



Fisheries and Oceans
Canada

Fisheries and Oceans Canada

PERCÉ, GASPÉSIA

GEOTECHNICAL STUDY

Description of required services

1. MANDATE

The mandate consists in conducting a geotechnical study based on a drilling campaign in the Percé wharf sector (see Figure 1 and pictures in Annex 1). This drilling program will require the completion of 9 bore-holes near the wharf on the water or on the dry beach at low tide, all depending on tidal conditions and the method of work that the firm intends to use. This method must comply with regulations.

Boreholes to be performed are numbered from F-1 to F-9 (Figure 2 of a Annex 2). These holes will be drilled in the order of priority established by the Department. The numerical sequence of drilling is the priority (F-1 to F-9). An exception to this order shall be subject to prior agreement with the Department representative. The location of the bore holes is shown in Annex 2 (exact chaining).

The mandate requires boreholes with geotechnical laboratory testing as well as standard dynamic penetration tests. It is anticipated that drillings F-2 to F-8 will be used for structural and environmental reasons. For their part, the F-1 and F-9 boreholes will be used exclusively for environmental reasons.

Geotechnics

In the case of boreholes F-2 to F-8, they must be drilled all down to the bedrock if required. If the rock is encountered before -12.0 elevation and is of poor quality (highly fractured, RQD below 30%), the drilling must be extended to sound rock to a maximum of 1.5 m. Notify as soon as possible the Department Representative. If the rock is not met before the elevation -12.0, drilling in the overburden should not exceed the -15.0 m elevation.

Borehole F-1 must be completed within the first 2.5 m of wharf exclusively. Borehole F-9 must be performed on the full height of wharf (around 8.5 m) but shall not exceed the seabed.

Boreholes F-1, F-2, F-6, F-7, F-8 and F-9 need to be drilled partly in the wharf party in the seabed. All drillings must be performed at a distance of 1,5 m from wharf faces and other obstacles.

According to available information in a previous geotechnical study, here are the expected drilling depths.



Table1. Approximate depths for borings in sediment/soil and rock

	F-1	F-2	F-3	F-4	F-5	F-6	F-7	F-8	F-9
Mort-terrain ou quai (m.l)	2,5	17	14	14	14	17	15,5	15,5	8,5
Roc (m.l)							1,5	1,5	

Sampling and analysis for environmental purposes

The mandate also includes sediment samples taken and wharf material to be characterized for better work management, and also to assess the environmental effects of the project, mitigation measures to be applied during work and management disposal method for sediment and excavated wharf soil . Altogether 21 samples of sediment and wharf soil will be taken for physico- chemical analysis in a laboratory for environmental purposes.

The samples to be collected for environmental purposes can be based on the following predefined layers :

Table 2. Samplings for environmental assessment

Borehole – Sample	Layer	Number of Samples*	Name of sample
F-1	0-30 cm under deck	2	PSED-1 (0-30)
	1,5 - 2,0m under deck		PSED-1 (1,5-2,0)
F-2	0-30 cm under deck	2	PSED-2 (0-30)
	1,5 - 2,0m under deck		PSED-2 (1,5-2,0)
F-3	0-30 cm	2	PSED-3 (0-30)
	1,5 - 2,0m		PSED-3 (1,5-2,0)
F-4	0-30 cm	2	PSED-4 (0-30)
	1,5 - 2,0m		PSED-4 (1,5-2,0)
F-5	0-30 cm	2	PSED-5 (0-30)
	1,5 - 2,0m		PSED-5 (1,5-2,0)
F-6	0-30 cm	2	PSED-6 (0-30)
	1,5 - 2,0m		PSED-6 (1,5-2,0)
F-7	0-30 cm	3	PSED-7 (0-30)
	1,5 - 2,0m		PSED-7 (1,5-2,0)
	3,5 – 4,0m		PSED-7 (3,5-4,0)
F-8	0-30 cm	3	PSED-8 (0-30)
	1,5 - 2,0m		PSED-8 (1,5-2,0)
	3,5 – 4,0m		PSED-8 (3,5-4,0)
F-9	0-30 cm	3	PSED-9 (0-30)
	1,5 - 2,0m		PSED-9 (1,5-2,0)
	3,5 – 4,0m		PSED-9 (3,5-4,0)
Total		21	



**Excluding duplicata*

The drilling should be considering special conditions on site such as tides, structural state of wharf, environment and existing operations on site.

2. BACKGROUND

The Department intends to undertake major works regarding the Percé wharf over the next years, such as the rehabilitation of wharf and the establishment of shore protection against erosion. This project is presently at a preliminary state and the results of the present geotechnical study and characterization campaign will be studied to clarify certain technical questions of the project and, if necessary, redirect the outline of project.

The works consist possibly in the establishment of a sheetpile or a Berlin wall, and the installation of a rock protection of the shoreline and wharf against erosion.

The seabed around the wharf is probably made of a thick layer of gravel / sand / silt located on a good quality rock. A previous geotechnical study may provide an interesting light on the seabed and location of rock (see General drilling plan in Annex 3).

3. AVAILABLE INFORMATION

Part the construction plans of existing wharf is provided in Annex 3. All plans will be provided to the retained Consultant. Some pictures of the existing wharf and surroundings are also presented in Annex 1.

The old wharf of Perce consisted of timber cribs that are still present in the foundations of the existing wharf. It is therefore normal to encounter wood in some bore holes. The wharf faces are made of sheet pile. The deck is made of concrete and wood. Low-level areas are built in the dock to facilitate mooring of cruise ships while protecting pedestrians.

4. SPECIAL CONDITIONS

Drilling in the existing wharf will be completed with machinery that does not cause excessive load on deck i.e. that respects an overload of 6 kPa maximum. The boreholes will have to be executed with equipment that minimizes loads and work practices that reduce stress and vibrations imposed on the wharf deck. The consultant is free to determine its own working method (cantilever, barge or land drilling at low tide to the shore if possible) but any direct intervention by land must comply with current regulations, including environmental regulations.



Drilling near the existing wharf must be made at an approximate distance of 1.5 m from the wharf walls, where the future walls will be installed. If machinery for drilling lies on the wharf deck, a minimum distance of 2.5 m inside the walls must be respected in order not to limit the excessive overloads on walls. In that case, a demonstration by the firm's of the loads compliance with the maximum overload 6 kPa shall be provided to the Department.

Drilling should not interfere with activities in the sector of wharf, mainly pedestrians and cruise ships moorings. The schedule of cruises is variable but generally consists of a few moorings during the day depending on demand. Cruises and touristic activities end at Thanksgiving. The selected consultant will have the choice of waiting for the end of the cruises season for drilling, or contact cruise lines in order to better plan the drilling and not interfere with their activities. It is the responsibility of the consultant to ensure that the schedule of works respects activities and provides all deliverables in time for Department.

If during drilling consultant drills into a subsea structure that is not shown on the plans, he must stop drilling immediately and notify the Departmental Representative before any other decision is taken by the later.

Given the nature of the old wharf (wooden cribs and landfill and sheetpiles) rock stones might be encountered during drilling into the wharf itself or also outside the wharf on the seabed. Then it will be possible for the consultant to move the drill a little further close to the initial borehole. The selected consultant is responsible for the successful drilling and maintaining his equipment in a good condition.

Joined to his financial proposal, consultants must propose a method to close the drill holes that will be made in the deck to assure security for pedestrians (6 holes in wharf).

If unexpected obstacles are met on deck or on wharf, all boreholes should be at least 1.5 m away from obstacles. The consultant will avoid all services wires on deck and in wharf, and slightly move the location of the boreholes if necessary (mainly electricity).

5. **TESTS**

According to geological and actual conditions on site, one must adapt his program to progressively achieve all drilling and testing. In general, required testing and information for all boreholes are as follows :

5.1. Field tests

- Standard penetration tests and sample collection every 1.52 meters and to any change of soil layer.
- Testing of all vane 1.52 meters c / c in the presence of clay soil.

5.2. Laboratory testing

Geotechnics

For each separate layer of soil or sediment, use at least two different samples of the same layer to perform the sieve analysis (particle size curve) and determine the dry and submerged



unit weight, the shear strength, the angle of internal friction and the allowable bearing capacity. The internal friction angle, insofar as the appropriate removal of samples is possible, will be determined using the triaxial tests.

In case of presence of clay determine the cohesion, the void ratio, the Atterberg limits, the water content, the compressibility index and the coefficient of consolidation for each of the layers and any other information needed to calculate settlements due to a massive stonework, especially shear strength parameters (effective) Long term ϕ and C.

Also provide an expert opinion on the sensitivity of clays to liquefaction if driving piles or sheetpiles of in clays.

If the bedrock is encountered, but it is unlikely, the consultant must identify rock angle, dip direction and determine its compressive and tensile strengths on representative samples, after discussions with the Department representative. These tests have to be made following the CAN / CSA latest standards. Determine recovery portion and RQD for each rock sample taken. Identify the discontinuity of the rock (litages, fractures, joints, faults, alteration zones ...). Indicate the feasibility of excavating the seabed using a hammer or tramac on the rock.

Provide a copy of laboratory test sheets for each of the tests carried out. In the procedure for calculating the required parameters, indicate whether it is an average value or a representative value and what is the standard deviation.

5.3. Sampling

a) *Clay*

In cases of layers containing at least a little clay are encountered during drilling, sample collection should be done using a "Shelby" 75 mm diameter piston levy. The goal being to collect samples that are the most intact possible, judgment of consultant's responsible on site prevails if quality of sampling needs to be changed. In the unit cost for drilling, the firm should take into account the risk of breakage of some "Shelby" samplers. In each soil layer containing at least some clay, 2 to 3 "Shelby" samples are required. Indicate the recuperation percentage and location of any collected material.

b) *In all other cases (including in the rock)*

The drilling will be done with the minimum of *N* gauge. The drilling method must be adapted to the conditions encountered in order to maximize the quality and representativeness of the collected samples. The Consultant shall take all means to meet this requirement. Indicate the recuperation percentage and location of any collected material. Provide details regarding the dip of the foliation of the rock and discontinuities.



6. SAMPLING AND CHARACTERIZATION OF SOIL AND SEDIMENT FOR ENVIRONMENTAL PURPOSES

The consultant is expected to take a total of 21 samples of wharf landfill, soils and sediments.

6.1. Sediment sampling

The consultant will take samples of surface sediments (0-30 cm) or at greater depths (30 cm to 2.5 m) near the dock.

The soil samples will be collected for analysis in boreholes that are already identified (see characterization plan).

The samples will be collected using light equipment or a team of divers.

The consultant will also provide for sample duplicata.

All samples must be taken and stored according to the *Guide d'échantillonnage des sédiments pour les projets de dragage et de génie maritime* from Environment Canada (volume 1 and volume 2) and comply to the requirements contained in *Critères pour l'évaluation de la qualité des sédiments au Québec et cadres d'application : prévention, dragage et restauration* (Environnement Canada et MDDEP, 2007).

The consultant will respect appropriate instrument cleaning methods to avoid cross contamination.

Actual sampling stations (boreholes) must be accurately positioned (approximately 1 meter) using a GPS.

Consultant shall provide a description of each sample (particle size, odor, color, debris, organic matter or marine organisms, etc.). The consultant will submit photographs of sampling and samples and also of the equipment used. If changes to the sampling plan were necessary, Department representative must approve changes before their realization.

6.2. Soil, sediments and wharf landfill sampling

The consultant will take samples of soil in shallow soil or landfill (30 cm - 2.5 m) in the wharf itself which consists of stone, concrete, and possibly of creosoted wood. All samples must be taken and stored according to the *Guide d'échantillonnage à des fins d'analyses environnementales : Échantillonnage des sols* du MDDELCC (2010).

The sampling stations will be positioned accurately (about 0.2 meters, see boreholes) and the consultant shall provide a description and photographs for each sample.



6.3. Analyses

The physico-chemical analyses of soil samples and sediments samples must be carried out according to the *Guide méthodologique de caractérisation des sédiments (1992)* by a laboratory accredited by the Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC).

The laboratory will perform analyses for the following substances:

- PAHs, PCBs, and TOC;
- Petroleum hydrocarbons C10-C50;
- Metals: arsenic, cadmium, chromium, copper, mercury, nickel, lead and zinc.

6.4. Sampling Report

The results of the sampling program should be presented in a separate report, which shall contain the following (without limitation):

- Description of field work; methodology, sampling program, analytical program, quality control program, analytical methods, positioning samples (latitude and longitude), etc. ;
- A brief description of the methods used for analyzes with references, identify the instruments / devices used with the detection limits and the main products employees;
- The location plan of sampling stations (boreholes);
- The list of samples in the form of a table (coordinates of sampling stations, name of sample, water depth, sampling method, analyzed parameters, visual and olfactory description, marine organisms, observations, particle size, volume of sample, etc.);
- The samples will be identified in the report according to the nomenclature identified in Table 1 (sample name).
- Photographs of the samples and the site at the time of sampling;
- A description of samples upon receipt at the laboratory (temperature, etc.);
- The presentation of analysis results tabulated in comparison to federal-provincial criteria, federal criteria for disposal at sea and the generic criteria (based on documents: Critères pour l'évaluation de la qualité des sédiments au Québec et cadre d'application : Prévention, dragage et restauration, Environnement Canada et MDDELCC (2007).
- For soils The analysis results are presented on contaminated soils management grid interim excavated from the Grille de gestion des sols contaminés excavés intérimaire de la Politique de protection des sols et de réhabilitation des terrains contaminés du MDDELCC (2002);
Certificates for chemical analysis and quality control according to Environment Canada standards;
- Field identification (sample number and name) must be included in all the tables and on all certificates of analysis with the laboratory number and, if applicable, the laboratory number of the subcontractor;
- Laboratory should use, as reference material, matrices of the same nature as the analyzed material (soil and sediment);
- Laboratory may be required to provide information on the analysis and answer



questions to regulatory organizations. The name of the chemist responsible for the project must be specified in the related contact information.

6.5. Materials and equipment

The laboratory will provide all materials and equipment necessary for carrying out the work and ensure their proper functioning.

6.6. Assurance / Quality Program

All characterization projects must include an insurance program and quality control for sampling and laboratory analysis. Together with the detailed sampling protocol, the consultant must present a quality control program for the field work, which should include the following:

- duplicate for sampling of soil and sediment must be about 10% of total samples ;

Moreover, the laboratory analysis program should include a set of intra-laboratory checks applied to daily operations. Various analyzes can be performed by the laboratory such as :

- White method;
- internal reference material;
- certified reference material;
- Laboratory duplication;
- fortified sample.

7. **ADDITIONAL DRILLINGS**

The Department reserves the right to require additional drilling and additional sampling to be performed in order to determine a more accurate profile of the rock (if applicable) or the characteristics of the seabed or landfill layers. This additional drilling will be carried out within the limits of actual project definition. It is understood, however, that the Department cannot guarantee that additional drilling and testing will be required for the purposes of this project.

8. **REFERENCE PLAN**

All elevations provided in drilling logs and technical reports shall be measured from the level of the tide gauge zero.

There are several benchmarks and geomatic stations nearby facilities that can be used to geo-reference boreholes. For this purpose, consult the plans provided or consult the following website: <http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/twl-mne/benchmarks-reperes/search-recherche-fra.asp?AREA=LAU>, and more specifically to the following address:

<http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/twl-mne/benchmarks-reperes/list-liste-fra.asp?stationname=perce&stationnum=&benchmarknum=&uniquenum=®ion=LAU&su>



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The boreholes drilled must be the closest to their location indicated in the plan. The exact location (within ± 0.1 m) of real boreholes must appear on the plans provided by the consultant in the report.

9. TECHNICAL REPORTS

A daily report should be sent to the Departmental Representative during the whole period of works, precisising the progress of works and presenting preliminary results. This daily report can be done verbally or by email sent to Departmental Representative. It is important that a close monitoring of the work is done, particularly if additional drilling is required, or if requested boreholes are no longer required.

One (1) copy of the preliminary technical report (which will have the same shape as the final) should be transmitted electronically no later than two (2) weeks following the end of drilling onsite for comments by the Department Representative.

Three (3) hard copies of the final report in French, which will include and correct all comments made by the Departmental Representative, will be provided one (1) week after reception of the Departmental Representative comments. A CD copy of all final documents must be provided together with the final report (in * .pdf format for text and figures and * .dwg format for plans).

The technical report will include among others:

1. A precise and accurate location plan of drilled boreholes and stratigraphic sections of seabed and wharf landfill. These cuts will highlight the different layers, their profiles and their characteristics.
2. All laboratory test results and physical-chemical analyses as well as those obtained on the site. The results will be grouped in tables highlighting the representative values of the parameters determined using tests, and this, for each of the soil layers or rock encountered.
3. Photographs of the equipment used and facilities on the site, plus a description of the equipment and methods used onsite and in laboratory. Pictures to illustrate the quality of rock if applicable.
4. The description of the benchmark, as well as a confirmation that all levels appearing in the technical report and plans relating to the Chart datum.
5. Boring logs for each executed drilling, gathering all relevant information.
6. All soil and rock characteristics necessary for calculating capacity for H-piles for a Berlin Wall or for sheet piles, including their anchoring to rock if applicable and the safety factors to be applied in the design of a new wharf.



7. All features necessary to calculate soil bearing capacity and check the stability of a structure weight as a breakwater or any massive structure.

8. Any other relevant information to accurately describe the wharf fill, the soil and the rock encountered (if applicable), particularly an evaluation of the shear strength in the short and long terms for each layer of soil and bearing capacity of different soil and rock layers encountered, depending on the types of structure planned. All safety factors used should explicitly appear in this report.

10. EXECUTION TIME

Preparation of campaign will start as soon as the contract is awarded and the drilling program will be completed onsite no later than November 30th 2015. Preliminary boring logs must be delivered to SCH in the next week, i.e. before December 15th, 2015.

Respect of schedules and time frames is important. The consultants must provide in its proposal a detailed proposed schedule that will take into account the nature of borings, place of work, weather conditions, specific site conditions and normal activities on site.

Final report must be submitted to Small Craft Harbour (SCH) no later than January 15th, 2016.

11. PAYMENT

Payments will be made according to present terms. The prices bid must comply with the minimum levels recommended by the Association des consultants et laboratoires experts (ACLE), Quebec Region (<http://www.acle.qc.ca/GUIDE.pdf>).

- **Item 1: Mobilization and Demobilization**

This item will be paid as a lump price and includes the cost of mobilization and demobilization of all equipment necessary for the geotechnical study, the drilling campaign and characterization campaign in link with this project, travel costs staff, lodging expenses, cover and wages, and this during the period of mobilization and demobilization.

- **Item 2: Borings**

- a) **In soil, seabed or fill**

This item will be paid per meter drilled in the soil. It will include:

- The costs of the drilling, the driller, the assistant driller and all necessary equipment (including the rig and barge), the salary of a responsible engineer at least at an intermediate level, and the salary of a resident engineer (or senior technician), which will monitor the work onsite. Both positions could be occupied by the same engineer at least at an intermediate level.



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- Replacement costs of equipment parts broken during drilling.
- Loss of time due to the failure of machinery, breakage, etc.
- Costs of all tests carried out on site (see section 5.1).

b) In rock

This item will be paid per meter drilled in the rock and will include the costs identified for drilling in the rock.

Will be considered rock any material requiring the use of a corer for at least 0.6 m long without interruption.

• **Item 3: Laboratory tests**

a) Geotechnical tests

This item will be paid by unit of test and include all costs incurred for the tests described in paragraph 5.0, and, for each of soil and rock layers encountered during the drilling. Item is broken down as follows :

- 1) Granular
- 2) Clay
- 3) Rock

b) Sampling and environmental tests

For all the work specified in paragraph 6.0, the consultant must submit a fixed unit price for each of the methods of sampling and analysis. Only the actual expenses incurred by the consultant will be charged. Item is broken down as follows :

- 1) Metals (As, Cd, Cr, Cu, Hg, Ni, Pb, Zn)
- 2) PAH
- 3) BCP (aroclor)
- 4) TOC
- 5) C₁₀-C₅₀

Notes :

1. Unit price for sampling includes measuring field parameters, sampling itself, materials and equipment required for sampling, producing daily reports, job preparation, transportation of containers, coolers and cooling, transport of samples to the laboratory and any other item inherent in the activities.

2. Unit price submitted for chemical analysis shall include, without limitation, costs related to the following items : internal quality control measures of the laboratory analysis certificates, and other services inherent in the sample analysis.



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- **Item 4: Technical Reports**

- a) **Geotechnical report**

This item will be paid as a lump sum and will include the completion of the geotechnical report containing all information requested, including the completion of a preliminary report and achieving a final report (following comments from PPB) supplied in three (3) hard copies and electronically.

- b) **Sampling and environmental report**

This item will be paid as a lump sum and will include the completion of the report containing all information on sampling and environmental analyzes requested, including the completion of a preliminary report and achieving a final report (following Comments from PPB) supplied in three (3) hard copies and electronically.

- **Item 5: Other costs**

This item will be paid as a global unity and will include all other non-planned expenses in other items.

- **Item 6 : Downtime**

This item will be paid by the hour of waiting for bad weather (for a maximum of eight (8) hours per day, including hours worked) and will include:

- a) Treatment of staff.
- b) The cost of hotel and meals for the team.
- c) The costs of machinery and equipment.

Only adverse weather conditions will be considered as valid reasons for waiting charges. It is important to supply a machinery in good working order as the machinery breakage resulting in loss of good times to drilling will not be taken into account in calculating the paid waiting time. The construction manager will necessarily contact the representative of the Ministry to advise of any waiting periods caused by bad weather conditions.

12. ADDITIONAL WORK

Any additional tests required by the Department (but not mentioned in this contract) will be paid according to the minimum rates of ACLE (<http://www.acle.qc.ca/GUIDE.pdf>).

13. NOTES

When indicating depth, it should be understood as applied to natural terrain. The concept of depth must in no case involve an embankment whose consultant would have placed to perform any drilling.



14. PROPOSALS

The Department does not commit itself in accepting the lowest or any of the proposals.

15. HEALTH AND SAFETY

The Consultant should ensure that the drilling work is done so that the health and safety of public and staff working on site and the environment take precedence over issues related to cost and schedule of work.

By accepting this contract, the Consultant agrees to take over all the responsibilities normally assigned to the project manager under the Law on Health and Safety at Work and act as site supervisor, regardless of the number of workers assigned to the site. Forward Engineer mechanical inspection certificate for each piece of machinery used in construction and safe work planning (mini prevention program) including the following:

- OHS corporate security policy
- Work schedule and costs
- Description and flowchart of the health and safety responsibilities
- Physical and material organization of the construction site
- First aid kit and materials
- Required training for workers
- Procedure in case of a serious accident / death
- Emergency Plan

People participating in project must always wear a life jacket (PFD) which keeps head above water when workers are on a floating equipment or near the edges of a wharf or breakwater. Ensure that the required life jacket complies with CAN/CGSB-65.7 of the Canadian General Standards Board (CGSB) Life Jackets, Inherently Buoyant.

Obtain and transmit to Departmental Representative a letter of compliance issued by Transport Canada for approval of lifeboat before the work begins.

Ensure that the lifeboat is available at all times for emergency.

Drilling must be made in compliance with applicable codes, standards and regulations. Particularly, the work must be done in accordance with:

- Canada Labour Code - Part II, Canadian Regulations on Safety and Health at Work;
- Canadian Standards Association (CSA);
- Health and Safety Act, RSQ Chapter S-2.1 (1997);
- Safety Code for the construction work, S-2.1, r.6 (1997) (affecting marine works).

Consultant must identify risks and hazards related to each task performed during the drilling campaign.



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Consultant must ensure that its workers received training and information needed to perform all work safely and that all required tools and protective equipment are available and that they meet the standards, laws and regulations.

Consultant must inform its workers of their right to refuse work that is considered dangerous to their health or safety.

Before starting work, Consultant must plan and organize the drilling work to help eliminate the source of identified hazards or risks or collective protection and thus minimize the use of personal protective equipment. When personal protective equipment is required, workers must ensure that the equipment meets the standards, laws and regulations.

In case of an unexpected incident, take all necessary steps, including stopping work, to protect the health and safety of workers and the public and immediately contact the Department Representative.



Annex 1

Photos of Percé's Wharf



Annex 2

Precise location of borings



Annex 3

Prior geotechnical study



Annex 4

Construction Plans (part)