

REPORT

Strategic advice to the Quang Nam Provincial People Committee on the integrated management and technical solutions for Truong Giang River Subcatchment

Inception Note

Client: Ministry of Economic Affairs and Climate Policy
(Netherlands) and Quang Nam Province PMU
(Vietnam)

Reference: BH7738-RHD-ZZ-XX-RP-Z-0001

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Date: 16 March 2021

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1 Introduction

We appreciate the assignment formulated by RVO to provide support and take advantage of nature-based solutions for the Truong Giang River subcatchment. The TOR prepared by RVO requests support in the preparation of the proposed Integrated Resilient Development Project (IRDP), in particular for the investments of Truong Giang river in Quang Nam province, under the International Bank for Reconstruction and Development Bank (IDRB) financing package of the World Bank.

This assignment is financed through the Partners for Water Program, executed by the Netherlands Enterprise Agency (RVO), part of the Netherlands Ministry of Economic Affairs and Climate. The Partners for Water Program is commissioned by the Ministry of Infrastructure and Water Management on behalf of the Interdepartmental Water Cluster.

Further background and the project setting is described in the Terms of Reference (TOR) by RVO. A copy is included in Appendix A1.

The assignment requested support in two forms:

Direct support in the form of expert advice to the Feasibility Study (FS) Consultant, the Quang Nam PMU and the World Bank.

Indirect support to the Quang Nam PPC and the Vietnamese government in general, by sharing international expertise on riverbank erosion and sedimentation, technical surveys and modelling approaches, as well as providing options for technical nature-based solutions and "soft" measures appropriate to the subcatchment.

We structure providing indirect support following **Integrated River Basin Management** principles. The process of **co-creation solutions** with key stakeholders is a very effective way of achieving integrated solutions. Co-creation facilitates joint ownership, creating a common understanding of the challenges, wishes and the requirements to potential solutions. Our approach to this assignment is to go through the design process together. As this is still an early stage of the IRDP (and its financing), we will formulate strategic directions for the subcatchment together. This would, in addition to the more traditional (hard) solution proposed by the PreFS Consultant, provide a broader range of possibilities for the PPMU and PPC. Typically, one of the directions will include the more traditional (hard) solutions (as elaborated by the PreFS Consultant) while others introduce hybrid (grey/green) and nature-based solutions.

Our workplan includes **Riverlab sessions** (workshops) to discuss and elaborate potential solutions with the PreFS Consultant, PPMU and PPC. The Riverlab sessions allow the participants and us to brainstorm, exchange ideas and learn from each other. The goal is to create an inspiring and integrative environment to design creative and nature-based solutions in a truly participative manner.

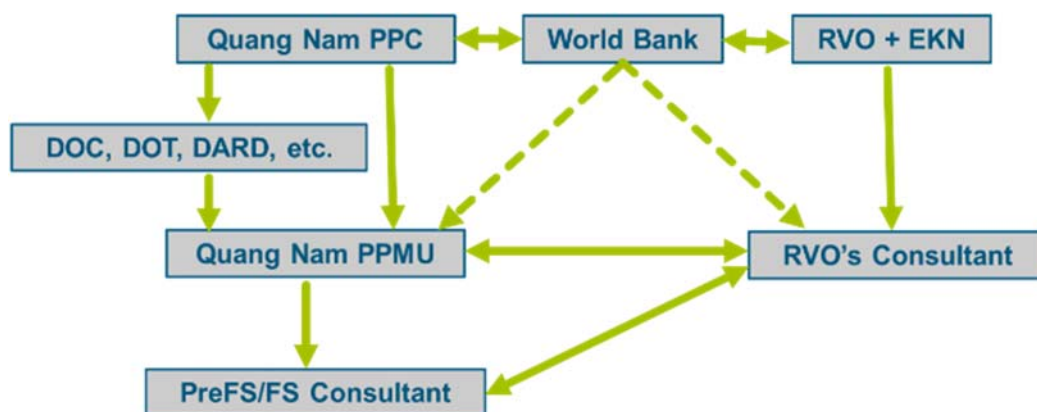


Figure 1-1 Relational diagram

2 Inception phase (Task 0)

2.1 Meetings & discussions held

During the inception phase, the following meetings have been held:

- 02 February 2021: Start-up meeting with RVO and World Bank.
- 24 February 2021: Kick-off meeting with World Bank, RVO, PPMU and PreFS Consultant.
- 03 March 2021: Work session and field visit with PPMU and PreFS Consultant.
- 04 and 05 March 2021: initial discussions with departments:
 - o Quang Nam Provincial Project Management Unit (PPMU)
 - o Department of Planning and Investment (DPI)
 - o Department of Transport (DOT)
 - o Department of Natural Resources and Environment (DONRE)
 - o Department of Construction (DOC)
 - o Department of Agriculture and Rural Development (DARD)
- 05 March 2021: wrap-up meeting of the week with PPMU, World Bank and PreFS Consultant.

Presentation provided for the Kick-off meeting (24 February), working session with the PPMU and PreFS Consultant (3 March), and the wrap-up meeting (5 March) have been included in Appendix A2.

2.2 Summary of initial meetings and discussions

Provincial Project Management Unit of Quang Nam Province (PPMU) and PreFS Consultant:

1. The draft PreFS has been submitted to the Government and Prime Minister for approval. Approval is expected in May 2021. After the approval, the FS should be conducted within a relatively short time span and is to be submitted for approval in September 2021. The PreFS mainly focusses on navigation improvement and river embankments.
2. The Chairman of the Province has expressed his interest in the project and the solutions that the project team from the Netherlands may offer. The Chairman has invited the project team for a site visit and further discussion. This activity is planned for after the team has sufficiently prepared and conceptualised first ideas (after Riverlab W2, see section 3.3).
3. Developing the river basin into an attractive tourist destination is an important objective. Currently, the tourism in the Truong Giang River area is some 1-2% of the provincial GDP. Plans and forecasts indicate a growth to 9-10%. Agricultural tourism is one of the potential ideas.
4. Forecasts made for transport over water through the Truong Giang River follow the national forecasts made for the province. Main transport consists of general goods and passengers (including tourists) between Da Nang, Hoi An and Tam Ky. The current PreFS does not include infrastructural facilities along the river, such as jetties, hubs and terminals, to transfer cargo from the basin to the cities. Also, the stream of goods through the river (point to point) is unclear at this moment.
5. Parts of the aquaculture (shrimp farms) will have to be relocated to widen the navigation channel in the river. Compensation will be given to the legal owners / certified farms. Uncertified farms will receive support in their relocation without receiving a compensation.

6. Another important objective of the study would be improving the water quality of the river. Improvement of the water quality depends on its user, e.g., for the shrimp farms brackish water could be beneficial while fresh water would benefit the rice farmers.
7. The exchange between the project team and the Planning Consultant (to be appointed by RVO) is important to smoothly continue the international support to IDRP.

PreFS Consultant

8. The numerical model developed for the PreFS cannot be shared with the project team. To conduct a review, a dedicated meeting will be organised between the two consultants in which the experts will walk through the model configuration. As exchanging the model is not possible, a solution should be sought to run additional model simulations related to integrated river basin management.

Department of Planning and Investment (DPI)

9. The province is generally divided into a mountainous western part, an intermitted zone and a coastal eastern part. The Province has the desire to economically develop the coastal eastern part in terms of tourism, industry, logistics, real estate and increasing the welfare of its citizens. A special focus is made on the Truong Giang River Basin, firstly in terms of urbanisation and secondly for tourism. Industry, services, green and clean (high-tech) agriculture are high on the agenda as well. While undergoing development, the environmental aspects should be preserved or even improved, such as protecting the (mangrove) eco-system.

Important developments in the area are:

- o Chu Lai airport expansion to 2,300 ha, growing to 5 million passengers per year in 2030.
 - o Chu Lai port expansion in the south (Truong Hai at Tam Ky), receiving vessels up to 30,000 to 50,000 DWT to import and export from the province.
 - o Offshore LNG exploration
 - o Improvement/construction of roads and power distribution lines.
10. During the past 3-4 years more investors have been drawn to the coastal area in Quang Nam Province, after construction of the new roads. The creation of roads also resulted in more jobs and for citizens to work elsewhere in the region. Some private developers have already committed to making multi-billion dollar investments in the area, with plot sizes up to 1,000 ha. More investments are expected. The Province safeguards the balance of investments between the different sectors in the area (tourism/industry/services). Typically, an investor proposes their ideas to the People's Committee, upon which this idea is further elaborated following government regulations.
 11. There is no specific focus in developing the industrial in the area. Currently important types of industry that come to mind are car manufacturing (Truong Hai) and the garment industry.
 12. Tourism is under the responsibility of the Department of Culture, Sports and Tourism.

Department of Transport (DOT)

13. The Truong Giang River is a special river and a potential highway for water transport between Tam Ky and Da Nang. Restoring this route has been decided at national level. Developing the ports at Da Nang and the Truong Hai are part of the national plans. The Ministry of Transport is the main responsible for the improvement of the Truong Giang waterway. The Provincial Department of Transport is involved to a lesser extent.
 - o Navigation is meant for the cargo flow between these two cities, however, currently vessels navigate along the coastline as the river is inaccessible.
 - o Navigation is also to be developed for passengers, mainly tourists, with ferries. The locations to stop will depend on the investors.

14. Developing the waterway infrastructure, such as river ports and quays, will follow after creating a navigable waterway. The expenses to realize a navigable waterway are relatively small.
15. Agricultural products from the fields are mainly transported by truck. The potential of shipping this over water is to be explored. Also, for passenger transport bus infrastructure will be realised, allowing also tourists to travel more easily.

Department of Natural Resources and Environment (DONRE)

16. The air and water quality are measured frequently and presented in the annual report by DONRE. The surveys that have been conducted do not indicate water pollution in the Truong Giang River. Industrial zones do not discharge wastewater to the river. The city of Tam Ky is connected to a wastewater treatment plant before water is being discharged.
17. Green zones in the Truong Giang River Basin are not well defined yet, nor planned for. The masterplan prepared by DOC should include the spatial plans by DONRE. Green zones in the coastal part of Quang Nam Province fall under the responsibility of:
 - o DARD is responsible for forests (including mangroves and pine trees)
 - o DONRE division Sea & Islands is responsible for the protection of the coastal line (including dunes)
18. To cope with climate change effects including salinity intrusion, a Climate Change Adaptation Action plan has been prepared under the Office of Provincial Commanding Committee of Natural Disaster Prevention and Control, Search and Rescue belong to DARD.

Department of Construction (DOC)

19. DOC is currently developing a new masterplan for the coastal part of the province. The authority will set out the overall strategy. Development directions are requested the eastern part of the province are needed to develop the plan. A Consultant has therefore been appointed to support and elaborate the plan. The plan should be finalised by the end of May 2021.

It has been agreed to explore the possibility of collaboration between the project team and the Consultant, to include Integrated River Basin Management principles and elements into the masterplan.
20. To guide the large stream of investment, investors are selected on several criteria and should have the same mindset as the province – such as preserving the ecology and mitigating/avoiding impact.
21. DOC acknowledges the great potential of the region, with 125 km beachline, two airports and two ports, precious culture heritages (villages along the river) and natural areas. Potentially the developments can follow the river: a water axes development from Hoi An to Tam Ky. An important part of the masterplan is to preserve the ecology and include space for green. DOC is very willing to do so.

Department of Agriculture and Rural Development (DARD)

22. High-tech agricultural areas have been allocated in the masterplan of DOC. To bring high-tech agriculture into the area, the DARD will provide training to the users and support implementation. A pilot project of 1,000 ha is being realised and another pilot of 200 ha is calling for investment. High-tech agriculture mainly focusses on fruit, vegetable, medicinal plants and aquaculture.
23. Under plan 2896 some 3,000 ha has been allocated for agriculture and some 2,000 ha is planned for, along the Truong Giang River these are mainly freshwater rice paddies. There is sufficient fresh water supply from the main reservoir up to at least 2030. DARD plans to invest in fresh water supply.

24. Aquaculture is currently not managed well, and the DARD has the intention to organise this better. Especially the environment is an issue. Aquaculture along the Truong Giang is generating wastewater that biologically and chemically causes pollution in large parts of the Truong Giang. Therefore, seawater and/or groundwater is taken in for aquacultural and agricultural activities.
25. Every year crop loss happens due to flooding along the Truong Giang, but farmers are accustomed, and severe damage rarely happens. Some creeks on the western side of the river may cause flooding locally (drainage issues) which should be further investigated; the drainage capacity of these canals could be improved.
 - o Mangrove restoration projects at Hoi An and Nui Thanh are ongoing in attempt to reduce flooding and also to offer shelter for ships during storms.
26. Navigation improvement to transport agricultural goods is likely not beneficial as the agricultural goods are processed through inland factories that are not connected to water.
27. The coastal protection forest cannot be disturbed following the law. In case the remaining thickness of the (pine) forest is not sufficient, new project developments may not be possible or additional trees are planted.

2.3 Field visit findings

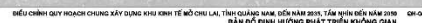
Truong Giang River, located in the Eastern Zone of Quang Nam Province, is an atypical river which runs along the coastal line connecting Dai river mouth in the north and An Hoa river mouth in the south. The river has total length of 67 km, deep - wide sections near the river mouths and shallow-narrow sections in the middle. During the field visit the project team, PPMU Quang Nam Province and the FS Consultant saw and discussed the several challenges the Truong Giang river is currently facing:

- **Shallow and narrow river sections:** In the middle of river, riverbed is filled by sedimentation, encroachment by (illegal) settlements and aquaculture (shrimp ponds, fish nets);
- **Flooding** from Vu Gia – Thu Bon River, Tam Ky River and many tributaries along the river;
- **Salinity intrusion** from both sides of river, at the side of Hoi An as well as at the side of Tam Ky;
- **Water stagnant and water pollution:** River is receiving wastewater from local resident area, aquaculture and agriculture activities in the sub-basin. The low flow velocities and the limited water exchange (long retention times) between river and sea are the main reasons causing the water pollution. However, due to the low population density and low production intensity, the water pollution is not very high according to the Vietnamese standard for surface water.
- **Navigation is obstructed** because the river is filled with sedimentation, many small and low bridges, shrimp ponds and fish nets.

Aside from the challenges the river faces, Truong Giang river has development potential on aspects like:

- **Inland waterway:** Truong Giang River together with Co Co River form a waterway unlocking a transport route between Da Nang Port and Ky Ha Port;
- **Tourist route** along the river connecting Hoi An Ancient Town with Ban Than Reef, and indigenous cultural and ecological sites along the river and the coast;
- Development of **high-quality agriculture and aquaculture** to provide for the local tourism services;
- Improvement of **water quality and flood drainage**;
- **Green corridors** along the river and coastal line;

Photo impressions from the field visit are shown in Figure 2-2.



16 March 2021



Fish net and shrimp pond inside the river



Narrow river section with its flood plain



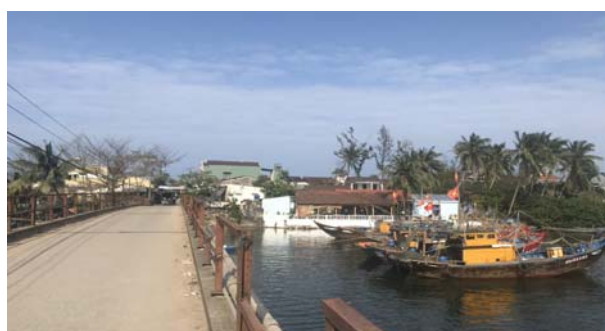
Water pollution



Low and narrow bridge



Only tiny boats can travel along the river



Storm shelter for fishing boats



New bridge crossing the river



Hoiana Major Integrated Resort – 985.6 Ha

Figure 2-2 Impressions of the field visit

2.4 Reflection on initial visit to Truong Giang River Basin and tailoring our scope of works

With respect to the two objectives of providing support to the Quang Nam Province and World Bank Programme for Truong Giang River Basin, our first visit to the Truong Giang River and Tam Ky has given us the following impressions:

Direct support in the form of expert advice to the *Feasibility Study (FS) Consultant, the Quang Nam PMU and the World Bank.*

- The PreFS has already been submitted for approval and is therefore largely finalised. Providing input for this study would mainly serve the FS which is the next stage. We agreed to quickly review the PreFS documents and designs and share critical comments (if any) with the PPMU. Providing expert opinion will largely be in preparation of the full FS that will commence in the coming months. We will identify and suggest points of improvements that can be worked on in the FS.

Based on the information available to us, we expect to provide technical support mainly on the following items (in preparation of the FS):

- o Hydrodynamic (flood) and morphological (sediment) modelling: we will conduct an in-depth peer-review the model schematisation and provide suggestions for additional simulations and elaborate improvements to the model schematisation, including expected maintenance dredging and flooding frequencies.
- o Technical design of the revetment: we will conduct a peer-review of the proposed revetments (hydraulic loads, location, dimensions, choice of materials etc.) and explore with the PreFS Consultant whether nature-based design elements could be incorporated.
- o Forecasts: we expect that the sustainability of the planned river improvement investment would benefit from an analysis of the navigation and its cargo flows, and of tourism and its passenger potential

Indirect support to the *Quang Nam PPC and the Vietnamese government in general, by sharing international expertise on riverbank erosion and sedimentation, technical surveys and modelling approaches, as well as providing options for integrated river basin management and technical nature-based solutions and "soft" measures appropriate to the subcatchment.*

- o To develop solutions following an Integrated River Basin Management approach was well received by the PPMU as well as the departments.
- o Our assignment we will draft a first conceptual basis for the Truong Giang River Basin, to be developed together with the main stakeholders.

The following topics are essential:

- Tourism: there is a high desire to develop tourism in the basin, however, how this is going to be realised and, e.g., what kind of tourists will be attracted is not yet elaborated?
- Passenger transportation over water;
- Flood management: elaborating the conceptual plan for the river to reduce flood impacts (e.g. room for the river or integrated flood risk management approach), including (model) investigation on how floods are caused;
- Improving water quality, especially in the middle of the river;
- High-tech agriculture (incl. aquaculture);

- Interaction with the surroundings of the river (dune system and touristic developments in the north, Hai Trung port in the east, villages along the river and industrial zones and green areas);
 - Sustainability and preserving the environment while increasing the tourism and overall economic potential of the basin.
- o The meeting with the Chairman of the Quang Nam Province will be a key activity in the assignment in which the first conceptual ideas are presented and discussed.

2.5 Data and information

During the Inception Phase, the project team requested the PPMU and PreFS Consultant for existing studies/literature/analysis and data collection. We have prepared an overview (in table format) for all data required (must-haves) and data that is desirable to have. Reference is made to Deliverable D1 Initial Document & Data Search for the results of this activity.

- Data & information list:
 - o Hydrometeorological data
 - o GIS / RS data
 - o Survey data
 - o Mathematic modelling
 - o Planning documents
 - o Truong Giang River subproject: (draft) Pre-FS documents
 - o Reference documents

An overview in table format is included in deliverable D01. The table will be updated during our assignment while data is being collected. We will organise and store all data received in a structured way (following BIM standards), to make it easily accessible in future projects. The data folder will be handed over as deliverable D9 at the end of the project.

3 Project work plan

In preparation of our proposal, we drafted a workplan covering the fourteen (14) activities requested in the TOR (page 8 to 10) which are needed to realize the project objectives of providing direct and indirect support. This workplan has been updated following findings of Chapter 2.

The fourteen activities are packaged into four overall tasks.

0. Inception phase

1. Create an understanding

Create a common understanding of the natural system, socioeconomics and areal planning;

2. Develop strategic directions together

Develop nature-based and hybrid solutions and define a preferred strategy (way forward) together with key stakeholders; and

3. Elaborate a conceptual solution

Elaborate solutions within the preferred strategy on conceptual level providing a proof-of-concept (MCA, CBA) and at least two attractive visualisations.

Our project activities have been numbered and start with the letter A, workshops start with the letter W, and deliverables with the letter D.

3.1 Task 0: Inception Phase

Task 0		Task lead: Karel Heijnert
Objectives		
As a solid start of our assignment, we will agree on the scope of works and create a clear understanding among all stakeholders what we will do, based on the TOR, this proposal and Client discussions in W1.		
Deliverables		
D1	Initial search for documents and data	
D2	Inception note	

This task has been completed and is described in Chapter 2. This task included the following activities:

W1: Kick-off workshop

A0.1: Quick-scan of available data and data-gaps

A0.2: Field visit

3.2 Task 1: Create an understanding

Task 1		Lead: Alwin Commandeur & Huy Hoang
Objectives		
Create an understanding of the existing natural system, the socioeconomics, and spatial planning. We will do this through data collection, literature review and collaboration on the mathematical model.		
Deliverables		
D3	Technical review report on Data Collection and Desk Review	

Task 1		Lead: Alwin Commandeur & Huy Hoang
D4	Technical report on risk assessment and mathematical modelling	
D5	Technical report on existing plans and frameworks	

A1.1: Literature review

The project team will conduct a desk-study on available analyses and literature for Truong Giang sub-catchment (including its river mouth and the coast), the downstream area of Vu Gia – Thu Bon river basin (including Thu bon river mouth and the coast) and Tam Ky river on topics like:

- flood risk management,
- river erosion and sedimentation,
- water transport,
- urban & industry development,
- eco-system, hydrological and hydraulic, etc.

Our findings will be included in deliverable D3. This deliverable also includes the review of the PreFS documentation.

A1.2: Guidance on mathematical modelling

The mathematical model developed by the PreFS Consultant is used to simulate the implementation of river measures. Therefore, it is important that the model is sufficiently accurate.

As part of our direct support, we will review and verify the model (incl. calibration and validation) as per TOR and Vietnamese regulations. Since the model cannot be handed over to us, we organise an in-depth walk through to do the peer review. We will elaborate suggestions for model improvements and additional simulations, which can be conducted in the FS. We will report on the performance and outcome of the model (our review) as part of deliverable D4.

For the Integrated River Basin Management approach and developing Nature Based Solutions, the model will also be an important tool to create a sound understanding of the hydraulic and morphological behaviour of the Truong Giang River, in terms of flooding, flow, tide (slack waters), erosion and sedimentation. It will help answer questions such as: how does the tide interact with the river discharges, what is the effect of storm surge, and what is the main cause of the overall sedimentation of the river? The model will help to define design criteria for the measures (nature based or more traditional). These may include the storage needed to effectively reduce flood waters, and the critical flow velocities along the riverbank (important parameter for stone revetment and/or natural protection).

Simulations needed to support the design of nature-based solutions are preferably done together with the FS Consultant. The FS Consultant has stated that the modelling tools will not be shared. Conducting potential model updates and additional simulations are not part of the agreed scope of work of the PreFS Consultant. This means that additional budget has to be found to request additional work from the PreFS consultant. New model development is not part of the current scope of our project.

In case additional model simulations will be carried out by the PreFS consultant, we will have to carefully specify which simulations are needed. These simulations should support creating adequate understanding of (i) support the understanding of morphological processes in the river to explain the sedimentation and erosion, and (ii) which flood risk management strategies will be most cost-effective (incl. future scenarios and climate change as per TOR).

We will present and discuss the system understanding that will provide the basis for proposed interventions during W2.

A1.3: Disaster risk assessment

Following the field visit and observations, literature review, model development and simulations, we will assess and document the risks caused by disasters (flooding incl. storm-surges, salinity intrusion, drought and erosion). During the assessment, we will make efficient use of our work done under the Hoi An Flood Forecasting Project (flood- and coastal storm surge modelling) as well as the Coastal Hazard Mapping project in Vietnam that developed structural and non-structural damage functions applicable to this coastal area. Where possible we will locate and map risks to create a clear spatial overview and indicate the urgency to address the risk. As our assessment will be high-level, we will specify which threats should be further investigated under the WB program and make recommendations on how this can be done.

Our findings will be included in deliverable D4.

A1.4: Consultations to assess existing situation and identify opportunities

In preparation of formulating strategic directions in Task 2, we will create an overview of existing development plans (and map them) and frameworks of various sectors in this activity, with which the project should integrate. Outcomes of the literature, modelling- and risk activities with experts, government agencies and research/academic institutes during a multi-day visit to Hoi An and the subcatchment in April 2021.

We will collect the information about ongoing projects/plans and explore potential opportunities for greener and spatial measures with them. Findings will be part of deliverable D5.

3.3 Task 2: Develop strategic directions together

Task 2		Lead: Karel Heijnert & Steven Petit
Objectives		
To develop two or three strategic directions for the river sub-catchment (including nature-based measures) for the Vietnamese Government to compare, and as alternative to the likely more traditional solutions commonly proposed in Vietnam.		
Deliverables		
D6	Report on integrated river sub-catchment management and development with relevant international experience and approaches	

A2.1: Develop an integral approach

This task is to prepare Riverlab W2, and subsequently deliver D6.

To feed the discussion and to consider several possibilities for the Truong Giang sub-catchment, we will gather innovative examples and past experiences from other river basins in the world, in particular from Myanmar, Indonesia, Bangladesh, Vietnam and The Netherlands. We will prepare a set of building blocks of commonly used nature-based solutions worldwide such as “natural embankments”, “porcupine fields”, “wetlands”, but also the zoning solutions such as “room-for-the-river” concepts. These building blocks can be used as conceptual solutions for addressing the challenges identified in the Inception Phase and Task 1.

The purpose of developing 2-3 strategic directions is to support and inform decision makers in formulating their vision for the area and the associated sustainable development directions. In view of the uncertainty of future developments, such as climate change and local economic and touristic development, it is important to ensure that development directions do not create lock-in situations or unwanted interdependencies, and to make sure that investments remain effective even when future developments significantly deviate from the current predictions. We expect that a combination of aspects from different

development directions will provide a good basis to elaborate conceptual measures in Task 3 that contribute to an integrated and adaptive development pathway towards the realization of the vision and project objectives.

The strategic directions will on the one hand be based on the experience gained by the Consultant related to good practices from international integrated basin planning projects and design of (nature-based) solutions related to flood resilience, river management, and inland waterway transport, particularly in regions with a similar risk profile and urbanization context as Hoi An and the Truong Giang. The insights of our Vietnamese expert team and the government will be of key importance to define expected and/or possible developments, targets, cultural, historical and other points of attention that are important to consider when defining the strategic developments.

The strategic directions will be attractively visualized for effective stakeholder communication to support the planning process.

DESIGN STRATEGIES



Figure 3-1 Visualization vision plan and design tools on scale river valley, awarded masterplan Han River, Da Nang, VN by OMGEVING

W2: Interactive plan development workshop

This so-called Riverlab is a 2-day collaborative design session in Hoi An with the PreFS Consultant, PPMU and key department and stakeholders (potentially the DOC Consultant) in which we will prepare joint strategic directions.

The goal in this Riverlab is to draw the attention away from customary practice and introduce new but effective solutions that combine flood risk management, riverbank protection, landscaping, social and economic development and other aspects in an integrated manner. The collaboratively prepared preferred development directions will be captured into attractive visualizations which show the proposed interventions and their impacts.

The tentative agenda of the Riverlab is as follows:

- On day 1, we will discuss what are the key criteria and success factors for the area and draft a vision together. These criteria partially form the basis for the scoring criteria of the MCA in the final Riverlab (W3 in Task 3). The day ends with an inspiring presentation with applicable examples from around the globe.
- On day 2, the group is split into small but diverse groups. The different directions are clarified and afterwards discussed per group. At the end of the session each group presents their pros and cons on each direction. If major discrepancies arise, further discussion on these topics is required. At the end of day 2, we will jointly define a preferred strategic direction.

3.4 Task 3: Elaborate a conceptual solution

Task 3		Task lead: Karel Heijnert
Objectives		
Based on the preferred strategy that was jointly chosen in Task 2, we will elaborate a set of technical solutions at a conceptual level. They will be sufficiently detailed to prepare an initial cost-estimate for the Cost Benefit Analysis.		
Deliverables		
D7	Report on options and technical solutions/designs for riverbank protection	
D8	Exchange of all materials produced	
D9	Exchange of all data & models	

A3.1: Propose a set of technical solutions

Using the building blocks and preferred strategic directions developed in Task 2 as a starting point, we will elaborate a set of suitable structural/non-structural measures on a conceptual level, including technical sketches. We will prepare a basic Cost-Benefit Analysis for the set of measures and provide at a conceptual (high-level) cost estimate.

In preparation of the third Riverlab on technical solutions (W3), we will prepare attractive visualisations of the proposed set of measures. A draft Multi-Criteria Analysis table will be prepared including criteria, weighing factors etc. These will be discussed and agreed upon in W3. The nature-based strategic direction can be compared and discussed to the more traditional solutions, clarifying why the alternative has potential, and may convince to elaborate these greener measures further in the FS.

After concluding W3, D7 is finalised, which includes a rationale for and description of the set of measures, reflects on the MCA-process, and results of W3.

W3: Workshop on technical solutions & MCA

The third and final Riverlab kicks off with a presentation including visualisations of the preferred strategic directions and the proposed set of measures. The visualised strategy builds on the preferred strategic direction from the Riverlab W2, though is further elaborated and refined. The visuals provide an insight in the impacts on a conceptual level, and offer the opportunity to further refine the conceptual measures.

Subsequently, a proposition will be presented for the different criteria (and their weight) for the MCA. The workshop leaves room for alteration and discussion on this topic. The main goal, however, is the analysis of two strategies: (i) the preferred nature-based strategy, and a strategy with more traditional measures. Through group discussion, both variants are evaluated based on mutually agreed criteria and weights.

The transparent analysis will help see the benefits and drawbacks of an innovative nature-based solution more clearly. This analysis will take place on a conceptual level. The duration of this workshop will be 0.5-1 day. The workshop is expected to result in an accepted framework for further analysis, and in an increased insight in the potential benefits of nature-based and hybrid solutions.

A3.2: Attend workshop by Quang Nam Province

At least one international and one national expert of our team will attend the workshop by the Quang Nam Province, to present and discuss our findings and recommendations.

A3.3: Exchange data & information

As closure of our assignment, we will prepare a bundle of all materials collected and produced within our assignment for future use, including:

- A project summary (max. 1/2 page)
- Minimum two license-free high-resolution images/visualisations
- All data collected (incl. data overview)

Although previously anticipated, no soft copy of the modelling tools will be provided because they are owned by the PreFS Consultant.

3.5 Deliverables

In total nine (9) deliverables have been specified in the workplan. The deliverables are a series of short reports, notes, documents, references, communication materials and data. They have been listed in Table 3-1.

Table 3-1 Overview of project deliverables

Deliverables		Format	Languages
D1	Initial search for documents and data	Note with overview table	English and Vietnamese
D2	Inception note	This document	English and Vietnamese
D3	Technical review report on Data Collection and Desk Review	D3.1 Note on review of PreFS D3.2 Note on literature review	English and Vietnamese
D4	Technical report on risk assessment and mathematical modelling	D4.1 Note on review of PreFS Model D4.2 Note on risk assessment	English and Vietnamese
D5	Technical report on existing plans and frameworks	Report	English and Vietnamese
D6	Report on integrated river sub-catchment management and development with relevant international experience and approaches	Report and visuals	English and Vietnamese
D7	Report on options and technical solutions/designs for riverbank protection	Report and visuals	English and Vietnamese
D8	Exchange of all materials produced	Data folder	
D9	Exchange of all collected data	Data folder	

Following the two objectives of the assignment, providing direct and indirect support, it will be more logical to deliver dedicated notes for deliverables D3 and D4, that can be shared when the PPMU needs these.

A draft version of each of the deliverables will be made available for one round of comments by RVO, WB and PPMU, upon which the final version will be shared. This ensures an efficient overall work flow of the project.

We propose to make these documents available in an attractive, easily accessible and interlinked manner on an RHDHV iReport website with password protected user access. The iReport website will be maintained for 2 years from the start of the project. The contents of the website can be retrieved as a pdf report, and provides PPMU/PC/PreFS Consultant, WB and RVO a clear overview of our work, status and handed over outputs.

3.6 Planning

The project planning has been updated (see Figure 3-2). The meeting with the Chairman of Quang Nam Province is preferably set after Riverlab 2 (W2) towards the end of April 2021. The main part of the project – including Riverlab 3 (W3) – is planned to be completed by mid-May.

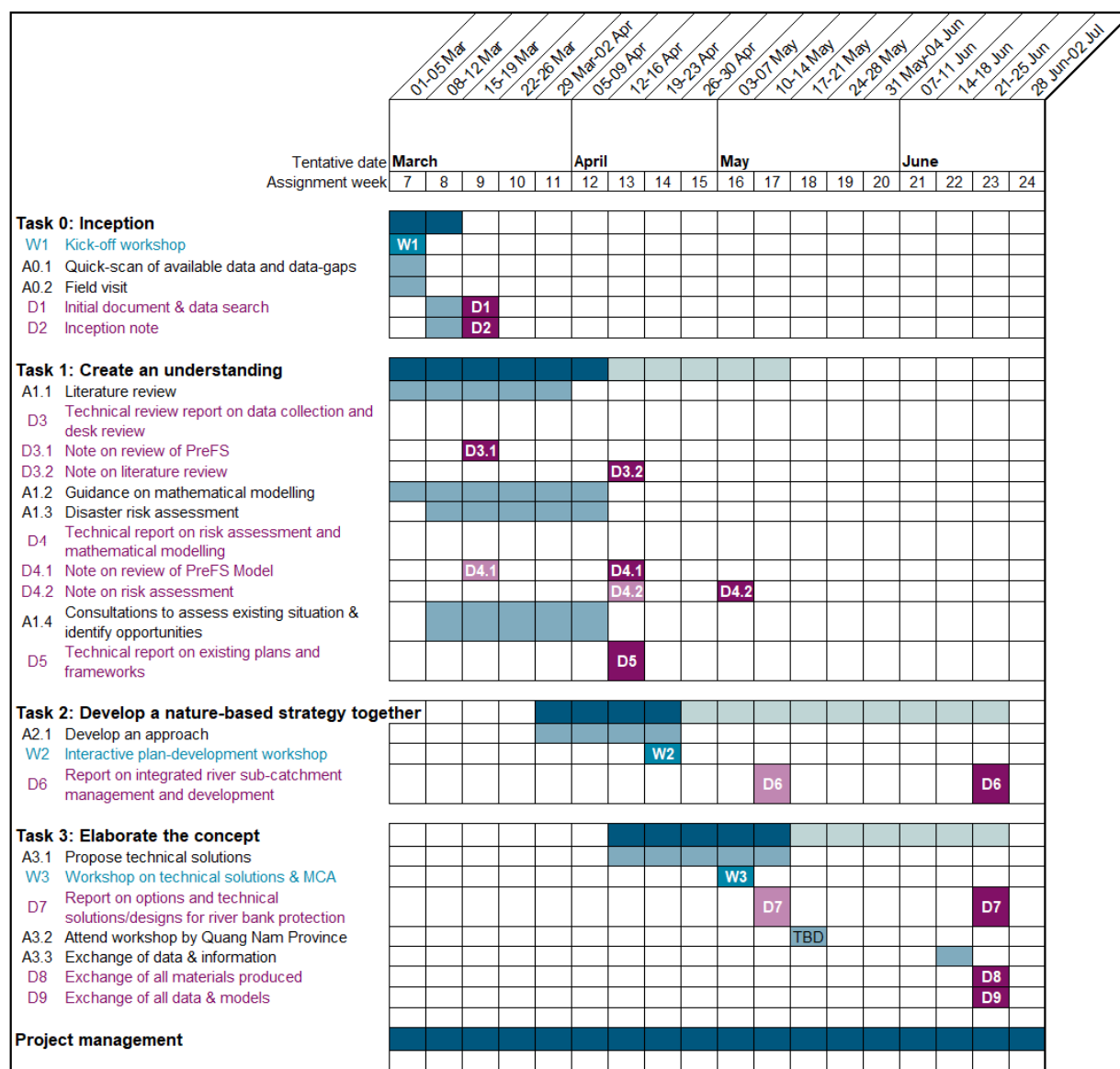


Figure 3-2 Updated planning

4 Communication & collaboration plan

4.1 Communication plan

Our team includes Vietnamese and English-speaking experts to be able to effectively include national and international expertise, and to be able to fully support communication in Vietnamese with all project stakeholders. Our primary project language shall be English. But we will be capable of providing quick translation, through the translation service we have established in our offices in Hanoi and Ho Chi Minh City. Important meetings (and Riverlab sessions) will be translated by a professional translator.

During the implementation of project Tasks 1 to 3, in addition to the Riverlab workshops, we foresee regular progress meetings of 1 or more hours depending on the topics that need to be addressed. These meetings will be held online but our VN-based team members may join in person. Where necessary, additional online or in-person meetings will be scheduled to address specific topics.

Exchange of information will be through a cloud-based system. HaskoningDHV uses Microsoft Teams and Box. A dedicated box folder has been made in which RVO, WB and PPMU can retrieve all presentations, deliverables and data (deliverable D9) can be found:

Project information: <https://royalhaskoningdhv.box.com/s/7wpssvqro3cvfst8drwkrn399ffupvjg>

4.1.1 External communication strategy

The proposed Riverlabs (workshops) are excellent communication means to reach out to a wider audience of external stakeholders. This will be discussed during the preparation and organisation of the workshop.

The visualisations prepared for the project may be used in external communication. As we propose to use our in-house web-based iReport platform (see section 3.5), it will be a small step to share information with a broader audience if needed.

4.2 Collaboration with FS Consultant

During the Inception Phase the communication link between the project team and the PreFS Consultant has been made. It has been agreed that dedicated working sessions (on the modelling and revetment design) will be arranged accordingly. Additional collaboration meetings can be organised when the need arises. These working sessions will be organized in close consultation with the PPMU and WB.

5 Project management

5.1 Project team

Our core project team includes 4 experts, of which 3 based in Vietnam. The lead team will be the linking pin between the PreFS Consultant, PPMU and PPC and the domain experts. Project coordination will be done by the team leader Karel Heijnert in close collaboration with the members of the core team. The domain experts will provide specific expertise to this assignment through sparring, strategic advice, and quality assurance of deliverables.

Core Team



Karel Heijnert (NL)
Team Leader



Huy Hoang (HCMC)
Hydrological Expert



Alwin Commandeur (HCMC)
River & Flood Expert



Steven Petit (HCMC)
Sr. Landscape Architect

Domain Experts



Petra Dankers (NL)
Nature Based
Approach Expert



Marius Sokolewicz (NL)
Sr. River Expert



Huy Vu (HCMC)
Sr. Structural Design



Quoc Thang Trinh (HCMC)
Jr. Landscape Architect



Huong Phan (HN)
GIS expert



Jarit van de Visch (NL)
Economic specialist

5.2 Progress meetings with RVO

We intend to have progress meetings based on bullet-wise e-mail progress reports shared prior the meeting. We suggest having these meetings every 4-6 weeks. Informal exchange of information is of course possible.

5.3 Quality assurance

The work for this project will be carried out in line with the RHDHV Quality Management System (QMS) which is ISO-9001 compliant). This system defines procedures and responsibilities for all project team members, assuring adequate internal communication and quality control. The latter involves amongst others the four-eye principle, which means that all products are reviewed by senior team members. Our QMS includes also adequate risk management procedures. At the start of the project, possible risks and appropriate mitigation measures will be identified. Major risks, if any, will be communicated to the Client throughout the project.

5.4 Data and information management

All incoming data will be centrally managed by the data manager (Huy Hoang). He will process and store the incoming data, share it with team members where useful/needed and assess the availability of data and potential data gaps (see also Chapter 3). A data overview as initially presented in Deliverable D1 will be managed to archive the incoming data and provide the team members and the Client of a clear overview of all available data.

All documents and deliverables will be prepared in one uniform project template. The following version management will be used:

- Draft version shared with Client: S04.1, S04.2 and so on.



- Final version submitted to Client: C01
- Final updated version submitted to Client (if any): C02

Appendices

A1 Terms of Reference



TERMS OF REFERENCE

Strategic advice to the Quang Nam Provincial People's Committee on the integrated management and technical solutions for Truong Giang River Subcatchment

Project code: PVW4A20055

Date: 11 December 2020

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1. INTRODUCTION

The Netherlands is internationally well-known for its expertise on water management, which is therefore one of the cornerstones of the bilateral relationships the Netherlands maintains. Through the Netherlands International Water Ambition (NIWA), more intense relationships with other countries are aimed for, which are fostered through strategic partnerships with seven so-called delta countries. Under the NIWA, several ministries are involved: Foreign Affairs (BZ), Agriculture, Nature and Food Quality (LNV), Economic Affairs and Climate (EZK) and Infrastructure and Water Management (I&W). Ultimate aim is to increase water security and water safety in the world of humans, plants and animals, and optimize the Dutch contribution to this aim.

The Netherlands and Vietnam have a relationship of international cooperation for more than 45 year. The water sector played a prominent role in that relation. In 2010 both countries signed a Strategic Partnership Arrangement on Climate Adaptation and Water Management. Under this collaboration, the Mekong Delta Plan (MDP) has been delivered in 2013.

This assignment is financed through the Partners for Water Program, executed by the Netherlands Enterprise Agency (RVO), part of the Netherlands Ministry of Economic Affairs and Climate. The Partners for Water Program is commissioned by the Ministry of Infrastructure and Water Management on behalf of the Interdepartmental Water Cluster.

2. BACKGROUND

Introduction of the Integrated Resilient Development Project

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In the South Central Coast region, the provinces of Khanh Hoa, Quang Nam, and Binh Dinh are regional industrial hubs while Phu Yen is rapidly developing as a tourism hub. Khanh Hoa, Quang Nam, and Binh Dinh host large-scale coastal economic zones and industrial parks (e.g., Cam Ranh, Van Phong, and Ninh Hoa in Khanh Hoa; Chu Lai-Ky Ha in Quang Nam; and Nhon Hoi in Binh Dinh). Khanh Hoa and Quang Nam, in particular, are among only 16 net contributing provinces to national revenue.¹ With long coastal areas and rich cultural heritages, the region is an emerging center of the tourism industry with easy connectivity and diverse tourism assets. Quang Nam is home to two UNESCO World Heritage Sites (i.e., the ancient town of Hoi An and the My Son temple complex) while Khanh Hoa drew over 7 million tourists in 2018 (including 3.6 international tourists) anchored on the resort city of Nha Trang. Tourism is a key driver of Phu Yen's long-term growth strategy anchored on the potential of its unspoiled beaches (e.g., Vung Ro and Xuan Dai bays) and the Da Dia Reef, which is a national heritage site. Binh Dinh also has a rich historical and cultural heritage as an ancient Champa centre while also having several natural attractions that draw both local and international tourists (e.g., Ba Mountains complex, Ham Ho waterfall, and Ghenh Rang beach).

The four provinces face particular challenges in the face of heightened risks of climate change and natural disasters. Based on recent analysis from the recent World Bank's Resilient Shores: Vietnam's Coastal Development Between Opportunity and Disaster Risk, coastal flooding remains a threat to Quang Nam, Binh Dinh, Phu Yen and Khanh Hoa, but the more serious risks come from pluvial and fluvial flooding. Table 1 summarizes the exposure of key economic sectors of the four provinces to a 50-year riverine flooding event. The analysis reveals that extensive shares of agricultural areas are exposed to a major flooding event, ranging from 15 percent for Phu Yen to 22 percent for Quang Nam. The share of hotels that are exposed to a 50-year riverine flooding event is very high for the four provinces, ranging from 45 percent in Khanh Hoa to 79 percent in Binh Dinh. Thousands of jobs are estimated to be affected in each province. While it was difficult to assess the potential economic losses, the estimated provincial GDP generated by the tourism sector that will be affected by a major flooding event is significant for the four provinces.

Table 1: Provincial Exposure of Economic Sectors and Assets in a 50-year Riverine Flooding Event

	Khanh Hoa	Quang Nam	Phu Yen	Binh Dinh
Agriculture				
- Agricultural crops exposed (% of area)	20%	22%	15%	20%
- Est. loss in export value (US\$ millions)	36.5	91.9	26.2	52.4

¹ Net contributing provinces are those where locally-generated revenues exceed local budget expenditures such that the provinces "contribute" surplus revenues to the national budget.

- Agricultural jobs affected (thousands)	24	60	17	34
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Tourism				
- Hotels exposed (% of total)	45%	61%	77%	79%
- Est. Tourism GDP affected (US\$ millions)	303.5	452.8	97.9	166.4
- Tourism jobs affected (thousands)	16	25	5	9
Industry				
- Industrial zones exposed (% of total)	0%	100%	67%	50%
Public Infrastructure				
- Schools exposed (% of total)	44%	30%	57%	58%
- Hospitals exposed (% of total)	55%	54%	25%	50%
- Power plants exposed (% of total)	100%	77%	67%	40%
- Electrical substations exposed (% of total)	27%	40%	14%	77%
- Est. contingent liability to roads (US\$ millions)	14.0	25.4	2.9	17.8

The Vietnam's government forthcoming update to its medium-term development plan reflects and increased prioritization of resiliency policies for coastal areas. The draft of *Vietnam's SEDP for 2020-2030* specifically recognizes the vulnerability of the South Central Coast region and calls for "proactive policies (to) be adopted to respond to climate change and mitigate natural catastrophe impacts." More generally, the SEDP prioritizes "more proactive response to climate change (and) reduction of GHG emissions," including the development infrastructure that "will be more resilient to climate change" and smart solutions that "enhance adaptation in agriculture, aquaculture and forestry." These principles and priorities are being incorporated in the respective *Provincial SEDPs for 2020-2030, with a vision to 2050* that are under preparation by each of the four provinces.

Request for International Bank for Reconstruction and Development Bank (IBRD) financing

Recognizing the risks faced by its coastal regions, while sustaining the economic growth, especially in the four coastal provinces of Quang Nam, Binh Dinh, Phu Yen and Khanh Hoa, the Government of Vietnam (GOV) has requested the World Bank for a IBRD financing package of US\$350 million² via the proposed Integrated Resilient Development Project (IRDP) for the period of 2021-2026. Objective of the project is to increase access to resilient infrastructure and services in selected provinces of the South Central Coast region in Vietnam. The project is structured around two components:

- *Component 1: Resilient Infrastructure.* This component will finance investments to improve access to resilient infrastructure and services in key coastal economic zones of the subproject provinces, with a focus on resilient connectivity, disaster risk reduction, and urban environmental sanitation. The proposed investments under this component is approximately US\$434.57 million (of which, US\$328.80 million from IBRD and US\$105.77 million from CF).

² The total project cost is estimated approximately of US\$469.16 million, of which US\$350 million from IBRD and US\$116.73 million from Counterpart fund. The total project budget could be changed following the development of the Project Investment Policy (PIP) in the later stage.

- *Component 2: Technical Assistance and Implementation Support.* This component will finance technical assistance activities focused on strengthening the resilience of public investment management and tourism development of the subproject provinces, as well as overall project implementation support. The proposed budget allocation in this component is approximately of U\$32.16 million (of which, US\$21.20 million from IBRD and U\$10.96 million from CF).

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The project preparation status as of Dec 7, 2020: The Project Proposal (PP) has been revised following comments given by MPI and MOF and was resubmitted to MPI in October, 2020. It is expected that the project proposal for the total IRDP project (focus on all 4 provinces) will be approved by Prime Minister in December 2020.

Project preparation timelines:

Milestones	Date
Project Proposal - Approval	Dec, 2020
Pre-Feasibility Study submission	Mar, 2021
Pre-Feasibility Study approval	Jun, 2021
WB Decision Meeting	Jun, 2021
Feasibility Study and safeguards document approval	Sep 30, 2021
Negotiations	Oct 15, 2021
WB Board Approval	Nov 30, 2021
Project Effectiveness	Mar 1, 2022

Proposed investments of Truong Giang river in Quang Nam province

Out of the total of US\$434 million investments in all 4 project provinces under Component 1, the total budget of the proposed construction investment in Quang Nam province is approximately US\$92 million (excluding resettlement and contingency allocation). This will be invested in:

- the rehabilitation and construction of coastal road along the Eastern marine line;
- the rehabilitation, restoration of Truong Giang river for flood risk management and inland waterway development, aimed at creating adequate solutions for river bank protection and water transport; and
- the rehabilitation and construction of bridges crossing Truong Giang river to increase east-west connections. Of which US\$26.5 million is proposed for item (ii).

This assignment focuses on a part of the IRDP area, to be precise the subcatchment of Truong Giang river in the Province of Quang Nam being part of the investment formulated under (ii).

The figure below shows the proposed investments in Quang Nam province.



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Background Truong Giang subcatchment

Vu Gia-Thu Bon river basin and Truong Giang subcatchment

Vu Gia-Thu Bon (VG-TB) is the ninth largest river basin in Viet Nam. The total area of Vu Gia- Thu Bon river basin, starting from upstream to the estuary is 10.350 km², the annual average amount of water supply is 20,22 billion M³. The river basins topography varies widely from high mountains upstream with sharp ridges and narrow valleys to broad and meandering riverbeds, allowing to spill over into the flood plain. The short, steep watersheds with highly seasonal flow typically generate large volumes of sediment, pollutants and have direct and immediate impacts on downstream environments, the estuaries and coastal environments.

The Vu Gia Thu Bon River basin sustains important functions and services, which provide water, food, and energy resources for the people living in the basin as well as for people beyond the basin boundaries. Furthermore, the river basin system provides regulating services like flow attenuation, and various cultural and recreational services. During the last decades, significant infrastructure, like reservoirs, channels, water treatment, and distribution networks, was built to increase the benefits generated from the basin in a reliable and secure way. Nevertheless these infrastructure also had impact downstream, among which Truong Giang subcatchment.

Truong Giang runs north-south from Cua Dai river mouth to Cua Lo river mouth connecting the downstream of Vu Gia - Thu Bon rivers in the north and Tam Ky - An Tan rivers system in the south. The river runs parallel to the coast and is about 67 km long.

Besides being one of the main flows to drain excess water during the flood season towards the sea (flood drainage from Vu Gia and Thu Bon rivers), the river is used for navigation, being an important waterway route in the region's inland waterway transport network. Both functions are under pressure. Due to severe erosion, sedimentation (river and sea deposits), encroachment by (illegal) settlements and aquaculture (shrimp ponds) the riverbed is filled by sedimentations. This has contributed to narrowing the rivers floodplain and significantly reducing the flood drainage capacity as well as the water transport capacity.

Navigation

Quang Nam has a total of 443.5 km of waterways, of which the 112-km-long main post is connected from the Ky Ha estuary through the Truong Giang river to Cua Dai and the lower section of the lower Thu Thu and Vinh Dien rivers to Cua Han. This is the arterial transport route connecting large economic residential areas of Quang Nam province, but also the key and shortest transport route connecting important hubs such as Hoi An wharf and Ky Ha port.

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However, in recent times, the massive development of aquaculture ponds and Co Linh dam (Binh Hai commune, Thang Binh district) have made river beds depleted and creeks narrowed. seriously, boats could not travel, the riverside area was flooded for long time when flood water came back. In order to "rescue" the Truong Giang River, contributing to increasing the flood drainage capacity for the eastern region of the province, the People's Committee of Quang Nam province had approved the project "Dredging and emergency drainage of Truong Giang river", with a total investment capital of nearly VND 1,000 billion from the Government Bond fund in 2010. However, the project has not been implemented since the project could not arrange capital.

Now, after many years of sedimentation and encroachment, Truong Giang is almost no longer exploited. Given the significant economic potential, including tourism development, the Ministry of Transport has planned a dredging of a standard IV river flow to restore this important waterway.

The proposal from Quang Nam province is to dredge (and protect the riverbanks) of the Truong Giang river enhancing the flow capacity and exploiting the water traffic for eco-tourism. The requirements proposed to meet the water traffic purpose from An Lac junction (Cua Dai) to Cua Lo (An Hoa) are as follows:

- Width: $B = 30\text{m}$
- Depth: $H = 2.3\text{m}$

Flooding

Floods on the Vu Gia - Thu Bon - Truong Giang - Tam Ky river system are mainly due to heavy rains after storms on the river upstream. The rivers are shorts and steep river bed sedimentation and river mouth narrowing has been happening under natural processes and human activities. Flush flood water and prolonged inundation have caused serious losses to human life and infrastructure.

For the Vu Gia - Thu Bon - Truong Giang - Tam Ky river system, floods on the river mainly flow into the sea through three main estuaries: Cua Dai, Lo and An Hoa. However, with the characteristics of the Central estuaries under the main impact of sea sediment, in the dry season most of the estuaries are depleted, the phenomenon of filling the river bed due to the natural deposition process as well as the constructions and aquaculture fields have contributed to narrowing the river cross-section. This significantly reduced the possibility of flood drainage, causing water inundation, prolonging the flood time in the downstream areas and greatly affecting the traffic waterway through the river mouth. Prolonged flooding causes severe damage to people's lives and property, damage to crops, cut off arterial roads, isolate flooded areas, and destroy important infrastructure in the region such as dikes and bridges, etc

Along the Truong Giang River, there are many important points where erosion often occurs, such as curved river sections, or weak soil of the river banks. These narrow river sections are adjacent to densely populated areas that require additional protection from landslides in the rainy season, along with river and coastal flood protection. The proposed embankment should be appropriate (tailor

made) for each section and if possible nature-based solutions should be applied. Given the issues faced by Quang Nam (and other coastal provinces), there is an urgent need to address critical weaknesses in flood mitigation infrastructure to reduce risks to vulnerable populations and key economic assets. Investments are also needed to improve connectivity and environmental sanitation systems to make these infrastructure services more resilient to the increasing stresses of climate change and natural disasters. Importantly, structural investments must be supported by developing integrated, smart planning and management systems that will modernize planning, decision-making, and accountability for disaster preparedness and management in the project provinces. Investments cannot solely rely on grey infrastructure solutions given that the extensive use of concrete, the felling of trees, and the extension and widening of the roads, increases both the urban heat island and greenhouse gas emissions (GHGs). Various green, nature-based solutions, such as retention and detention ponds, water absorbing landscapes, Nature based Solutions to create more natural embankments in order to reduce erosion etc., should complement the engineering measures.

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Assignment in short

Given the sensitive nature of the natural environment, as described above, development must be managed carefully to avoid locking in new risk and to enable resilient and productive development. The PPC Quang Nam is seeking guidance on how best to manage the development. To support Quang Nam province in preparation of the Feasibility Study for the Truong Giang river investment, the World Bank and the Dutch Government are looking for a qualified international consultancy team to:

- Develop an approach and set of characteristics for a future conceptual integrated development and management plan for Truong Giang sub-catchment and the downstream area of Vu Gia – Thu Bon River, considering landscape design, economic and social development, flood risk management and eco-system; and
- Offer alternative approaches and technical solutions to riverbank protection through the formulation of conceptual design (if possible nature based) solutions.

3. SPECIFICATIONS

Ambition

The ambition of this assignment is to support directly and indirectly a number of actors involved in the integrated river management of Truong Giang subcatchment.

Direct support in the form of expert advice will be given to the (Pre-)Feasibility Study Consultant contracted by the Quang Nam Provincial People Committee (PPC), the Quang Nam Project Management Unit as well as the World Bank team. Indirect support will be given to the Quang Nam PPC and the Vietnamese government in general. This will be done by, amongst others, sharing international experience on riverbank erosion and sedimentation research, technical surveys and modelling approaches as well as option menus of technical, nature-based solutions and “soft” measures that are appropriate to the Truong Giang river subcatchment management.

This assignment aims to open the opportunity to take into account innovative and creative preventative measures and erosion responses, including risk reduction, adaptive and nature-based solution measures. This assignment is an opportunity to demonstrate added value of such innovative and creative approaches. This should be done by, amongst others:

- reviewing intermediate and final deliverables of the pre-FS trajectory and;
- more broadly advise PMU and the PPC on opportunities (like Nature Based Solutions, cost reduction, win-win) and technical possibilities in the project.
- illustrate and complemented with inspiring Dutch and other international experiences/examples (so besides the experiences in the Rhine, Meuse, Scheldt delta, other concrete international examples) that are appropriate for the Truong Giang river and deltaic branches / estuaries
- including examples of field research and modelling approaches and actual river training measures.

The international team has to work closely with the government's hired Feasibility Study Consultant and Quang Nam Project Management Unit (PMU) to support their discussions with technical agencies, experts, researchers and academic institutes, state management agencies at national and subnational levels, international organizations (ADB, AFD, JICA, etc.) and other stakeholders as necessary to ensure the appropriateness of the proposed methodological approach and technical proposals, as well as the appropriate incorporation of the assignment result in the FS.

Activities

Project Initiation:

1. Organize and prepare a one day kickoff workshop where the Consultant works in close consultation with the (Pre-)Feasibility Study Consultant, PMU, World Bank and technical agencies to prepare a framing for assignment.
2. Deliver the kickoff workshop in person (team leader, Vietnamese experts) and remotely (other international consultants).

Data collection:

3. Conduct a quick screening of all available data and analyses for the Truong Giang subcatchment and surrounding areas;
4. Organize a field visit to get familiarized with the river and surrounding areas and gain deeper understanding of the geographical extent and condition of the project area. The team should also examine the impact of past natural disasters and study the existing structural and non-structural measures in place, and collect necessary data for presenting alternative solutions in the pre-FS phase. Support the PMU in their discussions with the Quang Nam PPC if data gaps exist.

Data analyses:

5. Conduct literature review of and consolidate the available analyses (including hydrological and hydraulic models) and data on the water resources management, flood risk management, river and coastal erosion, water transport, urban development, industry development, eco-system, sedimentation, sediment transport, hydrological and hydraulic, etc. for Truong Giang sub-catchment (including its river mouth and the coast), the downstream area of Vu Gia – Thu Bon river basin (including Thu Bon river mouth and the coast) and Tam Ky river;
6. Assess the existing situation of the river management of Truong Giang subcatchment and identify opportunities for a more integrated approach, including mapping out the existing development plans and frameworks of various sectors in this subcatchment;
7. Meet with experts, government agencies and research/academic institutes, consultants to discuss the methodology, technical aspects, the way forwards and additional data collection if needed.
8. Assess the risk caused by disasters (i.e. flood (riverine, tide, storm surge), salinity, drought, erosion) in the Truong Giang subcatchment.
9. Support and provide technical guidance to the client's consultant to develop the mathematical models³ to assess the flood risk, considering various hazards probabilities overlay with various development scenarios (including existing condition, proposed project investments, future development for different time horizons 2025, 2035, and 2050 for analyzing the changes) and the possible climate change impacts. The models need to be calibrated and validated in order to have reliable results. Calibration is required to determine if different model parameters are estimated correctly. After calibration, the models need to be validated. Validation of the model is done by using an independent set of data, not used for calibration. In case the model results agree with the independent set of data, the model is considered to be verified and ready for use. In case the model outputs do not correspond with the measured data, the model needs to be checked and calibration and validation needs to be done again until the model is verified. Calibration and validation is to be approved prior to commencing the next steps.

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Development of the conceptual management plan and proposing alternative technical solutions:

10. Develop an approach and set of characteristics for a future conceptual integrated development and management plan for Truong Giang sub-catchment and the downstream area of Vu Gia – Thu Bon River. This future plan will consider landscape design, economic and social development, flood risk management and the ecosystem. Recommendations for short, medium and long term development will also be developed. This approach should deliver the arguments* for applying more integral solutions, potentially nature-based, to the work financed

³ This requirement is to ensure the continued use and maintenance of the model by Quang Nam province after the assignment is completed

through IRDP. The consultant team may propose a format based on international examples, harmonized with the needs of the province.

*The approach will present the general outline towards the future and should make the Quang Nam Province / PMU feel comfortable that the new resilient NbS approach for the Asset will fit into the – to be developed – Spatial Vision of the area.

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11. Propose a set of technical solutions and design for riverbank protection of Truong Giang river that can be used for Pre-FS and FS development. Multi-criteria assessment (MCA) and Cost-Benefit Analyses (CBA) should be developed for a selection of the suitable technical solutions for river bank protection and design. The technical solutions and conceptual design options should be sufficiently detailed for the province to debate the different options and choose between the different alternatives.

Consultation, Advocacy and Final Workshop:

12. Conduct frequent consultation with the stakeholders (see Key counterpart organisations) through the development process at different scales. At least 3 larger workshops should be organized as part of this assignment, in liaison with PMU, PPC and World Bank: (1) Inception stage, (2) first draft of the development of conceptual integrated development and management plan for Truong Giang sub-catchment; and (3) first draft of the technical solutions and design for the riverbank protection. The frequent consultations also help to build capacity of government agencies in Quang Nam province and stakeholders. Special attention should be paid to compelling, attractive and creative visual material that is presented in those workshops. Besides scientific rigor and within the legal and procedural requirements, the presentations need to advocate effectively for alternatives to the prevalent hard infrastructural default approach and 'market' the advantages of those approaches.
13. Handover all data and results (including raw and modelled data) to the World Bank, RVO and the Quang Nam PMU with detailed instruction and guidance of data structure and use for future use and maintenance.
14. Physically or virtually participate in a workshop co-organized by the Quang Nam province, Netherlands Embassy, the World Bank to present and discuss the findings and recommendations for the next steps of Pre-FS and FS preparation.,

Working methods

The following working methods are expected to be deployed for this assignment:

- Desk review and data collection sources in different sectors, nationally and internationally
- Field visit and interviews/meetings of key experts in Viet Nam (face to face and virtual)
- Translation of key materials from Vietnamese into English and vice versa
- Report writing, with analysis of data and documents, interview results
- Preparation of workshop presentations

- Physically or virtually participate in a workshop co-organized by Quang Nam province, Netherlands Embassy, possibly World Bank and other stakeholders
- National and international experts will communicate through telecons, and international experts may take time at home base for preparations.

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Deliverables related to external communication about the project

- A project summary (of this assignment), including references to key deliverables (if applicable), an overview of project partners and impact on the SDGs to RVO and EKN at the end of this assignment. The project summary (max. ½ page, in English) will be used for the IATI-initiative on <http://aiddata.rvo.nl>.
- A set (minimum 2) of licence-free high-resolution images (photos and/or other visuals) related to the project, which are available for use in any project- and/or programme-related outreach, online and offline.
- Proactive delivery of at least two social media messages related to key activities or communication messages/outcomes, including media materials such as photos or videos. The contractor may use the organisation's own social media channels with #PartnersForWater and mentioning @RVO_Int_ and/or propose messages to be spread through the Embassy's and/or RVO and/or NWP social media channels.
- Note: any other (=not defined above) project or project scope related communication initiated by the contractor or subcontractors needs to include a reference to the support by the Government of the Netherlands through the Partners for Water programme.

Activities defined in this ToR are to be carried out from 18 January 2021 (or as soon as the tendering and contracting procedure has finished) until 30 June 2021. However, the primary input for the technical solutions and designs for Truong Giang riverbank projection should be incorporated in the pre-feasibility study which is expected to be submitted to the government for review and approval in April 2021. All outputs and deliverables are required in both English and Vietnamese. The following is a summary of deliverables and expected delivery timelines:

Activity/Deliverables	Timing
1. Initial document & data search	Early Feb 2021
2. Inception note, with proposed methodological approach, data requirement, data gaps, and detailed workplan	Early Feb 2021
3. Technical review report on data collection and desk review	Late Feb 2021
4. Technical report on the assessment of the existing plans and frameworks	Feb - Mar 2021
5. Technical report on the risk assessment, including mathematical models' development and calibrating.	The primary results available in late Mar 2021. The final results available in Jun 2021

6. A report on integrated river sub-catchment management and development with relevant international experience and approaches	The primary results available in April 2021. The final results available in Jun 2021
7. A report on options and technical solutions/designs for riverbank protection, including "non-structural" nature-based approaches and relocation of households and businesses.	The primary results available in April 2021. The final results available in Sep 2021
8. All materials, including presentations and workshop proceedings	End of contract
9. Transition and data (including raw and modelled data) with detailed instruction of data structure and use for the subsequent phase and future use	End of contract

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4. KEY COUNTERPART ORGANISATIONS

A broader set of counterpart organisations is supporting and/or connected to this assignment:

Organisation	Type of involvement and responsibility
RVO, team Partners for Water and Water as Leverage	Contracting authority and responsible for project management of this RVO-funded assignment. The main contractor is responsible for providing regular and timely information on progress, changes in planning, expert deployment, budget shifts, or other modifications of the assignment (based on ToR and work plan) to the designated program advisor of RVO, team Partners for Water.
Embassy of the Kingdom of the Netherlands	The First Secretary on Water and Climate maintains bilateral relationships with key counterparts at different Vietnamese ministries and international financing institutions such as World Bank. EKN is (after World Bank) responsible for assisting in gaining access to the relevant counterparts for this assignment, upon reasonable request from the contractor.
Quang Nam Provincial People's Committee and line departments	Provide strategic guidance to the PMU and line departments for technical inputs, advisory guidance and data provision. The PPC will be the executing agency of the project, overseeing project implementation, directing related departments and implementing agencies, ensuring compliance with government regulations and World Bank policy requirements. Provincial Departments including Department of

	Natural Resources and Environment (DONRE) and others will be engaged in coordination, various technical reviews and advising the PPC on issuance of decisions during project preparation and implementation. DONRE is also responsible for carrying out environmental compliance monitoring of selected subprojects in the province if necessary.
Quang Nam Provincial Project Management Unit	The Project Management Unit (PMU) will be the Borrower's representative at provincial levels, with responsibility for overall sub-project management including environmental and social management. Key partner in the execution of this assignment and responsible for the WB-funded project preparation and implementation, and the implementation of the integrated river subcatchment management of Truong Giang river in the future. PMU provides coordination with relevant departments and partners in Quang Nam, as well as data collection and provision, as well as stakeholder consultation.
Consultant Team	Team of consultants hired by the Quang Nam PPMU to draft the deliverables.
World Bank Vietnam	Provider of the loan for the IRDP. Has direct involvement and/or responsibility during the execution of this assignment. World Bank will take a leading role in bringing together relevant stakeholders and counterparts for this trajectory, related to the key activities of the consultant.

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A2 Presentations

The presentations given by our team can be retrieved through the following link (available till 30 April 2022):

<https://royalhaskoningdhv.box.com/s/7wpssvqro3cvfst8drwkrn399ffupvjg>.

The following presentations are available:

1. Online kick-off meeting PPMU, FS Consultant, WB and RVO (02 February 2021)
2. Work session PPMU, FS Consultant and WB (03 March 2021)
3. Wrap-up meeting PPMU, FS Consultant and WB (05 March 2021)