

A COMMUNITY-BASED SANITATION FACILITY DESIGN: ACHIEVING SUSTAINABLE SANITATION of the INDIGENOUS COMMUNITY in SITIO CAMACHILE, NABUCLOD, FLORIDABLANCA, PAMPANGA

Paul Vincent M. Infante¹, Lee Lorenz B. Lacson², Noriel A. Layson³, Jeanelle Dean L. Layug⁴, Mar B. Lucero Jr.⁵, Gorgette Mae M. Sahagun⁶, Engr. John Vincent G. Tongol⁷, Engr. Inla Diana C. Salonga⁸

¹(Department of Civil Engineering, Don Honorio Ventura State University, Bacolor, Pampanga, Philippines
Email: 2020101014@dhvsu.edu.ph)

²(Department of Civil Engineering, Don Honorio Ventura State University, Bacolor, Pampanga, Philippines
Email: 2020100208@dhvsu.edu.ph)

³(Department of Civil Engineering, Don Honorio Ventura State University, Bacolor, Pampanga, Philippines
Email: 2020100214@dhvsu.edu.ph)

⁴(Department of Civil Engineering, Don Honorio Ventura State University, Bacolor, Pampanga, Philippines
Email: 2020100215@dhvsu.edu.ph)

⁵(Department of Civil Engineering, Don Honorio Ventura State University, Bacolor, Pampanga, Philippines
Email: 2020100223@dhvsu.edu.ph)

⁶(Department of Civil Engineering, Don Honorio Ventura State University, Bacolor, Pampanga, Philippines
Email: 2020101307@dhvsu.edu.ph)

⁷(Department of Civil Engineering, Don Honorio Ventura State University, Bacolor, Pampanga, Philippines
Email: jvgtongol@dhvsu.edu.ph)

⁸(Department of Civil Engineering, Don Honorio Ventura State University, Bacolor, Pampanga, Philippines
Email: icsalonga@dhvsu.edu.ph)

Abstract:

Sanitation and hygiene, along with secure access to safe water, remain significant problems in the Philippines, particularly in the Indigenous community where, poverty, remoteness, exclusivity, and limited resources often amplify these challenges. This lack of necessities contributes to the high propagation of waterborne diseases and other illnesses, compromising overall health and well-being and negatively impacting the natural environment. Aeta residents of Sitio Camachile, Nabuclod, Floridablanca, Pampanga were assessed to better understand their conditions and situations in accessing safe water, sanitation, and hygiene (WaSH). The study utilized an embedded mixed-method design. The collected data and information from the developed assessment tool were scaled and rated based on the level of the WaSH services ladder set by the Joint Monitoring Program developed by the World Health Organization (WHO) and the United Nations (UN). The findings revealed that Sitio Camachile had a basic level of service for drinking water, indicating that water came from an improved source and could be accessed within a relatively short distance of less than half an hour however, some Aeta residents still relied on open sources like the river. Furthermore, the study found that more than half of the Aeta residents practiced unimproved sanitation, resorting to open defecation due to inadequate sanitation facilities. Additionally, hygiene practices were found unimproved, due to the lack of proper facilities to perform appropriate practices. These results showed that the Aeta community of Sitio Camachile needed interventions and initiatives to improve their sanitation and hygiene conditions. Hence, the study provided recommendations for various sites and locations of the proposed sanitation facilities in the entire sitio. The design and plan of the sanitation facilities prioritized accessibility, efficiency, security, and privacy to promote inclusivity and sustainability.

Keywords —*Safe Water, Sanitation, and Hygiene (WaSH), Indigenous Community, Sustainable Development Goals 6 (ensuring the rights for safe water and sanitation)*

I. INTRODUCTION

One requirement for the sustenance of well-being is having access to safe sanitation [1]. Sanitation is included in the WaSH programs created by the United Nations [2]. WaSH stands for Water (access), Sanitation, and Hygiene, and it is a set of interrelated programs and policies aimed at improving access to clean water, safe sanitation, and the promotion of good hygiene practices [1]. Within WaSH, sanitation plays a critical role in ensuring public health and well-being [1].

According to the United Nations, sanitation is the set of provisions of services that ensure privacy, safety, and dignity in the defecation and disposal of human waste [1]. One positive effect of proper sanitation services is preventing the spread of diseases and illnesses, through properly disposing of human excreta and separating it from human contact and the environment [2]. Also, it helps in maintaining cleanliness and hygiene. Additionally, sanitation contributes to promoting social equality and inclusivity, economic stability, and sustainable development.

Furthermore, the United Nations recognizes the importance of sanitation and includes it as a key component of the Sustainable Development Goals (SDGs), specifically SDG 6, “Ensure Availability and Sustainable Management of Water and Sanitation for all” [3] [4]. Goal 6 is dedicated to ensuring that everyone has access to these essential and basic services, especially the vulnerable groups who often get left behind [3] [4] [5].

Moreover, many Indigenous people are one of the most vulnerable groups of people who encounter barriers and challenges in accessing safe sanitation. Because these communities have specific and unique cultural and environmental circumstances, it is necessary to deal with concerns and issues about sanitation in a way that respects their beliefs and cultural and environmental traditions.

In the Philippines, Indigenous people make up almost 14% of the total population. However, they face different challenges and hardships that prevent them from enjoying their rights compared to the general population. They are among the least fortunate and most vulnerable groups in the country. Unemployment, illiteracy, and poverty rates are much higher for Indigenous people compared to the general population of the country. Moreover, these Indigenous communities tend to be very isolated and lack access to basic essential needs, so in return, they suffer from high rates of illness, starvation, and death from lack of access to basic needs [6].

Moreover, the Aetas, sometimes known as Agtas, are the largest Indigenous group in the Philippines, with a population of over 50,000. They mostly reside and make a living in the mountainous parts of the provinces in Luzon [7]. Furthermore, most Aetas in Pampanga are mainly in Floridablanca, Porac, Guagua, and Angeles City. In Floridablanca alone, 774 Aeta households live in Barangay Nabuclod [8]. Furthermore, Sitio Camachile, in Nabuclod, Floridablanca, is home to one-third

of these households or approximately 1,000 Aeta people [9]. Sitio Camachile is far from the city, which limits the resources of the residents. Concerns such as open defecation, substandard waste disposal, and inadequate hygiene practices continued to persist, deteriorating the well-being of the residents of the sitio. These issues impact public health and violate fundamental human rights to access secure and safe sanitation [7].

In line with these issues, addressing the sanitation challenges faced by the Aeta community in Sitio Camachile, Nabuclod, Floridablanca, Pampanga requires a comprehensive understanding and assessment of the existing poor sanitation condition [8]. The assessment identifies specific challenges, their root causes, and the unique socio-cultural factors that influence the sanitation condition of Sitio Camachile. This allows for the development of appropriate interventions that are culturally sensitive and aligned to the specific needs and preferences of the community [10].

II. METHODOLOGY

The study is dedicated to IMPROVING the overall quality of life by improving the sanitation condition of Sitio Camachile, Nabuclod, Floridablanca, Pampanga. The comprehensive multi-method approach to achieving this goal was organized into three phases as follows.

A. Phase 1: Assessment Tool Development

To gather relevant data and information, an assessment tool was developed for the evaluation of current water, sanitation, and hygiene (WaSH) services conditions with a focus on sanitation facilities and practices of the Aeta community in Sitio Camachile. The assessment tool was composed of five different sectors – three sectors (water management, the presence of sanitation facilities, and good hygiene practices) adapted and modified from WHO/UNICEF core questions in WaSH services and two sectors (households’ profile and WaSH-related activities) were created accordingly for the Aeta Community

The goal of developing the assessment tool was to gather comprehensive data and information that assessed the current WaSH service conditions in the Aeta community. The collected data and information then served as a basis for identifying areas that required improvement and developing interventions and initiatives to enhance water, sanitation, and hygiene practices in the community.

Furthermore, the developed tool was face-validated by experts in this field of study. Validation was important to check the tool's ability to gather relevant and useful data. Moreover, because the target population was Indigenous people, approval from the National Commission on Indigenous People (NCIP) of Floridablanca was undertaken.

B. Phase 2: The Administration of the Tool and the Assessment of WaSH Conditions of the Aeta Community in Sitio Camachile, Nabuclod, Floridablanca, Pampanga

After the validation of the developed WaSH assessment tool, the study administered the tool and conducted interviews among the Aeta residents of Sitio Camachile, Nabuclod, Floridablanca, Pampanga, to assess the present and existing WaSH condition of the community. For the interview and administration of the assessment tool, the National Commission on Indigenous Peoples (NCIP) of Floridablanca and the local government unit of Nabuclod were consulted, and permission was asked to conduct the study among the Indigenous Aeta community. The tool was administered to every household in the study locale. While the tool was intended to be administered to the entire population, it was crucial to respect the decisions of individual participants. Participants always had the right to reject or decline participation in the study. This evaluation aimed to identify the current WaSH services, their functionality, and the issues the Aeta Community faces in accessing them.

An embedded mixed-method design was utilized to conduct the study. Embedded research design simultaneously collected quantitative and qualitative data, whereas the qualitative data were embedded in the quantitative data. The study focused on quantitative data but needed supporting details from qualitative information. The study gathered quantitative data about the community's present water, sanitation, and hygiene practices, followed by interviews to accumulate qualitative data to explain the existing conditions of the community's water, sanitation, and hygiene practices. Moreover, descriptive statistics will determine the frequency and percentage of response distributions per question.

Furthermore, the statistical data was presented in point maps. Point maps will represent the condition of WaSH services in Sitio Camachile and display the geographic distribution of improved water access, toilet facilities, and handwashing facilities in the study locale.

C. Phase 3: Formulation of Sanitation Facility Plan and Design

Following the assessment of the WaSH condition, the study presented a visual representation of the sustainable sanitation facility plan and design suitable for the present circumstances of the community. This approach divided the study locale into clustered areas or zones by formulating the choropleth map of Sitio Camachile according to the gathered data. The gathered data, such as economic profile and water accessibility, will be the criteria and rubrics for the potential design of sanitation facilities. Furthermore, a point map will present households in the community with an improved sanitation facility and the ability to have one.

III. RESULTS AND DISCUSSION

This chapter comprised the data analyses, results, and discussion of the findings. Furthermore, the results of the study were based on the objective of the study focusing on the

WaSH condition of the Indigenous People in Sitio Camachile, Nabuclod, Floridablanca, Pampanga.

A. Development of Assessment Tool

The study aimed to comprehensively assess the conditions of the Water, Sanitation, and Hygiene (WaSH) in Sitio Camachile. The gathered data served a dual purpose. Firstly, to gain a deep understanding of the needs of the community focusing on the sanitation facilities that aim to improve the well-being of the Indigenous residents. Secondly, the data were shared with the local government unit (LGU) and the National Commission on Indigenous Peoples (NCIP) to advocate for long-term improvements in sanitation infrastructure and service delivery for the benefit of the Indigenous community.

Following the methodology developed for the study, in reference to several studies, assessments from various countries and different locations in the locale country, and with the adherence to the guidelines established by the Joint Monitoring Program (JMP) for Water Supply, Sanitation, and Hygiene of the World Health Organization (WHO) and United Nations Children's Emergency Fund (UNICEF), an assessment tool was developed. By aligning with these recognized standards, the assessment tool ensured the data collected were reliable, culturally sensitive, and could contribute to WaSH knowledge.

The assessment gathered data on the demographic profile, water access and usage, sanitation facilities, hygiene practices, water- and sanitation-related diseases, and the Indigenous Community's participation in WaSH-related programs and advocacies. Validation through item analysis was conducted, involving three professionals: a civil engineer, a licensed professional teacher, and a registered psychometrician. After passing through the validation process, the tool was submitted to the National Commission on Indigenous Peoples (NCIP) for approval to administer the tool to the Aeta community in Sitio Camachile. This process was done to ensure the accuracy and adherence to ethical standards in research involving Indigenous communities.

B. Assessment of the WaSH Condition of the Aeta Community in Sitio Camachile through the Assessment Tool

A total of 188 Aeta household respondents out of the 211 households residing in Sitio Camachile, achieving a high participation rate of 89%, were interviewed to gather data with the use of the formulated WaSH assessment tool. A face-to-face interview was conducted to collect data such as demographic and economic profile, water access and usage, sanitation facilities, hygiene practices, water- and sanitation-related diseases, and information access and participation of the Indigenous Community in WaSH-related programs and

advocacies. The following were the findings reported by the respondents based on the home visit interview:

1) Household Composition and Characteristics

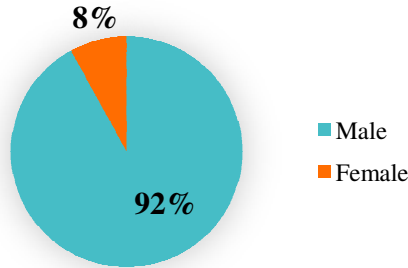


Fig. 1 Gender Distribution of Household Heads

It appeared in the figure above that most of the 92% of the household Sitio Camachile are headed by males while the remaining 8% have female heads.

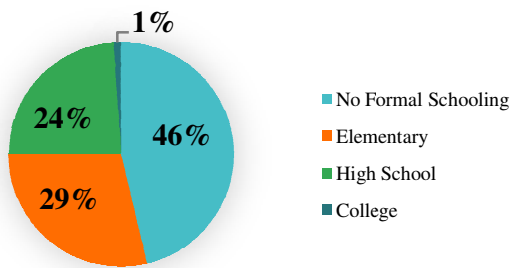


Fig. 2 Educational Background

The pie chart above, Fig.2, showed the distribution of educational attainment of 188 Aeta household heads. A significant portion, approximately 46%, lacked formal schooling. When interviewed, they attributed this to limited access to educational institutions and economic constraints. Only 1% or 2 household heads reported holding a college degree. While household heads who finished elementary and high school educational levels account for 29% and 24%, respectively.

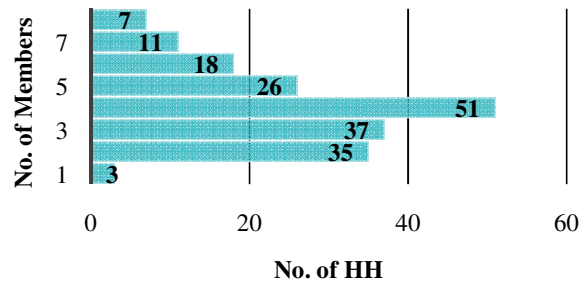


Fig. 3 No. of Members in Household

Fig. 3 depicted the distribution of the number of members across the 188 households that were interviewed. Households with 4 members were the most common household size in the community, with 51 households. There were also a significant number of households with 3 members (37 households) and 2 members (35 households). Smaller numbers of households have 5 members (26 households), 6 members (18 households), and greater than 6 members (18 households). The number of individuals accumulated through surveying 188 households was a total of 759 individuals.

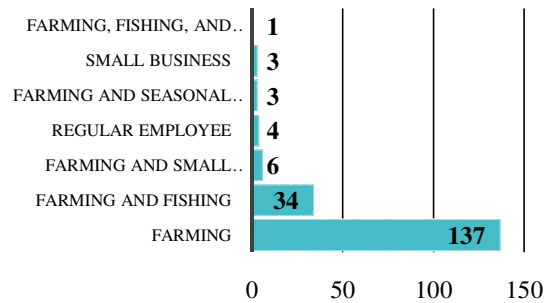


Fig. 4 HH Source of Income

Fig. 4 displays the distribution of income sources for the 188 Aeta households that were interviewed. The graph revealed that farming was the primary source of income for the community, with 137 households relying solely on it. However, a significant portion of the population combined income from multiple sources. Farming and fishing were a common combination (34 households), followed by farming and small businesses (6 households). Other income sources include regular employment, small businesses alone, and a combination of farming, seasonal employment, and subsidies.

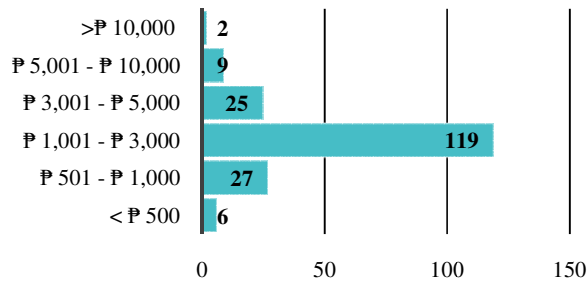


Fig. 5 Monthly Income

The average monthly income, shown in Fig. 5, of the interviewed households in the Sitio Camachile was rather low, ranging from ₱1,001.00 to ₱3,000.00. It was revealed in Fig. 5 that the largest portion of the interviewed households, 119 out of 188, have monthly incomes ranging from ₱1,001.00 to ₱3,000.00. This suggested that a significant portion of the community resides in a low-income bracket because of small-scale farming as their main source of income. It was then preceded by approximately 18% of the households whose income was less than ₱1,000.00. While a smaller proportion of households fall into the ₱3,001.00 to ₱5,000.00, 13% of the total households, and ₱5,001.00 to ₱10,000.00, 5% of the total households, range, only a very small number, 2 households, reported a monthly income exceeding ₱10,000.00.

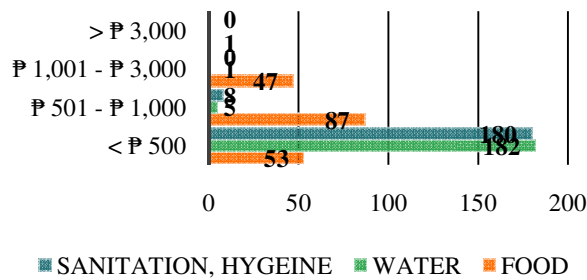


Fig. 6 Monthly Expenses on Food, Water, and Sanitation and Hygiene

When the household respondents were asked to rank their monthly expenses in terms of food, water, sanitation, and hygiene, all 188 households ranked food first as the most important monthly expense. The graph, Fig. 6, showed that 46% of the respondents spent ₱501.00 to ₱1,000.00, and other respondents allocated ₱1,001.00 to ₱3,000.00 of their monthly income. It signified that food was essential for survival and had no substitute, unlike water and sanitation which can potentially be obtained from alternative sources, such as rivers and other free sources. Moreover, the respondents ranked water, especially drinking water as the second most important expenditure monthly. A total of 182 out of 188 or 97% of the total spent at most ₱500.00 for their drinking water. Lastly, they ranked sanitation and hygiene as the least important

monthly expenditure where 99% of the total respondents reserved only less than ₱500.00.

A significant portion of residents in Sitio Camachile rely on farming for their livelihood. The results indicated that 137 out of 188 households relied on farming as their primary source of income. The income levels of the residents were low as a result of their strong reliance on small-scale farming. According to the data, 119 out of 188 households, or the largest group, had an income between ₱1,000.00 and ₱3,000.00. When it came to spending priorities, food emerged as a concern for all interviewed households. Considering their incomes, securing enough food was the priority of the residents. Households appeared to be charged in accessing water, especially drinking water, with most paying ₱500.00 or less for this essential resource. Furthermore, the majority of households considered sanitation and hygiene to be the least significant expense allocating only less than ₱500.00.

2) Household Access to Water

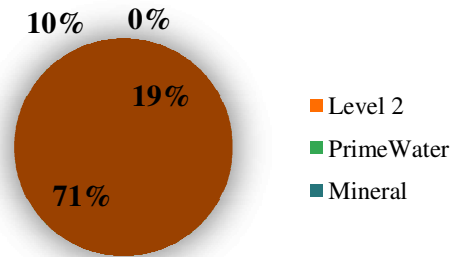


Fig. 7 Source of Water for Drinking and Cooking

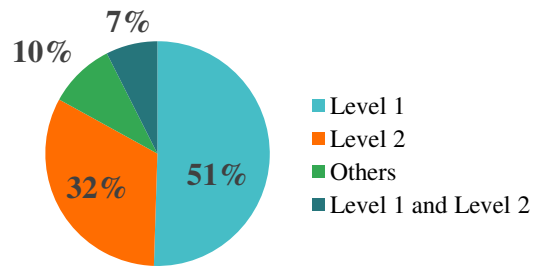


Fig. 8 Source of Non-Potable Water

The majority of the population in the study locale had only one water source for drinking and cooking purposes. Approximately, 71% of the total, 134 households bought water from a refilling station installed and managed by PrimeWater Infrastructure Corp. Another portion of the population, or 19% of the total respondents collect free water from a hydraulic ram pump planned and installed by Don Honorio Ventura State University, Department of Science and Technology, and the Municipality of Floridablanca. This water from the ram pump was graded as non-potable water

however, utilizing water from it as drinking water, while understandable given the cost of the treated water and income sources of the residents, could raise potential health risks associated with the usage of non-potable water. While the remaining percentage bought mineral water or fetched water from San Ramon, a nearby barangay, of the sitio.

Furthermore, the financial constraint imposed on purchasing drinking and cooking water, made the residents to resort alternative water sources for different purposes in the household. The residents collected and used water from other sources for non-potable purposes like bathing, laundry, and cleaning. The water they use for sanitation purposes mainly came from the hydram and river. 99% of the population used water for laundry, bathing, and cleaning from Level 1 and Level 2 sources. Frequently, residents bathed and did their laundry in the river or beside the hydram.

TABLE I
 Time and Distance for Water Collection

	On Average
Time Spent in Fetching Water	18 minutes
Distance Covered to Reach the Water Source	
• Water for Drinking and Cooking	560 meters
• Water for Household Tasks	450 meters
Fetches/Collected by	Frequency
• Men	136
• Women	49
• Children	3

The table above illustrated the difference in the average distances traveled to collect water depending on its purpose. Households traveled farther, an average of 560 meters, to obtain water for drinking and cooking, prioritizing the PrimeWater as the main source. Water for household tasks, like cleaning or bathing, required an average travel distance of 450 meters to collect water from alternative water sources such as the river and hydram. On average, residents spent 18 minutes fetching water regardless of the source or purpose, when there was no queuing when collecting or fetching. Moreover, a significantly higher number of men (136) compared to women (49) were reported responsible for collecting water. This reflected the physical demand associated with traveling with one to two containers or five to ten gallons of additional weight.

When the respondents were asked if water quality problems were encountered in the past two months, only three respondents answered that such problems occurred. The three respondents were known to have a Level 1 source of water which was a well. Moreover, the rest of the respondents did not encounter problems in their water sources in the past two months.

When it came to water fees, households, 132 out of 188, whose main potable water source was PrimeWater Corp., were charged three pesos (₱3.00) fee for every 5-gallon container, thirty pesos (₱30.00) for small drums, and sixty-pesos (₱60.00) for large drums. On average, a household spent ₱12.00 daily for their potable water and relied on free sources of water that would be used for other household tasks.

Moreover, based on observations, the behavior of the Aeta community became apparent in their management and utilization of their water sources. The tanks provided by their paid water provider, PrimeWater Corp., were well-managed and maintained, likely because they required a charge to utilize it. In contrast, their free water source, the hydraulic ram pump communal stations, despite being relatively newer than the paid source, showed significant damages such as leaks, non-functional faucets or outlets, and damaged tanks. This behavior implied that the Aeta community tended to take better care of and appreciate things that come with a fee. Furthermore, the presence of a person-in-charge or manager overseeing the operations of the paid water provider contributed significantly to its effective maintenance. This ensured that any issues were promptly addressed, and regular maintenance tasks were carried out, thereby enhancing the overall reliability and functionality. In contrast, the communal stations for the hydraulic ram pump lacked such dedicated oversight, leading to a lack of accountability and a higher incidence of neglect and damage. This behavior highlighted the importance of effective management to ensure sustainable utilization of resources within a community.

3) Household Access to Sanitation and Hygiene Practices

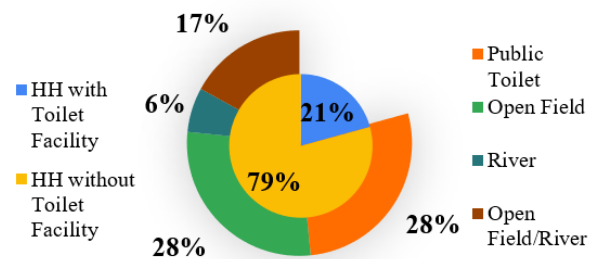


Fig. 9 Household Toilet Facility

Among all 188 respondents, only 21%, 39 households, had been recorded to have an exclusive toilet facility. 22 out of 39 households' toilets were located outside their house while the remaining 17 toilet facilities were attached or inside. 79% of the respondents were reported for not having a toilet facility for the household members. 28% of the total households, without toilet facilities, defecate on public toilets, that were recently built by Holy Angel University, School of Nursing, and shared toilets with their relatives. Moreover, an alarming

51% of the Sitio Camachile practice open defecation either in rivers or burrowing it in open fields.

Regarding those households who practice open defecation, when they were asked about where they defecate, respondents had the terms “Open pit” and “Sweat comes out first before the dump (fecal matter)”. This signified before defecation, they would find a place and dig holes where they could have a bowel movement. These practices posed a major public health risk, as they contaminated water sources and contributed to the spread of waterborne diseases.

The main obstacle reported by the respondents to building or constructing toilet facilities was funding. Due to limited income, residents prioritized essential needs such as food to survive, resulting in little to no resources available for the construction and development of sanitation infrastructure. However, when asked if there was support from different organizations or bodies, the respondents expressed their willingness to cooperate for the successful development of sanitation infrastructure.

Upon observation, it became evident that the majority of the free public toilet facilities were inadequately maintained due to a lack of assigned personnel responsible for their upkeep and oversight. The doors were detached from the jamb, and the toilet bowls, even relatively new, were tarnished and discolored. With those concerns, safety, privacy, and hygiene were being compromised because of the lack of maintenance, governance, and discipline of the user. The design of the facilities was rather basic and shared by both genders without considering the women and girl users. The absence of a lavatory or handwashing facilities raised another concern about hygiene practices. Furthermore, the inadequate number of existing sanitation facilities failed to accommodate all the residents who have problems with poor sanitation and hygiene practices. In line with that, a significant portion of the population continued to resort to open defecation, posing serious health and environmental hazards.

TABLE II
Handwashing Facilities

Where do household members usually wash their hands?	Frequency	Percentage
• Basin	76	40.4%
• Dipper (Tabo)	91	48.4%
• Bucket	41	21.8%
• Lavatory	12	6.4%

The Aetas responded that they were all washing their hands with soap. They wash their hands after and before eating, and using the toilet. They also wash their hands when performing farming tasks and washing children’s bottoms.

When asked where they usually wash their hands, there were four frequent answers. 48.4% of the respondents used a dipper filled with water as their primary handwashing method. A basin and bucket with water were also used for washing

hands. However, only 12 households, or 6.4% had a lavatory which was the most sanitary and hygienic method. While all the respondents in Sitio Camachile reported using soap, their primary method of handwashing was the usage of stagnant water filled in a container and did not involve a lavatory with proper drainage. Furthermore, upon observation, there was an absence of handwashing facilities near or beside the toilet facilities.

TABLE III
Bathing Site

Where do household member bathe?	Frequency	Percentage
• River	147	78.2%
• Hydram	32	17.0%
• Toilet Facility (CR)	19	10.1%
• Beside House	27	14.4%

The Aetas indicated that they bathe at least once a day. To be precise, 65% of the household members bathe twice a day and the remaining 35% take a bath at least every day. They also mentioned that they used body soap and hair products when bathing.

The table above showed the typical location where residents bathe. Due to the absence of sanitation facilities, the river was the most typical site for bathing where 78% of the household and its member cleanse their body at the river. This practice, while unstable because of the absence of sanitation facilities and lack of economic ability to construct one, posed significant health and environmental risks. Consistently bathing in the river increases the likelihood of waterborne illnesses and pollution, as untreated wastewater and contaminants from bathing activities mixed with the water supply, affecting both the community and downstream ecosystems. 17% of the respondents answered that they take a bath near the hydram communal stations, for easier access to water which should not be practiced and prohibited by the developers of the hydraulic ram pump. An alternative location mentioned by 14% of the respondents was beside their house which compromised the safety and privacy of the residents. Lastly, only 10% of the respondents indicated that their household members used the comfort room when bathing.

4) Incidences of Water- and Sanitation-Related Diseases

When the respondents were interviewed about illnesses and diseases relating to water, sanitation, and hygiene, only one out of 188 answered that he/she suffered from WaSH-related infections. The respondent described his/her experience when he/she was hospitalized for having abdominal distension, vomiting, and muscle weakness. The respondent was told by the doctor that the root cause of his/her disease came from contaminated water. On the contrary, all the respondents stated that they did not suffer from any illness from drinking their existing source of water and practicing their way of sanitation and hygiene methods.

Even though 187 out of 188 households did not suffer from WaSH-related illnesses, consuming water from an open-source, river, and practicing unsanitary hygiene were still major health risks. Improper sanitation can contaminate water. Moreover, contaminated water contains harmful bacteria, viruses, and pathogens that cause various diseases

5) WaSH Information, Communication, and Participation

When the Aetas were asked about laws, policies, and ordinances on safe water, sanitation, and hygiene, it revealed the lack of knowledge among the Aetas as what was important for them was that they could use water. This signified the need to improve WaSH education within the community and emphasized the importance of laws and regulations in managing water resources and promoting public health.

6) Ladder for WaSH Services

Water

The water service of the Indigenous People in Sitio Camachile can be categorized as “BASIC” and “UNIMPROVED” at the same time.

Sanitation

The sanitation services in Sitio Camachile were graded as “UNIMPROVED.”

Hygiene

The hygiene practices of the Indigenous People in Sitio Camachile were categorized as “UNIMPROVED.”

C. Community-based Sanitation Facility Plan and Design for the Aeta Community in Sitio Camachile

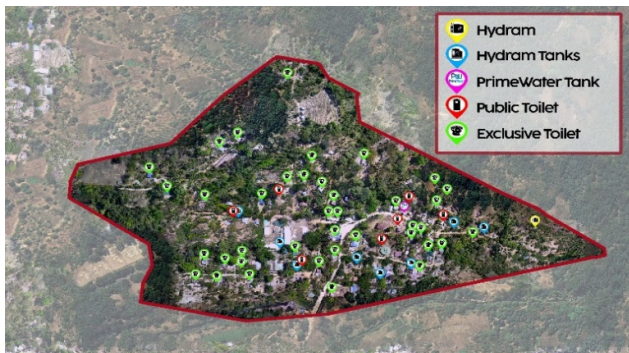


Fig. 10 Location of Sanitation Facilities and Water Sources of Sitio Camachile

Fig. 10 was a point show that showed the location of sanitation or toilet facilities available in Sitio Camachile with the available and existing water sources

As a result of the economic inability of Aetas to construct and build a private toilet facility for their household, the proposal for a communal or public sanitation facility was developed. This proposal would present a practical and inclusive solution to address the issue of open defecation while ensuring equitable access to essential sanitation services for all community members. This aimed not only to mitigate

the health risks associated with current sanitation and hygiene practices but also to promote privacy, security, and safety among the Aeta community. Furthermore, the establishment of a communal or public sanitation facility would promote inclusivity by ensuring that every member of the community had access to a dignified and hygienic toilet facility, regardless of economic status or household resources. By providing a safe and sanitary alternative to open defecation, the facility contributed to public health and environmental sustainability while maintaining the principles of social equity and human dignity.

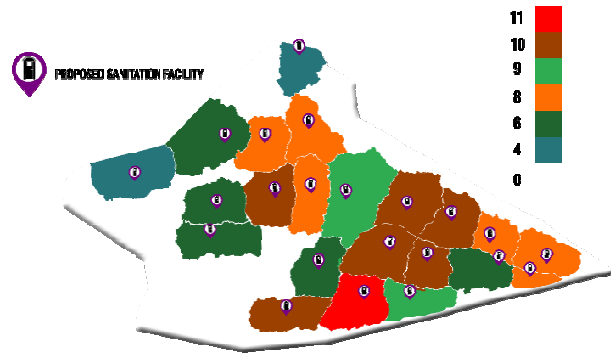


Fig. 11 Proposed Locations of Sanitation Facilities

Fig. 11 was a choropleth map of the Sitio Camachile. This choropleth map divided the sitio into 22 distinct zones or areas. The map was created with the use of images captured by drone technology, cross-referenced with Google Earth measurements for precise distance calculations. This map subdivided Sitio Camachile into 22 distinct zones, each representing clusters of neighboring households that were residing in the area at the time the study was conducted. Zone sizes varied, ranging from 4 to 11 households within a 150-meter radius. The map was designed with consideration to ensure convenient access to a proposed sanitation facility for residents residing within each zone. By considering household distances and optimizing infrastructure allocation based on household density, this approach aimed to significantly improve sanitation and hygiene conditions in Sitio Camachile. Moreover, the strategic location of the sanitation facility within residential clusters minimized travel distances, ensuring equitable access for all community members and maximizing the impact of the proposed sanitation facility in reducing open defecation and improving overall sanitation conditions in Sitio Camachile.

3-Dimensional Models



Fig. 12 3-D Model of Two-Section Sanitation Facility



Fig. 13 3-D Model of One-Section Sanitation Facility

Fig. 13 depicts the 3-dimensional models of the proposed sanitation facilities.

Floor Plans

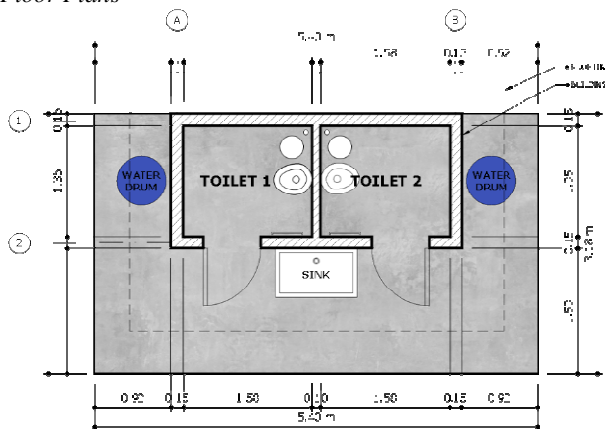


Fig. 14 Floor Plan of Two-Section Sanitation Facility

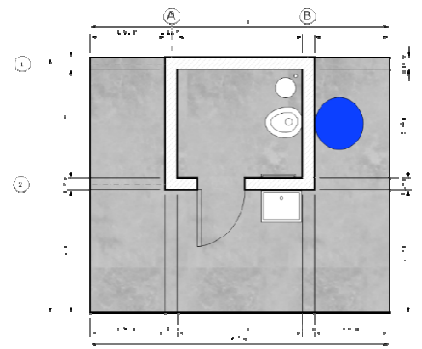


Fig. 15 Floor Plan of One-Section Sanitation Facility

Fig. 14 and Fig. 15 show the floor plans of two different designs of the sanitation facilities.

Incorporating the behaviors of the Aeta community, the assignment of a person in charge in each cluster should be implemented as a method to ensure the proper maintenance and management of sanitation facilities. Their roles would encompass a range of tasks, including oversight of the cleanliness and operational functionality of the facilities, and promptly addressing any arising issues. Moreover, a payment of one peso per two buckets of water, collected from free sources by the person who oversight the facility, should be established to support the maintenance and sustainability of the facilities. This small charge not only would contribute to covering maintenance costs but also promote responsible use of these facilities within the community.

IV. SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

A. Summary of Findings

The Aeta community in Sitio Camachile relied on basic and unimproved water services. The data gathered showed that the community utilized water from three different sources: the PrimeWater Infrastructure Corp., the hydraulic ram pump, and the river. The PrimeWaterInfrastructure Corp., a paid water provider, was categorized as a basic level of water service. On the other hand, the hydraulic ram pump and the river, a free water source, were labeled as unimproved water services.

Open defecation was the common sanitation practice in the community. Based on the gathered data, only a small portion of the community had access to safely managed toilet facilities. A significant portion relied on inadequate basic toilet facilities shared with other community members. Due to limited number of shared toilet facilities, left many Aetas with no choice but to resort to open defecation. Their term for this practice was “open pit,” which means digging holes before defecating and burying them with soil. While this practice aimed to minimize contamination, it still possessed a range of health risks, and Aetas had no choice

Hygiene practices in the community were unimproved. Even though results revealed that the Aeta bathed with body soap and hair products once a day if not twice, their common bathing site was the river, which was not free from contamination. Moreover, their handwashing method was not hygienic, even with the use of soap. Due to the absence of handwashing facilities, they resorted to using small containers filled with stagnant water shared with other household members.

The level of WaSH-related information was low among the Aeta community. Due to the geographical isolation of Sitio Camachile and the economic standing of the Aeta, they lack access to different sources of safe water, sanitation, and hygiene information. The results revealed little to no knowledge regarding existing laws, policies, and ordinances related to safe water, sanitation, and hygiene.

B. Conclusions

The study assessed and investigated the community's water, sanitation, and hygiene conditions through a formulated assessment tool. The tool was checked and validated through face validation and item analysis by a licensed psychometrician, licensed professional teacher, and the National Commission on Indigenous People—Floridablanca. This investigation and assessment were important tools and information for community-based sanitation facility plans and designs that would positively impact the overall sanitation practices of the Aeta community.

The assessment revealed that Aetas needed reliable sources of information about water, sanitation, and hygiene (WaSH). The sanitation and hygiene practices of the community were at the bottom step of the ladder set by the Joint Monitoring Program for Safe Water, Sanitation, and Hygiene. Open defecation was widely practiced in the community due to the limited resources of the Aeta residents of the sitio to construct a toilet facility. Moreover, while most Aeta respondents have access to basic water services, most of the community still relied on unimproved water sources. Even though there was an existing source of potable water, financial standings limited the accessibility of this source. Despite the presence of the hydram, it was only limited to certain areas of Sitio Camachile, hence there were still Aeta who relied on the river as their source of water.

Thus, with a focus on sanitation and hygiene, additional communal sanitation facilities were proposed in 22 locations throughout the sitio. The strategic placement aimed to increase accessibility and ensure equitable distribution for residents who faced challenges due to the distance and insufficiency of existing facilities. Bringing these facilities closer to various parts of the community would significantly improve access and convenience, especially for residents lacking safe and hygienic sanitation options. This increased accessibility and convenience were expected to improve the Aeta community's sanitation practices and overall well-being.

The sanitation facilities were designed to ensure that the Aeta community would have ease of use for each proposed facility with a focus on functionality, inclusivity, and accessibility. The dimensions and sizes of the proposed sanitation facilities were adjusted considering the natural stature of Aeta residents of Sitio Camachile to serve effectively and be used by the Aetas, including children, older adults, and persons with disabilities. It was based on a simple design that prioritized privacy, security, ease of use, and safety of the Aeta users. The sanitation facilities were designed to ensure that the Aeta community would have proper and safe sanitation facilities focusing on functionality, inclusivity, and accessibility. The dimensions and sizes of the proposed sanitation facilities were adjusted considering the natural stature of Aeta residents of Sitio Camachile to serve effectively and be used by the Aetas, including children, older adults, and persons with disabilities. It was based on a simple design that prioritized privacy, security, ease of use, and safety of the Aeta users. Two different sanitation facilities were designed in line with the provisions of the National Building Code and the National Plumbing Code of the Philippines. First, a two-section facility was designed to be shared by many households. Second, less than five neighboring households would share a one-section toilet facility. Each facility was equipped with pour-flush toilet technology and had proper ventilation and lighting to ensure ease of use and comfortability of the users. With these, the proposed sanitation facility designs would become a catalyst for achieving Sustainable Development Goal (SDG) 6 to ensure the availability, accessibility, and sustainable management of sanitation among the Aeta community in Sitio Camachile.

C. Recommendations

- Based on the knowledge gained in the study, it is recommended that educational campaigns and programs be developed and conducted in the Aeta and other Indigenous communities to promote proper management and practices for accessing safe water, sanitation, and hygiene. Implementing WaSH education and conducting workshops can improve the Aeta community's knowledge and perceptions of proper WaSH practices.
- To ensure the well-being of the Aeta community in Sitio Camachile, it is strongly recommended that the Municipality of Floridablanca and the LGU of Nabuclod prioritize the development and implementation of a comprehensive action plan addressing not only water availability and accessibility but also sanitation and hygiene needs of the Aeta.
- This was also an open letter to the Department of Health and the National Commission on Indigenous People. The DOH and NCIP should prioritize improving WASH (Water, Sanitation, and Hygiene)

conditions for all indigenous communities to achieve the United Nations Sustainable Development Goals (SDGs), which emphasize the right to safe water, sanitation, and hygiene.

- For other researchers who would like to continue this study, this is the first step in achieving SDG-6, the right to access safe water and sanitation. A study should not be limited to assessment; there must be an application to achieve SDG-6. In terms of improving the results of this study, a more comprehensive mapping technique shall be developed using platforms like ArcGIS Online or Google Earth Engine to allow ongoing data collection, analysis, and visualization to ensure the map remains relevant for future development in certain areas of the locale. Moreover, a detailed plan, including structural soundness, funding sources, construction process, timeline, and detailed cost estimate, is highly recommended to offer insightful information for the construction of sanitation facilities.
- In the civil engineering field, prioritizing the design and implementation of sustainable water and sanitation infrastructure in Indigenous communities could significantly improve Indigenous peoples' access to water and sanitation.

ACKNOWLEDGMENT

This study would not have been possible without the guidance and help of several individuals who in one way or another contributed and extended their valuable assistance in the preparation and completion of this study. The researchers would like to extend their deepest gratitude and appreciation to the following individuals.

To **Don Honorio Ventura State University**, College of Engineering and Architecture, for supporting them throughout the journey.

To **Engr. Inla Diana C. Salonga**, their CE Project Coordinator, for allowing them to discover the things that they can and cannot do and for inspiring them to pursue this field of study, Environmental Engineering with a focus on Sanitary Engineering, and for the insightful comments and suggestions to make the study worth studying.

To **Engr. John Vincent G. Tongol**, their thesis adviser, for the inspiration, guidance, motivation, patience, and great minds. Without his invaluable supervision, priceless wisdom, and unending support, the study would not be a success.

To **Engr. Aaron S. Malonzo**, **Engr. Jafet C. Culala**, and **Engr. Jean P. De Jesus** for the acknowledgment of the study and the insights, suggestions, and recommendations for the betterment of the paper.

To the **Aeta Community of Sitio Camachile** who voluntarily took part in the study. They appreciate the time and efforts they shared with them. Without their valuable

participation, the study would not have been great. With that, they will always be appreciative of their kind act.

To their **families**, they give the warmest thanks for their unending support, love, and care. Since the very beginning, their families have been there for them, always believing in them, even when they doubted themselves. For this unwavering support, they will be forever grateful.

Without the unconditional help and guidance of the **Almighty**, all these things would never be possible. With much sincerity and gratefulness, they thank You, Father, for granting their prayers, for listening to their cries when they are losing their hopes, for showering them with Your grace when they in the midst of adversities, and for Your everlasting love which keeps them going. To You be all the glory and praise!

REFERENCES

- [1] United Nations, "WASH – Water, Sanitation and Hygiene," *UN-Water*. <https://www.unwater.org/water-facts/wash-water-sanitation-and-hygiene>
- [2] UNICEF, "Water, Sanitation and Hygiene," *UNICEF*, 2021. <https://www.unicef.org/wash>
- [3] United Nations – Environment Programme. "GOAL 6: Clean Water and Sanitation." *UNEP - UN Environment Programme*, 2 June 2021, <http://www.unep.org/explore-topics/sustainable-development-goals/why-do-sustainable-development-goals-matter/goal-6>.
- [4] *Goal 6: Ensure Availability and Sustainable Management of Water and Sanitation for All – SDG Indicators*. <https://unstats.un.org/sdgs/report/2016/goal-06/>.
- [5] Gupta, Joyeeta, and Hilmer Bosch. "SDG 6: Ensure Availability and Sustainable Management of Water and Sanitation for All." *The Cambridge Handbook of the Sustainable Development Goals and International Law*, edited by Ellen Hey and Jonas Ebbesson, Cambridge University Press, 2022, pp. 163–84. *Cambridge University Press*, <https://doi.org/10.1017/9781108769631.008>.
- [6] Reyes-García, Victoria, et al. "Recognizing Indigenous Peoples' and Local Communities' Rights and Agency in the Post-2020 Biodiversity Agenda." *Ambio*, May 2021, <https://doi.org/10.1007/s13280-021-01561-7>.
- [7] "The Aeta People of the Philippines: Culture, Customs, and Tradition [Philippine Indigenous People | Ethnic Group]." *Yodisphere.com*, 2021, www.yodisphere.com/2022/03/Aeta-Culture-Customs-Tradition-Indigenous-People-Philippines.html.
- [8] "Nabuclod, Floridablanca, Pampanga Profile – PhilAtlas." *www.philatlas.com*, www.philatlas.com/luzon/r03/pampanga/floridablanca/nabuclod.htm
- [9] Luci-Atienza C., "DOST's Hydran project now providing water to upland Aeta community in Pampanga," *Manila Bulletin*. <https://mb.com.ph/2021/06/21/dosts-hydran-project-now-providing-water-to-upland-aeta-community-in-pampanga>
- [10] Velasco, L.G., Maddawin R. B. et al., 2021, "The Philippine Local Water Sector: Institutional Issues in Supply Governance," *www.pids.gov.ph*. <https://www.pids.gov.ph/publication/philippine-journal-of-development/the-philippine-local-water-sector-institutional-issues-in-supply-governance>