

The Team



Bataan Peninsula State University

College of Engineering and Architecture
Department of Civil Engineering
City of Balanga 2100 Bataan, Philippines



The ConCreators



SALUM, JERICHO
Product Testing and
Development



**AGUILA,
FRANCINE JOYCE**
Project Management



GARCIA, ALMIRA
Technical Research



MULI, PRECIOUS
Logistics



**ACERO,
ROB JUSTIN**
Marketing and Advertising



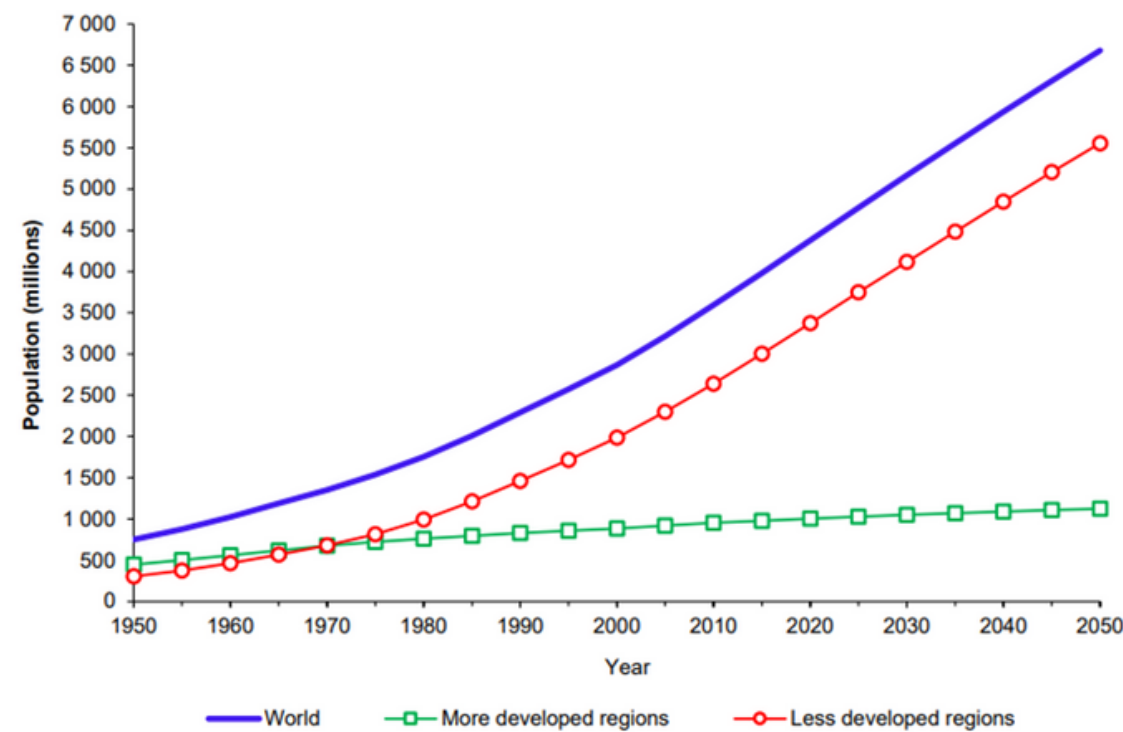
**ENGR. GIL CRUZ
JR., MSe**
Mentor

Department of Civil Engineering
College of Engineering and Architecture

PROBLEM STATEMENT

Circular Innovation Overview

Fig. 1 Estimated and projected urban populations of the world, the more developed regions and less developed regions, 1950-2050.



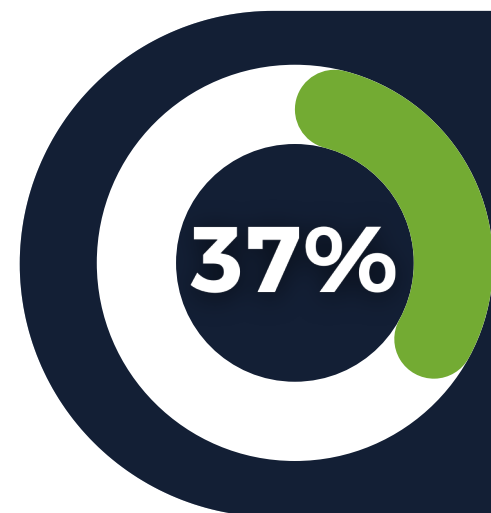
Pariatamby and Victor (2009), asserts that **rapid urbanization** in developing countries leads to an **increase in the generation of Municipal Solid Waste (MSW)**.



Kalyva (2011), highlights the connection between improper waste disposal and water pollution, emphasizing that the **inappropriate disposal of waste contributes significantly to water contamination**.



In the **global setting**, the Global Environment Outlook by the United Nations Environment Program (UNEP) in 2019 reported that **approximately 245,000 square kilometers of marine ecosystems are affected by eutrophication** (The United Nations Environment Programme, 2021).



In the **Philippines**, around **37% of the overall water pollution is attributed to agricultural activities**, and the occurrence of eutrophication is noticeable in the coastal area of Manila, which is linked to the primary drainage region surrounding Manila (Szekielda et al., 2014).

PROBLEM STATEMENT

Circular Innovation Overview



In the **Province of Bataan**, it is said that industrial activities can release pollutants such as **heavy metals, chemicals, and wastewater into nearby water bodies, leading to contamination and degradation of water quality.**

Talisay River in Balanga City, as one of the 17 principal river systems draining to Manila Bay, is said to be prone to effects or establishment activities such as garbage and sewage coming from commercial and residential areas (Project Management Office of Bataan, 2006).



According to a recent Philippine Statistics Authority report, a total of **53,066 Filipinos died between 2010 and 2019 due to water-borne diseases.**



A study conducted by the Department of Environment and Natural Resources showed that **180 of 421 rivers and other bodies of water nationwide are so heavily polluted they may soon be declared biologically dead.**



Based on the Philippine Environment Monitoring, the estimated annual costs of the **adverse impact of water pollution on the economy amount to approximately Php 67 billion.**

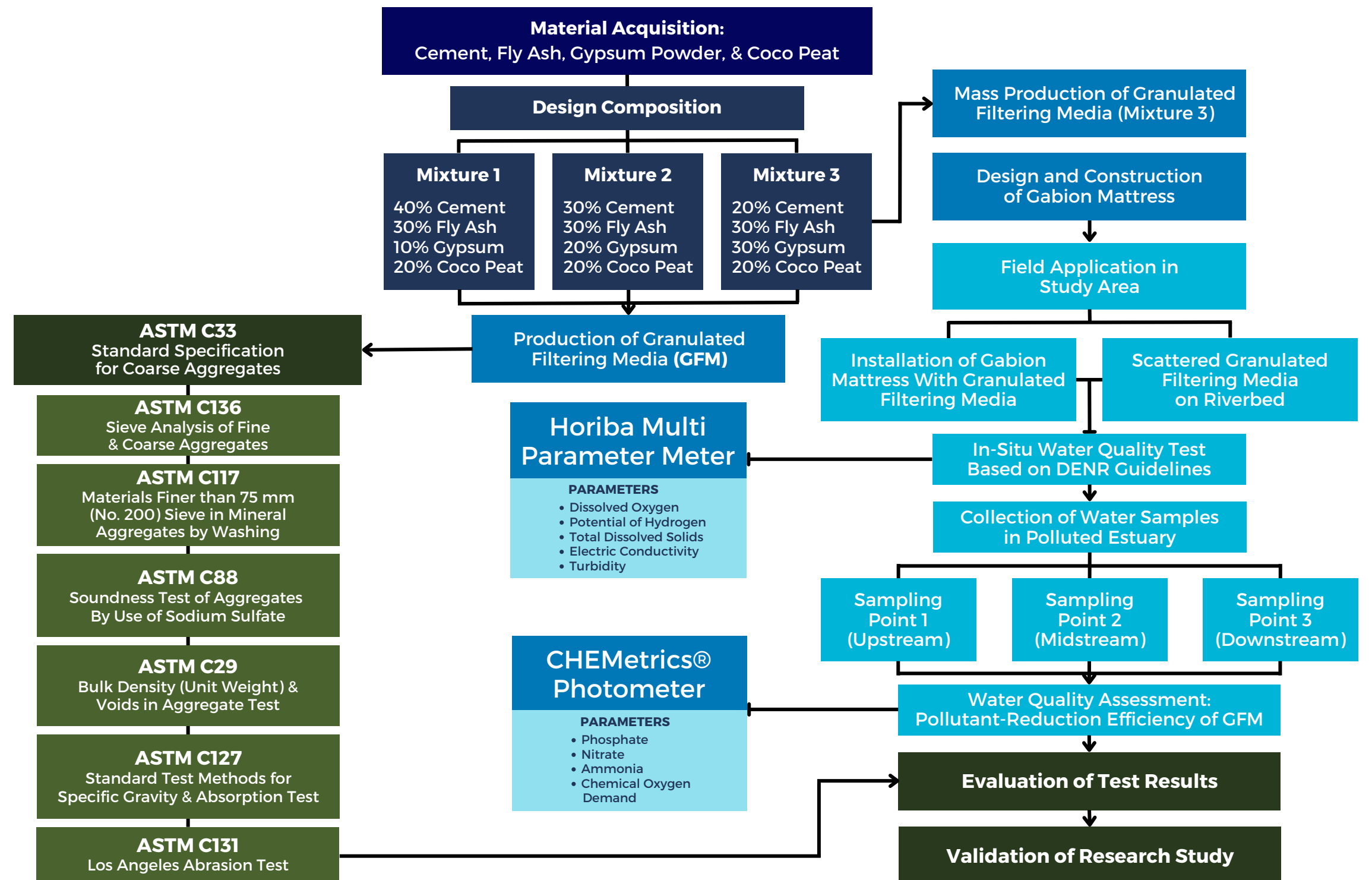
Circular Innovation Overview



Granulated Filtering Media

OUR SOLUTION

Utilization of Granulated Filtering Media (GFM) from Industrial By-Products, and Field Application of Gabion Mattress with GFM for Remediation of Polluted Creek at Balanga City, Bataan



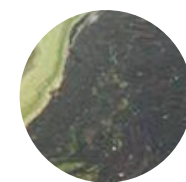
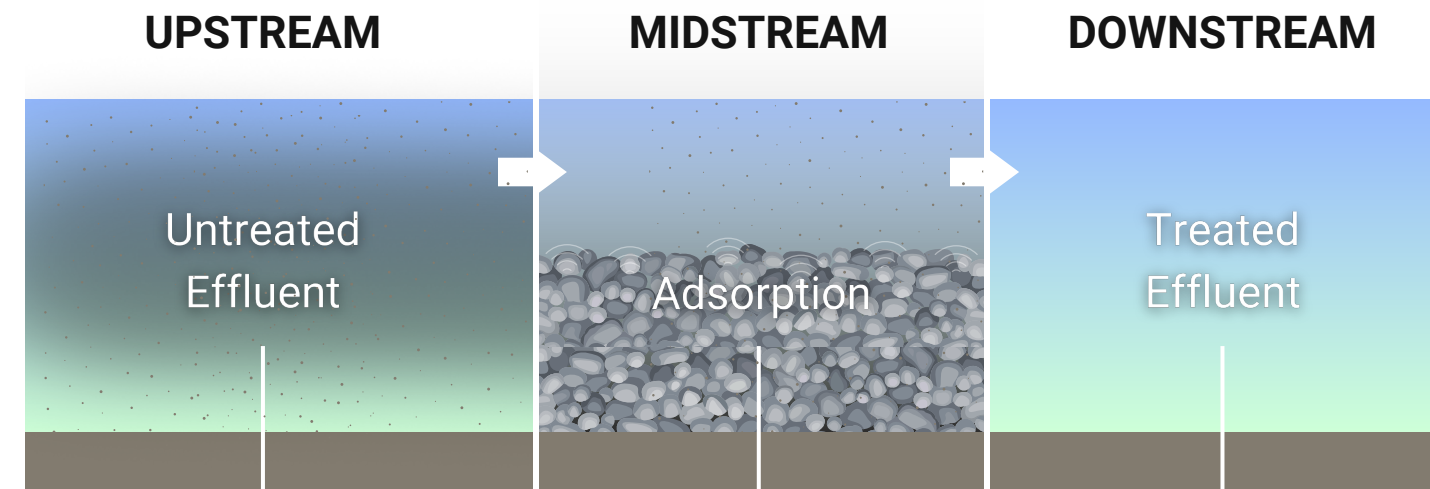
Circular Innovation Overview



Gabion Mattresses

OUR SOLUTION

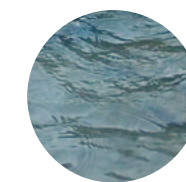
Utilization of Granulated Filtering Media (GFM) from Industrial By-Products, and Field Application of Gabion Mattress with GFM for Remediation of Polluted Creek at Balanga City, Bataan



**high concentration of nutrients, presence of heavy metals, and bad odor.*

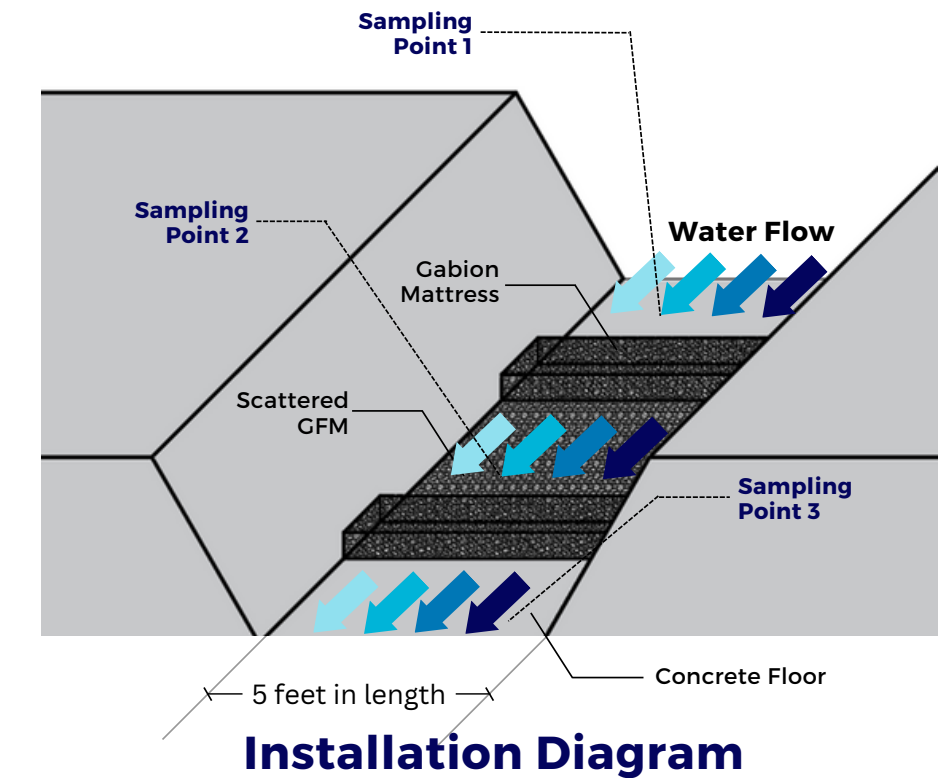


**GFM can adsorb and reduce certain pollutant parameters.*

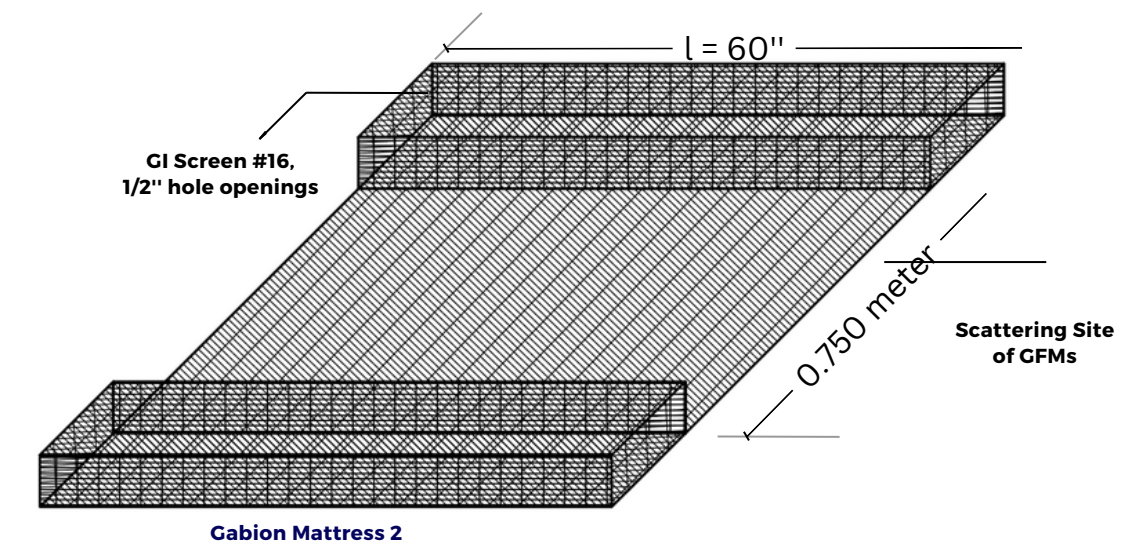


**reduced pollutants, treatment of heavy metals, removal of bad odor.*

Mechanism of the Prototype



Installation Diagram



Design of Gabion Mattresses

OUR ACTIVITIES

Preparation of Raw Materials



GFM's Dry Ingredients



OUR ACTIVITIES

Granulation of GFM



Dry Ingredients on Granulator



OUR ACTIVITIES

Curing of GFM



Air Drying of GFM



OUR ACTIVITIES

Field Application



BATAAN PENINSULA STATE UNIVERSITY
College of Engineering & Architecture
Department of Civil Engineering
City of Balanga 2100 Bataan, Philippines



ON-GOING THESIS PROJECT

"Field Application of Gabion Mattress with Granulated Filtering Media (GFM) for River Treatment and Pollutant Reduction"

LOCATION: Capitol Drive, Balanga City, Bataan 2100

DATE STARTED: May 15, 2023

COMPLETION DATE: JUNE 30, 2023

RESEARCHER: BS CIVIL ENGINEERING

Text or Call XXXX-XXX-XXXX for any concern/complaint about this project.

Layout of the Tarpaulin Used
for On-Going Project

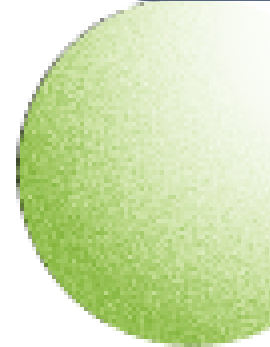


OUR ACTIVITIES

Aggregate Testing (ASTM C33)



Set of Sieves Used in GFM's Sieve Analysis

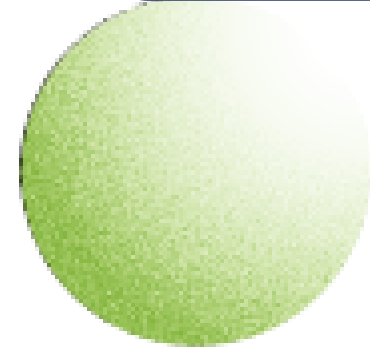


OUR ACTIVITIES

Water Quality Assessment Tests



HORIBA Multi-Parameter Meter



In-Situ Water Quality Testing



Laboratory Water Quality Testing



RESULTS

Results of Aggregate Testing



Soundness Test of Aggregates

Table 1 Summary of Test Results

STANDARD TEST	RESULTS	DESIGN MIXTURE			
		1	2	3 (7-Days)	3 (21-Days)
Sieve Analysis (ASTM C136)	PASSED	77.79%	73.56%	41.07%	87.60%
Materials Finer (ASTM C117)	FAILED	6.92%	3.07%	5.90%	2.14%
Soundness Test (ASTM C88)	PASSED	0.15%	0.07%	0.18%	3.33%
Bulk Density (ASTM C29)	PASSED	0.660	0.631	0.606	0.525
Relative Density (ASTM C127)	FAILED	2.98%	2.91%	2.96%	5.12%
Resistance to Degradation (ASTM 131)	FAILED	39.86%	43.47%	45.30%	42.95%

The table above shows which part of the aggregate test did GFM pass, which was indicated by green highlight. Accordingly, for the GFM to be used as gravel in gabion mattresses, it must be able to pass the Soundness Test, to which it did.

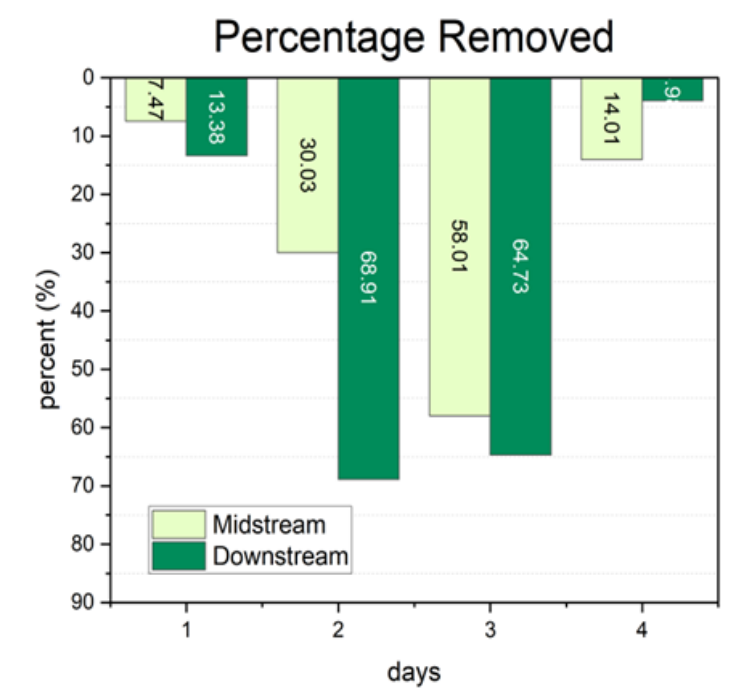
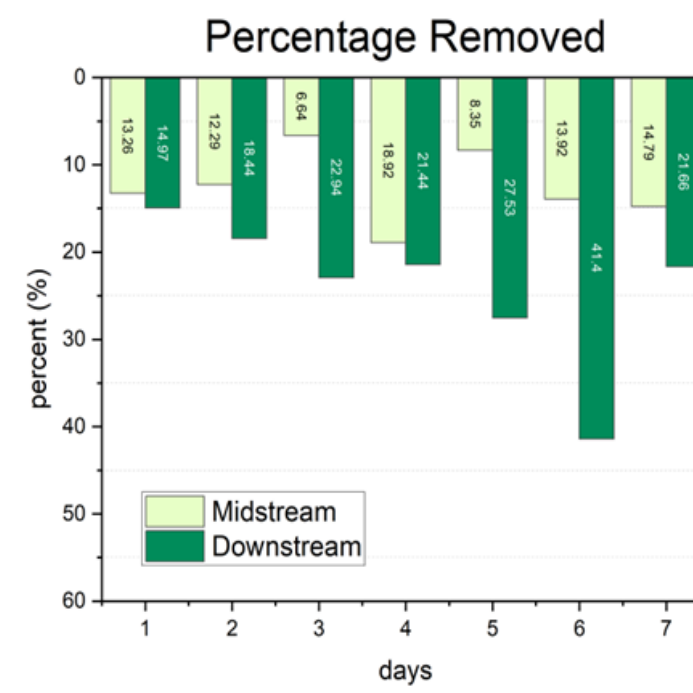
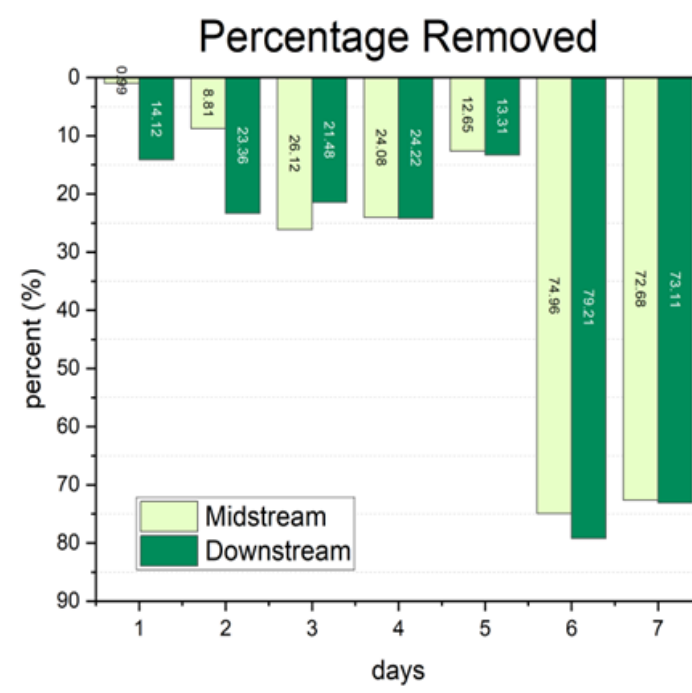
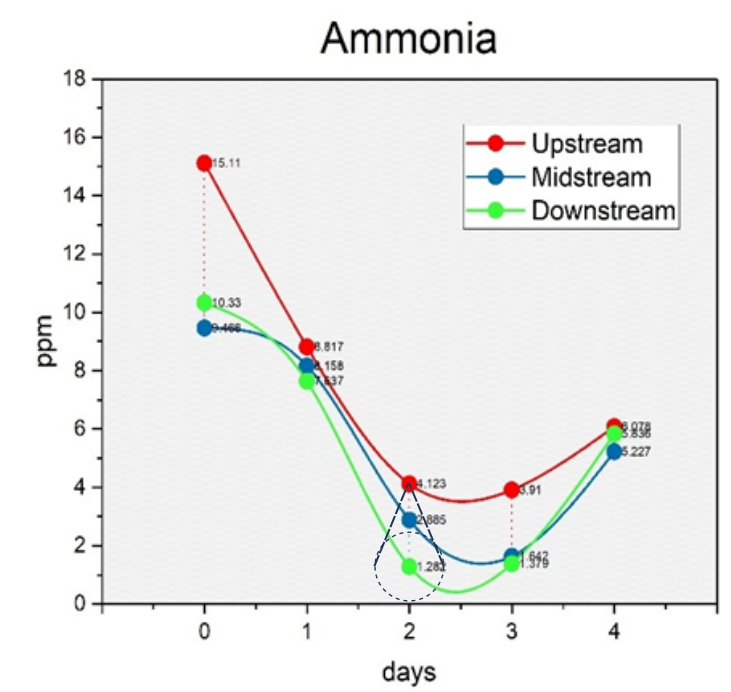
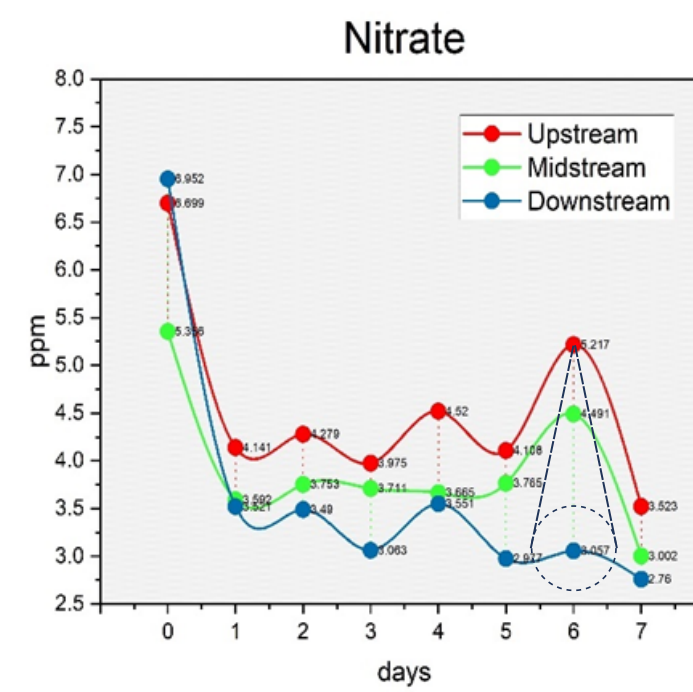
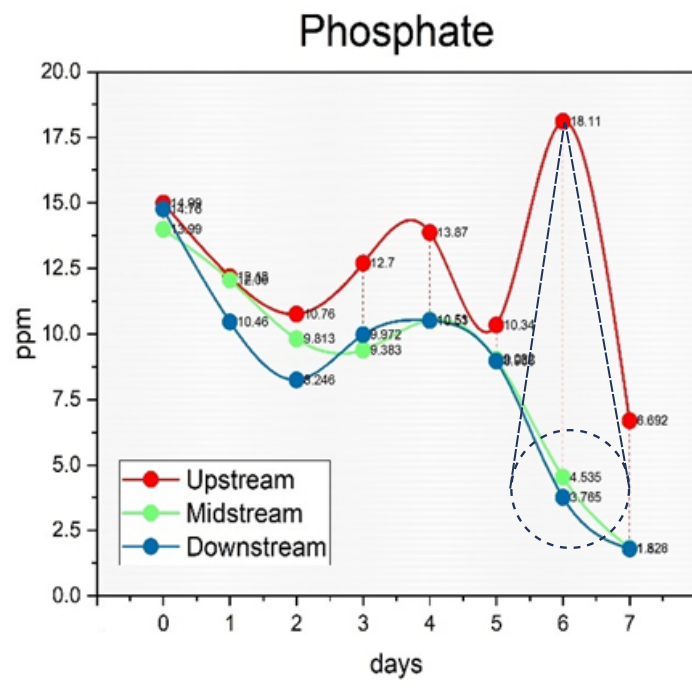
Passing of all the mixtures in the Soundness test means that it is able to resist weathering, disintegration, and withstanding even the freeze-thaw cycles.

RESULTS

Results of Water Quality Testing



Water Testing at BPSU's OES Laboratory



Day 0 indicates that the Gabion Mattresses are not yet installed. Moreover, the encircled point indicates the occurrence of the highest peak of pollutant-reduction during the entire duration of water quality testing.

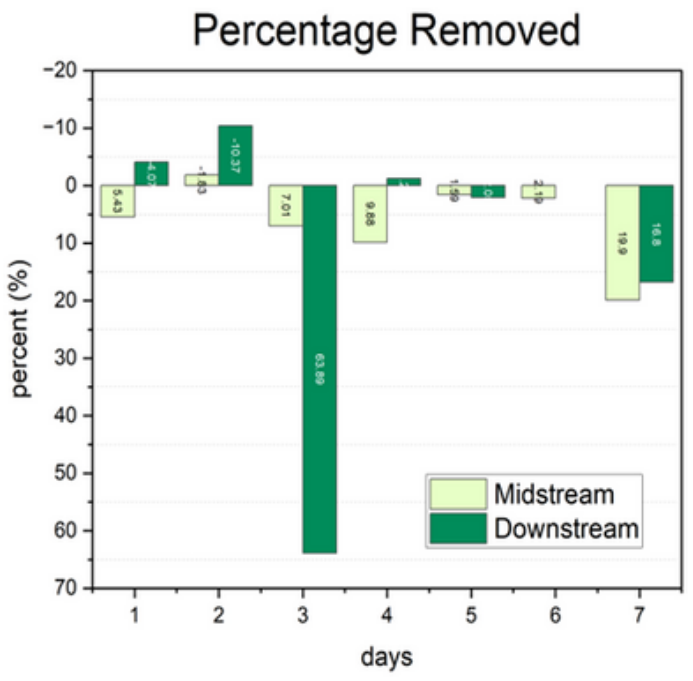
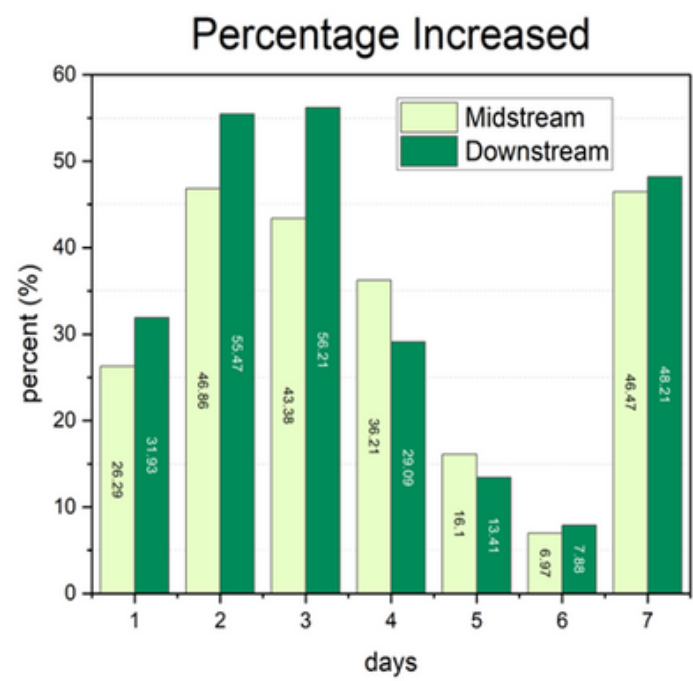
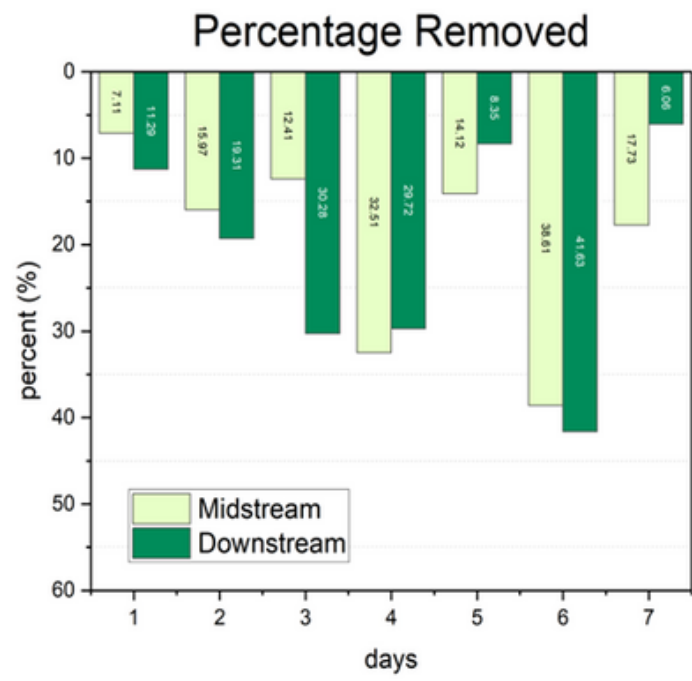
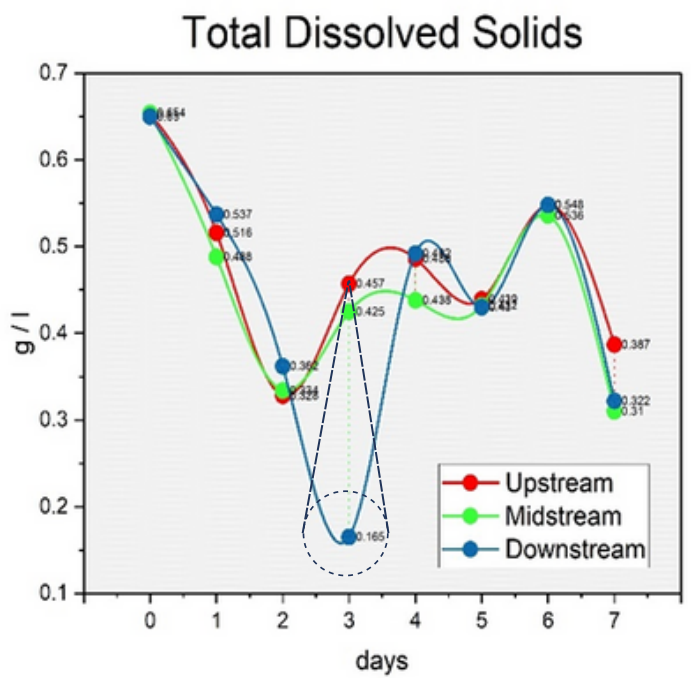
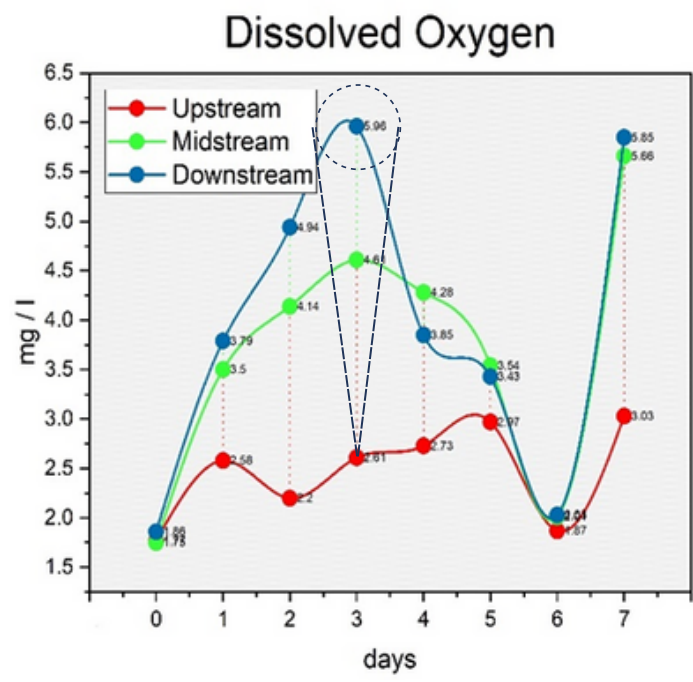
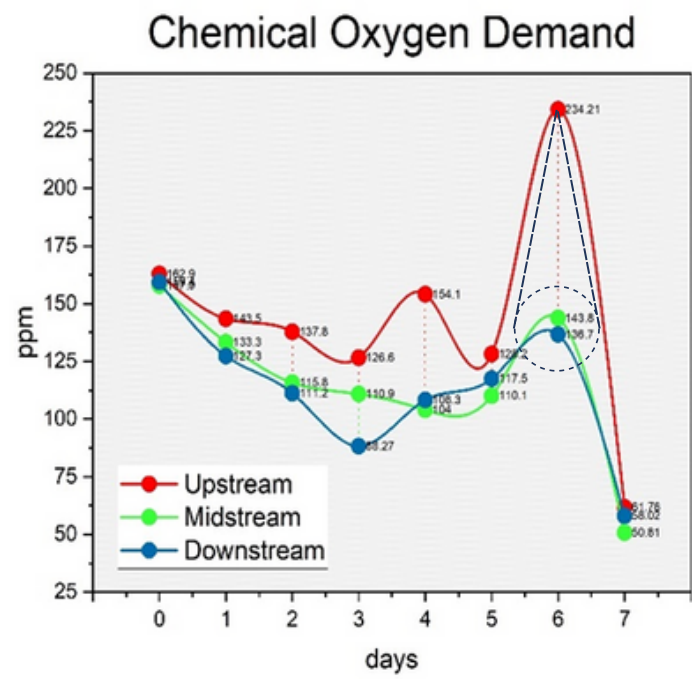
It can also be observed that the graph fluctuated at 4th and 6th day, this is because of the occurrence of rain phenomenon on those days. However, it will still be seen that the graph still fluctuates downward right after, thus showing pollutant reduction.

RESULTS

Results of Water Quality Testing



Centrifuge Machine and Photometer



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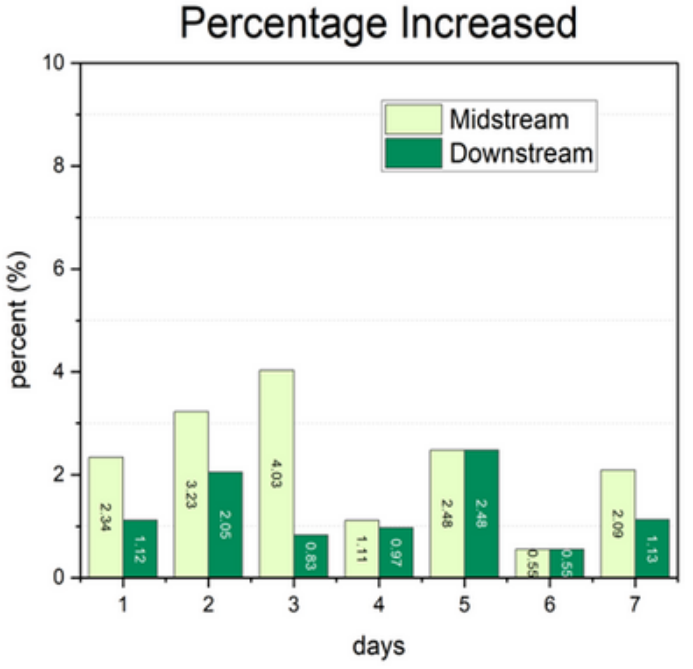
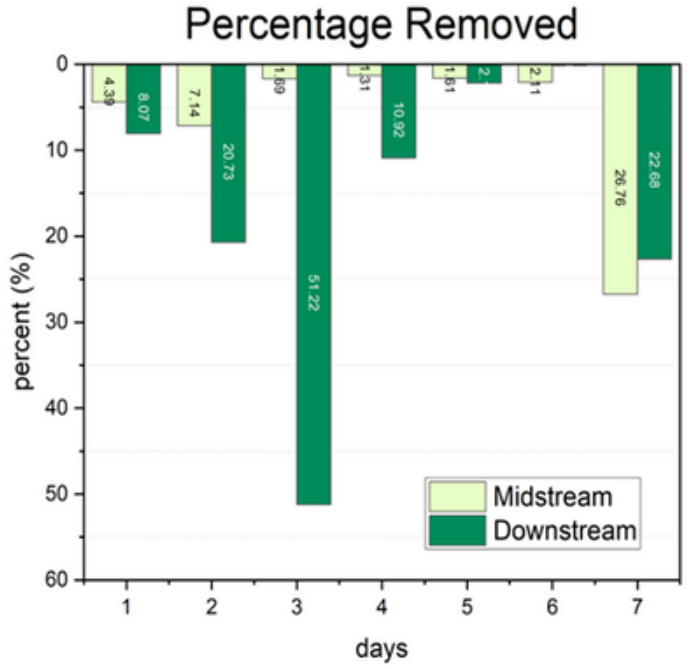
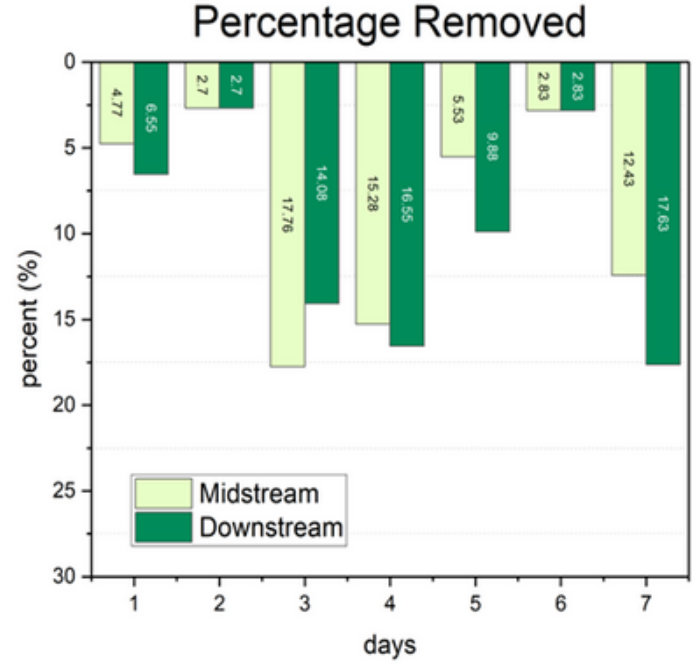
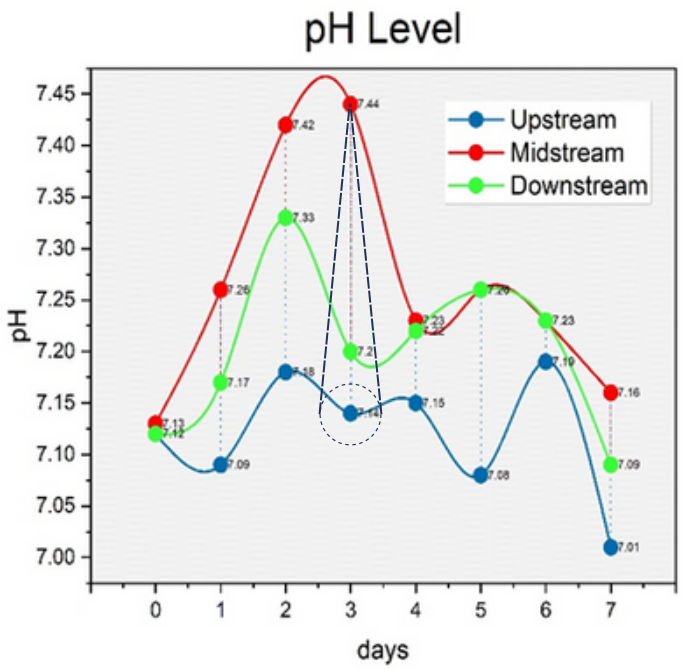
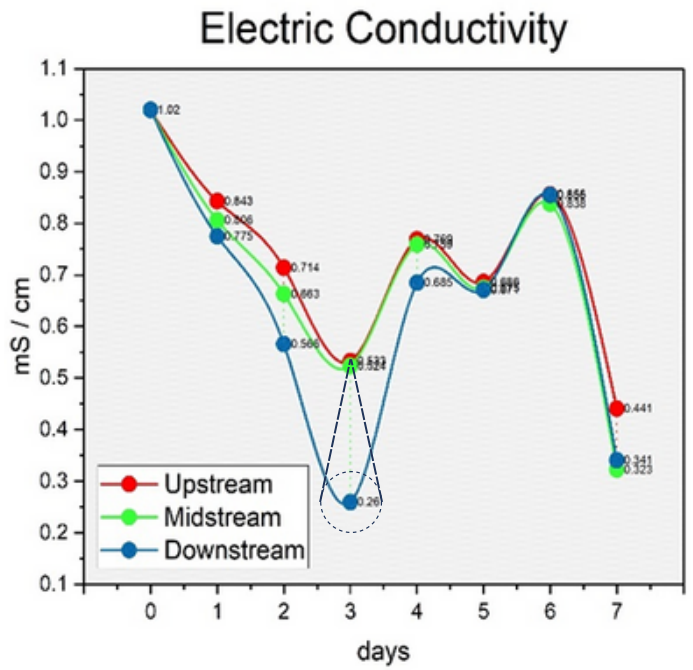
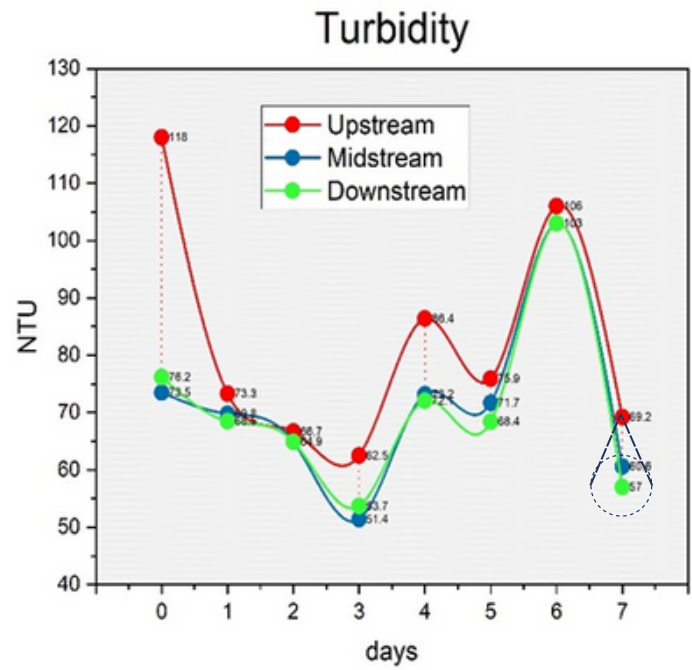
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RESULTS

Results of Water Quality Testing



TSS Apparatus at OES Laboratory



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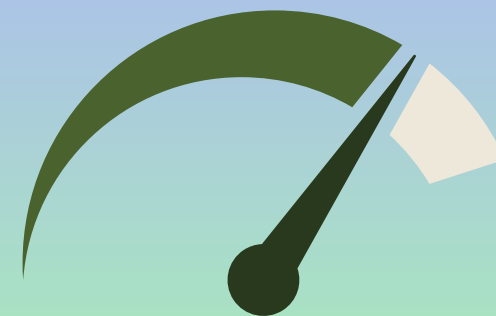
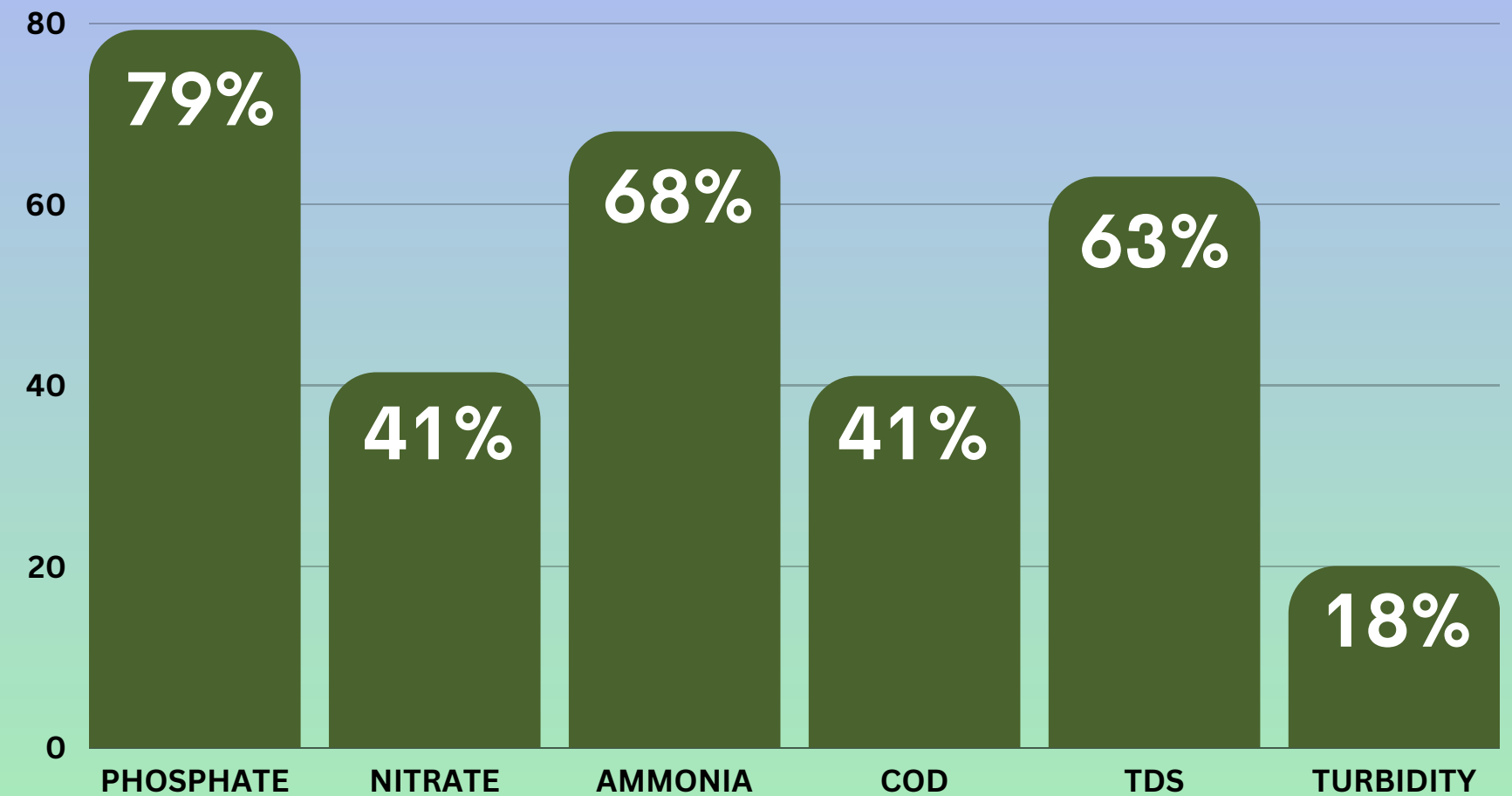
RESULTS

Conclusion

With all the methods, processes, analyses and discussions being done regarding the pollutant-reduction capability of gabion mattresses with GFM installed at polluted creek at Capitol Drive Balanga City, as well as the conformance of GFM itself to standard specification for coarse aggregates, the researchers came up to following conclusions:

Percentage Removed

This positive effect can be attributed to the adsorption of pollutants as they come into contact with the GFM, which acts as an effective adsorbent medium.



The study area has experienced an increase in both **pH levels** and **dissolved oxygen levels**.

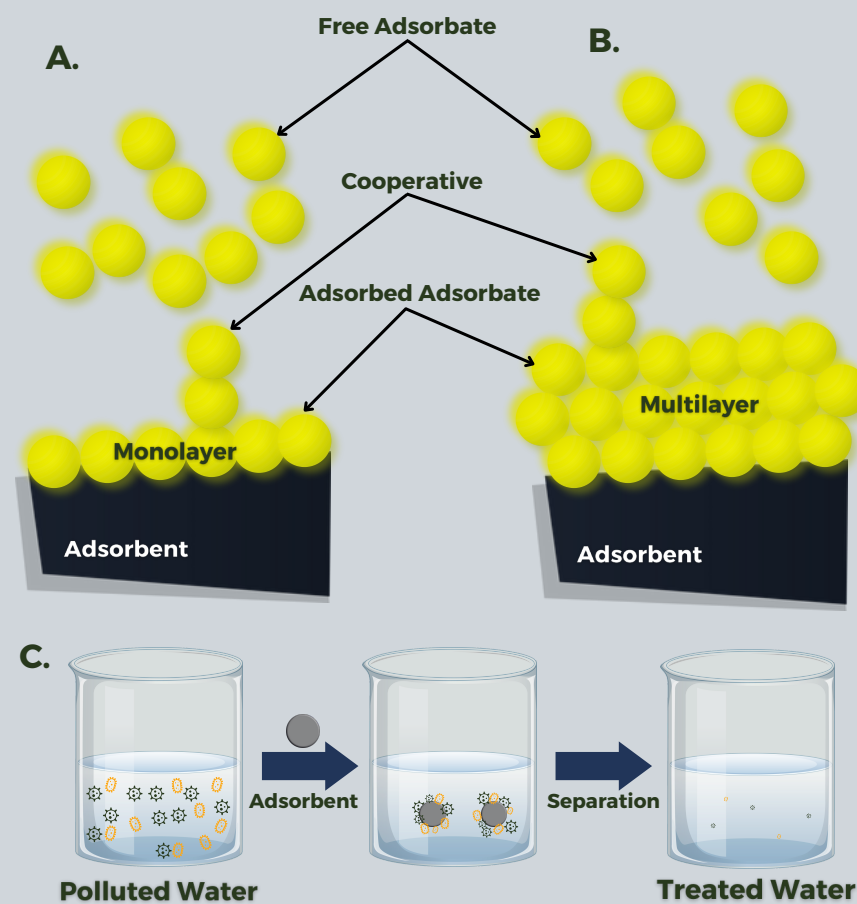
Passing to Specification for Coarse Aggregates

- ✓ Particle Size Distribution (Sieve Analysis)
- ✓ Soundness of Aggregates Test
- ✓ Bulk Density and Voids In Aggregates

OUR OBJECTIVES

Project's Goals

To have a further analysis about the pollutant-reduction capacity of Granulated Filtering Media (GFM) as coarse aggregates when incorporated in **Gabion Mattresses** and through **Scattering Method** in the polluted creek in Capitol Drive, Balanga City, Bataan.



Adsorption Process of GFM

To **produce** three (3) optimized mixtures of Granulated Filtering Media and subject to **Standard Specification for Coarse Aggregates (ASTM C33)**

To **incorporate** the Granulated Filtering Media in **Gabion Mattresses** as coarse aggregates and through **Scattering Method** on polluted creek for potential remediation.

To further investigate the pollutant-reduction efficiency of Gabion Mattresses with GFMs and Scattered GFMs in the polluted creek through Water Quality Assessment Tests of Primary Parameters and Effluent Standards set by the DENR.

Incubation Funding

With the incubation funding, the Team ConCreators has been able to spend every cent wisely, to make a more innovative applications of GFM, and to be able to effectively seek its best use, where market potential is higher.

With this, the team extends its deep gratitude to Circular Cities Asia and The Regional Project Energy Security and Climate Change Asia-Pacific (RECAP) of the Konrad-Adenauer-Stiftung

NO	DESCRIPTION	PRICE (PHP)
1	Materials	9,300.00
2	GFM Production	7,735.00
3	Pervious Reactive Concrete Production	2,710.00
4	Gabion Mattress Production	6,177.00
5	Aggregate Testing	15,125.00
6	Water Quality Tests	20,175.00
7	Labor and Food Expenses	18,810.00
8	Transportation	15,720.00
9	Papers and Miscellaneous	11,925.00
TOTAL:		PHP 107,777.00

Lessons Learnt



Team ConCreators with Ms. Roleen Sevilena



Exposing ourselves to this research and problem-solving industry allows us to have a holistic view of what is happening in society. Joining the Circular Campus Asia Programme enables us to expand our knowledge of the circular economy and utilize available resources to provide solutions to the problem. In the process of accomplishing this project, it taught the team to work well by acquiring good communication skills, technical knowledge, better project management skills, and improved problem-solving skills.

The team faced many challenges before reaping good results, from material acquisition to preparing the product for its application. In the materials acquisition, the team traveled from one city to another to find a suitable supplier but found one online. The journey went on to the preparation and creation of a product that challenged the team physically and mentally, wherein the team mass-produced the product using a single machine that needed four people to function successfully. Lastly, the team went to bodies of water to test and apply the product, got samples from streams, and placed it under testing before application. As we progress day by day, we haven't noticed that we're already far from what and where we've started.

GFM is still young, but it's opportunity in the market is high and will always be for the benefit of the community, the environment, and the circular world.



Stories



AGUILA, FRANCINE JOYCE
Project Management

"Joining CCA unveiled a lot of new knowledge to me. It made me realize that in research, it is not always go as what you plan or as what you expect the outcome to be... and that is the beauty of science an innovation. We may never know the value of an idea until we turn it into a tangible, functional object. Also, engaging with peers, mentors, and experts in the field allowed me to broaden my perspective and benefit from diverse insights."

"The CCA's programme does not only provide platform for young business-minded people out there, but as well as to raise awareness about the essence of circular economy and how beneficial it is in the contemporary world. The experiences and learnings that I have garnered during the incubation period will always be remembered as I partake my way through success. I know that there's more ahead of this journey, and through CCA, we are given the stepping stone to explore more, and to find greater meanings in the circular world."



SALUM, JERICHO
Product Testing and Development



GARCIA, ALMIRA
Technical Research

"My journey here in CCA is an extraordinary expedition that made explore the boundaries of knowledge and personal growth. Our journey here fosters intellectual curiosity, hones critical thinking skills, nurtures resilience, promotes collaboration, and rewards perseverance. It is a transformative process that not only contributes to the body of knowledge but also shapes the researcher's character and worldview. "

Stories



"Circular Campus Asia's Programme opens the opportunity to explore the circular economy and apply the knowledge from the boot camp to solve the underlying problems of society effectively. Aside from that, working on this project has equipped me with a better understanding of providing solutions and made me experience new things, such as doing experiments related to concrete. The journey here began with a spark of curiosity, a question or a problem that captured my attention and ignited my desire to seek answers.



MULI, PRECIOUS
Logistics



ACERO, ROB
Marketing and
Advertising

"The experience gained through CCA has left an indelible mark on my personal and professional growth. It has instilled in me a resilience to embrace the unknown, a willingness to adapt to unforeseen circumstances, and an appreciation for the iterative nature of research and innovation. As I delved deeper into this journey, I encountered obstacles made me learn the importance of resilience and adaptability."

Next Steps



Post-Installment of Gabion Prototype with Team's Mentor and a Representative from CENRO-Balanga

LARGE-SCALE APPLICATIONS

The GFM will be **applied in large-scale applications** like wider rivers. This will require more human resource, as well as research and developments.

INTEGRATING PARTNERSHIPS

The start-up will **integrate all possible partnerships** from private companies, environmental organizations, local government units, and government departments.

PRE-COMMERCIALIZATION

This will include **detailed capitalization and entrepreneurial preliminaries** in order to prepare the GFM in its early stage in the world of market and businesses.