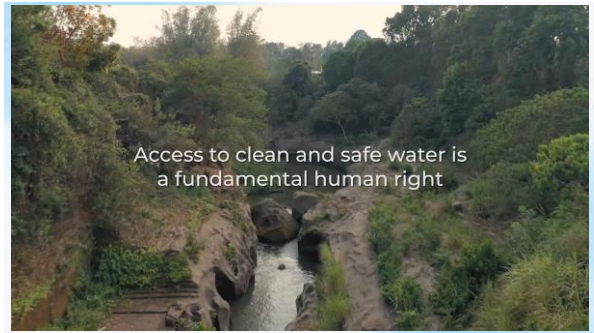


WATER *Sanitation*

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Philippine Context

- **12.4 million Filipinos** do not have access to basic drinking water services, relying mainly on **unsafe** sources; **26 million** do not have access to basic **sanitation** (Philippine Water Supply and Sanitation, 2022)
- **fragmented** water sector and regulation (National Economic and Development Authority, 2021)

- “However, due to poor infrastructure, investment, and planning, every year, millions of people—most of them children—**die from diseases** associated with inadequate water supply, sanitation, and hygiene” (UN General Assembly, 2021)
- acute bloody diarrhea (101%), rotavirus (123%), typhoid fever (101%), acute viral hepatitis (20%), hepatitis A (67%) have **risen** (DOH, 2023)

1. Water Sanitation

- provision of **safe, clean, and accessible drinking-water and sanitation services FOR ALL** (WHO, 2023)

2. Water Sources

- **GROUNDWATER**
 - underground in cracks and spaces in **soil, sand, and rock**
 - often **clear, free** from organic matter and bacteria (due to filtering effect of soil), contains minerals from soil
 - better in quality, less expensive
 - **TYPES: spring** (flows out), **well** (hole to withdraw water) (NEDA, 2021)

• SURFACE WATER

- **lakes, rivers** (highly vulnerable to pollution)
 - require **costly** treatment processes and specific operation **expertise**
- mostly recommended for **URBAN** areas: many connections and high consumption = recover costs (NEDA, 2021)
- example: **LAGUNA LAKE** -> Maynilad Water Services Inc., Manila Water Co.



3. Levels of Water Facilities

• LEVEL I (POINT SOURCE)

- protected well / developed spring with outlet but without distribution system
- go to source to fetch water
- **RURAL** areas (thinly scattered houses)
- average of 15 households within radius of 250 meters (NEDA, 2021)



• LEVEL II (COMMUNAL FAUCET SYSTEM / STAND POSTS)

- **piped system**: source, reservoir, piped distribution network, communal / public faucets (each to four to six households within a radius of 25 meters)
- go to supply point to fetch water
- **RURAL and URBAN** fringe areas (densely clustered houses) (NEDA, 2021)



• LEVEL III (WATERWORKS SYSTEM / INDIVIDUAL HOUSE CONNECTIONS)

- **system**: source, reservoir, piped distribution network, individual household taps
- can afford individual connections
- **URBAN** areas (densely populated) (NEDA, 2021)
- requires minimum treatment of disinfection



4. QUALITY

• WATER QUALITY

- measures how good water is, to support **beneficial uses** / meet environmental **values**

• POTABLE WATER

- suitable for drinking & cooking
- considers **SAFETY** in terms of health and **ACCEPTABILITY** to consumer (color, taste, odor)

- PREFERABLE: **MINIMUM AMOUNT OF TREATMENT** than sophisticated treatment plants (NEDA, 2021)

WATER QUALITY TESTS

Samples should be analyzed for **QUALITY PARAMETERS**.

Critical Parameters: 1. Microbiological (Total Coliform, Fecal Coliform) 2. Arsenic 3. Cadmium 4. Lead 5. Nitrate 6. Benzene 7. Color	8. Turbidity 9. Iron 10. pH 11. Manganese 12. Chloride 13. Sulfate 14. Total Dissolved Solids (TDS)
Other Parameters: 1. Temperature 2. Biological Oxygen Demand 3. Ammonia as NH3-N 4. Total Hardness 5. Chromium	6. Sulfide 7. Dissolved Silica 8. Total Mercury 9. Pesticides

Results shall be basis of **required treatment processes**.

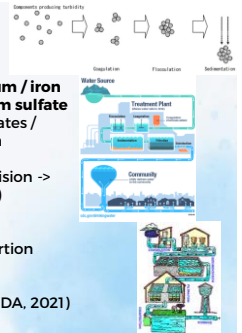
-> Phil. National Standards for Drinking Water of 2017 (NEDA, 2021)

>>> Water Treatment Methods

- depend on **QUALITY** of raw water being extracted (NEDA, 2021)

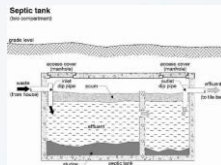
GROUNDWATER SOURCES	SURFACE WATER SOURCES
<ul style="list-style-type: none"> better quality 	<ul style="list-style-type: none"> may use conventional treatment process*
<ul style="list-style-type: none"> common problems: excessive iron and manganese 	<ul style="list-style-type: none"> turbidity, organic matter, pathogens, pollutants

- PRE-SEDIMENTATION**
 - removes / reduces sediment load
- COAGULATION**
 - adds and mixes (+) **coagulant (aluminum / iron salt, polyaluminum chloride; aluminum sulfate** - households) to destabilize (-) particulates / contaminants => bind; **can remove iron**
- FLOCCULATION**
 - gently **mixes** to accelerate particle collision -> aggregate into larger precipitates (**floc**) -> remove by sedimentation
- FILTRATION**
 - removes suspended particles in top portion
- DISINFECTION**
 - doses with **chlorine** before delivery (NEDA, 2021)



- Products when solids separate by settling and flotation:

- Scum**
 - lighter than water, **float to top**
 - e.g. oil, grease, fats
- Sludge**
 - sinkable, **settle at bottom**
 - e.g. soil, bones, unconsumed particles
- Effluent**
 - left over** after scum floated and sludge settled



Making Water Safe During Emergency

- If cloudy, filter through clean cloth / paper towel.
- Bring to **rolling boil for 1 minute** (bubbles are very large and quickly move to surface, where they break. Bubbles should move rapidly in the water as it is boiled)
- Let it cool. Store in clean sanitized containers. Cover tightly.
- To make taste better: add pinch of salt per liter OR pour multiple times from one container to another (**aerates** since air was lost)



[cdc.gov/healthywater/emergency/pdf/make-water-safe-during-emergency-p.pdf](https://www.cdc.gov/healthywater/emergency/pdf/make-water-safe-during-emergency-p.pdf)

DISINFECT

- Use unscented household **chlorine bleach**, iodine, or chlorine dioxide tablets. Mix well. Wait at least **30 minutes** before using.
 - 5-9% concentration of sodium hypochlorite:** little less than 1/8 teaspoon bleach in 1 gallon water OR 1/2 teaspoon in 5 gallons water
 - 1% concentration:** 1/2 tsp in 1 gallon OR 2 1/2 tsp in 5 gallons
 - cloudy tap water:** 1/4 tsp in 1 gallon

STORE

- at least 1 gallon per person per day for 3 days for drinking and sanitation
- 2-week supply, if possible
- Replace every six months

[cdc.gov/healthywater/emergency/pdf/make-water-safe-during-emergency-p.pdf](https://www.cdc.gov/healthywater/emergency/pdf/make-water-safe-during-emergency-p.pdf)

5. Frequency

- depend on source, past unsatisfactory results, treatment adequacy, contamination risks, disinfection practices

- Level I: every 3 months
- Level II: every other month
- Level III: monthly
- Food establishments: every other month
- Ice plants: once a month

(Philippine National Standards for Drinking Water of 2017)

6. Properties of Water

- **PHYSICAL**
 - color, turbidity, odor, temperature, taste
- **CHEMICAL**
 - pH, electrical conductivity, salinity (salts), alkalinity (bicarbonates), hardness (calcium, magnesium)
- **BIOLOGICAL**
 - microbial contamination (protozoans, bacteria, viruses, helminths), fecal matter (total coliform, E. coli)

7. Philippine National Standards for Drinking Water

(DOH Administrative Order 2017-0010)

- **STANDARDS FOR DRINKING-WATER QUALITY**
 - must be **clear** and does not have objectionable **taste, odor, and color**; pleasant to drink and free from harmful organisms, chemical substances, and radionuclides
 - standard values:
 - microbiological (e.g. total coliform, E. coli),
 - chemical (e.g. arsenic, cadmium, lead, mercury, nitrate),
 - physical (e.g. taste, odor, color, turbidity)

8. Water-related Diseases

- **WATER-BORNE**
 - infections spread through **contaminated drinking water** (e.g. with human / animal feces)
 - **Diarrheal diseases**: rotavirus, E. coli -> severe dehydration, fluid loss (WHO, 2017)
 - **Typhoid Fever**: bacterium Salmonella Typhi -> bloodstream
- **WATER-WASHED**
 - due to **lack of proper sanitation and hygiene**
 - **Ascariasis**: eggs in feces, can contaminate soil
 - **Ancylostomiasis**: infection with hookworm

• WATER-BASED

- infections transmitted through aquatic **invertebrate**
- **Schistosomiasis**: infested water: periodic, targeted treatment with praziquantel (WHO, 2023)

• WATER-RELATED INSECT VECTOR

- transmitted by **insects** that depend on water for propagation
- **Malaria**: female Anopheles -> fever, headache, chills (WHO, 2023)
- **Lymphatic Filariasis**: mosquitoes infected with microfilariae -> parasite larvae enter body (WHO, 2023)
- **Japanese Encephalitis**: mosquito-borne flavivirus

9. Other Laws / Policies

- **Republic Act 9275 (Clean Water Act)**
 - DENR as lead agency, DOH for quality standards
 - LGU: monitor water quality, emergency response
 - prohibits directly using **booster pumps** in distribution system
- **Implementing Rules and Regulations of the Code of Sanitation (P.D. 856) Chapter II**
 - prohibitions, such as drilling wells within 50 meters from cemetery, and constructing dwellings within catchment area of protected spring water source

10. Implications to Nurses' Care of Families

- **CONTAMINATION**
 - Prohibit washing and bathing **within a radius of 25 meters** from any well / drinking water source.
 - Prohibit construction of wells **within 25 meters** from any source of pollution.
 - Prohibit storage of radioactive materials **within a radius of 25 meters** from any well / water source.
- **SANITATION AND HYGIENE**
 - Habits (e.g. handwashing, personal hygiene), living conditions
 - Food preparation & storage, food choices, water storage (source, container, cover, duration)
 - Hydration