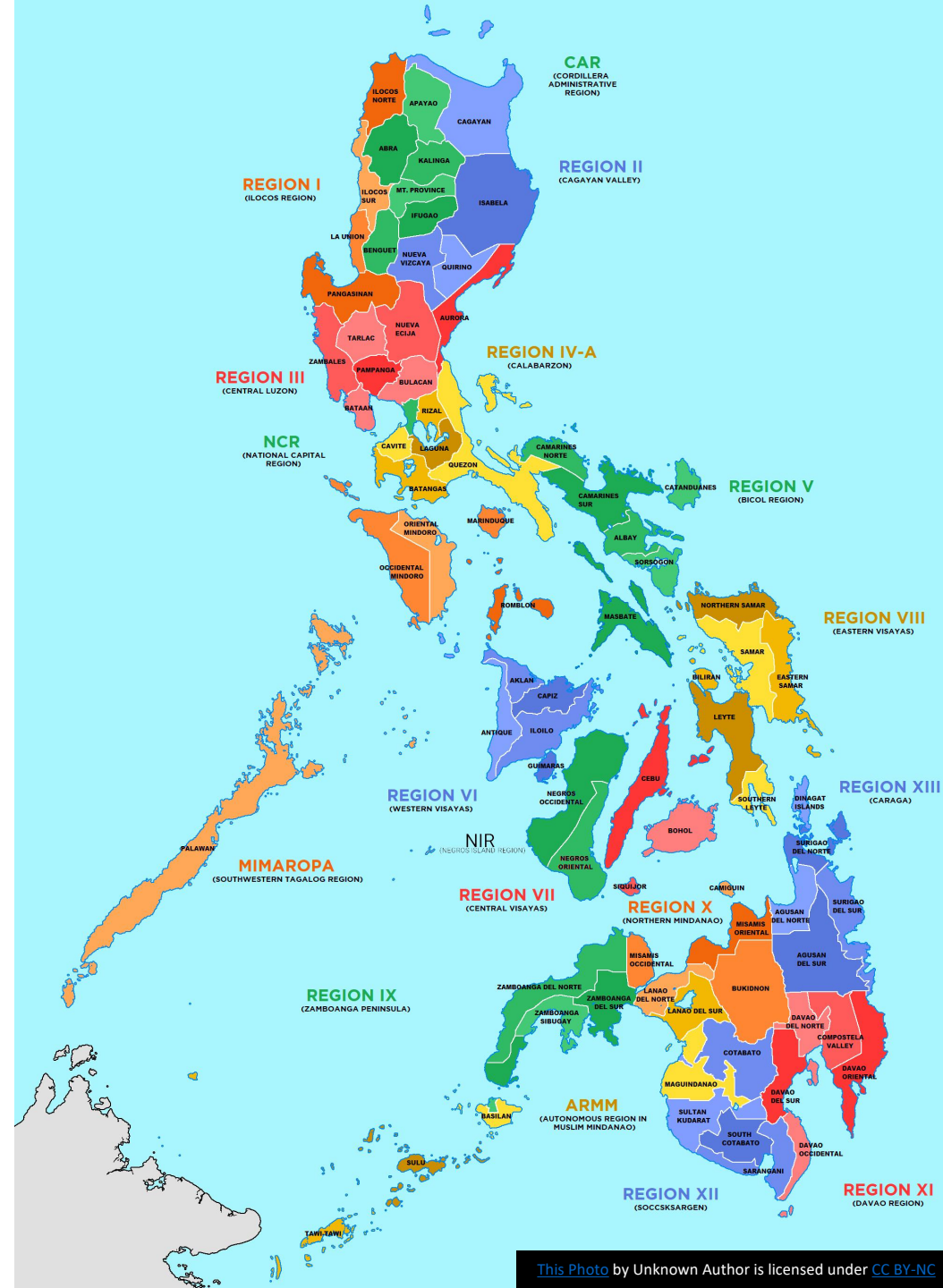




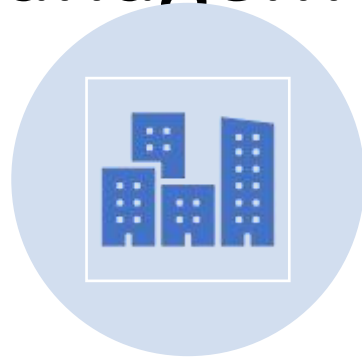
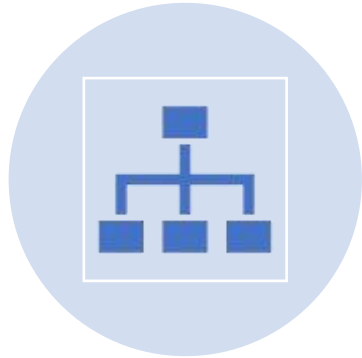
Using Satellite Information for Vulnerability Assessment: Case Study of the Philippines

The Philippines

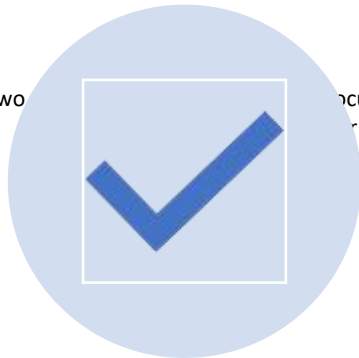
- A country in Southeast Asia
- Composed of 7100 islands (more or less)
- 113.9 M population (2020)
- Capital – Manila
- Ranked 1st in the World Risk Index in 2022



Vulnerability Assessment for Groundwater Management/Planning



The entire research project was divided into two



Phase 1 focused on creating a groundwater management plan for Zamboanga City by looking at the existing data and maps of Zamboanga's water resources, including an analysis of its quality and quantity.

Phase 2 deals with the establishment of ground water monitoring system in the identified vulnerable sites



The Study Site

- Identified as among the 9 critical cities
- Highly urbanized



ZAMBOANGA CITY Study Site

Legend

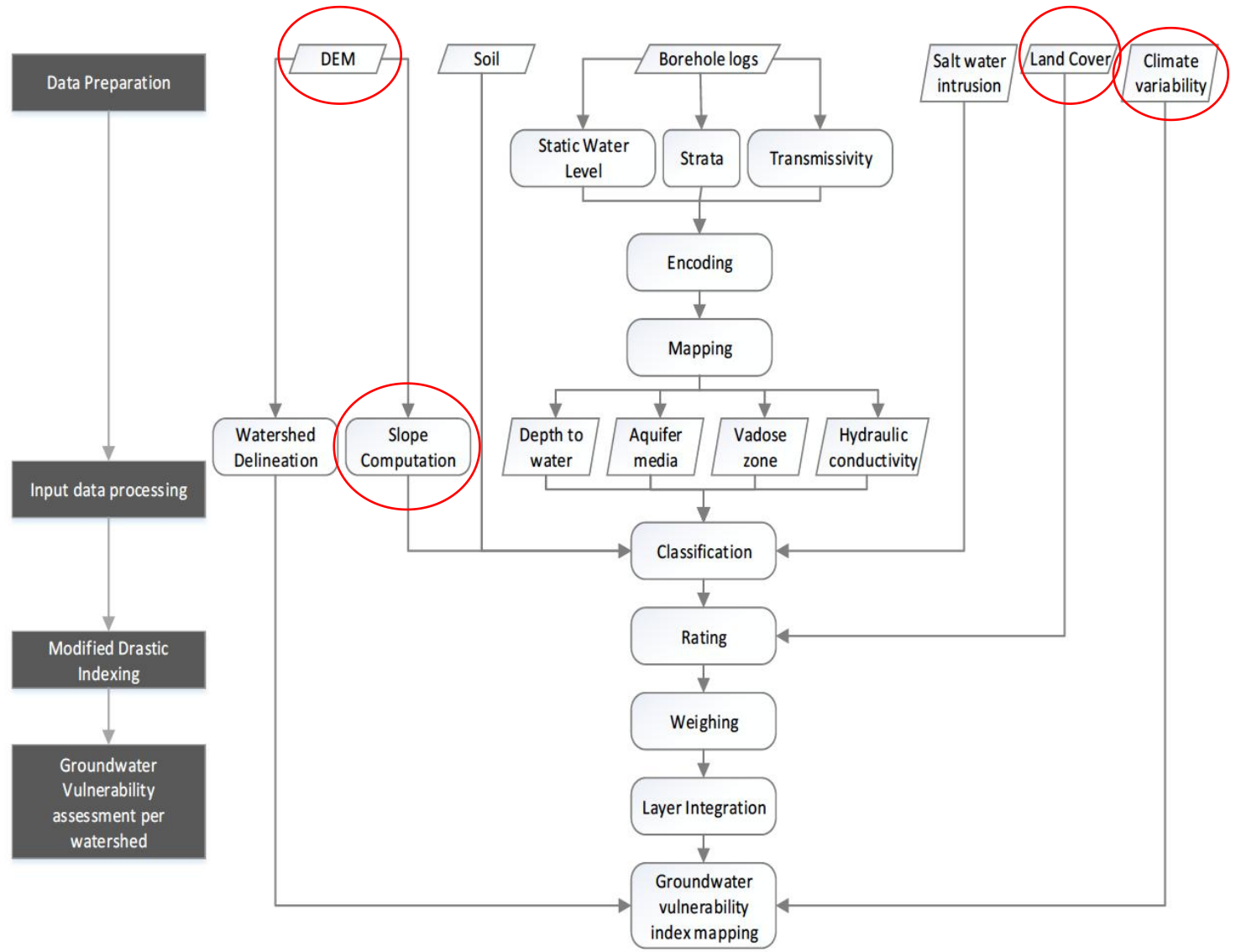
- Study Site
- Sea/Water
- City Boundary



Sources:
Zamboanga City CPDO. 2016. City Boundary.
MDA, UP-TCAGP, DOST-GIA. 2016. IFSAR DEM

Map Production:
Ateneo De Manila University. 24 October 2017. In
collaboration with Ateneo de Zamboanga University.
Funded by National Water Resources Board and
Department of Science and Technology.

Methodology



Satellite Imagery

- DEM
- Slope Computation
- Land Cover
- Climate Variability



Modified DRASTIC 2.0

$$VA = 5DR + 3AR + 2SR + 1TR + 5IR + 3CR + 5LUR + 4SWIR + 2RR + 1TR$$

Where,

DR = Depth to water rating

AR = Aquifer rating

SR = Soil rating

TR = Topography rating

IR = Impact of vadose zone rating

CR = Hydraulic conductivity rating

LUR = Land use rating

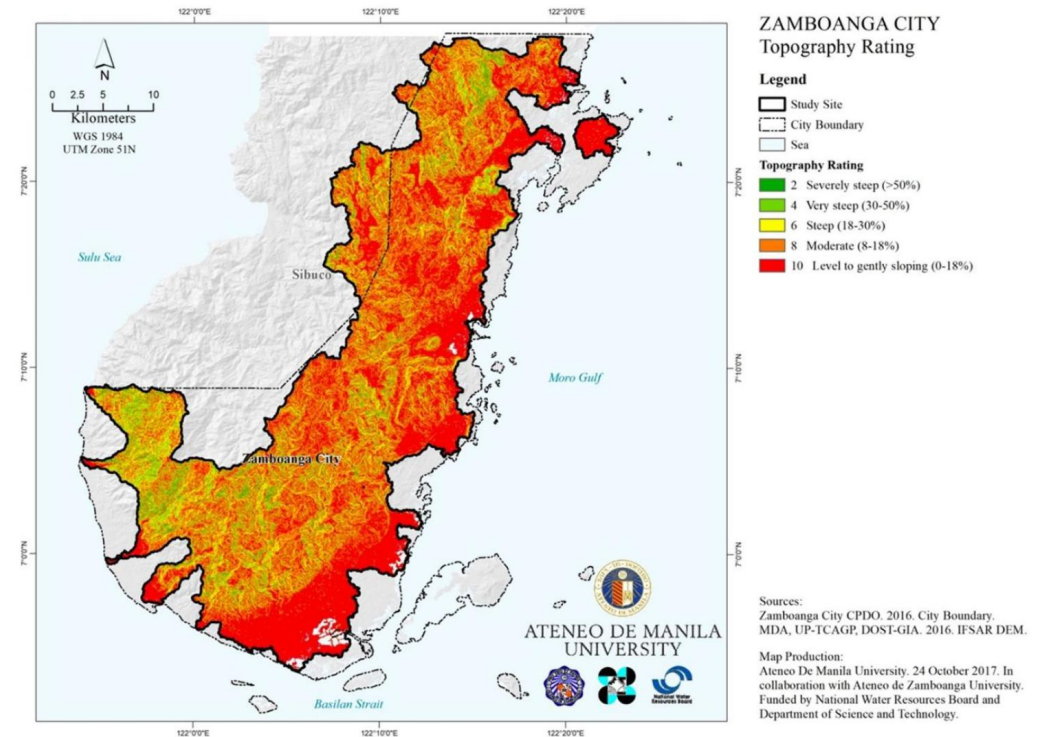
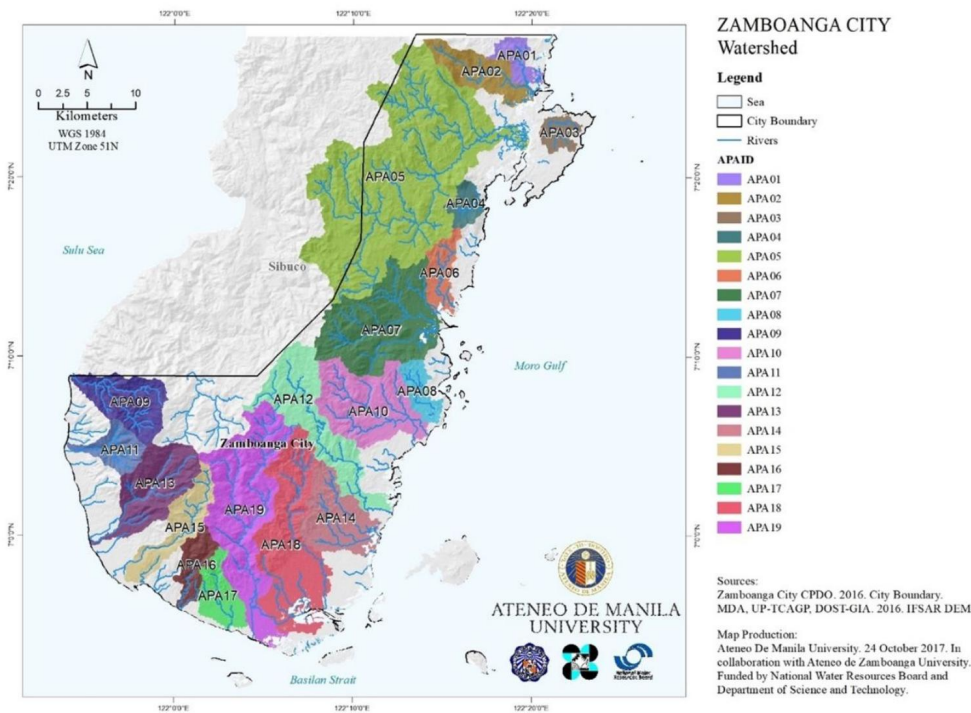
SWIR = Saltwater intrusion rating

RR = Projected rainfall rating (Year 2020, 2050)

TR = Projected temperature rating (Year 2020, 2050)

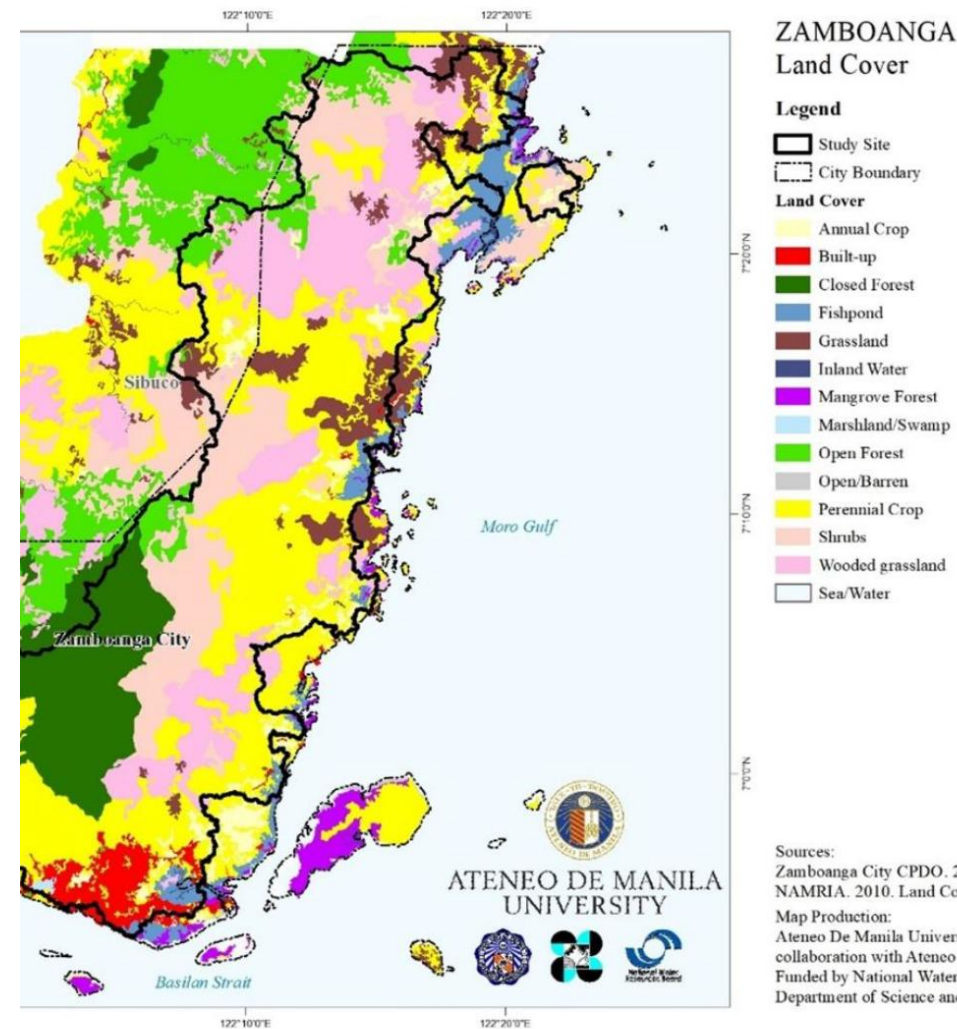
Watershed Delineation Using DEM

- IFSAR DEM was used to delineate the watershed of Zamboanga
 - Sub-shed was also identified
- Same DEM was used to create a slope map



Land Cover Mapping

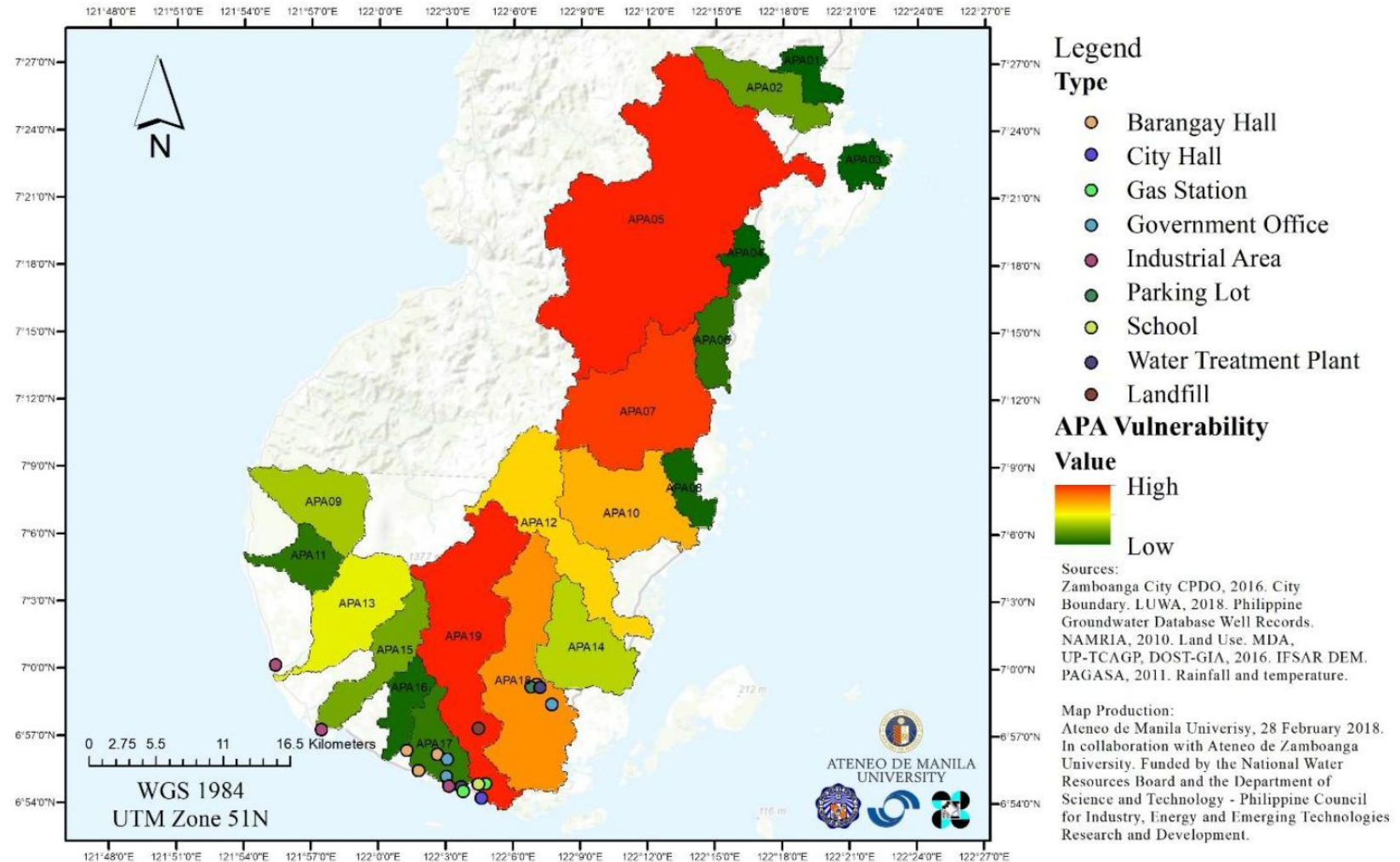
- Satellite imagery was used to prepare the land cover map
- Urban areas (residential, commercial & institutional areas) were identified
 - Demand for water was centered
- Forest & other vegetation areas were identified
 - Water “source” & “recharge areas”



ZAMBOANGA CITY GROUNDWATER VULNERABILITY

Vulnerability Analysis

- The vulnerability analysis resulted in the identification of aquifer protected areas (APA)



Results

- APA's 5, 7, and 19 were highly vulnerable
 - APA 18 & 19 – Central Business District
 - APA 5 & 7 – mountainous area/mining
- APA 18 – moderately vulnerable
- APA 17 – fish canning factories



What did we do with the results?

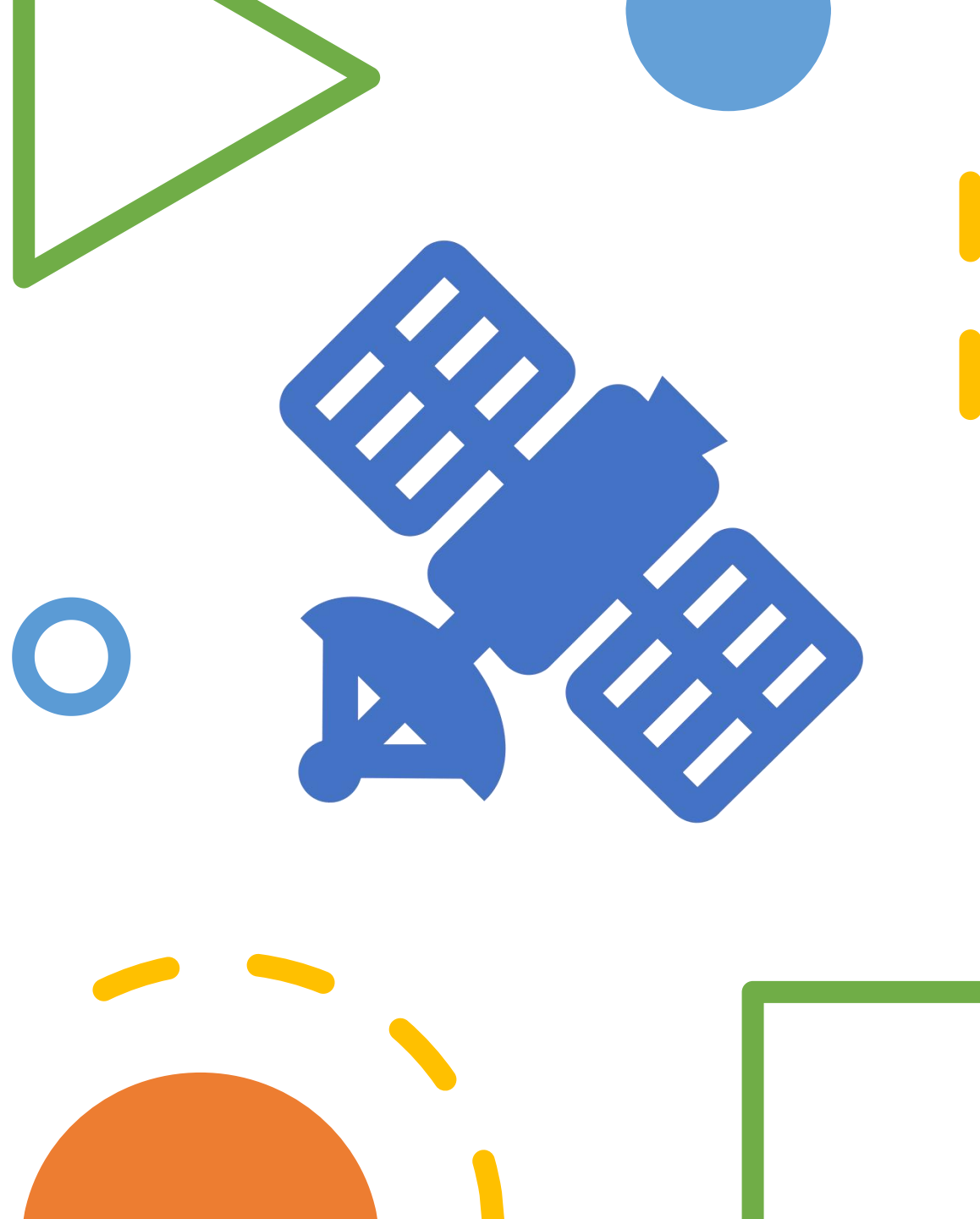
- Using the identified APAs with high vulnerability
 - Modeled water demand versus available water
 - Land use change
 - Population change
 - Monitored water quantity & quality

The background features a complex, layered geometric pattern of overlapping rectangular and zigzag shapes in various shades of light blue and grey. In the lower-left quadrant, there is a faint, semi-transparent reflection of a modern building with a grid-like facade. A thin, dark diagonal line is visible in the top-left corner, and a thin horizontal line runs across the bottom of the page.

Reflections

Satellite Data

- Satellite data is very convenient
 - Study large areas
 - Remote Areas
 - Areas with Insurgency Problems
 - Limited time to conduct the research





Limitations

- Sensing Below Ground
- Strata identification
- Cannot be used for quantity & quality issues with groundwater

Lessons Learned



Satellite Data is very useful



integrate with data on the
ground



Thank you very much!

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