

Philippine Science, Technology, Research and Development Program on Water Environment and Management

Seminar on Water Environment and Technologies



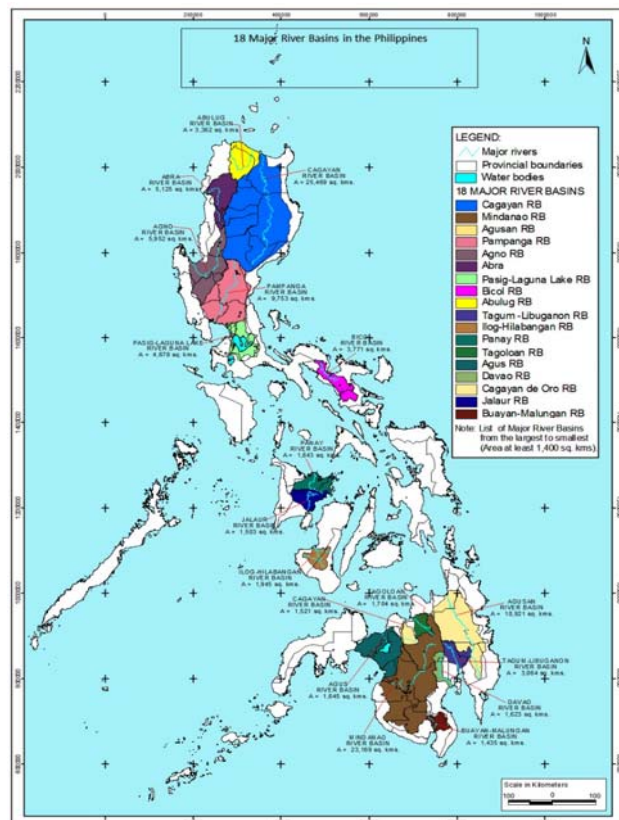
Research Center for Water Environment and Technologies
The University of Tokyo, Japan
June 12, 2019

Brenda L. Nazareth-Manzano
Undersecretary(Vice Minister), Phil. Department of Science and Technology

The Philippines has **12 water resources regions, 421 principal river basins in 119 proclaimed watersheds** – among these, **18** are considered **major river basins**



Source: National Water Resources Board



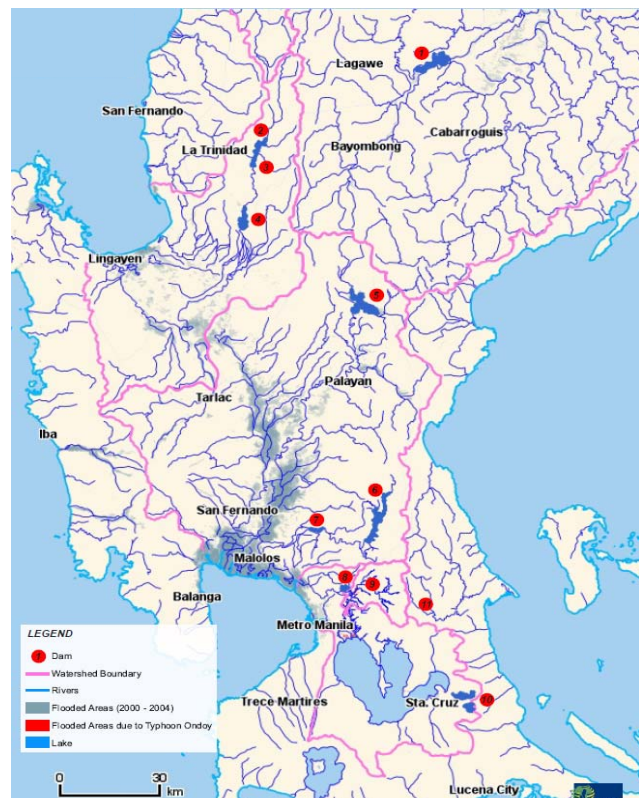
18 Major River Basins – at least 1,400 sq. km each

- **Pampanga River Basin** (9,759 sq. km)
- **Agno River Basin** (5,952 sq. km)
- Bicol River Basin
- **Cagayan River Basin** (27,753 sq. km)
- Pasig-Marikina River Basin
- **Abra River Basin** (5,125 sq. km)
- Cagayan de Oro River Basin
- Ilog-Hilabangan River Basin
- Jalaur River Basin
- Panay River Basin
- Tagum-Libuganon River Basin
- Abulog River Basin
- **Agusan River Basin** (10,921 sq. km)
- Agus River Basin
- Buayan-Malungon River Basin
- Davao River Basin
- **Mindanao River Basin** (21,503 sq. km)
- Tagolonan River Basin

Source: DENR-EMB / DOST-PAGASA

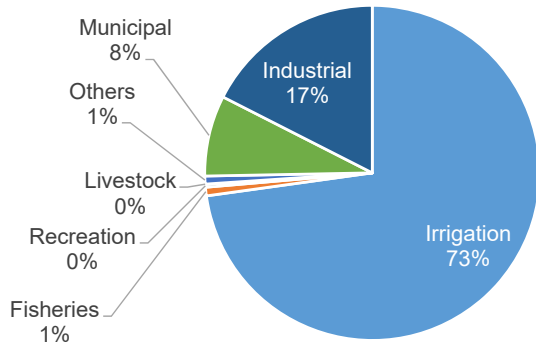
Dams and their Watersheds – Central Luzon

1. Magat Dam (1,250 MCM)
2. Ambuklao Dam (217 MCM)
3. Binga Dam (87.4 MCM)
4. San Roque Dam (850 MCM)
5. Pantabangan Dam (3,000 MCM)
6. Angat Dam
7. Ipo Dam
8. La Mesa Dam
9. Wawa Dam (*abandoned*)
10. Caliraya and Lumot Dam (130 MCM)
11. Laiban Dam (*proposed*)

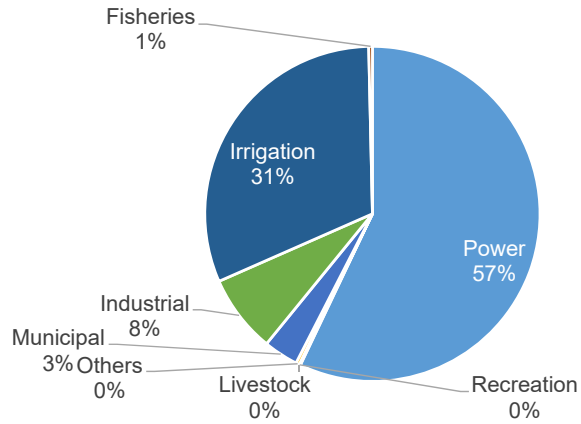


Source: www.essc.org.ph

**Water Resources Status
Consumptive Use**



**Water Resources Status
Non-Consumptive Use**



Source: Water Resources in the Philippines, National Water Resources Board

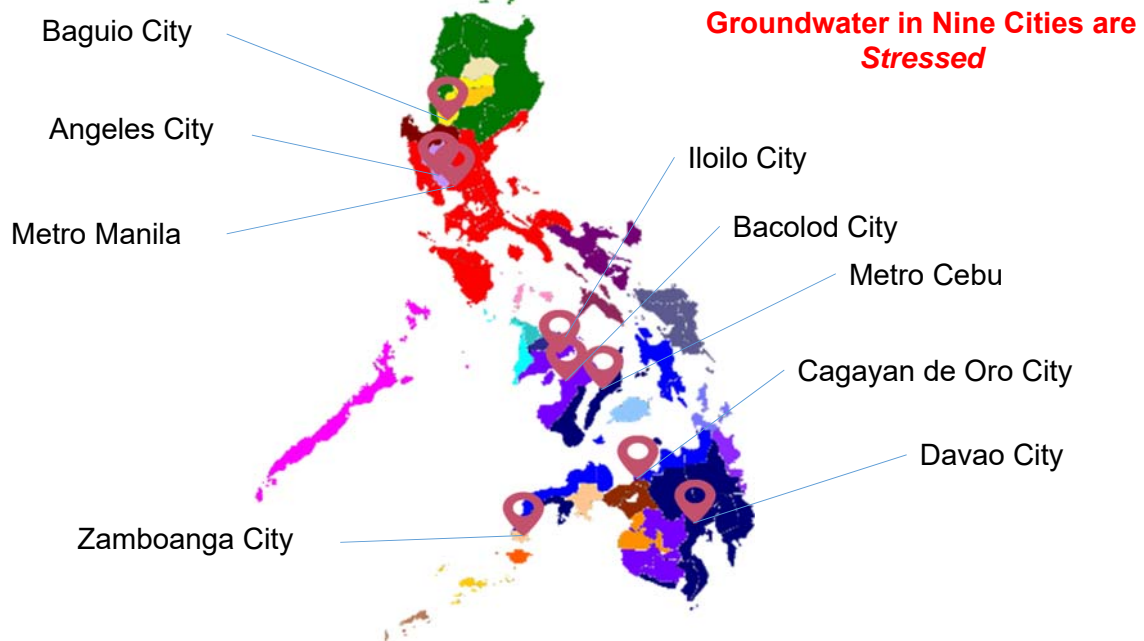
Water Resources Status

Water Resources Region	Groundwater	Surface Water (80% dependable flow)	Total Water Potential	Water Demand December 2018	Estimated Available Water
I	1248	3250	4498	4021.122	476.878
II	2825	8510	11335	9492.305	1842.695
III	1721	7890	9611	24117.785	-14506.785
IV	1410	6370	7780	16162.36	-8382.36
V	1085	3060	4145	3289.04	855.96
VI	1141	14200	15341	6274.32	9066.68
VII	879	2060	2939	3656.45	-717.45
VIII	2557	9350	11907	2876.2	9030.8
IX	1082	12100	13182	1515.27	11666.73
X	2116	29000	31116	6740.972	24375.028
XI	2375	11300	13675	5953.967	7721.033
XII	1758	18700	20458	7332.06	13125.94
Total	20197	125790	145987	91431.851	54555.149

Source: Water Resources in the Philippines, National Water Resources Board



Water Resources and Management – *Issues and Challenges*



Source: Water Resources in the Philippines, National Water Resources Board



Water Resources and Management – *Issues and Challenges*

The Philippines now has the **second lowest supply of water per capita in the ASEAN region** despite abundant rainfall due to poor infrastructure, management and frequent disasters

Water Resources and Management – *Issues and Challenges*

The quality of water resources has been **increasingly subjected to pollution** from untreated sewage, industrial wastes, livestock wastes, agro-chemicals, and sediments that end up in water bodies and aquatic ecosystems

Source: JICA Report, 2004

Water Resources and Management – *Issues and Challenges*

Water Quality and Quantity

- Unabated extraction of groundwater due to rapid urbanization and industrialization
- Inadequate sewerage and sanitation facilities
- Watershed degradation
- Deteriorating health of river and coastal systems
- Indiscriminate land use development



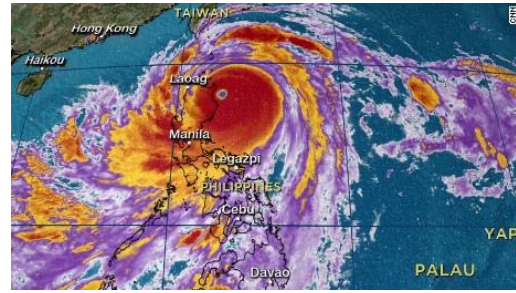
Source: Water Resources in the Philippines, National Water Resources Board



Water Resources and Management – *Issues and Challenges*

Extreme Events

- Increasing incidence and intensity of water related risks such as typhoons, floods, droughts and landslides



Source: Water Resources in the Philippines, National Water Resources Board



Water Resources and Management – *Issues and Challenges*

Increasing Water Demand

- Increasing water demand together with insufficient water infrastructure threatens to outstrip sustainable levels of supply



Source: Water Resources in the Philippines, National Water Resources Board



Water Resources and Management – *Issues and Challenges*

Groundwater and Surface Water Pollution

- Leaching of industrial, agrochemicals and animal wastes in agro-industrial areas
- Sub-surface discharges from latrines and septic systems and infiltration of polluted run-off
- Direct dumping of domestic solid waste in rivers and lakes
- Wastewater discharges from domestic and industries to bodies of water



Source: Water Resources in the Philippines, National Water Resources Board



Rationale – *the role of the Department of Science and Technology*

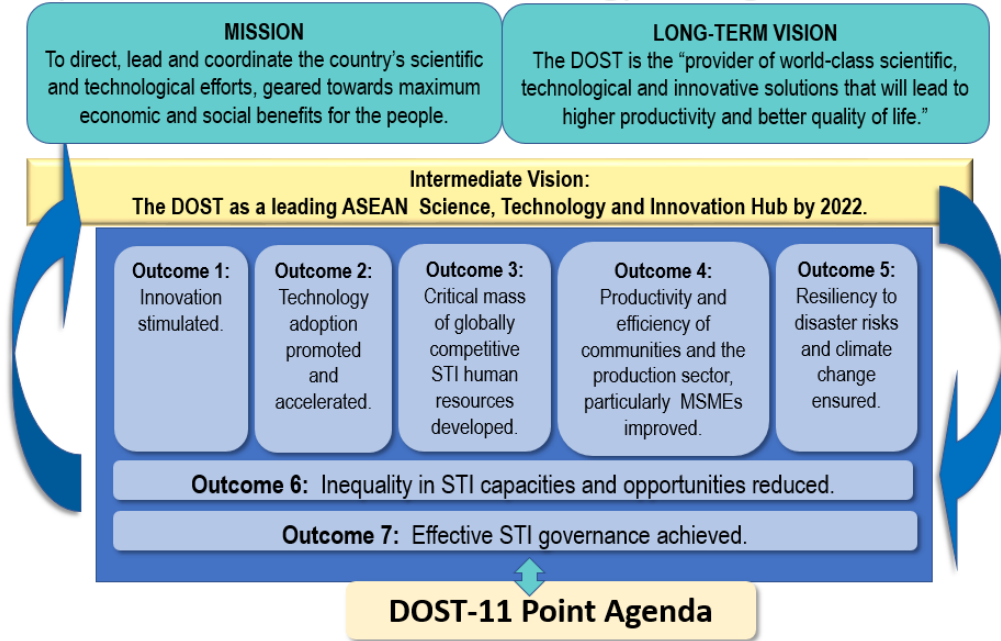
- DENR Administrative Order No. 2005-10 Implementing Rules and Regulations
- Philippine Clean Water Act of 2004 (RA No. 9275)

*Sec. 24 Pollution R&D Programs – the DENR, in coordination with the **DOST**, other concerned agencies and academic research institutions, shall establish a National R&D Program for the prevention and control of water pollution*

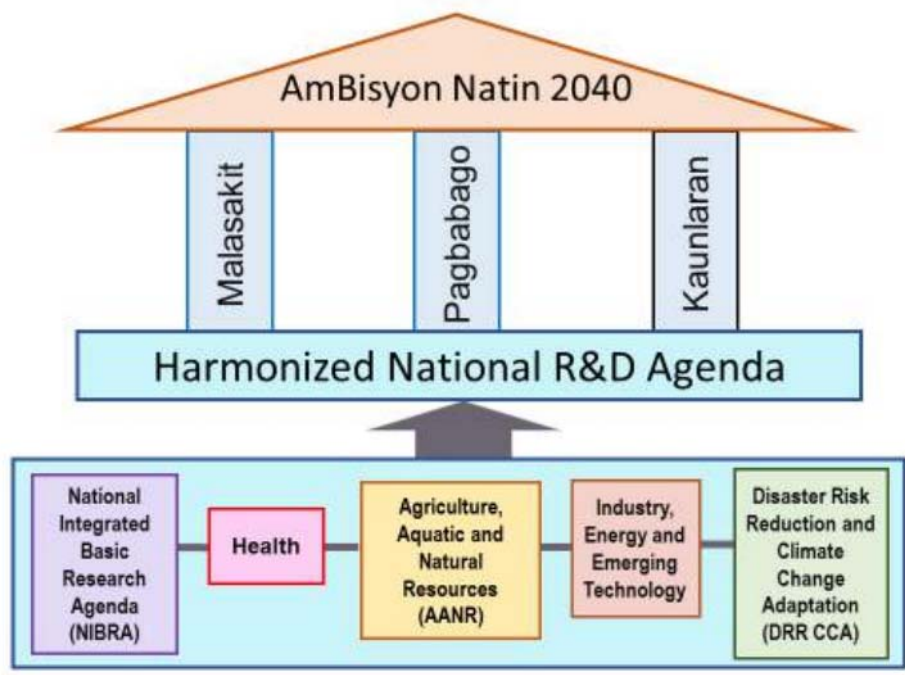
The **DOST** shall conduct and promote the coordination and acceleration of **research, investigation, experiments, training, surveys and studies** relating to the causes, extent, prevention and control of pollution among concerned government agencies and research institutions.

S&T Programs and Priority Areas – *the initiatives of DOST*

Department of Science and Technology Strategic Plan 2017-2022



S&T Programs and Priority Areas – *the initiatives of DOST*

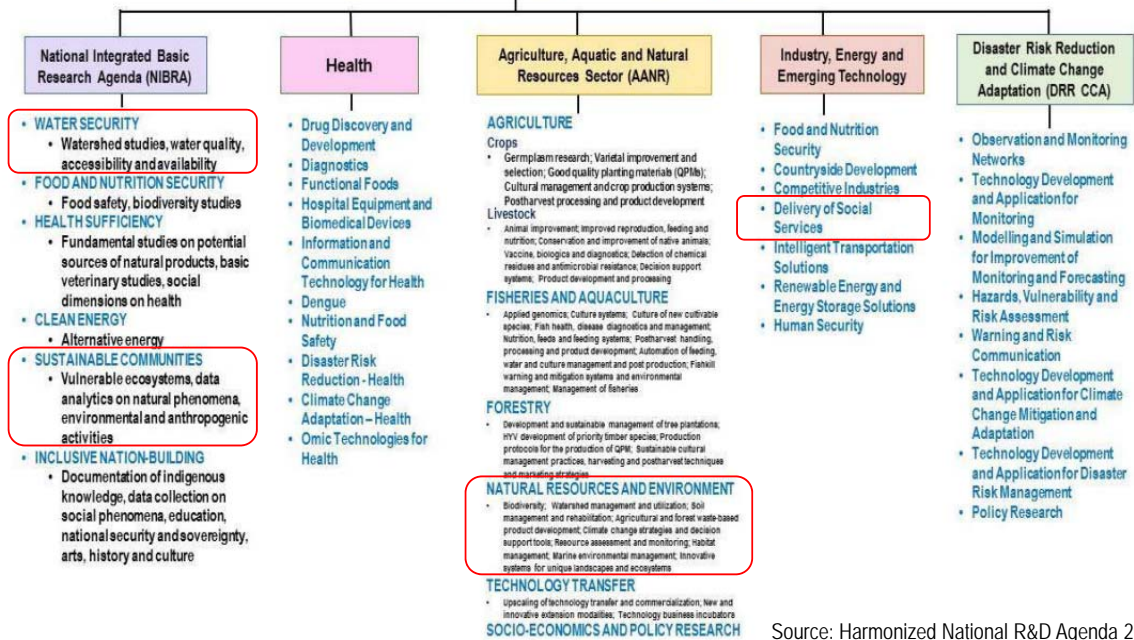


Source: Harmonized National R&D Agenda 2017 - 2022

S&T Programs and Priority Areas – the initiatives of DOST

HARMONIZED NATIONAL R&D AGENDA (2017-2022)

R&D Priority Areas and Programs



Source: Harmonized National R&D Agenda 2017 - 2022

S&T Programs and Priority Areas – the initiatives of DOST

Water Security (TUBIG Program) - NIBRA

- 1. Watershed Studies**
 - Biological, chemical and physical characterization
 - Water supply stress index
 - Population growth impacts on water resource availability
- 2. Water Quality, Accessibility & Availability**
 - Pollutants / contaminants (surface and ground waters)
 - Analysis of historical flows, sediment and toxicity loads of lakes and rivers
 - Weather modification for increasing water supplies in specialized localized areas

2017	2018	2019	2020	2021	2022	OUTPUT	
Characterization of water resources a. Pollutants/contaminants/toxicity b. Physico-chemical c. Socio-economic d. Biological e. morphological GROUNDWATER → RIVERS, RESERVOIR, DAMS →							Water quality assessment for policy per geographical area
Impacts on water supply a. El Nino b. La nina c. Regional Climate							Water availability index

Source: Harmonized National R&D Agenda 2017 - 2022

S&T Programs and Priority Areas – *the initiatives of DOST*

Sustainable Communities (SAKLAW Program) - NIBRA

1. Vulnerable Ecosystems

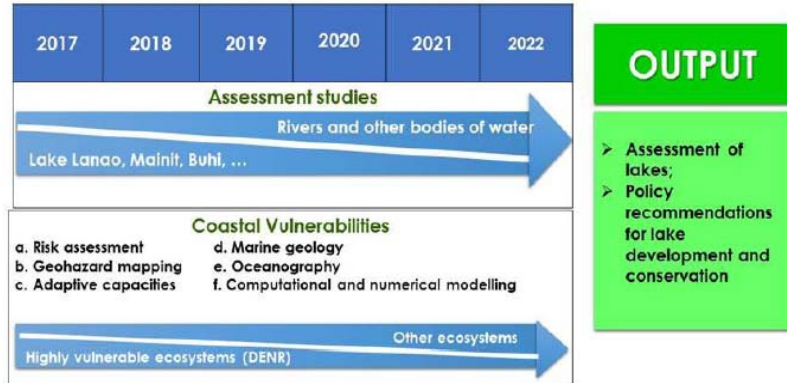
- Lakes, rivers and wetlands
- Oceans and marine studies
- Assessment of resource sustainability of various ecosystems
- Enhancing adaptive capacities of vulnerable communities

3. Environment & Anthropogenic Activities

- Processes in heavy metals sequestration from mine tailings, agri-farms
- Risk assessment of mining wastes and effluents, bioremediation studies

2. Data Analytics of Natural Phenomena

- Database of pollutants in abandoned mined-out areas
- Regional climate modelling and sensitivity analysis

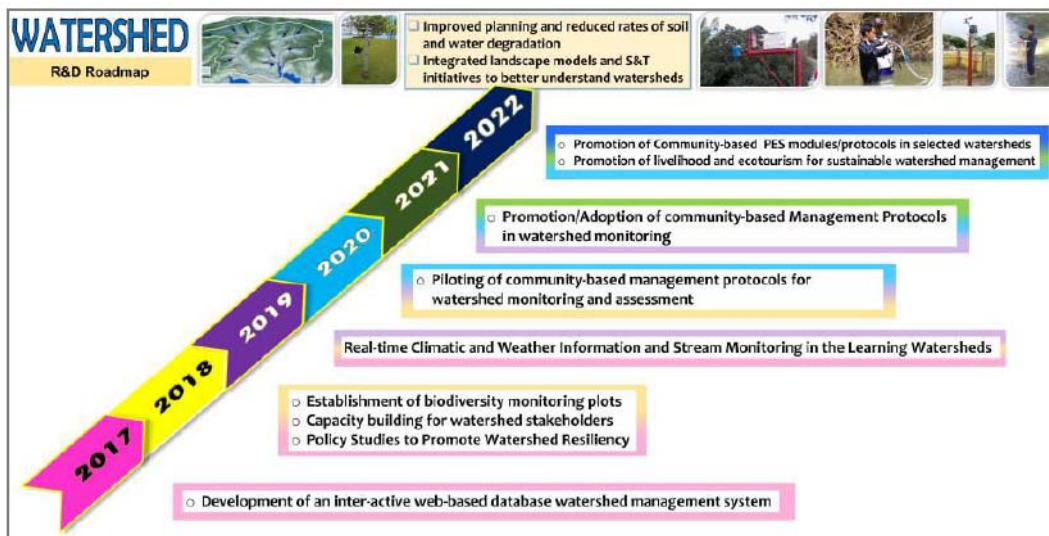


Source: Harmonized National R&D Agenda 2017 - 2022

S&T Programs and Priority Areas – *the initiatives of DOST*

Natural Resources & Environment R&D Agenda - AANR

- Sustainable watershed management and utilization
- Resource and ecosystems assessment monitoring
- Marine environmental management
- Innovative management systems for unique landscapes and ecosystems



Source: Harmonized National R&D Agenda 2017 - 2022



S&T Programs and Priority Areas – *the initiatives of DOST*

Delivery of Social Services - IEET

1. Environment and Pollution Control

- Wastewater management
 - Cleaner and safer technologies for application to industrial wastewater, waste management, safe and potable drinking water
 - Materials that detoxify harmful substances in water
 - Potable water
 - Storm water storage and rainwater technologies
 - New wastewater purification technologies
 - Treatment, control and monitoring sensors and systems

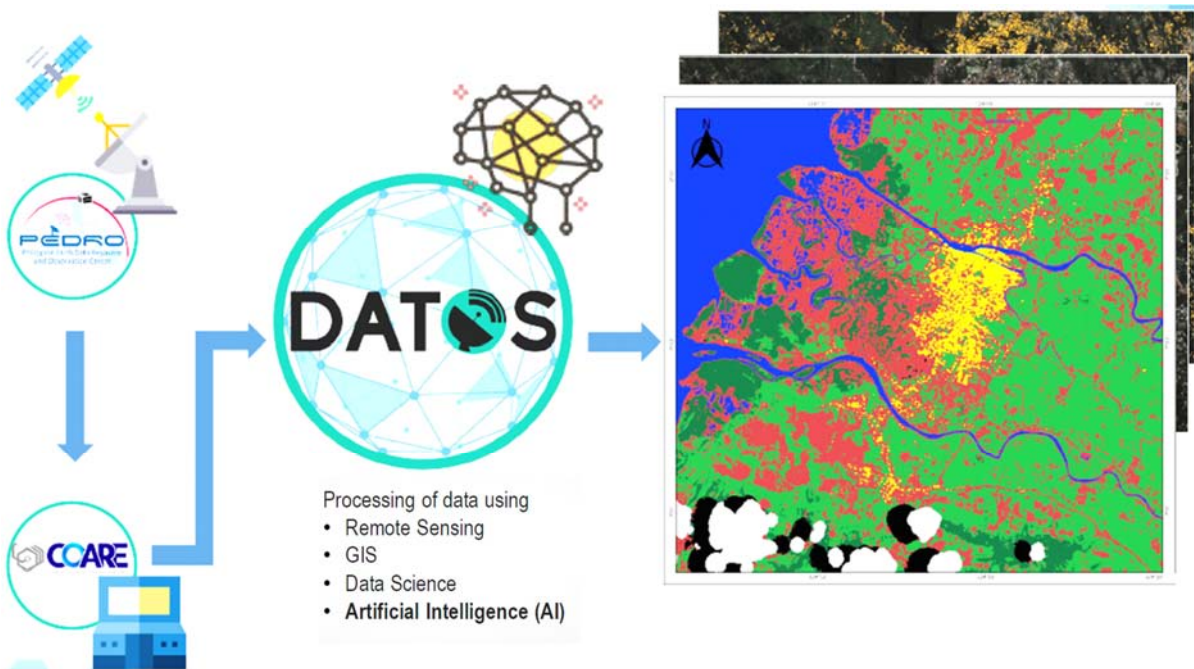


Source: Harmonized National R&D Agenda 2017 - 2022



S&T Programs and Priority Areas – *the initiatives of DOST*

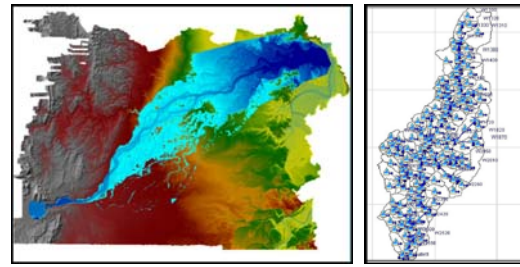
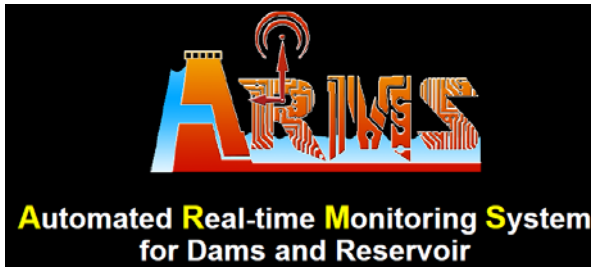
Monitoring / Mapping Technologies





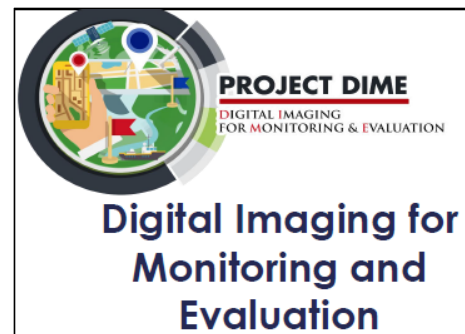
S&T Programs and Priority Areas – *the initiatives of DOST*

Monitoring / Mapping Technologies



S&T Programs and Priority Areas – *the initiatives of DOST*

Monitoring / Mapping Technologies



Geolocate Irrigation Projects

DBM data and Phil-LIDAR data can be used together to verify irrigation projects





S&T Programs and Priority Areas – *the initiatives of DOST*

Monitoring / Mapping Technologies



Aquosense

- Rapid, easy-to-use automated water quality monitoring system comprising of electronic sensors for measuring pH, dissolved oxygen, conductivity, turbidity, temperature, salinity and ammonia level quantitatively in real-time
- Able to store sensor readings and transmit data to an analytics cloud server over an internet connection for remote data access



S&T Programs and Priority Areas – *the initiatives of DOST*

Water and Wastewater Treatment Technologies



Organomineral (Vigormin)

- Formulation from naturally-occurring organominerals which reduces smell and muddy color in wastewaters and septic waters
- Stimulates growth of indigenous aerobic microorganisms in wastewater and boost degradation of organic pollutants



S&T Programs and Priority Areas – *the initiatives of DOST*

Water and Wastewater Treatment Technologies



Ceramic Water Filter

- Simplified, inexpensive and highly efficient clay-based water filter made of red clay and coated with nano-colloidal silver
- Mounted inside a top bucket receptacle with a pitcher-type receiver which will hold the top bucket making it a portable water filter system



S&T Programs and Priority Areas – *the initiatives of DOST*

Water and Wastewater Treatment Technologies

- **Eco-friendly Septic System for Temporary Shelters**

Septic System and Drainfield

Geotextile fabric
Sand/loam soil
Perforated pipe for effluent disposal
Soil absorption field
Two-compartment septic tank



S&T Programs and Priority Areas – *the initiatives of DOST*

S&T Water Environment Projects			
Water Use Management (Pollution Prevention)	Effluent Treatment (Point & Non-point Sources)	Water Resources & Water Environment	Water Supply (Clean Drinking Water)
Photocatalysis for textile & paper industries	Septic System for Temporary Shelters	Pasig River Stewardship through Science, Technology & Advocacy Program	Dome Type Ceramic Water Filters
Biological + Ozonation Process for wastewater treatment	Bioremediation technology for tannery & gold smelting wastewater	Green ACE Program – Estero de Paco	Production Centers for CWF
Nanofiber Membrane with Modified Nanoclay for Waste Water Treatment	Integrated Biological Wastewater Treatment Systems for the Food Processing Industry	Phytotechnologies Program	Pilot Production and Field-testing of Ceramics-based Water Filtration Systems
Coco Peat Filter Bed for Treatment of Heavy Metals	Isotopic and Geochemical Techniques to detect Organic Nutrient Contamination		
Philippine Montmorillonite Purification Technique for Nanocomposite Applications			
Electro-coagulation Treatment System for Pharmaceutical Waste Products			
Microbial Biofilms for the Rehabilitation of Heavy Metal			
Radiation-induced Grafting of Nonwoven Fabrics for Tanning Industry			



Philippine Science, Technology, Research and Development Program on **Water Environment and Management**

Seminar on Water Environment and Technologies



*Research Center for Water Environment and Technologies
The University of Tokyo, Japan
June 12, 2019*

Brenda L. Nazareth-Manzano
Undersecretary, Phil. Department of Science and Technology