

Tumatabu-Ba River Esplanade

Green-Gray Partnership
Project for Philippine Cities
and Municipalities

Municipality of Odiongan, Romblon

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CONSERVATION
INTERNATIONAL





About the Green-Gray Partnership

Climate change can no longer be ignored. The raging waters of typhoons Ondoy in 2009 and Haiyan 2013 are seared in Philippine collective memory. In the span of three weeks in 2020, three typhoons battered the country, inflicting over a hundred fatalities and at least PHP 25 billion (USD 518 million) worth of damage. The Philippines urgently needs to harness nature to uplift communities not just because it's better for the planet, but because making the most of available resources is an economic necessity.

In the last quarter of 2021, just as the Philippines was reining in the pandemic, Conservation International and AECOM began the Green-Gray Partnership Project with eleven local cities and municipalities to kickstart the adoption of nature-based solutions.

Integrating green natural systems into gray infrastructure provides multi-function and cost-effective solutions. Green-gray combines natural elements with hard infrastructure to protect and restore natural processes and create healthier urban environments. The combination allows the creation of natural habitats or system functionality (green infrastructure) in a resilient and optimized manner (gray infrastructure). Many green-gray solutions incorporate wetland and forest habitats. As with all habitat creation/restoration projects, the success of these initiatives depends on an understanding of the ecological structure and function of the target habitats.

Green-gray infrastructure approaches can apply in coastal, freshwater, and terrestrial settings and accomplish a variety of project goals. The typical infrastructure services such as flood management, coastal protection, and improving water quality are delivered alongside other benefits such as safeguarding biodiversity, providing livelihoods, increasing public space, and even financial returns to local communities through carbon credits.

A key reference for this engagement is the *Practical Guide to Implementing Green-Gray Infrastructure* by the Green-Gray Community of Practice, which is led by Conservation International. The guide, published in 2020, provides green-gray case studies and walks

readers through the process of project preparation, design, and implementation. It also defines the critical elements of the green-gray approach:

1. Using science and engineering to produce operational efficiencies;
2. Using natural processes to maximize benefits (i.e. ecosystem services);
3. Increasing the value provided by projects by including social, environmental, and economic benefits; and
4. Using collaborative processes to organize, engage, and focus interests, stakeholders, and partners.

Conservation International selected the pioneer batch of Green-Gray partner cities and municipalities based on the following criteria:

- **Commitment to a Resilient Future** Good track record and strong interest for pursuing a climate-resilient future for their locality;
- **Drivers of Change** Positioned as municipal leaders for a sustainable future for the Philippines;
- **Rich and Diverse Natural Assets** Representation of the abundant biodiversity of the Philippines; and
- **Vulnerability to Impacts of Climate Change** Exposure to the impacts of climate change.

The Green-Gray Partnership Project was meant to equip local governments units (LGUs) with capacities to identify opportunities for the adoption of nature-based solutions and prepare concept notes to rally support for pilots. At the beginning of the project, it was essential to transfer knowledge of green-gray infrastructure through the guide and workshops focusing on case studies. This built a base from which the local governments drew from in order to craft a Statement of Intent and a Concept Design Note (Annex 1), both of which are contained in this document.

This document, containing a high-level design and assessment, may be used by the local governments to seek support for project preparation (in which the concept should be refined with further studies), detailed design, and implementation. Support may be sought from national government, financing institutions, grant giving foundations, and private sector partners.

Municipality of Odiongan, Romblon, Philippines

Tumatabu-Ba River Esplanade

River Development for flood mitigation along Tumatabu-Ba River



Location
Municipality of Odiongan,
Romblon, Visayas

Proposed Site
Tumatabu-Ba River

Key Thematic Area
Riverine

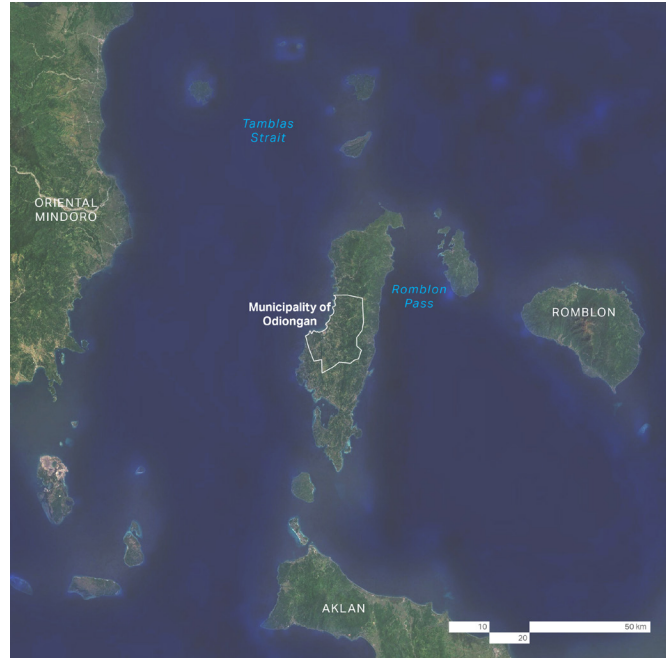
Key Issue
Flooding along the river due
to heavy upstream waterflow
aggravated by silted river

Green-Gray Solution
River embankment combined with
coastal breakwater

Proposed Implementation
Timeframe
2-5 years

- Executing Agencies
- Municipal Environment and Natural Resources Office
 - Municipal Planning and Development Office
 - Municipal Disaster Risk and Reduction Management Office
 - Municipal Agriculture Office
 - Municipal Engineer's Office

Project Aim
The Municipality of Odiongan has already planned for an infrastructure that addresses the flooding along the Tumatabu-Ba River through a river development project. The aim of this project is to propose an alternative option that will incorporate a Green-Gray Infrastructure approach as a substitute for the conventional breakwater infrastructure.



Odiongan Location Map



Odiongan Green-Gray Partnership Project Location Map

1,030
Benefitting Residents
source:
Tumatabu-Ba River
Profile, 2021

208 M
Increase in Tourism Revenue

391
Metric tons of Improved Biodiversity

Based only on assumptions and estimates; for verification in next stage



Overview

Odiongan’s proposed project focuses on flood mitigation along Tumatabu-Ba River, a major waterway on the western edge of downtown. A river control structure shall be constructed within a 2-kilometer stretch of the river spanning Barangays Tulay, Bangon and Budiong. Other interventions such as dredging, embankment, the creation of a promenade and esplanade, and mangrove reforestation will be part of the project.

Tumatabu-Ba River was the target of the Tourism and Agriculture Council’s Agri-Tourism Area that is envisioned to serve as one of the municipality’s main tourist attraction due to its beauty and rich biodiversity. This will boost the economy and create job opportunity for the community. The proposed project will be part of the realization of that development plan.

The protection of settlement areas in the project site which are vulnerable to flooding will be also be one of the main concerns of this project. While mitigating the flooding impact, the area will be transformed into an agriculturally productive and environmentally friendly park.

Sustainable Development Goals (SDG) Targets



Rationale

Based on the municipality's Climate Change and Disaster Risk Assessment process using PAGASA, DOST and MGB data, Barangays Budiong, Bangon and Tulay along the stretch of Tumatabu-Ba River are highly susceptible to flooding. The river is the biggest and widest waterway in the municipality, located at the southwestern part of the Poblacion (downtown) area. It serves as the outfall of various creeks and streams, which is why it is prone to flooding during heavy rainfall.

During heavy rains, floodwaters rise from a range of 1 meter to 3 meters in the most vulnerable areas. Listed below is the distribution of directly affected populations:

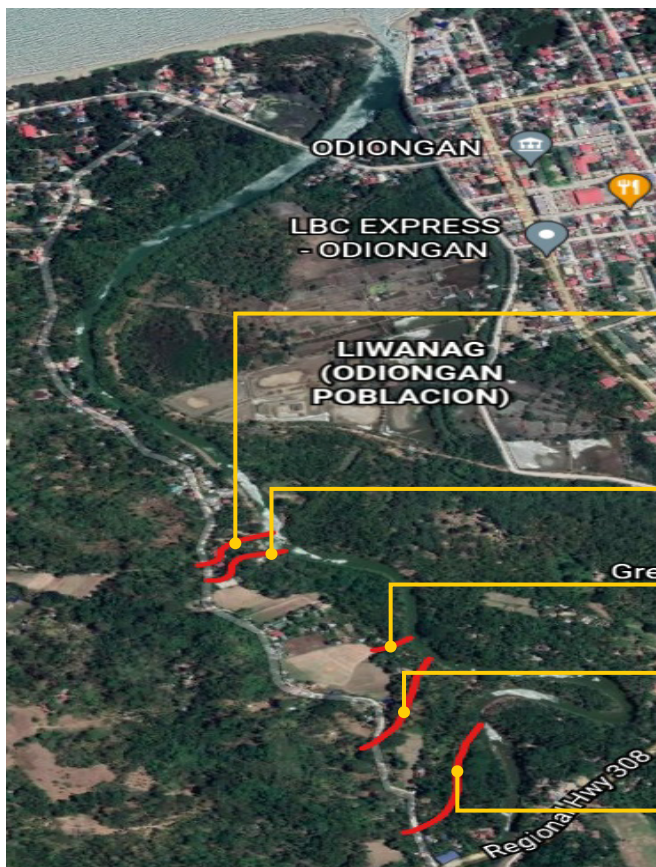
	Households	Residents
Sitio Mag-unlad, Brgy. Bangon	30	117
Sitio Magsikap, Brgy. Bangon	50	85
Purok Ilang-ilang, Brgy. Budiong	82	180
Purok Mary Gold, Brgy. Budiong	35	150
Total Directly Affected Population	197	532

Total Population directly affected by floodwater rise of Tumatabu-Ba River

The agriculture sector livelihood is the most affected by flooding events, particularly livestock, piggery, vegetables and rice products. It comprises almost 75% of the income of the residents in the affected area. During heavy rains wherein floods reach as high as 1 to 3 meters, homes are damaged. It takes 2 to 5 days for an affected resident to clean the area and restore damaged properties. In an isolated situation, there was one casualty in a flash flood during the occurrence of a typhoon.

The rivers and creeks in the municipality are used as dumping sites of solid and liquid wastes; thus, these become polluted and will significantly affect the environment and biodiversity if not mitigated. It is the result of urbanization because the area is adjacent to the town proper.

Based from Odiongan's Comprehensive Land Use Plan, Tumatabu-Ba River is Zoned as an Agri-Eco-Tourism area. Allowed activities and infrastructures are: resort, leisure/adventure park, tree parks, mangrove and sanctuary and some agricultural activities. Mangroves are present near the river delta so rehabilitation and protection should be included in the project.



Streams & Rivers along the western side of river at Barangay Bangon

approximately 4 meters width stream

stream connected to lined canal & culvert

approximately 1.5 meters width stream; waters flowing from rice fields

approximately 1.5 meters width stream; waters flowing from higher areas of Sitio Mag-unlad

approximately 7 meters width stream; waters flowing from Brgy. Anahao & Mallico

Project Proposal

The Department of Public Works and Highways (DPWH) has already started building up flood mitigating structures within the stretch of the river, prioritizing sections that are most vulnerable to flooding and riverbank soil erosion. For the Green-Gray Infrastructure project target area of 2 kilometers, 400 meters is already completed, and an additional 300 meters of river control is on-going.

With the DPWH river control project, public easement/ setback from the river has been established and possible settlement encroachment is being prevented. The Green-Gray Infrastructure project intends to enhance the original river control esplanade of the LGU through an embankment utilizing the dredged material (subject to evaluation of the characteristic of the sediments). This will help stabilize the structure that will also be developed into an elevated walkway/esplanade connecting Budiong Road to the Regional Highway 308. The embankment will incorporate vegetation along its edges to provide anti-erosion measures. A mangrove area adjacent to the river and Budiong Road is planned to be enriched for further flood protection. Both Barangay Bangon (population: 700) and Barangay Budiong (population: 330) both directly benefit from the project.

Green-gray infrastructure impact

Improving Tumatabu-Ba River using green-gray infrastructure may unlock multiple benefits including:

- Reduce the impact of inland flooding
- Restore the riverine ecosystems and biodiversity
- Increase the municipality's public space
- Increase tourism revenue
- Encourage the reforestation of the uplands

Ultimately, the pilot can make a case for the municipality wide adoption of nature-based strategies to:

- Make the city inclusive, safe, resilient and sustainable
- Conserve Odiongan's river network and riverine ecosystems



*Tumatabu-Ba River
during summer*

Sustainable Development Goals (SDG) Targets



Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all

By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities



By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums

Strengthen efforts to protect and safeguard the world's cultural and natural heritage

By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations

By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities

Substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels



Strengthen domestic resource mobilization, including through international support to developing countries, to improve domestic capacity for tax and other revenue collection

Mobilize additional financial resources for developing countries from multiple sources

Adopt and implement investment promotion regimes for least developed countries

Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed

Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the sustainable development goals, including through North-South, South-South and triangular cooperation

Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships



Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries

Integrate climate change measures into national policies, strategies and planning

Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities

Indicative Implementation Arrangements

Precise implementation arrangements remain to be determined at the pre-design preparation phase, but it is foreseen that the project shall be led and monitored by the Municipal Environment and Natural Resources Office, Municipal Planning and Development Office, Municipal Disaster Risk and Reduction Management Office, Municipal Agriculture Office, and Municipal Engineer's Office

Support may be sought from the Tourism Office. Partnership with the national government may happen through the Department of Environment and Natural Resources and the Department of Public Works and Highways.

Monitoring and Evaluation Plan

The progress and success of the project can be measured by looking into the following indicators:

- Reduction in annual costs due to inland flooding damage
- Increased tourism revenue

Due Diligence

This document contains a green-gray infrastructure design concept and high-level assessments. More details are required in order to refine this concept into a robust and detailed proposal; thus, the project preparation phase for this project should include:

- Feasibility Study
- Environmental and social impact assessment or environmental and social management framework
- Stakeholder consultations at national and project level implementation including with indigenous people, if relevant
- Gender assessment and action plan
- Operations and maintenance plan, if relevant
- Loan or grant operation manual, as appropriate
- Co-financing commitment letters

If required, the preparation of this project may include the following studies:

- Diagram of the theory of change
- Economic and financial model with key assumptions and potential stressed scenarios
- Pre-feasibility study
- Evaluation report of previous project
- Results of environmental and social risk screening

Conservation International's Diversity, Equity, and Inclusion (DEI) framework

At Conservation International (CI), we are committed to promoting human rights by reducing equity gaps and facilitating the enhancement of social and environmental sustainability. All of our projects are held to strict social and environmental principles as agreed upon and laid out by internationally accepted standards such as the Community, Biodiversity, and Carbon standard, as well as the Global Environmental Fund (GEF) and Green Climate Fund (GCF) safeguards. However, CI is taking our responsibility to communities and the environment even further with a commitment to tracking and monitoring Diversity, Equity, and Inclusion (DEI) benefits through our Environmental and Social Safeguards System (CISS), a system that exceeds international standards. To achieve maximum socio-environmental and climate benefits plus long-term sustainability of any project, we believe that communities must be at the center and actively participate in the design of any conservation initiative in which we engage. Central to this, CI engages communities in:

1. Developing the project components, including governance, management processes, and distribution mechanisms in a consultative, transparent and participatory manner with relevant stakeholders (Conservation Agreements ensure that all parties are heard and decisions are made jointly).
2. Addressing gender inequality in all of our conservation programming, monitoring, and reporting efforts.
3. Guaranteeing the long-term financial viability of the project through optimizing project implementation while maximizing benefits.
4. Prioritizing non-monetary benefits whenever possible to increase the number of beneficiaries and better guarantee long-term project success.

ANNEX Design Note

Statement of Problem and Thematic Area

The Municipality of Odiongan experiences flooding along the Tumatabu-Ba River due to the runoff coming from the upstream areas that puts the adjacent Barangays along the river vulnerable to flooding. This is exacerbated by the presence of silt within the estuary especially during high tide preventing flood to be discharged to the coast. The LGU has identified that the primary cause of the accumulation of the silt is coming from the currents coming from the coast .

Project Aim

The LGU of Odiongan has already planned for an infrastructure that addresses the flooding along the Tumatabu-Ba River through a river development project and a proposed breakwater infrastructure. The aim of this project is to propose an alternative option that will incorporate a Green-Gray Infrastructure approach as a substitute for the infrastructure.



*Proposed Breakwater to hold off coastal silt from building up in waterways (top right);
Proposed River Control and Esplanade to mitigate flooding in Bangon River (bottom right)*

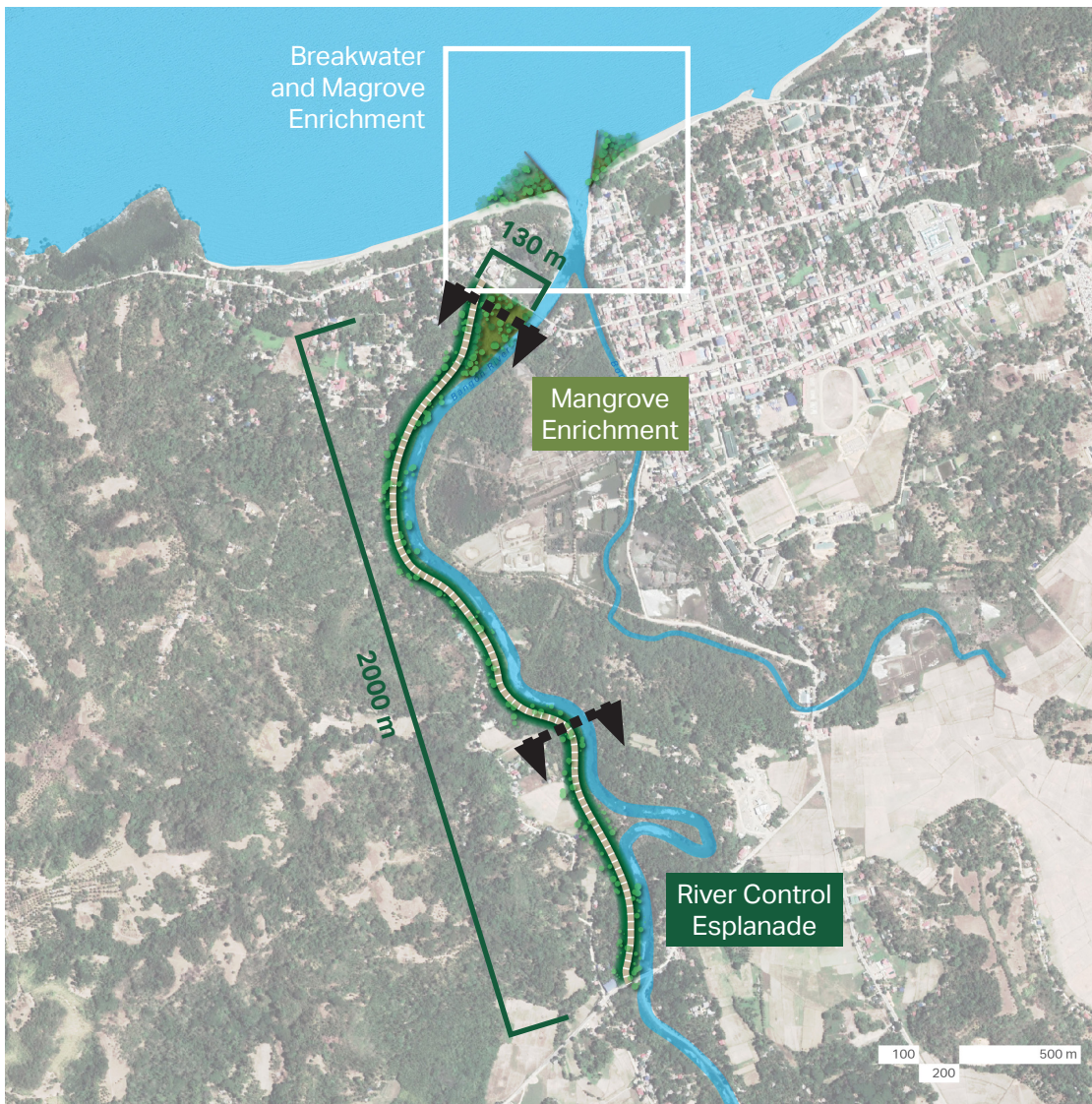


Flooding along Tumatabu-Ba River

Green-Gray Infrastructure Strategy

The proposed original river control esplanade of the LGU shall be designed to utilize the dredged material from the river to form the geotubes of the embankment subject to evaluation of the characteristic of the sediments. This will help stabilize the structure that will also be developed into an elevated walkway/esplanade connecting Budiong Road to the Regional Highway 308. The embankment will incorporate vetiver grass along its edges to provide anti-erosion measures. A mangrove area adjacent to the river and Budiong Road is planned to be enriched for further flood protection.

The proposed breakwater of the LGU to prevent sediments accumulating at the estuary shall be designed as a gray infrastructure. As per the initial high level analysis the breakwater should have maximum structural integrity due to its exposure to the open sea that can be subjected to strong wave action. Mangrove enrichment can be done at side of the breakwater that is protected from the wave action to have a layer of protection of the coastal areas from storm surge.



1.8 ha
total land area for planted mangrove

2.0 km
total length of river control esplanade

Odiongan GGI Concept Strategy Plan



1.7 ha

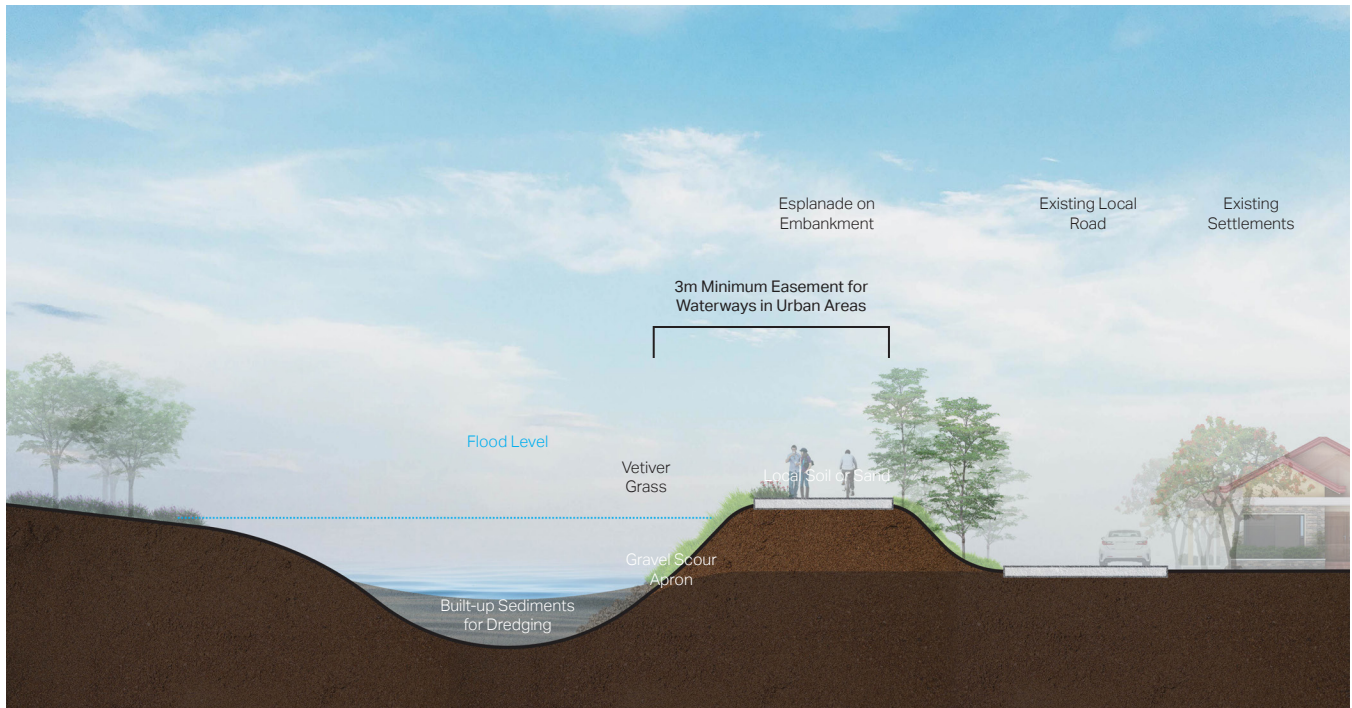
total land area
for planted
mangrove

0.3 km

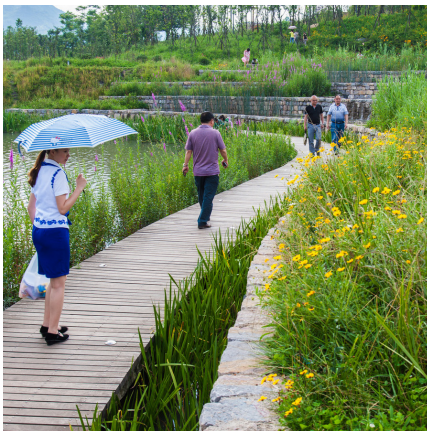
total length of
breakwater

Odiongan GGI Concept Strategy Blow-up Plan

Green-Gray Infrastructure Concept Strategy



Odiongan GGI Concept Strategy Section: River Control Esplanade



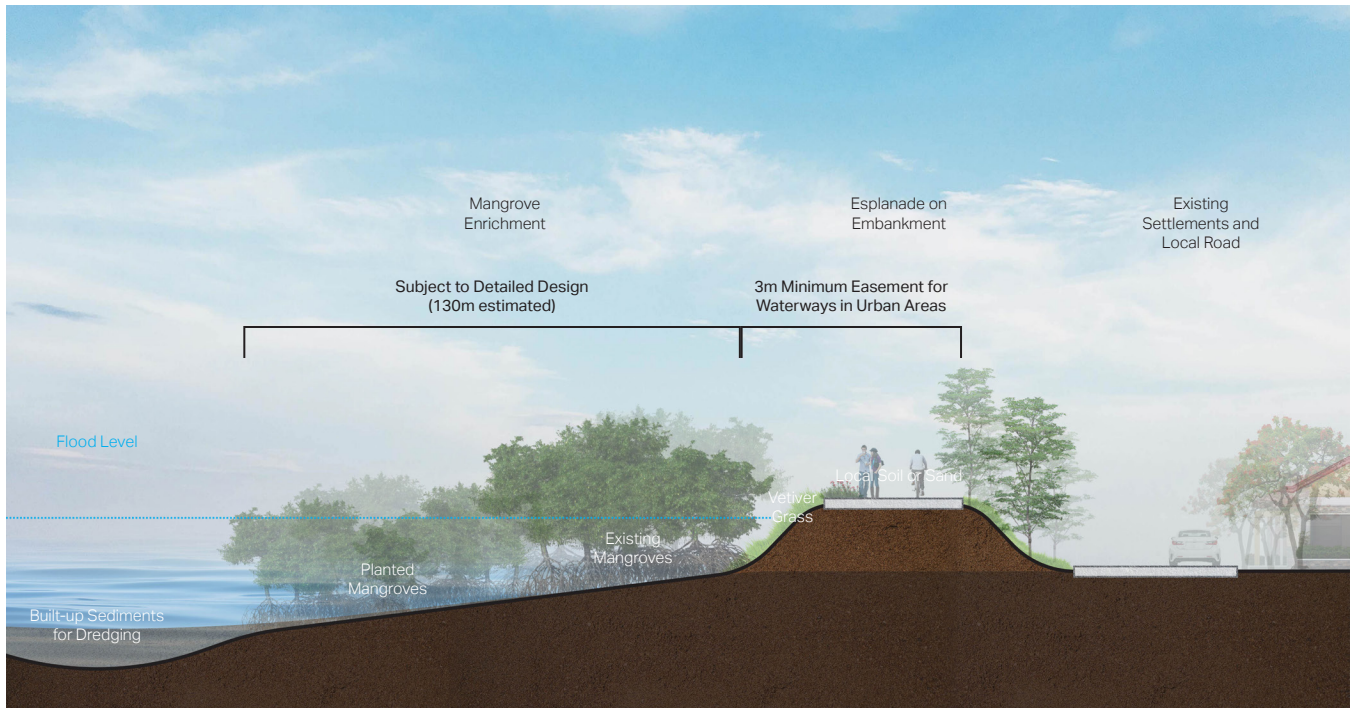
Promenade

Creek rehabilitation via waterside promenade with footpaths, cycle tracks and landscaping next to proposed river cruise .



Embankment

River embankments, sown with vetiver grass to protect against currents and waves, can be constructed above river flood levels to protect against flooding. They can also be constructed around a flood overflow area.

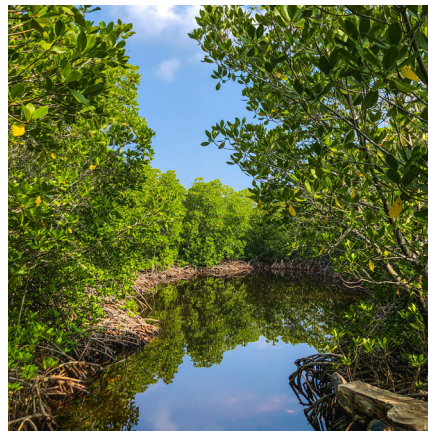


Odiongan GGI Concept Strategy Section: Mangrove Enrichment



Sediment Dredging

Silt and sediments that accumulated at the bottom of waterways require to be regularly dredged out for



Mangrove enrichment

Due to their interconnecting roots and branches, mangroves reduce wave energy. In comparison, they only have a minimal impact on storm surge which penetrates the mangroves.

Benefits of a GGI Solution

The proposed GGI solution is an alternative from a completely grey solution. This will provide the municipality a more natural esplanade that can become a tourist attraction. The mangrove enrichment initiatives will increase biodiversity in the area while also absorbing carbon. The breakwater will help reduce the need for the LGU to conduct periodic dredging to ensure continuous flow of water.

Integrated Holistic Approach

The proposed GGI Solution is a pilot project that is envisioned to be potentially scaled-up or replicated to the other parts of the municipality. Whilst, the proposed solution is addressing the key issue at hand, it is important to note that identifying the root cause of the problem is essential to be addressed.

Implementation Period

A timeline of 1-3 years is estimated to prepare, implement, and construct this GGI solution. Due to lack of data and information readily available, additional studies and scoping work shall be required to validate and collect more information regarding the key issues identified by the LGU and the assumptions that have provided during the concept design stage. The proposed project timeline shall cover the following phases:

1. Pre-design Phase

3-5 months;

This will include all the necessary study, scoping and data collection needed to establish, verify, and gather information required to proceed with a detailed engineering design.

2. Design Phase

2-4 months

A detailed engineering design shall be required to fully develop the conceptual design after using the verified data to accurately design the infrastructure according to the required specifications to address the key issue.

3. Implementation Phase

12-36 months

This will include the compliance to the required regulations/standards, seeking of approval of concerned agencies, and observance of due diligence. Upon obtaining the necessary approval and permits, the construction of the infrastructure or implementation of the prescribed program shall be done.

4. Operation, Maintenance and Adaptive Management

periodical

This shall include periodic monitoring of the infrastructure, maintenance and repair if required, evaluation of the impacts to surrounding communities, rehabilitation and retrofitting if required.

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Facts and figures

1.

AECOM launched when a handful of employees from design and engineering companies shared a dream of creating an industry-leading firm dedicated to making the world a better place.

2.

AECOM became an independent company formed by the merger of five entities. While our official founding was in 1990, many of our predecessor firms had distinguished histories dating back more than 120 years.

3.

Since then, more than 50 companies have joined AECOM and, in 2007, we became a publicly traded company on the New York Stock Exchange.

4.

As the world's trusted infrastructure consulting firm with an unrivaled heritage delivering design, planning, engineering, consulting and construction management solutions.

AECOM in the Philippines

Established in 1996, AECOM in the Philippines has grown into a 200+ strong team of planners, engineers, environmental scientists, geologists, landscape architects and technical management specialists driven by a common purpose to deliver a better world.

Creating Sustainable Legacies

We are leading the change towards a more sustainable and equitable future by partnering with our clients to provide solutions that help them achieve their environmental and social value ambitions and advancing sustainable business operations to help prevent the worst impacts of climate change.



47,000 people



Fortune 500 #163



Work across seven continents



2 Million Work Hours Awards



Revenue \$13.2 billion in fiscal year 2020



100% Rating on Corporate Equality Index / Best Places to Work for LGBT Equality 2021

Accolades

- ENR rankings No 1
- Environment Firm
- Transportation Design Firm
- Facilities Design Firm
- Mixed-Used Buildings
- Education Buildings
- Aviation
- Highways
- Chemical Remediation
- Top 10 Military Friendly company 2020
- Military Friendly® Top 10 Company
- Military Friendly® Top 10 Supplier
- Diversity Program
- Military Friendly® Top 10 Employer
- Military Friendly® Top 10 Spouse Employer
- National safety council: 155 Perfect Record Awards
- Achieved a minimum of 12 consecutive months without a recordable injury or illness.
- For each award, achieved a minimum of one million consecutive hours without an injury or illness that resulted in days away from work and zero fatalities.

About Conservation International



Bogota, Colombia (C) Conservation International

Since 1987, Conservation International has worked to spotlight and secure the critical benefits that nature provides to humanity.

Combining fieldwork with innovations in science, policy and finance, we've helped protect more than 6 million square kilometers (2.3 million square miles) of land and sea across more than 70 countries. Today, with offices in more than two dozen countries and a worldwide network of thousands of partners, our reach is truly global. But we couldn't have made it this far without you. Your contributions support our work to protect nature for the benefit of us all.

Conservation International's work in Asia-Pacific began in 1989 with a pledge to protect some three dozen of the Earth's biodiversity hotspots, including the Philippine archipelago and the Sundaland rainforests of Southeast Asia.

Since then, our focus in Asia-Pacific has expanded across the region to include other ocean and forest areas considered critical to human well-being. We help improve food security, support innovative financing for conservation projects and establish protected area networks that encompass essential ecosystems.

PRIORITIES

- **STABILIZING OUR CLIMATE BY PROTECTING AND RESTORING NATURE**
- **DOUBLING OCEAN PROTECTION**
- **EXPANDING PLANET-POSITIVE ECONOMIES**

