NATIONAL ECONOMIC AND DEVELOPMENT AUTHORITY

Volume 2: Philippine Water Supply and Sanitation Master Plan

Central Luzon Water Supply and Sanitation Databook and Regional Roadmap

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Acronyms

AHFF	Agriculture, Hunting, Fishery and Forestry
AIP	Annual Investment Plan
AM	Assistance to Municipalities
BOD	Biological Oxygen Demand
BWSA	Barangay Water and Sanitation Association
CapEx	Capital Expenditure
CBO	Community-Based Organization
CNC	Certificate of Noncoverage
DA	Department of Agriculture
DAO	Department Administrative Order
DENR	Department of Environment and Natural Resources
DILG	Department of the Interior and Local Government
DJF	December, January and February
DOH	Department of Health
DPWH	Department of Public Works and Highways
DTI	Department of Trade and Industry
EMB	Environmental Management Bureau
FA	Financial Assistance
FAO	Food and Agriculture Organization
FHSIS	Field Health Service Information System
FIES	Family Income and Expenditure Survey
GDP	Gross Domestic Product
GRDP	Gross Regional Domestic Product
GVA	Gross Value Added
HH	Household
HUC	Highly Urbanized City
IEC	Information, Education and Communication
IP	Indigenous People
IWRM	Integrated Water Resource Management
JICA	Japan International Cooperation Agency
JJA	June, July and August
LCE	Local Chief Executive
LDP	Local Development Plan
LFPR	Labor Force Participation Rate
LGU	Local Government Unit
LHB	Local Housing Board
LSB	Local School Board
LSSP	Local Sustainable Sanitation Plan
LWSSP	Local Water Supply and Sanitation Plan
LWUA	Local Water Utilities Administration
M&E	Monitoring and Evaluation
MAM	March, April and May
MDG	Millennium Development Goals
MGB	Mines and Geosciences Bureau
MSME	Micro, Small and Medium Enterprises
NAMRIA	National Mapping and Resource Information Authority
NCR	National Capital Region
NDRRMC	National Disaster Risk Reduction and Management Council
NEDA	National Economic and Development Authority
NGO	Nongovernment Organization
NRW	Nonrevenue Water
NSSMP	National Septage and Sewerage Master Plan
NWRB	National Water Resources Board
O&M	Operation and Maintenance
OBS	Observed Baseline

OCD	Office of Civil Defense
OD	Open Defecation
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PAWD	Philippine Association of Water Districts
PDP	Philippine Development Plan
PEM	Philippine Environment Monitor
PNSDW	Philippine National Standards for Drinking Water
PSA	Philippine Statistics Authority
PSGC	Philippine Standard Geographic Code
PWSSMP	Philippine Water Supply and Sanitation Master Plan
RBCO	River Basin Control Office
RDC	Regional Development Council
RDP	Regional Development Plan
ROW	Right-of-Way
RWSA	Rural Waterworks and Sanitation Association
RWS	Rural Water System
SALINTUBIG	Sagana at Ligtas na Tubig
SDG	Sustainable Development Goals
SMC	Septage Management Committee
SMERA	Small and Medium Enterprise Roving Academy
SMP	Septage Management Program
SON	September, October and November
STP	Septage Treatment Plant
SSF	Shared Service Facilities
SWTP	Surface Water Treatment Plant
TC	Tropical Cyclone
UN	United Nations
UNICEF	United Nations Children's Fund
UTM	Universal Transverse Mercator
WASH	Water, Sanitation and Hygiene
WD	Water District
WGS	World Geodetic System
WHO	World Health Organization
WQMA	Water Quality Management Area
WRR	Water Resources Region
WSP	Water Service Provider
WSS	Water Supply and Sanitation
WSSPMO	Water Supply and Sanitation Program Management Office
ZOD	Zero Open Defecation

Units

%	percent
°C	degree Celsius
CY	Calendar Year
km²	square kilometer
km	kilometer
lpcd	liters per capita per day
lps	liters per second
m³	cubic meter
MCM	million cubic meters
mm	millimeter
mg/L	milligrams per liter
PhP	Philippine peso

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Region III - Central Luzon

3

Central Luzon Region

Introduction

The Central Luzon Region is strategically located between Northern Luzon and the National Capital Region (NCR).

It is bordered by Pangasinan and Nueva Vizcaya on the north, Metro Manila, Cavite and Rizal on the south, Aurora and Dingalan Bay on the east, and Palauig Bay and Subic Bay on the west.

Designated as Region III, it is composed of seven provinces — Aurora, Bataan, Bulacan, Nueva Ecija, Pampanga, Tarlac and Zambales.

At the heart of Central Luzon are two first-class and highly urbanized cities (HUCs) — Angeles City (the commercial, industrial, aviation, tourism and financial center of Pampanga), and Olongapo City in Zambales.

Central Luzon is endowed with abundant natural resources with vast plains and farmlands planted with rice. It is the nation's top rice producer, hence its famous moniker — the "Rice Granary of the Philippines". It is also the second largest producer of sugarcane. Its other major crops include fruits, vegetables and cacao.

It is rich in timber and mineral deposits (metallic and nonmetallic). Its other natural wonders include towering mountains (e.g., Mt. Samat and Mt. Arayat), extinct and active volcanoes (such as Mt. Pinatubo), and sea harbors that stretch from the tip of the Bataan peninsula to the north of Manila Bay.

Land Classification

The region has a total land area of 22,296 square kilometers (km^2) and has the largest contiguous lowland in the country.

Its agricultural land and forestland cover around 40% and 45%, respectively, of its total land area. Gold, silver, chromite, limestone, marble, clay, sand and gravel abound in Zambales and Bulacan.

Economy

The service sector makes up the lion's share in Central Luzon's Gross Regional Domestic Product (GRDP), followed by the industry sector, and the agriculture, hunting, fishery, and forestry sector.[1]

The region's domestic sales reached an estimated PhP773.28 billion in 2016, approximately PhP67 billion more than its economic output in 2015 pegged at PhP706.34 billion.

Its economy, which contributed 0.9% to the country's 6.9% growth, was primarily driven by the food, beverage and transport manufacturing sector. The agriculture, hunting, forestry and fishing (AHFF) sector maintained its 0.6% growth rate for two consecutive years.

The growth of micro, small, and medium enterprises (MSMEs), aided by the Small and Medium Enterprise Roving Academy (SMERA) of the Department of Trade and Industry (DTI) and Shared Service Facilities (SSF), has likewise contributed to the rise in its domestic sales.[1]

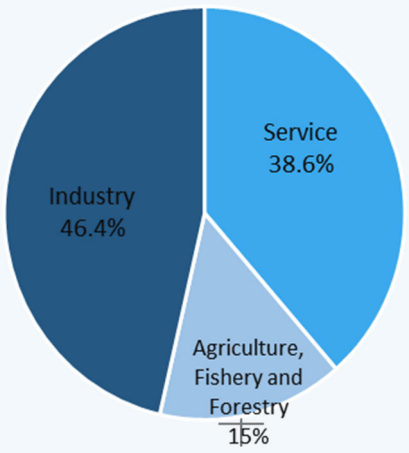

Figure 1: GRDP Contributions per Sector, 2016[2]

Labor and Employment

The current total labor force participation rate (LFPR) is estimated at 63% of the total regional population. Bulacan has the highest LFPR (66.0%) among the seven provinces, though there has been no significant difference therein with respect to the LFPR of other provinces.[3]

The employment rate is considerably high at 95%. However, the underemployment rate has further gone down to 16.1% in 2016 primarily because of seasonal job opportunities and the mismatch of job requirements and skills or academic qualifications of job hunters. Tarlac and Nueva Ecija have the highest employment rate at 95%.

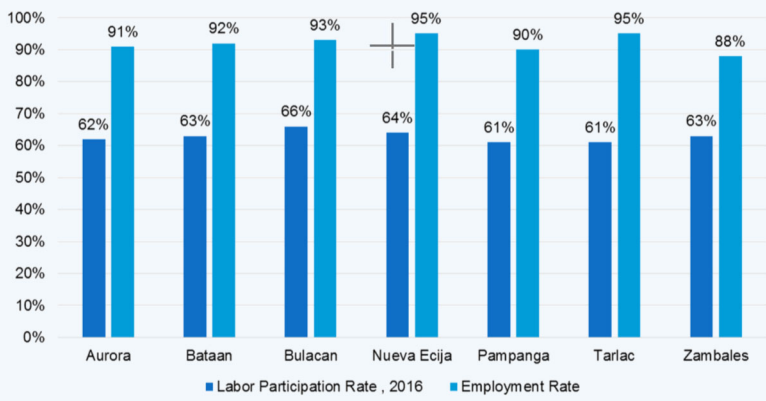

Figure 2: Labor Force Participation and Employment Rates per Province, 2016

[1] National Economic and Development Authority, Region III, Regional Economic Situationer, 2015
[2] Philippine Statistics Authority, CountryStat Philippines, 2016
[3] Philippine Statistics Authority, Labor Force Survey, 2017 and 2018

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Legend

Population Density (person/ha)

- 0.0 - 1.5
- 1.5 - 3.2
- 3.2 - 4.8
- 4.8 - 6.8
- 6.8 - 9.4
- 9.4 - 13.6
- 13.6 - 19.4
- 19.4 - 30.9
- 30.9 - 63.0
- 63.0 - 1820.3

Dilasag
Casiguran
Dinalungan
Carranglan
Dipaculao
AURORA
Lupao
San Manuel
Cuyapo
Pantabangan
Maria Aurora
Baler
Santa Cruz
Talugtug
San Jose City
Moncada
Anao
Nampicuan
Mu♦oz City
Rizal
Camiling
Paniqui
Ramos
Guimba
Llanera
Bongabon
San Clemente
Candelaria
Pura
NUEVA ECIJA
San Luis
Gerona
Talavera
Santa Ignacia
Victoria
General Mamerto Natividad
Mayantoc
Licab
Quezon
Masinloc
Palayan CityLaur
Gabaldon
Aliaga
Cabanatuan City
TARLAC
Tarlac City
Palauig
La Paz
Zaragoza
San Jose
Santa Rosa
Iba
Jaen
San Leonardo
Capas
Concepcion
San Antonio
Pe♦aranda
General Tinio
ZAMBALES
Gapan City
Dingalan
San Isidro
Botolan
Bamban
Magalang
Cabiao
Mabalacat
Arayat
San Miguel
Cabangan
Angeles City
Mexico
Santa Ana
Candaba
Porac
San Felipe
San Fernando City
Do♦a Remedios Trinidad
San Ildefonso
San Marcelino
PAMPANGA
San Luis
San Narciso
Santa Rita
Bacolor
Floridablanca
Santo Tomas
San Simon
Guagua
Minalin
Apalit
BULACAN
Castillejos
Baliuag
Angat
Subic
Olongapo City
Lubao
Macabebe
Calumpit
Pulilan
Bustos
Norzagaray
San Antonio
Sasmuan
Pandi
Plaridel
Dinalupihan
Masantol
Malolos City
Santa Maria
Hermosa
Balagtas
San Jose del Monte City
Hagonoy
Orani
Bulacan
Bocaue
Samal
Marilao
Morong
Meycauayan City
Abucay
Obando
BATAAN
Pilar
Orion
Bagac
Limay
Mariveles

Population Density

PSA, 2015 Census

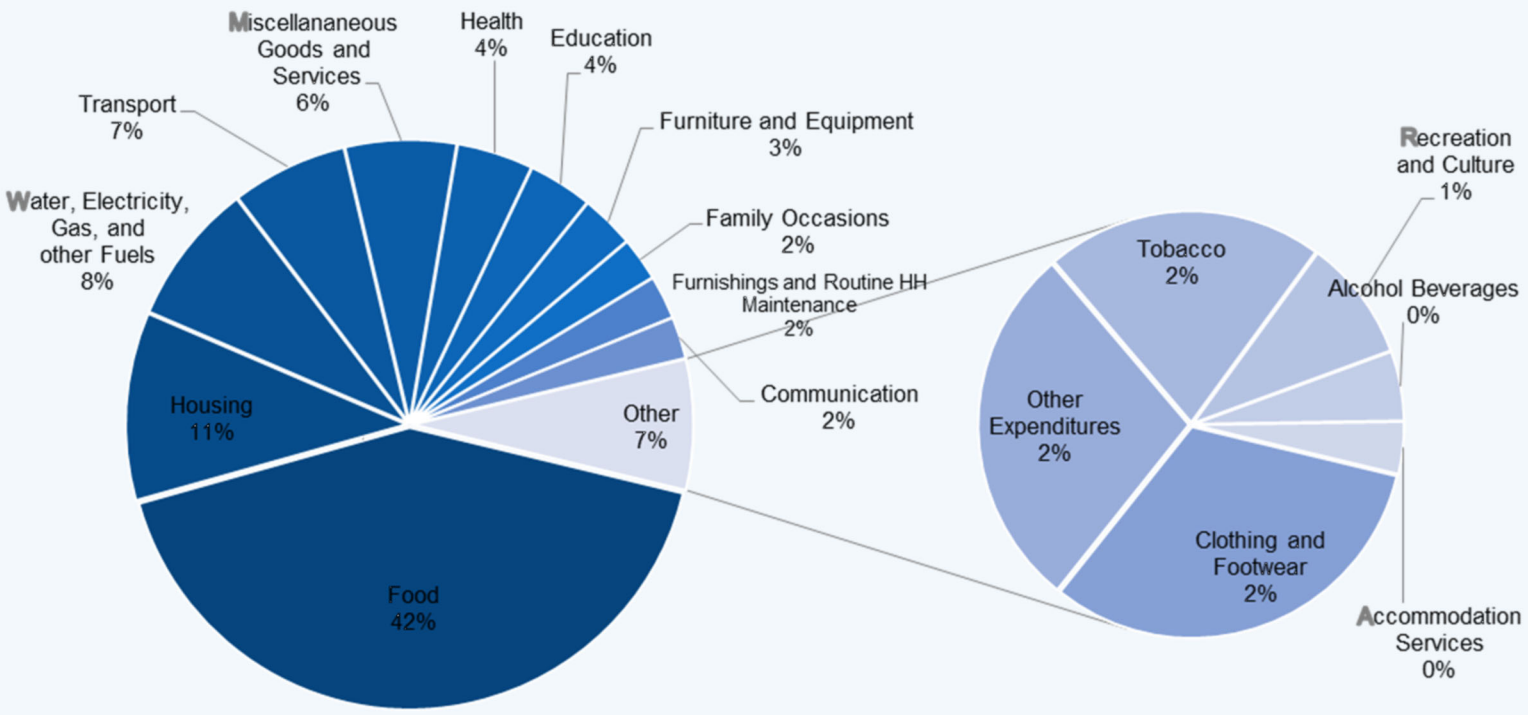

Figure 3: Distribution of Expenditure, 2015[4]

Family Income and Expenditure

Central Luzon has approximately 2,575,577 households (HHs), with an estimated annual average income of Php299,000 and an annual average expenditure of Php239,000.

The total average expenditure for the PhP40,000-59,999 category is greater than the average income, while the households in other categories have incomes greater than their expenditures. With family size as an indicator, a family of five has the largest income-expenditure difference, while a single-person household has the least income-expenditure difference. This shows that a family of five has more savings compared to other family sizes.

With respect to the disbursement patterns of the families and across income levels, the 2015 Family Income and Expenditure Survey (FIES) indicates that food expenditure registered the highest among the major expenditure groups at 42%. Housing expenses followed at 10.8%; expenses for water, electricity, gas and other fuels were estimated at 8.2%. Figure 3 graphs the expenditure distribution and shows that most families spend more for their basic needs.

Demography

The region's population was estimated at 11,218,177 in 2015, accounting for 1.95% of the country's total population. Bulacan had the largest population among the seven provinces, and Aurora had the smallest population. The region's population growth from 2000 to 2015 was recorded at 1.45%, which was lower than the national average of 1.84%.

The population density of the region averaged 503 persons per km^2 in 2015. Among local government units (LGUs), Angeles City had the highest density at 6,830 persons per km^2 — larger than that of the entire region. The map on the left shows that Central Luzon's population is concentrated in the cities as well as along the coastal areas.

The region is predominantly (77%) rural. Household size in the region averages at 4.1 persons.

Table 1: Population per Province/HUC, 2015

Region/ Province/City	Population	Land Area (km^2)	Population Density (Persons/km^2)
Central Luzon	**11,218,177**	**22,014.63**	**503**
Aurora	214,336	3,147.32	68
Bataan	760,650	1,372.98	554
Bulacan	3,292,071	2,796.10	1,177
Nueva Ecija	2,151,461	5,751.33	374
Pampanga (excluding Angeles City)	2,198,110	2,002.20	1,098
Tarlac	1,366,027	3,053.60	447
Zambales (excluding Olongapo City)	590,848	3,645.83	162
Angeles City	411,634	60.27	6,830
Olongapo City	233,040	185.00	1,260

Table 2: Urban and Rural Population per Province/HUC, 2015[5]

Region/Province/City	Urban Population	Rural Population
Central Luzon	**51%**	**49%**
Aurora	10%	90%
Bataan	49%	51%
Bulacan	71%	29%
Nueva Ecija	26%	74%
Pampanga (excluding Angeles City)	55%	45%
Tarlac	33%	67%
Zambales (excluding Olongapo City)	33%	67%
Angeles City	93%	7%
Olongapo City	98%	2%

[4] Philippine Statistics Authority, Family Income and Expenditure Survey, 2015
[5] Philippine Statistics Authority, Philippine Standard Geographic Code, 2015

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WGS 1984 - UTM Zone 51 N

Legend

- Type I - two pronounced season, dry from November to April and wet during the rest of the year. Maximum rain period is from June to September.
- Type II - no dry season with a very pronounced maximum rain period from December to February. There is not a single dry month. Minimum monthly rainfall occurs during the period of March to May.
- Type III - no very pronounced maximum rain period with a dry season lasting only from one to three months, either during the period from March to May. This type resembles Type I since it has a short dry season.
- Type IV - rainfall is more or less evenly distributed throughout the year. This type resembles Type 2 since it has no dry season.

Climate

PAGASA, 2015 Data

Climate

According to the Modified Coronas Classification, Central Luzon has three types of climate namely: Type I, Type II and Type III.

Type I has two pronounced seasons: dry from November to April, and wet the rest of the year. Type II has no dry season with a very pronounced maximum rain period from December to February, and Type III has no very pronounced maximum rain period with a dry season lasting only from one to three months, i.e., from March to May.

Disaster Risk

The region's water supply and sanitation (WSS) systems and facilities have not been fully upgraded because it is often battered by typhoons owing to its high vulnerability to geological and climatological hazards.

About 15 out of the average of 20 typhoons that visit the country each year travel across or make landfall in Central Luzon.

The Philippine Fault Zone, one of two main earthquake generators, traverses Luzon, Visayas, and Mindanao. The other is the Philippine Trench situated approximately 100 kilometers from the mainland of the eastern seaboard towards the Pacific Ocean.[6]

Climate Change and Hydrological Hazards

The Philippines is at great risk of climate-related hazards, such as tropical cyclones (TCs), floods, droughts and sea level rise. The effects of observed changes in extreme events and severe climate anomalies include increased occurrence of extreme rains causing: (a) floods and landslides; (b) longer and more intense droughts which cause massive crop failures, water shortages and forest fires; and (c) increased occurrence of TCs.

Global climate models, which were used to run two possible scenarios (A1B and A2), were downscaled to calculate projected Philippine rainfall. Studies show a general increase in rainfall for 2020, 2050 and beyond. The models, however, show higher variability in rainfall with increased peak rainfall during the wet season and longer dry conditions during the dry season. (Rainfall variability means changes in water supply dynamics spatially and year-to-year.)

Water supply is highly vulnerable to changes in river flows and the rate of replenishment of groundwater resources. Lower river flows will result in water shortages. More intense rainfall events may not necessarily mean more groundwater recharge compared to rain that is more evenly spread throughout the year. Lower than average rainfall or longer pronounced dry days may affect soil porosity and vegetation, which could lead to reduced soil infiltration rates. This means less groundwater recharge. Given this scenario, more water stress will likely be experienced by 2020 and 2050.

The projected seasonal temperature increase, seasonal rainfall change and frequency of extreme events (temperatures higher than 35°C, days when rainfall is more than 300 mm, and rainy days that outnumber dry days) in Central Luzon based on the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) downscaled climate projections are shown in Tables 3 and 4. Four seasons are provided: December, January and February (DJF); March, April and May (MAM); June, July and August (JJA); and September, October and November (SON). The projections were added to the observed values in the past 30-year baseline (1971-2000).

Table 3: Seasonal Projections Under a Medium-Range Emission Scenario

Seasonal Temperature Increase (in °C)	Observed Baseline (1971 - 2000)				Change in 2020 (2006-2035)				Change in 2050 (2036-2065)			
	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
Aurora	24.5	27.1	27.9	26.7	0.9	0.9	1.0	1.0	1.9	2.0	2.0	2.0
Bataan	26.4	28.7	27.6	27.3	1.0	1.1	0.8	1.0	2.0	2.1	1.7	1.9
Bulacan	25.6	27.9	27.1	26.7	0.9	1.1	0.9	1.0	1.9	2.1	1.7	1.9
Nueva Ecija	25.3	27.7	27.5	26.8	0.9	1.1	0.9	1.0	2.0	2.1	1.8	2
Pampanga	26.0	28.3	27.5	27.1	1.0	1.1	0.9	1.0	2.1	2.2	1.8	2
Tarlac	26.1	28.3	27.8	27.3	1.1	1.1	1.0	1.1	2.2	2.2	1.9	2.1
Zambales	26.3	28.3	27.4	27.2	1.0	1.1	0.9	1.0	2.1	2.1	1.7	1.9
Seasonal Rainfall Change (in %)	**Observed Baseline (1971 - 2000)**				**Change in 2020 (2006-2035)**				**Change in 2050 (2036-2065)**			
	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
Aurora	615.7	546.4	768.7	1151.1	-0.3	-17.1	6.7	5.8	8.7	-29.2	7.4	-5.7
Bataan	71.7	368.7	1326.2	872.6	2.7	-5.2	9.4	-0.4	-8.2	-8.1	29.1	1.5
Bulacan	212.4	288.9	1041.4	842.1	4.2	-23.0	12.8	-2.9	-13.2	-36.4	23.6	-3.3
Nueva Ecija	155.2	316.5	995.0	745.0	7.5	-13.8	10.1	1.6	-7.4	-25.7	22.7	-2.4
Pampanga	120.8	320.6	1030.4	785.2	16.3	-18.8	4.4	-5.1	-15.4	-26.4	13.9	-7.2
Tarlac	43.4	265.4	1193.5	644.3	26.0	-13.7	-1.6	-9.6	-6.7	-18.2	8.8	-5.5
Zambales	40.9	36.8	1793.9	872	34.2	-4.5	13.3	-1.6	-2.2	-21.6	31.4	5.6

Table 4: Frequency of Extreme Events in 2020 and 2050 Under a Medium-Range Emission Scenario

Province	Station	No. of Days w/ T_{max} > 35°C			No. of Dry Days			No. of Days w/ Rainfall > 300 mm		
		OBS	2020	2050	OBS	2020	2050	OBS	2020	2050
Aurora	Baler	397	819	2008	1295	6176	6161	12	43	43
Nueva Ecija	Cabanatuan	1293	3271	4796	8113	6117	6202	9	13	17
Pampanga	Clark	355	1855	3108	889	5701	5754	8	12	12
Zambales	Iba	259	573	1573	8034	6500	6325	4	12	13

[6] *National Economic and Development Authority, Region III, Regional Development Plan, 2017-2022*

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AURORA

NUEVA ECIJA

TARLAC

ZAMBALES

PAMPANGA

BULACAN

BATAAN

Contour Map

NAMRIA

160°0.000'W

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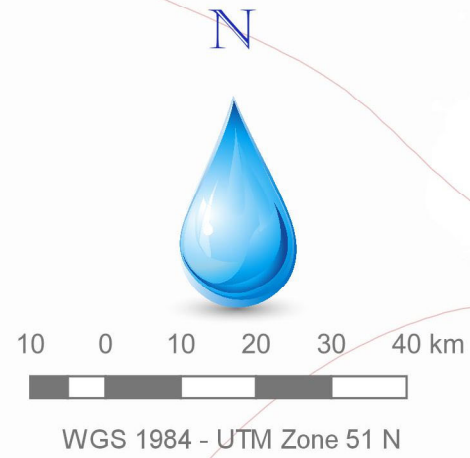
Average Rainfall

PAGASA, 2015 Data



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Annual Rainfall 2015

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WGS 1984 - UTM Zone 51 N

Legend

Safe Drinking Water (%)

- 1-77
- 78-89
- 90-95
- 96-98
- 98-100

Dilasag
Casiguran
Dinalungan
Carranglan
Dipaculao
AURORA
Pantabangan
Maria Aurora
Baler
San Luis
San Manuel
Cuyapo
Talugtug
San Jose City
Moncada
Anao
Nampicuan
Mu◆oz City
Rizal
Santa Cruz
Camiling
Paniqui
Ramos
Guimba
Llanera
Bongabon
San Clemente
Candelaria
Pura
NUEVA ECIJA
Gerona
Talavera
General Mamerto Natividad
Santa Ignacia
Victoria
Licab
Quezon
Mayantoc
Masinloc
Aliaga
Palayan CityLaur
Gabaldon
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Cabanatuan City
Palauig
La Paz
Zaragoza
San Jose
Santa Rosa
Jaen
San Leonardo
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San Miguel
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Santa Ana
Candaba
Porac
San Fernando City
San Ildefonso
Do◆a Remedios Trinidad
San Felipe
PAMPANGA
San Luis
San Marcelino
San Narciso
Santa Rita
Bacolor
Santo Tomas
San Simon
Floridablanca
BULACAN
Guagua
Minalin
Apalit
Castillejos
Baliuag
Bustos
Angat
Subic
Olongapo City
Lubao
Macabebe
Calumpit
Pulilan
Pandi
Norzagaray
San Antonio
Sasmuan
Plaridel
Dinalupihan
Masantol
Malolos City
Santa Maria
Hermosa
Balagtas
San Jose del Monte City
Hagonoy
Orani
Bulacan
Bocaue
Samal
Marilao
Morong
Meycauayan City
Abucay
Obando
BATAAN
Pilar
Orion
Bagac
Limay
Mariveles

Access to Safe Drinking Water

PSA, 2015 Census

WSS Sector Status

Access to Safe Water

Approximately 98% of Central Luzon's population had access to safe water sources in 2015[7].

This figure translates to approximately 1,674,000 out of the total. Approximately 49.01% of the population has Level III service connections in their homes, while 6.11% has Level II connections that are shared with the community. About 43.60% of the population has access to Level I service.

Safe sources of water under this category include tubed and piped deep/shallow wells (which users themselves own or share with the community), and protected springs, rivers, streams, etc.

The region's access to safe water is above the national average, with an 11% difference. Regarding access per level of service, Central Luzon's percentage does not differ significantly from the national figure, having variances greater than 10%, i.e., Level I (safe sources) in particular. Level III access, on the other hand, is higher at 49.01% as compared to 44.1% at the national level.

Table 5: National and Regional Access to Water Supply[8]

Level of Service	National	Region III
Level III	44.1%	49.0%
Level II	11.2%	6.1%
Level I (Safe Sources)	32.4%	43.6%
Subtotal (Safe Sources)	*87.7%*	*98.7%*
Level I (Unsafe Sources)	12.3%	1.3%
Total	100.0%	100.0%

Figure 4 shows the percentage distribution of the region's various water sources.

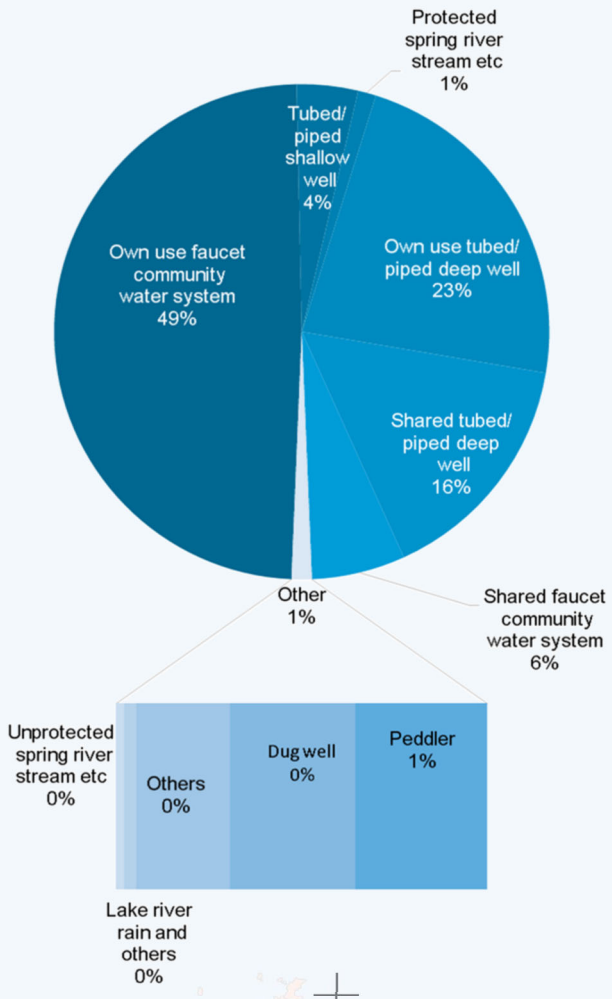

Figure 4: Main Sources of Water Supply, 2015

Table 6 shows safe water access in 2015 at the provincial level.

Table 6: Access to Water Supply per Province/HUC[9]

Region/Province/City	Access to Safe Water Supply
Central Luzon	**98.2%**
Aurora	100.0%
Bataan	97.1%
Bulacan	100.0%
Nueva Ecija	100.0%
Pampanga	94.0%
Tarlac	100.0%
Zambales	92.0%
Angeles City	100.0%
Olongapo City	100.0%

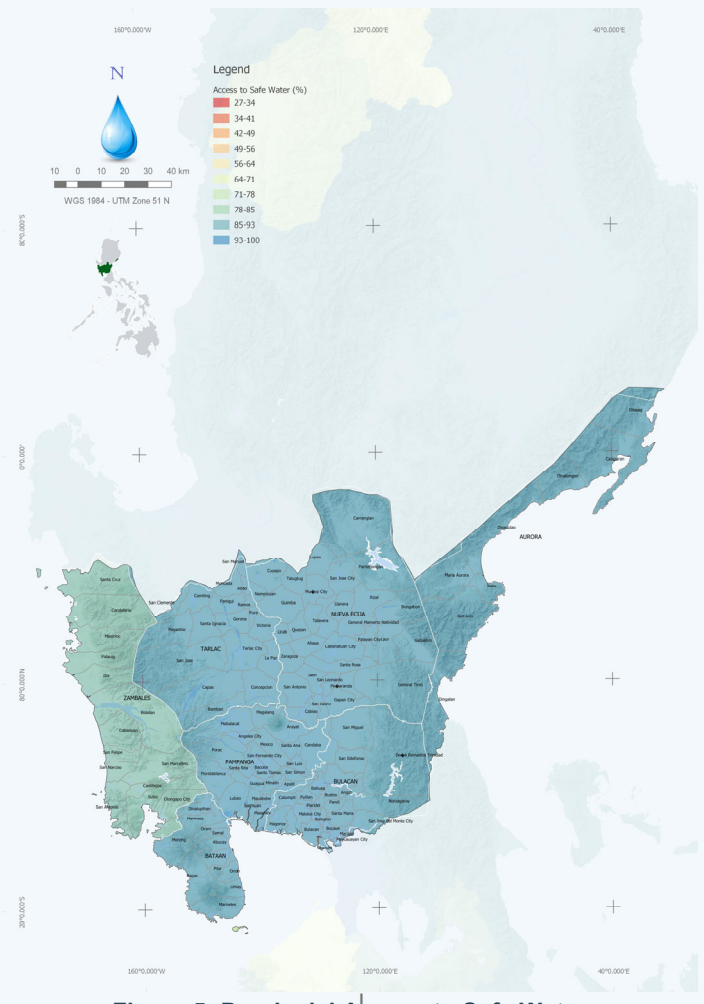

Figure 5: Provincial Access to Safe Water

Drinking Water

In terms of access to safe drinking water, the Philippine Statistics Authority (PSA) has released data up to the municipal level based on the latest 2015 Census. The classification of sources for drinking water is the same as that for sources of safe water with the addition of bottled water.

Approximately 98% of the population got its drinking water from improved and safe water sources. 35% of the region's population drinks bottled water.

Among the provinces, Zambales had limited access to safe drinking water at around 96% excluding Olongapo City whose access to safe drinking water was recorded at 98%. This rate can be attributed to the low population density in the area, which is 160 persons per km^2.

The map on the left shows the extent of access to safe drinking water at the municipal level

[7] Philippine Statistics Authority, Family Income and Expenditure Survey, 2015
[8] Ibid.
[9] Based on Region III provinces' firsthand data on access to safe water, as gathered during the regional consultation and planning workshop.

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WGS 1984 - UTM Zone 51 N

Legend

Sanitation Access (%)

- 16-25
- 25-33
- 33-41
- 41-50
- 50-58
- 58-67
- 67-75
- 75-83
- 83-92
- 92-100

Dilasag
Casiguran
Dinalungan
Dipaculao
AURORA
Maria Aurora
Baler
San Luis
Dingalan
General Tinio
Gabaldon
Palayan CityLaur
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San Jose City
Munoz City
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NUEVA ECIJA
Talavera
General Mamerto Natividad
Santa Rosa
Jaen
San Leonardo
Penaranda
Gapan City
San Isidro
Cabiao
San Antonio
Aliaga
Cabanatuan City
Zaragoza
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TARLAC
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Guimba
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Moncada
Anao
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Santa Maria
San Jose del Monte City
Bocaue
Marilao
Meycauayan City
Obando
BULACAN
San Miguel
San Ildefonso
Doña Remedios Trinidad

Access to Sanitation

Central Luzon Regional Workshop and Planning Consultation, 2017 Data

Access to Sanitation

Central Luzon's rapid growth as a region has been mainly driven by the industry, services and AHFF sectors. Having the third highest GRDP in 2017 among all regions in the country, it has necessarily required a significant increase in demand for sanitation services.

Approximately 82% of the region's population has access to improved sanitation.

The 2015 FIES has reported that Region III was slightly higher than the national average in regard to access to improved sanitation. The regional percentage slightly trailed behind the national percentage for basic sanitation. Its open defecation rate stood at .67%, which was significantly lower than the national percentage. (The open defecation rate is a proxy indicator of the lack of access to toilet facilities.)

Table 7: National and Regional Access to Sanitation[10]

Sanitation Coverage	National	Region III
Improved Sanitation	73.77%	81.98%
Basic Sanitation	19.96%	16.95%
Unimproved Sanitation	2.04%	0.40%
Open Defecation	4.23%	0.67%
Total	100.0%	100.0%

Table 8: Access to Sanitation Facilities per Province[11]

Year 2015	HHs with Sanitary Toilets	HHs with Complete Basic Sanitation Facilities
Central Luzon	**91.18%**	**77.93%**
Aurora	79.95%	52.64%
Bataan	91.01%	86.43%
Bulacan	89.49%	77.77%
Nueva Ecija	83.88%	62.52%
Pampanga	111.01%	88.37%
Tarlac	81.45%	73.12%
Zambales	91.38%	89.49%
Angeles City	90.00%	88.00%
Olongapo City	37.25%	37.11%

The minor discrepancy between Tables 7 and 8 regarding totals and averages highlights the difficulty of reconciling the definition of sanitation coverage under the Millenium Development Goals (MDG) with a more stratified and specific definition under the Sustainable Development Goals (SDG). Table 7 reflects the specifics per the SDG's definition. Table 8, on the other hand, reflects the rates of access as defined under the MDG, wherein the percentage of households with complete basic sanitation facilities is a subset of those with sanitary toilets.

Categorization of the facilities as per SDG definitions is as follows:

Improved Sanitation	▪ Water-sealed sewer septic tank (exclusive use)
Basic Sanitation	▪ Water-sealed sewer septic tank (shared) ▪ Water-sealed depository (exclusive use) ▪ Water-sealed depository (shared) ▪ Closed Pit
Unimproved Sanitation	▪ Open Pit
Open Defecation	▪ Other Means ▪ None

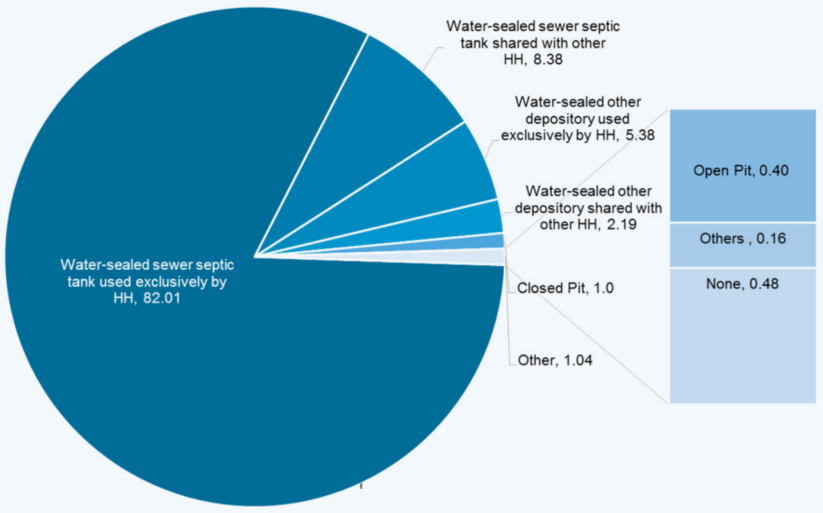

Figure 6: Percentage of Households with Access to Sanitary Facilities

Figure 6 shows the percentage of households per type of sanitation facilities. It represents the initial stages of the sanitation ladder in the region.

While one of the main objectives of the Philippine Development Plan (PDP) is to achieve universal access to sustainable sanitation by 2030, SDG 6.2 highlights the need to broaden the definition of sanitation access, that is, to include safely managed and improved sanitation through the treatment of wastewater or fecal sludge on-site or off-site.

Data on access to sanitation at the provincial level in Central Luzon were gathered during the regional consultation and planning workshop. The map on the left shows the extent of access to sanitation of the provinces in the region.

Figure 7 shows the few existing septage treatment plants in the region. Bulacan has recently put up 9 of these plants.

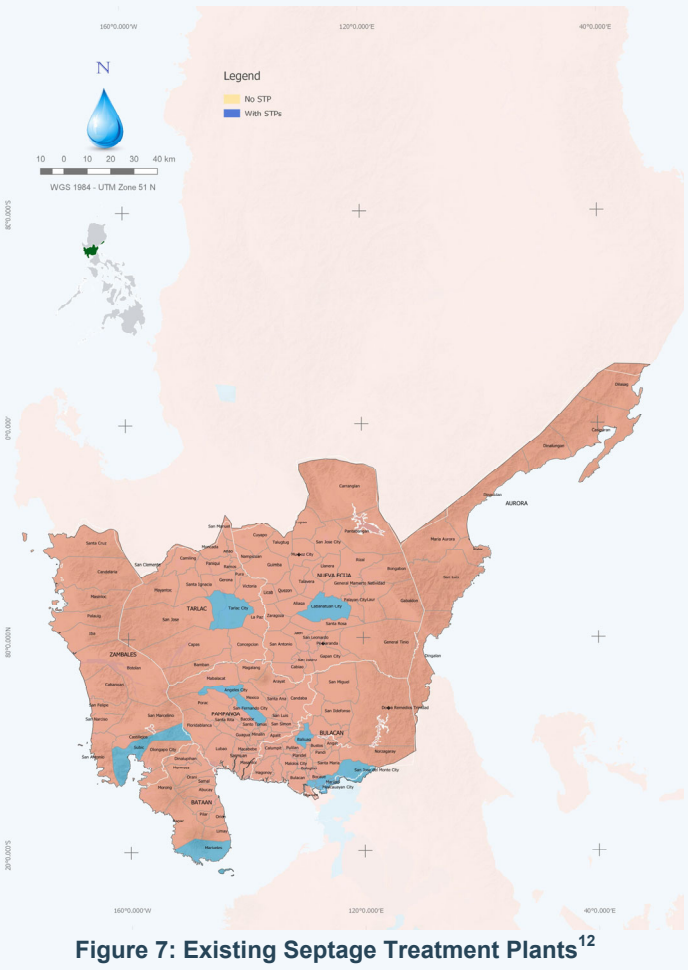

Figure 7: Existing Septage Treatment Plants[12]

[10] *Philippine Statistics Authority, Family Income and Expenditure Survey, 2015*
[11] *Department of Health, FHSIS Annual Report CY 2015*
[12] *Based on Region III provinces' firsthand data on access to safe water, as gathered during the regional consultation and planning workshop*

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Legend

Water Bodies

Major River Basin

10 0 10 20 30 40 km

WGS 1984 - UTM Zone 51 N

Abulug Watershed

Abra Watershed

Cagayan Watershed

Agno River Basin

Pampanga River Basin

Bataan Watershed

Pasig-Marikina River Basin

Cavite Watershed

AURORA

NUEVA ECIJA

TARLAC

ZAMBALES

PAMPANGA

BULACAN

BATAAN

Dilasag
Casiguran
Dinalungan
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Santo Tomas
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Floridablanca
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Arayat
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Capas
Concepcion
San Antonio
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Tarlac City
La Paz
Zaragoza
Aliaga
Talavera
Quezon
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Victoria
Gerona
Santa Ignacia
Mayantoc
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Palauig
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Iba
Botolan
Cabangan
San Felipe
San Marcelino
San Narciso
Castillejos
Subic
Olongapo City
San Antonio
Dinalupihan
Hermosa
Orani
Morong
Abucay
Balanga City
Pilar
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Bagac
Limay
Mariveles
Lubao
Macabebe
Masantol
Sasmuan
Hagonoy
Paniqui
Ramos
Pura
Camiling
Moncada
Anao
Nampicuan
Guimba
Talugtug
Cuyapo
San Manuel
Tubao
Muñoz City
San Jose City
Llanera
Santa Cruz
Candelaria
San Clemente

Central Luzon Rivers and Tributaries

DENR, NWRB, NAMRIA

Water Resources

Central Luzon ranks 9th in water resources potential among all administrative regions.

The region's water resources potential totals to 7,944 million cubic meters (MCM)/year, accounting for about 5.4% of the country's total.

The water resources potential of an area is divided into groundwater and surface water. Groundwater in the region is estimated at 1,423 MCM/year while surface water is estimated at 6,520 MCM/year. Annual rainfall in the region averages 1,977 mm/year.

These figures are based on the estimation of the potential of the country's water resources regions (WRR) (see National Databook). The WRRs do not necessarily coincide with the boundaries of the administrative regions. These hydrological boundaries are defined by their physiographic features and homogeneity in climate.

WRR 3 straddles Region 3 and Pangasinan in Region I.

Surface Water

Central Luzon is endowed with abundant water resources, particularly freshwater surface water. It is home to the Agno River Basin, Cagayan River Basin, Pampanga River Basin and Pasig-Laguna River Basin, 4 of the 18 major river basins in the country.

Table 9: Classification of Rivers

Agno River Basin	
Area	6,219.66 km^2
River Classification	Class A - upper portion Class C - lower portion
Scope	**Region**
Benguet	CAR
Ifugao	CAR
Mountain Province	CAR
Nueva Ecija	Region III
Nueva Vizcaya	Region II
Pangasinan	Region III
Tarlac	Region III
Zambales	Region III
Pampanga	Region III
Uses	Domestic, municipal, agricultural, energy and industrial

Cagayan River Basin	
Area	27,493 km²
River Classification	Class A - upper portion Class C - lower portion
Scope	**Region**
Apayao	CAR
Benguet	CAR
Ifugao	CAR
Kalinga	CAR
Mountain Province	CAR
Abra	CAR
Cagayan	Region II
Isabela	Region II
Nueva Vizcaya	Region II
Quirino	Region II
Aurora	Region III
Nueva Ecija	Region III
Uses	Agricultural, domestic, municipal, commercial, energy, tourism and industrial

Pampanga River Basin[16]	
Area	10,434 km^2
River Classification	Class A/C
Scope	**Region**
Pangasinan	Region I
Nueva Vizcaya	Region II
Nueva Ecija	Region III
Tarlac	Region III
Pampanga	Region III
Bulacan	Region III
Aurora	Region III
Zambales	Region III
Bataan	Region III
Rizal	Region IV-A
Quezon	Region IV-A
Uses	Domestic, municipal, agricultural, aquaculture, livestock, energy, industrial, recreation and others

Pasig-Marikina-Laguna River Basin	
Area	4522.7 km^2
Watershed	3651.5 km^2
Lake	871.2 km^2
River Classification	Class A/C
Scope	**Region**
National Capital Region	NCR
Bulacan	Region III
Rizal	Region IV-A
Laguna	Region IV-A
Cavite	Region IV-A
Uses	Domestic, municipal, agricultural, aquaculture, livestock, energy, industrial, recreation and others

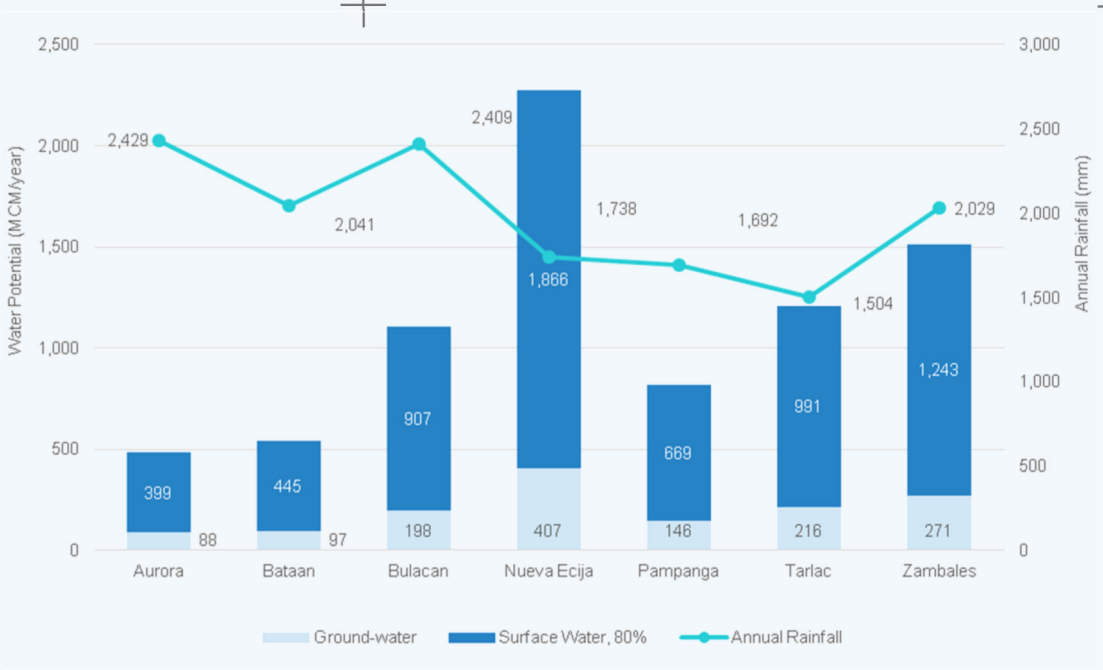

Figure 8: Water Resources Potential and Annual Rainfall[13]

[13] *JICA Master Plan on Water Resources Management in the Philippines, 1998; NWRB; PAGASA Rainfall Data; FAO*

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WGS 1984 - UTM Zone 51 N

Legend

- Extensive and Highly Productive Aquifers
- Fairly Extensive and Productive Aquifers
- Fairly Extensive and Productive, Aquifers with High Potential Recharge
- Fairly to Less Extensive and Productive Aquifers with Low to Moderate, Potential Recharge
- Local and Less Productive Aquifers
- Rocks with Limited Potential, Low to Moderate Permeability
- Rocks with Limited Potential, Low to Moderated Permeability
- Rocks without Any Known Significant, Groundwater Obtainable through Drilled Wells
- Lake

Dilasag
Casiguran
Dinalungan
Carranglan
Dipaculao
AURORA
Maria Aurora
Baler
San Luis
Bongabon
Rizal
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Apalit
Lubao
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Masantol

Groundwater Availability

MGB

Groundwater

Groundwater conditions are controlled by geology, topography, and the structure of the groundwater basin. The structure of the groundwater basin consists of distribution and hydrogeological conditions such as the aquifer structure and aquicludes, the physical characteristics of the formations as per transmissibility and storage coefficient and chemical characteristics of groundwater. These factors need to be defined in relation to the possible development depth and overall development potential.

The extent of groundwater availability in any given area also depends on its surface area and the amount of precipitation it receives. Furthermore, it is tied to groundwater storage based on the type and class of aquifer present in a study area (see Table 10).

Table 10: Aquifer Classes Based on MGB Aquifer Types

Aquifer Class	MGB Aquifer Type	Estimated Yields (boreholes un-
Major Aquifer (Highly permeable)	Intergranular: extensive and highly productive	Mostly 50-100 lps
	Fractured: fairly extensive and productive (aquifers with high potential recharge)	3-50 lps, spring yields up to 1000 lps
Minor Aquifer (Variably permeable)	Intergranular: fairly extensive and productive	About 20 lps
	Intergranular: local and less productive	Mostly 2-20 lps
	Fractured: less extensive and productive	Well yields up to 3 lps
Non-aquifer (Negligibly permeable)	Rocks with limited groundwater potential	Yields mostly less than 1 lps
	Rocks without any significant known groundwater	Yields mostly less than 1 lps

While some parts of Central Luzon are underlain by the major aquifer class, its other parts are predominantly underlain by the minor aquifer class (specifically the local and less productive kind).

Water Use

Water use in the region was estimated at 20,168.34 MCM annually based on awarded water permits as of 2017. Approximately 3,287.62 MCM (16%) was allocated for power generation and categorized as nonconsumptive use. The remaining 16,880.72 MCM was reserved for consumptive use (see Figure 9).

The irrigation sector consumes the greatest volume of water among all sectors with an allocation of 65.90%. The domestic sector consumes 7.08%.

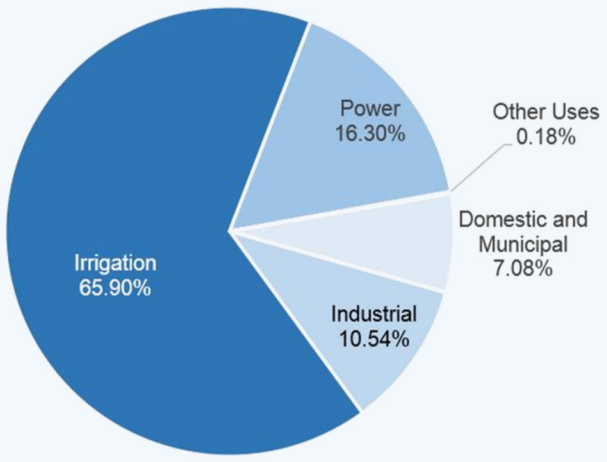


Figure 9: Consumptive Water Use, 2017[15]

Water Availability, Water Stress, and Water Scarcity

Hydrologists typically assess scarcity by looking at the population-water equation. An area is experiencing water stress when annual water supplies drop below 1,700 m^3 per person. When annual water supplies drop below 1,000 m^3 per person, the population faces water scarcity, and below 500 m^3 'absolute scarcity.'" (UN Water, n.d.)[14]

Water availability per capita was computed by comparing the region and provinces' potential against the 2015 population (as shown in Table 11).

Table 11: Water Availability per Province

Region/Province	Water Availability (m^3/capita/year), 2015
Aurora	2,272
Bataan	716
Bulacan	336
Nueva Ecija	1,056
Pampanga	312
Tarlac	884
Zambales	1,838
Central Luzon	**1,060**

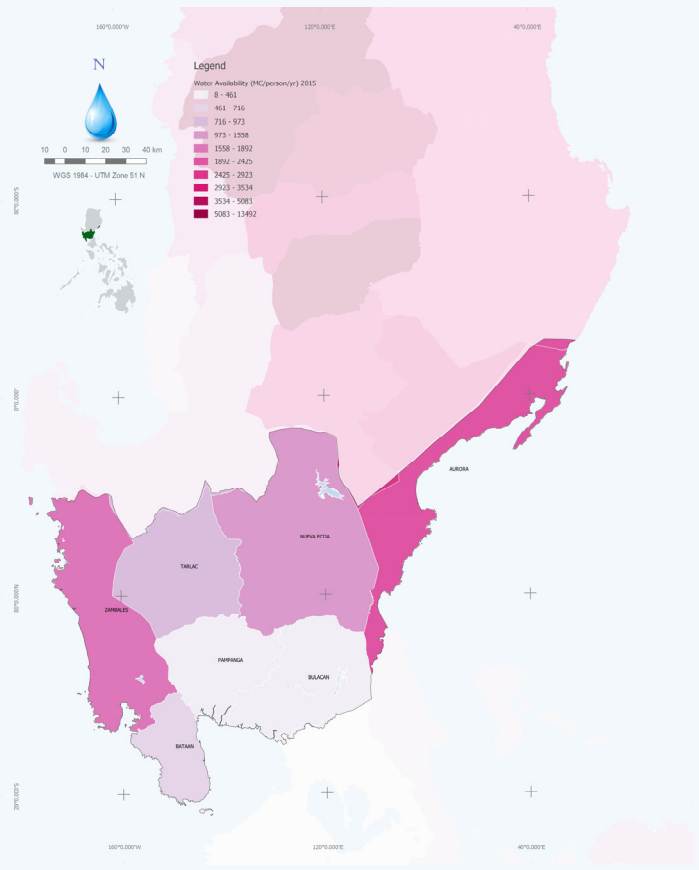


Figure 10: Water Availability Map, 2015

[14] Managing Water Report under Uncertainty and Risk, UN World Water Development Report 4 (Volume 1)
[15] National Water Resources Board. List of Water Permit Grantees, 2017

Demand

Population Projection

Population projection is important in estimating the future water and sanitation demand of a study area. It is a study of a recorded pattern of past population growth to establish future trends.

Employing PSA's 2010-based population projections which were adjusted to conform with the actual 2015 population, the region's population is projected to reach 15,181,502 by 2045.

Water Supply Demand

Water demand projection is fundamental to water supply feasibility studies and preliminary engineering design. It is also an important tool in the preparation of master plans, considering the future needs of a growing population. Water demand projections are developed based on the estimated projected population.

In general, the total water demand is equal to the sum of the domestic, commercial, industrial, institutional, and unaccounted-for water. Computation for water demand at the household level, in particular, is primarily based on the degree of urbanization of a barangay.

In projecting water demand, the units of consumption used are 120 liters per capita per day (lpcd) for urban populations, and 60 lpcd for rural populations. In the NCR and other HUCs, 150 lpcd and 80 lpcd are used for urban and rural populations, respectively.

By 2022, 2030, and 2040, the total water demand of the region would have reached 123.4 MCM/year, 140.5 MCM/year, and 161.8 MCM/year, respectively.

Water Demand vs. Water Resources Potential

The water demand of the industrial, business and domestic sectors in Central Luzon is expected to significantly increase in the near future. The efficient use and management of available water resources, therefore, must be ensured to promote universal access to stable and steady water supply.

Comparing the projected water demand (161.8 MCM/year) to the water resources potential of the region (7,943 MCM/year), the availability of water far exceeds the region's projected water demand up to 2045.

It must be noted, however, that the projected water demand of the region does not include that of its agricultural sector, which consumes the largest volume of water among all industry sectors. What appears to be abundant may be less once the agriculture sector uses its "share". It is estimated that agriculture takes up about 75% to 80% of the total consumptive use of water in the country.

Though there is no foreseeable water shortage in the region in the coming years, it is necessary to efficiently manage and use its water resources to control possible demand shifts.

To fully make use of its groundwater and surface water potential, however, the issue regarding mining activities in the region has to be immediately addressed.

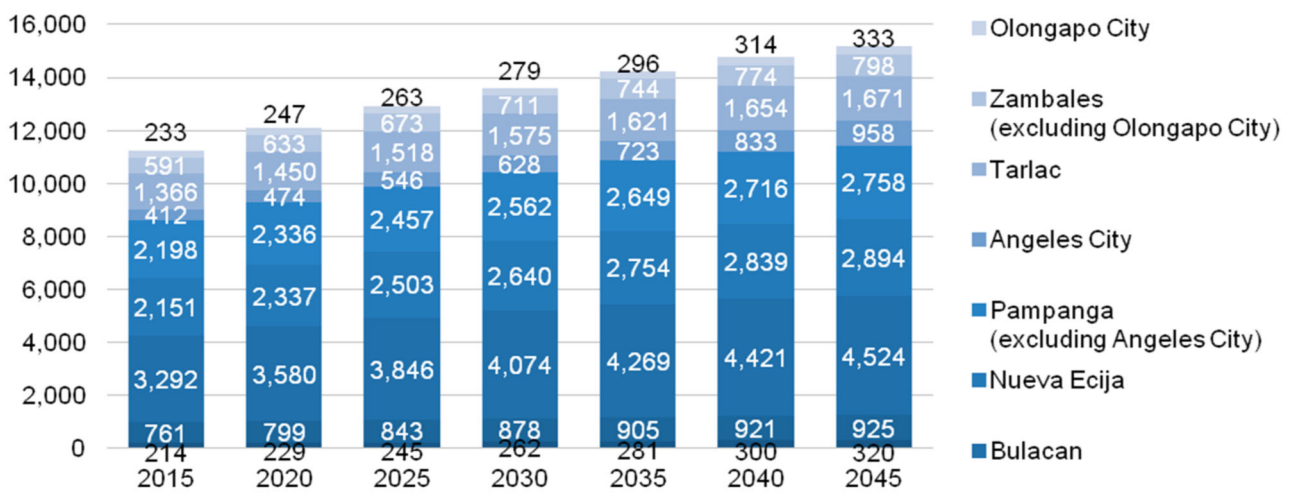


Figure 11: Projected Population

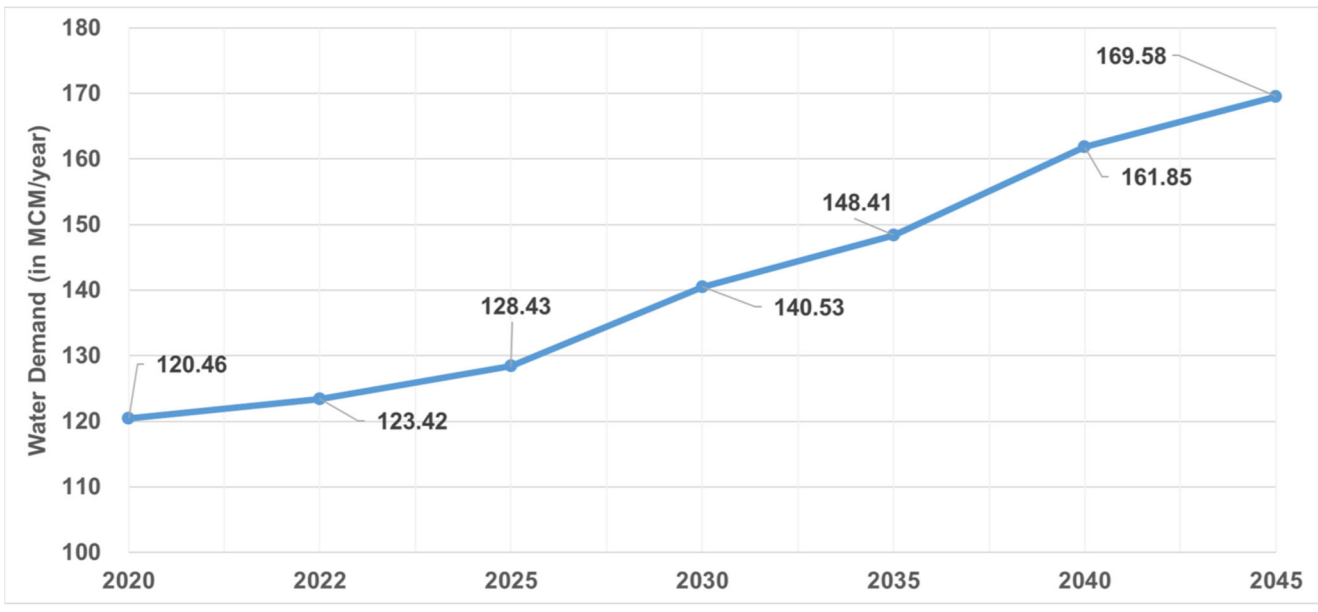
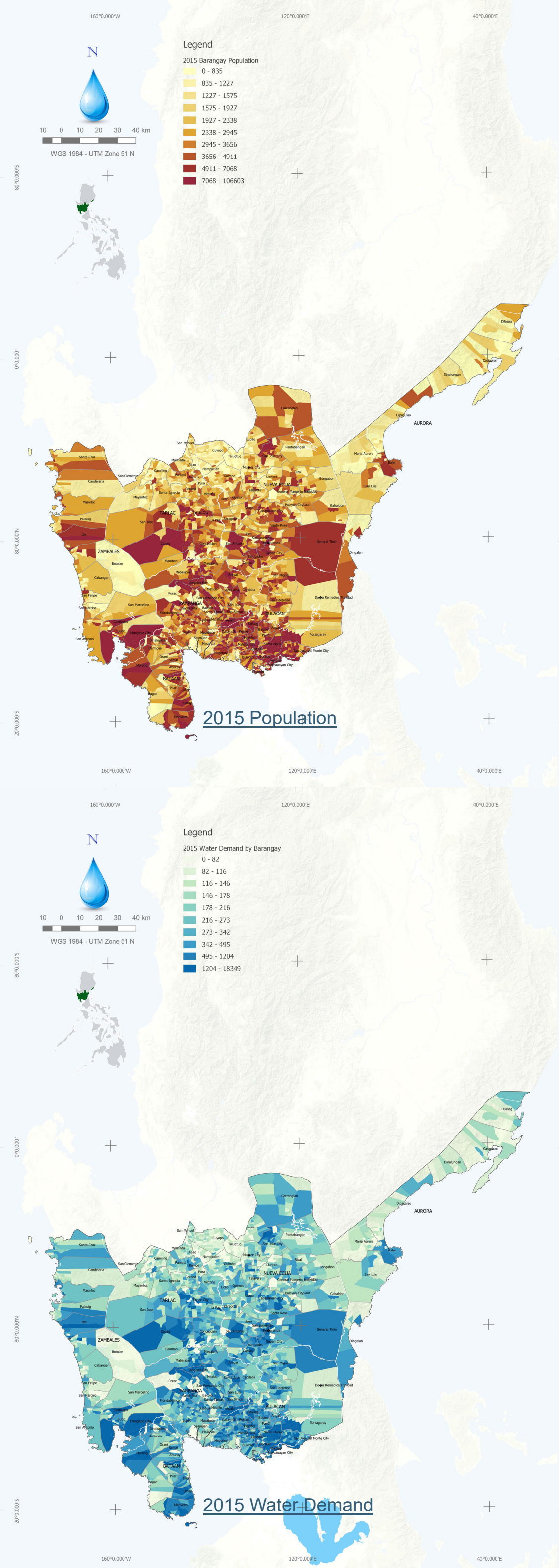


Figure 12: Projected Water Demand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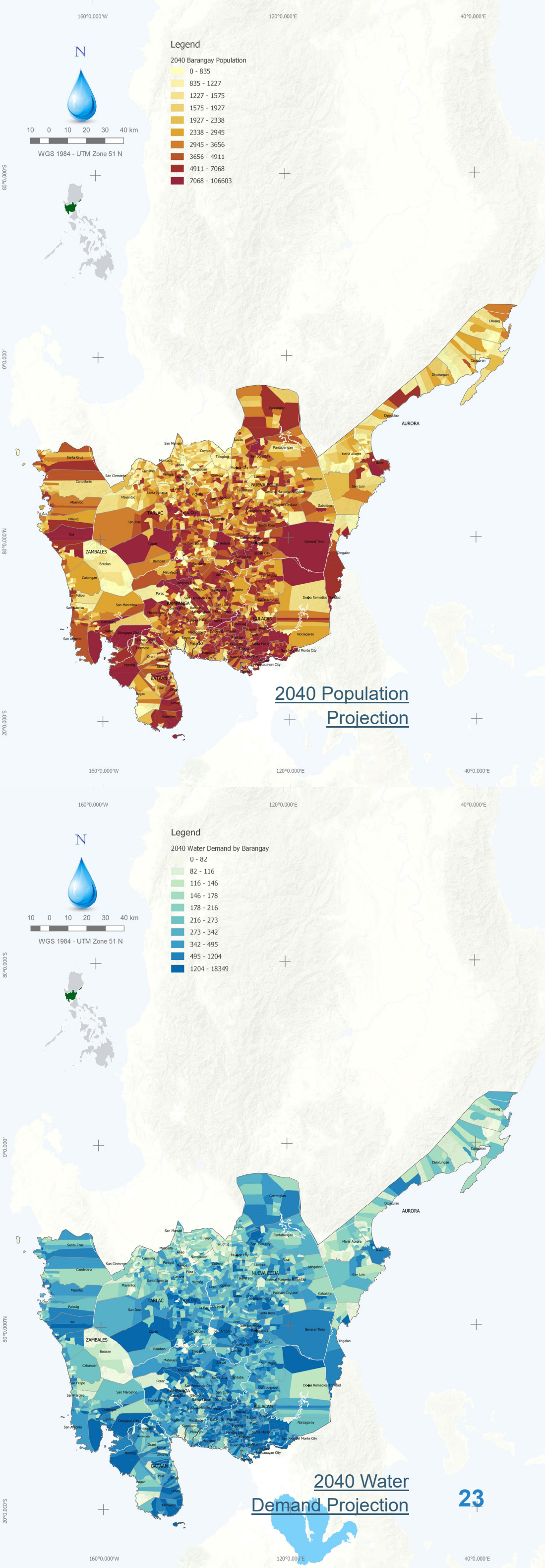
WGS 1984 - UTM Zone 51 N
Legend
2015 Barangay Population
0 - 835
835 - 1227
1227 - 1575
1575 - 1927
1927 - 2338
2338 - 2945
2945 - 3656
3656 - 4911
4911 - 7068
7068 - 106603
AURORA
NUEVA ECIJA
TARLAC
ZAMBALES
PAMPANGA
BULACAN
BATAAN
2015 Population
Legend
2015 Water Demand by Barangay
0 - 82
82 - 116
116 - 146
146 - 178
178 - 216
216 - 273
273 - 342
342 - 495
495 - 1204
1204 - 18349
2015 Water Demand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WGS 1984 - UTM Zone 51 N
Legend
2040 Barangay Population
0 - 835
835 - 1227
1227 - 1575
1575 - 1927
1927 - 2338
2338 - 2945
2945 - 3656
3656 - 4911
4911 - 7068
7068 - 106603
AURORA
NUEVA ECIJA
TARLAC
ZAMBALES
PAMPANGA
BULACAN
BATAAN
2040 Population Projection
Legend
2040 Water Demand by Barangay
0 - 82
82 - 116
116 - 146
146 - 178
178 - 216
216 - 273
273 - 342
342 - 495
495 - 1204
1204 - 18349
2040 Water Demand Projection

160°0.000'W
120°0.000'E
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80°0.000'S
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80°0.000'N
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Legend

- Non - Operational WDs
- Operational WDs
- Barangays with Existing Level 3 Water Service

10 0 10 20 30 40 km

WGS 1984 - UTM Zone 51 N

Water Districts and Areas Covered by Level III Service

LWUA, PAWD, NWRB Listahang Tubig, 2017 Data

WSS Infrastructure

Water service providers (WSPs) of various management types serve around 59% of Central Luzon[16].

These management types depend on the service areas (urban and rural), the number of potential water connections, and the level of service given.

For small urban towns and rural areas, community-based organizations (CBOs) – which include rural waterworks and sanitation associations (RWSA), barangay water and sanitation associations (BWSA), and water cooperatives – operate supply systems offering services at Level II (and in some cases, Level I). As the area grows and becomes more urbanized or more densely populated, water service providers mostly comprise water districts (WDs) and LGU-run utilities providing Level III service.

Areas that do not have access to any formal level of service rely on point sources, such as shallow and deep wells.

Water Supply Service Providers

The percentage of the population having access to or being served by these WSPs is not in accord with the figures in PSA's 2015 FIES mainly because the former came from various sources[17], with the bulk of the data coming from the National Water Resources Board's (NWRB) Listahang Tubig.

Furthermore, it cannot be ascertained that all WSPs in the region have already registered under Listahang Tubig or are continually updating their operations data. Nevertheless, these data help economic experts and engineers gain insights into the region's situation in relation to its existing water utilities.

Water Districts

As of 2015, there were 83 WDs in Central Luzon — 28 were nonoperational, serving roughly 8.85 million or 79% of the region's total population. Of this figure, about 5.1 million (or 57.63%) received Level III service.

Bulacan and Pampanga have the widest WD coverage at 69% and 66%, respectively, while Aurora has the most limited coverage at only 10%. (Only 2 out of Aurora's 6 WDs are operational.)

There are three WDs in Central Luzon that cover more than one LGU, namely, Calumpit, Hagonoy and San Fernando WDs. Calumpit WD also covers Pulilan and Malolos in Bulacan, as well as Apalit and Macabebe in Pampanga. Malolos and Macabebe have their respective water districts while Pulilan and Apalit have nonoperational water districts. Hagonoy WD extends its services to Paombong; San Fernando's WD covers Sto. Tomas.

Other Water Utilities

BWSAs, RWSAs and privately operated water systems comprise the rest of the water utilities. There are 1,295 of them in Central Luzon. Bulacan has 398 while Aurora has 77. Again, the tabulation will be further expanded to contain disaggregation by level of service as soon as the data have been processed.

The map on the left shows the location of operational and nonoperational WDs in the region as well as barangays provided with Level III water service by various WSPs (except WDs).

Table 12: Water Service Providers per Province

Province/Region	No. of LGUs	Water Service Providers		Service Area Population	Population Served	
		Type	No.		Total	%
Bataan	12	WDs	11	643,649	380,147	59.06%
		LGU-led	2		3,015	0.40%
		RWSA	36		36,645	4.82%
		BWSA	10		15,995	2.10%
		Others	228		92,255	12.13%
		Subtotal	**287**	**760,650**	**528,057**	**69%**
Zambales	14	WDs	14	505,967	163,499	32.31%
		LGU-led	3		1,750	0.21%
		RWSA	16		8,375	1.02%
		BWSA	-		-	-
		Others	141		43,620	5.29%
		Subtotal	**174**	**823,888**	**217,244**	**26%**
Tarlac	18	WDs	12	918,973	490,852	53.41%
		LGU-led	6		17,680	1.29%
		RWSA	5		2,995	0.22%
		BWSA	-		-	-
		Others	157	165,290	162,295	11.88%
		Subtotal	**180**	**1,366,027**	**673,822**	**49%**
Pampanga	22	WDs	17	1,943,878	1,279,872	65.84%
		LGU-led	1		10,815	0.41%
		RWSA	23		5,455	0.21%
		BWSA	3		4,045	0.15%
		Others	72		427,161	16.37%
		Subtotal	**116**	**2,609,744**	**1,727,348**	**66%**
Bulacan	24	WDs	24	3,019,061	2,093,217	69.33%
		LGU-led	7		40,995	1.25%
		RWSA	65		22,110	0.67%
		BWSA	8		23,765	0.72%
		Others	325		280,700	8.53%
		Subtotal	**429**	**3,292,071**	**2,460,787**	**75%**
Nueva Ecija	32	WDs	27	1,562,248	760,027	48.65%
		LGU-led	7		90,395	4.20%
		RWSA	40		27,125	1.26%
		BWSA	2		35,670	1.66%
		Others	92		83,730	3.89%
		Subtotal	**168**	**2,151,461**	**996,947**	**46%**
Aurora	8	WDs	6	69,298	6,680	9.64%
		LGU-led	5		23,520	10.97%
		RWSA	4		4,913	2.29%
		BWSA	10		11,240	5.24%
		Others	58		16,565	7.73%
		Subtotal	**83**	**214,336**	**62,918**	**29%**
Central Luzon	130	WDs	111	8663074	5,174,294	59.73%
		LGU-led	31	0	188,170	1.68%
		RWSA	189	0	107,618	0.96%
		BWSA	33	0	90,715	0.81%
		Others	1,073	165,290	1,106,326	9.86%
		Grand Total	**1,437**	**11,218,177**	**6,667,123**	**59%**

[16] Based on registered WSPs in Listahang Tubig (Data as of 2017)
[17] LWUA, PAWD, NWRB Listahang Tubig

160°0.000'W
120°0.000'E
40°0.000'E
80°0.000'S
0°0.000'
80°0.000'N
20°0.000'S

N

10 0 10 20 30 40 km

WGS 1984 - UTM Zone 51 N

Aurora
Zambales
Bataan

Dilasag
Casiguran
Dinalungan
Dipaculao
Baler
San Luis
Dingalan
General Tinio
Carranglan
Lupao
Cuyapo
San Jose City
Pantabangan
Munoz City
Nampicuan
Guimba
Talavera
Rizal
Bongabon
Quezon
Aliaga
Palayan City
Gabaldon
Laur
Santa Rosa
Zaragoza
San Leonardo
Penaranda
Gapan City
Cabiao
San Manuel
Moncada
Camiling
Paniqui
Santa Cruz
Candelaria
Santa Ignacia
Pura
Victoria
Masinloc
Mayantoc
Tarlac City
Palauig
San Jose
La Paz
Iba
Capas
Concepcion
Botolan
Bamban
Magalang
Mabalacat
Arayat
San Miguel
Cabangan
Porac
Mexico
Candaba
Dona Remedios Trinidad
San Felipe
Bacolor
San Ildefonso
San Narciso
San Marcelino
Santa Rita
San Luis
San Rafael
Guagua
Apalit
Angat
Castillejos
Calumpit
Subic
Lubao
Pandi
Norzagaray
San Antonio
Dinalupihan
Orani
Hagonoy
San Jose del Monte City
Bocaue
Bulacan
Meycauayan City
Morong
Abucay
Balanga City
Orion
Bagac
Limay
Mariveles

Legend

%Open Defecation

- 0.000 - 0.073
- 0.073 - 0.146
- 0.146 - 0.220
- 0.220 - 0.293
- 0.293 - 0.366
- 0.366 - 0.439
- 0.439 - 0.512
- 0.512 - 0.586
- 0.586 - 0.659
- 0.659 - 0.732

Open Defecation

PSA, 2015 Data

Sanitation

Sanitation is the provision of facilities and services for the safe management and disposal of human waste. Without sanitation, water quality degrades, health is compromised and the environment is adversely affected.

This section discusses the link between growing water demand and its detrimental effects on water quality and public health.

Open Defecation

As defined by the Joint Monitoring Program (JMP) for Water Supply, Sanitation and Hygiene of the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF), open defecation is the practice whereby people go out into the fields, bushes, forests, open bodies of water, or other open spaces rather than use the toilet to defecate. This can pollute the environment and cause various health-related problems.

The map on the left shows the areas in the region where open defecation is most prevalent.

Wastewater and Domestic Biological Demand

A measure of the organic strength of wastes in water is biological oxygen demand (BOD), which is the rate at which organisms use the oxygen in water or wastewater while stabilizing decomposable organic matter under aerobic conditions. The greater the BOD, the greater the degree of organic pollution.

The map below shows the current BOD in Central Luzon.

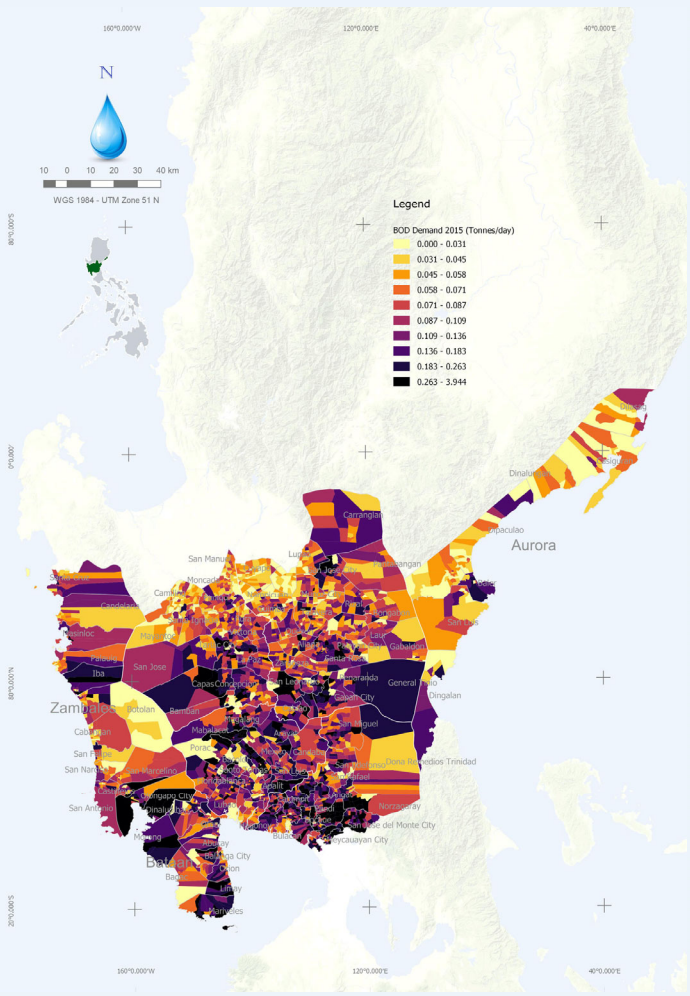


Figure 13: Biological Oxygen Demand, 2015

Industrial and agricultural wastewater generation may be estimated using guidelines provided by the WHO Rapid Assessment of Sources of Air, Water, and Land Pollution. Estimations, however, heavily depend on sectoral data not currently available to the Consulting Team.

Industrial wastewater generated is computed by industry type and depends on the present and future annual volume of production output per type. Agricultural wastewater generation and BOD estimation, on the other hand, are based on the present and future annual number of heads of livestock and poultry produced.

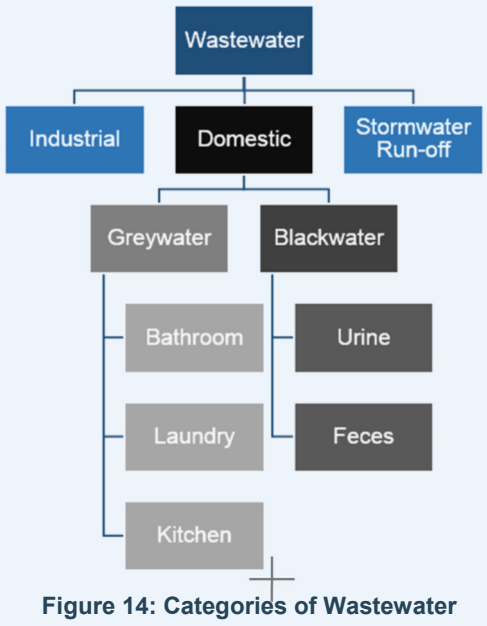


Figure 14: Categories of Wastewater

In the absence of other data, only domestic BOD can be estimated. A BOD factor of 37 grams per person per day (unit pollution load) is assumed; for highly urbanized areas, 53 grams[18] per person per day is used.

The wastewater[19] produced by each province is directly proportional to its water demand as well as its population. It is assumed that wastewater generated is 80% of the total water demand. The current wastewater in the region is shown in Figure 15.

BOD and wastewater projections until 2040 are shown in the succeeding pages.

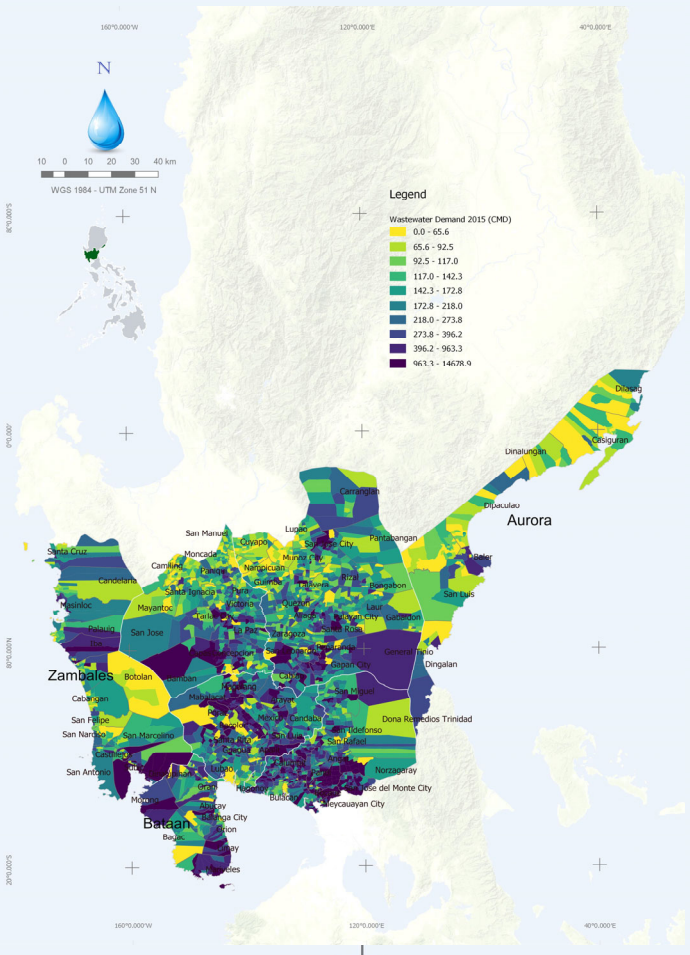
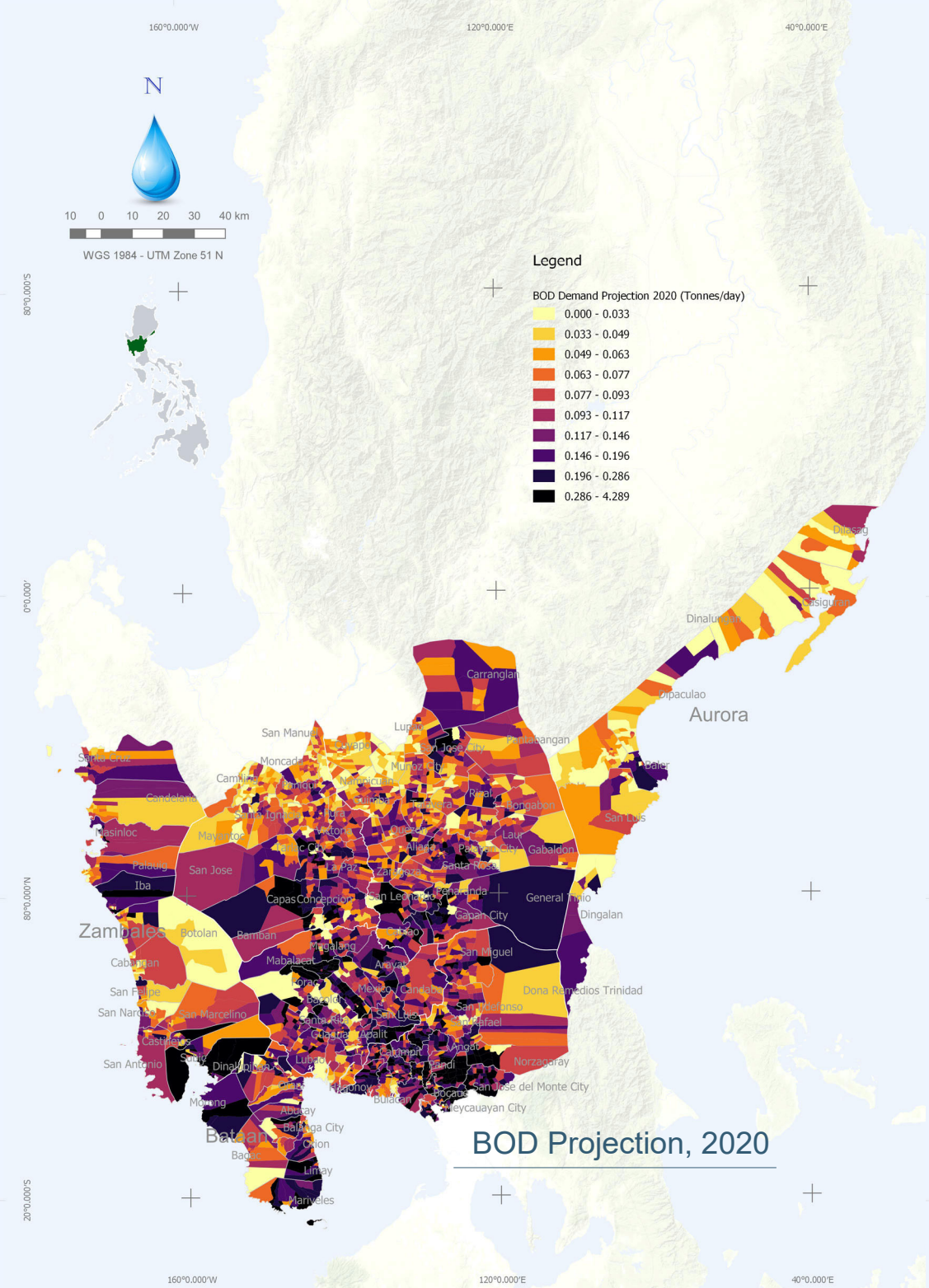
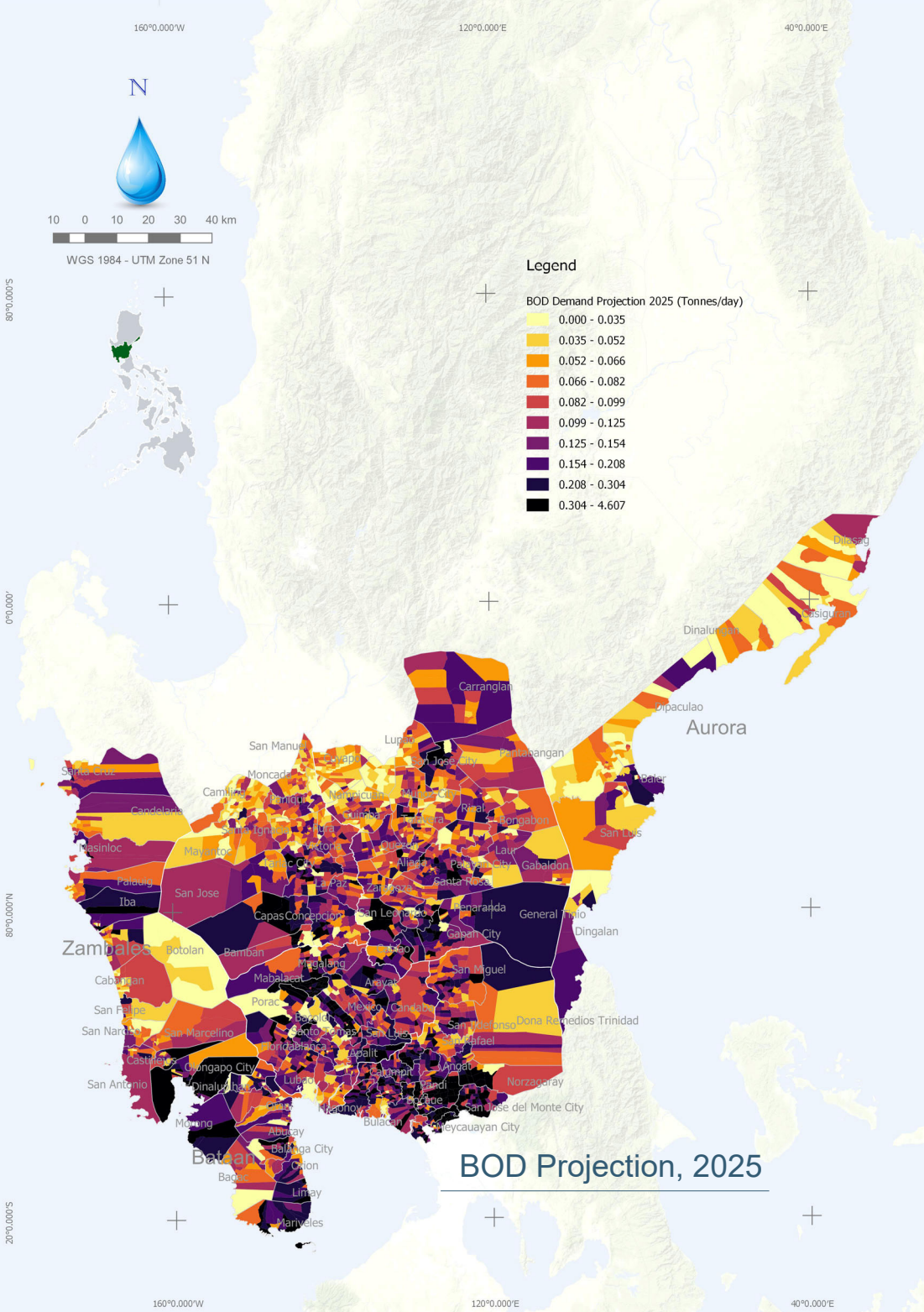
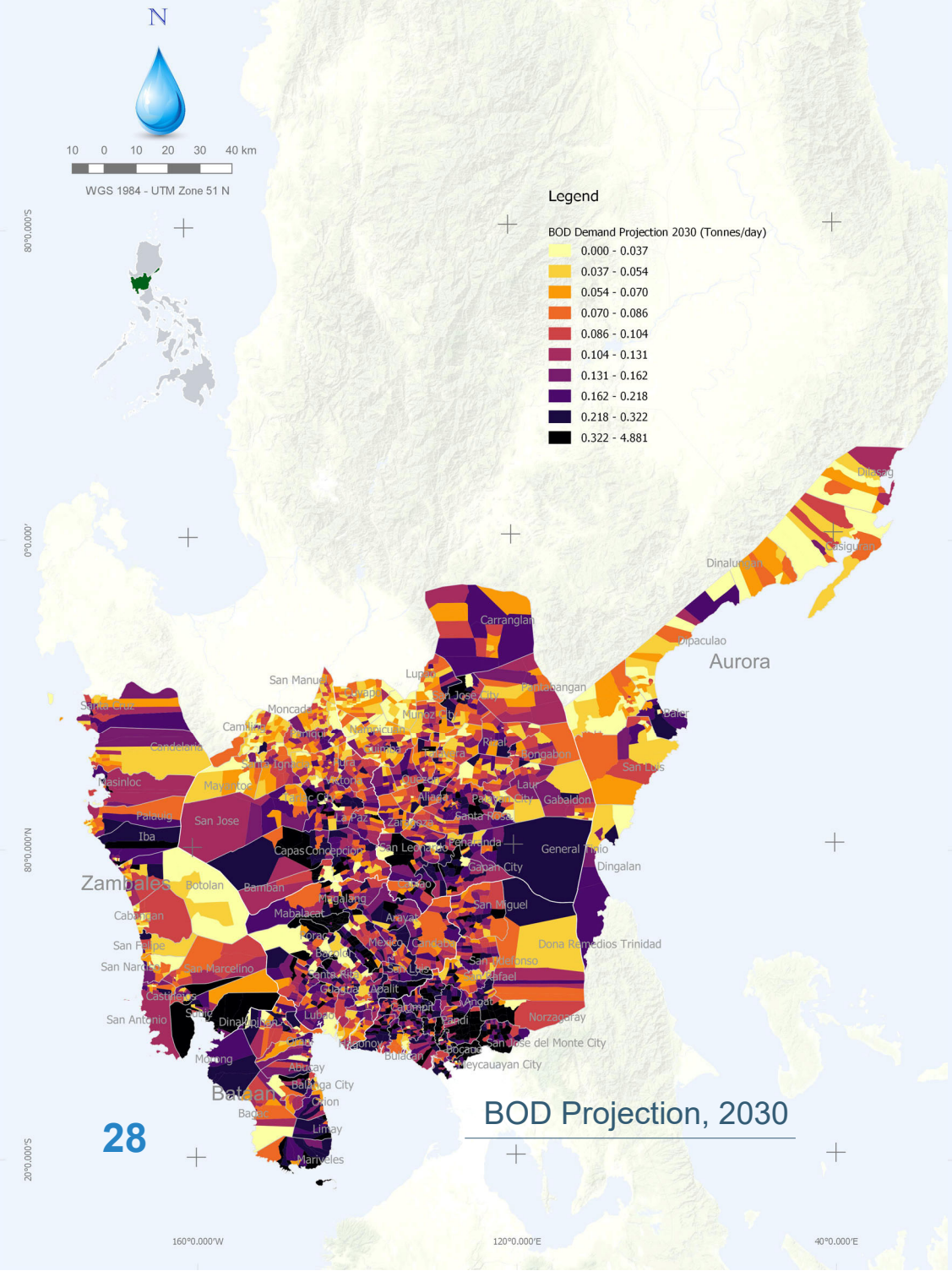


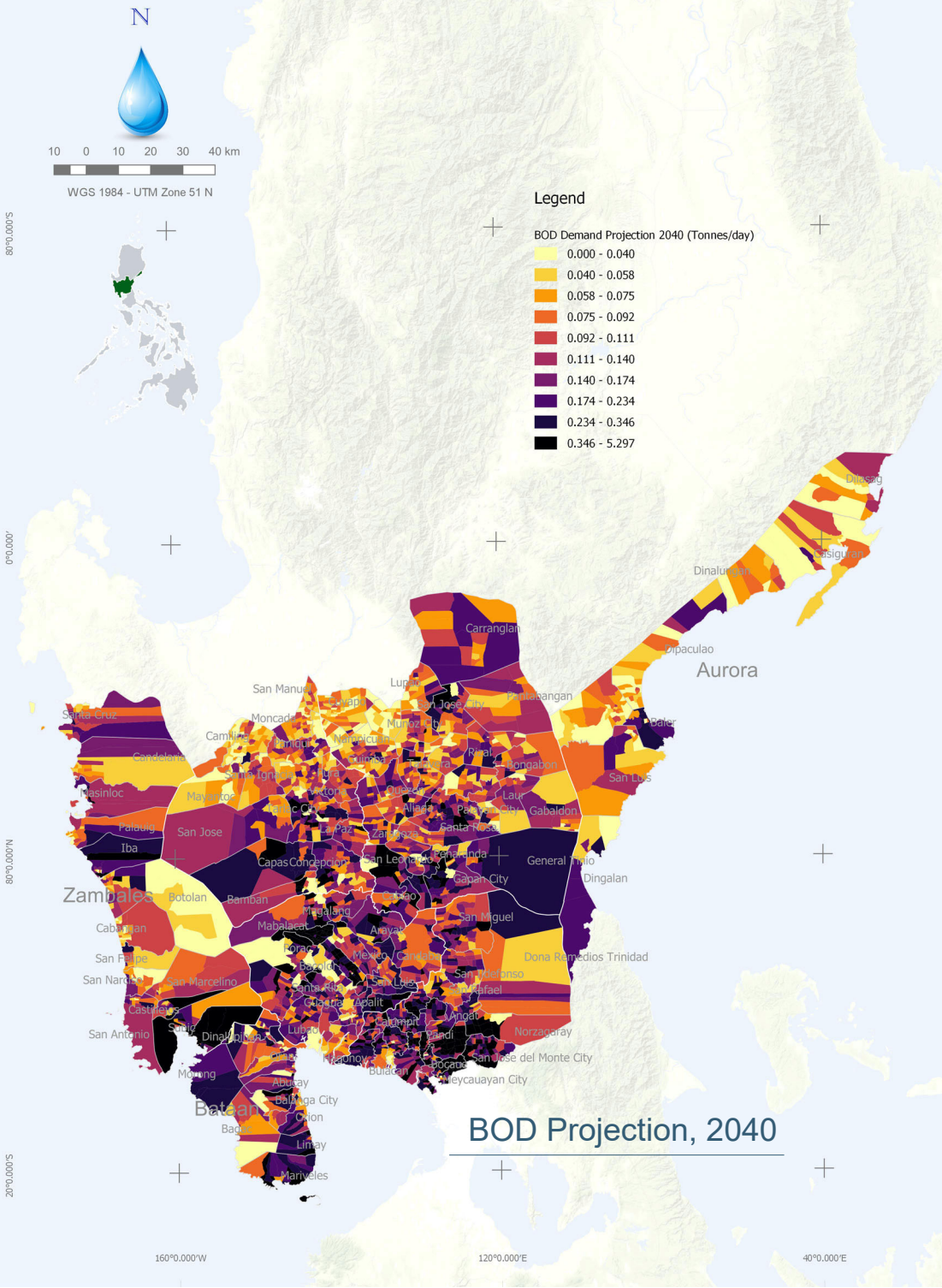
Figure 15: Wastewater Produced, 2015

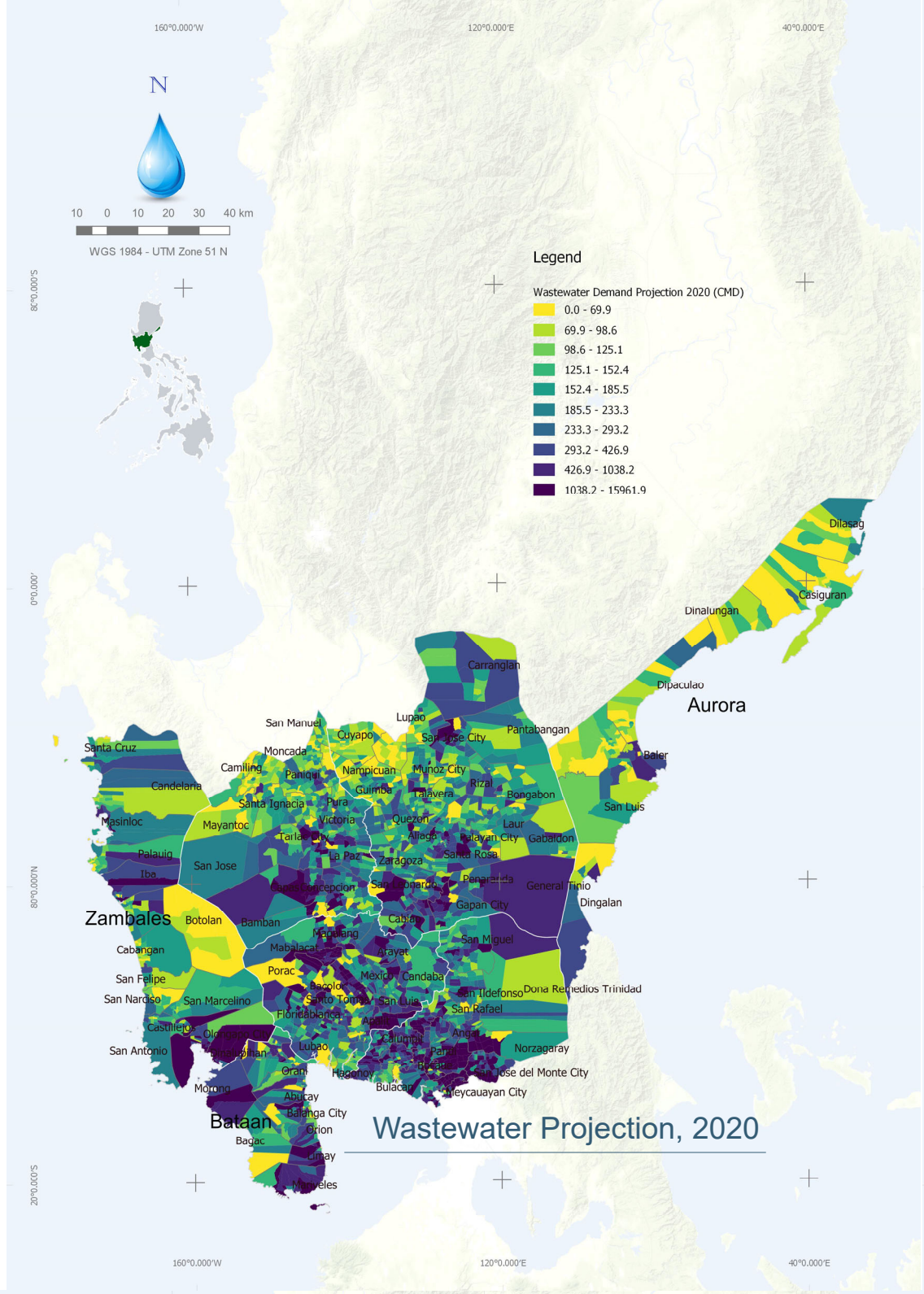
[18] *Philippine Environment Monitor (PEM), 2003*
[19] *Ibid.*

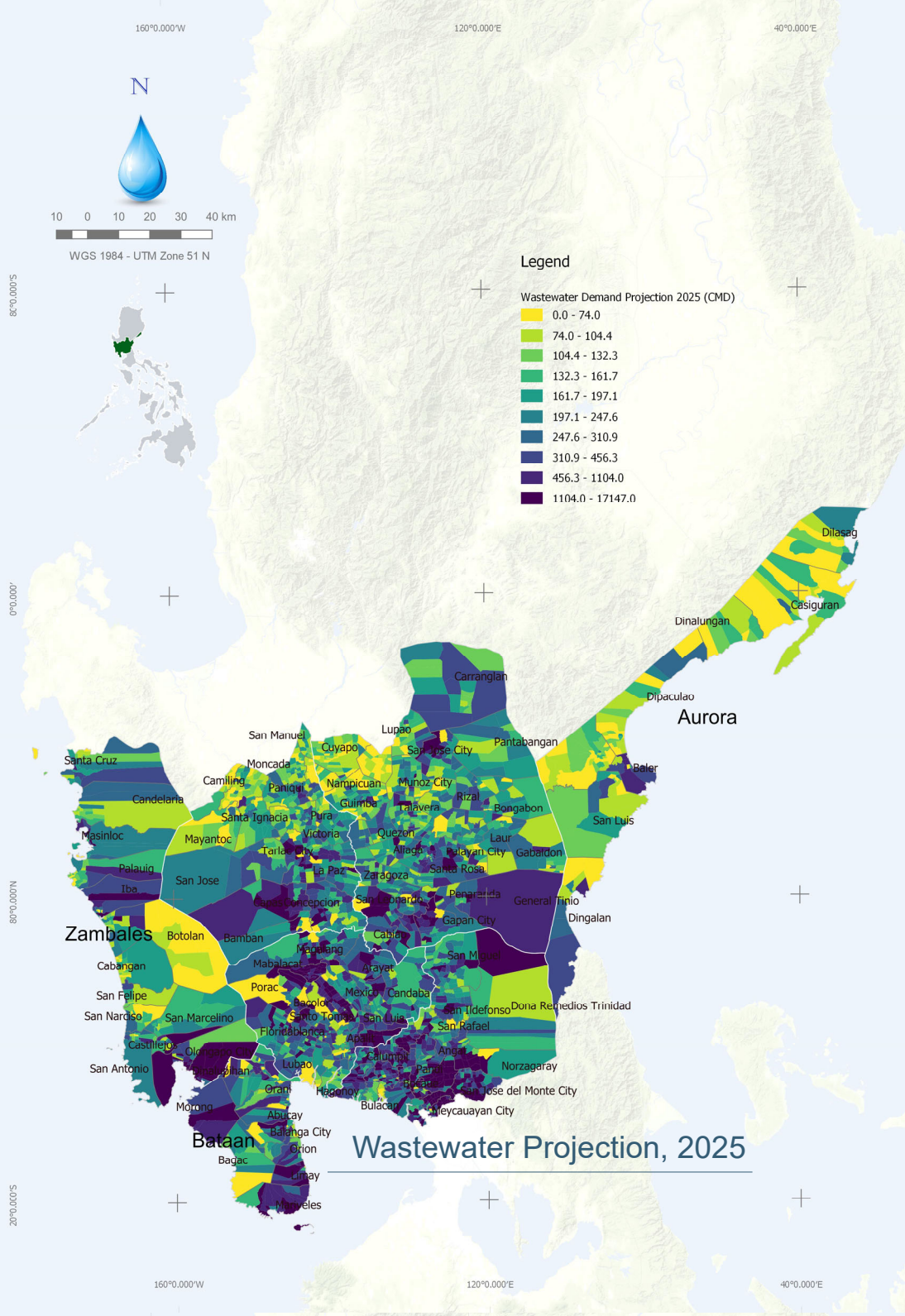

N
10 0 10 20 30 40 km
WGS 1984 - UTM Zone 51 N
Legend
BOD Demand Projection 2020 (Tonnes/day)
0.000 - 0.033
0.033 - 0.049
0.049 - 0.063
0.063 - 0.077
0.077 - 0.093
0.093 - 0.117
0.117 - 0.146
0.146 - 0.196
0.196 - 0.286
0.286 - 4.289
BOD Projection, 2020

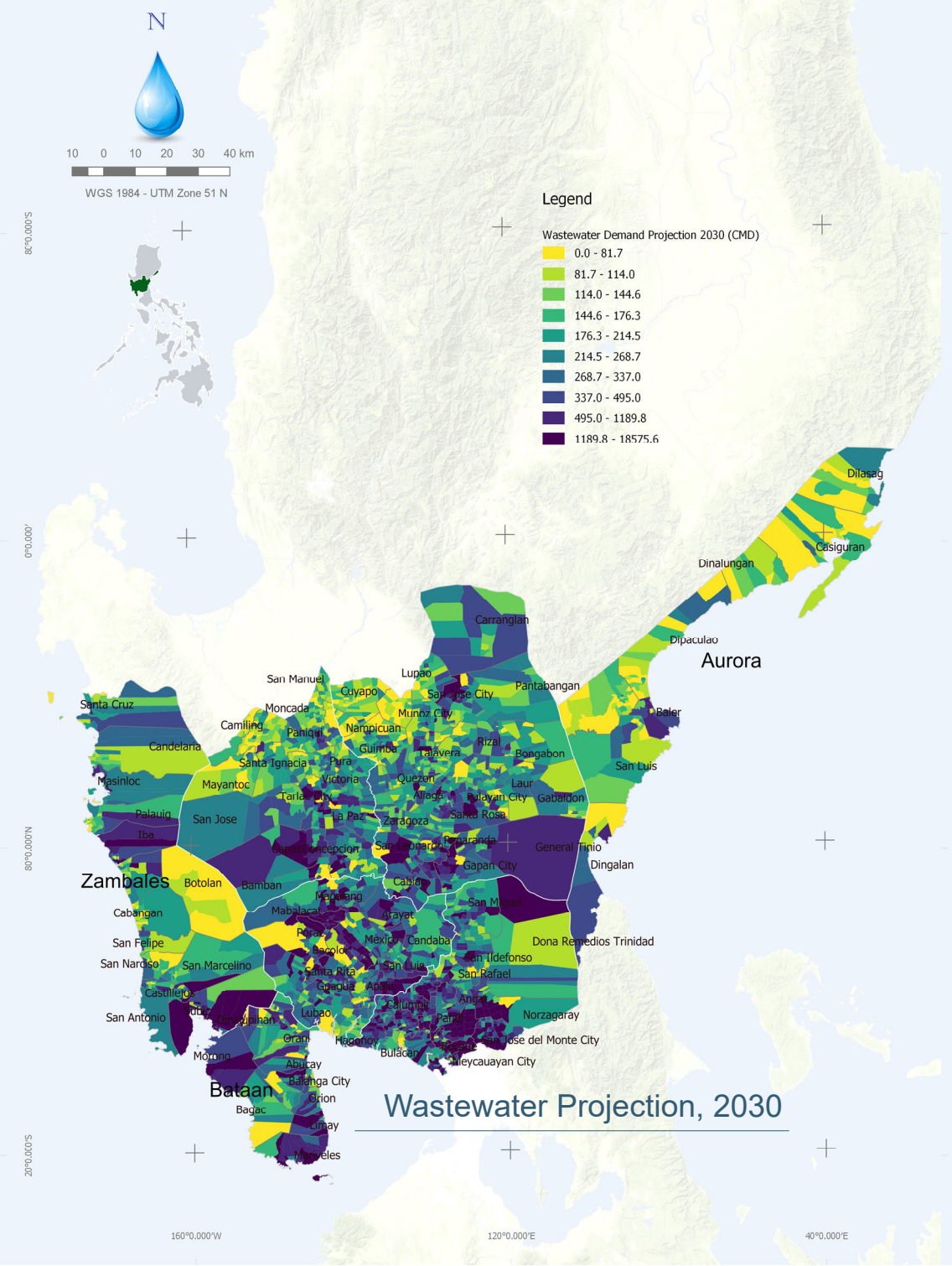

N
10 0 10 20 30 40 km
WGS 1984 - UTM Zone 51 N
Legend
BOD Demand Projection 2025 (Tonnes/day)
0.000 - 0.035
0.035 - 0.052
0.052 - 0.066
0.066 - 0.082
0.082 - 0.099
0.099 - 0.125
0.125 - 0.154
0.154 - 0.208
0.208 - 0.304
0.304 - 4.607
BOD Projection, 2025

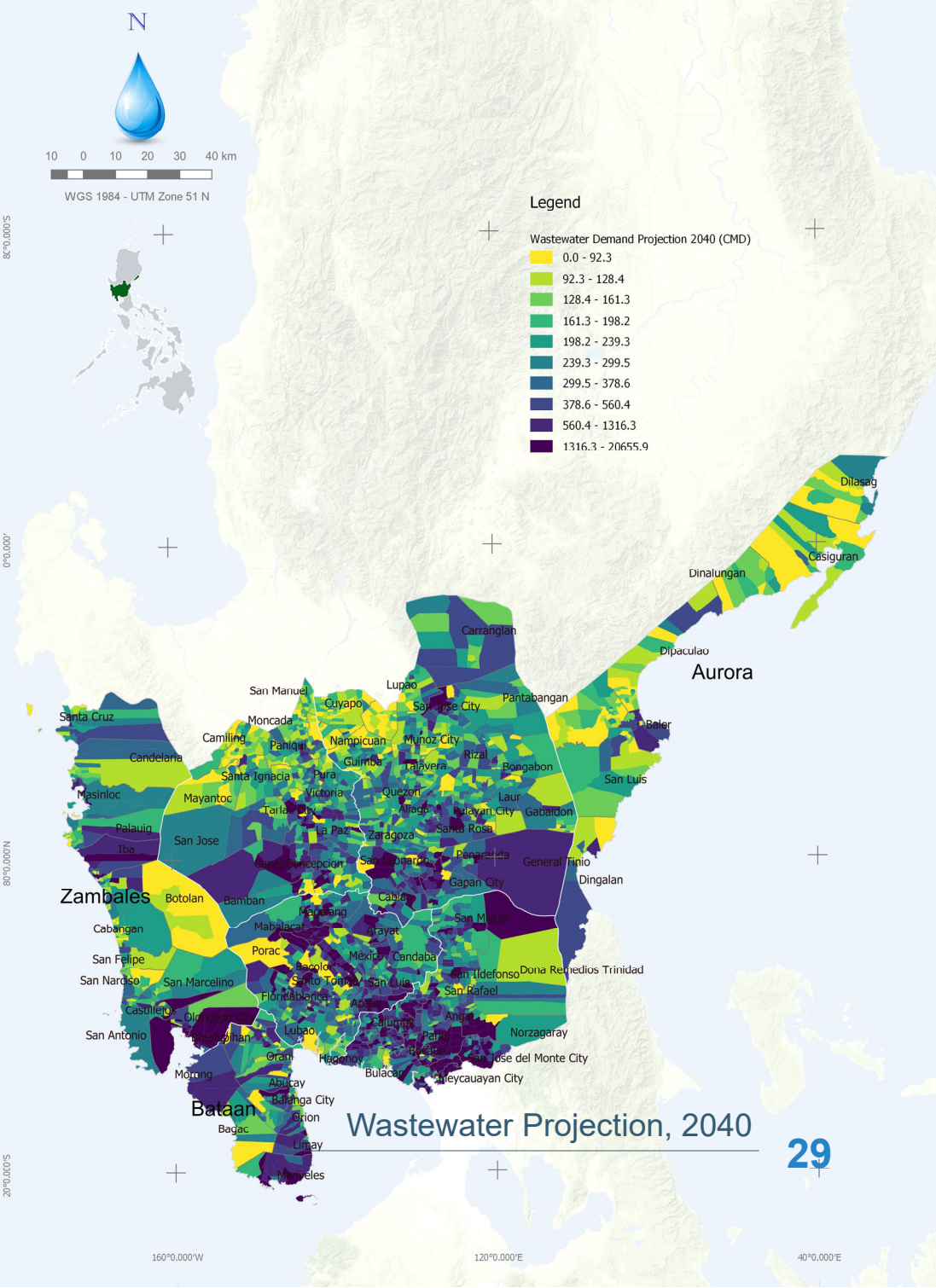

N
10 0 10 20 30 40 km
WGS 1984 - UTM Zone 51 N
Legend
BOD Demand Projection 2030 (Tonnes/day)
0.000 - 0.037
0.037 - 0.054
0.054 - 0.070
0.070 - 0.086
0.086 - 0.104
0.104 - 0.131
0.131 - 0.162
0.162 - 0.218
0.218 - 0.322
0.322 - 4.881
BOD Projection, 2030


N
10 0 10 20 30 40 km
WGS 1984 - UTM Zone 51 N
Legend
BOD Demand Projection 2040 (Tonnes/day)
0.000 - 0.040
0.040 - 0.058
0.058 - 0.075
0.075 - 0.092
0.092 - 0.111
0.111 - 0.140
0.140 - 0.174
0.174 - 0.234
0.234 - 0.346
0.346 - 5.297
BOD Projection, 2040


N
10 0 10 20 30 40 km
WGS 1984 - UTM Zone 51 N
Legend
Wastewater Demand Projection 2020 (CMD)
0.0 - 69.9
69.9 - 98.6
98.6 - 125.1
125.1 - 152.4
152.4 - 185.5
185.5 - 233.3
233.3 - 293.2
293.2 - 426.9
426.9 - 1038.2
1038.2 - 15961.9
Wastewater Projection, 2020


N
10 0 10 20 30 40 km
WGS 1984 - UTM Zone 51 N
Legend
Wastewater Demand Projection 2025 (CMD)
0.0 - 74.0
74.0 - 104.4
104.4 - 132.3
132.3 - 161.7
161.7 - 197.1
197.1 - 247.6
247.6 - 310.9
310.9 - 456.3
456.3 - 1104.0
1104.0 - 17147.0
Wastewater Projection, 2025


N
10 0 10 20 30 40 km
WGS 1984 - UTM Zone 51 N
Legend
Wastewater Demand Projection 2030 (CMD)
0.0 - 81.7
81.7 - 114.0
114.0 - 144.6
144.6 - 176.3
176.3 - 214.5
214.5 - 268.7
268.7 - 337.0
337.0 - 495.0
495.0 - 1189.8
1189.8 - 18575.6
Wastewater Projection, 2030


N
10 0 10 20 30 40 km
WGS 1984 - UTM Zone 51 N
Legend
Wastewater Demand Projection 2040 (CMD)
0.0 - 92.3
92.3 - 128.4
128.4 - 161.3
161.3 - 198.2
198.2 - 239.3
239.3 - 299.5
299.5 - 378.6
378.6 - 560.4
560.4 - 1316.3
1316.3 - 20655.9
Wastewater Projection, 2040

160°0.000'W
120°0.000'E
40°0.000'E
80°0.000'S
0°0.000'
80°0.000'N
20°0.000'S

N

Legend

With Water Quality Problem

10 0 10 20 30 40 km

WGS 1984 - UTM Zone 51 N

Dilasag
Casiguran
Dinalungan
Dipaculao
AURORA
Maria Aurora
Baler
San Luis
General Tinio
Dingalan
Carranglan
Pantabangan
Lupao
San Jose City
Rizal
Bongabon
NUEVA ECIJA
General Mamerto Natividad
Palayan City
Gabaldon
Laur
Cabanatuan City
Santa Rosa
Jaen
San Leonardo
Pe◆aranda
Gapan City
San Isidro
Cabiao
San Miguel
San Ildefonso
Do◆a Remedios Trinidad
Norzagaray
BULACAN
Baliuag
Bustos
Angat
Pandi
Plaridel
Malolos City
Santa Maria
Balagtas
San Jose del Monte City
Bocaue
Marilao
Meycauayan City
Bulacan
Obando
Hagonoy
Calumpit
Pulilan
Apalit
Guagua
Minalin
Santo Tomas
San Simon
Santa Rita
Bacolor
San Fernando City
PAMPANGA
Floridablanca
Porac
Mexico
Santa Ana
Candaba
Angeles City
Arayat
Magalang
Mabalacat
Concepcion
San Antonio
Capas
Bamban
Tarlac City
La Paz
Zaragoza
Aliaga
TARLAC
San Jose
Victoria
Licab
Quezon
Talavera
Gerona
Santa Ignacia
Mayantoc
Tarlac
Cuyapo
Talugtug
Nampicuan
Guimba
Muñoz City
Ramos
Pura
Anao
Moncada
Paniqui
Camiling
San Manuel
San Clemente
Santa Cruz
Candelaria
Masinloc
Palauig
Iba
ZAMBALES
Botolan
Cabangan
San Felipe
San Narciso
San Marcelino
Castillejos
Subic
Olongapo City
San Antonio
Dinalupihan
Hermosa
Orani
Samal
Abucay
Morong
BATAAN
Bagac
Pilar
Orion
Limay
Mariveles
Lubao
Macabebe
Sasmuan
Masantol
Porac
Floridablanca
Tarlac City
Tarlac
Pangasinan
Nueva Vizcaya
Quirino
Aurora
Nueva Ecija
Bulacan
Pampanga
Zambales
Bataan

Areas with Water Quality Problems

Water Districts' Water Quality Monitoring Data, LWUA, 2015

Water Quality

Water quality measures how good water is in terms of its beneficial use and environmental value. It is water relative to its use and measured in terms of its physical, chemical, biological and radiological characteristics. It is most frequently used in reference to a set of standards against which compliance can be assessed.

Wastewater projection maps (as shown in the preceding pages) indicate that most cities and growing municipalities have higher water demand compared to the other areas in the region. These areas are more exposed to problems related to water quality and health, among them waterborne diseases.

The map on the left shows the areas whose water sources have exhibited signs of poor water quality. The data are based on the water quality reports submitted by WDs to the Local Water Utilities Administration (LWUA). Data on water supply sources that are not covered or owned by WDs are not reflected on this map.

Waterborne Diseases

Waterborne diseases are generally transmitted through water in which pathogenic microorganisms live. These diseases can be spread while bathing, washing, or drinking water, or by eating food exposed to contaminated water[20].

Approximately 1,969 cases of acute watery diarrhea and 35 cases of typhoid and paratyphoid in Central Luzon were reported in 2015, per 2015 Field Health Service Information System (FHSIS).

These figures indicate that many residents in the region still have no access to safe drinking water and adequate sanitation facilities.

As of 2017, the Department of the Interior and Local Government (DILG) reported 2 waterless[21] municipalities in Central Luzon (see Figure 16).

Residents in these areas have limited access to safe (drinking) water, and thus, are forced to resort to unsafe sources of water. Doing so increases their exposure to a host of waterborne diseases.

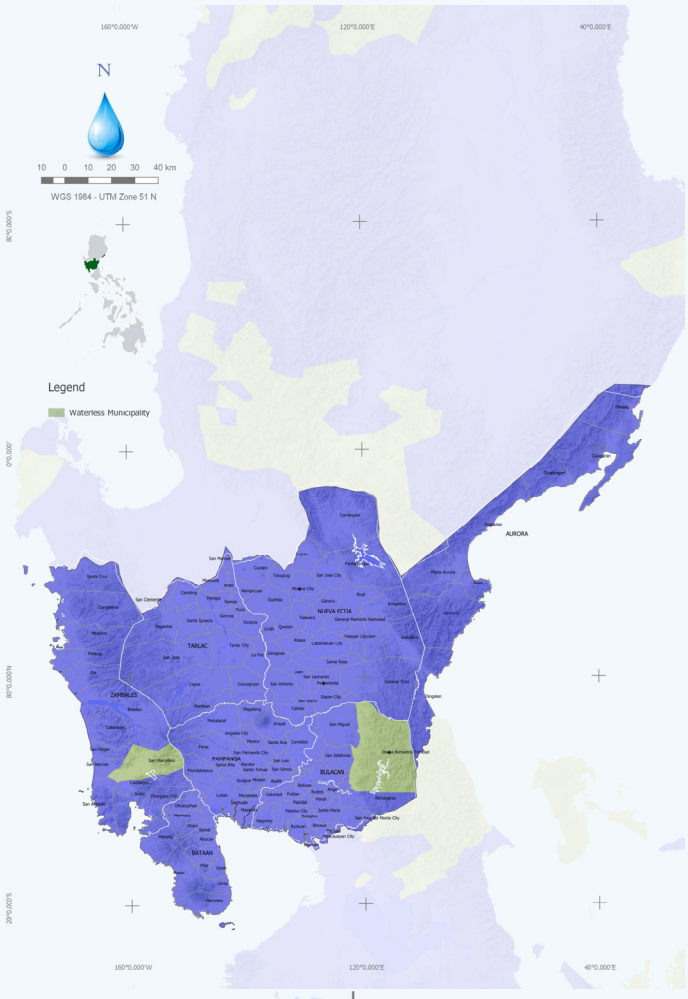


Figure 16: Waterless Municipalities

[20] *World Health Organization*

[21] *Municipalities with less than 50% service coverage, National Anti-Poverty Commission, 2010*

WSS Sector Gaps

In assessing the current state of the WSS sector in Central Luzon, areas that require upgraded facilities, improved water supply and sanitation systems as well as regular and extensive monitoring protocols were brainstormed and identified at the regional consultation and planning workshop.

Issues, Constraints and Challenges

The workshop on WSS in Region III produced a clear picture of realities on the ground, based on personal experiences, local knowledge and insights shared by key stakeholders and resource persons from the academe, nongovernment organizations (NGOs) and other concerned institutions.

The focused discussions resulted in the identification of weaknesses, inadequacies and other complications that have hindered the growth and development of the WSS sector in Region III. More importantly, the exchange of ideas also led to the adoption of specific recommendations on how to put an end to the sector's stagnation and facilitate the creation of momentum toward its accelerated development.

Planning and Development

In the course of input-sharing and discussion sessions, the weaknesses in the capability and competence of those responsible for the formulation of Region III's WSS development plan are emphasized.

The most common hindering factors were insufficient data to guide logical thinking and rational decision-making; inadequate budget to defray expenses for personnel empowerment and institution/systems upgrade; unavailability of technical expertise; limited competence of policy makers; poor leadership; questionable priority setting; lack of commitment on plan formulation and implementation; and inappropriate conduct and attitudes.

Priority facilitating measures included continuous capacity building on all levels of management and governance; multi-sectoral collaboration on all aspects of plan conceptualization and development; improvement in data gathering, management and utilization through partnership with NGOs, the academe and research institutions; and promotion of accountability through the active involvement of the community in activities that help shape intelligent public opinion, raise its awareness level, and foster community participation in checks and balances initiatives.

Service Provision

Resolving the various problems hindering the efficient delivery of water and sanitation service to Region III consumers was easier said than done. The complications are caused by external forces, lack of political will, financial constraints, dysfunctional regulatory mechanisms and consumer ambivalence.

High investment cost is a serious hindering factor, a problem worsened by consumers wanting to get the service but not willing to be billed for it. Another impediment is the contentious right-of-way issue with lot owners holding their ground against government expropriation. Their collective view was that people in government service were not doing their job. They claimed that LGUs were not enacting timely and necessary ordinances.

In addition, sanitation facilities are underfunded or unfunded due to the lack of political will and misplaced priorities by the local leadership. The recommended facilitating measures include promotion of better coordination between the LGUs and NWRB; harnessing public opinion to prompt local officials to fill the gaps in legislation, funding and expertise; creation of an information bandwagon to change consumer attitude; and, demonstration of strong political will to resolve right-of-way issues.

Regulation

Lamenting that regulation of water service and sanitation is not being given the importance it deserves, the attention to a number of factors hindering the proper and strict implementation of requisite guidelines, protocols and procedures required of all players in the WSS sector is called. The most glaring is the absence of policy on water drinking quality, a problem aggravated by prevailing weaknesses in monitoring compliance with prescribed health standards.

Fragmented regulatory and monitoring functions create inefficiencies that not only discourage private sector investments in WSS but also put consumers' health in jeopardy. Equally troubling are the inadequate resources being allocated by LGUs to water resources management especially in such critical areas as skills enhancement, technical advancement and competence buildup of personnel and institutions involved in policy formulation, master plan development and project implementation.

In addition, there is no existing collaboration or partnership between the government and WSPs, a serious deviation from the norms of efficient water management and regulation. Among the facilitating remedies recommended are the adoption and implementation of an integrated water resource management and regulation program; intensified monitoring and enforcement of applicable laws and regulations; creation of a mechanism that will inspire collaboration and partnership; and immediate activation of a water quality monitoring and standards enforcement body.

Table 13 summarizes the hindering and facilitating impacting the WSS sector in Central Luzon.

Table 13: Hindering and Facilitating Factors

Areas	Hindering Factors	Facilitating Factors
	General	
Planning and Development	Lack of evidence-based data; biased decision-making	Partnership with the academe/research institutions re: sources of data, data gathering and validation
	Lack of political will owing to the lack of awareness of pressing issues regarding water supply and sanitation	Involvement in the planning/conceptualization stage
	Lack of interaction and coordination between private service providers and the government	Regular coordination meetings with the objective of coming up with MOU/MOA
	Lack of competent policy makers	Capacity building program for legislators and their staff
	Poor implementation of policies	Executive and legislative commitment through the issuance of ordinances and implementing rules and regulations
	Lack of prioritization and awareness of the current state of the WSS sector	Gathering and updating of accurate data on the state of the WSS sector
	Lack of commitment regarding plan formulation and implementation	Impact measurement
	Lack of technical expertise	Continuous capacity building
	Lack of adequate ordinances; lack of resources	Formulation of policies in consultation with stakeholders; funding allocation
	Lack of political will among local leaders	Promotion of accountability and active involvement of citizens; recognition of or provision of incentives to LGUs adhering to best practices on sanitation
	Lack of awareness of existing laws or regulations	Rollout of information, education and communication (IEC) campaigns
	Lack of technical expertise in planning (re: sanitation)	Hiring of competent technical personnel; capacity-building activities through training, workshops
	Water	
Service Provision	Non-securing of water permits from NWRB	Proposal to have NWRB revisit service providers with water permits especially those that were not utilized
	Failure to seek or follow up the issuance of ordinance permits with NWRB	Formally requesting NWRB to grant exemptions from ordinance permits
	Red tape which delays the processing of water permit applications	Drumming up support or seeking endorsement from other concerned agencies, LGUs, Congress, etc. regarding the elimination of bureaucratic red tape
	Right-of-way issues	Entering into a memorandum of agreement (MOA) with lot owners, authorizing the government to study the premises
	Lot owners' reluctance or unwillingness to sell to the government their lots eyed as possible sites of WSS facilities	
	Lack of water quality experts and high investment cost	Adhering to the Philippine National Standards for Drinking Water 2017
		Conducting training programs and seminars on water treatment technologies; employee capacity building via outsourcing or by partnering with service providers
	Lack of a septage ordinance from LGUs	Passage of a septage ordinance by LGUs (per a directive from DILG); setting a deadline for complying with the Supreme Court mandamus, Philippine Clean Water Act, and Sustainable Development Goal No. 6
	Lack of political will among LGU officials	
	Sanitation	
	Lack of public awareness of the importance and benefits of improved sanitation	Public awareness/IEC programs
	Lack of knowledge among community residents regarding the value of sanitation	
	Lack of buy-ins among target users; lack of willingness to pay	
	General	
Regulation	Absence of a policy with regard to local drinking water quality	Creation of a local drinking water quality monitoring committee
	Low priority given to the WSS sector	Prioritization of WSS programs
	Reactive approach	
	Low level of awareness of technological advancement on the part of the LGUs	Intensified monitoring and enforcement of laws/guidelines
		Provision of capacity enhancement training to LGU leaders and staff employees
	Absence of a policy or an institutional mechanism that will initiate collaborations/partnerships	Creation of a policy or an institutional mechanism that will initiate and seal collaborations/partnerships
	Fragmented regulatory and monitoring functions	Creation of an agency that will handle all development/coordination functions in the water sector
	Inadequate resources of agencies tasked with water resources governance	
	Lack of technical expertise in water resources management and regulation	Provision of an integrated water resources management and regulation approach

Regional Vision

"A water supply and sanitation sector that is comprised of strongly committed, responsible, and collaborative stakeholders supported with adequate and competent human resource, and sufficient financial resources, through the efficient and effective implementation of WSS policies, management systems, and environmentally sound technologies in order to provide safe, adequate, accessible, and affordable water and sanitation services for a region that is healthy and productive."

The Central Luzon WSS vision was developed by the visioning group with the objective of enabling the entire region to achieve universal access to safe and sustainable water by 2030.

In the collective view of the workshop participants, safe water encompasses sanitation, rationalizing the necessity of improved water and sanitation projects that will sustain adequate water supply, ensure its good quality and affordability, and upgrade sanitation infrastructure.

In keeping with this vision, key strategies and corresponding success indicators contributing towards the achievement of the overall sector vision were adopted, and key projects and programs were identified, including WSS targets which will adhere to the national WSS targets that are in accord with the PDP and SDGs.

Strategic Framework

The creation of the strategic framework begins with the determination of the issues, constraints and challenges of the water supply and sanitation sector. The diagram on the right shows specific highlights and contrasts, pertaining to areas displaying best practices and those needing improvement.

The figure shows strategic priorities for Central Luzon highlighting the provinces' individual plans. Priority areas include capacity building, information dissemination, project development and politics. These priorities have been observed to be the major areas of concern in relation to the provincial plans (as discussed in "Issues, Constraints and Challenges").

Corresponding strategies were formulated to translate the regional vision into specific approaches to get the best results and achieve the region's WSS targets. These are the region's general approaches applicable to urban and rural contexts of ensuring access to safe water and sanitation.

A more detailed discussion with respect to achieving increased access to potable water considering the various segments comprising the water utilities (categorized as undeveloped/underdeveloped, developing and developed) is shown in Table 14.

Table 14: Strategies in Achieving Increased Access to Potable Water

Segment	Target	Strategic Statement
Undeveloped/Underdeveloped		
Level I	▪ Zero waterless barangays ▪ Reduction to 5% of unsafe sources of water supply (2022) and universal access to safe water (2030)	▪ Government investment in the development of water supply systems (WSS) to upgrade unsafe sources to safe sources ▪ Promoting water harvesting in far-flung areas
Level II	▪ Upgrade of Level II systems to Level III	▪ Establishing WDs or LGU-led water utilities that can operate commercially ▪ Upgrading Level II systems to Level III ▪ Creation of a body that provides technical and financial assistance to barangay water associations and rural waterworks to upgrade their level of service
Developing		
Water Districts (Categories C and D)	▪ Zero nonoperational WDs	▪ Prioritizing conversion of nonoperational to operational WDs ▪ Assisting low performing WDs in rehabilitation and expansion works ▪ Providing a window for low cost funds that can be accessed by low performing WDs to expand coverage
Non-WDs (financially struggling water utilities)	▪ Organizing water utilities and allowing them to operate commercially ▪ 100% recovery of O&M cost	▪ Allowing the commercialization of water utility operations; encouraging LGUs to establish WDs or similar local government corporations or economic enterprises
Developed		
Level III	▪ 100% coverage of franchise area ▪ Ensuring the sustainability of operations of Level III systems ▪ Continuing expansion programs to ensure 100% coverage	▪ Increasing private sector participation ▪ Ensuring a robust regulatory framework to balance the interest of consumers and operators/WSPs ▪ Encouraging business establishments and residential communities to embark on rainwater harvesting programs

Figure 17: Central Luzon WSS Strategic Framework

Access Targets for Water and Sanitation

As experts knowledgeable in and thoroughly familiar with the social and environmental conditions in their respective provinces, the workshop participants were given free rein in setting targets concerning water supply and sanitation access (even as they were guided by the prescribed goals).

Their targets were based on current and baseline data (i.e., population growth rates, water resources availability, topographical and geographical setting, etc.), the status quo (funding constraints, political and cultural challenges, etc.), and the realistic attainability of set targets.

Central Luzon strives to achieve 97.2% access to safe water by 2022 and 100% access by 2030. Universal access by 2030 means more than 3,200,000 HHs will benefit. Improved access to sanitation is set at 92.7% by 2022 and universal access by 2030.

Figures 18 and 19 graph the WSS targets in terms of households for 2022 and 2030.

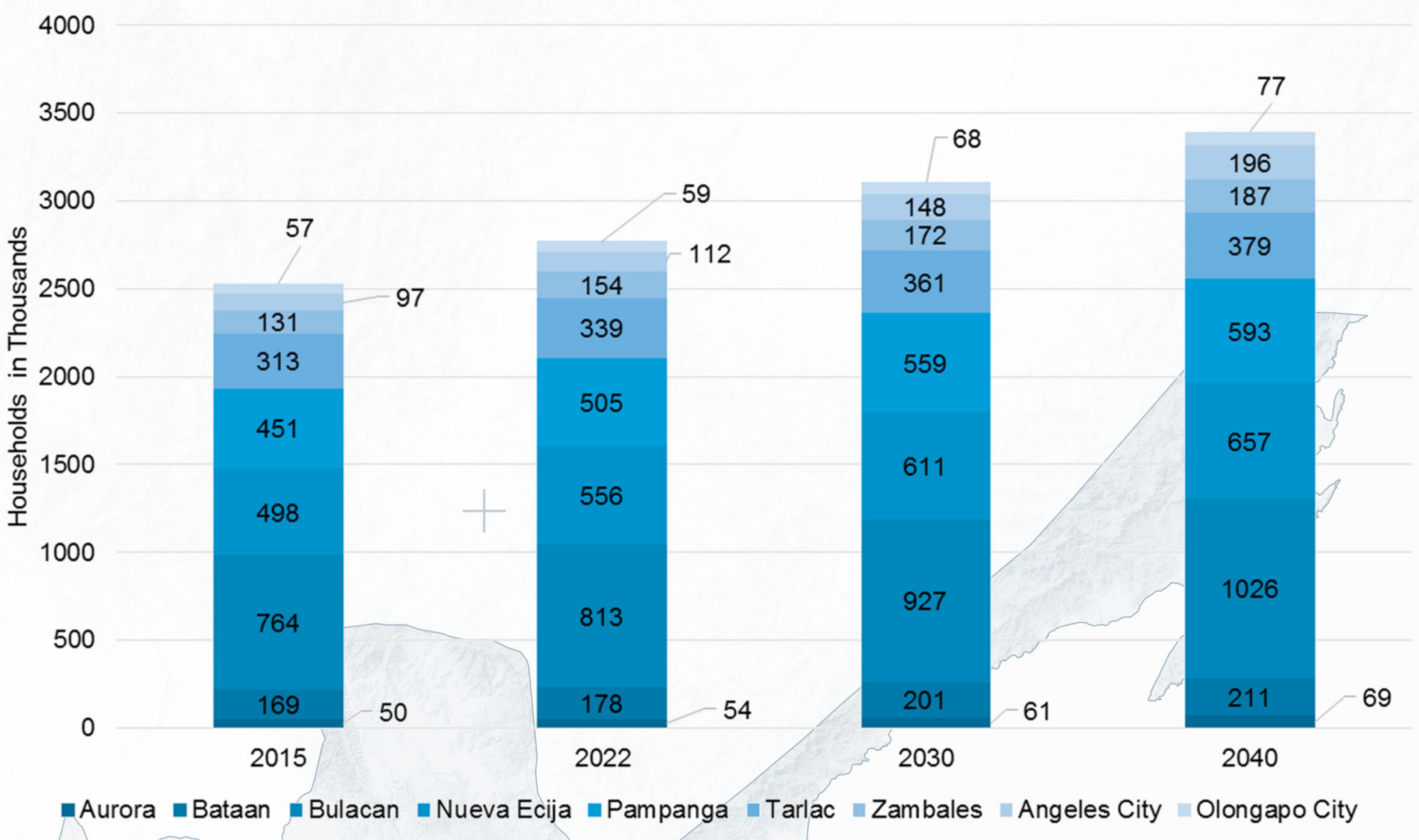


Figure 18: Targeted Households with Access to Safe Water

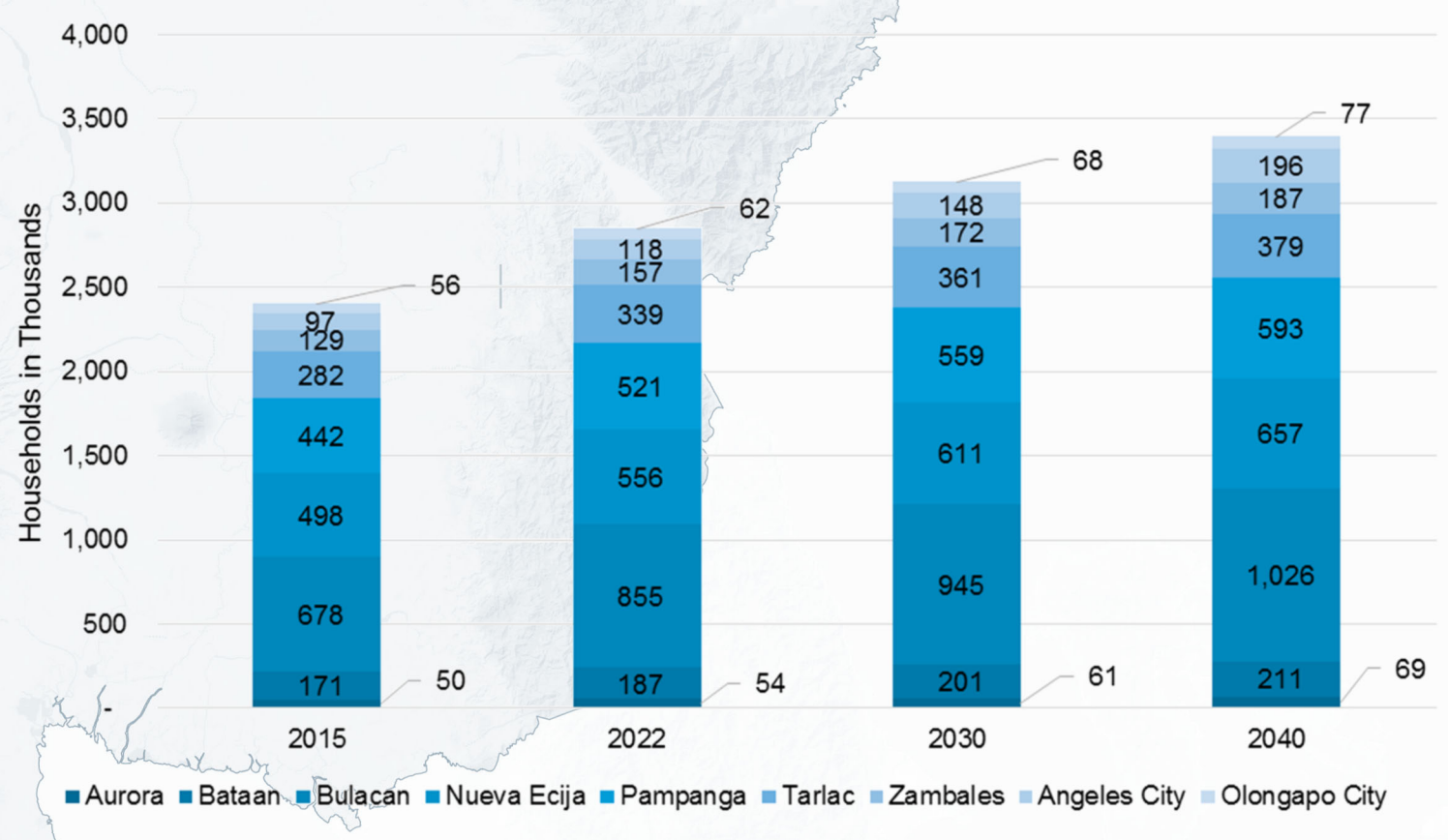


Figure 19: Targeted Households with Access to Sanitation Facilities

Water Supply Targets

AURORA			
	2022	2030	2040
Level III	40.0%	80.0%	100.0%
Level II	40.0%	10.0%	0.0%
Level I	20.0%	10.0%	0.0%
Safe Access	100.0%	100.0%	100.0%
No Access	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

BATAAN			
	2022	2030	2040
Level III	80.8%	92.9%	100.0%
Level II	2.4%	1.2%	0.0%
Level I	11.9%	5.9%	0.0%
Safe Access	95.0%	100.0%	100.0%
No Access	5.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

BULACAN			
	2022	2030	2040
Level III	80.0%	93.0%	100.0%
Level II	0.1%	0.1%	0.0%
Level I	15.0%	5.0%	0.0%
Safe Access	95.1%	98.1%	100.0%
No Access	4.9%	2.0%	0.0%
Total	100.0%	100.0%	100.0%

NUEVA ECIJA			
	2022	2030	2040
Level III	60.0%	70.0%	100.0%
Level II	0.0%	0.0%	0.0%
Level I	40.0%	30.0%	0.0%
Safe Access	100.0%	100.0%	100.0%
No Access	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

PAMPANGA (excluding Angeles City)			
	2022	2030	2040
Level III	82.3%	91.1%	100.0%
Level II	2.0%	0.4%	0.0%
Level I	12.7%	8.5%	0.0%
Safe Access	97.0%	100.0%	100.0%
No Access	3.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

TARLAC			
	2022	2030	2040
Level III	95.0%	100.0%	100.0%
Level II	5.0%	0.0%	0.0%
Level I	0.0%	0.0%	0.0%
Safe Access	100.0%	100.0%	100.0%
No Access	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

ZAMBALES (excluding Olongapo City)			
	2022	2030	2040
Level III	39.0%	53.0%	100.0%
Level II	28.0%	36.0%	0.0%
Level I	31.0%	11.0%	0.0%
Safe Access	98.0%	100.0%	100.0%
No Access	2.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

ANGELES CITY			
	2022	2030	2040
Level III	80.0%	92.0%	100.0%
Level II	11.0%	8.0%	0.0%
Level I	4.0%	0.0%	0.0%
Safe Access	95.0%	100.0%	100.0%
No Access	5.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

OLONGAPO CITY			
	2022	2030	2040
Level III	75.3%	80.0%	100.0%
Level II	10.0%	10.0%	0.0%
Level I	10.0%	10.0%	0.0%
Safe Access	95.3%	100.0%	100.0%
No Access	4.7%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

CENTRAL LUZON			
	2022	2030	2040
Level III	75.4%	86.8%	100.0%
Level II	4.0%	2.8%	0.0%
Level I	17.8%	10.3%	0.05
Safe Access	97.2%	100.0%	100.0%
No Access	2.8%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

Sanitation Targets

AURORA			
	2022	2030	2040
Improved	97.0%	100.0%	100.0%
Basic	3.0%	0.0%	0.0%
Shared/Communal/Limited	0.0%	0.0%	0.0%
Open Defecation	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

BATAAN			
	2022	2030	2040
Improved	97.0%	100.0%	100.0%
Basic	3.0%	0.0%	0.0%
Shared/Communal/Limited	0.0%	0.0%	0.0%
Open Defecation	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

BULACAN			
	2022	2030	2040
Improved	97.0%	100.0%	100.0%
Basic	3.0%	0.0%	0.0%
Shared/Communal/Limited	0.0%	0.0%	0.0%
Open Defecation	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

NUEVA ECIJA			
	2022	2030	2040
Improved	97.0%	100.0%	100.0%
Basic	3.0%	0.0%	0.0%
Shared/Communal/Limited	0.0%	0.0%	0.0%
Open Defecation	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

PAMPANGA (excluding Angeles City)			
	2022	2030	2040
Improved	97.0%	100.0%	100.0%
Basic	3.0%	0.0%	0.0%
Shared/Communal/Limited	0.0%	0.0%	0.0%
Open Defecation	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

TARLAC			
	2022	2030	2040
Improved	97.0%	100.0%	100.0%
Basic	3.0%	0.0%	0.0%
Shared/Communal/Limited	0.0%	0.0%	0.0%
Open Defecation	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

ZAMBALES (excluding Olongapo City)			
	2022	2030	2040
Improved	97.0%	100.0%	100.0%
Basic	3.0%	0.0%	0.0%
Shared/Communal/Limited	0.0%	0.0%	0.0%
Open Defecation	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

ANGELES CITY			
	2022	2030	2040
Improved	97.0%	100.0%	100.0%
Basic	3.0%	0.0%	0.0%
Shared/Communal/Limited	0.0%	0.0%	0.0%
Open Defecation	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

OLONGAPO CITY			
	2022	2030	2040
Improved	97.0%	100.0%	100.0%
Basic	3.0%	0.0%	0.0%
Shared/Communal/Limited	0.0%	0.0%	0.0%
Open Defecation	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

CENTRAL LUZON			
	2022	2030	2040
Improved	92.7%	100.0%	100.0%
Basic	1.2%	0.0%	0.0%
Shared/Communal/Limited	6.1%	0.0%	0.0%
Open Defecation	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

Strategic Interventions

After the regional planning and consultation workshop, a working document detailing specific strategic interventions to improve water supply and sanitation access in Region III was formulated. The participants deliberated on these proposed interventions to make them adaptable to actual local conditions. (These are discussed more thoroughly in the National Master Plan and may be adopted accordingly at the local level.)

Tables 15 and 16 show the specific strategic interventions for water supply and sanitation, respectively.

Table 15: Proposed Strategic Interventions for Water Supply

Access to Safe Water	Planning and Development	Service Provision	Regulation	Promotion
95% Access to Safe Water in 2022 Universal Access in 2030	▪ Planning, program or project design ▪ Establishing labs and water quality testing centers ▪ Lobbying for the Regional WSS Masterplan	▪ M&E expansion ▪ Rehabilitation/Non-revenue water (NRW) reduction maintained at 20% of total production ▪ Integration/ Amalgamation ▪ Automation ▪ Residuals management ▪ Mitigation ▪ Water potability maintained at all times ▪ Providing 24/7 water supply service ▪ Achieving 100% coverage ▪ Residuals management	▪ Water resources protection ▪ Arbitration ▪ Environmental and social safeguards ▪ Compliance with PNSDW 2017 ▪ Close monitoring of Joint Agreement ▪ Compliance training from DOH ▪ Resource studies	▪ Willingness to connect and pay ▪ Demand creation

Table 16: Proposed Strategic Interventions for Sanitation

Access to Improved Sanitation	Planning & Development *Planning* *Program or Project Design* *Institution Building* *Training* *Financing* *Climate/Disaster Resiliency* *Policy*	Service Provision *Operations* *M&E* *Expansion* *Amalgamation* *Automation*	Regulation *Tariff/Pricing* *Resource* *Arbitration* *Registration, Permits, Rights*	Promotions *Social Preparation* *Advocacy* *Demand Creation* *Behavior Change*
High Access Areas with 60% to 100% Improved Sanitation Coverage	▪ Local Sustainable Sanitation Plan (LSSP) should be incorporated into the WSS Sector Plan, local development plan (LDP), annual investment program (AIP), and local health plan. ▪ A sewerage system program should be developed to provide service in the urban core coordinating with those in charge of the septage management program; project urban sprawl ▪ A National Sewerage and Septage Management Program (NSSMP) subsidy grant for sewerage and septage management programs (SMP) should be in place. ▪ Capacity development in regard to sewerage systems should be planned and integrated with other infrastructure. ▪ A sanitation ordinance covering sewerage system and septage management services should be passed, possibly integrating it into the environment code and Water Quality Management Areas (WQMA) action plan.	▪ Sanitation programs should focus on implementing sewerage systems and completing septage management programs. ▪ Expansion of urbanized and urbanizing barangays should be pursued. ▪ M&E system should conform to PSA/ Census (covered by sewerage system, households desludged, and on-site systems).	▪ Tariff should be computed using full cost recovery with infusion of capex subsidy for sewerage projects. ▪ LGU implementers have undergone compliance training given by DOH and DENR (particularly in sewerage systems), and the Dept. of Agriculture (DA) with respect to regulations/guidelines governing disposal of by-products. ▪ Penalties should be strictly imposed on those not complying with certain requirements, including LGUs/WDs by filing cases with the environmental ombudsman.	▪ Promotions should focus on enjoining the public to connect to the sewerage system when made available stressing the importance of compliance and the benefits therefrom. ▪ Promotional efforts regarding water demand management should be supported to minimize wastage and unnecessary use of water. ▪ Building buy-in for paying for sanitation services should be promoted.

Physical Interventions

To meet the targets for access and coverage as well as the normative content of water (service standards), capital investments are necessary. The details of these investments in 2022 and 2030 are listed in Table 17.

Table 17: Capital Investments Required to Achieve Water Supply Targets

Service Level	2022	2030
Level III	▪ Water source assessment and development ▪ Construction of water treatment facilities ▪ Distribution network expansion ▪ Provision of service connections ▪ NRW reduction program ▪ Watershed and water resources protection, management and development ▪ Development of a Water Safety Program ▪ Adoption of a rainwater harvesting program ▪ Establishment of adequately equipped laboratory testing centers in strategic areas to serve all service levels clientele	▪ Water source assessment and development ▪ Construction of water treatment facilities ▪ Distribution network expansion ▪ Provision of service connections ▪ NRW reduction program ▪ Watershed and water resources protection, management and development ▪ Development of a Water Safety Program ▪ Adoption of a rain water harvesting program ▪ Automation of operations and major services
Level II	▪ Rehabilitation of existing water supply system to upgrade it to Level III	▪ Rehabilitation of water supply system to upgrade it to Level III
Level I	▪ Upgrading to “safe level” those water sources found “unsafe”	▪ Adoption of a rain water harvesting program in areas not reached by Levels II and III services

Capital investments for the sanitation targets will include basic sanitation programs, septage management programs, and sewerage management programs.

Targets for 2022 will mainly focus on basic sanitation. The septage and sewerage management programs are to be undertaken to achieve 2030 targets, although these programs may be implemented as early as 2022.

Nonphysical Interventions

To support the CapEx programs and ensure the efficient operation of the newly constructed facilities, institutional and regulatory reforms are to be undertaken (as shown in Table 18).

Table 18: Institutional and Regulatory Reforms Required to Meet Water Supply and Sanitation Goals

Items	Undeveloped/Underdeveloped	Developing	Developed
Water Service Provision	▪ LGUs will organize/establish water utilities as commercial enterprises in their jurisdictions or form a WD. ▪ LGUs will create offices to handle Level II and Level I services.	▪ WDs and LGU-run utilities will be motivated to improve their performance by offering them incentives/rewards.	▪ A system for independent evaluation and due diligence regarding public-private partnership projects will be set up.
Planning and Development	▪ An agency will be created to spearhead efforts to improve the WSS sector at the provincial level. The provincial office shall coordinate development plans for water and sanitation of all municipalities in each province, pursue efforts (in coordination with the DENR) in watershed rehabilitation, and provide training programs to LGUs in water supply development and management.		
Regulation	▪ Service standards for water supply and sanitation will be defined. ▪ An independent group will be formed to monitor the performance of water and sanitation service providers, other than the WDs, within each province. WDs will continue to be regulated by the LWUA. The monitoring group could later be made part of a regulatory body.		

160°0.000'W
120°0.000'E
40°0.000'E
80°0.000'S
0°0.000'
80°0.000'N
20°0.000'S

N

10 0 10 20 30 40 km

WGS 1984 - UTM Zone 51 N

Legend

- Approved Projects
- Pending Projects

Dilasag
Casiguran
Dinalungan
Carranglan
Dipaculao
AURORA
Lupao
San Manuel
Cuyapo
Talugtug
Pantabangan
San Jose City
Maria Aurora
Baler
Santa Cruz
Moncada
Anao
Nampicuan
Muñoz City
Rizal
Camiling
Paniqui
Ramos
Guimba
Llanera
Bongabon
San Clemente
Candelaria
Pura
NUEVA ECIJA
San Luis
Gerona
Talavera
Santa Ignacia
Victoria
General Mamerto Natividad
Mayantoc
Licab
Quezon
Masinloc
Palayan City
Laur
Gabaldon
Aliaga
Cabanatuan City
TARLAC
Tarlac City
Palauig
La Paz
Zaragoza
San Jose
Santa Rosa
Jaen
San Leonardo
Iba
Peñaranda
General Tinio
Capas
Concepcion
San Antonio
Gapan City
Dingalan
ZAMBALES
San Isidro
Bamban
Magalang
Cabiao
Botolan
Mabalacat
Arayat
San Miguel
Cabangan
Angeles City
Mexico
Santa Ana
Candaba
Porac
San Felipe
San Fernando City
San Ildefonso
Doña Remedios Trinidad
PAMPANGA
San Marcelino
San Luis
San Narciso
Santa Rita
Bacolor
Santo Tomas
San Simon
Floridablanca
BULACAN
Guagua
Minalin
Apalit
Castillejos
Baliuag
Bustos
Angat
Subic
Olongapo City
Lubao
Macabebe
Calumpit
Pulilan
Norzagaray
San Antonio
Sasmuan
Plaridel
Pandi
Dinalupihan
Masantol
Malolos City
Santa Maria
Hermosa
Balagtas
San Jose del Monte City
Hagonoy
Orani
Bulacan
Bocaue
Samal
Marilao
Morong
Meycauayan City
Abucay
Obando
BATAAN
Pilar
Orion
Bagac
Limay
Mariveles

LWUA Priority Projects

LWUA, 2018 Data

Addressing the Gaps

Water Supply Investment Requirements

Physical Investments

To address WSS infrastructure gaps and fulfill specific targets and commitments for 2022 and 2030, the cost of infrastructure investments was derived based on anticipated demand. Such demand was based on projected population, economic growth, as well as factored-in investments to ensure the continuous delivery of WSS services provided by existing systems. The computation included the anticipated need to upgrade existing service levels (i.e., from Level II to Level III, Level I to Level II or Level III).

Central Luzon requires capital investments for infrastructure development of about PhP25.73 billion and PhP21.13 billion to achieve 2022 and 2030 targets, respectively. Unit development costs used to arrive at these sums are estimated at PhP31,700 per household for Level III, PhP18,600 for Level II, and PhP8,400 for Level I.

These rates are direct costs and cover water source development, water treatment facilities, storage requirements, transmission and distribution lines, and pumping requirements, and provision of service connections.

Furthermore, these unit costs (determined to suit local conditions in Central Luzon) were derived by applying regional cost factors (with respect to labor, material, and equipment costs) to the computed development base costs for NCR. NCR values are pegged at PhP31,800 per household for Level III, PhP18,700 for Level II, and PhP8,400 for Level I.

The cost deviations (from the NCR base rates) were taken into account considering the region's distinct geographical, economical, and accessibility characteristics, and labor, material, and equipment costs, which are bound to affect the implementation costs of any project. The regionalization of costs ensures that computed regional investment requirements for the Master Plan and the Regional Roadmaps are as realistic as possible befitting each locale.

Aside from the direct costs, indirect costs were considered in estimating the total investment requirements. These items include project preparation activities (which may affect budget considerations) before actual construction work begins. Items considered and percentage values used in relation to the total direct costs computed are shown in Table 19.

Table 19: Indirect Costs Employed[22]

Water Supply		
Contingency	10.0%	Percentage of Total Direct Cost
Feasibility Study	3.0%	Percentage of Total Direct Cost
Detailed Engineering Design	6.0%	Percentage of Total Direct Cost
Construction Supervision	5.0%	Percentage of Total Direct Cost
ROW/Land Acquisition	3.0%	Percentage of Total Direct Cost
Organizational Cost/Permits	2.0%	Percentage of Total Direct Cost
Capacity Development	33,350	1 Staff Employee per 100 HH (LWUA)

Table 20: Total Investment Costs for Water Supply Sector

Province/City	Total Investment Cost (in PhP Million) 2022	Total Investment Cost (in PhP Million) 2030
Aurora	536.07	1,104.92
Bataan	1,307.24	1,474.41
Bulacan	3,501.47	8,036.70
Nueva Ecija	4,587.55	3,876.74
Pampanga (including Angeles City)	4,866.86	3,336.90
Tarlac	8,860.02	1,619.58
Zambales (including Olongapo City)	2,071.25	1,681.06
Total	**25,730.46**	**21,130.31**

Total expenses for establishing water quality testing laboratories have also been taken into account. It is assumed that one laboratory per province will be constructed.

Table 20 shows a summary of the total investment requirements of the region. (The detailed methodology of how the regional costs for Central Luzon were derived is referenced in Annex D of the main volume of the Philippine WSS Master Plan.)

Nonphysical Investments

Institutional and regulatory reforms have to be pursued to complement infrastructure development and ensure that water supply systems constructed will operate efficiently. Costs of reform implementation have not been estimated at the regional level and are projected to be not substantial compared to the infrastructure investments.

LGUs, WDs, and other stakeholders are obligated to influence decision makers to pursue relevant reforms in the water sector. These reforms serve as non-infrastructure investments and typically include organization/institutional development, regulatory strengthening, capacity building, and project management.

Proposed interventions include the following:

- The model of existing water utilities should be identified in areas where there are no water districts. The establishment of WDs should be proposed in municipalities with a population of at least 20,000, subject to an agreement with the local chief executives. If LGUs are not amenable to forming a WD, water utilities that can operate commercially (e.g., a similar local government water corporation or economic enterprise) should be set up.
- Priority should be given to operationalizing nonfunctional WDs, particularly those in municipalities categorized as 3rd class and higher.
- The target expansion of service coverage shall be conducted at the municipal level. Municipalities with lower than 50% coverage will be given priority in the investment program.

The map on the left shows nine Central Luzon municipalities where priority WD projects have been approved and those pending approval for LWUA's financial assistance (FA).

[22] *Based on industry standards*

160°0.000'W
120°0.000'E
40°0.000'E
80°0.000'S
0°0.000'
80°0.000'N
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WGS 1984 - UTM Zone 51 N

Legend

STP CLUSTERING

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- R3-CL2
- R3-CL3
- R3-CL4
- R3-CL5
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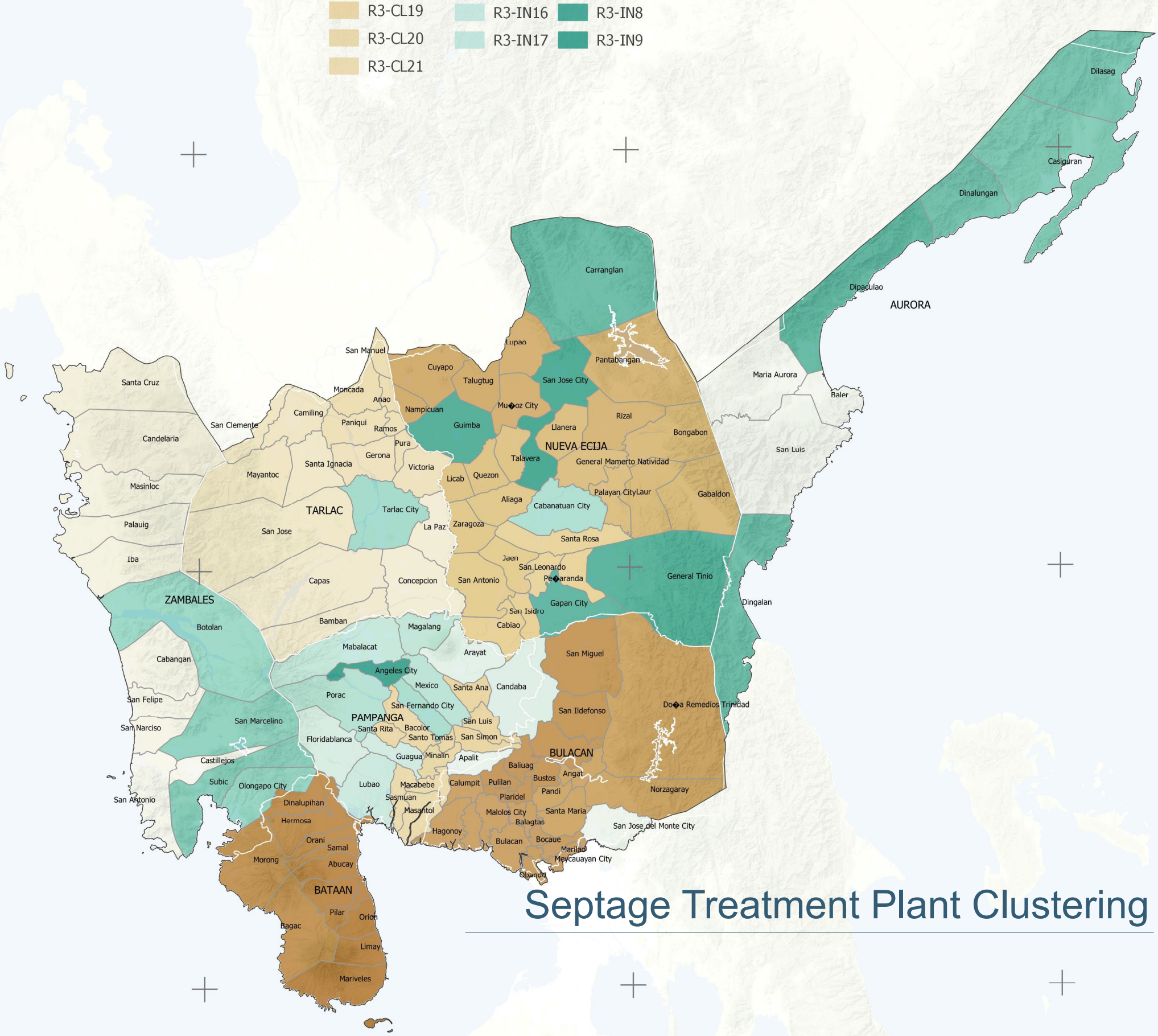
- R3-IN9



Septage Treatment Plant Clustering

Sanitation Investment Requirements

Physical Investments

Basic Sanitation Program. The Department of Health (DOH) plans to prescribe a national basic sanitation program for the entire country – looking into a combination of microfinance and behavior change communication. A Department Administrative Order on standard septic tank use and design will also be released by the DOH soon after planned consultation activities have been rolled out in the country's three major island groups (Luzon, Visayas and Mindanao).

Central Luzon will need about PhP4.3 billion for basic sanitation from 2016 to 2022 to reach its target of 92.7%.

This was derived by multiplying the unserved population by the unit development costs with regard to establishing specific on-site sanitation facilities. (An annex to this report and the National Master Plan explains the unit costs and derived costs for specific sanitation interventions.)

Septage Management Program. A clustering approach will be recommended to reduce capital costs and attain economies of scale. The proposed clustering per province is shown on the map on the left.

The region will need about PhP5.83 billion and PhP567 million for 2022 and 2030, respectively, for its septage management program.

Sewerage System Program. Only Angeles City and Olongapo City have been required to plan and put up a sewerage system for their urban core. However, rapidly urbanizing cities (i.e., candidate HUCs) should also consider planning for sewerage services in the interim.

The indicative cost for sewerage was computed based on the 50% coverage of the HUCs' urban population only. The unit cost was derived per the procedure applied to septage management, wherein the unit cost was based on the National Septage and Sewerage Master Plan (NSSMP) estimations and later adjusted considering other factors.

For sewerage services, both Angeles City and Olongapo City will require PhP4.2 billion by 2022 and an additional PhP822 million by 2030. In 2015, Angeles City's urban ratio was registered at a high 98%. The computational template provided for a 25% coverage of sewerage services by 2022 and an additional 25% coverage by 2030. This includes the incremental population in Angeles City and Olongapo City from 2015 to 2022 and from 2023 to 2030, respectively.

Candidate HUCs in Bulacan and Pampanga, for example, may be closely examined as the urbanization may set in more rapidly in these places than in other capital towns such as Mariveles and Dinalupihan in Bataan, Gapan, Guimba, San Jose City and Talavera in Nueva Ecija, Subic in Zambales, and Capas, Conception, and Tarlac City in Tarlac.

Nonphysical Investments

Central Luzon, like other regions in the country, will require substantial assistance from the national government, or where technical and financial assistance can be funneled. This will include an inventory or survey and assessment of existing sanitation facilities, capacity development for implementing local agencies (local health office, environment and natural resources office, office of the building official, and general services office), institutional, policy and regulatory environment development (which would require the involvement of capacitance support offices like the budget and treasurer's office, bids and awards committee, commission on audit office, engineering office, office of legal services/affairs, barangay affairs office, office of the local chief executive, and the local legislative council).

Other nonstructural interventions that may require a budget include developing a monitoring and evaluation (M&E) system to monitor progress, support planning, and guide development training programs, promotional campaigns and other legislative advocacies, and initiate hygiene promotion programs.

Table 21: Total Investment Costs for Sanitation Sector

Province/City	Total Investment Cost (in PhP Million) 2022	Total Investment Cost (in PhP Million) 2030
Aurora	1,383	188
Bataan	4,776	423
Bulacan	21,575	2,674
Pampanga	4,433	1,221
Tarlac	1,964	671
Zambales	3,829	426
Nueva Ecija	7,026	1,632
Angeles City	3,649	1,540
Olongapo City	2,067	323
Total	**50,702**	**9,098**

Proposed Projects and Programs

A list of projects and investment programs has been developed during the regional planning workshop to assess the current state of the WSS sector and propose projects to increase access to and upgrade water supply and sanitation facilities at the provincial or regional level.

The DILG, Department of Environment and Natural Resources (DENR) River Basin Control Office (RBCO) and LWUA have proposed projects in the WSS sector in addition to those discussed and agreed on at the regional workshop.

This list of projects does not cover only infrastructure projects, but also nonphysical investment requirements, such as capacity development programs, information dissemination campaigns, and watershed management plans. These projects run the gamut from conception, proposal, pre-feasibility and feasibility study stages, detailed engineering design, to pre-procurement and procurement. Figure 20 shows the distribution of the investment requirement per province and HUC. Based on the proposed projects and programs, the region needs PhP12,369 billion to boost its WSS sector.

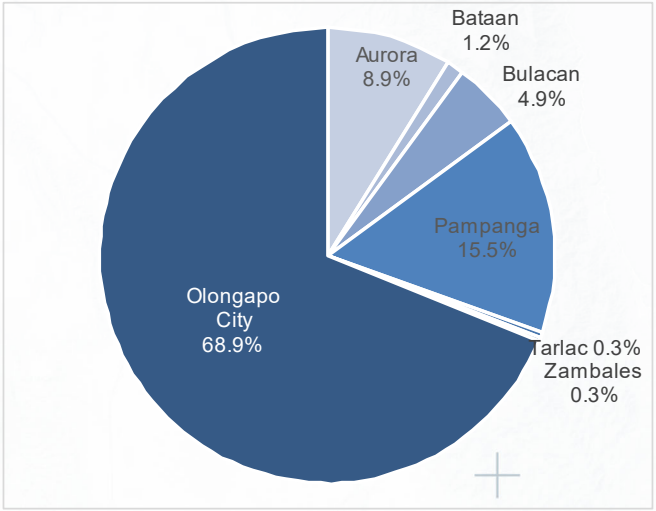


Figure 20: Distribution of Investment Requirement per Province/HUC

.AURORA									
	Water Supply	Period	Budget Requirement (PhP Million)		Sanitation	Period	Budget Requirement (PhP Million)	Total Budget Requirement (PhP Million)	HH Beneficiaries (2022)
1	Construction of water laboratory	Short Term	100	1	Construction of liquid waste facility	Medium Term	2,000		
2	Construction of water supply facilities and sources (deep wells, spring development)	Medium Term	1,530	2	Upgrading of solid waste management program (collection and disposal)	Long Term	2,500		
3	Continuing Education Program for implementers and end users	Short Term	10.0	3	Distribution of concrete toilet bowls; dissemination of information regarding use thereof	Medium Term	60.0		
4	Expansion of service area of Balibago Water District	Short Term	150			**TOTAL**	**4,560**		
5	Formation of Local Drinking Water Quality Monitoring Committee (LDWQMC)	Short Term	0.5						
6	Pipe laying projects (by Admin)	Long Term	60.0						
7	Training of WSS Committee	Short Term	20.0						
8	Water testing using PHC bottles	Short Term	65.0						
9	Regulation and control of construction of wells within a 150-meter radius	Short Term	-					**6,497.5**	**54,396**
10	Watershed management system (monitoring and safety of point sources)	Short Term	0.2						
		TOTAL	**1,936**						

	Water Supply and Sanitation	Period	Budget Requirement (PhP Million)
1	Awareness program re: water and sanitation with support from the academe	Short Term	1.5
2	Adoption of national laws about water supply and sanitation by SP & SB	Short Term	-
		TOTAL	**1.5**

BATAAN									
	Water Supply	Period	Budget Requirement (PhP Million)		Sanitation	Period	Budget Requirement (PhP Million)	Total Budget Requirement (PhP Million)	HH Beneficiaries (2022)
1	Construction of water systems			1	Construction of sewerage treatment plant (Phase II)	Long Term	700		
	Gabon, Hacienda, Abucay	Short Term	2.5	2	Construction of STP/water treatment facility	Long Term	5.0		
	E.C. Bernabe NHS, Bagac	Short Term	2.5			**TOTAL**	**705**		
	Brgy. Tubo-Tubo, Dinalupihan	Short Term	2.5						
	Brgy. Mabayo, Morong	Short Term	2.5						
	Kanawan, Morong	Short Term	2.0						
	Nagbalayong HS-Senior HS, Morong	Short Term	2.5						
	Sibul II, Daan Pare, Orion	Short Term	2.5						
	P. Roman NHS, Pilar	Short Term	2.5						
	Brgy. Palili, Samal	Short Term	2.0						
	Samal NHS, Senior HS, Samal	Short Term	5.0						
2	Repair/Rehabilitation of water systems								
	Bagac NHS-Parang, Parang, Bagac	Short Term	2,.0						
	Luakan NHS, Dinalupihan	Short Term	2.0						
	Sta. Lucia NHS, Dinalupihan	Short Term	2.5						
	Casupanan ES, Hermosa	Short Term	2.0					**897.78**	**187,312**
	Hermosa ES, Hermosa	Short Term	0.5						
	Sumalo, Hermosa	Short Term	0.5						
	Morong NHS, Morong	Short Term	2,.0						
3	Development of water impounding reservoir at Talisay River, Balanga City	Short Term	100						
4	Upgrading of water system, Bataan School of Fisheries, Orion	Short Term	2.5						
5	Construction of pump stations including wells	Short Term	20						
6	Rehabilitation of elevated steel tank (including cleaning and disinfection)	Short Term	0.28						
7	Repair/expansion of water district pipelines	Medium Term	30						
8	Establishment of water district (Level III), Samal & Abucay	Short Term	2.0						
		TOTAL	**192.78**						

BULACAN									
	Water Supply	Period	Budget Requirement (PhP Million)		Sanitation	Period	Budget Requirement (PhP Million)	Total Budget Requirement (PhP Million)	HH Beneficiaries (2022)
1	Malolos WD Water Supply Project	Short Term	1,915	1	Construction of septage treatment plant	Long Term	25.0		
2	Construction of glass fused to steel ground reservoir			2	Construction of 105 m³ septage facilities	Long Term	89.30		
	one (1) 1,000 m³ at Brgy. Bitungol	Short Term	14.5	3	Purchase of two vacuum trucks to be used for desludging	Short Term	10.00		
	one (1) 1,000 m³ at Brgy. Tigbe	Short Term	12.65	4	Septage Management Program	Long Term	1,066		
3	Construction of two (2) 1,000 m³ glass fused to steel bolted tank at Sitio Bato, Guyong Pump Station and Gulod, San Jose Patag Pump Station 1	Short Term	25.093	5	Proposed wastewater testing laboratory	Short Term	-		
4	Construction of 30mld treatment plant at Brgy. San Mateo including pipelines and reservoir	Medium Term	235	6	Construction of new pump station or mini-treatment plant	Short Term	7.5		
5	Pipeline expansion in different barangays in Norzagaray	Medium Term	3.0			**TOTAL**	**1,197.8**		
6	Pipe laying expansion programs in three (3) hydraulic areas (29,058 LM).	Medium Term	144						
7	Rehabilitation of pipelines in Barangay Friendship Village Resources (FVR) Phases I, II and III	Short Term	11.5						
8	Design and construction of 3,000 m³ glass fused to steel bolted tanks	Medium Term	38.1						
9	Development of new sources of surface water for the BBWSP (Labangan Channel, San Miguel-Sulipan, Angat River, Maasim River, Bayabas River, Bulo Dam)	Long Term	70						
10	Bulacan Bulk Water Supply Project	Short Term	-						
11	Watershed management (e.g. reforestation)	Short Term	-						
12	Improvement and expansion projects	Medium Term	162.06						
13	Surface water/infiltration gallery 5 MLD	Short Term	40.0						
14	District meeting area	Short Term	15.0					**3,997.6**	**855,197**
15	Storage facilities with 2,500 m^3 capacity	Short Term	45.0						
16	Transmission line 8"	Short Term	1.2						
17	Purchase of lot area 3,600 m^2	Short Term	8.8						
18	Well drilling 2 units	Short Term	14.0						
19	Pipeline expansion and rehabilitation of pipelines in different barangays	Short Term	24.0						
20	Partnership with water service providers and the academe	Short Term	-						
21	Improvement project - retapping	Short Term	0.75						
22	Production wells - 25	Short Term	5.0						
23	Inner barangay expansion	Short Term	2.0						
24	Rehabilitation of production wells at 11 pump stations	Medium Term	10.64						
		TOTAL	**2,797.3**						

	Water Supply and Sanitation	Period	Budget Requirement (PhP Million)
1	Aid to Rural Waterworks and Sanitation Association (RWSA) for the development, improvement and rehabilitation of water system	Short Term	2.0
2	Conduct of seminars re: water supply and sanitation	Short Term	0.5
3	WSS infrastructure for disaster risk management	Short Term	-
		TOTAL	**2.5**

Pampanga									
	Water Supply	Period	Budget Requirement (PhP Million)		Sanitation	Period	Budget Requirement (PhP Million)	Total Budget Requirement (PhP Million)	HH Beneficiaries (2022)
1	Lubao Bulk Water Supply Project	Short Term	706	1	Mabalacat City WD Septage Management Program	Long Term	100		
2	Metro Clark Bulk Surface Water Supply Project	Short Term	4,025	2	Septage treatment & disposal facilities in select LGUs of Tarlac, Bulacan, Pampanga	Long Term	582	**11,334**	**520,533**
3	Pampanga Bulk Surface Water Supply Project	Short Term	5,732	3	Sewerage system development projects in major urban centers	Long Term	189		
		TOTAL	**10,463**			**TOTAL**	**871**		

Tarlac									
	Water Supply	Period	Budget Requirement (PhP Million)		Sanitation	Period	Budget Requirement (PhP Million)	Total Budget Requirement (PhP Million)	HH Beneficiaries (2022)
1	Formulating an ordinance adopting RA 9275 (Clean Water Act of 2004)	Medium Term	1.0	1	Construction of septage treatment plant per cluster (8 clusters)	Long Term	237		
		TOTAL	**1.0**	2	Sewerage treatment plants in 3 district hospitals	Long Term	15.0		
						TOTAL	**252**		
	Water and Sanitation	Period	Budget Requirement (PhP Million)					**253**	**338,899**
1	Inclusion of water supply and sanitation projects in annual investment plan	Short Term	-						
		TOTAL	**-**						

ZAMBALES									
	Water Supply	Period	Budget Requirement (PhP Million)		Sanitation	Period	Budget Requirement (PhP Million)	Total Budget Requirement (PhP Million)	HH Beneficiaries (2022)
1	Provision of water supply systems (Level I, II, III) in various rural barangays in the province	Short Term	160	1	Provision of improved sanitary toilets to indigent households	Medium Term	9.0		
2	Rehabilitation of watershed/forestland to sustain water storage capacity (at least 130 hectares per year)	Short Term	10.5	2	Intensified solid waste management monitoring to protect groundwater quality	Long Term	2.81		
3	Provision of rainwater collector impounding structures	Long Term	-	3	Intensified implementation of sanitation protocols/standards in all municipalities	Long Term	1.0		
		TOTAL	**170.5**			**TOTAL**	**12.81**	**189.31**	**156,793**
	Water Supply and Sanitation	Period	Budget Requirement (PhP Million)						
1	Establishment of WSS Department as a local economic enterprise	Medium Term	6.0						
		TOTAL	**6.0**						

OLONGAPO CITY									
	Water Supply	Period	Budget Requirement (PhP Million)		Sanitation	Period	Budget Requirement (PhP Million)	Total Budget Requirement (PhP Million)	HH Beneficiaries (2022)
1	Creation of Local Drinking Water Quality Monitoring Committee	Short Term	0.50	1	Construction of communal septic tanks	Short Term	200		
2	Finalization of the Integrated Watershed Management Plan (IWMP)	Short Term	1.0	2	Sewerage and Septage Management Program	Medium Term	50,000		
3	Integrated Watershed Management Program			3	Provision of improved sanitary toilets to indigent households	Long Term	90.0		
	a. IWRM River and Waterways Management Program	Short Term	10.0	4	Intensified solid waste management monitoring to protect groundwater quality	Long Term	2.81		
	b. IWRM Forest Management Program	Short Term	10.0	5	Intensified implementation of sanitation protocols/standards in all municipalities	Long Term	10.0		
	c. IWRM Coastal Resource Management Program	Short Term	7.0			**TOTAL**	**50,303**		
	d. IWRM Urban Greening Program	Short Term	5.0						
4	Preparation of Water Safety Plan for all water service providers	Short Term	0.50						
5	Water sampling of doubtful sources	Short Term	3.0						
6	Franchise renewal of water service providers	Short Term	5.0					**50,400.5**	**61,815**
7	Silted Waterways and River Rehabilitation Program	Short Term	0.20						
8	River Gapo-ECO Warrior/River Patrol (IEC campaign/ annual event)	Short Term	3.0						
9	Implementation of "Tubig para kay Juan Project" (Anti-Heat Stroke and Dehydration Campaign)	Short Term	-						
		TOTAL	**37.0**						

	Water Supply and Sanitation	Period	Budget Requirement (PhP Million)
1	Establishment of Olongapo City Environment and Natural Resources Office (City ENRO)	Medium Term	10.0
2	Partnership with colleges/universities and other institutions re: research and development pertaining to water supply and sanitation	Short Term	0.50
3	Water Supply and Sanitation Program for Disaster Risk Reduction Management (DRRM)	Long Term	50.0
		TOTAL	**60.50**

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N

Legend

- Barangays with Assistance
- Municipality with Assistance
- Priority Projects (Barangay Level)
- Priority Projects (Municipal Level)

10 0 10 20 30 40 km

WGS 1984 - UTM Zone 51 N

AM, Salintubig Pipeline WSS Projects

DILG-WSSPMO, 2019 List of DILG Projects

Identified Priority Projects (2019-2020)

The tables below show the priority projects identified by LWUA and DILG for 2019-2020. The map on the left shows the various barangays and municipalities to be covered by DILG's Assistance to Municipalities (AM) and Salintubig Projects in 2019.

Assistance To Municipalities (2019)				
Province	Municipality	Project Type	Project Title	Amount (PhP)
Aurora	Baler	Potable water supply system	Expansion of Level III Water System	11,276,000
Aurora	Dingalan	Potable water supply system	Expansion of Level II Water System	9,816,000
Bataan	Orani	Health and sanitation	Construction Of Sanitary Toilets With Hygiene Facilities For Public Places	1,000,000
Bulacan	Bocaue	Health and sanitation	Construction Of Sanitary Toilets With Hygiene Facilities For Public Places	8,245,000
Bulacan	Pulilan	Potable water supply system	Rehabilitation/Improvement of Level III Water System	10,800,000
Bulacan	Pulilan	Potable water supply system	Expansion of Level III Water System	1,672,000
Nueva Ecija	Cabiao	Potable water supply system	Expansion of Level III Water System	2,925,000
Nueva Ecija	Gabaldon	Potable water supply system	Upgrading of Water System	10,021,000
Nueva Ecija	Lupao	Potable water supply system	New Construction of Level II Potable Water Supply System In Agupalo Weste	2,000,000
Nueva Ecija	Lupao	Potable water supply system	New Construction of Level II Potable Water Supply System In San Isidro	2,195,000
Nueva Ecija	Lupao	Potable water supply system	New Construction of Level II Potable Water Supply System In Salvacion I	2,000,000
Nueva Ecija	Lupao	Potable water supply system	New Construction of Level II Potable Water Supply System In Balbalungao	2,000,000
Nueva Ecija	Lupao	Potable water supply system	New Construction of Level II Potable Water Supply System In Parista	2,000,000
Nueva Ecija	Pantabangan	Potable water supply system	Expansion of Level II Water System	5,218,000
Nueva Ecija	Quezon	Potable water supply system	New Construction of Level II Potable Water Supply System	11,297,000
Nueva Ecija	Rizal	Potable water supply system	Expansion of Level II Water System	3,616,000
Pampanga	Candaba	Potable water supply system	New Construction of Level II Potable Water Supply System	2,000,000
Pampanga	Candaba	Health and sanitation	Construction of Sanitary Toilets With Hygiene Facilities for Public Places	1,080,000
Tarlac	Bamban	Potable water supply system	Rehabilitation/Improvement of Level III Water System	4,895,000
Tarlac	La Paz	Potable water supply system	Expansion of Level III Water System	10,614,000
			Total	**104,670,000**

SALINTUBIG (2019)
There are no DILG SALINTUBIG projects in Central Luzon pending approval for 2019.

LWUA (2017-2018)				
Province	Municipality	Project Type	Status	Amount
Bataan	Morong	Expansion/Improvement	Pending approval	25,000,000
Bulacan	Bocaue	Expansion/Septage	Pending approval	140,000,000
Bulacan	Bocaue	Expansion	Approved	19,000,000
Bulacan	Bustos	Expansion/Improvement	Pending approval	20,000,000
Bulacan	Pandi	Expansion/Improvement	Pending approval	25,000,000
Bulacan	Sta. Maria	Expansion/Improvement	Pending approval	182,300,000
Nueva Ecija	San Jose City	Expansion/Improvement	Pending approval	150,000,000
Nueva Ecija	Gen. Mamerto Natividad	Expansion	Approved	20,000,000
Nueva Ecija	Lupao	Expansion	Approved	5,000,000
Tarlac	Sta. Ignacia	Expansion	Approved	25,000,000
Pampanga	Candaba	Expansion/Improvement	Pending approval	16,500,000
			Total	**627,800,000**

Appendix A: Provincial and HUC Profiles

AURORA	eight (8) municipalities	Baler, Casiguran, Dilasag, Dinalungan, Dingalan, Dipaculao, Maria Aurora, San Luis
	151 barangays	4 urban, 147 rural
Land Area	3,147.3 sq. km.	
Demographics (2015)	Population (2015) – 214,336 Population Growth Rate (2000 to 2015) – 1.38 Population Density – 68 per sq. km.	
Economy	• Major industries - agriculture, fishery, cottage industries • Major crops - rice, coconuts, root crops, bananas • Major product - copra • The Aurora Pacific Ecozone and Freeport (APECO), located along the Pacific northeast seaboard in Casiguran, offers investors from neighboring countries investment and business opportunities in agriculture, aquaculture, eco-tourism, and light industries (such as electronics, garments and computer products).	
Poverty Incidence (2015)	On Families – 22.1% On Population – 26.3%	

BATAAN	11 municipalities	Abucay, Bagac, Dinalupihan, Hermosa, Limay, Mariveles, Morong, Orani, Orion, Pilar, Samal
	one (1) component city	Balanga City
	237 barangays	57 urban, 180 rural
Land Area	1,373.0 sq. km.	
Demographics (2015)	Population (2015) – 760,650 Population Growth Rate (2000 to 2015) – 2.06 Population Density – 550 per sq. km.	
Economy	• Major industries: agriculture, livestock raising, cattle raising, hog raising, poultry raising (particularly raising of broilers and ducks) • Mariveles hosts the country's first economic zone where the manufacture of garments and footwear, and petrochemical industries fuel its economy.	
Poverty Incidence (2015)	On Families – 1.6% On Population – 2.0%	

BULACAN	21 municipalities	Angat, Balagtas, Baliuag, Bocaue, Bulakan, Bustos, Calumpit, Doña Remedios Trinidad, Guiguinto, Hagonoy, Marilao, Norzagaray, Obando, Pandi, Paombong, Plaridel, Pulilan, San Ildefonso, San Miguel, San Rafael, Santa Maria
	three (3) component cities	Malolos, Mecauayan, San Jose del Monte
	569 barangays	329 urban, 240 rural
Land Area	2,796.10 sq. km.	
Demographics (2015)	Population (2015) – 3,292,071 Population Growth Rate (2000 to 2015) – 2.57 Population Density – 1,200 per sq. km.	
Economy	• Major industries - agriculture; leather tanning; manufacture of cement, ceramics, shoes, and garments; food processing; jewelry and furniture making • Major crops - rice, corn, high-value vegetables and fruits • Known as the "Northern Gateway from Manila", Bulacan is an ideal investment destination owing to its strategic location and the attractive investment incentives offered by the provincial government. • It has also become a tourist destination because of its many historic landmarks, particularly Malolos, the official capital of the first Philippine Republic.	
Poverty Incidence (2015)	On Families – 3.3% On Population – 4.5%	

NUEVA ECIJA	27 municipalities	Aliaga, Bondabong, Cabiao, Carranglan, Cuyapo, Gabaldon, General Mamerto Natividad, General Tinio, Guimba, Jaen, Laur, Licab, Llanera, Lupao, Nampicuan, Pantabangan, Penaranda, Quezon, Rizal, San Antonio, San Isidro, San Leonardo, Santa Rosa, Santo Domingo, Talavera, Talugtug, Zaragoza
	five (5) component cities	Cabanatuan, Gapan, Munoz, Palayan, San Jose
	849 barangays	92 urban, 757 rural
Land Area	5,751.33 sq. km.	
Demographics (2015)	Population (2015) – 2,151,461 Population Growth Rate (2000 to 2015) – 1.39 Population Density – 370 per sq. km.	
Economy	• Major industries - agriculture, fishery, livestock and poultry raising • Major crops - rice, corn, onions, garlic, calamansi, melons, mangoes • Major products - slippers, sandals • Nueva Ecija is the country's top producer of onions.	
Poverty Incidence (2015)	On Families – 18.6% On Population – 22.6%	

Appendix A: Provincial and HUC Profiles

PAMPANGA	19 municipalities	Apalit, Arayat, Bacolor, Candaba, Floridablanca, Guagua, Lubao, Macabebe, Magalang, Masantol, Mexico, Minalin, Porac, San Luis, San Simon, Santa Ana, Santa Rita, Santo Tomas, Sasmuan
	one (1) independent city	Angeles
	two (2) component city	Mabalacat, San Fernando
	538 barangays	170 urban, 368 rural
Land Area	2,062.5 sq. km.	
Demographics (2015)	Population (2015) – 2,198,110 Population Growth Rate (2000 to 2015) – 2.04 Population Density – 1,100 per sq. km.	
Economy	• Major industries - agriculture, fishery • Major crops - rice, corn, sugar cane, vegetables, fruits • Tilapia, milkfish, mudfish and prawns are usually grown in its creeks, swamps, springs, and fishponds. • The City of San Fernando is a model town promoting micro, small- and medium-scale enterprises under DTI's One Town One Product Program (OTOP). The city is popular for its famous product – the traditional Christmas lantern or parol.	
Poverty Incidence (2015)	On Families – 3.0% On Population – 4.9%	
TARLAC	17 municipalities	Anao, Bamban, Camiling, Capas, Concepcion, Gerona, La Paz, Mayantoc, Moncada, Paniqui, Pura, Ramos, San Clemente, San Jose, San Manuel, Santa Ignacia, Victoria
	one (1) component city	Tarlac City
	511 barangays	63 urban, 448 rural
Land Area	3,053.60 sq. km.	
Demographics (2015)	Population (2015) – 1,366,027 Population Growth Rate (2000 to 2015) – 1.62 Population Density – 450 per sq. km.	
Economy	• Major industries - agriculture, timber production, mining, ceramics, fertilizer manufacturing • Major crops - rice, sugarcane, corn, coconuts, vegetables (such as eggplants, garlic, and onions), fruits (such as mangoes, bananas, and calamansi) • Several rice mills, corn mills, and sawmills have been put up in Tarlac. It also hosts three sugar centrals. • Ceramics is an important industry in Tarlac because of its abundant clay deposits.	
Poverty Incidence (2015)	On Families – 14.7% On Population – 18.1%	

ZAMBALES	13 municipalities	Botolan, Cabangan, Candelaria, Castillejos, Iba, Masinloc, Palauig, San Antonio, San Felipe, San Marcelino, San Narciso, Santa Cruz, Subic
	one (1) independent city	Olongapo City
	247 barangays	41 urban, 206 rural
Land Area	3,830.8 sq. km.	
Demographics (2015)	Population (2015) – 590,848 Population Growth Rate (2000 to 2015) – 2.05 Population Density – 160 per sq. km.	
Economy	• Major industries - agriculture, fishery, tourism • Major crops - rice, mangoes • The entire coastal area of Zambales is a tourism haven because of its white sand beaches and rich coral reefs. • A big event promoting its mango industry is held annually in a bid of the provincial government to support its mango farmers and other stakeholders.	
Poverty Incidence (2015)	On Families – 12.3% On Population – 16.8%	

ANGELES CITY	Angeles City is the home of the emerging global communication technology industry.	
	33 barangays	33 urban, 0 rural
Land Area	60.27 sq. km.	
Demographics (2015)	Population (2015) – 411,634 Population Growth Rate (2000 to 2015) – 2.86 Population Density – 6,800 per sq. km.	
Economy	• Major industries - handicraft making, metalcraft, rattan furniture making • Major crops - coconuts • Major products - charcoal briquettes, toys, houseware, and garments • Angeles City hosts a number of call centers and world-class shopping malls.	

OLONGAPO CITY	Olongapo City is the center of trade, commerce and service in West Central Luzon.	
	17 barangays	17 urban, 0 rural
Land Area	185.0 sq. km.	
Demographics (2015)	Population (2015) – 233,040 Population Growth Rate (2000 to 2015) – 1.20 Population Density – 1,300 per sq. km.	
Economy	• Major industries - commerce, tourism • Olongapo City has three central business districts where 7,758 business establishments have been put up.	

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