Flood Situation in Davao City
ダバオ市の洪水状況

Dr. Anthony C. Sales, CESO III

Davao City Flooding
in 2011

Thousands of families in 5 Baranggays ***(Ma-a, Matina Pangi, Matina Crossing and Talomo Proper)*** where drenched in **10 feet** high flash flood for several hours due to heavy rain that poured on June 28, 2011, forcing families to seek for higher and safer grounds.

Damages of the Flash Flood Incident in Davao City

(Matina Pangi River) - 2011

Infrastructures, Private Properties, and Businesses

Health and Sanitation, Safety, Households, Livelihood

Flood Management in **Davao City**

Central 911

Central 911 functions as both a call center and a dispatch center that links residents with the emergency resources of the government. The Emergency Computer-Aided Dispatch **(ECAD)** system developed by Davao Light allows Central 911 to immediately locate the origin of emergency calls.

Hydromet Sensors

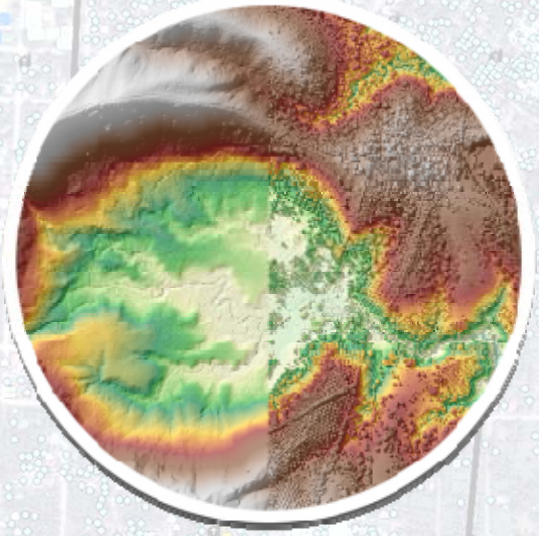
The Hydromet Project dovetails with this aim by using state-of-the-art weather tracking equipment to provide a better picture of the country's surface waters.
Data from the equipment will help experts and leaders make informed decision during severe weather conditions and floods.

UNIVERSITY OF THE PHILIPPINES MINDANAO

PHIL - LIDAR 1

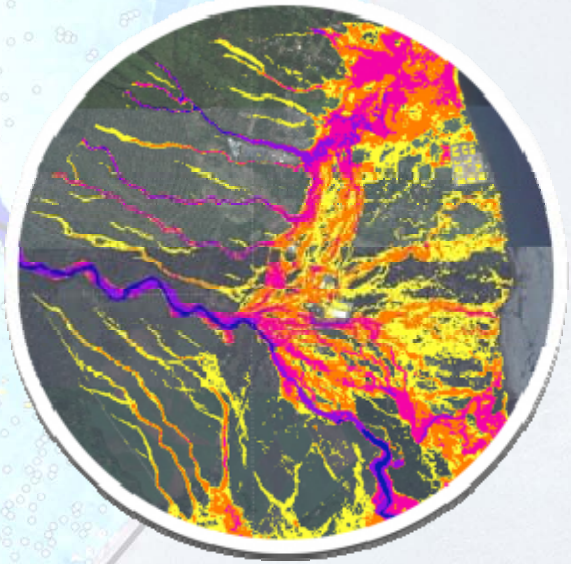
An expansion of the DREAM Program, aims to produce 3-D flood and hazard maps for the 2/3 of the Philippine river systems.

Aside from addressing disaster risk reduction and climate change adaptation, the resource information to be generated from this project will also be useful in providing the information requirements of various sectors in the country.



Digital Elevation Model

Critical Facilities

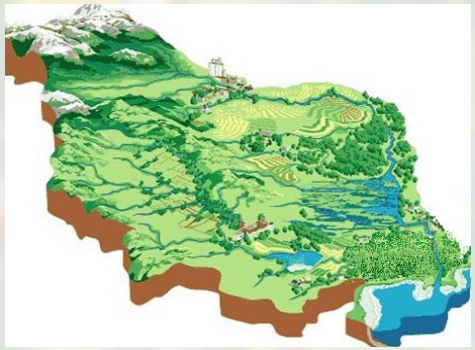


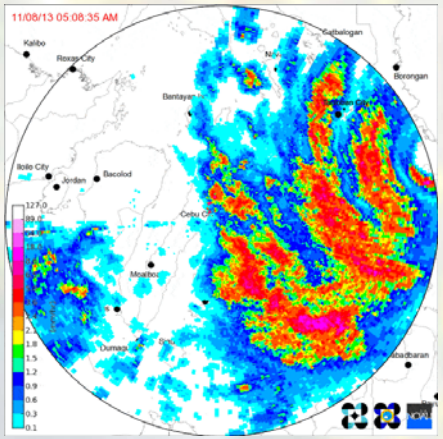
Flood Map

http://lidar1.upmin.edu.ph/phillidar1/

DOST Project NOAH

Nationwide **O**perational **A**ssessment of **H**azards



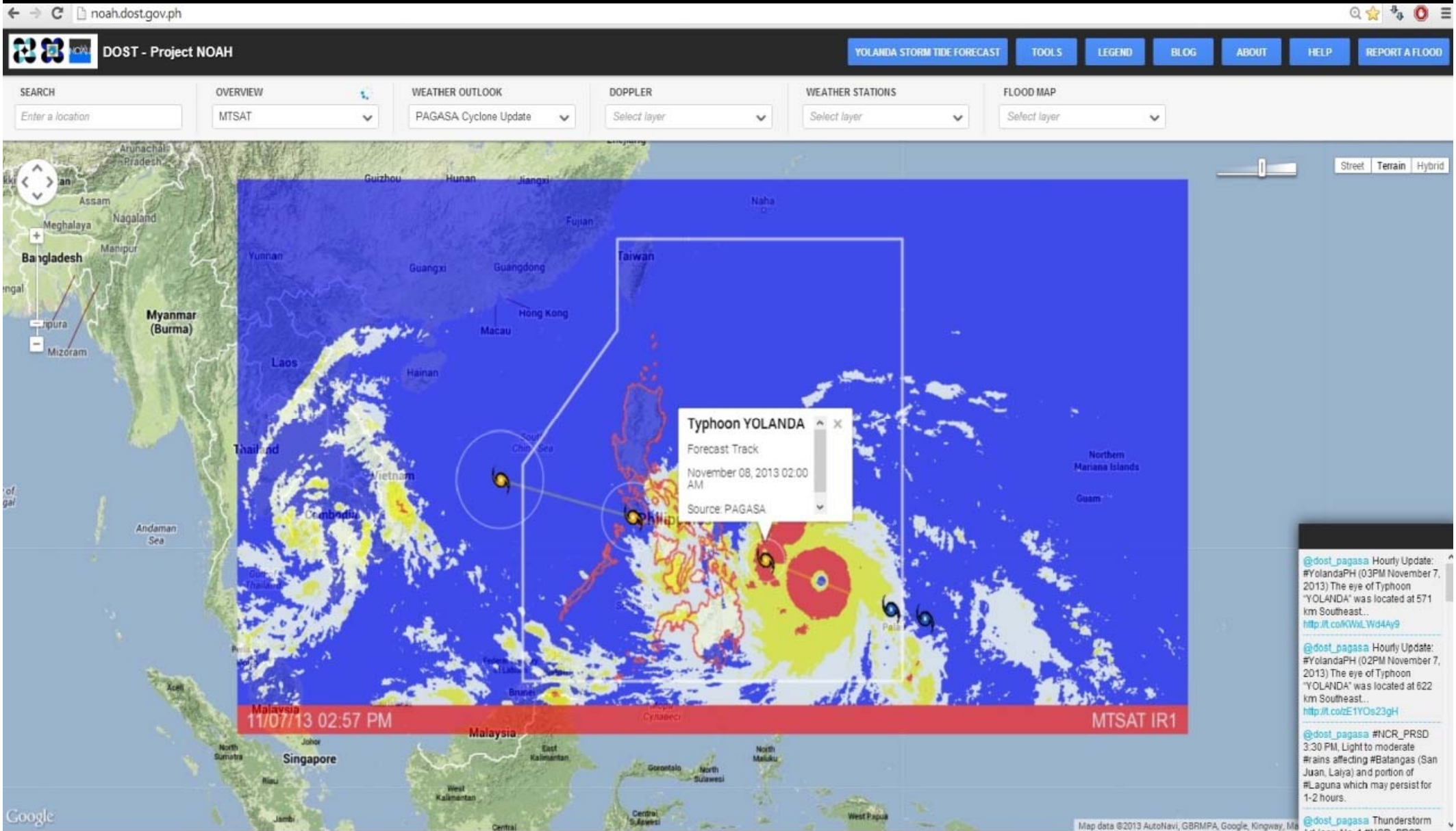


Project NOAH aims to provide:

- flood mitigation system, specifically targeting a 6-hour flood early warning system for communities along 18 major river systems;
- enhancement of geohazard maps and;
- enhancement of storm surge vulnerability maps

Project NOAH Website

noah.dost.gov.ph



Davao River Basin Master Plan (DRB: 2013-2014)

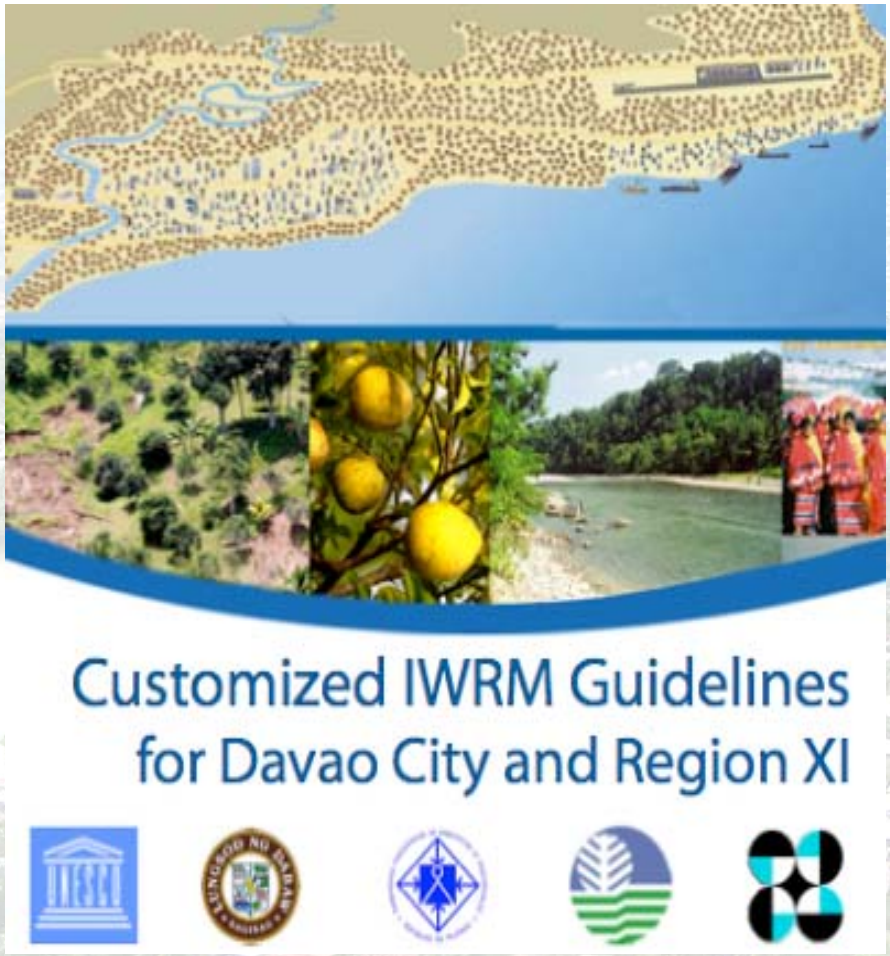
- The formulation of a master plan for the management and development of Davao River Basin (DRB) was aimed at addressing these threats particularly on water security and flooding. The DRB is the second biggest basin in the Davao Region and is eyed as potential additional source of water supply for Davao City and hydropower for Mindanao.
- The approach in the formulation of the master plan was anchored on the **Integrated Water Resources Management (IWRM)** approach

Actions Taken

- Customizing the IWRM Guidelines based on the actual experiences of Davao City and Davao Region, and soliciting the participative engagement of all stakeholders involved in planning of Davao Water Action Plan and drafting the resolution for the Region-wide adoption of IWRM Guidelines.

Series of Consultation and Planning Session among a Full Spectrum of Stakeholders in Davao Region

Outcomes



- Davao Water Partnership
- Water Vision for Davao Region
- 5-year DRR Action Plan for Matina Pangi River
- Regional Development Council Resolution for the Adoption of IWRM Davao Water Partnership Action Plan

Davao River Basin Strategies

Strategy 1

- Management of forest resources for ecosystem stability and resiliency (quality of natural assets)

Strategy 2

- Local socio-economic development for poverty alleviation, especially in the rural population *(sustainable use of assets to serve communities)*

Strategy 3

- Improved, decentralized governance *(management capacity)*

STRATEGY 1- Delineate, manage, rehabilitate, and regulate the Protection, Conservation, and High Hazard Areas of DRB for ecosystem stability and resiliency

Protection, Conservation and High Hazard Areas of DRB

- Remaining natural forests (33,327 ha in 2010)
- With slopes >50% and 1,000 masl
- Highly susceptible to flooding and landslides
- Conservation areas
- Cultural and sacred sites in CADTs

Expected Results

- Reduced siltation and sedimentation
- Reduced risk of and losses from landslides and flooding
- Conserved biodiversity
- Increased carbon stock
- Adequate and sustained water supply
- Sustainable ENR-dependent livelihood activities

STRATEGY 2 - Promote public and private investments to enhance DRB's Comparative Advantages in support of local socio-economic development

Sub-Strategies

- Optimize use of DRB water resources (irrigation, power, water supply, tourism)
- High value crop production and forest and fuelwood plantations
- Maximize DRB's tourism potential (eco-tourism, agri-tourism, cultural tourism)
- Reduce risks and adverse impacts of flooding and water pollution

Expected Results

- Increased access to safe water supply
- Increased production (agriculture, fisheries, perennial crops, forestry)
- Higher and diversified incomes
- Reduced damages from flooding
- Improved water quality
- Sustainable livelihood activities

STRATEGY 3 - Strengthen DRB governance and ENR management capacities at the basin, sub-basin, LGU and LRMU levels consistent with the principle of decentralized governance.

Key Actors: Policy to Implementation

- Bukidnon Watershed Protection and Management Council **(BWPMC)**
- Davao City Watershed Management Council **(DCMC)**
- Davao Gulf Management Council **(DGMC)**

- **MINDA**
- **NEDA** 10 and 11
- **DENR** 10 and 11
- **NCIP** 10 and 11
- Other national agencies **(DA, NIA, DOT, DTI, DPWH, NWRB)**

- LGUs
- Barangays
- IP tribal councils
- Tenure holders
- Private sector
- DCWD
- NGOs
- Civil society
- Academe

Davao River Basin Challenges

1. Protection and conservation of ENR assets, most of which are degraded
2. Alleviation of the poverty situation in rural areas, largely covered by CADTs
3. Increasing the resiliency of ecosystems, communities and livelihoods to natural hazards and climate change
4. Enhancement of the capability of designated on-site local resource managers
5. Putting in place appropriate governance system for DRB

Action Points

- To improve and make more climate resilient the conditions in DRB to ensure the sustainability of ecosystem goods and services derived from it.
- To promote local socio-economic growth of communities in DRB and reduce rural poverty.

Implementation

- **MOA** signing
- Set up coordinating office **(DENR XI or MINDA)** and working group
- Secure commitment of agencies and budget support/program complementation
- Secure commitment of on-site resource managers **(CADT and tenure holders)**; capacity building and resource management planning
- IEC and advocacy to generate support from various sectors
- Establish system for prioritizing SMAs and investments

Intervention and Investments

- **Improved Natural Resource Management**

Interventions	Key Targets	15-Year Investment (PhP M)	Funding Source
a. Protection of closed and open canopy forests	33,327 ha per year	481.4	LGU, DENR, donors, PES
b. Rehabilitation of degraded forestlands (>50% slope and >1,000 masl)	20,000 ha (rehab); 33,327 ha (protection)	938.3	LGU, DENR/NGP, donors, PES
c. Development of production forestlands	17,800 ha	629.0	LGU, DENR, tenure holders, private investors, PES
d. Mangrove rehabilitation	25 ha	2.0	LGU, DENR/NGP, CSR
Sub- Total for NRM		**2,050.7**	

- **Local Socio-Economic Development**

Interventions	Key Targets	15-Year Investment (PhP M)	Funding Source
a. Agricultural development (irrigation, staple and high value crops)	8,401 ha (irrigation)	968.6	LGU, DA, NIA, DTI, private sector/ landowners
b. Cultural, nature and agri tourism	16 new sites	32.5	LGU, DENR, DOT, private sector
c. Road access	260 km, 28 bridges	1,438.0	LGU, donors
d. Safe , potable water	205 Level 2; Level 3 facilities	12,002.0	LGU, donors, CSR, DCWD, BAWASAs

- **Local Socio-Economic Development** (cont..)

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Major Investments in Water-related Infrastructure

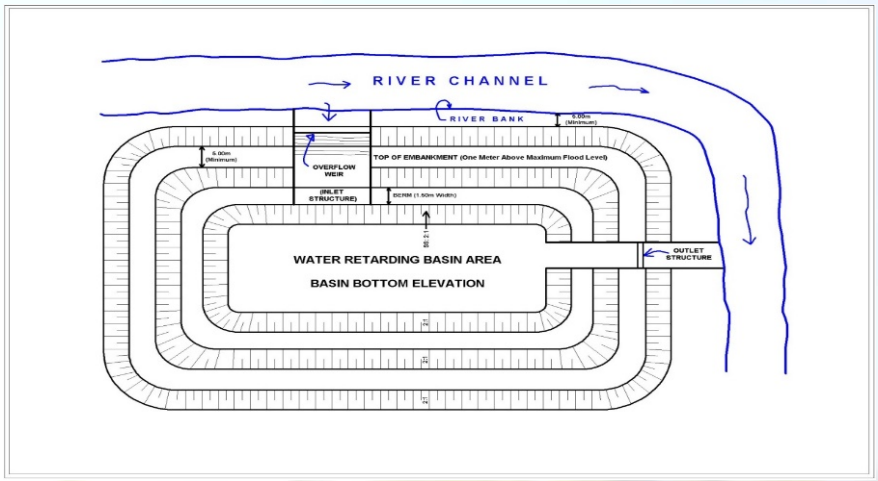
A. Expansion of Level 3 System of Davao City Water District

- **Water Source:** Tamugan
- **Scope of Expansion**
  - Improve water service in current service area (107 of 182 barangays of Davao City)
  - Cover 11 new barangays, 7 of which are in DRB

- **Facilities to be established:**
  - Intake structure and raw water transmission line
  - Water treatment plant
  - Run-of-river hydropower electric plant for the water treatment plant
  - Treated water transmission lines
  - Distribution mains, storage facilities, pipelines

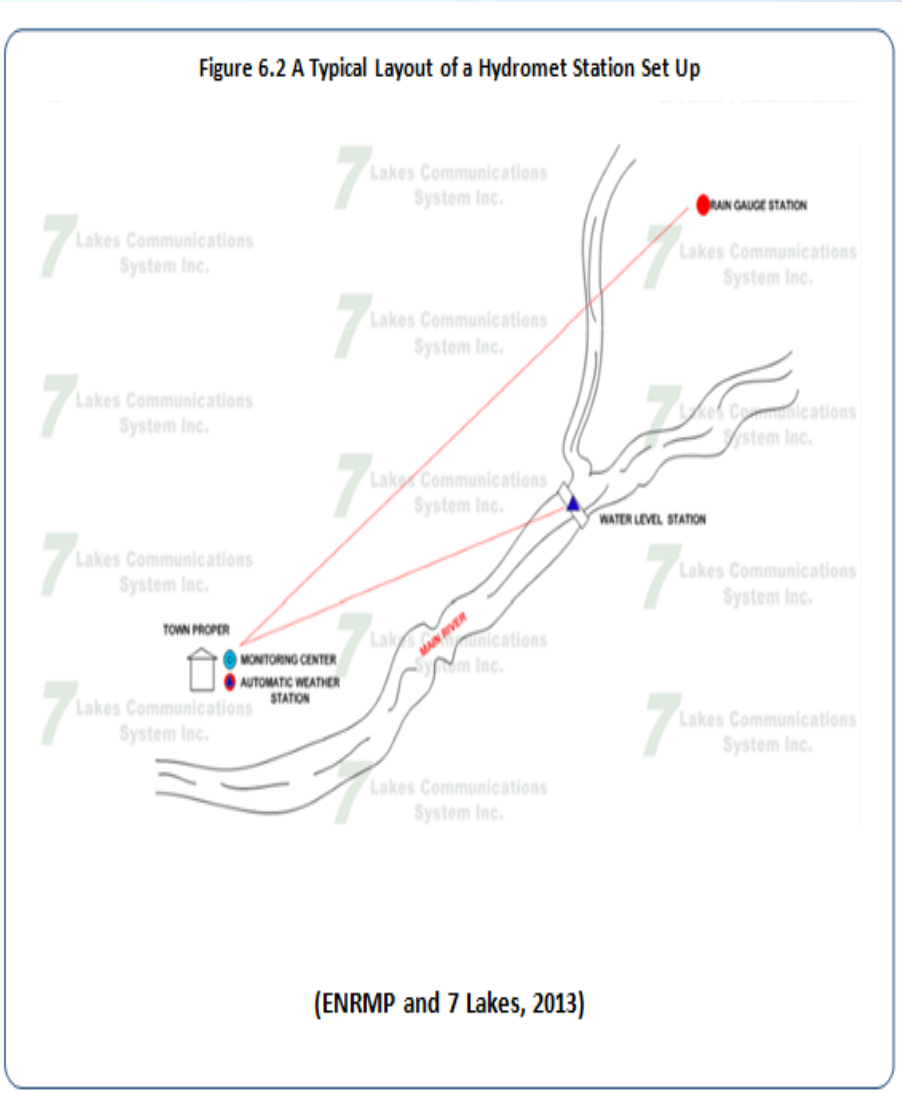
B. Retarding Basin to Mitigate Flooding

- **Retarding Basin:** temporarily diverts and collects flood discharge above carrying capacity.
- **Priority 1:** immediately upstream of city's residential and commercial area **(Brgy Mandug)**
- **Other uses:** irrigation, recreation, fishing.



C. Hydromet Station/Early Warning Device System *(linked with PAGASA network)*

- **Components:**
  - automatic weather station;
  - automatic water level gauging station
  - automatic rain gauging station in the watershed area
  - control center for operation/mgt of the system



The facility will help build up DRB database.

D. Hydropower Development

- Components: **Brgy. Lamanan**
- Target Power Generation: **160 MW**
- Developer: **San Lorenzo Ruiz Builders and Developers Group**
- Components: **Power plant and Weir**

Study is ongoing. Will be operational by Year 5.

E. Communal Irrigation Systems

13 CIS in NIA's pipeline program (five years) with total area of **1,250 ha**

Complementary program of DA: small scale irrigation schemes for **3-15 ha**

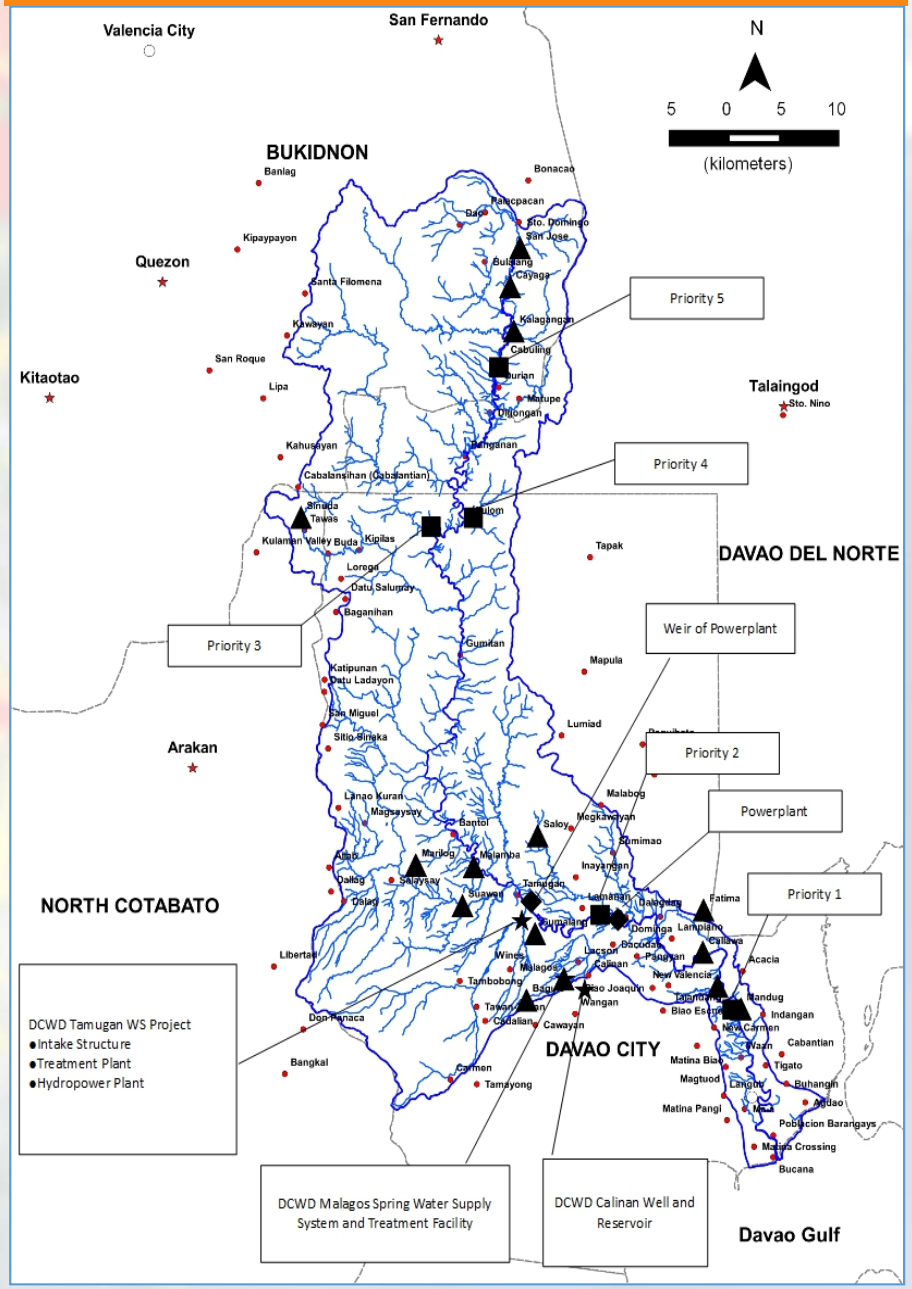
F. Water Supply Systems

Level 2 spring systems target: **205**, mainly for upland communities

G. Wastewater Treatment Systems

For **Bangkerohan public market** and **Davao City slaughterhouse**

Location of Water-Related Infrastructure



Governance Structure

Governance and ENR Mgmt at DRB Level
(Councils, regional agencies, civil society, private sector)

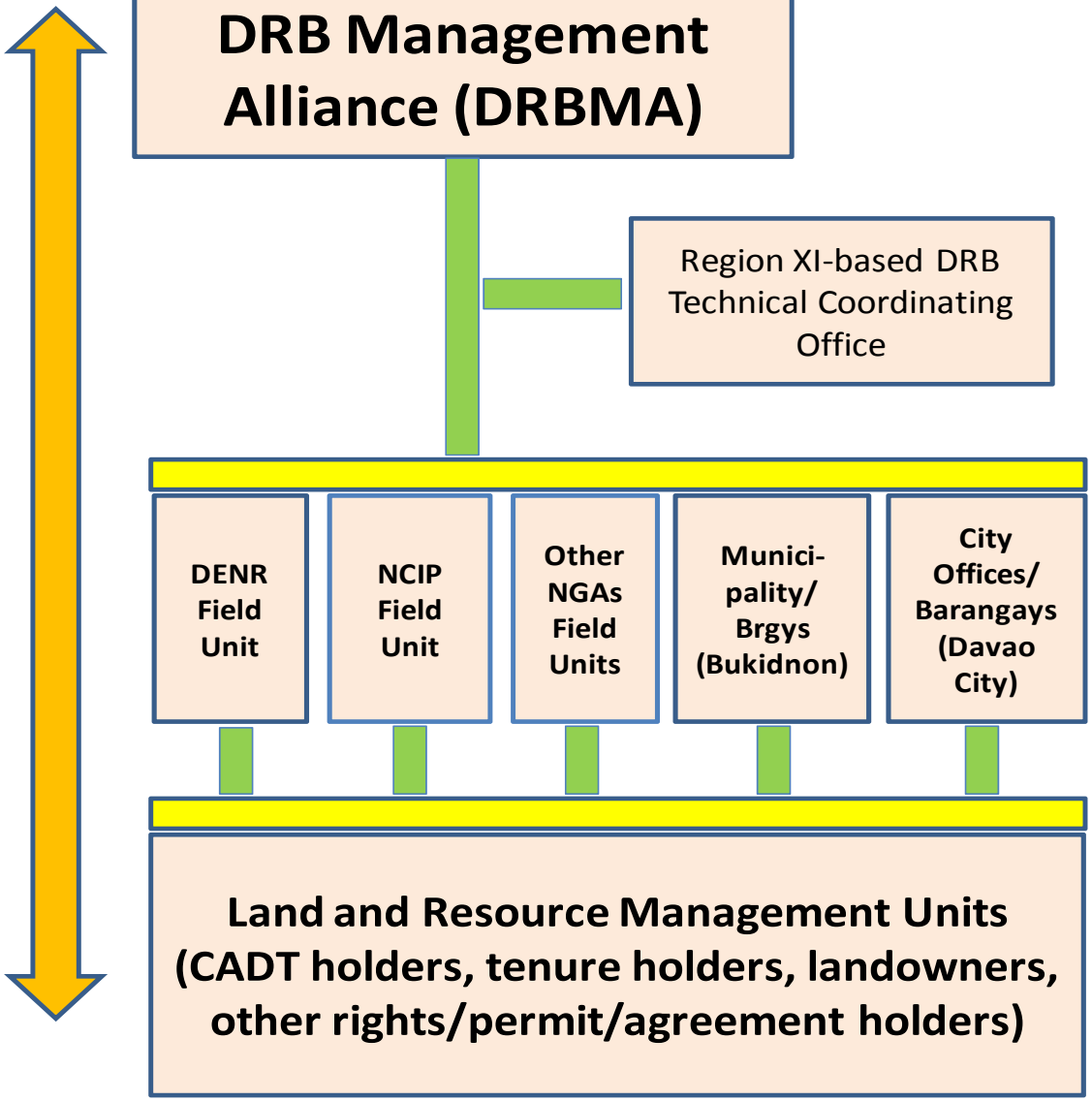
– policy formulation
– investment promotion
– M and E results
– advocacy
– program coordination
– conflict resolution
– database development

Governance and ENR Mgmt at Executing Level
(LGU, field units of agencies)

– implementation
– field coordination
– regulation and enforcement
– capability building and assistance to LRMUs
– M and E of operations

Governance and ENR Mgmt at LRMU Level
(CADT holders, tenure holders, landowners)

– ENR protection, conservation, management
– dev't of prodcution areas



Management Coordinating Office

- Technical secretariat of DRBMA
- Coordination of annual work planning and budgeting
- Leveraging and networking
- IEC and social marketing support
- Capacity development
- Resource mobilization; development of PES, other financing schemes
- Policy and technical studies
- DRB databases
- Results-based M and E

Estimated Operating Cost

Activities	Cost (PhP M)
1. DRBMA Activities	6.4
2. DRB Coordinating Office operations	76.1
3. Capacity Building and Training	17.7
Total	**100.2**
Ave. Annual Cost	**6.7**

Policy and Enforcement Support Priorities

- Land use regulation especially in PCHHAs
- Water use regulation and allocation
- Small scale mining and quarrying
- Water pollution
- Incentive systems for various activities
- Harmonization of DRB Master Plan and CLUPs and zoning plans; local ordinances

Capability Building Priorities

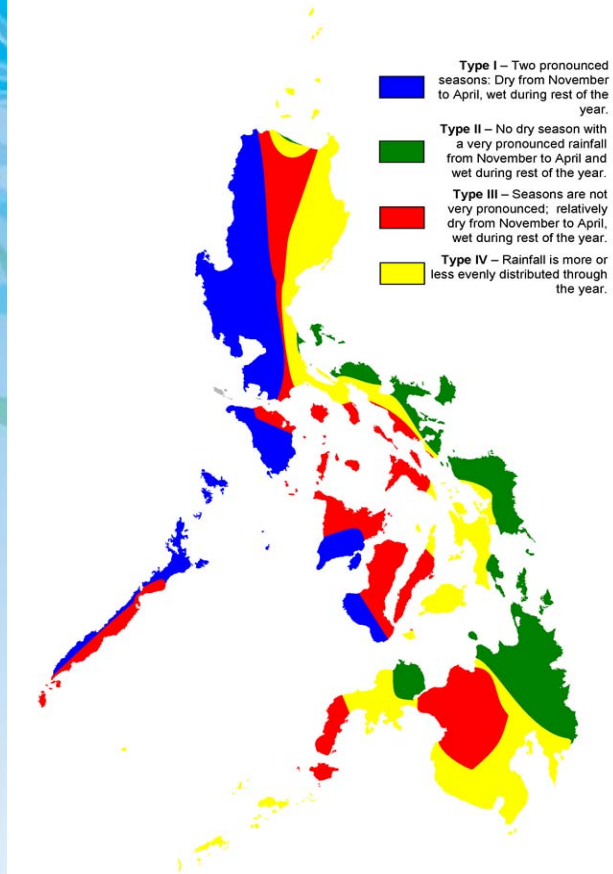
- Forest protection, conservation and rehabilitation, to include forest fire protection
- ADSDPP, resource management plan preparation
- Agroforestry and farm planning; soil and water conservation
- HVC and farm production technologies
- Vulnerability and risk assessments; community-based disaster preparedness
- Financing mechanisms (user fees, PES)
- M and E

Short, Medium and Long-Term Investments

COMPONENTS	ESTIMATED COST (Php Million)	YEARS 1-5	YEARS 6-10	YEARS 11-15
Natural Resource Management (NRM)	2,050.7	948.12	753.80	348.78
Local Socio-Economic Development (LSD)	32,953.8	28,031.06	2,573.68	2,349.02
Governance	100.1	40.63	30.80	28.70
TOTAL	**35,104.6**	**29,019.81**	**3,358.28**	**2,726.5**
Percent of Total	**100%**	**82%**	**10%**	**8%**

Sustainability Science Project
Davao City

(Demonstration Project)



The Philippines is a country with tropical and maritime climate, characterized by relatively high temperature, high humidity and abundant rainfall.

We expect around 20 tropical cyclones to enter or develop within the Philippine Area of Responsibility every year, and 8 to 9 would progress to landfall.

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Total Estimate Cost of Damage:
Php 11,000,000.00
(infrastructure, private properties)
Total Individuals Affected: **14,726 families**
Total Casualties: **30 Individuals**
Reported Missing: **1 Individuals**
Other immediate problems:
WASH, Food Security, Health and Safety, Shelter,

Flash Flood Incident in Davao City (Matina Pangi River) - 2011

Strategic Approach of the Sustainability Science project:

Component 1

- Database and Assessment using the Geographical Information System (GIS)

Component 2

- Development of Plan and Demonstration of Technologies

Component 3

- Capacity Building and Raising Awareness on Climate Change Adaptation

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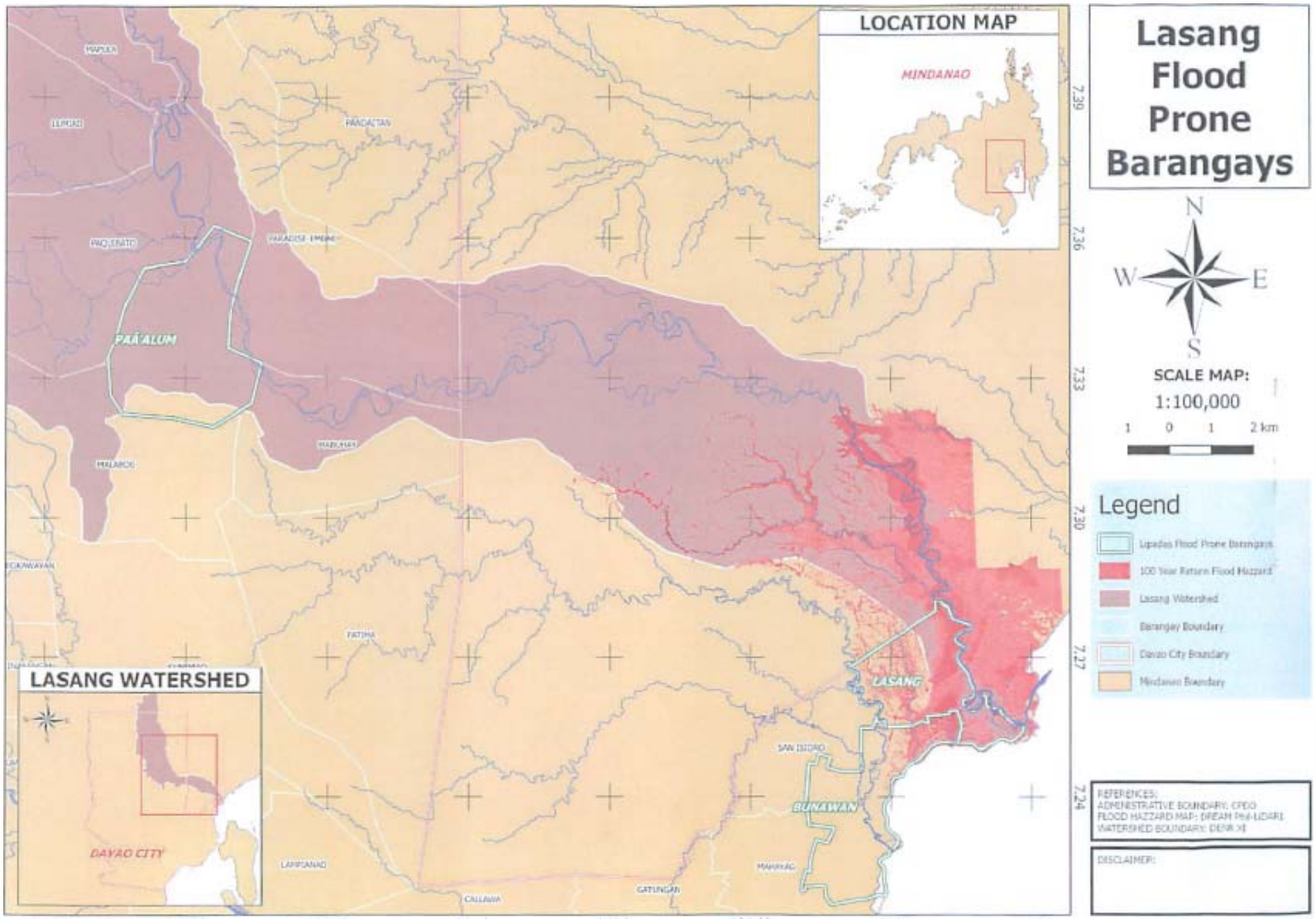
Sample of the Flood Hazard Maps



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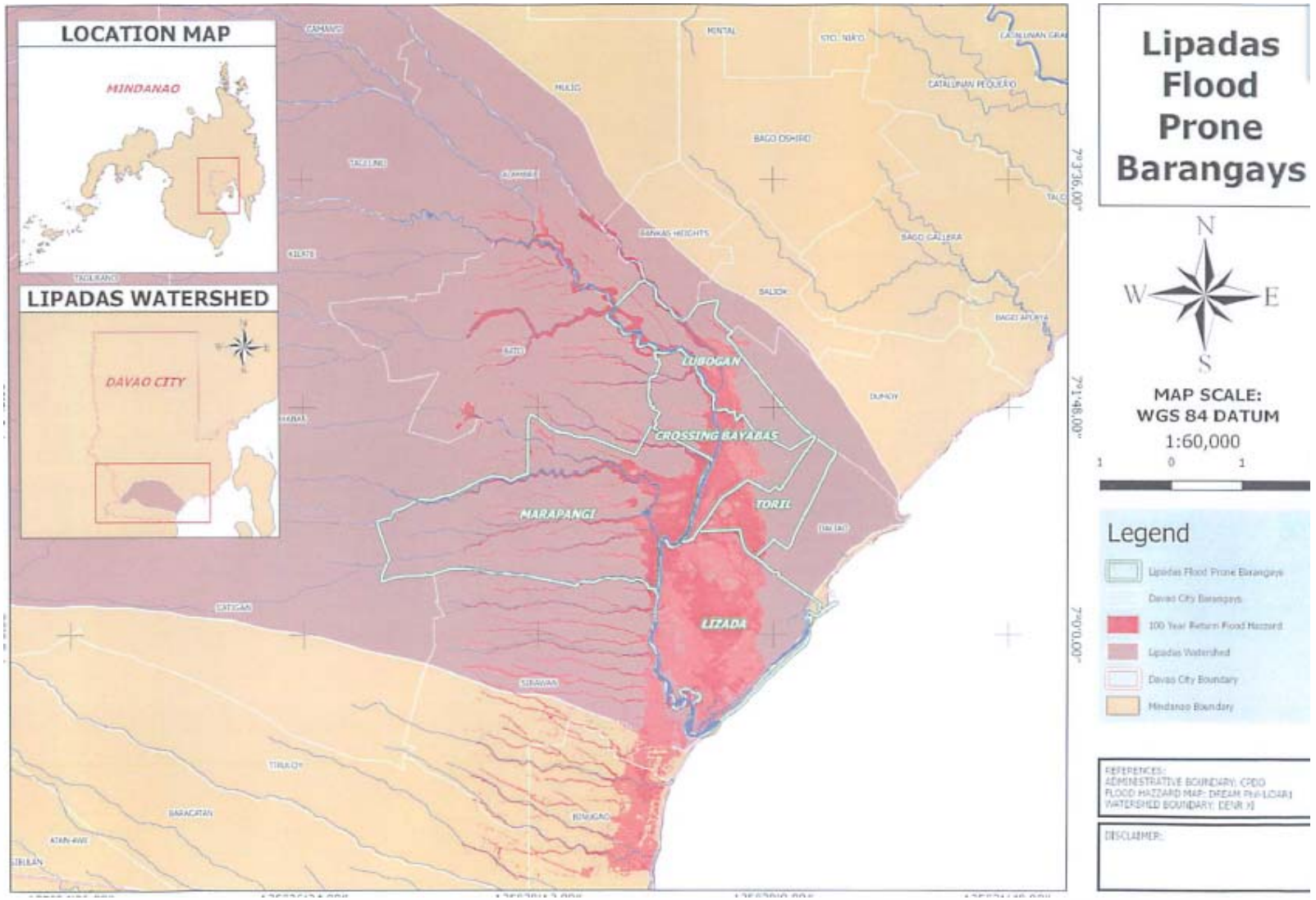

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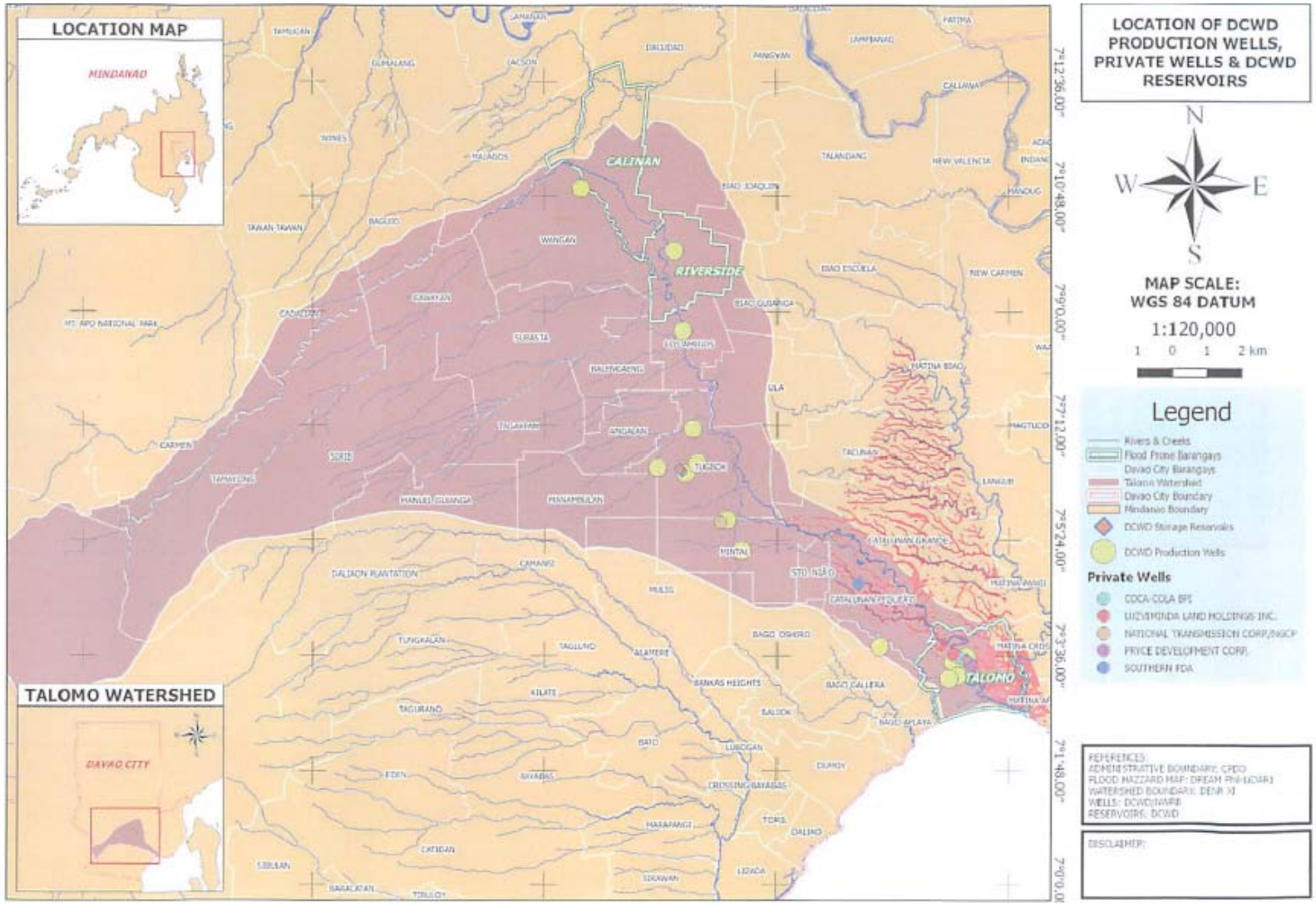

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Best Practices in Flood Management at Community Level

Best Practices and issues related to Knowledge of the Environment and Resources Gov't.

Gov't Agencies	Best Practices & Demonstration of Technologies
DCWD	• Periodic water quality monitoring of groundwater aquifers • Watershed management which includes water quality monitoring • 'Adopt-a-site' Program Tree planting activities along river banks (Riverbank Protection Program) • Age, condition and status of NEW pipelines are being monitored • Rainwater harvesting promotion
DILG	• Provides funds for LGUs for the study on installation of water pumps (non-DCWD areas)

Best Practices in Flood Management at Community Level *(cont..)*

Best Practices and issues related to level of preparation

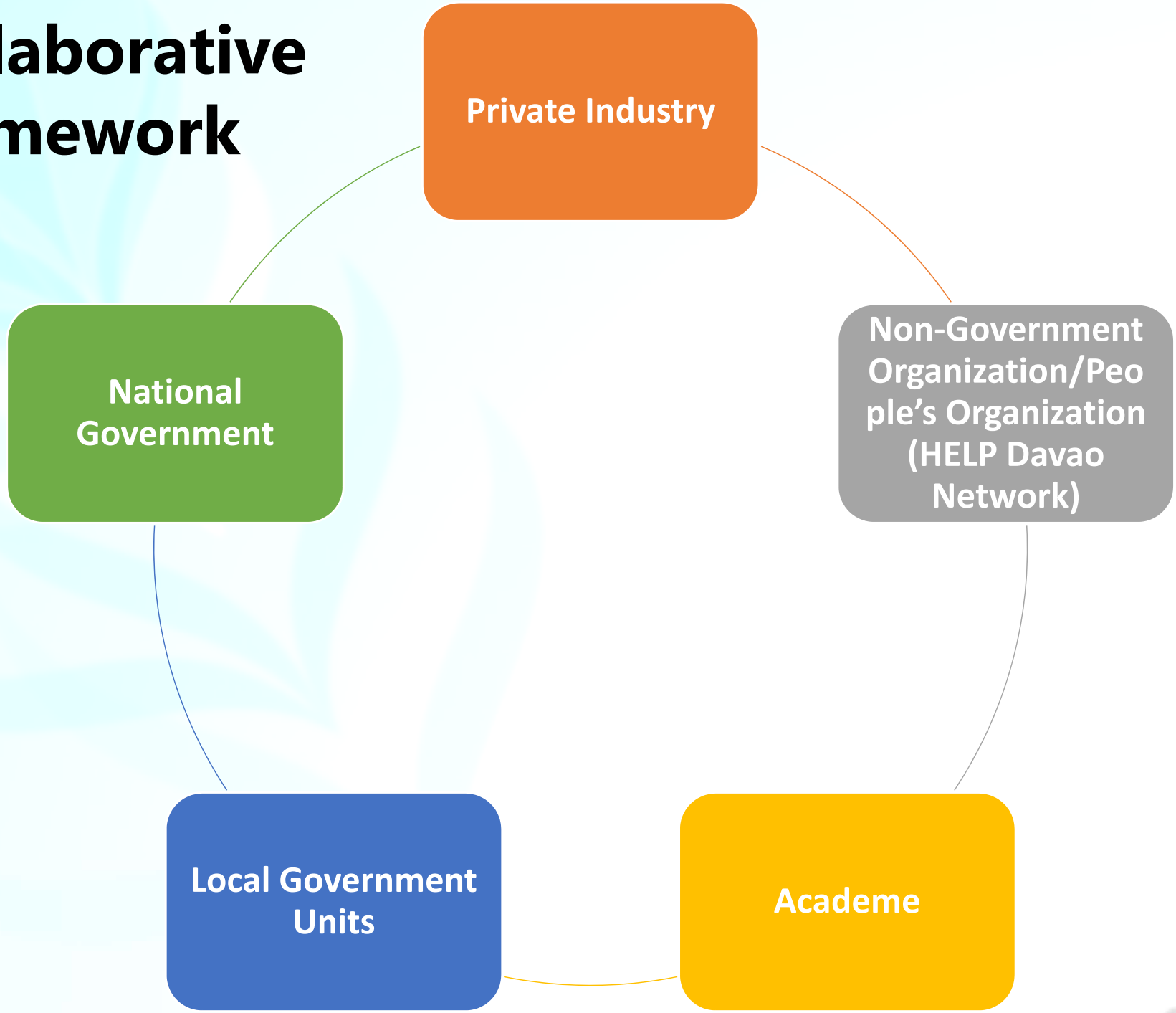
Gov't Agencies	Best Practices& Demonstration of Technologies
DCWD	Creation of the Davao City Task Force Drainage that coordinates all interventions that affect UWS Monitoring program for saltwater intrusion due to sea level rise
DPWH	QGIS maps used for modelling
CPDO	Watershed Management Monitoring Team DENR Watershed Management Monitoring Team
DOH	Provides technical assistance during disasters; monitors incidence of diarrhea cases and inform areas that are greatly affected by the disease
CDRRM	Has early warning system (EWS): equipment via radio communication & sirens, indigenous methods of EWS (far flung areas), weather monitoring, environmental signs, i.e. animal behaviour
DOST	Mandated to provide technology for EWS e.g. LiDAR

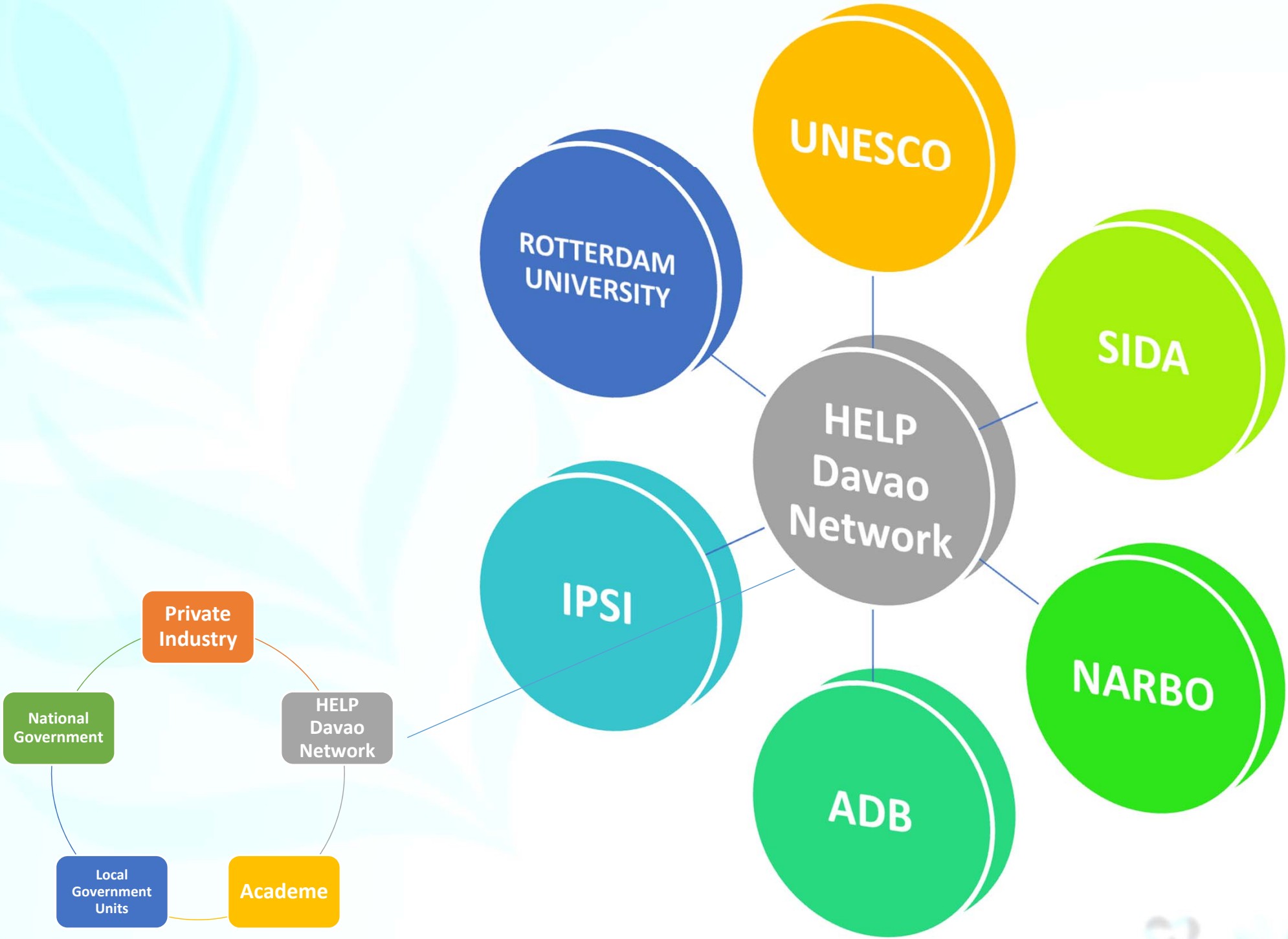
Best Practices in Flood Management at Community Level *(cont..)*

Best Practices and demonstration of technologies related to capacity to recover

Gov't Agencies	Best Practices& Demonstration of Technologies
DCWD	• Department in-charge for immediate repair and rehabilitation of affected infrastructure. • Provision of 'bottled' water of up to 10 cubic meters to affected areas • Mobile rations using water tanks for delivery • Utilizing mobile water treatment systems (desalination trucks) that can supply 20,000 liters of safe water per day.
CPDO	• Coordinates with 911, which has facility in water management during disasters • Coordinates with MinLAND, an NGO active in disaster issues
CDRRM	• DLPC is committed to cut down power to malls and other establishments for conservation purposes during disasters

Collaborative Framework

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Academe


ありがとうございました
Dr. Anthony C. Sales, CESO III