UNIVERSIDAD PARA LA COOPERACION INTERNACIONAL
(UCI)

PROJECT MANAGEMENT PLAN FOR THE DESIGN AND CONSTRUCTION OF A CONSTRUCTED WETLAND IN THE NEW RIVER WATERSHED

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DEDICATION

To my mom and dad who despite all challenges have always been steadfast in supporting all my achievements. To my brother and sister for always providing encouraging words to keep moving forward with this project. To my nephew for being my unconditional best friend. To my friends who listened to me in times of desperation during the completion of this project.

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To all family and friends who provided words of encouragement, especially during challenging times, sleepless nights while trying to balance my work and school life. Thanks for understanding and for all the patience, love and support.

ABSTRACT

The objective of this document is to develop a project management plan for the design and construction of a constructed wetland in the New River Watershed. This mitigates the impacts of point and non-point sources of pollution into the New River and prevents another eutrophication event.

The final product of this project also consists of the development of a sustainable development plan. This study is made of the final deliverables of the project that correspond to the management plans for scope, schedule, cost, quality, resource, communication, risk, procurement, stakeholder, and integration. The guide provided by the Project Management Institute as well as an analytical methodology to be used.

As a result of the project, it identifies that the development of this project is highly required as part of the project management processes, including tools, techniques, and best practices to ensure the successful completion of the project. The project management methodologies included in this project for the design and construction of a constructed wetland provide the framework for future projects under the Department of the Environment. It is recommended that all relevant documentation and data be submitted to secure the project funding and guarantee the project's success.

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AC	Actual Cost
CBA	Central Building Authority
CCAD	Central American Commission on Environment and Development
CPI	Cost Performance Index
CPM	Critical Path Method
CV	Cost Variance
DOE	Department of the Environment
EIA	Environmental Impact Assessment
EPA	Environmental Protection Act
EV	Earned Value
EVA	Earned Value Analysis
EVM	Earned Value Management
GCF	Green Climate Fund
GEF	Global Environment Facility
KPI	Key Performance Indicators
MAR	Mesoamerican Reef Ecoregion
NRW	New River Watershed
PEU	Project Execution Unit
PMBOK®	Project Management Body of Knowledge
PMI	Project Management Institute
PMO	Project Management Office
PPPU	Policy, Planning and Project Unit
PSC	Project Steering Committee
PV	Planned Value
RAM	Responsibility Assignment Matrix
RBS	Risk Breakdown Structure
RFP	Request for Proposal
RTM	Requirement Traceability Matrix
SDGs	Sustainable Development Goals
SIDS	Small Island Developing States
SPI	Schedule Performance Index
SV	Schedule Variance
TOR	Terms of Reference
UNEP	United Nation Environment Programme
WBS	Work Breakdown Structure

EXECUTIVE SUMMARY

Environmental pollution by anthropogenic activities within the past decades has given rise to various environmental problems. The Department of the Environment within the Ministry of Sustainable Development, Climate Change and Disaster Risk Management, functions with full autonomy to enforce the Environmental Protection Act granting the Department broad regulatory and enforcement authority for the prevention and control of environmental pollution, conservation, and management of natural resources. In 2019, with the driest dry season since the early 1980's, a prolonged drought concentrated nutrients and pollutants in the New River system for longer than usual. Rain was late and flow was reduced as water became stagnant leading to anaerobic conditions and associated stench that impacted near communities, including schools and businesses. Sugar cane production and processing has become the primary economic industry within the New River Watershed. This along with some tourism and other small operations, including aggregate mining, logging, lumber milling, fishing, hunting and agriculture. All of these economic activities and communities along the New River contribute to the cumulative impact to the New River Ecosystem. A significant load of pollutants are derived from the Tower Hill Sugar Processing Plant and the Orange Walk Town point sources of pollution with agriculture contributing a large amount of non-point source and point source pollutants into the river. The probable pollutants resulting from irresponsible development and unsustainable practices include pesticides, heavy metals, hydrocarbons, organic wastewater, sewage, sediment loads, and solid waste. Algal blooms resulting from the increased nutrients available in the river created high concentrations of dissolved oxygen in the daytime, at night billions upon billions of algal cells respiring stripped dissolved oxygen out of the water creating low oxygen levels for fish to survive resulting in large fish kills in the New River. The sulfur gases and methane, odor of rotting fishes, thick layers of wax and oil film loaded with bacteria and the abandonment of the habitat by many birds was observed. The purpose of this project is to create a project management plan that integrates sustainable principles to enable conditions and the environment for the treatment of pollution sources into the New River. The design and construction of a constructed wetland in the New River Watershed is critical to help filter the water through physical and biological processes providing nature-based solutions to treat and remove pollutants from stormwater before it enters into the New River. The management plan will serve as a pilot project and an asset to the Department of the Environment in securing funding for relevant future projects from international financial institutions.

The general objective was to develop a project management plan for the design and construction of a constructed wetland in the New River Watershed. The specific objectives were: to develop the scope management plan in order to ensure the successful completion of the project; to develop the schedule management plan to

manage the timely completion of the project; to develop the cost management plan to ensure the successful completion of the project within the given budget; to develop the quality management plan to ensure the quality of the deliverables of the project; to develop the resource management plan in order to successfully complete the project with the required resources; to develop the communication management plan in order to ensure the successful communication of the project; to develop the risk management plan to ensure the proper management of risks associated to the project; to develop the procurement management plan in order to manage the purchase of resources for the successful completion of the project; to develop the stakeholder management plan in order to ensure the stakeholder engagement of the project; to develop the integration plan to ensure the successful consolidation of all project phases; and to develop the sustainable management plan to ensure the sustainability of the project.

The methodology utilized for this research was analytical by quantitative and qualitative research methods. The management plans developed meet the standards provided by the project management methodology according to the Project Management Institute's Project Management Body of Knowledge Guide (PMBOK® Guide), sixth and seventh editions.

In conclusion, it can be stated that the Project Management Plan has been successfully implemented with the techniques and tools based on the PMI's Standard for Project Management. This Project Management Plan can serve as an asset to the Department of the Environment which should assist in executing successful future projects using the sound methodology which encapsulates the project management principles. Therefore, this Project Management Plan as well as all the subsidiary plans developed using the PMBOK ® Guide Seventh Edition must be integrated and serve as a model to improve on the implementation of projects more efficiently.

It is recommended that the Department of the Environment or the Ministry of Sustainable Development, Climate Change and Disaster Risk Management study the feasibility/viability of setting up a Project Management Office (PMO) within the Department/Ministry for effective project management and project development services. Furthermore, the recommendation from this project is for the DOE to adapt the use of the PMBOK ® Guide Seventh Edition aligning its work to the Guides principles in project management.

1. INTRODUCTION

1.1. Background

The Government of Belize through the Ministry of Sustainable Development, Climate Change and Disaster Risk Management contains various portfolios, including the Department of the Environment (DOE). The DOE was established in September 1989 to protect the nation's environment. With the passage of the Environmental Protection Act (EPA) in November 1992, the DOE became a full-fledged entity. The EPA legislation conferred broad statutory powers on the DOE concerning a wide range of environmental issues (Department of the Environment, 2020). The DOE functions with full autonomy to enforce the EPA which grants broad regulatory and enforcement authority for the prevention and control of environmental pollution, conservation, and management of natural resources. The DOE is headed by a Chief Environmental Officer and assisted by several technical staff. The Department's responsibilities are programmed into five units: Project Execution Unit, Environmental Information Management Unit, Public Awareness and Outreach Unit, Environmental Enforcement and Compliance Monitoring Unit and the Project Evaluation and Environmental Impact Assessment (EIA) Unit. The Project Execution Unit (PEU) within the DOE is tasked with the coordination of all activities for projects being executed under the Department to ensure their successful implementation and work closely with reputable international organizations to enhance environmental prospects for Belize.

1.2. Statement of the Problem

Cultural eutrophication, the pollution of coastal waters by nutrients, is a result of population growth, food production (agriculture, animal operations and aquaculture), and energy production and consumption, and is considered one of the largest

pollution problems globally (Howarth et al., 2002). In 2019, with the driest dry season since the early 1980's, a prolonged drought concentrated nutrients and pollutants in the river system for longer than usual. Rain was late and flow was reduced as water became stagnant leading to anaerobic conditions and associated stench that impacted nearby communities, including schools and businesses. As a result, New River was reported by media outlets to be in the worst condition in memory (Amandala 2019). Boles (2019) states that the New River Watershed (NRW) lies adjacent to the Rio Hondo Watershed to the west, the Belize River Watershed to the south and southeast (Crooked Tree Wetland system), and smaller coastal zone creeks to its northeast. The New River is a low elevation, slow flowing, wetland-dominated river that normally maintains a relatively heavy detritus load from all of the decaying algae, aquatic plants, and riparian forests. Originating within and flowing through a wetland landscape, New River waters are typically light to sometimes dark amber or tea- colored from all of the tannins released by decomposing plants. In the southern portion of the NRW forested areas are intact, and the protected lands of Crooked Tree Wildlife Sanctuary borders the southeastern side. However, the rest of the watershed, except for patches of remaining forests and wetlands along much of New River has largely been converted to agriculture, including corn, beans, cattle, and sugar cane production. Sugar cane production and processing has become the primary economic industry within NRW and communities in adjacent watersheds. This industry, along with some tourism, has promoted both economic and population growth, with Orange Walk Town, being the largest community in the watershed, which also includes 13 additional small communities and several clusters of houses. Two of the three sugar refiners in the country are located along the bank of New River, but only one plant, the Tower Hill Plant, is in operation. Smaller operations, including aggregate mining, logging, lumber milling, fishing, hunting, and a few other activities contribute to the economy, but not to the extent that sugar does. All of these economic activities and communities contribute to the cumulative impact to the New River Ecosystem. A

significant load of pollutants is derived from the Tower Hill Plant and Orange Walk Town point sources, with agriculture contributing a large amount of non-point source and point source pollutants into the river. This has been occurring over at least four decades and has been increasing as populations increase within the towns, villages, and communities; and as agricultural area and sugar processing capacity increases. Nutrients and other pollutants build up in the dry season when there is little rainfall and therefore little river flows to flush out the system. However, once the rainy season begins and flow increases, the occasional flood helps to purge the system. These materials of course get discharged into Corozal Bay. Probable pollutants resulting from irresponsible development and unsustainable practices include pesticides, heavy metals, hydrocarbons, organic waste waters, sewage, sediment loads, and solid waste. Sources include storm water and ditch discharge from extensive agricultural fields, scattered and clustered houses, small to large communities (especially Orange Walk Town), small businesses, the Tower Hill sugar processing plant, boat traffic on the river, and many other sources. Most of these impact sources are located right next to the river and discharge directly into the river. Those sources located away from the river discharge wastes into small, deforested streams, drainage canals, wetlands, and aquifers, usually as non-point source pollutants, that ultimately reach the river and the coastal zone. In 2019, the country suffered an intense drought. The extended drought meant that nutrients were held longer in the system, creating anaerobic conditions as bacterial respiration uses up free oxygen.

As water temperatures under cloudless skies increase, what little oxygen dissolved in the water evaporates or is used up by organisms as their metabolic rates increase within hotter waters. Without rain, rivers around the country reached extremely low water levels, further concentrating nutrients, and compounding the dire situation. Algal blooms responding to the increased nutrients available created high concentrations of dissolved oxygen in the daytime, when photosynthesis is highest,

that can be toxic to many fish species. At night, billions upon billions of algal cells are respiring, stripping dissolved oxygen out of the water, creating oxygen levels that are too low for fish to survive. As algae die out, dead cells release toxic materials into the water that greatly affect fishes and other aquatic life already stressed by low oxygen and high temperatures. Recently, the New River suffered large fish kills that people had to scoop up by the shovel full and carry off by pickup truck loads to be buried. The sulfur gases and methane, odor of rotting fishes, thick layers of wax and oil film loaded with bacteria, and the abandonment of the area by many birds alarmed people who demanded answers.

The land over which the New River flows goes from around 19 metres in elevation at its source to 0 metres in elevation when it reaches the New River Lagoon. From the New River Lagoon to the sea the land goes from 0 metres in elevation up to 13 metres in elevation at several points including San Estevan and then back to 0 metres in elevation at the sea. What this means is that the New River is slow moving and is vulnerable to stagnation at many points along its path due to the rise and fall in elevation of the land. Please see Figures 1 and 2 in the supporting information below. Since rainfall is the main source of water for the river, any lack of rainfall for extended periods will result in stagnation at many points along the New River. During severe stagnation the New River, as any river, could be reduced to a series of independent stagnant pools. During stagnation, the dissolved oxygen is naturally reduced and results in anoxic conditions that leads to the generation of a biofilm on the surface and the generation of hydrogen sulfide gas that smells like rotten eggs. These natural symptoms of stagnation are worsened when non-toxic compounds such as nitrates and phosphates are already present in the system since they contribute to rapid algal growth (basically a fertilization effect) and a further decline in dissolved oxygen. Without sufficient oxygen in the water, fish suffocate. Stagnation is further worsened when the water temperature increases due to hot weather, since this leads to further lowering of dissolved oxygen.

Rainfall data from the National Meteorological Service showed that the rainy season of 2019 had seen the lowest rainfall of any rainy season since 1983. Please see Figure 3 in supporting information. In fact, the rainy season of 2019 received as little as 100 mm of rainfall per month, which qualified it to be a dry season by definition. This extreme drought combined with the intrinsic vulnerability of the New River as described above are major factors that are leading to the problems being observed. However, through a Project Management Plan for the design and construction of a constructed wetland in the New River Watershed this will aid in decreasing the impact of point and non – point sources of pollution into the river. In addition, this will be developed using the best practices of project management with the tools, and techniques and the processes in order for the successful delivery of expected results.

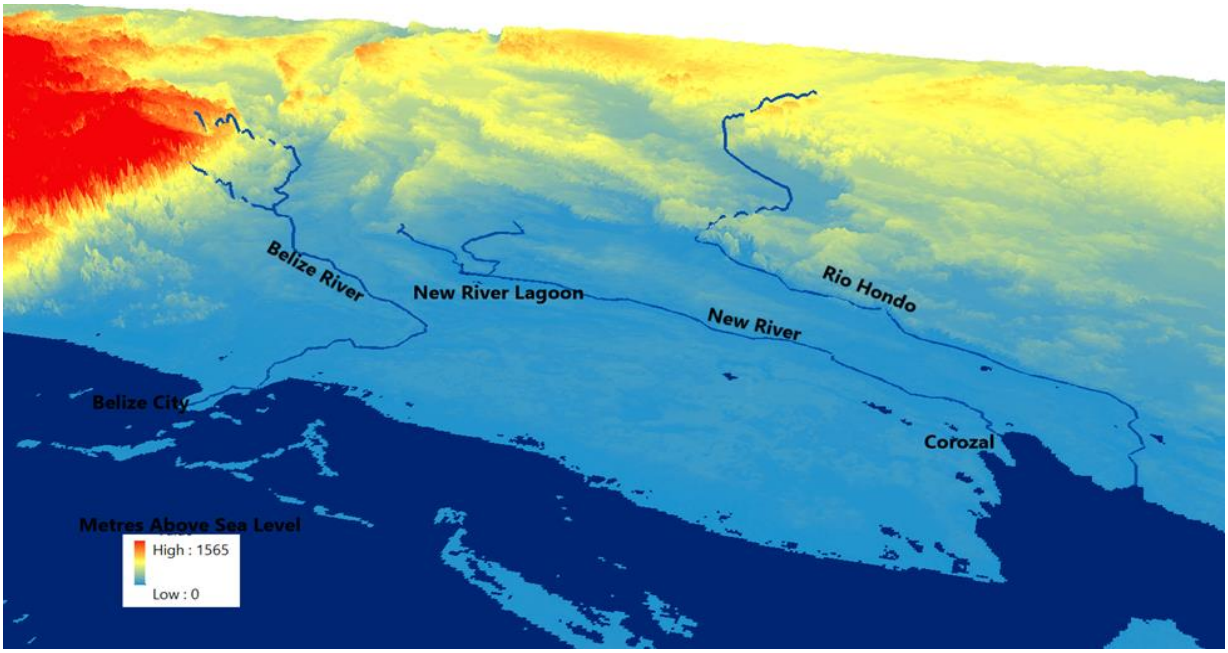

Figure 1.

3- dimensional rendering of the northern half of Belize showing the elevation over which the New River runs in comparison to the Rio Hondo and the Belize River. (Source: Shuttle Radar Topography Mission (SRTM) and Advance Spaceborne Thermal Emission and Reflection Radiometer (ASTER) n.d)

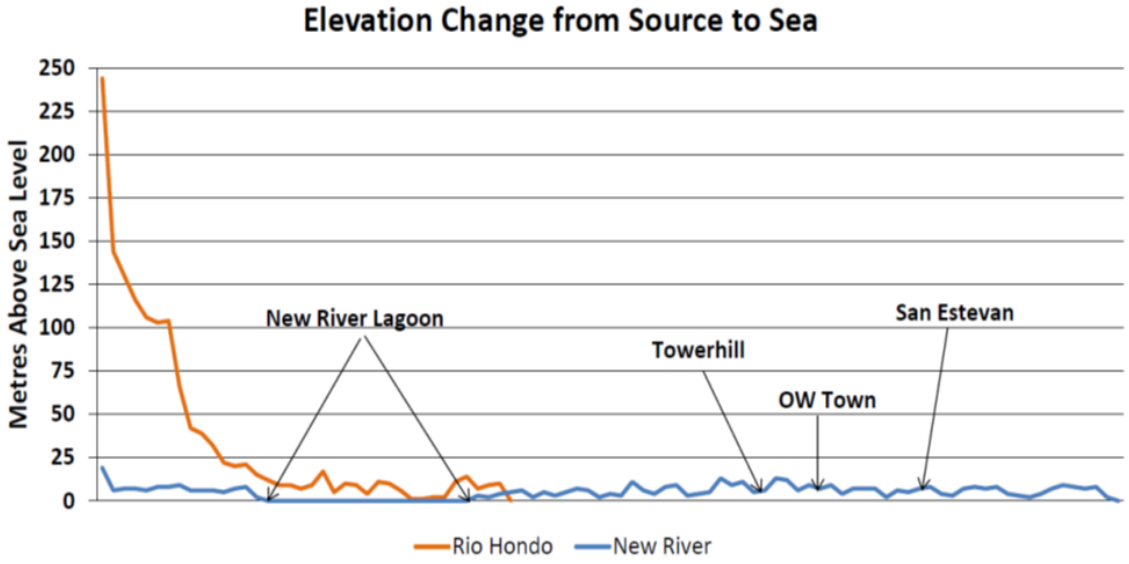

Figure 2.

The elevation of the New River from its headwaters to the sea, compared to that of the Rio Hondo. (Source: Shuttle Radar Topography Mission (SRTM) and Advance Spaceborne Thermal Emission and Reflection Radiometer (ASTER) n.d.)

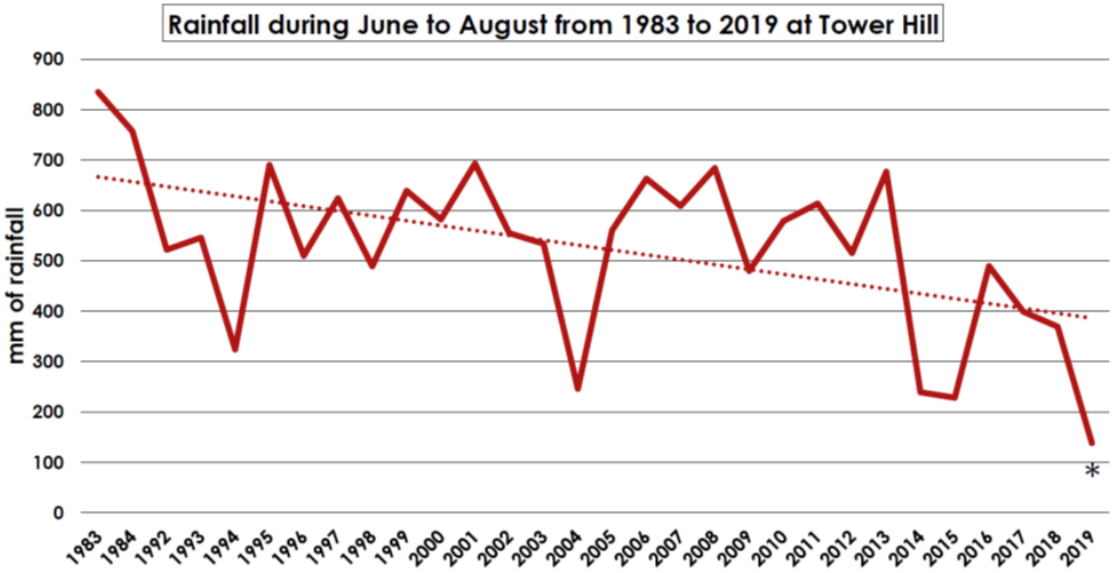

Figure 3.

Total rainfall during the months of June to August from 1983 to 2019 showing the driest rainy season in recent history occurring in 2019. (Source: National Meteorological Service of Belize, n.d.)

1.3. Purpose

The purpose of this project is to create a project management plan that integrates sustainable principles to enable conditions and the environment for the treatment of pollution sources into the New River. This project for the design and construction of a constructed wetland in the New River Watershed is critical to help filter water through physical and biological processes providing a natural way to treat and remove pollutants from stormwater before it enters into the New River.

This management plan will therefore become an asset for the Department of the Environment. It will serve as a pilot project and aid in securing funding for future relevant projects from international financial institutions such as the Global Environment Facility (GEF) and the Green Climate Fund (GCF). Belize, like many other Small Island Developing States (SIDS), is particularly vulnerable to climate change with limited access to national financial, technological, and technical resources to build the country's resilience. Belize ranks 9th on the Climate Change Vulnerability Index for the Latin American and Caribbean Region and recognizes the need to take proactive actions towards a climate resilient development pathway. This management plan will include the methodology to plan, execute, monitor, control and close processes of the project.

1.4. General Objective

To develop a project management plan for the design and construction of a constructed wetland in the New River Watershed.

1.5. Specific Objectives

1. To develop the scope management plan in order to ensure the successful completion of the project.
2. To develop the schedule management plan to manage the timely completion of the project.
3. To develop the cost management plan to ensure the successful completion of the project within the given budget.
4. To develop the quality management plan to ensure the quality of the deliverables of the project.
5. To develop the resource management plan in order to successfully complete the project with the required resources.
6. To develop the communication management plan in order to ensure the successful communication of the project.
7. To develop the risk management plan to ensure the proper management of risks associated to the project.
8. To develop the procurement management plan in order to manage the purchase of resources for the successful completion of the project.
9. To develop the stakeholder management plan in order to ensure the stakeholder engagement of the project.
10. To develop the integration management plan to ensure the successful consolidation of all the project phases.
11. To develop the sustainable development plan to ensure the sustainability of the project.

2 THEORETICAL FRAMEWORK

2.1 Company/Enterprise framework

2.1.1 Company/Enterprise background

Belize is located on the northeast coast of Central America. Situated south of the Yucatan Peninsula, it is bounded by Mexico to the north, Guatemala to the west and south, and the Caribbean Sea to the east. The land area is 8,866 square miles and with more than 1,000 cayes and a 174-mile coastline. The southern half of Belize is dominated by the rugged Maya Mountains. The northern half of the country consists of limestone lowlands and swamps. The lowlands are drained by the navigable Belize River, the New River, and the Hondo River; both the New River and the Hondo River drain into the Corozal Bay Wildlife Sanctuary (Chetumal Bay). Along the coast is the Belize Barrier Reef, the second largest barrier reef in the world. The reef reserve system was designated a UNESCO World Heritage site in 1996. The Mesoamerican Reef Ecoregion (MAR) shared by Belize, Guatemala, Honduras, and Mexico includes the world's largest transboundary barrier reef, spanning more than 1,000 km of coast and covering an area of 464,263 km^2 of ocean, coasts, and watersheds draining into the Caribbean. Its habitats and ecosystems make the MAR a biodiversity hotspot; considered one of the richest ecoregions and most diverse coral reefs in the Western Atlantic. The ecoregion provides livelihoods to communities and contributes to the national economies of the four countries through agricultural commodities, shrimp aquaculture, commercial fishing, and a rapidly growing tourism sector.

However, land use, change and inadequate agricultural and development practices cause sedimentation and pollution, which in turn affect freshwater quality of rivers that originate in the mountains and lowland aquifers and make their way to the coasts and into the sea. In addition, mass tourism and associated development industries

along the coast are expanding beyond control clearing mangrove forests and impacting the coral reefs while unsustainable fisheries threaten fish populations, ecosystem integrity and livelihoods. These anthropogenic threats have an impact from “ridge to reef” with consequences for freshwater, coastal and marine ecosystems compromising their ecological integrity.

In 1997, the heads of the four MAR countries identified the MAR region as a shared transboundary ecoregion and declared it a priority conservation area whilst expressing their commitment to work together for its improved conservation and management by signing the Tulum Declaration in 1997 and reconfirmed their commitment via the Tulum +8 Declaration. In these instruments, the countries commissioned the Central American Commission on Environment and Development (CCAD) to lead their joint efforts. For these reasons, Belize has made drastic efforts to steer into more sustainable management of its natural resources, and the protection of the environment (Lefeuvre, 2017).

2.1.2 Mission and Vision statements

Mission Statement:

The Department of the Environment’s mission statement originates from the EPA to monitor and implement. The Department’s mission is to ensure that Belize’s development is sound through effective environmental management for present and future generations (DOE, 2014).

Vision Statement:

In the most recent DOE’s National Environmental Action Plan, it outlines the vision of the Department as to be leaders in environmental stewardship for sustainable development both nationally and regionally (DOE, 2014).

2.1.3 Organizational structure

The DOE is a small department with a relatively large responsibility in environmental management. The Department is staffed with nineteen (19) permanent and established staff. The executive management of the DOE consists of the Chief Environmental Officer, Mr. Anthony Mai, with its Deputy Environmental Officer and Senior Environmental Officer among its Environmental Officers, Environmental Technicians, and other consultants and/or project manager hired from time to time.

The Department's responsibilities are programmed into five (5) units: Project Execution Unit, Environmental Information Management Unit, Public Awareness and Outreach Unit, Environmental Enforcement and Compliance Monitoring Unit and the Project Evaluation and EIA Unit. Figure 4 below shows the organizational chart for the DOE.

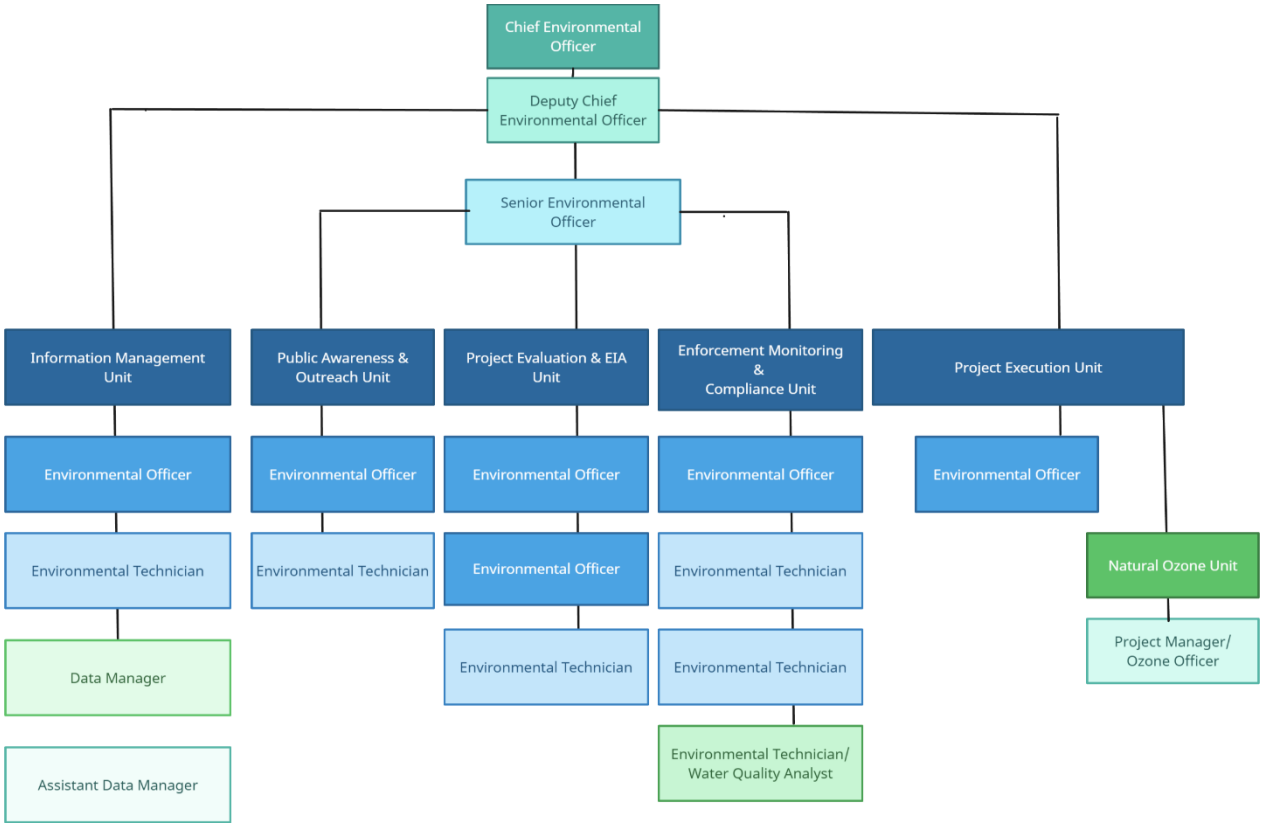

Figure 4. *Organizational structure (Source: Department of the Environment, n.d.)*

2.1.4 Products offered

The Department of the Environment, located on the 2nd Floor, Ministry of Sustainable Development, Climate Change and Disaster Risk Management Building, Hummingbird Highway, City of Belmopan, Cayo district, Belize C.A. offers the following environmental services:

- Water Quality analysis
- Capacity – building for enforcement officers
- Disaster Risk assistance
- Environmental Clearance to projects
- Importation Permits and Licenses for regulated commodities
- Community Outreach Programs (finance clean up campaigns)
- Monitoring and compliance of environmental projects

2.2 Project Management concepts

A project is a temporary endeavor undertaken to create a product, service, or result (PMI, 2017, p. 4). This project will develop a project management plan for the design and construction of a constructed wetland in the New River Watershed. Its focus is to apply pollution control of point and non – point sources of pollution into the New River.

2.2.1 Project management principles

According to PMI (2021), principles serve as a foundational guideline for strategy, decision making, and problem solving. The principles of project

management are not prescriptive in nature. They are intended to guide the behavior of people involved in projects.

The principles labels are:

- Be diligent, respectful, and caring steward
- Create a collaborative project team environment
- Effectively engage with stakeholders
- Focus on value
- Recognize, evaluate, and respond to system interactions
- Demonstrate leadership behaviors
- Tailor based on context
- Build quality into processes and deliverables
- Navigate complexity
- Optimize risk responses
- Embrace adaptability and resiliency
- Enable change to achieve the envisioned future state

The principles which we can touch basis on this project and hence are more relevant are: stewardship, team, stakeholders, leadership, quality, and adaptability and resiliency.

2.2.2 Project management domains

According to the PMI (2021), the system view reflects a shift from the Knowledge Areas in past editions of the PMBOK ® Guide to eight project performance domains. A performance domain is a group of related activities that are critical for the effective delivery of project outcomes. The performance domains represent a project management system of interactive, interrelated,

and interdependent management capabilities that work in unison to achieve desired project outcomes.

There are eight (8) project performance domains:

- Stakeholders – The stakeholder performance domain addresses activities and functions associated with stakeholders (PMI, 2021, p.8)
- Team – Team performance domain addresses activities and functions associated with the people who are responsible for producing project deliverables that realize business outcomes (PMI, 2021, p.16)
- Development Approach and Life Cycle – the development approach and life cycle performance domain addresses activities and functions associated with the development approach, cadence, and life cycle phases of the project (PMI, 2021, p. 32)
- Planning – The planning performance domain addresses activities and functions associated with the initial, ongoing, and evolving organization and coordination necessary for delivering project deliverables and outcomes (PMI, 2021, p.51)
- Project Work – the project work performance domain addresses activities and functions associated with establishing project processes, managing physical resources, and fostering a learning environment (PMI, 2021, p. 69)
- Delivery – The delivery performance domain addresses activities and functions associated with delivering the scope and quality that the project was undertaken to achieve (PMI, 2021, p. 80)
- Measurement – The measurement performance domain addresses activities and functions associated with assessing project performance and taking appropriate actions to maintain acceptable performance (PMI, 2021, p. 93)
- Uncertainty – The uncertainty performance domain addresses activities and functions associated with risk and uncertainty (PMI, 2021, p.116)

2.2.3 Predictive, adaptative and hybrid projects

2.2.3.1 Predictive Projects

Predictive project life cycles are characterized by an emphasis on specification of requirements and detailed planning during the beginning phases of a project. Detailed plans based on known requirements and constraints may reduce risk and cost. Milestones for key stakeholder involvement are also planned. As execution of the detailed plan progresses, the monitoring and controlling processes focus on constraining changes that might impact the scope, schedule, or budget (PMI, 2017, p.666).

2.2.3.2 Adaptive Projects

Highly adaptive or agile life cycles for projects is characterized by progressive elaboration of requirements based on short iterative planning and executing cycles. Risk and cost are reduced by progressive evolution of initial plans. Key stakeholders are continuously involved and provide frequent feedback which enables responding to change more quickly and also leads to better quality (PMI, 2017, p.666).

Adaptive projects are often decomposed into a sequence of phases called iterations. Each iteration utilizes the relevant project management processes. These iterations create a cadence of predictable, time-boxed pre-agreed, consistent duration that aids with scheduling (PMI, 2017, p667).

2.2.4 Project management

Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements. It is accomplished through the appropriate application and integration of the project management processes identified for the project. Project management enables organizations to execute projects effectively and efficiently (PMI, 2017, p. 10).

The Department of the Environment has a Project Execution Unit but does **not include** a project management office. The Ministry of Sustainable Development, Climate Change and Disaster Risk Management, however, has a newly established Policy, Planning and Projects Unit (PPPU) where one of the thematic areas is the monitoring and oversight of projects which includes existing and pipeline initiatives. The PPPU only consists of one staff member (project coordinator) and as such is ineffective to handle or oversee the implementation of this project.

Therefore, the use of the Project Management Body of Knowledge (PMBOK® Guide) will provide the framework for this project. The Project Management Institute (PMI) defines the project management body of knowledge (PMBOK) as a term that describes the knowledge within the profession of project management. The project management body of knowledge includes proven traditional practices that are widely applied as well as innovative practices that are emerging in the profession. Through the project management methodology of the PMBOK® Guide, this project will use its standards. The methodology will look at the five project processes: initiation, planning, monitoring, controlling, and closing.

2.2.5 Project management knowledge areas and processes

According to PMI (2017), a project management process group is a logical grouping of project management processes to achieve specific project objectives. There are five Process Groups that are independent of project phases.

2.2.5.1 Project Management Process Groups

- Initiating Process Group – Those processes performed to define a new project or a new phase of an existing project by obtaining authorization to start the project or phase (PMI, 2017, p.23).
- Planning Process Group – Those processes required to establish the scope of the project, refine the objectives, and define the course of action required to attain the objectives that the project was undertaken to achieve (PMI, 2017, p.23).
- Executing Process Group – Those processes performed to complete the work defined in the project management plan to satisfy the project requirements (PMI, 2017, p.23).
- Monitoring and Controlling Process Group – Those processes required to track, review, and regulate the progress and performance of the project; identify any areas in which changes to the plan are required; and initiate the corresponding changes (PMI, 2017, p.23).
- Closing Process Group – Those processes performed to formally complete or close the project, phase, or contract (PMI, 2017, p.23).

2.2.5.2 Project Management Knowledge Areas

According to PMI (2017), a knowledge area is an identified area of project management defined by its knowledge requirements and described in terms of its component processes, practices, inputs, outputs, tools, and techniques. The following ten (10) knowledge areas are described below:

- Project Integration Management – includes the processes and activities to identify, define, combine, unify, and coordinate the various processes and project management activities within the Project Management Process Groups (PMI, 2017, p.553).
- Project Scope Management – includes the processes required to ensure the project includes all the work required, and only the work required, to complete the project successfully (PMI, 2017, p.553).
- Project Schedule Management – includes the processes required to manage the timely completion of the project (PMI, 2017, p.553).
- Project Cost Management – includes the processes involved in planning, estimating, budgeting, financing, funding, managing, and controlling costs so the project can be completed within the approved budget (PMI, 2017, p.553).
- Project Quality Management – includes the processes for incorporating the organization's quality policy regarding planning, managing, and controlling project and product quality requirements, in order to meet stakeholder's expectations (PMI, 2017, p.553).
- Project Resource Management – includes the processes to identify, acquire, and manage the resources needed for the successful completion of the project (PMI, 2017, p.553).
- Project Communications Management – includes the processes required to ensure timely and appropriate planning, collection,

creation, distribution, storage, retrieval, management, control, monitoring, and ultimate disposition of project information (PMI, 2017, p.553).

- Project Risk Management – includes the processes of conducting risk management planning, identification, analysis, response planning, response implementation, and monitoring risk on a project (PMI, 2017, p.553).
- Project Procurement Management – includes the processes necessary to purchase or acquire products, services, or results needed from outside the project team (PMI, 2017, p.553).
- Project Stakeholder Management – includes the processes required to identify the people, groups, or organizations that could impact or be impacted by the project, to analyze stakeholder expectations and their impact on the project, and to develop appropriate management strategies for effectively engaging stakeholders in project decisions and execution (PMI, 2017, p.553).

2.2.6 Project life cycle

- The PMBOK® Guide explains a project life cycle is the series of phases that a project passes through from its start to its completion (PMI, 2017, p.19). It provides the basic framework for managing the project. Project life cycles can be predictive or adaptive. Within a project life cycle, there are generally one or more phases that are associated with the development of the product, service, or result. These are called development life cycles and can either be predictive, iterative, incremental, adaptive or a hybrid model (PMI, 2017, p.19).
- In a predictive life cycle, the project scope, time, and cost are determined in the early phases of the life cycle. These are also known as waterfall life cycles.

- In an iterative life cycle, the project scope is generally determined early in the project life cycle, but time and cost estimates are routinely modified as the project's team's understanding of the product increases.
- In an incremental life cycle, the deliverable is produced through a series of iterations that successively add functionality within a predetermined time frame. The deliverable contains the necessary and sufficient capability to be considered complete only after the final iteration.
- Adaptive life cycles are agile, iterative, or incremental. The detailed scope is defined and approved before the start of an iteration.
- A hybrid life cycle is a combination of a predictive and an adaptive life cycle. Those elements of the project that are well known or have fixed requirements follow a predictive development life cycle, and those elements that are still evolving follow an adaptive development life cycle.

For this project, the project scope, time, and cost will be determined in the early phases of the life cycle, thus, it will be a predictive life cycle which is also referred to as waterfall life cycle.

2.2.7 Company strategy, portfolios, programs, and projects

The strategies of the Department are centered on:

- Strengthening the coordination of environmental activities between government and non-government organizations.
- Establishing and enforcing standards for pollution control.
- Reviewing and revising, as necessary, existing environmental legislation and regulations as well as strengthening their enforcement.
- Promoting environmental planning for key areas of development such as the coastal zone, islands, and tourism sites.

- Establishing, upgrading, and maintaining information systems to store data and other information on the environment to facilitate planning and monitoring.
- Facilitating public participation in environmental issues, through public education campaigns and district outreach activities, in order to encourage community based environmental planning and enforcement of regulations.
- Ensuring that the Government’s Environmental Impact Assessment procedures are implemented for all environmentally sensitive projects.

3 METHODOLOGICAL FRAMEWORK

3.1 Information sources

An information source is a person, thing or place from which information comes, arises, or is obtained. They can be known as primary or secondary.

3.1.1 Primary sources

According to the University of Wisconsin (n.d.), primary sources of information are first-hand accounts of research or an event including:

- original scholarly research results,
- raw data,
- testimony,
- speeches,
- historic objects,
- or other evidence that provides unique and original information about a person or an event.

Primary sources allow researchers direct access to original ideas, events, and data. Some examples of primary sources include published original scholarly research articles, original creative works, and eyewitness accounts of contemporaneous events.

3.1.2 Secondary sources

Secondary sources analyze, synthesize, evaluate, and interpret primary sources (or other secondary sources). Secondary sources are created after an event has occurred and are written by someone who did not experience or observe the event firsthand. Some examples of secondary sources include:

- articles that interpret original scholarly research results and;

- critiques of original creative works.

Secondary sources are not evidence, but rather comment on and discuss previous evidence.

Chart 1. *Information sources (Source: Author)*

Objectives	**Information sources**	
	Primary	**Secondary**
1. To develop the scope management plan in order to ensure the successful completion of the project.	Technical reports and government documents, field interviews, PMI journals and PMBOK®,	Past thesis reports
2. To develop the schedule management plan to manage the timely completion of the project.	Meeting with the DOE's Project Execution Unit	PMBOK®, textbooks, literature reviews, reports
3. To develop the cost management plan to ensure the successful completion of the project within the given budget.	Technical reports and government documents, personal interviews, historical data and personal meetings.	PMBOK® and reports
4. To develop the quality management plan to ensure the quality of the deliverables of the project.	Technical reports and government documents, literature reviews, historical data and meetings.	PMBOK®, and past thesis reports
5. To develop the resource management plan in order to	Technical reports and government documents,	PMBOK®, textbooks, literature reviews, reports

successfully complete the project with the required resources.	journals, historical data, emails, and meetings.	
6. To develop the communication management plan in order to ensure the successful communication of the project.	Field interviews, emails, and meetings.	PMBOK®
7. To develop the risk management plan to ensure the proper management of risks associated to the project.	Technical reports and government documents, historical data, emails, and meetings.	PMBOK®, textbooks, literature reviews, reports
8. To develop the procurement management plan in order to manage the purchase of resources for the successful completion of the project.	DOE Procurement Manual, interviews, historical data, emails, and meetings.	PMBOK®, literature reviews and reports
9. To develop the stakeholder management plan in order to ensure the stakeholder	Field interviews, DOE's stakeholder engagement plan and meetings.	PMBOK®, literature reviews, reports

engagement of the project.		
10. To develop the integration management plan to ensure the successful consolidation of all the project phases.	Technical reports and government documents, journals, articles, interviews, historical data, emails, and meetings.	PMBOK®, textbooks, literature reviews, reports
11. To develop the sustainable development plan to ensure the sustainability of the project.	Technical reports and government documents, journals, articles, interviews, historical data, emails, and meetings.	PMBOK®, textbooks, literature reviews, reports

3.2 Research methods

For research projects, there are different forms of designing research. This directly depends on the problem the project aims to answer. Research methods are all those techniques used for the collection of information of research. Techniques for research are the behaviour and instruments used during observation, data collection and processing data (Manzoor, n.d.). There are two main types of research: Qualitative Research and Quantitative Research.

3.2.1 Qualitative Research Method

It uses a variety of methods and techniques that cannot be quantified (Miller & Yang 2007). The method of qualitative research uses data collection and analysis with the aim of social relation (Adams, et. al, 2007). Authors Adams, et. al (2007) mention that this method generally describes reality as experienced by the respondents. Qualitative research is characterized by various research methods, such as interviews.

Interviews

A qualitative research technique occurs by asking the participants open-ended questions. The author, Leavy (2017) explains open-ended questions to be those kinds of questions in which a participant's response is expressed in their own language and can go in any direction.

Participant Observation

Is appropriate for collecting data on naturally occurring behaviors in their usual contexts.

Focus Groups

Are effective in eliciting data on the cultural norms of a group and in generating broad overviews of issues of concern to the cultural groups or subgroups represented.

3.2.2 Quantitative Research Method

Quantitative research, based on the author, Neuman (2014) mentions that this research uses a systematic and follows a linear research path. This research is a methodological approach to deductive designs to refute or build evidence in favour of specific theories and hypotheses (Leavy, 2017). For example, surveys are one of the most used research methods of quantitative research.

Surveys

Specific methods or tools used to collect data which can be grouped into larger genres or design. Thus, a research method is a tool for data collection (Leavy, 2017). In the book, written by Neuman (2014), he explains that surveys can be used for exploratory, descriptive, or explanatory research. However, Neuman (2014) states that in surveys the categories can overlap to explore the following: behaviour, attitudes/beliefs, characteristics, expectations, self-classification, and knowledge. Common approached to quantitative research include: surveys, custom surveys, mail/e-mail/internet surveys, telephone surveys, self-administered questionnaire surveys, omnibus surveys, correlational research, trend analysis, exploratory research, descriptive research and experimental research. For the purpose of designing the research for this project, and to address the main problem, both analytical research methods will be used.

Chart 2. *Research methods (Source author)*

Objectives	**Qualitative Research Method**	**Quantitative Research Method**
1. To develop the scope management plan in order to ensure	Focus Group	Through conversation, data

the successful completion of the project.		will be gathered through structures or semi-structured questions.
2. To develop the schedule management plan to manage the timely completion of the project.	Secondary research will facilitate the collection of existing data for the development of this objective.	
3. To develop the cost management plan to ensure the successful completion of the project within the given budget.	The use of existing information and collecting data will meet this objective.	This can be achieved through interviews in order to fulfill this objective.
4. To develop the quality management plan to ensure the quality of the deliverables of the project.	Secondary research from various sources will integrate the information necessary for this objective.	Survey using questionnaires to facilitate the information for the development of the quality management plan.
5. To develop the resource management plan in order to successfully complete the project with the required resources.	Secondary research will be utilized to meet this objective.	
6. To develop the communication management plan in	Interviews, face-to-face and/ or virtual meetings, emails	

order to ensure the successful communication of the project.	will ensure the achievement of this objective.	
7. To develop the risk management plan to ensure the proper management of risks associated to the project.		Survey to collect the information needed for the development of this objective.
8. To develop the procurement management plan in order to manage the purchase of resources for the successful completion of the project.	Interviews and secondary research to facilitate the completion of the procurement plan.	
9. To develop the stakeholder management plan in order to ensure the stakeholder engagement of the project.	Interviews with stakeholders will provide the data required to develop the stakeholder management plan.	
10. To develop the integration management plan to ensure the successful consolidation of all the project phases.	Secondary research will ensure the achievement of this objective.	
11. To develop the sustainable development plan to ensure the sustainability of the project.	Secondary research to achieve the objective.	

3.3 Tools

Research instruments use tools as part of research studies to gather data. However, the PMBOK® Guide (PMI, 2017, p.725) describes tools as something tangible, such as a template… used in performing an activity to produce a product or result. This project has identified the tools to be used as seen below. There are six tools and techniques groups used in the PMBOK® Guide (2017, p. 868).

- Meetings - for the discussion of problems and finding a solution, to exchange information and build a relationship with the participants
- Data analysis - used to organize, assess, and evaluate data and information
- Project management information system
- Reserve analysis - used to determine and establish a reserve for the schedule duration, budget, estimated cost, or funds for the project
- Communication requirement analysis - for the transfer information between stakeholders
- Risk categorization - used to determine the areas of the project most exposed to the effects of certainty
- Source selection analysis - to review the competing demands for the project before deciding
- Stakeholder analysis - results in a list of stakeholders and their positions in the organization
- Document analysis - assessing the available project documentation and lessons learned

- Prioritization of stakeholders - a method to categorize stakeholders
- Expert judgement - making judgement based on skill, specialized knowledge in an area
- Activity list template - depicts a list of activities for the project
- Quality Management plan template- outlines the development of the quality management plan
- Cost management plan template - outlines the cost management plan for guidance

Chart 3. *Tools (Source: Author)*

Objectives	**Tools**
1. To develop the scope management plan in order to ensure the successful completion of the project.	- Expert judgement from the project manager and team - meetings - scope management plan template
2. To develop the schedule management plan to manage the timely completion of the project.	- Meetings - Expert judgement from environmental officers and technicians - Schedule management plan template
3. To develop the cost management plan to ensure the successful completion of the project within the given budget.	- Data analysis - meetings - expert judgement - Historical information review - cost management plan template
4. To develop the quality management plan to ensure the quality of the deliverables of the project.	- Data analysis - meetings - data gathering - quality management plan template
5. To develop the resource management plan in order to successfully complete the project with the required resources.	- Decision making - expert judgement - data gathering
6. To develop the communication management plan in order to ensure the successful communication of the project.	- Communication methods - project reporting - expert judgement

7. To develop the risk management plan to ensure the proper management of risks associated to the project.	- Expert judgement - risk categorization - data gathering - data analysis
8. To develop the procurement management plan in order to manage the purchase of resources for the successful completion of the project.	- Market research - expert judgement
9. To develop the stakeholder management plan in order to ensure the stakeholder engagement of the project.	- Stakeholder mapping - data gathering - power/interest grid - prioritization of stakeholders
10. To develop the integration management plan to ensure the successful consolidation of all the project phases.	- Expert judgement - data gathering - data analysis - meetings
11. To develop the sustainable development plan to ensure the sustainability of the project.	- Expert judgement - data analysis

3.4 Assumptions and constraints

3.4.1 Assumptions

The PMBOK® Guide defines assumption as a factor in the planning process that is considered to be true, real, or certain without proof or demonstration (PMI, 2017, p.699). ProjectManager.com states that an assumption can be an event or circumstance that one expects to happen over the life cycle of the project. The importance of assumptions is that in identifying them, you’re able to better

understand whether the project's goals and activities are realistic and achievable given the timeframe you have and analyzing assumptions is part of project risk management. Therefore, if you analyze your project assumptions and they're proven wrong, you have to revise your project plan. Hence, assumptions must be identified, tracked and managed throughout the life cycle of the project.

3.4.2 Assumptions and Constraints

A constraint, as defined in the PMBOK® Guide is a limiting factor that affects the execution of a project, program, portfolio, or process (PMI, 2017, p. 701). The following chart shows the assumptions and constraints that affect the execution of the project.

Chart 2. *Assumptions and constraints (Source: Author)*

Objectives	**Assumptions**	**Constraints**
1. To develop the scope management plan in order to ensure the successful completion of the project.	It is assumed that the DOE will assist in the development of the scope management plan.	Scope creep due to changes in the scope.
2. To develop the schedule management plan to manage the timely completion of the project.	It is assumed that the project will be completed in 3 months.	Project completion should not go beyond 3 months.
3. To develop the cost management plan to ensure the successful completion of the project within the given budget.	It is assumed that the project will be implemented within the baseline budget.	The process of acquiring consultants not foreseen in the plan may cause a

		budgetary constraint.
4. To develop the quality management plan to ensure the quality of the deliverables of the project.	It is assumed that the stakeholder's quality requirements are documented and will be met.	Quality requirements may be changed by stakeholders during the implementation of the project.
5. To develop the resource management plan in order to successfully complete the project with the required resources.	It is assumed that all the resources needed for the implementation of the project are locally available.	The resources required are not available.
6. To develop the communication management plan in order to ensure the successful communication of the project.	It is assumed that the support from the Public Awareness and Outreach Unit of the DOE will be made available.	The DOE does not count on a communication strategy for stakeholder engagement.
7. To develop the risk management plan to ensure the proper management of risks associated to the project.	It is assumed that all project risks will be identified and dealt with accordingly.	Resources are not available to address the risks.

8. To develop the procurement management plan in order to manage the purchase of resources for the successful completion of the project.	It is assumed that goods and services will be obtained locally.	Limited suppliers and requirements not met.
9. To develop the stakeholder management plan in order to ensure the stakeholder engagement of the project.	It is assumed that the relevant stakeholders will participate.	The interest of stakeholders may change during the implementation of the project.
10. To develop the integration management plan to ensure the successful consolidation of all the project phases.	It is assumed that all management plans are identified and successfully implemented.	The integration is not conducted successfully.
11. To develop the sustainable development plan to ensure the sustainability of the project.	It is assumed that the DOE is aware of the sustainable development goals and their indicators.	The SDGs are not met.

3.5 Deliverables

The PMBOK ® defines a deliverable as any unique and verifiable product, result, or capability to perform a service that is required to be produced to complete a process, phase, or project (PMI, 2017, p.704).

Chart 5. *Deliverables (Source Author)*

Objectives	**Deliverables**
1. To develop the scope management plan in order to ensure the successful completion of the project.	4.1.1 Introduction 4.1.2 Scope Management Approach 4.1.3 Roles and Responsibilities 4.1.4 Scope Definitions 4.1.5 Scope Statement 4.1.6 Project Scope Definition 4.1.7 Acceptance Criteria 4.1.8 Work Breakdown Structure 4.1.9 WBS Dictionary 4.1.10 Verification of Scope 4.1.11 Scope Control 4.1.12 Requirement Traceability Matrix
2. To develop the schedule management plan to manage the timely completion of the project.	4.2.1 Introduction 4.2.2 Schedule Management Approach 4.2.3 Responsibility Assignment Matrix 4.2.4 Schedule Baseline 4.2.5 Activity List and Durations 4.2.6 Milestone List 4.2.7 Control Schedule
3. To develop the cost management plan to ensure the successful completion of the project within the given budget.	4.3.1 Roles and Responsibilities for Cost Management 4.3.2 Performance Metrics and Earned Value Analysis

	4.3.3 Earned Value Management Metrics 4.3.4 Performance Indices 4.3.5 Estimate Costs 4.3.6 Budget Development 4.3.7 Cost Baseline 4.3.8 Cost Control 4.3.9 Change Request Control
4. To develop the quality management plan to ensure the quality of the deliverables of the project.	4.4.1 Quality Management Approach 4.4.2 Quality Objectives 4.4.3 Quality Criteria 4.4.4 Quality Roles and Responsibilities 4.4.5 Quality Assurance 4.4.6 Quality Audit 4.4.7 Quality Metrics 4.4.8 Quality Control 4.4.9 Quality Improvement Methods
5. To develop the resource management plan in order to successfully complete the project with the required resources.	4.5.1 Roles and Responsibilities 4.5.2 Resource Management Method 4.5.3 Responsibility Assignment Matrix 4.5.4 Resource Estimate 4.5.5 Acquisition of Team Members 4.5.6 Resource Calendar 4.5.7 Management of Team 4.5.8 Training 4.5.9 Performance Assessment 4.5.10 Recognition and Rewards

6. To develop the communication management plan in order to ensure the successful communication of the project.	4.6.1 Communication Methods 4.6.2 Monitor Communication
7. To develop the risk management plan to ensure the proper management of risks associated to the project.	4.7.1 Risk Management Approach 4.7.2 Risk Categories 4.7.3 Risk Breakdown Structure 4.7.4 Qualitative Risk Analysis 4.7.5 Probability and Impact 4.7.6 Risk Prioritization 4.7.7 Risk Management Strategy 4.7.8 Monitor of Risks
8. To develop the procurement management plan in order to manage the purchase of resources for the successful completion of the project.	4.8.1 Procurement Management Approach 4.8.2 Procurement Definitions 4.8.3 Cost Determination 4.8.4 Procurement of Goods 4.8.5 Procurement for Services 4.8.6 Contractual Procedures 4.8.7 Type of Contracts 4.8.8 Procurement Documentation
9. To develop the stakeholder management plan in order to ensure the stakeholder engagement of the project.	4.9.1 Introduction 4.9.2 Stakeholder Identification 4.9.3 Stakeholder Analysis 4.9.4 Manage Stakeholder Engagement 4.9.5 Monitor Stakeholder Engagement

10. To develop the integration management plan to ensure the successful consolidation of all the project phases.	4.10.1 Change Management Process
11. To develop the sustainable development plan to ensure the sustainability of the project.	4.11.1 Key Performance Indicators for the Sustainable Management Plan 4.11.2 Review and Reporting

SCOPE MANAGEMENT PLAN FOR THE DESIGN AND CONSTRUCTION OF A CONSTRUCTED WETLAND IN THE NEW RIVER WATERSHED

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4 RESULTS

4.1. Scope Management Plan

4.1.1 Introduction

The Scope Management Plan provides the framework for the design and construction of the constructed wetland in the New River. The purpose of the Scope Management Plan is to document a defined scope management approach, and its processes during the planning as well as identify roles and responsibilities of stakeholders. The document includes the Work Breakdown Structure (WBS), Defined Scope, the validation of deliverables, scope baseline and the change management of the scope.

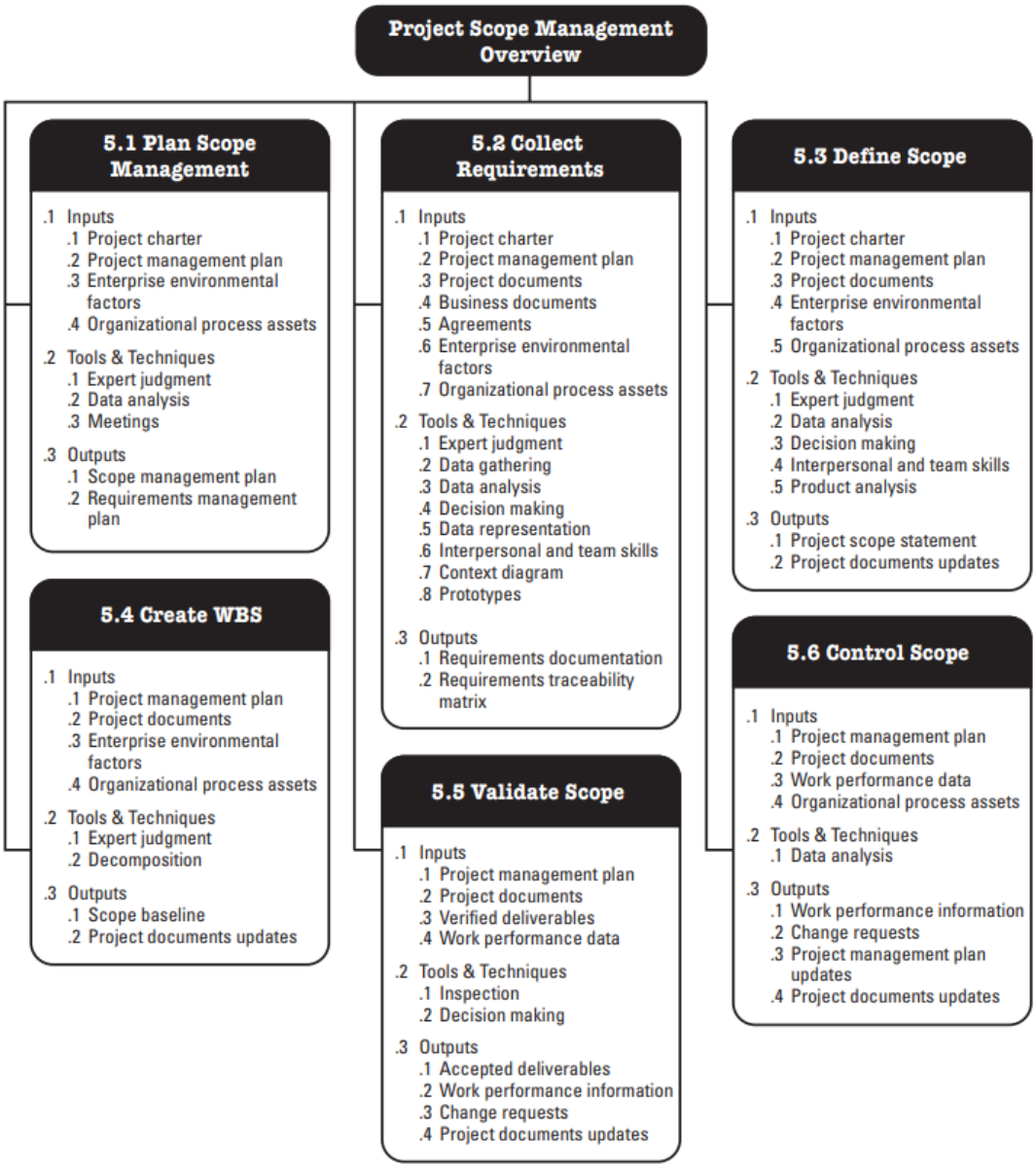

Figure 5 *Project Scope Management Overview*

4.1.2 Scope Management Approach

The purpose of the Scope Management Plan is to ensure that all the work required for the successful completion of the project is outlined. The plan will outline how the scope will be defined, verified, and controlled. It includes the scope management approach, define the roles and responsibilities of stakeholders, and provide the process to manage and control scope changes. The Project Manager will be responsible for the scope management. The Scope statement and the WBS define the scope. The project Sponsor, Stakeholders and the Project Manager will approve and establish the work performance measurements and deliverable quality checklists.

4.1.3 Roles and Responsibilities

The Project Manager, Sponsor and the Project Team are vital in managing the scope of the project. Their task is to ensure that the work performed is within the established scope for the entire project. Chart 6 below outlines the roles and responsibilities for scope management.

Chart 6. *Roles and Responsibilities for the scope management (Source: Author)*

Roles	Responsibility
Project Sponsor (Green Climate Fund, GCF)	Provides the finance

Implementing Agency (United Nations Environment Programme, UNEP)	Acts as the project sponsor Provides the disbursement of the funds Ensures the completion of the project deliverables Provides additional/contingency funds once changes are approved Supervises the financial audits of the project Supervises the interim progress report and the project completion report.
Project Director/Executing Entity (Department of the Environment)	Focal Point of the project Supervises the project activities Provides support to the management of the project
Project Manager	Manages the scope Manages the scope change requests Communicates results of scope change requests
Project Team	Assists the Project Manager
Project Steering Committee (PSC)	Accept the project deliverables Approves/denies changes in the scope
Stakeholders	Main providers of the requirement to develop the scope

4.1.4 Scope Definition

The scope was defined through the process of engaging, documenting and managing the requirements of the stakeholders in order to meet the objectives. The requirements were carried out by UNEP and the Department of the Environment.

4.1.5 Scope Statement

The Scope Statement provides a well-defined description of the product scope and major deliverables. The Statement will include the scope description, deliverables, and acceptance criteria.

4.1.5.1 Project Deliverables

The following are the project deliverables and failure to complete the following can pose a high risk for the project to be deemed unsuccessful. It is the duty of the project manager to ensure that all the deliverables are completed described in Chart 7 below.

Chart 7. *Deliverables of the project (Source: Author)*

Project Management	
0.1 Scope Management Plan	
0.2 Schedule Management Plan	
0.3 Cost Management Plan	
0.4 Quality Management Plan	
0.5 Resource Management Plan	
0.6 Communication Management Plan	
0.7 Risk Management Plan	
0.8 Procurement Management Plan	
0.9 Stakeholder Management Plan	
0.10 Integration Management Plan	
0.11 Sustainable Management Plan	
Characterization of the Wastewater discharged into the New River	
1.1 Demography	
1.2 Climate	
1.3 Hydrology	
1.4 Water Quality Monitoring	
Design of the Constructed Wetland	
2.1 Topographic Survey	2.1.1 Legislation

	2.1.2 Topographic map of the location
	2.1.3 Social, economic, and cultural characteristics of the population
2.2 Sizing Calculations	2.2.1 Sizing of the septic tank
	2.2.2 Wetland sizing
Relevant costs of a Constructed Wetland	
3.1 Investment Cost	3.1.1 Excavation and Piping
	3.1.2 Pre-treatment stage
3.2 Soil Filter	3.2.1 Liner
	3.2.2 Gravel and Sand
	3.2.3 Distribution and Drainage Pipes
	3.2.4 Pumps
3.3 Operation and Maintenance	
Building of a Constructed Wetland	
4.1 Permits	
4.2 Tenders	
4.3 Construction	
4.4 Planting & startup operations	

4.1.6 Project Scope Definition

The design and construction of a constructed wetland in the New River Watershed aims to prevent and control the contamination of the New River and its surrounding environment with the use of nature-based solutions. The project is designed to be achieved through five (5) project components: Project Management, characterization of the wastewater discharged into the New River, design of the constructed wetland, relevant costs of a constructed wetland and building of a constructed wetland.

4.1.7 Acceptance Criteria

The acceptance criteria as described below show the deliverables and acceptance criteria:

- Characterization of the wastewater discharged into the New River – The acceptance criteria is a report that highlights the demographic, climate hydrology and water quality parameters in the New River Watershed.
- Design of the constructed wetland – The acceptance criteria is the submission of a report which includes the topographic survey along with the dimensions of the wetland.
- Relevant costs of a constructed wetland – the accepting criterion is the submission of a report which outlines the costs incurred through the investment, soil filter and operation and maintenance.

Building of a constructed wetland – the acceptance criteria is the acceptance of the DOE for project completion.

4.1.8 Work Breakdown Structure (WBS)

The WBS contains the division of the project deliverables and project work as seen in Figure 6.

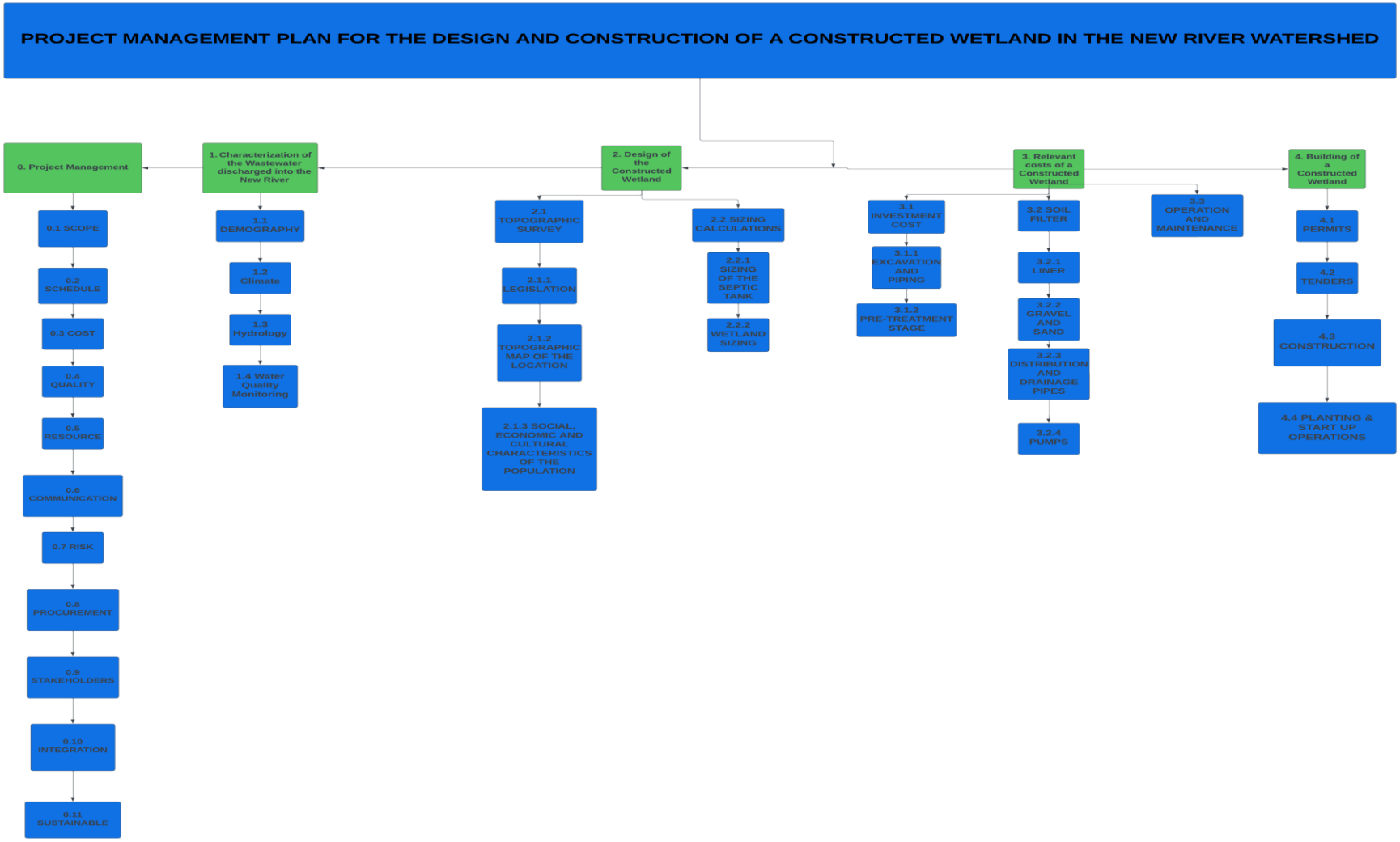

Figure 6. *Work Breakdown Structure (WBS) for the project (Source: Author)*

4.1.9 Work Breakdown Structure Dictionary

It is a broken-down form of all work activities that the project team will need to carry out to make the project successful. It includes the WBS code, deliverables, description of work, activities, and resources for each project component.

Chart 8. *Work Breakdown Structure Dictionary for the Project (Source: Author)*

Deliverable	WBS Code	Work Package Name	Description of Work	Activities	Resources required
Project Management	0.1	Scope Management Plan	Develop the scope plan of the project	Literature review, interviews with relevant stakeholders	Project Manager, laptop
	0.2	Schedule Management Plan	Develop the schedule plan of the project	Literature review, interviews with relevant stakeholders	Project Manager, laptop
	0.3	Cost Management Plan	Develop the cost plan of the project	Estimating, Literature review, interviews with relevant stakeholders	Project Manager, laptop
	0.4	Quality Management Plan	Develop the quality plan of the project	Literature review, interviews with relevant stakeholders	Project Manager and laptop
	0.5	Resource Management Plan	Develop the resource plan of the project	Literature review, interviews with relevant stakeholders	Project Manager and laptop
	0.6	Communication Management Plan	Develop the communication plan of the project	Meetings, Literature review, interviews with relevant stakeholders	Project Manager and laptop

	0.7	Risk Management Plan	Develop the risk plan of the project	Literature review, brainstorming, interviews with relevant stakeholders	Project Manager and laptop
	0.8	Procurement Management Plan	Develop the procurement plan of the project	Literature review, interviews with relevant stakeholders	Project Manager and laptop
	0.9	Stakeholder Management Plan	Develop the stakeholder plan of the project	Literature review, interviews with relevant stakeholders	Project Manager and laptop
	0.10	Integration Management Plan	Develop the integration plan of the project	Literature review, interviews with relevant stakeholders	Project Manager and laptop
	0.11	Sustainable Management Plan	Develop the sustainable plan of the project	Literature review, interviews with relevant stakeholders	Project Manager and laptop
Characterization of the wastewater discharged into the New River	1.1	Demography	Develop a demographic assessment of the New River Watershed	Literature review, interviews with relevant stakeholders, validation of the assessment	Demographic Expert, laptop, screen, and projector.
	1.2	Climate	Develop a climatological assessment of the New River Watershed	Literature review, interviews with relevant stakeholders, validation of the assessment	Climatologist, laptop, screen, and projector.

	1.3	Hydrology	Develop a hydrological assessment of the New River Watershed	Literature review, interviews with relevant stakeholders, validation of the assessment	Hydrologist, laptop, screen, and projector.
	1.4	Water Quality Monitoring	Develop a water quality assessment of the New River Watershed	Literature review, interviews with relevant stakeholders, validation of the assessment	Water Quality Expert, laptop, screen, and projector.
Design of the Constructed Wetland	2.1.1	Legislation	Policy Report	Literature review, Stakeholder engagement	Legal Consultant, laptop, screen, and projector.
	2.1.2	Topographic map of the location	Topographic Assessment of the site	Literature review, site visit, stakeholder engagement	Topography Expert, laptop, screen, and projector.
	2.1.3	Social, economic, and cultural characteristics of the population	Socio-economic and cultural assessment of the New River Watershed	Literature review, site visit, stakeholder engagement	Socio-economic expert, laptop, screen, and projector.
	2.2.1	Sizing of the septic tank	Report/blueprints on the septic tank dimensions	Literature review, site visit, stakeholder engagement, calculating dimensions and estimating	Environmental engineer, laptop, screen, and projector.

	2.2.2	Wetland sizing	Report/blueprints on the wetland dimensions	Literature review, site visit, stakeholder engagement, calculating dimensions and estimating	Environmental engineer, laptop, screen, and projector.
Relevant costs of a Constructed Wetland	3.1.1	Excavation and Piping	Blueprints and cost report on the excavation and piping networks	Literature review, site visit, stakeholder engagement, calculating dimensions and estimating costs	Contractor, laptop, screen, and projector.
	3.1.2	Pre-treatment stage	Cost report on the pre-treatment stage	Literature review, site visit, stakeholder engagement, calculating dimensions and estimating costs	Contractor, laptop, screen, and projector.
	3.2.1	Liner	Cost report on the liner	Literature review, site visit, stakeholder engagement, calculating dimensions and estimating costs	Contractor, laptop, screen, and projector.
	3.2.2	Gravel and Sand	Cost report on the gravel and sand to be used	Literature review, site visit, stakeholder	Contractor, laptop, screen, and projector.

				engagement, calculating dimensions and estimating costs	
	3.2.3	Distribution and drainage pipes	Blueprints and cost report on the distribution and drainage pipes	Literature review, site visit, stakeholder engagement, calculating dimensions and estimating costs	Contractor, laptop, screen, and projector.
	3.2.4	Pumps	Blueprints and cost report on the pumps	Literature review, site visit, stakeholder engagement, calculating dimensions and estimating costs	Contractor, laptop, screen, and projector.
	3.3	Operation and Maintenance	Cost report on the operations and maintenance	Literature review, site visit, stakeholder engagement, calculating dimensions and estimating costs	Contractor, laptop, screen, and projector.
Building of a Constructed Wetland	4.1	Permits	Obtain all relevant permits	Visit the Central Building Authority (CBA), submit application, follow-up with	Project Manager

				CBA for approval	
	4.2	Tenders	Process all received tenders/bids	Review procurement manual, design and conduct the evaluation process, write the evaluation report, develop the contracts	Procurement Officer
	4.3	Construction	Construction of the constructed wetland	All construction activities	Civil Engineer, all construction resources
	4.4	Planting and Start Up Operations	Planting and operations of the constructed wetland	All operation start-up activities	Civil Engineer, all construction resources

4.1.10 Verification of Scope

The Project Manager has the responsibility to review and verify all the deliverables of the project with the agreed Scope Statement and the WBS. Once verified, the Project Manager will seek acceptance from the Project Steering Committee. The PSC will sign off on the deliverables of the project. As seen on Chart 6, the Project Manager is responsible for the management of the scope, scope change request and to communicate the results of said change request. Note that the changes are approved/denied by the Project Director and/or Project Manager only after consultation with the Project Steering Committee.

4.1.11 Scope Control

The status of the project and the scope baseline is monitored and maintained throughout the project. Scope will be the responsibility of the Project Manager and the project team. Change request of the project scope during the project if needed can be observed with the provision of the estimate cost of those changes. The Project Director and the Project Manager shall review the changes and will approve or reject the changes after consultation with the Project Steering Committee. A formal change request can be submitted by using the template in Appendix 6.

4.1.12 Requirement Traceability Matrix

Projects have a lot of requirements. To ensure that they're executed properly, the project manager will use a requirements traceability matrix (RTM). An RTM is a list of all project requirements and the corresponding details to track them throughout the project's lifecycle. This way, the project manager ensures and is certain that all requirements have been met and completed satisfactorily. Figure 7 below depicts an example of an RTM template.

Figure 7. *Requirement Traceability Matrix Template*

Project	Development of a Project Management Plan for the design and construction of a constructed wetland in the New River Watershed
Project Manager	Francisco Javier Magaña

ID	WBS Code	Description	Acceptance Criteria	Priority	Source	Responsible

SCHEDULE MANAGEMENT PLAN FOR THE DESIGN AND CONSTRUCTION OF A CONSTRUCTED WETLAND IN THE NEW RIVER WATERSHED

Department of the Environment, 2nd floor, Green Complex Building, 7552 Hummingbird Highway, Belmopan, Cayo district, Belize, C.A.

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4.2. Schedule Management Plan

4.2.1 Introduction

The Project Schedule Management includes the processes required to manage the timely completion of the project. Processes for schedule management may include: the schedule management, defining the project activities, an estimation of the project activities duration, the development of the schedule, and how the schedule will be controlled (PMI, 2017, p.173). The schedule is the tool that communicates what work needs to be performed, the resources required to perform the work, and the time needed to be performed. The schedule is a reflection of all the work associated with delivering the project on time and its progress.

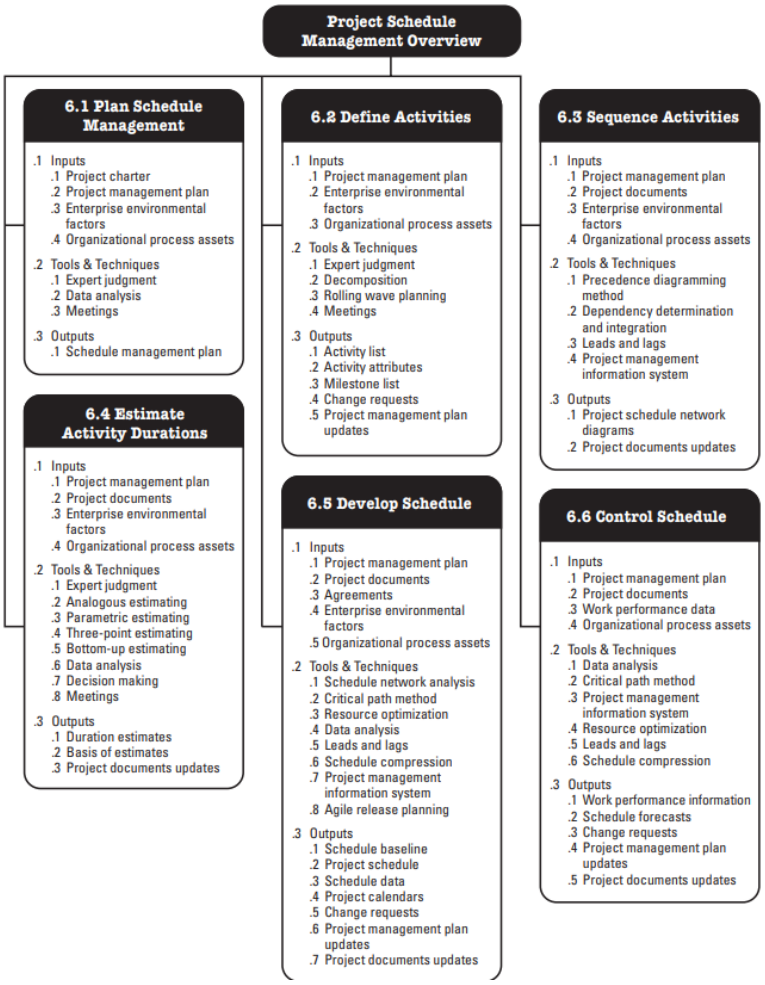


Figure 8 *Project Schedule Management Overview*

4.2.2 Schedule Management Approach

A project schedule shows the planned activities needed to be accomplished to achieve the project deliverables. Tools and techniques will be employed to monitor and control the project schedule and the progress of activities. The Project Manager is responsible for reporting on the project schedule performance during project status meetings. These meetings can be scheduled on a week's basis. Any deviations from the schedule are reported at the status meetings and the Green Climate Fund (sponsor) will approve any schedule changes brought through the Project Change Control process.

4.2.3 Responsibility Assignment Matrix (RAM)

The Responsibility Assignment Matrix shows the project resources assigned to each work package delineating levels of control and responsibility and indicates the authority and responsibility levels for the project. The RACI chart (responsible, accountable, consult and inform) is the tool used to ensure clear assignment of roles and responsibilities for internal and external resources. The matrix below shows all the activities accountable for any task in order to avoid any confusion.

Chart 9 Responsibility Assignment Matrix (RAM) for the project (Source: Author)

Project Task	PD	PM	PS	CON	IE
Project Management	C	A	I	R	I
Characterization of the Wastewater discharged into New River (demography, climate, hydrology, water quality monitoring)	C	A	I	R	I
Design of the constructed wetland (topographic survey and sizing calculations)	C	A	I	R	I

Relevant costs of a constructed wetland (investment cost, soil filter and operations and maintenance)	C	A	I	R	I
Building of a constructed wetland (permits, tenders, construction and planting and start-up operations)	C	A	I	R	I

Key:

R – Responsible for completing the work

A – Accountable for ensuring task completion/sign off

C – Consulted before any decisions are made

I – Informed when an action/decision has been made

PD – Project Director

PM – Project Manager

PS – Project Sponsor

CON – Consultants

IE – Implementing Entity

4.2.4 Schedule Baseline

The schedule baseline for the project is the approved version of the schedule model and can only be changed through a formal change control procedure along with the accepted and approved schedule baseline with baseline start dates and baseline finish dates (PMI, 2017, p. 217). Variances to the schedule will be determined during the monitoring and control phase of the project.

4.2.5 Activity List and Durations

This section provides a list of activities and tasks being implemented to establish and manage the project schedule. The estimated activity durations are used to determine the amount of time each activity needs for it to be completed were expert judgement, decision making and meetings.

Chart 10. Activity list and duration with resource names (Source: Author)

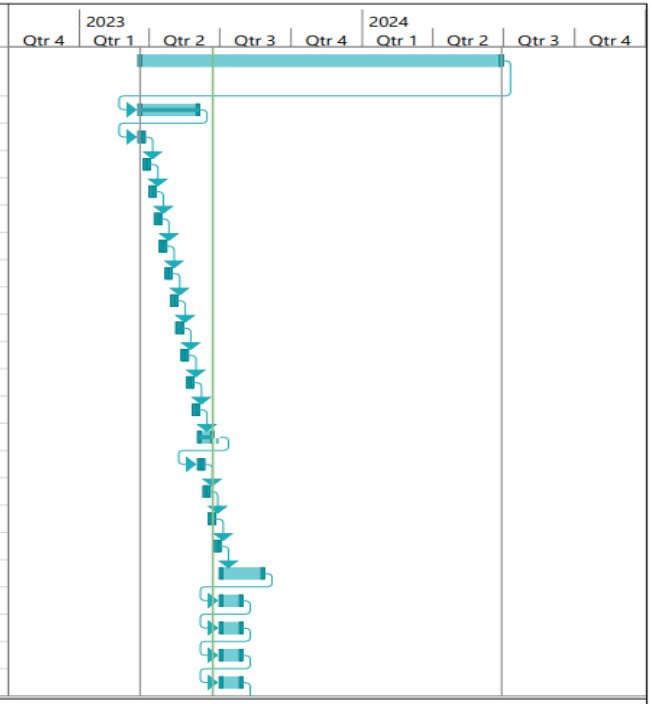
Deliverable	WBS Code	Work Name	Duration	Resource required
Project Management	0.1	Scope Plan	5 days	Project Manager and laptop
	0.2	Schedule Plan	5 days	Project Manager and laptop
	0.3	Cost Plan	5 days	Project Manager and laptop
	0.4	Quality Plan	5 days	Project Manager and laptop
	0.5	Resource Plan	5 days	Project Manager and laptop
	0.6	Communication Plan	5 days	Project Manager and laptop
	0.7	Risk Plan	5 days	Project Manager and laptop
	0.8	Procurement Plan	5 days	Project Manager and laptop
	0.9	Stakeholder Plan	5 days	Project Manager and laptop
	0.10	Integration Plan	5 days	Project Manager and laptop
	0.11	Sustainable Plan	5 days	Project Manager and laptop
Characterization of the Wastewater discharged into the New River	1.1	Demography	5 days	Consultant, Project Manager and Project Team
	1.2	Climate	5 days	Consultant
	1.3	Hydrology	5 days	Consultant

	1.4	Water Quality Monitoring	5 days	Consultant
Design of the Constructed Wetland	2.1.1	Legislation	20 days	Legal Consultant, Project Manager and Project Team
	2.1.2	Topographic map of the location	20 days	Consultant
	2.1.3	Social, Economic and Cultural Characteristics of the Population	20 days	Socio-Economic Expert
	2.2.1	Sizing of the Septic Tank	20 days	Environmental Engineer, Project Manager and Project Team
	2.2.2	Wetland Sizing	20 days	Environmental Engineer, Project Manager
Relevant costs of a Constructed Wetland	3.1.1	Excavation and Piping	3 days	Contractor, Accounting Clerk
	3.1.2	Pre-treatment Stage	3 days	Contractor, Accounting Clerk
	3.2.1	Liner	3 days	Contractor, Accounting Clerk
	3.2.2	Gravel and Sand	3 days	Contractor, Accounting Clerk
	3.2.3	Distribution and Drainage Pipes	3 days	Contractor, Accounting Clerk
	3.2.4	Pumps	3 days	Contractor, Accounting Clerk
	3.3	Operation and Maintenance	3 days	Contractor, Accounting Clerk,

Building a Constructed Wetland	4.1	Permits	60 days	Project Manager, Project Team, Project Director
	4.2	Tenders	20 days	Procurement Officer
	4.3	Construction	80 days	Civil Engineer, Project Manager, Project Team,
	4.4	Planting & Start Up Operations	40 days	Civil Engineer, Project Manager and Project Team

4.2.6 Milestone List

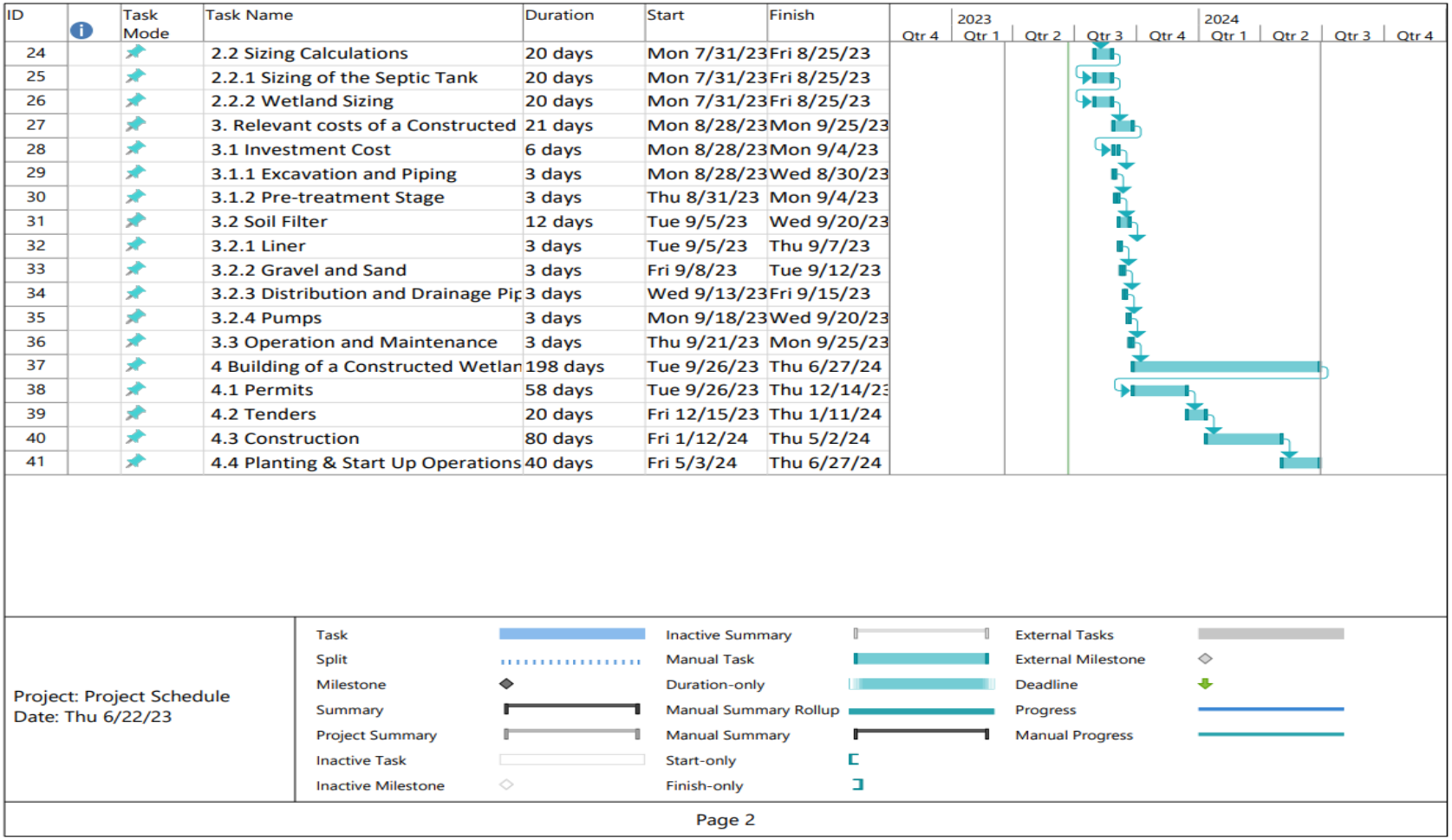
ID	Task Mode	Task Name	Duration	Start	Finish
1		Project Management Plan for the Design and Construction of a	335 days	Mon 3/20/23	Fri 6/28/24
2		0. Project Management	55 days	Mon 3/20/23	Fri 6/2/23
3		0.1 Scope Management Plan	5 days	Mon 3/20/23	Fri 3/24/23
4		0.2 Schedule Management Plan	5 days	Mon 3/27/23	Fri 3/31/23
5		0.3 Cost Management Plan	5 days	Mon 4/3/23	Fri 4/7/23
6		0.4 Quality Management Plan	5 days	Mon 4/10/23	Fri 4/14/23
7		0.5 Resource Management Plan	5 days	Mon 4/17/23	Fri 4/21/23
8		0.6 Communication Management I	5 days	Mon 4/24/23	Fri 4/28/23
9		0.7 Risk Management Plan	5 days	Mon 5/1/23	Fri 5/5/23
10		0.8 Procurement Management Pla	5 days	Mon 5/8/23	Fri 5/12/23
11		0.9 Stakeholder Management Plan	5 days	Mon 5/15/23	Fri 5/19/23
12		0.10 Integration Management Plar	5 days	Mon 5/22/23	Fri 5/26/23
13		0.11 Sustainable Management Plar	5 days	Mon 5/29/23	Fri 6/2/23
14		1. Characterization of the Wastewa	13 days	Mon 6/5/23	Fri 6/30/23
15		1.1 Demography	5 days	Mon 6/5/23	Fri 6/9/23
16		1.2 Climate	5 days	Mon 6/12/23	Fri 6/16/23
17		1.3 Hydrology	5 days	Mon 6/19/23	Fri 6/23/23
18		1.4 Water Quality Monitoring	5 days	Mon 6/26/23	Fri 6/30/23
19		2. Design of the Constructed Wetla	40 days	Mon 7/3/23	Fri 8/25/23
20		2.1 Topographic Survey	20 days	Mon 7/3/23	Fri 7/28/23
21		2.1.1 Legislation	20 days	Mon 7/3/23	Fri 7/28/23
22		2.1.2 Topographic Map of the Loca	20 days	Mon 7/3/23	Fri 7/28/23
23		2.1.3 Social, Economic and Cultura	20 days	Mon 7/3/23	Fri 7/28/23



Project: Project Schedule
Date: Thu 6/22/23

Task	Inactive Summary	External Tasks
Split	Manual Task	External Milestone
Milestone	Duration-only	Deadline
Summary	Manual Summary Rollup	Progress
Project Summary	Manual Summary	Manual Progress
Inactive Task	Start-only	
Inactive Milestone	Finish-only	

Page 1



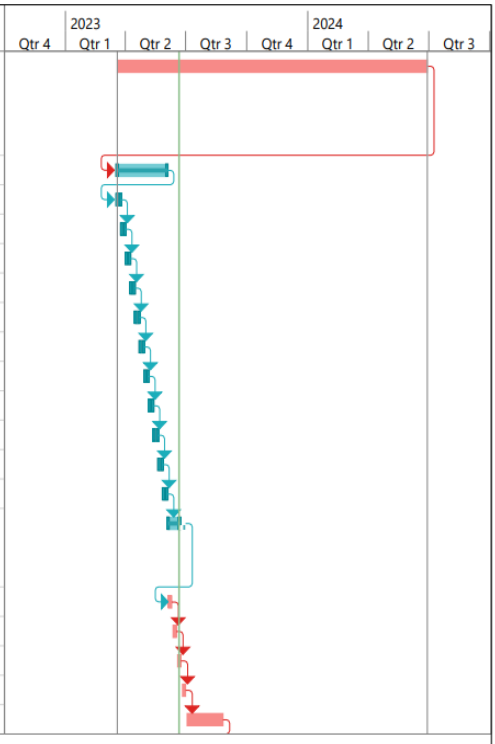
ID	Task Mode	Task Name	Duration	Start	Finish
24		2.2 Sizing Calculations	20 days	Mon 7/31/23	Fri 8/25/23
25		2.2.1 Sizing of the Septic Tank	20 days	Mon 7/31/23	Fri 8/25/23
26		2.2.2 Wetland Sizing	20 days	Mon 7/31/23	Fri 8/25/23
27		3. Relevant costs of a Constructed	21 days	Mon 8/28/23	Mon 9/25/23
28		3.1 Investment Cost	6 days	Mon 8/28/23	Mon 9/4/23
29		3.1.1 Excavation and Piping	3 days	Mon 8/28/23	Wed 8/30/23
30		3.1.2 Pre-treatment Stage	3 days	Thu 8/31/23	Mon 9/4/23
31		3.2 Soil Filter	12 days	Tue 9/5/23	Wed 9/20/23
32		3.2.1 Liner	3 days	Tue 9/5/23	Thu 9/7/23
33		3.2.2 Gravel and Sand	3 days	Fri 9/8/23	Tue 9/12/23
34		3.2.3 Distribution and Drainage Pip	3 days	Wed 9/13/23	Fri 9/15/23
35		3.2.4 Pumps	3 days	Mon 9/18/23	Wed 9/20/23
36		3.3 Operation and Maintenance	3 days	Thu 9/21/23	Mon 9/25/23
37		4 Building of a Constructed Wetlan	198 days	Tue 9/26/23	Thu 6/27/24
38		4.1 Permits	58 days	Tue 9/26/23	Thu 12/14/23
39		4.2 Tenders	20 days	Fri 12/15/23	Thu 1/11/24
40		4.3 Construction	80 days	Fri 1/12/24	Thu 5/2/24
41		4.4 Planting & Start Up Operations	40 days	Fri 5/3/24	Thu 6/27/24

Figure 9. *Schedule baseline of the project (Source: Author)*

The project schedule is monitored and controlled using the Critical Path Method (CPM). The CPM is the shortest possible project duration which is determined by the critical **p**ath. The activities highlighted in red in Figure 10 below are closely monitored to avoid delays.

The Project Manager is tasked to control the project through the CPM by ensuring that activities that can be done in parallel are done concurrently. Figure 10 below illustrates the CPM within the project emphasized in red.

ID	Task Mode	Task Name	Duration	Start	Finish
1		Project Management Plan for the Design and Construction of a Constructed Wetland in the New River Watershed	335 days	Mon 3/20/23	Fri 6/28/24
2		0. Project Management	55 days	Mon 3/20/23	Fri 6/2/23
3		0.1 Scope Management Plan	5 days	Mon 3/20/23	Fri 3/24/23
4		0.2 Schedule Management Plan	5 days	Mon 3/27/23	Fri 3/31/23
5		0.3 Cost Management Plan	5 days	Mon 4/3/23	Fri 4/7/23
6		0.4 Quality Management Plan	5 days	Mon 4/10/23	Fri 4/14/23
7		0.5 Resource Management Plan	5 days	Mon 4/17/23	Fri 4/21/23
8		0.6 Communication Management I	5 days	Mon 4/24/23	Fri 4/28/23
9		0.7 Risk Management Plan	5 days	Mon 5/1/23	Fri 5/5/23
10		0.8 Procurement Management Pla	5 days	Mon 5/8/23	Fri 5/12/23
11		0.9 Stakeholder Management Plan	5 days	Mon 5/15/23	Fri 5/19/23
12		0.10 Integration Management Plar	5 days	Mon 5/22/23	Fri 5/26/23
13		0.11 Sustainable Management Plar	5 days	Mon 5/29/23	Fri 6/2/23
14		1. Characterization of the Wastewater discharged into the New River	13 days	Mon 6/5/23	Fri 6/30/23
15		1.1 Demography	5 days	Mon 6/5/23	Fri 6/9/23
16		1.2 Climate	5 days	Mon 6/12/23	Fri 6/16/23
17		1.3 Hydrology	5 days	Mon 6/19/23	Fri 6/23/23
18		1.4 Water Quality Monitoring	5 days	Mon 6/26/23	Fri 6/30/23
19		2. Design of the Constructed Wetla	40 days	Mon 7/3/23	Fri 8/25/23



Project: Project Schedule
Date: Wed 6/21/23

Task
Split
Milestone
Summary
Project Summary
Inactive Task
Inactive Milestone
Inactive Summary
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only
Finish-only
External Tasks
External Milestone
Deadline
Critical
Critical Split
Progress
Manual Progress

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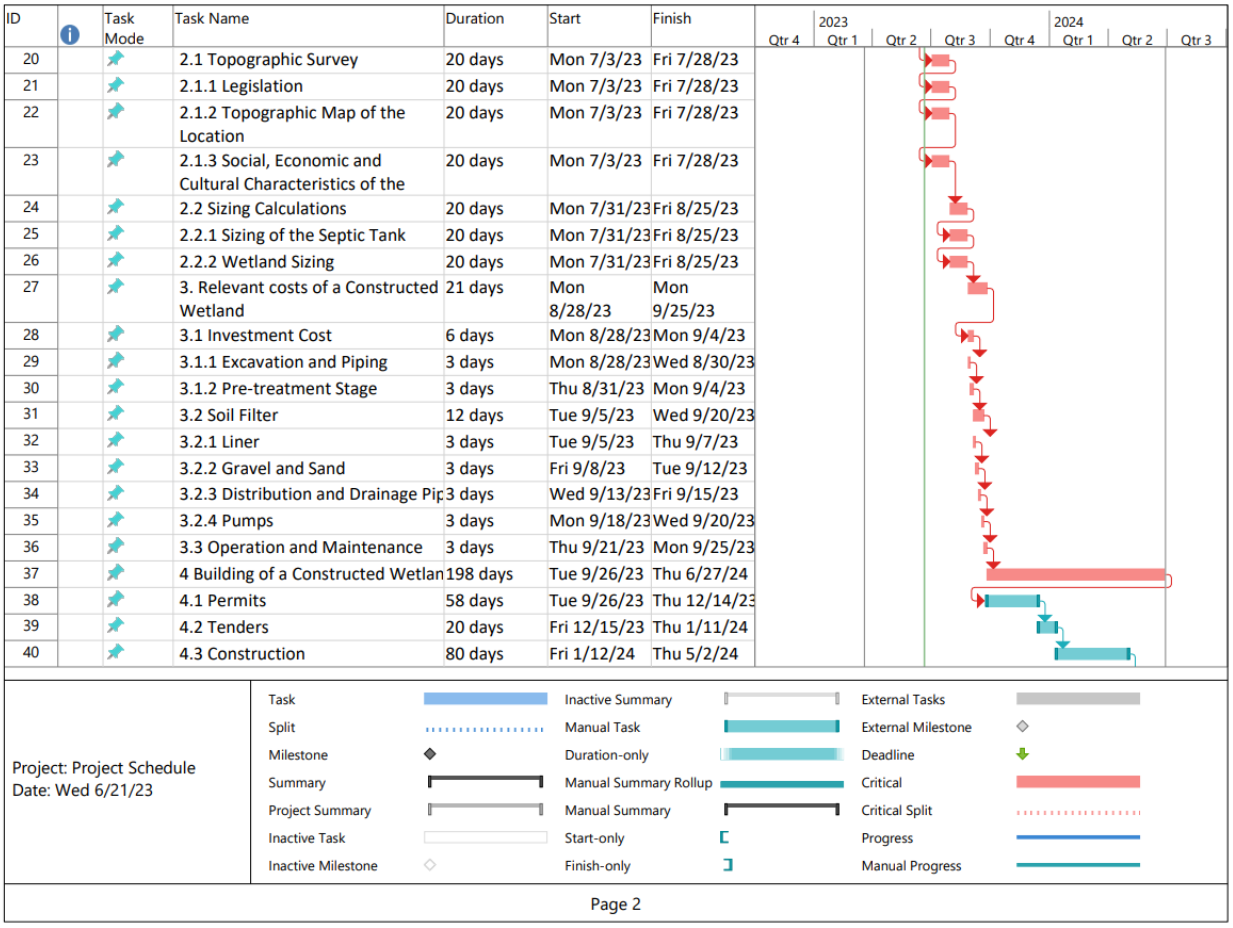

ID	Task Mode	Task Name	Duration	Start	Finish
20		2.1 Topographic Survey	20 days	Mon 7/3/23	Fri 7/28/23
21		2.1.1 Legislation	20 days	Mon 7/3/23	Fri 7/28/23
22		2.1.2 Topographic Map of the Location	20 days	Mon 7/3/23	Fri 7/28/23
23		2.1.3 Social, Economic and Cultural Characteristics of the	20 days	Mon 7/3/23	Fri 7/28/23
24		2.2 Sizing Calculations	20 days	Mon 7/31/23	Fri 8/25/23
25		2.2.1 Sizing of the Septic Tank	20 days	Mon 7/31/23	Fri 8/25/23
26		2.2.2 Wetland Sizing	20 days	Mon 7/31/23	Fri 8/25/23
27		3. Relevant costs of a Constructed Wetland	21 days	Mon 8/28/23	Mon 9/25/23
28		3.1 Investment Cost	6 days	Mon 8/28/23	Mon 9/4/23
29		3.1.1 Excavation and Piping	3 days	Mon 8/28/23	Wed 8/30/23
30		3.1.2 Pre-treatment Stage	3 days	Thu 8/31/23	Mon 9/4/23
31		3.2 Soil Filter	12 days	Tue 9/5/23	Wed 9/20/23
32		3.2.1 Liner	3 days	Tue 9/5/23	Thu 9/7/23
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35		3.2.4 Pumps	3 days	Mon 9/18/23	Wed 9/20/23
36		3.3 Operation and Maintenance	3 days	Thu 9/21/23	Mon 9/25/23
37		4 Building of a Constructed Wetlan	198 days	Tue 9/26/23	Thu 6/27/24
38		4.1 Permits	58 days	Tue 9/26/23	Thu 12/14/23
39		4.2 Tenders	20 days	Fri 12/15/23	Thu 1/11/24
40		4.3 Construction	80 days	Fri 1/12/24	Thu 5/2/24

Figure 10. *Schedule for the design and construction of a constructed wetland in the New River Watershed*

4.2.7 Control Schedule

By maintaining the schedule baseline throughout the project life cycle, the schedule is controlled. The project manager should manage and control the schedule based on the information received in a reporting period, utilizing the critical path method as the guide to complete the project on time. It is important that the Project Manager is able to use the critical path method in identifying the shortest possible project schedule/duration. This enables the Project Manager to

identify critical and non-critical activities with the aim of preventing execution-time problems. Changes to the schedule baseline must only be approved through the Perform Integrated Change Control Process. The Perform Integrated Change Control Process is the process of reviewing all change requests; approving changes and managing changes to deliverables, organizational process assets, project documents and the Project Management Plan and communicating the decisions. With the change control process, we can determine the status of the project schedule, review the schedule, and determine changes in the project schedule and manage those changes. Monitoring of scheduled activities will be reported during the weekly update meetings. Controlling the schedule throughout the project will be monitored through a variance analysis applied within the Earned Value Management (EVM). The variance is denoted by the schedule performance index (SPI) which measures how close the actual project is about to be completed compared to the schedule. If the SPI is less than one it indicates that the project is behind schedule, if the SPI is equal to one then the project is on schedule, but if the SPI is higher than one then the project is ahead of schedule.

COST MANAGEMENT PLAN FOR THE DESIGN AND CONSTRUCTION OF A CONSTRUCTED WETLAND IN THE NEW RIVER WATERSHED

Department of the Environment, 2nd floor, Green Complex Building, 7552 Hummingbird Highway, Belmopan, Cayo district, Belize, C.A.

(+501) 822-2548

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4.3 Cost Management Plan

Project cost management includes the processes involved in planning, estimating, budgeting, financing, managing, and controlling costs, so that the project can be completed within the approved budget (PMI, 2017, p. 231). The cost management plan deals with the cost of the resources needed to complete the project activities.

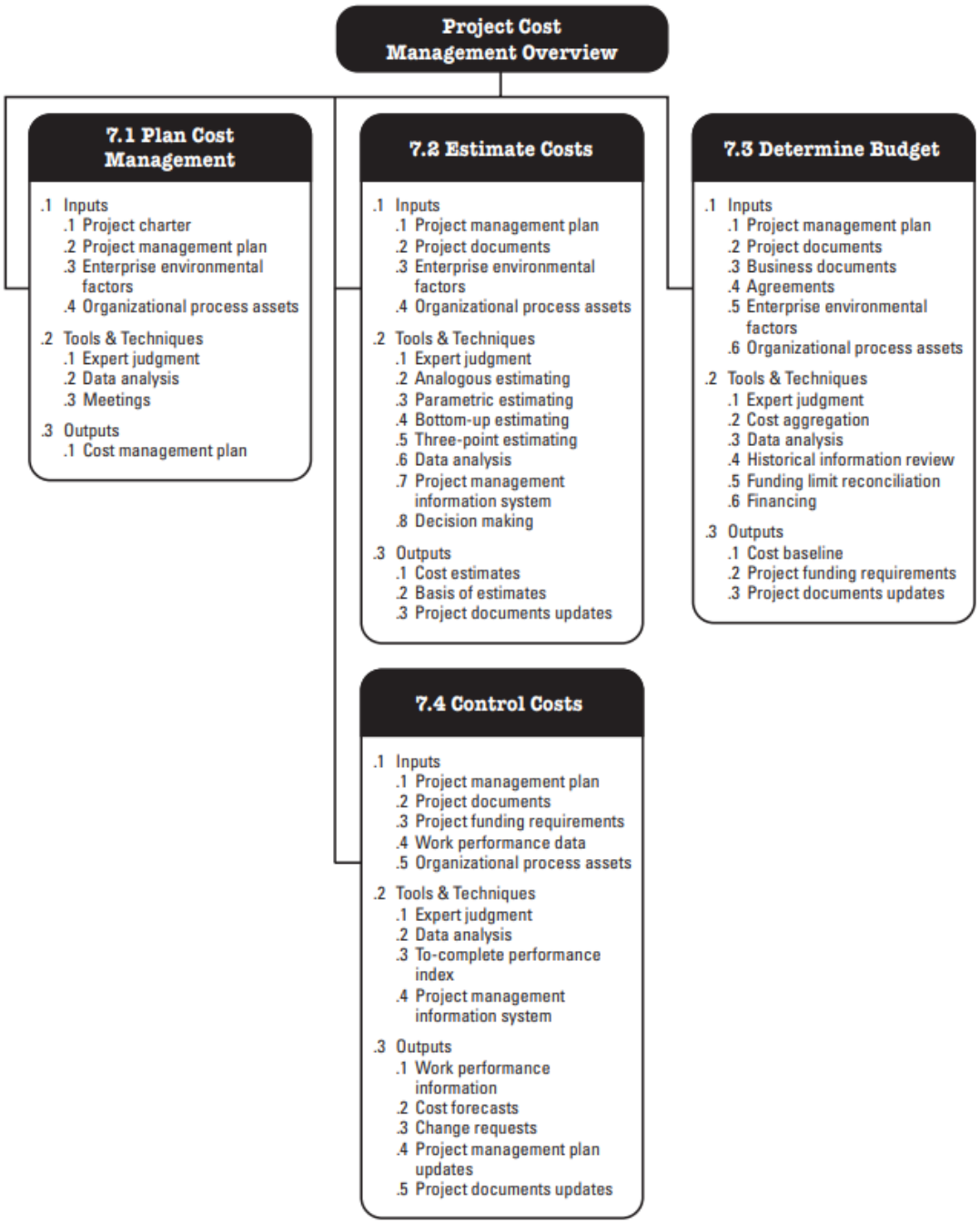

Figure 11. *Project Cost Management Overview*

4.3.1 Roles and Responsibilities for Cost Management

The Project team observed in Chart 11 is crucial and will contribute to the success of the project.

Chart 11. *Roles and responsibilities for cost management (Source: Author)*

Role	Responsibilities
Project Manager	Project Implementation organizing meetings with project team control the budget
Project Director (Department of the Environment)	Focal Point of the project Supervises the project activities Provides support to the management of the project
Project Sponsor (Green Climate Fund Secretariat)	Finances the project
Implementing Entity (UNEP)	Acts as the project sponsor Provides the disbursement of the funds Ensures the completion of the project deliverables Provides additional/contingency funds once changes are approved Supervises the financial audits of the project Supervises the interim progress report and the project completion report.

Figure 9 depicts the flow of funds from the project sponsor to the project director and project manager.

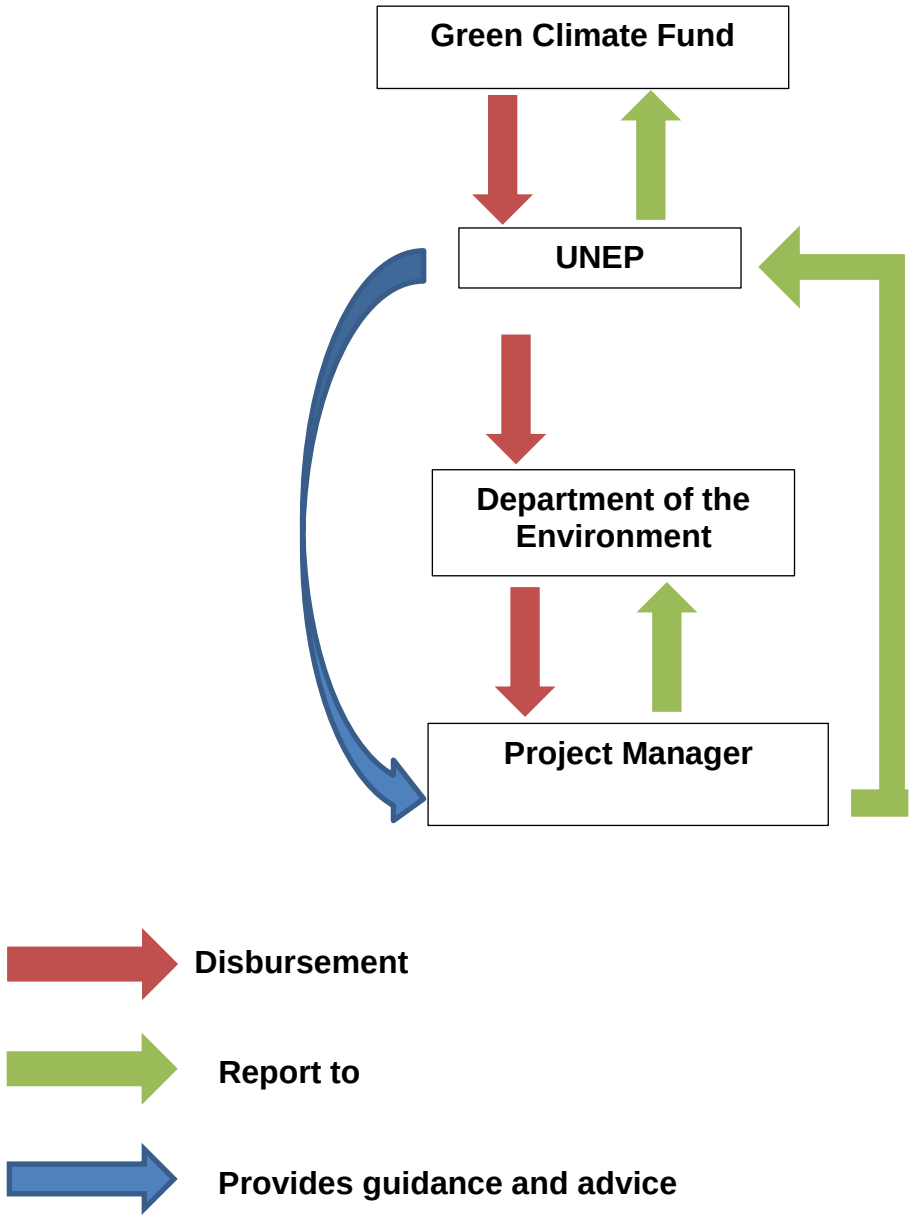

Figure 12. *Flow of funds for the project (author, 2023)*

4.3.2 Performance Metrics and Earned Value Analysis (EVA)

The Project Manager is tasked with the responsibility of managing and reporting on the project's cost throughout the duration of the project. The Project Manager is to present an interim progress report and a financial audit report 6 months from the project's start date. A project completion report and a financial audit report will be submitted to UNEP at the completion of the project. The following earned value measurements will be used:

- Schedule Variance (SV) is a measurement of the project's schedule performance. SV = EV - PV
- Cost Variance (CV) is a measurement of the project's budget performance. CV = EV - AC
- Schedule Performance Index (SPI) measures the progress achieved against that which was planned. SPI = EV/PV
- Cost Performance Index (CPI) measures the value of the work completed compared to the actual cost of the work completed. CPI = EV/AC

4.3.3 Earned Value Management Metrics

- Earned value (EV) is the measure of the work performed as expressed in the budget authorized for the work.
- Planned value (PV) is the authorized budget cost of the planned work.
- Actual cost (AC) is the cost for the work performed during a specific time period.
- Cost variance (CV) is the measurement of the budget performance for a project.

$$CV = EV – AC$$

Whereby if CV is zero (0), then the project is on budget. If the CV is greater that

zero, the project is earning more value than planned and is therefore under budget. If CV is less than zero, the project is earning less value than planned meaning it is over budget.

- Schedule variance (SV) is a measurement of the schedule performance for a project.

$$SV = EV – PV$$

Whereby, if the SV is greater than zero, the project is on schedule. If the SV is more than zero, then it is ahead of planned schedule but if the SV is less than zero then the project is behind schedule.

4.3.4 Performance Indices

The EVM Schedule is the measurement of performance indices, based on ratios and provides information on the current performance.
Cost performance indices (CPI) are a measure of the cost efficiency of budgeted resources expressed as the ratio of EV to actual cost.

CPI = EV/AC

- CPI equals budget of work accomplished/actual cost of work accomplished.
- CPI measures how much work is being produced for each unit of cost incurred.

Schedule Performance Indices (SPI) are a measure of efficiency regarding the time consumed with the amount of work accomplished.

SPI = EV/PV

- SPI equals the amount of work accomplished/amount of work planned to be accomplished

- SPI measures the actual rate at which the work is being accomplished relative to the expected work rate in the baseline.

4.3.5 Estimate Costs

The process of developing an approximation of the cost of resources needed to complete the project (PMI, 2017, p. 240). This assessment is based on the cost for resources that are required to complete each activity. The cost estimate is expressed in Belize Dollars, and the staff hours based on days of activity duration will be considered. The Project Manager along with the Director will review the cost of the previously executed project. The project budget should not exceed BZD $300,000.00 for a total of 1 year. The project is set to hire several experts in a diverse field of expertise, and the project manager being included in the project budget. The majority of the budget is associated with the design and construction of the constructed wetland. A minor survey was conducted among the project team in order to determine certain information of the cost management plan, see Appendix 5.

4.3.6 Budget Development

The determined budget is used to calculate the cost baseline. The project budget will be calculated as follows:

Project Budget = Cost Baseline + Contingency Reserve

The following chart shows the cost estimate for the activities of the project according to its deliverable.

Chart 12. *Budget breakdown for the activities and human resources of the project*

Project Deliverables	Cost BZD
Project Management	
Scope Plan	**$100.00**
Schedule Plan	**$100.00**
Cost Plan	**$100.00**
Quality Plan	**$100.00**
Resource Plan	**$100.00**
Communication Plan	**$100.00**
Risk Plan	**$100.00**
Procurement Plan	**$100.00**
Stakeholder Plan	**$100.00**
Integration Plan	**$100.00**
Sustainable Plan	**$100.00**
Characterization of the wastewater discharged into the New River	
Demography Report	$2,500.00
Climate Report	$2,500.00
Hydrology Report	$2,500.00
Water Quality Monitoring Report	$2,500.00
Design of the constructed wetland	
Legislation Report	$3,000.00
Topographic Map of the location	$3,000.00
Social, Economic and Cultural Characteristics of the Population	

Sizing of the septic tank Wetland Sizing	**$3,000.00** **$3,000.00** **$3,000.00**
Relevant Cost of a constructed wetland Excavation and Piping Pretreatment Stage Liner Gravel and Sand Distribution and Drainage Pipes Pumps Operation and Maintenance	 $25,680.00 $12,840.00 $12,840.00 $14,980.00 $20,330.00 $9,630.00 $8,000.00
Building a Constructed Wetland Permits Construction Planting and Start Up Operations	 **$5,000.00** **$50,000.00** **$10,000.00**
Project Management Cost Salary for Project Manager for 18 months at $3,000.00 per month	 $54,000.00
Total Cost Estimate	$249,400.00

4.3.7 Cost Baseline

The Cost Baseline is the approved version of the time-phased project budget and a contingency reserve and excluding the management reserve (PMBOK, 2017, p. 254).

Total Cost Estimate = $249,400.00

Contingency Reserve 2% of the cost estimate = $4,988.00

Cost Baseline = Total cost estimate + Contingency Reserve = $254,388.00

Management Reserve (1% of the cost baseline) = $2,543.88

Budget (Baseline + Management Reserve) = BZD $256, 931.88

The contingency reserve of $4,988.00 will be used to address identified risks of the project. With the possibility of incurring additional expenses as a result of demographic, climate, hydrology and/or water, quality monitoring analysis and reporting to be done. The contingency reserve will be available for use by the Project Manager. The management reserve, which is 1% of the cost baseline is $2,543.88 and is reserved for unforeseen work that may present itself within the scope of the project. The management reserve will be managed by the Project Director and will be made available upon approval by the Project Sponsor (GCF).

4.3.8 Cost Control

Cost control monitors the status of the project to update the project costs and manages changes to the cost baseline (PMBOK, 2017, p.295). Updating the budget requires knowledge of the actual costs spent to date. Any increases to the authorized budget can only be approved through the Change Control process. Project Cost Control includes:

- Bringing expected cost overruns within acceptable limits;

- Preventing unapproved changes from being included in the reported costs;
- Monitoring work performance against funds expended;
- Monitoring cost performance and understanding variances from the approved cost baseline;
- Ensuring that cost expenditures do not exceed the authorized funding by activity and in total for the project;
- Managing the actual changes when, and as they occur;
- Ensuring that all change requests are acted on in a timely manner;
- Influencing the factors that create changes to the authorized cost baseline.

Cost control is managed by the Project Manager who manages and foresees potential risks during the project.

4.3.9 Change Request Control

The change request control is a formal template proposed to modify the cost baseline when issues are identified during the course of the project. The change request (Appendix 6) may include a corrective action of an activity for the project work which will aid to steer the project back on track. The request is to be submitted by the Project Manager and approved by the Project Director (DOE).

QUALITY MANAGEMENT PLAN FOR THE DESIGN AND CONSTRUCTION OF A CONSTRUCTED WETLAND IN THE NEW RIVER WATERSHED

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4.4 Quality Management Plan

The project quality management plan is the management of the project, and the deliverables of the project. The purpose of the quality management plan will describe the actions and measures that will be taken to ensure the quality of the project (PMI, 2017, p. 273).

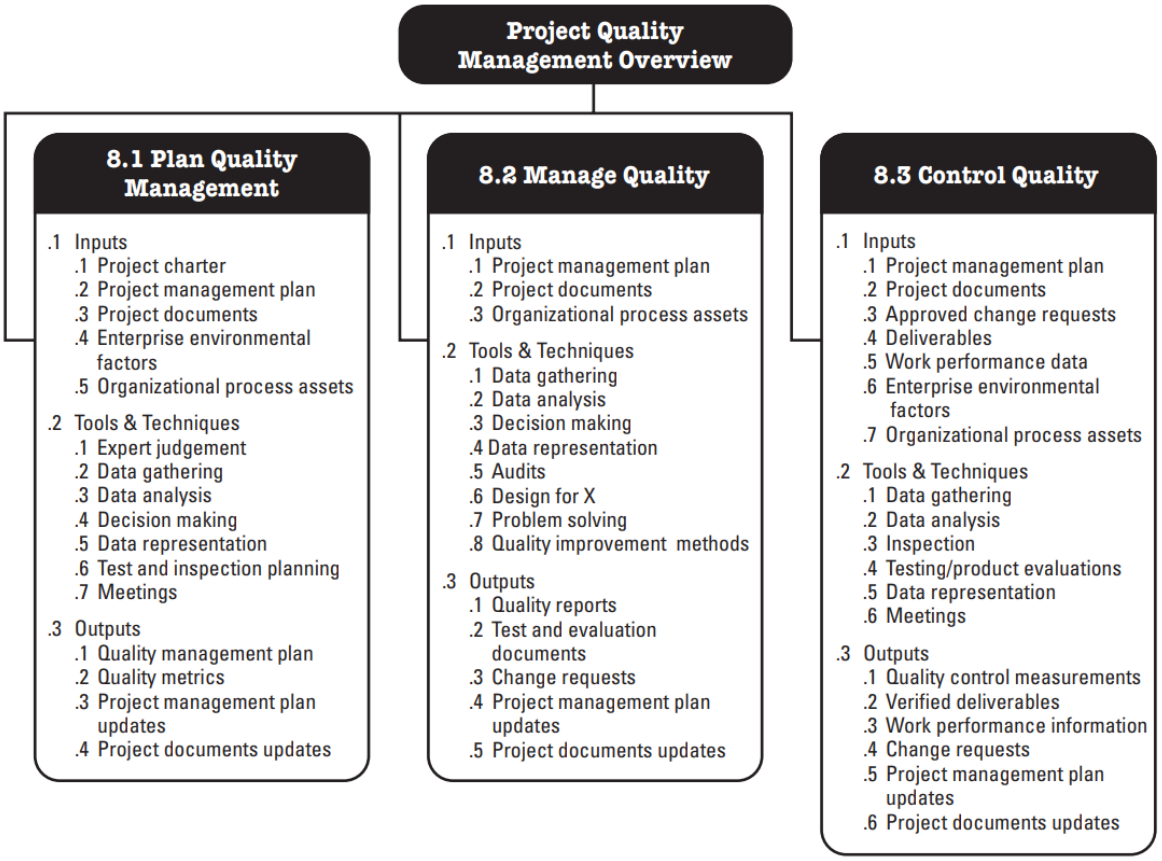

Figure 13. *Project Quality Management Overview*

4.4.1 Quality Management Approach

It describes the manner in which the quality of the project will be managed. The plan quality management process is concerned with the overall quality of the

work that needs to occur along with the quality processes throughout the project. Quality requirements will be identified and assessed under evaluation instruments. These quality requirements will be verified during control quality to ensure quality requirements are met by the project.

The purpose of the quality management plan is to ensure that the satisfaction of the deliverables is met to the standards of UNEP, the implementing entity. The results should conform to the requirements of the project as it was intended to be. To ensure continual satisfaction and improvement, the quality management plan outlines the quality improvement method used. The project manager and the team will ensure that quality is maintained throughout the life of the project.

The Project Quality Management Plan consists of 4 main processes:

- Quality Objectives
- Quality Assurance
- Quality Control
- Quality Improvement Method

4.4.2 Quality Objectives

The quality management objectives for this project are as follows:

- Deliverables meet the requirements of UNEP, implementing entity
- Design and construction meet the standards of the Central Building Authority (CBA) – Belize.

4.4.3 Quality Criteria

The quality criteria are for reporting of the project deliverables, project status reports, workshops reports, and reports for public accessibility. The criteria are as follows:

The content will depend on the type of deliverable and should contain all the information relevant to the activity needed by the implementing entity.

The following requirements are to be met:

a. Completeness – the information provided must be reliable and complete and supported with relevant references.
b. Accuracy – information shared should be on key issues.
c. Relevance – the information shared should be relevant for the achievement of the project objectives.
d. Language – the information shared as a final version should be proofread.

4.4.4 Quality roles and responsibilities

The roles and responsibilities in project quality management will be performed to assure the quality of the deliverables are according to the quality criteria.

Chart 13. *Roles and Responsibilities in quality management plan (Source: Author)*

Role	Responsibilities
Project Manager	To manage the overall quality and use quality tools to ensure quality requirements
Project Team	Oversee that quality requirements are maintained throughout the project life.
Project Director (DOE)	To analyse the status of all reports submitted by the Project Manager, ensure quality metrics are met and identify and recommend areas of improvement.
Implementing Entity (UNEP)	To ensure that the project requirements are to their expectations, also responsible to accept and approve the deliverables of the project.
Sponsor (GCF)	To provide templates, policy and overall guidance to the project.

4.4.5 Quality Assurance

Quality Assurance is using project processes effectively by meeting the standards to meet the project requirements (PMI, 2017, p.289). The successful implementation of the project is hinged on the timely completion of all proposed activities and the submission of quality deliverables. To ensure the latter, the DOE will closely monitor and adhere to the implementation plan. An interview will be carried out on certain members of the Project Team in order to evaluate and gather information on their knowledge of Quality Management in projects, see Appendix 7. The following activities will be conducted as part of the monitoring framework for quality assurance.

- **Continuous coordination of consultants:** for the development and completion of all activities, the DOE will collaborate closely with the consultants to ensure the successful completion of the proposed

activities within the stipulated timeframes. As per normal operations, hired consultants will be required to provide periodic and maintain continuous coordination with the DOE. This can be facilitated by daily update sessions which enable dynamic response to any unforeseen drawbacks or potential delays.

- **Assessment of Quality**: the DOE will be responsible for providing the technical oversight of deliverables under their project components. The DOE will ensure that all deliverables are of sound technical quality and of a standard acceptable to national and international agencies.
- **Quarterly Assessments:** Internally, through DOE's Monitoring and Evaluation Framework, a comprehensive analysis of project implementation will be performed to evaluate the status of ongoing consultancies. The report will include an update from each consultant, including information on future activities, potential delays, and solutions to delays.
- **Annual Progress Report to UNEP/GCF:** DOE will prepare an annual interim progress report as well as a Project Completion Report in line with UNEP's Grant Agreement Reporting Framework.

4.4.6 Quality Audit

At the end of the project, a project audit will be performed of both the operational and financial activities. The guideline for the audit will be provided by the Implementing Entity UNEP. The audit will be submitted to UNEP and the GCF. Recommendations and lessons learned from the project audits will be provided for corrective actions if necessary.

4.4.7 Quality Metrics

For this project, the quality metric verifies compliance in the monitoring efforts.

#	Activity	Frequency	Responsible
1	Continuous coordination of Consultants	Daily	DOE, Project Manager
2	Assessment of Quality	Monthly	DOE, Project Manager
3	Quarterly Assessments	Quarterly	DOE, Project Manager
4	Annual Progress Report to UNEP/GCF	Annually	DOE, Project Manager

Chart 14. *Quality Metrics and Assurance (Source: Author)*

4.4.8 Quality Control

The purpose of the control quality process is to determine the correctness of the deliverables (PMI, 2017, p. 305). The Project Manager along with the project team will hold meetings to discuss:

- The successful elements of the project;
- What best practices can be used;
- What elements of the project can be improved;
- What new elements can be incorporated into the project.

4.4.9 Quality Improvement Methods

In quality control, the project manager along with the project team must ensure that all standards are met within each deliverable. The Project Manager has to ensure

that all the stakeholders' criteria are satisfied. For this project, the Plan-Do-Check-Act (Rose K, 2014) improvement method will be adopted to analyse and evaluate opportunities for
improvement. The Plan-Do-Check-Act cycle repeats itself throughout the process for continuous improvement. It involves:

- Plan – Recognize an opportunity and plan a change;
- Do – Conduct a small-scale study;
- Check – Analyse the results and identify what have been learned;
- Act – Take action based on what was learned.

Figure 14. *PDCA Cycle for the project (Source: Author)*

Furthermore, Chart 15 below depicts a quality report template to be used for reporting quality management activities of the project.

Chart 15. *Quality Report Summary template (Source: Author)*

Project		Development of a Project Management Plan for the design and construction of a constructed wetland in the New River Watershed
Project Manager		Francisco Javier Magaña
Category		Clarification
Missing Documents	Issue	
	Corrective Action	
Relevant Stakeholders List	Issue	
	Corrective Action	
Stakeholders' Meetings Log	Issue	
	Corrective Action	

RESOURCE MANAGEMENT PLAN FOR THE DESIGN AND CONSTRUCTION OF A CONSTRUCTED WETLAND IN THE NEW RIVER WATERSHED

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4.5 Resource Management Plan

Resource management plan includes the processes that identifies, acquires, and manages the resources needed for the successful completion of the project. These processes ensure that the right resources will be available for the project manager and team at the right time (PMI, 2017, p 307).

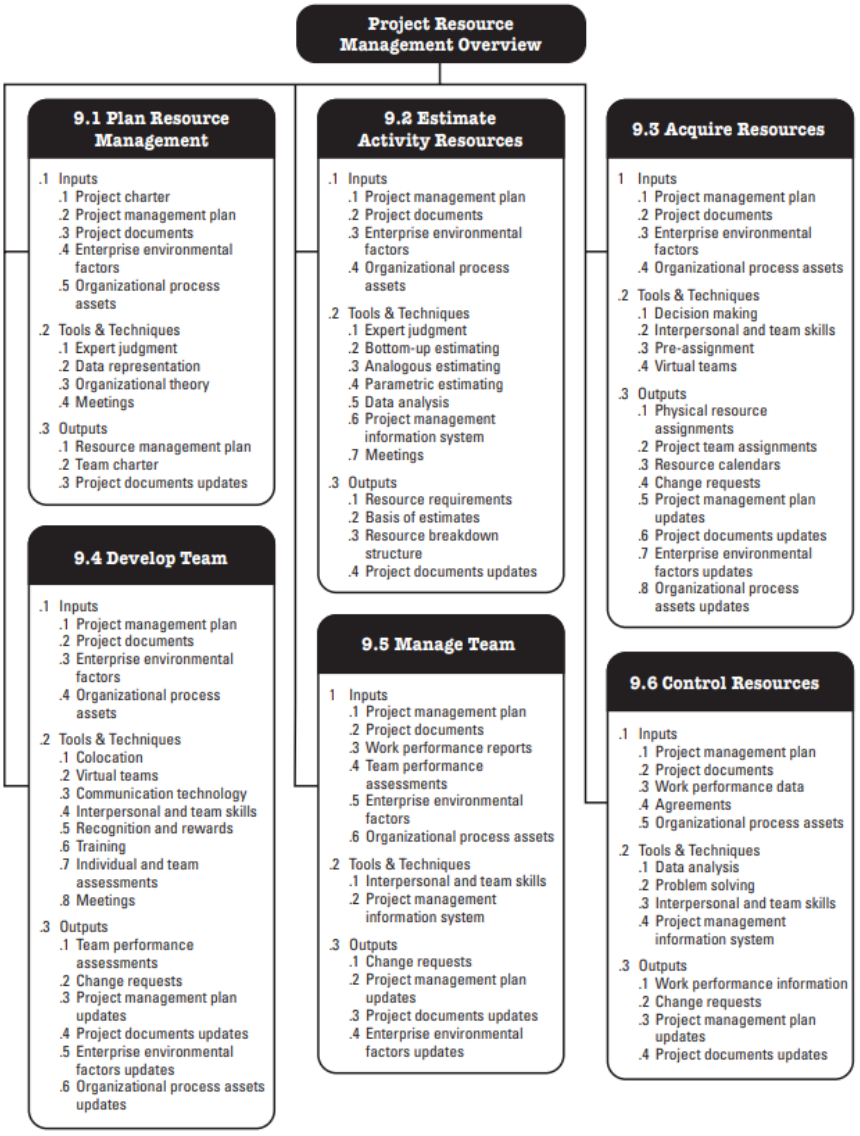

Figure 15 *Project Resource Management Overview*

4.5.1 Roles and Responsibilities

For this project, a project team will be assembled mainly comprised of the following:

Chart 16. *Roles and Responsibilities in resource management plan (Source: Author)*

Role	Responsibilities
Project Director (PD)	The Project Director is responsible for supervising the overall management of project activities and for accountability.
Project Manager (PM)	The Project Manager is responsible for the overall success of the project. The project manager also authorizes and approves project expenditures and work activities. The PM is responsible for communicating to stakeholders. The PM has the responsibility to develop project update reports and in charge of acquiring human resources in coordination with the Project Director and the Procurement Officer at the Environmental Management Unit within the DOE. The Project Manager will be responsible to supervise the work of the consultants.
Project Sponsor (PS)	The Project Sponsor responsibility is to provide the finance and overall guidance and acceptance of deliverables.
Consultants (CON)	The consultants must have the expertise which the project requires (demography, climate, water quality monitoring, hydrology, topography, legislation etc).

Implementing Entity (IE)	The Implementing Entity acts on behalf of the Project Sponsor. Its responsibility is to oversee the project's deliverables are as agreed in the Project Management Plan and Grant Agreement.

4.5.1.1 Organizational Breakdown Structure

A hierarchical representation of the project organization, which illustrates the relationship between project activities and the organizational units that will perform those activities.

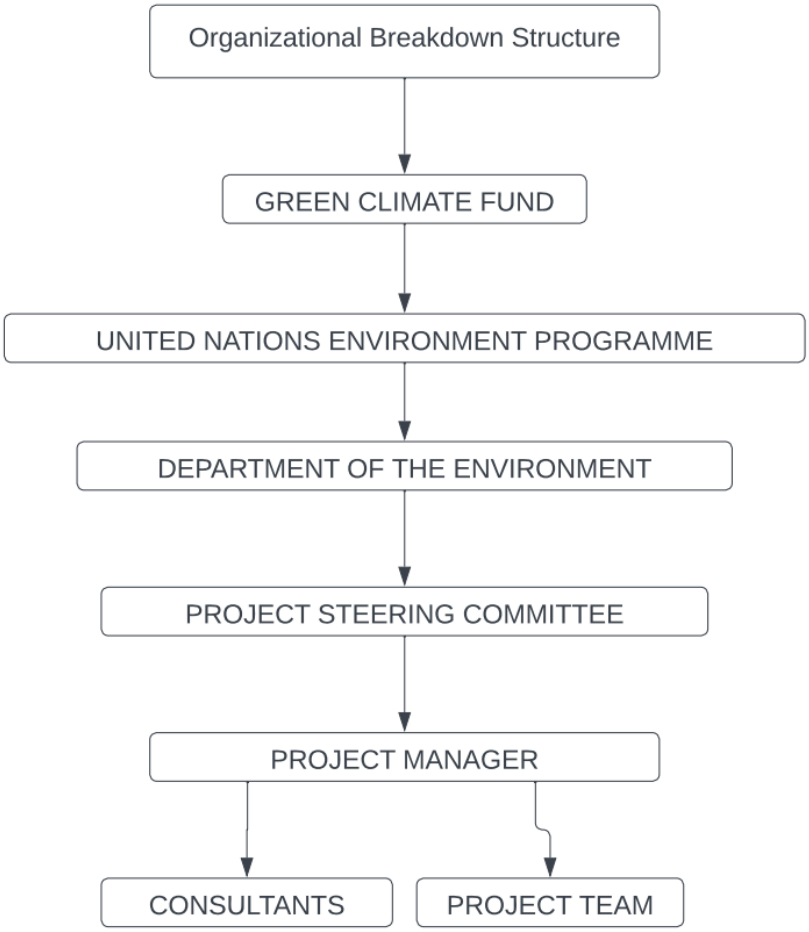

Figure 16. *The Project's Organizational Breakdown Structure*

4.5.1.2 Resource Breakdown Structure

The Resource Breakdown Structure is a hierarchical list of team and physical resources related by category and resource type that is used for planning, managing and controlling project work.

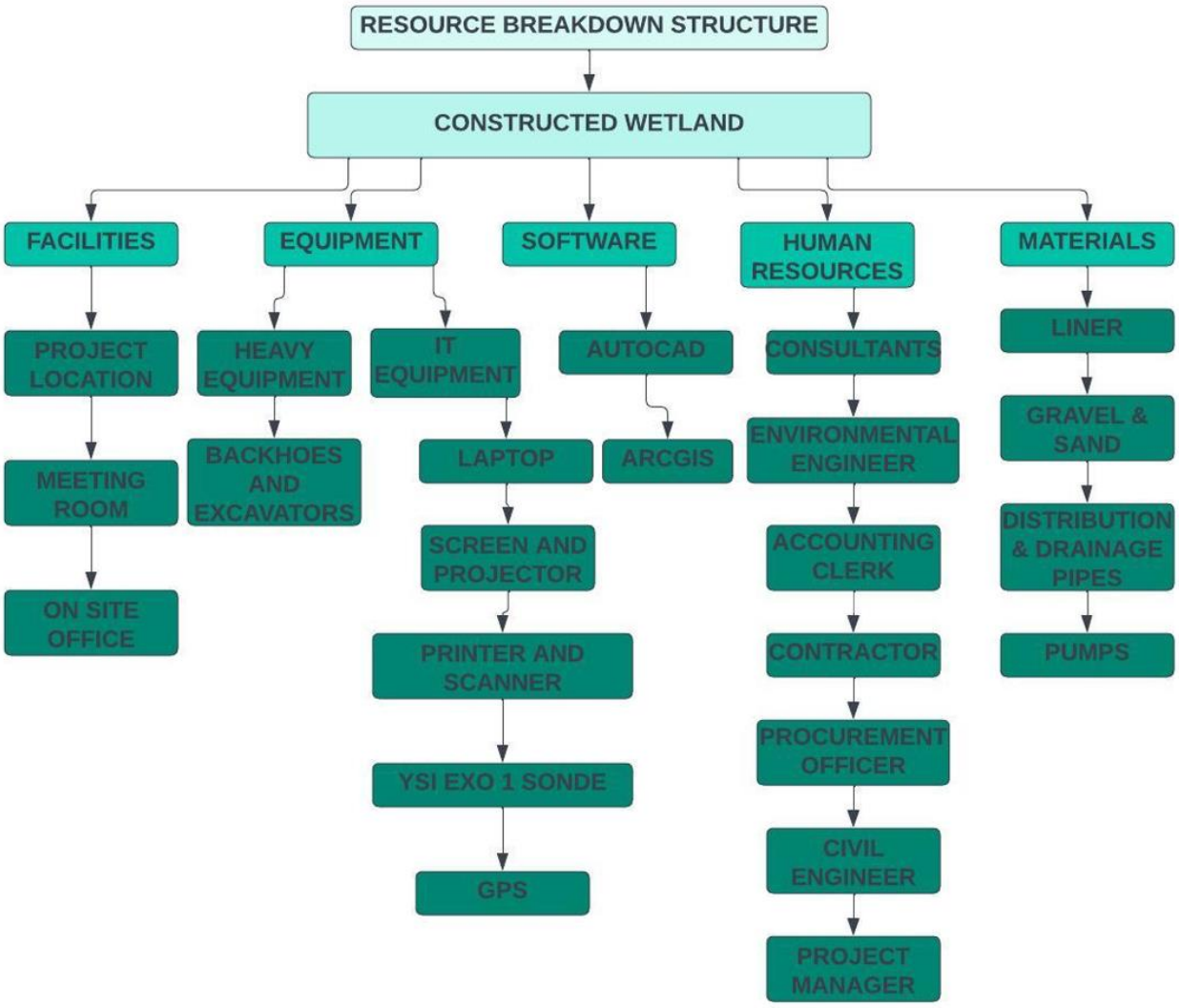

Figure 17. *Project's Resource Breakdown Structure*

4.5.2 Resource management method

Resource management is using the resources optimally and efficiently. Human resources include the processes that organize, manage and lead the project team who may have varied skill sets (Lewis, 2016). The Kaizen method can be utilized to provide continuous improvement based on guiding principles:

1. Determine the resource requirements of the project;
2. Identify resources by type;
3. Confirm the availability of resources;
4. Assign tasks and get feedback from team members;
5. Monitor the progress of the project and make adjustments when and where necessary;
6. Ensure plans for the unexpected;
7. Run a post-project evaluation.

4.5.3 Responsibility Assignment Matrix (RAM)

The RACI chart (responsible, accountable, consult and inform) is the tool used to ensure clear assignment of roles and responsibilities for internal and external resources. The matrix below shows all the activities accountable for any task in order to avoid any confusion.

Chart 17: *Responsibility Assignment Matrix (RAM) for the project (Source: Author)*

Project Task	PD	PM	PS	CON	IE	
Project Management	A	A	I	R	I	

Characterization of the Wastewater discharged into New River (demography, climate, hydrology, water quality monitoring)	A	A	I	R	I	
Design of the constructed wetland (topographic survey and sizing calculations)	A	A	I	R	I	
Relevant costs of a constructed wetland (investment cost, soil filter and operations and maintenance)	A	A	I	R	I	
Building of a constructed wetland (permits, tenders, construction and planting and start-up operations)	A	A	I	R	I	

Key:

R – Responsible for completing the work

A – Accountable for ensuring task completion/sign off

C – Consulted before any decisions are made

I – Informed when an action/decision has been made

PD – Project Director

PM – Project Manager

PS – Project Sponsor

CON – Consultants

IE – Implementing Entity

4.5.4 Resource Estimate

All materials related to the management of the design and construction of a constructed wetland are based on the scope requirements which are defined and estimated by the project manager.

Chart 18. *Resource estimate of materials (Source: Author)*

Element Name	Materials
Project Management	Laptop, calculator, screen, projector, paper, pens and pencils.
Characterization of the wastewater discharged into the New River	Catering (2-3 stakeholder engagements), YSI Exo1 Sonde, sample bottles, laptops, fuel, Secchi disk, tablet, GPS, paper, camera.
Design of the constructed wetland	Licenses for AUTOCAD and Arc GIS softwares, laptops, GPS,
Relevant costs of a constructed wetland	Calculator, printer, scanner, laptop
Building of a constructed wetland	Excavator and PVC pipes, geo-membrane (liner), gravel, sand, distribution and drainage pipes, pumps, construction equipment.

4.5.5 Acquisition of Team Members

For the project, the project staff will consist of internal resources, but will also subcontract external experts. The Project Manager along with the Project Director will identify and assign the resources for the project. All subcontracts will be performed with a signed contract/agreements for the services or

activities. All the subcontractors will be stationed at the Department of the Environment.

- **Qualifications/Skills**

  The subcontracting will take place by outsourcing consultants/experts to be performed within the scope of the project. The acquiring method for the subcontracts will be tendered after the approval of the Project Director and in line with the DOE's procurement manual. The Project Manager will assist the Project Director in the acquisition of the experts.

- **Virtual Teams**

  The use of virtual teams will be used exclusively in the event of a state of emergency is declared by the Government of Belize for precautionary health measures like a global pandemic.

4.5.6 Resource Calendar

The resource calendar for this project is 335 working days with 5 working days per week and 8 hours of work on a day (8am – 5pm). The resource calendar below shows the tentative number of hours required to complete the project for each resource.

Figure 18. *Human resource calendar with working hours (Source: Author)*

4.5.7 Management of Team

The Department of the Environment is an equal opportunity employer and does not discriminate against protected characteristics such as gender, age, sexual orientation, race, nationality, ethnicity, religion and disability. The Department focuses on developing and sustaining the project team throughout the life of the project. The development of the project team will improve their people skills, technical competencies, work environment and overall project performance (PMI, 2017, p. 338).

4.5.8 Training

Capacity development workshops and trainings are provided by the Green Climate Fund for the project team and environmental officers of the DOE in the

areas of Project Management and Development, Grievance Redress Mechanism and Environmental and Social Safeguards. Training may be on-site or online, given the possibilities to attend in-person training are available. Software training such as MS Project, Excel, AutoCAD will be made available upon request. Appendix 8 to this document provides an overview of a Procurement training agenda.

4.5.9 Performance Assessments

The Project Manager is tasked with the overall review and assessment of each team member assigned work activities from the onset of the project and communicate all expectations of work to be performed. The Project Manager will evaluate each team member throughout the project to assess their performance to determine their effectiveness at completing their assigned work. The Project Director is in charge of providing feedback for each team member's performance. Performance appraisals will be conducted by the Project Director for each team member as seen in Appendix 6. The team is assessed bi-weekly using the performance appraisal to ensure that the team members understand their strengths and weaknesses and to improve on their weaknesses. According to the PMBOK, when recommended corrective or preventive actions impact any of the components of the project management plan of project documents, the project manager needs to submit a change request. Change requests are processed for review and disposition through the Perform Change Control process. Any change to the project management plan goes through the organization's change control process via a change request.

4.5.10 Recognition and Rewards

The project does not allow for monetary rewards; however, the team members will be recognized and rewarded for their exceptional efforts in successfully completing the project. A Certificate of Appreciation will be given to the team members, followed by a reception with the DOE staff and relevant stakeholders.

STAKEHOLDER MANAGEMENT PLAN FOR THE DESIGN AND CONSTRUCTION OF A CONSTRUCTED WETLAND IN THE NEW RIVER WATERSHED

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4.6 Stakeholder Management Plan

4.6.1 Introduction

Stakeholders are people who directly or indirectly are affected by the decisions, project execution and its results. The stakeholder plan contains processes that support and analyze stakeholder expectations, assesses the degree to which they impact or are impacted by the project, and develops strategies to effectively engage stakeholders in support of project decisions, planning and execution of the work of the project. To ensure project success, it is necessary to identify all key stakeholders in this project. The identification of stakeholders leads to the understanding of each stakeholder’s preferred medium of communication and their needs.

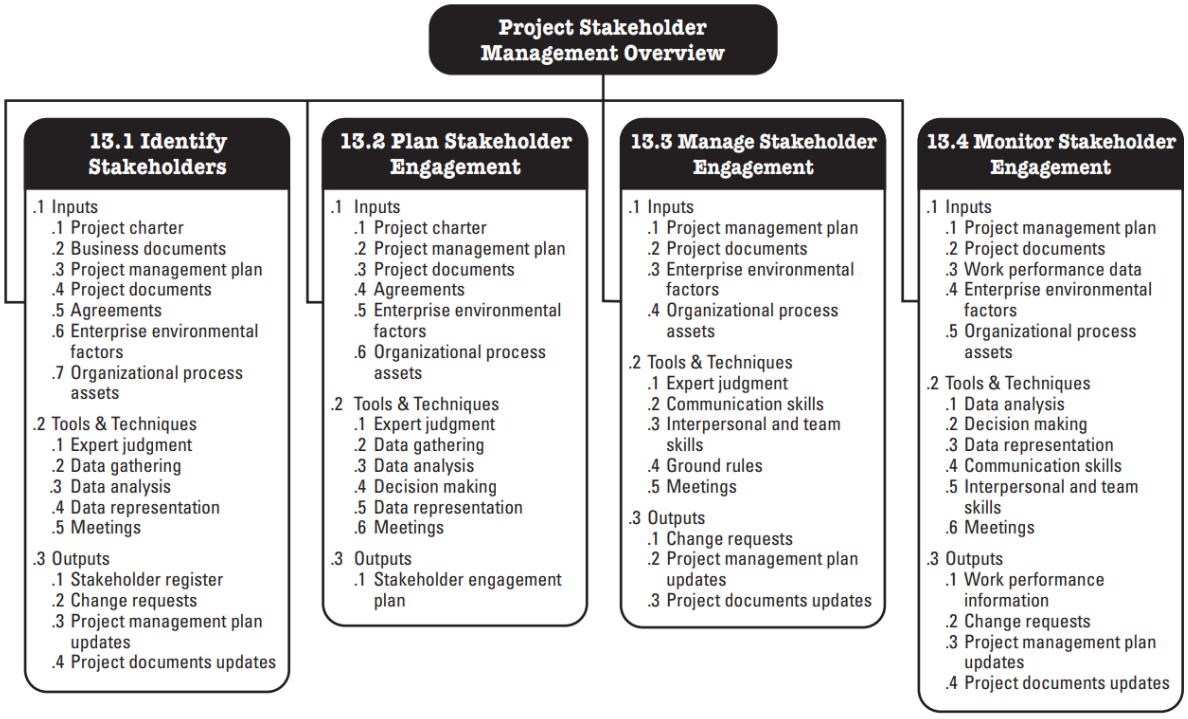

Figure 19. *Project Stakeholder Management Overview*

There are 14 key stakeholders:

- **Project Director (DOE)** – responsible for information exchange and authorizing information sharing
- **Project Manager** – responsible of ensuring quality of reports and sharing of information
- **Consultants** – responsible of providing reports, meeting reports and other required documents
- **Project Sponsor (GCF)** – provides support
- **Implementing Entity (UNEP)** – provides support
- **Orange Walk Town Council (Local Government)** – recipient of information exchange and reports of the project

- **Hydrology Unit (Central Government)** - recipient of information exchange and reports of the project
- **Fisheries Department (Central Government)** - recipient of information exchange and reports of the project
- **Sarteneja Alliance for Conservation and Development (NGO)** - recipient of information exchange and reports of the project
- **Friends of New River (NGO)** - recipient of information exchange and reports of the project
- **Programme for Belize (NGO)** - recipient of information exchange and reports of the project
- **Belize Solid Waste Management Authority (Central Government)** - recipient of information exchange and reports of the project
- **Ministry of Education (Central Government)** - recipient of information exchange and reports of the project
- **Belize Sugar Industries/American Sugar Refineries (Private Sector)** - recipient of information exchange and reports of the project

4.6.2 Stakeholder Identification

A stakeholder analysis is conducted to identify relevant stakeholders and plan the communication. The stakeholders directly or indirectly affected by the project are either positively or negatively affected by the overall results of the project. A stakeholder analysis will be conducted in order to identify all relevant actors in the project. The following steps will be taken for the stakeholder analysis:

- Identification of all primary and secondary stakeholders,

- Classification of the stakeholder group in relation to their interest in the project, their impact of the project on their interests, and their influence/power that will affect the project,
- A stakeholder register based on the information gathered.

4.6.3 Stakeholder Analysis

Stakeholder analysis identifies stakeholders and analyzes their needs and requirements of the project in order to deliver the products (PMI, 2017, p. 512). The analysis utilizes the information of each stakeholder and assesses their interest, power, influence, and impact each have on the project. This analysis also identifies who all need to be consulted in various phases of the project.

The attitude of stakeholders has an impact on project success, therefore knowing stakeholder expectations are critical. Stakeholder analysis metrics are performed by prioritization of stakeholders. This method places stakeholders based on their interest levels, influence, power, and impact. The following figures of stakeholders are analyzed based on power and interest.

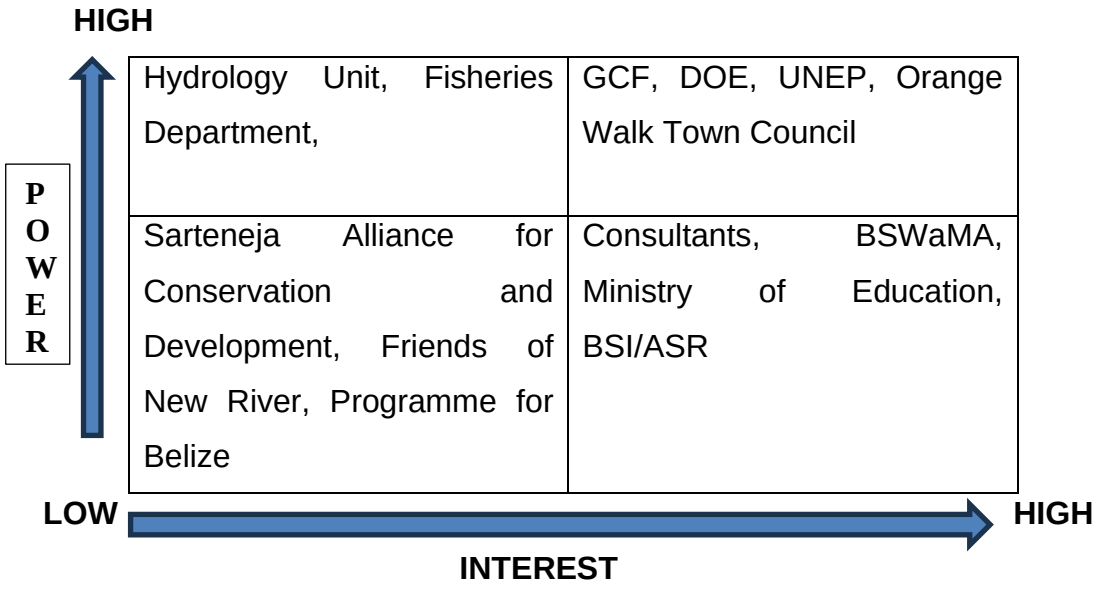

Figure 20. *Power-Interest grid matrix (Source: Author)*

The following figure analyzes stakeholders based on power and their influence on the project.

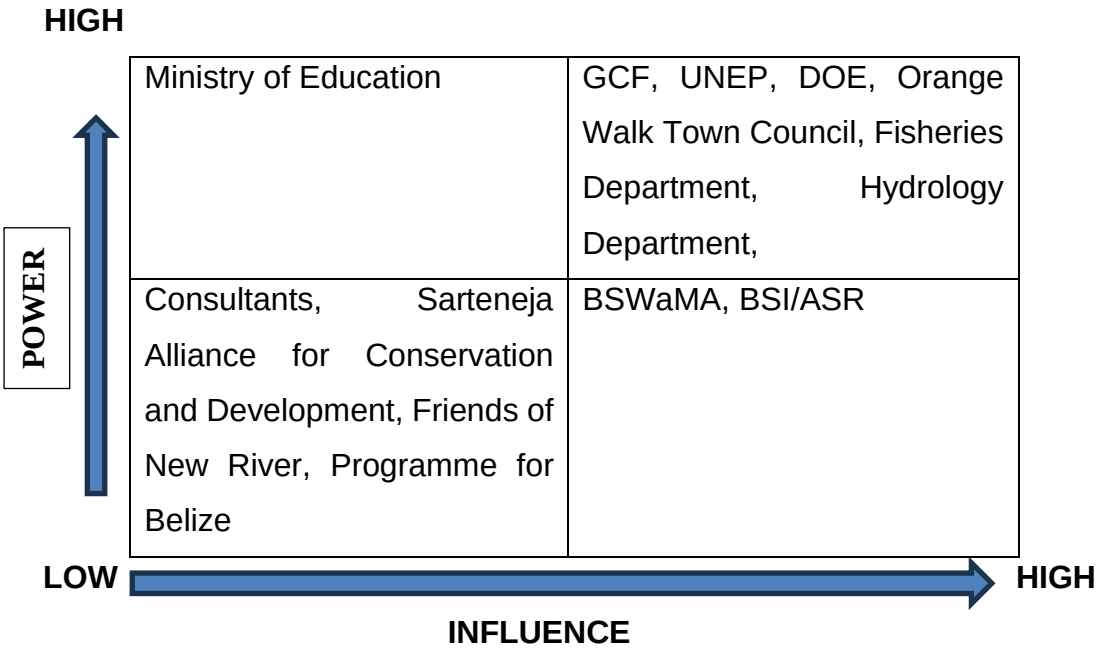

Figure 21. *Power-influence grid matrix (Source: Author)*

The following figure seen below analyzes stakeholders based on their influence on the project and their impact.

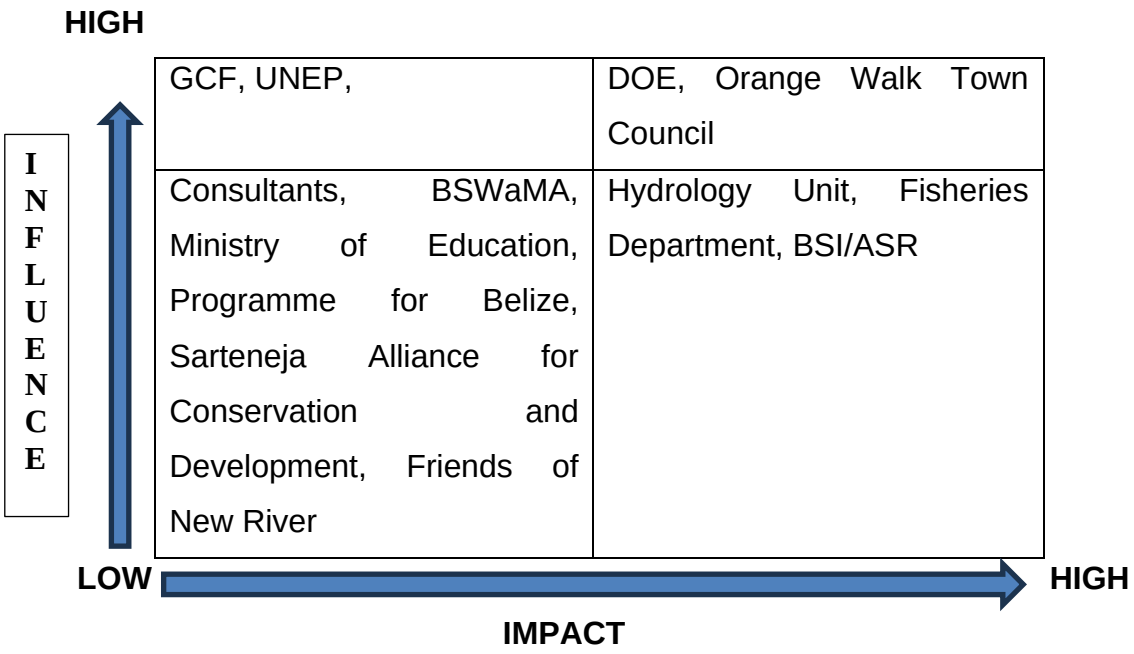

Figure 22. *Influence-Impact matrix (Source: Author)*

Chart 19. *Stakeholder Register for the design and construction of a constructed wetland on the New River Watershed project (Source: Author)*

Stakeholders		Organization	Contact Information	Roles & Responsibilities	Main Expectations	Major Requirements	Influence (Low, Med, High)
1	Mr. Anthony Mai	Department of the Environment	Doe.ceo@environment.gov.bz	Implementing/Executing partner	Supervise and coordinate national activities of the project	Oversee resource management	High
2	Mr. Francisco Magaña	Project Manager	projectmanager@environment.gov.bz	Planning, monitoring, and execution of the project	Execution of required project management and relevant activities	Execution of project within budget and time	High
3	Mr. Leo Heilman	UNEP	Leo.heilman@un.org	Sustainable development, water and sanitation Regional Director	Implementing Entity	Oversee that the project is completed according to the agreed time and budget	High
4	Mr. Kevin Bernard	Orange Walk Town Council	mayor@owtc.gov.bz	Oversee the growth and sustainable development of Orange Walk Town	Monitor the execution/implementation of the project	Involvement for the successful completion of project activities	High
5	Mrs. Tenielle Hendy	Hydrology Unit	Principal.hydrologist@naturalresources.gov.bz	Water resource management in Belize	Coordination	Assist in the execution of the project	High
6	Mr. Adriel Castañeda	Fisheries Department	Adriel.castaneda@fisheries.gov.bz	Fisheries regulator for Belize	Coordination	Assist in the execution of the project	Med
7	Mr. Joel Verde	Sarteneja Alliance for	execdirector@sacd.org	NGO and co-manager of the Corozal Bay	Coordination	Assist in water quality monitoring	Med

		Conservation and Development		Wildlife Sanctuary			
8	Mr. Edilberto Romero	Programme for Belize	execdirector@pfbelize.org	NGO and co-manager of the Rio Bravo Conservation and Management Area, Hill Bank Field Station	Coordination	Assist in water quality monitoring and implementation of the project	Med
9	Mr. Julio Maaz	Friends of New River	Julio.maaz@fnr.org	NGO	Coordination	Supervise project implementation	Low
10	Ms. Lumen Cayetano	Belize Solid Waste Management Authority	cayetanolu@gobmail.gov.bz	Solid waste management in Belize	Coordination	Involvement in the successful completion of project activities	Low
11	Mrs. Namrita Balani	Ministry of Education	Namrita.balani@education.gov.bz		Coordination	Assist in dissemination of information	Low
12	Mrs. Seidy Lienez	BSI/ASR	Seidy.lienez@asr-group.com	Environmental, Health and Safety	Coordination	Liaise with the private sector	Low

4.6.4 Manage Stakeholder Engagement

The involvement of project stakeholders to meet their needs and expectations for the success of the project. The stakeholder register will be updated regularly in an effort to reflect changes to the stakeholder community (PMI, 2017, p. 518). Stakeholder's requirements will be logged during meetings, prioritized and ranked by the project team. A stakeholder engagement assessment will be performed to support the comparison of the current engagement level and the desired engagement level for a successful project delivery (PMI, 2017, p. 521).

4.6.5 Monitor Stakeholder Engagement

Throughout the lifecycle of the project, stakeholders will be engaged to obtain and maintain their continued commitment towards the successful completion of the project. Effective communication is crucial; thus, the communication plan will be utilized to disseminate information, collect feedback, and resolve conflicts which may arise. A stakeholder engagement assessment matrix supports comparison between the current engagement levels of stakeholders and the desired engagement levels required for successful project delivery. Chart 20 shows the Stakeholder Engagement Assessment Matrix for the project. All issues will be logged, using the template in Appendix 17.

Chart 20 *Stakeholder Engagement Assessment Matrix (Source: Author)*

Stakeholder	Unaware	Resistant	Neutral	Supportive	Leading
Mr. Anthony Mai				C	D
Mr. Francisco Magaña				C	D
Mr. Leo Heilman				C	D
Mr. Kevin Bernard			C	D	
Mrs. Tenielle Hendy				C D	
Mr. Adriel Castañeda			C	D	
Mr. Joel Verde			C	D	
Mr. Edilberto Romero			C	D	
Mr. Julio Maaz			C	D	
Ms. Lumen Cayetano				C	
Mrs. Namrita Balani			C	D	
Mrs. Seidy Lienez				C D	

The engagement level of stakeholders is classified as follows:

- Unaware – Unaware of the project and potential impacts
- Resistant – Aware of the project and potential impacts but resistant to any changes that may occur as a result of the work or outcomes of the project,

these stakeholders will be unsupportive of the work or outcomes of the project.

- Neutral – Aware of the project, but neither supportive nor unsupportive.
- Supportive – Aware of the project and potential impacts and supportive of the work and its outcomes.
- Leading – Aware of the project and potential impacts and actively engaged in ensuring that the project is a success.

RISK MANAGEMENT PLAN FOR THE DESIGN AND CONSTRUCTION OF A CONSTRUCTED WETLAND IN THE NEW RIVER WATERSHED

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4.7 Risk Management Plan

The Risk Management Plan (RMP) is the process conducted by the project team to identify potential risks, estimate its impact, and define a response to those risks. It is an uncertain event or condition that can have a negative or positive effect on one or more project objectives (PMI, 2017, p. 720). The risk management plan for this project will contain the risks identified and describe the way it will be monitored during the execution of the project.

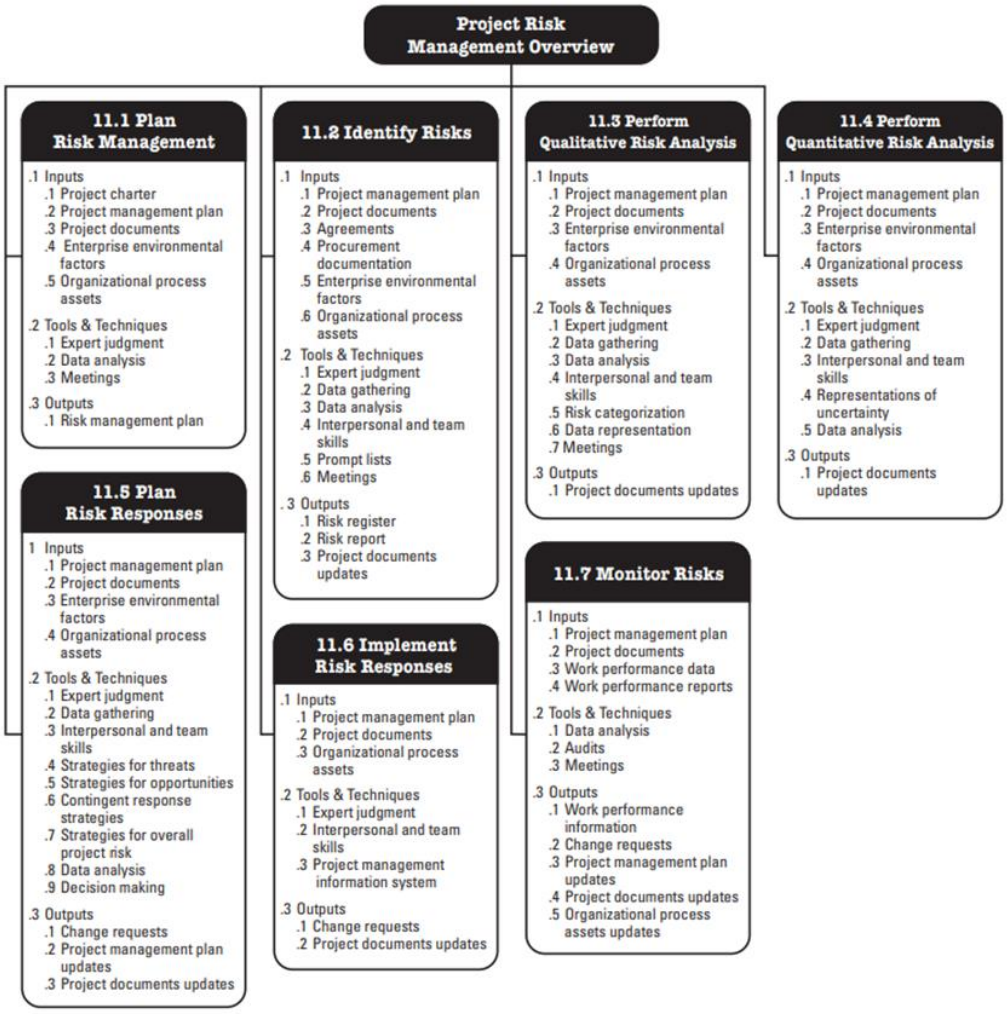

Figure 23. *Project Risk Management Overview*

4.7.1 Risk Management Approach

Risk management is vital for the successful implementation of the project- The Project Team will continuously monitor and update the risk management approach throughout the life of the project. Not taking into consideration the unidentified risks of the project can jeopardize its successful completion. Therefore, it is imperative to identify, analyze, and respond to the risks.
The Project Team will develop a risk register in order to record the risks and continually identified risks by the project manager. The Team is also tasked with monitoring and responding accordingly to the risks.

The identification of risks will be done by the project team through discussions and brainstorming sessions with relevant stakeholders. A risk management plan survey will be conducted on the project team to gather and assess their information regarding the subject, see Appendix 9. Data analysis techniques such as SWOT analysis will be used to examine the project from each of the strengths, weaknesses, opportunities and threats. Risks can be categorized with a risk breakdown structure (RBS) as a representation of the potential risks of the project (PMI, 2017, p.405).

Once the Project Team has identified the risks, they will proceed to analyze the possibility of occurrence and their impact on the project objectives based on information gathering techniques. As a result, the team will develop a risk response strategy during the process to address the identified potential risks either as threats or opportunities to reduce the risks.

4.7.2 Risk Categories

The following risk categories have been identified for the project:

- Technical risk – Is the risk associated with the evolution of the design and the production of the system of interest affecting the level of performance necessary to meet the stakeholder expectations and technical requirements.
- Management risk – Is the risk -financial, ethical or otherwise – associated with ineffective, destructive, or underperforming management.
- Operational risk – Is the risk of loss as a result of ineffective or failed internal processes, people, systems, or external events which can disrupt the flow of business operations.
- External risk – Risks that an organization has little to no control over if, when or how it might occur.
- Internal risk – Is a risk that exists within the organization. It can be thought of as any risk that can be identified and managed by the same organization.

4.7.3 Risk Breakdown Structure (RBS)

The RBS is a representation of the potential risks that may affect the project identified by the project team during the brainstorming sessions.

Chart 21. *Risk Breakdown Structure for the project (Source: Author)*

RBS Level 0	RBS Level 1	RBS Level 2	RBS Level 3
	1. Technical Risk	1.1 Technical Skill	1.1.1 Information Management skills

All sources of project risk	2. Management Risk	2.1 Project Management	2.1.1 Communication
			2.1.2 Poor Procurement planning
	3. Internal Risk	3.1 Human Resources	3.1.1 Lack of qualified human resource
	4. External Risk	4.1 Weather	4.1.1 Natural Disasters
		4.2 Human Health	4.2.1 Global Pandemic
	5. Operational Risk	5.1 Resources	5.1.1 Lack of available material

4.7.4 Qualitative Risk Analysis

The qualitative risk analysis will establish prioritized project risks in order to plan risk response. During analysis, the identified risks will be prioritized, based on the probability of it occurring, and the impact it will have on the project objective if it occurs. The impact of each identified risk will be assessed, risks with low probability and impact will be included in a risk register to be monitored. Risks are assigned to a priority level based on the combination of their assessed probability and impact, using a probability and impact Matrix.

4.7.5 Probability and Impact

The Chart below provides the various descriptions of probability and impact for the project.

Chart 22. *Probability definitions for the project (Source: Thorhallsdottir, n.d.)*

Description	Probability	Numerical
Very Likely	A definite hazard that has a highest frequency, generally more than 80% and will be revealed during certain project stages.	0.9
Likely	Risks that lie among 60-80% chances of occurrence	0.7
Possible	Hazard which has 50/50 likelihood of occurrence	0.5
Unlikely	Unlikely risks will occur and contain low probability of occurrence of 20-30%	0.3
Highly Unlikely	Unlikely risks which have a rare level occurrence such as less than 10%	0.1

Chart 23. *Impact definitions for the project (Source: Kendrick, 2015)*

Description	Impact	Numerical
Very High	An impact that would result negatively on project outcomes, and the project budget, and with an increase to cost of more than $10,000.00	0.8
High	Any impact that would threaten the project's objective (failure to meet one or more of the triple constraints parameters) or that might lead to	0.4

	significant, measurable in long term impact, and with an increase to cost of $5001 – $10,0000	
Moderate (3)	Any impact that would result in significant project replanning or that would lead into a noticeable and inconvenient effect with an increase to cost of $3,001 - $5,000	0.2
Low	Any impact that can be managed within the project team and whereby functions are noticeably reduced with an increase of cost of $1001 - $3,000	0.1
Very Low	Any impact that can have a negligible effect on the project cost less than $1000	0.05

4.7.6 Risk Prioritization

The project team has defined the acceptable scales and probabilities of possible risk and their impacts on project cost.

Chart 24. *Definitions for Probability and Impacts (Source: PMI, 2017, p.407).*

Scale	Probability	Impact on Cost (BZD)
Very High	>80%	>$10,000
High	60-80%	$5,001 - $10,000
Medium	>50%	$3,001 - $5,000
Low	20-30%	$1,001 - $3,000
Very Low	<1-10%	<$1,000

Chart 25. *Probability x Impact Matrix (Source: Author)*

	Impact					
		Very Low (0.05)	**Low (0.1)**	**Medium (0.2)**	**High (0.4)**	**Very High (0.8)**

Probability	**Very Likely (0.9)**	0.05	0.09	0.18	0.36	0.72
	Likely (0.7)	0.04	0.07	0.14	0.28	0.56
	Possible (0.5)	0.03	0.05	0.1	0.20	0.40
	Unlikely (0.3)	0.02	0.03	0.06	0.12	0.24
	Highly Unlikely (0.1)	0.01	0.01	0.02	0.04	0.08

Chart 26. *PxI Scale (Source: Author)*

Risk Level	Rate
Very Low	<0.05
Low	0.05 – 0.13
Medium	0.14 – 0.25
High	> 0.26

Chart 27. *Project Risk Register (Source: Author)*

RBS Code	Cause	Risk	Consequence	Probability	Impact	PxI	Owner	Risk Response Strategy	Cost of Strategy (BZD)
4.1.1	Hurricane threat and heavy rainfall	Restricted access to project location	Delays in the project	0.7	0.4	0.28	Project Director, Project Manager	Mitigate: Monitor weather patterns and disturbances	$2,000.00
3.1.1	Limited recruitment	Lack of qualified experts/consultants	Delays in the project	0.5	0.4	0.2	Project Manager	Mitigate: extend submission of bids to regional and international consultants	$300.00
2.1.1	Poor communication	Project team lacks knowledge because of communication gaps	Delays in the project	0.5	0.2	0.1	Project Manager	Mitigate: Strengthen the project team to enhance their skills	$200.00

5.1.1	Unavailability of construction supplies	Cease of operations	Delays in the project	0.3	0.2	0.06	Project Manager	Mitigate: Outsourcing of material and supplies	$1,000.00
1.1.1	Lack of training in information management	Poorly collected, stored and managed information handling	Lack of information on constructed wetlands	0.1	0.05	0.01	Project Manager	Mitigate: strengthen the information system with expertise knowledge	$500.00
4.2.1	New Covid-19 wave	Cease of operations	Delays in the project	0.5	0.4	0.2	Project Director and Project Manager	Avoid: This threat is beyond the realm of the Project Manager. A governmental decision for a total lockdown impedes all processes and project in country. Mitigation measures to	$2,000.00

								be considered include social distancing, mask wearing, and working virtually.	
2.1.2	Lack of procurement processes, manual, procedures and guide.	Delays	Delays in procurement, delays in selecting consultants, contractor, vendor etc. Overall delay in the project	0.5	0.2	0.1	Project Manager	Transfer: The hiring of an experienced procurement officer with knowledge of international financial institution's procurement policies and framework. The use of user-friendly procurement software systems.	$500.00

4.7.7 Risk Management Strategy

The DOE will manage risk including policies, procedures used to identify, assess, respond to, and monitor risks. In the response planning the risk owners will be responsible to reduce the probability and impact of risks.

4.7.8 Monitor of Risks

Monitoring the risks include processes of monitoring the implementation of agree-upon risk response plans, tracking identified risks, identifying and analyzing new risks, and effectively evaluating risk process throughout the project (PMBOK, 2017, p.453). During project execution, the information generated will be used to monitor risks and determine if:

- Contingency reserve for cost or schedule requires modification,
- Risk management approach is still valid,
- Status of identified individual project risk have risen,
- Level of overall project risk has changed,
- Implemented risk responses are effective (PMBOK, 2017, p. 454).

PROCUREMENT MANAGEMENT PLAN FOR THE DESIGN AND CONSTRUCTION OF A CONSTRUCTED WETLAND IN THE NEW RIVER WATERSHED

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4.8 Procurement Management Plan

This Plan will document the project procurement process, the approach and identify potential sellers to acquire goods and services (PMBOK, 2017, p. 466). The design and construction of a constructed wetland in the New River Watershed is an environmental project which aims to control the amounts of contaminants that enter the New River ecosystem. The goods and services required to complete this project are outlined in the procurement plan.

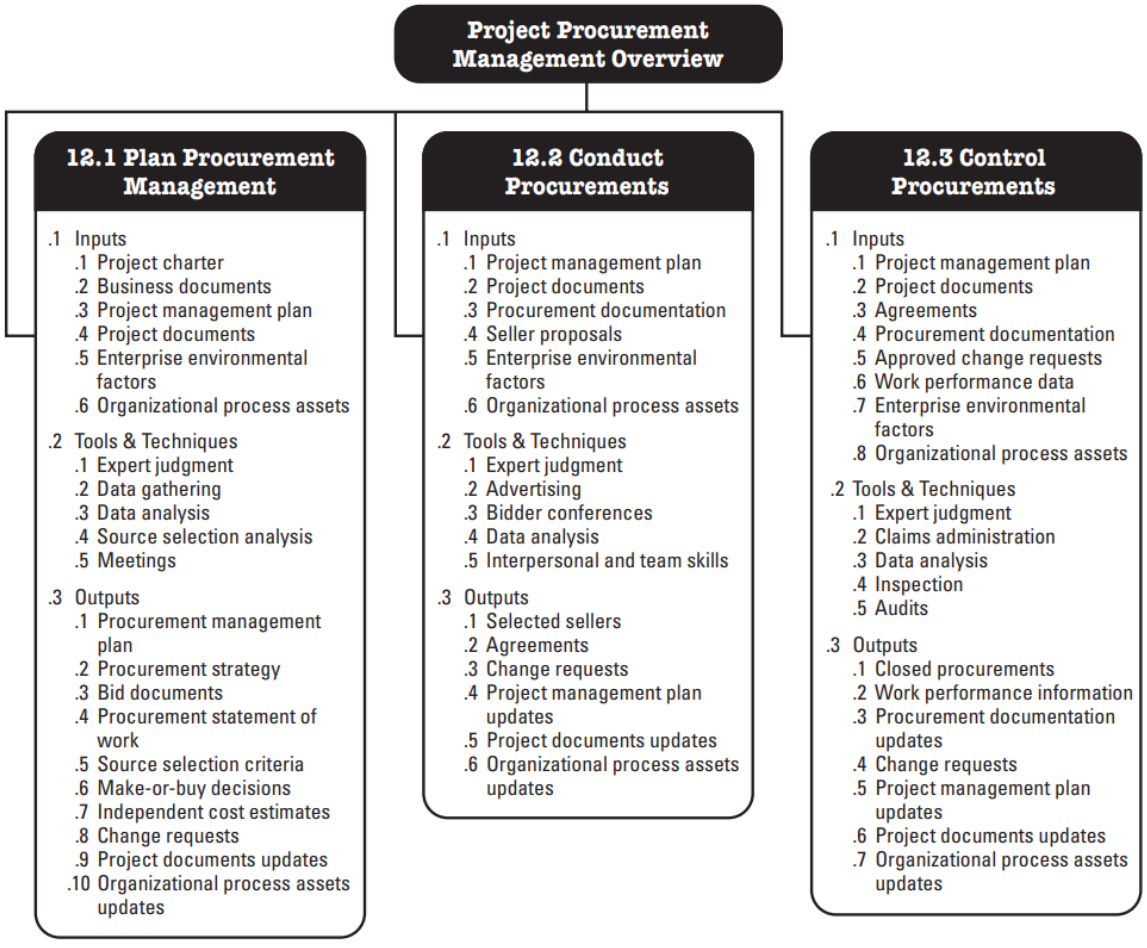

Figure 24. *Project Procurement Management Overview*

4.8.1 Procurement Management Approach

The project manager and the project team will be responsible for developing the procurement plan and informing the project director of the decisions. The approach will assist in selecting the right bidders to participate, receive greater bids and increase the prospects of receiving value for money. Essentially, the approach will provide better delivery of the project outcomes within budget, time and quality.

The following bid documents will be utilized in the procurement plan:

- Bids
- Tender
- Quotations (Request for quotation, Request for proposal)

The Project Manager is responsible for identifying the goods and services required for the completion of the project. The procurement process to acquire the goods and services will be followed by using the Ministry's Public Procurement Procedures (PPP) Handbook. It outlines the principles of value for money, fairness and equal treatment, transparency and accountability, and ethical standards (Ministry of Finance, 2013).

4.8.2 Procurement Definitions

In this section, items listed will be procured to ensure the timely completion of the project.

Chart 28. *List of items to be procured based on service or goods (Source: Author)*

Item	Goods or Services	Justification
Project Manager	Service	Develop the Project Management Plan

Demographic Expert	Service	NRW demographic assessment
Climatologist	Service	NRW climate assessment
Hydrologist	Service	NRW hydrology assessment
Water Quality Expert	Service	NRW water quality assessment
Legal Consultant	Service	NRW policy/legislation assessment
Topography Expert	Service	Topographical assessment of the NRW
Socio-economic Expert	Service	Socio-economic assessment of the NRW
Environmental Engineer	Service	Septic tank and wetland sizing
Liner	Goods	Operations of the Wetland
Gravel and Sand	Goods	Construction of the Wetland
Pipes	Goods	Operations of the Wetland
Pumps	Goods	Operations of the Wetland
Concrete	Goods	Construction of the Wetland
Plants	Goods	Bioremediation processes
Contractor	Service	Construction of the Wetland
Civil Engineer	Service	Construction of the Wetland
Financial Auditor	Service	Perform Financial Audit
Conference Room	Service	Consultations and validation meetings with stakeholders
Catering	Goods	Food and beverage for stakeholders
Office Supplies	Goods	Supplies for the Department
Office Equipment	Goods	Desktop computer, laptop and printer
Sampling Equipment	Goods	To collect water samples

4.8.3 Cost Determination

The cost determination outlines the manner costs are determined. A Request for Quote will be issued to the vendors containing the needs and requirements

for the service or goods and requesting them to submit a bid for their goods/services. The process is crucial as costs are a determining factor and criteria for selection.

4.8.4 Procurement of Goods

As a government entity in the public sector, the funds are required to be managed in a transparent and accountable manner. Therefore, the procurement of goods will be performed by the Project Manager who will be required to obtain three quotations from vendors as described in the DOE's procurement manual while still obtaining best value for money. The Project Director will proceed to select the best vendor from the 3 and approve. The Project Manager along with the DOE's Procurement Officer will proceed to develop the Purchase Order as seen in Appendix 7 for the selected vendor. The DOE's Accountant will sign off on the approved POs for direct payments for less than $5,000.00. For payments above the $5,000.00 threshold, approval will be sought from Mr. Anthony Mai, Chief Environmental Officer at the DOE and the Project Director.

4.8.5 Procurement for Services

The design and construction of a constructed wetland in the New River Watershed Project requires expertise in the different subject areas for the completion of the activities and project objectives. The following list identifies the twelve (12) experts required to provide professional services.

- Project Manager
- Demographic Expert
- Climatologist
- Hydrologist

- Water Quality Expert
- Legal Consultant
- Topography Expert
- Socio-economic Expert
- Environmental Engineer
- Contractor
- Civil Engineer
- Financial Auditor

4.8.6 Contractual Procedures

The Terms of Reference (TOR) and the Request for Proposal (RFP) will be developed by the Project Manager and in conjunction with the Project Director. They will contain the tasks the experts will be required to perform. The TOR and RFP will contain the data that needs to be submitted for approval and contain a detailed list of all data and services that will be provided in the contract. The RFP will be published through all forms of communication such as government emails, local newspaper, DOE website and social media platforms for a minimum period of two (2) weeks.

The submission of RFP will be reviewed, and a panel of examiners will evaluate the proposal packages. The panel consists of three or five members (odd numbers only) mainly: one from the DOE, one from the Ministry of Sustainable Development, Climate Change and Disaster Risk Management and one from either the Hydrology Unit or the Fisheries Department. The Procurement Officer from the DOE will guide the panel through the evaluation process and the panel will evaluate the packages using an evaluation sheet as seen in Appendix 8. The selected consultant along with the evaluation report as seen in Appendix 9 will then be forwarded to the Project Director for

final approval. Once approved, the procurement officer will proceed to develop the contract. Both parties (DOE and selected consultant) will sign off on the contract and the consultancy services will begin with an inception meeting. Payment of services will be based upon submission and approval of deliverables along with its corresponding invoice.

4.8.7 Type of Contracts

The project will support awarding service contracts based on an individual local consultant. The Project Manager will define the quantities, type of items required, and the time required for its use in order to complete the project's outcomes. The Project Manager is overall in charge of developing the requests for proposals and requests for quotations from various sellers.

4.8.8 Procurement Documentation

The use of a standard procurement documentation will be prepared by the Project Manager in collaboration with the Department of the Environment. The documentation will contain details of the requirements when issuing an RFP and will be beneficial for the selection process when the comparison for the best value for money is observed.

The standard list of templates for procurement documentation for this project are as follows:

a. Terms of Reference (see Appendix 14)
b. Request for Proposal (see Appendix 15)

COMMUNICATION MANAGEMENT PLAN FOR THE DESIGN AND CONSTRUCTION OF A CONSTRUCTED WETLAND IN THE NEW RIVER WATERSHED

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4.9 Communication Management Plan

The communication management plan for this project will ensure that communication and dissemination of information are based on the needs of the key relevant stakeholders.

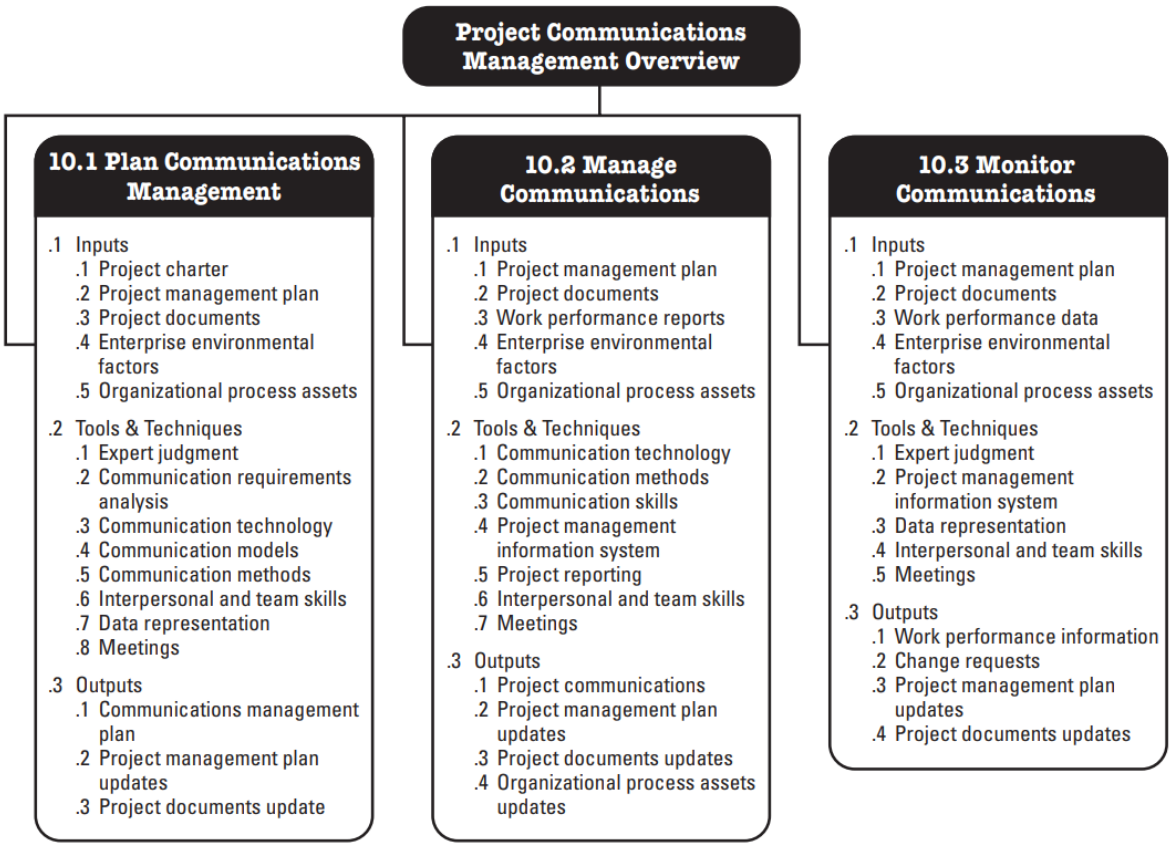

Figure 25. *Project Communications Management Overview*

Official communication of information to be disseminated to the key relevant stakeholders will be in English only. There are 14 key stakeholders:

- **Project Director (DOE)** – responsible for information exchange and authorizing information sharing

- **Project Manager** – responsible of ensuring quality of reports and sharing of information
- **Consultants** – responsible of providing reports, meeting reports and other required documents
- **Project Sponsor (GCF)** – provides support
- **Implementing Entity (UNEP)** – provides support
- **Orange Walk Town Council (Local Government)** – recipient of information exchange and reports of the project
- **Hydrology Unit (Central Government)** - recipient of information exchange and reports of the project
- **Fisheries Department (Central Government)** - recipient of information exchange and reports of the project
- **Sarteneja Alliance for Conservation and Development (NGO)** - recipient of information exchange and reports of the project
- **Friends of New River (NGO)** - recipient of information exchange and reports of the project
- **Programme for Belize (NGO)** - recipient of information exchange and reports of the project
- **Belize Solid Waste Management Authority (Central Government)** - recipient of information exchange and reports of the project
- **Ministry of Education (Central Government)** - recipient of information exchange and reports of the project
- **Belize Sugar Industries/American Sugar Refineries (Private Sector)** - recipient of information exchange and reports of the project

The communication requirements for the design and construction of a constructed wetland in the New River Watershed are described in Chart 29.

Chart 29. *Communication requirements based on each stakeholder (Source: Author)*

Communication	Audience	Goals	Frequency	Format	Responsibility	Method of Communication
Inception Meeting	All key stakeholders	Introduction of the project to stakeholders	One time event	Formal meeting, project charter, power point presentation	Project Manager	Presential meeting
Steering Committee	Project Director, Project Manager, Implementing Entity	Review project status,	Monthly	Project charter and management plans	Project Manager	Virtual meeting
Status Reports	Project Directors, Project Managers, Implementing Entity and Consultants	Report on the project progress, report on issues, challenges, constraints and risk	Weekly	Emails, reports	Project Team and Consultants	Presential meeting
Team meeting	Project Team	Report on status of the project, identify issues	Daily and/or weekly	Meeting and status report	Project Team	Virtual meeting or Email
Milestone Review	Steering Committee, Project Director,	Review project status and feedback	At every project milestone	Meeting review	Project Team and Consultants	Paper communication
Project Closure	All key stakeholders	Review success and failure for future project implementation	Closing of the project	Meeting, press release	Project Manager, Project Team and Project Director	Paper Communication and email

4.9.1 Communication Methods

The communication method used for this project to share information among key stakeholders will include the following approaches:

- Interpersonal communication which is a face-to-face approach such as between the Project Manager and the Consultants. Examples: Face to face (presential) meetings or virtual meetings.
- Small group communication among 3 to 6 people to review project status and/or to address risks or concerns. Examples: Face to face (presential) meetings or virtual meetings.
- Public communication, for example, during the inception meeting.
- Mass communication will be utilized to share results and reach mass audiences through press releases and interviews with local media outlets. Example: Paper Communication
- Social media communication will be used to share newsletters, press releases, video updates or announcement of public consultations. Examples: Email and WhatsApp Messages

The Project will use communication media such as: telephone, emails, videoconferences, social media posts and instant messaging.

4.9.2 Monitor Communication

The Project's communication should be carefully evaluated to ensure that the correct message with the right content is delivered to the right audience, through the right channel, and at the right time (PMBOK, 2017, p. 389). Monitor communications may require a variety of methods such as customer satisfaction surveys, collecting lessons learned, observations of the team, reviewing data from the issue log, or evaluating changes in the stakeholder engagement

assessment matrix. An interview was conducted with several project staff and relevant stakeholders to gather information relating to the communication management of the project, see appendix 16. The Monitor Communications process often results in the need for adjustment, action, and intervention on communications activities defined in the communications management plan. Change requests are processed through the Perform Integrated Change Control process. The changes requests may result in revision of stakeholder communication requirements including stakeholders' information distribution, content or format, and distribution method and new procedures to eliminate bottlenecks (PMBOK, 2017, p. 393). The communication management plan can therefore be amended to improve its effectiveness and reach its targeted audience. The Chart below shows the coordination among the project team to discuss critical issues, challenges or concerns.

Chart 30. *Coordination meeting communication (Source: Author)*

Meeting	Frequency	Duration	Objective	Lead
Coordination Meeting	**Weekly**	30 mins	To raise issues of concern, review team's performance, discuss delays and possible solutions	Project Manager

Milestone meeting	**Monthly**	30 mins	To discuss the project's achieved milestones and the upcoming milestones	Project Team
Team Performance Assessment	**Bimonthly**	20 mins	Discuss the team member's assessment and any other grievances.	Project Director

INTEGRATION MANAGEMENT PLAN FOR THE DESIGN AND CONSTRUCTION OF A CONSTRUCTED WETLAND IN THE NEW RIVER WATERSHED

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4.10 Project Integration Management

The first step in the development of the Project Management Plan for the design and construction of a constructed wetland was the creation of a Project Charter. Brainstorming with the team, meeting minutes, interviews as well as the PMBOK ® Guide were critical in the development of the Charter. The template of the Project Charter was obtained from the Project Management Institute database and was completed during the graduation seminar. The Project Charter provides the Project Manager with the authority to assign resources to project activities. The **Charter includes** the rationale, goals, and relevant stakeholders of the project. The Charter also includes the purpose of the project, general and specific objectives, project description, risks, assumptions, budget, deliverables, milestones schedule, approval requirements. The PMBOK ® Guide highlights the inputs, tools and techniques required to develop a Project Charter as shown in Figure 15 below. (PMI, 6th edition. p. 75)

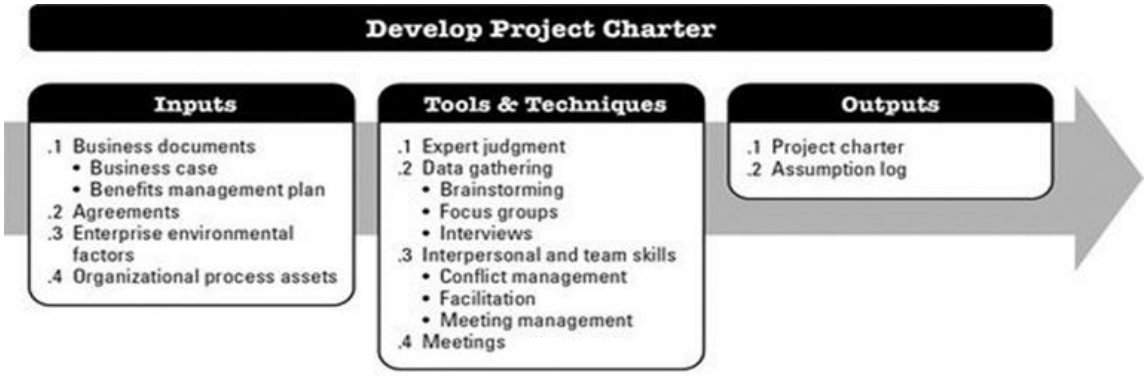

Figure 26. *Develop Project Charter: Inputs, Tools and Techniques and Outputs*

The Project Manager ensured that all relevant documentation was embedded in the development of the Project Charter as well as ensuring its use in the execution of the project.

Chart 31. *Project Charter (Source: Author)*

Project Charter	
Version 1.0	June 2023
	Project Management Plan for the design and construction of a constructed wetland in the New River Watershed
Application area/sector	Environment
Knowledge Areas/Processes	Knowledge areas: Project Scope Management Project Schedule Management Project Cost Management Project Quality Management Project Resource Management Project Communication Management Project Risk Management Project Procurement Management Project Stakeholder Management Project Integration Management Project Sustainable Management Process groups: Project Initiation Project Planning
Purpose	The aim of this Final Graduation Project (FGP) is to develop a project management plan that will eventually guide the execution of the construction of a constructed wetland in the New River Watershed. In 2019, the New River experienced a eutrophication event due to a drought which affected especially northern Belize, this along with the accumulation of effluent discharge from point and non-point sources of pollution unleashed a series of events in the local town of Orange Walk forcing businesses and schools along the river bank to close down due to the mal odor emanating from the river. Tours and expeditions to the Lamanai Archaelogical site were cancelled and many fish kills were observed along the New River. The elaboration of a project management plan will aid in the proper management and execution needed for the success of the project. This project

	management plan can also be replicated and utilized by the Department of the Environment as the basis for future environmental projects. The project for the construction of a constructed wetland in the New River Watershed is vital and hence must be professionally managed to fulfill the social, economical and environmental needs of the Orange Walk town and its surrounding communities.
General Objective	To develop a project management plan for the design and construction of a constructed wetland in the New River Watershed.
Specific Objectives	To develop the scope management plan in order to ensure the successful completion of the project. To develop the schedule management plan to manage the timely completion of the project. To develop the cost management plan to ensure the successful completion of the project within the given budget. To develop the quality management plan to ensure the quality of the deliverables of the project. To develop the resource management plan in order to successfully complete the project with the required resources. To develop the communication management plan in order to ensure the successful communication of the project. To develop the risk management plan to ensure the proper management of risks associated to the project. To develop the procurement management plan in order to manage the purchase of resources for the successful completion of the project. To develop the stakeholder management plan in order to ensure the stakeholder engagement of the project. To develop the integration management plan to ensure the successful consolidation of all the project phases. To develop the sustainable development plan to ensure the sustainability of the project.

Assumptions	Information about the New River Watershed and other relevant documents are easily obtained and readily available. The researcher will invest 12 hours per week during the development of the Final Graduation Project's development process. Access to water quality monitoring data on the New River will be granted by the Department of the Environment for academic purposes. The Orange Walk Town Council (local government), the Department of the Environment (central government) and the Friends of New River (NGO) are able and willing to assist in the execution of activities related to the project.
Constraints	Time: The maximum time allotted for the completion of the Final Graduation Project is 12 weeks. Cost: The cost for the completion of the Final Graduation Project is relatively high considering that the researcher will invest out of pocket money in the FGP. Resource: The researcher is the only human resource available for the development of the FGP. Quality: The quality of the FGP depends highly on the available relevant information.
Preliminary Risks	A hurricane watch/warning for the coasts of Belize might delay tours and data collection in the field and may delay the timely submission of deliverables. A eutrophication event in the New River might restrict access to the site location and to the river and may delay the development of the FGP. Heavy rainfalls can create flood events/warnings and might restrict access to the site location and the river and may delay the development of the FGP. Covid – 19 restrictions can restrict access to the site and to the river for data collection and may delay the development and execution of the FGP.

Budget

Project Deliverables	Cost BZD
Project Management	
Scope Plan	**$100.00**
Schedule Plan	**$100.00**
Cost Plan	**$100.00**

Quality Plan	**$100.00**
Resource Plan	**$100.00**
Communication Plan	**$100.00**
Risk Plan	**$100.00**
Procurement Plan	**$100.00**
Stakeholder Plan	**$100.00**
Integration Plan	**$100.00**
Sustainable Plan	**$100.00**
Characterization of the wastewater discharged into the New River	
Demography Report	$2,500.00
Climate Report	$2,500.00
Hydrology Report	$2,500.00
Water Quality Monitoring Report	$2,500.00
Design of the constructed wetland	
Legislation Report	$3,000.00
Topographic Map of the location	$3,000.00
Social, Economic and Cultural Characteristics of the Population	
Sizing of the septic tank	**$3,000.00**
Wetland Sizing	**$3,000.00**
	$3,000.00
Relevant Cost of a constructed wetland	$25,680.00
Excavation and Piping	$12,840.00
Pretreatment Stage	$12,840.00
Liner	$14,980.00
Gravel and Sand	$20,330.00
Distribution and Drainage Pipes	
Pumps	$9,630.00
Operation and Maintenance	$8,000.00
Building a Constructed Wetland	
Permits	**$5,000.00**
Construction	
Planting and Start Up Operations	**$50,000.00**
	$10,000.00
Project Management Cost	$54,000.00

Salary for Project Manager for 18 months at $3,000.00 per month	
Total Cost Estimate	$249,400.00

Budget (Baseline + Management Reserve) = BZD $256, 931.88

Milestones

Deliverable	Finish estimated date
1.1 FGP Deliverable	
1.1.1 Project Charter	15 January 2023
1.1.2 Work Breakdown Structure	22 January 2023
3 Introduction	29 January 2023
1.1.4 Theoretical Framework	5 February 2023
1.1.5 Methodological Framework	12 February 2023
1.1.6 Annexes	19 February 2023
1.2 Graduation Seminar Approval	26 February 2023
Tutoring Process	March to May
2.1 Tutor	26 March 2023
2.2 Adjustments of previous chapters	31 March 2023
2.3 Chapter 4 Development (Results)	30 April 2023

	2.4 Conclusion	28 May 2023
	2.5 Recommendations	31 May 2023
	Reading by Reviewers	10 working days
	3.1 Reviewers Assignment Request	14 June 2023
	3.2 Reviewers Work	
	Adjustments	28 June 2023
	Defense to Board of Examiners	5 July 2023
Stakeholders	Project Director (DOE) Project Sponsor (GCF) Project Manager Implementing Entity (UNEP) Consultants Orange Walk Town Council Hydrology Unit Fisheries Department Sarteneja Alliance for Conservation and Development Friends of New River Programme for Belize Belize Solid Waste Management Authority Ministry of Education BSI/ASR	
Project Manager Francisco Javier Magaña	Signature 	

4.10.1 Change Management Process

The change management process is a mechanism that will be used to initiate, record, assess, approve, or resolve project changes (PMBOK® Guide, 2017). In this Project, all change requests must go through the change management process sanctioned by the Project Manager. The changes requested will be processed by the Project Manager who either accepts or rejects changes after careful consideration. All changes, whether accepted or rejected, will be

documented. When changes are approved, it will be applied to the project and the relevant documents will also be updated.

SUSTAINABLE MANAGEMENT PLAN FOR THE DESIGN AND CONSTRUCTION OF A CONSTRUCTED WETLAND IN THE NEW RIVER WATERSHED

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4.11 Sustainable Management Plan

Sustainability will be integrated in the design and construction of a constructed wetland in the New River Watershed Project and in the overall project management plans within the project using the PRiSM Project Management Methodology. The sustainable management plan will be managed and governed throughout the lifecycle of the project. The P5 standard tool of people, planet, prosperity, process, and product will be used to measure project sustainability. The Project Manager and the Project Team will utilize the P5 standard tool to deliver a sustainable project in a sustainable way. Daily, weekly, and monthly update meetings will be used as a tool to ensure that the team is implementing the necessary sustainable concepts into the various project phases. The implementation of sustainability with the project is the role and responsibility of each team member and under supervision from the Project Manager and Project Director. This in order to realize the benefit of the sustainable management plan. Chart 32 depicts the roles and responsibilities within the sustainable management plan.

Chart 32. *Roles and Responsibilities of the Project Team Sustainability Engagement (Source: Author)*

Roles	Responsibilities
Project Sponsor (GCF)	• Ensure that sustainability is considered throughout the project lifecycle • Establish a culture that champions sustainability within the project and among the Project Team
Project Director (DOE)	• Supervise that the Project Team maintains a sustainable path through the project's lifecycle
Project Manager	• Coordinate with the Project Team to implement responses identified in the P5IA • Develop, disseminate, and implement the Sustainability Management Plan • Develop and update the P5 Impact Analysis (P5IA) with the support of the Project Team.
Project Team	• Support the implementation of sustainability initiatives. • Support the delivery of project sustainability objectives and targets
Consultants	• Embed sustainability requirements in their work plans. • Ensure that sustainability requirements are communicated to the project team and stakeholders

4.11.1 Key Performance Indicators for the Sustainable Management Plan

Chart 33 provides the sustainable KPIs within the project.

Chart 33. Sustainable KPI's (Source: Author)

P5 Domain	Category	Key Performance Indicator	Metric
Product	Lifespan of product	Life expectancy	20 – 30 years
	Servicing of product	Number of stakeholders involved in maintenance and operations	The DOE is solely responsible to identify someone
Process	Effectiveness of project processes	Number of DOE staff actively participating	50% of DOE staff
	Efficiency of project processes	Number of scheduled meetings	
	Fairness of project processes	Number of engagements with stakeholders	10 engagements
People	Labor practices and decent work	Capacity building for the project team	At least 2 training sessions
	Society and customers		
	Human rights	Equity in hiring	3 females form part of the Project Team
	Ethical behavior	Number of suppliers not paid timely	0
Planet	Transport		
	Energy	Percentage of energy obtained from renewable resources	70%
	Land, Air, and Water	Abide by relevant environmental regulations	90%
	Consumption	Percentage of reusable solid waste	50%
Prosperity	Business case analysis		
	Business Agility		
	Economic Stimulation	Percentage of local suppliers use in the project	90%

4.11.2 Review and Reporting

The project reporting will be used to monitor the project's progress towards delivering expected results, and sustainability. Meetings will be used to discuss major concerns as well as relevant decisions on project sustainability. The P5IA will be used to provide an overview to stakeholders of the sustainability impacts

of the project. Overall, in the P5 categories, the areas in green indicate where the project is improving in project sustainability after the proposed response mechanism is implemented to mitigate potential impacts. On the other hand, the red areas indicate a reduction in project sustainability. The Project Manager will need to pay close attention to the red areas and brainstorm better response mechanism/strategy to improve project sustainability.

Chart 34. P5IA (Source: Author)

People Impacts								
Category	Labor Practices and Decent Work	Lens	Scored	Description	Initial Impact Score	Proposed Response	New Impact Score	Change
Element	Definition							
Employment and Staffing	Employment and staffing is the process of obtaining the personnel needed to carry out the project. It includes identifying the skills required for successful completion of the project, recruiting potential individuals (internally or externally), managing their time and performance, training them when needed, and compensating them accordingly.	Fairness	Yes	Limited human capacity within the DOE with knowledge in Project Management	2	Attract and compensate staff knowledgeable in Project Management	4	2
Labor Management Relations	Labor/management relations in the project context means building trust, understanding, and cooperation among project and other	Effectiveness	Yes	Staff has limited knowledge in regards to their roles and	3	Update meetings to keep the team focused and on track	4	1

	managers, organizational staff, and project team members. It involves respecting each other's opinions, resolving conflicts proactively, communicating clearly, and ensuring that everyone is aware of their roles and responsibilities.			responsibilities				
Equal Opportunity	Equal opportunity is the practice of providing individuals with access to jobs, opportunities, and responsibilities based on their qualifications regardless of gender, race, age, or other characteristics. It seeks to eliminate any type of discrimination in the workplace and to ensure that all team members are treated fairly and given an equal chance to participate in an appropriate way.	Fairness	Yes	There is a discriminatory gap on hiring females	3	When hiring staff, include a paragraph that states that the project hires based on qualifications and experience	5	2
Category	Ethical Behaviors	Lens	Scored	Description	Impact Score Before	Proposed Response	Impact Score After	Change
Element	Description							
Sustainable Procurement and Contracts	Sustainable procurement and contracts includes practices for obtaining goods, raw materials, and	Effectiveness	Yes	There is a lack of sustainable procurement practices	3	Adapt sustainable procurement practices	4	1

	services that take into account environmental, economic, and social impacts. It means contracting for resources in an ethical manner. It requires establishing agreements which adhere to environmental, social, and human rights standards.					for goods and services		
Planet Impacts								
Local Procurement	Local procurement is the practice of purchasing products and services from local suppliers.	Effectiveness	Yes	Limited sources of local goods and services	3	Advertise TOR's locally on digital platforms and local newspapers	4	1
Energy Consumption	Energy consumption is the amount of energy used by the project throughout its duration. It encompasses all aspects of energy use from office lighting to the energy required for transportation.	Effectiveness	Yes	The energy consumption during the project is not monitored	2	Monitor the energy consumption	3	1
GHG Emissions	GHG emissions are gases (mostly carbon dioxide and methane) released into the atmosphere as a direct result of activities associated with the project. This includes emissions	Effectiveness	Yes	GHG emissions are not monitored during the execution of the project	1	Monitor the GHG and reduce the amount of GHG released to the	3	2

	as a direct result of project energy consumption as well as emissions from transport of procured goods, raw materials, and services. It also includes GHG emissions caused by the distribution, operation, and disposal of the project product.					atmosphere		
Air and Water Quality	Air and water quality involves measures of contamination in air and water sources.	Effectiveness	Yes	There is no water quality monitoring in the New River	2	Establish a water quality monitoring programme and protocol for the New River Watershed	4	2
Recycling and Reuse	"Recycling involves transforming a waste item into a useful one. Items that can be recycled run the gamut from plastic water bottles to computers to electrical generators. Reuse involves using the same item again and again or finding a new purpose for it."	Effectiveness	Yes	No monitoring of recyclables during the project	1	Conduct a solid waste management and recycling programme during the execution of the project	3	2
Disposal	Contamination and pollution is the release of waste	Effectiveness	Yes	No monitoring of pollution	2	Establish a pollution control	4	2

	materials or hazardous substances into the environment. It will almost always have a negative impact on ecosystems and human health. Contamination and pollution most often occurs due to neglectful practices in manufacturing, construction, agriculture, and related industries that generate waste materials or hazardous chemicals, but it can also occur in other projects that do a poor job of disposal.			during the execution of the project		mechanism during the execution of the project		
Prosperity Impacts								
Social Return on Investment	Social return on investment (SROI) is a framework for measuring and accounting for project results and outcomes by including social and environmental costs and benefits along with the traditional economic ones. It is based on the idea that projects create value in ways other than just financial returns. For example, a community	Effectiveness	Yes	No SROI programme of any projects	1	Establish a SROI framework for measuring and accounting of the project results	5	4

	development project may create value by improving the health and well-being of residents, reducing crime, and increasing social cohesion.							
Indirect Benefits	Indirect benefits are the positive impacts that go beyond the immediate outcomes of the project and may not always be immediately visible. These benefits can include improved quality of life, increased economic activity in the local area, and environmental improvements such as cleaner air or water.	Effectiveness	Yes	No studies to report on the indirect benefits	2	Study the possible indirect benefits of the constructed wetland in the New River Watershed	4	2

4 CONCLUSIONS

The development of the Project Management Plan for the design and construction of a constructed wetland in the New River Watershed will guide the delivery of the final product on time, within budget, scope, high quality and overall satisfaction of the relevant stakeholders. The eleven (11) plans were designed using the analytical research method as well as the seventh edition of a Guide to the Project Management Body of Knowledge (2017) standards and publications.

1. The Department of the Environment (DOE) within the Ministry of Sustainable Development, Climate Change and Disaster Risk Management is a project-oriented department. Therefore, detailed documentation of all project related activities is imperative for the overall success of the project. The scope management plan will provide the Department with the necessary guidance to execute the project. The Plan underlines how any changes to the scope will be managed.
2. The Project Schedule Management Plan was designed to ensure that the project is completed on time. The Department has had challenges in controlling and maintaining the project's schedule. For this reason, the Plan has a detailed plan of activities with their duration identified along with milestones.
3. The Project Cost Management Plan was created to develop the project budget and ensure that the project is successfully completed within budget. Any changes in scope and procurement usually affect cost, hence it's imperative to monitor both closely. The Plan provides the Department with management and control of the costs of the Project. Any variations to the

project will be monitored and controlled thus keeping the project's cost in check.

4. The Project Quality Management Plan was developed to ensure that the deliverables meet the expectations of the sponsors. By defining quality metrics within the project, the Department will benefit from obtaining the best from the project's deliverables and assure its quality.
5. The Resource Management Plan was created to categorize, allocate, and manage resources throughout the lifecycle of the project ensuring that these are readily available at the right time. The Plan provides the Department with the ability to maximize the demands of the required resources in an effective and efficient way.
6. Communication within the DOE plays a vital role in ensuring that the relevant stakeholders are informed and that their feedback is obtained. The Project Communication Plan was designed to keep all the relevant stakeholders informed using the ideal mechanism. The Plan outlines the expected frequency and mode of interaction ensuring an effective mode of communication. A communication matrix was developed highlighting all project stakeholders throughout the project lifecycle ensuring the circulation of information.
7. The DOE is not known to handle or manage risks in most projects unless it is requested by the sponsor. The Project Risk Management Plan was created to identify all project risks and design a plan to manage, respond and monitor all potential risk throughout the project lifecycle. This approach proves beneficial as it encourages the Department to take a proactive management of the risks.
8. The Project Procurement Management Plan was developed to aid in the acquisition of project resources. It provides a guide on the management and control processes for contracts, and procurement of goods and services. The

Plan can provide the Department with a standard document and process for contracting vendors, procuring goods and services.

9. The relationship among stakeholders of the project is vital for its success. The Stakeholder Management Plan was created to underscore how stakeholders will be identified, classified, managed, and engaged throughout the project lifecycle. The Plan provides a way to engage stakeholders based on their interests, and impact on the project. Support of stakeholders is a critical success factor for the project.
10. The Project Charter provides a clear overview of the project's components, scope, and stakeholders. The Charter provides an opportunity to review the objectives of the project, risks, assumptions, constraints, milestones, and budget.
11. The Sustainability Management Plan was developed to ensure that the project mitigates negative environmental, social, and economic impact within the project activities. A sustainable KPI's and P5 Impact Analysis were developed to ensure project processes and deliverables on the environment.

5 RECOMMENDATIONS

1. The DOE should utilize the Scope Management Plan for future project implementation to minimize scope creep within the projects.
2. The Project Manager should implement the Schedule Management Plan to ensure that the project remains on schedule and within budget to avoid delays and cost overruns.
3. The Resources Management Plan emphasizes the human capital and goods needed to successfully execute the project. The DOE must provide continuous ongoing capacity building and training to environmental officers and project staff to ensure the team operates at a high level of performance.
4. The Department does not come with a Project Management Office (PMO); therefore, it is recommended that the DOE look into the possibility of establishing a PMO within the Department to manage and implement projects successfully.
5. The Project Manager and the Project Team must monitor the budget closely to ensure there are no budget overruns. Any deviation should be reported as it can create an imbalance in the project budget which is a threat to the scope, time, and schedule.
6. The Project Manager should monitor the risk register based on the quantitative risk analysis and update if required.
7. The Project Manager needs to ensure that the stakeholder engagement plan is updated regularly to ensure fully engaged stakeholders.
8. The Department of the Environment should adopt the planning process and templates developed for the Project Management Plan as a basis for implementing a procedure to be used by the DOE for future projects.
9. The Chief Environmental Officer of the DOE should encourage the Environmental Officers to implement the project management best practices and processes guided by the Project Management Institute.

VALIDATION OF THE PROJECT IN THE FIELD OF REGENERATIVE AND SUSTAINABLE DEVELOPMENT

According to the United Nations, the 2030 Agenda for Sustainable Development, adopted by all United Nation member states in 2015, provides a shared blueprint for peace and prosperity for people and the planet. At its heart are the seventeen (17) Sustainable Development Goals (SDGs), which are urgent calls for action by all countries – developed and developing – in a global partnership. The member states recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth; all while tackling climate change and working to preserve our oceans and forests. The 17 SDGs are as follows:

0. No poverty
1. Zero hunger
2. Good health and well-being
3. Quality education
4. Gender equality
5. Clean water and sanitation
6. Affordable and clean energy
7. Decent work and economic growth
8. Industry, innovation, and infrastructure
9. Reduced inequalities
10. Sustainable Cities and communities
11. Responsible consumption and production
12. Climate action
13. Life below water
14. Life on land
15. Peace, Justice and strong institutions

16. Partnerships for the goals.

According to the CReW+ Project, the Wider Caribbean Region faces multiple challenges in the wastewater and sanitation service provision. About 70% of the region's population lacks access to safely managed sanitation and hygiene. Approximately 80% of the wastewater is being discharged to the environment without any treatment as a result of weak legislative, political, and regulatory frameworks and lacking financial means to maintain the infrastructure. This causes severe pollution of groundwater, soils, watersheds and ultimately the Caribbean Sea and disrupting the natural cycle.

The project management plan for the design and construction of a constructed wetland in the New River Watershed project aims to provide an innovative and nature-based solution to mitigate some of the effects of point and non – point sources of pollution on the environment and public health. The design and construction of a constructed wetland in the New River also aims to contribute directly to the achievement of the SDGs 3, 6, 11, 14 and 15. The SDGs also count with a set of targets, indicators and custodians who monitor the overall success of the SDGs in the country. Regarding SDG 6 (ensure availability and sustainable management of water and sanitation for all), target 6.6 – "By 2020, protect and restore water -related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes." With its indicator 6.6.1 – Change in the extent of water-related ecosystems overtime and the custodians for target 6.6 are the United Nations Environment Programme (UNEP) and Ramsar.

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APPENDICES

Appendix 1: FGP Charter

CHARTER OF THE PROPOSED FINAL GRADUATION PROJECT (FGP)

1. Student name

Francisco Javier Magaña

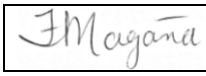
2. FGP name

Development of a project management plan for the design and construction of a constructed wetland in the New River Watershed

3. Application Area (Sector or activity)

Environment

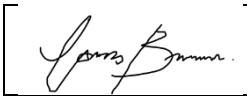
4. Student signature



5. Name of the Graduation Seminar facilitator

Carlos Brenes Mena

6. Signature of the facilitator



7. Date of charter approval

February 26th, 2023

8. Project start and finish date

January 2023	June 2023

9. Research question

What legislation and guidelines allow the design and construction of a constructed wetlands in the New River Watershed?

10. Research hypothesis

Is it possible to design and construct a constructed wetland in the New River Watershed to minimize the contamination of point and non – point sources of pollution?

11. General objective

To develop a project management plan for the design and construction of a constructed wetland in the New River Watershed.

12. Specific objectives

1. To develop the scope management plan in order to ensure the successful completion of the project.
2. To develop the schedule management plan to manage the timely completion of the project.
3. To develop the cost management plan to ensure the successful completion of the project within the given budget.
4. To develop the quality management plan to ensure the quality of the deliverables of the project.
5. To develop the resource management plan in order to successfully complete the project with the required resources.
6. To develop the communication management plan in order to ensure the successful communication of the project.
7. To develop the risk management plan to ensure the proper management of risks associated to the project.
8. To develop the procurement management plan in order to manage the purchase of resources for the successful completion of the project.
9. To develop the stakeholder management plan in order to ensure the stakeholder engagement of the project.
10. To develop the integration management plan to ensure the successful consolidation of all the project phases.
11. To develop the sustainable development plan to ensure the sustainability of the project.

13. FGP purpose or justification

The aim of this Final Graduation Project (FGP) is to develop a project management plan that will eventually guide the execution of the construction of a constructed wetland in the New River Watershed. In 2019, the New River experienced a eutrophication event due to a drought which affected especially northern Belize, this along with the accumulation of effluent discharge from point and non-point sources of pollution unleashed a series of events in the local town of Orange Walk forcing businesses and schools along the river bank to close down due to the mal odor emanating from the river. Tours and expeditions to the Lamanai Archaeological site were cancelled and many fish kills were observed along the New River.

The elaboration of a project management plan will aid in the proper management and execution needed for the success of the project. This project management plan can also be replicated and utilized by the Department of the Environment as the basis for future environmental projects.

The project for the construction of a constructed wetland in the New River Watershed is vital and hence must be professionally managed to fulfill the social, economic, and environmental needs of the Orange Walk town and its surrounding communities.

14. Work Breakdown Structure (WBS). In table form, describing the main deliverable as well as secondary, products or services to be created by the FGP.

FGP
1. Graduation Seminar
  1.1 FGP deliverable
    1.1.1 Project Charter
    1.1.2 Work Breakdown Structure
    1.1.3 Introduction
    1.1.4 Theoretical Framework
    1.1.5 Methodological Framework
    1.1.6 Annexes
      1.1.6.1 Bibliography
      1.1.6.2 Schedule
2. Tutoring Process
  2.1 Tutor
    2.1.1 Tutor Assignment
    2.1.2 Communication
  2.2 Adjustments of previous chapters

2.3 Development (Results)
- 2.3.1 Scope Management Plan
- 2.3.2 Schedule Management Plan
- 2.3.3 Cost Management Plan
- 2.3.4 Quality Management Plan
- 2.3.5 Resource Management Plan
- 2.3.6 Communication Management Plan
- 2.3.7 Risk Management Plan
- 2.3.8 Procurement Management Plan
- 2.3.9 Stakeholder Management Plan
- 2.3.10 Integration Management Plan
- 2.3.11 Sustainable Development Plan

2.4 Conclusions
2.5 Recommendations
3. Reading by Reviewer
3.1 Reviewers Assignment Request
- 3.1.1 Assignment of 2 Reviewers
- 3.1.2 Communications
- 3.1.3 FGP submission to Reviewers

3.2 Reviewers work
- 3.2.1 Reviewer 1
  - 3.2.1.1 FGP Reading
  - 3.2.1.2 Reader 1 Report
- 3.2.2 Reviewer 2
  - 3.2.2.1 FGP Reading
  - 3.2.2.2 Reader 2 Report

4. Adjustments
4.1 Report for Reviewers
4.2 FGP Update
4.3 Second Review by Reviewers
5. Defense to Board of Examiners
5.1 Final review by Board
5.2 FGP Grade Report

15. FGP budget

	Project Deliverables	Cost BZD
	Project Management	
	Scope Plan	**$100.00**
	Schedule Plan	**$100.00**
	Cost Plan	**$100.00**
	Quality Plan	**$100.00**
	Resource Plan	**$100.00**
	Communication Plan	**$100.00**

Risk Plan	**$100.00**
Procurement Plan	**$100.00**
Stakeholder Plan	**$100.00**
Integration Plan	**$100.00**
Sustainable Plan	**$100.00**
Characterization of the wastewater discharged into the New River	
Demography Report	$2,500.00
Climate Report	$2,500.00
Hydrology Report	$2,500.00
Water Quality Monitoring Report	$2,500.00
Design of the constructed wetland	
Legislation Report	$3,000.00
Topographic Map of the location	$3,000.00
Social, Economic and Cultural Characteristics of the Population	
Sizing of the septic tank	**$3,000.00**
Wetland Sizing	**$3,000.00**
	$3,000.00
Relevant Cost of a constructed wetland	$25,680.00
Excavation and Piping	$12,840.00
Pretreatment Stage	$12,840.00
Liner	$14,980.00
Gravel and Sand	$20,330.00
Distribution and Drainage Pipes	
Pumps	$9,630.00
Operation and Maintenance	$8,000.00
Building a Constructed Wetland	
Permits	**$5,000.00**
Construction	
Planting and Start Up Operations	**$50,000.00**
	$10,000.00
Project Management Cost	
Salary for Project Manager for 18 months at $3,000.00 per month	$54,000.00
Total Cost Estimate	$249,400.00

Budget (Baseline + Management Reserve) = BZD $256, 931.88

16. FGP planning and development assumptions

1. Information about the New River Watershed and other relevant documents are easily obtained and readily available.
2. The researcher will invest 12 hours per week during the development of the Final Graduation Project's development process.
3. Access to water quality monitoring data on the New River will be granted by the Department of the Environment for academic purposes.
4. The Orange Walk Town Council (local government), the Department of the Environment (central government) and the Friends of New River (NGO) are able and willing to assist in the execution of activities related to the project.

17. FGP constraints

1. Time: The maximum time allotted for the completion of the Final Graduation Project is 12 weeks.
2. Cost: The cost for the completion of the Final Graduation Project is relatively high considering that the researcher will invest out-of-pocket money in the FGP.
3. Resource: The researcher is the only human resource available for the development of the FGP.
4. Quality: The quality of the FGP depends highly on the available relevant information.

18. FGP development risks

1. A hurricane watch/warning for the coasts of Belize might delay tours and data collection in the field and may delay the timely submission of deliverables.
2. A eutrophication event in the New River might restrict access to the site location and to the river and may delay the development of the FGP.
3. Heavy rainfall can create flood events/warnings and might restrict access to the site location and the river and may delay the development of the FGP.
4. Covid – 19 restrictions can restrict access to the site and to the river for data collection and may delay the development and execution of the FGP.

19. FGP main milestones

Milestones are related to deliverables on the second level (deliverables) and third level (control accounts) of the WBS of section 14 of this Charter. At the

same time the deliverables are related to the specific objectives (in the case of the FGP please include the times for the tutorship reviews as well as for the readership).

Deliverable	Finish estimated date
1.1 FGP Deliverable	
1.1.1 Project Charter	15 January 2023
1.1.2 Work Breakdown Structure	22 January 2023
1.1. 3 Introduction	29 January 2023
1.1.4 Theoretical Framework	5 February 2023
1.1.5 Methodological Framework	12 February 2023
1.1.6 Annexes	19 February 2023
1.2 Graduation Seminar Approval	26 February 2023
2. Tutoring Process	March to May
2.1 Tutor	26 March 2023
2.2 Adjustments of previous chapters	31 March 2023
2.3 Chapter 4 Development (Results)	30 April 2023
2.4 Conclusions	28 May 2023
2.5 Recommendations	31 May 2023
3. Reading by Reviewers	10 working days
3.1 Reviewers Assignment Request	14 June 2023
3.2 Reviewers Work	
4. Adjustments	28 June 2023
5. Defense to Board of Examiners	5 July 2023

20. Theoretical framework

20.1 Estate of the “matter”

The Department of the Environment (DOE) was established in September 1989 to protect the nation’s environment. The first Chief Environmental Officer was Dr. Victor Gonzalez. Soon thereafter Dr. Gonzalez was promoted to Permanent Secretary of the recently established Ministry of Tourism and the Environment at the time. During this time, Mr. Ismael Fabro was hired as DOE’s first Environmental Officer, who was quickly promoted to the second Chief Environmental Officer of the Department. He worked arduously until the DOE became a full-fledged entity with the passage of the Environmental Protection Act (EPA) in November 1992; the EPA is a piece of legislation which conferred broad statutory powers on the DOE concerning a wide range of environmental issues. It is believed that the passage of the EPA was quickened by 2 events:

(i)The Rio Summit of 1992 (also known as the Earth Summit is a United Nations conference held in 1992 in Rio de Janeiro, Brazil that focused Governments to look at global environmental issues and patterns of development) and (ii) the Hatchet Caye Incident of 1992 (an incident that was reported to have occurred near Hatchet Caye where the developer began to dynamite the barrier reef to make a channel for the navigation of marine vessels).

The Department of the Environment functions with full autonomy to enforce the Environmental Protection Act which grants broad regulatory and enforcement authority for the prevention and control of environmental pollution, conservation, and management of natural resources.

The Final Graduation Project is being implemented on the New River Watershed located along the Orange Walk and Corozal districts. The development of a Project Management Plan for the design and construction of a constructed wetland aims to reduce the impacts of point and non – point sources of pollution.

The strategies of the Department are centered on:
1.Strengthening the coordination of environmental activities between government and non-government organizations.

12. Establishing and enforcing standards for pollution control.
13. Reviewing and revising, as necessary, existing environmental legislation and regulations as well as strengthening their enforcement.
14. Promoting environmental planning for key areas of development such as the coastal zone, islands, and tourism sites.
15. Establishing, upgrading, and maintaining information systems to store data and other information on the environment to facilitate planning and monitoring.
16. Facilitating public participation in environmental issues, through public education campaigns and district outreach activities, in order to encourage community based environmental planning and enforcement of regulations.
17. Ensuring that the Government's Environmental Impact Assessment procedures are implemented for all environmentally sensitive projects.

The DOE is headed by a Chief Environmental Officer and assisted by several technical staff. To carry out its functions, the Department's responsibilities is programmed into five units: Project Execution Unit, Environment Information Management Unit, Public Awareness & Outreach Unit, Environmental Law & Policy Unit, Environmental Enforcement & Compliance Monitoring Unit, and

the Project Evaluation & EIA Unit. This project is set to be developed and implemented under the Project Execution Unit which coordinates all activities for projects being executed under the Department to ensure their successful implementation and work closely with reputable international organizations to enhance environmental prospects for Belize.

The DOE as the executing agency will provide the researcher with all access to data and relevant information such as the Integrated New River Watershed Management Plan, the National Water Quality Monitoring Program and Protocol and any other report produced by national and/or international consultants.

According to the Project Management Standard, the principles of project management are:
1. There must be a project as defined in the PMBOK, and not just a task or an ongoing activity.
2. There must be a single leader (project manager), one who is experienced and willing to take responsibility for the work.
3. There must be an informed and supportive management that delegates appropriate authority to the project manager.
4.There must be a dedicated team of qualified people to do the work of the project.
5. The project goal must be clearly defined along with the priorities of the "shareholders."
6. There must be an integrated plan that outlines the action required in order to reach the goal.
7. There must be a schedule establishing the time goals of the project.
8. There must be a budget of costs and/or resources required for the project.

According to the Project Management Institute, a project performance domain is defined as a group of related activities that are critical for the effective delivery of project outcomes. The domains are stakeholder, team, development approach and life cycle, planning, project work, delivery, measurement, and uncertainty.

According to the Australian Institute of Project Management, traditional is more linear, focusing on up front planning with requirements fully defined before a project commences. Like its name suggests, work cascades, much like a waterfall, through different project phases. Each phase needs to be completed before the next one can begin (AIPM, 2021).

According to Karigar (2021), the traditional method is well-covered by the PMBOK guide. According to Karigar, in the predictive method, the project decides the scope first, and then time and cost estimations are done.

The Australian Institute of Project Management states that Agile Framework includes a set of principles and values that came to life in 2001, created by 17 technology leaders. Underneath the umbrella of Agile are a range of frameworks and product delivery methods, such as Scrum, Lean, Six, Sigma and Kanban. Agile frameworks and methods do not generally manage the project lifecycle but rather provide a flexible and iterative solution which allows you to adapt as the situation demands (AIPM, 2021).

Karigar (2021) also states that the Agile approach is positively represented by the four values (self-organization, empowerment, trust, and accountability) and 12 agile principles. The author also states that in the adaptive approach, the project team first establishes time and cost first and then the scope is taken up.

The project life cycle includes the steps required for project managers to successfully manage a project from start to finish. The five phases are: initiating, planning, executing, monitoring, and controlling and closing phase.

Dr. Ed Boles, aquatic ecologist states on his Google Earth Assessment of the New River Watershed that the NRW lies adjacent to the Rio Hondo Watershed to the west, the Belize River Watershed to the south and southeast (Crooked Tree Wetland system), and smaller coastal zone creeks to its northeast. The elongated catchment of NRW lies within the confinement of a north-northeast/south-southwest oriented fault line. New River is a low elevation, slow flowing, wetland-dominated river that normally maintains a relatively

heavy detritus load from all of the decaying algae, aquatic plants, and riparian forests. Originating within and flowing through a wetland landscape, New River waters are typically light to sometimes dark amber or tea-colored from all of the tannins released by decomposing plants.

The University of Florida, on their Environmental water quality assessment for the New River, Belize stated the status of the problem. In 2019, with the driest dry season since the early 1980's, a prolonged drought concentrated nutrients and pollutants in the river system for longer than usual. Rain was late and flow was reduced as water became stagnant leading to anaerobic conditions and associated stench that impacted nearby communities, including schools and businesses. As a result, New River was reported by media outlets to be in the worst condition in memory (Amandala 2019, 7 News Belize 2019). The Department of Environment conducted initial water quality sampling, beginning in July 2019 through September 2019. The University of Florida, per invitation from the Department of Environment conducted additional water quality sampling from 5 October 2019 through 10 October 2019.

20.2 Basic conceptual framework

List of the basic concepts to be included in the document.

- Project Management
- Initiation Process
- Planning Process
- Execution Process
- Monitoring and Controlling Processes
- Closing Process
- Project Charter
- Project Management Plan
- Scope Management
- Schedule Management
- Cost Management
- Quality Management
- Resource Management
- Communication Management
- Risk Management
- Procurement Management
- Stakeholder Management
- Integration Management
- Sustainable Development Plan
- Constructed Wetland

- Sewage
- Grey Water
- Stormwater
- Industrial Wastewater
- Vegetation
- Soil
- Organisms
- Biofilter
- Pollutants
- Suspended Solids
- Organic Matter
- Nutrients
- Pathogens

21. Methodological framework

Objective	Name of deliverable	Information sources	Research method	Tools	Restrictions
1. To develop the scope management plan in order to ensure the successful completion of the project.	Scope Management Plan	Primary: field interviews. PMBOK PMI Journals Secondary: Past thesis, reports	Qualitative Research Quantitative Research Written information analysis.	WBS Lucid Chart	Limited time of the researcher. Limited access to cheap/free project management apps.
2. To develop the schedule management plan to manage the	Schedule Management Plan	Primary: PMBOK PMI Journals	Quantitative Research	Gantt Chart	Limited time of the researcher. Limited access to

timely completion of the project.		Secondary: Past thesis			cheap/free project management apps.
3. To develop the cost management plan to ensure the successful completion of the project within the given budget.	Cost Management Plan	Primary: PMBOK PMI Journals Secondary: Past thesis	Quantitative Research	Expert judgement Analogous Estimation	Limited time of the researcher. Limited access to cheap/free project management apps.
4. To develop the quality management plan to ensure the quality of the deliverables of the project.	Quality Management Plan	Primary: PMBOK PMI Journals Secondary: Past thesis	Qualitative Research	Histograms Flowcharts Check Sheets	Limited time of the researcher. Limited access to cheap/free project management apps.
5. To develop the resource management plan in order to successfully complete the project with the required resources.	Resource Management Plan	Primary: PMBOK PMI Journals Secondary: Past thesis	Qualitative Research	Gantt Chart WBS	Limited time of the researcher. Limited access to cheap/free project management apps.
6. To develop the communication management	Communication Management Plan	Primary: PMBOK PMI Journals	Qualitative Research	Microsoft Word Microsoft Excel	Limited time of the researcher.

plan in order to ensure the successful communication of the project.		Secondary: Past thesis		Email	Limited access to cheap/free project management apps.
7. To develop the risk management plan to ensure the proper management of risks associated to the project.	Risk Management Plan	Primary: PMBOK PMI Journals Secondary: Past thesis	Qualitative Research	SWOT Brainstorming Probability and Impact Matrix	Limited time of the researcher. Limited access to cheap/free project management apps.
8. To develop the procurement management plan in order to manage the purchase of resources for the successful completion of the project.	Procurement Management Plan	Primary: PMBOK PMI Journals Secondary: Past thesis	Quantitative Research	Expert Judgement Data Gathering Data Analysis	Limited time of the researcher. Limited access to cheap/free project management apps.
9. To develop the stakeholder management plan in order to ensure the stakeholder engagement of the project.	Stakeholder Management Plan	Primary: PMBOK PMI Journals Secondary: Past thesis	Qualitative Research	Influence X Interest Matrix	Limited time of the researcher. Limited access to cheap/free project management apps.

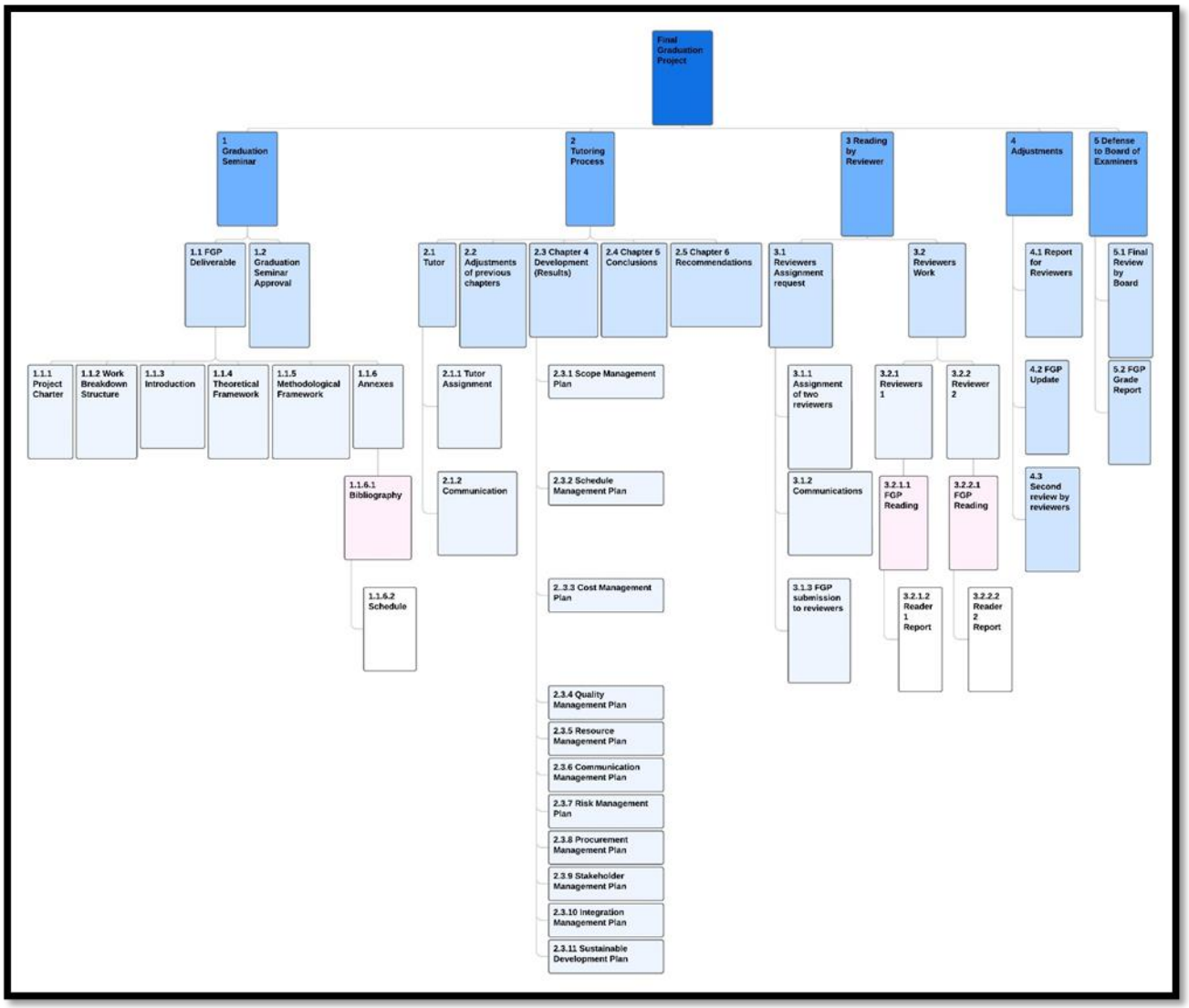
10. To develop the integration management plan to ensure the successful consolidation of all the project phases.	Integration Management Plan	Primary: PMBOK PMI Journals Secondary: Past thesis	Qualitative Research Quantitative Research	Expert Judgement Data Gathering Data Analysis Meetings	Limited time of the researcher. Limited access to cheap/free project management apps.
11. To develop the sustainable development plan to ensure the sustainability of the project.	Sustainable Development Plan	Primary: PMBOK PMI Journals Secondary: Past thesis	Qualitative Research		Limited time of the researcher. Limited access to cheap/free project management apps.

22. Validation of the work in the field of regenerative and sustainable development.

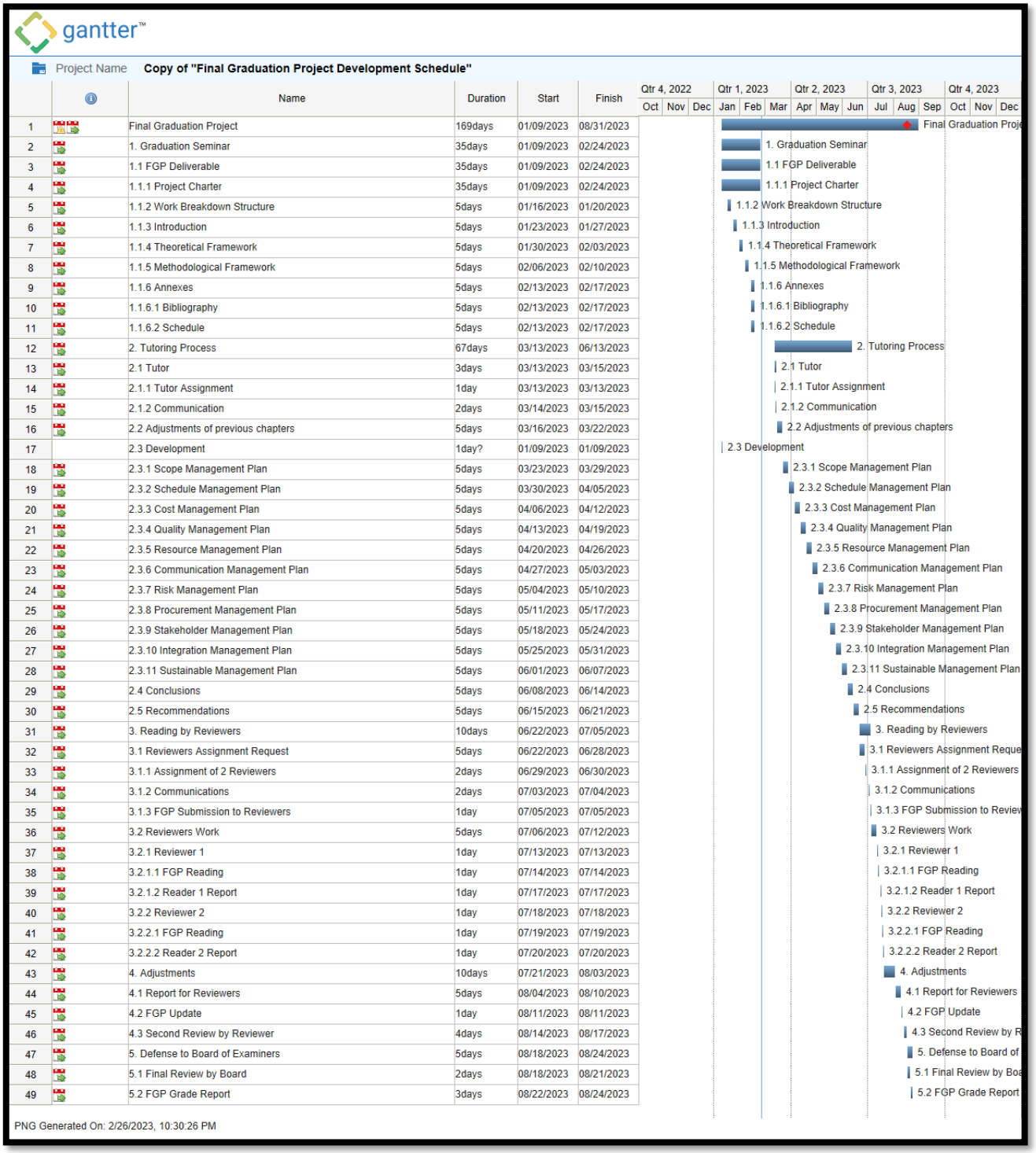
The United Nations 2030 Agenda for Sustainable Development will be utilized to develop the FGP's concept on sustainable development. According to the UN, in 2015 UN member states recognized that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests. At its heart are seventeen sustainable development goals (SDGs) namely: 1 - no poverty, 2 – zero hunger, 3 – good health and well-being, 4 – quality education, 5 - gender equality, 6 – clean water and sanitation, 7 – affordable and clean energy, 8 – decent work and economic growth, 9 – industry, innovation and infrastructure, 10 – reduced inequalities, 11 – sustainable cities and communities, 12 – responsible consumption and production, 13 – climate actions, 14 – life below water, 15 – life on land, 16 – peace, justice and strong institutions and 17 – partnerships for the goals.

The project management plans for the design and construction of a constructed wetland in the New River Watershed aim to provide an innovative and nature-based solution to mitigate the impacts of point and non-point sources of pollution. This project seeks to contribute directly to the achievement of the SDGs 3, 6, 11, 14 and 15. The SDGs also count with a set of targets, indicators and custodians who monitor the overall success of the SDGs in the country.

Appendix 2: FGP WBS



Appendix 3: FGP Schedule



gantter™

Project Name **Copy of "Final Graduation Project Development Schedule"**

		Name	Duration	Start	Finish
1		Final Graduation Project	169days	01/09/2023	08/31/2023
2		1. Graduation Seminar	35days	01/09/2023	02/24/2023
3		1.1 FGP Deliverable	35days	01/09/2023	02/24/2023
4		1.1.1 Project Charter	35days	01/09/2023	02/24/2023
5		1.1.2 Work Breakdown Structure	5days	01/16/2023	01/20/2023
6		1.1.3 Introduction	5days	01/23/2023	01/27/2023
7		1.1.4 Theoretical Framework	5days	01/30/2023	02/03/2023
8		1.1.5 Methodological Framework	5days	02/06/2023	02/10/2023
9		1.1.6 Annexes	5days	02/13/2023	02/17/2023
10		1.1.6.1 Bibliography	5days	02/13/2023	02/17/2023
11		1.1.6.2 Schedule	5days	02/13/2023	02/17/2023
12		2. Tutoring Process	67days	03/13/2023	06/13/2023
13		2.1 Tutor	3days	03/13/2023	03/15/2023
14		2.1.1 Tutor Assignment	1day	03/13/2023	03/13/2023
15		2.1.2 Communication	2days	03/14/2023	03/15/2023
16		2.2 Adjustments of previous chapters	5days	03/16/2023	03/22/2023
17		2.3 Development	1day?	01/09/2023	01/09/2023
18		2.3.1 Scope Management Plan	5days	03/23/2023	03/29/2023
19		2.3.2 Schedule Management Plan	5days	03/30/2023	04/05/2023
20		2.3.3 Cost Management Plan	5days	04/06/2023	04/12/2023
21		2.3.4 Quality Management Plan	5days	04/13/2023	04/19/2023
22		2.3.5 Resource Management Plan	5days	04/20/2023	04/26/2023
23		2.3.6 Communication Management Plan	5days	04/27/2023	05/03/2023
24		2.3.7 Risk Management Plan	5days	05/04/2023	05/10/2023
25		2.3.8 Procurement Management Plan	5days	05/11/2023	05/17/2023
26		2.3.9 Stakeholder Management Plan	5days	05/18/2023	05/24/2023
27		2.3.10 Integration Management Plan	5days	05/25/2023	05/31/2023
28		2.3.11 Sustainable Management Plan	5days	06/01/2023	06/07/2023
29		2.4 Conclusions	5days	06/08/2023	06/14/2023
30		2.5 Recommendations	5days	06/15/2023	06/21/2023
31		3. Reading by Reviewers	10days	06/22/2023	07/05/2023
32		3.1 Reviewers Assignment Request	5days	06/22/2023	06/28/2023
33		3.1.1 Assignment of 2 Reviewers	2days	06/29/2023	06/30/2023
34		3.1.2 Communications	2days	07/03/2023	07/04/2023
35		3.1.3 FGP Submission to Reviewers	1day	07/05/2023	07/05/2023
36		3.2 Reviewers Work	5days	07/06/2023	07/12/2023
37		3.2.1 Reviewer 1	1day	07/13/2023	07/13/2023
38		3.2.1.1 FGP Reading	1day	07/14/2023	07/14/2023
39		3.2.1.2 Reader 1 Report	1day	07/17/2023	07/17/2023
40		3.2.2 Reviewer 2	1day	07/18/2023	07/18/2023
41		3.2.2.1 FGP Reading	1day	07/19/2023	07/19/2023
42		3.2.2.2 Reader 2 Report	1day	07/20/2023	07/20/2023
43		4. Adjustments	10days	07/21/2023	08/03/2023
44		4.1 Report for Reviewers	5days	08/04/2023	08/10/2023
45		4.2 FGP Update	1day	08/11/2023	08/11/2023
46		4.3 Second Review by Reviewer	4days	08/14/2023	08/17/2023
47		5. Defense to Board of Examiners	5days	08/18/2023	08/24/2023
48		5.1 Final Review by Board	2days	08/18/2023	08/21/2023
49		5.2 FGP Grade Report	3days	08/22/2023	08/24/2023

Qtr 4, 2022 | Qtr 1, 2023 | Qtr 2, 2023 | Qtr 3, 2023 | Qtr 4, 2023

Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

PNG Generated On: 2/26/2023, 10:30:26 PM

Appendix 4: Preliminary bibliographical research

Bentley, C. (2019, September). *Final comprehensive national water quality monitoring program and protocol.* – This document contains a general water quality monitoring program and protocol for Belize which was developed for the Department of the Environment. Having a standardized template for the collection of water quality data enables the Department to efficiently collect water quality data from the Ministry, NGO's and the industries which monitor water quality from the different watersheds in Belize.

Boles, E. (2019, September 6). *Google Earth assessment of New River Watershed*. – This document contains vital background information of the New River Watershed.

Cano, A. (2022). *Integrated New River watershed management plan.* – This document was developed by a consultancy firm for the Department of the Environment. - This document is a guide to the adequate use and management of the New River Watershed.

Department of the Environment. (2009, August 8). Environmental protection (effluent limitations) (amendment) regulations. https://doe.gov.bz/wp-content/uploads/2019/03/Effluent-Limitations-Amendment-Regulations-2009.pdf - This document by the Government of Belize is the legislation/policy that governs the use of Class I and II waters in Belize. This legislation states what organic effluents can be discharged into Class I waters and the limitations it contains.

Department of the Environment. (2019, September 5). *Stagnation of the New River, what is being done and the prospect for improvement.* – This document by the Department of the Environment highlights the series of events during the New River eutrophication event.

Lefler, F. W., Dalaba, J. R., Laughinghouse, H. D., Gonzalez, V., & Mazzoti, F. J. (2019, December). *Environmental water quality assessment for the New River, Belize*. – This document produced by the University of Florida provides a water quality assessment of the New River during the eutrophication event.

Legorreta, T. A. (2019, December). *Water quality diagnosis of New River, Belize*. – This document is a comprehensive water quality report provided by the “El Colegio de la Frontera Sur, ECOSUR).

Sarteneja Alliance for Conservation and Development. (2017). *New River watershed assessment.* – This document provided by SACD (NGO) highlights the watershed assessment of the New River.

Sarteneja Alliance for Conservation and Development. (2019, July). *Methodology for the water quality monitoring of Corozal Bay Wildlife Sanctuary.* – This document provided by SACD depicts the methodology utilized by the NGO to monitor, track, and control the water quality monitoring along the Corozal Bay Wildlife Sanctuary which forms part of the New River Watershed.

Shukla, A., Parde, D., Gupta, V., Vijay, R., & Kumar, R. (2021). A review on effective design processes of constructed wetlands. *International Journal of*

Environmental Science and Technology, 1-26. – This document is a guide for the design and construction of a constructed wetland.

Appendix 5: Cost Management Plan Survey

Dear Respondent,

This survey is intended to provide information for a study that leads to the development of a cost management plan for the project entitled: “Project Management Plan for the design and construction of a Constructed Wetland in the New River Watershed.”

You have been selected to participate in this research study by providing information and are kindly requested to complete the questionnaire as honestly as possible.

Respondent Name: _____

Respondent Role: _____

Please circle your best answer.

1. In your experience, how are cost of construction projects estimated?
    a) By experience
    b) Techniques based on calculations
    c) Techniques based on combination of calculations and experience
    d) Other techniques

2. In your experience, what technique is used for project cost control?
    a) Project cost – value reconciliation
    b) Earned Value Analysis

c) Program Evaluation and Review Technique (PERT)
d) Unit Costing
e) Overall Profit or Loss
f) Other techniques

3. In your experience, which software package is best for cost control?
    a) Project Costing System
    b) Microsoft Project
    c) Asta Power Project
    d) Microsoft Excel
    e) Other software

4. Who is mainly responsible for cost planning and estimation of the project?
    a) Project Sponsor
    b) Implementing Entity
    c) Project Director
    d) Project Manager
    e) Any other

5. Please insert any other information you would like to share relating to the cost management plan of the project:

_____
_____
_____
_____

Appendix 6: Change Request Form

Project Name	**Project Management Plan for the design and construction of a constructed wetland in the New River Watershed**		
Requested By		**Date**	
Request No.		**Name of Request**	
Change Description			
Change Reason			
Status	**In Review**	**Approved**	**Rejected**
Approval Date	**Dd/mm/yyyy**		
Approved By			

Scope Acceptance

Approved by: **Date:**

_____ _____

Project Director (DOE)

Appendix 7: Quality Management Plan Interview

The following list of questions was used to conduct semi-structured interviews with the project team in order to gather information on their knowledge of Quality Management in a project.

1. What is your experience in quality management?
2. How do you ensure the sponsor satisfaction?
3. What methods have you used to motivate project team members to improve performance?
4. What technique have you used to identify potential areas for process improvement?
5. Describe the most significant challenge that you faced with quality management.
6. What are the qualities or skills needed to be successful in quality control?
7. Explain PDCA Model

Appendix 8: Procurement Training Agenda

Ministry of Sustainable Development,
Climate Change & Disaster Risk Management

PROCUREMENT TRAINING

Wednesday June 14, 2023

MSDCCDRM Auditorium

Moderator: Mrs. Vanessa Figueroa-Wade

TIME	ACTIVITY	PRESENTER
9:00 a.m. – 9:15 a.m.	**ARRIVAL AND REGISTRATION**	
9:15 a.m. – 9:30 a.m.	Welcome Remarks	Mrs. Judene Tingling Linarez
9:30 a.m. – 10:30 a.m.	Overview of the MSDCCDRM's Budget, and Internal Procedures and Policies.	Mrs. Judith Middleton (Finance Officer)
10:30 a.m. – 10:45 a.m.	**Question and Answer Session**	
10:45 a.m. – 11:00 a.m.	**COFFEE BREAK**	
11:00 a.m. – 12:00 a.m.	Breakout Group Session	Mrs. Judith Middleton (Finance Officer)
12:00 a.m. – 1:00 p.m.	**LUNCH**	
1:00 p.m. – 1:30 p.m.	The Government of Belize Procurement Procedures and Policies	Procurement Unit
1:30 p.m. – 1:45 p.m.	**Question and Answer Session**	
1:45 p.m. – 2:00 p.m.	Closing Remarks	Mrs. Floridalia Quiroz (Administrative Officer)

Appendix 9: Risk Management Plan Survey

Dear Respondent,

This survey is intended to provide information for a study that leads to the development of a risk management plan for the project entitled: “Project Management Plan for the design and construction of a Constructed Wetland in the New River Watershed.”

You have been selected to participate in this research study by providing information and are kindly requested to complete the questionnaire as honestly as possible.

Respondent Name: _____

Respondent Role: _____

Please place an X on your best answer.

Survey Questions	Disagree	Not Sure	Agree
1. Managers and personnel are involved in periodic review or planning exercises, which lead them to identify, source and quantify risks.			
2. Responsibilities and accountabilities for risk identification are clearly defined and understood.			

3. There is a periodic review process to ensure that the organization's risk assessments remain current.			
4. Appropriate methodologies are in place to allow the team to measure the impact of identified risks on objectives with some degree of accuracy.			
5. Appropriate information is identified and captured to identify, assess and respond to risk and manage the project, obtained from appropriate internal and external sources, generated manually and electronically and is in appropriate formal and informal formats.			
6. The required information is available to allow proper monitoring of risk throughout the project.			

Appendix 10: Performance Appraisal Summary (Source: Author)

Assessment of Performance Factors/Competencies

Rating	Description
5 points	Exceeds Expectations
4 points	Meets Expectations
3 points	Meets Most Expectations
2 points	Meets Some Expectations
1 point	Did Not Meet Expectations

Insert X in the applicable box

Factor/Competence		5	4	3	2	1
1	**Technical Competence**					
	The person demonstrates in-depth knowledge and technical expertise relevant to the scope of work.					
2	**Quality of Work**					
	The person demonstrates accuracy, attention to details, thoroughness, and effectiveness of work.					
3	**Responsibility**					
	The person takes action and makes decisions on matters associated with the task at hand. The person acts on his/her sole decision and is willing to accept additional duties from time to time.					
4	**Dependability**					
	Effectively manages time and completes all assigned tasks on time, is punctual for work, meetings, and appointments.					
5	**Interpersonal Skills**					
	Works, interacts, and communicates effectively in a team					
6	**Decision-Making**					
	Analyzes information, factors in alternatives and solutions to problems, arrives at logical conclusions.					
Total						

Computation of Overall Score	Total/30 x 100%	%

Any other comments regarding the evaluatee:

_____
_____
_____
_____

Appendix 11: Example of a Purchase Order (Source: Author)

PACT
Protected Areas Conservation Trust

GREEN CLIMATE FUND

Purchase Order

Date	P.O. No.
22/06/2023	GCF 8 - 44

PACT - GCF Readiness 8
3rd Floor MSD Building
Hummingbird Highway
Belmopan, Cayo District

Vendor	Ship To
San Ignacio Resort Hotel Escander Bedran Family Hotel Ltd. BBL 121149010120002	PACT - GCF Readiness 8 3rd Floor MSD Building Hummingbird Highway Belmopan. Cayo Disrict

Item	Description	Qty	Rate	Amount
workshop/training	Rental of Caracol Room | 8am to 1 pm	1	550.00	550.00
workshop/training	Breakfast for 15 persons at 9 am | Order from Group a la Carte | Includes - coffee/tea and orange juice	15	27.00	405.00
workshop/training	Equipment Rental - projector, screem audio with 2 mics	1	45.00	45.00
workshop/training	Lunch for 15 persons at 12 pm | Order from group a la carte - Order in before 10 am | Includes fruit juice	15	32.00	480.00
workshop/training	WIFI - download 180mbps. upload 106 pbps - free of cost - Private router			0.00
workshop/training	Stakeholder networking		700.00	700.00
workshop/training	Service Charge		327.00	327.00
workshop/training	GST		313.38	313.38

PROTECTED AREAS CONSERVATION TRUST
GCF
BELIZE

Total $2,820.38

Approver:

** This Purchase Order is valid for 90 days only **

Appendix 12: Evaluation Matrix Templates

Consultancy Services to conduct an audit of GCF Readiness 8
Technical Scores

Criteria/Sub-Criteria	Points			Average	Points			Average
Adequacy of proposed methodology and workplan in response to the TOR								
i. Technical approach and methodology	**10**			#DIV/0!	**10**			#DIV/0!
ii. Work Plan	**15**			#DIV/0!	**15**			#DIV/0!
iii. Organization and Staffing	**5**			#DIV/0!	**5**			#DIV/0!
Specific Experience as a Firm/Team								
	30			#DIV/0!	**30**			#DIV/0!
Key Experts' qualifications and competence for the assignment								
i. Lead Expert has a minimum of a Master's degree in Project Management	**20**			#DIV/0!	**20**			#DIV/0!
Qualified as a Chartered Professional Accountant (CPA) and/or certified by the Association of Chartered Certified Accountants (ACCA).	**20**			#DIV/0!	**20**			#DIV/0!
TOTAL	**100**		**0**	**0**	**100**		0	**0**

Signature of Panelist
EMF Manager

_____
Mrs. Sobheidy Urbina

Signature of Panelist
Procurement Officer

_____
Mr. Radin Santos

Accepted by:

_____
Mr. Anthony Mai
Chief Environmental Officer

Consultancy Services for Project Manager Position
Financial Scores

Criteria	Points	PA	RS	Average	Points	PA	RS	Average
Breakdown of Deliverables	**20**			#DIV/0!	**20**			#DIV/0!
Adequacy of budget breakdown	**35**			#DIV/0!	**35**			#DIV/0!
Total Financial Proposal (based on available budget)	**45**			#DIV/0!	**45**			#DIV/0!
Total	**100**		0	**0**	**100**		0	**0**

Signature of Panelist
EMF Director

_____
Mrs. Sobheidy Urbina

Signature of Panelist and Date
Procurement Officer

_____
Mr. Radin Santos

Accepted by:

_____
Mr. Anthony Main
Chief Enviornmental Officer

Consultancy Services to conduct an audit of GCF Readiness 8

Combined Technical & Financial Scores

Firm	Technical Evaluation		Financial Evaluation		
	Technical Score	Weighted TS (60%)	Financial Score	Weighted FS (40%)	Final Score
	0	0	0	0	**0**
	0	0	0	0	**0**

Signature of Panelist
EMF Manager
_____
Mrs. Sobheidy Urbina

Signature of Panelist
Procurement Officer
_____
Mr. Radin Santos

Accepted by:
_____
Mr. Anthony Main
Chief Environmental Officer

Appendix 13: Evaluation Report Template

Project Manager Position

Evaluation Report

March, 2023

Agreement number:

Project Processing Number:

BACKGROUND

PROCUREMENT PROCEDURE

ROLES AND RESPONSIBILITIES OF THE PROJECT ASSISTANT

CHARACTERISTICS OF THE POSITION

Institutional arrangements

Duty Station

EVALUATION

_____

Radin Santos
Procurement Officer
DOE

_____

Mrs. Sobheidy Urbina
Environmental Management Fund
DOE

_____

Anthony Mai
Chief Environmental Officer
Department of the Environment

GIZ Project Assistant - Evaluation Matrix (Based on the submission, please evaluate accordingly on your section which falls under your name initials).

Compiled Technical Score

Criteria	POINTS	Ismael Landero				Emeli Alvarado				Daril Avila				Diana Mai			
		RS	PA	MG	Average	RS		MG	Average	RS	PA	MG	Average	RS	PA	MG	Average
Specific Work Experience relevant to assignment	30	20	20	20	30	5	5	15	6.25	25	25	22	18	24	25	25	18.5
Experience in working with stakeholders in this sector	20	15	10	12	18.5	5	1	10	4	18	18	15	12.75	18	15	20	13.25
Qualifications for this assignment	45	45	40	40	62.5	45	35	30	27.5	45	45	35	31.25	45	40	40	31.25
Knowledge of Policies, legislation & procedures of FD	5	2	3	1	3	1	1	1	0.75	5	4	3	3	4	3	5	3
Total	**100**	82	73	73	**57**	56	42	56	**38.5**	93	92	75	**65**	91	83	90	**66**

Signature of Panelist _____ Mr. Radin Santos
Date _____

Signature of Panelist _____ Mr. Pablo Ayala
Date _____

Signature of Panelist _____ Ms. Minerva Gonzalez
Date _____

Criteria	POINTS	Kelsha Chavarria				Jose Puc				Diane Cho				Clarita Orellana			
		RS	PA	MG	Average	RS	PA	MG	Average	RS	PA	MG	Average	RS	PA	MG	Average
Specific Work Experience relevant to assignment	30	20	20	27	33.5	15	11	10	9	25	25	25	18.75	20	5	10	8.75
Experience in working with stakeholders in this sector	20	10	10	12	16	10	5	10	6.25	15	15	15	11.25	15	10	5	7.5
Qualifications for this assignment	45	45	40	42	63.5	45	40	30	28.75	45	40	42	31.75	45	40	20	26.25
Knowledge of Policies, legislation & procedures of FD	5	2	1	1	2	2	1	1	1	4	2	3	2.25	3	3	1	1.75
Total	**100**	77	71	82	**57.5**	72	57	51	**45**	89	82	85	**64**	83	58	36	**44.25**

Signature of Panelist _____ Mr. Radin Santos
Date _____

Signature of Panelist _____ Mr. Pablo Ayala
Date _____

Signature of Panelist _____ Ms. Minerva Gonzalez
Date _____

Criteria	POINTS	Jollie Ruiz				Sherman Cawich				Jeanne Solis				Einer Coye			
		RS	PA	MG	Average	RS	PA	MG	Average	RS	PA	MG	Average	RS	PA	MG	Average
Specific Work Experience relevant to assignment	30	20	10	5	17.5	20	25	20	16.25	25	10	10	11.25	20	15	5	10
Experience in working with stakeholders in this sector	20	15	5	10	15	10	10	10	7.5	10	5	10	6.25	15	5	12	8
Qualifications for this assignment	45	45	40	20	52.5	25	30	20	18.75	45	35	20	25	45	40	42	31.75
Knowledge of Policies, legislation & procedures of FD	5	3	2	1	3	2	1	3	1.5	3	2	1	1.5	3	1	1	1.25
Total	**100**	83	57	36	**44**	57	66	53	**44**	83	52	41	**44**	83	61	60	**51**

Signature of Panelist _____ Mr. Radin Santos
Date _____

Signature of Panelist _____ Mr. Pablo Ayala
Date _____

Signature of Panelist _____ Ms. Minerva Gonzalez
Date _____

Criteria	POINTS	Liana Santos															
		RS	PA	MG	Average				Average				Average				Average
Specific Work Experience relevant to assignment	30	20	5	10	17.5				0				0				0
Experience in working with stakeholders in this sector	20	10	5	8	11.5				0				0				0
Qualifications for this assignment	45	45	40	35	60				0				0				0
Knowledge of Policies, legislation & procedures of FD	5	2	1	1	2				0				0				0
Total	**100**	77	51	54	**45.5**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**

Signature of Panelist _____ Mr. Radin Santos
Date _____

Signature of Panelist _____ Mr. Pablo Ayala
Date _____

Signature of Panelist _____ Ms. Minerva Gonzalez
Date _____

Appendix 14: Terms of Reference Template

Terms of Reference

Consultancy Services for …

Title of Project:

Project Objective:

Delivery Partner:

1. **BACKGROUND**

2. **SCOPE OF WORKS**
   The scope of work for the Consultancy firm will include but not limited to the following:

3. **DELIVERABLES AND TIMEFRAME**
   - All documentation submitted must be in English.

Deliverables	Timeframe

4. **APPROACH**
   An interactive and participatory approach is a requirement.

5. **PAYMENT SCHEDULE**
   Payment arrangements is as follows:

#	Deliverable Output	Percentage
1	After contract signature and delivery and acceptance of	15%
2	Delivery and acceptance of	30%
3	Delivery and acceptance of	30%
4	Delivery and acceptance of	25%

6. **PROFESSIONAL QUALIFICATIONS AND EXPERIENCE REQUIREMENTS**

7. **CHARACTERISTICS OF THE CONSULTANCY**
   Duration:
   Reporting Responsibility:
   Start date:

8. SUBMISSION AND APPROVAL OF REPORTS

9. MONITORING AND EVALUATION

10. DOCUMENTATION REQUIRED AND EXPRESSION OF INTEREST

- Interested consultants are asked to submit a detailed technical proposal for the deliverables. The technical proposal should include methodology, work schedule, quality control and quality assurance.

- They must also provide most recent Curriculum Vitae

- Those interested should present the technical offer and budget proposal that responds to the contents of this ToR no later than 5:00 pm (Central Standard Time), October 21, 2022. The proposal should be addressed to:

  Mr. Radin Santos
  Procurement Officer
  Department of the Environment
  Re: Expression of Interest –

Soft copies should be sent via email to:

Procurementofficer@doebelize.org and ProjectManager@doebelize.org

The consultant will be selected in accordance with the International Competitive Bidding Method.

The DOE is an equal opportunity employer and does not discriminate against protected characteristics (gender, age, sexual orientation, race, nationality, ethnicity, religion, disability).

DOE is not liable for any costs incurred by applicants in submission of their application.

Appendix 15: Request for Proposal Example

Appendix 8: Request for Proposals

INSERT PROJECT LOGO

Request for Proposals

For
[insert procurement title]

Ref No: [insert ref #]

Issue date:

Section I. Letter of Invitation Requesting Proposals

[city, country]
[month, day, year]

Re: *[insert name and ID number of procurement]*

Dear Madam/Sir,

The Department of the Environment invites proposals ("proposals") to provide the following services ("services"): *[insert name of services assignment]*. More details on these services are provided in the terms of reference – Section VI. A consultant will be selected using *an* evaluation procedure in accordance with the Public Procurement Procedures Handbook of the Ministry of Finance.

The RFP includes the following sections:

Part 1 – Proposal and Selection Procedures

Section I	Letter of Invitation Requesting Proposals (LOI)
Section II	Instructions to Consultants (ITC)
Section III	Proposal Data Sheet (PDS)
Section IV	Qualification and Evaluation Criteria
Section V A	Technical Proposal Forms
Section V B	Financial Proposal Forms
Section VI	Terms of Reference

Proposals must be delivered to the address and in the manner specified no later than *[insert local time and date]*. Late proposals will not be accepted under any circumstances. Electronic proposals *shall* be accepted.

Upon receipt of this letter and before *[insert date]*, please inform us in writing, or by electronic mail, at the address shown below:

(a) that you received the request for proposals; and
(b) whether you will submit a proposal alone or in association.

Yours Sincerely,

_____
Project Director

Tender Acceptance/Decline Letter

Date:

Martin Alegria
Department of the Environment
First Floor Old Land's Building
Market Square, Belmopan City
Belize C.A.

Sender's Company/Individual name
Address
Subject: Response to the tender invitation for the project [Insert name]

Dear Mr. Alegria,

I have received your tender invitation and hereby acknowledge that I

- □ Intend
- □ Do not Intend

to submit the requested proposal. Again, thank you for sending us a tender invitation.

Best regards,

_____
Name

Preparation of Proposals

Cost of Proposal

The consultant shall bear all costs associated with the preparation and submission of its proposal, and the client shall not be responsible or liable for those cost, regardless of the outcome of the proposal process.

Language of Proposal

Proposal shall be submitted in English.

Preparation of Proposal

In preparing their proposal, consultants are expected to examine in detail the documents comprising the RFP. Failure to provide the information requested may result in rejection of a proposal.

While preparing the technical proposal, consultants must give particular attention to the following:

(a) The available budget is provided in the Proposal Data Sheet (PDS), and the financial proposal shall not exceed this budget.

(b) The Curriculum Vitae (CVs) of the key professional personnel signed by the staff themselves and/or by the authorized representative.

Consultants are required to submit a technical proposal, which shall provide the information indicated in the following:

- A brief description of the consultants' organization and an outline of recent experience of the consultant and of each associate, if any, on assignments of a similar nature is required
- A description of the approach, methodology and work plan for performing the assignment covering the following subjects: technical approach and methodology, work plan, and organization and staffing schedule. The work plan should be consistent with the work and deliverables schedule.

The Financial Proposal shall be prepared by listing all costs associated with the assignment, including (a) remuneration for key experts and non-key experts and expenses associated with assignment implementation.

Only one Proposal
Consultants shall submit only one proposal as a sole consultancy firm or as an individual consultant. If a consultant participates in more than one proposal, all such proposals shall be disqualified.

Currencies of Proposal
Consultants must submit their financial proposals in the currency or currencies specified in the **PDS**. Consultants will be paid in the currency specified in the **PDS**.

Period of Proposal Validity

Proposals shall remain valid for the period specified in the **PDS** after the proposal submission deadline. During the period of proposal validity, consultants shall maintain the availability of key professional personnel identified in the proposal.

Sealing and Marking of Proposals

The "original" and each "copy" of the technical proposal shall be placed in a sealed envelope/parcel clearly marked "technical proposal". Similarly, the "original" and each "copy" of the financial proposal shall be placed in a separate sealed envelope/parcel clearly marked "financial proposal".

Each envelope/parcel shall bear the name and address of the client as stated in the **PDS**, the name and address of the consultant (in case they may have to be returned unopened), and the name and reference number of the assignment as stated in the **PDS.**

The client shall not be responsible for misplacement, losing or premature opening if the outer envelope/carton and/or marked as stipulated. This circumstance may be cause for proposal rejection.

Deadline for Submission of Proposals
Proposals must be received by the client before the submission deadline specified in the **PDS.**

Late Proposals
Any proposals received by the client after the deadline for submission of proposals shall be declared late, rejected, and returned unopened to the consultant.

Proposal Opening

The client shall open the outer envelopes in the meeting at the address, date and time specified in the **PDS** as soon as possible after the deadline for submission and sort the proposals into technical proposals or financial proposals as appropriate. The client shall ensure that the financial proposals remain sealed and securely stored until such time as the opening of financial proposals takes place.

Evaluation of Proposals

Confidentiality

Information relating to the evaluation of proposals and recommendations of contract award shall not be disclosed to consultants or any other persons not officially concerned with the process, until the publication of the award of contract.

Evaluation of Technical Proposals

The client's Evaluation Committee (TEC) shall evaluate the technical proposals based on their responsiveness to the terms of reference, applying the evaluation criteria, sub-criteria, and point system specified. Each responsive proposal will be given a technical score (St). A proposal may be rejected at this stage if it does not respond to the RFP or if it fails to achieve the minimum technical score indicated.

Evaluation of Financial Proposals based on Quality & Cost-based Selection

The financial proposal opening shall take place at the location indicated in the **PDS**. The notification shall also advise those consultants whose technical proposals did not meet the minimum qualifying mark.

The Technical Score (St) and only the total proposal price, as stated in the financial proposal submission form (form FIN-1) shall be read out aloud and recorded.

For Quality and Cost Based Selection (QCBS), the lowest evaluated Financial Proposal (Fm) will be given the maximum financial score (Sf) of 100 points.

Proposals will be ranked according to their combined technical (St) and financial (Sf) scores using the weights (T = the weight given to the technical proposal; F = the weight given to the financial proposal; T + F = 100%) indicated in the PDS. S = St x T% + Sf x F%.

Award of Contract

After the completion of the evaluation report and having obtained all the necessary internal approvals and Ministry of Finance's no-objection as per the Public Procurement Procedure Handbook, the client shall send the notice of intent to award to the successful consultant. The notice of intent to award shall include a statement that the client shall issue a formal notification of award and draft contract agreement after expiration of the period.

At the same time, it issues the notice of intent to award, the client shall also notify, in writing, all other consultants of the results of the selection process.

Commencement Dates
The consultant is expected to commence the assignment on the date and at the location specified.

Adapted from International Fund for Agricultural Development, https://capmf.cdt.ca.gov/files/CA-PMF_Planning_Templates_with_Instructions/Procurement_Management_Plan_Template_with_Instructions.docx

Appendix 16: Communication Management Plan Interview

The following list of questions was used to conduct semi-structured interviews with the project team in order to gather information on their knowledge of Quality Management in a project.

1. How will you help set an effective communication strategy in the project?
2. Have you ever encountered challenging communication before? If yes, please explain.
3. What communication management software are you familiar with?
4. How would you manage a workplace conflict?
5. In your experience, what are the most crucial attributes of communication plans?
6. Do you have experience in overseeing digital communications?

Appendix 17: Issues Log

ISSUE LOG

Project Title:

_____

Date:

_____

ID	Status (Open, In Progress, Closed)	Priority	Issue Description	Actions

Due Date: _____

Additional Comments:

_____

_____

Appendix 18: Philologist Dictum

1 Valencia Street
City of Belmopan
Cayo District
Belize

26th June 2023

Academic Advisor
Master's Degree in Project Management
Universidad para la Cooperacion Internacional

Dear Academic Advisor,

Re: Philosophical Review of Final Graduation submitted by Francisco Javier Magana in partial fulfillment of the requirements for the Master's in Project Management Degree.

I hereby confirm that Francisco Javier Magana has made all required corrections and improvements suggested to the project entitled "PROJECT MANAGEMENT PLAN FOR THE DESIGN AND CONSTRUCTION OF A CONSTRUCTED WETLAND IN THE NEW RIVER WATERSHED" document as I have recommended. In my judgement, the document meets the literary and linguistic standards required of a student studying for a degree at the Master's level.

Yours sincerely,
Cecile M. Ramirez
Miss Cecile Ramirez M. Ed.


University of North Florida

Master of Education


University of North Florida

College of Education and Human Services

Certificate of Award