NATIONAL ECONOMIC AND DEVELOPMENT AUTHORITY

Volume 2: Philippine Water Supply and Sanitation Master Plan

Cordillera Administrative Region Water Supply and Sanitation Databook and Regional Roadmap

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Acronyms

AARB	Apayao-Abulug River Basin
AIP	Annual Investment Plan
AM	Assistance to Municipalities
BOD	Biological Oxygen Demand
BWSA	Barangay Water and Sanitation Association
CAR	Cordillera Administrative Region
CapEx	Capital Expenditure
CBO	Community-Based Organization
CLTS	Community-Led Total Sanitation
CSR	Corporate Social Responsibility
CWSA	City Water and Sanitation Association
DA	Department of Agriculture
DED	Detailed Engineering Design
DENR	Department of Environment and Natural Resources
DILG	Department of the Interior and Local Government
DJF	December, January and February
DMA	District Metered Area
DOH	Department of Health
DPWH	Department of Public Works and Highways
DTI	Department of Trade and Industry
FAO	Food and Agriculture Organization
FHSIS	Field Health Service Information System
FIES	Family Income and Expenditure Survey
FS	Feasibility Study
GRDP	Gross Regional Domestic Product
HH	Household
HUC	Highly Urbanized City
IEC	Information, Education and Communication
IKSP	Indigenous Knowledge Systems and Practices
JICA	Japan International Cooperation Agency
JJA	June, July and August
LDP	Local Development Plan
LFPR	Labor Force Participation Rate
LGU	Local Government Unit
LSSP	Local Sustainable Sanitation Plan
LWUA	Local Water Utilities Administration
M&E	Monitoring and Evaluation
MAM	March, April and May
MDG	Millenium Development Goals
MGB	Mines and Geosciences Bureau
MSME	Micro, Small and Medium Enterprise
MBWD	Metro Bangued Water District
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
NIA	National Irrigation Administration
NRW	Nonrevenue Water
NSSMP	National Septage and Sewerage Master Plan
NWRB	National Water Resources Board
O&M	Operation and Management
OBS	Observed Baseline
OCD	Office of Civil Defense

PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PAWD	Philippine Association of Water Districts
PDP	Philippine Development Plan
PDPFP	Provincial Development and Physical Framework Plan
PEM	Philippine Environment Monitor
PES	Payment for Environmental Services
POW	Program of Work
PNSDW	Philippine National Standards for Drinking Water
PSA	Philippine Statistics Authority
PSGC	Philippine Standard Geographic Code
PWSS	Potable Water Supply System
PWSSMP	Philippine Water Supply and Sanitation Master Plan
RBCO	River Basin Control Office
RDP	Regional Development Plan
ROW	Right-of-Way
RWSA	Rural Waterworks and Sanitation Association
SALINTUBIG	Sagana at Ligtas na Tubig
SDG	Sustainable Development Goals
SGLG	Seal of Good Local Governance
SMERA	Small and Medium Enterprise Roving Academy
SMP	Septage Management Program
SON	September, October and November
STP	Septage Treatment Plant
SSF	Shared Service Facilities
TC	Tropical Cyclone
UN	United Nations
UNICEF	United Nations Children’s Fund
WASH	Water, Sanitation, and Hygiene
WD	Water District
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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CAR 16

Introduction

Cordillera Administrative Region

The Cordillera Administrative Region (CAR) is located in the northern central part of Luzon Island.

It is bounded by Ilocos Norte and Cagayan on the north, Pangasinan and Nueva Ecija on the south, Cagayan Valley on the east, and the Ilocos Region on the west. It is the country's only landlocked region.

The region comprises six provinces, namely: Abra, Apayao, Benguet, Ifugao, Kalinga, and Mountain Province. Its only highly urbanized city (HUC) is Baguio City (in Benguet) also known as the country's summer capital because of its year-round cool mountain climate.

It is generally mountainous and has major rivers from where it draws much of its water supply for irrigation and energy and that of Northern Luzon, hence its moniker: the "Watershed Cradle of North Luzon".

The region is home to the world-renowned Banaue Rice Terraces in Ifugao. Rice, corn and bananas, tubers, bulbs, and leafy vegetables are among its major crops.

Though abundant mineral reserves are found in the region, the volume of mineral production has suffered a downtrend in recent years.

Baguio City and La Trinidad (also in Benguet), acknowledged as the region's industrial centers, are also major travel destinations for domestic and foreign tourists.

Land Classification

The region has a total land area of 19,422.03 square kilometers (km^2) representing around 13% of the island of Luzon and 6.1% of the country's total land area. About 85% is forestland and 15% is alienable and disposable land.

Economy

The industry sector makes up the lion's share of the region's gross regional domestic product (GRDP) followed by the service sector, and the agriculture, fishery and forestry sector.[1]

Among the provinces, Abra accounted for around 23% of the total Department of Trade and Industry (DTI)-registered investments valued at PhP332.16 million in 2016. It was followed by Benguet at 20.1% (PhP289.56 million), Apayao at 19.8% (PhP285.02 million), Mountain Province at 15.5% (PhP223.95 million), Baguio City at 10.4% (PhP150.06 million), Kalinga at 7.3% (PhP105.69 million), and Ifugao at 3.9% (PhP 55.98 million).

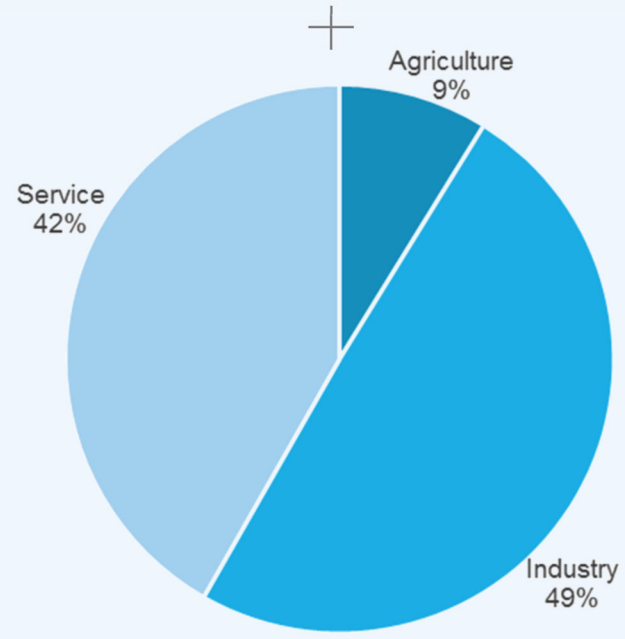

Figure 1: GRDP Contributions per Sector, 2016

The rise in domestic sales has been attributed to government interventions such as Micro, Small and Medium Enterprises (MSMEs) assistance from the Department of Trade and Industry (DTI) through programs such as the Small and Medium Enterprise Roving Academy (SMERA) and Shared Service Facilities (SSF).[2]

Labor and Employment

As of 2017, the current total labor force participation rate (LFPR) was estimated at 72.2% of the total population of the region (or a population of 1.24 million). This shows an increase of 0.6% from the 2016 LFPR.[3]

The employment rate was considerably high at 96.4% (from 93.9% in 2016). Among the region's provinces, Mountain Province had the highest employment rate at 98.9%.

The unemployment rate was registered at 3.6% (from 6.1% in 2016) while underemployment was recorded at 14.8% (from 11.7% in 2016).

While the unemployment rate declined, the region's underemployment rate soared to 3.8% — higher than the percentage in 2016. This was significantly attributed to seasonal job opportunities and a mismatch of occupations and skills.

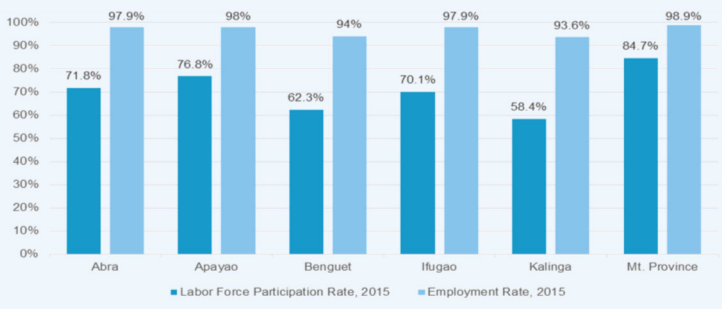

Figure 2: Labor Distribution per Province

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

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Legend

Population Density (person/ha)

- 0.01 - 0.19
- 0.19 - 0.39
- 0.39 - 0.58
- 0.58 - 0.88
- 0.88 - 1.25
- 1.25 - 1.90
- 1.90 - 2.78
- 2.78 - 4.94
- 4.94 - 42.91
- 42.91 - 755.88

Luna
Santa Marcela
Calanasan
Pudtol
Flora
APAYAO
Kabugao
Tineg
Lagayan
Danglas
Conner
San Juan
Lacub
La Paz
Dolores
Lagangilang
Langiden
Bangued
Tayum
ABRA
Licuan-Baay
Malibcong
Pinukpuk
Pidigan
Pe♦arrubia
Bucay
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San Quintin
Sallapadan
Rizal
San Isidro
Bucloc
Daguioman
KALINGA
Manabo
Tabuk City
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Kapangan
Atok
BENGUET
Tublay
Sablan
La Trinidad
Bokod
Baguio City
Tuba
Itogon

Population Density

PSA, 2015 Census

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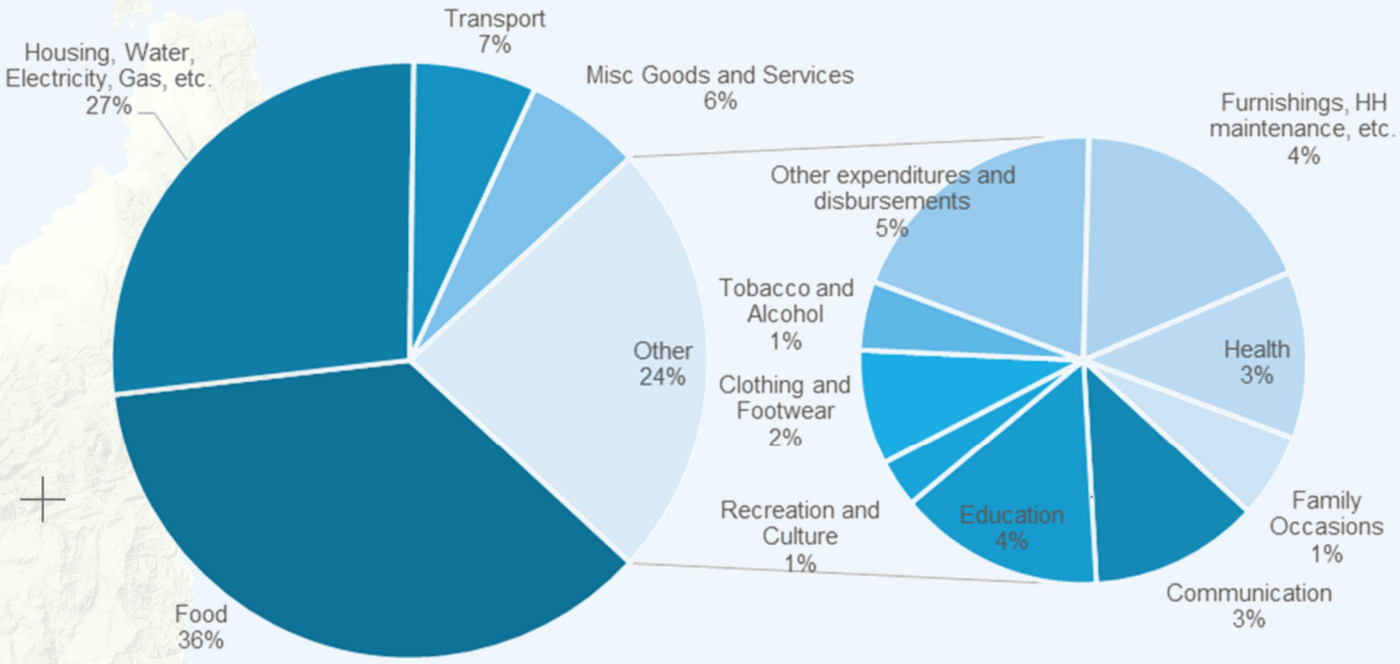

Figure 3: Distribution of Expenditure, 2015

Family Income and Expenditure

There are about 402,000 families in CAR, with an estimated total average income of PhP282,000 and a total average expenditure of PhP209,000.

In terms of income class, the total average expenditure of families under the PhP40,000-PhP59,999 category is greater than its average income, while the rest earn 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 indicates that a family of five has more savings compared to other family sizes.

With respect to the disbursement patterns of the families in the region and across income levels, the Family Income and Expenditure Survey (FIES) conducted in 2015 revealed that food expenditures were the highest among the major expenditure groups at 36%. Expenses for housing followed at 27% and transportation at 7%. Figure 3 graphs the expenditure distribution and shows that most families spend more for their basic needs.[4]

Demography

CAR's total population was estimated at 1.72 million as of 2015, with about 396,000 households (HHs), accounting for 1.7% of the Philippine population. It registered an average annual population growth rate of 1.21% from 2010-2015.

The population density of the region in 2015 averaged 89 persons/km^2. Among local government units, Baguio City has the highest density at 6,005 persons/km^2, about 85 times larger than that of the entire region.

The region is predominantly (73%) rural. Household size averages 4.3 persons (see Table 2).

Table 1: Population per Province/HUC, 2015

Region/Province/ City	2015 Population	Land Area (km^2)	Population Density (Persons/km^2)
CAR	**1,722,006**	**19,422.03**	**89**
Abra	241,160	4,165.25	58
Apayao	119,184	4,413.35	27
Benguet (excluding Baguio City)	446,224	2,769.08	161
Ifugao	202,802	2,628.21	77
Kalinga	212,680	3,231.25	66
Mountain Province	154,590	2,157.38	72
City of Baguio	345,366	57.51	6,005

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

Region/Province/City	Urban Population	Rural Population
CAR	**27%**	**73%**
Abra	4%	96%
Apayao	1%	99%
Benguet (excluding Baguio City)	45%	55%
Ifugao	1%	99%
Kalinga	19%	81%
Mountain Province	6%	94%
City of Baguio	59%	41%

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

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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.

APAYAO

ABRA

KALINGA

MOUNTAIN PROVINCE

IFUGAO

BENGUET

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Climate

PAGASA, 2015 Data

Climate

CAR has two types of climate: Type II and Type III. In a Type II climate, there is no dry season with a very pronounced maximum rain period from December to February. In a Type III climate, there is no pronounced maximum rain period with a short dry season lasting only from one to three months, i.e., from December to February or from March to May.

A study undertaken by Concepcion (2004) has revealed that the average annual rainfall in the region is about 2,500-3600 mm, with a typhoon frequency of 2-2.5 times per year.[6]

Disaster Risk

The Rapid Geohazards Assessment identifies the most common geohazards in the region (see Table 3).

Table 3: Climatological and Geological Hazards

Category	Specific Hazards
Geological	Earthquake, liquefaction, earthquake-induced landslide, tsunami
Climatological	Tropical cyclones (TCs), flooding, drought, rain-induced landslide, sea level rise, storm surges

Natural disasters are nothing new to the region because of its geographic location and topography. There were 104 natural disasters that struck the region from 2010 to 2014 affecting about 555,000 people.

From 2015 to 2016, natural disasters affected around 696,000 people. The region is moderate to highly susceptible to geological hazards, specifically landslides, debris flow, and rockslides along the foot slopes of mountainous areas.[7]

The region is also highly susceptible to climatological hazards, specifically to typhoons and flood-related disasters. The most devastating disaster incident was recorded in 2015 when 524,000 people were affected. A total of 31 of typhoons (or an average of 7 typhoons each year) crossed the region from 2007 to 2010.

Climate Change and Hydrological Hazards

The Philippines is at great risk of climate-related hazards, such as 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 CAR based on the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) downscaled climate projections are shown in Tables 4 and 5. 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 4: Seasonal Projections Under a Medium-Range Emission Scenario

Seasonal Temperature Increases (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
Abra	24.5	27.4	27.2	26.4	0.8	1	0.8	0.9	2	2.1	1.6	1.9
Apayao	24.8	28	28.4	27.1	0.8	0.9	0.9	0.8	1.9	2.1	1.9	1.8
Benguet	19.4	21.9	22	21.2	0.9	1	0.8	1	2	2.1	1.7	1.9
Ifugao	22.2	25.6	25.8	24.5	0.9	0.9	0.9	0.9	1.9	2.1	2	1.9
Kalinga	23.8	27.5	27.7	26.1	0.8	0.9	0.9	0.8	1.9	2.1	2	1.9
Mountain Province	22.7	26	26.1	24.9	0.9	0.9	0.9	0.9	1.9	2.1	1.9	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
Abra	43.5	220.6	1218.9	634.4	5	-1.8	22.3	14	-2.1	-28.1	35	15.9
Apayao	144.6	184	822.7	720.1	2.6	0.4	5.8	16.6	3	-23.7	1.1	-0.3
Benguet	47.7	422.3	1734.9	931.8	8	0.2	31.6	21.7	-6	-26.7	63.1	21.8
Ifugao	102.6	321	1071.1	724.9	-6	-9.6	14.4	8.9	-1.3	-24.2	17.6	-2.9
Kalinga	92.3	228	892.3	691.9	1	-9.1	4.5	14.8	4.2	-21	3.9	1.1
Mountain Province	74.8	286.8	1121.1	699.2	-2.7	-7.7	16.4	14.9	1.1	-27.4	26.6	8.5

Table 5: 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 >300mm		
		OBS	2020	2050	OBS	2020	2050	OBS	2020	2050
Benguet	City of Baguio	0	0	0	7248	5320	5379	29	39	35

[6] *Concepcion RN. 2004. Gateway to land and water information: Philippine National Report*
[7] *Office of Civil Defense, National Disaster Risk Reduction and Management Council*

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APAYAO

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MOUNTAIN PROVINCE

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Contour Map

NAMRIA

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Luna

Santa Marcela

Calanasan

2500

500

Pudtol

Flora

3000

Apayao

Kabugao

1000

Tineg

Lagayan

Conner

Danglas

San Juan

Lacub

1500

La Paz

Dolores

Langiden

Malibcong

Pinukpuk

Bangued

Abra

Balbalan

Pidigan

Bucay

Rizal

San Quintin

Sallapadan

2000

San Isidro

Daguioman

Kalinga

Manabo

Pasil

Pilar

Boliney

Luba

Lubuagan

Tanudan

Tubo

Tinglayan

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Sadanga

Paracelis

4000

4500

5000

Natonin

Besao

Sagada

Bontoc

Barlig

Tadian

Bauko

Sabangan

Banaue

Aguinaldo

Alfonso Lista

Mayoyao

Mankayan

Hungduan

Hingyon

Bakun

Lagawe

Kiangan

Buguias

Kibungan

Tinoc

Asipulo

Lamut

Kabayan

Kapangan

Atok

Sablan

Tublay

Benguet

Bokod

La Trinidad

Baguio City

Tuba

Itogon

Average Rainfall

PAGASA, 2015 Data

Legend

Annual Rainfall 2015

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Legend

Safe Drinking Water (%)

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

Calanasan
Luna
Santa Marcela
Pudtol
Flora
APAYAO
Kabugao
Tineg
Lagayan
Danglas
San Juan
Lacub
Conner
La Paz
Dolores
Lagangilang
Langiden
Bangued
Tayum
ABRA
Licuan-Baay
Malibcong
Pinukpuk
Pidigan
Pe♦arrubia
San Quintin
Bucay
Balbalan
Rizal
Sallapadan
San Isidro
Bucloc
Daguioman
KALINGA
Tabuk City
Manabo
Villaviciosa
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Paracelis
Sadanga
Besao
Sagada
Bontoc
Natonin
MOUNTAIN PROVINCE
Barlig
Tadian
Sabangan
Bauko
Banaue
Aguinaldo
Alfonso Lista
Mayoyao
Hungduan
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Mankayan
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Lamut
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Sablan
La Trinidad
Bokod
Baguio City
Tuba
Itogon

Access to Safe Drinking Water

PSA, 2015 Census

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WSS Sector Status

Access to Safe Water

About 87% of CAR's population as of 2015 had access to water sources classified as "safe".[8]

This figure translates to around 344,300 households. About 27% of the population has Level III service connection at home while only 3% has Level II service which the households share with the community. About 57% has access to Level I service.

Safe sources of water under this category include tubed and/or 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 on a par with the national average of about 88% — a discrepancy of only about 1%. In terms of access per level of service, access to Level III and Level II service is way below the national average while Level I access is significantly higher.

Table 6: National and Regional Access to Water Supply[9]

Level of Service	National	CAR
Level III	44.1%	26.4%
Level II	11.2%	3.3%
Level I (Safe Sources)	32.4%	56.8%
Subtotal (Safe Sources)	*87.7%*	*86.5%*
Level I (Unsafe Sources)	12.3%	13.5%
Total	100.0%	100.0%

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

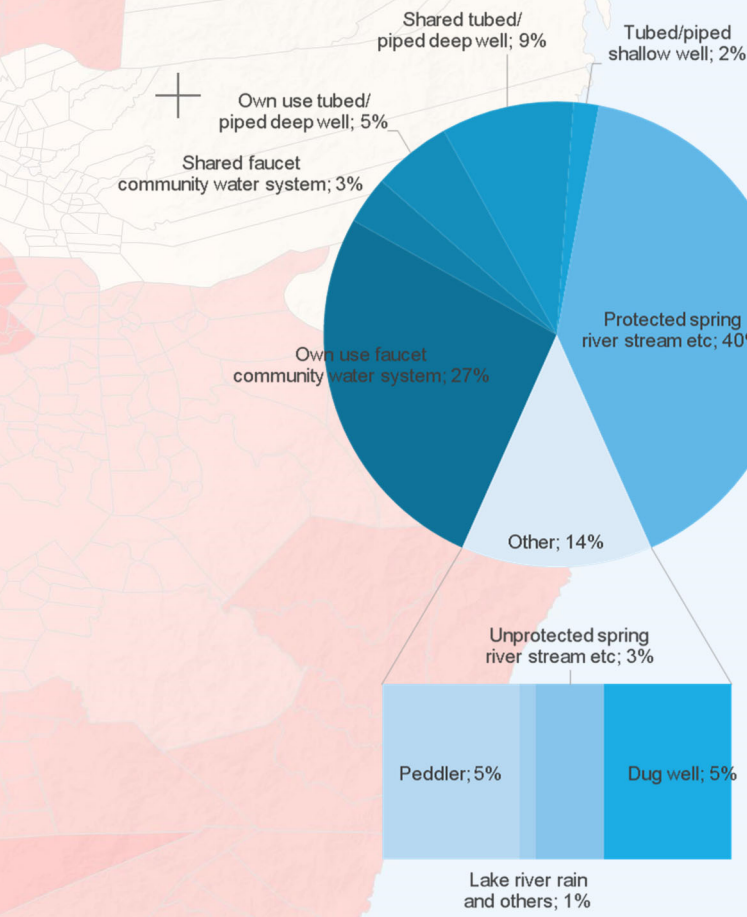

Figure 4: Main Sources of Water Supply, 2015

Table 7 shows safe water access in 2015 at the provincial level.

Table 7: Access to Water Supply per Province/HUC[10]

Region/Province/City	Access to Safe Water Supply
CAR	**92.0%**
Abra	80.0%
Apayao	74.9%
Benguet	100.0%
Ifugao	100.0%
Kalinga	98.1%
Mountain Province	100.0%
City of Baguio	84.0%

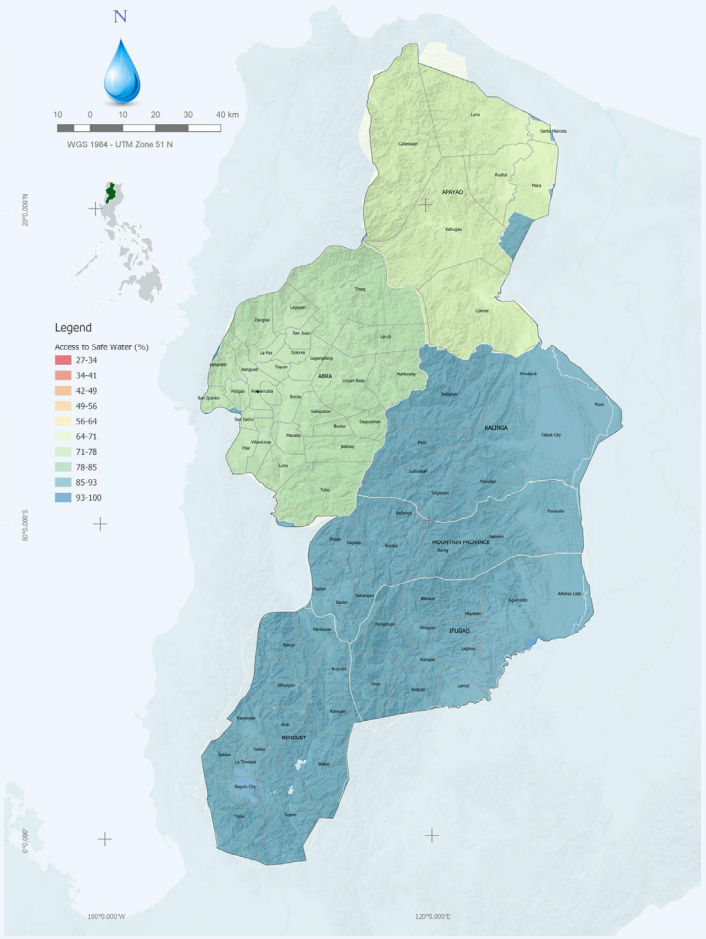

Figure 5: Provincial Access to Safe Water

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.

As of 2015, 86% of the region's population drank water from sources considered "improved" and "safe". About 34% thereof drank bottled water.

Among the provinces, Apayao had the lowest access (40%) to safe drinking water, while Ifugao and Kalinga registered the highest access: 95%.

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

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

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Legend

Sanitation Access (%)

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

Luna
Santa Marcela
Calanasan
Pudtol
Flora
APAYAO
Kabugao
Tineg
Lagayan
Danglas
San Juan
Lacub
La Paz
Dolores
Lagangilang
Langiden
Bangued
Tayum
ABRA
Malibcong
Licuan-Baay
Pidigan
Pe◆arrubia
San Quintin
Bucay
Sallapadan
San Isidro
Bucloc
Daguioman
Manabo
Villaviciosa
Pilar
Boliney
Luba
Tubo
Conner
Pinukpuk
Balbalan
Rizal
KALINGA
Tabuk City
Pasil
Lubuagan
Tanudan
Tinglayan
Sadanga
Paracelis
Besao
Sagada
Bontoc
Natonin
MOUNTAIN PROVINCE
Barlig
Tadian
Sabangan
Bauko
Banaue
Aguinaldo
Alfonso Lista
Mayoyao
Hungduan
Hingyon
IFUGAO
Mankayan
Bakun
Lagawe
Kiangan
Buguias
Kibungan
Tinoc
Asipulo
Lamut
Kabayan
Kapangan
Atok
BENGUET
Tublay
Sablan
La Trinidad
Bokod
Baguio City
Tuba
Itogon

Access to Sanitation

CAR Regional Planning and Consultation Workshop, 2017 Data

160°0.000'W

120°0.000'E

Access to Sanitation

The region's growth in the industry and service sector has, as a matter of course, contributed to an increased demand for water supply and sanitation services.

Approximately 72% of the region's population has access to improved sanitation.

The 2015 FIES has reported that in terms of improved sanitation, CAR posted a figure slightly lower than the national average and was in the midrange with respect to basic sanitation.

The open defecation rate of the region is below the national average at 1.54%. (The open defecation rate is a proxy indicator for the lack of access to toilet facilities.)

Table 8: National and Regional Access to Sanitation[11]

Sanitation Coverage	National	CAR
Improved Sanitation	73.77%	71.88%
Basic Sanitation	19.96%	18.64%
Unimproved Sanitation	2.04%	7.94%
Open Defecation	4.23%	1.54%
Total	100.0%	100.0%

The two provinces with the highest population base in the region, Benguet and Abra, recorded the highest sanitation access at 87.28% and 83.85%, respectively, according to the 2015 Annual Report of the Field Health Services Information System (FHSIS) of the Department of Health (DOH). Baguio City recorded a high 97.98% access.

Table 9: Access to Sanitary Facilities per Province[12]

Region/Province/ City	HHs with Sanitary Toilets	HHs with Complete Basic Sanitation Facilities
CAR	**83.95%**	**52.91%**
Abra	83.85%	36.71%
Apayao	72.57%	48.50%
Benguet	87.28%	52.31%
Ifugao	78.19%	40.01%
Kalinga	67.74%	23.84%
Mountain Province	86.18%	50.87%
City of Baguio	97.98%	99.65%

The minor discrepancy between Tables 8 and 9 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 8 reflects the specifics per the SDG's definition. Table 9, 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 other depository (exclusive use) ▪ Water-sealed other depository (shared) ▪ Closed Pit
Unimproved Sanitation	▪ Open Pit
Open Defecation	▪ Other Means ▪ None

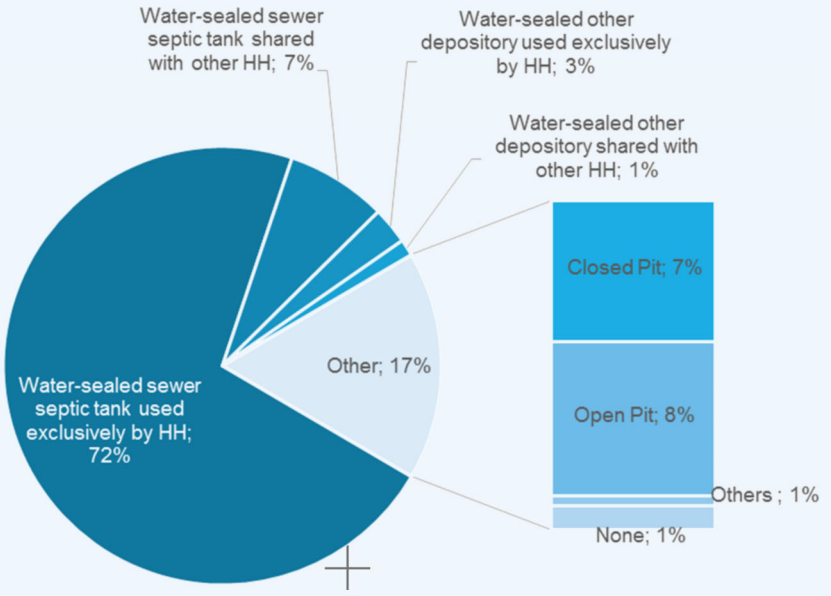

Figure 6: Percentage of Households with Access to Sanitary Facilities

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 CAR 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, on the other hand, shows the location of the only septage treatment plant (STP) in the region.

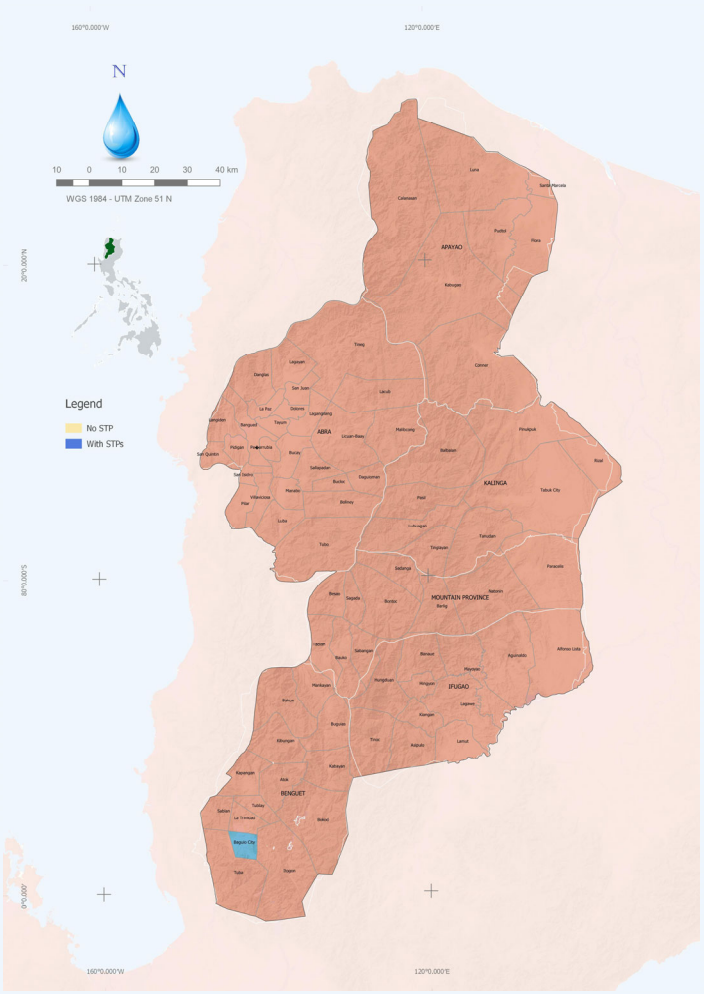

Figure 7: Existing Septage Treatment Plant[13]

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

160°0.000'W

120°0.000'E

N

10 0 10 20 30 40 km

WGS 1984 - UTM Zone 51 N

20°0.000'N

80°0.000'S

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Legend

Water Bodies

Major River Basin

Luna
Santa Marcela
Calanasan
Abulug Watershed
Pudtol
Flora
APAYAO
Kabugao
Tineg
Lagayan
Conner
Danglas
San Juan
Lacub
La Paz
Dolores
Lagangilang
Langiden
Bangued
Tayum
ABRA
Licuan-Baay
Malibcong
Pinukpuk
Pidigan
Pe♦arrubia
Bucay
Balbalan
San Quintin
Rizal
Sallapadan
San Isidro
Abra Watershed
Daguioman
Bucloc
KALINGA
Manabo
Tabuk City
Pasil
Villaviciosa
Pilar
Boliney
Luba
Lubuagan
Tanudan
Tubo
Tinglayan
Sadanga
Paracelis
Natonin
Besao
Sagada
Bontoc
MOUNTAIN PROVINCE
Barlig
Cagayan Watershed
Tadian
Sabangan
Bauko
Banaue
Aguinaldo
Alfonso Lista
Mayoyao
Hungduan
Hingyon
Mankayan
IFUGAO
Bakun
Lagawe
Kiangan
Buguias
Kibungan
Tinoc
Asipulo
Lamut
Kabayan
Kapangan
Atok
BENGUET
Tublay
Sablan
La Trinidad
Bokod
Baguio City
Itogon
Tuba
Agno River Basin

CAR Rivers and Tributaries

DENR, NWRB, NAMRIA

160°0.000'W

Pampanga River Basin

120°0.000'E

Water Resources

CAR ranks 11th among all administrative regions in terms of water resources potential.

The region's water resources potential totals 5,626 million cubic meters (MCM)/year, accounting for 3.9% of the country's total.

The water resources potential of an area is divided into groundwater and surface water. Groundwater is estimated at 1,463 MCM/year while surface water is estimated at 4,163 MCM/year. Annual rainfall averages 2,237 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.

The region straddles two WRRs — WRR 1 and WRR 2. The first cluster of CAR's provinces belongs to the former comprising Abra and Benguet. Apayao, Ifugao, Kalinga and Mountain Province are part of WRR 2 along with the provinces of Region II (Cagayan Valley).

Surface Water

CAR has four major river basins namely: Abra River Basin, Agno River Basin, Apayao-Abulog River Basin, and the Cagayan River Basin.

Abra River Basin

The Abra River Basin has an area of 4,923.66 km^2. The provinces of Abra, Benguet, and Mountain Province are located within the river basin, i.e., all 27 municipalities of Abra, and 3 municipalities each from Benguet and Mountain Province.

Of the 343 water grantees, per records of the National Water Resources Board (NWRB) as of 2013, 14% of the use of waters is intended for domestic consumption, 3% for power and 3% for industrial consumption.

Eighty percent (80%) of water use is intended for irrigation. Most power users are in the upper watershed areas in Benguet and Mountain Province.

Agno River Basin

The Agno River Basin has an area of 6,219.66 km^2. It is located along western Luzon, draining into the Lingayen Bay. It is the 5th largest river basin in the Philippines straddling Benguet, Ifugao, Mountain Province, Nueva Ecija, Nueva Vizcaya, Pangasinan, Tarlac, Zambales, and Pampanga.

It encompasses around eight critical watersheds and three major hydroelectric dams, which are the region's key sources of water and energy. With about 4,024 kilometers of rivers and tributaries, 3,297 hectares of lakes and reservoirs, and extensive aquifers underlying the river basin, the area is abundant in surface water and groundwater resources.

Apayao-Abulug River Basin

The Apayao-Abulug River Basin has an area of 3,776 km^2. In view of the size of its watershed, the Apayao-Abulug River ranks 6th among the Philippine's largest river systems with a drainage area spanning 3,776 km^2 and stretching 175 kilometers. About 27.72% of the combined population of Apayao and Cagayan lives along this river basin. It traverses 11 municipalities (6 in Apayao and 5 in Cagayan).

Similar to all major river basins of note, it crosses several geopolitical and administrative boundaries, populated by people of diverse cultures and ethnicities, and is administered by several sector-based government agencies.

Discharge granted with regard to surface water utilization is mostly intended for power generation (82%). Of the 391,900 liters per second (lps) granted, 81% is used for power generation and 19% for irrigation.

Cagayan River Basin

The Cagayan River Basin has an area of 27,493.49 km^2. It covers the provinces of Apayao, Benguet, Ifugao, Kalinga, Mountain Province, and the outskirts of Abra in CAR, the provinces of Cagayan, Isabela, Nueva Vizcaya, and Quirino in Region II, and parts of Aurora and Nueva Ecija in Region III.

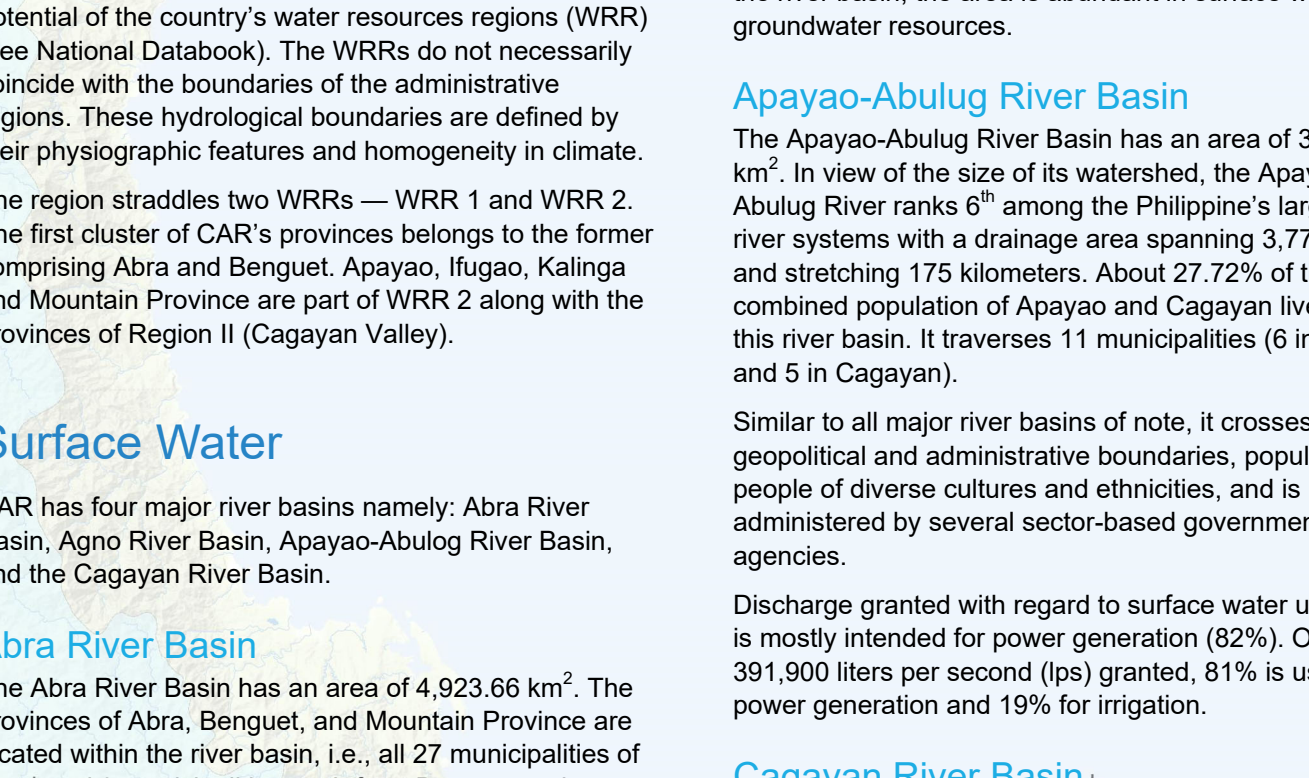

Figure 8: Water Resources Potential and Annual Rainfall[14]

[14] *JICA Master Plan on Water Resources Management in the Philippines, 1998; NWRB; PAGASA rainfall data; FAO*

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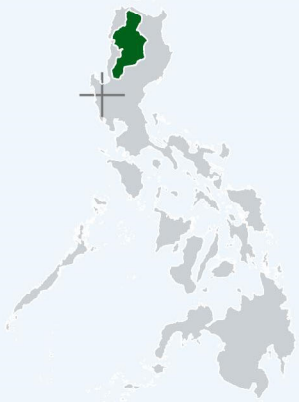
WGS 1984 - UTM Zone 51 N

20°0.000'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 without Any Known Significant, Groundwater Obtainable through Drilled Wells
- Lake

80°0.000'S

Luna
Santa Marcela
Calanasan
Pudtol
Flora
APAYAO
Kabugao
Tineg
Lagayan
Danglas
Conner
San Juan
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Dolores
Lagangilang
Langiden
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Malibcong
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Pe◆arrubia
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Tabuk City
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Tublay
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La Trinidad
Bokod
Baguio City
Tuba
Itogon

Groundwater Availability

MGB

160°0.000'W

120°0.000'E

Table 10: Aquifer Classes Based on MGB Aquifer Types

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

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).

Only small parts of Abra and Apayao are minor aquifers. The rest of the region has aquifers having moderate to low permeability. Groundwater obtainable through drilled wells traverses the entire region.

Water Use

Water use in the region was estimated at 23,485.72 MCM annually based on awarded water permits as of 2017. Roughly 84% (or about 19,752.40 MCM) is allocated for power generation and is categorized under nonconsumptive use. The remaining volume of 3,733 MCM is allocated for consumptive use (Figure 9).

The irrigation sector consumes the largest volume of water among all sectors with an 88% allocation. The domestic sector consumes only 8%, and the industrial and commercial sectors 2% and 1%, respectively.

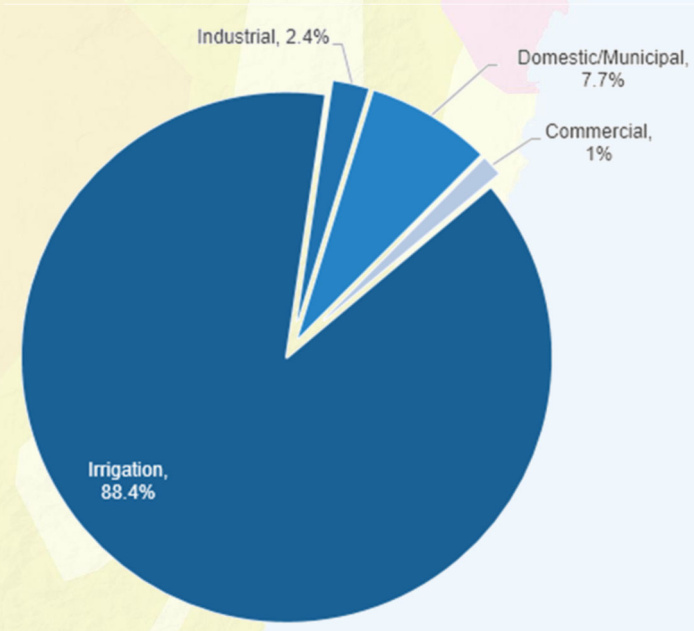


Figure 9: Water Use, 2017[15]

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.)[16]

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 Population
Abra	5,139.10
Apayao	6,927.90
Benguet (including City of Baguio)	921.17
Ifugao	5,735.95
Kalinga	4,005.40
Mountain Province	3,494.70
CAR	**4,370.71**

The region's per capita water availability is above said threshold — around 4,300 m^3/year.

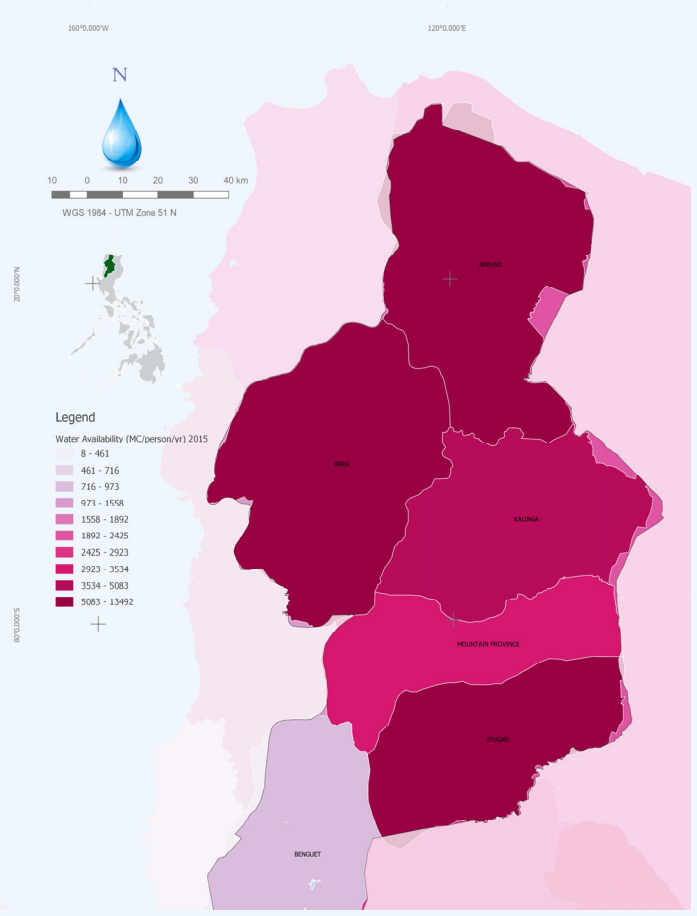


Figure 10: Water Availability Map, 2015

[15] National Water Resources Board's list of water permit grantees, 2017
[16] Managing Water Report under Uncertainty and Risk, UN World Water Development Report 4 (Volume 1)

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 2,697,606 by 2045.

Water Supply and 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 89.7 MCM/year, 106.5 MCM/year, and 125.5 MCM/year, respectively.

Water Demand vs. Water Resources Potential

The water demand of the industrial, business and domestic sectors in CAR 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 (125.5 MCM/year) to the water resources potential of the region (5,626 MCM/year), the availability of water far exceeds the projected water demand of the region 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.

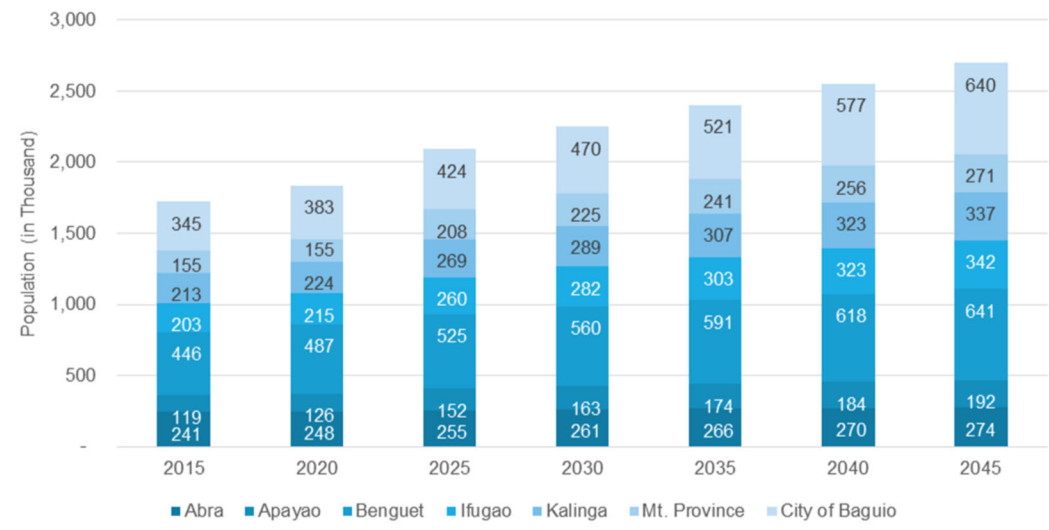


Figure 11: Projected Population per Province

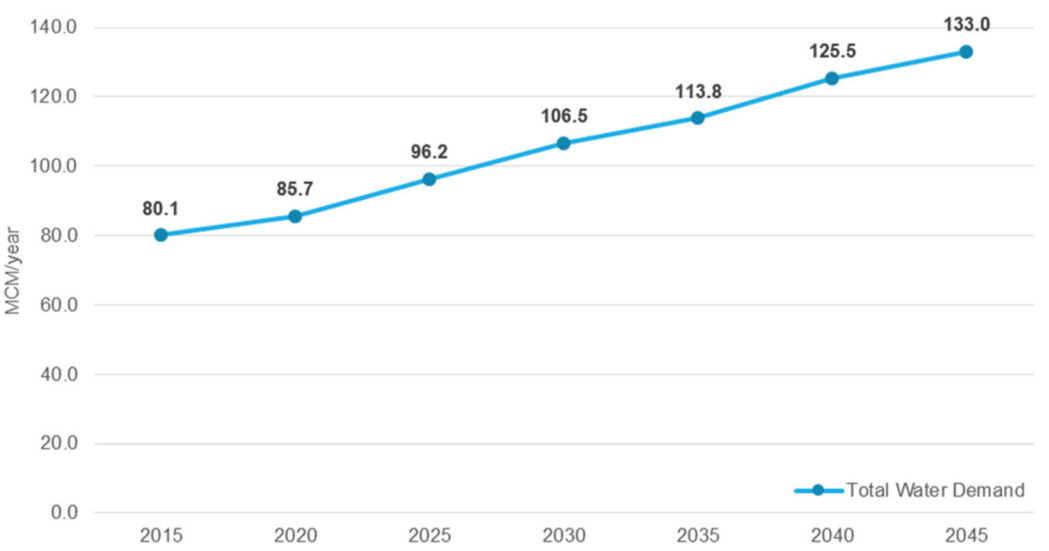
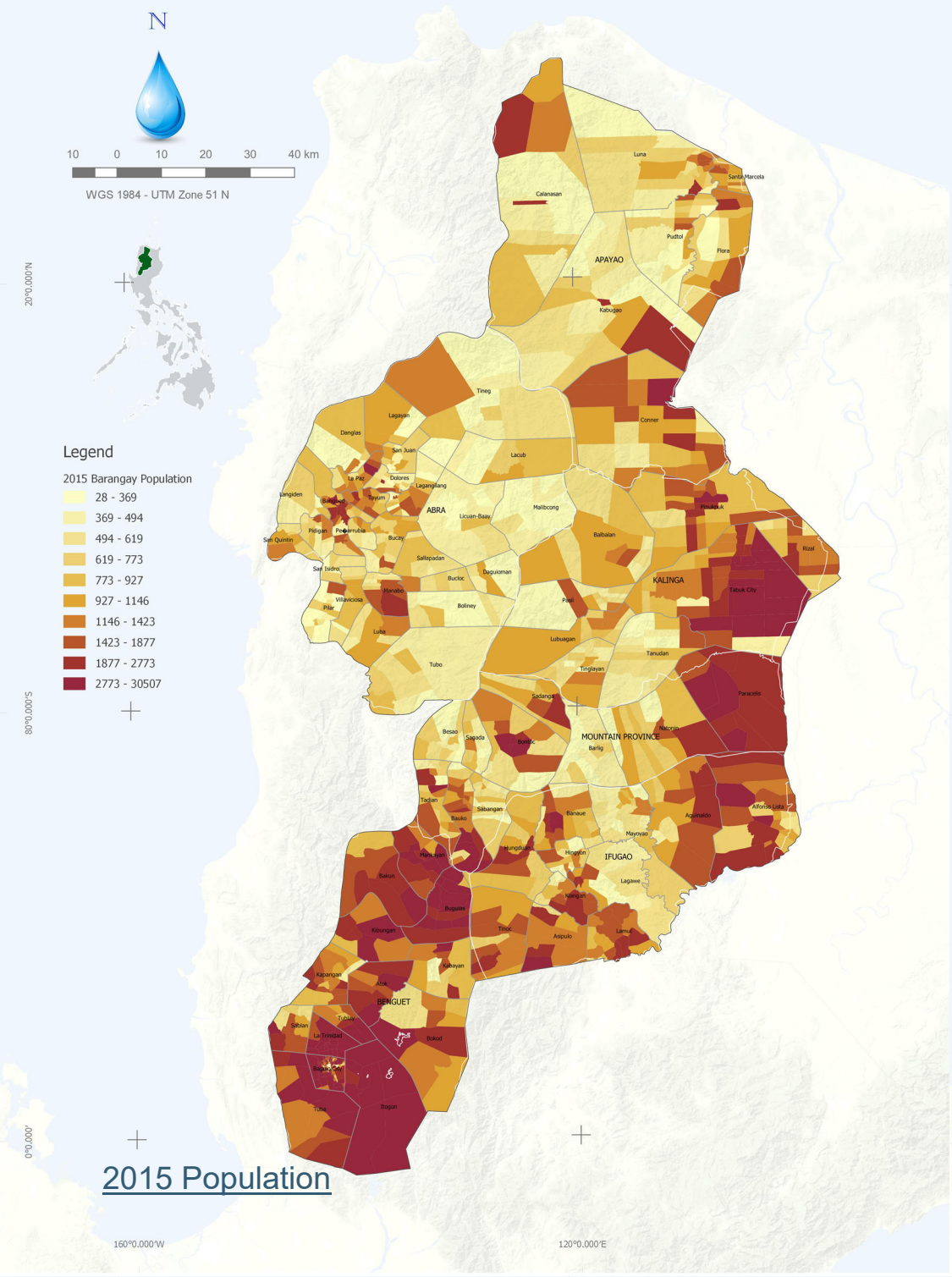
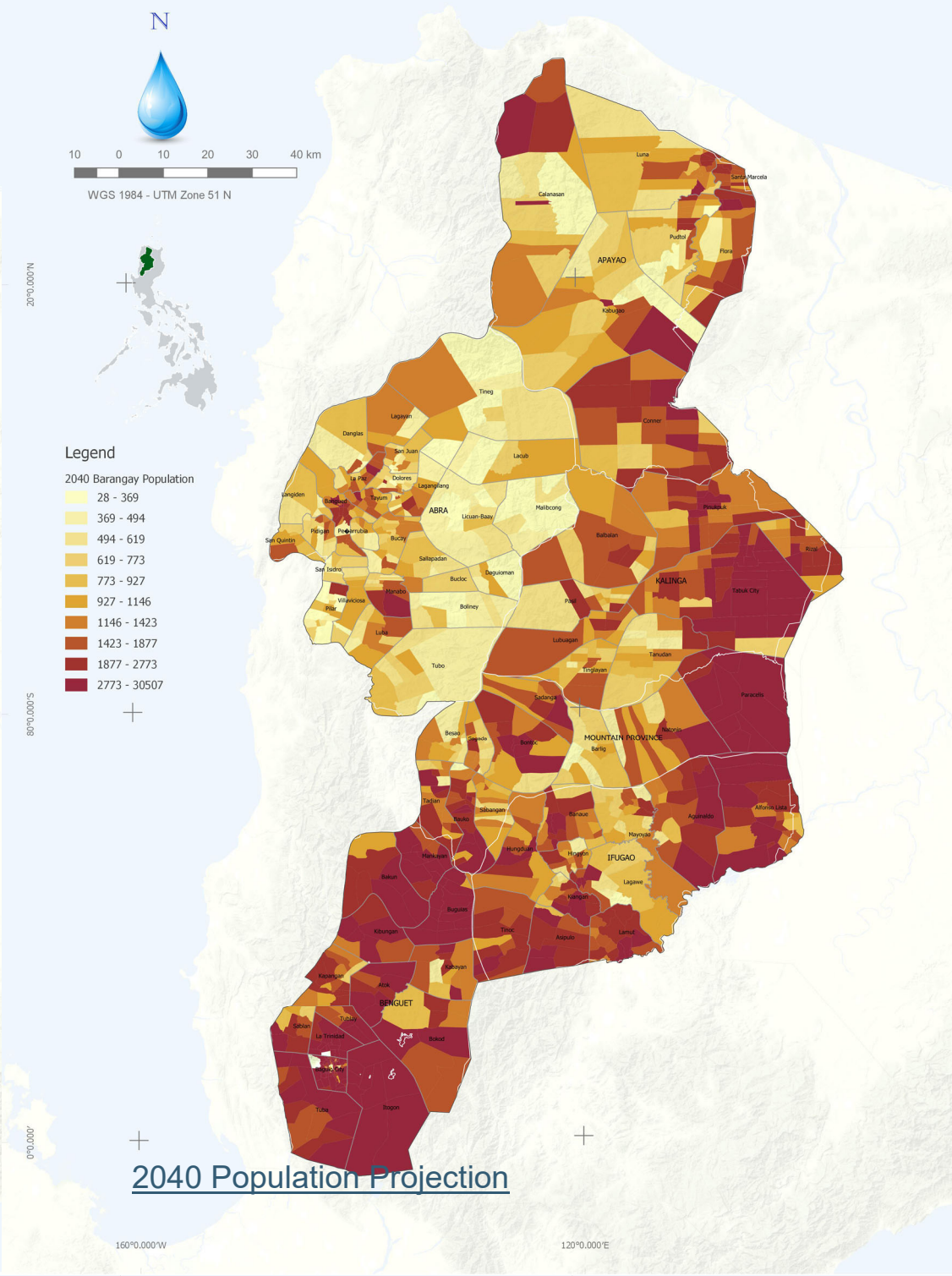


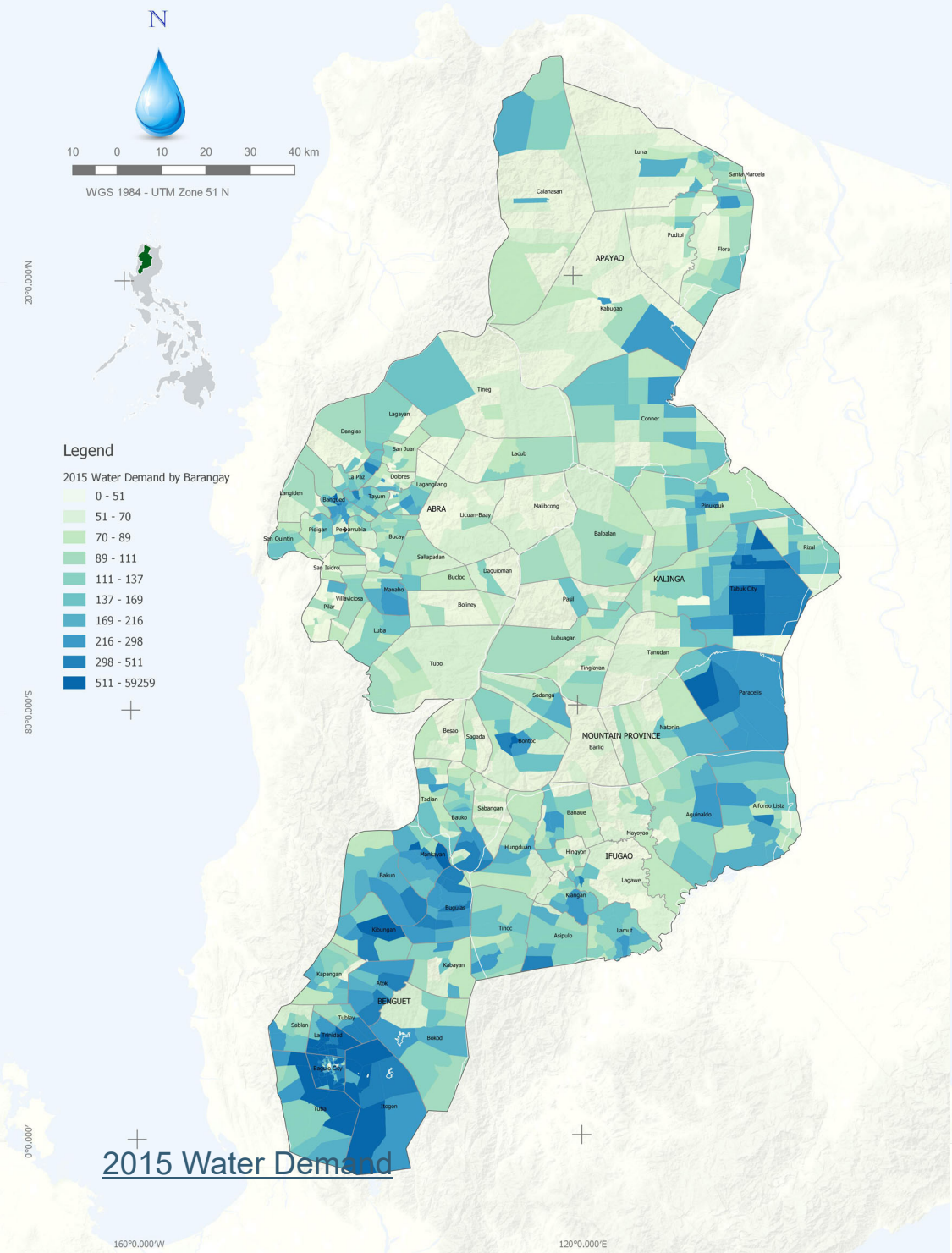
Figure 12: Projected Water Demand



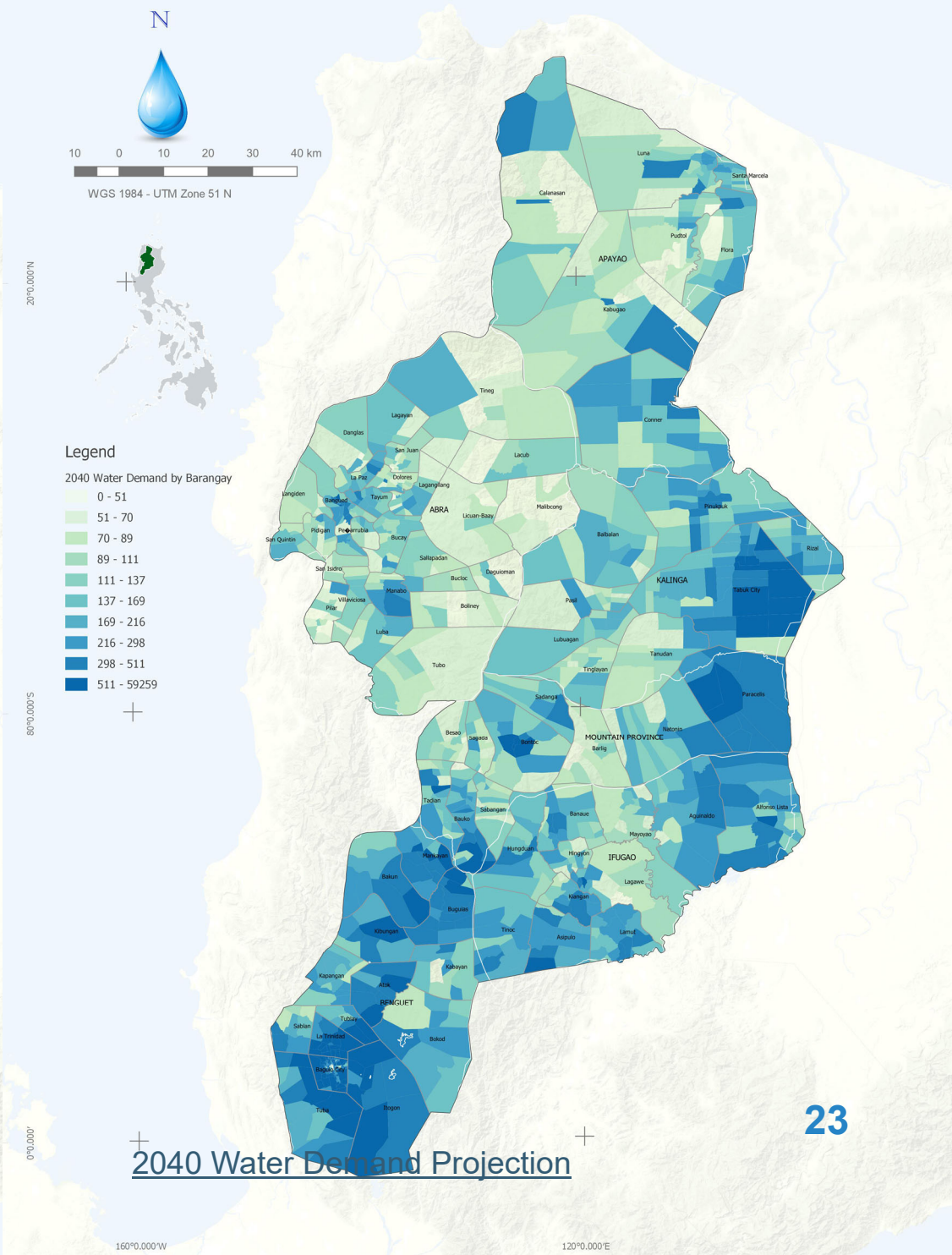
2015 Population



2040 Population Projection



2015 Water Demand



2040 Water Demand Projection

160°0.000'W

120°0.000'E

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80°0.000'S

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N

10 0 10 20 30 40 km

WGS 1984 - UTM Zone 51 N

Legend

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

Luna
Santa Marcela
Calanasan
Pudtol
Flora
APAYAO
Kabugao
Tineg
Conner
Lagayan
Danglas
San Juan
Lacub
La Paz
Dolores
Lagangilang
Langiden
Tayum
Bangued
ABRA
Malibcong
Licuan-Baay
Pinukpuk
Pidigan
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Balbalan
San Quintin
Bucay
Rizal
Sallapadan
San Isidro
Daguioman
Bucloc
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Tabuk City
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Villaviciosa
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Sadanga
Paracelis
Besao
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MOUNTAIN PROVINCE
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Aguinaldo
Alfonso Lista
Mayoyao
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Hungduan
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Buguias
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Asipulo
Lamut
Kabayan
Kapangan
Atok
BENGUET
Tublay
Sablan
La Trinidad
Bokod
Baguio City
Tuba
Itogon

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 42% of the CAR.[17]

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 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[18], 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 are 33 WDs in the region, 6 of which are operational and 27 nonoperational. These cover 51% of the population, where only 290,973 users out of a population of 570,069 receive water service. Abra has the highest service coverage at 47.3%.

LGU-Led Water Utilities

There are 135 LGU-led water utilities in the region serving 27 areas and covering 93,855 users out of the total population or roughly 5.5%.

Kalinga has 52 LGU-led utilities serving 23,190 users. Benguet, despite its comparatively smaller number of LGU-led utilities (totaling 41), these supply water to a population of 27,265.

BWSA

There are 240 BWSA utilities in the region covering 35 areas and supplying water to 70,305 users or about 4.1% of the population. Abra has the highest number of BWSA utilities at 67 and the largest served population estimated at 32,090.

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	No. of LGUs	Type & No. of WSPs		Service Area	Population Served	
					Total	%
Abra	27	WDs	18	73,733	34,860	47.3%
		LGU-led	24		14,330	5.9%
		BWSA	67		32,090	13.3%
		RWSA	54		14,299	5.9%
		Private/Others	99		21,998	9.1%
		Subtotal	**262**	**241,160**	**117,577**	**48.8%**
Apayao	7	WDs	2	-	-	-
		LGU-led	3		2,695	2.3%
		BWSA	51		7,515	6.3%
		RWSA	4		700	0.6%
		Private/Others	-		-	-
		Subtotal	**60**	**119,184**	**10,910**	**9.2%**
Benguet	14	WDs	4	474,499	251,863	53.1%
		LGU-led	41		27,265	3.4%
		BWSA	26		11,210	1.4%
		RWSA	9		3,635	0.5%
		Private/Others	23		45,845	5.8%
		Subtotal	**103**	**791,590**	**339,818**	**42.9%**
Ifugao	11	WDs	3	21,837	4,250	19.5%
		LGU-led	5		12,285	6.1%
		BWSA	46		8,035	4.0%
		RWSA	-		-	-
		Private/Others	291		49,409	24.4%
		Subtotal	**345**	**202,802**	**73,979**	**36.5%**
Kalinga	8	WDs	5	-	-	-
		LGU-led	52		23,190	10.9%
		BWSA	48		10,460	4.9%
		RWSA	34		7,725	3.6%
		Private/Others	207		32,468	15.3%
		Subtotal	**346**	**212,680**	**73,843**	**34.7%**
Mountain Province	10	WDs	1	-	-	-
		LGU-led	10		14,090	9.1%
		BWSA	2		995	0.6%
		RWSA	-		-	-
		Private/Others	136		99,103	64.1%
		Subtotal	**149**	**154,590**	**114,188**	**73.9%**
CAR	77	WDs	33	570,069	290,973	51.0%
		LGU-led	135		93,855	5.5%
		BWSA	240		70,305	4.1%
		RWSA	101		26,359	1.5%
		Private/Others	756		248,823	14.4%
		Grand Total	**1,265**	**1,722,006**	**730,315**	**42.4%**

[17] Water District data were based on LWUA and PAWD; other WSPs were based on Listahang Tubig (data as of 2017)
[18] LWUA, PAWD, NWRB Listahang Tubig

160°0.000'W
120°0.000'E
40°0.00
20°0.000'N
80°0.000'S
0°0.000'

N

10 0 10 20 30 40 km

WGS 1984 - UTM Zone 51 N

Luna
Santa Marcela
Calanasan
Pudtol
Flora
Apayao
Kabugao
Conner
Tineg
Lagayan
Danglas
San Juan
Lacub
La Paz
Dolores
Langiden
Malibcong
Banqued
Pidigan
Bucay
Abra
San Quintin
Sallapadan
San Isidro
Daguioman
Manabo
Boliney
Pilar
Luba
Tubo
Pinukpuk
Balbalan
Rizal
Kalinga
Tabuk City
Pasil
Lubuagan
Tanudan
Tinglayan
Sadanga
Paracelis
Natonin
Besao
Sagada
Bontoc
Barlig
Tadian
Bauko
Sabangan
Banaue
Mayoyao
Aguinaldo
Alfonso Lista
Mankayan
Bakun
Hungduan
Ifugao
Kiangan
Buguias
Tinoc
Asipulo
Lamut
Kibungan
Kabayan
Kapangan
Atok
Tublay
Benguet
Bokod
Sablan
La Trinidad
Baguio City
Tuba
Itogon

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 region has an open defecation rate of 1.54%.

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

Wastewater and Domestic Biological Oxygen 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 CAR.

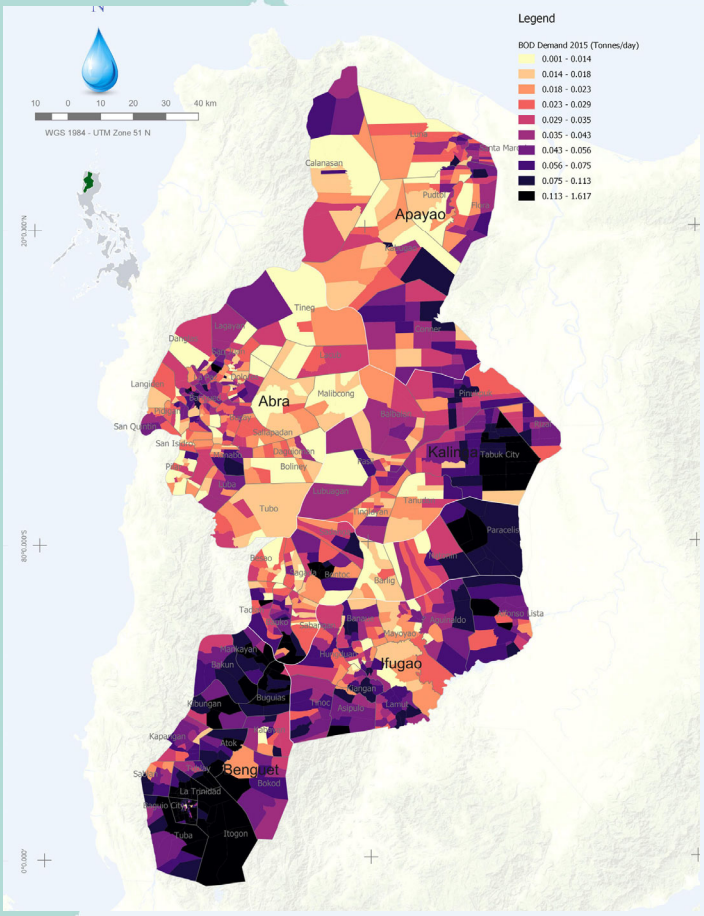


Figure 13: Biological Oxygen Demand, 2015

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.

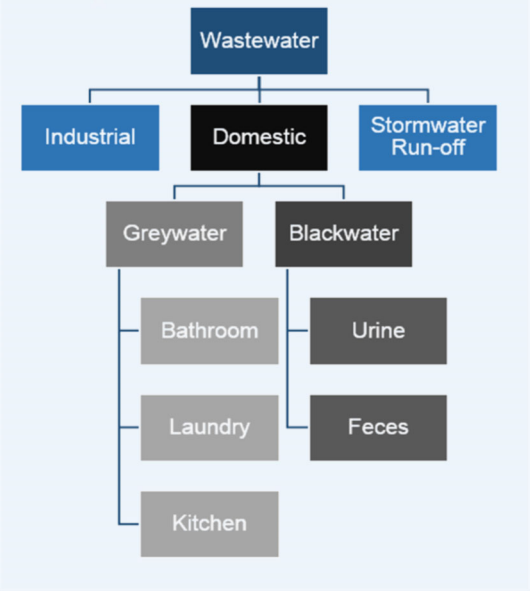


Figure 14: Categories of Wastewater

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[19] per person per day is used.

The wastewater[20] 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.

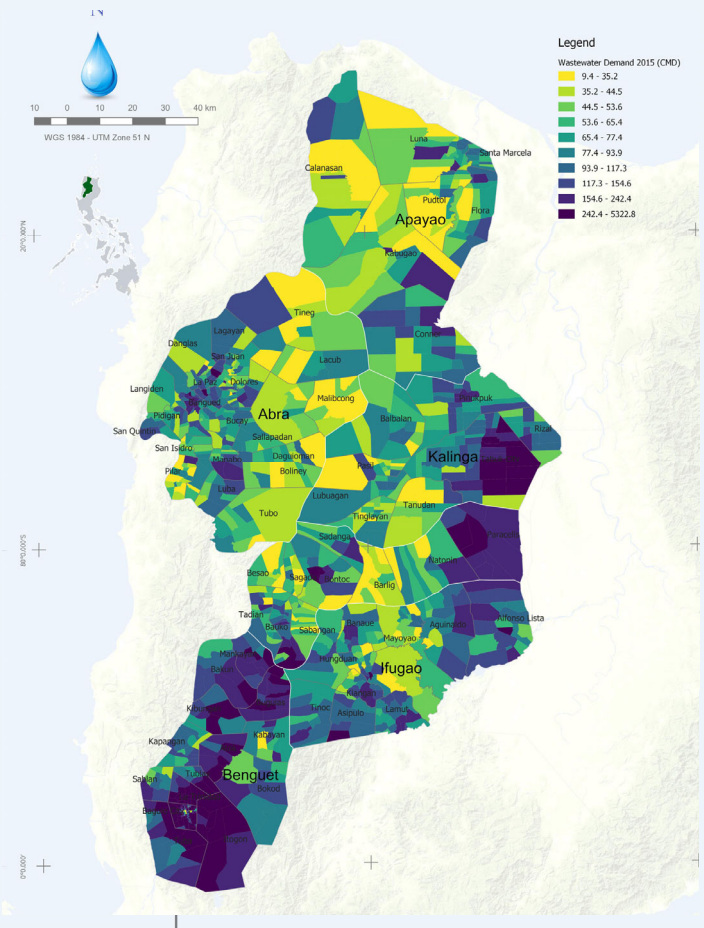
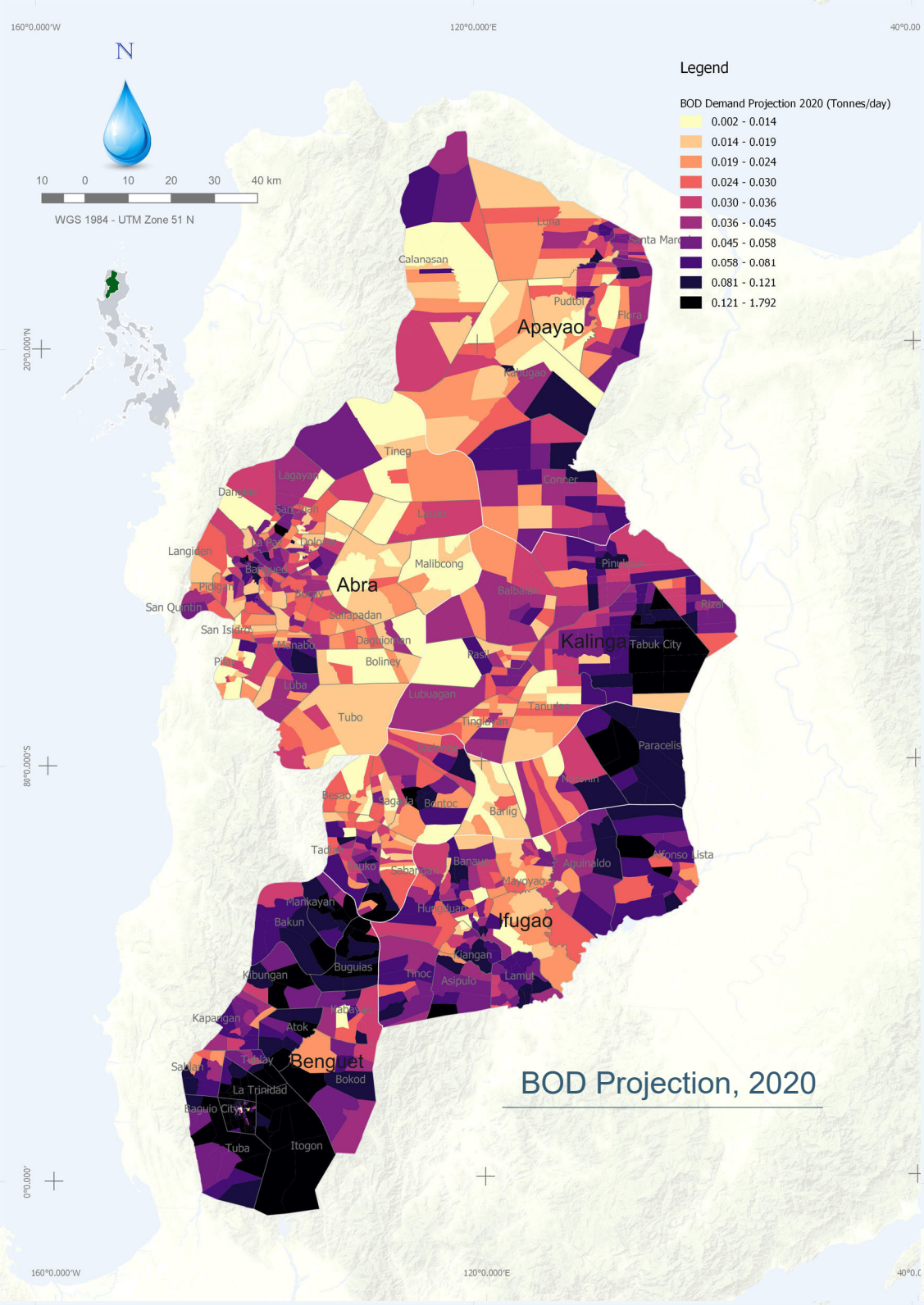
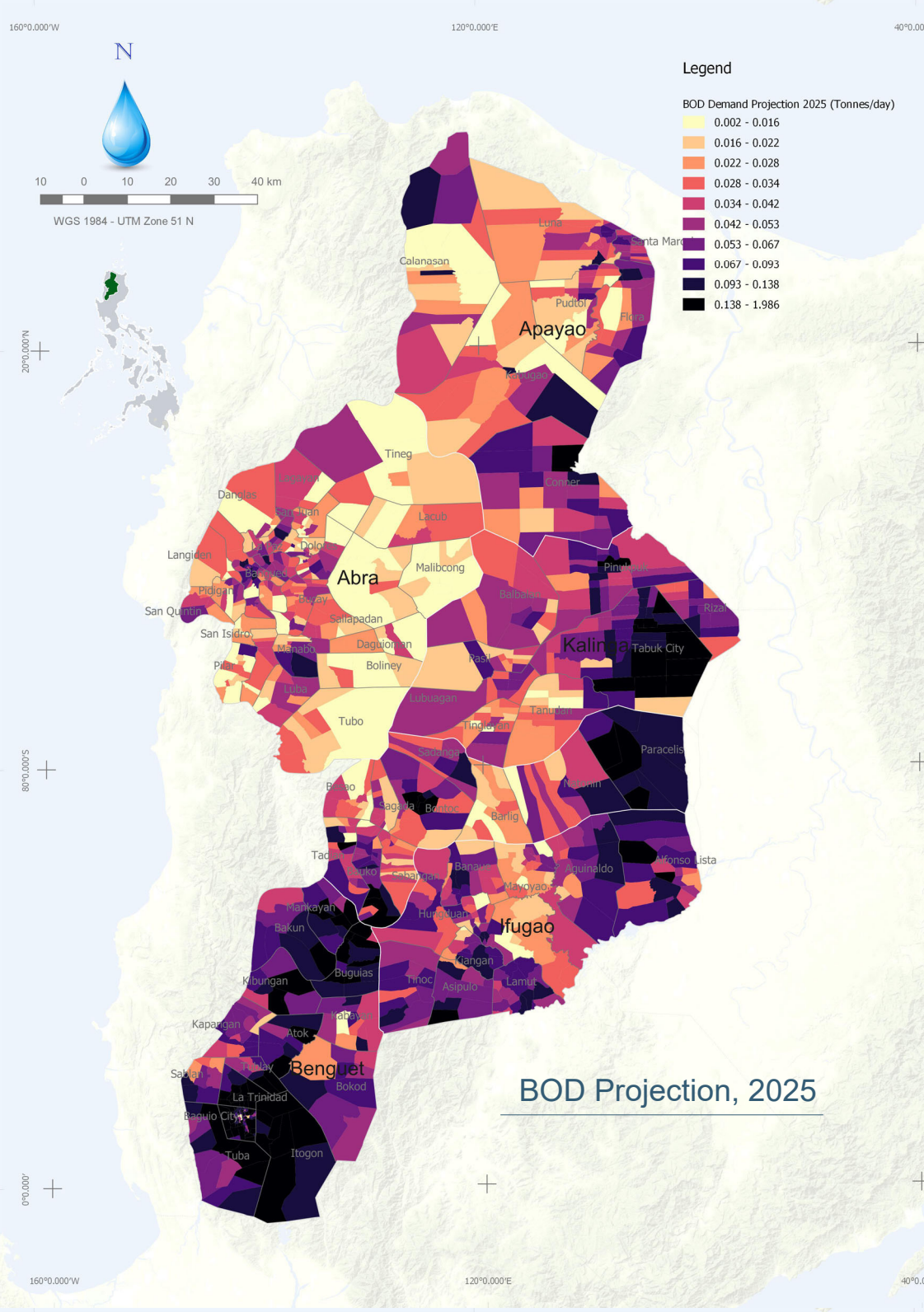
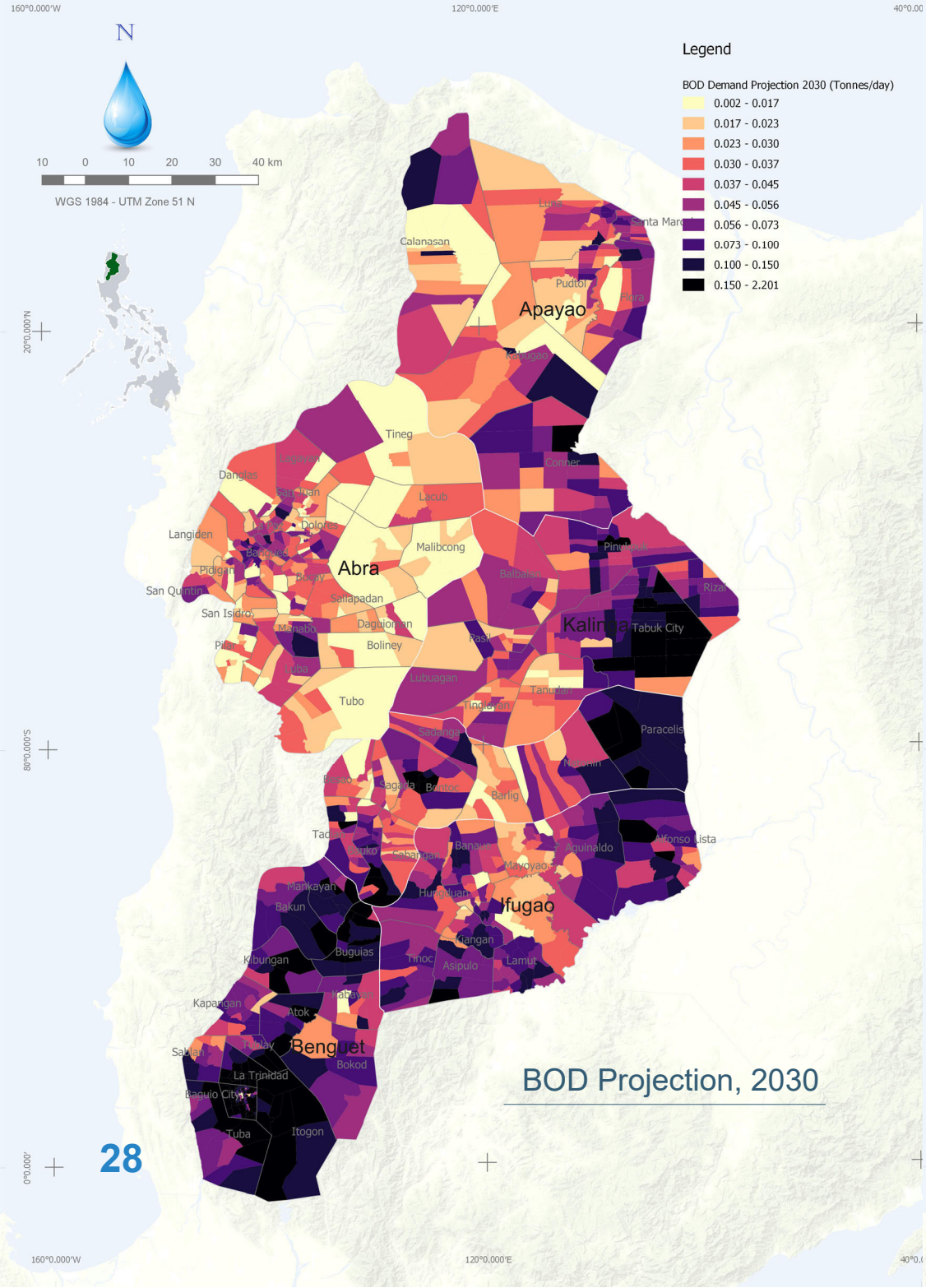


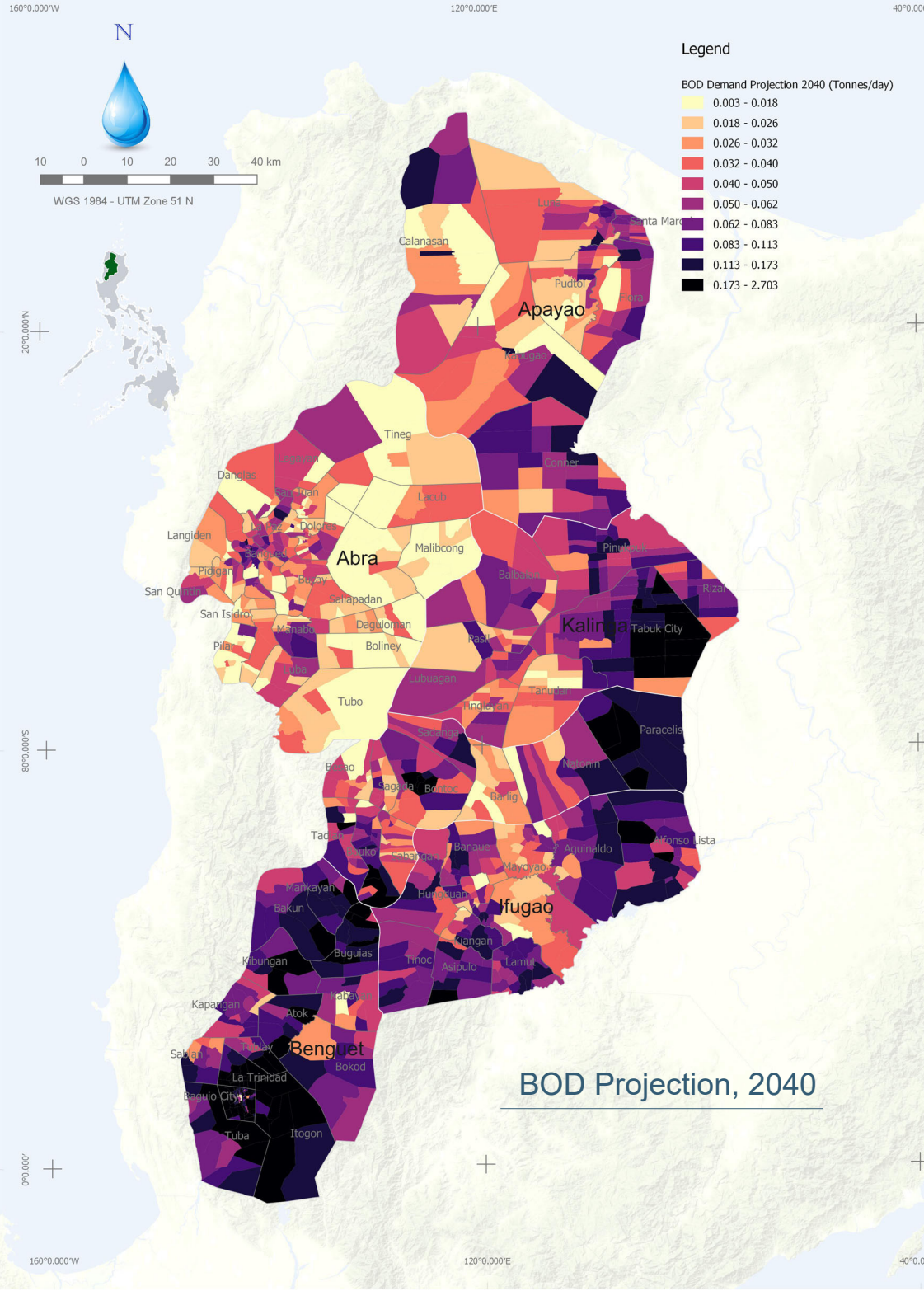
Figure 15: Wastewater Produced, 2015

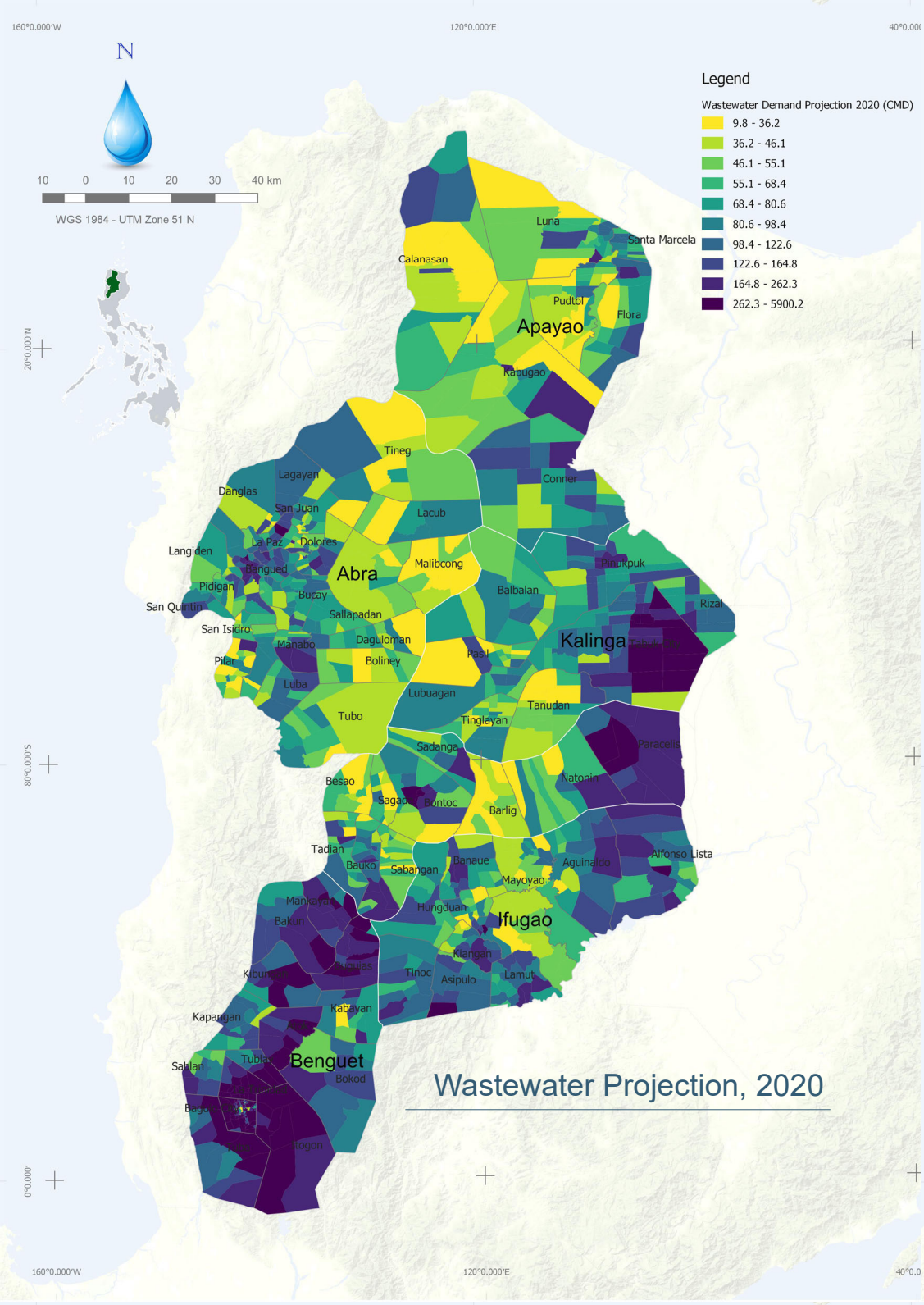
[19] *Philippine Environment Monitor (PEM), 2003*
[20] *Ibid.*


N
10 0 10 20 30 40 km
WGS 1984 - UTM Zone 51 N
Legend
BOD Demand Projection 2020 (Tonnes/day)
0.002 - 0.014
0.014 - 0.019
0.019 - 0.024
0.024 - 0.030
0.030 - 0.036
0.036 - 0.045
0.045 - 0.058
0.058 - 0.081
0.081 - 0.121
0.121 - 1.792
Apayao
Abra
Kalinga
Ifugao
Benguet
Tabuk City
BOD Projection, 2020


N
10 0 10 20 30 40 km
WGS 1984 - UTM Zone 51 N
Legend
BOD Demand Projection 2025 (Tonnes/day)
0.002 - 0.016
0.016 - 0.022
0.022 - 0.028
0.028 - 0.034
0.034 - 0.042
0.042 - 0.053
0.053 - 0.067
0.067 - 0.093
0.093 - 0.138
0.138 - 1.986
Apayao
Abra
Kalinga
Ifugao
Benguet
Tabuk City
BOD Projection, 2025


N
10 0 10 20 30 40 km
WGS 1984 - UTM Zone 51 N
Legend
BOD Demand Projection 2030 (Tonnes/day)
0.002 - 0.017
0.017 - 0.023
0.023 - 0.030
0.030 - 0.037
0.037 - 0.045
0.045 - 0.056
0.056 - 0.073
0.073 - 0.100
0.100 - 0.150
0.150 - 2.201
Apayao
Abra
Kalinga
Ifugao
Benguet
Tabuk City
BOD Projection, 2030


N
10 0 10 20 30 40 km
WGS 1984 - UTM Zone 51 N
Legend
BOD Demand Projection 2040 (Tonnes/day)
0.003 - 0.018
0.018 - 0.026
0.026 - 0.032
0.032 - 0.040
0.040 - 0.050
0.050 - 0.062
0.062 - 0.083
0.083 - 0.113
0.113 - 0.173
0.173 - 2.703
Apayao
Abra
Kalinga
Ifugao
Benguet
Tabuk City
BOD Projection, 2040


N
10 0 10 20 30 40 km
WGS 1984 - UTM Zone 51 N
Legend
Wastewater Demand Projection 2020 (CMD)
9.8 - 36.2
36.2 - 46.1
46.1 - 55.1
55.1 - 68.4
68.4 - 80.6
80.6 - 98.4
98.4 - 122.6
122.6 - 164.8
164.8 - 262.3
262.3 - 5900.2
Apayao
Abra
Kalinga
Ifugao
Benguet
Luna
Santa Marcela
Calanasan
Pudtol
Flora
Kabugao
Tineg
Lagayan
Danglas
San Juan
Lacub
Conner
La Paz
Dolores
Langiden
Bangued
Malibcong
Pinukpuk
Pidigan
Bucay
Balbalan
Rizal
San Quintin
Sallapadan
San Isidro
Manabo
Daguioman
Pilar
Boliney
Pasil
Luba
Lubuagan
Tanudan
Tubo
Tinglayan
Sadanga
Paracelis
Besao
Natonin
Barlig
Tadian
Bauko
Sabangan
Banaue
Aquinaldo
Alfonso Lista
Mayoyao
Mankayan
Hungduan
Bakun
Kiangan
Buguias
Tinoc
Asipulo
Lamut
Kapangan
Kabayan
Sablan
Tublay
Bokod
Wastewater Projection, 2020

N
10 0 10 20 30 40 km
WGS 1984 - UTM Zone 51 N
Legend
Wastewater Demand Projection 2025 (CMD)
10.1 - 41.3
41.3 - 52.2
52.2 - 63.2
63.2 - 78.3
78.3 - 92.3
92.3 - 111.5
111.5 - 140.1
140.1 - 188.9
188.9 - 291.3
291.3 - 6539.5
Apayao
Abra
Kalinga
Ifugao
Benguet
Luna
Santa Marcela
Calanasan
Pudtol
Flora
Kabugao
Tineg
Lagayan
Danglas
San Juan
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La Paz
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San Isidro
Manabo
Daguioman
Pilar
Boliney
Pasil
Luba
Lubuagan
Tanudan
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Tinglayan
Sadanga
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Sabangan
Banaue
Aquinaldo
Alfonso Lista
Mayoyao
Mankayan
Hungduan
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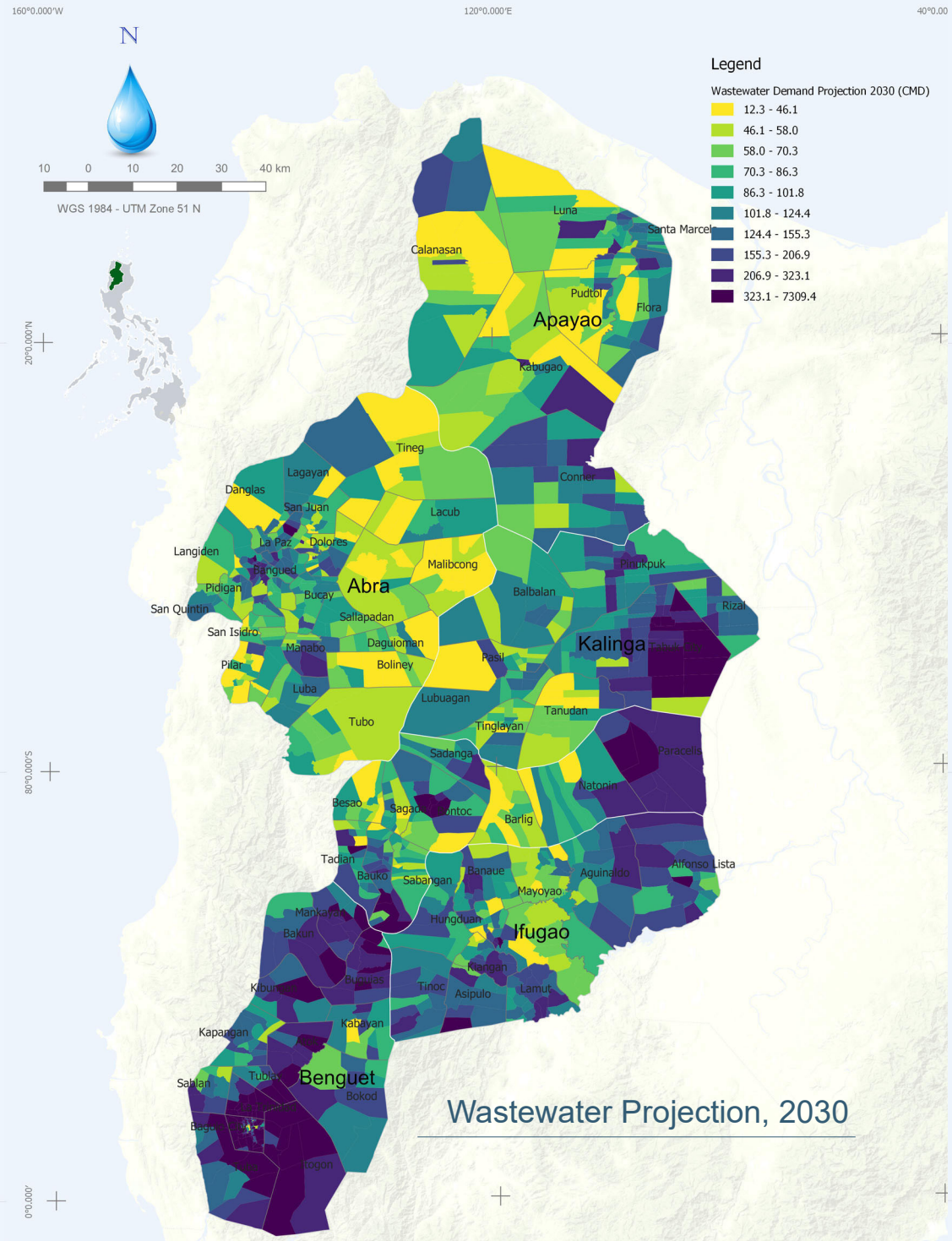
Kiangan
Buguias
Tinoc
Asipulo
Lamut
Kapangan
Kabayan
Sablan
Tublay
Bokod
Wastewater Projection, 2025


N
10 0 10 20 30 40 km
WGS 1984 - UTM Zone 51 N
Legend
Wastewater Demand Projection 2030 (CMD)
12.3 - 46.1
46.1 - 58.0
58.0 - 70.3
70.3 - 86.3
86.3 - 101.8
101.8 - 124.4
124.4 - 155.3
155.3 - 206.9
206.9 - 323.1
323.1 - 7309.4
Apayao
Abra
Kalinga
Ifugao
Benguet
Luna
Santa Marcela
Calanasan
Pudtol
Flora
Kabugao
Tineg
Lagayan
Danglas
San Juan
Lacub
Conner
La Paz
Dolores
Langiden
Bangued
Malibcong
Pinukpuk
Pidigan
Bucay
Balbalan
Rizal
San Quintin
Sallapadan
San Isidro
Manabo
Daguioman
Pilar
Boliney
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Luba
Lubuagan
Tanudan
Tubo
Tinglayan
Sadanga
Paracelis
Besao
Natonin
Barlig
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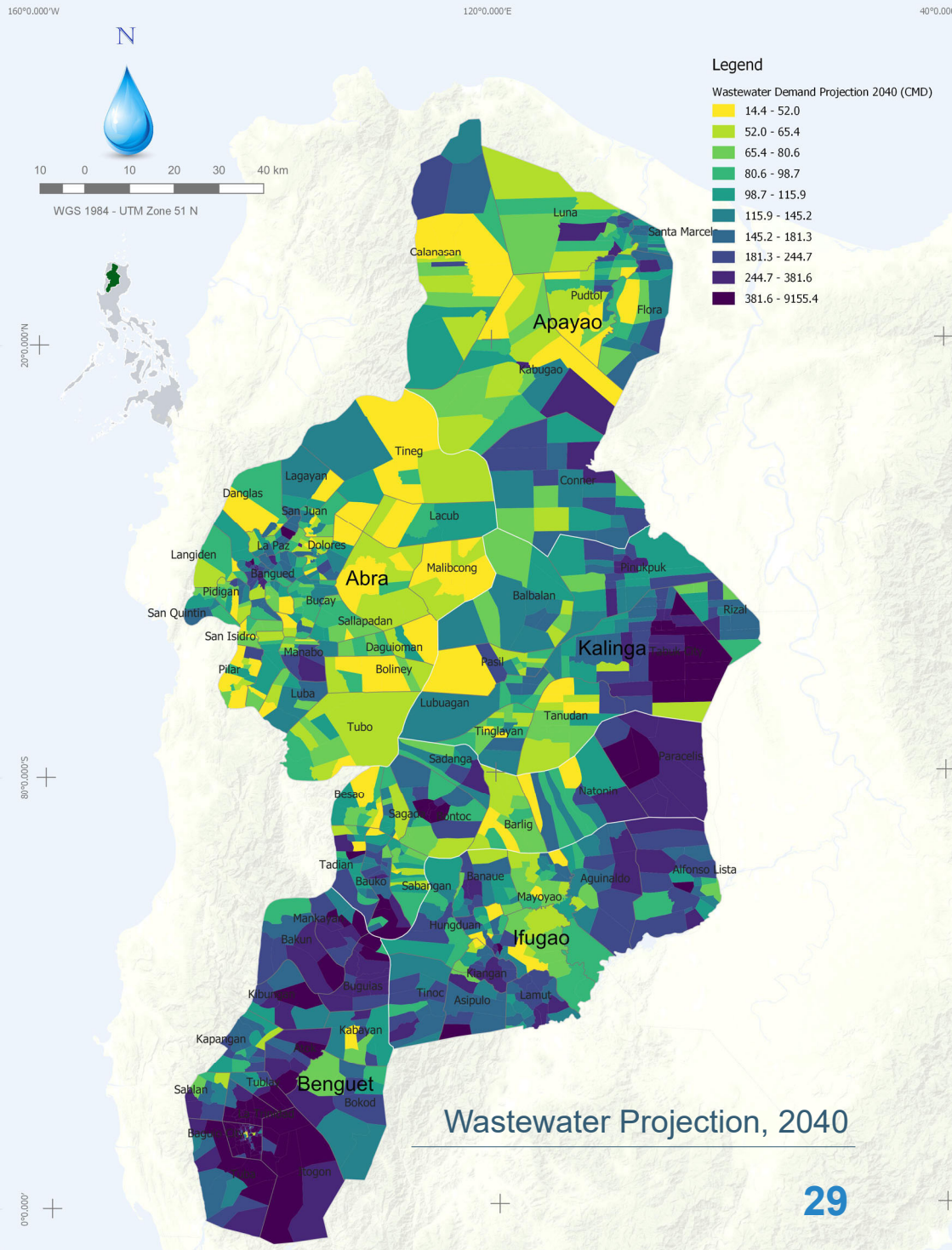
Bauko
Sabangan
Banaue
Aquinaldo
Alfonso Lista
Mayoyao
Mankayan
Hungduan
Bakun
Kiangan
Buguias
Tinoc
Asipulo
Lamut
Kapangan
Kabayan
Sablan
Tublay
Bokod
Wastewater Projection, 2030


N
10 0 10 20 30 40 km
WGS 1984 - UTM Zone 51 N
Legend
Wastewater Demand Projection 2040 (CMD)
14.4 - 52.0
52.0 - 65.4
65.4 - 80.6
80.6 - 98.7
98.7 - 115.9
115.9 - 145.2
145.2 - 181.3
181.3 - 244.7
244.7 - 381.6
381.6 - 9155.4
Apayao
Abra
Kalinga
Ifugao
Benguet
Luna
Santa Marcela
Calanasan
Pudtol
Flora
Kabugao
Tineg
Lagayan
Danglas
San Juan
Lacub
Conner
La Paz
Dolores
Langiden
Bangued
Malibcong
Pinukpuk
Pidigan
Bucay
Balbalan
Rizal
San Quintin
Sallapadan
San Isidro
Manabo
Daguioman
Pilar
Boliney
Pasil
Luba
Lubuagan
Tanudan
Tubo
Tinglayan
Sadanga
Paracelis
Besao
Natonin
Barlig
Tadian
Bauko
Sabangan
Banaue
Aquinaldo
Alfonso Lista
Mayoyao
Mankayan
Hungduan
Bakun
Kiangan
Buguias
Tinoc
Asipulo
Lamut
Kapangan
Kabayan
Sablan
Tublay
Bokod
Wastewater Projection, 2040

160°0.000'W

120°0.000'E

N

10 0 10 20 30 40 km

WGS 1984 - UTM Zone 51 N

20°0.000'N

Legend

With Water Quality Problem

80°0.000'S

Luna
Santa Marcela
Calanasan
Pudtol
Flora
APAYAO
Kabugao
Tineg
Lagayan
Danglas
San Juan
Lacub
Conner
La Paz
Dolores
Lagangilang
Langiden
Bangued
Tayum
ABRA
Malibcong
Licuan-Baay
Pinukpuk
Pidigan
Pe♦arrubia
Bucay
Balbalan
San Quintin
Rizal
Sallapadan
San Isidro
Daguioman
Bucloc
KALINGA
Tabuk City
Manabo
Villaviciosa
Pilar
Boliney
Pasil
Luba
Lubuagan
Tanudan
Tubo
Tinglayan
Sadanga
Paracelis
Besao
Sagada
Bontoc
Natonin
MOUNTAIN PROVINCE
Barlig
Tadian
Sabangan
Bauko
Banaue
Aguinaldo
Alfonso Lista
Mayoyao
Hungduan
Hingyon
Mankayan
IFUGAO
Bakun
Lagawe
Kiangan
Buguias
Tinoc
Asipulo
Lamut
Kibungan
Kabayan
Kapangan
Atok
BENGUET
Tublay
Sablan
La Trinidad
Bokod
Baguio City
Tuba
Itogon

0°0.000'

Areas with Water Quality Problems

Water Districts' Water Quality Monitoring Data, LWUA, 2015

160°0.000'W

120°0.000'E

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.

As discussed earlier in “Water Resources”, CAR’s 4 major river basins cover all its provinces and some surrounding areas. Table 13 shows a list of rivers in the region and their corresponding classification.

Table 13: Classification of Rivers

Province	Name of River	Class
Abra	Abra*	A
	Tineg*	B
Apayao	Akutan	A
	Baren	B
	Cabicungan	B
	Malunog	B/C
	Nabuangan	B
	Nagan	A
	Saltan*	B
	Ziwanan	B
	Zumigue	B
Benguet	Binuan	B
	Karagawan	B
	Laco	B
	Malabanig	B
	Tumog	B/C
	Agno*	A
	Ambalanga	C
	Amburayan*	B
	Bokod	A
	Budacao	A
	Bued	C
	Depanay	A
	Eddet	A
	Galiano	B
	Lake Ambulalakaw	AA
	Naguillan	A
	Pugo	B
	Alenod	A
Kalinga	Tanudan*	A
	Lower Chico River	B
	Abulug*	C
	Alimit*	C
Mountain Province	Chico Upper	B
	Chico*	B
	Ibulao*	C
	Lamut*	C
	Mallig	B
	Siffu	B

** Principal river*

Abra River has suffered the brunt of water pollution caused by domestic sewage and the dumping of waste by mining operators.

An independent study conducted by Dulay (2005) of the Lepanto Mining mill outlet and tailings dam spillway, and of other municipalities in Abra showed that all the water samples indicated high levels of cyanide (Cn), chromium (Cr), lead (Pb) and mercury (Hg). The levels of these toxic substances were found higher than the limits set by the Department on Environment and Natural Resources (DENR) per Department Administrative Order 34.

The quality of water of the Agno River Basin has likewise degraded as a result of various forms of indiscriminate practices: improper waste management and agricultural chemical run-off; siltation and sedimentation caused by mine tailings; and unsustainable, systemic livelihood practices.

The natural topography of the basin especially in the headwater area has also contributed to the worsening state of the river basin. This is exacerbated by insufficient surface water especially in the mountainous sections of the river basin.

In contrast, Apayao River has clear and colorless water. This condition, however, is usually observed only from December to May or during the dry season. During the rainy season when typhoons and thunderstorms are common, its color turns reddish brown — indicating soil erosion.

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.[21]

Based on the Food and Waterborne Diseases Report 2015 of the Department of Health (DOH), there were 39,090 reported cases of acute bloody diarrhea. Two cases of cholera and 214 cases of typhoid and paratyphoid were reported in 2016. There were no reported cholera and schistosomiasis cases.

As of 2017, the Department of the Interior and Local Government (DILG) reported 12 waterless[22] municipalities in the region (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.

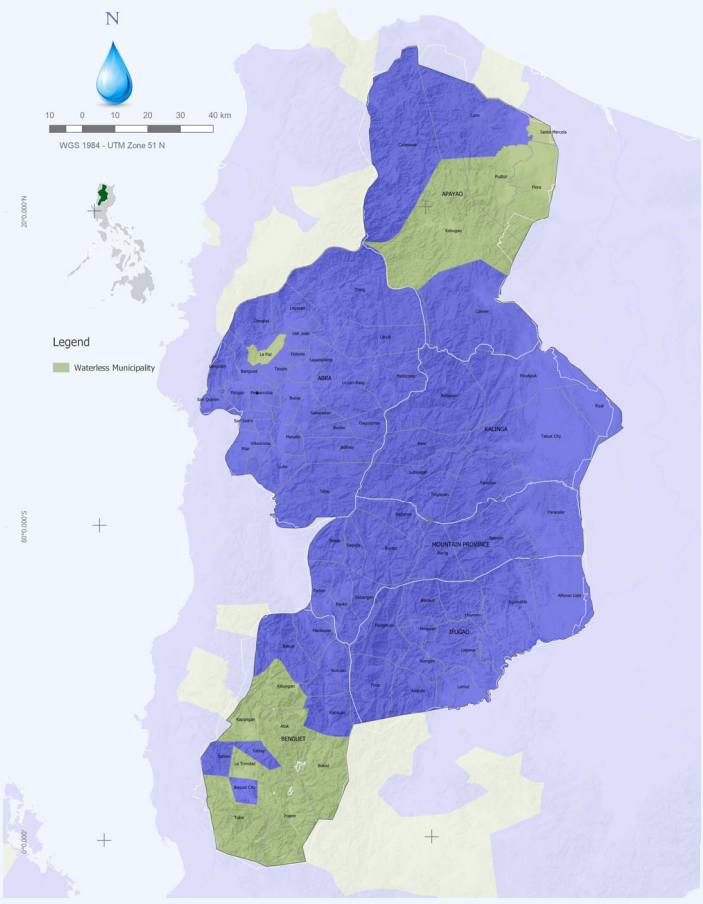


Figure 16: Waterless Municipalities

[21] *World Health Organization*
[22] *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 CAR, areas that require upgraded facilities, improved WSS 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 CAR 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 planning workshop attended by provincial officials in CAR and representatives of regional line agencies identified certain “hindering and facilitating factors” and classified specific issues, constraints, and challenges confronting the WSS sector in three areas of concern: (a) Planning and Development, (b) Service Provision, and (c) Regulation.

Planning and Development

On top of the myriad of factors hindering the development of the water supply and sanitation sector is the lack of funds from LGUs and their inability (or initiative) to source funds from donor agencies or other financing institutions in the form of loan or fund grants.

Political and local leaders have been observed giving greater importance to politicking rather than pushing for a stable, sustainable supply of water and sanitation — a sector that has been relegated to the back burner of their “priorities”. It seems even households and establishments content themselves with collecting rainwater and reusing wastewater. Under these circumstances, timely delivery of relevant public information on sanitation is sorely lacking.

Because of the region’s generally mountainous terrain, finding locations for and building water treatment plants have become a daunting task, hence the high cost of plant operations.

LCEs are encouraged to create an enabling environment to attract investors and encourage private sector participation. Institutional arrangements such as forging linkages with the DOH, DPWH and DILG are in order.

Service Provision

The prevalence of poor water and sanitation service delivery was attributed to several hindering factors specifically: financial constraints, dwindling groundwater, costly installation of septic tanks, water contamination caused by illegal structures that encroach watersheds, and poor appreciation by the general public of the necessity of water service fees.

Among the practical solutions include: the creation of small WSPs to fill the gaps in water service delivery and supply, assistance from the regional WatSan hub in pushing for the protection of the region’s watersheds, hiring of competent technical personnel and urban planners, and procurement of toilet facilities, and the promulgation of a city water code.

Regulation

The sorry state of the WSS sector in CAR pointed to a “failure of regulation” as the cause.

Among the hindering factors are: the weak enforcement of laws governing WSS; unwillingness of consumers in rural areas to pay for water service, the unsustainability of the service by BWSA/CWSA, and noncompliance with the sanitation code resulting in the contamination of water sources.

Among the solutions proposed are: crafting of enabling bylaws governing the operation of barangay or community water supply systems, and a thorough review of research studies before projects are approved and implemented.

Table 14 summarizes the hindering and facilitating factors impacting the WSS sector in CAR.

40°0.000′E
40°0.000′W

Table 14: Hindering and Facilitating Factors

	Hindering Factors	Facilitating Factors
Planning and Development	Political interference re: project priorities and release of funds	Availability of external fund sources for WSS (grants, loans, etc.)
	Cultural beliefs that are barriers to the promotion and enforcement of basic sanitation practices	Capability building programs conducted by DILG
	Rigid procedures in processing/approving water permit applications	Funding assistance from the national government to municipalities
	Right-of-way issues	Available technologies on rain/wastewater collection & sewerage for treatment and reuse
	Processing and approval of water rights applications not devolved to regional offices (e.g., NIA CAR or DPWH CAR)	IKSPs on watershed preservation
	WSS not a priority among households and political leaders	Proper consultation with affected communities
	Lack of sources of safe water (especially in Abra)	Establishing a partnership with DOH
	Limited LGU funds	CAR to be groomed as the “watershed cradle of the North”
	High cost of operation and maintenance	Provision of sanitary toilet bowls by DOH
	Economic status of households	DPWH awards for best sanitation practices of LGUs
	Unavailability of lots for treatment plants	Encouraging private sector participation in managing water supply and sewerage systems
	Non-sustainable water development projects traced to lack of community ownership	
	Lack of competent managers to oversee WSS projects	
	Lack of monitoring mechanisms to ensure sustainability of projects	
	Limited technology and equipment with which to assess water quality/ resources at the local level	
	Lack of awareness among barangay officials on the beneficial impact of water supply systems	
	Lack of public information on sanitation	
	Private water sources	
	Sporadic geographical locations of households	
	Negative attitudes/behaviors of target stakeholders	
	Political affairs given greater priority than WSS	
Service Provision	Water Supply	
	Encroachment and proliferation of illegal structures in watersheds	Creation of small WSPs to fill the gaps in service offered by WDs and big WSPs
	Topography of service areas, i.e., elevation differences between source and service area	Issuance of ordinances by LGUs re: creation of WDs
	Water contamination due to the proliferation of illegal structures in watersheds	Assistance from regional ‘WatSan’ hub to water supply projects
	Ancestral domains’ limited acquisition of additional water sources	Establishing partnerships with LGUs, DENR, WDs, and private sector in watershed protection
	Nonrevenue water (leakage, illegal connection, pilferage)	
	Overextraction and depletion of groundwater and the increasing number of unregistered wells	
	Lack of service coverage expansion programs	
	Lack of understanding or poor appreciation among consumers of the important components of water service fees	
	Climate change	
	Sanitation	
	Limited funds	Frequent monitoring and inspection of water sources
	Indifference and lack of cooperation among residents, LGU officials	Dialogues (through behavioral change communication) with community residents motivating them to adopt proper hygiene habits
	Political interference and changes in administration	Hiring of competent urban planners; inclusion of sanitation in existing development plans
	Costly septic tanks	Existing mechanism of collecting fees for sanitation management
	Unavailability of treatment facilities	
	Water Supply and Sanitation	
	Promulgation of a city water code	
	Increasing population (and the large number of tourists flocking to the region)	
Regulation	Weak enforcement of laws	Crafting of bylaws governing barangay/community water systems
	Noncompliance with standards governing distance between water sources and septic tanks making such practice a source of contamination	Creation of an operations and maintenance group
	Difficulty in collecting tariffs in rural areas	Thorough review of FS prior to project implementation
	Improper turnover of funds among LGUs	Recognition of barangays with best sanitation practices
	Non-accreditation of O&M by local legislative bodies	
	Political interference	
	Unclear definition of terms	
	Unsustained BWSA/CWSA service	

40°0.000′E
40°0.000′W

Regional Vision

“Equitable Access to Safe and Adequate Water and Sanitation for the Cordillerans”

The CAR WSS vision was crafted by the visioning group with the goal of achieving universal access to safe and sustainable water all throughout the region by 2030.

In essence, 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 WSS 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 CAR highlighting the provinces’ individual plans. Priority areas include health and research, water exploration, septage management, alliance building, capacity building, 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 15..

Table 15: 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: CAR 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.

CAR strives to achieve 97% access to safe water by 2022 and 100% access by 2030. Universal access means more than 500,000 HHs will benefit. With regard to sanitation, improved access is set at 67.5% for 2022 and universal access by 2030.

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

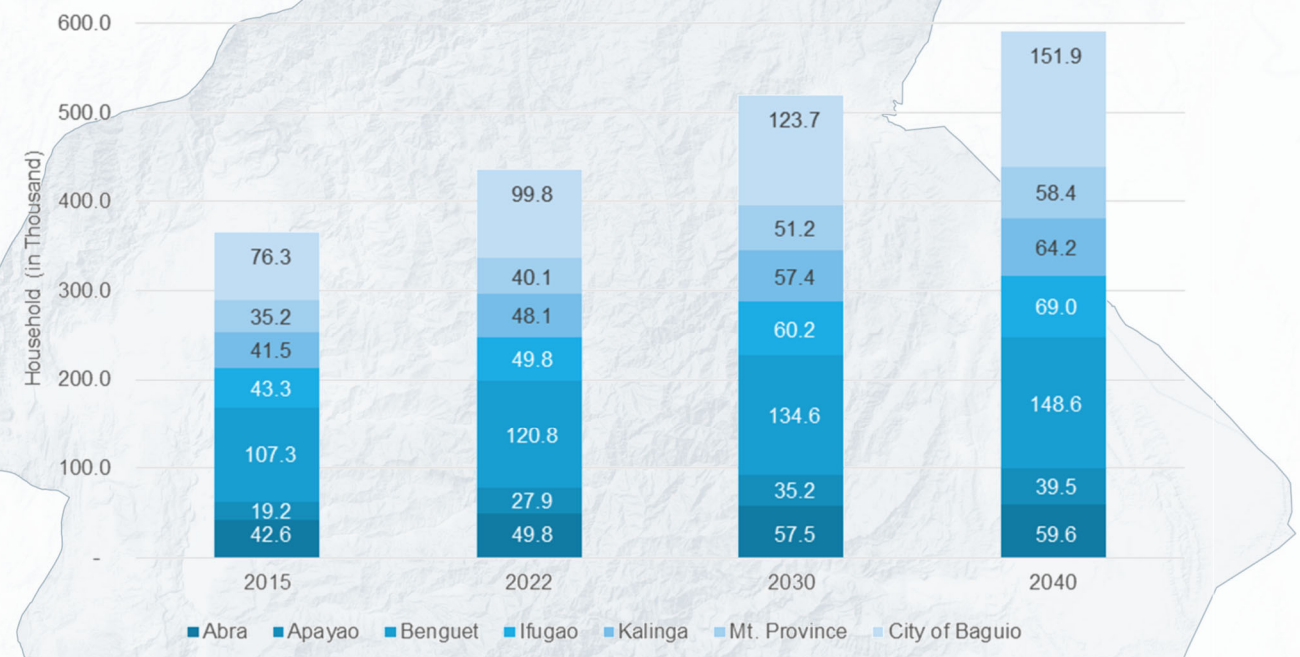


Figure 18: Targeted Households with Access to Safe Water

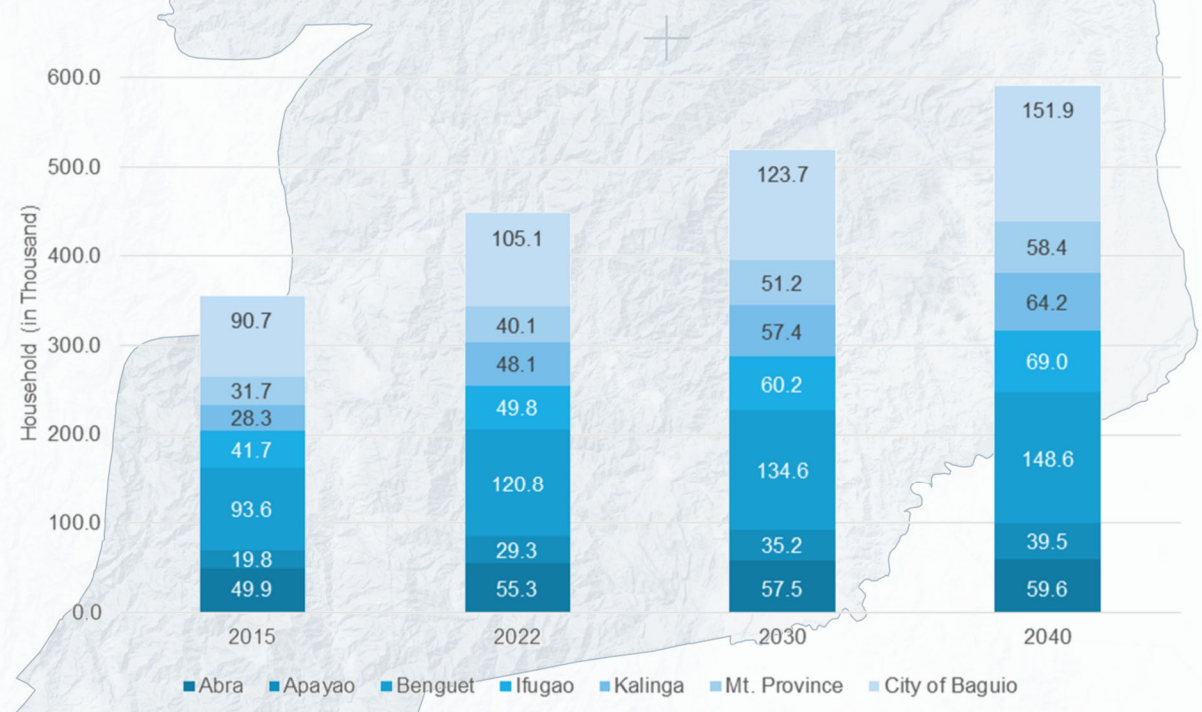


Figure 19: Targeted Households with Access to Sanitation Facilities

Water Supply Targets

ABRA			
	2022	2030	2040
With Access	90.0%	100.0%	100.0%
Level III	20.0%	80.0%	100.0%
Level II	60.0%	20.0%	0.0%
Level I	10.0%	0.0%	0.0%
No Access	10.0%	0.0%	0.0%

APAYAO			
	2022	2030	2040
With Access	95.0%	100.0%	100.0%
Level III	27.0%	29.0%	100.0%
Level II	18.0%	20.0%	0.0%
Level I	50.0%	51.0%	0.0%
No Access	5.0%	0.0%	0.0%

BENGUET (excluding BAGUIO CITY)			
	2022	2030	2040
With Access	100.0%	100.0%	100.0%
Level III	90.0%	100.0%	100.0%
Level II	10.0%	0.0%	0.0%
Level I	0.0%	0.0%	0.0%
No Access	0.0%	0.0%	0.0%

IFUGAO			
	2022	2030	2040
With Access	100.0%	100.0%	100.0%
Level III	20.0%	30.0%	100.0%
Level II	65.0%	65.0%	0.0%
Level I	15.0%	5.0%	0.0%
No Access	0.0%	0.0%	0.0%

KALINGA			
	2022	2030	2040
With Access	100.0%	100.0%	100.0%
Level III	40.0%	70.0%	100.0%
Level II	45.0%	25.0%	0.0%
Level I	15.0%	5.0%	0.0%
No Access	0.0%	0.0%	0.0%

MOUNTAIN PROVINCE			
	2022	2030	2040
With Access	100.0%	100.0%	100.0%
Level III	75.0%	90.0%	100.0%
Level II	15.0%	7.0%	0.0%
Level I	10.0%	3.0%	0.0%
No Access	0.0%	0.0%	0.0%

CITY OF BAGUIO			
	2022	2030	2040
With Access	95.0%	100.0%	100.0%
Level III	91.0%	99.0%	100.0%
Level II	1.5%	0.5%	0.0%
Level I	2.5%	0.5%	0.0%
No Access	5.0%	0.0%	0.0%

CAR			
	2022	2030	2040
With Access	97.3%	100.0%	100.0%
Level III	60.7%	78.7%	100.0%
Level II	26.7%	15.9%	0.0%
Level I	9.9%	5.4%	0.0%
No Access	2.7%	0.0%	0.0%

Sanitation Targets

ABRA			
	2022	2030	2040
Improved	97.0%	100.0%	100.0%
Basic	1.5%	0.0%	0.0%
Shared/Communal/Limited	0.9%	0.0%	0.0%
Open Defecation	0.7%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

APAYAO			
	2022	2030	2040
Improved	97.0%	100.0%	100.0%
Basic	1.0%	0.0%	0.0%
Shared/Communal/Limited	1.0%	0.0%	0.0%
Open Defecation	1.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

BENGUET (excluding BAGUIO CITY)			
	2022	2030	2040
Improved	97.0%	100.0%	100.0%
Basic	0.0%	0.0%	0.0%
Shared/Communal/Limited	0.0%	0.0%	0.0%
Open Defecation	3.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

IFUGAO			
	2022	2030	2040
Improved	97.0%	100.0%	100.0%
Basic	1.0%	0.0%	0.0%
Shared/Communal/Limited	1.0%	0.0%	0.0%
Open Defecation	1.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

KALINGA			
	2022	2030	2040
Improved	97.0%	100.0%	100.0%
Basic	0.1%	0.0%	0.0%
Shared/Communal/Limited	0.1%	0.0%	0.0%
Open Defecation	2.8%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

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

CITY OF BAGUIO			
	2022	2030	2040
Improved	97.0%	100.0%	100.0%
Basic	0.0%	0.0%	0.0%
Shared/Communal/Limited	1.5%	0.0%	0.0%
Open Defecation	1.5%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

CAR			
	2022	2030	2040
Improved	67.5%	100.0%	100.0%
Basic	5.5%	0.0%	0.0%
Shared/Communal/Limited	27.0%	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 CAR 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 16 and 17 show the specific strategic interventions for water supply and sanitation, respectively.

Table 16: 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 17: Proposed Strategic Interventions for Sanitation

Access to Improved Sanitation	<u>Planning & Development</u> *Planning* *Program or Project Design* *Institution Building* *Training* *Financing* *Climate/Disaster Resiliency* *Policy*	<u>Service Provision</u> *Operations* *M&E* *Expansion* *Amalgamation* *Automation*	<u>Regulation</u> *Tariff/Pricing* *Resource* *Arbitration* *Registration, Permits, Rights*	<u>Promotions</u> *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 18.

Table 18: Capital Investments Required to Meet 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 19).

Table 19: Institutional and Regulatory Reforms Required to Achieve 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

N

10 0 10 20 30 40 km

WGS 1984 - UTM Zone 51 N

20°0.000'N

80°0.000'S

0°0.000'

Legend

Approved Projects

Pending Projects

Luna
Santa Marcela
Calanasan
Pudtol
Flora
APAYAO
Kabugao
Tineg
Lagayan
Conner
Danglas
San Juan
Lacub
La Paz
Dolores
Lagangilang
Langiden
Bangued
Tayum
ABRA
Licuan-Baay
Malibcong
Pinukpuk
Pidigan
Pe♦arrubia
Balbalan
San Quintin
Bucay
Rizal
Sallapadan
San Isidro
Daguioman
Bucloc
KALINGA
Manabo
Tabuk City
Villaviciosa
Pilar
Boliney
Pasil
Luba
Lubuagan
Tanudan
Tubo
Tinglayan
Sadanga
Paracelis
Besao
Sagada
Natonin
Bontoc
MOUNTAIN PROVINCE
Barlig
Tadian
Sabangan
Banaue
Aguinaldo
Alfonso Lista
Bauko
Mayoyao
Hungduan
Hingyon
Mankayan
IFUGAO
Bakun
Lagawe
Kiangan
Buguias
Tinoc
Asipulo
Lamut
Kibungan
Kabayan
Kapangan
Atok
BENGUET
Tublay
Sablan
La Trinidad
Bokod
Baguio City
Tuba
Itogon

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).

CAR requires total investments for infrastructure development of about PhP3.97 billion and PhP5.68 billion to achieve 2022 and 2030 targets, respectively. Unit Unit development costs employed to arrive at these sums are estimated at PhP31,000 per HH for Level III, PhP18,200 for Level II, and PhP8,200 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 CAR) 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 HH 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 20.

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 21 shows a summary of the total investment requirements of the region. (The detailed methodology of how the regional costs for CAR 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 the two CAR LGUs where priority WD projects are pending approval for LWUA's financial assistance (FA) — Dolores in Abra and Banaue in Ifugao.

Table 20: Indirect Costs Employed[23]

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 21: Total Investment Costs for Water Supply Sector

Province/City	Total Investment Cost (in PhP Million) 2022	Total Investment Cost (in PhP Million) 2030
Abra	394.59	1,409.57
Apayao	280.15	168.10
Benguet	974.66	1,044.54
Ifugao	490.93	487.11
Kalinga	503.71	844.31
Mountain Province	257.23	644.59
City of Baguio	1,070.69	1,082.40
Total	**3,971.95**	**5,680.61**

[23] *Based on industry standards*

160°0.000'W

120°0.000'E

N

10 0 10 20 30 40 km

WGS 1984 - UTM Zone 51 N

20°0.000'N

80°0.000'S

0°0.000'

Legend

STP CLUSTERING

- CAR-CL1
- CAR-CL2
- CAR-CL3
- CAR-CL4
- CAR-CL5
- CAR-CL6
- CAR-CL7
- CAR-CL8
- CAR-CL9
- CAR-CL10
- CAR-CL11
- CAR-CL12
- CAR-CL13
- CAR-CL14
- CAR-CL15
- CAR-CL16
- CAR-CL17
- CAR-CL18
- CAR-CL19
- CAR-CL20
- CAR-CL21
- CAR-CL22
- CAR-IN1
- CAR-IN2
- CAR-IN3
- CAR-IN4
- CAR-IN5
- CAR-IN6
- CAR-IN7
- CAR-IN8
- CAR-IN9
- CAR-IN10
- CAR-IN11
- CAR-IN12
- CAR-IN13
- CAR-IN14

Luna
Santa Marcela
Calanasan
Pudtol
Flora
APAYAO
Kabugao
Tineg
Lagayan
Danglas
San Juan
Lacub
La Paz
Dolores
Lagangilang
Langiden
Bangued
Tayum
ABRA
Licuan-Baay
Malibcong
Pidigan
Pe♦arrubia
San Quintin
Bucay
Sallapadan
San Isidro
Bucloc
Daguioman
Manabo
Villaviciosa
Pilar
Boliney
Luba
Tubo
Conner
Pinukpuk
Balbalan
Rizal
KALINGA
Tabuk City
Pasil
Lubuagan
Tanudan
Tinglayan
Sadanga
Paracelis
Besao
Sagada
Bontoc
Natonin
MOUNTAIN PROVINCE
Barlig
Tadian
Sabangan
Bauko
Banaue
Aguinaldo
Alfonso Lista
Mayoyao
Hungduan
Hingyon
IFUGAO
Mankayan
Lagawe
Bakun
Kiangan
Buguias
Tinoc
Asipulo
Lamut
Kibungan
Kabayan
Kapangan
Atok
BENGUET
Tublay
Sablan
La Trinidad
Bokod
Baguio City
Itogon
Tuba

Septage Treatment Plant Clustering

Sanitation Investment Requirements

Physical Investments

Basic Sanitation Program. The 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).

CAR will need about PhP915 million for basic sanitation from 2016 to 2022 to reach a target of 67.5%.

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 PhP962 million and PhP153 million for 2022 and 2030, respectively, for its septage management program.

Sewerage System Program. Only Baguio City will be required to plan and implement a sewerage system for its 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, Baguio City will require PhP1.5 billion by 2022 and an additional PhP263 million by 2030. The computational template provided for a 25% coverage of sewerage services by 2022 and an additional 25% coverage by 2030. This includes the city's incremental population from 2015 to 2022 and from 2023 to 2030.

Candidate HUCs such as Bangued in Abra, Kabugao in Apayao, La Trinidad in Benguet, Lagawe in Ifugao, Tabuk City in Kalinga and Bontoc in Mountain Province may be closely examined initially as urbanization may set in more rapidly in these places than in other capital cities or towns.

Nonphysical Investments

CAR, 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 22: Total Investment Costs for Sanitation Sector

Province/City	Total Investment Cost (in PhP Million) 2022	Total Investment Cost (in PhP Million) 2030
Abra	318.75	67.11
Apayao	779.88	180.04
Benguet	2,874.10	383.42
Ifugao	1,344.58	323.90
Kalinga	639.78	307.71
Mountain Province	418.46	322.91
City of Baguio	2,067.90	737.56
Total	**8,443.44**	**2,322.64**

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, 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 PhP 7.87 billion to boost its WSS sector.

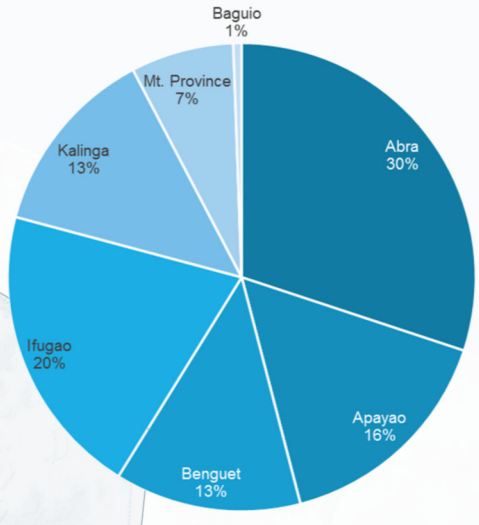


Figure 20: Distribution of Investment Requirement per Province/HUC

Abra

	Water Supply	Period	Budget Requirement (in PhP Million)
1	Provision of testing kits in community-managed water systems	Short Term	27.00
2	Construction of water reservoir	Short Term	3.00
3	IEC campaign during barangay assemblies/ meetings, radio program; production of IEC materials	Short Term	1.00
4	Micro-hydro projects	Short Term	3.00
5	Reforestation projects in watershed areas	Short Term	15.00
6	Training in database software	Short Term	15.00
7	Development of springs and deep wells as water sources	Short Term	15.00
8	Water treatment laboratory	Short Term	15.00
9	Water sources development	Short Term	4.50
10	Transmission line replacement/installation	Short Term	8.25
11	Water pressure management	Short Term	5.00
12	128 cu.m. reservoir in Pidigan	Short Term	7.50
13	Distribution line replacement/installation	Short Term	4.50
14	Construction of MBWD office building	Short Term	45.00
15	MBWD corporate social responsibility (CSR) initiatives	Short Term	1.05
		Total	**169.80**

	Sanitation	Period	Budget Requirement (in PhP Million)
1	Training of municipal and barangay personnel in charge of health and sanitation	Short Term	10.80
2	Acquisition of land for construction and establishment of septage treatment plants/ facilities	Short Term	80.00
3	Feasibility studies on sanitation	Short Term	8.00
4	Selection and awarding of healthiest barangay and municipality	Short Term	0.00
5	IEC campaign during barangay assemblies/ meetings and over the radio; production of IEC materials	Short Term	1.00
6	Improvement or expansion of sanitary permit collection	Medium Term	0.00
7	Provision of plastic and ceramic toilet bowls	Short Term	1.93
8	Purchase of sludging equipment	Short Term	20.00
9	Seal of good housekeeping	Short Term	0.00
10	Septage management project	Short Term	52.40
11	Purchase of lot and trucks re: septage management	Medium Term	45.00
12	Septage management facility	Long Term	2,000.00
		Total	**2,219.13**

	Water Supply and Sanitation	Period	Budget Requirement (in PhP Million)
1	Capacity building re: WSS	Short Term	1.00
		Total	**1.00**

Total Budget Requirement (in PhP Million)	HH Beneficiaries (2022)
2,389.93	**55,303**

Apayao

	Water Supply	Period	Budget Requirement (in PhP Million)
1	Construction of water facilities (wells, springs) to benefit 7,250 HHs	Long Term	313.69
2	Provision of plastic toilet bowls (5,716 HHs)	Short Term	3.09
3	Quarterly monitoring	Short Term	0.4
4	Rehabilitation and repair of sanitary facilities	Short Term	750.00
5	Training re: BWSA management	Short Term	5.00
6	Updating of PDPFP	Short Term	-
		Total	**1,072.18**

	Sanitation	Timeline	Budget Requirement (in PhP Million)
1	Construction of sanitary facilities and STPs	Short Term	107.00
2	FS re: construction of STPs	Short Term	10.00
3	Reforestation projects	Short Term	7.00
4	Rehabilitation and repair of water supply facilities	Medium Term	10.00
5	Water quality monitoring/water quality testing laboratory	Short Term	17.00
		Total	**151.00**

Total Budget Requirement (in PhP Million)	HH Beneficiaries (2022)
1,223.18	**29,316**

Benguet

	Water Supply	Period	Budget Requirement (in PhP Million)
1	Amendment of SGLG criteria to include water and sanitation indicators	Short Term	-
2	Construction and rehabilitation of waterworks and water supply systems	Medium Term	276.00
3	Promotion and provision of incentives to practitioners of organic farming	Short Term	-
4	Reforestation/delineation/protection of watersheds	Short Term	-
5	Strict enforcement of policies on pesticide/ chemical use	Short Term	-
		Total	**276.00**

	Sanitation	Period	Budget Requirement (in PhP Million)
1	Construction of communal septic tanks	Short Term	35.00
2	Construction of STP	Short Term	200.00
3	Provision of tax incentives and streamlining of business permit procedures	Short Term	-
4	Provision of toilet bowls	Short Term	401.60
5	Sanitary landfill	Short Term	100.00
6	Search for best sanitation practices of LGUs	Long Term	-
		Total	**736.60**

Total Budget Requirement (in PhP Million)	HH Beneficiaries (2022)
1,012.60	**120,759**

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Ifugao									
	Water Supply	Period	Budget Requirement (in PhP Million)		Sanitation	Period	Budget Requirement (in PhP Million)	Total Budget Requirement (in PhP Million)	HH Beneficiaries (2022)
1	Construction and rehabilitation of LGU-owned potable water supply system	Long Term	26.80	1	Annual search for and awarding of the Cleanest and Greenest Barangays	Short Term	2.50		
2	Family forest maintenance (MUYONG PROJECT)	Short Term	50.00	2	Assessment	Medium Term	2.00		
3	Lamut water system	Short Term	40.00	3	Construction of anaerobic baffled reactor, drainage and sewerage systems, STPs, and installation of sanitary toilets	Medium Term	1,123.11		
4	Hiring of medical technologists, sanitary engineers	Short Term	10.00	4	Sanitation projects	Short Term	2.50		
5	Advocacy initiatives over local radio programs, reproduction of printed materials, conduct of Community-Led Total Sanitation (CLTS) program	Short Term	2.50	5	Strict implementation of policies	Short Term	-	**1,619.56**	**49,765**
6	Mega project list	Short Term	250.00	6	Training in WASH and CLTS in11 municipalities	Short Term	1.25		
7	Reforestation activities	Short Term	100.00			**Total**	**1,131.36**		
8	Training in WASH, water analysis (chemical/ bacterial analysis)	Short Term	0.50						
9	Water testing facilities, reagents	Short Term	8.40						
		Total	**488.20**						

Kalinga									
	Water Supply	Period	Budget Requirement (in PhP Million)		Sanitation	Period	Budget Requirement (in PhP Million)	Total Budget Requirement (in PhP Million)	HH Beneficiaries (2022)
1	Construction of water treatment plant	Short Term	200.00	1	Advocacy campaign/IEC activities on Zero Open Defecation	Short Term	3.00		
2	Construction/Improvement of waterworks system and facilities in various barangays	Short Term	61.00	2	Capacity development (training/benchmarking) for technical personnel including sanitary inspectors	Short Term	3.00		
3	Procurement of water testing equipment/facilities, water reagents and disinfectants	Short Term	5.00	3	Feasibility study on septage/sewerage treatment facility and water treatment plant	Short Term	6.00		
4	Training of BWSA and water district personnel	Short Term	0.30	4	Construction of sewerage/septage treatment plant and system	Medium Term	500.00		
		Total	**266.30**	5	Opening of additional positions for sanitary inspectors	Short Term	-		
				6	Enforcement of sanitation laws and regulations	Short Term	-	**1,046.35**	**48,097**
	Water Supply and Sanitation	Period	Budget Requirement (in PhP Million)	7	Formulation of contingency plans	Short Term	-		
1	Conduct of a feasibility study	Short Term	1.00	8	Preparation of a 10-Year Ecological Solid Waste Management Plan	Medium Term	0.05		
		Total	**1.00**	9	Provision of 10 units of Portalets during disasters (province-wide)	Short Term	250.00		
				10	Provision of sanitary toilet bowls to 14,747 HHs	Short Term	6.00		
				11	Site development and construction of septage/ sewerage treatment facilities	Medium Term	11.00		
						Total	**779.05**		

Mountain Province									
	Water Supply	Period	Budget Requirement (in PhP Million)		Sanitation	Period	Budget Requirement (in PhP Million)	Total Budget Requirement (in PhP Million)	HH Beneficiaries (2022)
1	Preparation of proposed standards for CAR	Short Term	-	1	Construction of communal septic tanks	Short Term	94.50		
2	Fencing of water sources; reforestation; adoption/ delineation/protection of watersheds; spring development	Short Term	190.00	2	Construction of STPs for municipalities and hospitals	Short Term	102.70		
3	Accreditation of PWAL	Short Term	-	3	Provision of tax incentives and streamlining of business permit procedures	Short Term	0.30	**535.42**	**40,108**
4	Amendment of SGLG criteria to include water and sanitation indicators	Short Term	-	4	Provision of toilet bowls	Short Term	136.62		
5	Hiring of chemists and staff for PWAL	Short Term	8.00	5	Search for best sanitation practices of LGUs	Long Term	0.30		
6	Training of BWSA employees on O&M	Short Term	3.00			**Total**	**334.42**		
		Total	**201.00**						

Baguio City				
	Sanitation	Period	Budget Requirement (in PhP Million)	Total Budget Requirement (in PhP Million)	HH Beneficiaries (2022)
1	Construction and rehabilitation of sewer lines	Short Term	45.70	**45.70**	**105,083**
		Total	**45.70**		

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Legend

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

Luna
Santa Marcela
Calanasan
Pudtol
Flora
APAYAO
Kabugao
Tineg
Lagayan
Danglas
San Juan
Conner
Lacub
La Paz
Dolores
Lagangilang
Langiden
Bangued
Tayum
ABRA
Malibcong
Licuan-Baay
Pinukpuk
Pidigan
Pe♦arrubia
Bucay
Balbalan
San Quintin
Sallapadan
Rizal
San Isidro
Bucloc
Daguioman
KALINGA
Manabo
Tabuk City
Villaviciosa
Pilar
Boliney
Pasil
Luba
Lubuagan
Tanudan
Tubo
Tinglayan
Sadanga
Paracelis
Besao
Sagada
Bontoc
Natonin
MOUNTAIN PROVINCE
Barlig
Tadian
Sabangan
Banaue
Alfonso Lista
Aguinaldo
Bauko
Mayoyao
Hungduan
Hingyon
IFUGAO
Mankayan
Bakun
Lagawe
Kiangan
Buguias
Tinoc
Asipulo
Lamut
Kibungan
Kabayan
Kapangan
Atok
BENGUET
Tublay
Sablan
La Trinidad
Bokod
Baguio City
Itogon
Tuba

AM, Salintubig Pipeline WSS Projects

DILG-WSSPMO, 2019 List of DILG Projects

Identified Priority Projects (2019-2020)

The table 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 Title	Amount (in PhP Million)
Abra	Lacub	Upgrading Of Water System	3.09
Abra	Lagayan	Construction Of New Sanitary Toilets With Hygiene Facilities For Public Places	0.50
Abra	La Paz	New Construction Of Level 2 Potable Water System In Naguillan, San Gregorio	3.05
Abra	La Paz	New Construction Of Level 2 Potable Water System In Canan	3.05
Abra	Villaviciosa	Rehabilitation/Improvement Of Level 3 Potable Water System In Lap-Lapog	2.05
Abra	Villaviciosa	Rehabilitation/Improvement Of Level 3 Potable Water System In Lumaba	2.05
Benguet	Kapangan	Rehabilitation Of Level 2 Danicag Domestic Water Supply	0.69
Benguet	La Trinidad	Provision Of Rainwater Catchment Facility	1.13
Ifugao	Alfonso Lista	Expansion Of Level 3 Water System	6.93
Ifugao	Tinoc	Upgrading Of Water System	1.36
Kalinga	Tinglayan	New Construction Of Belong Level 2 Water System	2.00
Mountain Province	Tadian	Rehabilitation/Improvement Of Level 2/Level 3 Water System	1.69
		Total	**27.58**

SALINTUBIG (2019)			
Province	Municipality	Project	Amount (in PhP Million)
Abra	La Paz	Construction of potable water supply system	6.00
Abra	Bangued	Construction of potable water supply system (56 Units Dw) (Malita and Tablac)	2.50
Abra	Pilar	Construction of potable water supply system (Nanangduan)	2.00
Apayao	Sta. Marcela	Construction of potable water supply system	10.00
Apayao	Luna	Construction of potable water supply system (Tumog, Sta Lina, San Francisco, Dagupan and Shalom)	10.00
Benguet	Atok	Construction of waterworks system	15.00
Benguet	Itogon	Improvement of waterworks system	15.50
Benguet	La Trinidad	Construction of domestic water supply system	16.00
Kalinga	Lubuagan	New construction of Level II potable water supply system (Payao, Dugong, and Lower Uma)	2.00
Kalinga	Lubuagan	New construction of Level II potable water supply system (Latawan and Western Uma)	2.00
Kalinga	Lubuagan	Construction of Lubuagan waterworks system (Dangoy, Poblacion, Antonio Canao and Mabilong)	10.00
Ifugao	Banaue	Construction of potable water supply system in various barangays	16.00
		Total	**107.00**

LWUA (2017-2018)			
Province	Municipality	Project Type - Status	Amount (in PhP Million)
Abra	Dolores	Expansion - Pending approval	20.00
Ifugao	Banaue	Expansion - Pending approval	
		Total	**20.00**

Appendix A: Provincial and HUC Profiles

ABRA	27 municipalities	Bangued, Boliney, Bucay, Bucloc, Daguioman, Danglas, Dolores, La Paz, Lacub, Lagangilang, Lagayan, Langiden, Licuan-Baay, Luba, Malibcong, Manabo, Peñarrubia, Pidigan, Pilar, Sallapadan, San Isidro, San Juan, San Quintin, Tayum, Tineg, Tubo, Villaviciosa
	303 barangays	5 urban, 298 rural
Land Area	4,165.25 square kilometers	
Demographics (2015)	Population (2015) – 241,160 Population Growth Rate (2000 to 2015) – 1.14 Population Density – 58 per sq. km	
Economy	• Major industries - agriculture, livestock, weaving • Major products - livestock such as chicken and goat; natural dyes and weaves • Major crops - rice, corn, coconut, banana, mango • Abra is referred to as the "Natural Dye Capital of the Philippines" for its abundance of natural dye-producing materials, and also for the practices of the indigenous Itneg/Tingguin people handed down through generations.	
Poverty Incidence (2015)	On Families – 19.9% On Population – 2.0%	
APAYAO	7 municipalities	Calanasan, Conner, Flora, Kabugao, Luna, Pudtol, Santa Marcela
	133 barangays	10 urban, 123 rural
Land Area	4,413.35 square kilometers	
Demographics (2015)	Population (2015) – 119,184 Population Growth Rate (2000 to 2015) – 1.49 Population Density – 27 per sq. km	
Economy	• Major industries - agriculture, garment crafting, food processing • Major products - crafts and house wares, baskets, handicrafts • Major crops - rice, corn, coffee, root crops, fruits and vegetables	
Poverty Incidence (2015)	On Families – 30.98% On Population – 34.9%	

BENGUET	13 municipalities	Atok, Bakun, Bokod, Buguias, Itogon, Kabayan, Kapangan, Kibungan, La Trinidad, Mankayan, Sablan, Tuba, Tublay
	one (1) highly urbanized city	Baguio City
	140 barangays (excluding Baguio City)	22 urban, 118 rural
Land Area	2,833.0 square kilometers	
Demographics (2015)	Population (2015) – 446,224 Population Growth Rate (2000 to 2015) – 2.04 Population Density – 161 per sq. km	
Economy	• Major industries - agriculture, mining, tourism • Major products - flowers, minerals such as gold, copper and chromite; hand-woven and wood carved materials • Major crops - coffee, potato, strawberry, cabbage, broccoli, peas • Benguet is often called as the “Salad Bowl of the Philippines” because of its abundant production of highland vegetables. • Benguet is also one of the country’s leading gold producers.	
Poverty Incidence (2015)	On Families – 2.5% On Population – 3.5%	

IFUGAO	11 municipalities	Aguinaldo, Alfonso Lista, Asipulo, Banaue, Hingyon, Hungduan, Kiangan, Lagawe, Lamut, Mayoyao, Tinoc
	175 barangays	15 urban, 160 rural
Land Area	2,566.36 square kilometers	
Demographics (2015)	Population (2015) – 202,802 Population Growth Rate (2000 to 2015) – 1.69 Population Density – 79 per sq. km	
Economy	• Major industries - agriculture, livestock, tourism • Major products - livestock such as chicken and duck; delicacies such as rice cookies, native rice-coated polvoron and coffee bars • Major crops - rice, corn • Ifugao hosts the famous Rice Terraces of the Philippine Cordilleras (a UNESCO World Heritage Site) and the Banaue Rice Terraces.	
Poverty Incidence (2015)	On Families – 26.1% On Population – 32.5%	

Appendix A: Provincial and HUC Profiles

KALINGA	7 municipalities	Balbalan, Lubuagan, Pasil, Pinukpuk, Rizal, Tanudan, Tinglayan
	one (1) component city	Tabuk City
	152 barangays	6 urban, 146 rural
Land Area	3,231.25 square kilometers	
Demographics (2015)	Population (2015) – 212,680 Population Growth Rate (2000 to 2015) – 1.48 Population Density – 66 per sq. km	
Economy	• Major industries - agriculture, livestock, handicraft, weaving, textile • Major products - fruit and rice wine, chili paste, hand-woven items, clothes and garments • Major crops - coffee, rice,	
Poverty Incidence (2015)	On Families – 30.0% On Population – 34.9%	
MOUNTAIN PROVINCE	10 municipalities	Barlig, Bauko, Besao, Bontoc, Natonin, Paracelis, Sabangan, Sadanga, Sagada, Tadian
	144 barangays	2 urban, 142 rural
Land Area	2,493.86 square kilometers	
Demographics (2015)	Population (2015) – 154,590 Population Growth Rate (2000 to 2015) – 0.92 Population Density – 62 per sq. km	
Economy	• Major industries - agriculture, livestock, weaving, • Major products - woven products such as bags, purses and clothes; • Major crops - potato, cabbage, carrots, other vegetables	
Poverty Incidence (2015)	On Families – 29.5% On Population – 39.0%	

CITY OF BAGUIO	Baguio is the commerce, business and education center in northern Luzon. It is the regional center of CAR. 129 barangays — 46 urban, 83 rural
Land Area	57.51 square kilometers
Demographics (2015)	Population (2015) – 446,224 Population Growth Rate (2000 to 2015) – 2.04 Population Density – 7759 per sq. km
Economy	• Major industries - tourism, trade and commerce, • Major products - local delicacies made from strawberries; raisin bread, various retail products • Baguio City is known as the “Summer Capital of the Philippines” owing to its year-round cool climate due to its high elevation. • The city is also dubbed as the “City of Pines” with the presence of the Luzon tropical pine forests.

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