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MINISTRY OF TRANSPORT
PROJECT MANAGEMENT UNIT OF WATERWAYS

World Bank

NORTHERN DELTA TRANSPORT DEVELOPMENT PROJECT (NDTDP)

CORRIDOR 3

DEMDP

Dredged and Excavated Materials Disposal Plan

In association with

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QUALITY ASSURANCE SHEET

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1. PROJECT DESCRIPTION

The project region of the Northern Delta Transport Development Project (NDTDP) Phase II Project WB6) covers 3 provinces, namely: Phu Tho, Ninh Binh and Nam Dinh.

The Red River Delta system make an outstanding network of inter-connected navigable waterways covering most of the northern coastal area on East/West axis for Corridor one and Northern/Southern axis for Corridor 3. It provides major transport routes from the port of Hai Phong to Pha Lai, Hanoi and Viet Tri (Corridor 1) and from ports of Viet Tri and Ninh Phuc to Day and Ninh Co River mouths (Corridor 3).

The river system has naturally fairly favorable navigation condition and is extensively used for transport of main bulk commodities (sand and gravel, cement, timber coal and fertilizer). In parallel the road network of the Northern Delta region is not yet fully developed and the share of waterway transport is 67% of total transport performance in ton.km.

To enhance the advantage provided by the naturally favorable conditions of Inland Waterways and its environmentally friendly contribution to the Country's transport system the Government of Vietnam has embarked in two main projects: the Mekong Delta Transport Infrastructure Development Project (MDTIDP) and the Northern Delta Transport Development Project (NDTDP). The Vietnamese Government received a credit amount from the International Development Association (IDA) and the World Bank. This Inception report concerns the item no. CS-A5i-NDTDP. Detailed Design and Bidding Documents Preparation for Phase 2 of Northern Delta Transport Development Project (NDTDP).

A feasibility study and preliminary engineering designs for the Northern Delta Transport Development Project – NDTDP was approved in 2008[1] including 3 components and several subcomponents as follows:

➔ **Component A: Multimodal Transport Corridor Investments**

- Subcomponent A1. Improvements of two National waterway corridors :
  (i) east-west northern corridor between Viet Tri and Quang Ninh; and
  (ii) north-south western corridor between Hanoi and Ninh Co River estuary.
- Subcomponent A2. Improvements to Ninh Co River Estuary and an inter-connecting canal between the Day and Ninh Co Rivers with a navigation lock
- Subcomponent A3. Improvements to Provincial Ports
- Subcomponent A4. Pilot Maintenance Contract

➔ **Component B: Investments in small ferry boat stages**

➔ **Component C: Institutional support to MoT, VIWA and provinces.**

Corridor 3 consists of:

[1] Northern Delta Transport Development Project – Feasibility Study and Preliminary Engineering Design – Final report, March 2008, SMEC, Royal Haskoning and centre of VAPO

- A coastal channel in Lach Giang estuary,
- Several different river sections including Ninh Co and Red rivers from the sea to Hanoi,
- A connecting canal between Ninh Co and Day rivers
- A section of Day river from the connecting canal to Ninh Phuc port
- Ninh Phuc and Viet Tri ports improvement.

The overall length of Corridor 3 is 183 km.

The Project is expected to increase the capacity of the inland waterway transport system to meet growing transport demands and support economic development by reducing transport costs for both producers and consumers. After improvement the waterway will be able to allow:

- 3000 DWT from Lach Giang estuary to the bifurcation point of the Day river and Dao Nam Dinh river – River mouth section 1
- 3000 DWT and barges 4X400 Tones from the bifurcation point of the Day river and the Dao Nam Dinh river to Ninh Phuc port – River mouth section 2
- 1050 DWT and barges 4x400 Tones from Hanoi port to the bifurcation point of the Red river and Ninh Co River (sector of Mom Ro). – Corridor 3 – section 1
- 3000 DWT for the Ninh Co river – Corridor 3 – section 2

The main design choices and considerations for the Corridor 3 are:

1) The 4 x 400 Tones barges are expected to sail from Ninh Phuc port to Hanoi port, on the Dao Nam Dinh River and the Red river.
2) The maximum sea river vessel considered to sail all the way to Hanoi has a capacity up to 1050 DWT.
3) The 3000 DWT sea river vessel will sail to Ninh Phuc port, but will not continue to Hanoi.

The upgrading of the corridor 3 will entail dredging; bend corrections, bank protection, shoal regulation, a lock ship and a bridge with a lifting span through the main canal and provision of aids to navigation.

1.1 Scope of investments

The project purposes consist in:

1. Waterway corridor 3 (Hanoi – Lach Giang) from Lach Giang estuary through Ninh Co river, Red river to Hanoi: training work and improvement and upgrade of channel to reach the channel class I;

2. Construction of a connecting canal from Day River to Ninh Co River (DNC canal) including a ship lock in the middle of the canal;

3. Construction of an access channel and breakwaters in Lach Giang estuary to permit 2.000DWT vessels to access from the sea to the Ninh Co river and join Ninh Binh Port. The 3.000DWT vessels can be able to use it during high tide or with load reducing.

4. Modernization of Viet Tri Port by construction of 1 berth of 600 T, warehouse, stockyard, conveyor, inner road, drainage system, runoff water treatment, anti-dust equipment, etc.;

5. Modernization of Ninh Phuc port by construction of 1 berth of 3.000DWT, warehouse, stockyard, conveyor, inner road, drainage system, runoff water treatment, anti-dust equipment.

1.2 Project location

The project area is located in Northern Vietnam and concerns a part of the Inland Waterway of the Red River Delta, from Hanoi to the sea. The project mostly concerns the Ninh Co River and the Day and Dao rivers.

The project is divided in 6 sites, located in the boundary of 3 provinces:

- Nam Dinh province,
- Ninh Binh province
- Phu Tho province.

In Nam Dinh province, training works of a 50 km section in Corridor 3 will be conducted in Nam Dinh province. However the training works are not continuously implemented in the whole length of this river section but they concern only at 5 areas which do not meet actually the requirements of waterway class I. I and II in Ninh Binh and Phu Tho provinces, ports (Ninh Phuc port in Ninh Binh province and Viet Tri ports, respectively, in Phu Tho province) which will be upgraded.

The project is implemented in 06 following areas:

Table 1: Project sites

TT	Project site	Province	Commune
1	Mom Ro (Km126-131)	Nam Dinh	An Vinh village, Truc Chinh commune, Truc Ninh district, Nam Dinh province
2	Do Bui (Km134-138)		Lo Xuyen village, Phuong Dinh commune, Xuan Truong district, Nam Dinh province.
3	Day Ninh Co connecting canal DNC (Km164-167)		Nghia Son and Nghia Lac communes, Nghia Hung district, Nam Dinh province
4	Lach Giang estuary (Km180-181)		Thinh Long town, Hai Hau district, Nam Dinh province
5	Ninh Phuc port	Ninh Binh	Bich Dao ward, Ninh Binh town, Ninh Binh province
6	Viet Tri port	Viet Tri	Ben Got ward, Viet Tri city, Phu Tho province

Overview of the project sites is shown in Figures 1 and 2.

1.1 Project Components

The following paragraph is a synthesis of the project components which are detailed in the Detailed Design Reports (DDR). This chapter presents the location of each project site and explains the purpose of the works. The projects are illustrated by a synthetic drawing for each area. The technical drawings are available in the Detail Design Reports.

The projects components are summarized in the table 2.

Figure 1: General location map of Corridor 3

Figure 2: Overview of project sites include in corridor 3

Table 2: Synthesis of projects components

Project Area	**Main purpose**	**Works**	**Excavated/dredged materials management and quantities**	
Mom Ro	Adapt Curve radius	Dredging Bend cutting Derivation canal Groins Embankments	Reuse of clay by bricks factory Use of all the "un-clay" materials for agricultural soils improvement by communes	921 700 m3
Do Bui	Adapt Curve radius	Dredging Bend cutting Groins	Use of all the materials for agricultural soils improvement by commune	485 150 m3
DNC	Link 2 rivers	Connecting canal Ship lock Dredging Bend cutting	Reuse of clay by bricks factories Use of all the "un-clay" materials for agricultural soils improvement by communes	1 300 000 m3
Lach Giang Estuary	Link sea and river	Channel access Sea Dikes Dredging	Use of 25 % materials for agricultural soils improvement by commune Use of 75% of materials for filling new dikes system	1 320 000 m3
Viet Tri Port	Upgrade industrial port	Berth construction New storages yard New Warehouse Drainage system Loading/uploading equipment Runoff waste water system	Soil disposal	10 300 m3
Ninh Phuc Port	Upgrade industrial port	Berth construction New storages yard New Warehouse Drainage system Runoff waste water system	Soil disposal	16 100 m3

2. OBJECTIVE OF DOCUMENT

The NDTDP will provide, among other components, significant improvements to sections of a 200 km inland waterway extending from Viet Tri through Hanoi to Ninh Co River mouth. Waterway improvements will include dredging and excavating to attain standard design width and depth, building by pass canal, connecting canal + ship lock, bank protection at some locations, placing of river-training groins and channel access to the sea in Lach Giang. The Environmental Impact Assessment of the Corridor 3 Project identified waterway dredging and excavation activities as potentially creating moderate to significant environmental impacts to the aquatic environment; disposal of supernatant water from the disposal areas as potentially creating limited to moderate environmental impacts to the aquatic receiving environment; and the land-based disposal of dredged materials as potentially creating environmental impacts to elements of the terrestrial and built environments.

The objective of the Dredged and Excavated Materials Disposal Plan, provided herein, is to describe best practices and mitigation measures to significantly reduce identified environmental impacts. Elements of the Dredged Material Disposal Plan include:

- Description of Dredging, Transport and Disposal methodologies;
- Characterization of the materials to be dredged, including scope of contamination;
- Discussion of disposal alternatives;
- Mitigation measures and monitoring;
- Operational Plan

It is critical to note the Dredged Material Disposal Plan forms one component of the (Project) Environmental Management Plan. Environmental monitoring activities, referenced in this document, are more fully detailed in the Environmental Management Plan. Similarly, the criteria for deployment and maintenance of mitigation measures, referenced in this document, are more fully detailed in the Environmental Management Plan.

3. DREDGING AND EXCAVATION METHODOLOGIES

The Corridor 3 Project Component is not a simple channel dredging project, but consists of a combination of:

1) Dredging of channel sediments to adapt channel design profile (depth of navigation, channel width and/or channel profile);
2) Excavation of headlands and other areas currently above the water line to facilitate channel re-alignment;
3) Dredging of sediments as part of the channel re-alignment associated with excavation of headlands and shoreline re-profiling; and,
4) Non-excavation components including installation or re-deployment of aids to navigation, placement of shoreline protection to limit erosion and placement of river-training groins to facilitate natural flushing processes and reduce future maintenance dredging requirements.
5) In land soil excavation and sediment dredging for building by pass canal in Mom Ro and connecting canal on Day and Ninh Co River
6) Inland soil excavation and sea materials (sand, sediments, soils) for creating new channel access from Ninh Co River to Ocean at Lach Giang river mouth
7) Dredging and soil excavation for improvement of 2 industrial ports: Viet Tri and Ninh Phuc

The dredging equipment and mode of implementation described in this Section provides a general description of different methods of dredging and excavating + dredged and excavated material disposal, with particular reference to environmental impacts associated with each mode and how these impacts can be reduced. As discussed elsewhere in this Report, it may be necessary to further reduce impacts, primarily loss of dredged materials resulting in increased loading of suspended solids and turbidity, by implementation of various mitigation measures, as described elsewhere in this Report.

3.1. Overview of Dredging Methodologies

The following text provides an overview of different types of dredging equipment. There are three broad classes of water-based dredging equipment: mechanical, hydraulic and special. Depending of the sediments and river characteristics and of the choices of the contractors, different adapted equipment can be used.

Mechanical dredging uses mechanical force to cut/excavate the sediments and then lift the excavated materials to the surface where they are (typically) placed in adjacent barges for transport to a disposal site. By means of driven piles (spuds), the mechanical dredge remains in one position and excavates across a zone before shifting the spuds and beginning a new dredging cut. The dredging cut or face is thus a series of overlapping curved surfaces along a survey line. The three most common mechanical dredges are: clamshell or grab, bucket or ladder and dipper or excavator. Modifications to mechanical dredges have focused on extending the depth to the working sediment face; increasing the amount of material excavated during each pass; and, reducing loss of excavated materials at the cutting face or during raising to the surface. Because of the potential to closely control dredge location and thus the cut face, mechanical dredges are often used in areas with limited access, limited turning radius or to provide precise dredge cuts.

The clamshell or grab dredge is essentially a standard cable crane on a barge, with the clamshell forming the bucket of the crane. The technology is well-developed, but there are two aspects of the operation which can result in loss of sediments from the dredging area (a) impact on the bottom during clamshell deployment sending up a plume of re-suspended materials and (b) “winnowing” of materials from the clamshell during recovery and placement in a barge. Both forms of sediment loss can result in environmental impacts associated with increased turbidity at the dredging site and down-current, as well as increasing the potential for off-site transport of contaminants associated with the suspended materials. Various designs and modifications have been made to reduce “winnowing” effects, primarily by re-design of the basic clamshell. Reduction of re-suspension during operations is primarily a function of operator handling and equipment deployment.

The bucket or ladder dredge consists of two pontoons separated by a ladder containing a continuous chain of buckets. Materials are dumped from the buckets into a trough or conveyor belt which then transfers the materials to an adjacent barge for transport to the disposal site. As with the other mechanical dredges, the bucket dredge is positioned using two or more hydraulically-controlled spuds.

This technology is well-developed and commonly used in for the laying of pipelines or dredging of narrow channel or small harbors because of the accuracy of dredging. The one aspect of the operation which can result in loss of sediments is “winnowing” during rising of the buckets. This aspect is difficult to minimize and therefore this type of dredge is primarily used in areas with reduced or limited environmental sensitivity and with sediments having limited contamination.

The dipper or backhoe dredge is essentially a large backhoe/excavator mounted on a barge. The operation is similar to excavation of a trench or pit on land. The technology is well-developed, with most modifications focused on the “reach” of the dipper arm and the size of the excavator bucket. There are two aspects of the operation which can result in loss of sediments (a) impact on the bottom during excavator deployment sending up a plume of re-suspended materials and (b) “winnowing” of materials from the excavator during recovery and placement in a barge. Because of the open design of the dipper or backhoe component, this type of equipment is most commonly used for dredging of coarse-grained uncontaminated materials or rock/cobble.

Hydraulic dredging uses centrifugal pumps and water flow to cut sediments at the dredging face and raise excavated materials to the surface. The three most common hydraulic dredges are: suction, cutter suction and trailing suction. Suction and cutter suction hydraulic dredges are most commonly positioned by the use of hydraulically-controlled spuds, similar to those used with mechanical dredges. Alternatively, these two types of dredges can be positioned by cables to increase dredging efficiency (i.e., reduced downtime to shift operating position). Trailing suction hopper dredges are self-propelled. Suction and cutter suction discharge the pumped dredged materials, most commonly, via a pipeline to the disposal site. As necessary, the pipeline length can be increased by the use of intermediary booster pumps. Modifications to suction and cutter suction dredges have focused on extending the depth to the working sediment face; increasing the amount of material excavated (i.e., content of solids in the pumped discharge); and, reducing loss of excavated materials at the cutting face. Trailing suction hopper dredges discharge the material into on-board hoppers during transit across a dredging area and then transport the materials to the disposal site where the materials are either dumped via a split-hull mechanism or via pump-out.

With mechanical dredging, the volume of associated or supernatant water associated with the dredged material is limited. Thus the discharge of such water does not typically result in a significant environmental impact. In contrast, hydraulic dredging systems typically generate contain less than 20% solids content. Disposed materials consist of thoroughly re-suspended sediments and a large quantity of associated water. Therefore a critical environmental management issue is the need to separate the excess supernatant water from the dredged sediments within a disposal area. Inadequate separation can result in very turbid drainage waters. Resultant environmental impacts to receiving waters can include reduced oxygen loading, reduced turbidity, re-location of suspended solids on critical aquatic habitats and off-site transport of contaminants associated with the re-suspended sediments. Hydraulic dredging also results in a higher winnowing rate of sediments at the dredging face, compared to mechanical dredging operations.

For dredged materials that are predominately medium to coarse sands, such as the Red River materials, hydraulically dredged sediments readily separate from the hydraulic water. If the dredged materials are pumped into a barge, separation may occur within minutes permitting discharge of the supernatant water at the dredging site and thereby effectively increasing the barge capacity. For cases of hydraulic pumping of mostly sand materials, dewatering is very effective, often without the requirement for containment. With rapid separation of sands from the supernatant water, the issue of suspended solids in the discharging supernatant water is not critical. Disposal site management is a relatively simple process of directing the supernatant water back to the receiving system (river or coastal waterway).

For materials that are mostly silt-clay or sand with significant silt-clay content, the separation of sediments from supernatant water can be time-consuming, requiring days or even weeks to adequately reduce the content of suspended solids in the supernatant water before discharge back to a river. Different methods have been developed to enhance phase separation and reduce the time between discharge to the disposal area and return of supernatant water to a river. If materials are pumped/discharged into a confined shoreline or upland area, the disposal area can be divided into a series of cells. Supernatant water flow is directed through the series of cells in a convoluted pattern, thereby extending the length of transit from the entry discharge to the site discharge. This phase separation process can be further enhanced by the addition of a flocculating agent, added within the pumping system. The flocculating agent promotes the agglomeration of the silt-clay materials and enhances phase separation. Management of the content of suspended solids in the discharge effluent also provides for management of contaminants that are predominately associated with the suspended solids. Figure 3-7 provides a plan-view of a multi-cell confined disposal facility (CDF), illustrating how the flow of the suspended solids and supernatant water is managed to maximize separation of phases. This design can be used for either shoreline or upland disposal facilities.

<u>Suction (hydraulic) dredging</u> is the application of a simple vacuum to draw water and associated unconsolidated sediments to the surface. Subsequently, mechanical beaters or injected water agitation were added to re-suspend the sediments and thereby facilitate material removal. Suction dredgers are commonly used to remove unconsolidated materials, particularly fine silts, clays and organic debris/sludge. Excavated materials are typically transported by pipeline to a disposal site or pumped into adjacent barges for transport to a disposal site. The technology is well-developed with most modifications focused on increasing the content of solids in the pumped discharge. Because the dredging process readily results in significant “winnowing” at the dredging face, this form of dredging is often restricted to confined ponds, waterways and small harbors where silt curtains and other environmental mitigation measures can be readily implemented to reduce environmental impacts.

<u>Cutter suction (hydraulic) dredges</u> introduce a combination of mechanical action (cutter head) with the suction hydraulic process to improve the cutting rate and enhance the overall process efficiency. The introduction of the mechanical component results in an increase in suspended solids at the face of the cut and therefore increases the environmental impact of the project. As with the suction hydraulic dredge and mechanical dredges, the cutter suction dredge is positioned through the use of one or more hydraulically-positioned spuds. The technology is well-developed, with most modifications focused on the “reach” of the cutter arm and the ability of the cutter head to cut or excavate sediments that are particularly consolidated or hard.

<u>Trailing suction hopper (hydraulic) dredges</u> combine a raking mechanical action with the hydraulic agitation and suction process. Materials are raised and pumped into a hopper that forms of the dredge. Typically trailing suction hopper dredges are used to dredge long river channels or at deep water sites with subsequent transport of the dredged materials by the dredge itself. The technology is well-developed, with most modifications focused on the “reach” of the trailing arm; the capacity of the trailing arm to rake sediments while the suction process is operated; and, the capacity of the internal hoppers.

The key environmental issue is the loss of re-suspended materials during the raking or re-suspension stage. There have also been site-specific issues related to loss of aquatic biota (e.g., turtles) during the suction stage of the process.

Special dredges can be divided into two broad categories: agitation and contained.

Agitation dredging is commonly used to remove continuously accumulating sediments that are not contaminated. This format is often used to remove sand bars or other repetitive accumulations of sediments to maintain adequate navigational depth or channel profile. In some extreme examples, agitation dredging is essentially a continuous process where typical episodic dredging would not maintain adequate navigational depth or channel profile. Agitation dredging can be accomplished by water injection or mechanical agitation. Re-suspended materials are naturally transported away from the dredge site by river or long-shore currents.

Contained or remedial dredging is highly specialized with a wide variety of unusual designs all having the same objective: minimal to no loss of sediments or re-suspended materials during dredging. Initially, this type of dredging equipment represented modifications of existing mechanical or hydraulic dredging equipment to reduce loss of re-suspended materials, with associated contaminants. Modifications were developed, essentially on a site-by-site basis, to best address the physical and chemical characteristics of the sediments, the ecologically sensitivity of the waterway or coastal system and the project dredging design. Over the past decade the focus of contained dredging has shifted from dredging to meet navigational requirements, with part of the project site having contaminated sediments, to remedial dredging with the objective of removing contaminated sediments, thereby reducing the contaminant load within a waterway or coastal system; i.e., there is no navigational requirement for the project. Examples include the dust-pan dredge, Pneumatic dredge and box dredge.

3.2. Overview of Excavating Methodologies

In land soil excavation will used classical equipment adapted to clay and sandy clay materials of the Red River Delta.

The earth excavation is performed by mechanical means (shovels, bulldozer, and backhoes). Excavated materials are loaded by shovels or loaders strips directly onto trucks to be evacuated to storage sites or grouped on a temporary storage area and then taken a shovel and loaded into trucks or barges by means of transport selected by the company in charge of the work.

Mechanical equipment excavates the soil and transfers the materials to trucks and/or vessels. The transfer can be implemented directly, with a conveyor belt or by pumping equipment – depending on the fluidity of materials.

3.3. Overview of dredged and excavated materials transfer to disposal areas methodologies

Depending on the nature of the materials, their water content, their fluidity and technical choices to be made by companies moving and dredging, the transfer of materials extracted to storage sites will be based on several techniques:

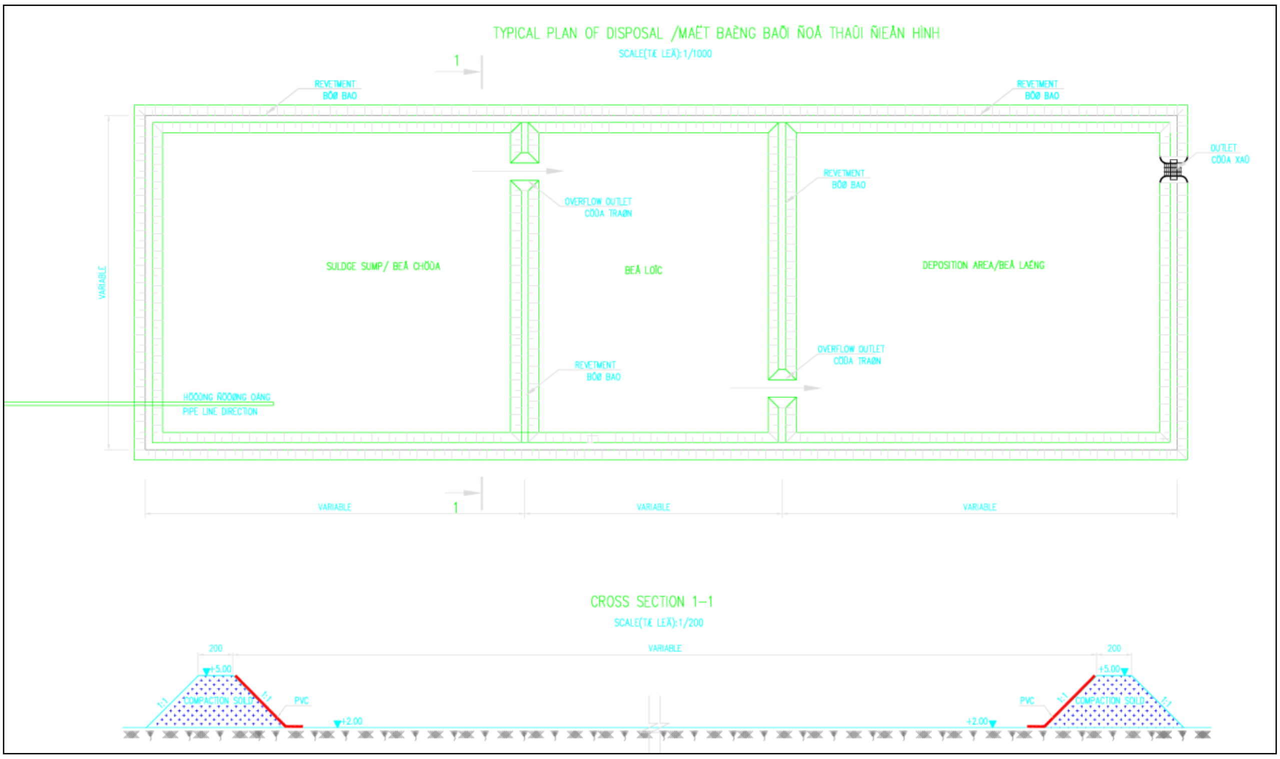
- ***Evacuation by truck***: This method will mainly concern inland extracted materials. They will be directly loaded into trucks or dumpsters after times since grouping area and temporary storage on the excavation site. Trucks borrow trails and access roads that connect the area to the extraction site of deposition. The shortest route will be preferred as well as to avoid densely populated areas. The materials are then dumped by trucks on the disposal zone and leveling ensuring by backhoes.
- ***Evacuation by waterway:*** materials extracted or dredged can be loaded into barges. For excavated material on land, they are either directly involved with a shovel from the excavation site is dumped into a hopper barges for possibly supplied by conveyor belt. For dredged materials, transfer to barges can be done directly from the jet drag (fluid materials), or by loading from the pontoon excavator (cohesive

materials). The materials are then transported by waterway to the soil disposal areas. Transfer from barges is provided by a recovery using a hydraulic excavator (cohesive materials) or by pumping (fluid materials).

- ***Direct deposit from the dredging area***: if the dredging site is near the storage area, it is possible to use suction dredgers with direct discharge into storage tanks. This technique requires large storage volumes to allow sedimentation worse the gravity drainage of water.

3.4. Overview of soil disposal areas design

For projects of corridor 3, the typical design of the storage structure is shown in the figure below:



It consists to create surrounding dykes in local materials (sand bag, clay, soil, etc.) creating several pools and permitting sedimentation and water evacuation with acceptable TSS concentration.

The following phases will be respect by the contractors:

1°) Constructing a contained disposal area by sand sackcloth or clay. A ditch created by the excavation of material will form the drainage ditch for the disposal area that is located on the outside of the perimeter dyke.

The disposal area shall be divided into a number of sub-containment areas by a suitable arrangement of internal bunds. These sub-containment areas are filled in sequence during the excavation/dredging activity. Once a sub-containment area is filled the surplus water/leach ate cannot be discharged directly to the waterway, as suspended sediments have not had sufficient time to settle. One day should be sufficient for suspended sediments to settle and then the surplus water/leach ate can be drained from the area. Drainage structures are placed within the perimeter dyke to facilitate drainage of surplus water. A drainage ditch located around the periphery of the perimeter dyke will collect water/leach ate from the disposal area and lead it to the main discharge channel back to the waterway. The height of the dikes and intermediate bund shall be sufficient to prevent any overflow at the top of such dikes and bunds. The construction of these dikes and bunds can be with materials excavated at the top of the waterway side slopes by the excavators or with materials excavated in the disposal site with bulldozer or excavator.

No dredged spoil will be dumped in any area other than spoil grounds agreed or directed by the Engineer. Contractor shall give evidence that all loads have been deposited at designated areas. The Contractor shall remove all materials dumped outside the limits of the approved spoil grounds and dispose of such material within the limits of the approved spoil grounds.

All material dredged or excavated is to be placed into confined spoil relocation areas. Under no circumstances is dredged or excavated material to be placed onto land without confinement bonding or dykes. If modifications are necessary, the contractor will propose new solutions to the Engineer for approval.

2°) The thickness of dredged material deposited in a continuous operation is usually limited to about 1.5 m as dewatering of this fine-grained clay becomes increasingly difficult and time consuming as the thickness increases. The final level of the disposal sites after ending of dumping operations shall be according to the design level previously submitted to and approved by the Engineer.

- Vertical Dimension. The maximum height of relocated material shall not exceed 1.50 meters above the original ground level at any point at the completion of the four months management period. If the maximum height must exceed this limit value, the Contractor shall inform the Engineer Representative and follow his instructions to rectify the matter.
- Horizontal Dimension. All dredged material shall be placed within the perimeter dyke of the spoil relocation area. If Dredged material had been placed outside of the spoil relocation area, the Contractor shall follow the instructions of the Engineer's Representative to rectify the matter.

3°) Ensure safety near the containment area. These disposal areas can prove to be very dangerous places for people (especially children) before consolidation has taken place. It is therefore important that sufficient measures are taken to prevent the local population from entering this area (warning panels, fences ...).

4°) For permanent disposal areas, vegetation will be carried out to stabilize the surface of the area. For some disposal areas, the land will be give back to farmers by the communes. In these case, the vegetation will be provide and plant by farmers.

Note: For the disposal of ASS or PASS sediments, the above disposal methods will be implemented and the dykes will be covered with PVC membrane to ensure drainage does not occur through the dyke walls. Testing of the quality of the sediment will be required before temporarily stored sediments are released for reuse. Addition of lime could be needed to improve the sedimentation.

<u>Specific recommendations for Disposal areas:</u>

Access and Access Roads

The Contractor shall make the necessary arrangements for access to all on land spoil relocation sites. The Contractor shall construct roads if required for access to the land spoil relocation sites to levels that will prevent the roads from being flooded and shall construct sufficient number of culverts under the roads to ensure proper drainage of adjacent areas. There shall be no requirements for the finished surface of the roads, other than that they shall be safe to travel in all weather conditions and shall not cause delay or difficulty to the movement of project related traffic. The Contractor's design in this respect shall be submitted for approval by the Engineer's Representative prior to the start of any road construction.

Perimeter and Internal Dykes

All on land spoil relocation activities are to be executed within a confined area which will be surrounded by a suitable perimeter dyke. The perimeter dykes shall be constructed before the dredging works commence to the approval of the Engineer's Representative.

Perimeter dykes can be constructed from local material to be excavated from the spoil relocation sites provided the Contractor can demonstrate to the satisfaction the Engineer that the proposed perimeter dykes are sufficiently stable, durable, erosion resistant and watertight for a period of not less than 2 years after completion of the dredging and spoil relocation works at that section of the waterway.

If the local material on the spoil relocation sites proves to be unsuitable for the construction of perimeter dykes, the Contractor shall provide suitable material to the site to the approval of the Engineer at no additional cost to the Employer. Approval from the Engineer of proposed construction techniques will be required before these activities can commence. The construction and layout of internal bonding of these areas shall be to the approval of the Engineer.

Design of Spoil Relocation Areas

The Contractor shall establish the size of the spoil relocation areas required based on the data established from the Planning Survey of the dredging and non-dredging areas and Pre-Dredge Survey along the waterways. Based on the Contractor's requirements for spoil relocation and the locations provided to the Contractor for spoil relocation of dredged material, the Contractor shall prepare detailed designs of the required spoil relocation areas, which shall be submitted to the Engineer for approval before any dredging or spoil relocation of material commences in any such area.

Pipeline Discharge of Dredged Material

The Contractor shall at all times to ensure that the pipeline discharging dredged material does not deposit outside the boundaries of the spoil relocation areas.

All pipelines are to be maintained in good conditions and leaks are to be promptly remedied. The discharges from the mouths of the pipelines shall be controlled so as to ensure even distribution of the dredged material within the spoil relocation areas.

Drainage

All the equipment, structures and devices the Contractor intends to use for water management in and around the on land spoil relocation area requires the approval of the Engineer's Representative.

- Drainage of Dredge Run-off Water. Drainage of dredge run-off water from the spoil relocation areas shall be facilitated by the placement of suitable adjustable drop inlet weir overflows. Upon completion of use of each spoil relocation area all drop inlet weirs are to be removed and their locations are to be filled with soil and left in a safe and workmanlike manner to the approval of the Engineer's Representative.

• Suitable measures shall be taken, to the satisfaction of the Engineer's Representative, to ensure the controlled discharge of dredge run-off water, natural surface water, natural groundwater and precipitation from the spoil relocation area and the immediate surrounding areas to artificial or natural waterways. This does not relieve the Contractor of the obligation to ensure that drainage of dredge run-off water does not cause problems with flooding or sedimentation in areas adjacent to or further away from any spoil relocation site.

• The Contractor shall immediately take suitable corrective action to remedy any problem with the drainage of dredge run-off water at no additional cost to the Employer. The Contractor will be responsible for and bear all costs or damages related to direct or indirect loss of property, damage or inconvenience to third parties caused by the drainage of dredge run-off water.

• Any water discharged from spoil relocation areas into natural or artificial water courses shall never increase the natural upstream/reference TSS/Turbidity concentration of more than 50 %.

- Drainage of Surface Water. On land spoil relocation areas shall not affect the natural drainage of surface water of the surrounding land. All costs relating to the control and regulation of surface water drainage, or the adoption of measures or methods to ensure continued surface water drainage, are deemed to be included in the Contractor's rates and prices.

Fencing

In order to protect public safety, the Contractor shall install fencing and other suitable means to secure the spoil relocation areas from public access. Fencing shall be installed during the construction of the spoil relocation areas and before the discharge of dredged materials. The fencing systems shall be of a material and construction suitable to remain in place for a period of at least two years after completion of dredging and spoil relocation works in the adjacent waterway sections. The fencing systems shall be subject to the approval of the Engineer before work commences.

Signs

The Contractor shall erect signs, written in both the English and Vietnamese languages, around the perimeter of the spoil relocation areas and in nearby local public places to warn the public of the dangers of entering such areas. The Contractor shall make arrangements for patrols to ensure public compliance with safety requirements.

Management of Spoil Relocation Areas

Notwithstanding other requirements related to the construction of the spoil relocation areas, the Contractor shall be responsible for every single area, including the environmental requirements, for a period of four months after the last dredged spoil has been deposited in the same area.

At the completion of the four months management period for a dredge spoil relocation area, all access road, perimeter dyke and internal bund surfaces are to be left in a level and stable condition unless otherwise approved by the Engineer's Representative. All rubbish, debris or other material used by the Contractor during the use of the spoil relocation area shall be cleared from the area to the approval of the Engineer's Representative.

4. LOCATIONS OF DREDGING AND EXCAVATING AREAS AND QUANTITIES

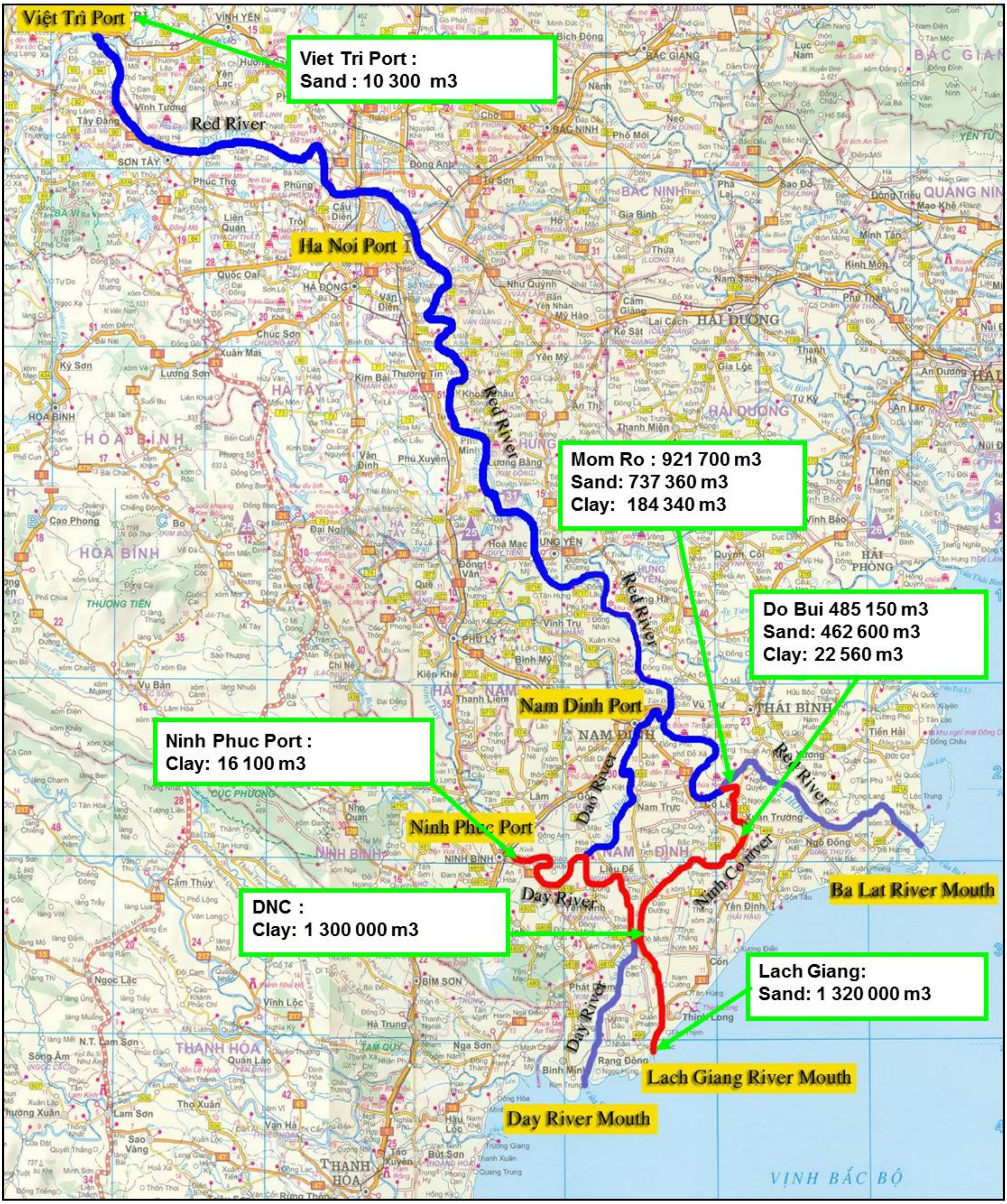


Figure 3: Location and quantities of dredging and excavating

Works areas	Estimated volume of dredging (place measure)	Estimated volume of excavation (place measure)	Total excavated + dredged materials	Total Volume sandy or sandy + clay materials	Total Volume clay materials	Direct evacuation to brick factories	Reused in project area	Total Volume for disposal sites	Disposal sites	Surface of Proposed Disposal sites	Total Capacity of disposal sites
	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	number	ha	m^3
Mom Ro	761,700	160,000	921,700	737,360	184,340	100,000	0	821,700	4	24	1,150,000
Do Bui	474,850	10,300	485,150	462,600	22,550	0	0	485,150	3	30	900,000
DNC	210,000	1,351,315	1,561,315	0	1,561,315	400,000	1,000,000	161,315	3	47	3,350,000
Lach Giang Estuary	1,320,000	0	1,320,000	0	0	0	1,000,000	320,000	1	20	400,000
Viet Tri Port	10,300	0	10,300	10,300	0	0	0	10,300	1	3	70,000
Ninh Phuc Port	16,100	0	16,100	0	16,100	0	0	16,100	1	2	20,000
Total	2,792,950	1,521,615	4,314,565	1,210,260	1,784,305	500,000	2,000,000	1,814,565	13	126	5,890,000

Table 3: Quantities / each sites / clay-sand / destination (soil disposal / brick factories / agricultural soils improvement….)

5. MATERIALS CHARACTERIZATION

5.1. Geotechnical characteristics

The Red River has long been exploited for clay, sand and gravel for construction aggregate and fills materials. Sand and clay mining typically consists of cutter suction dredging with materials pumped shoreline on the river side of the main flood dyke. In some areas, sufficient sand deposits have occurred over time or represent naturally unfilled former river channels, thereby permitting, on-shore mining of materials. Subsequently, these dredged sediments have been used for several beneficial uses: construction aggregate, infill of natural depressions and creation of agriculture areas on the River side and inside the main flood protection dyke.

The extensive sand mining, both in-river and along select shorelines reflects the natural sediment dynamics of the Red River, resulting in extensive shifting of channels, creation of bars and sand islands, creation of elongated shoals parallel to the river course, and infilling of former channels; all representative of a dynamic sediment regime with significant deposition/accretion processes.

All along Ninh Co River, the soils are mainly characterized by clay and sandy clay layer. The thickness of clay/sandy clay can be from 15 to 100 m. The surface soils are cultivated soils with brown clay and sometimes filing soil with broken bricks elements.

In Lach Giang, the ocean influence is important on beach with more sand but only on surface. The deeper layers are Poorly graded sand + lean clay mix with sand.

Table 4: Geotechnical synthesis of materials in Corridor 3 project locations

Area of River to be dredged/excavated	General description of sediments /river bank and soil materials
Mom Ro	Surface soil is agricultural soil (0-0.50 m) – 2d layer(0-3 m) is clay – below mix sand and clay
Do Bui	Surface: Sediments: River bed clay and mud – Land: Soil filling/Cultivated Soil (Brown Clay). Below Poorly graded Sand
DNC	Cultivated soil in surface Clay + sandy silts below
Lach Giang	Surface Poorly graded sand, loose, lying on surface Below Lean clay mixed with sand
Viet Tri Port	Surface: Filling soil – Sandy clay with sand and broken bricks, loose. Below: Poorly graded sand + Lean clay mixed sand
Ninh Phuc Port	*Surface: Sandy clay with sand and* Sandy clay with brick broken, Below: Lean clay with sand

5.2. Physical-chemical characteristics

The following results come from the monitoring organized in 2012 and from feasibility study 2008.

Sediments:

Sediment plays an important role of water pollution monitor. Heavy metals, pesticides and organic compound with high density often absorb to sediment and then gradually disperse in to water and lastly affect the aquatic system. As for some chemicals, it's difficult to observe them in water but easy to analyze in sandy and silt samples. Hydrocarbon in sediment is stored longer thanks to anaerobic conditions. The sediment samples with symbol of SD (coordinate close to surface water sampling points, 1.5-2.0 m far from the shore) are shown in the figure.

As Vietnam has no specification on sediment quality we refer to Dutch specification as the basis to evaluate.

The result shows Cd content in Mom Ro and Km 134-137 is 1.07 to 2.48 times higher than the Dutch permitted specification (Fig. 23). In FS, among the heavy metals, cadmium displays slight exceed of the Dutch Reference Concentration. This is true for both 1998 and the 2007 sampling. Besides, Cd and Hg in some locations in Lach Giang estuary are above the permitted specification, specifically: Ni at 7-SD38, 7-SD39, 7-SD40 and 7-SD41 location is 1.24 to 1.50 times higher than the permitted specification (Figs. 24 & 25); Hg in 7-SD39 and 7-SD40 is 1.09 to 1.46 times higher than permitted specification.

TOC fluctuates from 941 to 16685 mg/kg. Other metals such as As, Cu, Cr, Pb, Zn is lower than the specification.

According to the analysis result, organochlorine pesticides are much lower than the Dutch permitted specifications. It is similar to the FS of 2007 sampling.

Although the hydrocarbon is not found in Mom Ro, Km 134-137, DNC it is found in Lach Giang, Ninh Phuc and Viet Tri port (Fig. 26). As Vietnam has no specification on this content in sediment sample, we have no basis for evaluating this result. However, in our opinion, this result is also consistent with the real situation because the ships often transports in this area than others in these 3 areas. Therefore, oil (one of content of HCs) can leak out with the negligible level.

Some parameters in sediment samples in sampling areas at survey time are higher than Netherland permissible standard for example Cd (in Mom Ro and Km 134-137) and Ni, Hg (in Lach Giang estuary). As for dredging in some locations in the above-mentioned areas, the project is necessary to consider treatment measures of mental Cd surrounding the location of 1-SD3, 2-SD1, 2-SD2; Ni, Hg surrounding the locations of 7-SD39, 7-SD40 and 7-SD41.

The dredging process will disturb sediment close to the dredging area and will cause a re-suspension of sediments containing contaminants which, in case of specific physical-chemical characteristics (low oxygen, acidification, …), may return to solution in surface waters and causing the effect on bed organism populations (clams, oysters, crabs, snails ...). Therefore, the natural physical-chemical conditions in Red River system are not favorable to pollutants dissolution and the floods during wet season naturally cause high re-suspension of the same sediments. But, to minimize as possible the risk of pollution increasing during the dredging works, the contractor should have the appropriate construction methods to minimize widespread influence to other areas. In addition, disposal areas with sealing under layer, filter and drainage system should be designed to block the pollutants which are contained by sediments when catching rain will affect surface water, ground water and soil quality

Surface soils:

The surface soil samples taken in surveyed areas are agricultural soils except for two ports which have industrial soils. Thus we apply the specification QCVN 03:2008 as the basis to evaluate the soil quality.

According to the analysis results, pH is in the range of 4.7 to 6.6 (the lowest pH at 7-S45 is 4.7; the highest pH is 6.6 in Lach Giang estuary). Therefore, if the project dumps the waste soil to surrounding surface of 7-S45, it should concern that pH in this location is acidic.

The metal indicators in general are lower than the Vietnamese and Dutch permitted specification. Only As and Ni are higher than the permitted specification in some areas, specifically As indicator in Mom Ro, DNC and Viet Tri port is 1.32 to 2.38 times higher than the permitted specification. At the location of 10-S65 in Viet Tri port, arsenic indicator reaches the highest value (28.592 mg/kg, 2.38 times higher than the specification QCVN 03:2008/BTNMT). Ni content in Lach Giang is 1.27 times (7-S44) and 2.31 times (7-S45) higher than the permitted specification (Fig. 27 & 28).

The dredging/excavating of surface soil from 0- 50 cm in Mom Ro, DNC and Viet Tri port should be concerned by the project since given the results at survey time, arsenic concentration in some locations in these areas exceed from 1.32 to 2.38 times; Ni concentration in Lach Giang estuary exceeds from 1.27 to 2.31 times Vietnamese permissible standard. As surface soil layer in Mom Ro and DNC is agricultural soil so it can be used as cultivation soil. Nickel concentration at 7-S44 location in Lach Giang estuary is 1.27 times higher than Vietnam permissible standard; it can be used as agricultural soil. In contrast, surface soil samples at location of 7-S45 consists of mainly sand with nickel content exceeding 2.31 times Vietnamese permissible standard, this soil should be used for leveling purposes.

Deep soils:

In order to allow ships of under 1000 DWT to go easily from Lach Giang estuary to Hanoi port and in turn; ships of under 3000 DWT to go from Ninh Co through Day river to Ninh Phuc port and in turn, the project needs to expand the curve radius in Mom Ro river; conduct bank correction in Km134-137 in Ninh Co river, build Day – Ninh Co canal and dredge Lach Giang estuary. With above- mentioned purposes, the project needs to dredge a great number of agriculture land with the average depth of 6m. Evaluation of deep soil sample quality should be done in order to manage the environment in this area.

Besides the above-said areas, the project's purpose is to improve and upgrade exploitation capacity in Viet Tri and Ninh Phuc port. Therefore the evaluation of in-depth soil sample quality in areas which are intended to construct bridge and port, storehouse… in these two ports is very necessary to plan disposal soil treatment.

***Along the channel in corridor 3**:*

As content in two among four locations in Lach Giang estuary (LG6 and LG67) is 1.18 to 1.21 times higher than QCVN 03:2008/BTNMT, Hg content in 3 among 4 locations in Lach Giang estuary (LG1, LG10 and LG67) is 1.62 to 1.85 times higher than QCVN 03:2008/BTNMT, and Hg content in Km134-137 (NC13 and NC15) is 1.77 to 2.03 times higher than QCVN 03:2008/BTNMT.

In two ports:

Ninh Phuc port: As content in two among four locations (NPC2 and NPK6) is 1.05 to 1.36 times higher than QCVN 03:2008/BTNMT.

Viet Tri port: Hg content in one among three locations (VTC5) is 1.16 time higher than QCVN 03:2008/BTNMT.

Metal contents are lower than the allowable specification.

Through analysis of results of salt the time of the survey showed that deep soil in these areas ranged from 0.05 to 14.66 ‰, the highest in the Km134-137 area (from 8.81 to 14.66 ‰). According to geological classification, soil salinity is a soil that contains soluble salt content greater than 3% by weight of dry soil. Therefore, soil depths in these areas at the time of the survey are not saline.

Surface soils with arsenic, nickel content exceed Vietnamese standards in some project areas. However, in deep soils, arsenic pollution just appears in some locations: LG6 and LG67 (Lach Giang estuary), NPC2 and NPK6 (Ninh Phuc port). Besides, as for deep soil samples in Lach Giang estuary and Km1340137, Hg content is found to be higher than the permissible standards (at the locations of LG1, LG10, LG67, NC13 and NC15).

<table>
<tr><th rowspan="2">rks areas</th><th colspan="3">Soil Disposal sites</th><th>Surface for disposal area</th><th rowspan="2">Actual uses of land</th><th rowspan="2">Agreement</th><th rowspan="2">Uses of soil disposal materials</th></tr>
<tr><th>number</th><th>Name</th><th>Location</th><th>ha</th></tr>
<tr><td rowspan="4">Mom Ro</td><td rowspan="4">2</td><td>Truc Chinh</td><td>Truc Chinh Commune</td><td>7</td><td>Agriculture (rice)</td><td>Commune OK</td><td rowspan="4">100 % Temprary storage (reused for bricks factory)</td></tr>
<tr><td rowspan="3">Nam Ninh BF</td><td rowspan="3">Truc Chinh Commune</td><td rowspan="3">10</td><td>Clay storage (2 ha)</td><td rowspan="3">Brick Factory OK</td></tr>
<tr><td>Ponds (7 ha)</td></tr>
<tr><td>Banana trees (1 ha)</td></tr>
<tr><td rowspan="6">Do Bui</td><td rowspan="6">3</td><td>Dai Thang</td><td rowspan="6">Phuong Dinh commune</td><td rowspan="2">20</td><td>Agriculture (5 ha)</td><td rowspan="6">Commune OK</td><td rowspan="6">100 % Definitive storage = Backfill 3 low agricultural areas to improve agriculture production (asked by communes)</td></tr>
<tr><td>1 & 2</td><td>Pond (15 ha)</td></tr>
<tr><td rowspan="2">Phuong Ha</td><td rowspan="2">10</td><td>Agriculture (3 ha)</td></tr>
<tr><td>Pond (7 ha)</td></tr>
<tr><td rowspan="2">Van Lai Drain</td><td rowspan="2">5</td><td>Agriculture (2 ha)</td></tr>
<tr><td>Pond (3 ha)</td></tr>
<tr><td rowspan="3">DNC</td><td rowspan="3">3</td><td>Duc Lam BF</td><td>Duc Lam brick factory in Nghia Son commune</td><td>8.5</td><td>Clay storage</td><td>Commune OK</td><td rowspan="3">100 % Temprary storage (reused for bricks factories)</td></tr>
<tr><td>Dong Bang BF</td><td>Nghia Lac commune</td><td>8</td><td>Clay and sand storage</td><td>Commune OK</td></tr>
<tr><td>Lach Giang</td><td>Thinh Long town</td><td>30</td><td>Clay and sand storage</td><td>Town OK</td></tr>
<tr><td rowspan="2">Lach Giang Estuary</td><td rowspan="2">1</td><td rowspan="2">Yard 1</td><td rowspan="2">Thinh Long Town</td><td rowspan="2">20</td><td rowspan="2">Pond surface</td><td rowspan="2">Commune OK</td><td>25% for backfilling low area and Casuarina trees plantation asked by commune</td></tr>
<tr><td>75% reused in project (filling the dikes+groins)</td></tr>
</table>

	2 optionals	Yard 2	Song Giang Brick Factory	20	Clay and sand storage	Brick Factory OK	15 km by boat from Lach Giang Project
		Yard 3	Ninh Cuong Brick Factory	6	Clay and sand storage	Brick Factory OK	25 km by boat from Lach Giang Project
Viet Tri Port	**1**	Ben Got ward	Lake inside Viet Tri Port area	3	Pond for aquaculture	Viet Tri port OK	100 % Definitive strorage to fill pond for urban and industrial projects development of commune
Ninh Phuc Port	**1**	Bich Dao Ward	People commitee pond near Ninh Phuc	2	Pond for aquaculture	Commune OK	100 % Definitive storage for the stadium project of commune
TOTAL				**98.5**			

Table 5: Disposal areas identified for corridor 3 projects

6. LOCATIONS OF SOIL DISPOSAL AREAS

The total quantity of material to be dredged and excavated is estimated to 4.05 millions of cubic meters (table 2). Reused materials quantity in Lach Giang project is estimated to 1 million m3.

A total of 3.2 million m3 will be evacuated:

- 2.75 million m3 will be temporary stored for later reused (clay by bricks factories and sand by construction companies)
- The remaining quantities are 0.83 million m3 and will be evacuated for definitive storage.

Within Corridor 3 projects, 12 Disposal areas have been identified (table 4):

- 9 selected soil disposal areas
- 2 disposal area into an existing ponds (Viet Tri port and Ninh Phuc Port)

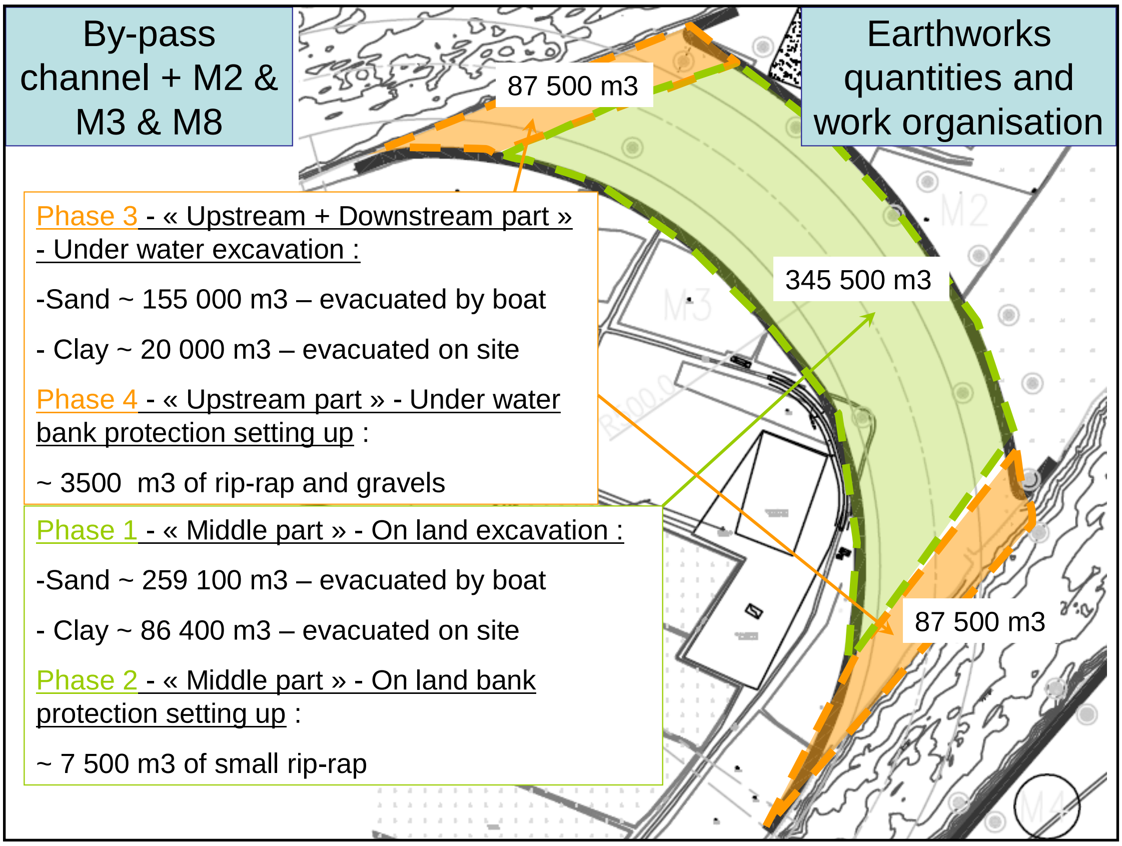
6.1. Mom Ro

On Mom Ro project 921 700 m3 will be excavated and dredged. Direct reused by brick factory will concern 100.000 m3. The remaining materials (821 700 m3) will be temporary stored for later reused for bricks production. Three disposal areas are selected:

- Soil disposal area of Truc Chinh Commune for temporary storage of clay to reused for bricks production. It concerns 7 ha of agricultural land with a capacity of 0.6 million m3 of material (clay + sandy clay).
- Nam Ninh brick factory storage areas for temporary storage of clay to be reused for bricks production. It has a capacity of 0.6 million m3 to dispose on 10 ha of exploited land for clay and now converted, for a part into ponds and agriculture and for other part into clay storage.
- If non-reusable materials for bricks production appear, they will be sent to Phuong Dinh Commune disposal area (described in Do Bui chapter).

The methodology of dredging and excavation is presented in the figures below.

Figure 4: Mom Ro work phases 1 and 2



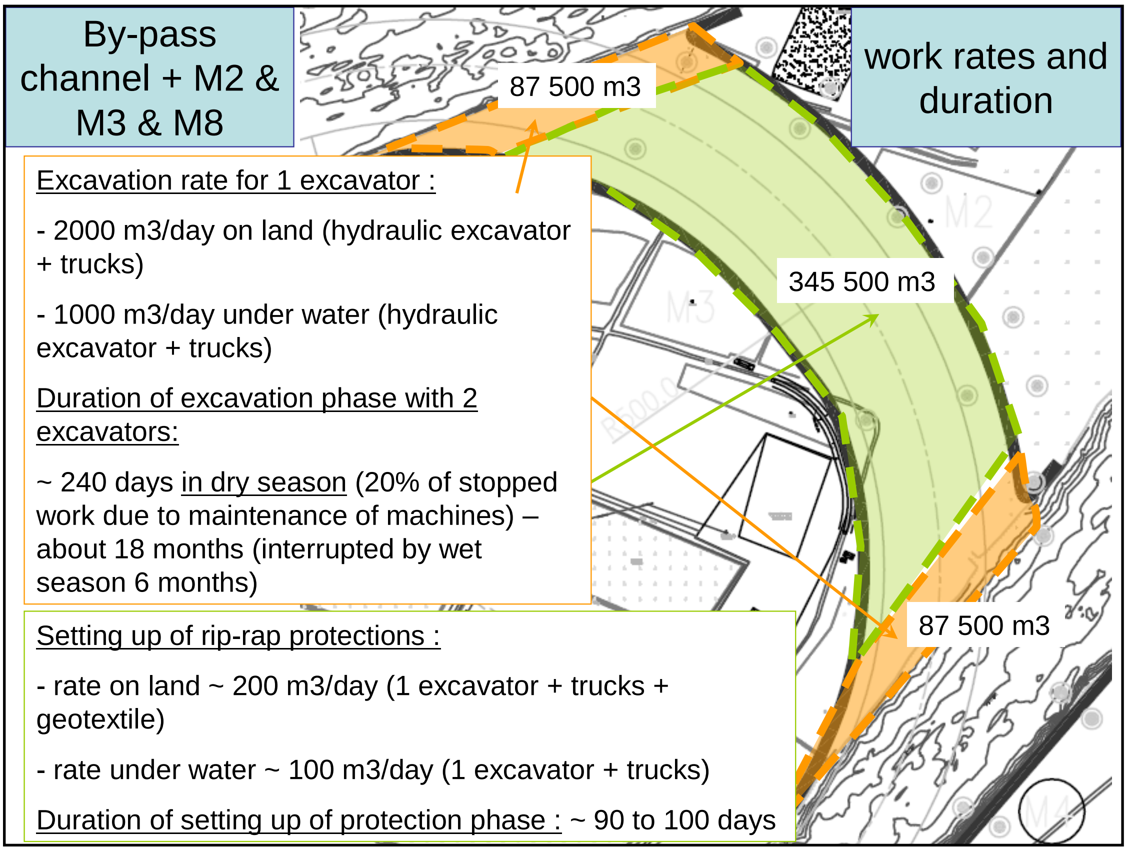


Figure 5: Mom Ro work phases 3 and 4

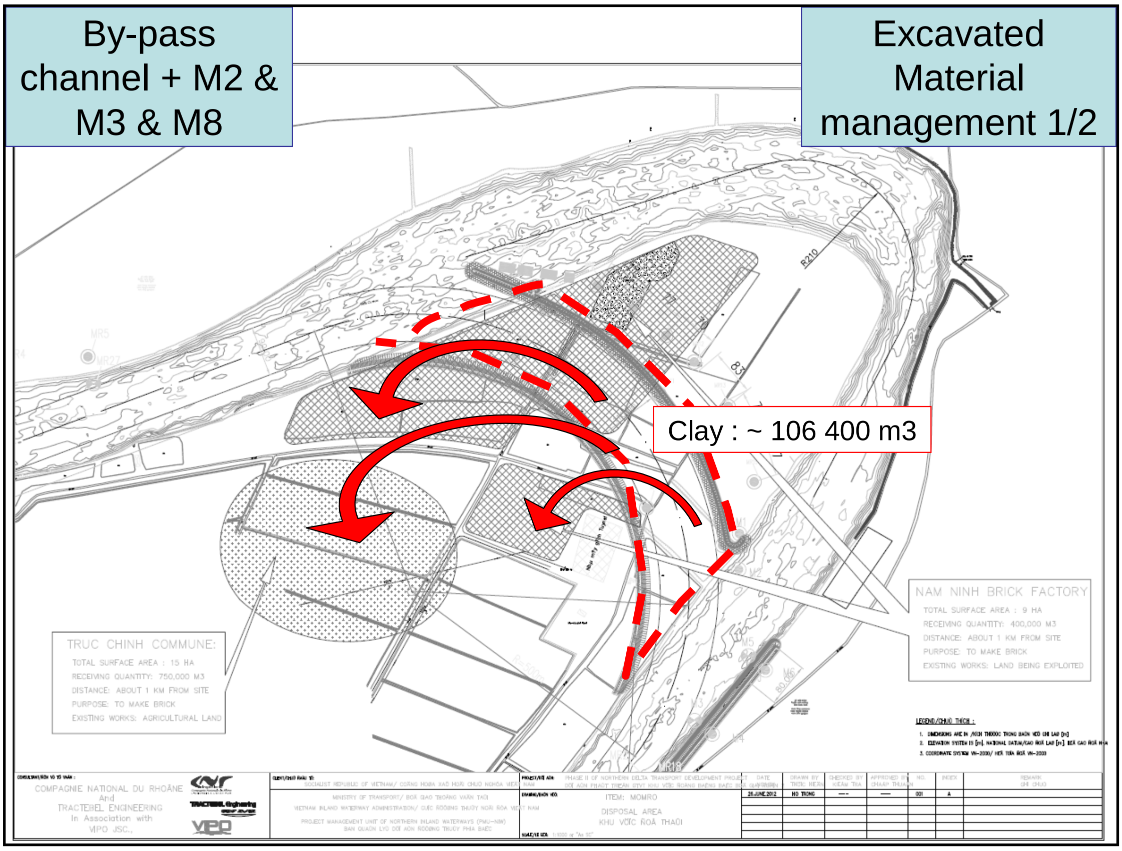


Figure 6: Mom Ro work phase 5

Figure 7: Mom Ro soil disposal area design – general view

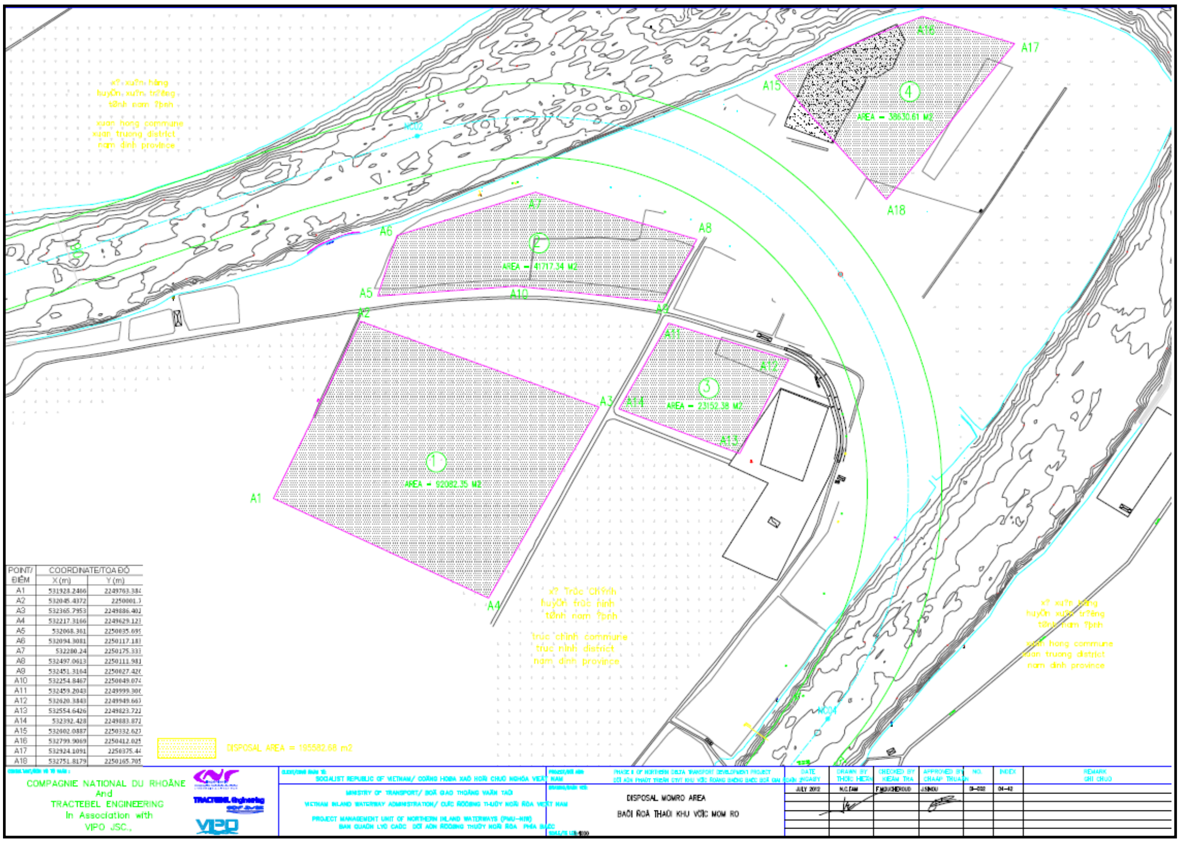


Figure 8: Mom Ro Truc Chinh commune soil disposal area

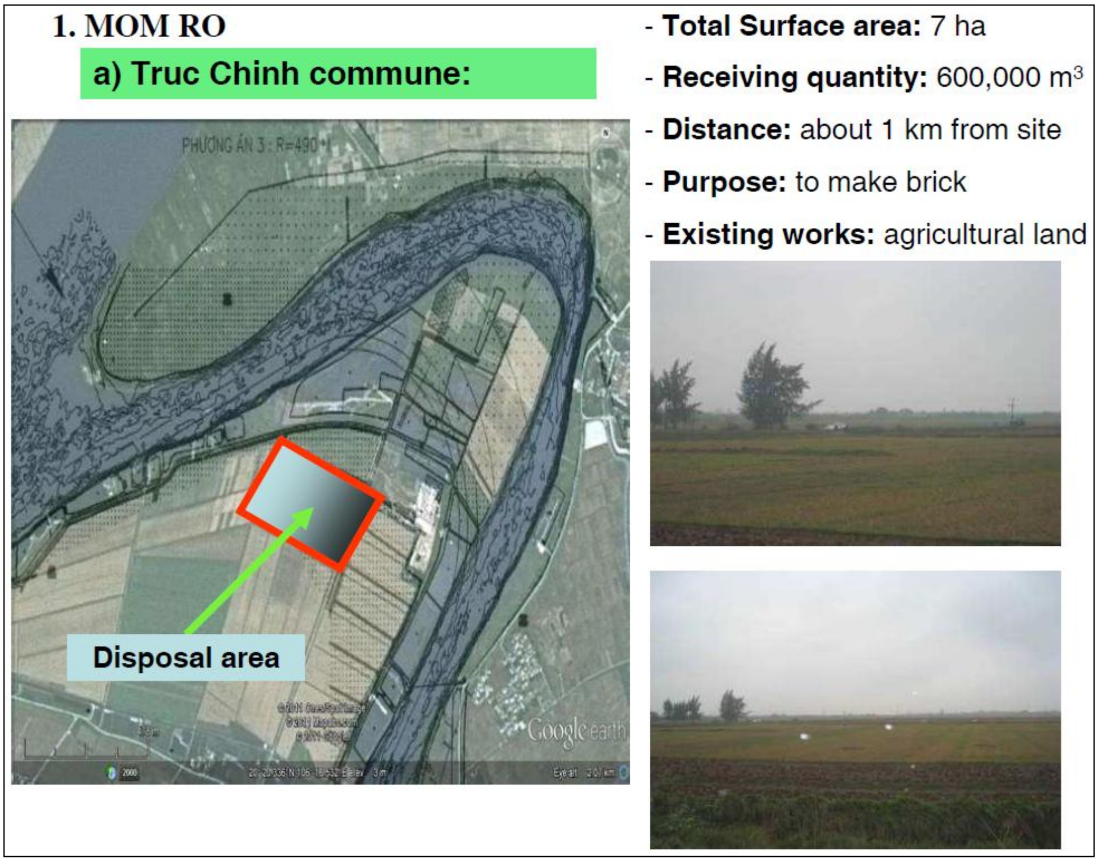


Figure 9: Mom Ro Nam Ninh brick factory soil disposal areas

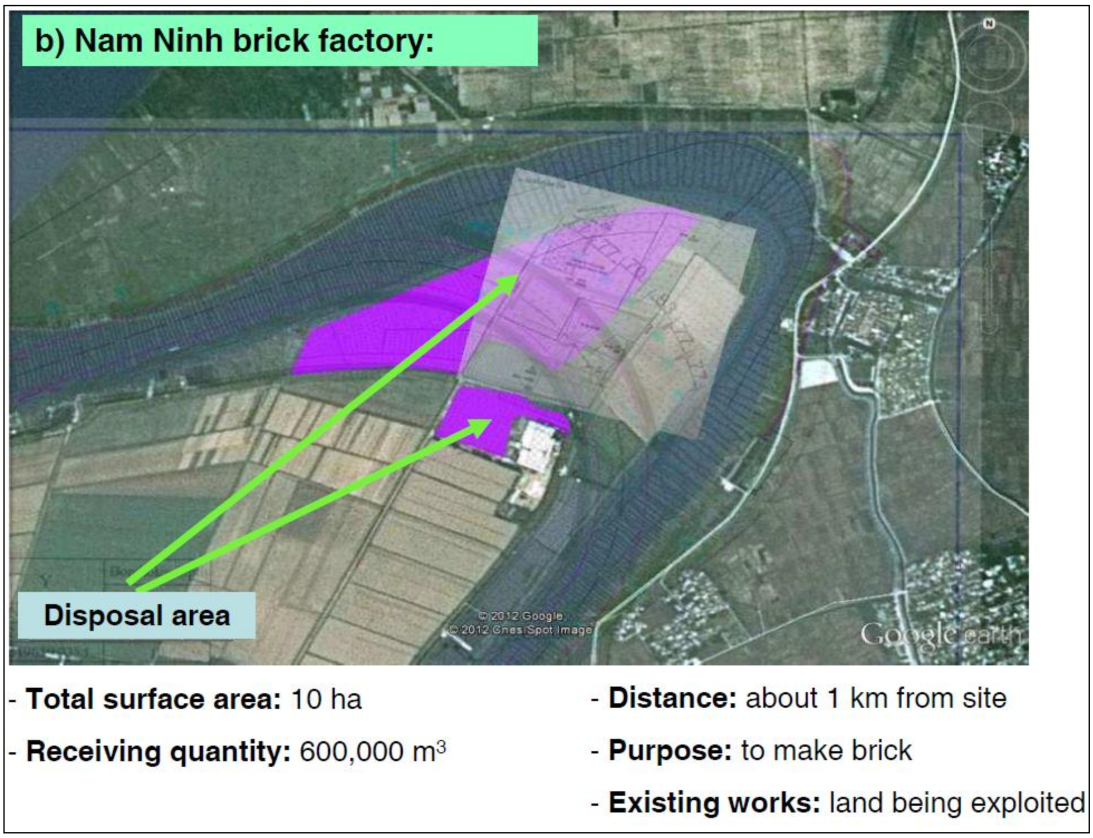
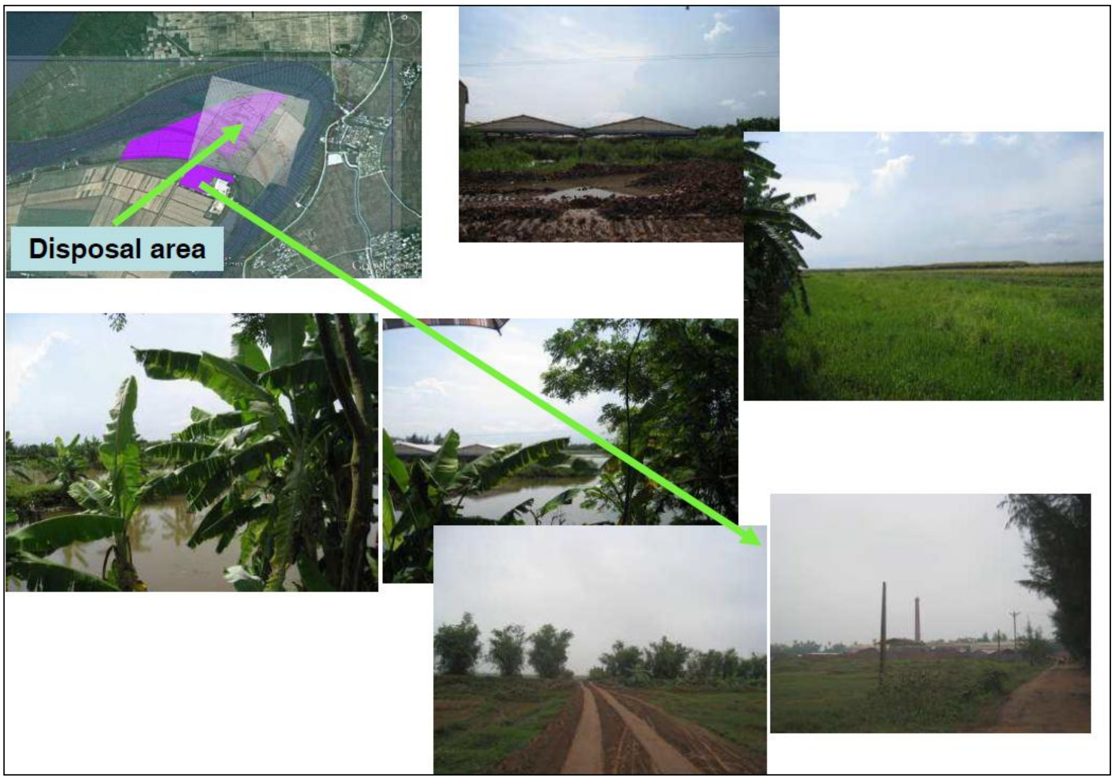


Figure 10: Mom Ro Nam Ninh brick factory soil disposal areas



6.2. Do Bui – km 134-137

On Do Bui project 485 150 m3 will be excavated and dredged. The material will be transferred on 3 soil disposal area of Phuong Dinh Commune to backfill 3 low agricultural areas. The commune and farmers ask for materials to increase agricultural yields.

35 ha are available for 900 000 m3 capacity and will be used at 53% by Do Bui Project. Non-reusable materials (sandy clay) for bricks production from Mom Ro project area will be also dispose on this site.

Figure 11: Phuong Dinh Commune soil disposal areas general view

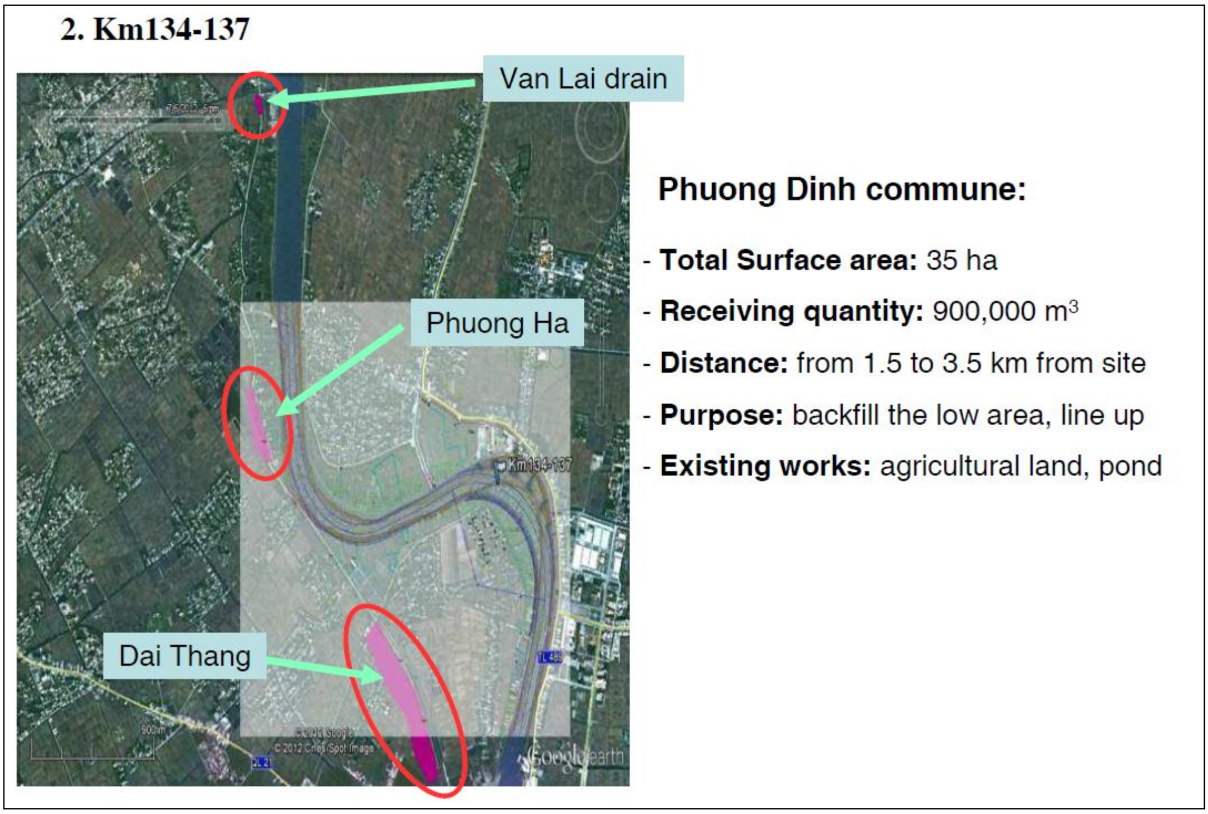


Figure 12: Do Bui soil disposal area - general design view

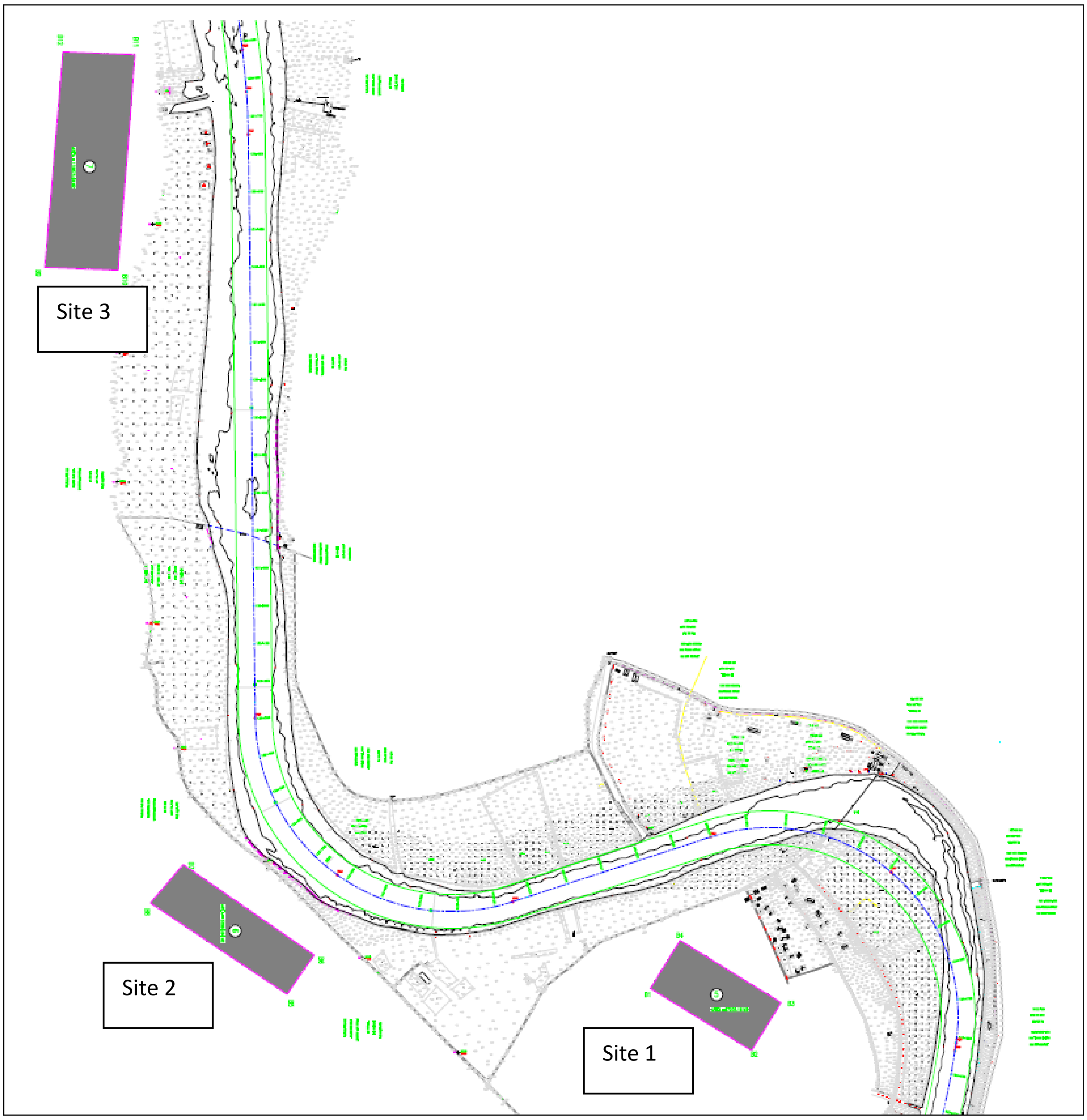


Figure 13: Do Bui soil disposal area n°1 design – general view

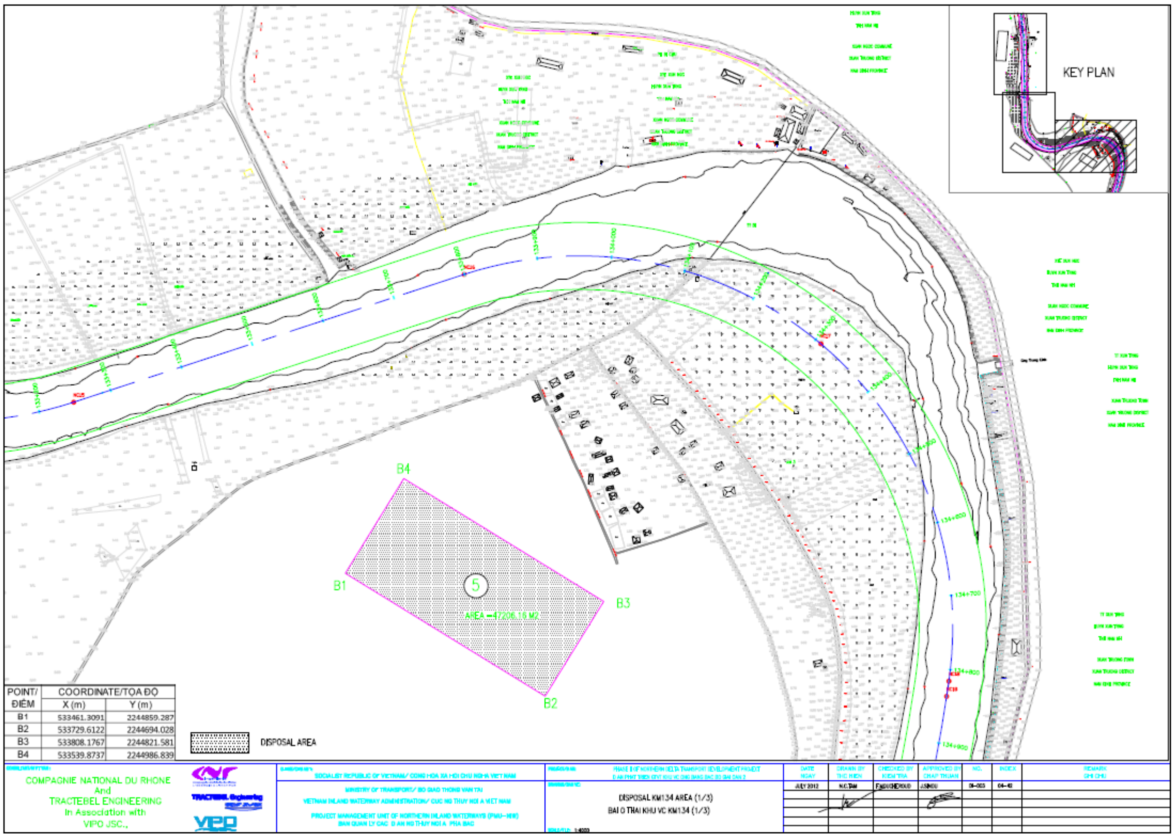


Figure 14: Do Bui soil disposal area n°3 design – general view

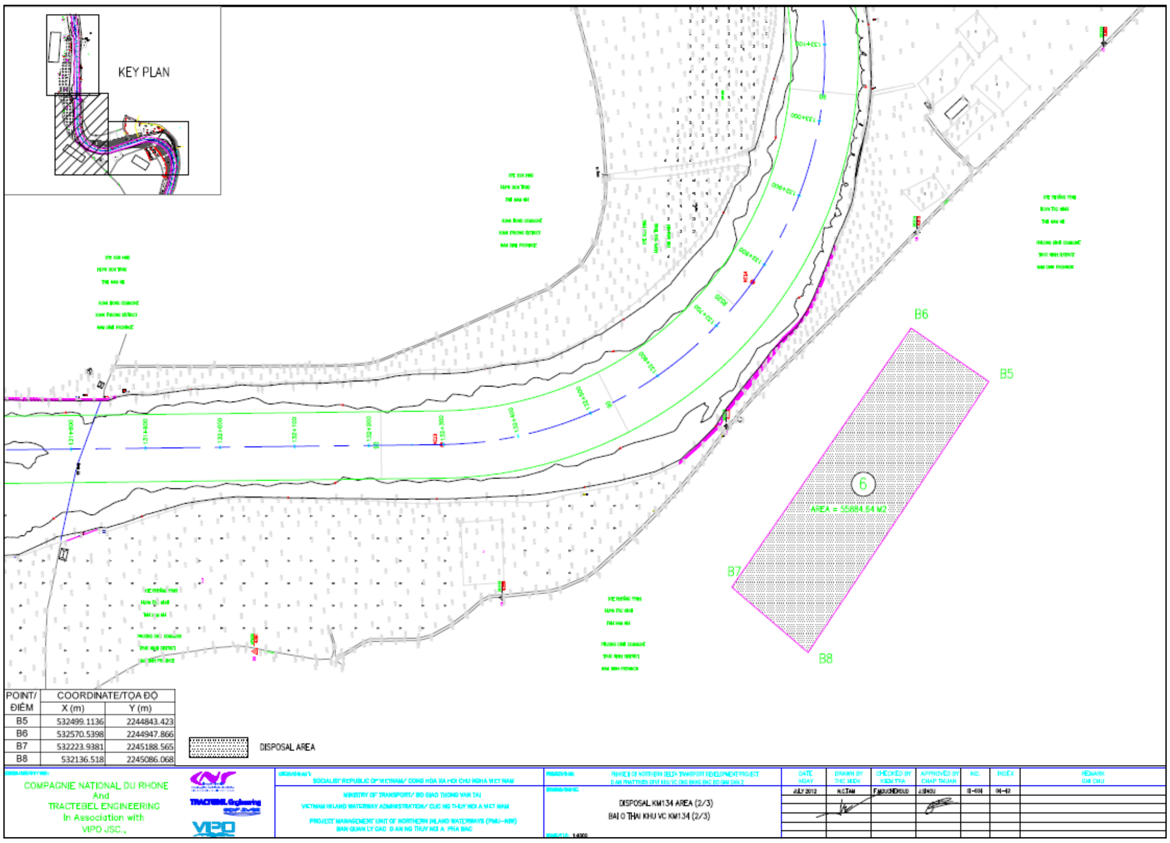
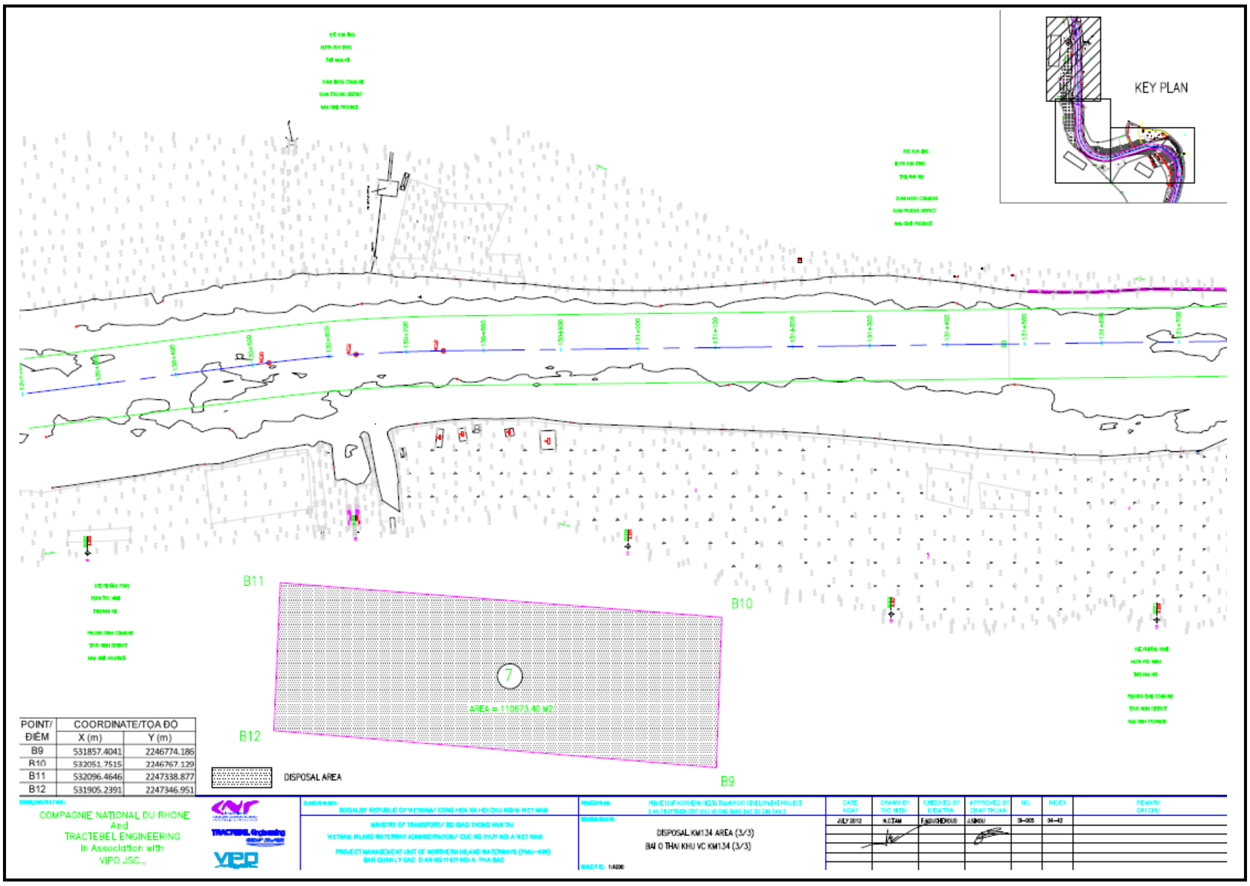


Figure 15: Do Bui soil disposal area n°3 design – general view



6.3. DNC Canal

Apart from the World Bank-financed activities under NDTDP, the Ministry of Transport or other government agencies at the Provincial and local level have no additional existing or planned activities in the Project area that would have a negative cumulative impact on Valuable Ecological Components relevant to Project activities – namely, water quality, aquatic biodiversity, and the quality of life of agricultural communities in the Project area and downstream.

The environmental impact of the DNC Canal Project itself has long term positive environmental impacts. The Project will adopt an innovative ecological engineering approach. A mixed bank protection scheme is proposed for the Project, based on ecological bank protection (vegetation capacity to fix the banks) and classical bank protection (rip rap), which will enhance biodiversity and protect against the effect of waves and erosion on the river banks and adjoining wetland, creating and/or restoring approximately 9 ha of aquatic and wetland habitats— an area 18 times greater than the lost habitat. Moreover, the transfer of a significant portion of dredged/excavated material to Lach Giang's Southern Disposal area will expedite the filling (and subsequent closure) of the disposal site, allowing for the plantation of income generating Casuarina trees on 30 ha of the disposal site. During the tree maturation period, this will provide favorable habitat for birds and invertebrates. It is anticipated that these ecological approaches to riverbank protection and disposal site closure – in providing examples of cost-effective and environmentally friendly mitigation solutions – will lead to a positive cumulative impact on "green" construction practices in Vietnam.

All sub-projects under the Parent project are already completed and operational. As such, there will be no additional cumulative environmental or social impacts ensuing from these sub- projects.

On DNC project a total of 1,561,315 m^3 will be excavated or dredged. The major part of this, 1,549,000 m^3, will be excavated or dredged for the Canal and Ship-lock construction. The earthworks for bridge and road will mobilize 11,700 m^3 of excavation and 27,800 m^3 of soil filling.

There are 3 disposal sites for DNC area, all of which have been approved and authorized by MONRE: 2 sites belonging to 2 brick factories, namely Duc Lam and Dong Bang, and a third site at the Lach Giang bypass access channel complex—constructed under NDTDP—Southern disposal area, which was presented in the project's EIA of 2013 and approved by MONRE. Thus, the project proposes using these 3 sites to store dredging/excavating materials in DNC construction area.

Existing status of disposal sites:

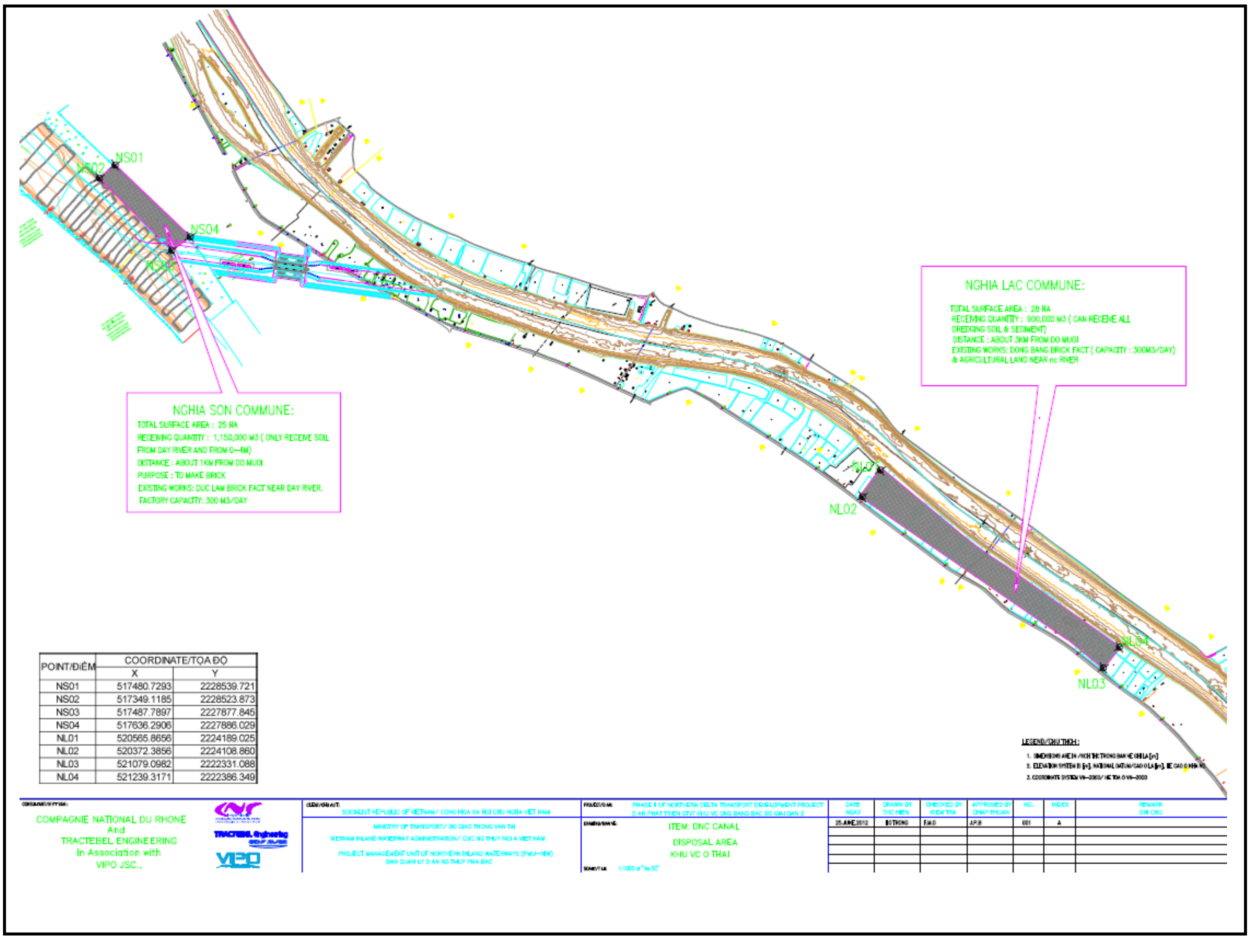
- Lach Giang: one disposal area in Southern with the purpose of casuarina plantation (financed by Project) was built to store dredging materials in the Lach Giang channel project. Although Lach Giang project was finished, however, the dredging materials in Lach Giang were not filled up yet. At the moment, it can store from 700,000 to 1,300,000 m^3 of additional material. The surrounding area is the sea, and this is located far away—1500m—from the nearest residential area (see the figure below).

- Duc Lam and Dong Bang brick factories: the land for disposal sites are belong factories. The land is borrowed from communes to produce bricks. Surrounding area is far away 500m from residential area.

The methodology of dredging and excavation is presented in the Detailed Design Report.

The materials will be transfer from dredging and excavation sites by trucks, boats and/or pipes lines depending of the technical choices of the contractor(s). The final dredging/excavating program as the execution drawings will be submitted by the contractor(s) to the Consultant for approval.

Figure 16: DNC canal soil disposal areas design – general view



POINT/ĐIỂM	COORDINATE/TỌA ĐỘ	
	X	Y
NS01	517480.7293	2228539.721
NS02	517349.1185	2228523.873
NS03	517487.7897	2227877.845
NS04	517636.2906	2227886.029
NL01	520565.8656	2224189.025
NL02	520372.3856	2224108.860
NL03	521079.0982	2222331.088
NL04	521239.3171	2222386.349

Figure 17: Duc Lam Brick factory soil disposal area design

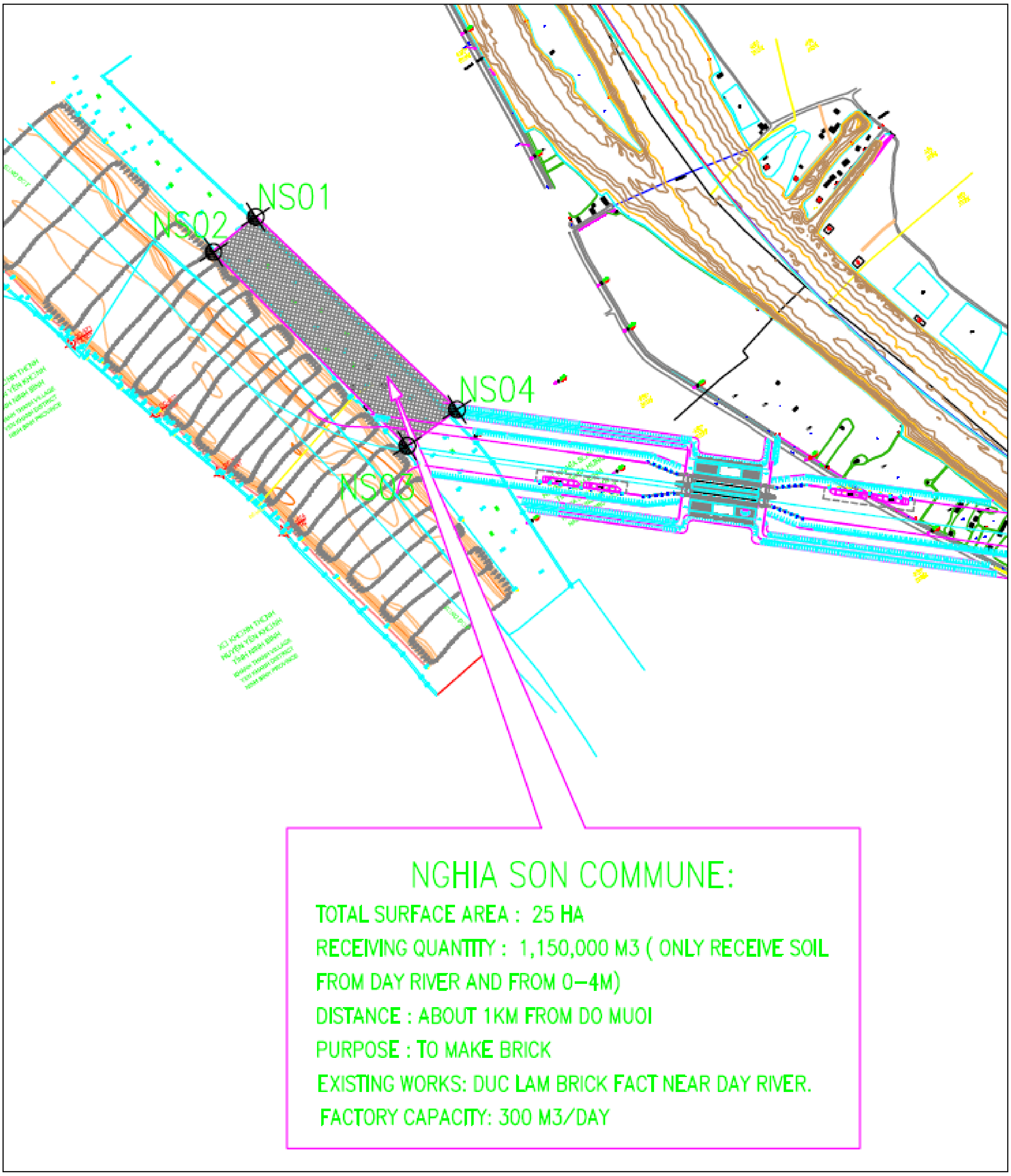
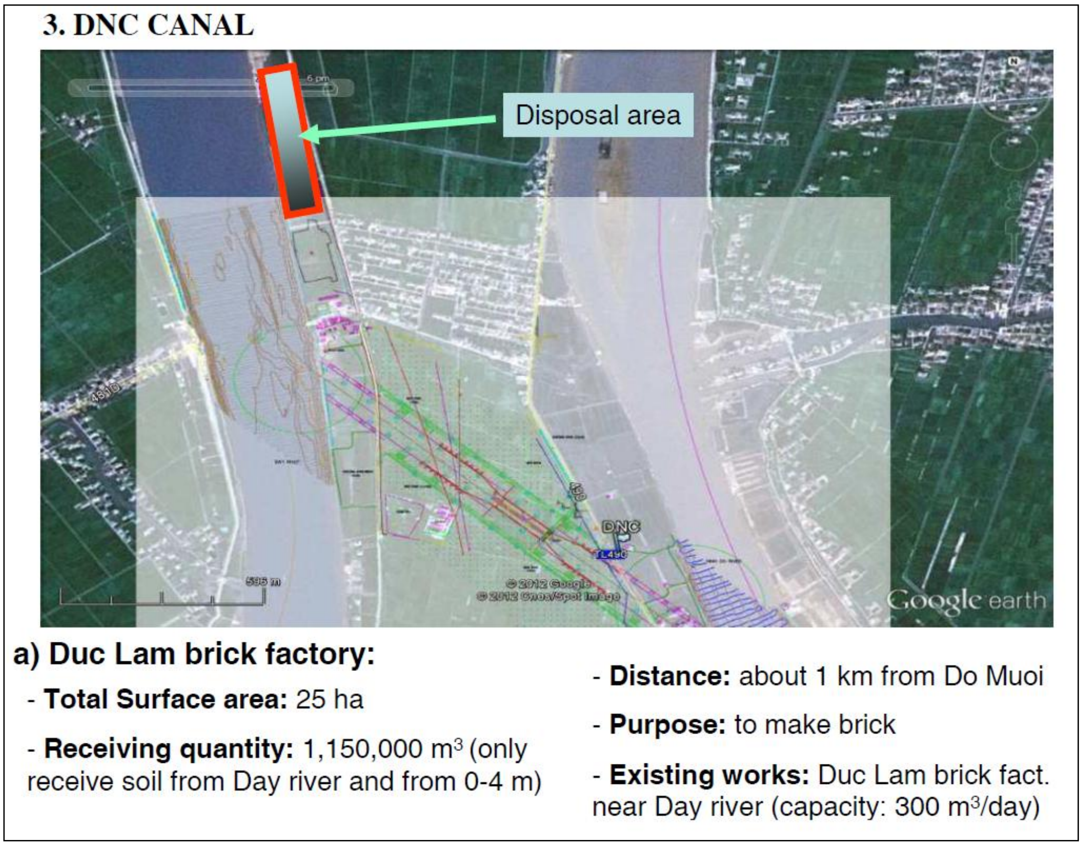


Figure 18: Duc Lam Brick factory soil disposal area



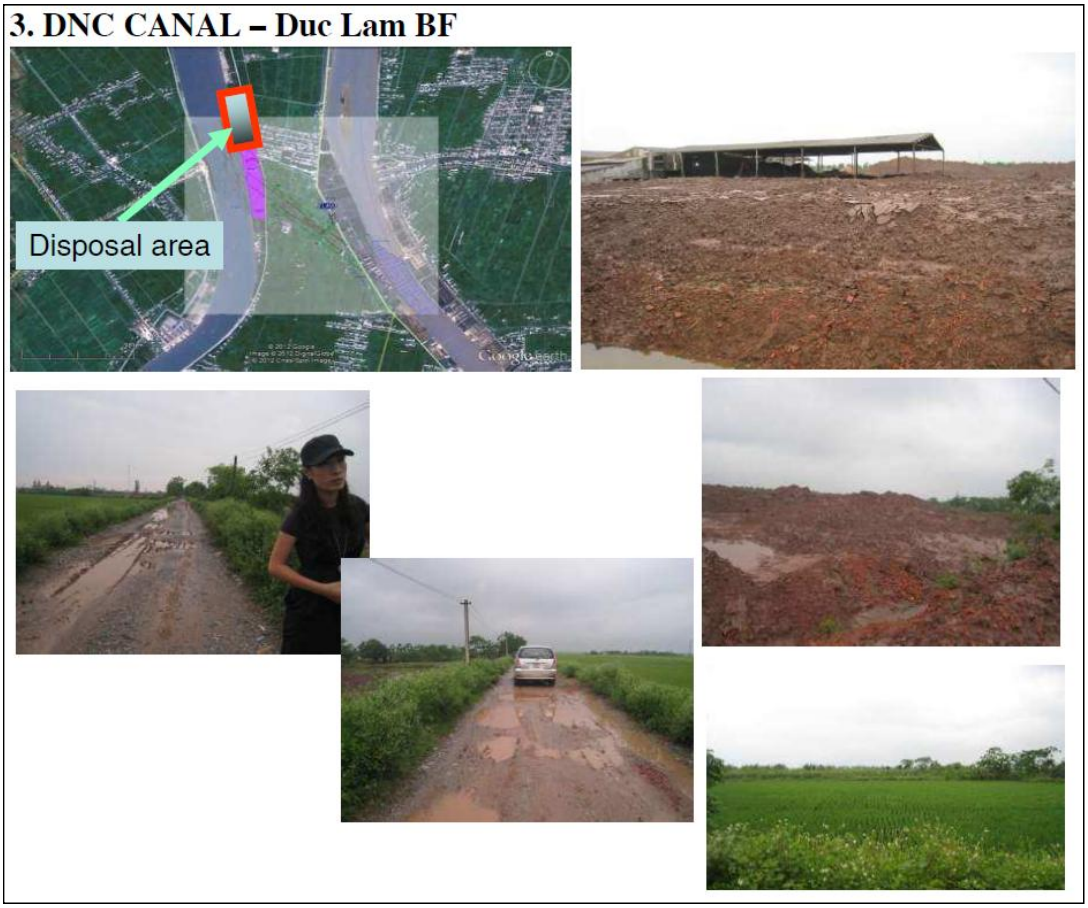


Figure 19: Nghia Lac commune soil disposal area design

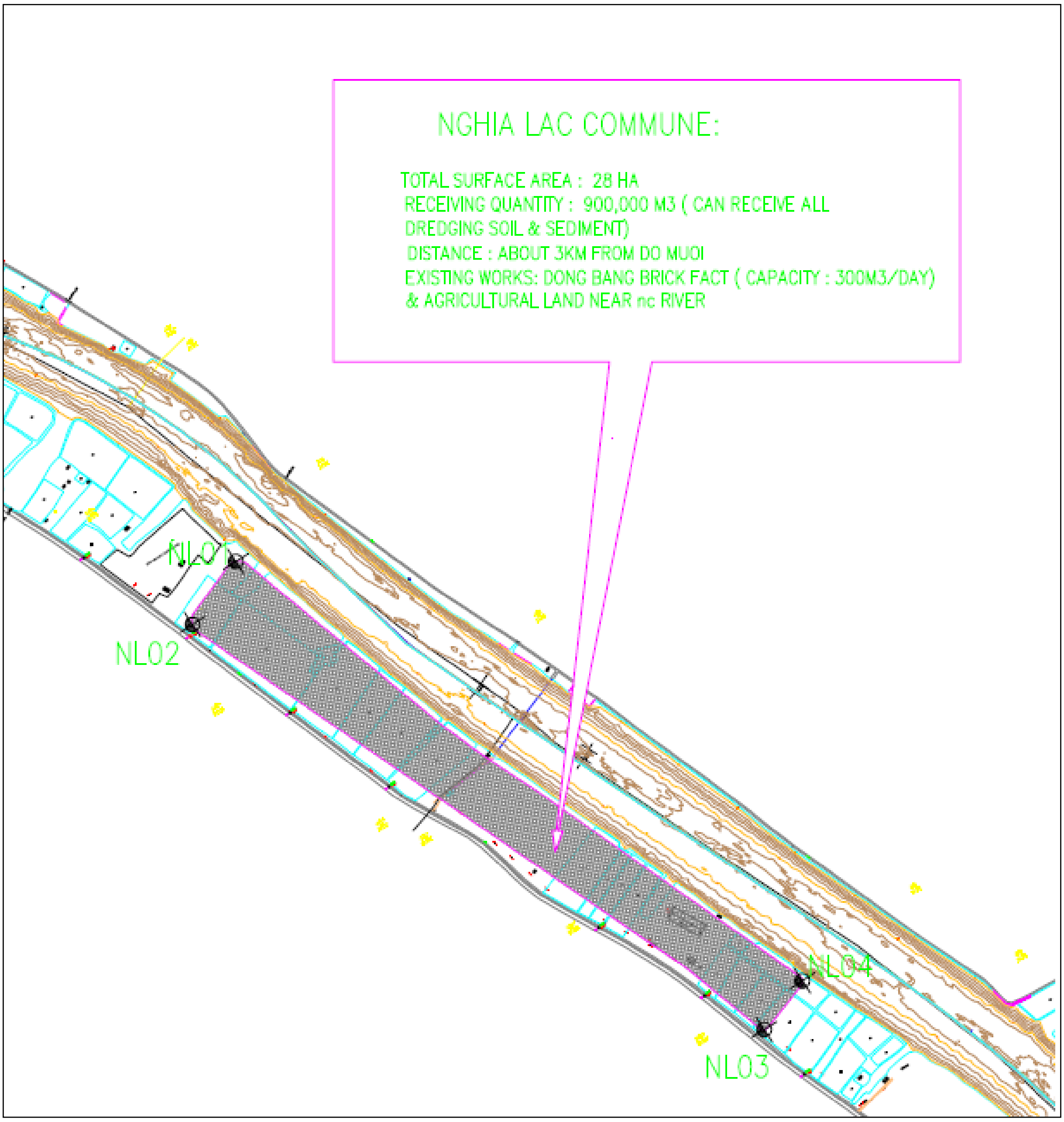
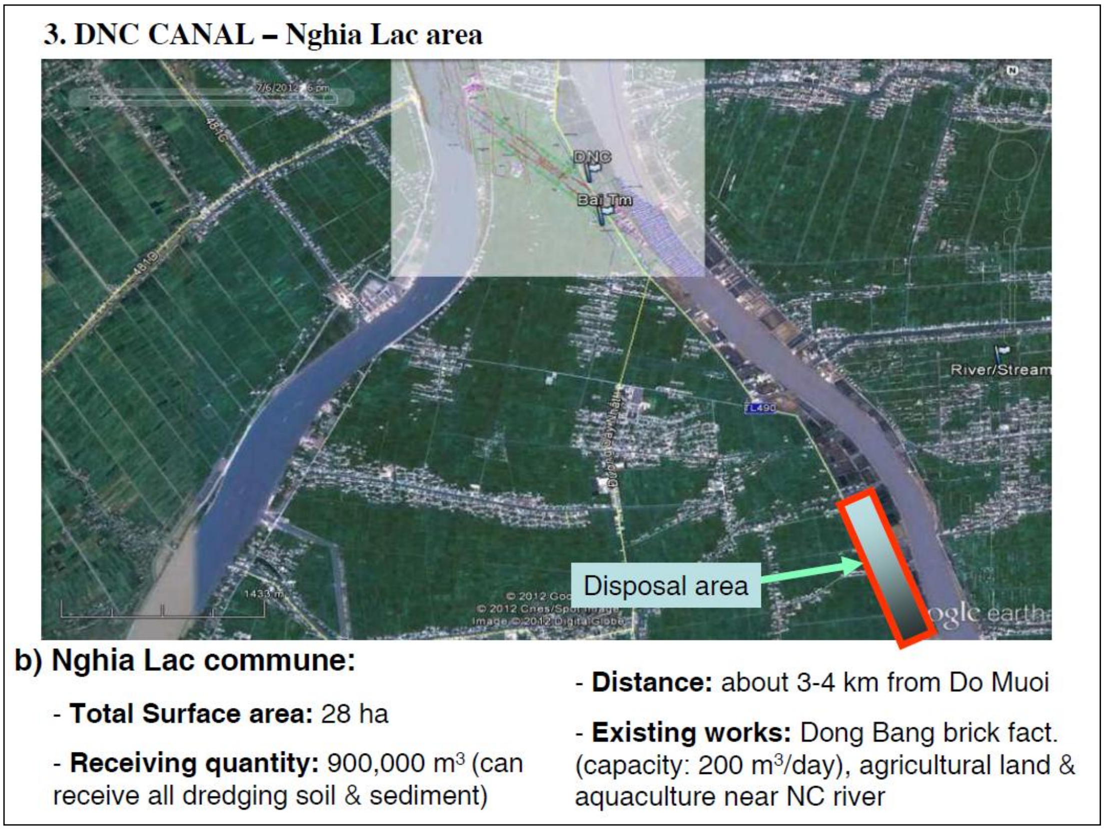
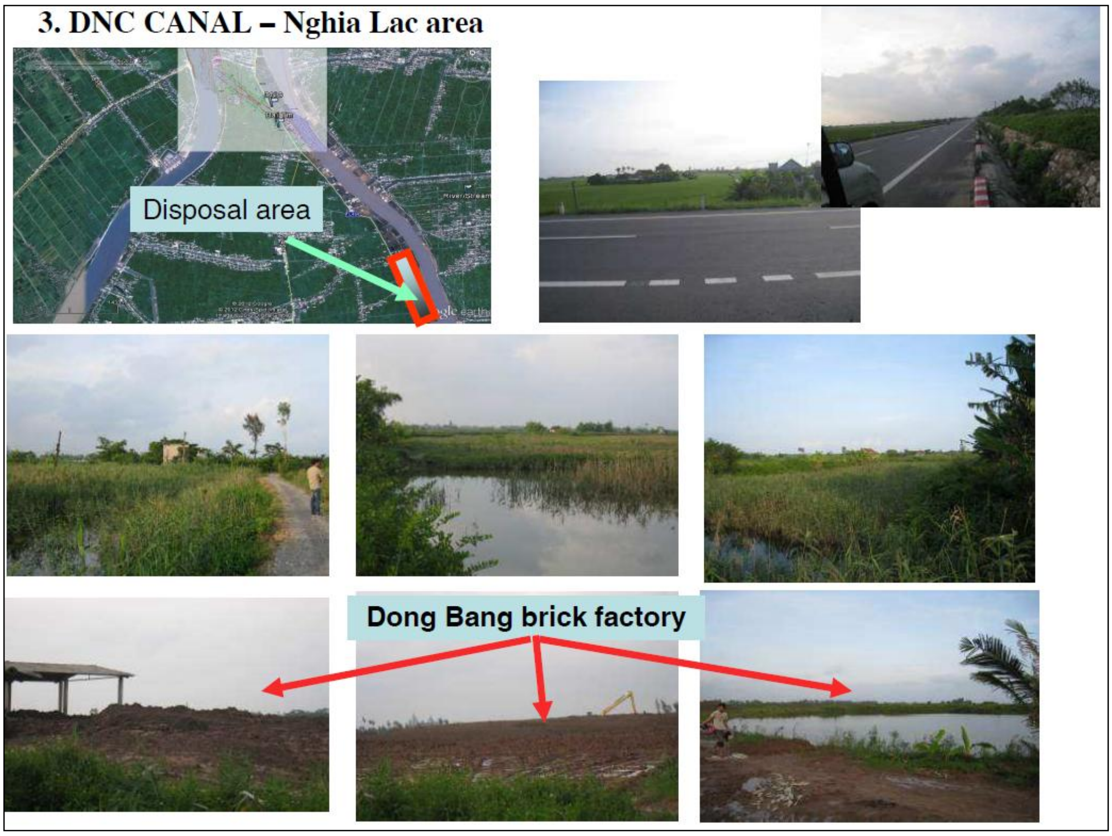


Figure 20: Nghia Lac commune soil disposal area





6.4. Lach Giang

On Lach Giang project 1.320.000 m3 will be excavated and dredged. From this quantity, 1.000.000 m3 will be used for the project construction (backfill the northern and southern bunds). The remaining quantity concerns 320.000 m3 of sandy clay and sand. 1 disposal area is selected:

- Soil disposal area of Thinh Long Town. This area of 20 ha and 400.000 m3 capacity is actually occupied by ponds and non-used land. The commune project is to backfill this low interest area with 320.000 m3 of materials coming from Lach Giang channel access and to plant Casuarinas trees on it.

Two other optional disposal areas have been identified but actually not selected because they are located too far away from Lach Giang (15 and 25 km) :

- Song Giang brick factory storage area (20 ha – 1.000.000 m3 capacity)
- Ninh Cuong brick factory storage area (6 ha – 500.000m3 capacity)

The general methodology of dredging and excavation is presented in the Detailed Design Report and will .be precise by contractor(s) – depending of the technical choices during execution drawing phase.

The materials will be transfer from dredging and excavation sites by trucks, boats and/or pipes lines depending of the technical choices of the contractor(s). The final dredging/excavating program as the execution drawings will be submitted by the contractor(s) to the Consultant for approval.

The following drawing shows the locations of the 2 bunds and the Thinh Long soil disposal area

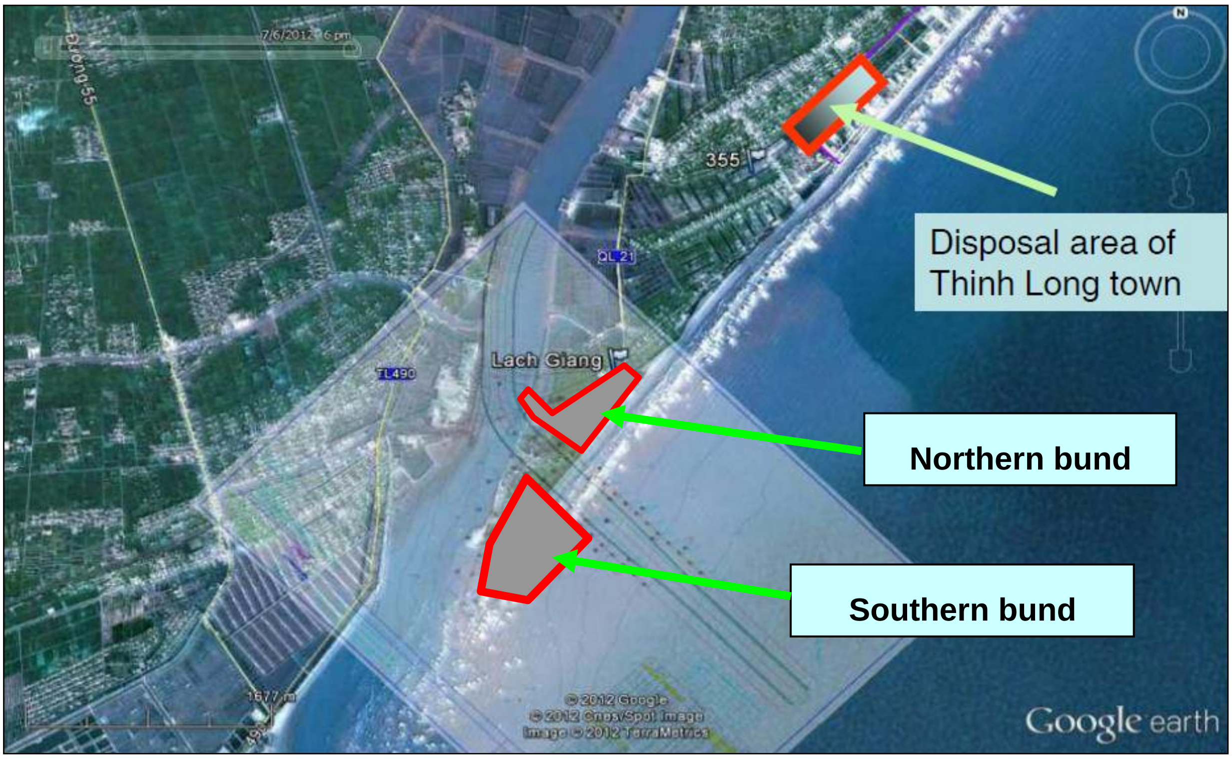


Figure 21 : General view of the 3 disposal sites in Lach Giang project

6.4.1. *Disposal materials in Southern and Northern bunds of Lach Giang breakwaters*

The main quantities of materials will be used to fill the southern and Northern bunds of the breakwaters structure. It represents 1.280.000 m3 (76 %) of the excavated/dredged materials.

The following drawing shows the locations of the 2 bunds.

Figure 22 : Southern and Northern Disposal sites/bunds in Lach Giang breakwaters project

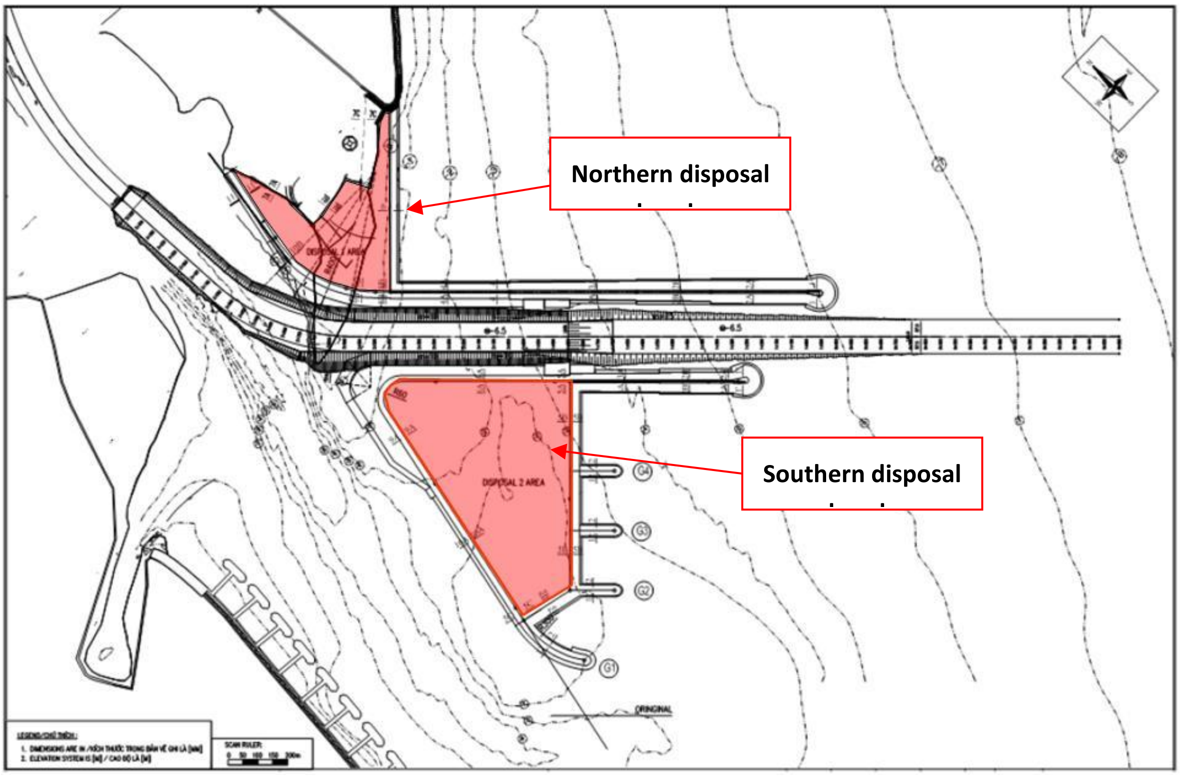
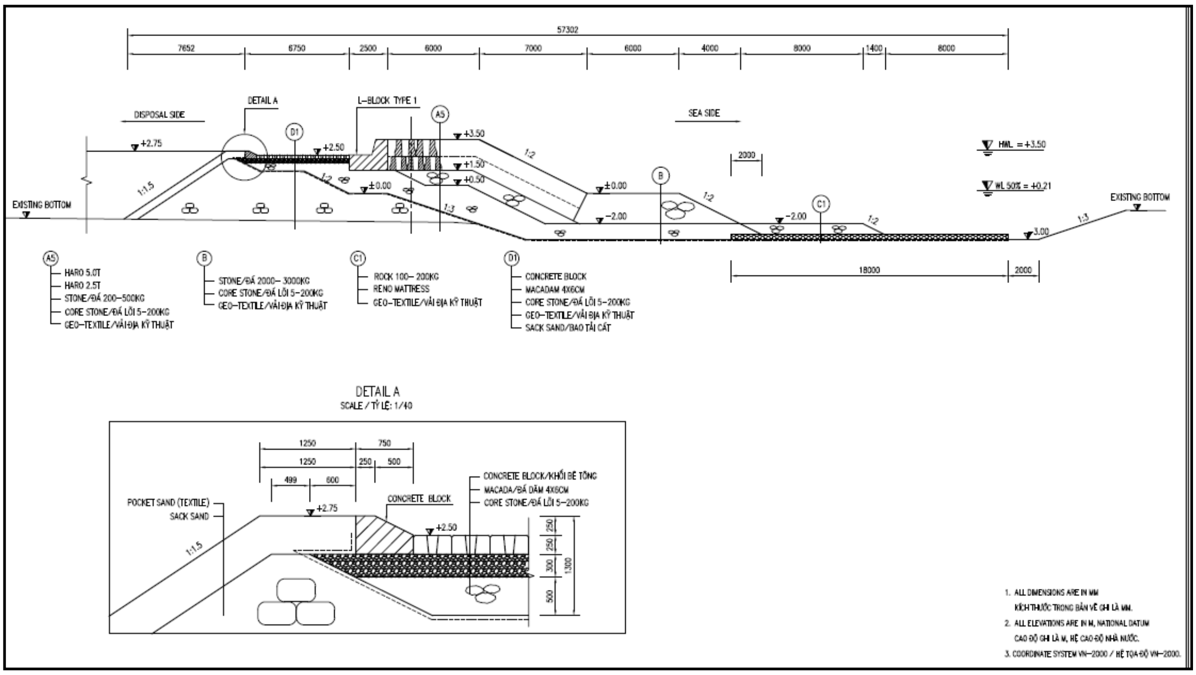


Figure 23 : Disposal area structure – typical cross section



6.4.2 Remaining materials Disposal Site in Thinh Long Town

The remaining quantity of excavated/dredged materials will be dispose on Thinh Long Town disposal site. This area of 20 ha – proposed by Thinh Long Commune during the public consultation will be used to dispose 320.000 m3 of sandy/clay materials. The commune wants plant Casuarinas trees on this actually non-used land.

Figure 24: Thinh Long Town soil disposal areas

6.4.3 *Optional Remaining materials Disposal Sites*

Two other sites have been identified as optional disposal sites – but not selected because far away (15 to 25 km) from the excavation/dredging area.

- Song Giang brick factory storage area: 20ha / 1.000.000m3 capacity / 15km from Lach Giang
- Ninh Cuong brick factory storage area: 6ha / 500.000m3 capacity/25km from Lach Giang

Figure 25: Song Giang brick factory optional soil disposal area

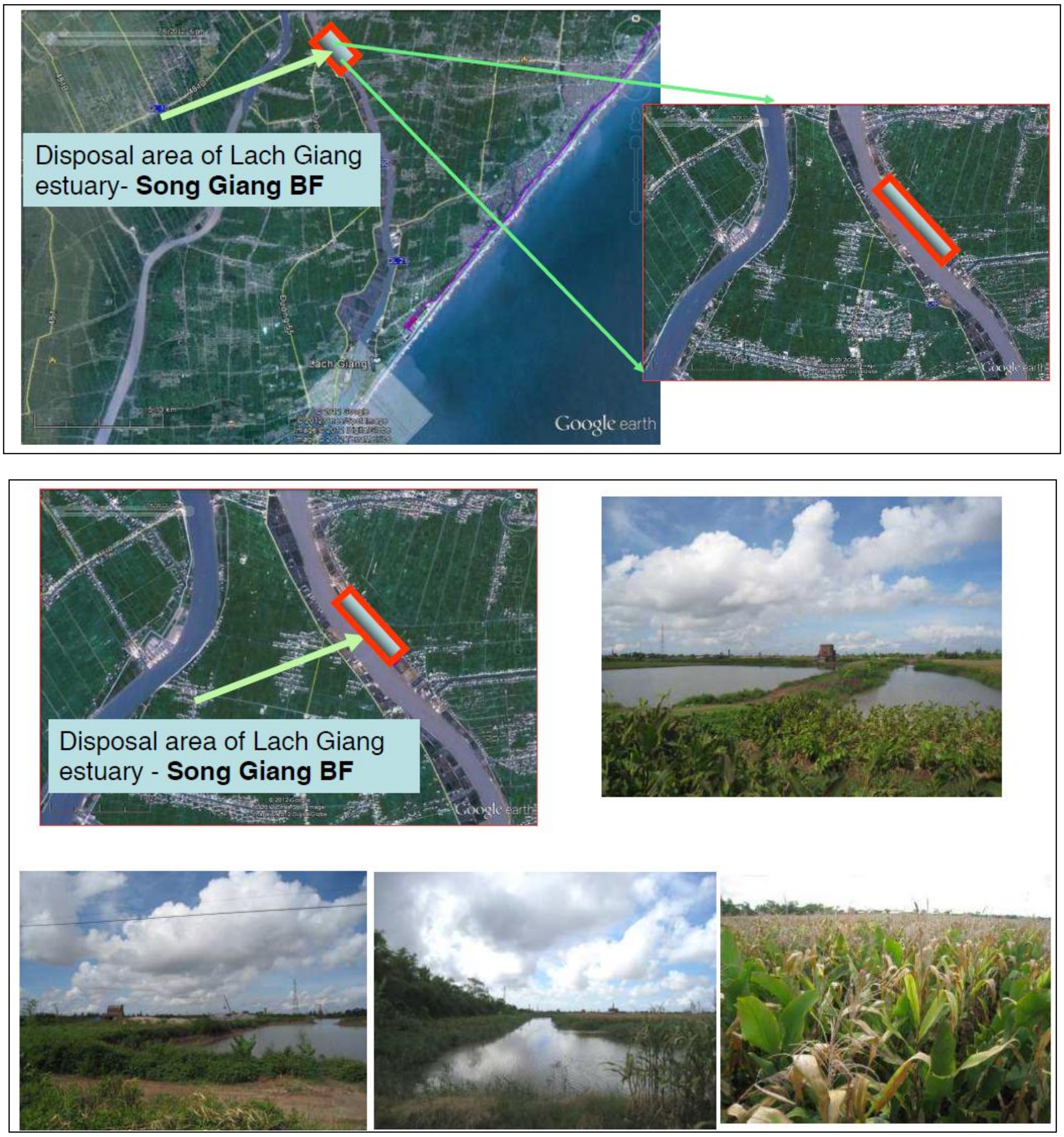
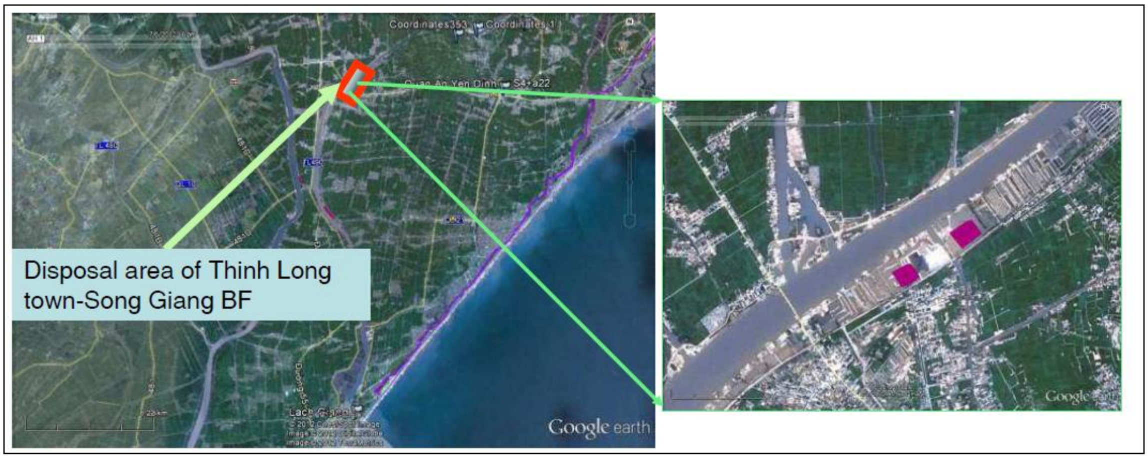


Figure 26: Ninh Cuong brick factory optional soil disposal area



4. LACH GIANG – Disposal area at Ninh Cuong brick factory – Pics at site

6.5 Ninh Phuc Port

On Ninh Phuc Port improvement project 16.100 m3 will be excavated and dredged. The materials will be evacuated for definitive storage. One disposal area is selected:

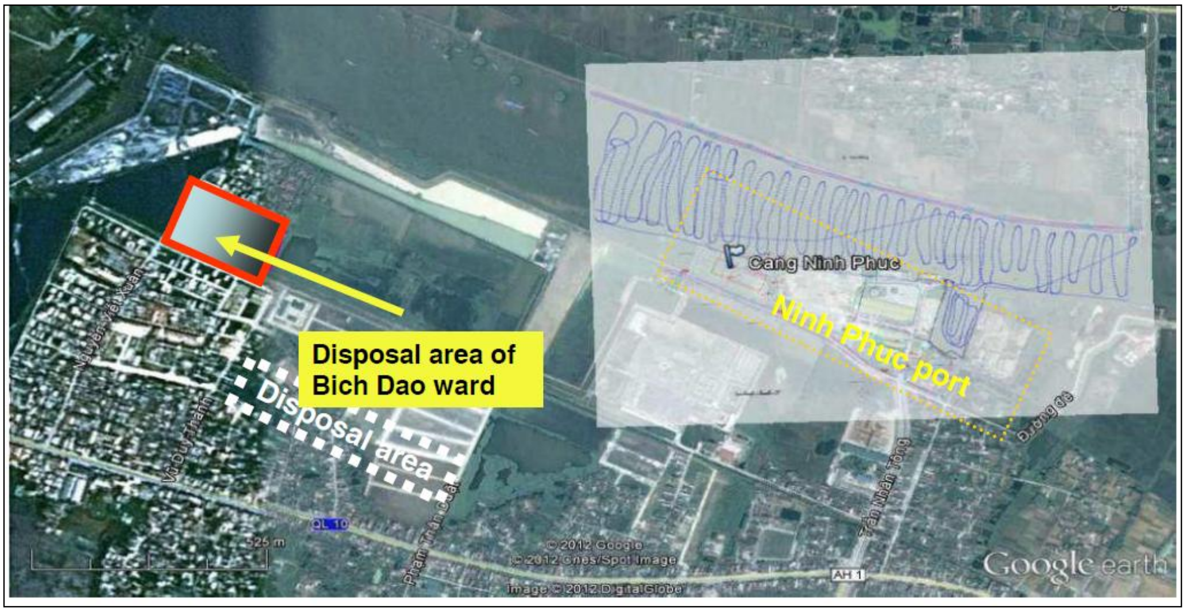
- Bich Dao ward and pond. It concerns 2 ha of ward and pond for 20.000 m3 capacity. The commune asks for materials and will transform the ward and pond after backfilling into a football stadium.

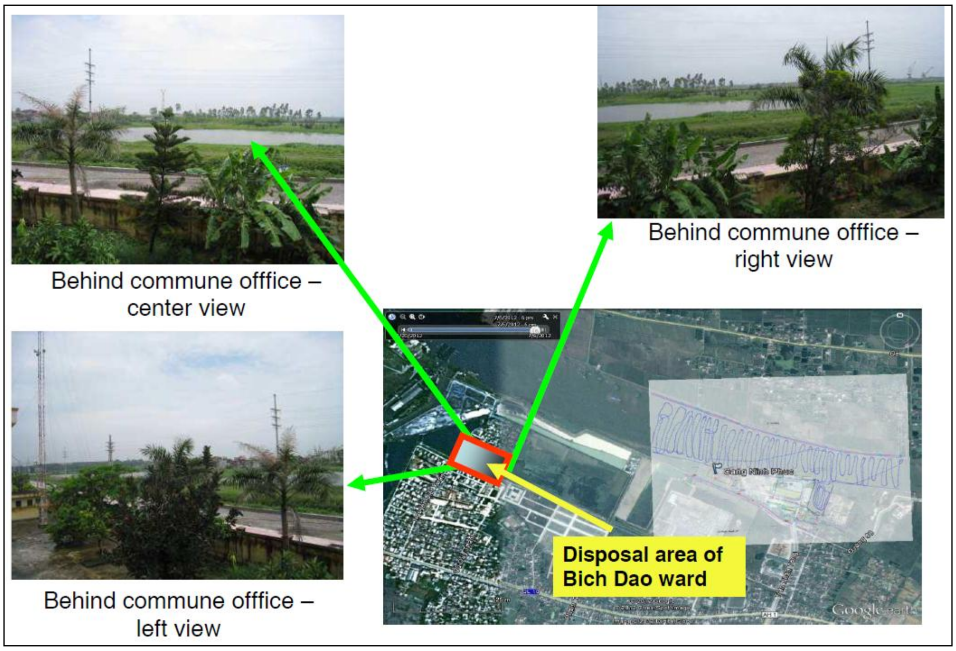
The general methodology of dredging and excavation is presented in the Detailed Design Report and will be precise by contractor – depending of the technical choices during execution drawing phase.

The materials will be transfer from dredging and excavation sites by trucks, boats and/or pipes lines depending of the technical choices of the contractor(s). The final dredging/excavating program as the execution drawings will be submitted by the contractor(s) to the Consultant for approval.

The following drawing shows the locations of the soil disposal area near Ninh Phuc Port.

Figure 27: Bich Dao ward soil disposal area location





6.5. Viet Tri Port

On Viet Tri Port improvement project 10.300 m3 will be excavated and dredged. The materials will be evacuated for definitive storage. One disposal area is selected:

- Viet Tri port pond/lake. It concerns3 ha of pond for 70.000 m3 capacity.

The material will be used to back fill a part of the pond which is expected to backfill to increase industrial surfaces available in this area.

The general methodology of dredging and excavation is presented in the Detailed Design Report and will .be precise by contractor – depending of the technical choices during execution drawing phase.

The materials will be transfer from dredging and excavation sites by trucks, boats and/or pipes lines depending of the technical choices of the contractor(s). The final dredging/excavating program as the execution drawings will be submitted by the contractor(s) to the Consultant for approval.

The following drawing shows the locations of the soil disposal area near Viet tri Port.

Figure 28: Viet Tri Port improvement soil disposal area location

Figure 29: Views of Viet Tri Port improvement soil disposal area

7. ENVIRONMENT AND SOCIAL SENSITIVITY / IMPACTS RISK FOR MATERIALS MANAGEMENT

7.1. Mom Ro

Loss of agricultural Land

Modification of local circulation

Local modification of irrigation system

No particular sensitivity for water quality

7.2. Do Bui – km 134-137

Loss of mulberry trees plantations on the dredging/excavating area

Improve surface of agricultural land in the disposal areas

Presence of supply water pumping station on left side of Ninh Co river with very low risks of disturbing by dredging.

No water supply in or near the disposal areas

No irrigation system in or near the disposal areas

7.3. DNC Canal

Loss of agricultural Land

Modification of local circulation

Local modification of irrigation system

No water supply in or near the disposal areas

7.4. Lach Giang

No water supply in or near the disposal areas

No irrigation system in or near the disposal areas

No particular sensitivity for water quality near the disposal areas

7.5. Ninh Phuc Port

Loss of aquaculture pond

No particular sensitivity for water quality near the disposal areas

No water supply in or near the disposal areas

No irrigation system in or near the disposal areas

7.6. Viet Tri Port

Partial Loss of industrial pond

No water supply in or near the disposal areas

No irrigation system in or near the disposal areas

8. ENVIRONMENTAL MANAGEMENT

8.1. Environmental Management within Project Management Unit

8.1.1. Overview

Pursuant to the basic environmental laws of Viet Nam and associated regulations and further to various requirements of the World Bank with respect to loans for infrastructure projects, the Corridor 3 Project is proposed to include key elements of environmental management. Within the structure of the Project Management Unit is an Environmental Management Section. This Section describes specific responsibilities to provide the Project Management Unit with the appropriate staff and resources to implement, supervise and report on appropriate environmental monitoring activities during Project implementation, as well as to recommend initiation of mitigation measures and conduct the evaluation of these measures and any other contractor activities that impact on environmental quality issues.

The overall objective of the Environmental Management activities is to ensure the Corridor 3 Project is implemented and completed with minimal impact to the aquatic and associated terrestrial environments defining the Lo River (Viet Tri Port), the Ninh Co River and he Day River.

The Environmental Impact Assessment of the Corridor 3 Project identified various aspects of the Project that may impact the aquatic and/or terrestrial environments. On the basis of this Assessment, various mitigation measures have been identified with the objective of minimizing the scope and/or timing of identified impacts. These mitigation measures ranged from positioning of disposal sites to timing of Project activities. To assess the scope and/or timing of any impacts, various environmental monitoring components have been identified and outlined for each Project Area.

The purpose of the Environmental Management Section of the Project Management Unit is to implement, supervise and report on the environmental monitoring activities; assess the effectiveness of mitigation measures and then to provide recommendations to further reduce impacts to the aquatic and terrestrial environments.

A third critical activity of the Section is the preparation and provision of reports to the Project Management Unit director/management board, as well as to the national and provincial Ministries of Natural Resources and Environment, local People's Committees, World Bank, etc. These reports will serve to ensure all stakeholders receive timely information and provide the local communities with an understanding that the Project is being implemented within appropriate environmental controls.

9. INSTITUTIONAL STRUCTURE

To assist the Project Director in management of the environmental aspects of the Project, the Project Management Unit has established an Environmental Management Office within the main project office, with an Environmental Management Section Head reporting directly to the Project Director. The responsibilities of the Environmental Management Section Head include:

- Providing general management and supervision of staff comprising the Environmental Management Section;
- Reviewing and approving all environmental monitoring reports prepared for presentation and submission to the Project Director, Project Management Unit, national and provincial Ministries of Natural Resources and Environment (MONRE) and other entities (e.g., local People's Committees, World Bank).
- Ensuring all environmental monitoring data are collected within the Standard Operating Procedures set by the Project and the data meet project criteria in Project areas.
- Ensuring all environmental monitoring is conducted within appropriate time constraints and project schedules.
- Ensuring all Environmental Management staff, outside contract staff and/or outside groups retained to perform specific monitoring tasks (e.g., laboratory analyses) meet the necessary specifications, training and requirements of the Project.
- Instituting workshops or information seminars for Environmental Management staff, Project Management Unit staff, outside contract staff, Project contractors and/or other outside groups as part of overall provision of information regarding the environmental aspects and constraints of the Project.
- Instituting seminars for and/or information meetings with local People's Committees to provide a mechanism for reporting on the environmental aspects of the Project and to ensure there is a 'feed-back' loop of information regarding local concerns related to environmental impacts of the Project activities.

As required, the Project Management Unit will ensure there are sufficient staffs with appropriate qualifications, assigned to the Environmental Management Section. Each River section will have one person acting as supervisor for environmental management activities within that River. This assumes Project activities will be implemented within all six River sections at the same time; otherwise, staff can be shifted to meet project demands.

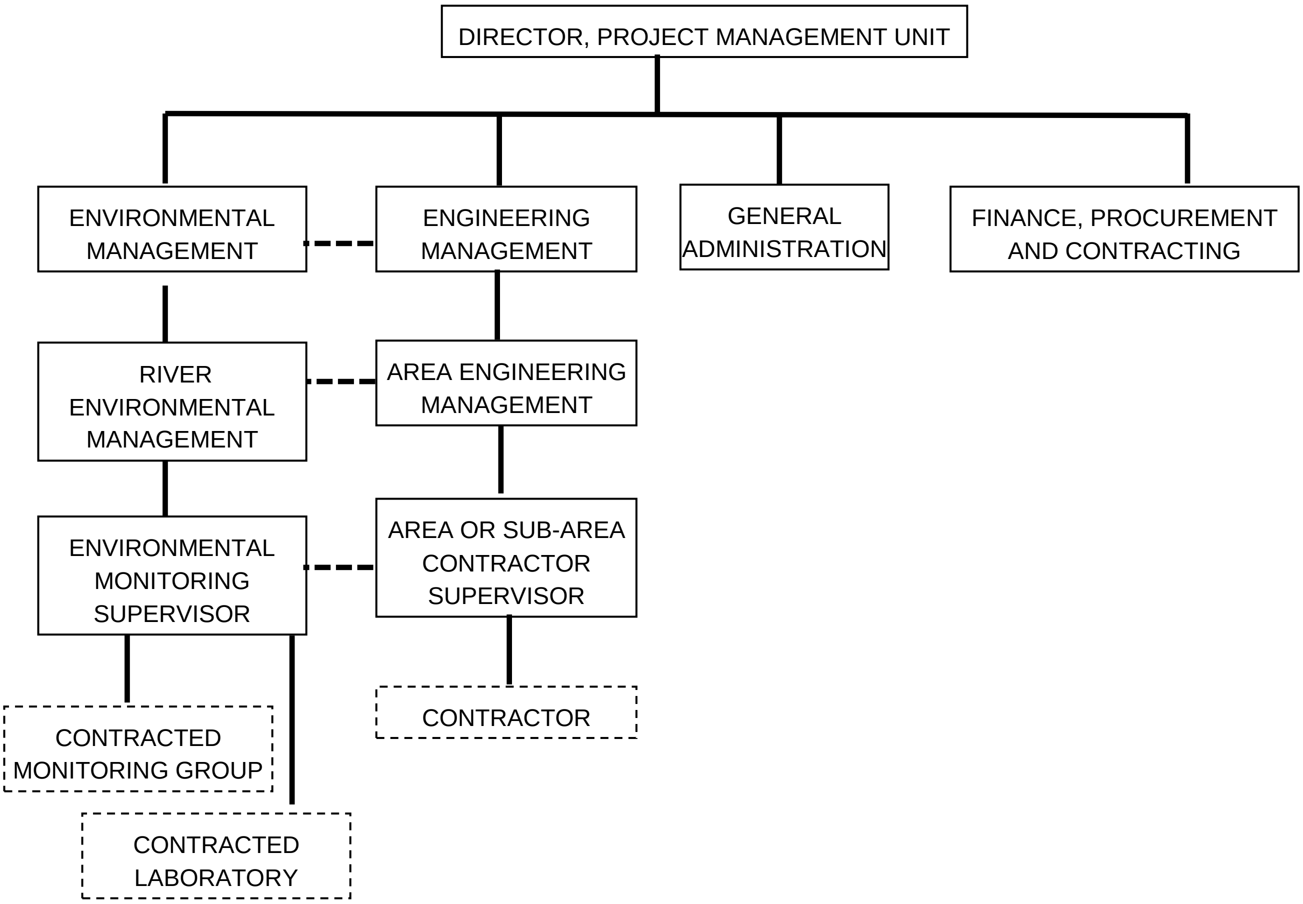
A person will be designated for each Project Area to supervise monitoring activities. Again this assumes simultaneous activities in several areas; alternatively, fewer staff can be appointed if Project activities are implemented on a reduced schedule.

A key aspect of the Environmental Management Section duties will be to:

- Initiate environmental monitoring at appropriate times within the defined impact zone of each Project Area.
- Contract with outside groups to conduct the actual sample collection and laboratory analyses.
- Monitor the results of the laboratory testing to ensure results are reported on a timely basis and the information is provided to the Environmental Management Section Head.
- Work with the Section Head to provide information to the Area project supervisor/engineer in the event additional mitigation measures are required, particularly where dredging or discharge rates have to be reduced.
- Meeting with local People's Committees to obtain information on environmental concerns from citizens near the project areas (e.g., traffic disturbance, unnecessary noise, etc.).
- Supervise the implementation of mitigation measures to ensure Project requirements will be met.

An organizational structure is illustrated in Figure 10.1. Solid lines indicate lines of management responsibility and information flow; dashed lines indicate lines of communication. This is a proposed figure and should be adjusted to meet actual project requirements (timing of activities, etc.). This figure does not illustrate lines of communication with outside groups; local People's Committees national and provincial Ministries of Natural Resources and Environment. The key aspect of the proposed organizational chart is the communication linkages at each level of responsibility between the Environmental Management Section and the Engineering Management Section.

Figure 30: Organizational Structure for Environmental Management within the Project Management Unit



10. SITE ENVIRONMENTAL MANAGEMENT

To facilitate adoption and implementation of environmental management of the Project activities, the Corridor Project will be divided into 6 construction area sections:

- Mom Ro
- Do Bui
- DNC
- Lach Giang
- Viet Tri port
- Ninh Phuc Port

with a supervisor within the Environmental Management Section responsible for each section. This assumes activities within all thirteen Project Areas will be undertaken simultaneously. Alternatively, if components of the Project are implemented sequentially, one staff member could be responsible for more than one River section. Subordinate to each River section supervisor will be Project Area supervisors. Each Project Area environmental supervisors will meet on a regular basis to review project activities, to review implementation of the mitigation measures and to report on the results of environmental monitoring. The presentations and discussions at these meetings will form part of the Monthly environmental management report to the Director, Project Management Unit.

It is proposed that site monitoring will be contracted to an outside group or agency with appropriate equipment and staff to undertake the routine monitoring. As necessary, laboratory analyses may also be contracted to another group or agency or to the laboratory of the monitoring group. The environmental supervisor for each Project Area will meet on a weekly basis, as necessary, with the environmental monitoring team to ensure all contractual and operational issues are being addressed. As appropriate and necessary, the Site Engineering Supervisor may also attend such meetings.

11. MITIGATION MEASURES

11.1. General mitigation means

The "best mitigation measure" for any dredging project is operator "best practices". The operators should ensure they minimize unnecessary bottom disturbance; do not discharge dredged materials beside the dredge rather than by pipeline to a disposal site; and do not over-dredge a channel section.

Where shoreline sections above the waterline or headlands are to be removed by land-based excavation, a "berm" of material should be retained during excavation in the dry. This berm should not be removed by a dredge until all of the shoreline section or headland has been excavated to design depth and the exposed area is suitably clean and free of debris and detritus. The size of the berm should be minimized, but should be sufficient to constrain the river during the excavation process.

Where shoreline sections are small and will be removed by cutter suction dredge, it may be necessary to temporarily deploy a silt curtain to constrain loss of re-suspended materials during the site activity. Implementation of this mitigation measure will be a function of inspection and discussions between the Site Environmental Supervisor and the Site Engineer.

11.1.1. Water quality monitoring

Environmental monitoring will focus on changes in the concentrations of Total Suspended Solids within the Rivers and ocean (for Lach Giang), as the Project dredging and dredged material disposal activities are implemented. Total Suspended Solids or turbidity represents a parameter that is fully representative of the impacts of dredging and dredged material disposal while also providing a parameter that can be analyzed by virtually any laboratory and provides a cost-effective monitoring tool.

Surface water quality survey (pH, temperature, dissolved Oxygen, conductivity, turbidity) will be organized on each dredging area and on each water reject from soil disposal area:

- 1 reference sampling station 100 to 200 m upstream dredging area/disposal area water reject with 3 sampling points (right side, center, left side) and 2 depths (0-1 m, middle depth, 1 m above bottom of the river)
- 1 control sampling station 500 m downstream dredging area/disposal area water reject with 3 sampling points (right side, center, left side) and 2 depths (0-1 m, middle depth).

For TSS/Turbidity: Average value (3 points surface + 3 points middle depth) on controlled station will then be compared to the upriver samples to assess the change from "ambient conditions The result on the control station must not exceed the reference value upstream of more than 50%. (ea: if reference value is 50 mg/l or 50 NTU, control value 500 m downstream dredging area must not exceed 75 mg/l or 75 NTU). This point is important to consider because during dry season the natural TSS / turbidity is about 50 to 150 mg/l or NTU. During rainy season the TSS/ can naturally reach TSS / turbidity of 10 to 30.000 mg/l (or NTU).

Changes of more than 50% above natural ambient conditions of TSS/Turbidity will be considered as an unacceptable impact and the Contractor must implement appropriate mitigation measures to reduce TSS/Turbidity below acceptable limits; e.g., reduction in scope of dredging activity; diversion of supernatant waters to an additional settling pond before discharge to the River, etc.

For Dissolved oxygen: downstream value must no reach decrease of more than 25 % of the upstream DO concentration.

All results for monitoring of water quality monitoring will be reported to the Environmental Management Section within 24 hours of collection. The timely provision of information to the Project Management Unit is a critical second activity for the Section. Timely receipt of information permits timely implementation of additional mitigation measures as appropriate.

11.1.2. Mitigation for Fuel Spillage and Similar Accidents

During dredging or excavation, there is risk of spillage of petroleum products (e.g., vessel re-fuelling, operation of hydraulic lines, etc.). The dredging and excavation contractors will be required to maintain suitable equipment, booms and other clean-up supplies to respond to spills or leaks associated with loss of petroleum hydrocarbons from their equipment. All land-based equipment will be fuelled and serviced in areas well removed from the river. All storage of fuels, lubricants and other liquid materials will be within appropriate Government-approved containers and stored within bermed areas to limit dispersal of any spilled product.

The Project Environmental Protection and Implementation Plan will provide detailed instruction on reporting, clean-up of spills and general response procedures. These will be also detailed in the general operating requirements pursuant to various dredging contracts.

If a spill of petroleum hydrocarbons (liquid fuel, hydraulic fluids, etc.) occurs, the Contractor will immediately inform the Project Area Environmental Supervisor and the provincial Ministry of Natural Resources and Environment, while at the same time initiating appropriate mitigation measures.

Mitigation measures will include deployment of a containment boom, particularly if the spill occurs within the River; deployment of sorbent materials or sheets; stopping operations that resulted in the spill; and the recovery of all spilled product. Timing is critical due to the strong currents in many of the Project Areas. Implementation of mitigation measures will follow the protocols and procedures described in the Contractor's Project Environmental Protection Plan. A detailed incident report will be prepared by the Area Environmental Supervisor. Actions leading up the spill and actions taken to mitigate the spill and clean-up the accident will be reviewed by the Project Management Unit and the senior Contractor staff. As appropriate or as directed by the Ministry of Natural Resources and Environment, monitoring for petroleum hydrocarbons in River water or on land will also be implemented under direction of the Area Environmental Management Supervisor.

11.1.3. Mitigation of Spillage of Dredged Materials During Pumping

Some of the Project Areas will be dredged using standard cutter suction dredging equipment with materials transported to the disposal area by pipeline. There are numerous components which can give way, resulting in accidental discharge of dredged materials into the River. The Project Environmental Protection and Implementation Plan will provide detailed instruction on reporting, clean-up of spills and general response procedures. These will be also detailed in the general operating requirements pursuant to various dredging contracts.

If a dredging transport pipeline breaks or accidently discharges materials into the River, the Contractor will immediately inform the Project Area Environmental Supervisor and the provincial Ministry of Natural Resources and Environment, while at the same time initiating appropriate mitigation measures. Mitigation measures will include deployment of a containment boom, particularly if the spill occurs within the River; stopping operations that resulted in the spill; and the suction pumping of spilled/discharged product. Timing is critical due to the strong currents in many of the Project Areas. Implementation of mitigation measures will follow the protocols and procedures described in the Contractor's Project Environmental Protection Plan. A detailed incident report will be prepared by the Area Environmental Supervisor. Actions leading up the spill and actions taken to mitigate the spill and clean-up the accident will be reviewed by the Project Management Unit and the senior Contractor staff. As appropriate or as directed by the Ministry of Natural Resources and Environment, additional downriver monitoring for Total Suspended Solids in the River will also be implemented under direction of the Area Environmental Management Supervisor.

11.1.4. Mitigation of Impact of Dredging on Water Intakes

There are several water intakes for community water supply and other uses along the Corridor 3. In particular there is 1 pumping station in the vicinity of Do Bui area. The pumping station is located on the opposite site of the bed cutting/dredging area but near the groins construction area.

There is also some water pumping stations to irrigate some agricultural lands that will need to be preserved from excessive TSS.

To protect the pumping stations, monitoring will be undertaken at each drinking water intake every three days while there is dredging within two kilometers upriver of the water intake. These measurements may be made by the Water Supply Company itself as part of their routine testing of intake waters and, if so, such data should be obtained and actual sampling is not required.

However, for other intakes, such sampling by the Project will be necessary. Data will be compared to ambient water quality data to identify excess events. If excess occur, the Contractor should install a silt curtain around the intake to limit entry of suspended solids until completion of the dredging or excavation in that area.

In addition the following mitigation measures shall be taken by the Contractors in conjunction with the supervision Consultant and PMU-NIW:

- Inform local communities and water supply companies before dredging is started,
- Carry out consultation with water supply companies on the time (daily and seasonally) that dredging should be minimized or avoided
- Contractor to adjust his work plan accordingly.

11.1.5. Mitigation measures for de-watering

For dredged channel materials to be barged to an upland disposal site will need to mitigate issues related to dispose material de-watering. Supernatant water will be discharged from the transport barges at the dredging site before transport to the disposal area. Loss of "fines" during de-watering should appear. The contractor will implement a TSS/Turbidity control and the downstream value must not exceed 50 % of the natural upstream conditions.

For dredged channel materials to be dredged by cutter suction dredge with materials to transported by pipeline to designated shoreline disposal sites. Site mitigation for the disposal sites will include construction of temporary berms to an appropriate height to ensure there is no uncontrolled loss of supernatant water and/or disposed sediments. As the materials are clay and sands, loss of "fines" during de-watering should appear. De-watering supernatant will be directed by channel or pipeline back to the River. If monitoring for total suspended solids indicates concentrations are more than 50% greater than ambient (upriver) conditions, the mitigation measure will be the diversion of the dewatering supernatant to a holding/polishing pond for further settling out of suspended materials, before subsequent discharge to the River.

12. ENVIRONMENTAL MONITORING

The physical properties of dredged material along Corridor 3 are homogenous in the river. The context is different in Lach Giang

12.1. Environmental monitoring on River construction areas

For River construction areas (Mom Ro, Do Bui, DNC, Viet Tri and Ninh Phuc), the following monitoring survey is proposed:

Environmental monitoring will focus on changes in the concentrations of Total Suspended Solids within the Rivers and ocean (for Lach Giang), as the Project dredging and dredged material disposal activities are implemented. Total Suspended Solids or turbidity represents a parameter that is fully representative of the impacts of dredging and dredged material disposal while also providing a parameter that can be analyzed by virtually any laboratory and provides a cost-effective monitoring tool.

Surface water quality survey (pH, temperature, dissolved Oxygen, conductivity, turbidity) will be organized on each dredging area and on each water reject from soil disposal area:

- 1 reference sampling station 100 to 200 m upstream dredging area/disposal area water reject with 3 sampling points (right side, center, left side) and 2 depths (0-1 m, middle depth, 1 m above bottom of the river)
- 1 control sampling station 500 m downstream dredging area/disposal area water reject with 3 sampling points (right side, center, left side) and 2 depths (0-1 m, middle depth).

For TSS/Turbidity: Average value (3 points surface + 3 points middle depth) on controlled station will then be compared to the upriver samples to assess the change from "ambient conditions The result on the control station must not exceed the reference value upstream of more than 50%. (ea. if reference value is 50 mg/l or 50 NTU, control value 500 m downstream dredging area must not exceed 75 mg/l or 75 NTU). This point is important to consider because during dry season the natural TSS / turbidity is about 50 to 150 mg/l or NTU. During rainy season the TSS/ can naturally reach TSS / turbidity of 10 to 30.000 mg/l (or NTU).

Changes of more than 50% above natural ambient conditions of TSS/Turbidity will be considered as an unacceptable impact and the Contractor must implement appropriate mitigation measures to reduce TSS/Turbidity below acceptable limits; e.g., reduction in scope of dredging activity; diversion of supernatant waters to an additional settling pond before discharge to the River, etc.

For Dissolved oxygen: downstream value must no reach decrease of more than 25 % of the upstream DO concentration.

All results for monitoring of water quality monitoring will be reported to the Environmental Management Section within 24 hours of collection. The timely provision of information to the Project Management Unit is a critical second activity for the Section. Timely receipt of information permits timely implementation of additional mitigation measures as appropriate.

Frequency and Parameters to be monitored

Component	Construction	Operation
1. Parameter	Temperature, pH, Conductivity, Turbidity, DO, COD, BOD_5, TSS, Cu, Zn, Pb, As, Cd, Hg, Fe, Al, NO_2^-, NO_2^-, Cr^{6+}, PO_4^{3-}, Salinity, Oil and Grease.	Temperature, pH, Conductivity, Turbidity, DO, COD, BOD_5, TSS, Cu, Zn, Pb, As, Cd, Hg, Fe, Al, NO_2^-, NO_2^-, Cr^{6+}, PO_4^{3-}, Salinity, Oil and Grease.
2. Frequency	1times/month, 2samples/sites (surface and 2m down from surface)	3times/month in a year after finishing, 2samples/sites (surface and 2m down from surface)
3. Location		7
4. standard	QCVN 08 : 2008/BTNMT (Column B2)	

12.2. Environmental monitoring on Lach Giang area

For Lach Giang a specific monitoring program including potential evolution from the rivers, from the sea and influences of winds and tides.

To minimize pollution during the course of construction, the following monitoring activities should be implemented at locations (short or long-term) identified by the Consultant (summarized in Table 5) and/or Client during the course of construction:

- Water quality (surface/underground)
- Soil surface quality
- Noise
- Ambient air quality

This monitoring will be also useful to evaluate the local impact/disturbance on social uses around the work area.

The Contractor is responsible for undertaking directly or by contract to appropriate groups, all monitoring activities. The type of monitoring equipment must be approved by the Consultant. Results of all monitoring surveys must be reported to the Consultant.

Adverse environmental impacts attributable to the proposed project in Lach Giang are primarily due to short term impacts during construction operations, including equipment noise; air pollution from dredges, excavators and trucks; loss of re-suspended materials during dredging (due to either dredging activities or pipeline/bare operations); and/or, loss of deposited materials during discharge of supernatant water from the disposal site.

Table 6: Environmental general monitoring location

The location coordinates are given as information. Depending of the local conditions, the contractor could propose to move some points in more accessible locations with the engineer/consultant approval.

Air quality and Noise Emissions					
No	Area	Location	Code	Coordinate	
1	Field/land near Lach Giang works area	Upstream Ninh Co river mouth	7-A44	X =	520765.3157
				Y =	2214220.2683
2		Downstream Ninh Co river mouth	1-A45	X =	520984.6750
				Y =	2213360.9468

Surface water quality					
No	Area	Location	Code	Coordinate	
1	In Ninh Co river & in the sea	Upstream Ninh Co river mouth	7-SW38	X =	520478.8564
				Y =	2213935.317
2		Downstream Ninh Co river mouth	7-SW39	X =	520340.1426
				Y =	2212926.138
3		Near the protection southern bund	7-SW40	X =	520241.0162
				Y =	2212158.028
4		Near the protection northern bund	7-SW41	X =	521095.2796
				Y =	2212661.150
5		Near the groin G4	7-SW42	X =	520864.0643
				Y =	2211646.683
6		Near the groin G2	7-SW43	X =	520510.2276
				Y =	2211398.308
7		About 1000 m in the northern east from the construction area	7-SW44	X =	522268.5315
				Y =	2212251.825
8		About 1000 m from the front of the channel	7-SW45	X =	522054.5860
				Y =	2211743.477

Sediment quality					
No	Area	Location	Code	Coordinate	
1	Disposal area in Lach Giang estuary	In the southern disposal area	7-SD40	X =	520392.9919
				Y =	2212112.3056
2		In the northern disposal area	7-SD41	X =	520792.4460
				Y =	2212975.7103

Underground Water Quality					
No	Area	Location	Code	Coordinate	
1	Field/land near Lach Giang works area	Near the civil works	7-UW44	X =	521042.8281
				Y =	2213813.4550
2		Near the civil works	7-UW45	X =	520694.1123
				Y =	2213658.4834

Surface soil quality					
No	Area	Location	Code	Coordinate	
1	Field/land near Lach Giang works area	Upstream Ninh Co river mouth works area	7-S44	X =	520800.2390
				Y =	2214270.1323
2		Near the block house	7-S45	X =	520997.7139
				Y =	2213410.2809

Figure 31: Monitoring location map in Lach Giang area

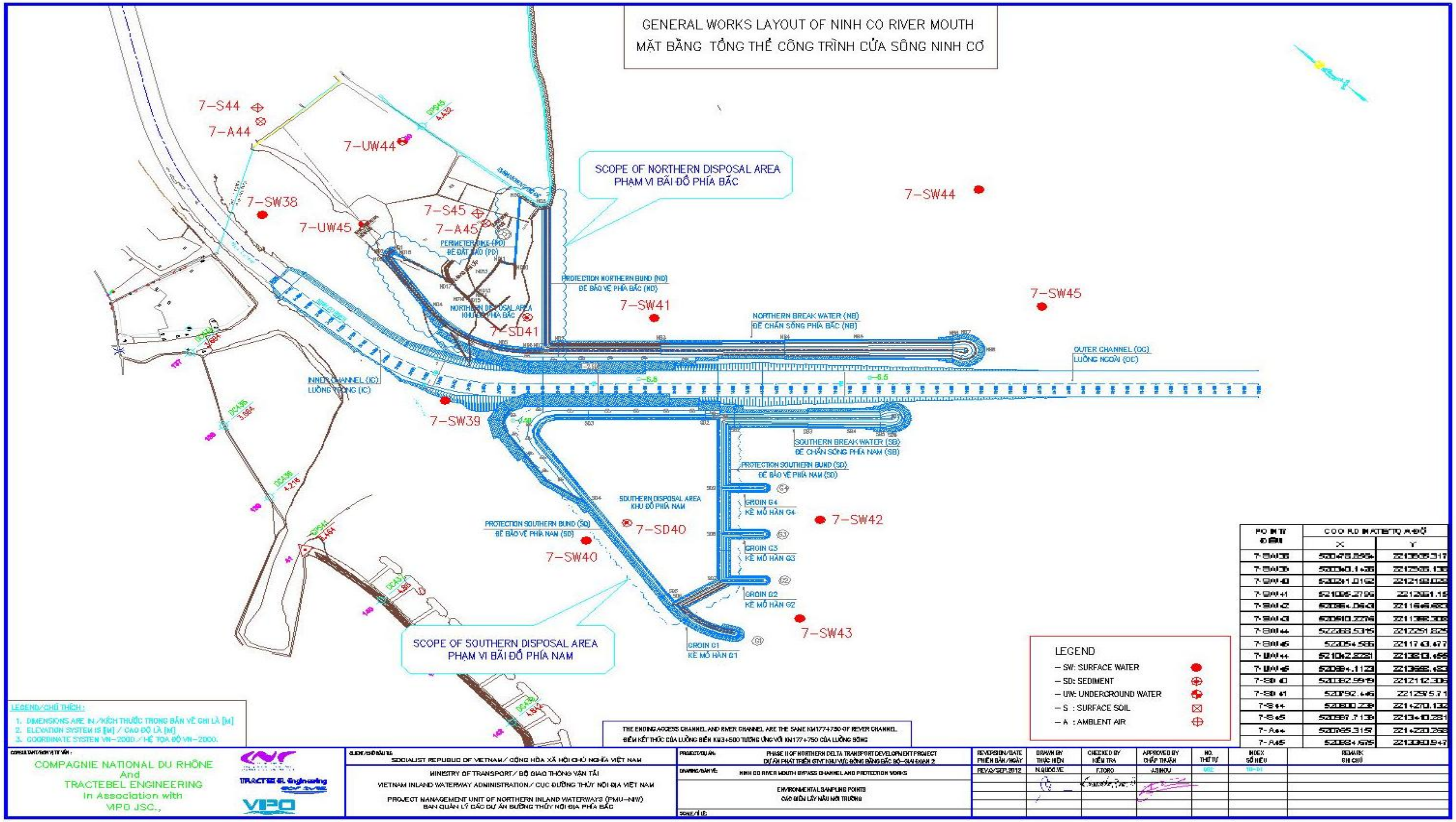


Table 7: Components and their characteristics

No.	Component	Construction
I	**Noise**	
	1. Parameter	Leq, Lmax, L50
	2. Frequency	2 times/month
	3. Location	2 sites
	4. Standard	QCVN 26:2010/BTNMT
II	**Air quality**	
	1. Parameter	TSP, PM_{10}, CO, SO_2, NO_2, and Microclimate
	2. Frequency	2 times/month
	3. Location	2 sites
	4. Standard	QCVN 05 :2009/BTNMT
III	**Surface Water quality**	
	1. Parameter	Temperature, pH, Conductivity, Turbidity, DO, COD, BOD_5, TSS, Cu, Zn, Pb, As, Cd, Hg, Fe, Al, NO_2^-, NO_3^-, Cr^{6+}, PO_4^{3-}, Salinity, Oil and Grease, E.Coli and Total Coliform
	2. Frequency	2 times/month, 1sample/monitoring point (0.5 / 1 m deep)
	3. Location	8 sites
	4. Standard	QCVN 08 : 2008/BTNMT
IV	**Underground Water quality**	
	1. Parameter	Temperature, pH, Conductivity, Turbidity, DO, COD, BOD_5, TSS, Cu, Zn, Pb, As, Cd, Hg, Fe, Al, NO_2^-, NO_3^-, Cr^{6+}, PO_4^{3-}, Salinity, Oil and Grease, E.Coli and Total Coliform
	2. Frequency	1 time/month, 1sample/monitoring point (at minimum 1 m deep inside underground water)
	3. Location	2 sites
	4. Standard	QCVN 09 : 2008/BTNMT
IV	**Dredging - Surface Water quality**	
	1. Parameter	Turbidity (NTU) DO
	2. Frequency	1 day/week = 4 times / day : Before starting dredging During dredging morning / midday/afternoon
	3. Location	3 sampling points between 50 to 1000 m upstream dredging area (reference) : left side, middle river, right side 3 sampling points 100 m downstream dredging area (control) left site, middle river, right side All the samples will be taken between 0.5 to 1 m deep from the surface
	4. Standard	TSS or Turbidity :Maximum Increase of TSS/Turbidity authorized: 50 mg/l or 50 NTU more than upstream values DO : QCVN 08 : 2008/BTNMT

Other monitoring on Lach Giang:

Specific monitoring in the preconstruction phase:

1 reference sampling campaign before beginning the construction phase

Specific monitoring during dredging phase:

1 sampling campaign (surface water only) / 2 weeks during dredging phase (sea and river –including sediment disposal in the groins/dike).

Specific monitoring on disposal areas

Monitoring of soil and water pollution potentially caused by soil/sand/sediment disposal: the contractor will proposed an adapted monitoring plan (location, parameters, numbers, and frequency) to prevent and control any source of water pollution from disposal soils/sediments/sands.

At list, 2 sampling points will be controlled (upstream reference and control point at 500 m downstream the run-off point). Parameters: Temperature, pH, Conductivity, Turbidity, DO, COD, BOD5, TSS, Cu, Zn, Pb, As, Cd, Hg, Fe, Al, NO2-, NO3-, Cr6+, PO43-, Salinity, Oil and Grease, Fecal Coli and Total Coliform.

Frequency: 1 time/month

All the samples will be taken between 0.5 to 1 m deep from the surface

Specific monitoring of wastewater from the workers camp:

Monitoring of water pollution potentially caused by waste water from workers: if waste-water from worker's camp is supposed to be run-off in the river, contractor will proposed a monitoring plan to control the quality of the water downstream the run-off.

At list, 2 sampling point will be controlled (upstream reference and control point at 200 m downstream the run-off point of waste water). Parameters: pH, Conductivity, Turbidity, DO, COD, BOD5, Fecal Coli and Total Coliform.

Frequency: 1 time/month

All the samples will be taken between 0.5 to 1 m deep from the surface

12.3. Responsible for Environmental monitoring

Environmental management of Project activities is described in detail in the previous sections.

Under legal grounds, the Project Management Unit of Waterways is the representative of VIWA who is responsible for implementing the Law on Environmental Protection No. 52/2005/QH11. Project Management Unit is the organizer, appoints department in charge of the environment. On behalf of project management unit, the Project Manager who is most responsible for the undertaking will report to the State management agency on the status of environmental compliance of the project periodically (every 3 months) and in extraordinary cases.

Practically, environmental monitoring will be ensured by a team of supervisors reporting to the PMU-W in coordination with the Resident Engineer of the Construction Supervision Consultant. Environmental monitoring will preferably be entrusted to an independent consultant with appropriate equipment and staff to undertake the routine monitoring. As necessary, laboratory testing may be entrusted to the laboratory of the monitoring consultant or other laboratories. Each of the Project Area will be under the control of one environmental supervisor ensuring the supervision of implementation of the mitigation measures and reporting on environmental monitoring.

12.4. Environmental monitoring Costs

Indicative cost estimates for the initial implementation of the Environmental Monitoring Program are as follows:

Table 8: *Indicative Estimated Cost for Training Activities*

No	Training	Item	Unit	Qty	Unit price (VND)	Estimation cost (VND)	Total (VND)	Total (USD)
1	Training for PMU's staffs on the environmental & social impacts in the Pre-Construction phase	0.5 man month for local environmental expert	day	3	1,000,000	3,000,000	**34,400,000**	**1,670**
		Cost for room	day	3	5,000,000	15,000,000		
		Color printing	page	200	5,000	1,000,000		
		Black & White printing	page	800	500	400,000		
		Lunch (3 days x 20 persons)	person	60	200,000	12,000,000		
		Additional fee	day	3	1,000,000	3,000,000		
2	Safety training in the Construction phase	0.5 man month for local environmental expert	man-month	0.5	20,000,000	10,000,000	**62,800,000**	**3,049**
		Cost for room	day	2	5,000,000	10,000,000		
		Lunch & Dinner (3 meals x 2 days x 40 persons)	person-meal	120	200,000	24,000,000		
		Rest cost	person	40	300,000	12,000,000		
		Color printing	page	400	5,000	2,000,000		
		Black & White printing	page	1600	500	800,000		
		Additional fee	day	2	2,000,000	4,000,000		
3	Training on environmental protection in the Construction phase	0.5 man month for local environmental expert	man-month	0.5	20,000,000	10,000,000	**62,800,000**	**3,049**
		Cost for room	day	2	5,000,000	10,000,000		
		Lunch & Dinner (3 meals x 2 days x 40 persons)	person-meal	120	200,000	24,000,000		
		Rest cost	person	40	300,000	12,000,000		
		Color printing	page	400	5,000	2,000,000		
		Black & White printing	page	1600	500	800,000		
		Additional fee	day	2	2,000,000	4,000,000		
4	Training on environmental monitoring and reporting in the Construction phase	0.5 man month for local environmental expert	man-month	0.5	20,000,000	10,000,000	**62,800,000**	**3,049**
		Cost for room	day	2	5,000,000	10,000,000		
		Lunch & Dinner (3 meals x 2 days x 40 persons)	person-meal	120	200,000	24,000,000		

Table 9: Preliminary Estimate of EMP Costs

EMP Component	**Quantities**	**Estimated Cost (VND)**	**Estimated Cost (USD)**
SEMPs (Contractor – built into contract)	8 contractors	240,000,000	11,650
Environment and Safety Supervision (consultant)	lump-sum	15,462,500,000	750,607
Air/water/Soil/sediment monitoring from Contractors	24 months	6,000,000,000	291,262
Air/water/Soil/sediment monitoring control from Consultant	lump-sum	3,600,000,000	174,757
Salinity monitoring in DNC / Lach Giang	lump-sum	2,430,182,000	117,970
Coastal and river morphology monitoring Lach Giang	lump-sum	100,000,000	4,854
River morphology monitoring from Mom Ro to Lach Giang	lump-sum	1,400,000,000	67,961
Training to Environment protection	lump-sum	62,800,000	3,049
Training to Labor safety	lump-sum	62,800,000	3,049
Additional Studies	lump-sum	50,000,000	2,427
Total Initial EMP Costs		**29,408,282,000**	**1,427,587**

It should be noted however that the estimate costs above are highly tentative, based on the initial set up described in this section. PMU-W will necessarily revise these costs and develop annual operating costs for the EMP.