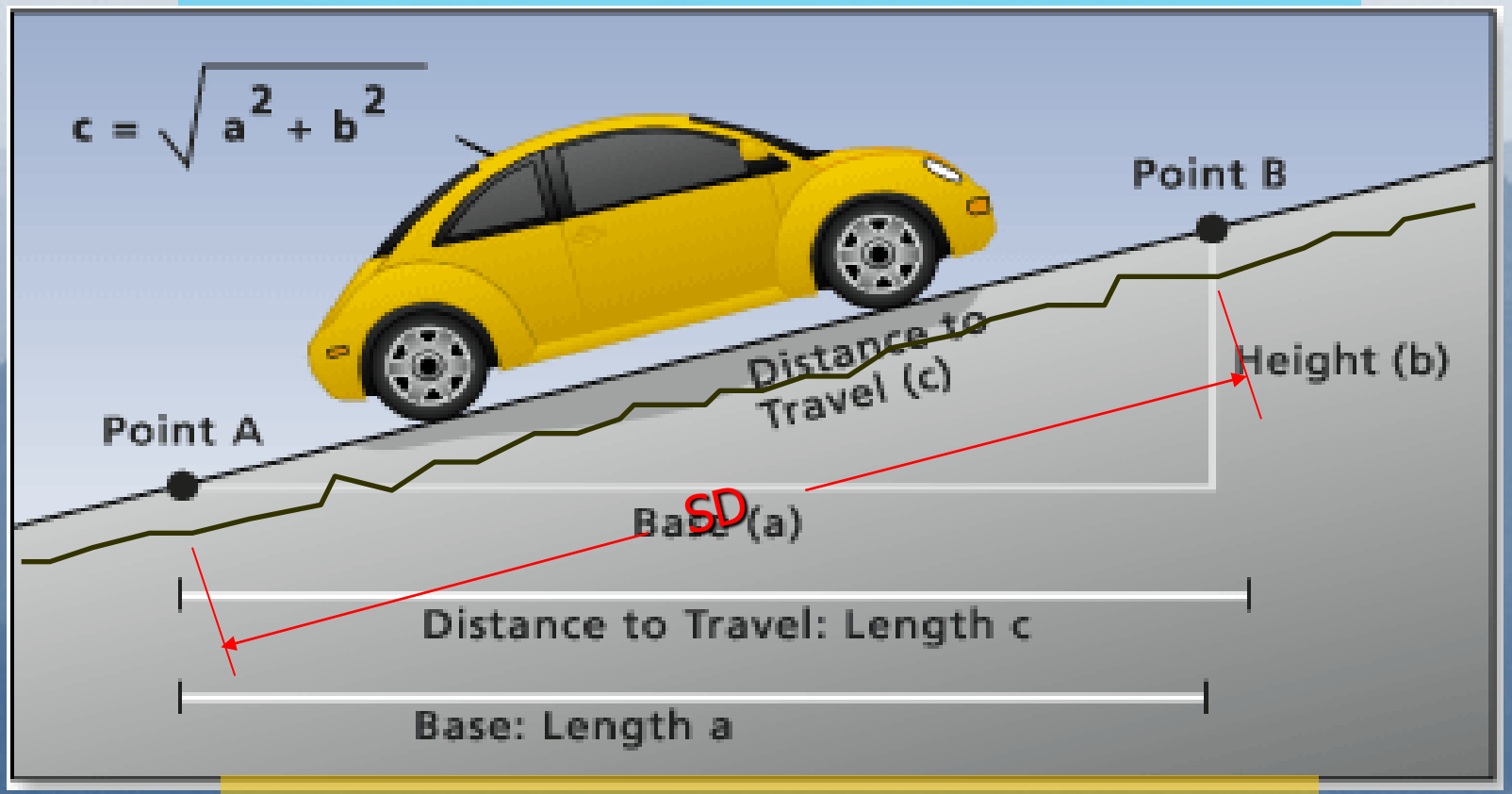


Fuel used = F*D

- GIS Analysis Technique (**Spatial Analysis**)

Cost Path Distance Principle

Cost of Fuel used for traveling from A to B



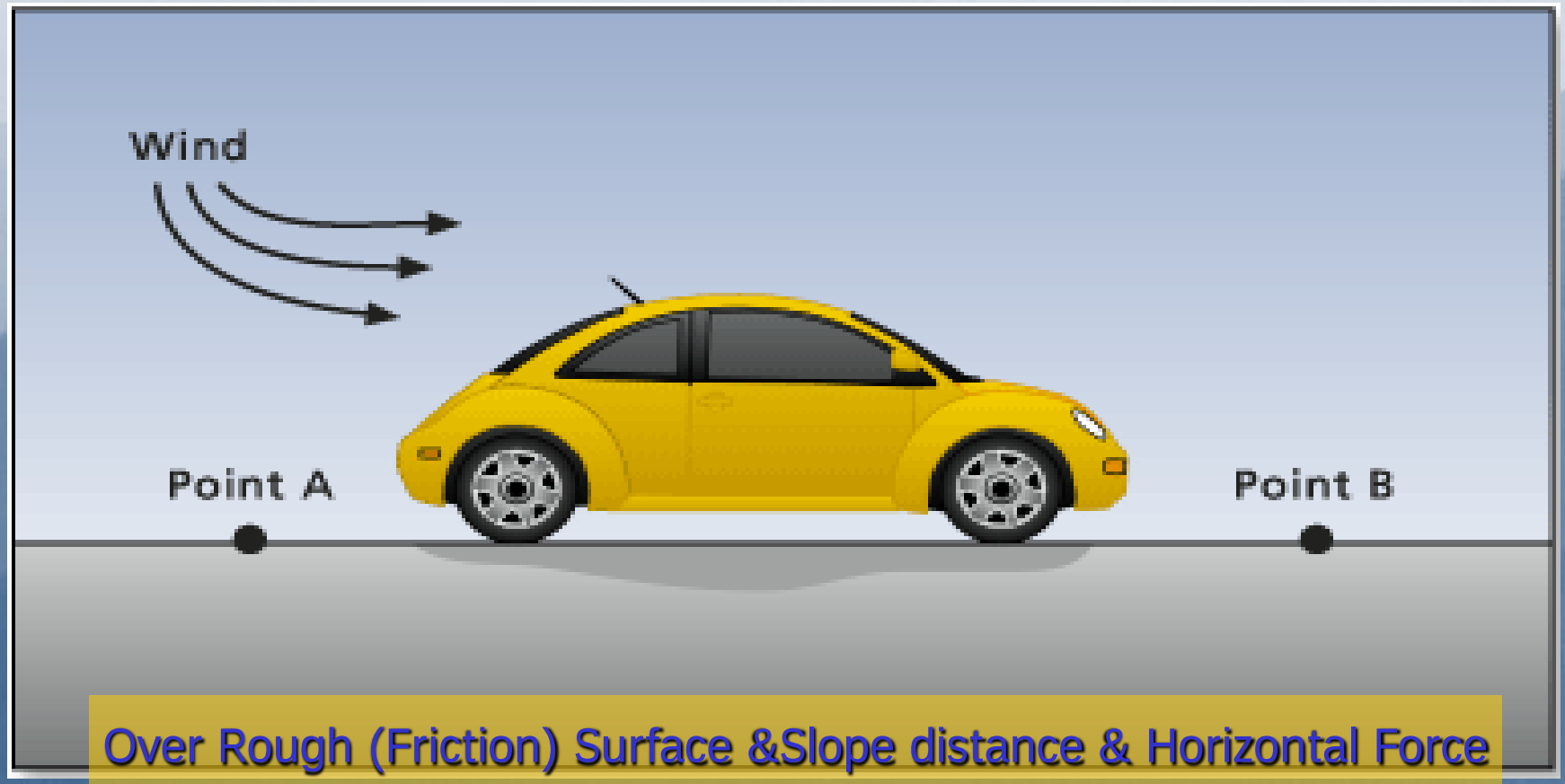
Over Rough (Friction) Surface & Slope Distance

Fuel used = F*SD

- GIS Analysis Technique (**Spatial Analysis**)

Cost Path Distance Principle

Cost of Fuel used for traveling from A to B



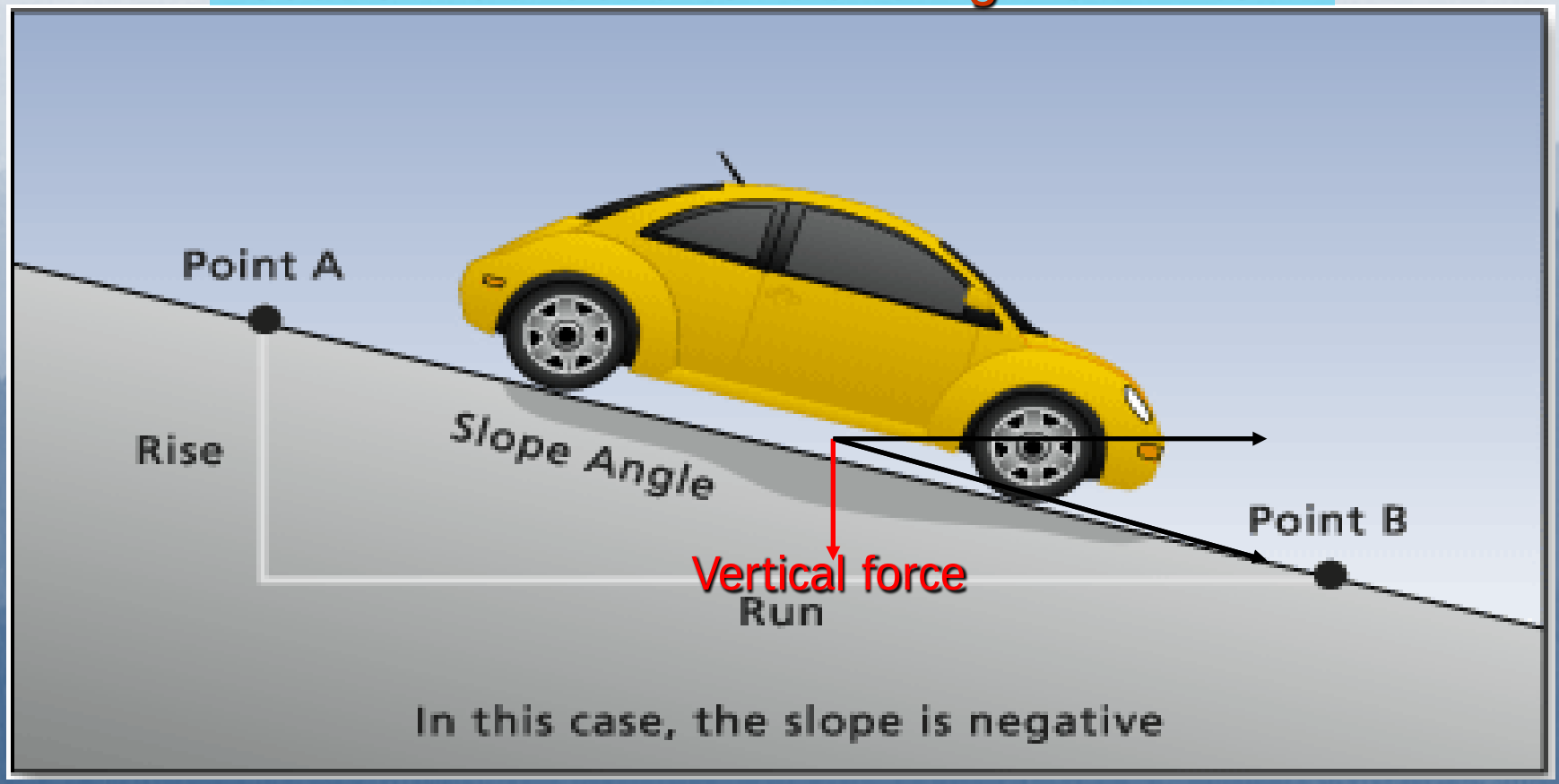
Over Rough (Friction) Surface &Slope distance & Horizontal Force

Fuel used = F*SD*HF

- GIS Analysis Technique (**Spatial Analysis**)

Cost Path Distance Principle

Cost of Fuel used for traveling from A to B

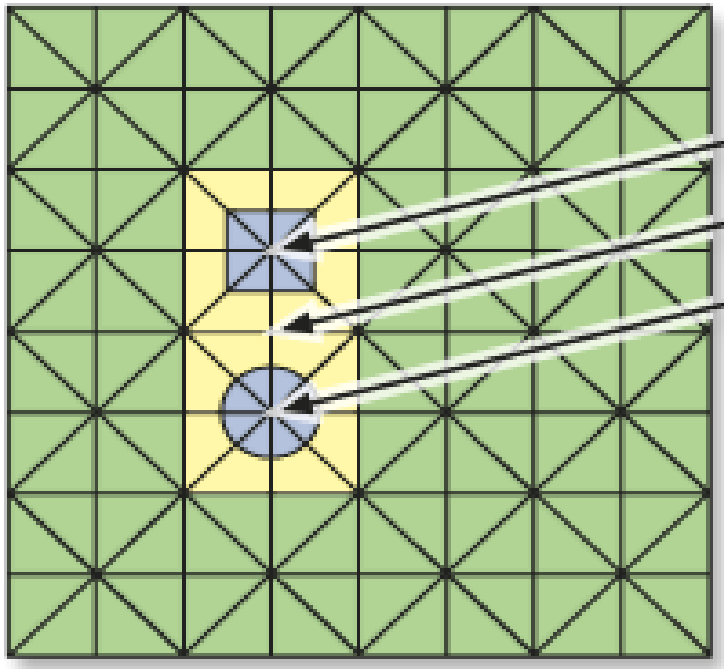


Over Rough (Friction) Surface &Slope distance& Horizontal and Vertical Force

Fuel used = F*SD*HF*VF

- GIS Analysis Technique (**Spatial Analysis**)

Cost Distance Principle

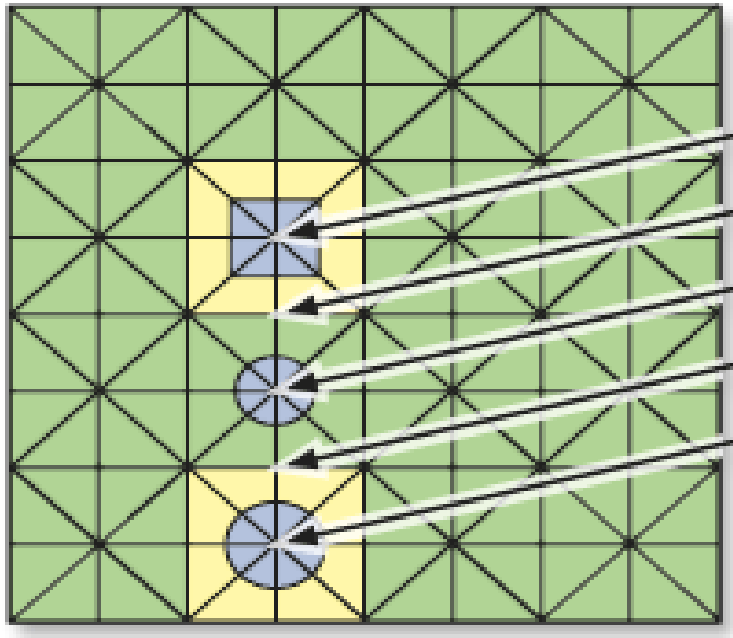


$$a1 = \frac{\text{cost 1} + \text{cost 2}}{2}$$

Horizontal and verticle node calculations

- GIS Analysis Technique (**Spatial Analysis**)

Cost Distance Principle



Accumulative cost node calculations

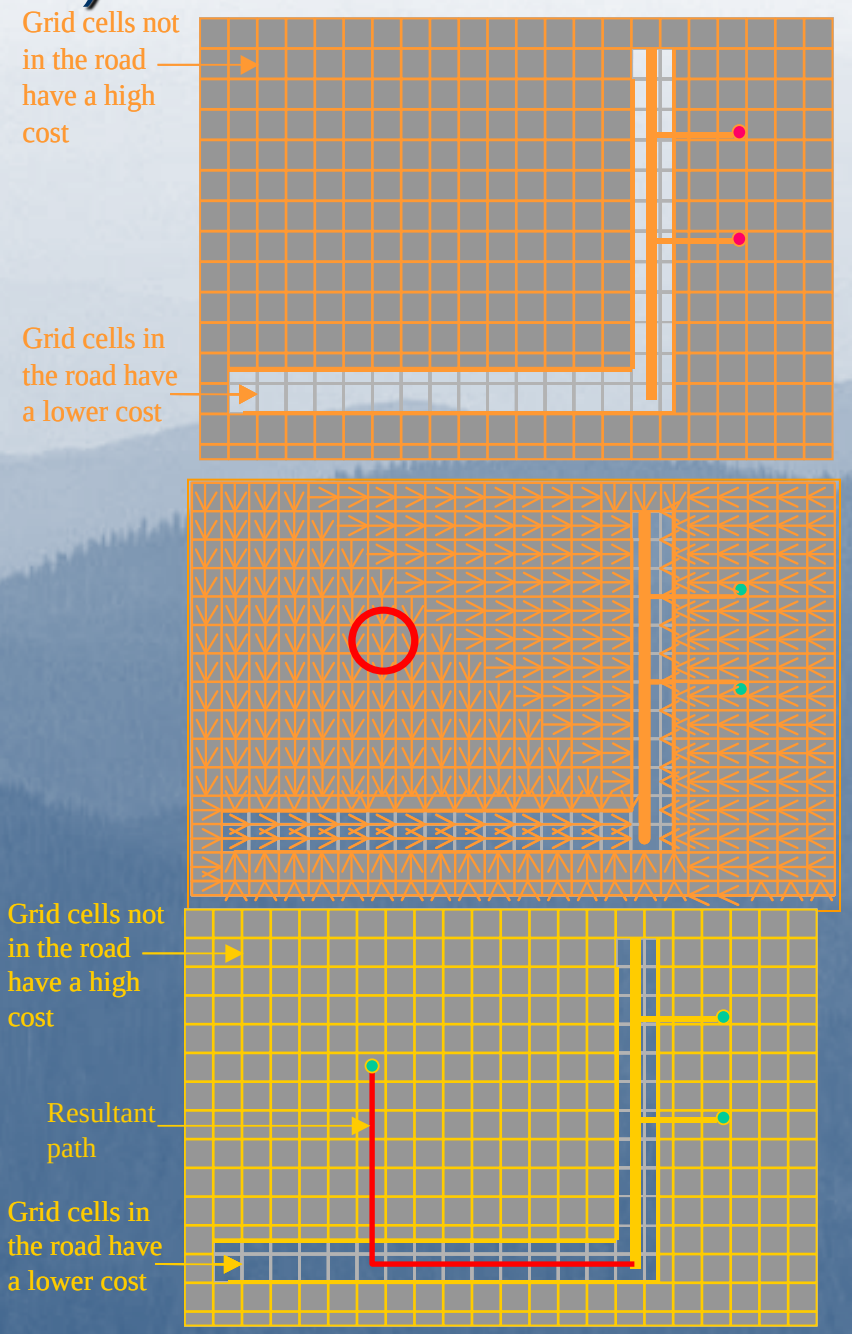
$$a2 = \frac{\text{cost 2} + \text{cost 3}}{2}$$

$$\text{accum\_cost} = a1 + a2$$

- GIS Analysis Technique (**Spatial Analysis**)

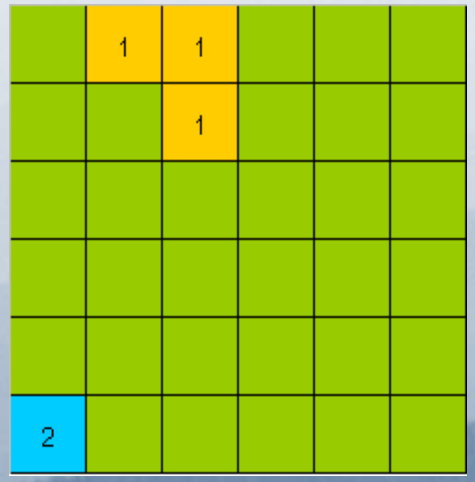
Cost Path distance Analysis

- Ability to perform routing over a raster surface.
- You can assign relative penalties to different grid cells based on some criteria (cost, hard to traverse areas, steep slopes, etc..).
- Useful for routing transmission lines over a landscape

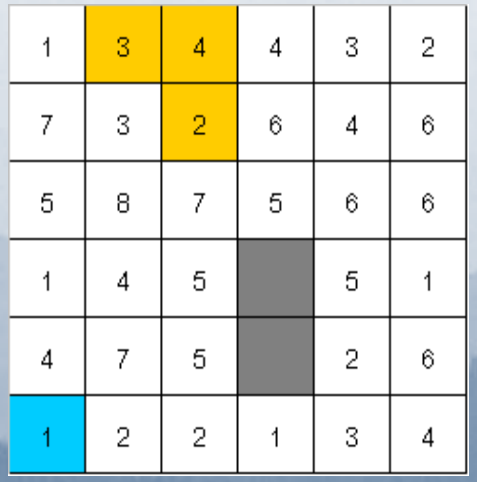


- GIS Analysis Technique (**Spatial Analysis**)

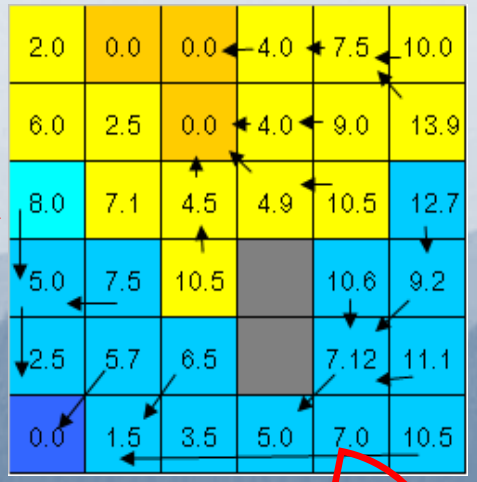
Exsample of Spatial Analysis



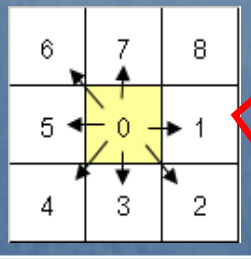
River Raster



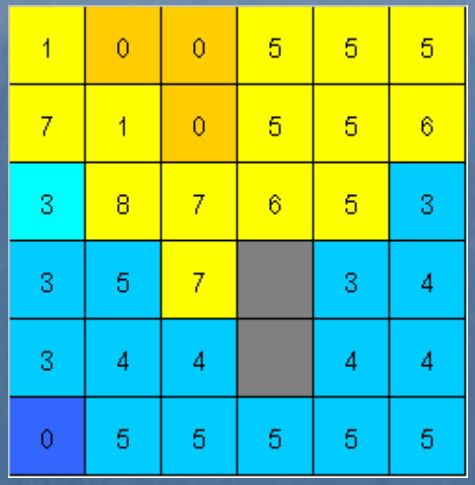
Elevation Raster



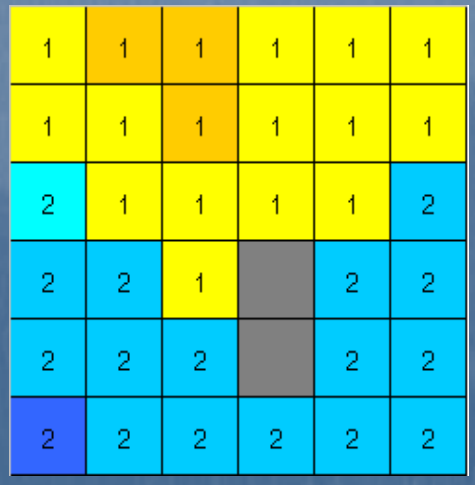
Cost distance



Direction Coding



Flow direction



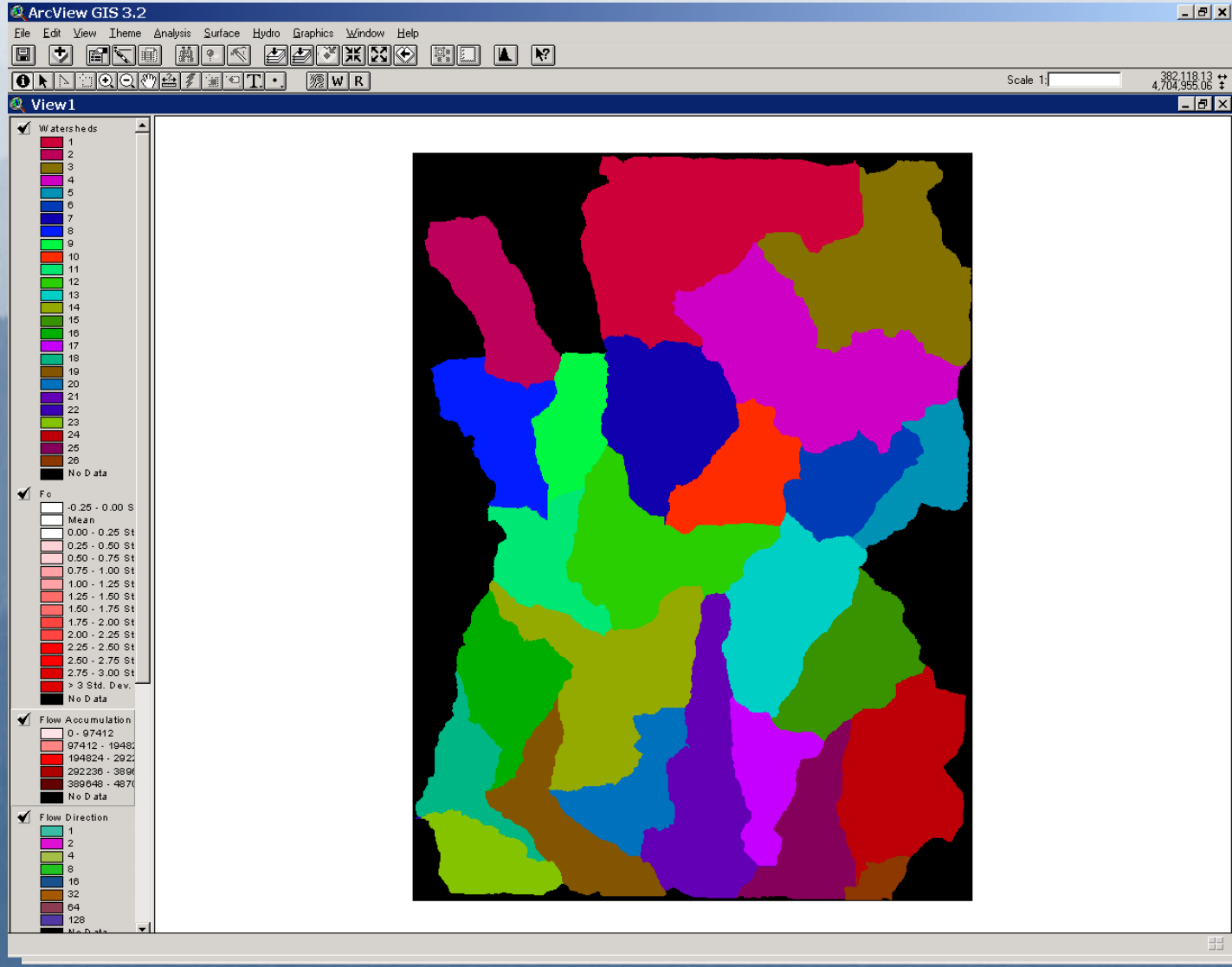
Watershed area

No Data

- GIS Analysis Technique (**Spatial Analysis**)

Hydrology analysis

- Fill Sinks in DEM
- Compute Flow Direction
- Compute Flow Accumulation
- Generate Watershed & etc.



The Project on Capacity Development
in Disaster Management in Thailand

Spatial Analysis Method

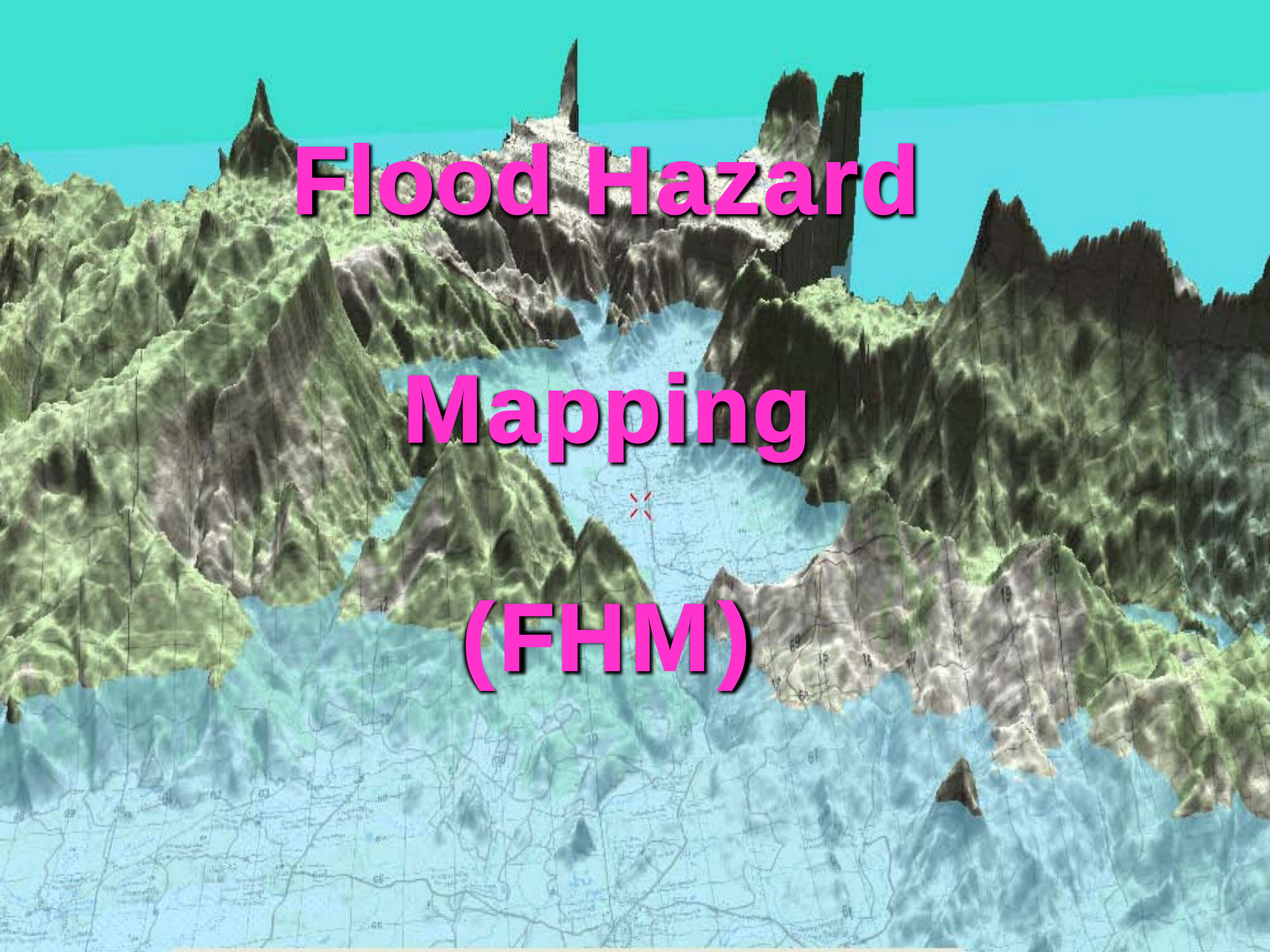
For

Flood & Mud and Debris Flow Hazard Mapping

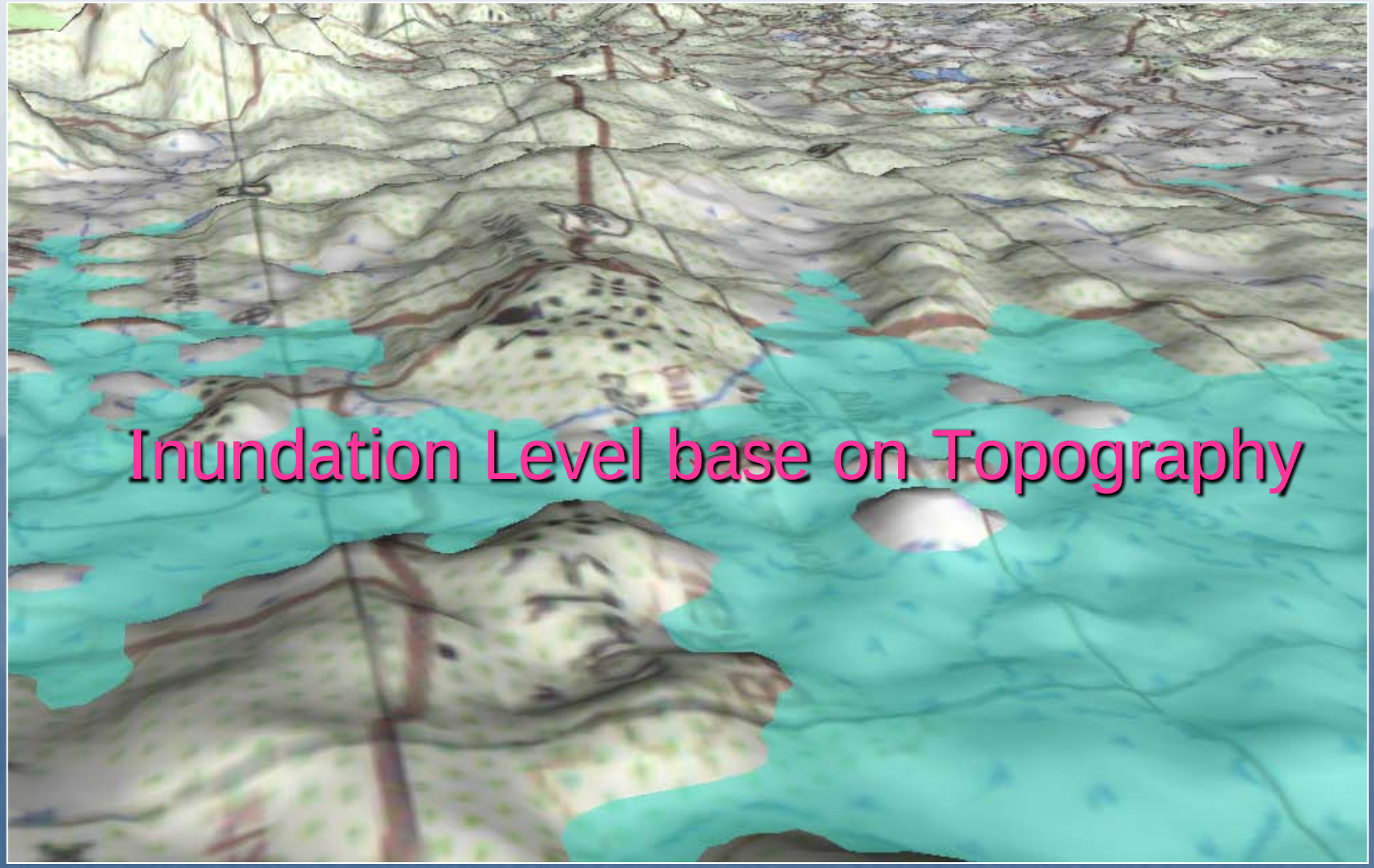
Basically Idea

- KEYWORD

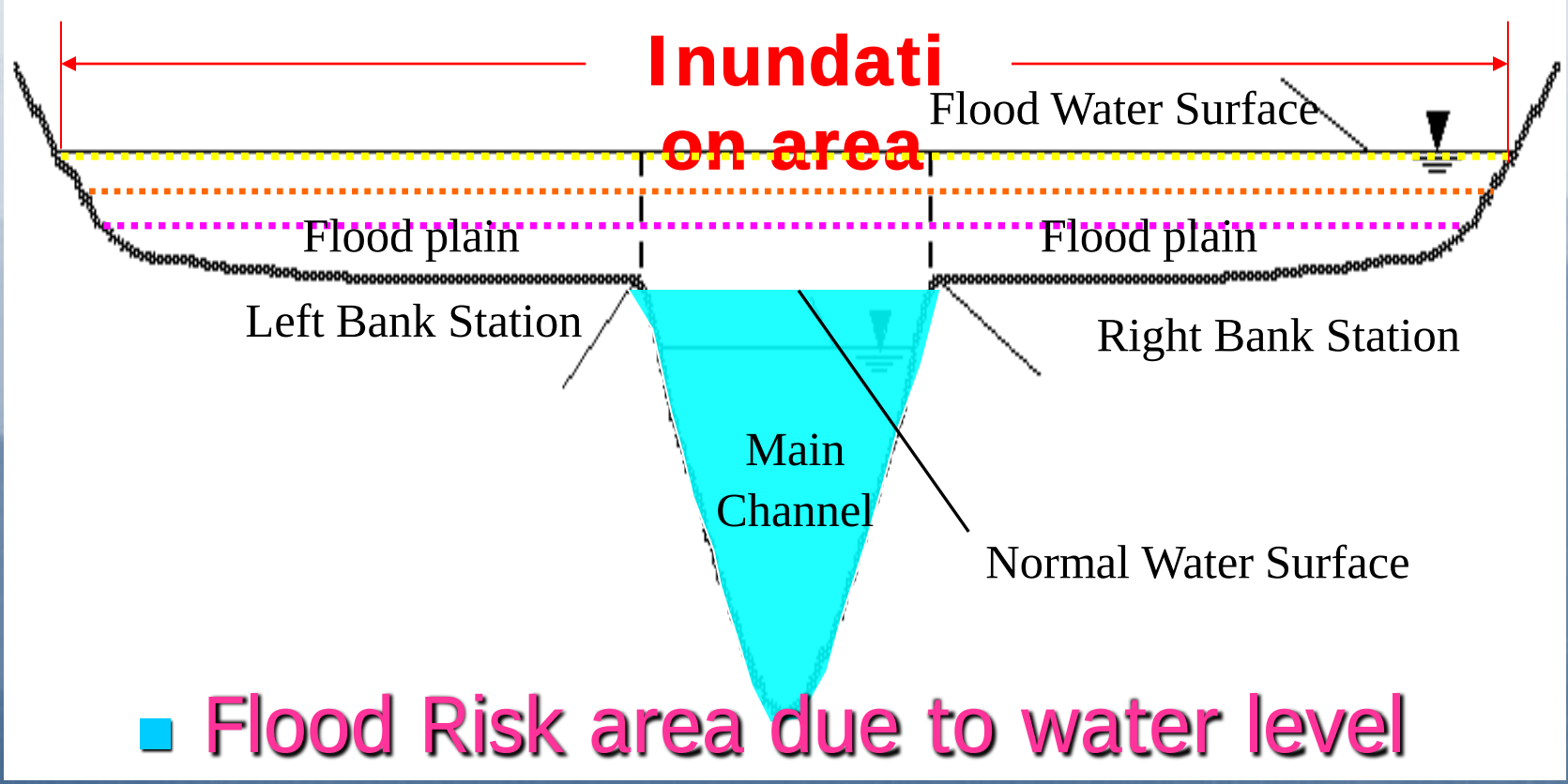
  “The Potential of Flood & Mud Flow may depend upon Flow Capability on the Surface of Topography”


Flood Hazard
Mapping
(FHM)

Flood Potential Conceptual Idea

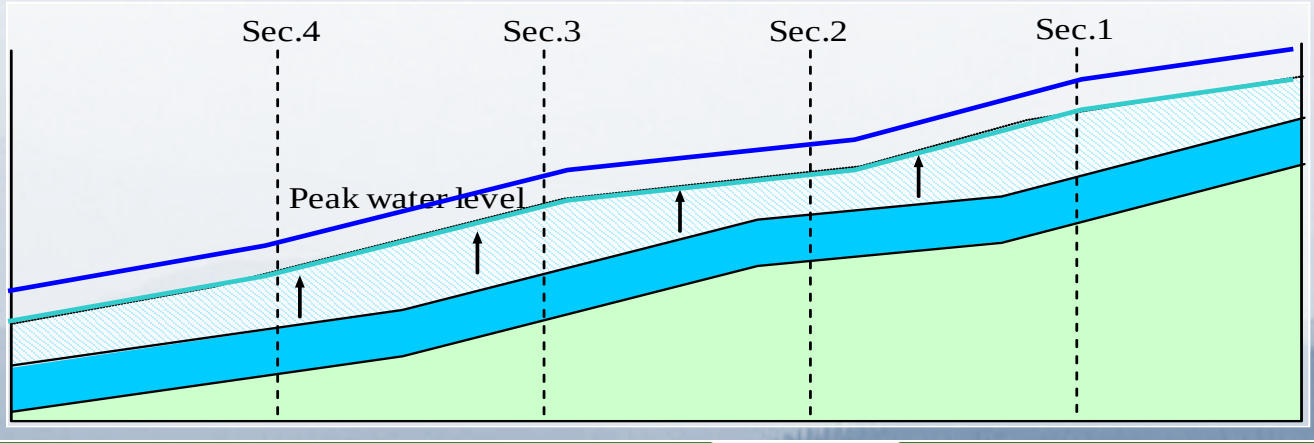


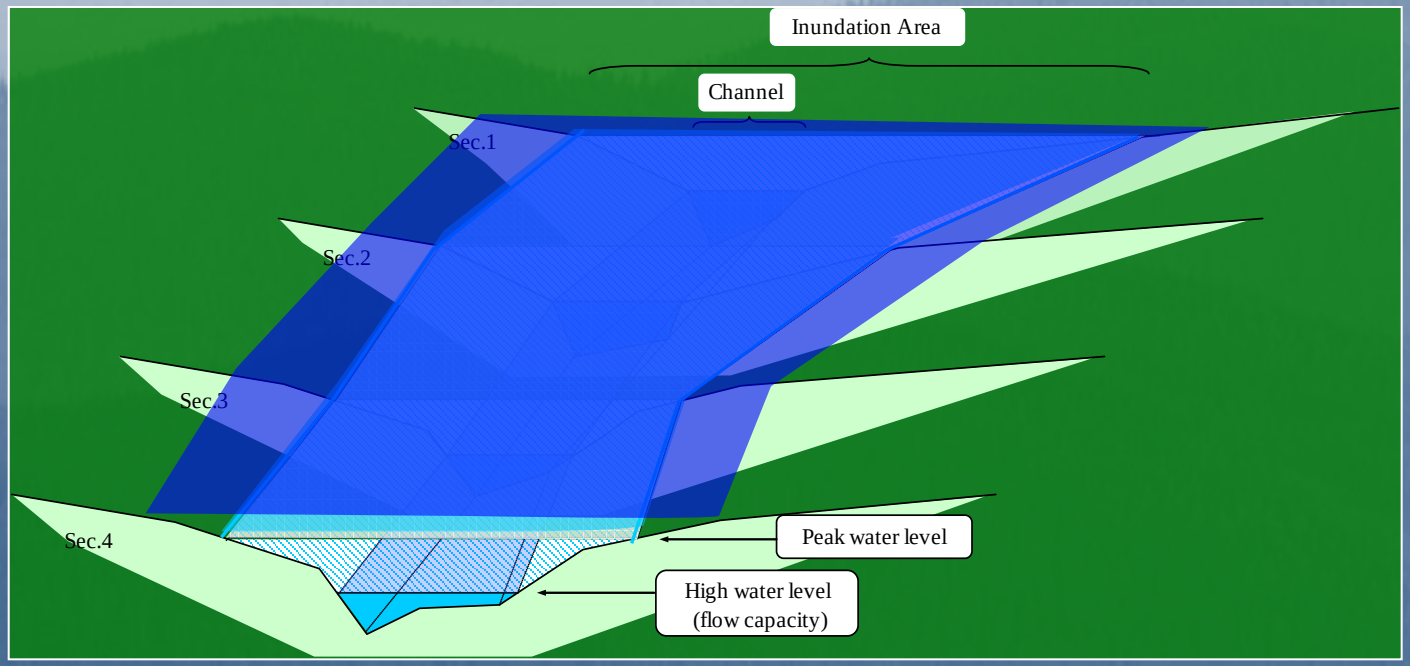
Flood Potential Conceptual Idea



- Flood Risk area due to water level

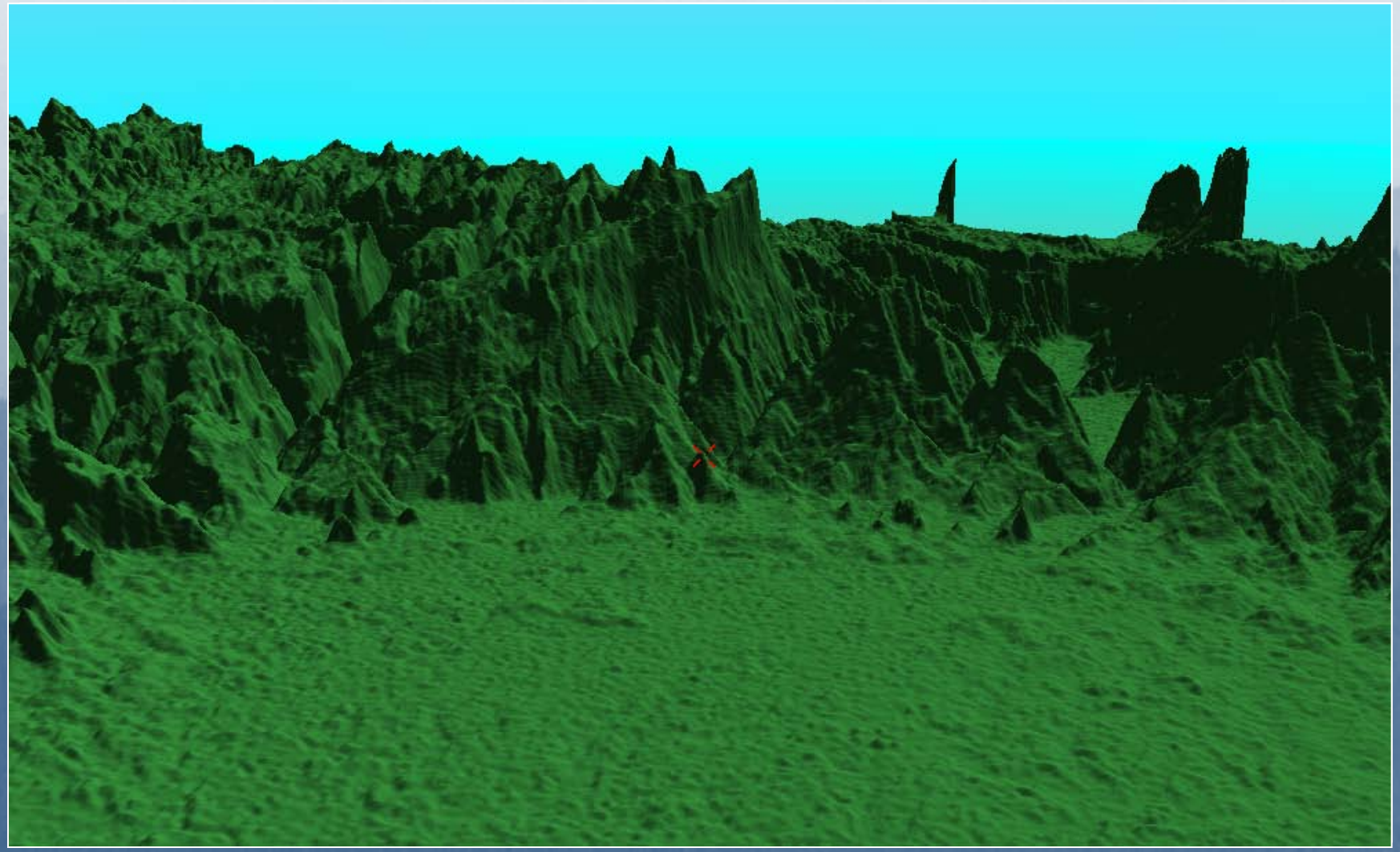
Flood Potential Conceptual Idea





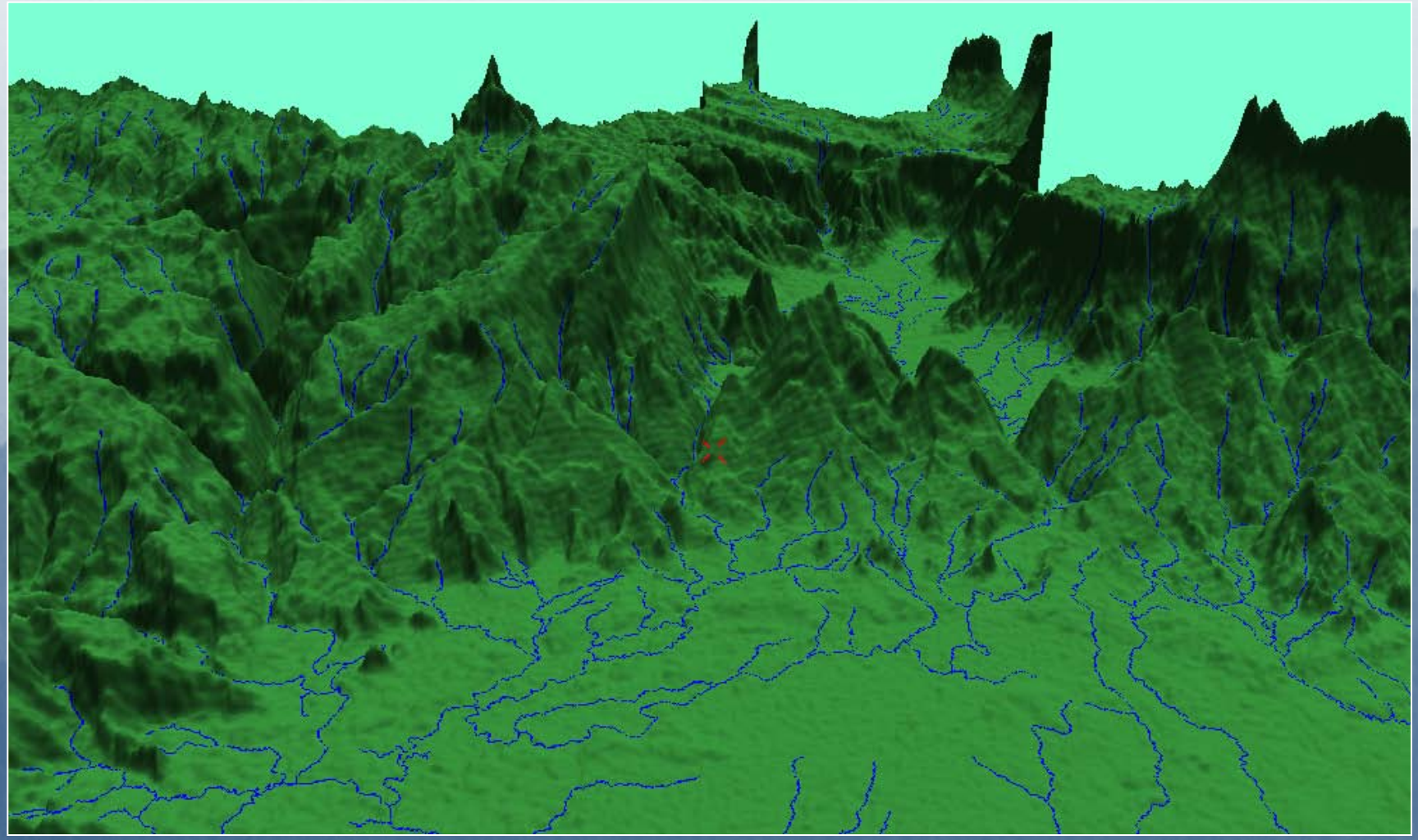
- **Rise up water level on the surface and then capture the boundary of inundation**

Topography



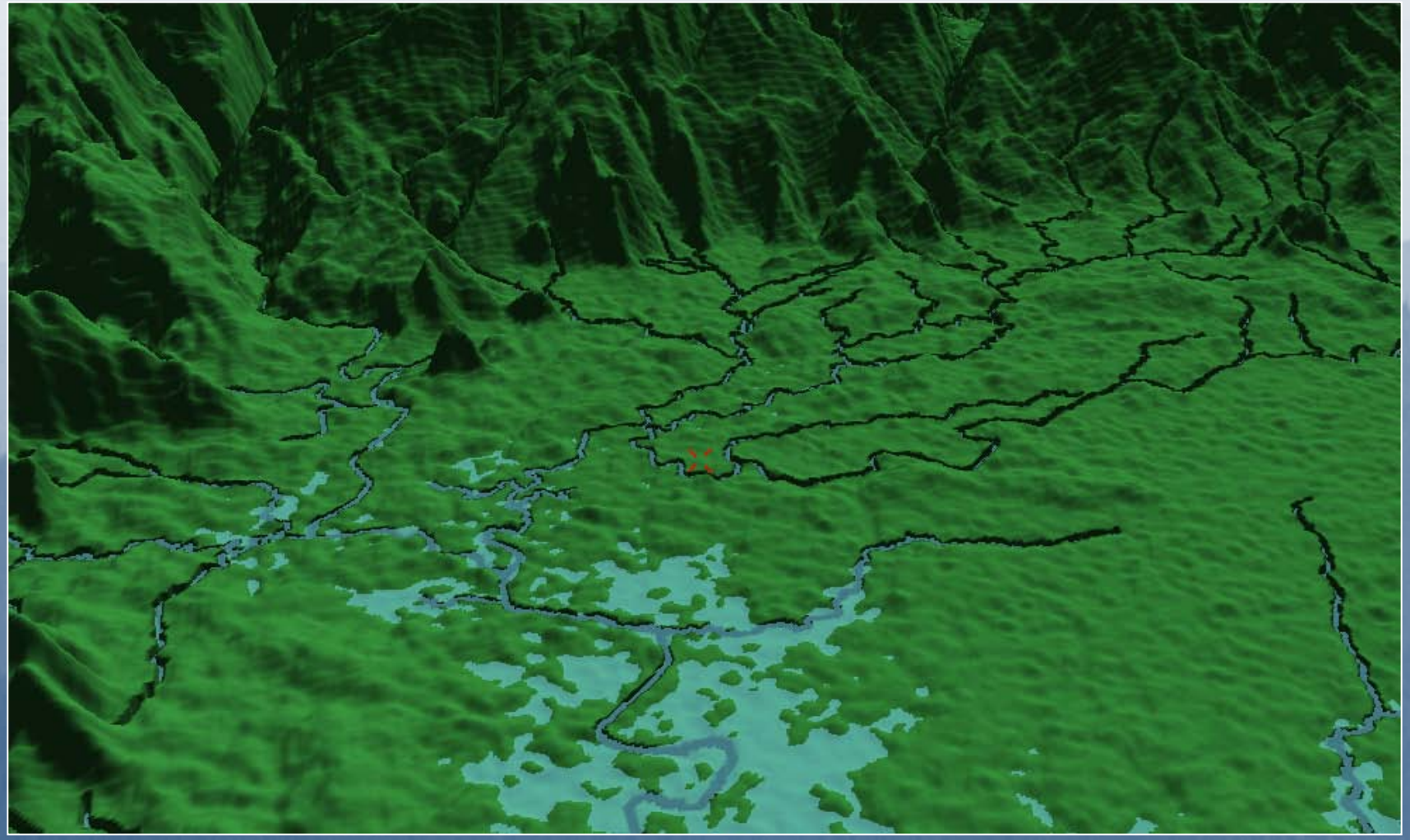
- **DATA**: Digital Elevation Model (DEM-3D view)

FHM Procedure



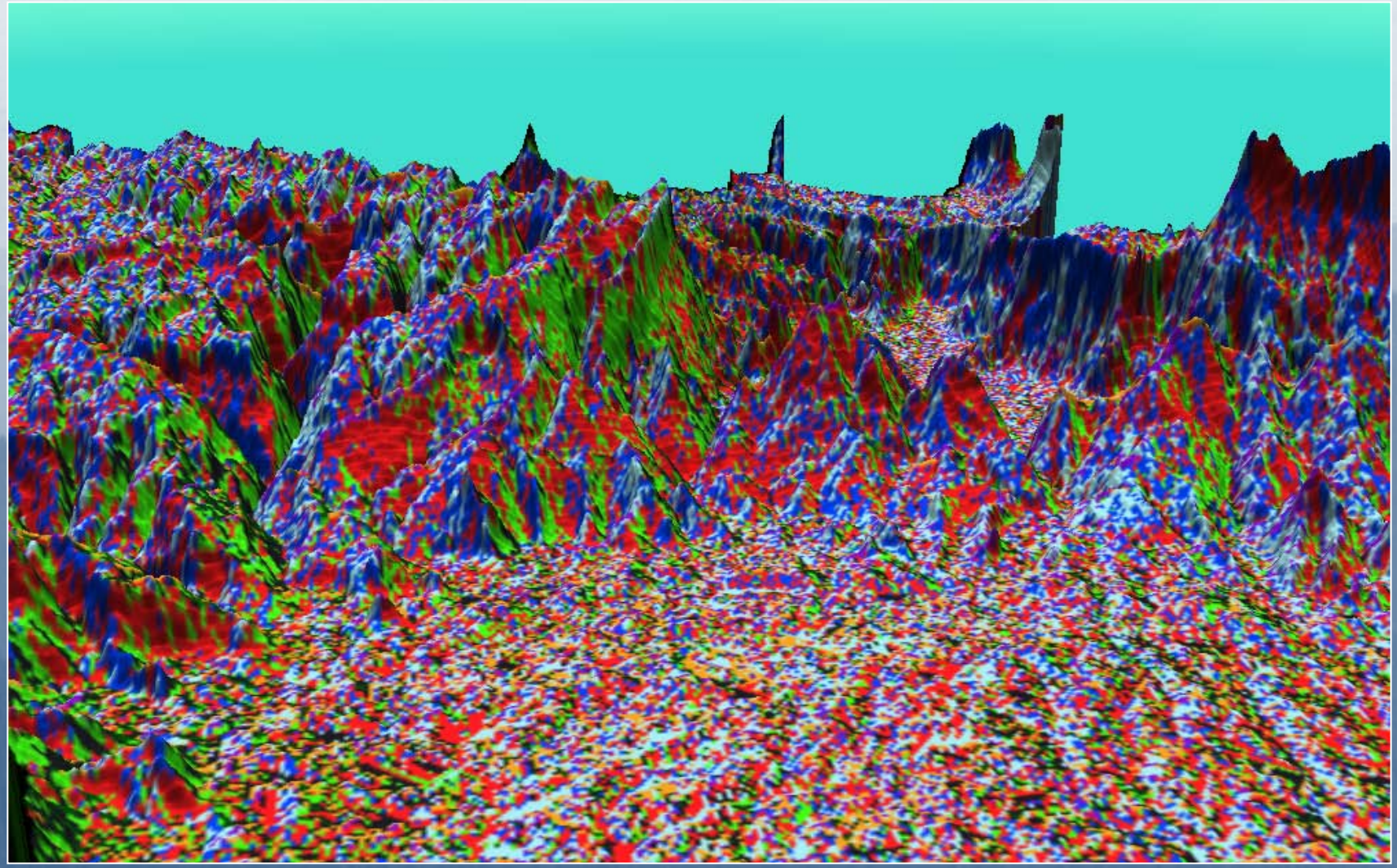
- **DATA**: Stream Line

FHM Procedure



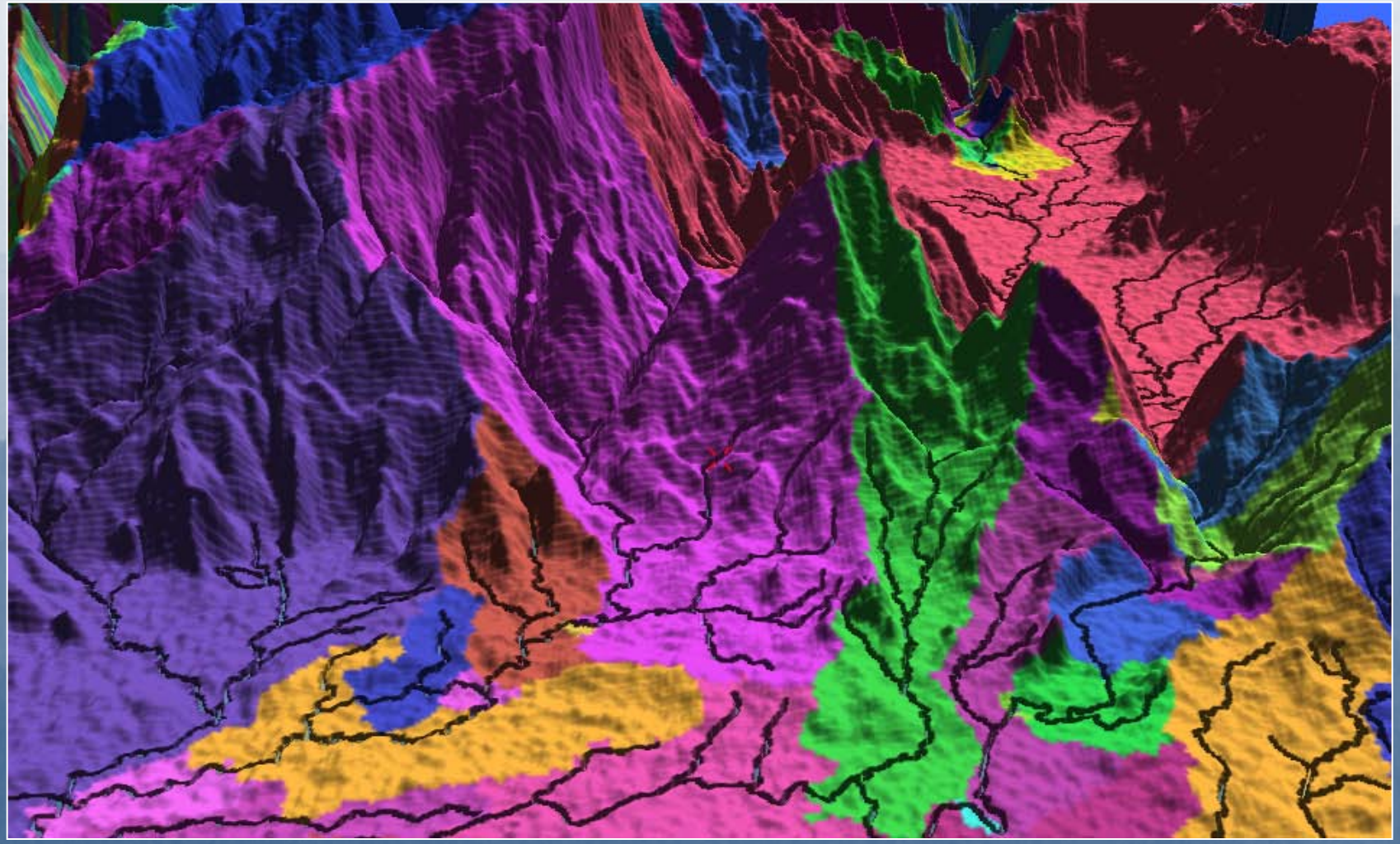
- Corrected Stream line on plain area of DEM

FHM Procedure



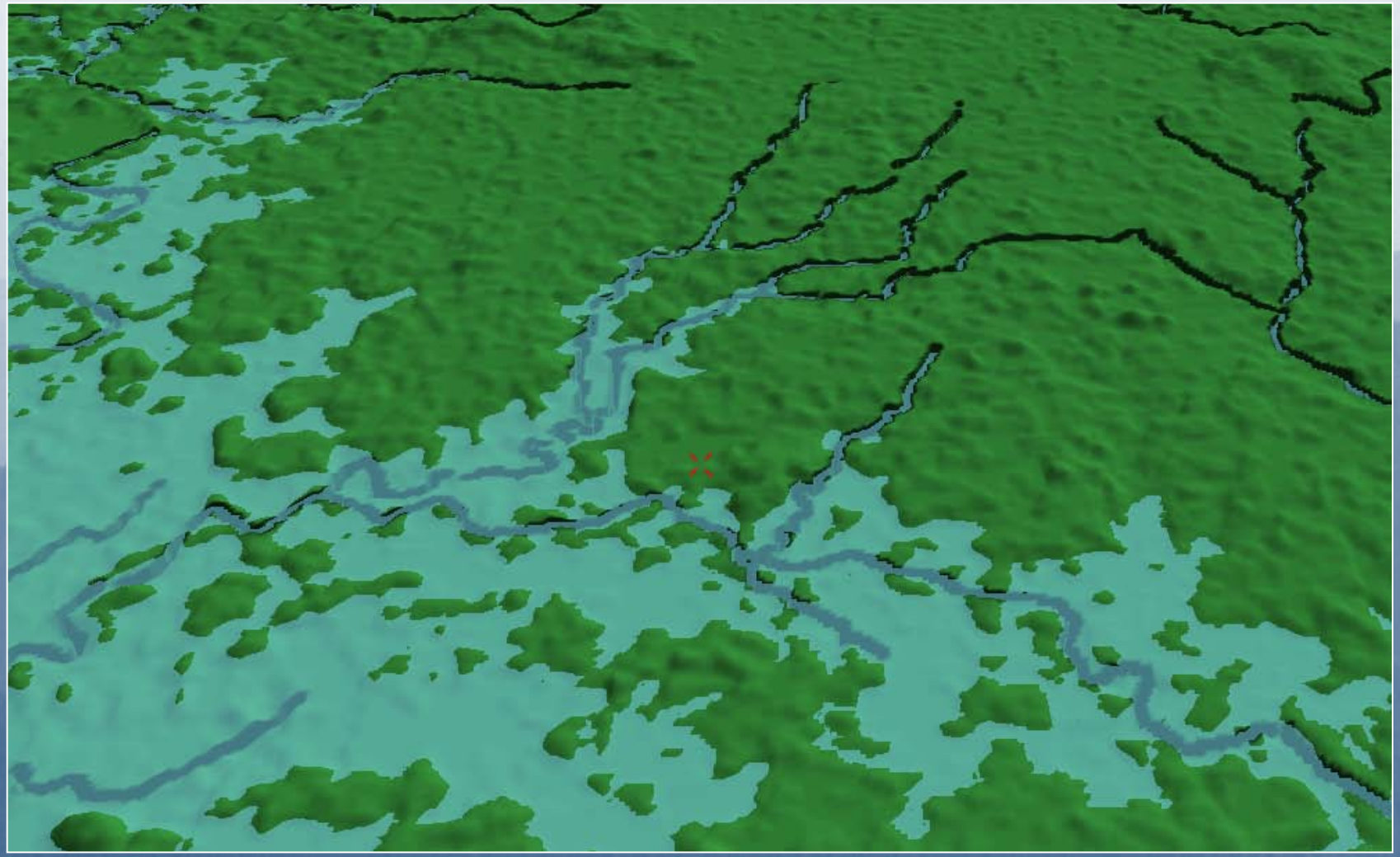
- **Hydrological Analysis : Flow Analysis**

FHM Procedure



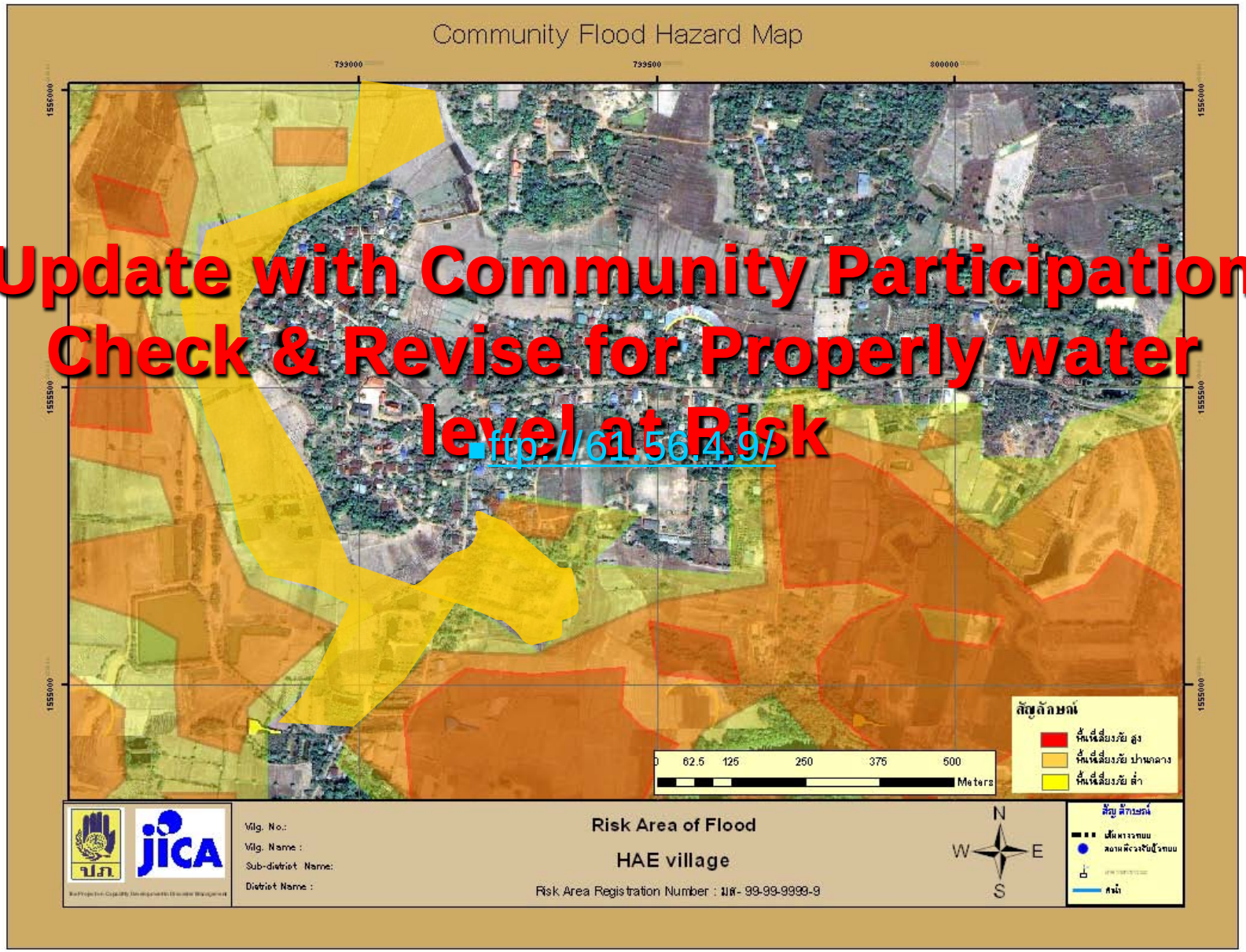
- **Hydrological analysis** :Lateral Watershed area analysis

FHM Procedure

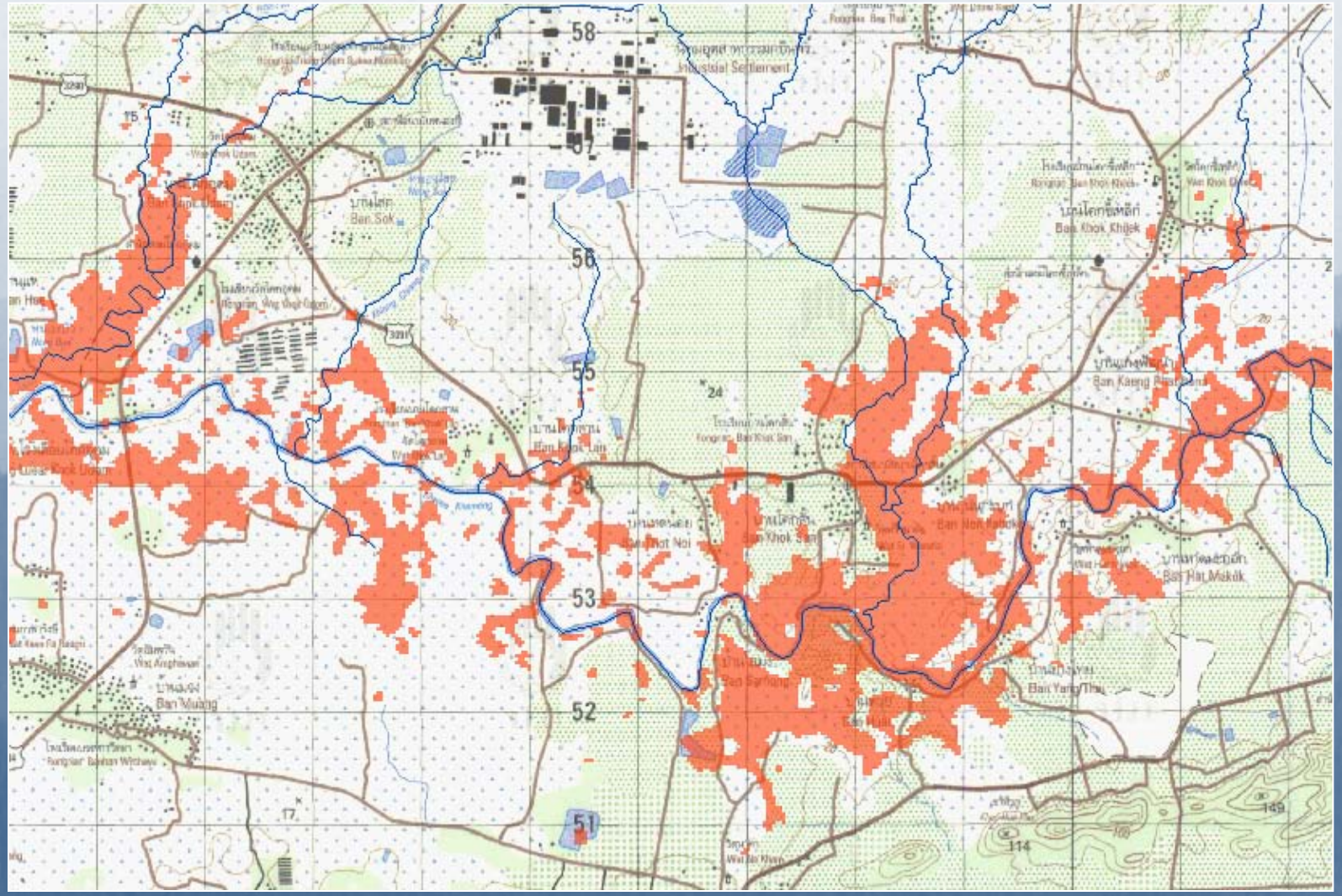


- Inundation Depth analysis

Update of Flood Hazard Map

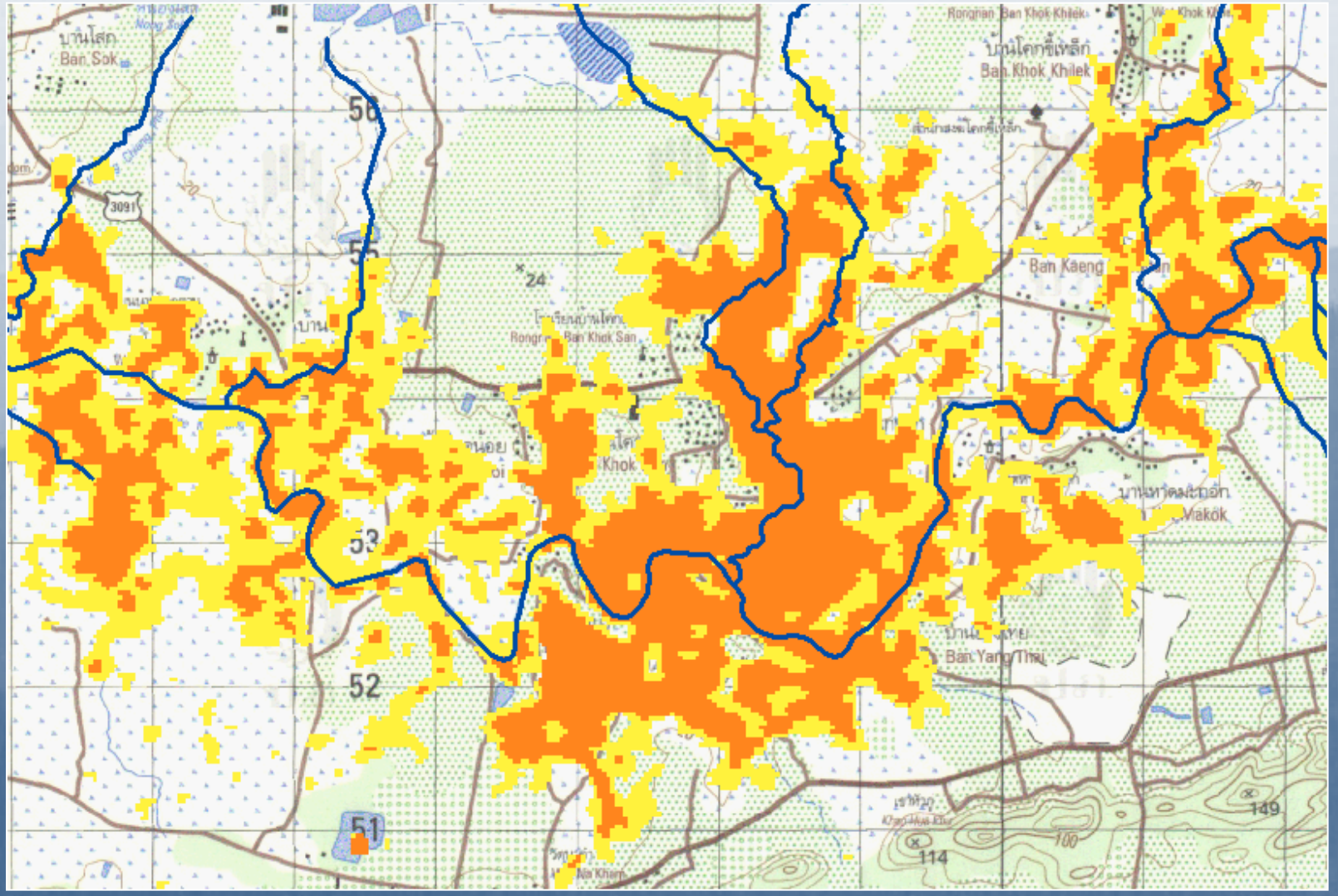


FHM Procedure



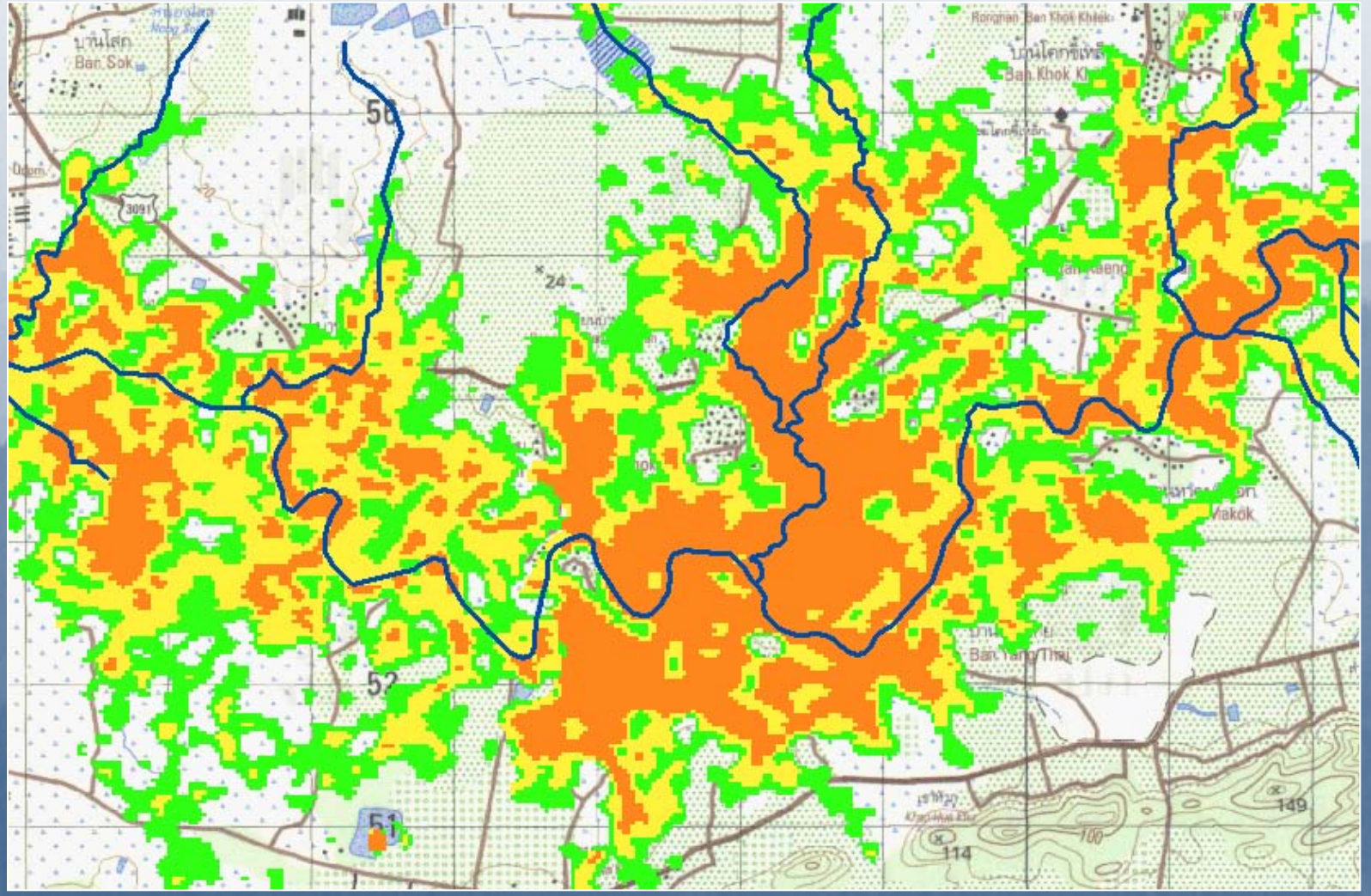
- Inundation area extraction

FHM Procedure



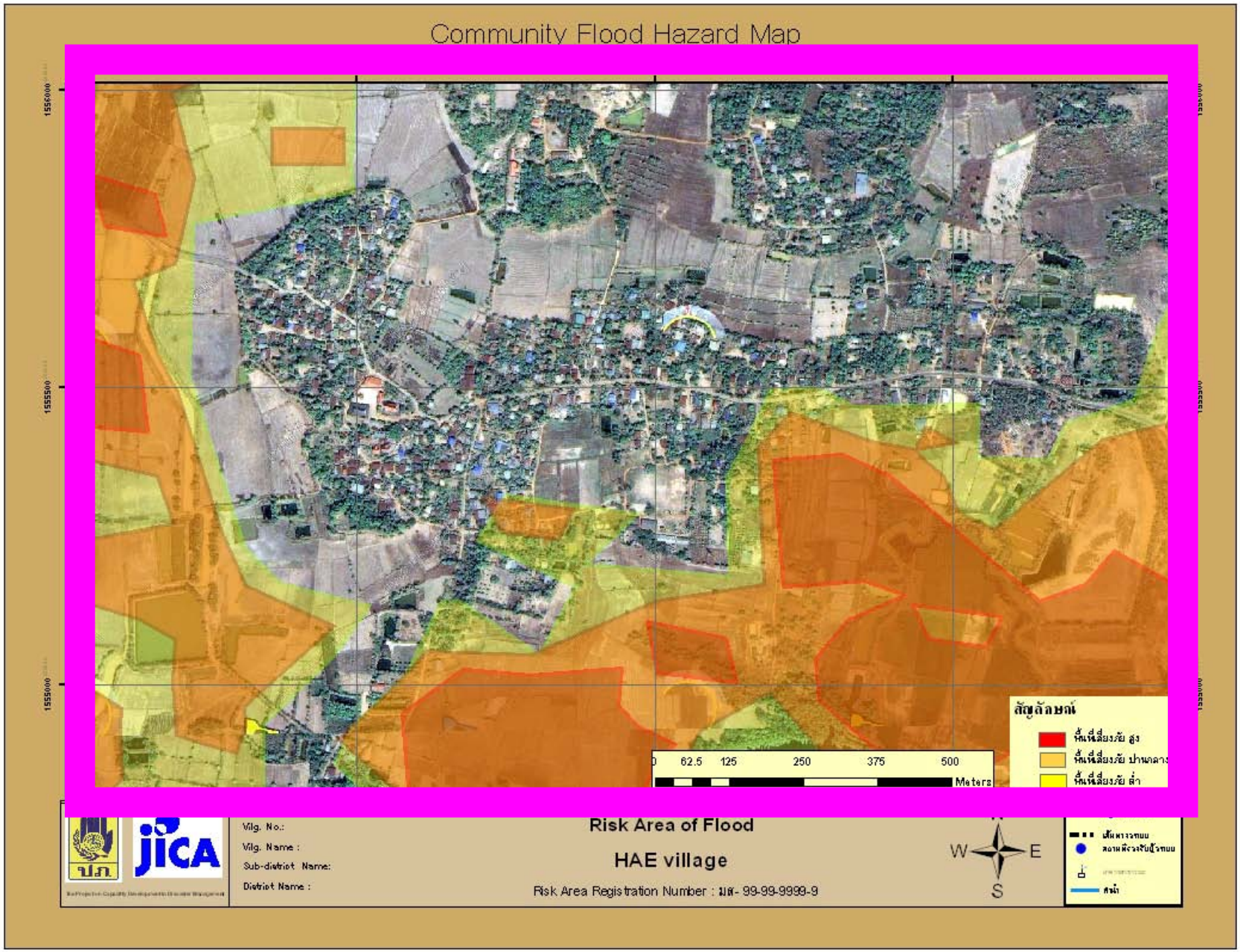
- Inundation area extraction of other water level

FHM Procedure

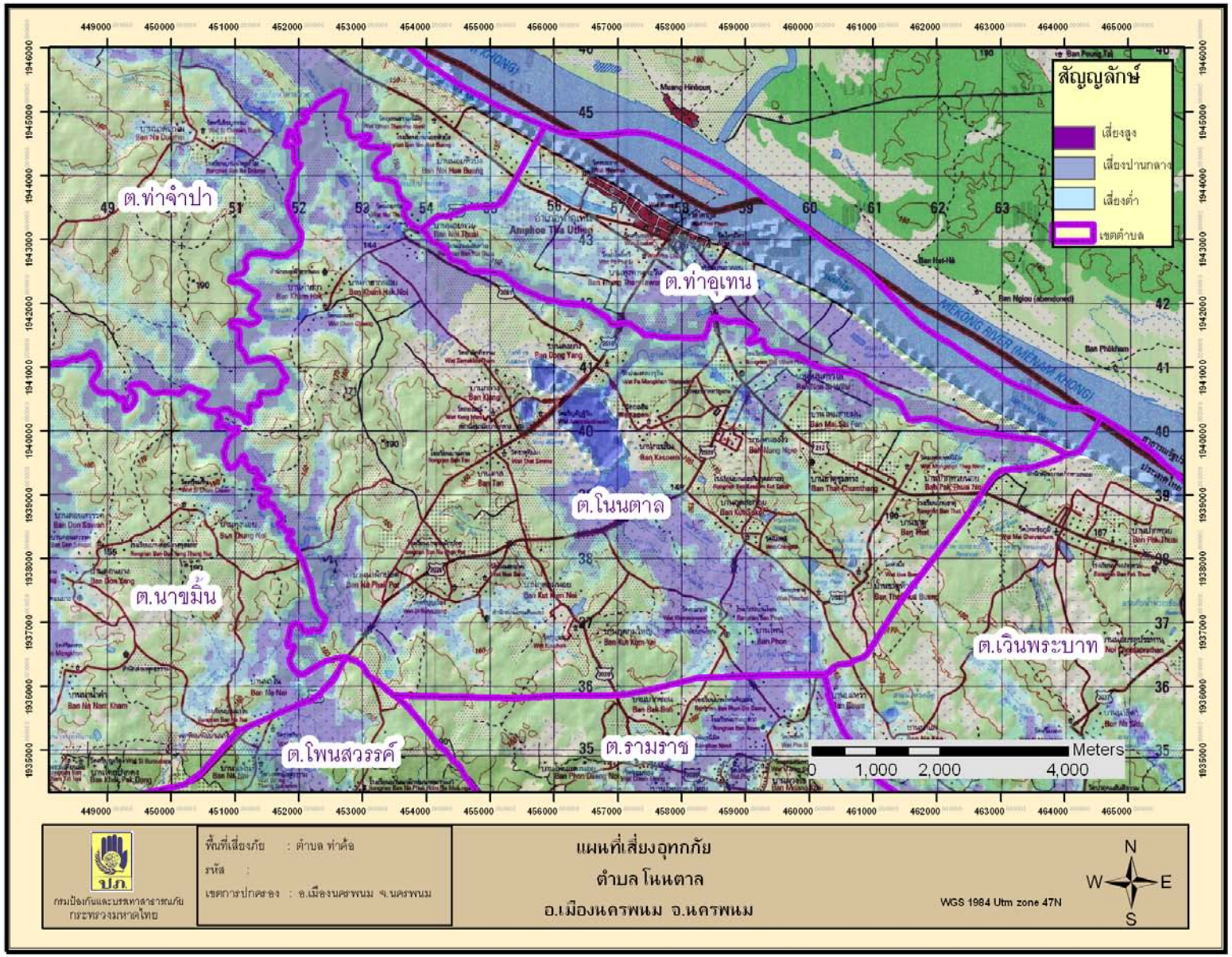


- Integrated Inundation area from each level to be Risk area

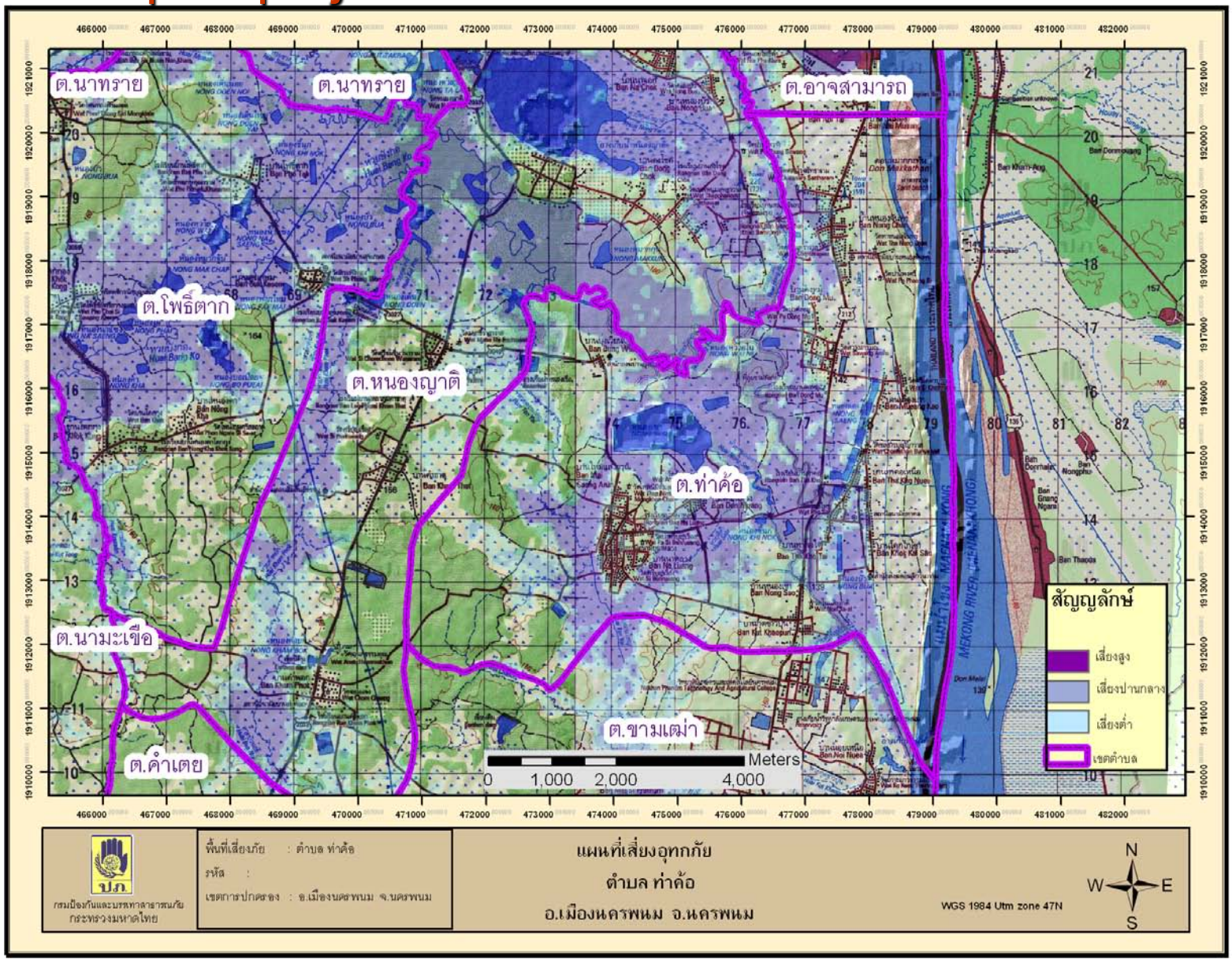
TAMBOL Flood hazard Map

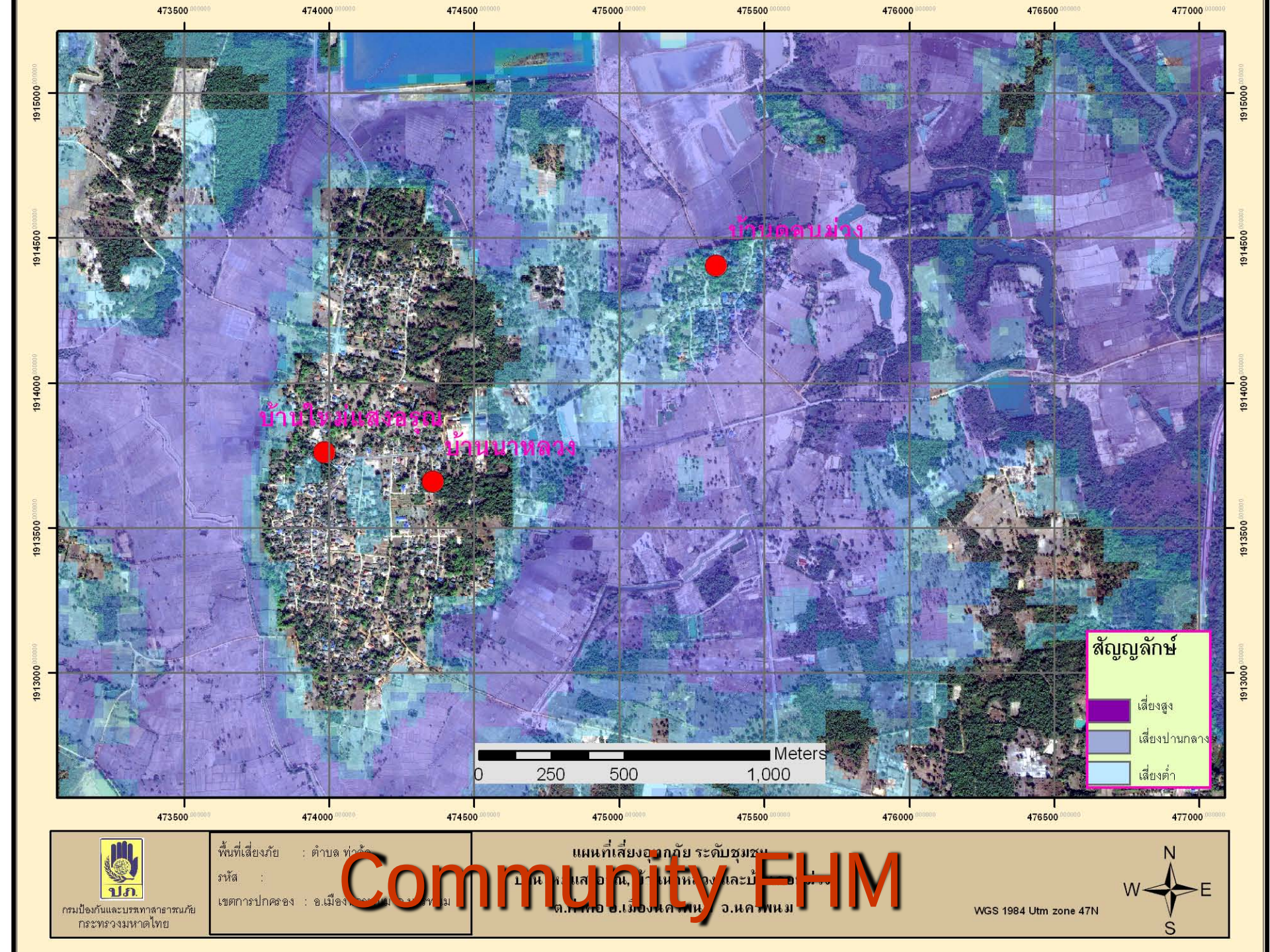


C4: pilot project NONTAL Sub - Districs FHM

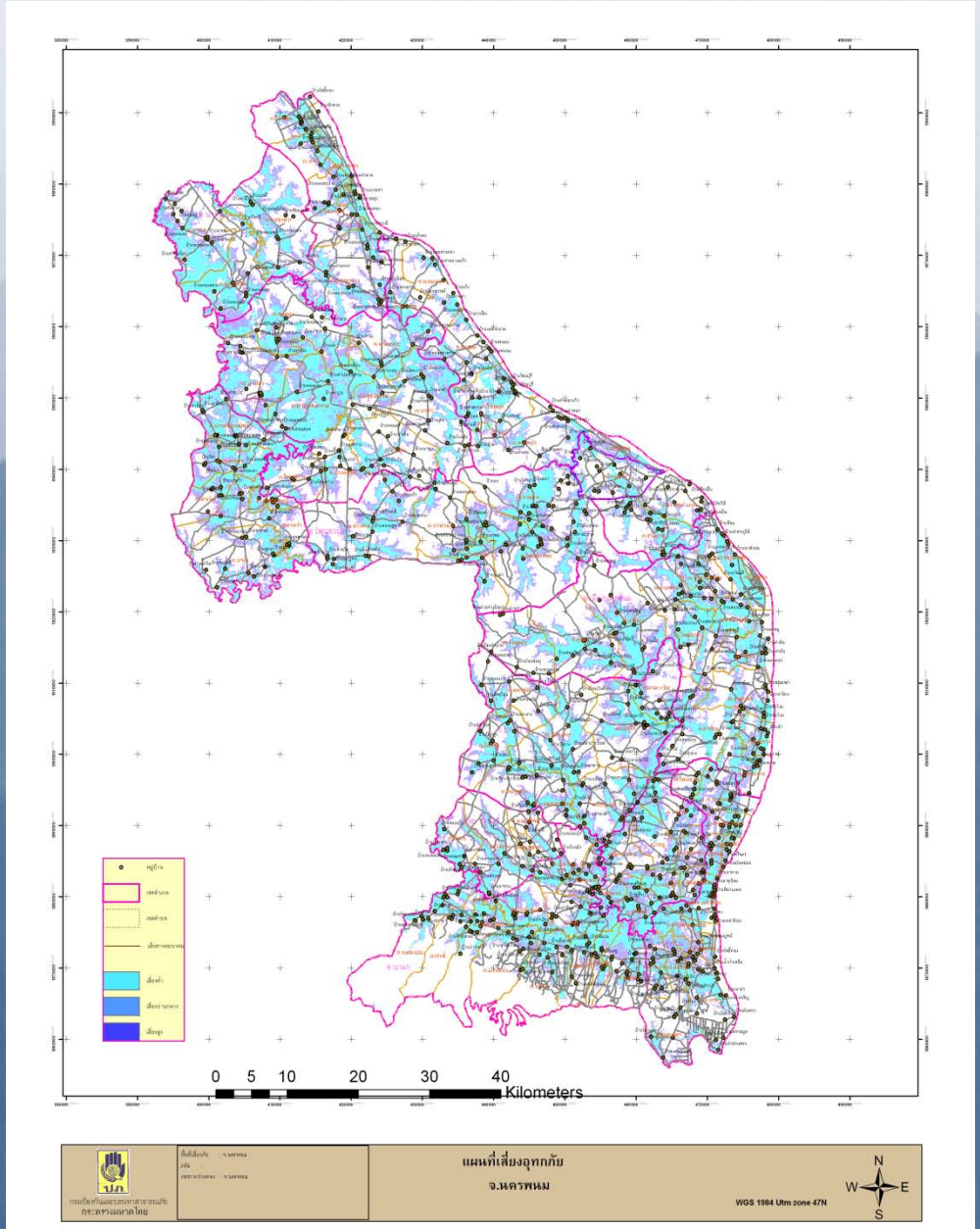


C4: pilot project THASKHO Sub - Districts FHM



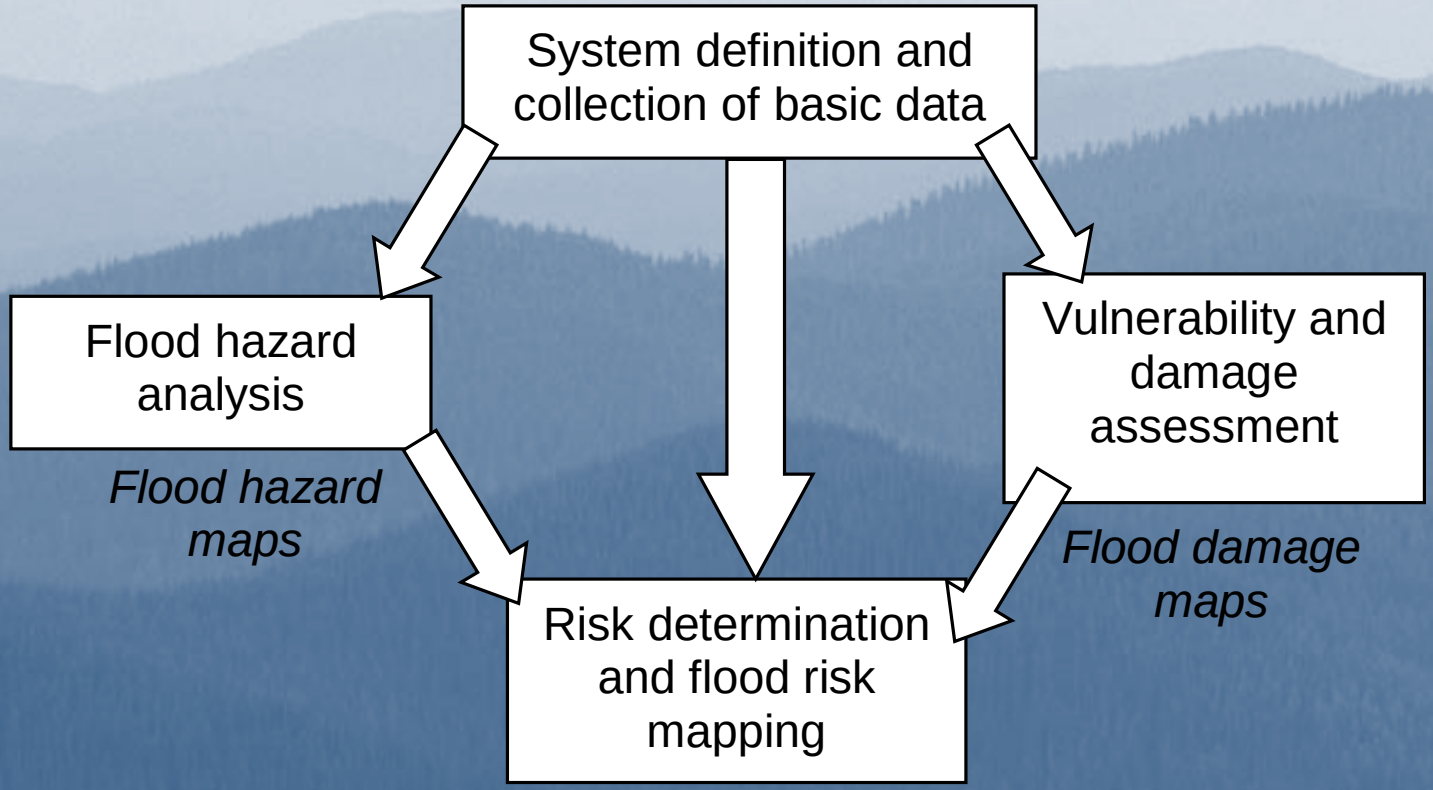


Nakhonphanom Province Flood hazard Map



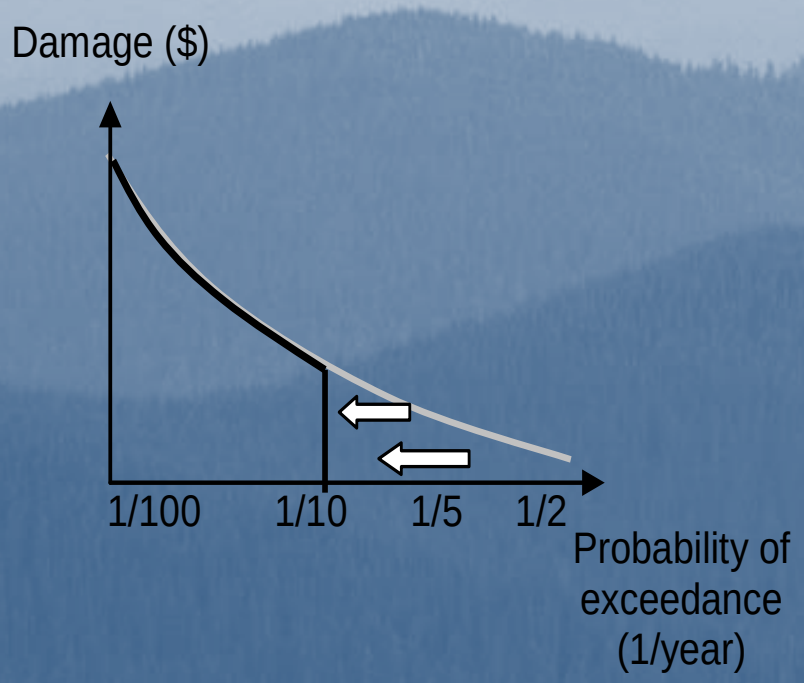
The Implementation of Hazard map

FLOOD RISK ASSESSMENT

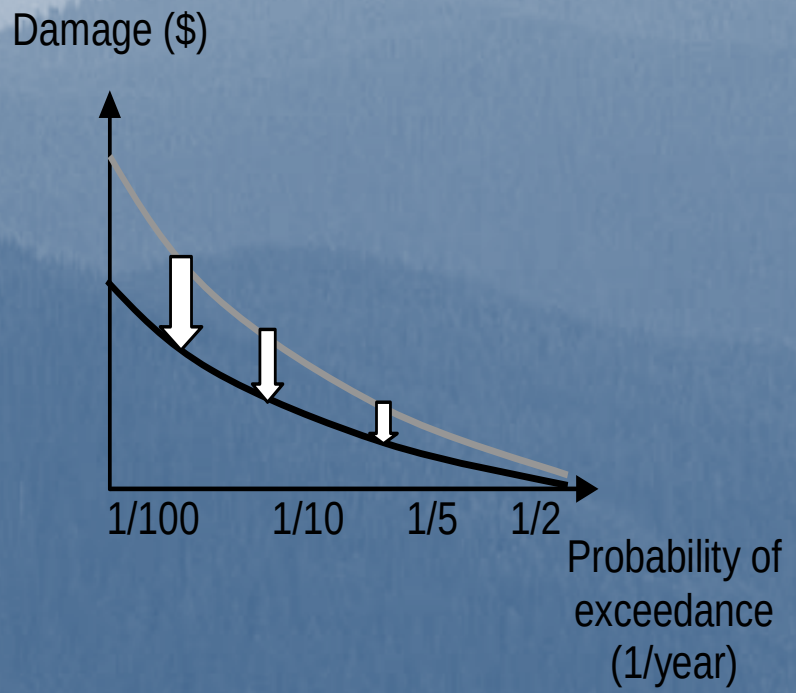


APPLICATION

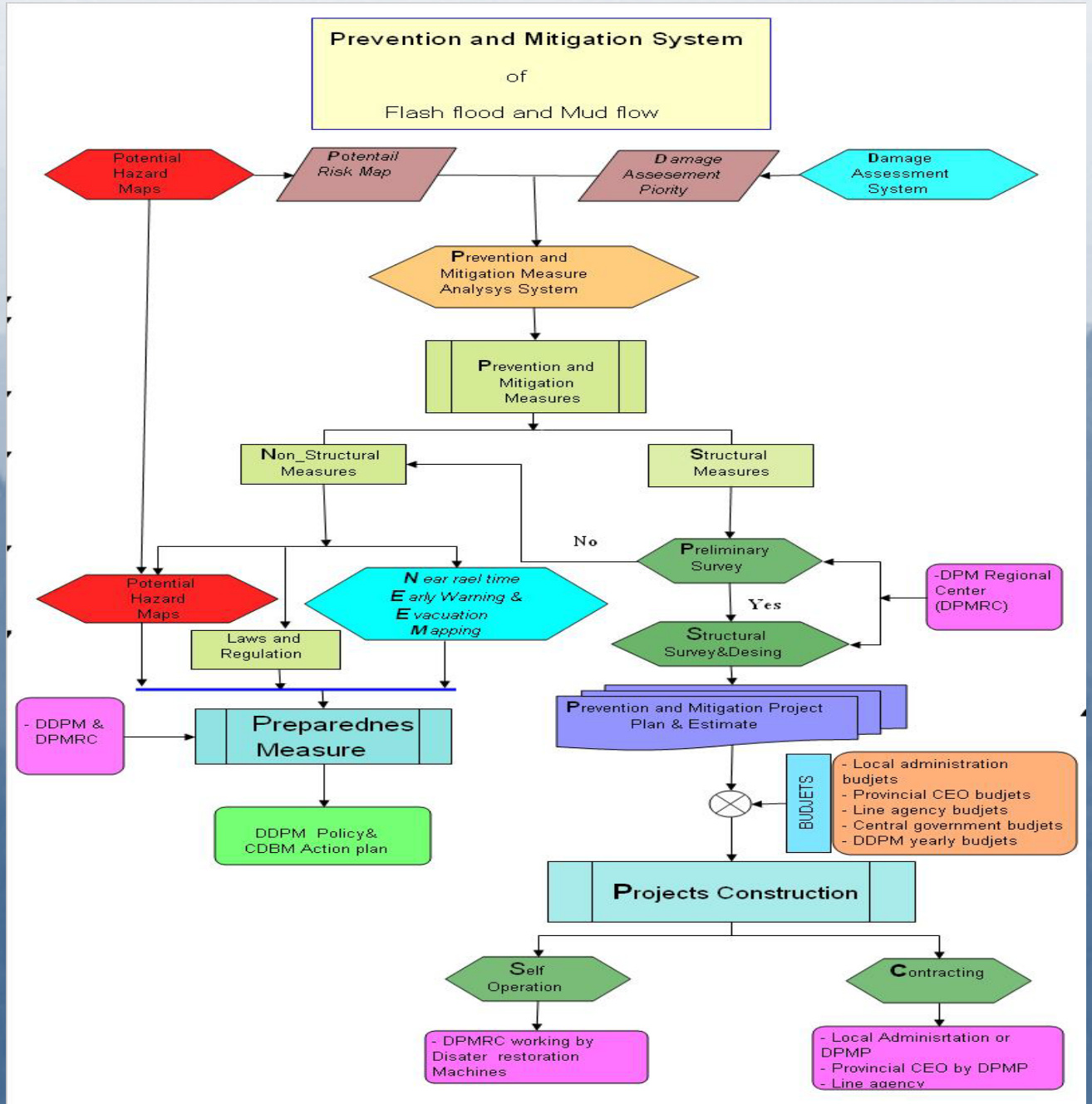
Reduction of probability



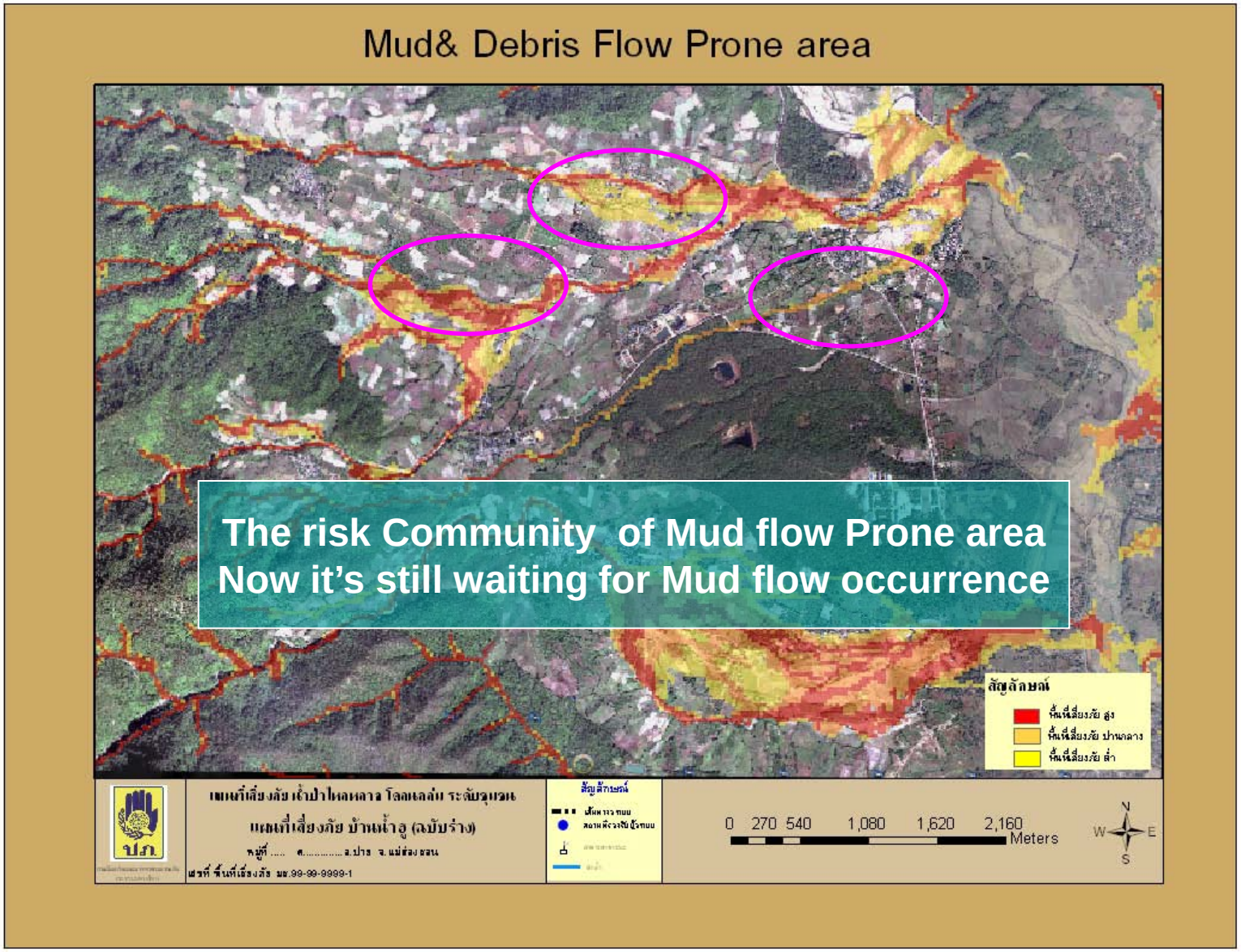
Reduction of consequences



Prevention & Mitigation Frame work



Many community waiting for Mud flow occurrence



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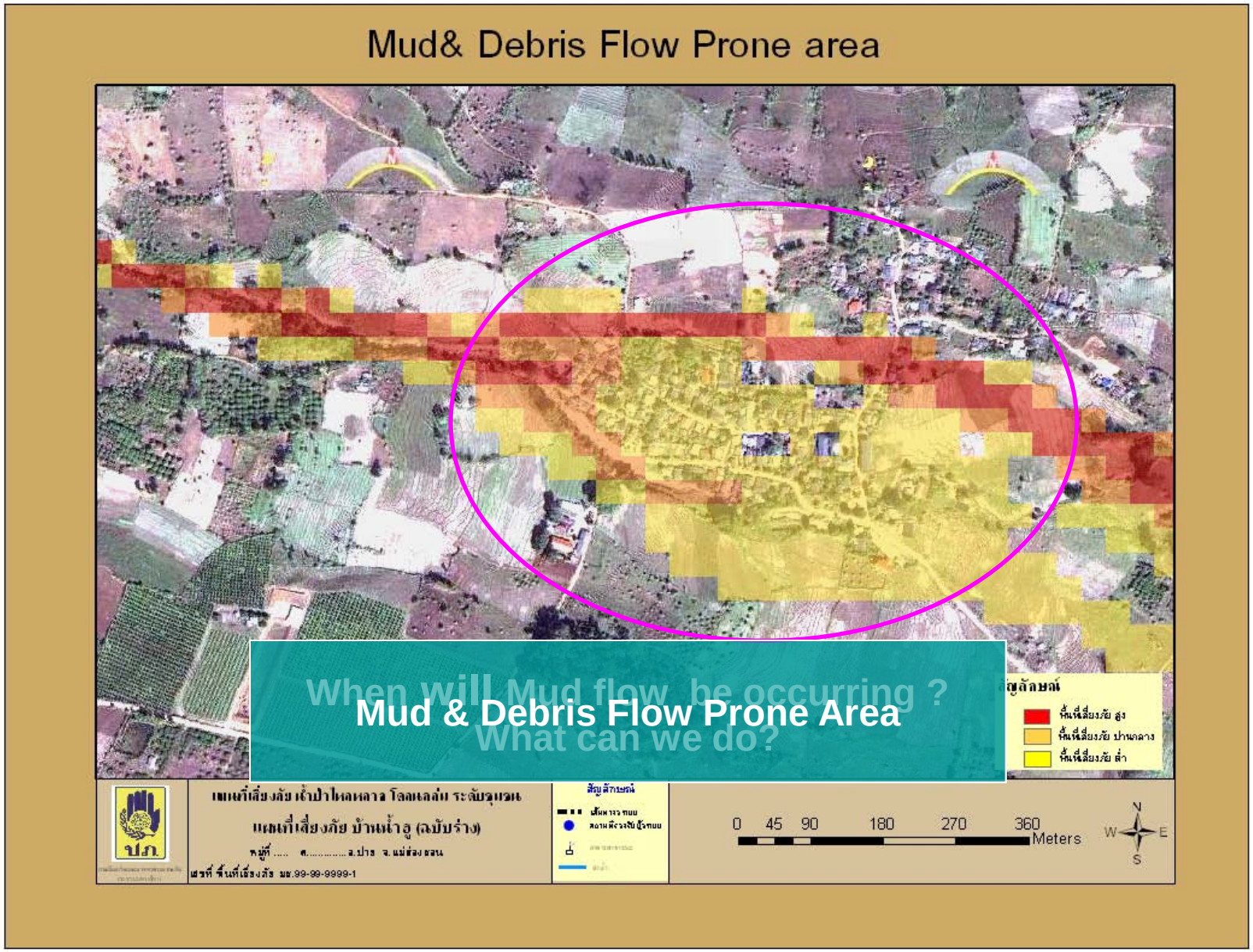
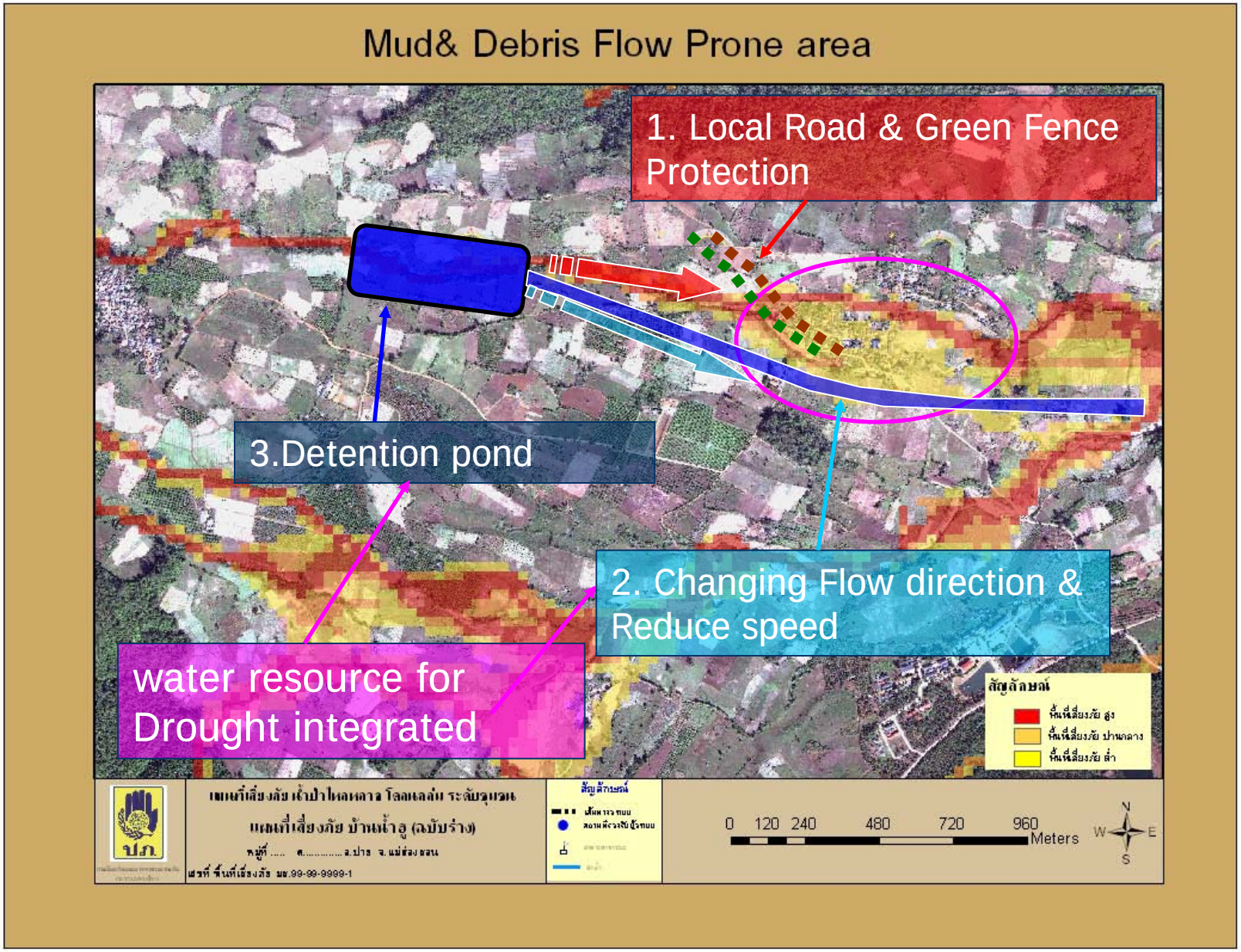


Structural Measures Implemented

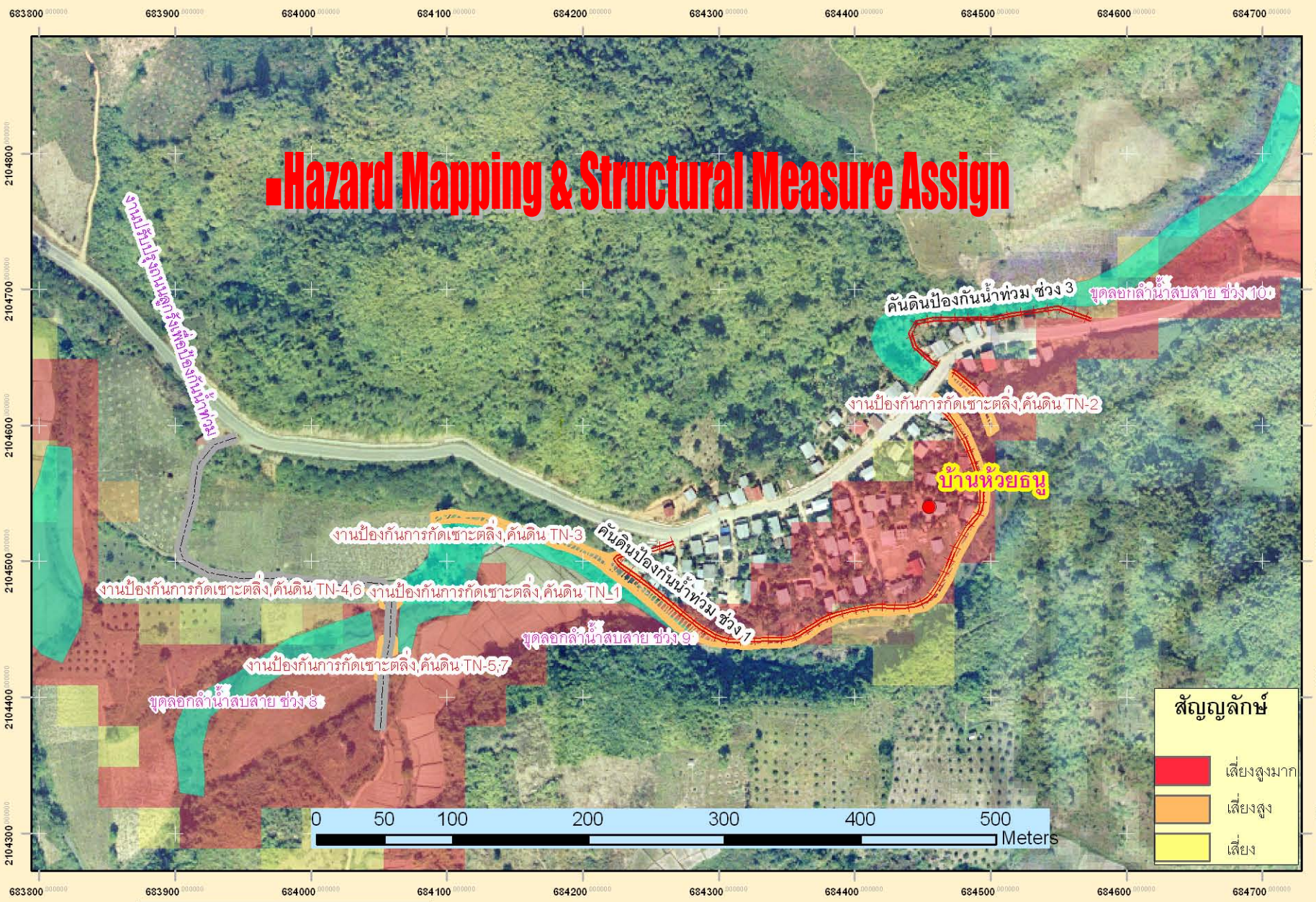


The implementation of FFHM on prevention and mitigation with structural measure 2011 Pilot Project (80m฿)

7 concepts preparation

- Hazard Mapping
- Structural Measure preliminary consideration
- Provincial Meeting
- Local Administration Meeting
- Public Hearing
- Construction surveying and design
- Integrated into Local development plan

2008 Mud flow event



พื้นที่เสี่ยงภัย : บ้านห้วยธนู

รหัส : นน.01-060509

เขตการปกครอง : ต.ตาลชุม อ.ท่าวังผา จ.น่าน

การประยุกต์ใช้แผนที่เสี่ยงภัยน้ำป่าไหลหลากและโคลนถล่ม

: มาตรการป้องกันและลดผลกระทบ โดยใช้โครงสร้าง

WGS 1984 Utm zone 47N

N W E S

Provincial Meeting

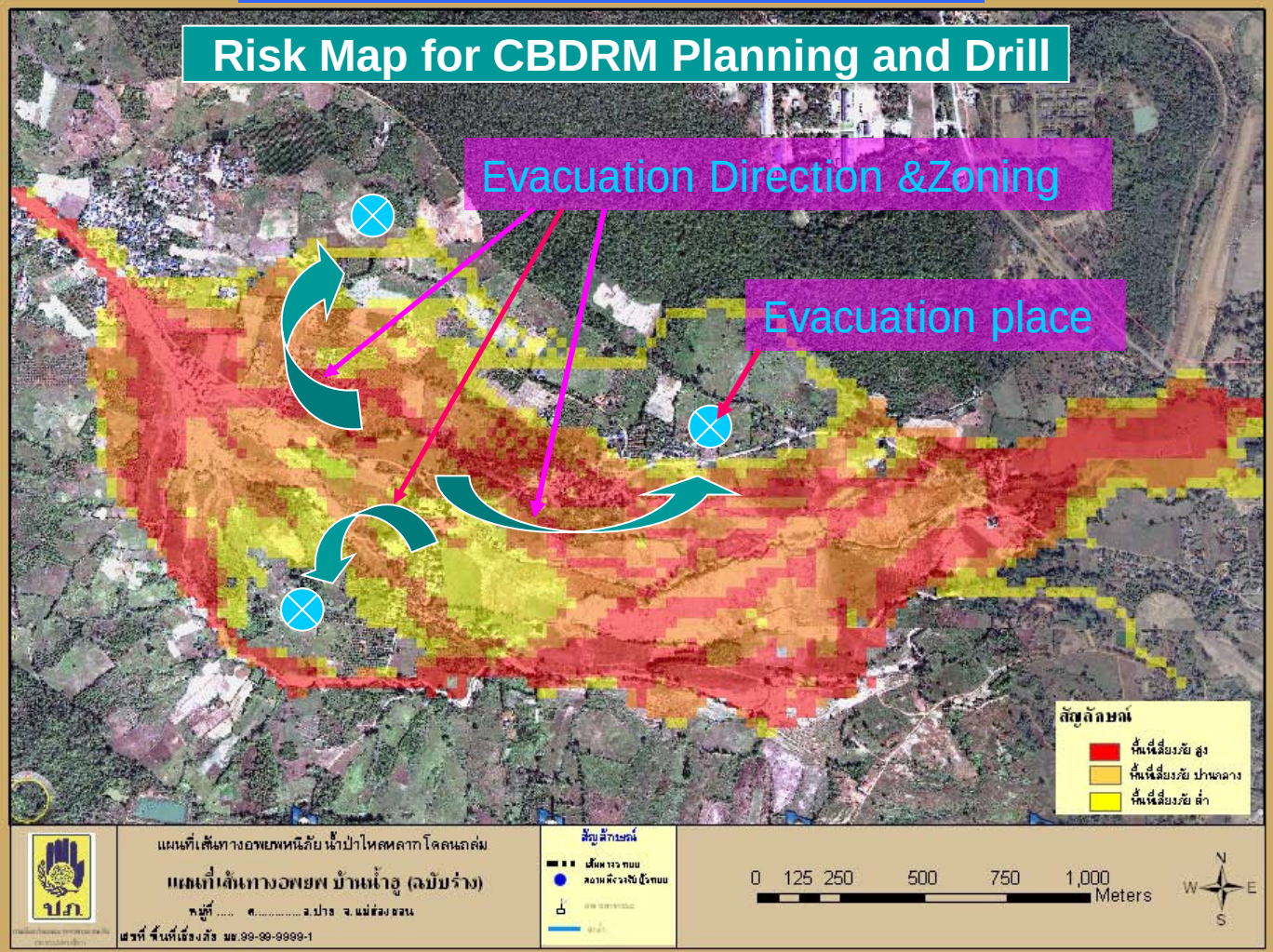
Local cabinet & community Leader meeting

Site Visiting and Interview with Community Leader

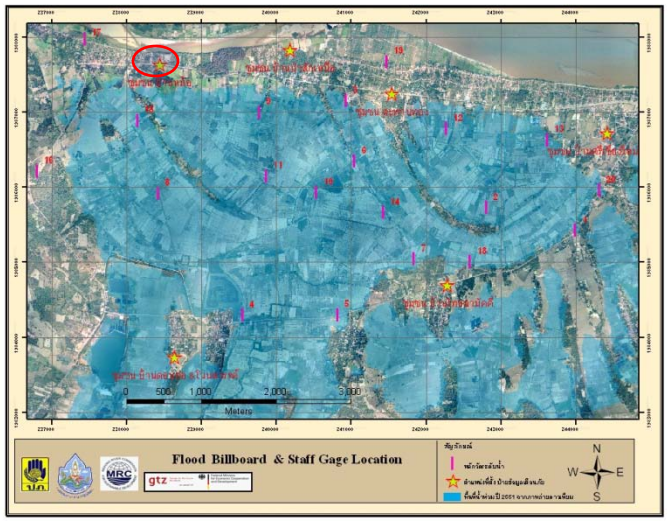
Public Hearing

Non-Structural Measure Implemented

Preparedness system



Flood billboard MRC:C5



Mekong River Commission (MRC) Project

:Flood Management and Mitigation Programme

:Component 5 (FMMP-C5) : Land Management

Executed by : MRC, GTZ , DWR, DDPM & PDPM

Funded by : Germany

10.00

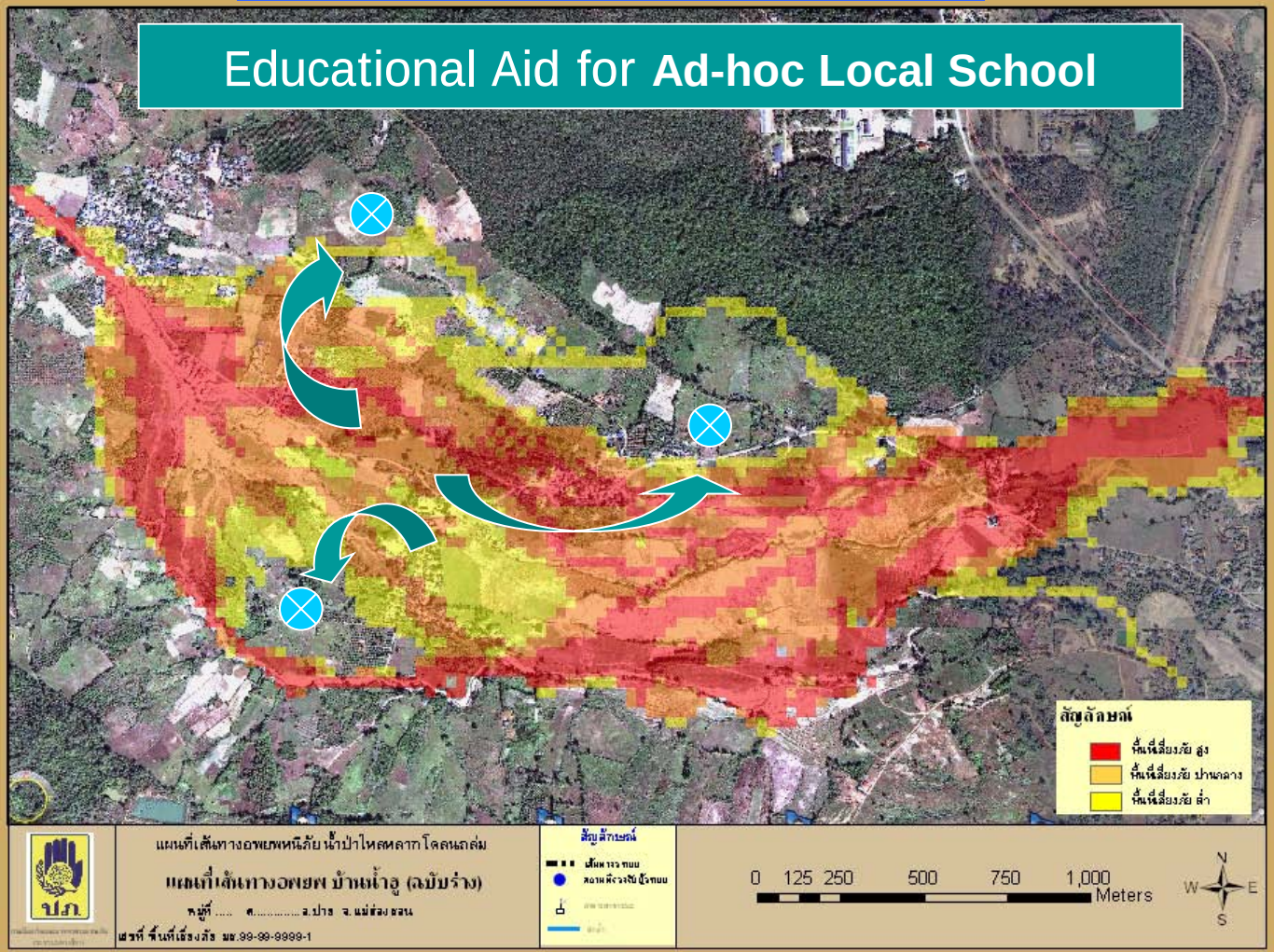
10.74

12.30

(xx.xx.xx)

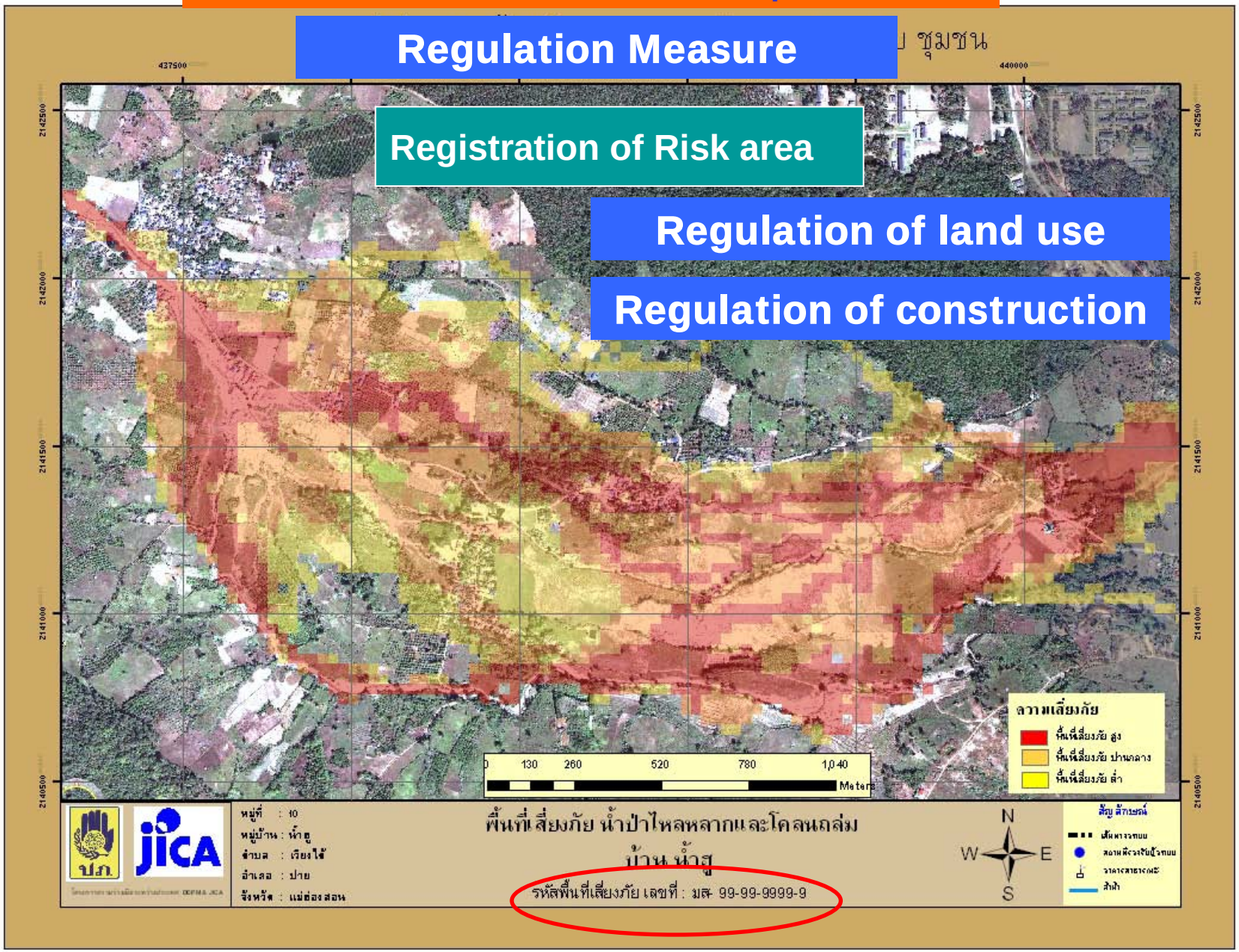
Non-Structural Measure Implemented

Preparedness system

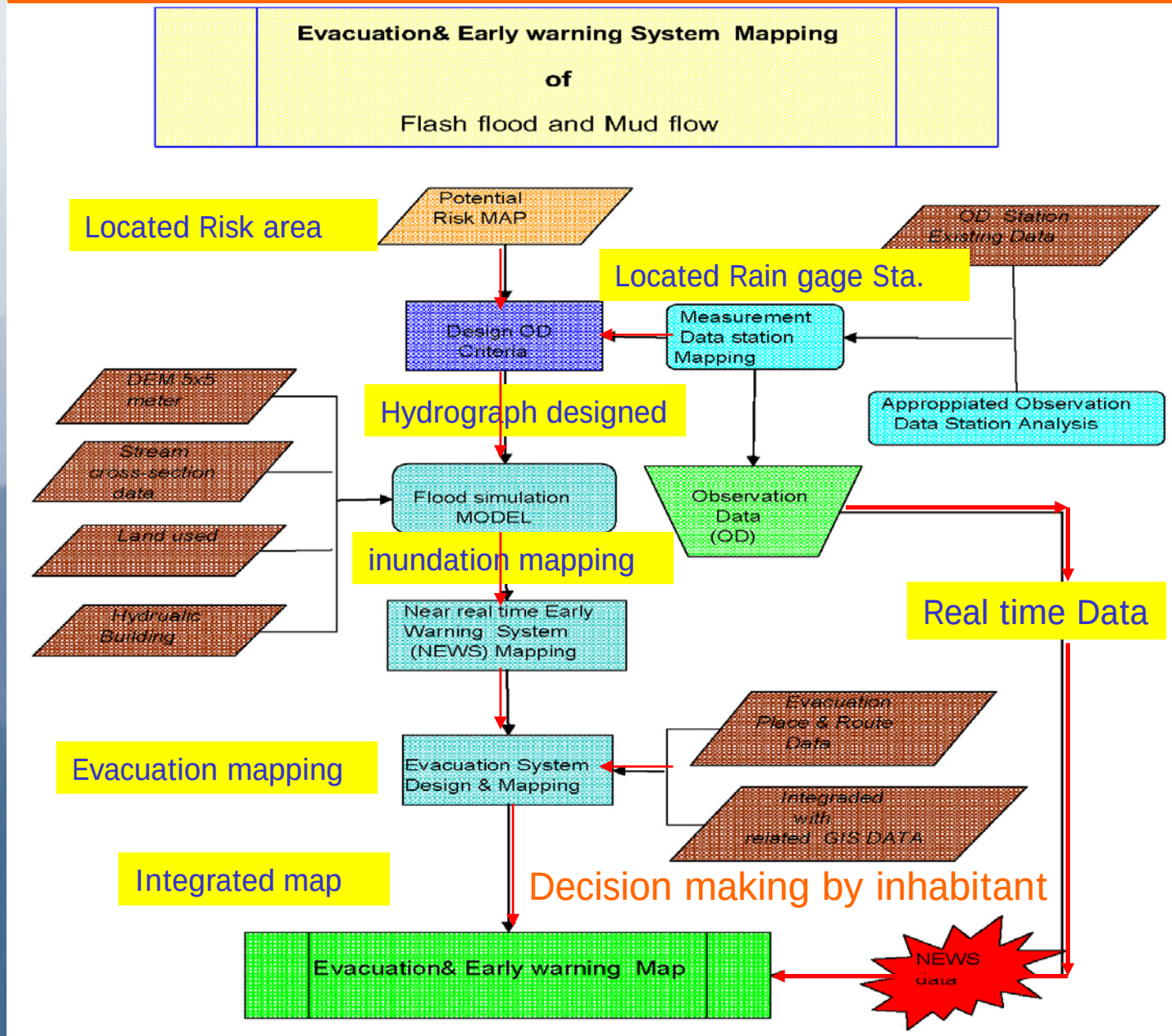


Non-Structural Measure Implement

Regulation Measure

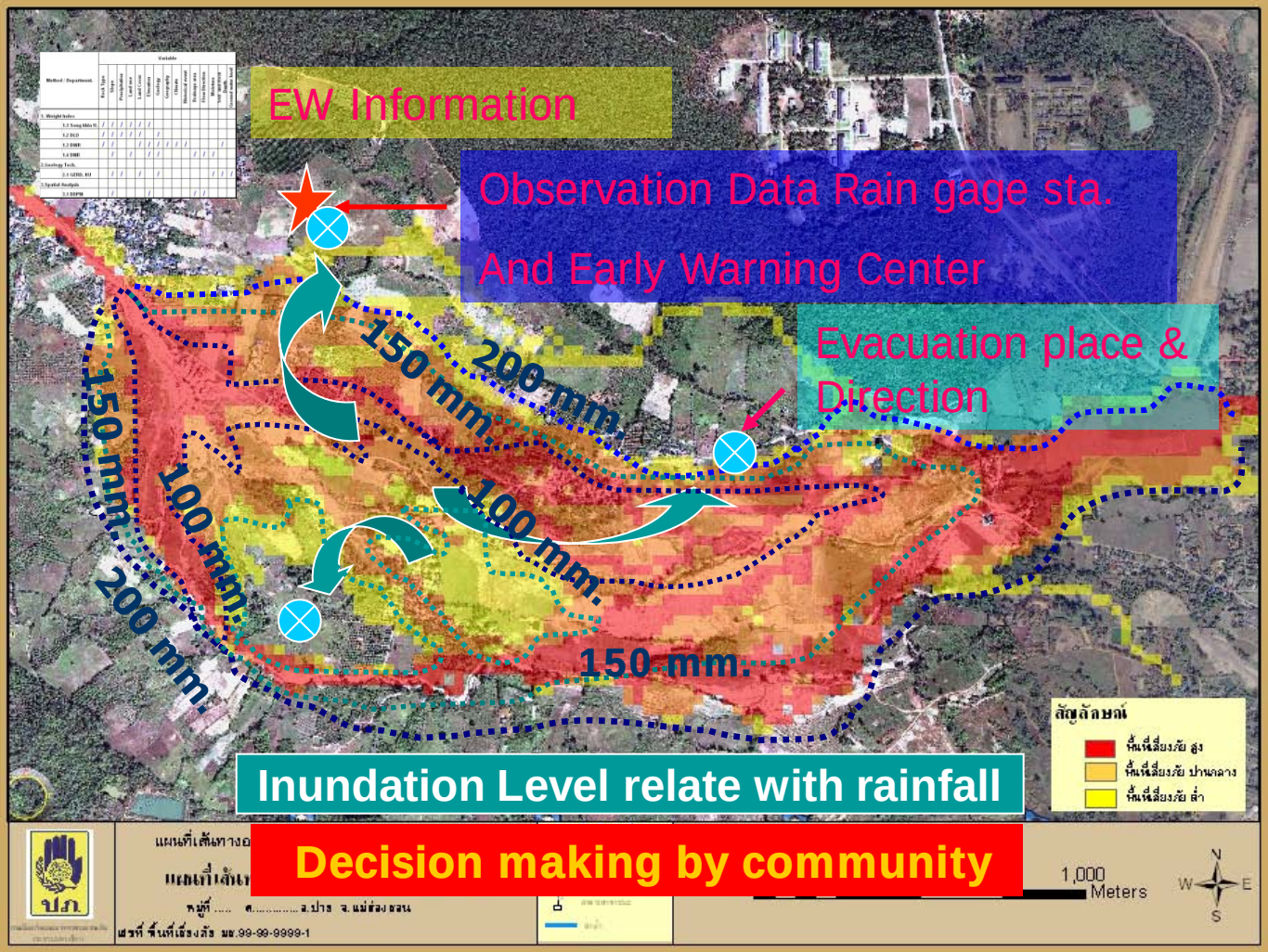


Flow chart of Near real time Early Warning &Evacuation mapping



Flood simulation for Early Warning System

Concept Idea of Near real time early warning & Evacuation Mapping



Evacuation Time < Time of concentration.

Early Warning (EW) Information (Example)

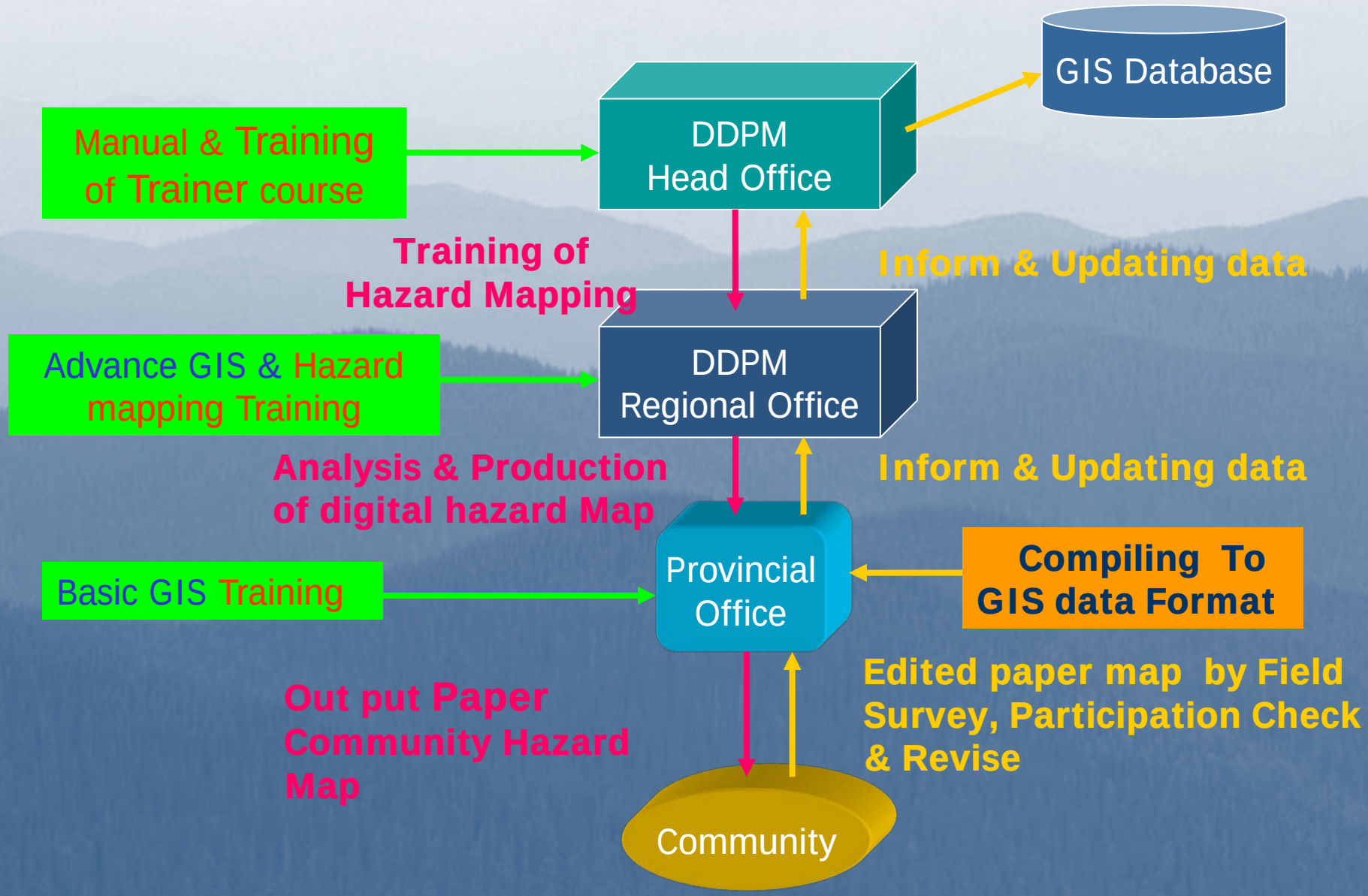
Duration (hr.) / Line No.	1	2	3	4	5
100	300	250	200	150	100
150	350	300	250	200	150
200	400	350	300	250	200
250	450	400	350	300	250

2 Hours of 300 mm. precipitation related with 150 inundation boundary line and the time that high peak of flood would be occurred in this area after rainstorm is equal to or less than the time of concentration.

*This is the time for evaluated the evacuation drill.

Capacity Building with Hazard Map

Organization of Hazard Map



Update of Community Hazard Map

GIS Database

Update digital Map

DDPM Head Office

update digital Map

DDPM Regional Office

Out put Community level digital Map

update digital Map

Provincial Office

Update data in Digital format

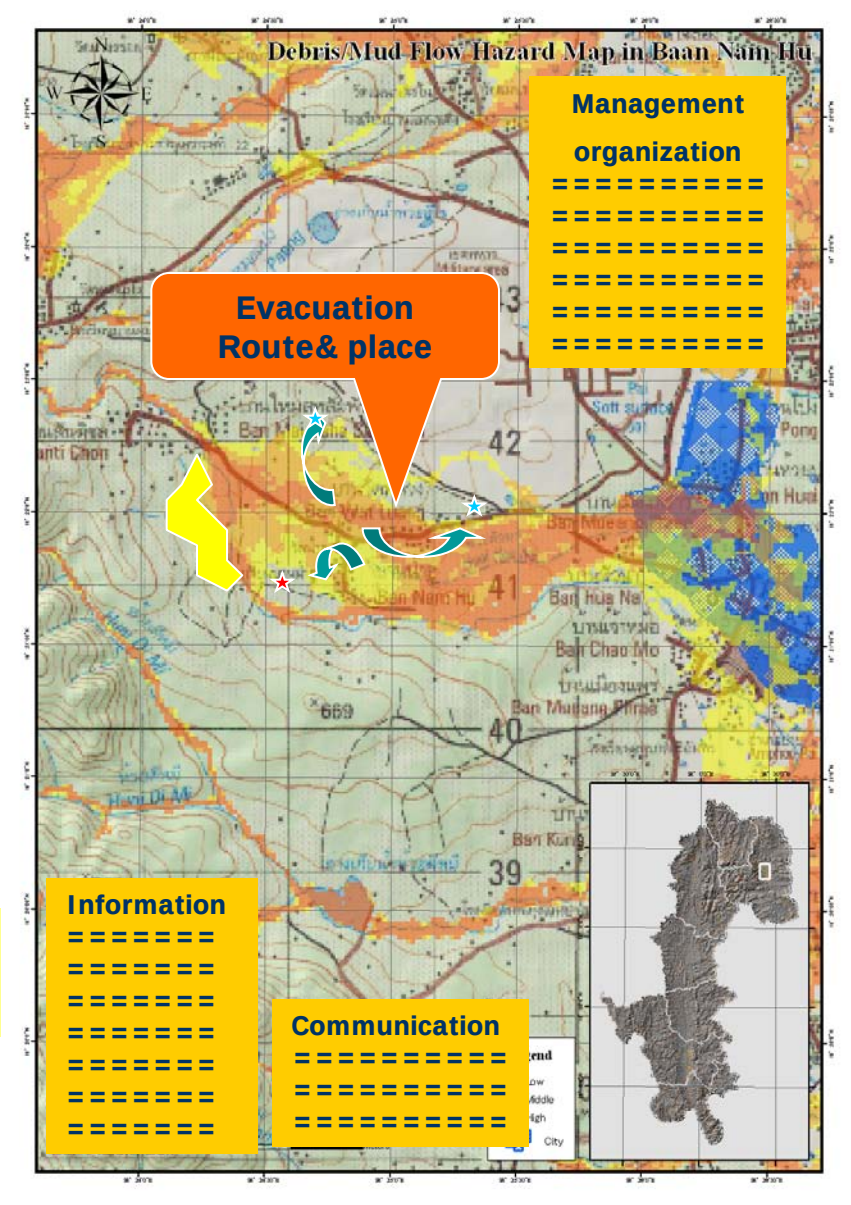
Out put paper Map & CDBM

Community paper hazard map print out

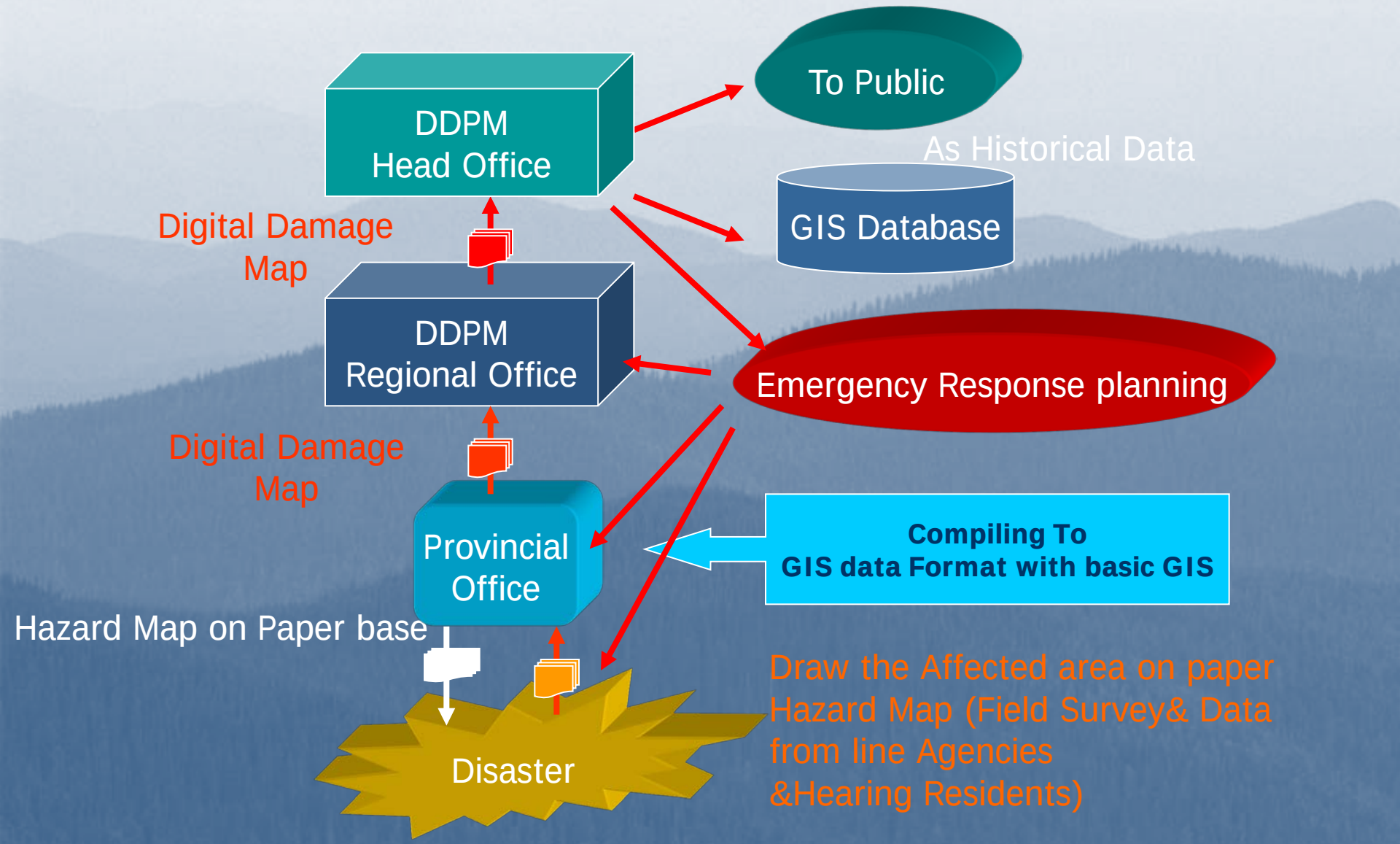
CDBM result

Local Information Verify &accumulate

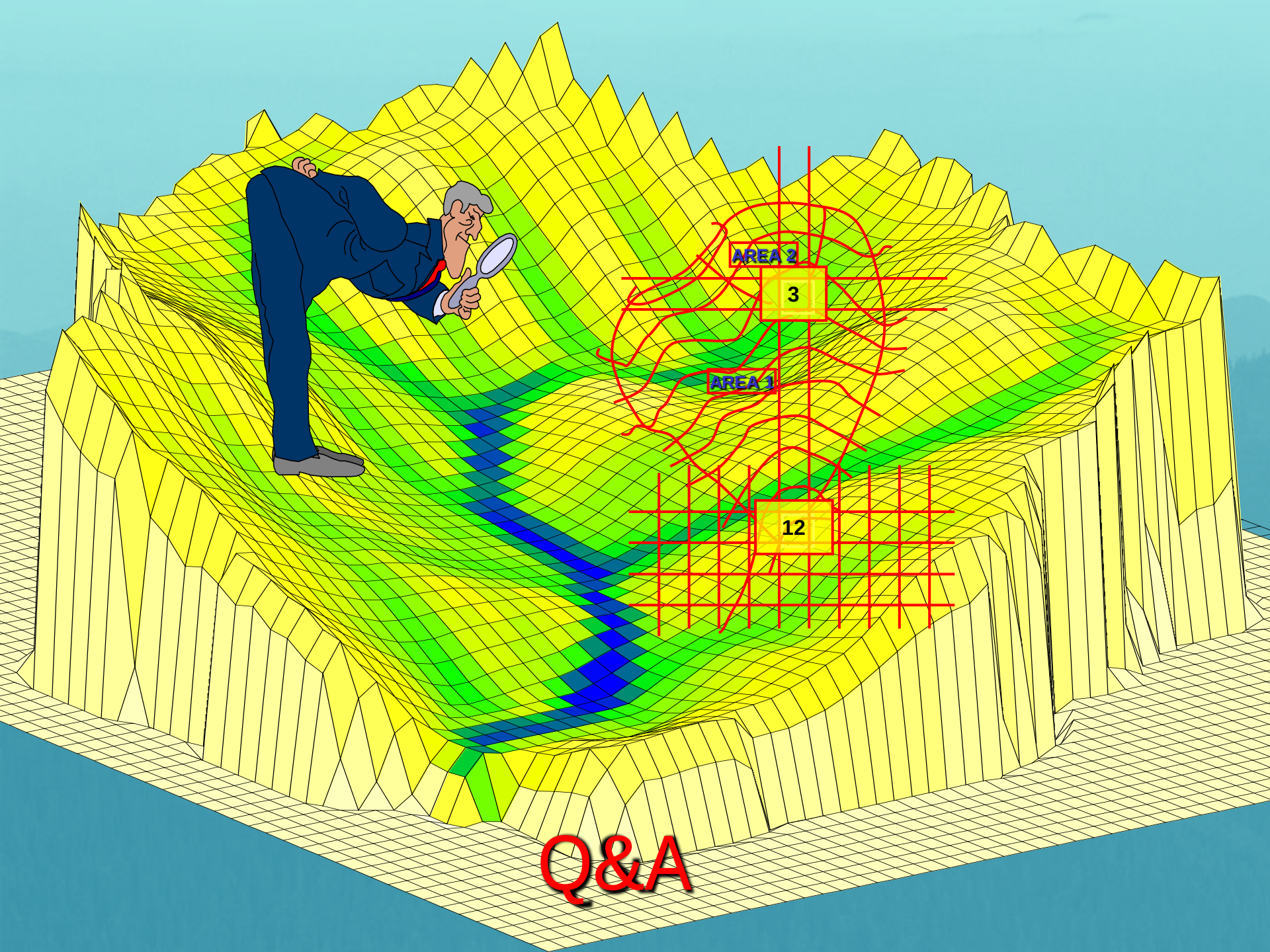
Community



Utilization of Hazard map for Post-Disaster



Rapidly Response & Unique Public Information


AREA 2
3
AREA 1
12
Q&A

THANK YOU