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Water, Sanitation, and Hygiene (WASH) Situation in Bicol University, Albay, Philippines

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Abstract

The Philippines is committed to "achieve universal and equitable access to adequate, safe, affordable drinking water and equitable sanitation and hygiene for all by 2030" (SDG 6). Thus, this study attempted to assess the water, sanitation, and hygiene (WASH) situation of Bicol University (BU) in terms of existing water facilities and water quality, sanitation, and hand washing facilities; the ratio of female and male students and personnel to WASH facilities; and the risks for contamination of wells with mechanized pumping. This study employed the descriptive survey of WASH facilities utilizing spot-checking and observation checklists based largely on School Sanitation and Health Services Guidelines and Sanitary Inspection Form from the Department of Health (DOH) as well as document analysis of the existing DOH microbiological test report. Of the 15 colleges and three support units of the university, six (33%) had wells with mechanized pumping (Level 1), 10 (56%) were being served by water districts (Level 3) and two (11%) had both Levels 1 and 3. Water from the aforesaid wells was unsafe to drink based on the DOH 2018–2019 microbiological test report of fecal contamination, which corroborates the moderate risk assessment findings. The sanitation facilities were not sufficiently maintained and proper hygiene not strictly observed due to non-functioning equipment, inadequate water supply, and non-provision of cleaning materials and toiletries, hence students and personnel are at risk for WASH-related infections. The present ratio of female and male students and personnel to WASH facilities meet the Code on Sanitation of the Philippines standards. It is therefore advocated to increase financial investment in operation and maintenance of existing WASH facilities through sustainable budgetary allocation for repair, janitorial services, cleaning materials, and toiletries.

Keywords: *microbiological, risk assessment, students, university, WASH facilities*

Introduction

Access to safe, accessible, available, affordable, and acceptable water, sanitation, and hygiene is a human right (Gleick, 1998). The Philippines is committed to "achieve universal and equitable access to safe and affordable drinking water for all" and to attain access to adequate and equitable sanitation and hygiene for all by 2030 through updating the national standards for safe drinking water (Lomboy *et al*., 2017).

Students around the globe have no access to adequate water and improved sanitation and almost 50% of grade schools in the underdeveloped countries have no adequate water and sanitation on school grounds (UNICEF, n.d.). It is noteworthy that students and personnel spend much of their waking hours in the school. In fact, their activities of daily living (ADLs) are performed mostly in the academic institution, which usually involve water for drinking, hand washing and personal hygiene, and sanitation. Hence, availability of sufficient, safe drinking water, clean toilets, and hand washing facilities is highly important in promoting the general welfare of the students and personnel of Bicol University. Further, girls and women are more vulnerable to sexual harassment and abuse than men, thus, facilities should be gender-sensitive (Benya *et al*., 2018). They may also be anatomically predisposed to genitourinary infections, so they need more water for their personal hygiene. The prevalence of water-borne infections among students and personnel in the university could not be determined because their possible exposure to contaminated water could happen outside the campus, hence, this study focused mainly on the risks.

This study attempted to establish the present situation of students and personnel in terms of access to safe water, improved sanitation, and proper hygiene in the colleges and units of Bicol University. Specifically, it tried to assess the existing water facilities and water quality, sanitation (toilets), and hand washing facilities (lavatories) and the ratio of female and male students and personnel to number of WASH facilities, as well as the risk for contamination of wells with mechanized pumping (Level 1 water facilities).

Materials and Methods

Data Gathering Methods

All colleges and units of Bicol University were included in this descriptive survey. Spot-checking and observation checklists based largely on School Sanitation and Health Services of the Code of the Philippines Guidelines, and sanitary inspection tool from the DOH were used in the survey of water, sanitation, and hygiene (WASH) facilities of Bicol University and in assessing the level of risk for contamination of water from wells without treatment (Level 1).

Assessment through spot checking of water facilities as sources of drinking water, handwashing, and personal hygiene in various colleges and units of the university was conducted. The existing water facilities were then categorized into Level 1 and Level 3 based on Local Water Utilities Administration (LWUA) criteria. Likewise, assessment of the university's toilets and hygiene facilities utilizing the spot checking and observation checklists was done. The checklists were designed to measure the number of both functional and nonfunctional bowls, urinals, and basins (lavatory) for hand washing for both female and male students and personnel of Bicol University. Other significant observations such as water supply to toilets, urinals, and lavatories, flush and faucet and provisions of soap and soap dispenser, towels, and trash bins were also noted. Likewise, lighting and ventilation, partitions, and locks of cubicles were part of the assessment.

The researcher performed risk assessment of all Level 1 facilities (deep wells) in various campuses and colleges of BU using the Department of Health (DOH) Sanitary Inspection Form, which contains the specific Diagnostic Information for Risk Assessment. The number of *yes* answers to the nine questions in the checklist were used to determine the risk score and interpreted as indicated in Table 1.

Table 1. Risk Score Interpretation

Risk Score	Description
7–9	High
3–6	Moderate
0–2	Low

Secondary Data and Documents

To determine water potability (quality) of water sources of the university, the researcher made a review of the existing data on microbiological tests of water samples from wells with mechanized pumping (Level 1) submitted to the DOH in 2018-2019 by the university health clinic personnel. The results of the DOH water tests are presented in Table 2.

The number of female and male students and personnel were also obtained from the University Registrar's Office (URO) and Human Resource Management Office (HRMO), respectively, to determine the ratio of female and male students and personnel to the number of existing WASH facilities.

The yellow star found in the spot map (Figure 1) shows the location of wells with mechanized pumping and the blue star for water districts. Colleges of Nursing (main campus) and Agriculture and Forestry (Guinobatan Campus), and the Research & Extension Office in the BU East Campus were connected to water districts and so were the other campuses, colleges, and units not found in the spot map. The College of Science located in the Main Campus, the Colleges of Social Sciences and Philosophy (CSSP), and Business, Economics & Management (CBEM) in Daraga Campus had wells with mechanized pumping as their source of water. Likewise, all colleges in the East Campus, namely Engineering, Industrial Technology, and Architecture extract water from wells with mechanized pumping without treatment facility.

This study underwent ethics review and approved by the Institutional Review Board (IRB) of Bicol Regional Training & Teaching Hospital (BRTTH), Legazpi City, Albay, Philippines. It was structured in accordance with ethical considerations with special attention on the protection of all participants. The duration of the study was six months after its technical and ethical soundness was established.

Descriptive statistics, such as frequency count and

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Figure 1. Bicol University Main Campus (A), Daraga Campus (B), East Campus (C) and Guinobatan Campus (D). Legend: Yellow star for wells with mechanized pumping - Level 1; Black star for Water Districts - Level 3.

percentage, were used in this study. The data generated by the spot checking and observation checklists were collated, interpreted, and analyzed in three levels: textual analysis, analysis with implications, and inference.

Results and Discussion

Existing Water Facilities and Water Quality

Of the 15 colleges and units and three support units of the university, six or 33% had wells with mechanized pumping (Level 1). Ten (56%) colleges and units were being served by water districts (Level 3) while 2 or 11% had both Levels 1 and 3. Six colleges and units with the aforesaid wells submitted water samples to DOH for microbiological tests while two did not.

Sources of water are categorized into three levels: Level 1, or point source which may be a well or a developed spring with an outlet but without a distribution system, and serves only 60 to 100 individuals; Level 2, a communal faucet system, which consists of source, a reservoir, and piped distribution network that can serve an average of 400 persons; and Level 3, a waterworks system with individual house connections that requires a minimum treatment of disinfection (Del Rosario *et al*., 2012).

Only the Colleges of Nursing in the BU Main Campus, College of Social Sciences and Philosophy, and College of Business Economics and Management in Daraga Campus, as well as College of Engineering, College of Industrial Technology, and Institute of Architecture in the East Campus had available records of microbiological water testing in their health clinics. It was also found out that only water samples collected from wells were submitted to the DOH for microbiological tests (Table 3).

According to Johnson (2010), a laboratory commonly will report the bacteriological test as positive or negative, indicating the presence or absence of total coliform bacteria. A negative total coliform bacteria result means the water is safe for human consumption

Table 2. Existing Water Facilities in Bicol University

Campus	College/Unit	Water Facility Level	Description
BU Main Campus	BUCM	Level III	Water District
	BUCAL	Level III	Water District
	BUCN	Level III	Water District
	BUCS	Level I	Well with mechanized pumping
	BUIPSR	Level I	Well with mechanized pumping
	BUCE	Level III	Water District
	BUGASS	Level III	Water District
		Level III	Water District
BU East Campus	BUCENG	Level I	Well with mechanized pumping
	BUIA	Level I	Well with mechanized pumping
	BUCIT	Level I	Well with mechanized pumping
	BURDMD	Level III	Water District
	BUEMD	Level III	Water District
BU Gubat Campus	BU Gubat	Level III	Water District
BU Guinobatan Campus	BUCAF	Level III	Water District
		Level I	Well with mechanized pumping
BU Daraga Campus	BUCBEM	Level I	Well with mechanized pumping
	BUCSSP	Level I	Well with mechanized pumping
BU Polangui Campus	BU Polangui	Level III	Water District with electric pump, pressure tank and reservoir
BU Tabaco Campus	BU Tabaco	Level III	Water District

from a bacteriological standpoint while a positive total coliform test would indicate unsanitary conditions and the possible presence of disease-causing organisms. Total coliform bacteria are a group of several kinds of bacteria commonly found in the environment, including soil, vegetation, untreated surface water and in the intestinal tract of warm-blooded animals, including humans. Further testing should include the subgroup fecal coliform and its subgroup, *Escherichia coli*. A positive fecal coliform would indicate possible recent sewage or animal waste contamination (Johnson, 2010).

Significantly, samples of well water having the highest fecal coliforms were collected from wells in the College of Business, Economics & Management (2018) and colleges of Engineering and Institute of Architecture (2019) both with 8.0. For total coliforms, the colleges that registered the highest were Colleges of Nursing and Engineering with 129.8 and 8.8, respectively. Overall, all water samples were positive for total coliforms, which suggests contamination and pollution of water sources; thus, water from these sources is non-potable or not safe to drink. Nevertheless, health clinic personnel of the university made sure that students and personnel are well-informed of the dangers of utilizing water from these wells.

There were no available data on microbiological tests for water samples from water districts in health clinics of the university. The health personnel simply did not submit water samples from water districts for microbiological test probably because water from

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Table 3. Microbiological test report of selected water sources within Bicol University

Colleges/Units with Deep Wells	Date Specimen Collected	Result of Analysis		Remarks
		Fecal Coliforms	Total Coliforms	
Main Campus				
College of Nursing	2019	<1.0	129.8	Failed
College of Science	No available data	-	-	-
Daraga Campus				
College of Social Sciences & Philosophy	2018	1.1	>8.0	Failed
College of Business, Economics & Management	2018	8.0	8.0	Failed
East Campus				
College of Engineering	2019	>8.0	>8.8	Failed
College of Industrial Technology	2019	4.6	>8.0	Failed
Institute of Architecture	2019	>8.0	>8.0	Failed
Guinobatan Campus				
College of Agriculture & Forestry	No available data	-	-	-

these sources undergo physical and chemical treatment. In fact, Legazpi City Water District's (LCWD) water supply system includes water storage facilities, hydraulic control structures, wells, springs, and a water treatment plant being operated by the Philippine Hydro Incorporated. For BU Tabaco Campus, Tabaco City Water District (TAWAD) is its water supplier, while BU Polangui Campus is connected to Polangui Water District.

Despite the amount of awareness created, waterborne diseases still pose threat, especially in developing countries. Onichandran and colleagues (2014) investigated the occurrences of waterborne parasites from various samples in the Philippines, and the study revealed that samples obtained from dispenser, well, and faucet were positive for *Acanthamoeba* spp. and *Naegleria* spp. Waterborne pathogen contamination in water resources and related diseases are a major water quality concern throughout the world, so there is a need to provide a broader perspective of pathogen contamination in fresh water (rivers, lakes, reservoirs, and groundwater) and saline water (coastal waters) resources (Pandey *et al*., 2014). Floods, droughts, and heat waves enhance the effects of waterborne pathogens by increasing the concentration of biological agents in surface water (Marcheggiani *et al*., 2010).

De Guzman (2012) found that drinking water from unchlorinated wells was a significant risk factor in the cholera outbreak in Nabua, Camarines Sur in 2012. She suggested that future efforts to control cholera should include not just improving water and sanitation systems but also intensified behavior change campaign on proper hygiene.

The amount of water locally extracted from deep wells in the university could not be calculated because wells (Level 1) have no water meter. It was observed that there was no continuous water supply to WASH facilities (toilets, urinals, and lavatories), which could be due to low water supply or losses from defective distribution pipelines, flush, and faucet, or both. According to personnel assigned in Level 1 water facility, water extracted from deep wells is not sufficient to meet the needs of students and personnel. It is safe to say then that the minimum of 40 liters per capita per day is not maintained (Implementing Rules and Regulations of Presidential Decree No. 856) in colleges and units not covered by water districts.

The Philippines has among the lowest total water potential per capita of all Asian countries, defined as availability in both ground and surface water in million cubic meters (Fehr *et al*., 2013). According to the

Philippines Water Code, the central government owns all water, and all uses of water must be approved and permitted by the water authorities. Water shortage is made worse by a history of government mismanagement and environmental degradation, and many parts of the country frequently experience drought as a result of El Niño weather (Fehr *et al*., 2013).

Students' access to adequate and safe sources of water can result in better health and, therefore, better school attendance and performance with positive longer-term consequences for their lives.

Sanitation (Toilets) and Hand Washing Facilities

Fifty-nine percent (59%) of bowls had non-functional flush, 88% of urinals had non-working flush, 52% of wash basins had defective faucet, all of which with or without continuous water supply (Figure 2). Further, there is little to no provision of soap and toilet papers. These suggest that majority of toilets are insufficiently maintained and personal hygiene not properly observed; hence, the students are at risk for diseases via contact transmission. In addition, 41% of toilets had no proper ventilation and having unpleasant smell, 20% had inadequate lighting, and 25% had damaged partition or without lock.

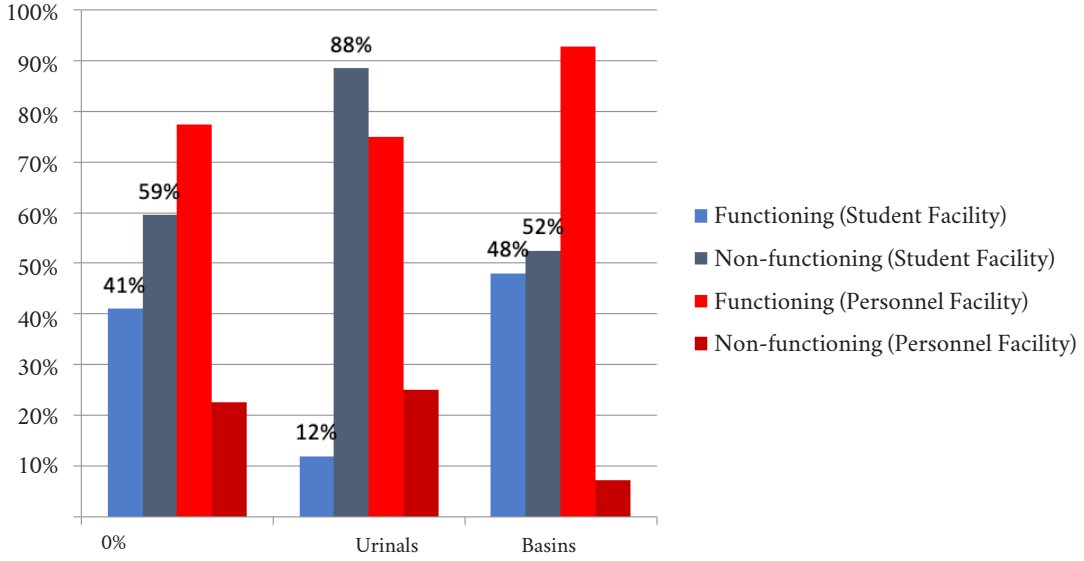

Figure 2. Sanitation (Toilets) and Hand Washing Facilities in Bicol University

Schools and universities that properly design their comfort rooms and carefully choose the equipment and fixtures for them are in better position to provide students with safe, clean and user-friendly facilities. Toilets do not always receive the attention they require. Their design may not have been thought of originally. Cleaning and maintenance schedules may not be sufficient to remove grime and stinky odors. In schools where thousands of students and personnel a day may use a toilet, this can lead to facilities that are breeding grounds for pathogens and parasites. Some students may decide to endure physical discomfort rather than take a step into such an unsafe and unsanitary place, and they may find it difficult to concentrate on their school work. The use of the toilet may cause many students and personnel discomfort or embarrassment.

Of 254 bowls, 151 or 59.45% had non-functional flush and/or without continuous water supply. Water is stored in water buckets without cover and manual flushing is done by users. If they are in a rush, they tend to forget to flush the bowl and urinal after use. Contamination of water is likely to happen during transport and storage. Water containers without cover may also become breeding places for dengue mosquitoes. Needless to say, the presence of water inside the toilet is of particular importance in school where water is culturally the primary anal cleansing material.

Of 86 urinals, 76 or 88.37% had non-functional flush with or without continuous water supply. Where

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building codes allow, educational institutions may install urinals that use no water. Manufacturers estimate that a no-water urinal can save up to 40,000 gallons of water a year or can install ultra-low flow urinals, which use as little as one-eighth of a gallon per flush (Tilley, 2014). A growing emphasis on energy conservation and environmental awareness in schools and universities has given rise to many ways for institutions to cut back on the use of water and electricity.

Of 168 basins for hand washing, 88 or 52.38% had defective or non-functional faucet with or without continuous water supply. It is assumed that proper hand washing is not habitually practiced among students due to insufficient water, defective sinks, and unavailability of soap and toilet paper or hand dryer. Thus, there is high risk for transmission of fecal-borne infections through contact transmission.

The Implementing Rules and Regulations (IRR) of the School Sanitation and Health Services of the Code on Sanitation (PD 856) provides that wash basins shall be installed inside the toilet room and shall be provided with water and soap at all times. Paper towels are preferred for hand drying in the absence of mechanical drying device. The use of a common towel shall not be permitted. Inside the toilet, installing covered trash bins, soap dispensers, paper towel dispensers, and wall-mounted fixtures so they are tamper-resistant help prevent abuse. An open entryway deprives students of the isolation that may give them the opportunity to pick on another student or destroy fixtures, equipment, and facilities. In addition, the open doorway enables personnel to keep an eye on student behavior without difficulty from the corridor.

Of 65 toilets, 13 or 20% had busted bulbs or insufficient number of bulbs. Inadequate lighting may make a toilet seem less clean. A well-lighted space will seem more welcoming and possibly lessen the anxieties of students who are apprehensive about using a school toilet especially at night.

Out of 65 toilets for students, 27 or 41.54% had unpleasant smell since there was no proper ventilation nor provision for soap, cleaning materials, deodorizers, and disinfectants to maintain the cleanliness of toilets and wash areas. Only five colleges had their hand-washing facilities constructed outside the toilets, which make them more accessible to users. Of the 254 cubicles, 64 or 25% had damaged partitions or without lock. This condition may provide opportunities for bullying and other inappropriate behavior among students.

The study by Ngidi (2018) revealed that learners experienced toilets as the most dangerous areas inside their school, reporting that they encountered a lot of bullying in these spaces. In particular, bullying in the school toilets was characterized by violence, including physical, and sexual assaults, as well as criminal activity (mostly muggings) and threats of violence (Ngidi, 2018). The impacts of bullying on the victim, in particular, but also on the bully and those around them, are dire. For example, such bullying has been found to result in long-term psychological and physical harm for the victim. In particular, young people's social and cognitive development are negatively impacted, where learners study in fear, concentration is impaired, and schooling outcomes are compromised (Mncube & Steinmann, 2014).

Toilets had no periodic desludging of septic system and there was no treatment facility for waste water generated by school laboratories. This is one of the risks identified most especially in the College of Science who have laboratories dedicated for microbiological experiments (Guerrero & Serrano, 2018). Septic tank practices in the Philippines are traditionally haphazard. Septic tanks are mostly undersized and poorly constructed. They are frequently installed underneath buildings, driveways, or sidewalks due to small lot sizes, thus, making access for inspecting or desludging difficult. In many instances, what people refer to as "septic tanks" are not septic tanks at all, but are instead seepage pits. These single-chambered and unlined earthen receptacles not only do a very poor job at treating sewage, but they frequently serve as direct conduits to aquifers, resulting in fecal contamination that can impact precious drinking water supplies (Robbins, 2007). Most of the time, discharge is directed to drainage canal without treatment.

In the Philippines, only 10% of wastewater is treated while 58% of the ground water is contaminated. Only 5% of the total population is connected to a sewer network. The vast majority uses flush toilets connected to septic tanks. Since sludge treatment and disposal facilities are rare, domestic wastewater is discharged without treatment (Claudio, 2015).

Ratio of Students and Personnel to WASH Facilities

According to Section 6 of the Sanitary Facilities Requirements of School Sanitation and Health Services Code of the Philippines, for every 100 males, there must be two toilet bowls, one urinal, and two lavatories. For each additional 100 males, there should be an addition

of one toilet bowl, one urinal, and one lavatory. On the other hand, for every 100 females, two toilet bowls and two lavatories must be provided, and one toilet bowl for each additional 50 females, and one lavatory for each additional 100 females (DOH, 2016).

Sex-disaggregated data were gathered because female and male students may have varied WASH needs and preferences and so do female and male personnel. Sustainable Development Goals (SDG) call for WASH facilities that are gender sensitive and responsive. In fact, WASH and gender equality are represented in SDGs 6 and 5, respectively, and also contribute to the achievement of other sectoral goals across the development agenda. Effective gender-responsive programming in the Water, Sanitation, and Hygiene (WASH) sector can contribute to progress towards gender equality and important WASH results (UNICEF, 2017).

The ratio of toilets and hand washing facilities (both functional and non-functional) to number of students and personnel of Bicol University is ideal (Table 4). However, it is projected that the number of students enrolled in Bicol University shall double in two years when students will have reached college levels 3 and 4. By then, the WASH facilities such as bowls, urinals, and basins will fall short in terms of ratio to the number of students. There is a need to provide additional toilets, urinals, and lavatories in anticipation for the expected inadequacy of these facilities.

Table 4. Ratio of Students and Personnel to WASH Facilities

	Females			**Males**			
	Total	Bowls	Basins	Total	Bowls	Urinals	Basins
Students	7,797	142	90	4,930	112	87	63
Ratio		1:55	1.87		1:44	1:57	1:78
Projected Ratio in 2021-2022	15,594	1:109	1:173	9,860	1:88	1:113	1:157
Personnel	475	57	55	397	31	48	28
Ratio		1:8	1:9			1.8	1.14

The data in Table 4 show that students' toilets and hygiene facilities are gender sensitive and responsive because there are separate facilities for females and males while most bowls and basins in personnel's toilets are shared.

Among ASEAN countries, around a quarter of all workplaces did not have toilets in Cambodia, and around 14% of workplaces had inadequate toilets in the Philippines (Aidara, 2016). In Vietnam, around 74% of marketplaces had no toilets. Assuming women employees were absent for one day a month due to lack of WASH facilities during their menstrual period, Aidara (2016) estimates more than 15 million workday absences in the Philippines and Vietnam combined and corresponding economic losses of millions of dollars. She emphasized that female employees need services and infrastructure, in particular private, clean and equipped spaces where they can change and wash, and dispose of sanitary materials safely and discretely. In fact, a safe work environment should include access to these services as a critical component of a decent work environment (PSA, 2019). Hence, employers need to provide at least one toilet for the workplace, and separate toilets for men and women if there are workers of both sexes in the workplace.

Risks for Contamination of Wells with Mechanized Pumping (Level I)

The most common risk assessment findings among the eight sites include the presence of a toilet and sewer within 100 m of pump house, faulty drainage around the pump house, absence of fence around the pump house allowing animal entry, permeability of the floor to water, and accumulation of water pools. Five risk factors were found to exist in five wells (62.5%) while three sites (37.5%) displayed four of the identified risk factors. Generally, the risk scores of all sites surveyed were interpreted as moderate level of risk.

The study of Escamilla (2013) revealed that wells surrounded by toilets, latrine-polluted ponds, and higher population densities were more frequently contaminated with fecal coliforms. The use of broken septic tanks result in surface contamination, the risk

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Table 5. Risk Assessment of Level 1 Water Facilities of Bicol University

College/Institute	Risk Score	Level of Risk
Nursing	4	Moderate
Science	5	Moderate
Engineering	5	Moderate
Industrial Technology	5	Moderate
Architecture	5	Moderate
Business, Economics and Management	4	Moderate
Social Sciences and Philosophy	4	Moderate
Agriculture & Forestry	5	Moderate

of shallow aquifer contamination increases and in turn influences health. For every additional toilet within a 40-m radius of a well, the fecal coliforms detection frequency increases by 1.5 percent. Detectable fecal contamination in wells indicates a need for groundwater treatment. She emphasized the importance of integrating population and environment data to identify circumstances in which shallow well water quality is compromised and students and personnel are put at risk of contracting diarrheal diseases. Sanitation interventions should highlight the spatial separation of toilets and drinking water wells to limit contamination (Escamilla, 2013).

Students and personnel in the university are often dependent on low-yielding wells fitted with mechanized pumps for water supply, and on communal toilets for the disposal of human sewage. The disposal of sewage to the subsurface from which groundwater is also pumped could lead to cross-contamination. Reduced separation between on-site sanitation systems and water supply wells, and hence an increased risk of pollution (Macdonald, 1999). Where on-site sanitation and wells are in close proximity is the contamination of well water by pathogenic microorganisms which include bacteria, viruses and protozoa. Analysis of water samples from the 6 wells whose samples were microbiologically tested at the DOH Region V in Legazpi City, had identified fecal coliform in all the 6 wells assessed.

The need to assess the quality of water from the source to ascertain the role of well construction methods has now become imperative because of the health impacts on individuals (Ayantobo *et al.*, 2012). *E. coli* and total coliform counts are more pronounced in wells that are installed close to domestic refuse waste, abattoir, toilet, stagnant water and drainage. Concentrations decrease with increasing distance from the pollution sources irrespective of well classification. Hence, he recommended regular monitoring of groundwater quality, abolishment of unhealthy waste disposal practices and regulation of self-supply well construction and design.

Sanitary surveys carried out at the well sites showed moderate risk for contamination from latrines: all eight wells had a latrine within 10–15 m. However, contamination of a well does not necessarily mean that either the latrines are responsible or that the groundwater is widely contaminated—contamination may be the result of poor design and/or construction (Macdonald, 1999). The microbiological test and sanitation assessment results would appear to show there is significant bacteriological contamination, and it is possible that this may be derived from toilets with contaminants entering wells at shallow depths.

Majority of the sites were densely populated by students. Their activities in school may be considered as a risk factor. Most water becomes polluted by human activities, which include throwing sewage and industrial waste into rivers and oceans, and even littering. All of these human activities seriously affect water sources. Dumping sewage waste and contaminated water into rivers and oceans pollutes the environment and becomes a health problem (Stroupe, 2014).

The areas around most wells were water logged being located in the annual floodplain of a river. Especially for colleges in the main campus, these wells are proximal to the Sagumayon river whose continuous flooding may contribute to this water-logging (Cipriano, 2018). Floodplains are land areas adjacent to rivers and streams that are subject to recurrent overflowing and flooding, which is a natural event for a river or stream (Organization of American States, 1991). Moreover, most wells were not fenced so humans and astray animals could get near the water source. It is noteworthy that mechanized pumping may contribute to seepage of fecal materials into the water sources. Generally, there is moderate risk for contamination of wells with mechanized pumping (Level 1) water facilities in the university brought about by the aforesaid factors.

With these findings, the following are recommended:

1. Integrate WASH program in the 10-point agenda of the university president.

2. Increase financial investment in operation, repair, maintenance, and cleanliness of existing WASH facilities. This can be accomplished via national budget allocations or by identifying income-generating projects of each college and unit of the university. Allocate sustainable budget for WASH facilities, specifically for repair, proper cleaning materials, and toiletries such as soap and toilet paper or dryer.

3. All colleges and units of the university must be connected to Level 3 water facility (water districts).

4. Put up treatment facility for wells with mechanized pumping (Level 1) water facilities in the university.

5. Collect water samples from all water sources (Levels 1 & 3) of BU and submit to DOH accredited laboratories for drinking water analysis at regular period.

6. Put up treatment facility for waste water generated by school plumbing and laboratories.

7. Formulate water safety plan for all water facilities in the university in order to identify and manage risks from catchment to consumer.

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