ASTALDI CANADA Inc.

nalcor energy

NALCOR ENERGY
LOWER CHURCHILL PROJECT

PACKAGE CH 0007
CORE TECHNICAL PROPOSAL

APPENDIX A13
EXECUTION PLAN

ASTALDI CANADA Inc.

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5. Curriculum Vitae - Project Manager - Vittorio Agabio
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11. Curriculum Vitae - Environmental Manager - Sandro Capadona
12. Curriculum Vitae - Health, Safety - Federico Moro
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PART A EXECUTIVE SUMMARY OF THE WORKS

Astaldi's Proposal is to construct the Muskrat Falls powerhouse, spillway and transition dams to meet Nalcor's quality and schedule requirements while, at the same time, providing significant commercial and educational benefits to the Province of Newfoundland and Labrador.

From the outset, Astaldi realized that the challenges on this project arise from its remote location and the severe weather conditions in the region. Astaldi therefore focused its efforts during the Proposal phase on exploring and developing the logistics and temporary site infrastructure and services necessary to achieve the Project goals. The results are shown in this Execution Plan and its attachments and are also reflected in the material presented in all of the other Appendices to Astaldi's Proposal.

To achieve Project success, Astaldi must:

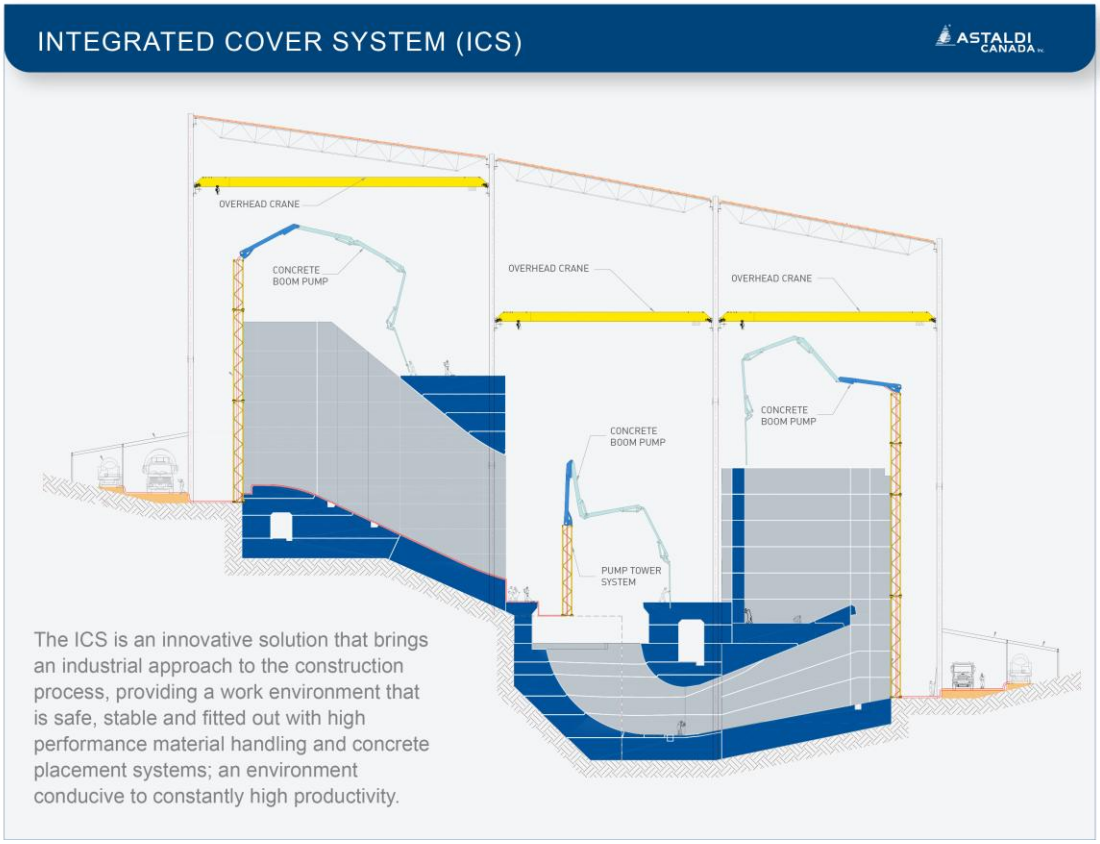
- establish with the Owner and its representative, at the outset, an excellent working relationship based on a full mutual understanding of the Owner's requirements, the Contractor's obligations, and the means of communication and collaboration among the project participants that will best serve the needs of the project;
- organize and realize an efficient early mobilization;
- be ready at site prior to the first winter (2013-2014) with all temporary equipment and the site organization infrastructure in place;
- design, procure, deliver and erect the Astaldi's Integrated Cover System (ICS) over the powerhouse and intake structures in the early stages of the work;
- procure, install, test and commission the permanent batch plants and crusher facilities by March 2015;
- achieve a successful launch of Astaldi's campaign to reach out to the Inuit community as well as the local, provincial and Canadian community for the purpose of attracting the qualified trade, technical, supervisory, managerial and administrative personnel, to the project to suit the needs of the project;
- ensure that Astaldi's procurement activities draw upon all local, regional and provincial (both Labrador and Newfoundland and Nova Scotia) subconractors, suppliers, consultants and service providers;
- successfully implement Astaldi's integrated project management systems to ensure proper management of quality, safety, and the environmental as well as project controls.

Our execution plan has been developed for the express purpose of providing a viable plan to achieve these goals. The Astaldi **Project Start-Up Task Force** is a key element in this and will include members of the Proposal team, key personnel from the Astaldi international organization, as well as personnel from Newfoundland and Labrador and other areas of Canada. As the project progresses, Astaldi will transfer the management and technical functions taken on at the outset by its international engineers and managers to local engineers and managers. The project manager, however, is not expected to change.

Astaldi will finalize its transporation logistics immediately, start moving equipment, temporary plants and material to site and in order to be ready to produce concrete within two months of contract award. This will allow the development of the site infrastructure and the start of foundation preparation at both the spillway and powerhouse.

During the first winter, the entire spillway foundation will be prepared under the protection of a unique system of temporary covers that are designed to allow rapid relocation.

The technical core of the Astaldi proposal is the Integrated Cover System (ICS) shown below.



The ICS will be in place at the end of February 2014, at the time that the permanent batch plants will be operational and tested. The ICS will be equiped with four reception bays that are designed to allow the unloading and tranfer of material from delivery vehicles to the work areas in a controlled environment protected from the elements.

Starting in March of 2014, the spillway, separation wall, north and central transition dams and the intake and powerhouse will all be under construction. The Milestone Dates set out in the RFP, and in particular the Milestone Dates for the spillway completion (February 2015), yield a production peak from July to October 2014.

Astaldi has designed its temporary plant and equipment with sufficient capacity and reliability (industrial installations, redundance, availability of service, etc.) to ensure that this peak production can be achieved.

- Up to 9 simultaneous concreting stations (Putzmeister 150 m3/hr pumps and booms);
- 29 cranes (from 5 ton to 200 tons);
- 10 concrete trucks;
- 2 batch plants (total hourly rated capacity of 250 cubic metres)
- 20 trailers for the transport and temporary storage of reinforcing steel (to avoid double-handling)
- Up to 70 cement trucks
- 7 trucks for the transport of aggregates from the borrow pit to the crusher plan (18 to 30 ton capacity)

Astaldi will hire a peak of approximately 1,200 trade workers and 280 staff (supervision, technical, management and administrative) most of whom will be at site. Astaldi has developed a The Astaldi well established and well structured project management systems, combined with the use of state of the art communication and internet based technologies will allow the rapid and effective integration of new personnel into the project management team to support the fast growth rate of production up to the anticipated peak one year into the project.

Astaldi will work with experienced designers and suppliers of specialty forwork for hdyro-electric projects. Complex formwork (draft tubes) will be pre-fabricated off site. Astaldi favours auto-lifting vertical formwork for efficiency reasons.

Astaldi will use a combination of steel and wood faced forms, depending on the specified concrete finishes. Reinforcing steel will be fabricated (cut and folded) off site and transported to site on a "just in time" basis with an on-site buffer that avoids double handling.

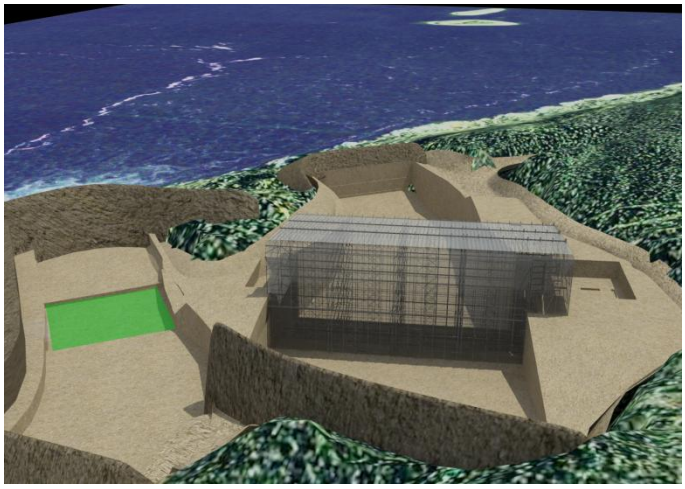
The remaining challenges include the procurement and erection of the structural steel for the powerhouse, the coordination of Astaldi's work with the hydro-mechanical and hydro-electrical contractors and the completion of the work.

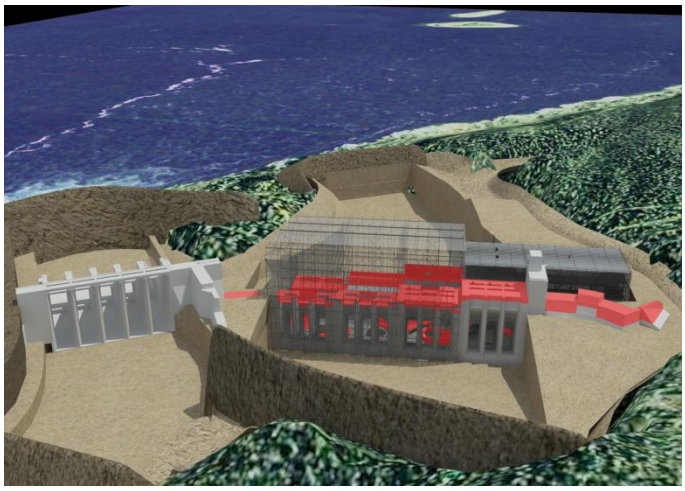
The images on the right highlight Astaldi's philosophy for the successful execution of this project in the remote and climatically challenging area of Muskrat Falls.

The first image shows the Integrated Cover System (ICS) over the powerhouse and intake structures in place in early 2014 The second image shows the advancement of the concreting of the intake and powerhouse structure under the protection of the ICS in the summer of 2015. The final image shows the completed structure after removal of the ICS. (These are only a few samples extracted from the model prepared by Astaldi for this Proposal.)

These images were extracted from the 3D model that Astaldi built for the purpose of analyzing and then developing its construction methodology for the project and finally, using the model to create a 3D visualization tool that will be used to facilitate the construction process (detailed planning, detection of interferences, training of project personnel including trades people, subcontractors and suppliers. (see **Attachments 28 to 32 and 39**)

Astaldi will continue to develop this model to incorporate the specifics of all selected construction plant, equipment, materials and temporary facilities.





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PART B THE MATRIX APPROACH

B.1 ASTALDI STRATEGY TO CONCRETE THE MUSKRAT FALLS HYDRO POWER STATION

The Muskrat Falls Generation Project represents the first step of the Lower Churchill Hydroelectric Improvement carried out by NALCOR development program. As in all energy development programs it is extremely important to achieve the objectives from the early beginning of the project.

The contract CH0007 represents within this context one of the most critical moments of the project development itself. The correct execution of all main concrete works on schedule and within the expected budget will permit:

- to allow the river diversion on the expected time through the Spillway
- to guarantee the installation of all hydromechanics equipment permitting to continue to construct during the diverted water passage
- to permit to electromechanical contractors to install the draft tube casings and the turbine rings and to maintain their foreseen schedules for turbines and generators installations.

Astaldi is very familiar with such kind of approach, having completed in the last years several hydropower projects from the early beginning to the final commissioning and operation included the procurement and installation of all hydro mechanical and electro mechanical components.

Astaldi strategy to successfully achieve this work is based on the following main items:

1) to identify all the direct and indirect risks of the project and of the Contract
2) to manage the detected risk from the early tender stage, by choosing the best way to procure and construct
3) to allocate the residual risk and wherever is possible, to share them with the client in order to always conduct a comfortable management of the contract
4) to plan a feasible working schedule with an appropriate allocation of floating time, in order not to risk to be late on the given milestones;
5) to develop successful partnerships with the Natives, the local communities and the Unions in order to improve the manpower efficiency and productivity by develop an attractive working environment, based on high safety and health standards and a very efficient winter protection approach.

6) to have a neutral to positive cash flow, permitting to have comfortable relationships with the client and all subcontractors, suppliers, providers, consultants, etc.

For the both the Spillway and Transition Dams Works Astaldi intends to make specific Joint Ventures with Nominated Subcontractors, in order to allow them to become Partners in the Works, with clear responsibilities and benefits.

At the same time, being part of the same Joint Venture, Astaldi will have the possibility to act in case of non performance of the Partner, always guaranteeing in this way to Nalcor and its Engineer the direct control of all the **Works.**

B.2 THE ORGANIZATION CHART: SERVICES AND WORKS

The Muskrat Fall Generation Station Project is mainly characterized, within others, by the fact:

1) to always guarantee a very high safe, health quality and environmental context,

2) to be executed in remote areas, with specific procurement and logistics problems,

3) to be realized for more than 5 months under severe winter conditions, represented by very low temperatures, intensive snow falls and strong wind storms,

4) to require an important specialized manpower contribution under a specific Labour Agreement, involving as first the Natives and the local communities

5) to involve as much as possible local subcontractors, suppliers and providers, in order to increase the development of the local industry with the consequent attraction and development of the manpower in Newfoundland and Labrador.

Astaldi, based on its experience as General Contractor, has decided to adopt for this project the Project Management Matrix Approach, which is based on the fact that all the strategic **Services** (Management, HSQE, Engineering, Human resources, Procurement, Site Organization, Facilities, etc.), **Materials** (Concrete, formworks, steel reinforcement, etc.,) and equipment (Cranes, Concrete Mix Trucks, Pumps, etc.) will be supplied to the different **Works** (Spillway, Transition Dams, Intake, Powerhouse, etc.) that will be either executed by selected Subcontractors, Suppliers, etc. The same services and materials will be also used for all those works that Astaldi intends to self perform.

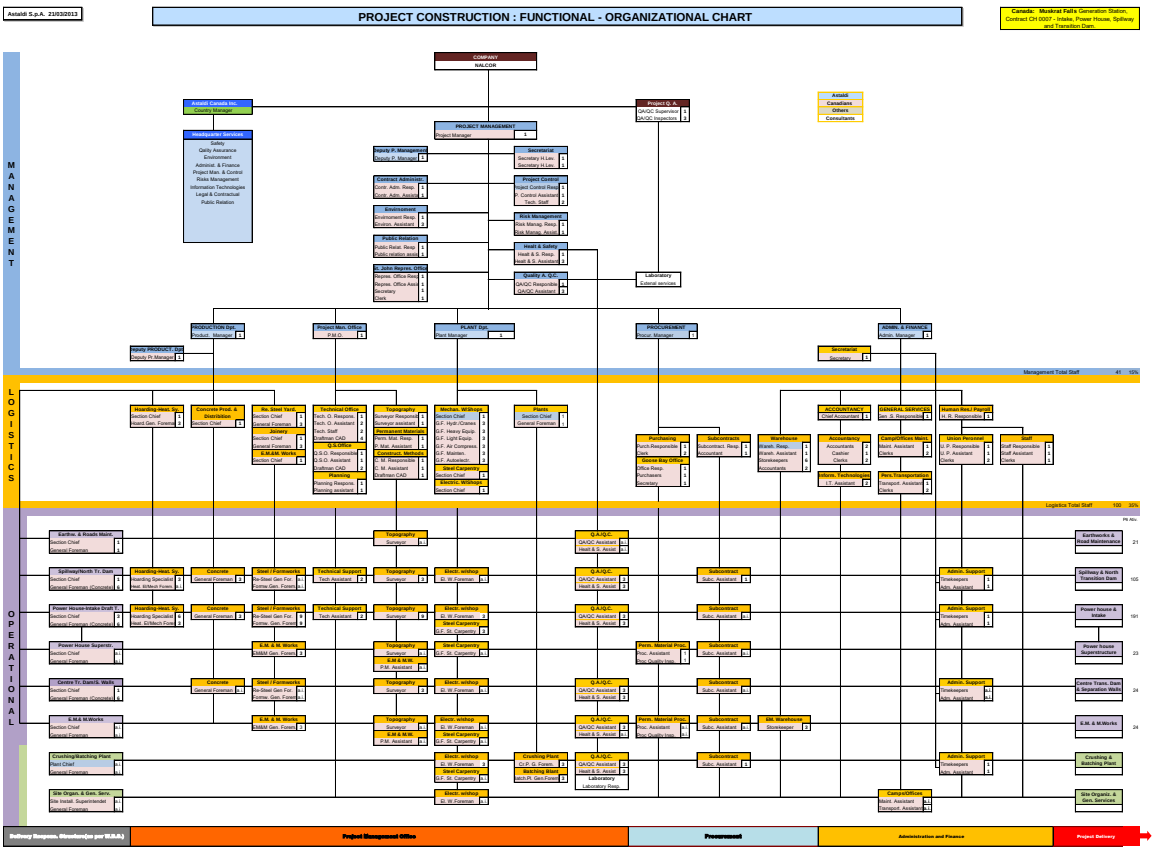


Figure 1: Astaldi Project Management Matrix Approach for Muskrat Falls Project (See **Attachment 2** for a larger scale version)

PART C THE SERVICES: CRITERIA AND STRATEGY

C.1 MANAGEMENT

C.1.1 ON SITE MANAGEMENT

The Contractor proposed Project Functional Organization Chart for the Project Delivery Team shall consist in three functional organization structures: the Management, the Logistics and the Operational Staff as shown in the submitted Attachment to this Appendix A13. The personnel staff foreseen in the three functional structures shall be distributed in accordance to the Figure 2.

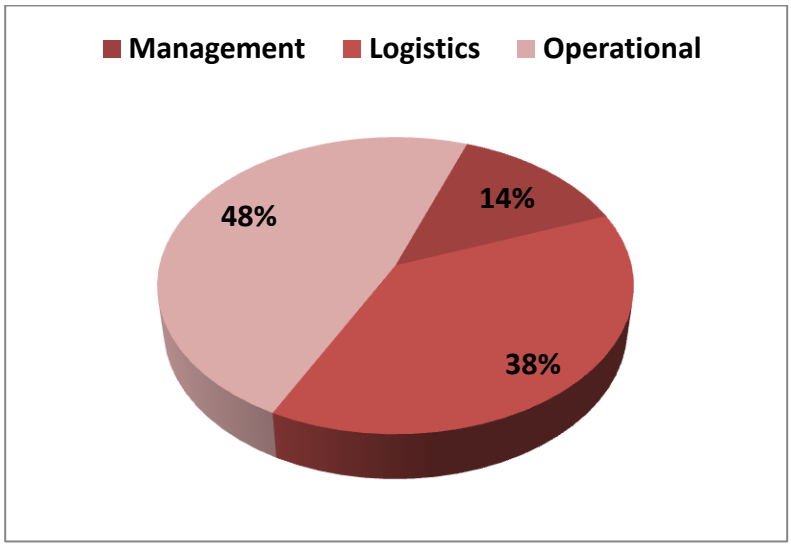


Figure 2: Distribution of the staff per functional areas (in percentage).

In the proposal of a matrix organization structures, the supervision staff would end up working both under a department head (at the Operation and Logistics level) and the Project manager of the Project Delivery Team. A matrix organization goes over the traditional vertical hierarchy introducing some form of lateral authority and/or communication lines that bring to two chains of functional relations—one along the functional areas lines (Management, Logistic and Operation) and another along the Project section lines (Project WBS or Work Sections). The matrix structure has been implemented by the Contractor after realizing the need for a strong technical assistance required across the Project Work Sections.

In the functional organization given by a matrix chart, the staff involved in the project delivery shall remain under control of the Project Manager, while Sector Chiefs/Manager (Functional Managers) shall be designated to oversee the project sections and their respective functional areas as briefly shown in Figure 4.

The Project Manager (PM) shall maintain the communications with Project Stakeholders and the Contractor Board. Indeed the PM shall be the primary Company and Stakeholder contact for the project. The PM shall bear the responsibility to monitor the coordination and progress of the processes that support the Operation and the Logistics functional areas as well as the Project Management functional areas in accordance to the Figure 3. The Project Manager shall be a local Canadian and shall be supported by an expatriate Deputy Project manager.

Project Manager (Canadian)-Deputy Project Manager (Expat)	
Project Management Functional Area	**Logistic & Operation Functional Area**
• Contract Administration (Canadian) • Environment (Canadian) • Public Relation (Canadian) • Project Control (Expat) • Risk Management (Canadian) • Health & Safety (Canadian) • QA/QC • Satellite Office (St John's)	• Production (Expat) • Project Management Office –PMO (Local-CA) • Plant (Expat) • Procurement (Expat) • Administration & Finance (Expat)

Figure 3: Functional Area of the Organization Chart

In the Logistics and Operation Departments the Functional Managers shall provide data/documents and assist the Project Manager and his Deputy. Moreover they will provide coordination and communication among their technical staff and the other discipline technical staff.

At the Operation level where the Section Chiefs and the Logistics Staff form a team relation grid, the grid would provide liaison not only between the Logistic department offices but also with the production/operation units (Work sections) where considered necessary for the particular needs of the Project. A two-way flow authority and responsibility would be then established between the Operational Team and the Logistic Team allowing a more efficient use of resources being specialized figures shared or transferred from one Work section to another. In each functional area of the Logistics Team (Production, PMO, Plant, Procurement, Administration & Finance) the authority and responsibility will flow vertically down the lines, but the authority of the Section Chief at the Operational level will flow horizontally in the organization structure providing high integration and flexibility among the individuals of the organization.

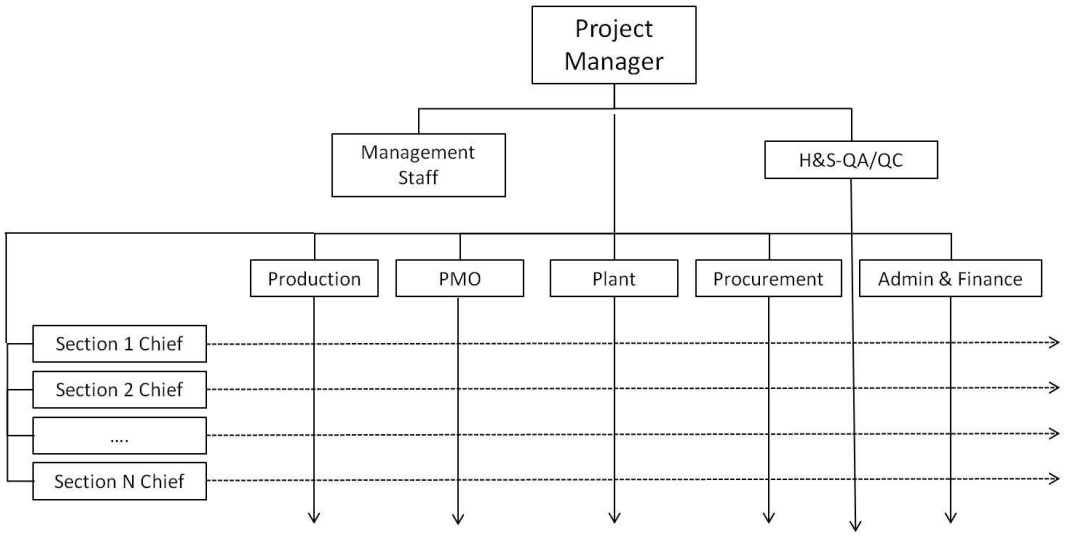


Figure 4: Simplified Project Matrix Organization Chart

In the Contractor proposal the **Production Department** shall report to the Project Manager and will be headed by a Production Manager and a Deputy Production Manager supervising five (5) units for: hoarding system, concreting, steel yard, joinery and EM Works.

The five units shall be further joined in the organization relation with the eight (8) Operation units (Work Sections) for:

1. Earthworks,
2. Spillway/North Transition Dam,
3. Powerhouse/Intake,
4. Powerhouse Superstructure,
5. Centre and South transition Dam,
6. EM&M Works,
7. Crushing/Batching Plants, and
8. General Services.

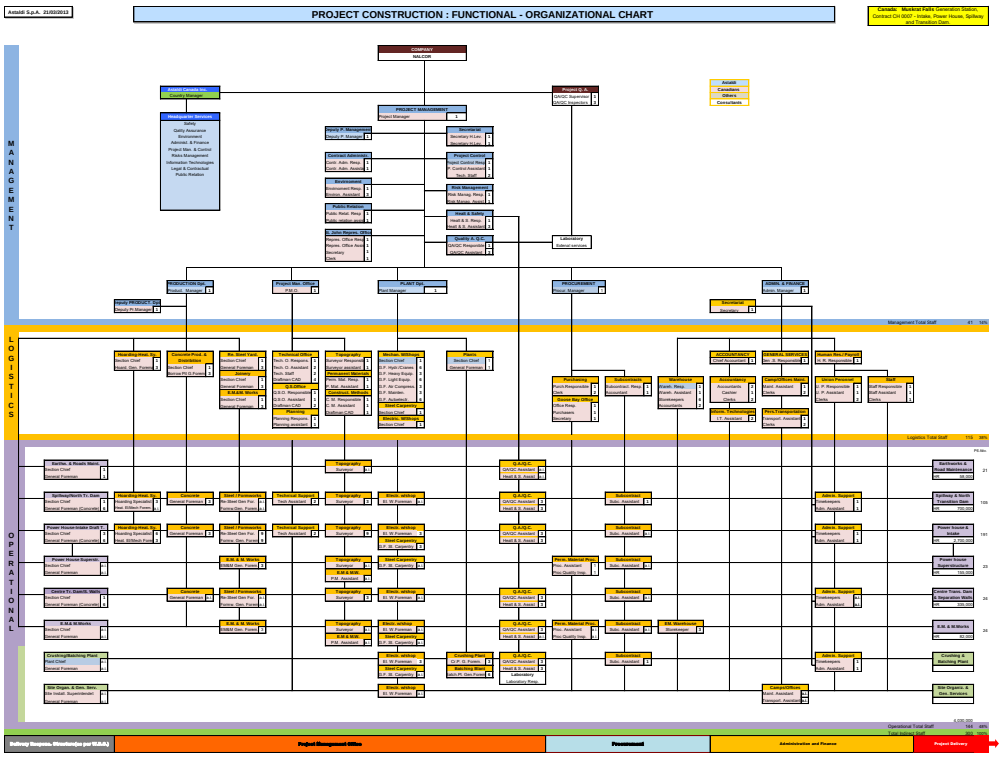


Figure 5: Astaldi Project Management Matrix Approach for Muskrat Falls Project

The **PMO,** through its PMO manager, shall report to the Project Manager and shall control and supervise five (6) departments:

1. Technical Office,
2. Quantity Surveying Office,
3. Planning Office,
4. Topography Office,
5. Permanent Material Office and
6. Construction Methods Office.

Each of the department has a department responsible and assistants. The large Contractor experience in similar scale Projects all over the world brought to implement a full time PMO in order to improve the communication between the technical department and the other functional lines and to speed up all the engineering matters related to the permanent and the temporary works.

The **Plant Department** shall report to the Project Manager and shall supervise the Mechanical Workshop, the Steel carpentry, the Electric workshop and the Site Plants in general.

The **Health & Safety Department** shall directly report to the Project Manager. The Health and Safety Manager will head a team of at least one (1) inspector per each Work Sections. A similar organization structure will be foreseen for the **QA/QC Department** whose function will be also to liaise with the External Laboratory and the Company QA/QC supervision team.

The **Procurement Department,** headed by the Procurement Manager, is one of the recognized Key departments for the Project exploitation. A special attention has been deserved to the Procurement that shall directly report to the Project Manager and will be resourceful for the whole Project duration. The local Purchasing office on site, the Goose Bay purchasing office and a subcontracts procurement office will report to the Procurement Manager. The authority and responsibility of the Subcontractor procurement office will flow vertically down the lines throughout each section of the Works.

The **Administration & Finance Department** shall report through the Administration Manager to the Project Manager and shall have authority and responsibility over the Accountancy department, the General Logistic Services, the Human Resources and the Warehouse.

The Contractor recognized the risk of the Workload and in order to guarantee a right span of control proposed a redundancy in the roles through the use in the Functional Organization Chart of many figures in the position of Deputy Manager in order to allow for a Management efficiency of the Project for the whole duration of the works and for the assumed working days per month.

C.1.2 TASK FORCE

In order to achieve the schedule deadlines a Project Start-up Task Force Team (STF) will be formed comprising members of the Contractor management together with some specific project allocated staff. The core STF team that should be seen as a frontend management team will be mainly consisting in:

- Project coordinator
- Project manager
- Deputy project manager
- Procurement Manager
- Construction manager

- Technical manager
- Cost control manager
- Plant manager

The TF team will be entrusted and will be mobilized to prepare and submit the following documents before the contract award:

- Muskrat Project Integrated Management Plan including
  - Health & Safety Plan,
  - Quality assurance / control Plan
  - Environmental Plan
- Muskrat Project Internal procedure
- Detailed construction program schedule
- Material Procurement Plan
- Personnel recruitment plan
- Equipment and machinery procurement plan
- Transport and logistics plan
- Site layout and use proposals
- Construction Methods
- Analysis of alternative construction methods
- Review of permanent design and proposal for possible value Engineering

For this purpose Astaldi is ready to start to mobilize internal high-level personnel as soon as possible after the tender submission date and during the negotiation phase.

The negotiation phase shall be managed from the team who participated in the preparation of the bid but in the mean time a construction team shall be mobilized.

This team shall be constitute from senior construction personnel, with large experience in hydroelectric project, and, in large part, they shall participate in the construction phase.

The major task of this team is to organize the operational structure of the projects following the guides and directives of Astaldi Management according to the procedures normally applied by

the company and indicated in the quality Plan.

See **Attachments 3 to 17** inclusive for copies of the curriculum vitae of the individuals identified below.

The team shall be led by the future Project Manager of Muskrat Fall HP, with the support of a senior construction manager provided by the company for this task.

Mr. Guido Venturini is the Tender Manger of this Proposal and he will be the Project Coordinator of the STF team, Astaldi Canada and the Parent Company Astaldi SpA. Mr Venturini is a senior engineer with 21 years of experience in planning, study and execution of hydroelectric projects in more than 9 countries including preparation of technical and feasibility study for the Santo Antonio Hydro Power Plant on the Rio Madeira in Brazil with a total installed capacity of 3150 MW.

The STF Project Manager shall be Mr. Vittorio Agabio. He is graduated as Engineer in "Politecnico di Torino – Italy" and has a wide and strong experience in General Management and Project Management developed in huge worldwide entrepreneurial ventures. Specifically he worked more than 20 years as Project Manager or Senior Project Manager. In the last years Mr. Agabio has been Astaldi's Project Manager for Huanza Hydroelectric Project in Peru'.

Mr. Ken Chryssolor shall assist Mr. Agabio as Deputy Project Manager. Mr. Chryssolor is a senior Canadian engineer with more than 30 years of experience in heavy construction works in Canada. Mr. Chryssolor, with is large experience in hydroelectric project built in Canada, provides a link to the Canadian market especially for the research of the construction personnel (superintends, foremen, etc...), suppliers and subcontractors. Among his functions there is the task of organizing the logistic of the job site, with particular attention to the delivery of material to site (cement, steel , rebar, diesel, etc…).

Mr. Aldo Dussi is a professional with more than 35 years of experience in Procurement and Logistic for international projects. He has experience working overseas and also implementing successfully QA/QC systems in activities under his supervision. During the last 3 years he was the Procurement Manager for the Kadikoy - Kartal Metro in Istanbul, Turkey which is one of the most successful projects of Astaldi in the recent years.

Mr. Vittorio Robiati shall be the construction manager for the mobilization phase. Mr Robiati has 45 total years of experience managing world class projects. These projects have given to Mr Robiati a strong experience in working in various types of Works. In the last 3 years Vittorio was one of the main Construction Managers of Consortium what built the new development of the Panama Channel. Currently, Mr Robiati is working as the Astaldi Area Production Manager in Central America and as expert advisor for the construction of the Cerro de Aguila Hydro Power Plant.

Mr. Cesare Zampini shall operated has plant manager. Mr. Zampini is a senior plant manager, with almost 40 years of experience in heavy construction. He is in charge for the plant

department of Astaldi in Florida and he shall be involved in the research of the equipment and machine required for in the project.

Mr. Juan Carlos Bassi shall be in charge for the Project Control Department. Mr. Bassi has a large experience in Project management control and shall coordinate the planning department, the Cost control department and Quantity surveyor.

Mr. Antonio David Pizzimenti has more than 10 years of continue experience as Technical Office Manager in infrastructure projects in Europe leading activities related to schedule, budget and particular emphasis of engineering works. During last two years, Mr. Pizzimenti has been the Proposal Manager lead of Astaldi for projects in Qatar and the Middle East.

C.1.3 OFF SITE MANAGEMENT

C.1.3.1 ST JOHN'S OFFICE

Astaldi intends to establish an office in St John in order to guarantee a direct and continuous relationship with Nalcor, SNC, the Unions and to improve relationships with the local industry and entrepreneurs that would be interested in participating in the exploitation of the Project package CH0007.

St. John's office will also facilitate the development of labor relationships, increasing the opportunities of local employments, always in strict contact and coordination with Nalcor and its Engineer SNC.

C.1.3.2 GOOSE BAY OFFICES AND FACILITIES

An office managed by a responsible and by an assistant, will be established in Goose Bay in order to facilitate all the logistic, transportation and local procurement aspects. Goose Bay office will represent the logistics hub for all shipped material from both land and sea transport and for the manpower arriving and departing from the job site.

Goose Bay office will also facilitate the development of labor relationships, increasing the opportunities of local employments, always in strict contact and coordination with Nalcor and its Engineer SNC.

C.2 SAFETY, HEALTHY, QUALITY AND ENVIRONMENTAL

C.2.1 HEALTH AND SAFETY

The management team of Astaldi will be vitally interested in the health and safety of its employees, subcontractors and the general public. Protection of employees from injury, occupational disease, violence or harassment is a major priority.

Astaldi will make all the effort to provide and maintain a safe, healthy work environment in which all individuals will be treated with respect and dignity. In addition, it is the policy of Astaldi and a requirement of its employees and subcontracted trades to perform all work in a manner that ensures minimal impact on the environment.

All Astaldi employees and subcontracted workers must be dedicated to the continuing objective of reducing the risk of injury in the workplace. Every worker is responsible for protecting his own health and safety by working in compliance with the Occupational Health and Safety Act of Newfoundland Labrador, and with the safe work practices established by Astaldi.

As per the requirements of the proposed Lower Churchill Muskrat Falls Hydroelectric Development project, all Astaldi employees and subcontracted workers will abide by all of the relevant SNC-Lavalin health and safety requirements and the requirements of OSHAS 18001:2007.

Should there be discrepancy between the requirements of the Occupational Health and Safety Act of Newfoundland Labrador, the safe work practices established by Astaldi, the requirements set forth by SNC-Lavalin and the OSHAS 18001 standard, the more stringent of the four shall apply.

The Principals of Astaldi Canada Inc. are committed to their Health and Safety Program to the extent that every reasonable precaution will be taken for the protection of their workers from injury, occupational disease or potential risks associated with workplace violence and harassment.

Supervisors will be held responsible for the health and safety of workers under their direct supervision. Supervisors are responsible to ensure that machinery and equipment are safe and that workers work in compliance with established safe work practices and procedures. All workers must receive adequate training in their specific work tasks to protect their health and safety.

All parties shall consider health and safety before commencing any activity. Subcontractors and their employees are expected to meet or exceed the requirements of Astaldi's Health and Safety Program. Those found failing to comply would be disciplined accordingly.

C.2.1.1 SAFETY ORGANIZATION AND RESPONSIBILITIES

Our Company is committed to avoiding, preventing and reducing loss due to injury, property damage, reduced productivity and reduced Quality. We will maintain a safety and health program that confirms to the best practices of organizations in our industry. This requires co-operation in all safety and health matters, not only between supervisor and employee, but also between each employee and his or her fellow workers.

The responsibility for health & safety is shared amongst the different levels within the organization as follows:

- The employer is responsible for the leadership in the safety and health program, its effectiveness and improvement, and the safeguards to ensure safe conditions.
- Project Managers and Supervisors are responsible for developing good attitudes towards safety, and for ensuring that all operations are performed with the utmost regard for the safety and health of everyone.
- Workers are responsible for co-operating with all aspects of the safety and health program, including compliance with all rules and regulations.

Astaldi will establish and operate an occupational health and safety committee. This committee will have access to management staff with the authority to resolve health and safety issues and to access information about the employer's operations as required under the Occupational Health and Safety Act of Newfoundland Labrador. This committee shall be also responsible for the maintenance of membership records, procedural rules and training committee members as required under the Act.

C.2.1.2 HAZARD EVALUATIONS

Astaldi has adopted the use of a Job Safety Analysis (JSA) form in order to carry out Hazard Evaluations for specific job-site activities.

The first objective of the JSA is to identify the hazards through the completion of the Hazard Identification List". The purpose here is to inventory all operations, activities, equipment, machinery, materials, tools, ergonomic factors, chemicals, environmental factors, etc. that may be involved with a specific work task that could have potential hazards associated with them. To aid in the identification of these hazards, the individual "Job Steps" are also listed (in sequential order) on the JSA form.

An assessment of the potential risk must be carried out for each identified hazards. The assessment must evaluate the risk from the perspective of the frequency of exposure to the

hazard, potential consequences of exposure, and probability of the hazard occurring.

Based on the risk assessments performed, control measures are to be identified and listed on the JSA form. These measures may be in the form of specialized training, PPE, etc.

Tools and equipment are also to be identified as part of the JSA process with the expectation that all tools and equipment are checked for proper operation before use.

The JSA process also requires that all persons working on the specific task be identified and that each of these individuals acknowledge (by way of signature) that they have participated with the JSA procedure. As well, other adjacent crews and/or visitors must also be identified and included with the JSA process as required and/or applicable.

JSA forms will kept on site and made available for review and revision as deemed necessary and/or required. Copies of the JSA forms will also be archived at Astaldi's regional offices.

C.2.1.3 GENERAL SAFETY RULES

All Astaldi employees and subcontracted employees working at a project site are expected to work safely at all times and as such are expected to follow the following rules while carrying out their respective duties:

- Appropriate clothing and PPE must be worn at all times while at a jobsite as follows:
- Only authorized, trained and licensed employees will operate, maintain or adjust tools, equipment and/or machinery at the jobsite.
- Horseplay or fighting will not be tolerated at the jobsite
- No alcohol, drugs, firearms or other weapons will be allowed at the site regardless of it being on a person or within a workers vehicle.
- Equipment machinery and tools must be operated correctly and should not be modified in any way that could hinder it's safe operation
- Only authorized personnel are allowed to carry out servicing and repairs of equipment
- All vehicles and mobile equipment are to be operated in accordance with applicable regulations
- Do not start or operate equipment that has been tagged Do Not Use.
- All accident, incidents or near misses are to be reported to the site supervisor.

- Smoking is allowed in designated areas only.
- Hand tools are to be used for what they are made for. All damaged or worn parts are to be repaired or replaced immediately.
- Power tools are to be used by authorized personnel with all manufacturers guards in place
- Workers are not to work alone. Should there be a need to work alone, a safe work procedure will have to be approved by KGS Group prior to such action.

Any worker employed on the site who fails to comply with any of the above “General Safety Rules” or any other applicable Health & Safety regulations will be subject to:

- First offense – Verbal warning
- Second offense – Written Warning
- Third offense – 1-2 day suspension without pay
- Fourth offense – Extended suspension or Dismissal

Any offense deemed by management to be of a serious nature may result in action up to and including immediate dismissal, regardless of whether it is a first offence or not. All warnings will be documented accordingly.

C.2.1.4 TRAINING

All Astaldi employees will be required to be suitably trained and prepared to perform their specific duties.

All Astaldi employees at the site will be required to receive an orientation upon arrival at the site. This orientation is intended to cover a number of topics that are considered important to all the newly arrived workers. The Site Specific Safety Plan” will be reviewed in order to ensure that all Health & Safety protection measures are followed throughout the project.

All certificates or other forms of record for Health & Safety training will be kept on site as verification of the workers training. All workers will be expected to arrive on site having already received the training necessary to carry out their duties.

C.2.1.5 MONITORING

It is Astaldi's policy to ensure that their workplace is safe and as free as possible from hazard. Regular site inspections are an important part of our overall Health and Safety program. Through ongoing inspections by the Site Supervisor, it is considered that the control of hazards can be kept to a minimum. All workers are expected to continually assess hazards as part of their job responsibilities. This behavior will identify hazardous conditions in order to either correct them immediately or report them for corrective action.

Astaldi will ultimately be responsible for ensuring that all equipment being used at the site is in safe operating condition. As such, all equipment at the site will be required to be inspected daily. Where equipment is under the direct ownership and care of a sub-contractor, the subcontractor will be responsible for these inspections. Where equipment is under the control of Astaldi, Astaldi will be responsible for these inspections. Documentation of these inspections will be kept at the site under the control of the Astaldi Site Supervisor.

Daily site inspections in order to identify Health & Safety concerns will be performed by the Site Supervisor. These inspections will be done in concert with daily environmental inspections and will be reported as part of the daily diary reports produced by the Site Supervisor.

Any SNC-Lavalin representative will be given full cooperation from all workers at the site. The Astaldi Site Supervisor will accompany and assist the SNC-Lavalin representative. Workers will participate and cooperate in any exercises or investigations if requested by the representative. On completion of any such inspection, any corrective actions deemed necessary are to be carried out and a copy of the inspection report is to be forwarded to the Astaldi Project Manager.

The respective Health and Safety Representatives will monitor and inspect the workplace as well as per the responsibilities outlined in the Health and Safety Act of Newfoundland Labrador. Generally speaking, the H&S Rep is expected to identify workplace hazards by inspecting the site at least once a month.

Any Government Health and Safety inspectors will be given full cooperation all workers at the site. The Astaldi Site Supervisor will accompany and assist the Government inspector. Workers will participate and cooperate in any exercises, investigations, and/or stop work order if requested by the inspector. On completion of any such inspection, any corrective actions deemed necessary are to be carried out and a copy of the inspection report is to be forwarded to the Astaldi Project Manager.

Should a deficiency be found by any one of the monitoring bodies, the first priority will be to correct the noted deficiency as soon as possible. In all such cases, the required regulatory bodies and/or SNC-Lavalin shall be suitably notified and all required documentation will be generated and distributed.

C.2.1.6 EMERGENCY RESPONSE

As per the Occupational Health and Safety Act and regulations of Newfoundland Labrador, “serious incidents” (as defined as an accident takes place at a workplace that results in serious injury to a person or results in the death of a person; or that had, or continues to have, the reasonable potential of causing serious injury to or the death of a person) will be immediately reported to the assistant deputy minister.

Notice of a “serious incident” shall also be given to health and safety committee, the worker health and safety representative or the workplace health and safety designate.

In the context of a “serious incident”, a "serious injury" means:

- fracture of the skull, spine, pelvis, femur, humerus, fibula or tibia, or radius or ulna;
- an amputation of a major part of a hand or foot;
- the loss of sight of an eye;
- a serious internal hemorrhage;
- a burn that requires medical attention;
- an injury caused directly or indirectly by explosives;
- an asphyxiation or poisoning by gas resulting in a partial or total loss of physical control;
- another injury likely to endanger life or cause permanent injury,

However, the above does not include injuries to a worker of a nature that may be treated through first aid or medical treatment and the worker is able to return to his or her work either immediately after the treatment or at his or her next scheduled shift.

Workplace injuries must be reported to The Workplace Health, Safety & Compensation Commission of Newfoundland and Labrador if the injury

- happened at work, on company property or on company business;
- needs medical treatment; and
- may or may not need time away from work.

First aid facilities and first-aid and CPR trained employees will be provided in keeping with the applicable regulations.

Specific medical and/or fire emergency response plans will be provided for the proposed work

site. These plans will include all relevant contact names and phone numbers along with specific site drawings indicating muster points, site entrances, travel routes to local hospitals, etc.

C.2.1.7 INCIDENT INVESTIGATIONS

It is the policy of Astaldi that all of the following types of incidents will be investigated in order to determine the cause and corrective action needed to prevent a reoccurrence of a similar event:

- Personal Injury
- Occupational Illness
- Fire or Explosion
- Property and/or Equipment Damage
- Environmental Damage
- Near-miss Incidents

While investigating and reporting incidents can help prevent reoccurrence of the incident, it can also be invaluable in helping to settle insurance claims, compensation claims, litigation, etc resulting from the original incident.

Commitment to health and safety forms is an integral part of this organization, from the president to the front line workers. With everyone's cooperation, Astaldi will continue to provide a safe and healthy workplace.

C.2.2 QUALITY

C.2.2.1 GENERAL

Astaldi establishes, documents, and maintains a Quality System to ensure that the Client's specific requirements are met or surpassed. This Quality System is one of the primary management tools for the project. It is used to control the quality of the work and will provide the Client with documentation to demonstrate that the work performed conforms to the contract specifications. The Quality System documentation hierarchy is as follows:

- Quality Manual;
- Quality Procedures Manual;
- Quality Plan;
- Quality Records

Astaldi has provided a copy of the Quality Manual and Quality Procedures as part of this proposal. Astaldi follows the procedures of ISO as laid out in the following documents:

- ISO 9001:2000 Quality Management System- Requirements;
- ISO 9004:2000 Quality Management System - Guidelines for performance improvements; Quality Management
- SO 9000:2000 System - Fundamentals and vocabulary;

On award of the contract, Astaldi will complete the development of a site-specific Quality Plan for the Muskrat Falls GS construction project.

The plan will define the Quality Management System implemented by Astaldi for controlling the quality of the services on the project in order to ensure that the product fulfils Client requirements. The key areas that will be covered in the site-specific Quality Plan are:

- The Quality Management System
- Management Responsibilities
- Resource Management
- Execution
- Measurement, Analysis and Improvement

C.2.2.2 QUALITY MANAGEMENT SYSTEM

Astaldi plans to maintain and monitor its Quality Program by the various methods described in the Astaldi Quality Manual. Procedures adopted to ensure that the manual is followed will include:

- Record inspection and test information in inspection reports, daily diaries, and daily reports;

- Standard forms will be used for:
  - Non-conformance report,
  - corrective action request,
  - Preventive Action Request,
  - and any required follow-up to these reports will be logged via job site registers and logs.
- Weekly crew tool box meetings will be held to provide a forum for management to discuss specific prevalent productivity, quality and safety issues with site personnel.
- Quality audits will be initiated and conducted by qualified, trained off-site personnel.
- Subcontractors/suppliers will be required to comply with the Site-Specific Quality Plan to the same extent as Astaldi. These compliance procedures include:
  - Subcontractor/supplier development of their respective sections of the job-specific documents;
  - Subcontractor testing in accordance with subcontractor-defined inspection and test plans, and Client's requirements;
  - Documentation of specific quality tests performed;
  - Subcontractors will be required to sign standard subcontracts that oblige them to the same Contract quality obligations that the contractor has with the Client. Failure to comply can lead to termination of a subcontract/supply contract;
  - Subcontractor/supplier attendance at weekly meetings as required by Astaldi

C.2.2.3 DOCUMENTATION

The Astaldi engineering staff will be responsible for all document control for Astaldi operations. All documents received from the Owner, the Owner's Engineer and other organizations will be addressed to the Astaldi Project Manager. The site-specific Quality Plan will detail the document procedures for the Astaldi office including correspondence, transmittals, approved construction documents and revisions.

The documentation structure of the Astaldi Quality Management System for the project consists of four levels of documents:

- **The Site Quality Plan (QP):** is developed by Astaldi in order to provide guidelines and is an overview of its Health-Safety, Environment and Quality Management programs in

accordance with OHSAS 18001, ISO 14001 and ISO 9001 standards.

- **System Processes, Quality System Procedures & Work Instructions** are documents that will be set up by Astaldi in order to implement the Integrated Management System. They will be used to determine who is responsible for what and what action should be performed to meet QP guidelines.

- Plans, Programs & operational supporting documentation such as:

  - **Astaldi Quality Management Plan (QMP):** In order to address the client's quality requirements, the QMP will define the QC activities for the project, their implementation and who is responsible for performing them.

  - **Quality Assurance Program (QAP):** It is defined as a subdocument to the Quality Management System. The QAP is a stand-alone document that will be developed by the Project QA Manager. This is a controlled document establishing the processes for conducting and documenting the quality assurance completed on the quality controls (construction) and survey activities. In order to address the client's requirements, the QAP will define the QA activities for the project, their implementation and who is responsible for performing them. QA Monitoring (observations) Reports and Quality Audit Finding Reports will be developed, implemented and tracked to support the Quality Assurance Program.

  - **Design Quality Management Plan (DQMP):** It is defined as a subdocument to the Quality Management System. The DQMP is a standalone document developed by the QA Design Coordinator with the collaboration of Astaldi's Design group and the Design Sub-Consultants. [Temporary works only] This is a controlled document establishing the design processes. The DQMP identifies the design steps needed to meet the requirements for the temporary works. The DQMP will define design activities for the project, their implementation and who is responsible for performing them.

  - **Off-site Project Procurement Plan (PP):** It is defined as a subdocument to the Quality Management System. The PP is a standalone document developed by the Procurement QA/QC Manager. This is a controlled document establishing the procurement processes for permanent materials. The PP identifies the procurement steps needed to meet the requirements set out in Astaldi's Agreement with the Owner. In order to address the Owner's requirements, the PP will define procurement activities for the project, their implementation and who is responsible for performing them.

  - Operational supporting documents such as specific work instructions, forms and checklists will be developed by Astaldi to support the Quality Plan implementation.

  - External reference documents including codes, standards, regulations and specifications will be used as reference for the operational supporting documents.

- **QA/QC Records**: Astaldi will ensure that storage facilities are allocated to guarantee that all stored records are identifiable and retrievable, and that these facilities are safe to avoid deterioration and loss.

C.2.2.4 MANAGEMENT RESPONSIBILITY

Management responsibility, authority and communication will be clearly defined in accordance with the Quality Organization Chart submitted with this proposal. The management section will describe the responsibilities, authority and relationship of management personnel, who direct, implement and verify tasks which impact on Quality as well as the organizational structure for the construction project

The document will clearly describe the function and responsibilities of key personnel including the Project Sponsor, Project Manager, Project Engineers, Quality Manager and field superintendents.

C.2.2.5 RESOURCE MANAGEMENT

Necessary qualifications and required training for site supervisory and craft workers will be identified and addressed through a process detailed in the site Quality Plan. This will include such items as safety orientations, specific training requirements such as confined space entry and lock out procedures.

Tool box meetings and training sessions will be held to address items including specific quality issues.

C.2.2.6 EXECUTION

An execution plan will be finalized on award of the contract. Throughout the construction period, there will be ongoing communication with the client on all quality related matters to address issues arising and client concerns.

The section will cover design and development for all temporary works. Also covered will be the purchasing process, including supplier selection, monitoring and receiving.

Pre-construction meetings will be held to ensure that all necessary planning has been performed prior to commencement of any work activity. From these meetings Quality Guidelines will be established and provided to the responsible parties.

Identification and traceability of products from receipt through all stages until final installation will be addressed. This will include Quality Control testing information so that location, quantity and dates can be traced for any product. Handling, storage and preservation of materials will

be addressed.

C.2.2.7 EQUIPMENT

Equipment identification and calibration required for the project will be identified and procedures established to ensure requirements are met. Equipment will have calibration date and status identified by labels attached to the equipment. Forms regarding all calibrations will be filled in as this exercise is performed.

C.2.2.8 MEASUREMENT ANALYSIS AND IMPROVEMENT

Astaldi will carry out internal audits of the project quality to identify any corrective measures required and to identify possible areas for improvement. These audits will be in addition to any quality audits performed by the client or his representatives. Quality issues will be discussed with the client on an ongoing basis.

An inspection and test procedure will be prepared for the project that will involve inspection and testing plans being developed prior to performance of site inspections. Astaldi Quality officers will carry out inspections daily when work is in progress both for initial, follow-up and completion inspections to ensure that controls are established that will provide work which conforms to the contract requirements. Astaldi engineering and quality personnel will all maintain daily diaries to describe activities and record quality (and environmental and safety) issues that may arise and discussions held.

Procedures will be put into place for identification, evaluation and remediation of any product that is found to be non-conforming with the specifications.

Astaldi constantly strives for improvement of quality on its job sites. This is achieved through a process of lessons learned including incident reporting, development of corrective actions and development of preventive actions.

C.2.3 ENVIRONMENTAL

C.2.3.1 ENVIRONMENTAL MANAGEMENT

Astaldi will implement the environmental management measures outlined in this section to minimize environmental effects during construction of their components on the Nalcor Energy Muskrat Falls Project. Astaldi places a high priority on environmental protection and will maintain an environmental compliant work site throughout the project.

Applying, monitoring, reporting and adapting (as required) these environmental management measures will demonstrate Astaldi's commitment to the protection of the environment, compliance with provincial and federal environmental legislation and to satisfy the Nalcor Energy contractual and policy requirements.

The environmental management measures discussed here will be described in detail in the required Contract Specific Environmental Protection Plan (C-SEPP), consistent with the C-SEPP template provided; and submitted to SNC Lavalin for acceptance. The C-SEPP will identify potential risks to the environment, effective controls to prevent the threats and damage to the environment, include measureable and achievable performance targets and Astaldi's Environmental Management Plan.

C.2.3.2 ENVIRONMENTAL POLICY

The environmental aspects of Astaldi's Corporate Policy have been developed to ensure health and safety of the environment through sustainable development. The code of ethics includes goals of ensuring compliance with environment laws and regulations; and design of projects to prevent or mitigate pollution where possible.

The corporate policy integrates and adopts the principles stated by ISO 9001, ISO 14001 and OHSAS 18001 standards, which enables Astaldi to turn commitments into results. Projects are conducted in compliance with all mandatory regulations while maintaining effective and efficient management practices that ensure reliable results. From the earliest stages of a project, Astaldi assesses and mitigates areas of risk through design and planning practices and monitoring and adjusting a project as required.

Astaldi uses quality control, best practices and informing and training of employees to ensure respect for the environment. All employees of Astaldi are made aware of and expected to comply with the principles stated in the Corporate Policy at all times. Astaldi also encourages suppliers and subcontractors to adopt the environmental commitments. Astaldi is committed to the Environment and expects that employees and business partners will follow the corporate

lead in this commitment.

Astaldi will target and will seek to create a sustainable built environment that minimizes ecological impact by rating aspects regarding energy saving capability, indoor environmental quality, carbon dioxide emissions, and resource preservation while measuring the social and economic impact of the Project, both regionally and globally. Astaldi will encourage and promote the construction and operation of responsible and sustainable built environments and recognizes environmental leadership in the building industry.

Amongst the most actions Astaldi would like to give these examples of sustainable approach:

- Energy efficiency – the use as much as possible of natural daylight, natural ventilation;
- Waste management – during construction and operations;
- Social interaction – providing spaces with facilities to encourage social interaction
- Local development and interaction - encouraging scholarship with the local schools and university for site visits and training.

C.2.3.3 REGULATORY FRAMEWORK

In Newfoundland and Labrador, the Environmental Protection Act and its associated regulations form the primary laws governing environmental protection and management. As such, the C-SEPP, and therefore the manner in which the associated work to which the plan will refer, will be carried out with strict adherence to the requirements of the Act.

Work at the site will be primarily bound by the Government of Newfoundland and Labrador, Department of Environment and Conservation requirements. Any and all permits, authorizations and/or certificates that may be required from the Department and other provincial and federal regulatory agencies will be secured before the respective scope of work begins on site.

Astaldi will review the scope of work to identify permits, authorization and certificates required in addition to the preliminary list developed by Nalcor Energy. The complete list of permits and a copy of each application will be provided to SNC Lavalin for review prior to submission. Additionally, Astaldi will provide information, as required, in a timely manner for SNC Lavalin to complete any applications under their responsibility.

C.2.3.4 ROLES AND RESPONSIBILITIES

Astaldi commits to having a full time Environmental Manager and Environmental Monitors on site during the project, in addition to the Project Manager. The specific roles and responsibilities of Astaldi as well as the Project Manager, Environmental Manager, Environmental Monitors and general workers will be detailed in the C-SEPP.

The Environmental Manager will be responsible for the overall environmental condition at the job site; ensure adherence to the company Environmental Policy; implementation of the Environmental Management Plan; and ensure compliance with environmental legislative requirements (provincial and federal).

The Environmental Manager is responsible for coordinating and overseeing the Environmental Monitors who assist the manager with the day to day (on shift) implementation of these responsibilities. Additional responsibilities for the environmental team include incident investigations, sampling/monitoring, reporting, implementation of environmental procedures and policies, hazard management and general environmental awareness.

C.2.3.5 POTENTIAL ENVIRONMENTAL EFFECTS

Significant environmental effects will be mitigated through best management practices (BMPs), construction standards and specifications or project design. Potential environmental impacts typically associated with a project of this nature relate to:

- Wildlife (Fish, Birds, Animals)
- Vegetation
- Noise
- Air Emissions (Dust)
- Traffic
- Materials Management
- Waste Management
- Erosion and Sediment Control
- Heritage and/or Archaeological

C.2.3.6 CONTROL MEASURES

Astaldi will follow established standards and BMPs to ensure all on-site activities are carried out with due regard for the environment. BMPs are guidelines that apply the best available methods or technologies based on known science that, if followed, should allow a proponent to meet the required standard(s) or achieve the desired objective(s) of not only complying with mandatory regulations (environmental and construction), but also maintaining a superior level of environmental performance.

BMPs support 'sustainable practices/principles' and are generally accepted techniques that, when used alone or in combination, prevent or reduce any adverse effects a project can create for the natural environment. The following are critical environmental protection measures and BMPs that Astaldi applies to a project of this nature:

- Site orientation and safety training
- Erosion and sediment control plans
- Emergency spill response plan (with necessary spill clean-up equipment)
- Access Management Plans to minimize traffic disruption during construction.
- Key material supply plan (borrow, aggregate, equipment, etc.)
- Waste management plan
- Environmental monitoring plan
- Fire protection (site and forest fires)

C.2.3.7 DOCUMENTATION / REPORTING

Proper and timely documentation is a critical facet of any successful construction project. The various forms of documentation compiled during the construction of a waterpower project provide a lasting record of all activities and inspections.

Documentation maintained on site should also include copies of all environmental permits and conditions, approvals and correspondence with the various regulatory agencies. In some cases, unforeseen site conditions may necessitate the amendment to existing permits or acquisition of new ones.

These particular documents inform all parties of the environmental requirements for the project, provide standards and objectives which are to be met, and allows for the planning for and

advancement of critical work that is needed to ensure that the construction schedules can be maintained with a high regard for environmental protection.

The provision of environmental reports and inspection records can also inform all parties involved in the construction as to the current conditions of the site, identify areas of concern (present and future), document receipt of environmental clearance(s) to proceed with site activities, and keep the regulatory agencies up to date with the progress of the construction and overall success of the protective measures employed. These reports document undertakings in environmental protection and, through established communication protocols, ensure that appropriate reactions are undertaken quickly and efficiently.

While every attempt is made to ensure adequate environmental protection, some unforeseen incidents may occur during the life of the construction project. The proper documentation of these events provides a record of the incident and the action taken to resolve the issue. Astaldi will immediately notify SNC Lavalin of all environmental incidents including any loss of hazardous or controlled products.

The Canadian Coast Guard will be notified about any spill on a natural water body or for spills on land greater than 70 litres or that have the potential to enter a natural water body or impact private land. In some cases, it is a simple correction and clean up while in other cases longer term monitoring may be required to ensure that remediation/restoration has been effective. These reports can then be used to adjust future activities to prevent similar incidents as well as demonstrate that “due diligence” was being maintained.

Examples of site documentation typically maintained on a waterpower construction project can include:

- Provincial permits and federal authorizations
- Permit/Approval amendments and extensions
- Construction schedules, site drawings and tender documents, change orders
- Performance / progress reports (monthly - environment incidents, non-compliance)
- Site and equipment inspection records (daily inspections, environmental compliance)
- Spill and accident reports, forms and follow up action lists
- Environmental contingency plans
- Waste manifests (provide with monthly performance reports)
- Fuel consumption (monthly reports)
- Pre-clearing assessments (nest searches, plant surveys)

- Correspondence (letters and emails)

C.3 ENGINEERING

The Information Management systems to be implemented by Astaldi for Muskrat Fall project will be extended to include the information generated during the full execution of the work and will be not limited to Engineering only.

The engineering documents received will be processed through a data based and compiled in a central repository database that includes all project documents.

Oracle – Primavera Contract Management and/or Prolog Manager from Meridian System will be the applications to be used to control all documents provided by Engineer. The application will be installed in a “Hosting Server” with all internet capabilities.

This arrangement “Application” and “Hosting Service” solution has been implemented and used by Astaldi successfully on projects in the past.

The process does not work alone and requires specific planning, implementation and follow up to ensure that system work efficiently.

Phases of implementation process and following up may be summarized as follows:

- Development of project specific procedures for engineering control
- Training for engineering procedures
- Training of Application
- Initialization to control engineering work
- Follow up and audits of engineering process

The arrangement for the “Application” and “Server” will be as follows:

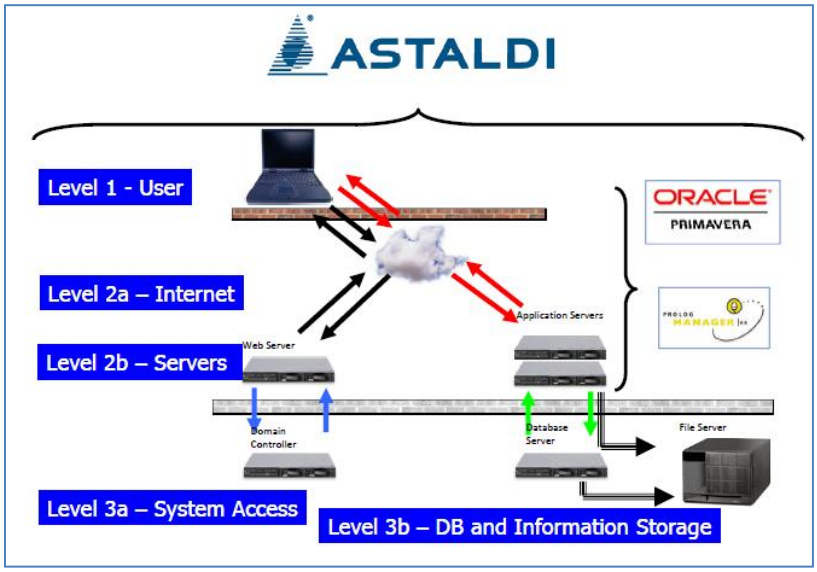


Figure 6: Arrangement for application and server based structure

The flow chart for implementation of the MIS and related engineering work may be seen below: (See **Attachment 18** for a larger scale copy of this chart)

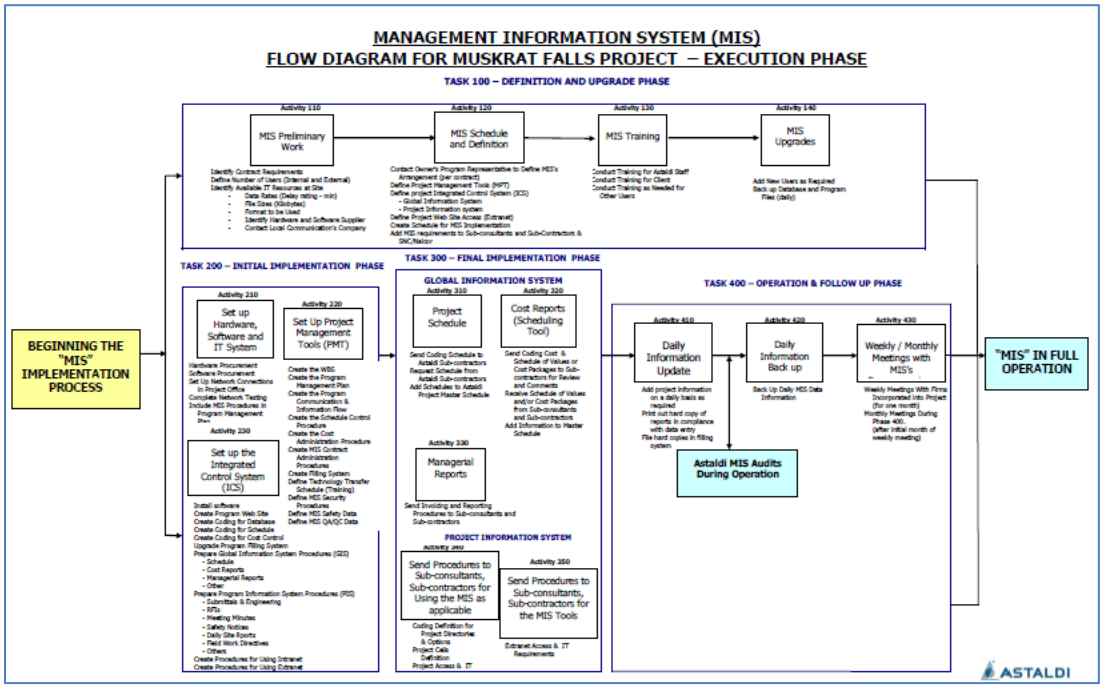


Figure 7: Management information system

C.3.1 ENGINEERING OFFICE SITE ORGANIZATION

The technical office lead and his assistant will be responsible to manage the review and production of shop drawings through an engineering firm from Newfoundland and Labrador. Specific information regarding interfaces of the technical office may be seen in **Attachment 2** – Organization Chart herewith.

C.3.2 METHODS AND PROCEDURES

After the Notice of Award is received, Astaldi will prepare specific project procedures related with all project tasks i.e. management, procurement, construction management, construction, etc. Regarding engineering services the following generic procedures will be prepared as part of the engineering task:

- Value Engineering review
- Constructability Review
- Review and Control of Design
- Control of Engineering Design Changes
- Control of Engineering Change Notices

All these procedures will be implemented on site and all engineering documents provided by the engineer and applicable tasks will be tracked and follow up through the MIS.

C.3.3 SHOP DRAWINGS

After the Notice of Award is received specific project procedures to control the submittal will be prepared. Generic list of these procedures are provided for reference below:

- Procedure No XXX – Procedure to Prepare and Deliver Shop Drawings to Astaldi (Submittal package definition, packing preparation, number of copies required, and submittals of documents).
- Procedure No XXX – Review of Shop Drawings Prepared by Supplier, Vendors and Sub-contractor (review and approval process, status of reviews, re-submittal process, etc.).
- Procedure No XXX - Control of Shop Drawings.

- Reporting (weekly and monthly reports definition).
- Survey Control

The technical office lead and his assistant will be responsible to manage all sub-consultants responsible for survey work on site. It is expected that survey works will be awarded to specialized firms from Newfoundland and Labrador and/or Nova Scotia. Specific management procedures will be developed by Astaldi and provided to each survey firm hired to ensure that work is coordinated as needed. In addition, any survey firm working on site will be responsible to develop its procedures for execution of work. Generic list of Procedure are provided below for reference:

Astaldi Management Procedures

- Procedure No XXX – Preparation of Monthly Report to Astaldi (by Survey Firms).
- Procedure No XXX – Preparation of Payment Application to Astaldi (by Survey Firms).
- Procedure No XXX – Preparation of Change Orders Request and Claims against Astaldi.

Sub-consultant Project Execution Procedure

- Procedure No XXX – Preparation of Project Survey Baseline.
- Procedure No XXX – Preparation of Astaldi Work Progress (Quantity Surveying Site Work)
- Procedure No XXX – Project Closeout – Survey Work

C.3.4 OFF SITE ORGANIZATION

In addition to engineering firms subcontracted by Astaldi to perform the work on site, it is expected that outside engineering services will be also hired. However, the management of any off site work will be managed by the technical office lead and its team and needed. Typical examples of engineering services to be hired outside site are listed for reference below:

- Geology and geotechnical services
- Environmental engineering services
- Value engineering services
- Plain concrete engineering services

C.4 HUMAN RESOURCES

Astaldi Canada INC carried out a detailed analysis of the manpower requirements during the Project execution with particular relevance given to the workforce peaks during the project exploitation in order to provide reliable information to the Client in assessing the planned total capacity of the Camp Accommodation.

The following histogram shows the total employed labour force at the Project site quarterly. A peak of about 1150 workers is expected on site during the third trimester of the year 2014. The same peak is reflecting the need of the Contractor to fulfill the interface and milestone M4 occurring at the first trimester of 2015 (Figure 8).

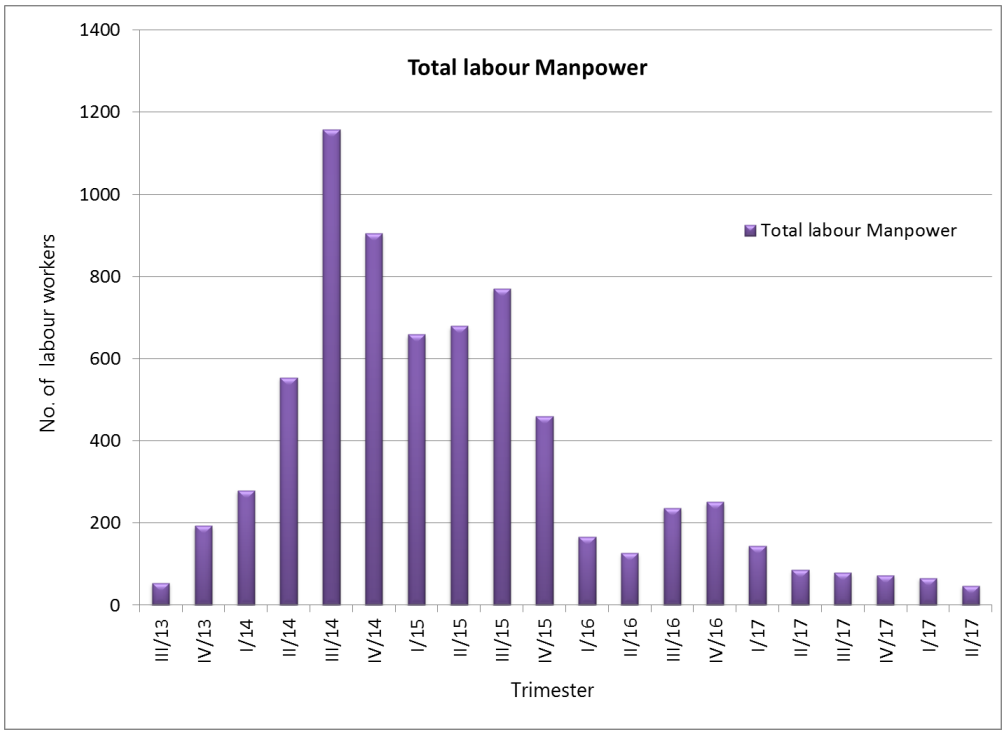


Figure 8: Manpower histogram per trimester

The histogram at Figure 8 presents two distinct peaks whose size is strictly related to the concrete production schedule. Most of the manpower of the concrete works will be required between the second trimester of the 2014 and the fourth trimester of the 2015 with an average of about 750 workers. The first peak in the figure shows an increase in the manpower number that should be read as a consequence of the fulfillment of the milestones at the Spillway. The second peak is strictly depending on the handing over milestones (interface milestones) at the Unit 1 and Unit 2 of the Powerhouse.

A histogram of the manpower trade is shown at the following figure that further assesses the above statement in terms of manpower distribution and peaks of manpower. A total number of about 480 carpenters have been estimated for the third trimester of 2014.

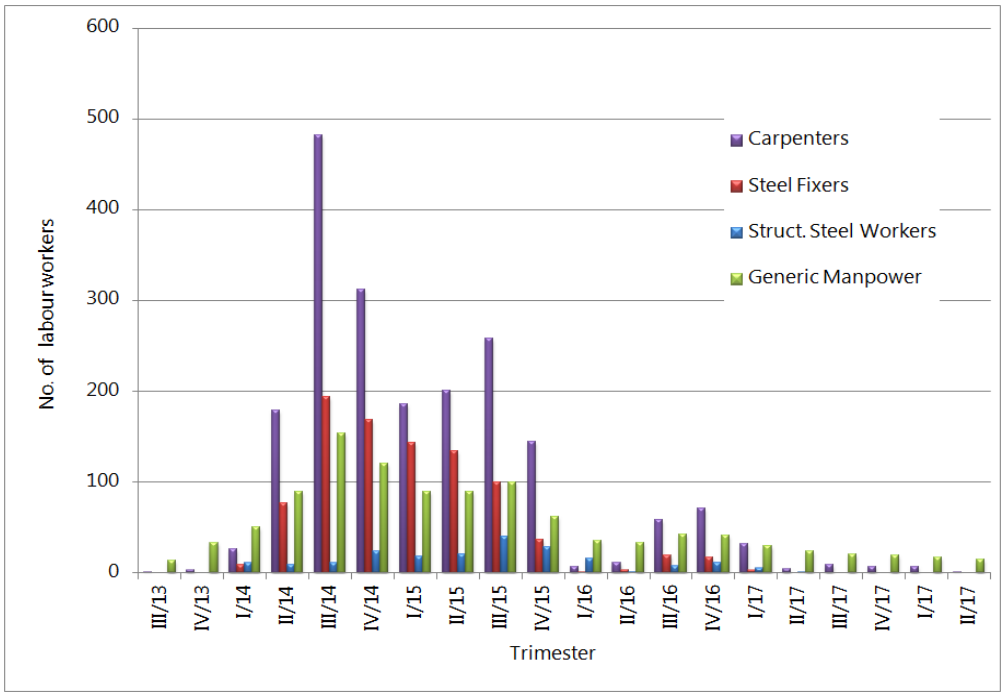


Figure 9: Manpower histogram per work trade

The Figure 10 shows the Contractor required equipment operators broke down in the heavy and light equipment.

An average of about 90 heavy equipment operators will be required between the second trimester of the 2014 and the fourth trimester of the 2015, with a peak of about 115 operators on the third trimester of 2015. When considering the overall manpower required for the heavy and the light equipment the average skilled operators required will be about 135 between the second trimester of the 2014 and the fourth trimester of the 2015.

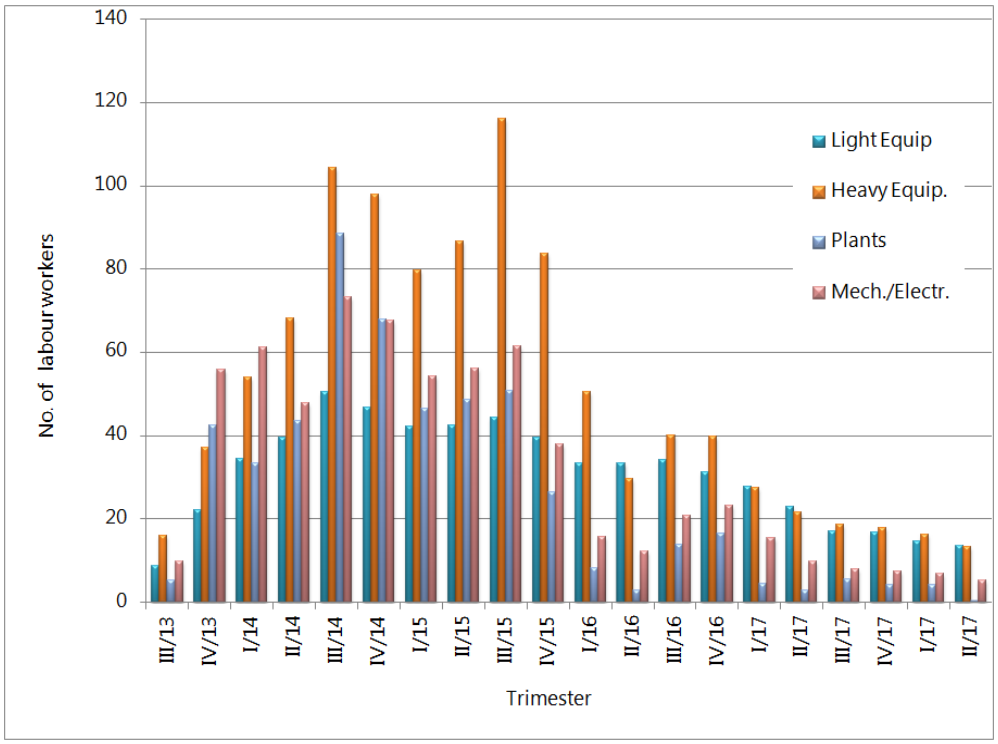


Figure 10: Manpower Histogram for equipment operators

C.4.1 MANPOWER MANAGEMENT

Details of Labour attraction and retention strategy

Comments on:

- First Nation employment
- Union employment
- Non union employments

C.5 SITE ORGANIZATION

C.5.1.1 ACCESS ROADS

An access road will be foreseen at each working area (Spillway U.S., Spillway D.S., Powerhouse U.S, transition dams etc.); road and ramps shall be executed with a maximum gradient of 12% and will be possibly located not to interfere with the progressive status of the site works by the Company, e.g. when executing the cofferdams or the roads at the next phases of the works.

See **Attachments 19 and 20** for construction engineering drawings prepared by Astaldi showing access roads.

Access roads will be made by material from the crushing plants and, where necessary, will be rolled, compacted and paved with cast in situ lean concrete with anti-slip treatment.

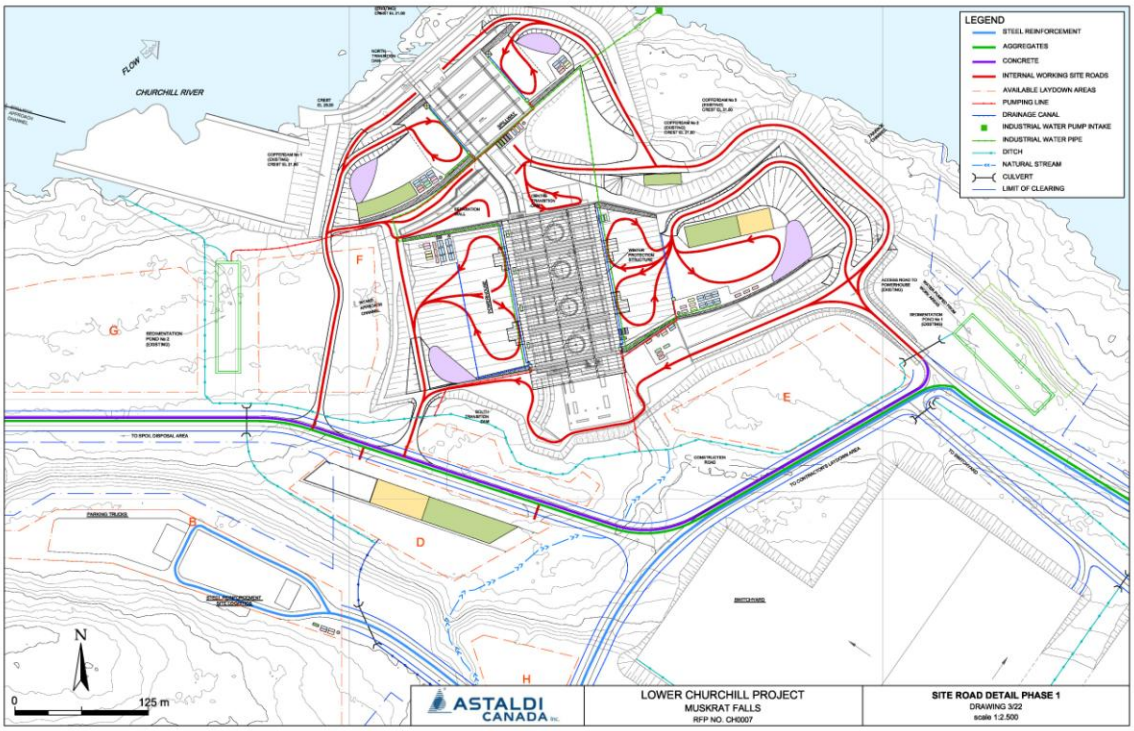


Figure 11: Powerhouse and Spillway Access Road Scheme

Portacabin for offices and services will be installed in proximity of the working areas with the aim to reduce the walking and transport distance of the workers to the site. In reaching the service cabin workers will walk on a pedestrian path. The company target is to differentiate footpaths in order to separate the pedestrian flow in the working areas from the travel routes used by vehicles.

C.5.1.2 WATER SUPPLY

For the industrial water supply the contractor will require a water license for pumping water from the Churchill river. Three pumping station will be installed for the scope.

- The first station close to the contractors area dedicated to the batching plant.
- The second station close to the spillway and powerhouse area
- The third station nearby the storage facilities at Company's lay-down area

The short distance between the pumping areas and the exploitation areas together with proper pipe insulation will allow to minimize pipes freezing during winter time.

C.5.1.3 ELECTRIC SUPPLY LIGHTING AND HEATING

Astaldi Canada INC will make use of the power supply provided by the Company. Generators set will be procured on site to provide the additional power requirements and to guarantee in case of interruption/failure of the main power supply source by the Company.

A study has been carried out starting from the contents of exhibit 12 Site conditions art. 2.1.1; (the maximum electrical load provided for free is 2,900 KVA) and has been finalized with the analysis of the power supply requirements at the working and industrial areas and the dimension of power supply network and generators, (including emergency purposes). For each area was the Contractor assessed the need and sized the fuel storage tanks, the electric generators for continuous use, and the electric generators for emergency supply.

Lighting poles/towers will be installed in all access roads to the working sites ensuring a minimum of 10 lux lighting level, road junctions and ramps traveling in a curve will be illuminated, for safety Reasons, with at least 50 lux. The luminance for the working areas will be 300 lux. Lighting towers or floodlights fixed to the structures in elevation; furthermore mobile lighting fixtures will be used in the less accessible areas.

Containers for services and offices will be heated by heat pumps; working areas will be heated by diesel fired frost fighters; fuel tanks will be installed in each working area, and all environmental requirements and permits provided by the Contractor.

C.5.1.4 DEWATERING AND SEWERAGES

The Dewatering network will be put in operation by the Bulk Excavation Contractor that will transfer it to the Contractor for its maintenance and, if required, for the dewatering network

refurbishment and improvement. The water will be pumped to the sedimentation ponds provided by the Company others subcontractors. Additional pumping stations will be installed in order to manage heavy rainfall phenomena.

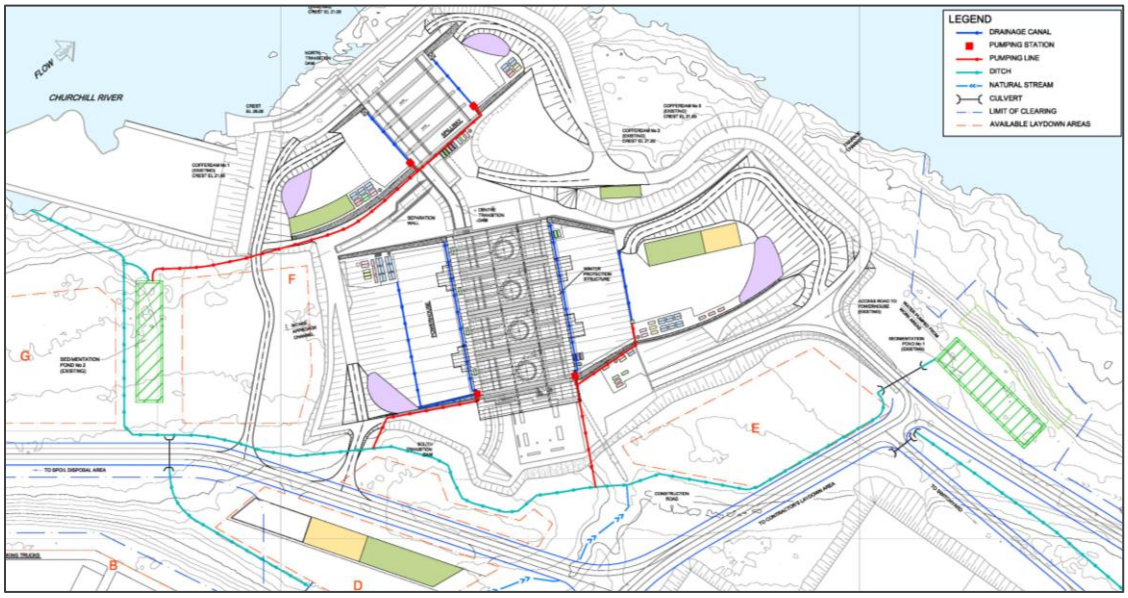


Figure 12: Powerhouse and Spillway Dewatering Scheme

The wastewater from the working and industrial areas will be collected to septic tanks that will be periodically drained by specialized providers of services for waste management. See Appendix A1 and **Attachment 21** for more details.

C.5.1.5 SNOW REMOVAL

During the winter period the snow will be dumped in stock piles at site designated and approved areas. Snow stockage areas have been indicated in the site organization drawings (**Attachments 22 to 25**). For the main roads the snow is supposed to be disposed to be disposed along the driveway on the road verges. Steep areas and streets in wintertime salt and gravel will be spread for de-icing.

C.5.1.6 WORKERS FACILITIES

The solution to install small modules type "sea containers" will be chosen for all the facility services on the site work areas. The modules are easily transportable and will allow to easily

move the location of the service yard in accordance to the processing steps. Services will be located close to the work-areas and will be connected by walkways. Water cooler and vending machines for cold/hot beverages and snacks will be provided in all working areas. See **Attachments 22 and 23** for the proposed location of the workers facilities.

C.5.2 WORKING AND INDUSTRIAL AREAS

C.5.2.1 ACCOMMODATION COMPLEX

The office area will foresee four (4) blocks for the Contractor offices and one (1) offices block for sub-contractors. The area will be equipped with all services, a multipurpose room, a parking area and a mess hall. The area will be paved with lean concrete, and illuminated with a lighting level of about 200 lux.

Figure 13: Contractor's Office Area

Although all the utilities will be provided by the Company, including the power supply; the Contractor is considering the possibility of a lack/failure in the power supply. A generator 200kW will be installed. For the emergency purpose will be provided a generator of 300kVA and a 3,500 liters fuel tank, in order to guarantee a back-up system for three days. See

Attachment 25 for more details.

C.5.2.2 COMPANY LAY DOWN AREA

The Company will provide the Contractor with approximate 20.000 m2 to install its storage and plants. The area will be organized to include:

- Open and covered storages,
- An heated warehouse
- A joinery for maintenance and processing of formworks,
- A mechanical workshop
- Site offices
- Parking and facilities for workers (locker rooms, lunch rooms, wash rooms)

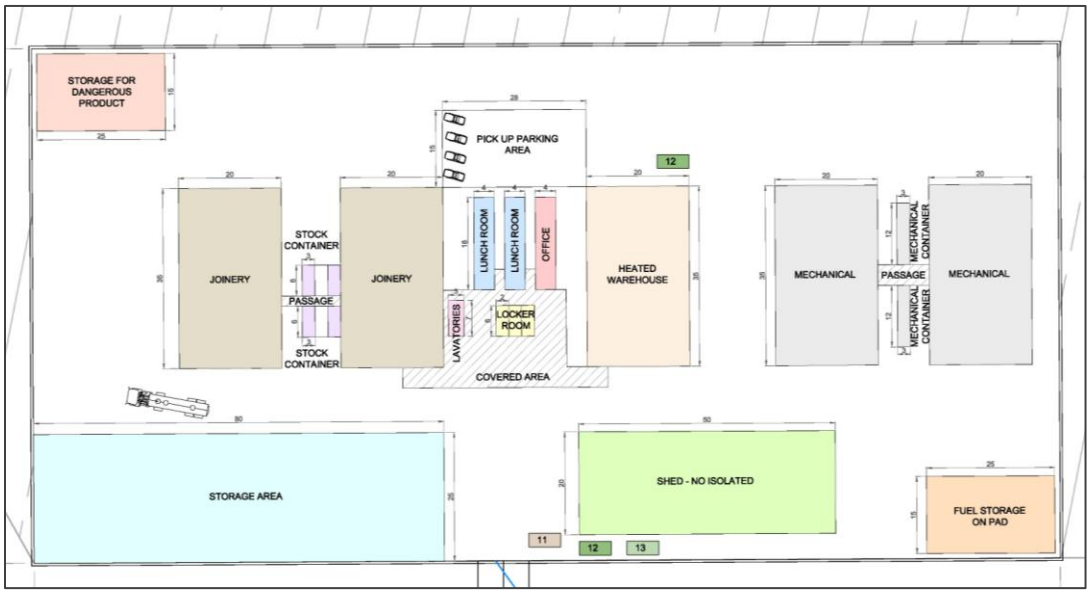


Figure 14: Laydown area

This area will be fenced, paved with lean concrete, provided the utilities connections and illuminated with lighting level of about 100 lux.

The industrial water will be pumped from the river and distributed by insulated pipes. A septic tank will be installed for the sewage collection.

The breakdown of the power supply required in the area (considering that 60 kW is the power supplied by the Company) has been calculated as

- Total installed power: 338 kW
- Absorbed power: 228 kW
- Additional power to be provided: 168 kW

The additional power supply required at site will be obtained by an electrical generator of 300kVA. An estimated fuel consumption of 1,450/1,550 liters of diesel per day has been assumed.

The emergency situations will be handled, by a single generator of 400kVA with a dedicated fuel tank of 4,800 liters in order to ensure a continuous service for three days. See Volume 5 (Equipment and Plants) and **Attachment 24** for more details.

C.5.2.3 POWERHOUSE

The upstream access to the Powerhouse area will be granted by an access road that brings to an intermediate level 19.00m and will also allow the access to the south transition dam and the separation wall areas. The access downstream it will be granted through the access already built by the bulk excavation contractor.

The ramps will have a maximum gradient of 12% and paved with lean concrete with anti-slip treatment. The protection of the access roads against the ice falling will be granted by an enlargement in the carriageway width and a roadside emergency lane (identified in the drawings as restricted area).

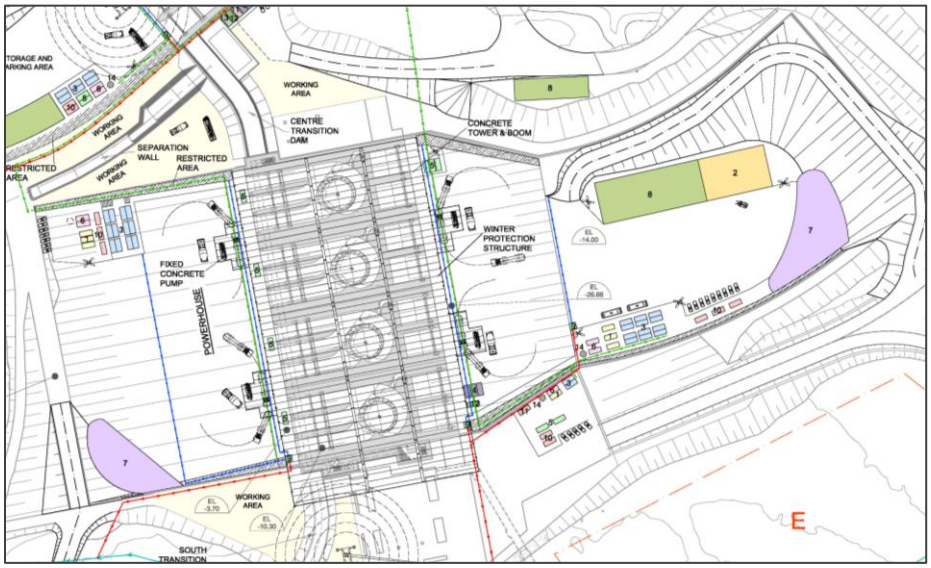


Figure 15: Powerhouse general site layout (1/2)

The upstream ramp will be removed at end of the works; the downstream one will be removed by the bulk excavation contractor.

Workers facilities, site offices and storage area will be provided either in the upstream site area or the downstream site area. The offices will be installed as close as possible to the working areas in order to minimize the walking distance by workers. The workers walking path will be separated by the other site access routes in order the two flows (pedestrian and vehicles) to not interfere. (see **Attachment 23**, drawing 7 and 10)

The working area is characterized by a large provisional shelter coated with insulated panels that will allow working in continuity in wintertime.

In the second phase when the protection shelter and the overhead cranes inside will be removed, the materials on site will be handled by a 70 ton or 220 ton crane, operating from level +15.50 or from the upstream and downstream benches (see **Attachment 23**, drawing 9).

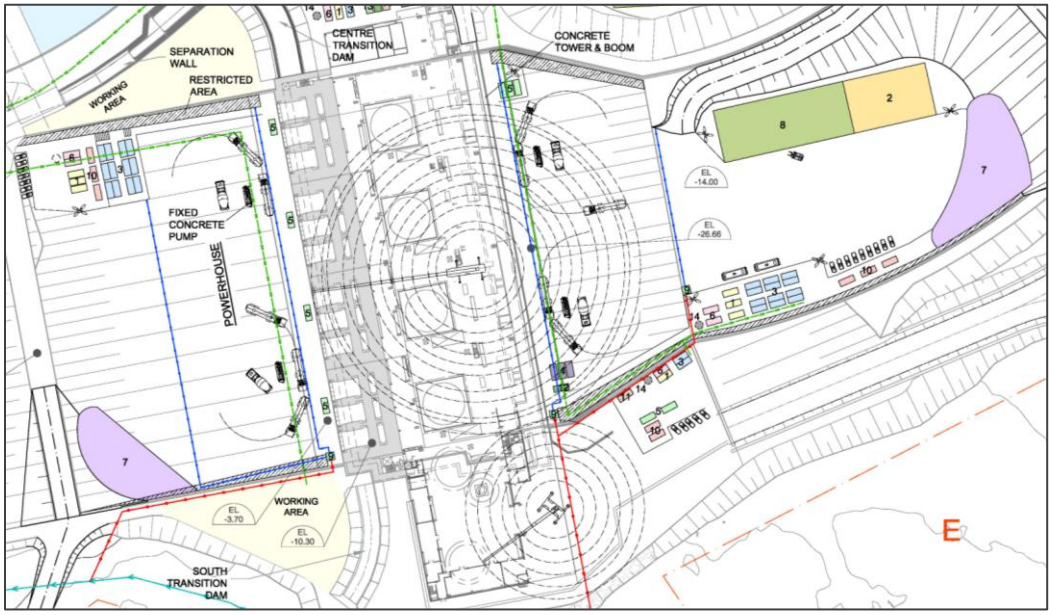


Figure 16: Powerhouse general site layout (2/2)

The Company will supply 740 kW at the Powerhouse site area, the requirements in terms of the additional required power has been calculated as follows:

- Installed power: 1,892kW
- Absorbed power: 1,305kW
- Additional power to be provided: 565.5kW

The additional power supply required at site will be obtained by an electrical generator of 2X550kVA. An estimated fuel consumption of 3,550/3,800 liters of diesel per day has been

assumed. The emergency situations will be handled, by a single generator 900kVA with a dedicated fuel tank of 25,000 liters in order to ensure a continuous service for three days.

C.5.2.4 SPILLWAY

The upstream access road to the Spillway area will be granted by a road parallel running parallel to the cofferdam No1 and accessing the upstream working area beside the storage and parking area shown in the drawing.

The downstream access will depart from the crest of the cofferdam No. 3 and will access the working area running parallel (upstream side) to the cofferdam No. 2

The protection of the access roads against the ice falling will be granted by an enlargement in the carriageway width and a roadside emergency lane (identified in the drawings as restricted area).

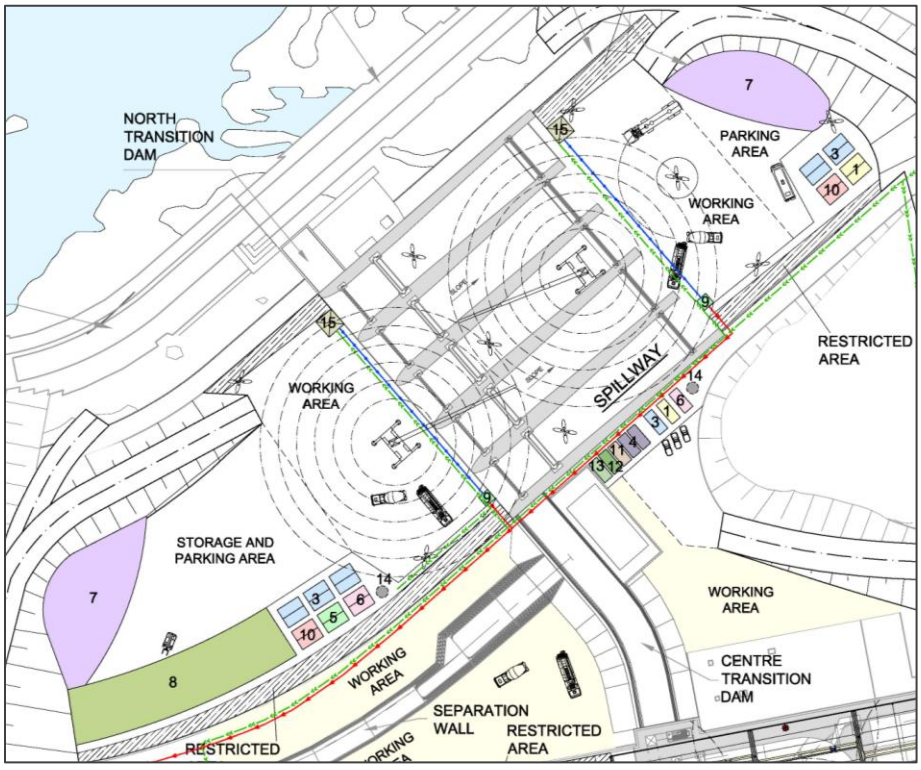


Figure 17: Spillway general site layout

Workers facilities (washroom, lockers and lunch room) will be located both upstream and downstream nearby working areas, A storage area will be provided in the upstream area close

to the access ramp, another storage area is foreseen, downstream side, between the two cofferdams No2 and No3. A snow stockpiling area will be provided close to both access roads.

The handling and supply of materials, upstream and downstream, will be carried out by 70-ton wheel-cranes and a 220 ton crane, whenever required.

At the phase 2 of the works the storage areas, the facilities and the offices will be removed from the spillway site area in order to allow, the Churchill river to flow through. At this stage the access for the remaining works will be granted from the spillways bridges and from the lateral banks.

All the facilities and the storage areas (that at this work stage will be quite reduced) will be relocated to the north bay.

The Company will supply 240 kW at the Spillway site area, the requirements in terms of the additional required power has been calculated as follows::

- Installed power: 528kW
- Absorbed Power: 348kW
- Additional power to be provided: 108kW

The additional power supply required at site will be obtained by an electrical generator of 200kVA. An estimated fuel consumption of 660/705 liters of diesel per day has been assumed. The emergency situations will be handled, by a single generator 630kVA with a dedicated fuel tank of 7,200 liters in order to ensure a continuous service for three days.

C.5.2.5 CONTRACTORS LAY DOWN AREA

The C1 area will be mainly dedicated (75% of the used are) to the production of gravel aggregates and the concrete batching plant.

The Contractor will locate this area close to the C2 stockpile area in order to speed the supply chain to the crushing plant, the area left on the northern side will be used by other contractors. The contractor will provide in the area also the following facilities:

- Heated pad for sands,
- Washing area for concrete mixers
- A Concrete Laboratory
- Services for the staff

- Offices for the staff

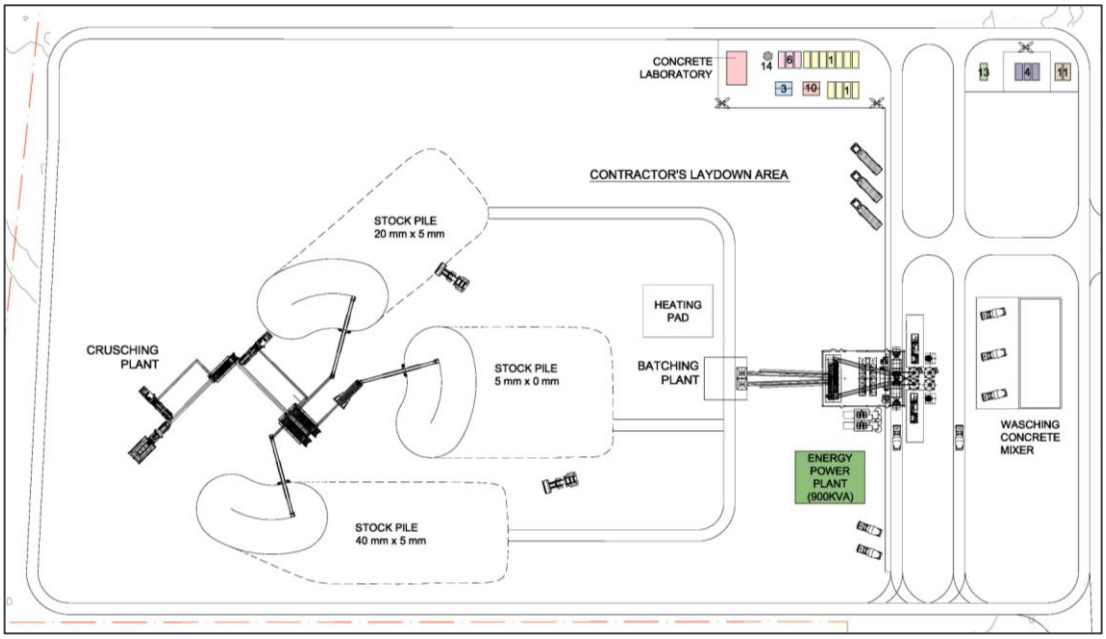


Figure 18: Contractor laydown area with batching plants

The Company will supply 1280 kW at the contractor laydown area, the requirements in terms of the additional required power has been calculated as follows:

- Installed power: 4,773kW
- Absorbed power: 3,410kW
- Additional power to be provided: 2,130kW

The additional power supply required at site will be obtained by an generator set of four (4) generators in parallel of 900kVA (4X900kVa). An estimated fuel consumption of 13,400/14,350 liters of diesel per day has been assumed.

In order to optimize the power supply distribution for the batching plant and the crushing plants, the latter will be directly supplied with the power supply source provided by the Company. Indeed the batching plant will be supplied by the gen-sets. A MV power line will be built for the crushing plant with a transformer substation located to the power station feeding the concrete batching plant.

The emergency situations will be handled, by a single generator 900kVA with a dedicated fuel tank of 25,000 liters in order to ensure a continuous service for three days.

A small generator with 60 kVA of installed power connected to a 500 liter tank will be dedicated

to the staff premises located in the north-east side of the plot.

C.5.2.6 AREA D

The area D is the selected by the Contractor area for the storage of materials The area will be covered by shed and will have open air storage as well. A part of the area will be used as an interim storage area for the waste materials and a recycling procedure will be implemented. For storage purposes the Contractor will also intend to use part of the area E.

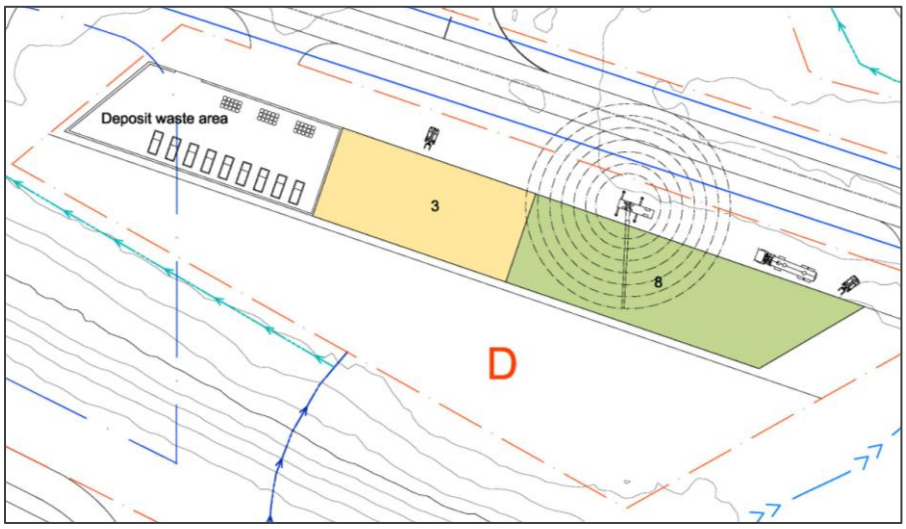


Figure 19: Proposed site Layout at AREA D.

C.5.2.7 AREA B

The area B is the designated stabling area for the vehicles and trucks. Part of the area will be used as temporary parking for steel reinforcing semi-trailers, cement trucks and other materials.

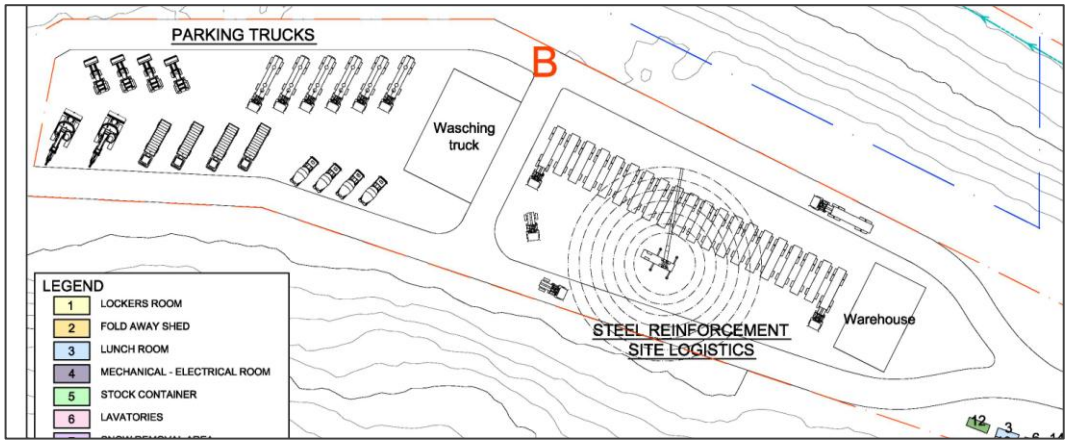


Figure 20: Proposed site Layout at AREA B.

C.6 WINTER PROTECTIONS

C.6.1 TEMPORARY WINTER PROTECTIONS

In order to manage the severe winter conditions (low temperatures, wind, snow storms, etc) Astaldi is planning to use winter shelters. A type of structure largely used in Canada.

The Astaldi strategy is to utilize for the Works both stable structures like Megadome or similar and portable structures like Dynamic Air Shelters or similar. The portable structures have the advantage to be easily relocated on site during the winter period. Astaldi is planning to have a certain number of these structures with different sizes ready to be installed wherever required.

Figure 21: Temporary shelter structure (Alaska Structures)

A typological shelter that can be used on site during winter season is the air inflated provided by Dynamic Air Shelters Company or similar. Such a shelters are made by Kevlar and Vinyl inflatable structures forming a support shell and suitable to withstand snow and wind loads, moreover the multi-layers material of the cover structure provides a thermal insulation. The structure is connected to the ground by tensile resistant anchors. A simple foundation can be also used to anchor the shelter. In the following Figure 22 all the shelter different parts are displayed: the outside roof layer (fly), the inside inflatable shell (column), and the inner layer (curtain).

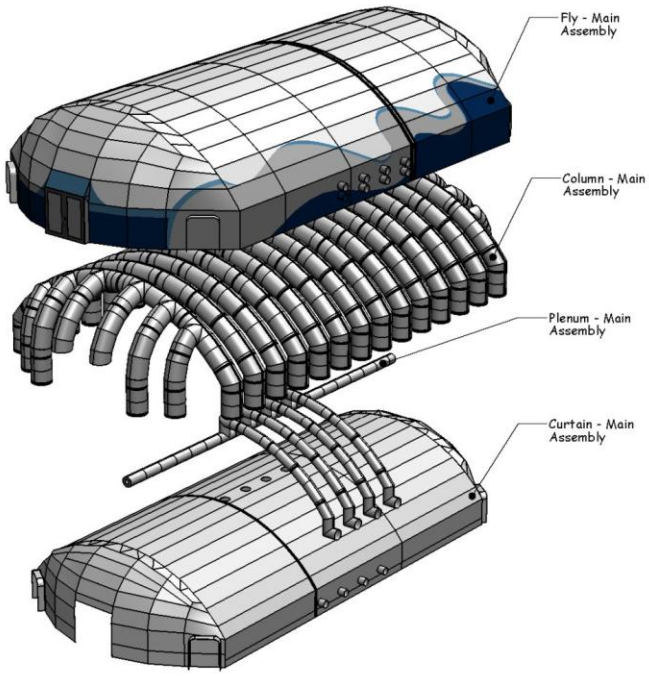


Figure 22: 3D Visualization of temporary winter protection

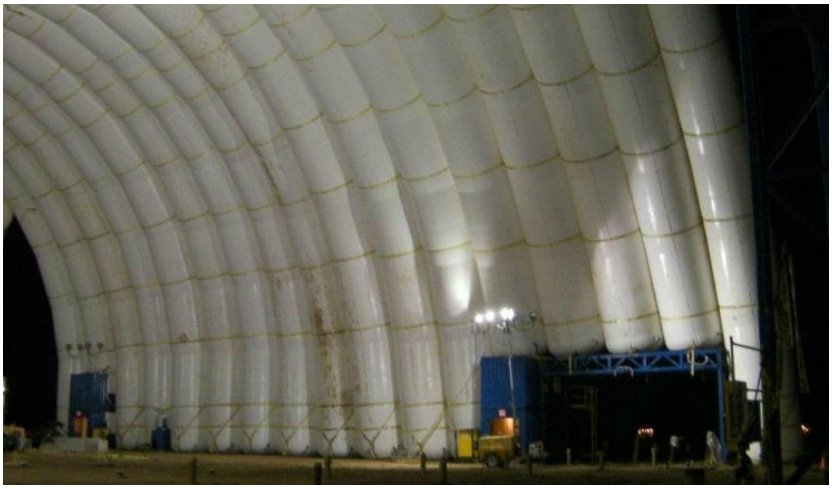


Figure 23: Temporary winter protection (100x100x30 ft)

C.6.2 INTAKE AND POWERHOUSE WINTER PROTECTIONS

The present section deals with the Contractor strategy for the execution of the concrete works in the Intake and Powerhouse structures during winter season.

The general structure to be built consists in an open air Intake and Powerhouse lodging four (4) turbines for a total installed power of 824 MW.

The structure overall dimensions are:

- Length 142.5 m
- Width 78.5 m
- Height 79.6 m (lowest level -34.1 m, top level + 45.5 m)

General geometry and layout of the Powerhouse structures is illustrated in the following Figure 24.

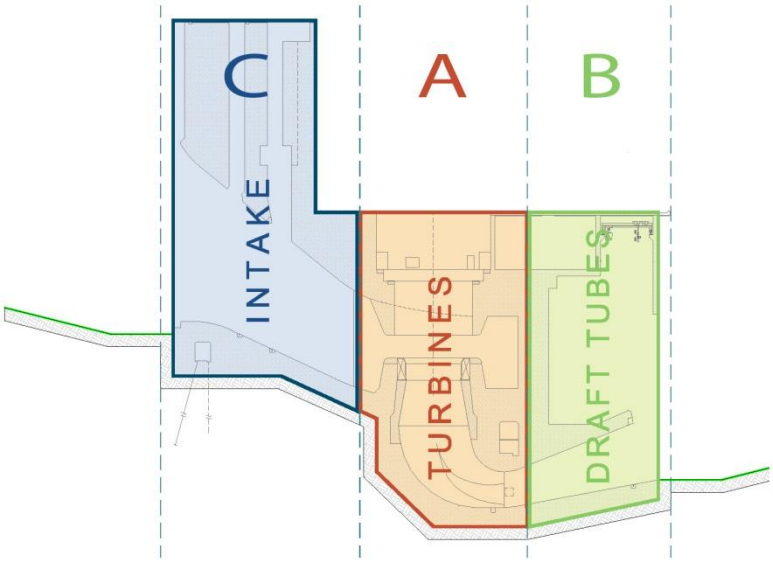


Figure 24: Subdivision of the powerhouse structure: (A) Turbines sector; (B) Draft Tube sector; (C) Intake structure

The overall structure can be divided into three main sectors identified by their construction joints:

The Turbines central structure, which is completed by an upper steel structure fitted with an overhead crane and part of a draft tube in the lower portion, and a draft tube liner spiral case (to be provided by others) below the rotor.

Draft tube exits with draft tube gates, on top of the draft tube gallery and transformer bays.

Intake structure which comprehend:

- trash rack and intake bulkhead gates
- Intake head gates and overhead intake gates hoist building
- gate hoist building
- mezzanine control rooms
- Facilities dewatering gallery.

The powerhouse is completed by the south and the north erection bays. The south erection bay will be covered by an integral cover during the works to protect the concreting activities during winter time.

C.6.2.1 FORECASTED SCHEDULE AND MILESTONES

Foreseen beginning of construction activities at the PH complex will correspond to the end of winter 2013-2014. The start dates, for units from 1 to 4 and for the south and north service bays, will have a delay of roughly one month.

C.6.2.2 GENERAL CLIMATIC CONDITIONS

The Lower Churchill Project working site area features very hard weather conditions during winter period because of its geographical location.

The Labrador plateau has a continental climate, characterized by hot summers and cold winters and a wide range of temperatures.

Recorded extremes for the Upper Churchill River basin run between -45.6°C and 33.4°C, and the average annual temperature is -4°C. At Happy Valley - Goose Bay the temperature ranges from -39° and 38°C, with an average annual temperature of 0° C.

The Goose Bay index station represents the central region of Labrador and reports a typical distribution of mean monthly temperature: the coldest month is January with mean monthly temperatures in the -10.3°C to -22.3°C range, and February is the second coldest.

The warmest month is typically July, with monthly temperatures between 9.8°C and 15.5°C. Mean monthly temperatures move above the freezing point during May and return to below freezing point during October or sometimes September.

The mean annual precipitation in Labrador varies from a low of about 600 mm in the north to a high of about 1200 mm in the south-east. The distribution of precipitation in Labrador is fairly uniform throughout the year.

About 55% of the annual precipitation occurs as rainfall and 45% as snowfall, with an annual average around 950 mm. The snow accumulation period generally lasts from December to March, whereas April, May, and June correspond to periods of significant snowmelt and runoff. The local frost-free period normally lasts from June to September.

The mean annual snowfall in Labrador varies from a low of about 250 cm in the north to localized highs of about 525 cm in central and south-eastern Labrador. Mean annual snowfall is fairly consistent throughout most of Labrador. More than 75% of Labrador has a mean annual snowfall between 400 cm and 500 cm.

Powerhouse is located approximately south-southwest, and winds from north - northeast (NNE) will be the most critical for severe ice loading on the structures during construction at Muskrat Falls.

Hourly wind data (speed and direction) were collected from the Happy Valley I Goose Bay climatic station for the period 1953 to 2011. A statistical analysis of the data showed that the probability of experiencing north - north east wind during winter was about 14 days per winter. The highest wind velocity from the north-northeast recorded at the station is 72 km/h.

C.6.2.3 CLASSICAL APPROACH ON CONCRETING DURING WINTER

As described in the previous paragraphs, the project area is characterized by very intense winters, with average temperatures below -20 ° and snow, for a period of seven months starting in mid-October. Starting from May, temperatures can range from -6 ° to +20 °, with peaks of 100 mm of rain per month and 75 mm per day.

With these assumptions, concrete pouring operations are extremely challenging, with a related slowing down of the production cycle.

Pouring system in similar climatic conditions areas are generally carried out separating each single pouring cycle, providing a specific local thermal insulation by building up small shelters/cover structures.

The internal volume of the covering system can be heated using mobile heating systems, in

order to increase the temperature and allowing the concrete pouring in normal temperature conditions. This conceived pouring cycle leads to an increase in the manpower for each single pouring stage, considering the working team dedicated to the hording and heating procedures. Moreover the working efficiency is deeply influenced by the changing in weather conditions, giving unpredictable impacts on the schedule.

Considering the actual site weather conditions previously mentioned, it become clear that such pouring cycles are prone to face critical situations, most of them related with important issues such as:

- Maintain high efficiency for all the pouring cycles
- The workers' safety in the working area during winter period
- Equipment performance due to the low temperatures
- Work schedule time delay because of the reduced operation capability of working site for unexpected outdoor weather conditions

C.6.2.4 THE INTEGRATED COVER SYSTEM

To overcome all the drawbacks related to concreting in extreme winter conditions, the Contractor chose to set up a safe internal environment through which it will be possible and safe to run all concreting tasks in controlled and favorable climatic conditions, ensuring a safely, healthy and warm environment.

With this perspective, the whole pouring process of the Powerhouse concrete structures has been imagined as "wrapped" by a cover system made of a shelter structure built that insulates the inner working areas from the outdoor climatic conditions.

The integrated cover system structure follows the ideal subdivision of the concrete pouring sequences in three sections, each section being encased in a covering insulated structure system.

The execution of the Powerhouse and the Intake will involve also other main contractors. For such reasons, achieving forecasted milestones and intersections dates become a primary target, in order to let the other contractors be able to timely complete their specific tasks.

Benefits coming out by using this innovative methodology should be listed as follows:

- Avoid the negative impact of snow storms during winter and rainfalls during summer period.

- Maintain a controlled temperature on all working areas, permitting to better manage all the concreting procedures
- Generate a reliable pouring schedule, independent from outside weather conditions.
- reduce working inefficiency due to bad weather conditions

The heated volume will be represented by the effective space between the current elevation of the concrete structure and the roof of the cover; moreover temporary horizontal partitions could be installed in order to reduce the volume to be heated.

At the end of the construction process, the whole system shall be removed, as its main scope was to act as a temporary covering structure.

The covering structure system shall be a steel structure made by trusses, steel columns and insulated panels covering both the roof and the walls.

Each one of the sections will be spanned by a covering structure bay, simplified as follows:

A truss frame that is the beam roof element, purlins, a corrugated steel deck plate and insulated panels. The whole component should then act as an insulating element separating top part of working area from the outside weather conditions.

Columns that should be made by steel sections of 5 m high, will be vertically braced to join the columns together and to prevent buckling phenomenon in the columns.

Two Overhead cranes per each section unit will be used, six overhead cranes per each generation Unit. A total of twenty four (24) overhead cranes will be installed within the integrated cover system.

Four insulated reception bays, two on the intake side and two on the Draft Tube side, will be realized to allow trucks and vehicles to discharge materials such as reinforcing steel, forms, etc. Contiguous covered areas connected to the main cover structure will host concrete pumps in a temperature controlled environment. The pumps will be used for the pouring operations inside the cover structure.

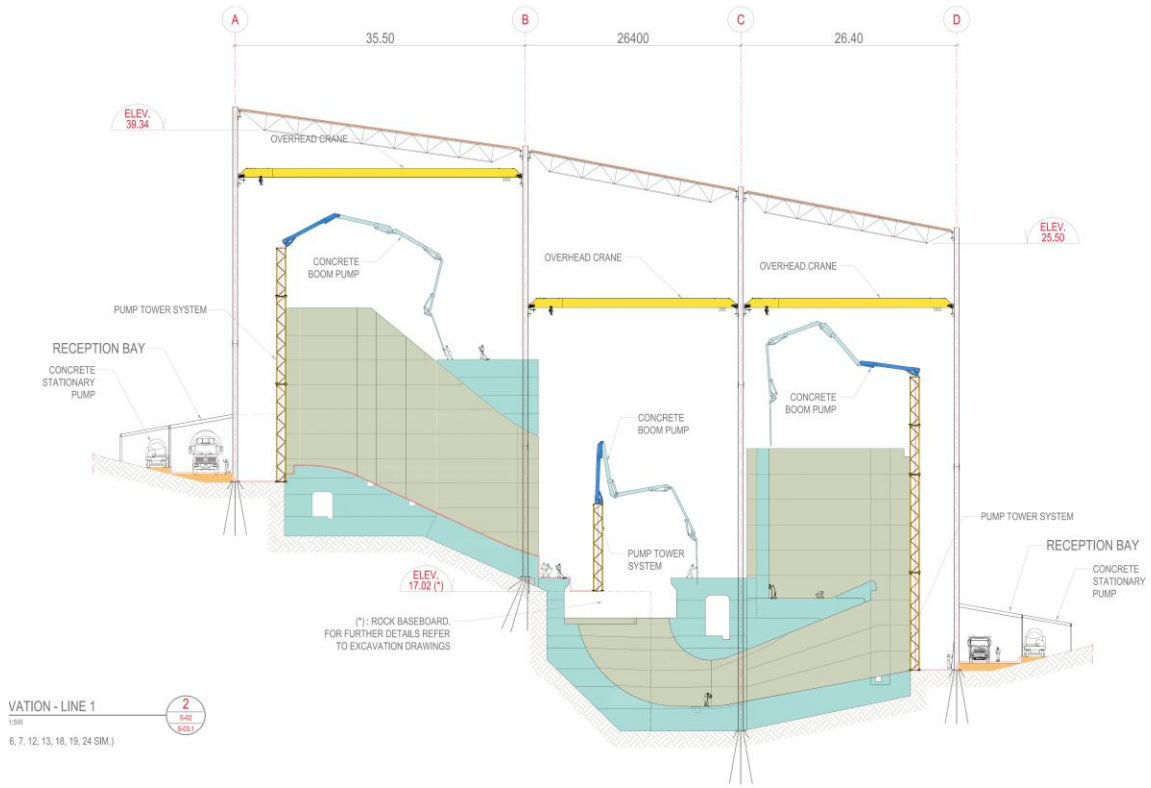


Figure 25: Integrated cover structure - lateral view

Within the cover structure will located 13 concrete towers: 4 towers located in the upstream side, 4 others located downstream and 5 concrete tower for the central span. Each tower will be equipped with a concrete line connected to a pedestal. 4 concrete booms of 24 meter extension each (plus 1 boom as back-up) will permit to pouring the different sectors of the powerhouse. They will be relocated by the overhead cranes on top of the different towers to suit the pouring requirements. See **Attachment 26 and 27** for additional engineering drawings of the ICS

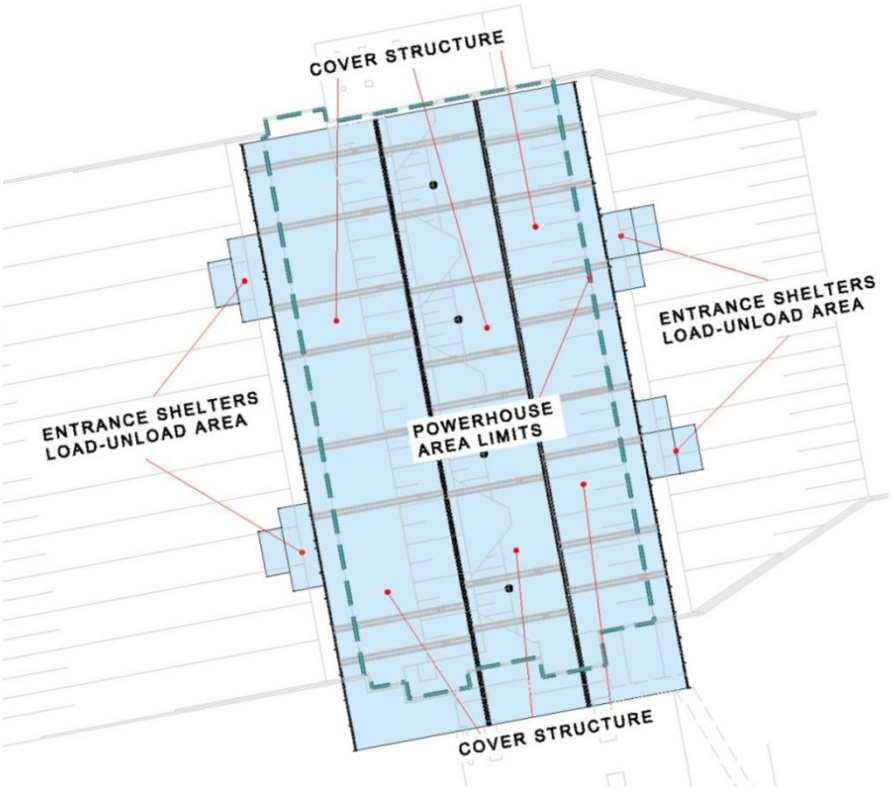


Figure 26: Cover structure, Powerhouse area limits and entrance

C.6.2.5 DIMENSIONS

The total covered area will have a length 148 m and a width of 80 m. An extra area that needs to be covered is the one related to the South Service Bay, a portion delimited by the bulk excavations limits between elevations -26.66 m and +14.00.

The final elevation of the concrete pouring inside the cover system will be +15.50 m in the Draft Tubes and +26.30 m in the Turbines and Intake sections, follows that the maximum height of the cover structure will be:

- In the Draft tube section: +27.60 m
- In the Turbine section: +37.60 m
- In the Intake section: +42.60 m

The following figure shows the three-span structure of the cover system with the subdivision of

the three section units below.

The span length for each one of these sections is:

- Intake section: 35.5 m
- Turbine section: 26.4 m
- Draft tube section: 26.4 m

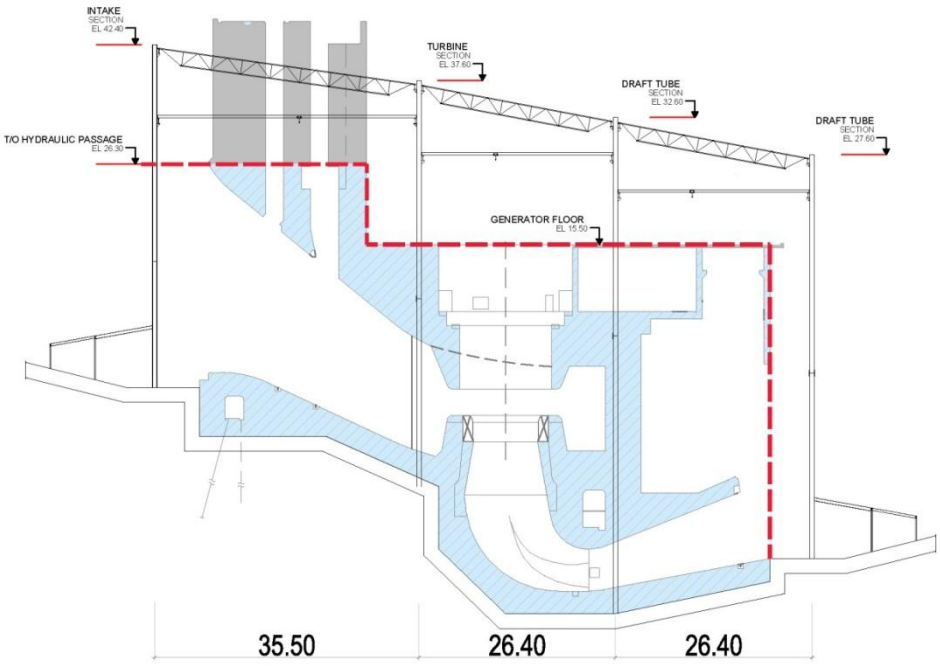


Figure 27: Cover structure maximum elevations, Sections spans and Powerhouse concrete pouring limits to reach

On the Powerhouse side the position of the column of the cover structure columns has been determined to allow for the access of the trucks.

The distance between columns is 6.74 m. This distance has been determined to avoid clashes between the columns position and the contraction joints and/or the concrete structures above. The distance between columns is maintained the same for all the four units, in order to create a regular structural tridimensional frame.

Each Powerhouse Unit will be covered by a Roof Block Unit, with a span of 33.50 m and a transversal span equal to the each column spacing.

The structural system of the Roof Block Unit consist in the following structural elements:

- Joists and joists bridging
- Beams
- Overhead Crane Rails
- Interior horizontal structure
- Bracing system
- Steel Deck and Insulated panels

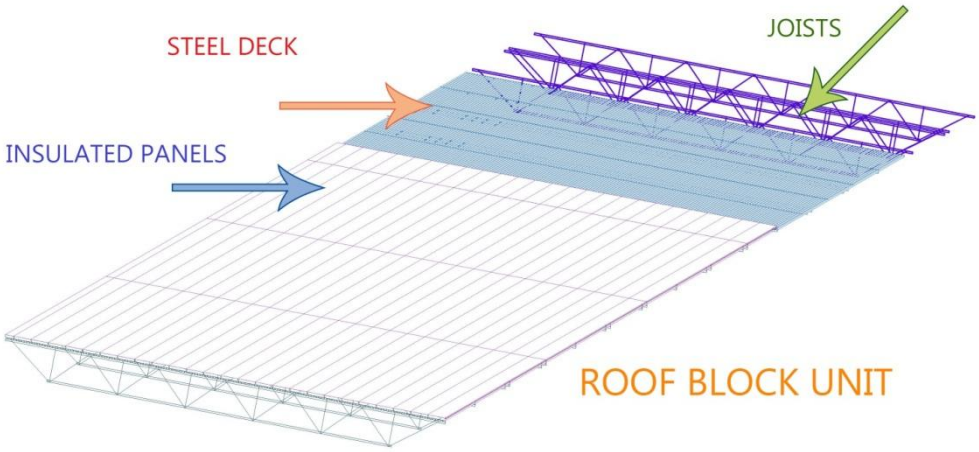


Figure 28: Cover deck structure

The total weight for each block unit is:

- Intake section: 124 t
- Turbine section: 72 t
- Draft tube section: 72 t

This main roof element is then bearing on corbels fixed to the main steel columns and is forming a steel frame structure together with longitudinal and transversal bracings to avoid buckling. All vertical walls are made by a continue interposition of insulated panels such as Vic West Double Mesa 40 type or Kings Span 900 High Rib type or similar, with an average thickness of 6 inches. The insulated panels are mutually connected in order to ensure a perfect insulation and a certain structural resistance for the external loads.

Roof panels are jointed together with steel decks, combining both insulation and wind and snow loads resistance. In the following figure, a typical construction details of the roof panel

and the deck connection to the columns is shown in Figure 29.

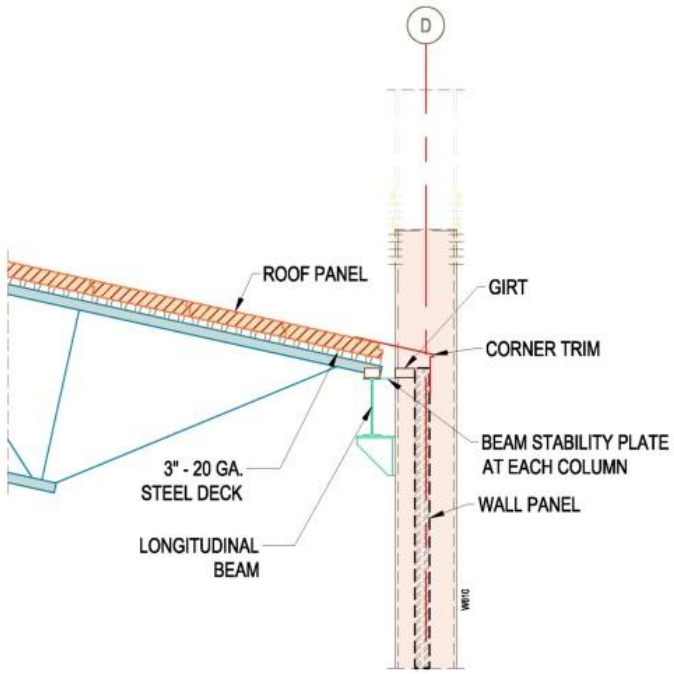


Figure 29: Cover structure maximum elevations, Sections spans and Powerhouse concrete pouring limits to reach

C.6.2.6 PHASES

The Powerhouse concrete pouring lifting sequences of each of the three sections previously described will be done at different time, being mandatory to fulfill the contractual milestones per each unit.

Astaldi has developed two alternative solutions allow for a timely assembly and disassembly of the cover structure.

The first solution is to build the covering system reaching all the final elevations without intermediate steps, so that the structure would be in place during all the scheduled pouring period without any intermediate lifting stages during the construction. This would mean that the construction of the cover structure will be done at one time and to cover the maximum elevation in each sections of the Works. This solution allows to have a single stage of initial assembly and a single stage of final disassembly.

This solution has a main disadvantage in the total volume to be initially heated. Building the

structure in such way would increase the inner volume to be heated.

The second solution has been developed to solve the main disadvantage of the first solution. A self-lifting roof structure that lifts the roof block unit in an easy and fast way has been conceived to create two different step construction stages. In a self-lifting solution, the roof block unit will ideally follow the concrete pouring lifts minimizing the heated inner volume.

C.6.2.7 BUILDING UP THE COVER SYSTEM

The assembly procedures to build up the cover system starts after the Powerhouse working site area will be delivered by the client, on November 4th, 2013. At this date, all preliminary tasks such as final design, approval by the client, procurements, fabrication and delivery shall be completed.

The building up process should be summarized as follow:

- General site organization and lifting equipment mobilization (mobile cranes with capacity from 70 up to 200 tons), laydown of the structural steel materials such as steel columns, joists, insulated panels, etc.
- Preparation and excavation of the steel columns foundations
- Connection of the columns to the foundations
- Erection of all columns to their final elevations
- Transversal and longitudinal bracing of all columns to prevent buckling.
- Assembly on site of all the Roof Block Units by the connection of the elements.
- Erection and placement of each Roof Block Unit for every Powerhouse Unit
- Erection of all the overhead cranes
- Vertical assembly of all insulated panels to create walls
- Creation of side entrances shelters
- Installation of internal lighting, ventilation and heating systems

C.6.2.8 AUTO-LIFTING SYSTEM

The self-lifting system consists in a hoist mounted on a steel plate welded to the outer end of the column and connected to a lifting cable that will allow to lift the roof elements to the new elevation.

In each Powerhouse unit, the lifting system will be installed on specific steel columns following a load pattern showed in next figure, in order to avoid buckling in the columns.

Joists, decks, insulated panels and longitudinal beams form a roof block unit that can easily and quickly lift up because of its light weight and their simple structural scheme.

The bolts connection easily removed to disconnect the entire roof block unit on each Intake, Turbine and Draft section. Once the roof elements are lifted up to the new elevation they will be connected again to the steel columns through the corbels that were previously relocated to the new elevation.

The main advantage in the proposed self-lifting method is the roof connection implemented that will strongly reduce the time for the connecting and disconnecting operations avoiding the use of tower - mobile cranes, or large manpower.

The same procedure should be also used for overhead cranes lifting.

In following image hoists system and connection/disconnection schematic phases are shown.

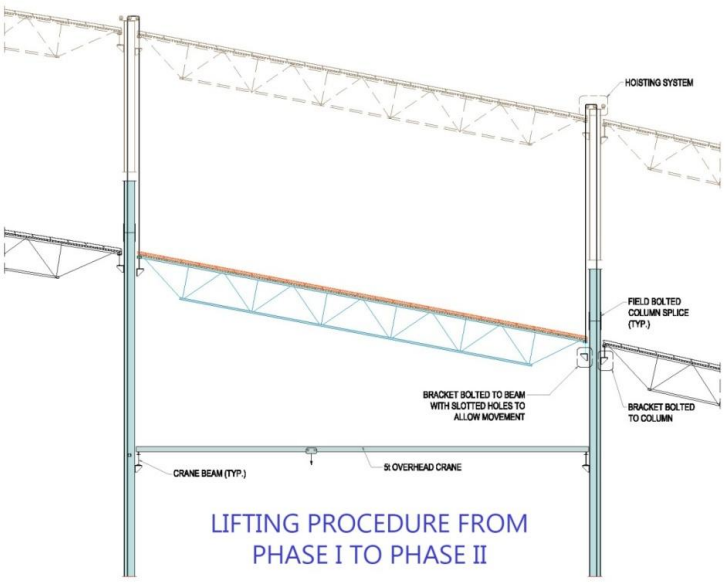


Figure 30: Typological scheme of lifting procedure

The overall lifting procedure should be summarized as follow:

- Extension of steel columns till final elevation is reached
- Hoist lifting mechanism is fixed on the end eternal portion of the columns by welding
- Hoists steel cables are connected to roof block unit by hooks placed on longitudinal beams
- Beams and brackets are disconnected from columns, previously connected to steel columns by bolts
- Each hoist lifts up the single lifting block of each section, such as for Intake, Turbines and Draft Tube, up to the final elevation where new bolts holes will let the whole roof unit block rejoin to the steel columns
- Once the designed height is reached, the whole lifting block should be reconnected with new columns by bolting beams brackets.
- Overhead cranes rails beams are disconnected and lifted up with the cranes till final elevation
- New brackets to let connect overhead cranes system are in place and rails beams can be rejoined again to the steel columns

C.6.2.9 INDOOR HEATING

Another important aspect of the Covering system is how to reach a suitable indoor average temperature that can allow all the concrete pouring operations and the manpower working condition over high and reliable standards.

Diesel-fired heating systems will be implemented. Other heating system using electrical power supply and gas would be not accessible at Muskrat falls site.

In designing the Heating system of the indoor volume the following system constraints have been verified:

- A constant minimum temperature value for concrete pouring, ripening and curing operations.
- A constant minimum temperature to let indoor works to progress like in an averagely good weather conditions
- Efficiency of all the equipments involved in the task, such as hydraulic pumps, cranes, booms.

Due the large dimensions of the structure, the heating system shall be divided in two main sources:

- General heating of the volume
- Local or specific heating where and when needed for special purposes

The total volume of the inner environment will change during the construction: the expected maximum volume to be heated is about 240.000 m3. In a conservative scenario, where the maximum volume inside the cover structure shall be heated, the following table summarizes the results in terms of fuel consumption per month:

	Average T ºC	DT ºC	KW/h	BTU/hr	l/hr	liter /month
Nov	-4.5	10	2,675.6	9,129,307.8	248.27	178,753
Dec	-13.9	19	5,323.1	18,162,517.6	493.92	355,624
Jan	-18.1	23	6,506.0	22,198,632.6	603.68	434,652
Feb	-16.3	21	5,999.1	20,468,869.0	556.64	400,783
Mar	-9.6	15	4,112.0	14,030,304.6	381.55	274,715
Apr	-1.7	7	1,887.0	6,438,564.4	175.09	126,068

Further to this preliminary analysis, a number of thirty (30) diesel-fired heaters with 750.000 BTU/hour/each and 12.500 m3/hr air flow will be used assuming that a constant of +5° C indoor temperature will be reached.

A broad choice of such kind of equipment is available on the market. Further to the preliminary calculations, it has been considered the use of different diesel air burner conveyors located in determined positions around the cover structure. The heaters will be directly connected to the indoor area by high efficiency convectors (see the Figure 31). A detailed thermodynamic design will be carried out by the Contractor at the construction stage.

Figure 31: Fuel-fired heaters

C.6.2.10 INDOOR LIGHTING

The contractor is pursuing the target to maintain well illuminating areas inside the cover structure and, in the mean time, will not interfere with the other equipments like tower booms, overhead cranes and others. The cover structure will have an average indoor elevation at the start of the works of about 40 m. Assuming this a reference height, the lighting level needs to perform in a similar fashion like the indoor lighting of sport facilities or exhibition halls. A metal halides type of lamp with a wide illumination angle shall be the lamps used for the scope (see Figure 32).

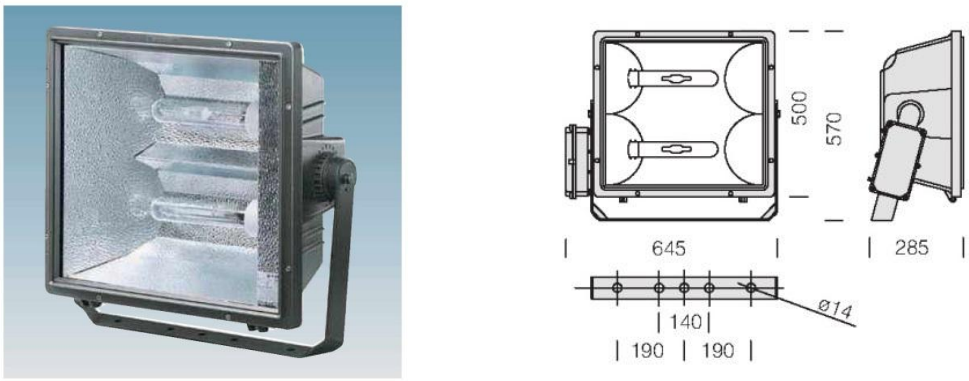


Figure 32: Indoor illumination fixtures

Such a light weight (about 15 kg each) will be mounted on the joists steel elements of the roof unit and will create a functional illuminating scheme where each lamp would cover an average area of 100 m^2. A preliminary estimated number of 143 lamps has been foreseen (see the layout in the figure below).

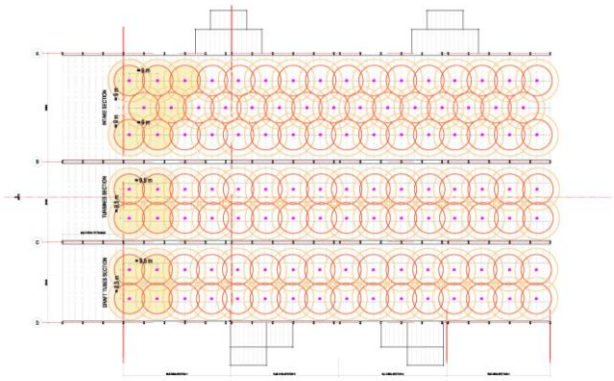


Figure 33: Powerhouse, Lighting layout inside the cover structure

The scheme presents two rows of lamps with an average distance of 9.5 m in the Draft Tubes section and Turbines section, and three rows of lamps spaced 9 m in the Intake section.

PART D MATERIALS: PROCUREMENT AND PRODUCTION STRATEGY

D.1 PROCUREMENT AND SUBCONTRACTING STRATEGY

The first step in developing a suitable project Procurement Strategy is to achieve a successful solution that verifies the needs of the project.

The Astaldi philosophy was to scan the market with the aim to establish and prioritise the objectives to be met by the project and the financial and physical programme parameters. The final goal was the creation of a project vendor list from the proposal stage. Astaldi started from the work breakdown structure to build up the first steps of its procurement strategy.

In assessing the various options aimed to define a vendor list, a priority has been given to the selection of local suppliers (Labrador and Newfound land) associated with INNU/INNUAVUIT or to Canadian suppliers working in partnership with local companies. Astaldi was fully committed to maximize the benefit to the local market since the early stage of the procurement strategy. Furthermore Astaldi deemed fundamental in defining the selection criteria for a vendor list the distance of the supplier source from the project area as well as the most convenient delivery routes selected by the supplier to get to the site. Astaldi reckons that the transport and the long distance from the suppliers' areas is one of the main challenges of this Project.

After a first scanning of the market based on the criteria above, the possible vendors have been further evaluated in terms of their bonding capacity, their annual turnover, their Health & Safety records, their track record for similar projects and their technical capacity to do the work. Astaldi, during the definition of a potential vendor list, realized the market difficulties in obtaining reliable and complete proposals and considered this point as a further criterion in selecting a final vendor list.

Astaldi, notwithstanding his large experience in similar project all over the world, considered fundamental at this stage to hire a local company to assist in the selection process, particularly when it come to evaluating the real potentiality of the local companies in the local situation.

Once the preferred vendors list was fully defined (further details are given in the **Appendices A1** and **A16**) the further step was to finalize the overall Procurement Strategy. In the Astaldi Procurement Strategy the Montreal Area (see also the next section) has been selected as the centripetal area at the supply and delivery stage.

Astaldi already established an office in Montreal that will be further strengthened from the early negotiation stage in the procurement phase and will be dedicated to the monitoring activities of all the procurement process at the source of the supply chain. The office in Montreal will be the first centre to be activated upon the award of the contract and in the negotiation stage of the

proposal in order to timely start the procurement.

In developing a subcontracting strategy Astaldi tried to give much more importance on subcontracting, when applicable, to the local companies or to companies in partnership with local companies. This will allow to have great benefits to the local companies that will also employ local manpower.

Two subcontracting strategy plans have been developed, in the first option Astaldi is considered to self-perform the majority of the Works. In detail the following activities will be self-performed:

- Concrete Supply
- Concrete placement
- Formwork installation
- Rebar Installation
- Other minor works as
- Dewatering of structure areas
- Temporary heating, ventilating and lighting of Powerhouse

As an alternative option the subcontracting component will be predominant. The following additional activities will be subcontracted.

- Concrete Supply
- Concrete placement and formwork installation for Dams, Separation Wall and Spillway:
- Rebar Installation

The criteria for selection of the main subcontractors followed the same procedure indicated in the Procurement Strategy with preference given to local entities, such as the following companies already associated with INNU/INNAVUIT contractors, in case of similar rate for the other selection options investigated. As an example the following contractors are considered among the preferred subcontractors for the Works:

BIG LAND with ADAMS (local partner)

OLYMPIC METAL with PISHUMUSS (local partner)

CAHILL with ISKUETEU (local partner)

PENNECON

D.2 TRANSPORTATION

M Astaldi has dedicated a great effort in order to study and plan the best methods and routes to deliver equipment, components and materials on site. The main issues to be investigated in developing a proper logistic strategy in the Project contest are:

- Existing infrastructures
- Existing infrastructure restrictions
- Existing Facilities
- Distances
- Expected average climate conditions
- Available transportation fleet
- Costs
- Risks

Most of the heavy equipment and plants will be relocated to site during the early mobilization period. The majority of them will be delivered, by the vendors, to Montreal metropolitan area and after that transported by Astaldi to the Project Area or delivered by the same suppliers/vendors on site.

The company assessment brought to a conclusion that the most feasible mean to deliver plant & equipment to the Project site area is by land, indeed some alternatives considering sea transport has been investigated and analyzed.

In the preferred alternative of the land transport the assumed route is the one running through R138, R389 and R500 via Baie Comeau / Labrador City (about 1750km). In this route an average daily driving distance of about 600km has been assumed to be covered. The lorries will be supposed to stop (**Error! Reference source not found.**) in Baie-Cameau (1st day), ermont or Labrador City (2nd day) and Goose Bay (3rd day). It means that a full round trip of a lorry will take about 6 days.

Astaldi is considering to directly manage and supervise or eventually to subcontract the management of the rest/maintenance stop areas along the way and located in proximity of the above mentioned locations. In the rest/maintenance stop areas a back-up tractor will be used as a safety truck in case of lorries breakdown. A dedicated truck with spare parts lorries will be also provided in case of repair and replacement of a lorry along the roadway.

City/village	distance from Montreal (Km)	partial distance (Km)	hotels	gas station	mechanic yard
Quebec City	245	245	yes	yes	yes
Forestville	560	315	yes	yes	
Baie-Comeau	665	105	yes	yes	yes
Lac Vallant	758	93		yes	
Barrage Manic 5	881	123			
Fermont/Labrador City	1,240	359	yes	yes	yes
Churchill falls	1,493	253		yes	
Happy Valley Goose Bay	1,784	291	yes	yes	yes

Figure 34: Main facilities (and their distance) along the delivery routes to the site

The delivered goods and equipments will be within legal clearances for volume and weights. In the case of over-size equipments, the machines will be disassembled (i.e. Dozer from blade and rippers) and delivered per parts. All components will be engraved with origin stamp and serial number (each piece/package) and photographed prior to wrapping for more efficient unloading processing on site. Any special support equipment (e.g. lifting rings) installed on certain pieces to assist handling will be noted.

Load & offload requirements & sequencing will be pre-planned (i.e. numbers & capacities of trailers / cranes needed etc.).

All information will be sent to local the logistics team in advance for arrival forward planning and ground handling preparation and preparation of lay-down/assembly site and plan for lifting equipment provided.

Delivery route to the site will be confirmed and all permits arranged in advance. Exact number and configuration of trailers and selection of trailer load capacity will be given to the client in advance.

All plants components will be delivered on site separately and then re-assembled and erected. Most of the selected parts of the plants will be transported by containers and will follow the procedure above.

Astaldi is aware of the current weight and width restrictions on “Pont Riviere Pecan”, and will strictly follow the prescriptions and, when necessary, will apply for an overweight permit.

Due to their bulk nature, reinforcing steel & structural steel will be delivered by road or by sea. Special care will be taken in planning deliveries and quantities considering the monthly requirements, in order to receive shipments during the warmer seasons.

In order to avoid a cumbersome re-handling of the delivery activities on site, steel reinforcement loaded trailers and semi-trailers once will get on site will be parked and waiting to deliver the material at the designated areas of the works. The lorry tractor that brought the loaded semi-trailer will drive back to the steel reinforcement warehouse an empty trailer. A dedicated parking place able to receive up to 20 semi-trailers will be provided on site.

The procurement and supply of general materials and spare parts, will be managed by a purchasing department located in a convenient place to easily and quickly deal with the main suppliers.

A preliminary proposal for the location of the purchasing and procurement offices will follow the current list of vendors location as follows:

Phase A)	**mobilization**	**(August 2013, December 2013)**
	Main purchasing and procurement office:	Montreal
	Secondary purchasing and procurement office:	St. John's
	Site purchasing and procurement office	Muskrat Falls
	Local human resources logistics office (flights, etc)	Goose Bay
Phase B)	**main works**	**(December 2013 to the end)**
	Main purchasing and procurement office:	Muskrat Falls
	Secondary purchasing and procurement office:	St. John's
	Secondary purchasing and procurement office	Montreal
	Local human resources logistics office (flights, etc)	Goose Bay

It is the intention of Astaldi to storage in advance on site the various equipment / plant spare parts in order to prevent any delay in case of an equipment failure.

Astaldi logistic strategy is also considering the establishment of a delivery point managed by local agents where the goods, will be delivered, stored and eventually shipped to site. Although the transport will be carried out by roads, airfreight will be considered for urgent delivery.

Astaldi will guarantee cement supply from local reputable cement factories. The material will be

delivered and stored in silos located in the Contractor laydown area.

In the contractor laydown area will be installed eight (8) silos, able to guarantee for a 7 day continuous production in case of lack of cement delivered by trucks (the assumed peak consumption of about 300 Mtons/day). Once the cement is loaded into the silos the truck will drive back to the origin point, that is currently assumed to be Montreal.

At the production peak time the Contractor will deal with more than 65 cement trucks per day. If the designated delivery point will be further than 2.000 km, 85 trucks per day will be required.

D.3 LOGISTICS

In the following tables the distances among the main logistic points within the site area are listed.

Site internal travelling distances		
from	**to**	**km**
Industrial Area	borrow pit	1.8
	lay- down area	3.9
	powerhouse DS	2.1
	Spillway DS	2.4
	powerhouse US	2.5
	Spillway and Transition dams US	2.6
Lay-down area	industrial area	3.9
	borrow pit	5.4
	powerhouse DS	2.6
	Spillway DS	2.8
	powerhouse US	1.8
	Spillway and Transition dams US	1.9
Main Camp	Industrial area	9.0

		borrow pit	10.8
		lay- down area	12.9
		powerhouse DS	11.1
		Spillway DS	11.4
		powerhouse US	11.5
		Spillway and Transition dams US	11.6
Goose (airport)	bay	Main Camp	37.3
		Industrial area	46.2
		borrow pit	48.0
		lay- down area	50.1
		powerhouse DS	48.4
		Spillway DS	48.6
		powerhouse US	48.8
		Spillway and Transition dams US	48.8

D.4 EQUIPMENT

D.4.1 HEAVY EQUIPMENT

In the following pages are listed the main heavy equipments that the Contractor is considering to use for the Works exploitation:

1	Hydr. Excavator cap.2.2M3 243hp	CAT 349 EL	winter package,
1	Hydr. Hammer (bucket and quick coupler)	CAT180	
1	Hydr. Excavator cap.2.2M3 243hp	CAT 336EL	winter package
1	Crawler dozer Hp240 with ripper	CAT D7E	winter package

1	Wheel loader 3.1M3 HP266	CAT 966K	winter package
2	Wheel loader 2.5M3 HP210	CAT 950H	winter package
2	Grader hp145	CAT 12M	winter package
1	Grader with plow and wing	CAT14M	winter package,
1	Back hoe tool carrier loader	CAT 420F	winter package
4	Fork lift cap.3ton Tele Handler	CAT TH 255	winter package
4	Articulating boom lift	CAT 600 AJ ,	60 to 69 ft
1	self prop.roller 10ton	CAT CS 56	winter package
4	Dumper cap 30tn	TEREX TA 300	webasto heater
2	Dumper 16m3 Mack	GU813E 2013	
5	Truck concrete pump 160 m3/hr	Mack / Putzmeister	BSF 48Z.16H
4	Trailer Diesel pump crete	70/120m3/hr	BSA 2109 HE
4	Surge hopper for concrete pumps,	Maxon, 10 m3,	hydraulic
5	Hydraulic boom multi Z, 4 section,	Putzmeister,	MX24 / 28Z
13	tower system up to 42 meters	Putzmeister,	MX24 / 28Z
10	Truck Mixer cap.8M3 Mack /	London 9 m3	double tandem
1	Fuel tank 20 Tn, HP 360	20,000 litre	Mack GU 813
1	Lube truck Kenworth	T 300	enclosed heated lub van.
1	Workshop truck, Kenworth	T 300	single axle automatic
5	Flat bed 11Tn. W/crane 7,0Tn.,	HP 250 Mack	GU 532
1	Water tank 40 Tn., HP 380 Mack GU 813		4,000 gallon water tank
2	Tandem dump truck c/w sander, plow and wing		GU 713 Granite
1	Hydro excavation, vacuum truck HV 6400 vac truck		c/w pressurized water

3	Flat truck Mack	GU 813	
10	Bus 55 passenger HP 420	Mack / Hickman	winter package
4	Minibus 24 seats, HP 175	Mack / Hickman	winter package.
80	Pickup single/double cabin 150HP	Ford F150	winter package
1	Flat bed Manac, 3 axle,	53 - 90 ft	
22	Step deck Manac, 3 axle	53 ft	

D.4.2 LIGHT EQUIPMENT

In the following pages are listed the main light equipments that the Contractor is considering to use for the Works exploitation:

12	Tower light	Magnum	MLT 4080K, 8 KW
4	Generator sets Cat	C 32,	1000 KW standby
3	Generator sets Cat	C15,	500 KW standby
4	El. subm. water pump Flygt NS3202	20m3/1', HP 73	45kW
10	El. subm. water pump Flygt BS2660	2,58 m3/1', HP 24,5	11.2kW
4	Stationary electr. Compressors	Atlas Copco	GA 200 / 10 Bar
5	1060 Gallon Air tank	Atlas Copco	Air for 8 compressors
5	El. Welding machine, HP 15	Big Blue,	600A
30	Frost fighter	IDF 350	700,000 BTU
16	Frost fighter	IHS 700	1,400,000 BTU
2	Ground Heater	Wacker	E 3000, 5,000 to 6,000 ft2
2	Ground Heater	Wacker	E 5000, 11,000 to 12,000 ft2

2	Water tanker TREMCAR Stainless steel	50,000 litre	
2	Enviro Tainer	27,000 litre	In 20 ft ISO container
4	Enviro Tainer	60,000 litre	In 40 ft ISO container

D.5 PLANTS

D.5.1 CRUSHING PLANTS

D.5.1.1 TEMPORARY CRUSHING PLANT

The temporary crushing plant will be delivered on site 15 days after the mobilization date and will be located in the Contractor laydown area. The proposed temporary crushing plant with a pre-screening is a portable crushing plant by Metso LT106 or similar with a nominal productivity rate of 100 ton / hr used for the primary, secondary, 3 (to 4) aggregates classes. The plant will have three (3) conveyor delivery stockpiles.

The technical specifications of the plants are given in the Volume 5 – Equipment Technical Specifications.

D.5.1.2 MAIN CRUSHING PLANT

The permanent crushing plant will be located in the Contractor laydown area. The proposed permanent crushing plant is a Telsmith with a nominal productivity rate of 200 ton / hr used for the primary, secondary, 3 (to 4) aggregates classes. The plant will have three (3) conveyor delivery stockpiles.

The technical specifications of the plant are given in the Volume 5 – Equipment Technical Specifications.

D.5.2 BATCHING PLANTS

D.5.2.1 TEMPORARY BATCHING PLANT

A Temporary portable Concrete Batching Plant type Stephens Thoroughbred will be used at the earliest project stage. The plant with gravity drop cement and a capacity of 50 m3/hour will be installed with a 60 tons silo and a 200tonX5 aggregates bins. The Thoroughbred plant is wired in conduit and pre-plumbed. The main disconnect and plant power panel are enclosed in a steel cabinet with hinged, lockable steel doors, positioned to face away from the transfer conveyor for cleaner, safer operation. The plant air compressor is located on the plant's 5th wheel, away from the transfer conveyor for a cleaner and safer operation.

The sloping sides of the aggregate batcher and bins are 1/4" steel. The Stephens bin will have sufficient clearance under overhead gates to allow room for work. Gates are not below or even with the top of the aggregate batcher, so a clean out hatch or door is not required. All gates have six (6) 3/4" thick teeth that are permanently lubricated and bolted on.

D.5.2.2 MAIN BATCHING PLANT

Two (2) complete Concrete Batching Plants will be procured to the Project. These plants are designed for a productivity of 100m^3 per hour in order to fulfill the proposed Construction schedule at the Appendix 9 – Interface and Milestone Schedule.

The batching plant facilities are designed for both hot weather and cold weather concreting and will be equipped with heated and insulated facilities, heated aggregate facilities and hot water plant. Water chillers, as well as ice plants, have been also foreseen for hot weather concreting. Aggregate storage shelters will protect aggregate during the winter and summer seasons.

A breakdown of each batching plant equipment is given as following:

Item	Type	Description
1	Aggregate bin	No. 5 aggregate bins 50tons each equipped with 2 weigh hoppers (cap. 4.5 m^3 each) , No. 2 discharge conveyors 900mm X 10 mt, No.2 transfer conveyors 900mm x 22.6 mt
2	Air Compressor	No. 2 Air compressor 18.5kW each and lubricator

1	Cement Storage Silos	No2. 2 Cement / Fly ash storage silo cap. 200ton each complete with sensor, filters, handrails, safety valve No.4 qty4 WAM screw conveyor diameter 300mm
7	Additional Silos	No. 7 Cement silo single compartment. Cap 300Short tons/220 m3 compete of safety release valve, ladders, handrails, electromatic low/high level sensors, butterfly valves, 500cfm low pressure blower with hoses, plus rotary vane feeders plus 2 WAM screw conveyors 300mm x7.3mt
1	Ice and water scales	No. 2 ice and water scales cap. 4.5 m3 screw feeders, water meters air vibrator
1	Drum Mixer	No. 2 Rollmaster reversing drum mixer cap. 4.5 m3
1	Computerized batching plant control	No. 2 Expandable PLCs with necessary input/output modules including Nema cabinets and emergency Separation Wall switches. No. 2 IBM compatible workstations. Approximately 10% of analog inputs are left available in the system and can be expanded for any additional need of the plant. The manual operation is via mouse and does not include manual terminal. It is possible to connect the system from this terminal to another terminal. Each system includes the following software: Windows 7 operating program, Microsoft Access (ODBC) data base, Tel-Assist telephone support module, Data base automatic backup module, Marcotte order entry and delivery slip software, Marcotte batch control system
1	Control room	Control room
1	Admixture system	No. 2 Complete admixture systems each consisting of : 5 admixture system with sight glasses +1 set of 5 polyethylene tanks cap.8.000 lts + pumps
1	Aggregate loading hopper + loading conveyor	Aggregate loading hopper cap. 16ton with qty 1 loading conveyor 30"x32.9mt complete with gearbox, sheave, motor, head and tail drums etc.
2	Ice plant	Modular Ice maker R404 refrigerant, Cap. 70ton/24hrs, Mykom compressors, motors, 4 bottom bin total capacity 80ton transfer system+Ice holding hopper above the ice scales
2	Water Chiller	Air cooled water chiller cap 25m3/hr from 14 to 4C in container complete of pumps, diagnostic control panel, condenser etc
1	Building	Prefab metal building 19.5mx29.5mx12.2m including steel structure 4mandoors,one double mandoor, three motorized 3.6mx4.26 overhead doors with windows, oil furnaces Reznor 175,000BTU with oil tanks all hardware, electrical hardware , lights exit signs distribution panels and cables.
1	Thermal plant	No. 2 Polarmatic Turbomatic thermal energy unit cap. 1500kW in 40' container , 10000lt tank, turbogas generator, oil burner 7 hot air butterfly valve No. 1 Polarmatic turbomatic thermal energy unit cap. 500kW in 20' container

A general layout of the two batching plants foreseen in the Contractor laydown area is given in the Figure 35. More detailed information about the concrete batching plants is provided in the Volume 5 – Equipment Technical Specifications.

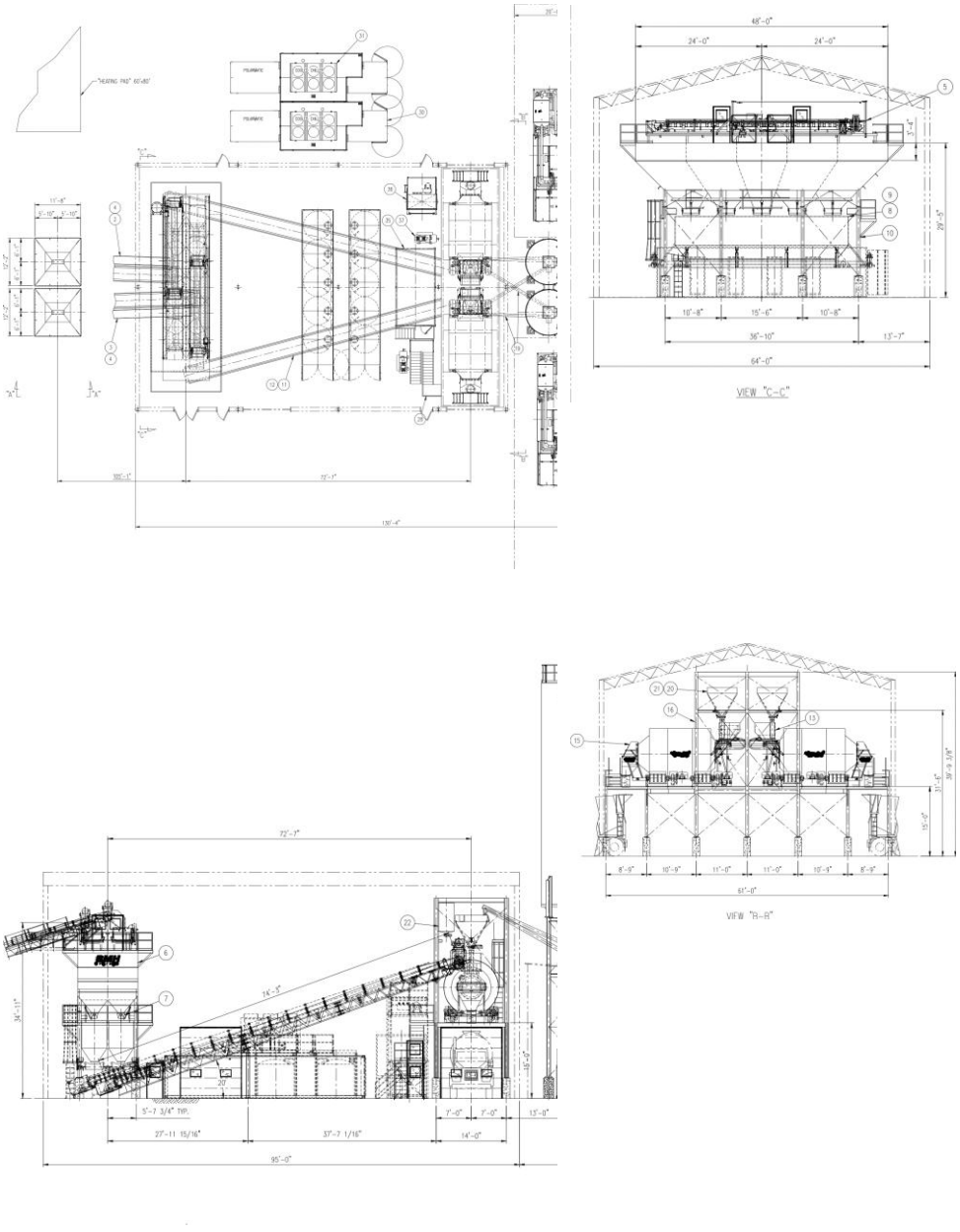


Figure 35: Concrete Batching plants layout

D.5.3 CRANES

A craneage analysis has been carried out and further details can be found in the site lay-out drawings included in the Appendix A13 and for each of the working areas of the Project.

D.5.3.1 OVERHEAD CRANES

The contractor will use twenty four (24) overhead cranes in the construction site of the powerhouse as mentioned in the above chapters. The overhead cranes will operate inside the integrated cover structure to speed up the material handling operation. The typical overhead crane will be a 5 tons Ekke Top Running Single Girder Crane with a 26.5m to 35 m span, equipped with a Demag DCPRO 25/4000 2/*4 H25 chain hoist cap. The lifting capacity is 25 m.

D.5.3.2 MOBILE WHEEL CRANES

The Contractor is considering to use for the Works exploitation a certain number of telescopic boom crawler cranes:

- 3 Hydr. Rough Terrain Crane cap. 30Tn — TEREX RT 230 XL-1
- 2 Hydr. Rough Terrain Crane cap. 60Tn — TEREX RT 670
- 3 Hydr. Rough Terrain Crane cap. 90Tn — TEREX RT 100
- 1 Hydr. All Terrain Crane cap.220Tn — GROVE GFK 6220

D.6 MATERIALS

D.6.1 CEMENT AND ADDITIVES

Cement and additives will be supplied to the site by land transport from Montreal region and will be stored in 8 silos of 300 Tons each in order to guarantee at least 7 days of autonomy during the project peak production.

A permanent storage system located in the Goose Bay harbor has been considered as a contingency to mitigate the shortage that might arise due to the transportation issues. An

authorization process and a general agreement with the Company will be discussed at the Project stage in order to further develop such a proposal.

D.6.2 AGGREGATES

The total planned production for aggregates has been estimated in about 1 Million tons. The aggregate consumption will be mainly concentrated between April 2014 and October 2015. The Aggregates production will start in late 2013 and will continue during the 2014 and 2015 summer seasons as shown in the figures below. In the Figure 36 the aggregates monthly foreseen production and the maximum hourly production per month is shown.

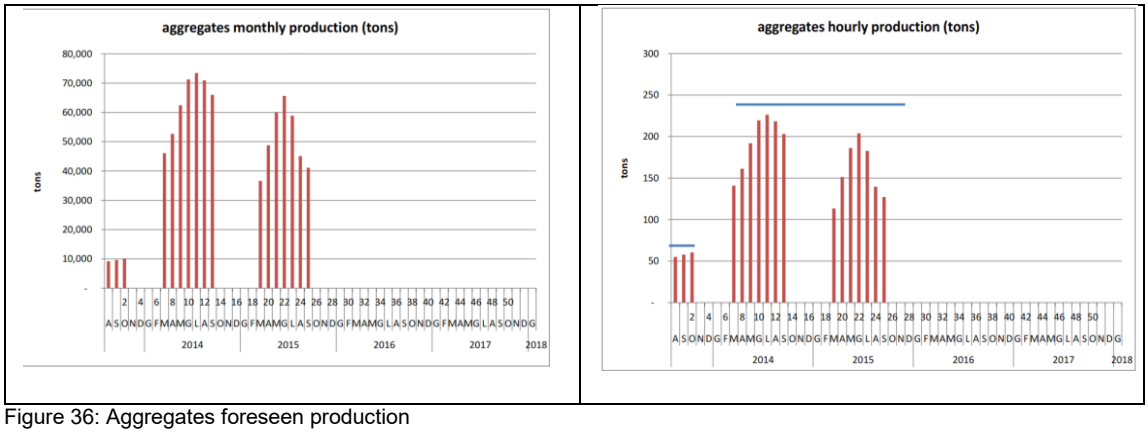


Figure 36: Aggregates foreseen production

The expected production will reach his peak of about 250 tons/hours in 2014, delivering an average monthly production of about 70.000 ton from May to August 2014.

The foreseen stockpiles will globally reach their maximum size of 140.000 tons in 2014, and their second peak size of 120.000 tons in 2015. The stock piles will be gradually used during the first winter season and then completely consumed within the remaining years. An additional storage of 15 to 20% of the required aggregates (the additional storage has not been included in the graphs here enclosed) will be considered as a contingency measure in order to avoid the risk of shortage during the winter season.

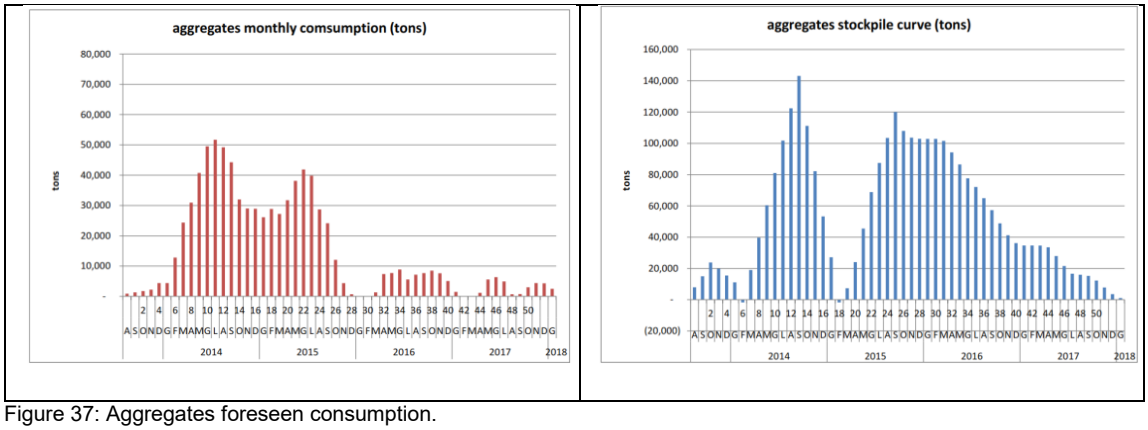


Figure 37: Aggregates foreseen consumption.

The fine aggregates (sand) will be produced from the borrow pit GD11 located 5.4 km south east from the laydown area, where both the crushing plant and the batching plant will be located.

Sand excavation will take place only from late April to October and the whole excavated volumes will cover the aggregate consumption during the summer and the next winter. The borrow pit excavation will be carried out by an excavator CAT 349 or similar, dumping on a 30 tons TEREX type dumpers or similar.

The sand from the borrow pit will be then transferred to the crushing plant, washed and processed, if required, then stockpiled before the use in the batching plant. During the winter season, the sand, before to be used will be heated by a sheltered floor heated system, in order to reach the appropriate characteristics required by the specifications.

The coarse aggregates (5-20; 20-40 and 40-80) will be obtained from the rock stockpiled whose production is in the other contractors' scope. The aggregates will be stockpiled in 2 or different stockpiles ready to be used by the batching plant.

D.6.3 FUEL, OIL, GREASE

Fuel for trucks and equipment will be partially stored in the industrial area, close to the mechanic warehouse, in the batching plant area and in the truck parking area.

Fuel for generators will be stored in fuel tanks close to the power stations, while fuel for the powerhouse heaters will be stored in special fuel tanks upstream and downstream of the powerhouse itself. All fuel tanks will be refilled by tank trucks that will take fuel from the company stock.

Grease, oil and other similar materials will be stored close to the mechanical yard. Small

quantities will be also stored in the deposits close to the powerhouse, spillway and transition dams works.

Fuel, oil and grease storage will be managed in conformity to the technical specifications and the environmental rules. Exhausted oil and grease will be properly stored and the waste managed in accordance to the environmental management plan.

D.6.4 REINFORCEMENT STEEL

The reinforcing steel will be cut and bent out of the job site, either in protected warehouse in Goose Bay or directly at the origin at the manufacturer yard. The reinforcement steel will be delivered to the site by semitrailer and unloaded in the temporary deposit area, and then transferred to the work site.

The reinforcing steel to be used in the powerhouse will be transferred first in the reception bay by semi-trailers, and then delivered to the powerhouse using an intermediate overhead crane (Crane A – red shown in the figure below). Once the reinforcing steel gets inside the integrated cover structure it will be positioned in the desired location by the overhead cranes (Crane B-blue shown in the Figure 38 below).

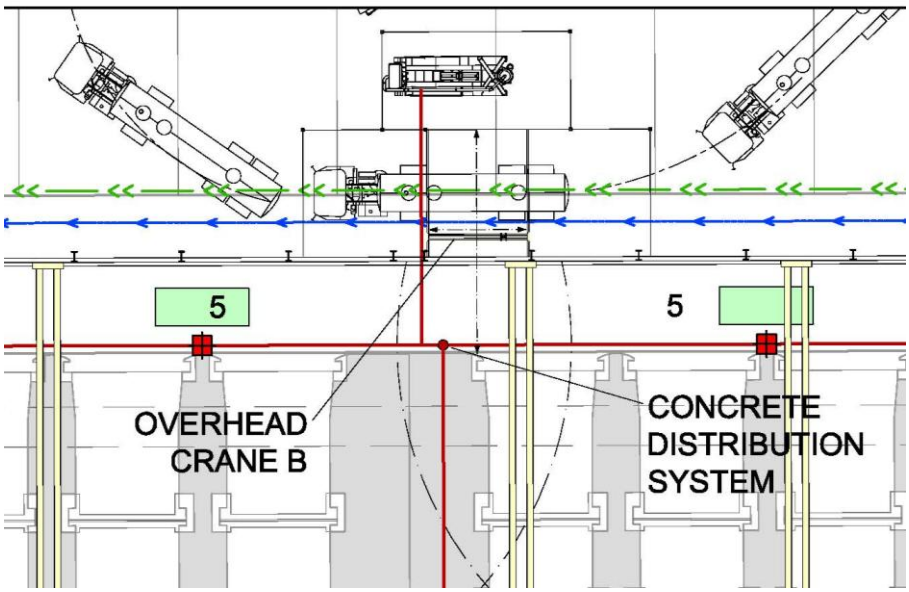


Figure 38: Access and handling of the steel reinforcement delivery inside the Cover Structure.

D.6.5 STRUCTURAL STEEL

The structural steel will be delivered to the site by semitrailer and unloaded in the temporary deposit area following an agreed with the Client packing list, and then transferred to the work site.

A steel workshop in the south erection bay area will carry out additional assembly works, whenever required, and a mobile crane will be dedicated for the scope.

D.6.6 MATERIAL TRACKING SYSTEM

It is intention of Astaldi to use a code bar tracking system for all materials that will be transferred from the original supplier factories or warehouses to the Works area. The position of batch will be tracked on real time by tracking system as the one shown in the Figure 39 below.

Figure 39: Example of tracking system for the real time detection of the material supply chain.

D.7 CONCRETE

Temperature of the fresh concrete is a vital means to be controlled in the very sense that this will constitute a rapid hydration upon the placement of concrete. Components of the fresh concrete including its mixing and delivery periods shall be controlled and by practical means their temperatures will be controlled and the following methods applied:

- Storage of fine and coarse aggregates shall be shaded.
- Sufficient cement storage to prevent shortage.

- Using water chillers (ice) to cool the mixing water during the hot season. Use of crushed or flaked ice for part of the mixing water.
- Above ground water tanks used for the mixing water should be provided with shade And thermal insulation.
- Silos, bins & mixers shall be coated with heat-reflective light color paints.
- For mass pours, thermally insulate the exposed concrete surfaces (after setting) using polystyrene sheets to reduce heat loss and avoid thermal cracks.
- Protect the concrete from moisture loss during placing and curing periods to avoid Plastic shrinkage cracking.
- Minimize the period of delivery from the time of mixing to the start of placement by proper coordination with the site and the batching plant.
- The time interval between the mixers shall also be planned in advance in order to avoid delays and waiting of other trucks at the jobsite.

Only cementations materials approved for use in concrete shall be allowed on site.

Each silo at each batching plant shall be clearly labeled with a number and material type.

The Tanker Driver shall report to the Batching Plant Operator immediately on arrival at the plant. The Batching Plant Operator shall instruct the Tanker Driver, which silo number and powder type to discharge the load into.

The Batching Plant Operator shall ensure that the silo to be filled has sufficient space to accept the load and that the silo filters are Separation Wallitched on and operational.

The Tanker Driver must not leave the controls whilst discharging the load. If there is any form of dust emission or if the silo high-level alarm sounds the Tanker Driver shall stop discharging immediately and investigate with the Batching Plant Operator.

Only chemical admixtures approved for use in concrete shall be allowed on site.

All chemical admixtures shall be stored in appropriate containers and adequately labeled.

The Batching Plant Operator shall instruct the Admixture Tanker Driver on arrival where to discharge and ensure that there is sufficient space in the tank to accept the quantity delivered.

All admixtures shall be securely stored in designated areas. All admixtures shall be kept in bonded storage. Admixtures past their ‘use by’ date or waste admixtures shall be appropriately containerized, adequately labeled and disposed by a registered specialist contractor.

It is the responsibility of each and every member of the Concrete Production Team to ensure

the plant and surrounding areas are kept clean and free from buildup.

The following procedures shall be implemented prior to placing of concrete:

- Plan the schedule of pouring so it will be placed promptly upon arrival.
- All equipment should have adequate feasible operating condition.
- Stand by concrete mixers shall be made available at site during concrete operation.
- There should be an ample vibration equipment and manpower to consolidate the concrete immediately after placement.
- Provision of windbreaks along the perimeter of the area to control the velocity of wind.
- Adequate water supply should be available at the vicinity for moistening the sub-grade as well as for fogging the forms and reinforcement.
- Polyethylene sheets and wet hessian shall be used to cover the fresh concrete after the initial setting.
- Stock pile of fine sand is also required use for ponding water during curing.

D.7.1 CONCRETE PLACEMENT

The Contractor will use for the works Mobile Concrete Pumps, Concrete Tower Booms and Trailer Mounted Pumps.

In the Intake/Powerhouse structure, under the Integrated Cover System, the concrete will be placed by tower-mounted concrete placing booms. four (4) concrete placing towers will be installed in the draft tube and the intake section bays, five (5) concrete placing towers in the turbine section. A total of thirteen (13) concrete placing towers will be foreseen in the powerhouse site area (see the Figure 40 below)

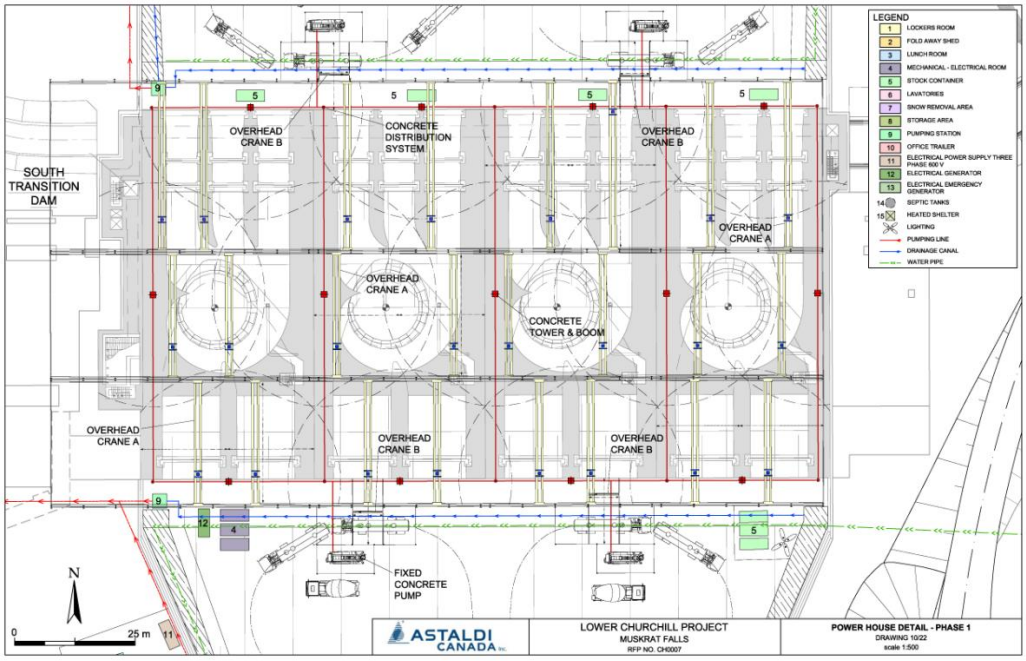


Figure 40: Layout of the concrete placing towers inside the cover structure

At the top of all towers will be installed the pedestal structures (2 tons each), connected to the concrete lines. All the intake and powerhouse will be poured by Putzmeisters Booms MX24/28Z, 5" diameter, with a maximum horizontal extension of 24 meters.

Two (2) concrete placing booms type Putzmeisters MX24/28Z will be used for the Units G1 and G2, while the other two (2) concrete placing booms Putzmeisters MX24/28Z will be used for the Unit 3 and 4. An additional concrete placing boom identical to the previous four will be available as backup placing boom.

No	Unit	Brand	Type	Description	Supplier	Section of the Works
CONCRETE PLACING BOOMS						
5	Pcs	Putzmeister	MX24 / 28Z	Hydraulic boom multi Z, 4 section, complete with pedestal,	Pompaction, Montreal	Intake Powerhouse
8	Pcs	Putzmeister		Putzmeister tower system up to 42 meters	Pompaction, Montreal	Intake Powerhouse
5	Pcs	Putzmeister		Putzmeister tower system up to 30 meters	Pompaction, Montreal	Intake Powerhouse

CONCRETE PIPE LINE						
500	Meters	Putzmeister	ZX 125	5" delivery line, including couplings, elbows, welding rings and pipe supports, Budget price	Pompaction, Montreal	Intake Powerhouse
CONCRETE DIVERSION VALVES						
12	Pcs	Putzmeister	DVH 5/2 ZX125	5" hydraulic diversion valve	Pompaction, Montreal	Intake Powerhouse

The four (4) Intake concrete placing towers will be connected by a pipe network to two (2) stationary concrete pumps (type Putzmeister BSA 2109 HE) located upstream outside of the integrated cover structure under a heated cover protection.

Conversely the five (5) turbine concrete placing towers and the four (4) draft tube concrete placing towers will be connected by a pipe network to two (2) stationary concrete pumps (type Putzmeister BSA 2109 HE) located downstream outside of the cover under a shelter.

Once the placing boom complete the concrete placement for one block section will be shifted by the overhead cranes to the next tower in order to start the concrete placement for the next block section.

The Contractor investigated the alternative to install a bigger placing boom system like the MX42/48 but the solution was discarded because of the multiple clashes that would occur with the other equipments inside the cover structure. Moreover such a boom is very heavy and cannot be easily relocated by the foreseen overhead cranes.

In case of a temporary failure to one of the four (4) stationary pumps used to feed the concrete lines in the powerhouse, one of the other pumps will be shifted in order to ensure a continuous concrete supply inside the working area.

TRAILER MOUNTED CONCRETE PUMPS				
Diesel pump 120m3/hr	Putzmeister	BSA 2109 HE (Electric)	Pompaction, Montreal	Intake Powerhouse

With the aim to guarantee a continuous concrete supply each pump will be equipped with a remix surge hopper (10 m3) to provide a continuous concrete supply in case of delay in the arrival of the concrete mixer trucks.

REMIX SURGE HOPPER				
Surge hopper for concrete pumps	Maxon	10 m3, electric , hydraulic	Pompaction, Montreal	Intake Powerhouse

The Concrete Placement of all spillway structures, the Transition Dams, the separation walls and the other minor structures will be carried out by Truck-mounted concrete pumps with a pouring capacity of 120 m3/hr, 5" diameter and maximum pouring height of 48 meters.

In the Spillway area the concrete trucks will get the access to the pouring areas from both upstream and downstream as mentioned in the Site Organization chapter. The Separation wall will be also accessed for concrete placement from both sides, while the transition dams will be mainly accessed from upstream.

TRUCK MOUNTED CONCRETE PUMPS				
Truck mounted concrete pump 120 m3/hr	Truck: Mack Truck: Pump: Putzmeister	BSF 48Z.16H	Pompaction, Montreal	Spillway Transition dams Separation walls

Astaldi is planning to procure the first truck mounted concrete pump at the very early stage of the works, other two (2) pumps equipment will be delivered on site from March 2014. Further two (2) truck mounted concrete pumps will be eventually available during the peak production phases (summer of 2014 and 2015).

Although Astaldi is planning to execute few concrete works during the winter seasons, except for those of regarding the protected intake and powerhouse area, any concrete pouring by truck mounted concrete pump will be always executed under a mobile cover protection.

D.8 FORMWORKS

D.8.1 TYPE OF FORMWORKS

The Contractor, due to the remote location of the construction site, considered the use of a formwork typology with as few systems as possible.

This would mean that the equipment will be reused across the different sections of the Works.

The selected supplier of the formworks is Harsco Infrastructure. (See **Attachments 33 to 38**)

The typical formwork system used all through the Works section consists in a:

- Wall formwork H20 – a panel form system with high adaptability to the different geometry.

- SCB dam climbing system. A system able toabsorb the most different inclinations both positive and negative (sub-panel casting) of the wall keeping the different work floors in horizontal position in order to make safe and easy staff allocation and passage on them. The system fits to positive and negative inclinations with a few simple steps (see the figure below).

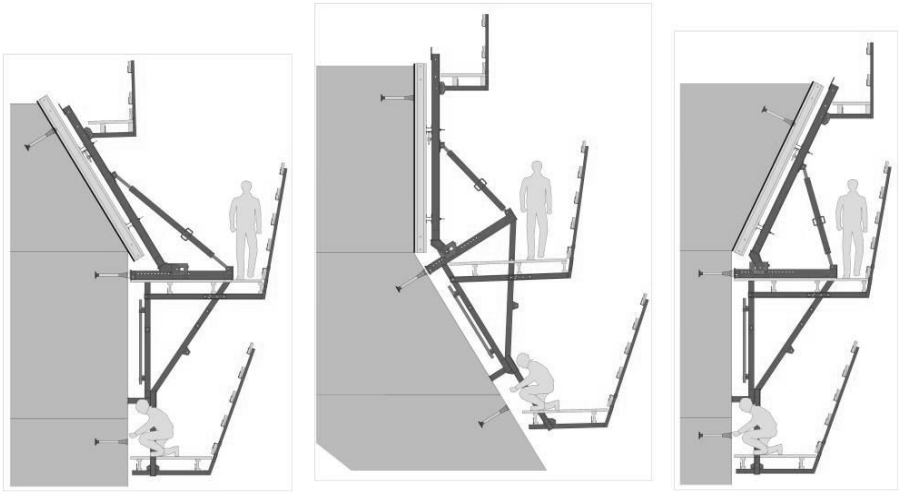


Figure 41: SCB type climbing formwork system.

- Shoring towers ID15. The shoring towers will be used to support the roof structures especially in the complex geometry of the intake and the draft tube.

The special design of Vertical waler in the dam climbing system SCB and the Dam bracket SCB allows the execution of the first phase pouring without additional components in the formworks.

The anchorage system of the formwork consists in threaded anchor plate, tie rod and anchor cone. At the formwork installation stage the shuttering panel must be prepared and provided with a through drill hole at the correct level of the anchorage insertion. The lead cone is then to be screwed to the plywood by using the fit screw from behind the shuttering skin. If the drilling of the plywood is not possible, the preparation is done through the nailable fixing disk that is directly nailed on the shuttering skin. In order to prepare the formwork to climb after cast, before the moving back of formwork for the dismantling, the fixing screw will be unscrewed. The formwork element is then loosened from the wall when dismantling.

The formwork and falseworks solutions supplied for each structure can be summarized following the sections of the Works.

The transition dams, the separation dam and the Spillway will be erected by a formwork system consisting in a combination of:

- Wall formwork H20.

- SCB dam climbing system.
- Shoring towers ID15. The shoring towers will be used to support the roof of the drainage galleries.

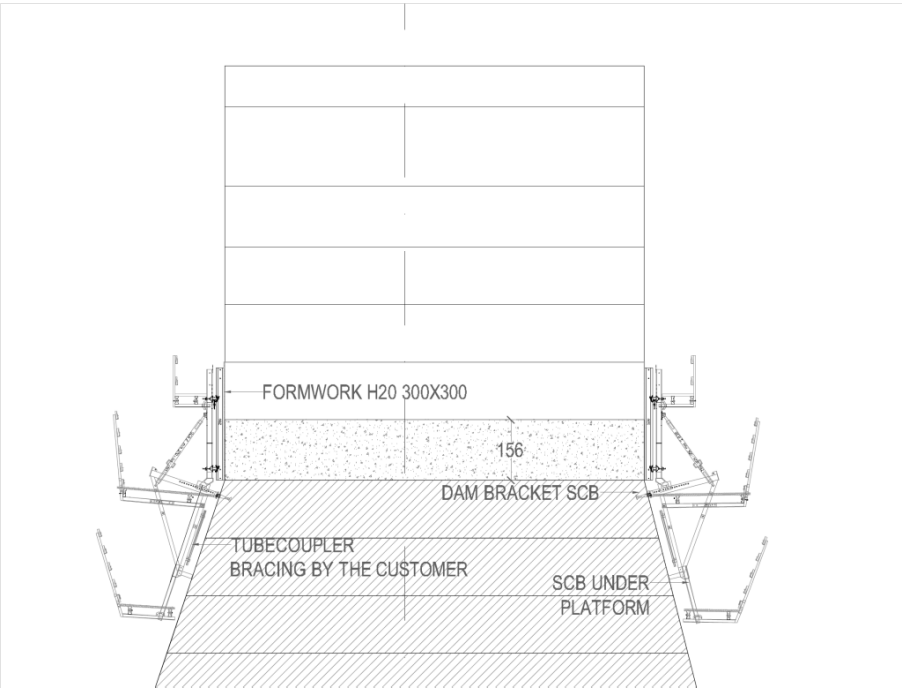
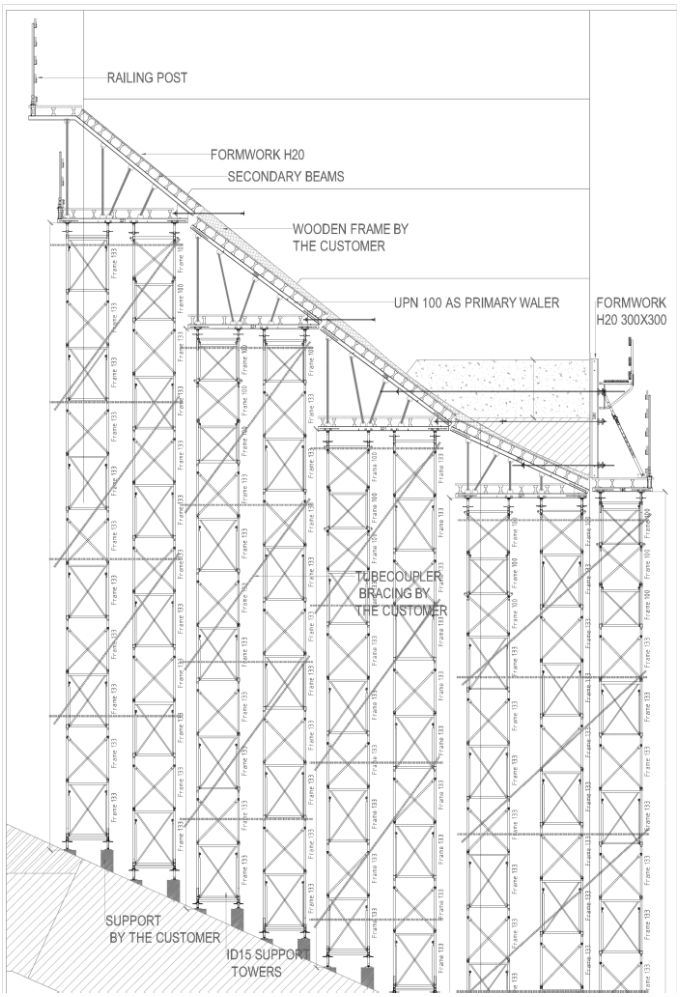


Figure 42: Climbing formwork system for the transition dams

The pouring phase will be carried out in 3,00 m high steps (height of the formwork 3,0m). The step shown in the figure is not the one followed in the execution and is here shown only as an example of the use of the formwork system.

The Contractor will use for the Intake a system consisting in a combination of:

- Wall formwork H20.
- SCB dam climbing system.
- Shoring towers ID15. The shoring towers will be used to support the roof of the intake.



The complex geometry of the draft tube structure brought to a different formwork system concept that includes a combination of:

- Wall formwork H20
- SCB dam climbing system
- HSB frame for high single sided pouring
- Shoring towers ID15
- Self reacting circular wall formwork for the draft tube
- Special steel double curvature formwork for the bottom draft tube.

The draft tube will be executed by a bespoken steel formwork that follows the complex geometry of the tube including the variable diameter between 11,00m and 6,80m. The rectangular shaped columns of the draft tube, located in its front part, will be executed using the formwork type SCB. The shoring towers ID15 will be positioned to support the curved roof structure, the formwork being made of a wooden anisotropic plate. For the double-curvature area a metallic plate form will be used and supported on a wooden plate.

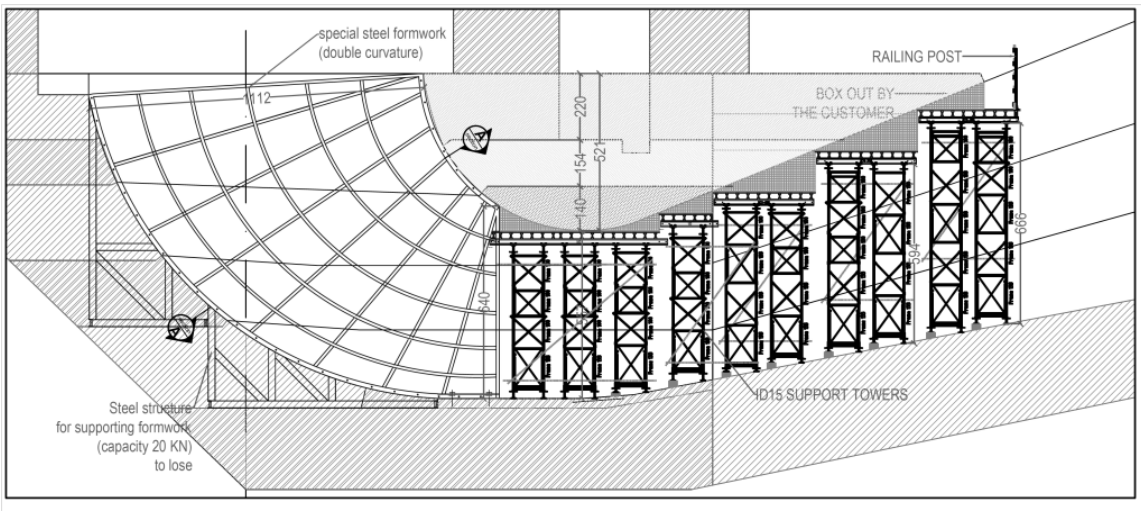


Figure 43: Special formwork for the draft tube and the turbine section.

Further details of the formwork system used for each of the sections of the Works are given in the drawings attached to this Appendix A13 submission.

ASTALDI CANADA Inc.

PART E THE WORKS

E.1 CONSTRUCTION SCHEDULE

The Present Construction Schedule has been developed following the requirements in the Exhibit 9 – Interface and Milestone Schedule for performance of the Work in order to complete the Work in accordance with the Milestones indicated in Exhibit 9 – Interface and Milestone Schedule. See **Attachment 1** for a copy of this schedule.

E.1.1 BASIC DATA (CALENDARS) AND LAYOUTS

The Contractor used N° 3 Calendars in the Work schedule, as follows:

1. **Work Calendar CH0007 7days+Festivities** that includes the 11 statutory holidays in Canada used for all the works activities;
2. **Work Calendar CH0007 5days+Festivities** that includes the 11 statutory holidays in Canada and has been used for the Plants procurement, the authorization and permits and the supply of materials by Other Contractors;
3. **Work Calendar CH0007 7days+Milestones** included in order to include the milestone dates that are occurring at a festivity date.

WBS Name and Activity Codes

Primavera P6 WBS names at Level 2 as used in the work schedule are summarized in the table below.

1. PRELIMINARIES
1.1 AUTHORIZATION PROCEDURES and SUBMITTALS
• Crushing Plant • Concrete Batch Plant No. 1 • Concrete Batch Plant No. 2 • Mobile plants • Cover System (Winter Protection) • Structural Steel • Formwork • Special formwork (draft tube, spillway, rollway, turbine areas, ...) • Approvals
2. CONSTRUCTION WORKS
2.1 GENERAL

ASTALDI CANADA Inc.

- Mobilization and Site Installation
- Access Roads, access ramps and pads
- Dewatering of Structure Areas
- Temporary Bridge
- Construction Crane
- Temporary heating, ventilating and lighting of powerhouse
- Chain link fences and gates
- Temporary Lateral support and bracings
- Anchor points

2.2 TRANSITION DAMS

- North Transition Dam
- Center Transition Dam
- South Transition Dam
- Separation Wall

2.3 SPILLWAY

- Spillway Structure - Pier No. 1 (Rollway excluded)
- Spillway Structure - Pier No. 2 (Rollway excluded)
- Spillway Structure - Pier No. 3 (Rollway excluded)
- Spillway Structure - Pier No. 4 (Rollway excluded)
- Spillway Structure - Pier No. 5 (Rollway excluded)
- Spillway Structure - Pier No. 6 (Rollway excluded)
- Spillway Structure - Bay No. 1 (Rollway Construction)
- Spillway Structure - Bay No. 3 & 5 (Rollway Construction)
- Spillway Structure - Bay No. 4 & 2 (Rollway Construction)
- Spillway Bridges
- Spillway Discharge Channel - Phase 1
- Spillway Discharge Channel - Phase 2 (Optional)
- Spillway Discharge Channel - Phase 3 (Optional)

2.4 INTAKE

- Intake Structure - Unit 1
- Intake Structure - Unit 2
- Intake Structure - Unit 3
- Intake Structure - Unit 4
- Intake - Electrical Works

2.5 POWERHOUSE

- Substructure - South Service Bay
- Substructure - North Service Bay
- Substructure - Unit 1
- Substructure - Unit 2
- Substructure - Unit 3

• Substructure - Unit 4 • Superstructure (Intake and Powerhouse) - South Service Bay • Superstructure (Intake and Powerhouse) - North Service Bay • Superstructure (Intake and Powerhouse) - Unit 1 • Superstructure (Intake and Powerhouse) - Unit 2 • Superstructure (Intake and Powerhouse) - Unit 3 • Superstructure (Intake and Powerhouse) - Unit 4
2.6 TURBINE GENERATOR & ANCILLARIES
• Electrical Works • Mechanical Works
2.7 WORK EXECUTED FOR COMPANY'S OTHER CONTRACTOR
2.8 DEMOBILIZATION

Activity Codes – To allow other organization and activities filtering, the following Activity Codes and their descriptions have been defined:

CH0007 – SUB AREA	
MILE	Area Milestones
GENE	General
1110	Access road to spillway
1120	Dewatering of structure areas
1150	Temporary bridge
1170	Construction crane
1180	Temporary HAVC
2361	North transition dam
2362	Center transition dam
2363	South transition dam
2364	Separation wall
2410	Spillway structure

2411	Spillway bridges
2430	Spillway discharge channel
3220	Intake structure
3290	Intake electrical work
3310	Substructure
3320	Superstructure
3430	Electrical work
3440	Mechanical work
3510	Supply of concrete to company's others contractor
CH0007 – DEPARTMENT	
MAN	Management
ENG	Engineering
HAND	Handover to the company
PROC	Procurement, fabrication and delivery
CONS	Construction
PREC	Pre-commissioning
COMM	Commissioning
CH0007 – DISCIPLINE/TRADE	
GEN	General
CIV	Civil
CONC	Concrete
STRU	structural steel
ELEC	Electrical

MECH	Mechanical/HAVC
CH0007 – FACILITY	
GEN	General
COV S	Cover system
BAT 1	Batching plant 1
BAT 2	Batching plant 2
CRUS	Crushing plant
T BAT	Temporary batching plant
T CRUS	Temporary crushing plant
U1	Unit 1
U2	Unit 2
U3	Unit 3
U4	Unit 4
BAY 1	Unit 1
BAY 2/4	Unit 2/4
BAY 3/5	Unit 3/5
PIER 1	Pier 1
PIER 2	Pier 2
PIER 3	Pier 3
PIER 4	Pier 4
PIER 5	Pier 5
PIER 6	Pier 6
CH0007 – MAIN AREA	

GEN	CONTRACT SIDE WIDE
PER	PERMITS AND AUTHORIZATIONS
0000	MOBILIZATION AND SITE INSTALLATIONS
1100	GENERAL
2360	TRANSITION DAMS
2400	SPILLWAY
3200	INTAKE
3300	POWERHOUSE
3400	TURBINE GENERATOR AND ANCILLARIES
3500	WORK EXECUTED FOR COMPANY'S OTHERS CONTRACTOR
CH0007 – RESPONSIBILITY	
AST	ASTALDI
NAL	NALCOR
SNC	SNC-LAVALIN
OTH	OTHERS

Activity IDs – A simple ID has been attributed to each activity. The structure of the ID codes is:

CH0007–XXXX

Where:

CH0007= Project Package Number

XXXX = Activity Number

Critical Path

For the development of the present preliminary schedule the Exhibit 9 Interface and Milestone Schedule have been used with a “Finish on” constraint for the Finish Milestones. The interface Milestones defined as Start Milestones have been included with a “Start On or After” constraint.

The Critical Path of the Program, with activities having a Total Floating less than 15 days, as a result of the logical Relationships and Constraints included in the Primavera file, has been attached at the Appendix A.9 – Interface and Milestone Schedule.

The following document dealing with the proposed construction schedule has been attached to the Appendix A.9 – Interface and Milestone Schedule:

- Primavera P6 Release 7 *.xer file;
- Layout n°1 (Critical Activities, Total Float<15days)

E.1 SPILLWAY AND NORTH TRANSITION DAM

E.1.1 GENERAL DESCRIPTION

The spillway structure is composed of two (2) side walls, four (4) intermediate piers and five (5) rollways.

The walls and piers incorporate the structures to install the guides for the upstream and downstream stop logs and of the gates, forming five (5) bays with rollways.

The works shall be performed according to the following sequence:

1. Preliminary works
   a) Removal of sand layer used to protect the excavated areas during winter season
   b) Cleaning with pressurized air and water (only during summer season) with manual finishing of the excavated surface
   c) Slush grout and dental concrete
   d) Overbreak concrete
2. Foundation works
   a) Pour of sub-foundation concrete and lean concrete

b) Execution of Phase I and Phase II drilling and grouting works

c) Placement of foundation formworks

d) Placement of steel reinforcement

e) Placement of foundation concrete and curing

3. Elevated works

a) Placement of relevant formworks

b) Placement of steel reinforcement

c) Placement of structural concrete

d) Placement of secondary concrete forms

e) Placement of second phase concrete

4. Over structures

a) Steel bridges

E.1.2 FORECASTED SCHEDULE AND MILESTONES

The construction of Spillway, as foreseen in the design, will take place in two phases:

Phase 1 — Construction activities, rollways excluded, from beginning of the work (in accordance with Interface I1) up to temporary river diversion through the Spillway.

Phase 2 — Rollways construction activities in accordance with the proposed construction sequence (Interfaces and Milestones I2-M12, I4-M14, I3-M13) and based on the management, per steps, of the water flow through the Spillway, also taking into account the different flow rates in the different seasons of the year.

A synthesis of relevant dates for the execution of the spillway is reported in the following table.

Spillway		
Description (main activities)	Start	Finish
Phase I - Slab and Piers		
Civil Works	30 Jan 14	30 Jul 14

Concrete Works	15 Mar 14	25 Nov 14
Other Works	22 Apr 14	29 Jan 15
Phase II - Rollway Bay No. 1		
Concrete Works	6 Oct 16	18 Jan 17
Phase II - Rollway Bay No. 3 & 5		
Concrete Works	2 Jun 17	26 Aug 17
Phase II - Rollway Bay No. 2 & 4		
Concrete Works	8 Nov 17	18 Feb 18
Upstream Bridges		
Concrete Works	8 Sep 14	5 Jan 15
Other Works	29 Oct 14	8 Feb 15
Downstream Bridges		
Concrete Works	30 Sep 14	13 Dec 14
Other Works	21 Oct 14	18 Jan 15
Discharge Channel – Phase 1		
Civil Works	16 May 14	30 May 14
Concrete Works	31 May 14	13 Dec 14
Discharge Channel – Phase 2 and 3 (Optional)		
Civil Works	30 Apr 17	2 Jun 17
Concrete Works	16 May 17	7 Dec 17

The construction schedule of the Spillway has been defined in order to respect the correspondent Interface and Milestones schedule, in compliance with the document “Exhibit 9 – Interface and Milestone Schedule”, reported in the following table:

Milestone Interface No.	Description	Date
I1	Spillway Site Ready for Start of Works	11 Nov 2013
I22	All Spillway Hydro-Mechanical Primary Anchors, Delivered to Site by Company Other Contractor (CH0032)	4 Dec 2013
M4	Spillway and Related Works required for Diversion, including: Northern Two Monoliths of Centre Transition Dam including the Platform for Spillway Electrical Building Complete; Completion of Separation Wall; Completion of North Transition Dam, Spillway Discharge Channel Phase 1; Downstream Temporary and Permanent Spillway Bridges Installed. Ready for start of hydro-mechanical works by Company Other Contractor (CH0032)	15 Feb 2015
I2	Bay No. 1 Available for Start of Rollway Construction	4 Oct 2016
M12	Bay No. 1 Rollway Construction Complete and Ready for start of hydro-mechanical works by Company Other Contractor (CH0032)	13 Mar 2017
I4	Bay No. 3 & 5 Available for Start of Rollway Construction	31 May 2017
M14	Bay No. 3 & 5 Rollway Construction Complete and Ready for start of hydro-mechanical works by Company Other Contractor (CH0032)	19 Sep 2017
I3	Bay No. 2 & 4 Available for Start of Rollway Construction	6 Nov 2017
M13	Bay No. 2 & 4 Rollway Construction Complete and Ready for start of hydro-mechanical works by Company Other Contractor	17 Mar 2018

	(CH0032)	
M16A	Completion of Phase 2 of Spillway Discharge Channel Lining	29 Sep 2018

With respect to the revised Interface and Milestone Schedule proposed by the Engineer, at present the only milestone that force to concrete during the winter period is the M13. If, during the construction the interaction with the other works, would allow to revise it, it would be suitable to relocate it in order to accomplish the related works during the summer period.

E.1.3 MOBILIZATION AND LOCAL SITE ORGANIZATION

The Spillway and the North Transition Dam (NORTH TRANSITION DAM) will be constructed on the right side of Churchill River between the riverside RCC cofferdam and the Center Transition Dam, as shown in the following Figure 44.

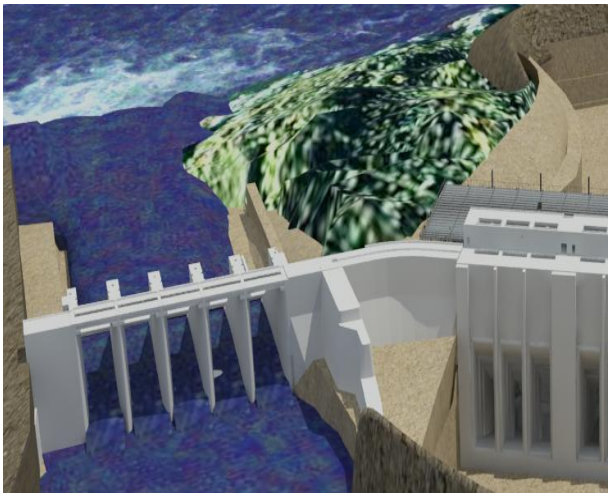


Figure 44: Spillway and NORTH TRANSITION DAM – Location of Works that will be mainly managed from the inlet channel and the discharged channel

E.1.3.1 ACCESS

The Spillway construction area is located in a quite critical position with respect to access possibilities, being enclosed between cofferdams having different crest levels (21 – 26 m). The construction area will need on the downstream side one access ramps on the discharge channel area from the cofferdam No. 2.

The existing cofferdams will be used for accessing the construction area; additional platforms

or local enlargements will be done without changing their structural characteristics. Careful maintenance of the access roads will be continuously ensured especially during winter to take care of the snow and of the slippery conditions which may require regular spraying with sand, recovered and stocked from the cleaning operation of the foundation treatment.

In the downstream area of the walls, since ground level is only a few meters higher than the excavation level, a short temporary ramp will be built directly on the existing sand covering the finished bedrock excavation. The presence of the sand will make the removal of the ramp easier.

These ramps, apart from being the access of the equipments and plants for the drilling and grouting, will enhance the pouring of the concrete of the overbreaks and the sub-foundation, dental concrete or lean concrete. These operations will be directly done from the truck mixer chutes where possible, or by the mean of concrete pump trucks, were track access would not be available (Figure 45).

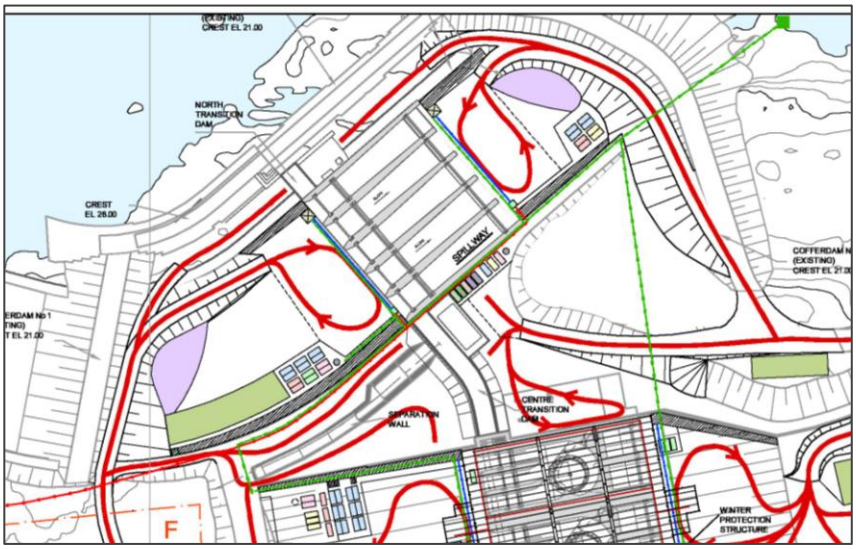


Figure 45: Spillway and NORTH TRANSITION DAM – Area for site installations (Access ramps and Tower cranes)

The Spillway will be managed as an independent construction site, so that all required temporary installations will be placed in the available zone beyond the working area. Such installations include prefabricated structures for temporary offices, a small warehouse to preserve different utensils, sanitary facilities, undressing rooms, insulated water tank and whatever is necessary for the proper execution of the works.

E.1.3.2 LIFTING DEVICES

Astaldi is planning to operate in the Spillway area with mobile lifting devices, accessing and operating both from downstream ad upstream or between the different pears. Two mobile cranes type TEREX RT670 or similar have been foreseen in order to support the whole Spillway construction.

In fact, although the use of tower cranes would be possible from both the external sides of the structure, their operative limitations during winter time, due to both wind and snow storms, driven Astaldi to choose the mobile cranes as more flexible on reliable solution.

The cranes will be of 70 metric tons capacity with an operating radius of at least 50 m. A detailed method statement, including a description of the technical features of the cranes, will be submitted before commencement of the works. The cranes will be mainly used to locate reinforced steel bars on place, at the moment that formworks will be executed with the use of auto lifting HARSCO or EFCO type forms. Cranes will also assist formworks for specific operations like (inclined forms, etc.).

The Cranes will have the capacity to eventually pour concrete with a 1.5 m3 bucket. In case of special operation and requirements, a biggest mobile crane of 200 tons, type GROOVE GMK5200 or similar, will be used.

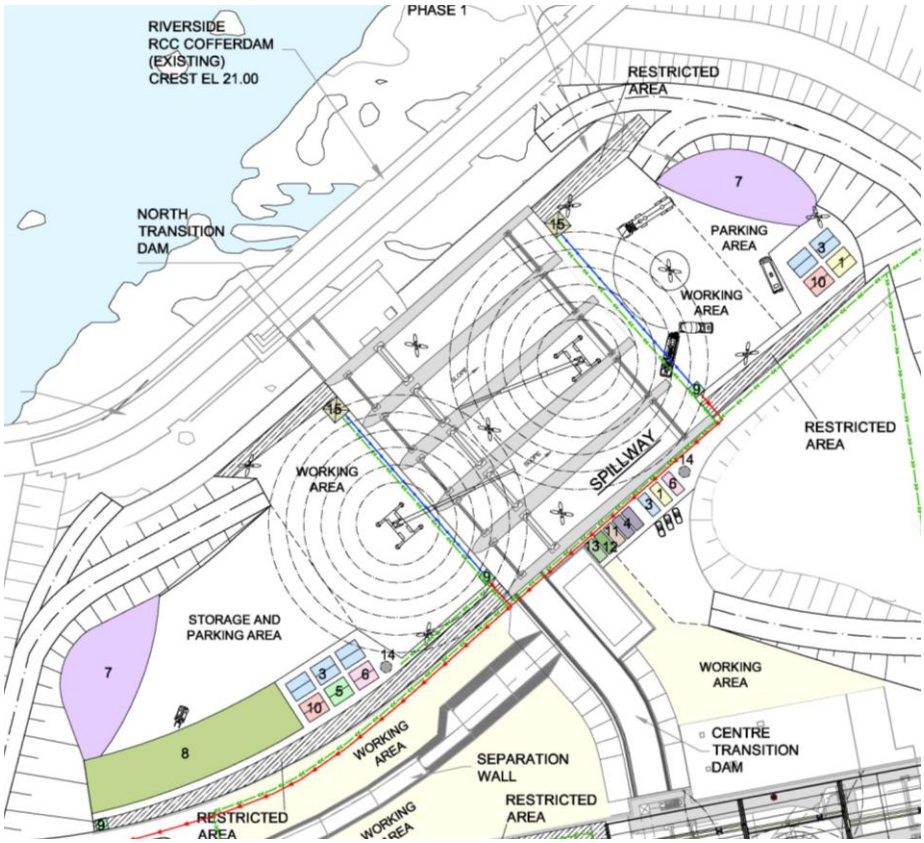


Figure 46: Schematic plan view illustrating the foreseen basic position of the two mobile cranes during the first phase operations. (See **Attachment 22** for a larger scale of this drawing).

During the second phase of works (rollways construction) the cranes will operate from the upstream permanent and temporary bridges. The bridges can bear cranes up to 200 tons as shown in the drawings. The cranes will be used for:

- placing and removing from inside the bays small lifting equipment, small equipment for excavations, demolition of concrete, surface treatment of concrete and joints
- placing inside of steel reinforcement and formwork
- placing and removing pumps for dewatering
- removing of the roll off containers with materials from the cleaning, demolitions, etc.

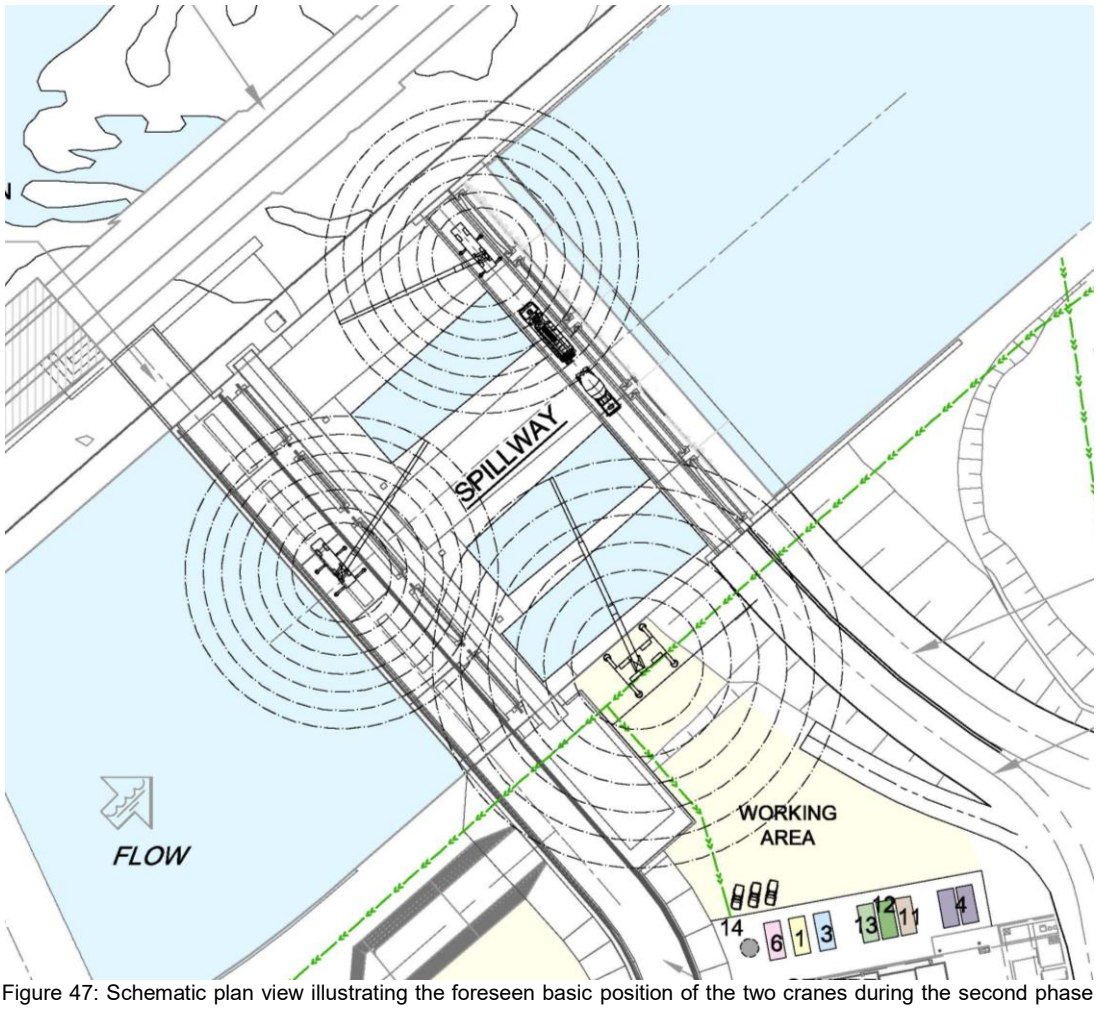


Figure 47: Schematic plan view illustrating the foreseen basic position of the two cranes during the second phase operations

E.1.3.3 EQUIPMENT

Cleaning of the overbreak areas and removal of sand will be performed by mean of excavators and wheel loaders and / or bobcat type equipment. Transports of material to the disposal areas will be done by Dumper Trucks type Mack GU813E 2013 or similar of 20 tons of capacity.

Water and air cannon, as described in the following, will be adopted for cleaning of surfaces and cracks.

For heating of the frozen ground, heating systems such as the E3000 ground heater will be adopted. This is a mobile hydronic heating system which provides consistent heat supply for

thawing and curing applications. The ground heaters will be equipped with diesel generators.

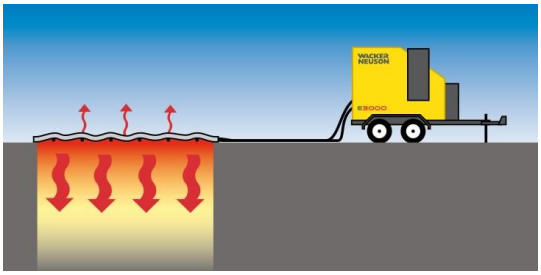


Figure 48: Example ground heater foreseen for thawing operations

Liqua blaster type of equipment is foreseen for joint treatment. Drill rig such with around 400 KN of torque (Atlas Copco D7 or similar) will be used for drilling and grouting operations.

The transportation of all kinds of materials from the stock areas or warehouses to the construction area will be provided by mean of trucks and semi trailers, covered during the winter period, whereas for the transportation of the steel reinforcement the use of lowboy trucks with service cranes is foreseen.

The transport of concrete will be done by mean of “All weather/All terrain” LONDON or MACK concrete truck mixers with 8 m3 of capacity, duly insulated for the winter season. All Truck and equipment will be equipped with the startup winter package.

The placement of the concrete will be executed with concrete pumps trucks type Putzmeister 47Z (or 58Z for the highest sectors) or similar equipment, with foreseen hourly capacity of 150 m3/h with a 46 m reach; in winter conditions, the concrete pumps will be placed under a shelter when operating. Concrete pumps will be characterized by 5’’ pipes and booms comprised between 42 and 58 m in order to reach all the working areas.

The mobile cranes with an approved basket to lift people and materials and a boom of 20 m will be used to lift workers for joint treatment of the piers in the areas in contact with the rollways. Cherry pick equipment on tracks or wheels may also be used.

Access to the working sites will be ensured by different systems as tower stairs, Alimak type mechanized equipment, cherry picks lifting equipment, high reach forklifts, and aluminum protected stairs and ladders. In case of need, connection between some elevation structures may be obtained with light type bridges supplied by specialized companies like Harsco or Doka.

These materials may be jacked in for environmental conditions. These will increase the level of safety for the personnel moving between the different structures by avoiding climbing down and up from one structure to the other. In compliance with H&S procedures,2 types of escape routes will be provided, with tower stairs and Alimak type mechanized lifting equipment. Access to the rollways concrete areas will be done with the same type of equipment described above.

E.1.3.4 FACILITIES AND INFRASTRUCTURES

Facilities and infrastructures to be ensured on site include the followings:

- offices
- changing rooms
- canteen
- sanitary facilities
- decanting and water treatment plant
- electric generation
- industrial water facilities
- compressed air
- Covered areas for parking of concrete pumps, parking of foreseen machinery and all will be required for the execution of the works in the winter conditions.

During the first phase of the works, all the mentioned facilities will be located in the excavated platform upstream and downstream of the spillway works and surrounding areas.

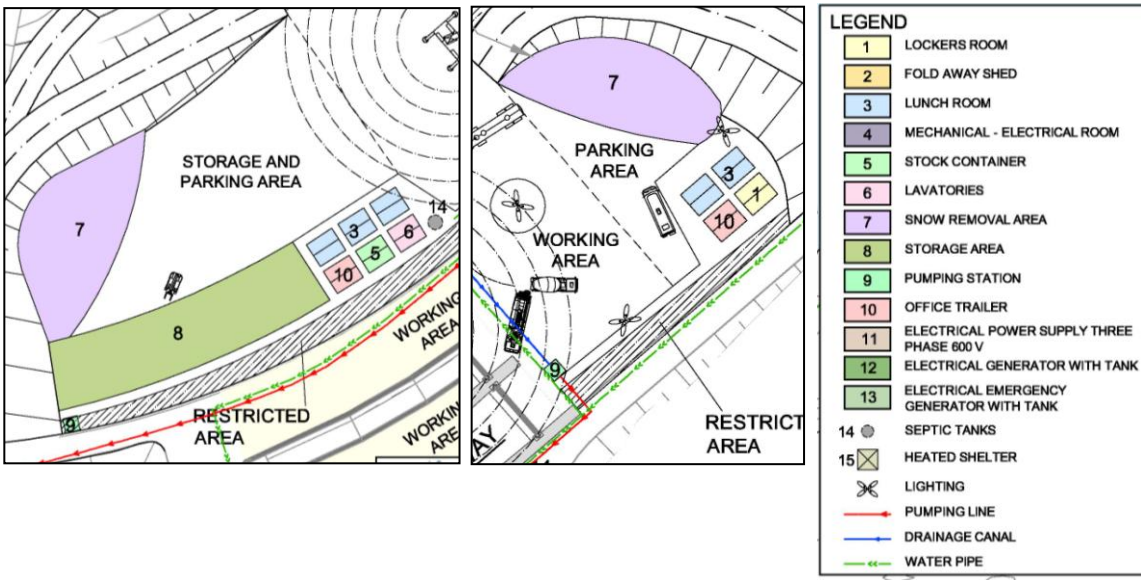


Figure 49: Spillway site organization during the 1st phase of the works

Once the first phase works will be completed, all the infrastructures will be dismantled and temporarily parked on the service areas of the main site and only a portion will be re-transported to the site for preparation of the second phase of the works corresponding to the rollways construction.

The area will be cleaned and properly prepared for back handling to the Engineer with surveying

to allow for the water diversion after the removal of the cofferdams by others.

The plan scheme with the organization of the facilities during the second phase of the works, i.e. after the water has been diverted in the spillway and the rollways construction has been started.

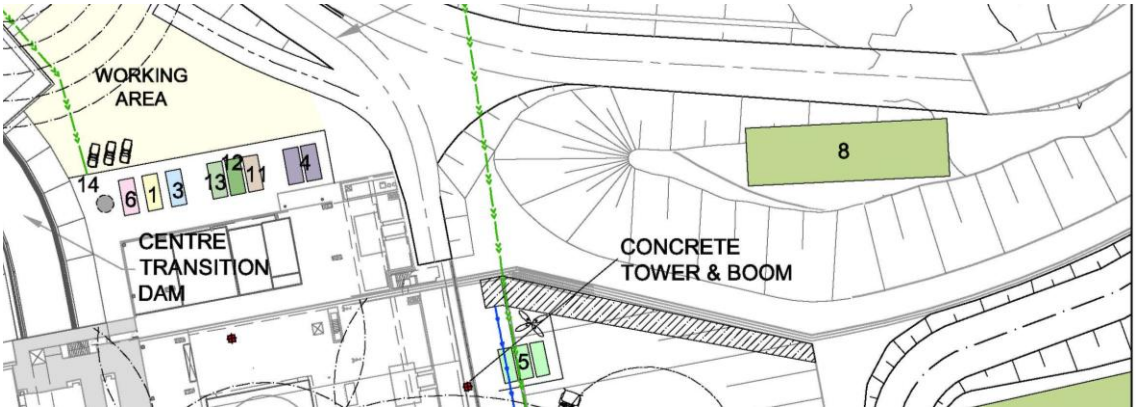


Figure 50: Spillway site organization during the 2nd phase (rollway construction). All infrastructures will be relocated in the southern portion.

E.1.4 WINTER PROTECTION STRATEGY

The spillway will be mainly executed during the summer period. In the first winter period 2013 – 2014, all the foundation treatment will be realized under cover. The detail of these operations under winter protection systems will be explained in the next chapter.

For the works planned during the winter period at the ground level (foundation slabs, rock treatment, etc) 100x100x30 ft heated shelters will be used, such as Dynamic Air Shelters or similar. 450.000 BTU Fuel Heater Booms will guarantee the expected working temperature within the Shelters. Shelters will be deplanced following the detailed construction schedule.

E.1.5 PRELIMINARY CONSTRUCTION ACTIVITIES

Preliminary construction activities for the spillway will be performed will begin immediately after contract assignment.

Preparatory activities comprehend submission of all the detailed method statements, some minor mobilization with setting of some infrastructures such as a few containers for offices, some mobile infrastructures for the early machinery, some machinery to perform preliminary

works etc. With respect to first works to be realized, these include

1. excavation of the sand,
2. cleaning of the rock foundations,
3. dewatering,
4. slush grout,
5. dental concrete,
6. lean concrete and
7. positioning of standard formwork to start pouring the first blocks.

The foundation preparation works shall conform to all requirements of the technical specifications. The type and extent of the foundation treatment to be carried out will be defined after inspection of the foundation by the Engineer.

E.1.5.1 REMOVAL OF THE SAND LAYER FOR WINTER PROTECTION

First operation for cleaning of rock foundations corresponds to the removal of the protective sand layer placed on top of rock by the contractor that has executed the excavation activities.

Equipment for such works includes:

- small wheel loader such as Cat 938 or similar
- excavators type Cat 320 or similar
- dumpers with a capacity of 10/12 m3 will be used for transport of the loaded material to the disposal areas or to be stocked in specific areas to be defined for reuse of the material by the contractor, for e.g. placing on roads or walkways during the winter season.

The removal will be realized in phases with use of larger type equipment for bulk large quantities whereas smaller equipment (e.g. Bob cat type or Cat 306 mini hydraulic excavator) will be adopted by approaching the rock surface and for finishing works.

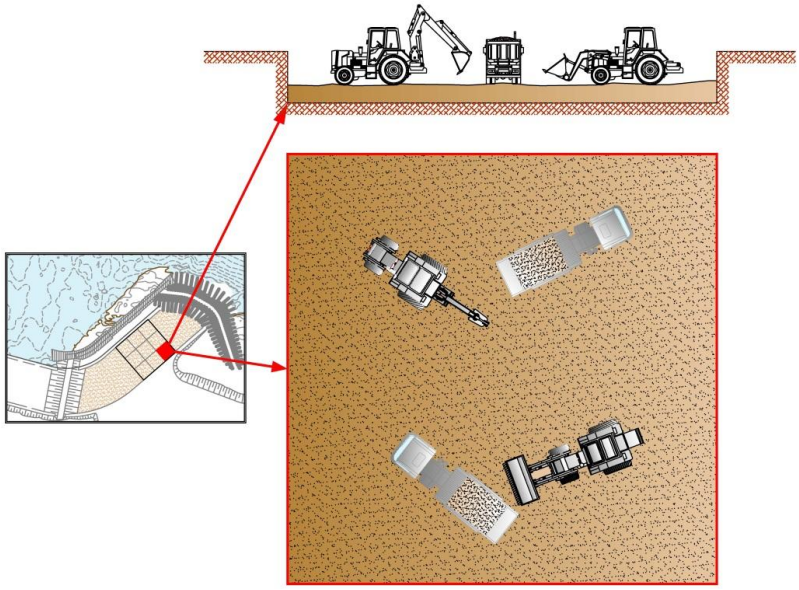


Figure 51: Cleaning of the excavation by excavator and wheel loader to remove most of the protecting sand layer

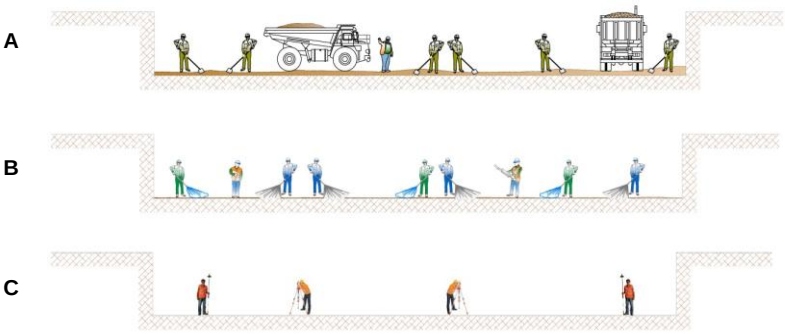


Figure 52: A – Cleaning up and removing of the residual sand by hand with the aid of shovels; B – Removing of the residual material with compressed air or heated water; C – Topographical phase: setting out of the works

E.1.5.2 CLEANING OF ROCK FOUNDATION

Before placing concrete and eventual dry pack, the rock foundation will be cleaned. Cleaning operations will be performed using high pressure cannon with a combination of water and air, or only air in the winter months, or a powerful vacuum cleaner.

For the narrow cracks this operation may be done utilizing a Liqua Blaster type of equipment composed of high pressure water and a spray gun. This type of equipment works at a pressure of up to 1000 Bar at the nozzle and will be fed with a flexible high pressure pipe connected to the main industrial water piping network. A special set of filters will be installed at the exit connection with the main water supply, in case the water would not be perfectly clean and may

contain fine particles that may damage the nozzles.

The operation will be done in such a way that the material proceeding from this operation which will include gravel and debris will be concentrated in one area where the workers team dedicated to the cleaning operation may load it using a Bob Cat type or loader or Cat loaders or excavators or similar.

The team for cleaning operations will be composed of 3 to 5 workers, according to the quantity of material to be removed. An example of the vacuum pump trucks foreseen for loading of water, slurries, sand and debris is illustrated in the following Figure 53.

Figure 53: Example of vacuum pump truck proposed for cleaning operations at the spillway

The final pools of water of relatively small quantity will be dried up mechanically with a sucker or by sponging. In case it will be necessary, the water resulting from this process shall be treated to respect the environment, in the special plant installed in the batching plant area.

Some light cleaning operations for the rock may be necessary will be done later on in the areas where grouting operations will be carried out as well as on the surfaces of the sub-foundations or lean concrete before the placement of the steel reinforcement. Cleaning of rock foundation will be performed in compliance with Technical Specification 311600 part 3.1.5.

E.1.5.3 DEWATERING

The water in excess derived from cleaning operations will be transported, by gravity or by pumping, into a settlement pit to separate the solids from the clean water eventually pumped away once it has been determined that the water is characterized by minimum solid content

and quality requirements indicated in technical specifications.

Small quantities of water remained on the rock surface will be removed by sponges or Venturi type sucker pipes until the area is dry. The same procedure will be adopted after drilling and grouting operations will be completed as well as dental concrete and lean concrete activities.

E.1.5.4 SLUSH GROUT AND DENTAL CONCRETE

Once the rock will be cleaned and scaled, any micro cracks and larger cracks need to be treated by mean of slush grout and dental concreting.

The slush grout is a liquid water cement mix that can be thrown using guns on the area to be treated where micro crack are visible. The slush mix will be worked up and down with a broom in a way that it can penetrate as deep as possible in the cracks.

Larger cracks where a concrete mix may penetrate and be workable will be filled with a high slump mix and properly vibrated in the fissures to fill them up completely.

During the winter these operations have to be made under a covered structure, as already mentioned in the present chapter.

The mixes of slush grout and dental concrete will be in compliance with technical specifications and all will be done with the instructions of the Engineer.

E.1.5.5 OVERBREAK CONCRETE

The reconstruction of the overbreak areas will start from the area to be grouted. Some of the areas may have to be formed: 20% of the volumes will be formed and the others just will be filled after their cleaning operation has been made and the areas accepted by the Engineer.

The concrete will be delivered directly to the cavities via the truck mixer chutes, without any particular workmanship except compaction which will be done if requested by the Engineer depending on the position and size of the overbreak areas.

When the concrete pours have reached the top, it will be leveled with a leveling device, and compacted if requested by the Engineer. Some concrete, depending on the quantity, may be poured using concrete pumps.

Overbreak concrete will be of the same Class as the structural concrete with which it is in

contact, unless noted otherwise by the Engineer (Figure 54).

Figure 54: Overbreak concrete operations

E.1.6 FOUNDATION PREPARATIONS

Prior of structural concrete placement and after preliminary works, the lean concrete and the drilling and grouting activities will be performed.

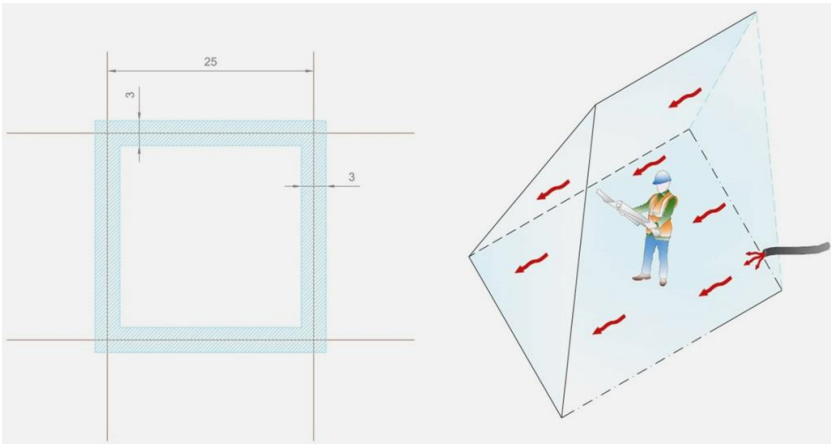


Figure 55: Installation of a tent to protect the workers from the severe weather conditions and introduction of warm air in order that the workers may continue the work inside in a heated condition

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E.1.6.1 LEAN CONCRETE

According to the practice, lean concrete is widely used worldwide to place a layer of concrete which may incorporate the over break areas in order to form a nice and clean surface on top of which the steel reinforcement may be placed in a more appropriate way. The lean concrete will also be useful when cleaning of the different surfaces will be carried out and the dirt accumulated in a suitable area to be eventually removed.

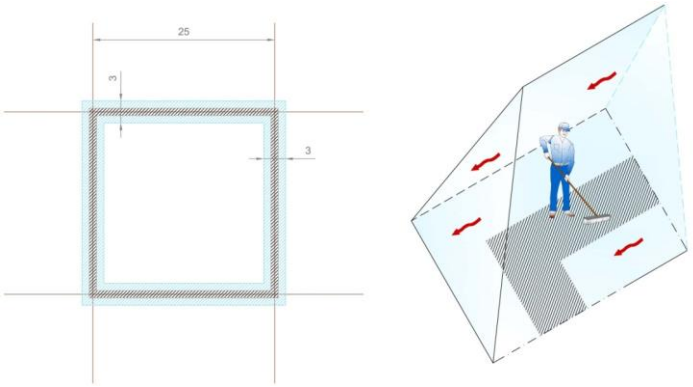

Figure 56: Cleaning by hand of the area where the lean concrete, 60 cm wide, will be executed including foundation treatment (Slush Grout) and dental concrete

The concrete will be produced in the batching plant and transported to the site of placement by mean of 8 cubic meter truck mixers and directly placed using the truck mixer chute. Lean concrete will be of Class D, unless noted otherwise by the Engineer.

Figure 57: Phases of placing of lean concrete by mean of truck mixer (left) and spreading and leveling by mean of a leveling screed (right)

The concrete will be placed directly from the truck mixers or using concrete pumps. The finished level to be obtained will be marked with steel pegs drilled into the rock every 2 m and

reference square tubing placed at the finished level to be removed as the concrete has been completed or using strips of concrete some 30 cm wide formed and leveled at the exact finished elevation of the lean concrete platform, which will be used as guides for the leveling devices for the remaining part of the surface, or eventually controlled using a rotating laser to allow the workers to place the concrete at the correct level.

The team will be composed of 1 foreman, 1 flagman,1 pump operator, 4 workers at the actual pour and 1 worker at the chute. The sequence of operations described above is illustrated in the Figure 57.

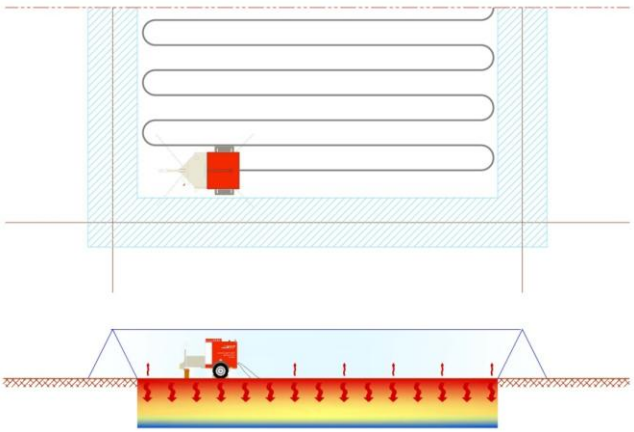

Figure 58: Placement of the equipment to defrost the surface

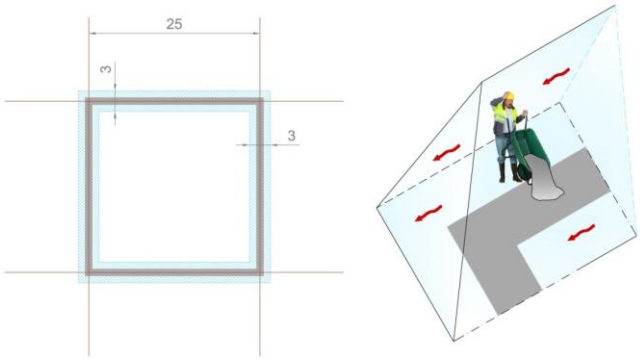

Figure 59: Final cleaning and execution of the lean concrete which has to be kept warm for its curing. Further stages of construction activity are illustrated in the following pages.

E.1.6.2 DRILLING AND GROUTING

The drilling and grouting activities will conform to all requirements of the technical specification. Drilling and grouting operations shall be performed once lean concreting has been completed, in order to operate from a consolidated concrete base; this approach also enhances the

cleaning of the operating surface and avoids drilling dust and injection slurries and grout to be mixed with rock surface, which would lead to significant difficulties in final cleaning operations.

Grouting activities are foreseen basically in the upstream area of the Spillway as well as in some areas which may require contact grouting as reported in the drawings.

Holes for grouting are of 65 mm and approximately 25 m long for a foreseen total length of drilling of 650 m and will be executed by mean of hydraulic rig such as Atlas D7 or Casagrande C6 or similar equipment, which may ensure a penetration rate up to 25 m/hr. The foreseen quantity of cement for grouting corresponds to 23,000 kg.

Water pressure tests will be used for final control of rock permeability. One rotary percussion drilled check hole of 25 m and one cored borehole of 25 m will be performed for final verifications of the results.

Due to the relatively small quantity of work to be carried out, it can be organized within the program of works in a way that will not affect the program itself.

When the injection works have been completed and all the equipment eventually removed, the contractor will proceed with the cleaning of the rock and of the injected surfaces, and to the pour of the sub foundation of the area previously utilized for the transit of the equipment.

E.1.7 WORKS SEQUENCE

The sequence for construction works, after preliminary activities and foundation preparation, is as below:

1. Concrete slab construction
2. walls and piers construction
3. bridges construction
4. discharge channel construction (Phase 1)
5. rollways construction
6. discharge channel construction (Phase 2/3 – Optional)

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E.1.7.1 SPILLWAY CONCRETE SLAB CONSTRUCTION

The Spillway foundation has been divided into three longitudinal sectors with Contraction Joints and in three transverse sectors with Construction Joints for a total of 9 concrete slabs with variable volumes. They are in general 22 x 24 m with the biggest corresponding to 29 x 24 m. The structure has overall dimensions of length = 67.7 m, width = 74.5 m and variable height = 3.0 to 2.1 m. The proposed sequence of operations allows minimizing the interferences and operational stops for curing of the different blocks.

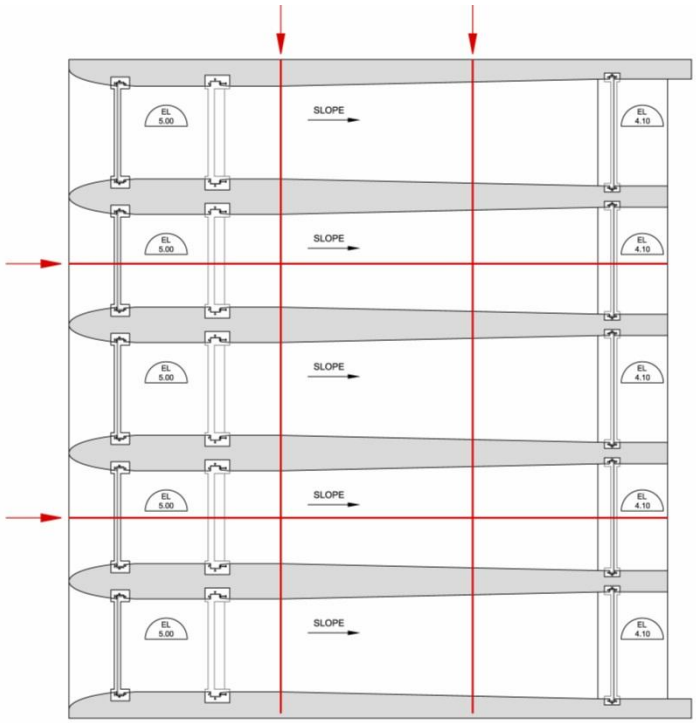

Figure 60: Spillway – Plan of base slab longitudinal sectors with Contraction and construction (vertical lines) Joints

The work will be done in a continuous cycle following a chess sequence, as to the curing time. In the programme of works the time required has been considered for each block; this matches the milestone dates.

Formwork, concrete pouring and other activity will be carried out simultaneously with respect to the placement of steel reinforcement by working on separate foundation blocks.

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E.1.7.2 EXECUTION PHASES OF SPILLWAY CONCRETE SLAB DURING WINTER CONDITIONS

For concreting operations in the spillway during the summer season, metal or wooden forms, as well as forms making use of marine plywood, can be adopted. In case marine plywood type forms are used, the plywood has to be replaced every3 uses. Forms can be such as Peri, or Harsco type, with 20 mm plywood skin: they will be assembled in the joinery before transportation on site; this allows assembling large panels with the proper height required for the lifts. For concreting operations during winter season, a particular procedure needs to be adopted, as described in the present paragraph.

The following figures show the process for execution of a typical concrete block of foundation slab in winter conditions. Some phases cannot be done under cover but the bulk of the concrete will be executed in a confined heated area.

Adopted forms shall be 2 m higher than the foundation block, to install on top the closed structure for working during winter conditions. The forms will have several working platforms, at the top, in the middle and at the base, that will be also used for finishing and repair works. Working platforms will be properly protected to avoid falling of material and to ensure an adequate degree of safety for personnel working on the platforms.

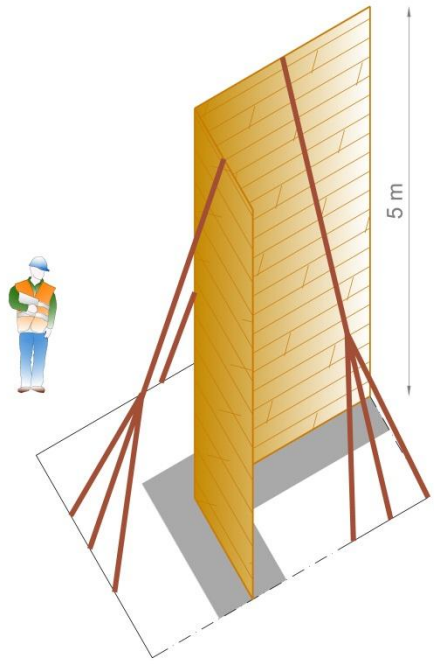

Figure 61: Removal of tent and installation of the special preformed externally insulated formworks, 5 m high, capable of supporting beams for a roof

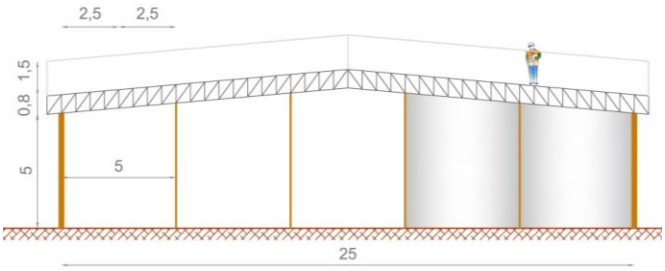

Figure 62: Positioning of beams, main and secondary ones, with props every 5 m to support them

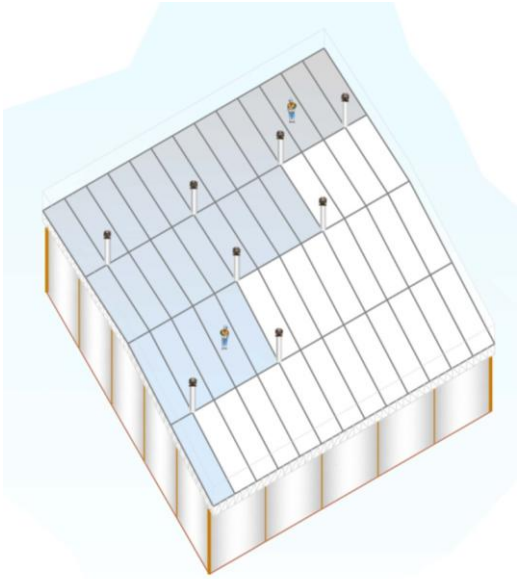

Figure 63: Placement of the cover panels, installation of pipes (12”) to send in heated air as well as equipment to move the air in the corners and installation of extractor chimneys of the contaminated air

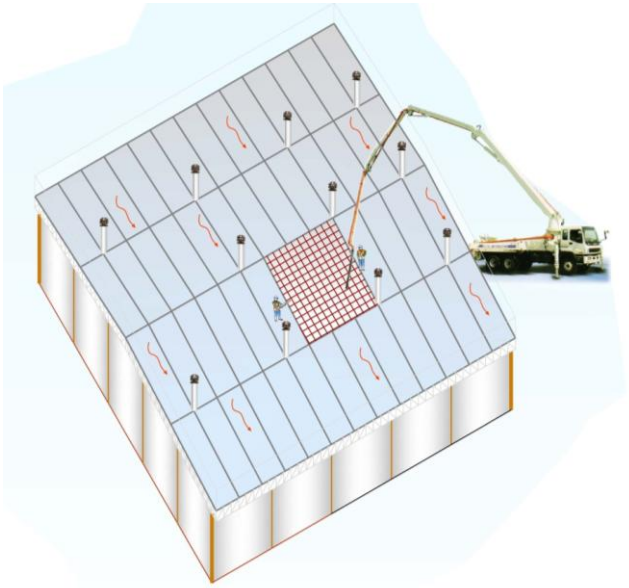

Figure 64: Execution of the lean concrete by pump via the roof openings.

E.1.7.3 SPILLWAY WALLS AND PIERS CONSTRUCTION

Walls and piers have been designed in three cross sectors with Construction Joints, as described in the following (see also the following Figure 65):

- Sector A, the upstream part up where walls and piers start to lean (N. 14 lifts), including the upstream stop logs and gates;
- Sector B, the central part leaning progressively up to back-up (N. 10 tapering lifts);
- Sector C, the back-up part supporting the downstream bridges (N. 7 lifts) and including the slot guides of the upstream stop logs.

As soon as the foundation blocks have been completed in the first portion of sectors, the works for the structures in elevation will proceed with the following activities:

1. joint treatment
2. main forming operations
3. forming of the electromechanical slots
4. placement of the embedded parts

5. placement of the steel reinforcement.

In the pours of the side walls, holes will be left out for execution of contact grout operations.

The works will be done with 14 to 7 lifts of variable height ranging between 1.10 m at the top to the 3 m of standard lifts.

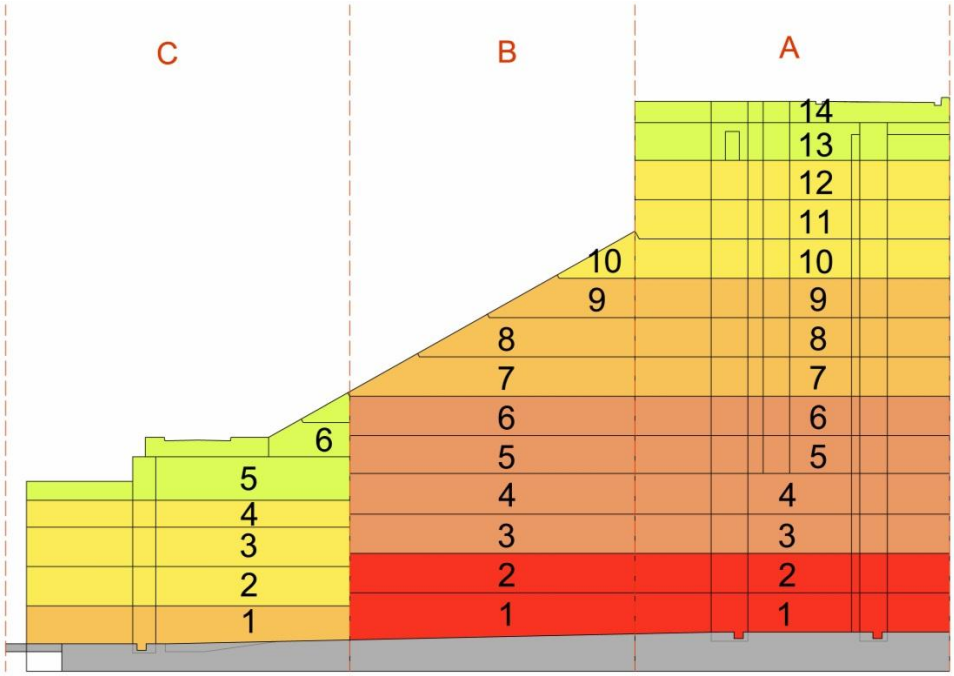

Figure 65: Spillway – Concrete section of piers and detail of the foreseen lifts

The portion of piers for Sector A and B will be formed simultaneously with the introduction of a separation form to create the intermediate construction joint; whilst the pouring of the two sectors will be done separately. When at the top of the Sector B, this form will be moved to the Sector C while the Sector A will continue to the top.

The sequence for walls and piers construction is as below:

- Placement of formwork which skin has been treated with a stripping agent (equipment used: mobile crane and eventually tower crane in the summer)
- Assembling and placement of reinforcement (equipment used: mobile crane and eventually tower crane in the summer)
- Placement of the slot forms, treated with a stripping agent (equipment used: mobile crane and eventually tower crane in the summer)
- Survey checks according to the Inspection Test List and approval for the pour

- Placement of concrete (equipment used: self propelled or fixed concrete pumps, truck mixers)
- Vibrating of pour with 2'' vibrators next to the forms and with 4'' vibrators for the rest of the mass concrete
- Curing of concrete before form stripping. After the curing phase, the forms for the second phase concrete works will be removed and the necessary finishing and repair works will be performed on the previous lift using the forms working platforms;
- Concrete consolidation
- Stripping or lifting and cleaning of forms (equipment used: mobile crane and eventually tower crane in the summer)
- Preparation of horizontal surfaces or second phase concrete area with brushing and blowing, bush hammerings, eventual high pressure water jetting and using vacuum type equipment;
- Curing and eventual finishing, placing eventual blankets if necessary
- Extension upwards of stairs and eventual Alimak type mechanical lift.

Use of scaffolding as well as motorized lifts of 400 kg capacity, also used for lifting of construction material to the working elevation, is foreseen for access to the working areas (see examples in the following Figure 66); all the equipment and procedures will be set in compliance with safety rules and laws. These structures will be connected to the walls via the anchor bolts used to fix the forms and incorporated to the concrete pour.

Figure 66: Example of service scaffolding and motorized lifts for works at elevation

The design of all these structures will be performed and verified by supplying companies and submitted for approval to the Engineer, in accordance with the health and safety manual. The

surfaces that will receive a second phase concrete will all be treated in accordance with the specifications to receive the next second phase concrete done by others.

The construction sequence for the piers of the spillway is illustrated in the following Figure 67.

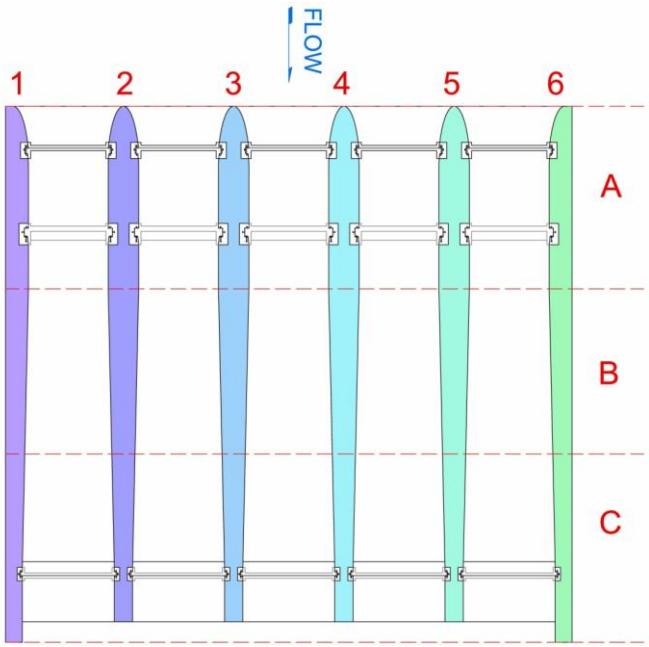

Figure 67: Foreseen construction sequence for the piers from 1 to 6 and position of the construction joints

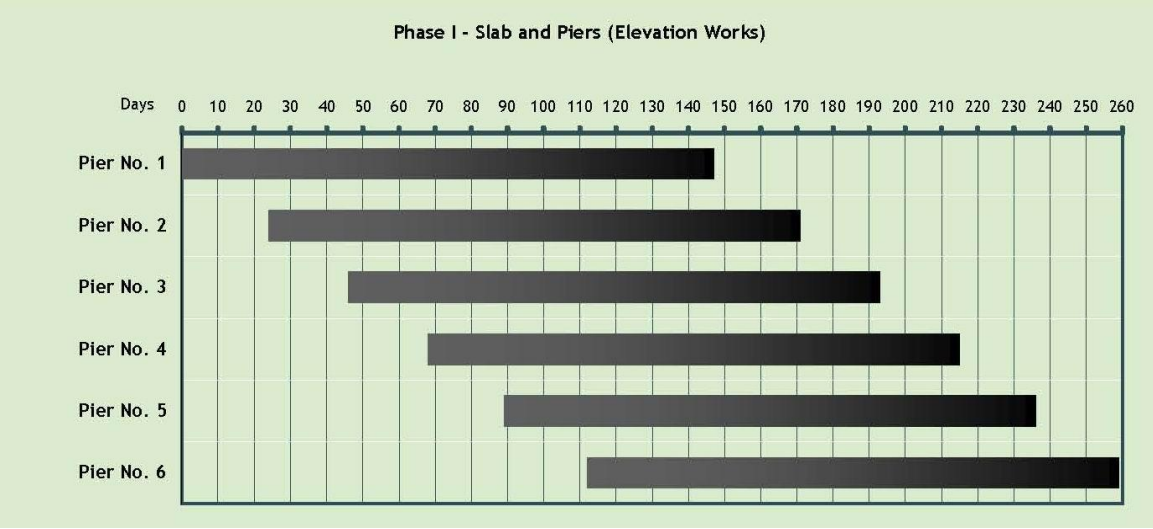

Figure 68: Foreseen construction sequence for the piers from 1 to 6 and position of the construction joints

With respect to the construction cycles, it can be considered that each pier will have 31 pouring steps for a total of 186 pours. With reference to Figure 68, the duration of the construction works for piers in sections A – C will correspond to 126 day. An interval of 22 days will be ensured between the different piers (from1 to6), therefore the total duration of pier construction will correspond to 226 days.

As to the working teams for piers and walls construction, the following organization is foreseen:

1. The formwork team will be composed of 1 foreman, 6 carpenters and 2 laborers
2. The concrete pour team is formed by 1 foreman, 1 carpenter, 1 pump operator, 6 laborers and 1 cement finisher
3. The steel reinforcement team is composed of 1 foreman, 8 iron assemblers, 1 laborer

Formworks for construction of piers and walls will be Harsco type self climbing or similar. An example of proposed formworks is presented in the following Figure 69.

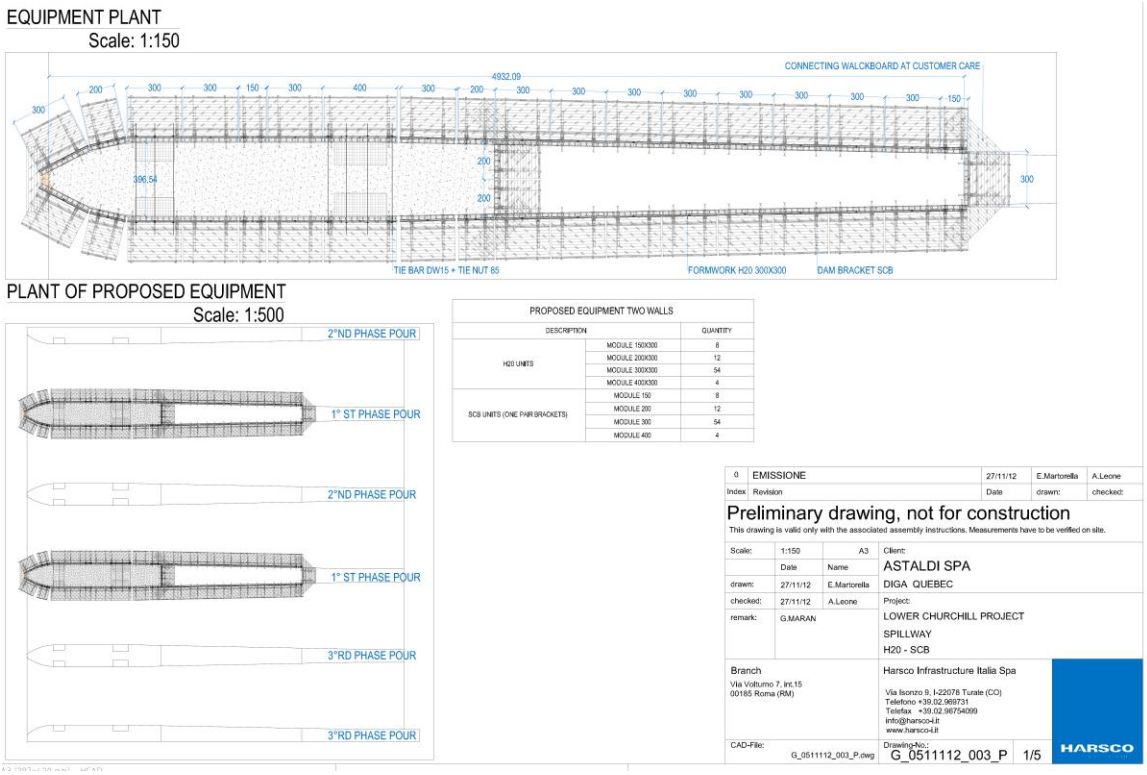

Figure 69: Example of self climbing formwork by Harsco or similar, proposed for concreting of piers and walls

For all the operations requiring the use of cranes, a crane coordinator shall be present for each shift, as foreseen in the H&S manual and procedures. The foremen working in the formworks, steel reinforcement and concrete teams will coordinate and supervise the following specific items:

- Verify that the toolbox as specified in the health and safety manual and in the safety laws of the country is properly done at the beginning of the shift for each team and that everyone uses the prescribed personal safety materials;
- Coordinate the movement and positioning of the cranes;
- Oversee the cleaning of the forms,
- Placing of the stripping agents,
- Placing of the water stops,
- Placing the slot forms,
- Placing the embedded parts of the electro mechanical contracts,
- Execute the joint treatment and pressure cleaning of all the surfaces, of the Joints and of the slot area joints for stop logs, gates etc.
- Execute the placement of the concrete and its compaction particularly in the important areas as said earlier,
- Execute the finishing of the concrete and its repairs,
- Placing and installing of all the stairs and protective equipment.
- Verify the matching between the construction drawings and the drawings of the steel reinforcement,
- Coordinate with the team in charge of the quality assurance and inspection team for all the clearances to be given for proceeding or intervening personally when there are discrepancies which have to be corrected.

E.1.7.4 SPILLWAY BRIDGES CONSTRUCTION

The Spillway bridges are three:

1. a Temporary Downstream Bridge
2. a Permanent Upstream one and
3. a Permanent Downstream bridge.

The downstream temporary bridge will be used as a haul road for carrying out the works for the main dam, cofferdams, RCC, etc.

The downstream permanent bridge will be used as a working platform when the rollways will have to be built together with upstream one (until the date the electromechanical works will begin). This bridge will be used as base for positioning of cranes, pumps, transporting material trucks etc. for execution of the rollways.

The temporary bridge will be dismantled at the end to allow the Spillway being operative with high waters.

The bridges are a composite structure made of steel beams and a slab of concrete poured on site. In order to avoid the use of conventional forms and stripping from below, the use of a lower formwork as a pre-slab, made with Pittini type steel reinforcement, and a thickness of 5/6 cm concrete slab, can be proposed (see following Figure 70). The whole of the decks are placed on top of the completed piers of the Spillway.

Figure 70: Example of pre-slab made with Pittini type steel reinforcement, to be used for the spillway bridges

The downstream bridges are located in the sector C of the Spillway at elevation of 18.38 m and of 15.06 m for permanent and temporary one respectively. The sequence of activities for the downstream permanent bridges is described below.

Downstream permanent bridge

The downstream bridge is composed of five bays.

For each bay the sequence implies:

- installation of bearing pads;
- installation of steel structures;
- formworks with foreseen use of preslab;
- reinforcement steel;
- concreting;
- curing.

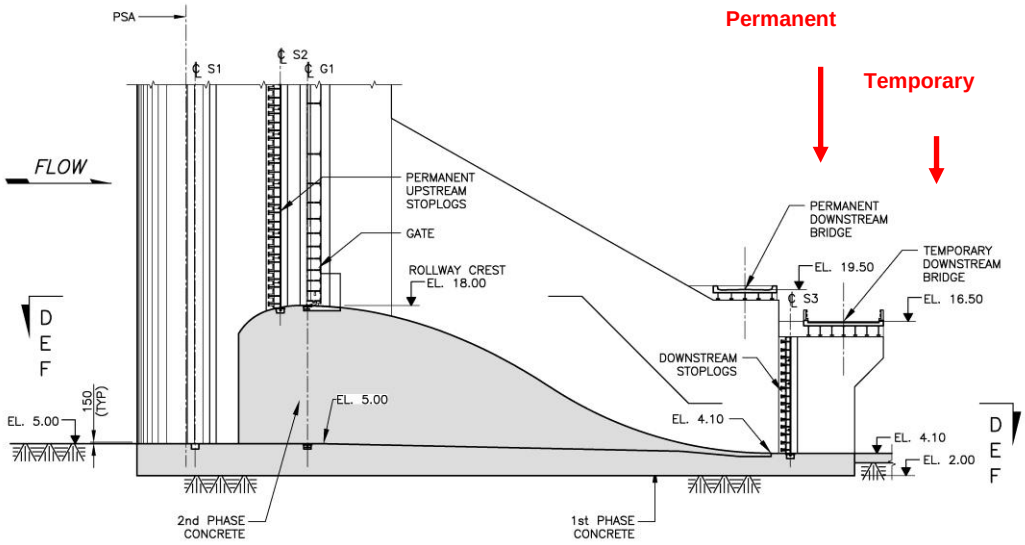

Figure 71: Position of downstream spillway bridges

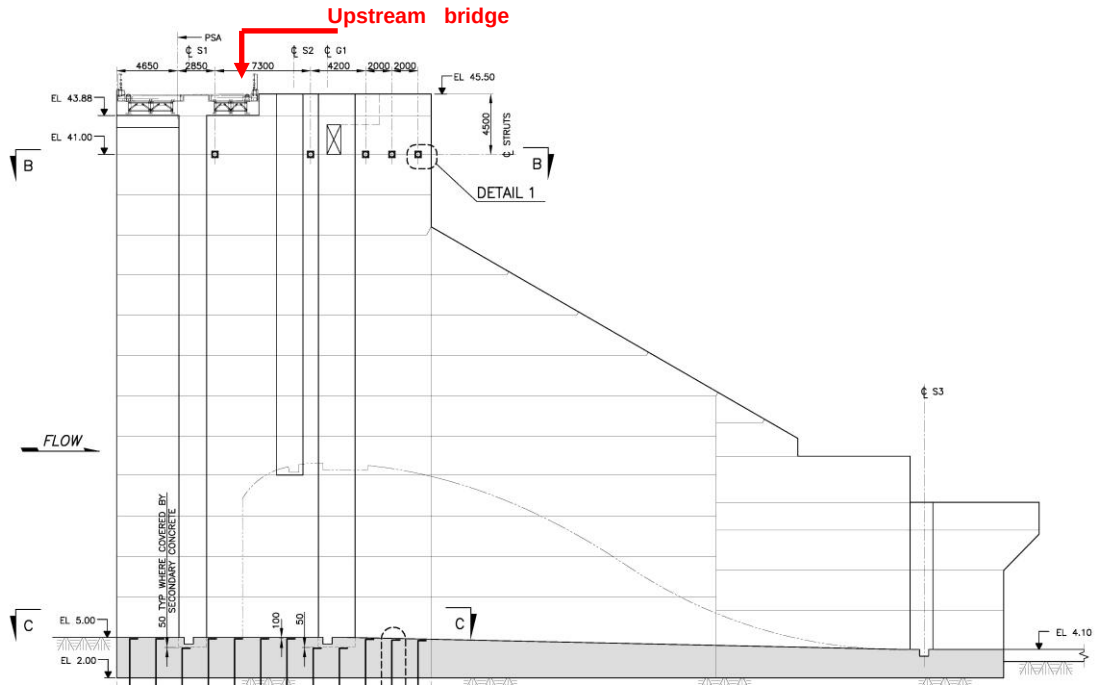

Figure 72: Position of upstream spillway bridge

The Permanent Upstream Bridge is located in the sector A of the Spillway at elevation of 43.88 m. The sequence of activities for the upstream permanent bridges is described in the following.

Upstream bridge

The upstream bridge is composed of two sections and five bays.

For each bay the sequence implies:

- installation of bearing pads;
- installation of steel structures;
- formworks (the use of pre-slab is highly recommended as stated above and as illustrated in previous Figure 70);
- installation of reinforcement steel;
- concreting;
- rails installation;
- grouting;
- Installation of guard rail.

E.1.7.5 SPILLWAY DISCHARGE CHANNEL CONSTRUCTION

The discharge channel concrete lining (Phase 1) will be made during the first phase of Spillway construction, between May and October 2014. The first phase will be realized without water running in the channel.

Phases 2 and 3 of the discharge channel are optional and will be eventually performed after removal of the cofferdam: once the cofferdam will be removed by Others and the area will be accessible and visible, decision will be taken about operation to be done.

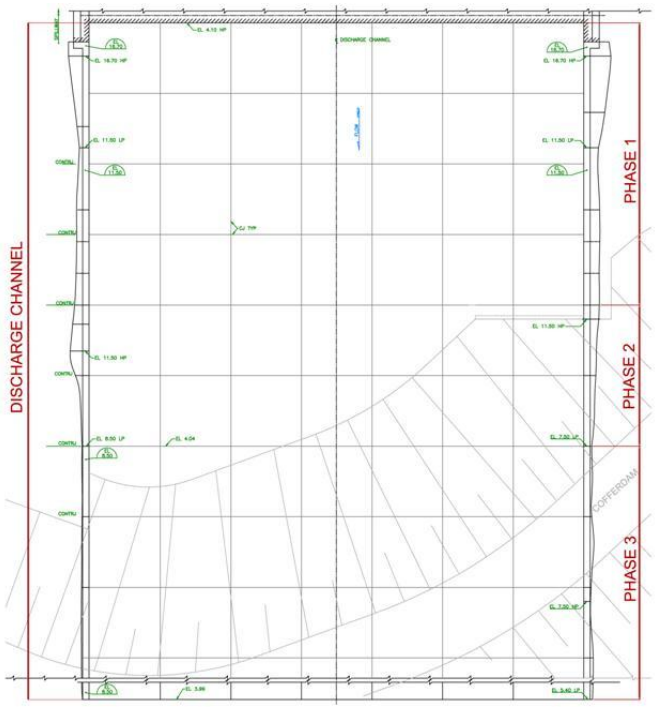

Figure 73: Construction of the discharge channel slab (phases 1 to 3)

The general dimensions of the structure downstream of the spillway discharge for the first phase are: length = 40 m; width = 71.9 m; variable height of about 0.6 m.

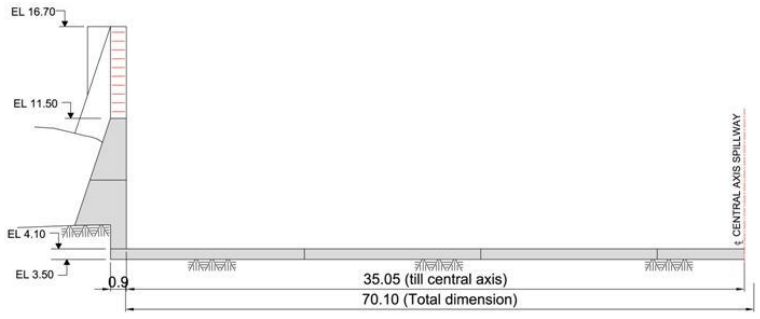

Figure 74: Layout of discharge channel

The concrete slab has been designed in seven longitudinal sectors and in four cross sectors with Construction Joints for a total of 28 concrete slabs.

The main slab has a thickness of 50 cm; the two side walls have a trapezium shape with an irregular height of approximately 7 m and are characterized by the following widths:

- At the bottom at slab level: 0.90 metres
- At the main base: 2.50 meters
- At the top: 0.90 metres

The sequence of the works is as follows (for a detailed description of the single works please refers to the description of the methods presented above for the spillway structure):

1. Preliminary works
    - During the first phase, dewatering of infiltrating water or rain water shall be carried out to keep the area dry. The water will be pumped into a decanting pit for subsequent discharge into the river;
    - Cleaning and scaling operations have to be done on the rock surface. A joint survey will also be performed together with the engineer;
    - Based on the instructions of the engineer, overbreak activity can be performed in bottom of the channel as well as on the two sides where the walls are located;
2. Foundations works
    - Lean and overbreak concreting, according to the design requirements
    - Drilling of anchor holes and placing of anchors following a chess sequence. The team for boring and installation of anchors is composed of:
        - 1 foreman
        - 1 drilling operator
        - 2 laborers
        - 1 injection specialist
        - 2 laborers at the mixing plant
        - 2 specialists for grouting of the anchors
        - Concrete slab construction, based on the following steps:

- Forms and concrete slabs
- Finishing
- curing

3. Elevations works

- Execution of side concrete walls. The walls will be realized after completion of the slabs according to the following steps:
  - Formwork
  - Steel reinforcement
  - Concreting
  - Form stripping
  - curing

The phases 2 and 3 are optional works and their execution will be defined after removal of the cofferdam.

The structure of phase 2 has overall dimensions of length = 20 m and width = 71.9 m and the concrete slab has been designed in seven longitudinal sectors and in two cross sectors with Construction Joints for a total of 14 concrete slabs.

The structure of phase 3 has overall dimensions of length = 50 m and width = 71.9 m and the concrete slab has been designed in seven longitudinal sectors and in five cross sectors with Construction Joints for a total of 35 concrete slabs.

Depending on the water levels in the downstream area of the river, some diversion works will have to be done to isolate the working area; the work sequence will be the same described for the phase 1.

E.1.7.6 WORKING PHASE 2 - ROLLWAYS CONSTRUCTION

Temporary site installations in the spillway area will be removed and relocated elsewhere prior to the beginning of the second phase or delivered to the main infrastructure facilities of the project or removed from the site if considered that they will not be required any more.

It can be expected that dewatering shall be provided during further works and the pumping system as well as a decanting system will be maintained on site. The dewatering piping system

and the delivery point are shown in the following Figure.

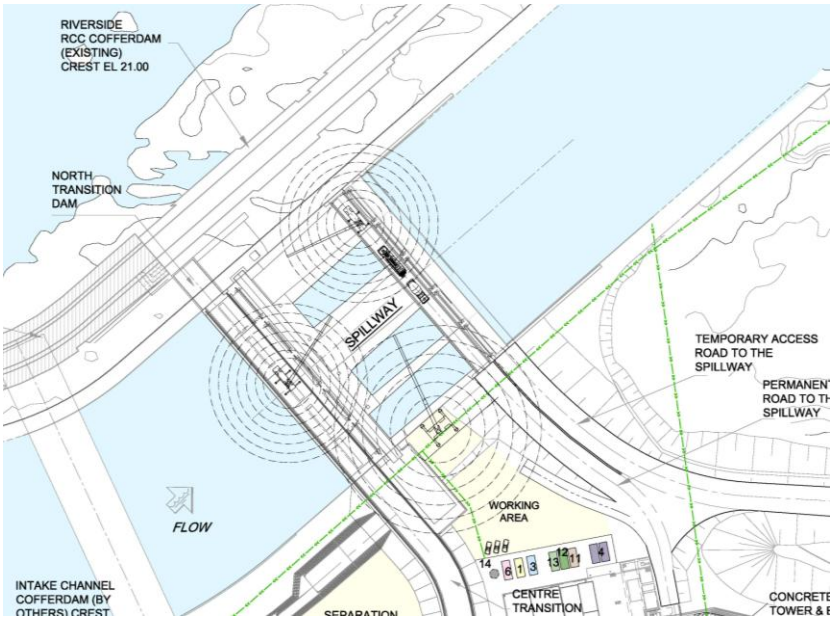

Figure 75: Site installations during phase 2 of the works for rollways construction

As already mentioned, the second phase of the spillway construction corresponds to the execution of the rollways, in compliance with document “Exhibit 9 – Interface and Milestone Schedule”.

Hands over dates are related to the completion of the bays of the spillway and according to the construction sequence of the piers and walls as indicated below:

- Bay1 will be available for beginning of rollway construction on 4th October 2016;
- Bays 3 and 5 will be available for beginning of rollway construction on 31st May 2017;
- Bays 2 and 4 will be available for beginning of rollway construction on 6th November 2017.

Rollways construction will take place in four different stages, as illustrated in the following Figure 76:

- Phase 0 – River flows through the five Spillway bays
- Phase 1 – Construction of first rollway (Bay 1)
- Phase 2 – Construction of second and third rollways (Bays 3 and 5)

- Phase 3 – Construction of fourth and fifth rollways (Bays 2 and 4)

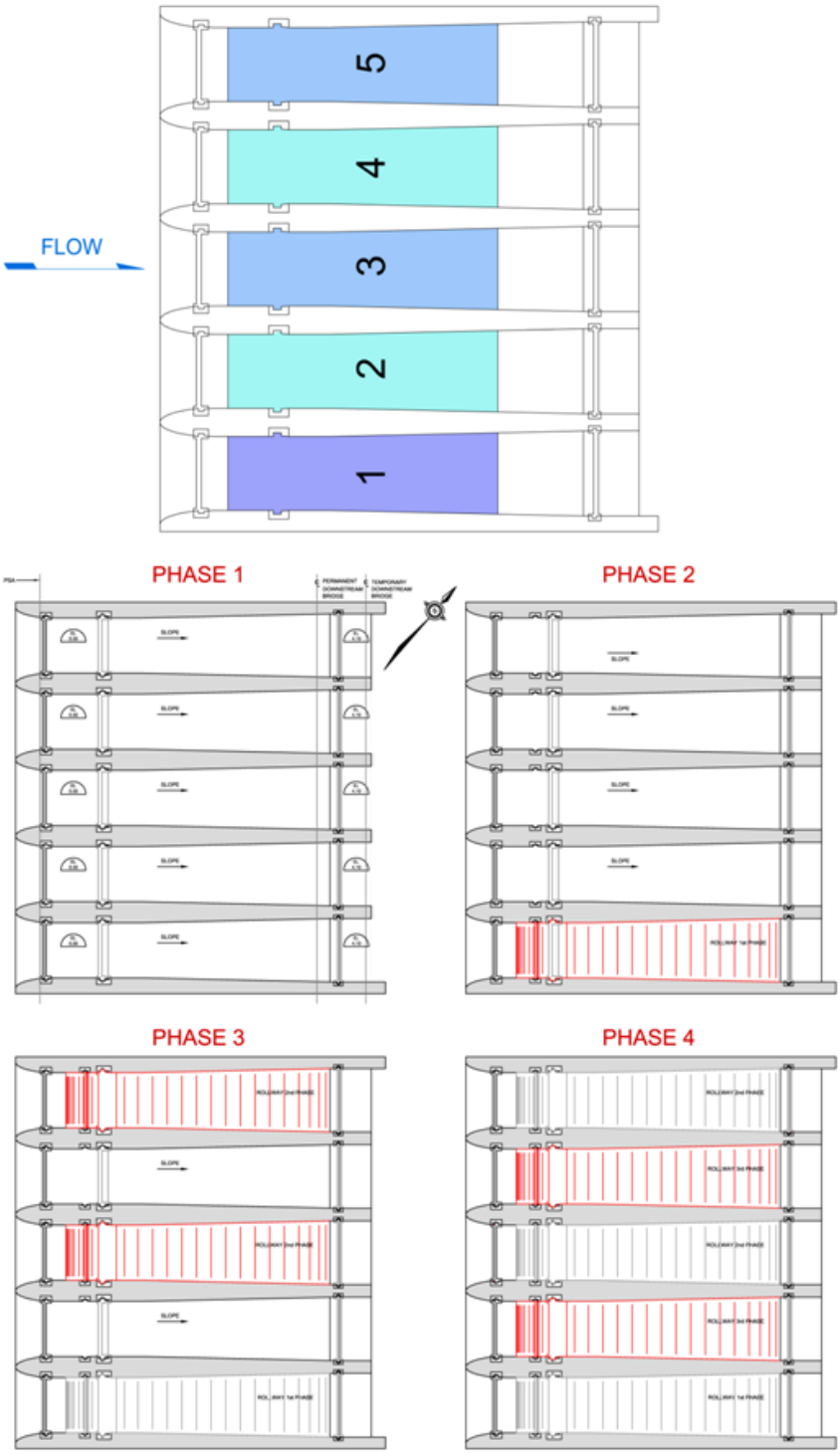

Figure 76: Spillway – Position of the rollways and construction sequence – phase 0, phase 1, phase 2, phase 3

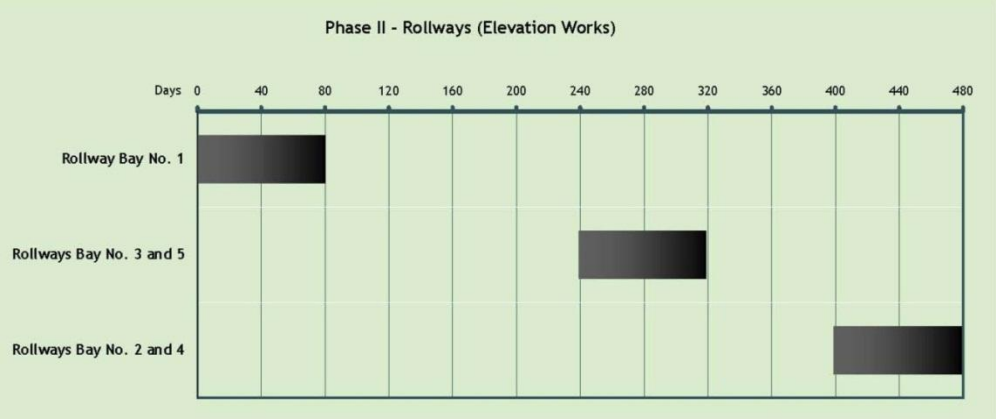

Figure 77: Sequence of works for rollway construction according to the program of works

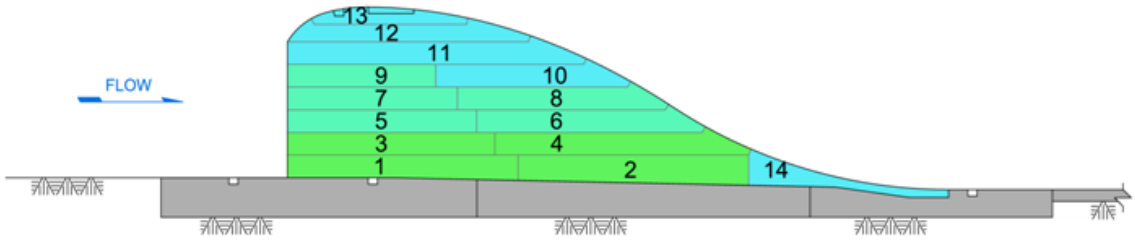

Figure 78: Sequence of works for rollway construction according to the program of works

Before the commencement of the works some preliminary activities shall be performed, including:

- Dewatering the enclosed areas by pumping of all the water by the stop-logs to decanting pits or treatment plants according to the quality of the water and in compliance with indications of the environmental team;
- Cleaning of all the area by eliminating the river debris accumulated over one year of flow. Removal of all the material will be performed using Bobcat type or similar small loader and small excavators. The material will be loaded into containers such as e.g. roll-off containers which will be then lifted by the mobile crane operating on the bridge and placed onto roll-off trucks and transported away (see following Figure 79 for examples);
- Performing a topographic survey as well as detailed visual inspection and photographic reports.

Figure 79: Example of roll off container and truck for transport of material away from the bays of the spillway during cleaning operations

As a matter of fact, damages may occur due to the volume of debris transported by the river in the peak flow periods. These damages may have also occurred on the sides of the Walls including caving and damage to the steel of the walls themselves. Eventual remedial works, which are not included in the foreseen activities, will be performed in compliance with instructions of the Engineer.

The site installations removed at the end of the first phase will be re-established on site. It can be envisaged that dewatering of seepage or rain water or molten snow could be executed during all the period of rollway construction.

During working phase 2, since the cofferdam will be removed, access to the site will be through the temporary and permanent bridges built during phase 1 of the works. For accessing to the spillway structure, roads passing in front and behind the powerhouse will be used.

According to the proposed program of works it can be noted that part of the works have to be performed during the winter season. Accordingly a simple cover structure will be used for the period from November to February. The structure will be anchored using the formwork anchors left behind in the existing piles or supported at the top of the piles. Working under a cover structure also implies the use of small size equipment such as e.g. small size lifting device.

The sequence for the rollway construction is as follows:

- Pumping of water
- Scarification of wall and pier surfaces
- Cleaning of the concrete foundation
- Topographical survey
- Removal of existing concrete from base slab to construct rollway key
- Placement of formwork which skin has been treated with a stripping agent

- Assembling and placement of reinforcement
- Survey checks and all the list of the Inspection Test List and approval for the pour
- Placement of concrete
- Vibrating of pour
- Curing of concrete before form stripping
- Concrete consolidation
- Removal and cleaning of formwork
- Preparation of horizontal surfaces
- Removal of existing concrete to construct rollway key
- Removal of existing concrete from base slab to construct rollway key will be executed prior to commencement of rollway construction. This operation involves an area of about 12 m x 8.6 m with a variable thickness of 0.60 m. The small dimension of the area will enhance the isolation of the slab sector to be demolished during the construction of the foundation.

In the pour during the construction of foundation, special care will be paid to isolate the slab area which shall be eventually demolished and removed. The separation will be ensured by use of a suitable membrane which will not damage the finished surface (the surface could be eventually trimmed with a marble polisher in case the surface may not result hydraulically suitable). This approach allows avoiding the demolition of the structure including the steel reinforcement and may result in a cleaner and more rational operation.

The structure to be eventually demolished above the membrane will be fitted with decompression holes reaching the finished surface; this will allow any possible infiltration of the water running in the spillway, to lift the same concrete slab. Eventually a few dowel bars from below will be left in place to hold the slab down and these will be fitted with couplings for easy removal and repair.

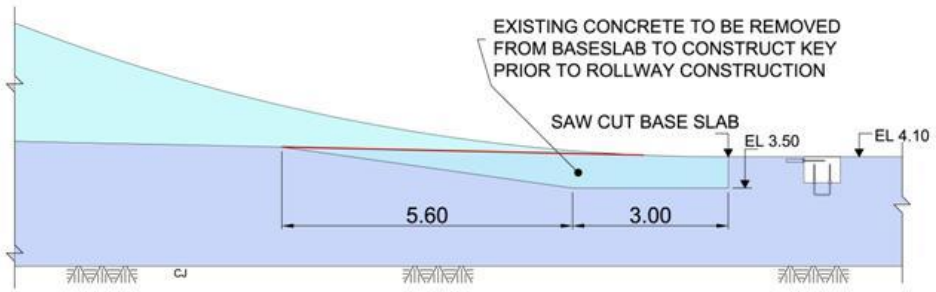

Figure 80: Removal of existing concrete from base slab to construct rollway key

The sequence of activities for this operation is listed below:

- Cutting of the concrete on the sides of the area to be treated, using special mobile equipment fitted with diamond saw blades;
- Demolition of the associated concrete area with small size equipment;
- Eventual scarification to be performed by mean of a trimmer;
- Sandblasting of the exposed steel reinforcement bars and possible replacement of some of these in accordance with the Engineer instructions. This operation may be required due to possible damage to the perimeter surfaces by the alluvium material carried by the river during peak flood periods.

Figure 81: Cutting operations for removal of existing concrete during rollway construction

Figure 82: Demolition of the concrete area with small size equipment

After having defined the area to be demolished, the demolition of the concrete will begin. The equipment shown in the previous Figure 81 and Figure 82 allows demolition without damaging the steel reinforcement since the area will be isolated with a membrane. When the demolition has been completed, the steel structure will be inspected together with the Engineer; as already mentioned sand blasting or additional steel reinforcement will be executed according to the instructions of the Engineer.

E.1.7.7 SCARIFICATION OF WALL AND PIER SURFACES

During the demolition activity, the scarification of wall and pier surfaces will be done using a jet of pressurized water, pressurized abrasive, water and air, or any other means approved by the Engineer, to remove laitance, expose coarse aggregate and obtain a roughness of at least 5 mm.

At the end of the treatment, the foundation slab will be cleaned with compressed air and air jets to remove the debris that have been produced by previous operations and will be loaded and transported to the disposal area. The time required for the surface treatment will not affect the overall time of the works because it may be done simultaneously to the operation of the demolition of the foundation slab.

E.1.7.8 GUIDES FOR FINISHING OF THE ROLLWAYS CONCRETE

Rollways have been designed in eight vertical lifts with corresponding construction Joint; each lift is divided in two parts with stepped vertical construction joints up to elevation of 13.62 m. In the first lift there is an additional vertical joint at the end of the portion.

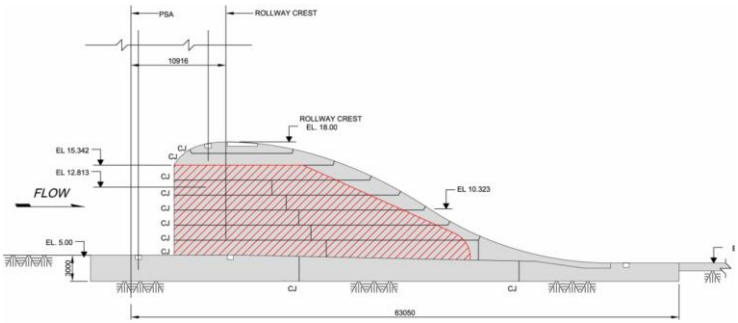

Figure 83: Spillway - Concrete section of rollways

Rollways concrete shall be class A-2, except for hatched area shown in the previous Figure 83 which shall be class B-2; class A-2 will be placed within 30 minutes of placing B-2 for each lift and vibrated into adjacent concrete.

Due to the particular shape of rollway an ordinary formwork cannot be used and needs to be replaced by timber or metal guides, having the exact profile of the designed slope. Special leveling aluminum devices running over these guides will allow obtaining a perfectly shaped surface; at the end of this work the surface will be manually steel toweled.

In order to allow access to the surface area without walking on top of it, walkways will be installed using a set of transverse special structures. These structures will follow the shape of the concrete: in this way the workers can reach the working areas as well as the bottom where the concrete is placed; this system also enhance vibrating of concrete and finishing works by providing ease access to the top portion of the pours. The walkways will be realized by using L-type supports fixed on the form anchors and supporting the frames of the walkway itself.

Figure 84: Example of guides for finishing of the rollways concrete

Procedures for concreting and pouring are illustrated in other sections of the present method statement; for a detailed description of these items please refer to Section D for a detailed explanation of these activities.

Slots for embedded parts and inserts to lodge the horizontal supports of the gate's guides will be placed on top of the rollways.

With respect to the equipment to be adopted for the works, apart from those needed for foundation works, the following equipment will be used for elevation works:

- Mobile cherry picker elevators for the joint treatment and finishing works;
- Equipment for demolition and cutting of the concrete (see previous Figure 84);

- Sand blasting equipment.

E.1.8 EXPECTED PRODUCTION INCIDENCES

Assumed production incidences for the spillway structure are illustrated in the following Figure 85. The tables and diagrams show the production incidences for the Phase 1 and for the Phase 2 and are related to the Pier 1 and to the Rollway N 1. Incidences for Piers from 2 to 6 and for Rollways from 2 to 5 are the same than reported.

For each lift the following information is indicated:

- Starting and completion date;
- Duration of the pour;
- General dimensions of the lift (height, depth and width, volume, elevation).

The scatter diagram allows to better illustrate the pattern of the production activity.

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Spillway P1								
Concrete works from April 8th to August 16th, 2014			dimensioning data					
			days per pour	high	deep	large	volume	elev.
	Starting Date	Ending Date		m	m	m	m3	m
Monolith A		8-Apr-14						5.00
lift 1	8-Apr-14	18-Apr-14	10	3	24.0	2.85	205	8.00
lift 2	19-Apr-14	29-Apr-14	10	3	24.0	2.85	205	11.00
lift 3	30-Apr-14	8-May-14	8	3	24.0	2.85	205	14.00
lift 4	9-May-14	17-May-14	8	3.1	24.0	2.85	211	17.10
lift 5	18-May-14	26-May-14	8	2.9	24.0	2.85	200	20.00
lift 6	27-May-14	4-Jun-14	8	3	24.0	2.85	205	23.00
lift 7	5-Jun-14	13-Jun-14	8	3	24.0	2.85	205	26.00
lift 8	14-Jun-14	22-Jun-14	8	3	24.0	2.85	205	29.00
lift 9	23-Jun-14	1-Jul-14	8	3	24.0	2.85	205	32.00
lift 10	2-Jul-14	10-Jul-14	8	3	24.0	2.85	205	35.00
lift 11	11-Jul-14	19-Jul-14	8	3	24.0	2.85	205	38.00
lift 12	20-Jul-14	28-Jul-14	8	3	24.0	2.85	205	41.00
lift 13	29-Jul-14	6-Aug-14	8	2.9	24.0	2.85	195	43.90
lift 14	7-Aug-14	15-Aug-14	8	1.6	24.0	2.85	141	45.50
Monolith B		8-Apr-14						5.00
lift 1	8-Apr-14	18-Apr-14	10	3	21.7	2.85	171	8.00
lift 2	19-Apr-14	29-Apr-14	10	3	21.7	2.85	162	11.00
lift 3	30-Apr-14	8-May-14	8	3	21.7	2.85	162	14.00
lift 4	9-May-14	17-May-14	8	3.1	21.7	2.85	165	17.10
lift 5	18-May-14	26-May-14	8	2.9	21.7	2.85	158	20.00
lift 6	27-May-14	4-Jun-14	8	3	21.7	2.85	162	23.00
lift 7	5-Jun-14	13-Jun-14	8	3	21.7	2.85	143	26.00
lift 8	14-Jun-14	22-Jun-14	8	3	16.2	2.85	105	29.00
lift 9	23-Jun-14	1-Jul-14	8	3	11.6	2.85	76	32.00
lift 10	2-Jul-14	10-Jul-14	8	3.6	5.8	2.85	29	35.60
Monolith C		22-Jun-14						4.00
lift 1	22-Jun-14	1-Jul-14	9	3	24.7	2.85	152	7.00
lift 2	2-Jul-14	11-Jul-14	9	3	24.7	2.85	162	10.00
lift 3	12-Jul-14	21-Jul-14	9	3	24.7	2.85	162	13.00
lift 4	22-Jul-14	28-Jul-14	6	2.06	24.7	2.85	105	15.06
lift 5	29-Jul-14	5-Aug-14	7	3.32	14.5	2.85	95	18.38
lift 6	6-Aug-14	11-Aug-14	5	2.62	5.9	2.85	33	21.00
lift 7	12-Aug-14	16-Aug-14	4	2	3.8	2.85	10	23.00

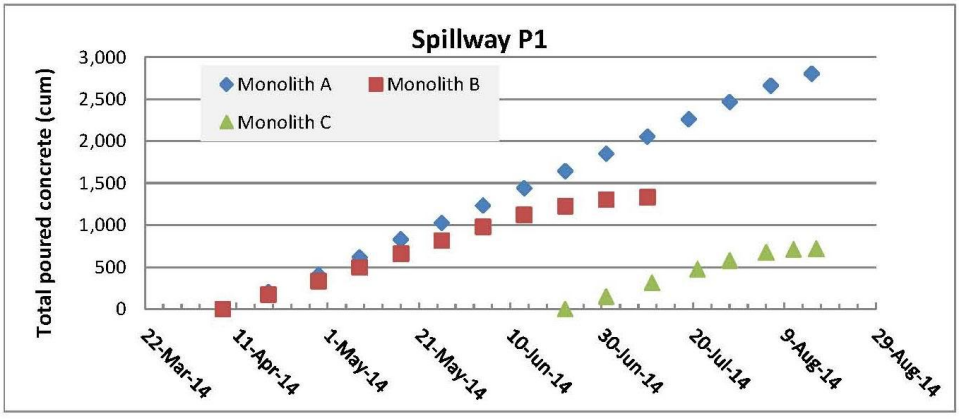

Figure 85: Assumed production incidences for the Pier 1 of the spillway. Same rates have been assumed for piers from 2 to 6

Spillway R1								
Concrete works from October 9th, 2016 to January 18th, 2017			dimensioning data					
			days per pour	high	deep	large	volume	elev.
	Starting Date	Ending Date		m	m	m	m3	m
Monolith 1		9-Oct-16						5.00
lift 1	9-Oct-16	17-Oct-16	8	1.72	18.5	10.8	344	6.72
lift 2	18-Oct-16	27-Oct-16	9	1.72	20.7	10.8	384	6.72
lift 3	28-Oct-16	3-Nov-16	6	1.72	16.1	10.8	298	8.44
lift 4	4-Nov-16	12-Nov-16	8	1.72	19.1	10.8	354	8.44
lift 5	13-Nov-16	19-Nov-16	6	1.72	14.7	10.8	273	10.16
lift 6	20-Nov-16	28-Nov-16	8	1.72	16.9	10.8	314	10.16
lift 7	29-Nov-16	4-Dec-16	5	1.72	13.1	10.8	243	11.88
lift 8	5-Dec-16	10-Dec-16	5	1.72	14.2	10.8	263	11.88
lift 9	11-Dec-16	15-Dec-16	4	1.72	11.4	10.8	212	13.60
lift 10	16-Dec-16	21-Dec-16	5	1.72	12.3	10.8	228	13.60
lift 11	22-Dec-16	31-Dec-16	9	1.74	20.2	10.8	379	15.34
lift 12	1-Jan-17	6-Jan-17	5	1.33	15.9	10.8	228	16.67
lift 13	7-Jan-17	11-Jan-17	4	1.33	8.8	10.8	126	18.00
lift 14	12-Jan-17	18-Jan-17	6	3.22	7.3	10.8	254	6.80

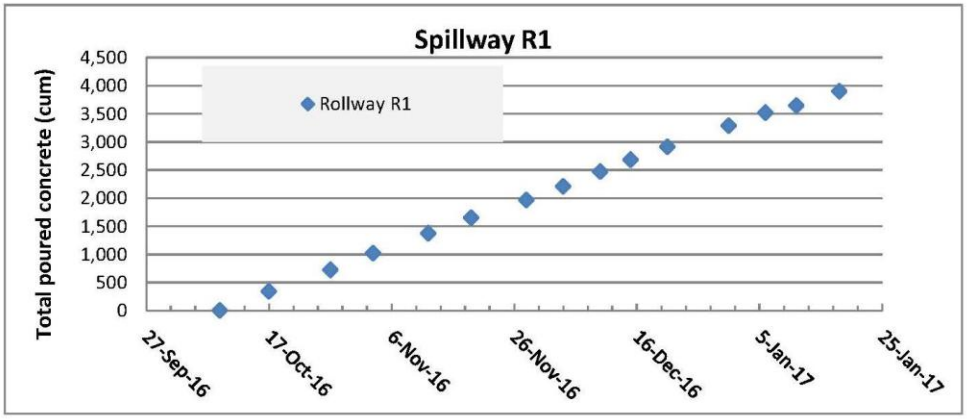

Figure 86: Assumed production incidences for the Rollway 1 of the spillway. Same rates have been assumed for rollways from 2 to 5

E.2 NORTH TRANSITION DAM CONSTRUCTION

E.2.1.1 GENERAL DESCRIPTION

The NORTH TRANSITION DAM is a small structure connecting Spillway and North RCC Dam/RCC cofferdam, as shown in the following Figure 87. The dimensions of the portion of the structure in contact with the North RCC dam are as follows:

- Length = 15 m
- Height = 35 m
- Width at the foundation level = 32 m
- Width at the crest = 9.3 m

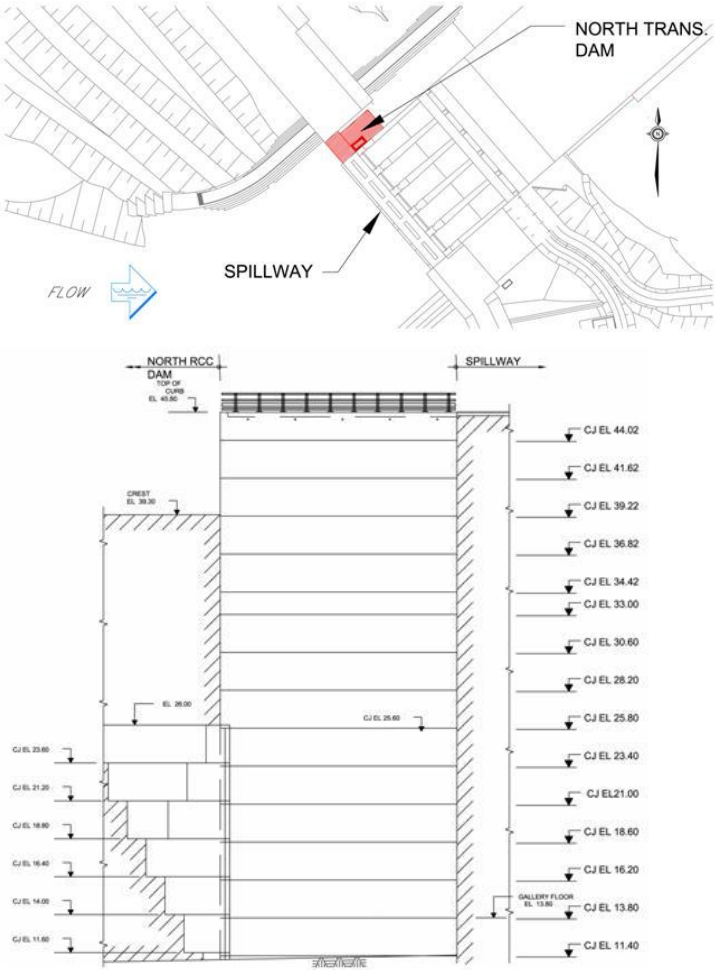

Figure 87: North Transition Dams: general plan view and sections. The smaller portion at the interface with the existing RCC cofferdam is a block of 9 x 8 m with a staircase shape and height about = 15 m

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E.2.1.2 FORECASTED SCHEDULE AND MILESTONES

The following table reports a synthesis of the key dates for the construction of the NORTH TRANSITION DAM.

North Transition Dam		
Description (main activities)	Start	Finish
Phase I - Slab and Piers		
Preliminary and foundation works	16 Feb 14	9 Jul 14
Elevation Works	24 Apr 14	21 Oct 14
Other Works	11 Sep 14	14 Dec 14

A summary of Spillway and NORTH TRANSITION DAM Interface and Milestones schedule is illustrated in the following table:

Milestone Interface No.	Description	Date
I1	Spillway Site Ready for Start of Works	11 Nov 2013
I22	All Spillway Hydro-Mechanical Primary Anchors, Delivered to Site by Company Other Contractor (CH0032)	4 Dec 2013
M4	Spillway and Related Works required for Diversion, including: Northern Two Monoliths of Centre Transition Dam including the Platform for Spillway Electrical Building Complete; Completion of Separation Wall; Completion of North Transition Dam.	15 Feb 2015
M54	Center Transition Dam complete including Trashrack cleaner rails installed	13 Aug 2016
M55	South Transition Dam Complete	12 Dec 2015

A synthesis of the construction time for the NORTH TRANSITION DAM with respect to the execution of the spillway is presented in the following Figure 88.

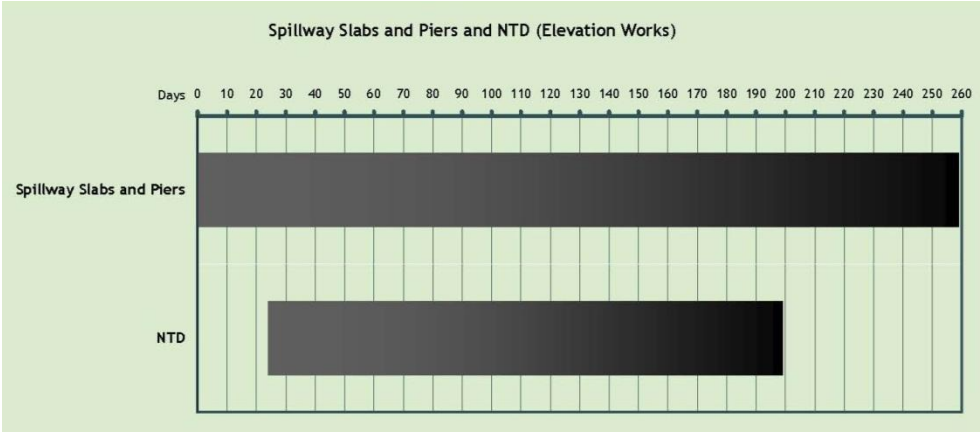

Figure 88: Foreseen construction time of the NORTH TRANSITION DAM with respect to the execution of the spillway

E.2.1.3 ACCESS

The Access roads to the North Transition Dam (NORTH TRANSITION DAM) are shown in the following Figure 89 and described in the previous chapters.

The accesses for the Nord Transition Dam (NORTH TRANSITION DAM) will be possible from two main directions: (a) from the eastern side by the access road to the spillway and (b) from the western side by using the access road to the northern service bay of Powerhouse.

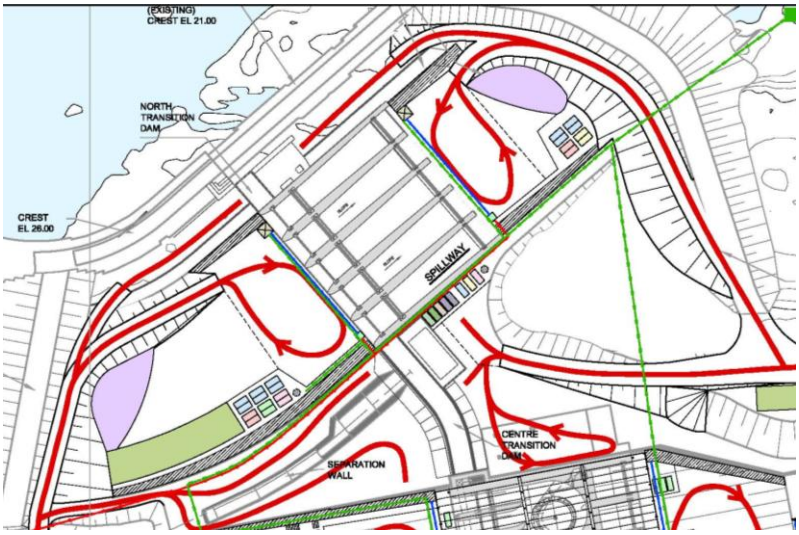

Figure 89: Plan view of the working sites of the NORTH TRANSITION DAM with indication of access roads

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E.2.1.4 WORK SEQUENCE

The NORTH TRANSITION DAM structure has been designed in 16 lifts with Construction Joints for the main portion and in 6 lifts with Construction Joints for the smallest portion (the height of the concrete lifts reaches a maximum of 2.4 m) (see following Figure 90).

In the lower area of the dam, at elevation of 13.8 m, there are two galleries: one is used for drainage (about 15 m long having a dimension of 3 x 2.5 m) and the other is used for access (about 17 m long having a dimension of 3 x 5 m).

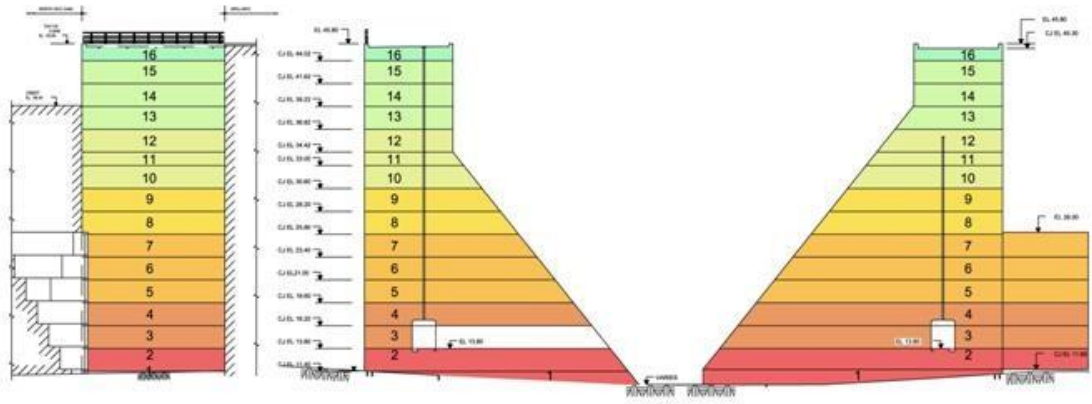

Figure 90: NORTH TRANSITION DAM – Detail of the concrete pour levels

The drainage gallery formwork will be obtained utilizing prefabricated concrete panels (predalles) which ensure a better quality of finishing on the exposed faces, whilst the access gallery will be realized using prefabricated concrete panels (predalles) for the vertical faces and Peri type Skydeck or similar forms for the cover deck.

The sequence for construction works is as below:

1) Preliminary works

- Removal of the sand layer which has been placed to protect the excavated surfaces in the winter protection
- Cleaning of rock foundation with a pressure gun using water and air with a manual trimming of the excavated surfaces
- Dental concrete

2) Foundations works

- Lean concrete

3) Elevations works

- Placement of formwork and waterstop
- Assembling and placement of reinforcement
- Placement of items in the formwork treating to prevent concrete from adhering
- Topographical survey
- Moistening before placement of concrete
- Placement of concrete
- Vibrating of pour
- Curing of concrete before form stripping
- Concrete consolidation
- Removal and cleaning of formwork
- Preparation of horizontal surfaces
- Curing and finishing
- Extension of formwork
- Drilling and grouting (from drainage gallery)

For a detailed description of the methods for the realization of these activities, please refer to the relevant sections of the present document.

E.2.1.5 DRILLING AND GROUTING

In the NORTH TRANSITION DAM consolidation grouting is foreseen after the placement of structural concrete. Some lined holes will be left in place in the structural concrete, to enable drilling and injection operations to be performed at a later stage.

Holes for grouting are of 65 mm and approximately 20 m long for a foreseen total length of drilling of 200 m and a foreseen quantity of cement for grouting corresponds to 7,000 kg.

Water pressure tests will be used for final control of rock permeability. Eventually, rotary percussion and cored boreholes shall be executed as additional testing.

Finally, for NORTH TRANSITION DAM No. 5 drainage holes, 75 mm in diameter and 13 m in

length, will be drilled for a total length of 65 m. Drainage holes will be closed with PVC caps.

This activity will be performed from inside the 3 m high drainage gallery and therefore micro-drilling equipment shall be used with short rod extension. The injection plant will be located outside the gallery, in covered, insulated and heated shed. The plant will include mixers, injection pumps and related equipment for control of injection pressure, flows, timing etc.

A detailed method statement will be submitted before commencement of the works, in compliance with technical specifications.

According to the construction sequence of the NORTH TRANSITION DAM foundation and in case of possibilities, drilling operations will be performed without the gallery in place, since this would allows the use of larger equipment and ensure higher drilling rates.

E.2.1.6 EXPECTED PRODUCTION INCIDENCES

Assumed production incidences for the NORTH TRANSITION DAM are represented in the following Figure 91. For each lift the following information are reported:

- Starting and completion date;
- Duration of the pour;
- General dimensions of the lift (height, depth and width, volume, elevation).

The scatter diagram allows to better illustrate the pattern of the production activity.

NORTH TRANSITION DAM (9,130 cum)								
Concrete works from April 8th to October 5th, 2014			dimensioning data					
			days per pour	high	deep	large	volume	elev.
	Starting Date	Ending Date		m	m	m	m3	m
Monolith 1		8-Apr-14						10.00
lift 1	8-Apr-14	15-Apr-14	7	1.4	29.0	15.8	367	11.40
lift 2	16-Apr-14	30-Apr-14	14	2.4	27.0	15.8	1024	13.80
lift 3	1-May-14	15-May-14	14	2.4	25.2	15.8	956	16.20
lift 4	16-May-14	28-May-14	12	2.4	23.4	15.8	889	18.60
lift 5	29-May-14	10-Jun-14	12	2.4	21.7	15.8	821	21.00
lift 6	11-Jun-14	23-Jun-14	12	2.4	19.9	15.8	754	23.40
lift 7	24-Jun-14	5-Jul-14	11	2.4	18.1	15.8	686	25.80
lift 8	6-Jul-14	17-Jul-14	11	2.4	16.3	15.8	619	28.20
lift 9	18-Jul-14	29-Jul-14	11	2.4	14.5	15.8	551	30.60
lift 10	30-Jul-14	10-Aug-14	11	2.4	12.8	15.8	484	33.00
lift 11	11-Aug-14	21-Aug-14	10	1.4	11.0	15.8	260	34.42
lift 12	22-Aug-14	30-Aug-14	8	2.4	9.2	15.8	349	36.82
lift 13	31-Aug-14	8-Sep-14	8	2.4	9.2	15.8	349	39.22
lift 14	9-Sep-14	17-Sep-14	8	2.4	9.2	15.8	349	41.62
lift 15	18-Sep-14	26-Sep-14	8	2.4	9.2	15.8	349	44.02
lift 16	27-Sep-14	5-Oct-14	8	1.5	9.2	15.8	349	45.50

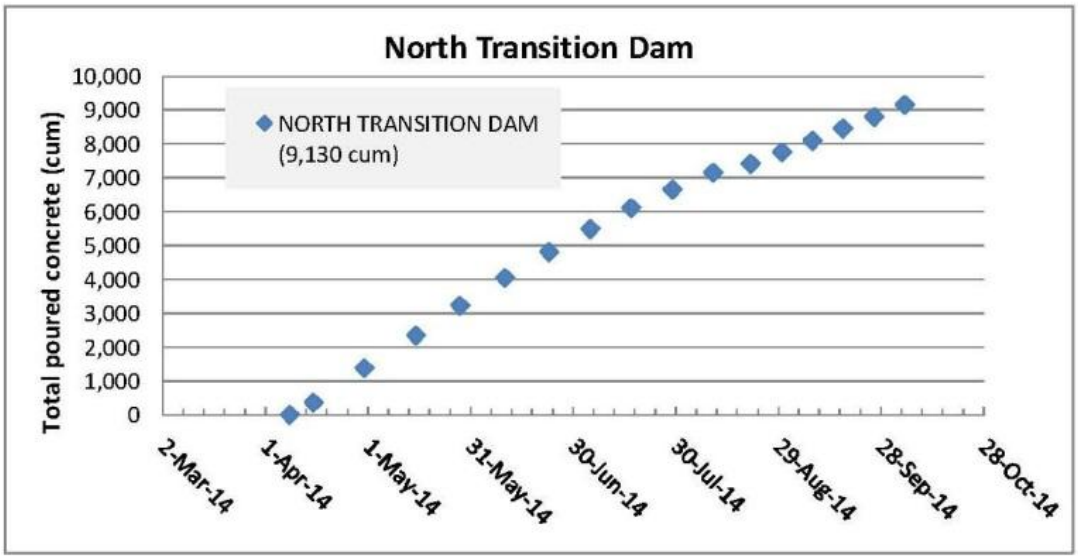

Figure 91: Assumed production incidences for the NORTH TRANSITION DAM

E.3 CENTRAL TRANSITION DAM AND SEPARATION WALL

E.3.1 GENERAL DESCRIPTION

The Central Transition Dam (CENTRE TRANSITION DAM) is a relatively small structure characterized by following dimensions:

- Length = 66 m
- Height = 31 m
- Width at the foundation level = 22 m
- Width at the crest = 11 m

The CENTRE TRANSITION DAM is characterized by a horizontal curvature and has been divided into 5 monolith with Contraction Joints.

The separation wall corresponds to a retaining wall located next to the spillway with the following dimensions:

- Length = 107 m
- Height between 9 and 24 m; average height of the wall is 16.5 m
- Width at the foundation level = 6 to 11 m
- Width at the crest = 3 to 8 m

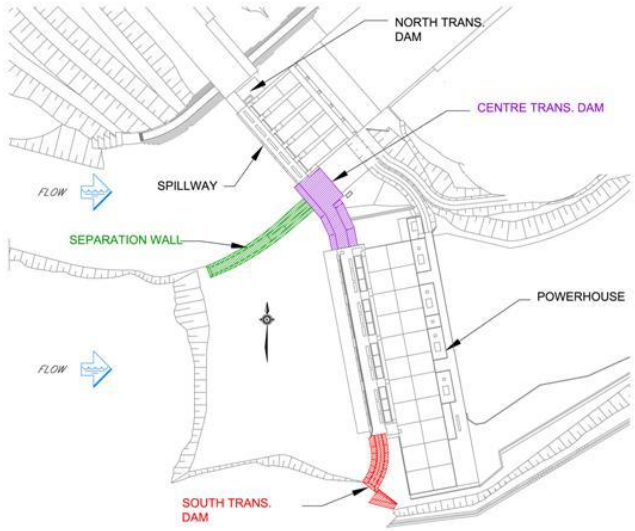

Figure 92: General plan view of the structures

The CENTRE TRANSITION DAM structure has been designed in 14 lifts with Construction Joints (see following Figure 93) and it has been divided into 5 monoliths with Contraction Joints.

In Phase 1 the first two northern monoliths will be realized. A delay of some days will be applied for the beginning of the different monoliths.

In Phase 2 the monoliths 3, 4 and 5, the last of those representing the connection with the Intake structure, will be built.

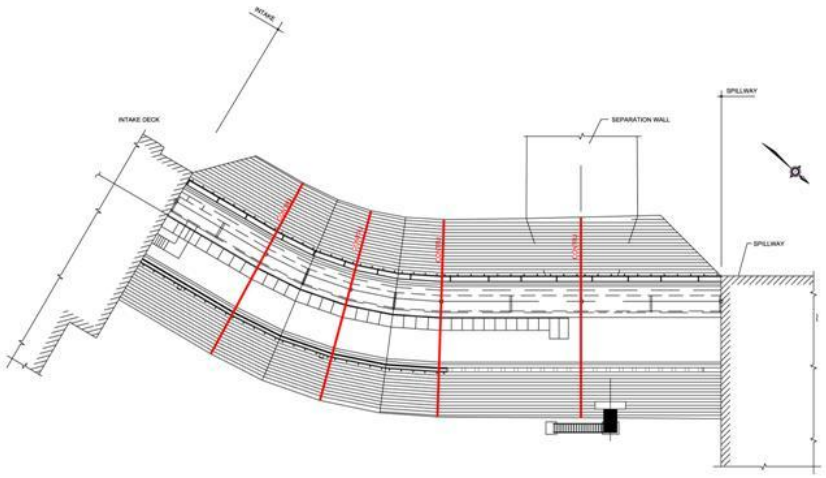

Figure 93: Detailed plan view of the CENTRE TRANSITION DAM with indication of the Construction Joints

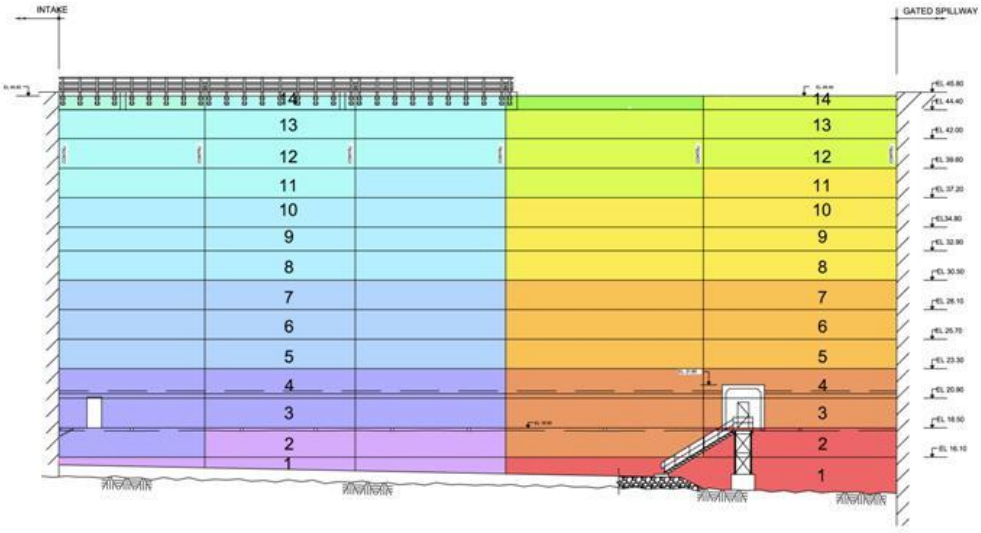

Figure 94: Longitudinal sections of CENTRE TRANSITION DAM with detail of the concrete pour levels.

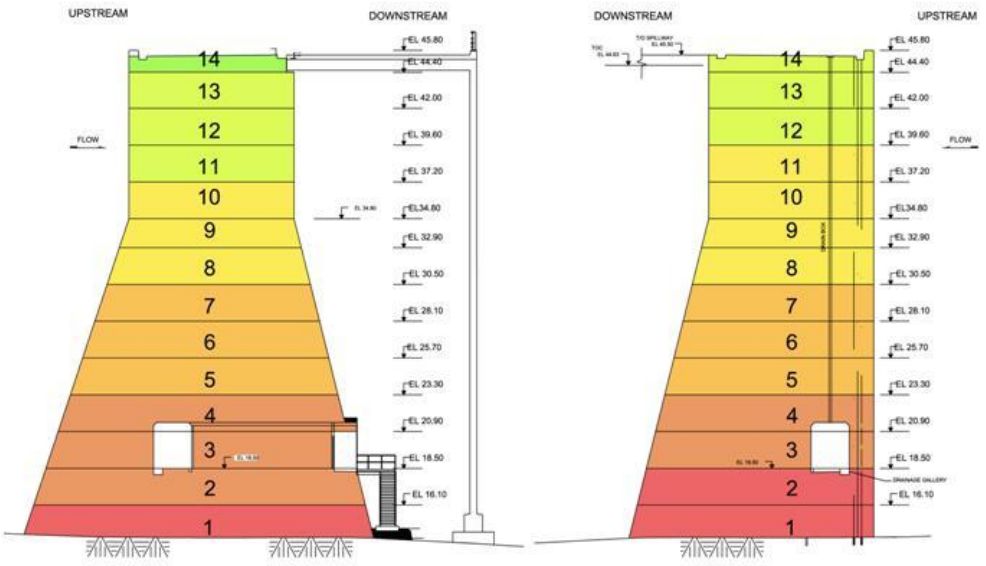

Figure 95: Cross sections of CENTRE TRANSITION DAM with detail of the concrete pour levels , with the steel structure elevated deck (right side) and position of drainage and access galleries

Three galleries are foreseen in the lower portion of the dam, at an elevation 18.5 m:

- A drainage gallery, about 65 m long and with section of 3 x 2.5 m;
- two others galleries to be used as access: one of about 10 m in length and a section of 3 x 2.5 m and a smaller gallery about 6 m long and section of 3 x 1.2 m. The access galleries to reach the drainage gallery can be reached from the outside via a steel stairs.

With respect to the forming of the drainage gallery, prefabricated concrete panels and pre-dalle type slabs will be adopted for forming and pouring of the roof.

E.3.1.1 CENTRE TRANSITION DAM STRUCTURE ELEVATED DECK

A large elevated deck structure has to be erected for the CENTRE TRANSITION DAM, as shown in the following Figure 96. This activity will be realized by specialized subcontractors.

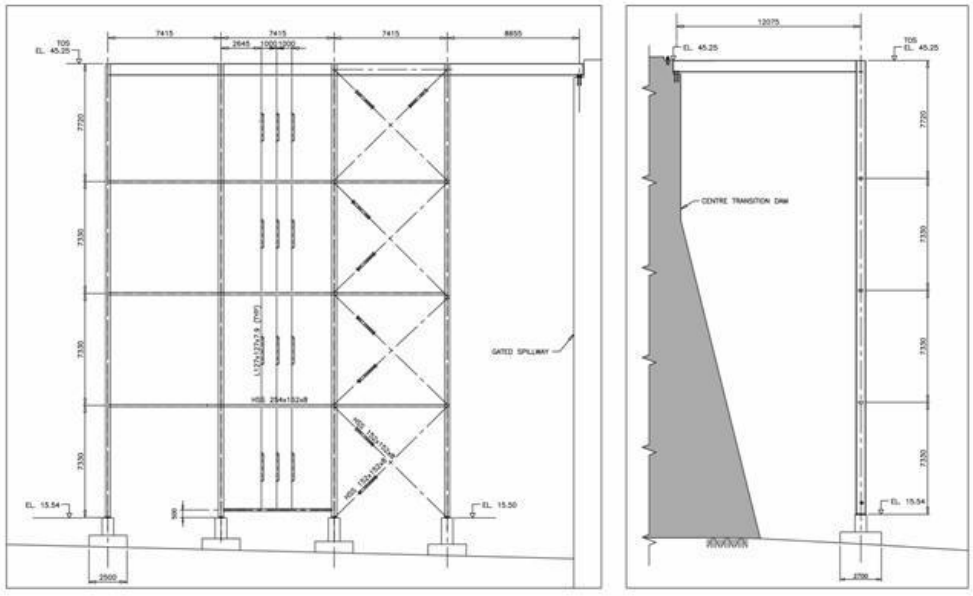

Figure 96: CENTRE TRANSITION DAM – Scheme of the elevated deck

E.3.1.2 SEPARATION WALL CONSTRUCTION

The SEPARATION WALL structure has been designed in 11 lifts, with lifts of 2.4 maximum, for the higher section and in 4 lifts for the lower section with Construction Joints and is divided horizontally into seven sectors with Contraction Joints. No steel reinforcement is foreseen for the SEPARATION WALL.

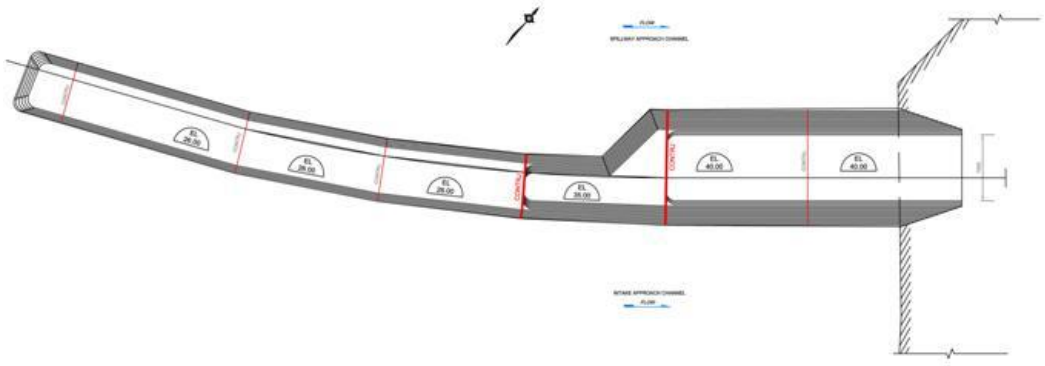

Figure 97: Detailed plan view of the SEPARATION WALL with Contraction Joints

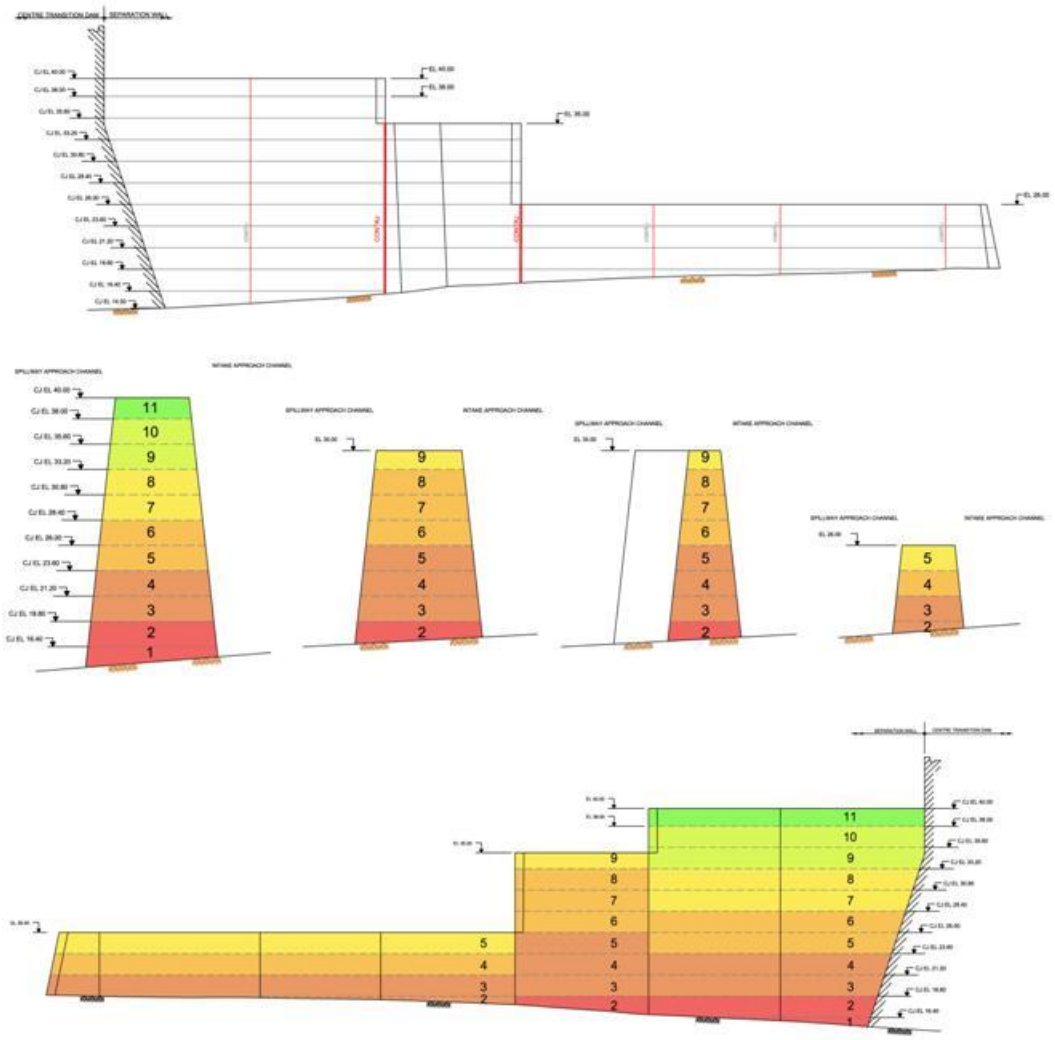

Figure 98: Cross sections of SEPARATION WALL with Contraction Joints and indications of the phases of work

E.3.2 FORECASTED SCHEDULE AND MILESTONES

The construction of the Central Transition Dam will take place into 2 phases:

- Phase 1: Construction of northern two monoliths;
- Phase 2: Construction of southern monolith from 3 to 5 connecting to the Powerhouse.

A synthesis of the relevant dates for the two phases is reported in the following table.

North Transition Dam		
Description (main activities)	**Start**	**Finish**
Monoliths 1+2		
Preliminary and Foundation Works	24 May 14	13 Sep 14
Elevation Works	13 Jun 14	12 Nov 14
Other Works	13 Nov 14	2 Feb 15
Monoliths 3,4, and 5		
Preliminary and Foundation Works	24 Apr 15	6 Oct 15
Elevation Works	16 Jun 15	10 Nov 15
Other Works	21 Sep 15	5 Dec 15

The realization of the separation wall will be completed within about 6 months as indicated by the following relevant dates.

Separation Wall		
Description (main activities)	**Start**	**Finish**
Preliminary and Foundation Works	24 May 14	24 Jul 14
Elevation Works	7 Jul 14	20 Nov 14
Other Works	-	-

Special care will be paid to the coordination for the connection area between the Intake and the Central Transition Dam. Priority will be given to the works on the critical path or that can generate possible negative interferences with the other ongoing activities.

According to the document “Exhibit 9 – Interface and Milestone Schedule” some milestones have to be considered for the construction of the CENTRE TRANSITION DAM, as summarized below.

Milestone Interface No.	Description	Date
I1	Spillway Site Ready for Start of Works	11 Nov 2013
I22	All Spillway Hydro-Mechanical Primary Anchors, Delivered to Site by Company Other Contractor (CH0032)	4 Dec 2013
M4	Spillway and Related Works required for Diversion, including: Northern Two Monoliths of Centre Transition Dam including the Platform for Spillway Electrical Building Complete; Completion of Separation Wall; Completion of North Transition Dam.	15 Feb 2015
M54	Center Transition Dam complete including Trashrack cleaner rails installed	13 Aug 2016

A synthesis of the construction time for the CENTRE TRANSITION DAM (Phase 1 and Phase 2) with respect to the execution of the Separation Wall and of the South Transition Dam is presented

in the following

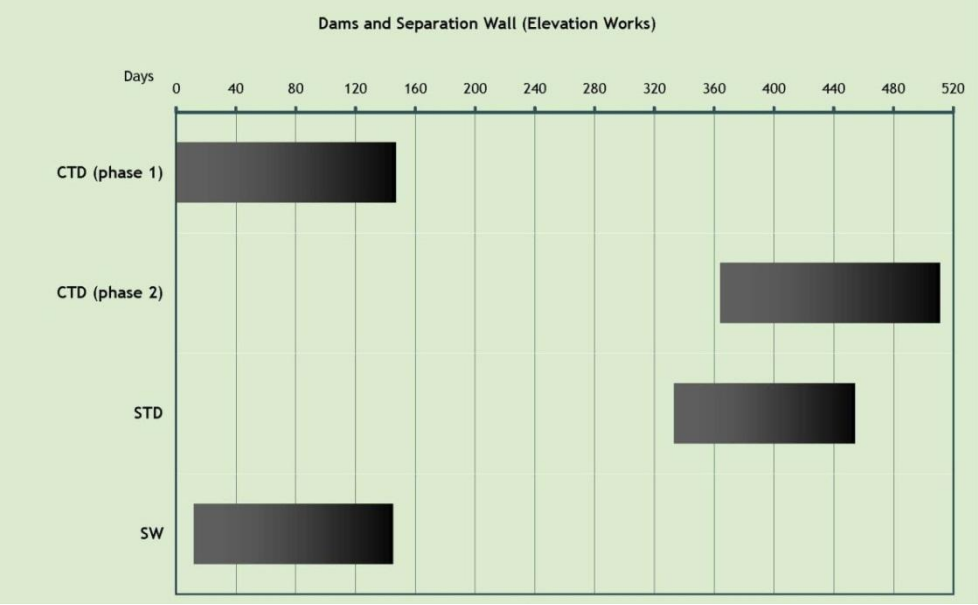

Figure 99: Foreseen construction time of the CENTRE TRANSITION DAM (Phase 1 and Phase 2) with respect to the execution of the Separation Wall and of the South Transition Dam

E.3.3 ACCESS

Access to the CENTRE TRANSITION DAM is shown in the following

Figure 100. The accesses for the Center Transition Dam (CENTRE TRANSITION DAM) will be possible from two main directions: (a) from the southern side by the access road to the Intake and the Powerhouse area and (b) from the northern side by using the access road to the Spillway (North side) forming two different areas.

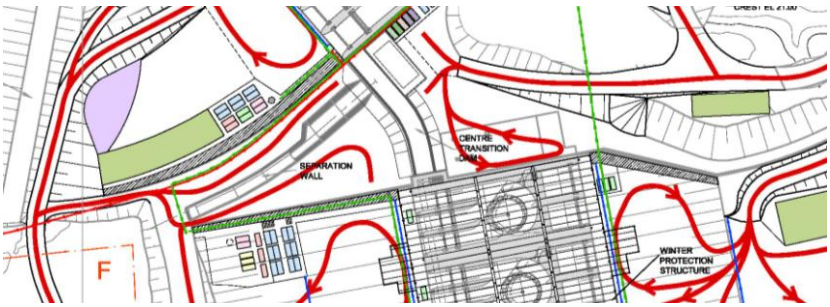

Figure 100: Plan view of the working sites of the CENTRE TRANSITION DAM and SEPARATION WALL with indication of access roads

The access to the Separation Wall (SEPARATION WALL) will be possible from the Spillway and the CENTRE TRANSITION DAM construction areas. A detailed program concerning the usage of access roads to avoid interferences of activities at different working sites will be submitted before commencement of the works.

E.3.4 WORK SEQUENCES

The foreseen sequence of activities is listed in the following. For a detailed description of the methods for the single activities, please refer to Section D and previous chapters in Section E of the present document.

1) Preliminary activities and foundations

- Removal of the sand layer placed as protection during the winter (this item does not apply to the SEPARATION WALL)
- Cleaning of rock foundation with pressure gun using water and air and manual trimming of the excavated surfaces
- Dental concrete
- Lean concrete

2) Elevation works

- Placement of formwork and waterstop
- Assembling and placement of reinforcement
- Placement of items in the formwork treating to prevent concrete from adhering
- Topographical survey
- Moistening before placement of concrete
- Placement of concrete
- Vibrating of pour
- Curing of concrete before form stripping
- Concrete consolidation
- Removal and cleaning of formwork

- Preparation of horizontal surfaces
- Curing and finishing. A particular item concerning the CENTRE TRANSITION DAM is related to the application of bitumen coating of the joints. For the CENTRE TRANSITION DAM 3060 sqm of surface to be treated is foreseen.
- Extension of formwork
- Drilling and grouting (from drainage gallery) – Not for the SEPARATION WALL

E.3.4.1 DRILLING AND GROUTING

In the CENTRE TRANSITION DAM consolidation grouting has to be performed after the placement of structural concrete. Some lined holes will be left in place in the structural concrete, to enable drilling and injection operations to be executed at a later stage.

Holes for grouting are of 65 mm and approximately 20/25 m long for a foreseen total length of 600 m of drilling and a foreseen quantity of cement for grouting corresponding to 20,000 kg.

Drainage holes consist in No. 20 drainage holes, 75 mm in diameter and 10 m in length will be drilled, for a total length of 200 m. All the drainage holes will be closed with PVC caps.

E.3.5 EXPECTED PRODUCTION INCIDENCES

Assumed production incidences for the CENTRE TRANSITION DAM (for the Phase 1, monoliths 1 and 2 and for the Phase 2, monoliths 3, 4 and 5) as well as for the SEPARATION WALL are represented in the following Figure 101. For each lift the following information is reported:

- Starting and completion date;
- Duration of the pour;
- General dimensions of the lift (height, depth and width, volume, elevation).

The scatter diagram allows to better show the pattern of the production activity.

ASTALDI CANADA Inc.

CENTRE TRANSITION DAM (29,560 cum)								
Concrete works from June 8th to November 6th, 2014 and from June 11th to November 5th, 2015			dimensioning data					
			days per pour	high	deep	large	volume	elev.
	Starting Date	Ending Date		m	m	m	m3	m
Monolith 1		8-Jun-14						14.60
lift 1	8-Jun-14	17-Jun-14	9	1.5	22.5	15.75	532	16.10
lift 2	18-Jun-14	28-Jun-14	10	2.4	21.1	15.75	797	18.50
lift 3	29-Jun-14	12-Jul-14	13	2.4	19.7	15.75	744	20.90
lift 4	13-Jul-14	24-Jul-14	11	2.4	18.3	15.75	691	23.30
lift 5	25-Jul-14	4-Aug-14	10	2.4	16.9	15.75	637	25.70
lift 6	5-Aug-14	15-Aug-14	10	2.4	15.5	15.75	584	28.10
lift 7	16-Aug-14	25-Aug-14	9	2.4	14.0	15.75	531	30.50
lift 8	26-Aug-14	4-Sep-14	9	2.4	12.6	15.75	477	32.90
lift 9	5-Sep-14	14-Sep-14	9	1.9	11.2	15.75	336	34.80
lift 10	15-Sep-14	23-Sep-14	8	2.4	10.7	15.75	404	37.20
lift 11	24-Sep-14	2-Oct-14	8	2.4	10.7	15.75	404	39.60
lift 12	3-Oct-14	11-Oct-14	8	2.4	10.7	15.75	404	42.00
lift 13	12-Oct-14	20-Oct-14	8	2.4	10.7	15.75	404	44.36
lift 14	21-Oct-14	29-Oct-14	8	1.1	10.7	15.75	185	45.50
Monolith 2		15-Jun-14						
lift 1	15-Jun-14	24-Jun-14	9	0.85	22.5	16.15	309	16.10
lift 2	25-Jun-14	5-Jul-14	10	2.4	21.1	16.15	817	18.50
lift 3	6-Jul-14	19-Jul-14	13	2.4	19.7	16.15	763	20.90
lift 4	20-Jul-14	31-Jul-14	11	2.4	18.3	16.15	708	23.30
lift 5	1-Aug-14	11-Aug-14	10	2.4	16.9	16.15	653	25.70
lift 6	12-Aug-14	22-Aug-14	10	2.4	15.5	16.15	599	28.10
lift 7	23-Aug-14	1-Sep-14	9	2.4	14.0	16.15	544	30.50
lift 8	2-Sep-14	11-Sep-14	9	2.4	12.6	16.15	490	32.90
lift 9	12-Sep-14	21-Sep-14	9	1.9	11.2	16.15	344	34.80
lift 10	22-Sep-14	1-Oct-14	9	2.4	10.7	16.15	415	37.20
lift 11	2-Oct-14	10-Oct-14	8	2.4	10.7	16.15	415	39.60
lift 12	11-Oct-14	19-Oct-14	8	2.4	10.7	16.15	415	42.00
lift 13	20-Oct-14	28-Oct-14	8	2.4	10.7	16.15	415	44.36
lift 14	29-Oct-14	6-Nov-14	8	1.1	10.7	16.15	190	45.50

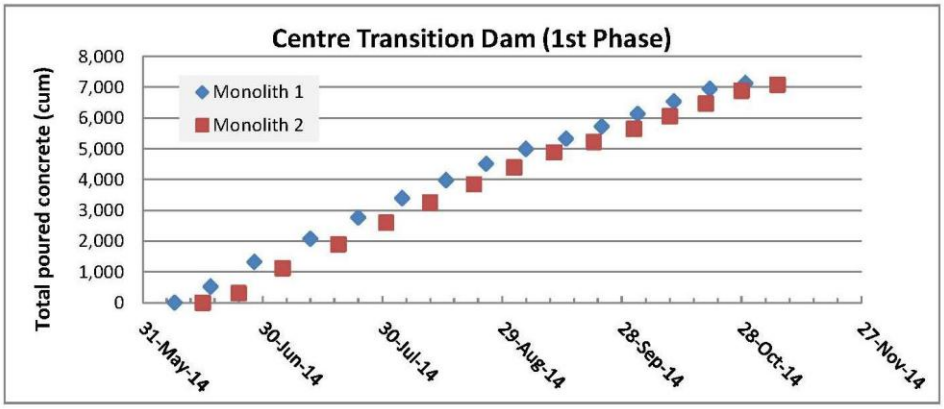

Figure 101: Assumed production incidences for the CENTRE TRANSITION DAM – Phase 1: monoliths 1 and 2

ASTALDI CANADA Inc.

CENTRE TRANSITION DAM (29,560 cum)								
Concrete works from June 8th to November 6th, 2014 and from June 11th to November 5th, 2015			dimensioning data					
			days per pour	high	deep	large	volume	elev.
Monolith 3		11-Jun-15						
lift 1	11-Jun-15	19-Jun-15	8	0.6	22.5	12.25	165	16.10
lift 2	20-Jun-15	30-Jun-15	10	2.4	21.1	12.25	620	18.50
lift 3	1-Jul-15	14-Jul-15	13	2.4	19.7	12.25	579	20.90
lift 4	15-Jul-15	26-Jul-15	11	2.4	18.3	12.25	537	23.30
lift 5	27-Jul-15	6-Aug-15	10	2.4	16.9	12.25	496	25.70
lift 6	7-Aug-15	17-Aug-15	10	2.4	15.5	12.25	454	28.10
lift 7	18-Aug-15	27-Aug-15	9	2.4	14.0	12.25	413	30.50
lift 8	28-Aug-15	6-Sep-15	9	2.4	12.6	12.25	371	32.90
lift 9	7-Sep-15	16-Sep-15	9	1.9	11.2	12.25	261	34.80
lift 10	17-Sep-15	25-Sep-15	8	2.4	10.7	12.25	315	37.20
lift 11	26-Sep-15	4-Oct-15	8	2.4	10.7	12.25	315	39.60
lift 12	5-Oct-15	13-Oct-15	8	2.4	10.7	12.25	315	42.00
lift 13	14-Oct-15	22-Oct-15	8	2.4	10.7	12.25	315	44.36
lift 14	23-Oct-15	31-Oct-15	8	1.1	10.7	12.25	144	45.50
Monolith 4		13-Jun-15						
lift 1	13-Jun-15	21-Jun-15	8	0.55	22.5	12.25	152	16.10
lift 2	22-Jun-15	2-Jul-15	10	2.4	21.1	12.25	620	18.50
lift 3	3-Jul-15	16-Jul-15	13	2.4	19.7	12.25	579	20.90
lift 4	17-Jul-15	28-Jul-15	11	2.4	18.3	12.25	537	23.30
lift 5	29-Jul-15	8-Aug-15	10	2.4	16.9	12.25	496	25.70
lift 6	9-Aug-15	19-Aug-15	10	2.4	15.5	12.25	454	28.10
lift 7	20-Aug-15	29-Aug-15	9	2.4	14.0	12.25	413	30.50
lift 8	30-Aug-15	8-Sep-15	9	2.4	12.6	12.25	371	32.90
lift 9	9-Sep-15	18-Sep-15	9	1.9	11.2	12.25	261	34.80
lift 10	19-Sep-15	27-Sep-15	8	2.4	10.7	12.25	315	37.20
lift 11	28-Sep-15	6-Oct-15	8	2.4	10.7	12.25	315	39.60
lift 12	7-Oct-15	15-Oct-15	8	2.4	10.7	12.25	315	42.00
lift 13	16-Oct-15	24-Oct-15	8	2.4	10.7	12.25	315	44.36
lift 14	25-Oct-15	2-Nov-15	8	1.1	10.7	12.25	144	45.50
Monolith 5		15-Jun-15						
lift 1	15-Jun-15	24-Jun-15	9	0.4	22.5	11.95	108	16.10
lift 2	25-Jun-15	5-Jul-15	10	2.4	21.1	11.95	605	18.50
lift 3	6-Jul-15	19-Jul-15	13	2.4	19.7	11.95	564	20.90
lift 4	20-Jul-15	31-Jul-15	11	2.4	18.3	11.95	524	23.30
lift 5	1-Aug-15	11-Aug-15	10	2.4	16.9	11.95	484	25.70
lift 6	12-Aug-15	22-Aug-15	10	2.4	15.5	11.95	443	28.10
lift 7	23-Aug-15	1-Sep-15	9	2.4	14.0	11.95	403	30.50
lift 8	2-Sep-15	11-Sep-15	9	2.4	12.6	11.95	362	32.90
lift 9	12-Sep-15	21-Sep-15	9	1.9	11.2	11.95	255	34.80
lift 10	22-Sep-15	30-Sep-15	8	2.4	10.7	11.95	307	37.20
lift 11	1-Oct-15	9-Oct-15	8	2.4	10.7	11.95	307	39.60
lift 12	10-Oct-15	18-Oct-15	8	2.4	10.7	11.95	307	42.00
lift 13	19-Oct-15	27-Oct-15	8	2.4	10.7	11.95	307	44.36
lift 14	28-Oct-15	5-Nov-15	8	1.1	10.7	11.95	141	45.50

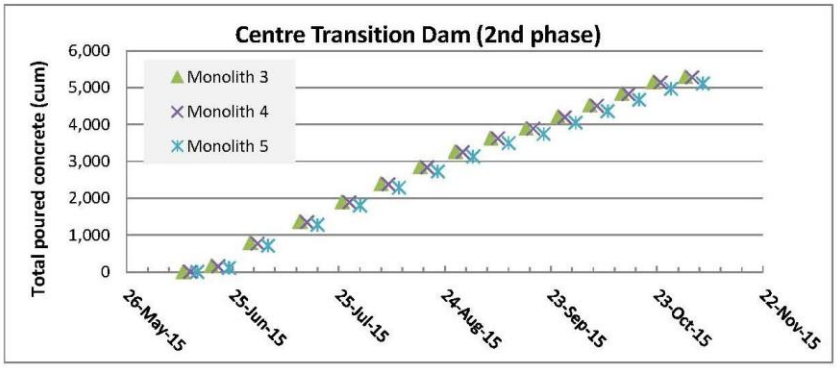

Figure 102: Assumed production incidences for the CENTRE TRANSITION DAM – Phase 2: monoliths 3 to 5

ASTALDI CANADA Inc.

SEPARATION WALL (10.850 cum)								
Concrete works from June 20th to November 4th, 2014			dimensioning data					
			days per pour	high	deep	large	volume	elev.
	Starting Date	Ending Date		m	m	m	m3	m
Monolith 1 (26 m)		20-Jun-14						17.90
lift 1	20-Jun-14	14-Jul-14	24	0.5	7.0	48	168	18.80
lift 2	15-Jul-14	8-Aug-14	24	2.4	6.5	48	749	21.20
lift 3	9-Aug-14	2-Sep-14	24	2.4	6.0	48	691	23.60
lift 4	3-Sep-14	27-Sep-14	24	2.4	5.5	48	634	26.00
Monolith 2 (30m)		15-Jun-14						16.90
lift 1	15-Jun-14	25-Jun-14	10	1.2	11.5	14	193	18.80
lift 2	26-Jun-14	6-Jul-14	10	2.4	10.9	14	366	21.20
lift 3	7-Jul-14	17-Jul-14	10	2.4	10.3	14	346	23.60
lift 4	18-Jul-14	28-Jul-14	10	2.4	9.7	14	326	26.00
lift 5	29-Jul-14	8-Aug-14	10	2.4	9.1	14	306	28.40
lift 6	9-Aug-14	19-Aug-14	10	2.4	8.5	14	286	30.80
lift 7	20-Aug-14	30-Aug-14	10	2.4	7.9	14	265	33.20
lift 8	31-Aug-14	10-Sep-14	10	1.8	7.0	14	176	35.00
Monolith 3 (40)		1-Jun-14						14.90
lift 1	1-Jun-14	11-Jun-14	10	1	12.4	33	409	16.40
lift 2	12-Jun-14	28-Jun-14	16	2.4	11.5	33	911	18.80
lift 3	29-Jun-14	15-Jul-14	16	2.4	10.6	33	840	21.20
lift 4	16-Jul-14	1-Aug-14	16	2.4	9.7	33	768	23.60
lift 5	2-Aug-14	16-Aug-14	14	2.4	8.8	33	697	26.00
lift 6	17-Aug-14	31-Aug-14	14	2.4	7.9	33	626	28.40
lift 7	1-Sep-14	15-Sep-14	14	2.4	7.0	33	554	30.80
lift 8	16-Sep-14	28-Sep-14	12	2.4	6.1	33	483	33.20
lift 9	29-Sep-14	11-Oct-14	12	2.4	5.2	33	412	35.60
lift 10	12-Oct-14	24-Oct-14	12	2.4	4.6	33	364	38.00
lift 11	25-Oct-14	4-Nov-14	10	2	7.0	33	462	40.00

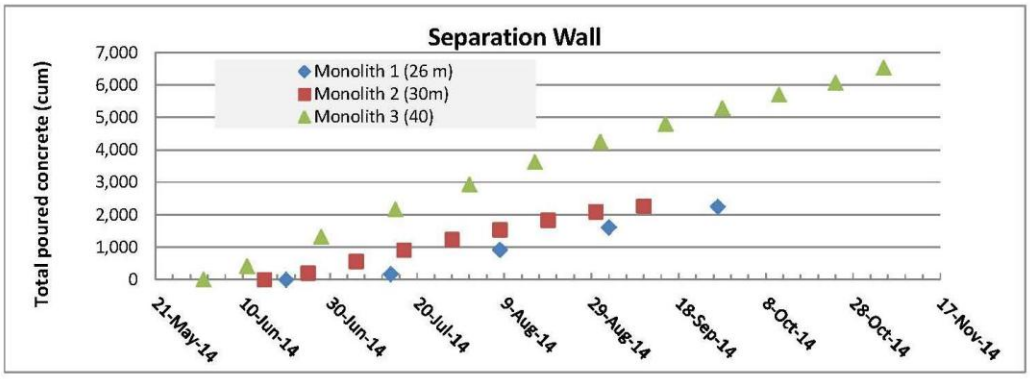

Figure 103: Assumed production incidences for the SEPARATION WALL

E.4 SOUTH TRANSITION DAM

E.4.1 GENERAL DESCRIPTION

The South Transition Dams (SOUTH TRANSITION DAM) is a relatively small structures with the following dimensions:

- Length = 47 m
- Height = 31 m
- Width at the foundation level = 20 m
- Width at the crest = 7 m

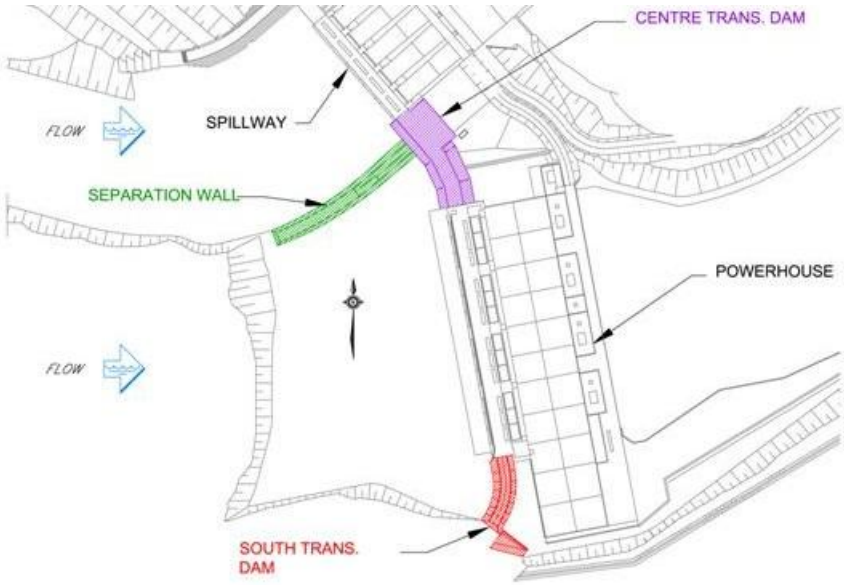

Figure 104: General plan view of the SOUTH TRANSITION DAM

The SOUTH TRANSITION DAM structure has been designed in eleven. (11) lifts with Construction Joints and is formed by three monoliths with a reinforced retaining wall at the south end of the dam.

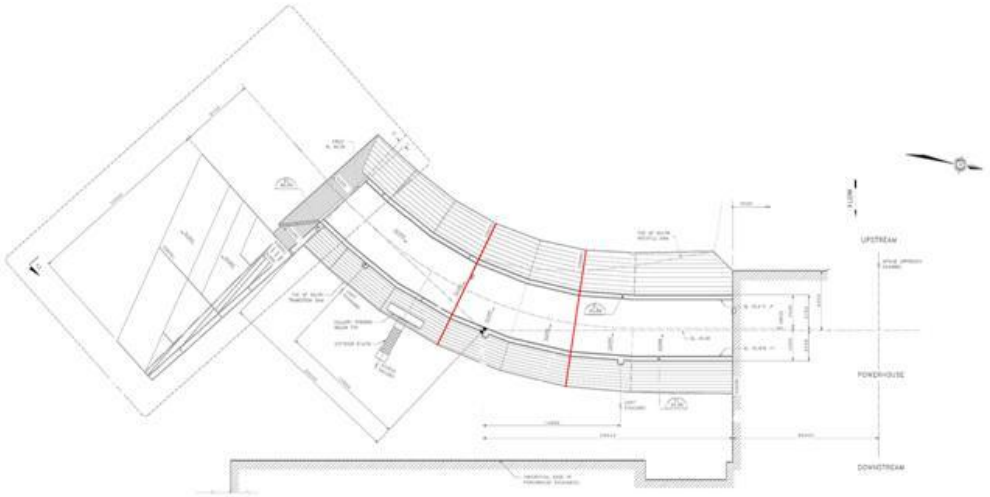

Figure 105: Plan view and section of the SOUTH TRANSITION DAM with position of the contraction Joints and the phases of the works.

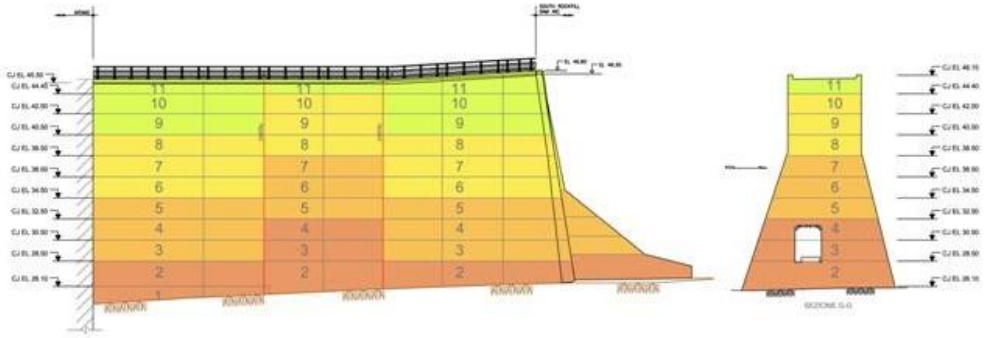

Figure 106: Cross sections of SOUTH TRANSITION DAM with detail of concrete pour levels

Two galleries are located in the lower part of the dam, at an elevation 28.5 m:

- A drainage gallery, about 42 m long and with section of 3 x 2.5 m;
- An access gallery to be used as access with length of about 6 m and a section of 3 x 3.5 m.

As mentioned above for the CENTRE TRANSITION DAM and with respect to the forming of the drainage gallery, prefabricated concrete panels and pre-dalle type slabs will be adopted for forming and pouring of the roof.

For the reinforced retaining wall at the south end of the SOUTH TRANSITION DAM, wooden formworks will be adopted. The formworks will be type Peri or similar or alternatively assembled on site. For concreting of the wall 23 lifts, of 0.9 m each as average, are foreseen.

E.4.2 FORECASTED SCHEDULE AND MILESTONES

A synthesis of the relevant dates for the execution of the SOUTH TRANSITION DAM is reported in the following table.

South Transition Dam		
Description (main activities)	**Start**	**Finish**
Preliminary and Foundation Works	24 Apr 15	10 Sep 15
Elevation Works	12 May 15	5 Sep 15
Other Works	17 Jul 15	17 Oct 15

Special care will be paid to the coordination for the connection area between the SOUTH TRANSITION DAM and the PH. Priority will be given to the works on the critical path or that can generate possible negative interferences with the other ongoing activities.

According to the document “Exhibit 9 – Interface and Milestone Schedule” some milestones have to be considered for the construction of the SOUTH TRANSITION DAM, as summarized below.

Milestone Interface No.	Description	Date
I1	Spillway Site Ready for Start of Works	11 Nov 2013
I22	All Spillway Hydro-Mechanical Primary Anchors, Delivered to Site by Company Other Contractor (CH0032)	4 Dec 2013
M4	Spillway and Related Works required for Diversion, including: Northern Two Monoliths of Centre Transition Dam including the Platform for Spillway Electrical Building Complete; Completion of Separation Wall; Completion of North Transition Dam.	15 Feb 2015
M55	South Transition Dam Complete	12 Dec 2015

A synthesis of the construction time for the SOUTH TRANSITION DAM with respect to the execution of the CENTRE TRANSITION DAM and of the SEPARATION WALL is presented in the following Figure 107.

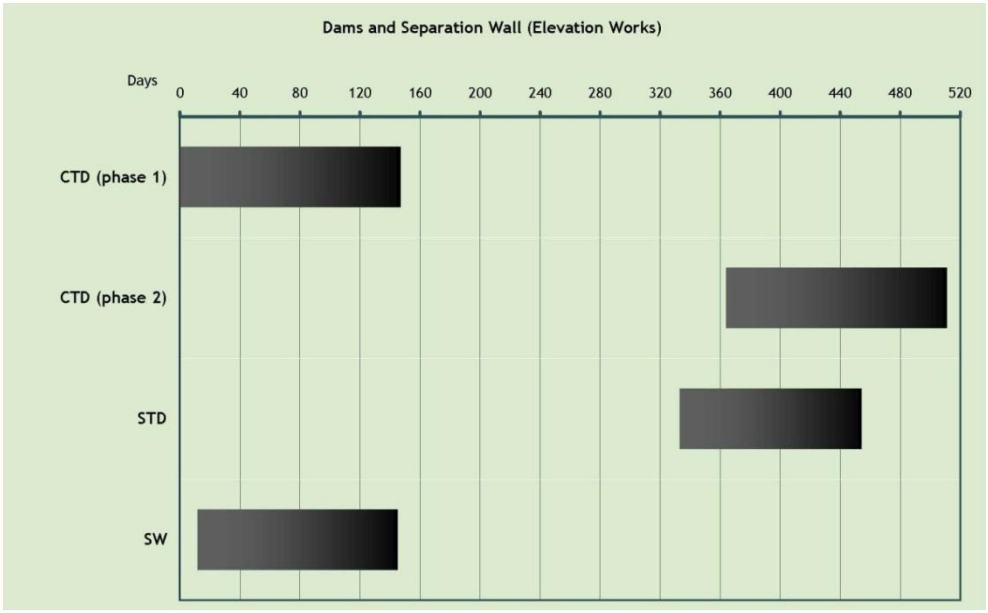

Figure 107: Foreseen construction time of the CENTRE TRANSITION DAM (Phase 1 and Phase 2) with respect to the execution of the Separation Wall and of the South Transition Dam

E.4.3 ACCESS

As shown in the following Figure 108 the construction site of the SOUTH TRANSITION DAM will be accessible by the construction road to the southern side of the Powerhouse and Intake complex

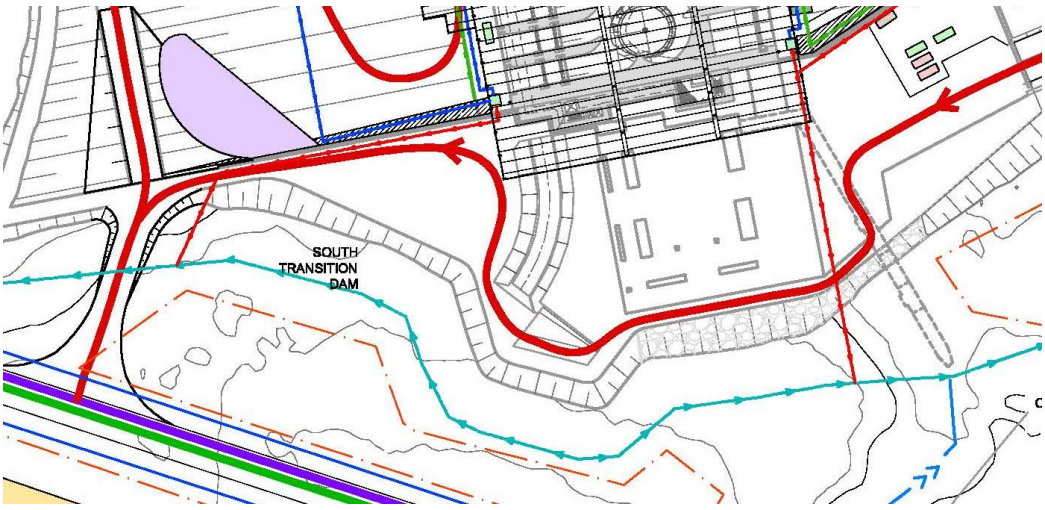

Figure 108: Plan view of the working sites of the SOUTH TRANSITION DAM with indication of access roads

A detailed program concerning the usage of access roads to avoid interferences of activities at different working sites, will be submitted before commencement of the works.

E.4.4 WORK SEQUENCES

The foreseen sequence of activities is listed in the following. For a detailed description of the methods for the single activities, please refer to Section D and previous chapters in Section E of the present document.

1) Preliminary activities and foundations
   - Removal of the sand layer placed as protection during the winter
   - Cleaning of rock foundation with pressure gun using water and air and manual trimming of the excavated surfaces
   - Dental concrete
   - Lean concrete
2) Elevation works
   - Placement of formwork and waterstop
   - Assembling and placement of reinforcement
   - Placement of items in the formwork treating to prevent concrete from adhering
   - Topographical survey
   - Moistening before placement of concrete
   - Placement of concrete
   - Vibrating of pour
   - Curing of concrete before form stripping
   - Concrete consolidation
   - Removal and cleaning of formwork
   - Preparation of horizontal surfaces
   - Curing and finishing. A particular item concerning the SOUTH TRANSITION DAM is related to the application of bitumen coating of the joints. About 680 sqm of

surface to be treated is foreseen.

- Extension of formwork
- Drilling and grouting (from drainage gallery)

E.4.4.1 DRILLING AND GROUTING

In the SOUTH TRANSITION DAM consolidation grouting has to be performed after the placement of structural concrete. Some lined holes will be left in place in the structural concrete, to enable drilling and injection operations to be executed at a later stage.

Holes for grouting are of 65 mm and approximately 20/30 m long for a foreseen total length of 500 m of drilling and a foreseen quantity of cement for grouting corresponding to 18,000 kg.

Drainage holes consist in No. 15 drainage holes, 75 mm in diameter and 15 m in length will be drilled, for a total length of 225 m. All the drainage holes will be closed with PVC caps.

E.4.5 EXPECTED PRODUCTION INCIDENCES

Assumed production incidences for the SOUTH TRANSITION DAM are represented in the following Figure 109. For each lift the following information is reported:

- Starting and completion date;
- Duration of the pour;
- General dimensions of the lift (height, depth and width, volume, elevation).

The scatter diagram allows to better show the pattern of the production activity.

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SOUTH TRANSITION DAM (9,700 cum)								
Concrete works from May 7th to August 31th, 2015			dimensioning data					
			days per pour	high	deep	large	volume	elev.
	Starting Date	Ending Date		m	m	m	m3	m
Monolith 1		7-May-15						25.30
lift 1	7-May-15	15-May-15	8	0.8	15.0	17.37	208	26.10
lift 2	16-May-15	26-May-15	10	2.4	14.1	17.37	589	28.50
lift 3	27-May-15	8-Jun-15	12	2	13.3	17.37	460	30.50
lift 4	9-Jun-15	21-Jun-15	12	2	12.4	17.37	430	32.50
lift 5	22-Jun-15	1-Jul-15	9	2	11.5	17.37	400	34.50
lift 6	2-Jul-15	11-Jul-15	9	2	10.6	17.37	369	36.50
lift 7	12-Jul-15	21-Jul-15	9	2	9.8	17.37	339	38.50
lift 8	22-Jul-15	31-Jul-15	9	2	8.9	17.37	308	40.50
lift 9	1-Aug-15	10-Aug-15	9	2	8.0	17.37	278	42.50
lift 10	11-Aug-15	20-Aug-15	9	1.9	7.0	17.37	231	44.40
lift 11	21-Aug-15	30-Aug-15	9	1.1	7.0	17.37	134	45.50
Monolith 2		1-May-15						
lift 1	1-May-15	8-May-15	7	1.29	15.0	13.43	260	28.50
lift 2	9-May-15	19-May-15	10	2	14.1	13.43	379	30.50
lift 3	20-May-15	1-Jun-15	12	2	13.3	13.43	356	32.50
lift 4	2-Jun-15	14-Jun-15	12	2	12.4	13.43	332	34.50
lift 5	15-Jun-15	24-Jun-15	9	2	11.5	13.43	309	36.50
lift 6	25-Jun-15	4-Jul-15	9	2	10.6	13.43	285	38.50
lift 7	5-Jul-15	14-Jul-15	9	2	9.8	13.43	262	40.50
lift 8	15-Jul-15	24-Jul-15	9	2	8.9	13.43	238	42.50
lift 9	25-Jul-15	3-Aug-15	9	1.9	8.0	13.43	204	44.40
lift 10	4-Aug-15	13-Aug-15	9	1.1	7.0	13.43	103	45.50
Monolith 3		15-May-15						
lift 1	15-May-15	27-May-15	12	1.14	15.0	16.71	286	28.50
lift 2	28-May-15	9-Jun-15	12	2	14.1	16.71	472	30.50
lift 3	10-Jun-15	22-Jun-15	12	2	13.3	16.71	443	32.50
lift 4	23-Jun-15	2-Jul-15	9	2	12.4	16.71	414	34.50
lift 5	3-Jul-15	12-Jul-15	9	2	11.5	16.71	384	36.50
lift 6	13-Jul-15	22-Jul-15	9	2	10.6	16.71	355	38.50
lift 7	23-Jul-15	1-Aug-15	9	2	9.8	16.71	326	40.50
lift 8	2-Aug-15	11-Aug-15	9	2	8.9	16.71	297	42.50
lift 9	12-Aug-15	21-Aug-15	9	1.9	8.0	16.71	254	44.40
lift 10	22-Aug-15	31-Aug-15	9	1.1	7.0	16.71	129	45.50

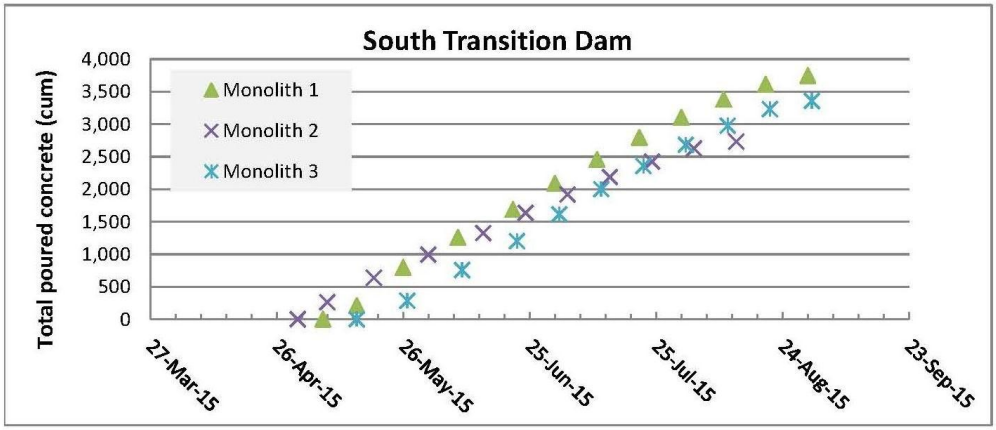

Figure 109: Assumed production incidences for the SOUTH TRANSITION DAM

E.5 INTAKE AND POWERHOUSE

E.5.1 GENERAL DESCRIPTION

The general structure to be built consists of an open air Powerhouse (PH) lodging 4 turbines for a total installed power of 824 MW. The structure has overall dimensions of:

- Length = 142.5 m
- Width = 78.5 m
- Height = 79.6 m

Elevation of the lowest level corresponds to -34.1 m whereas elevation of the top of the structure corresponds to + 45.5 m. General geometry and layout of the Powerhouse structures is illustrated on the following

Figure 110 and Figure 111.

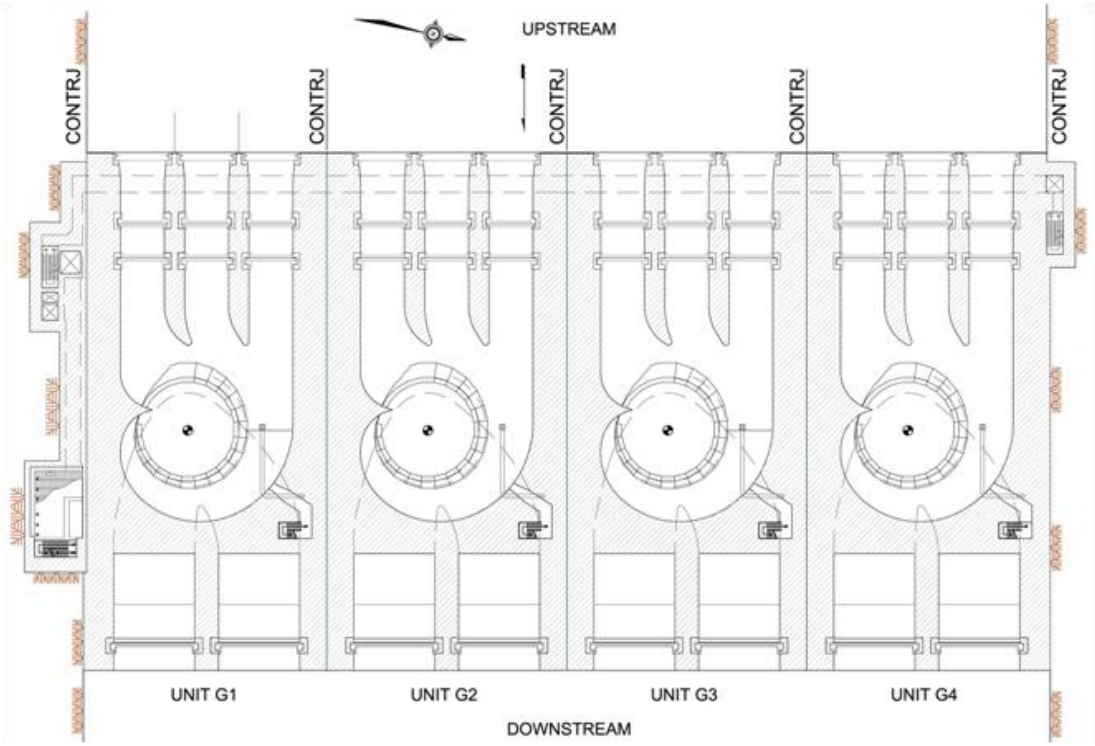

Figure 110: Plan view of the Powerhouse structure

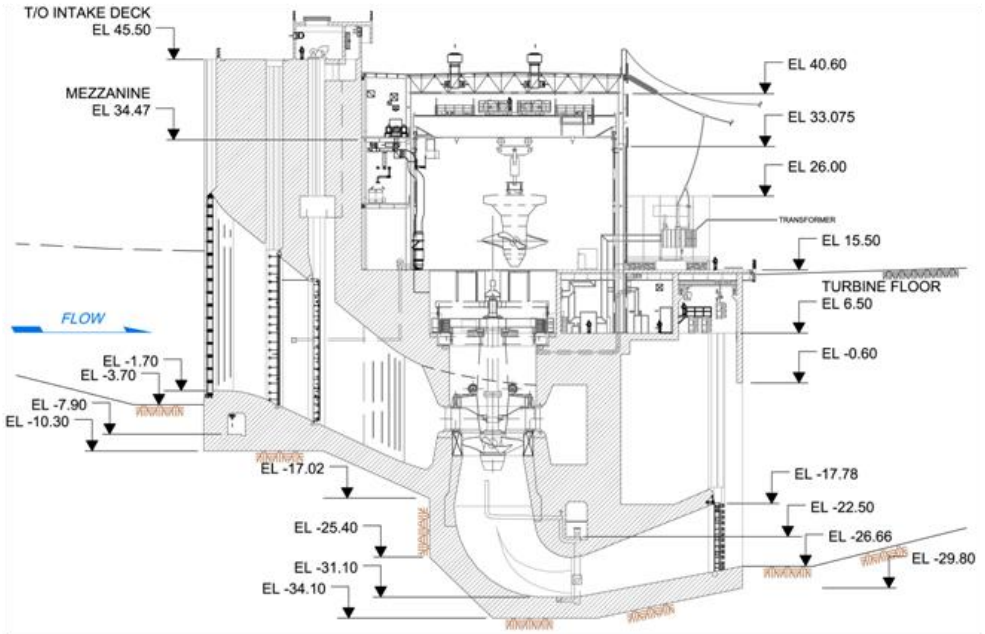

Figure 111: Vertical section of the Powerhouse structure

The overall structure can be divided into three sectors (see also the following Figure 112):

A. The **Turbines** central structure which is completed by an upper steel structure fitted with an overhead crane and part of a draft tube in the lower portion, and a draft tube liner spiral case (to be provided by others) below the rotor;

B. **Draft tube** exits with draft tube gates, on top of the draft tube gallery and transformer bays;

C. **Intake** structure which comprehends:

- trash rack and intake bulkhead gates
- Intake head gates and overhead intake gates hoist building
- gate hoist building
- mezzanine control rooms
- Facilities dewatering gallery.

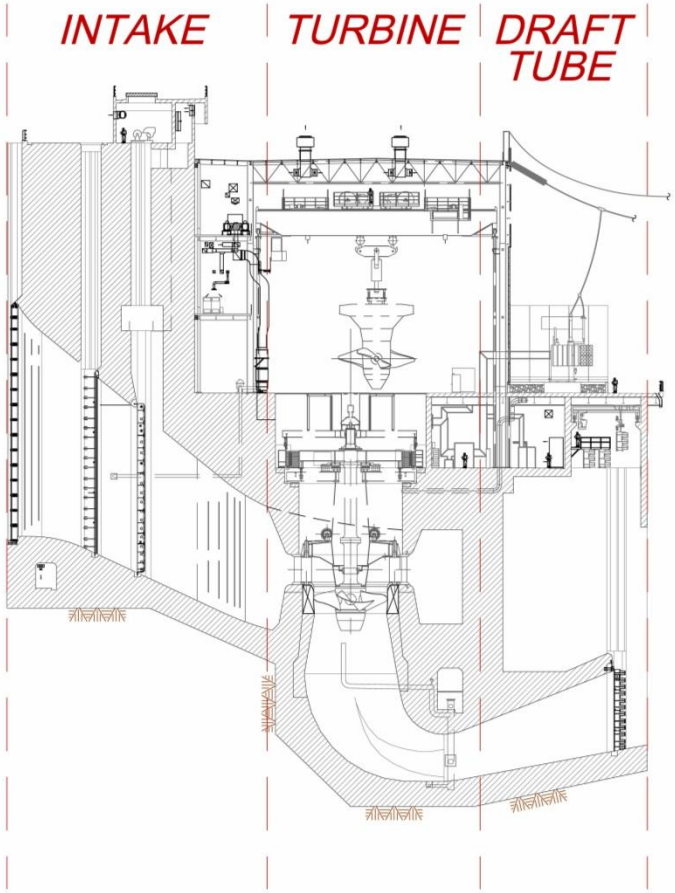

Figure 112: Subdivision of the powerhouse structure: (A) Turbines sector; (B) Draft Tube sector; (C) Intake structure

On the southern end of the PH is located an erection bay with a 46 x 60 m floor slab characterized by a covered portion of 46 x 36 m at the generator floor level (elev. +15.5 m) and a 30 m high structure.

A second bay is located on the northern end of the structure with dimensions corresponding to 78.5 x 17 m; this second bay will be finally occupied by services. These two areas will be used during the construction period to position heavy construction equipments such as cranes, concrete pumps etc.

E.5.2 FORECASTED SCHEDULE AND MILESTONES

Foreseen beginning of construction activities at the PH complex will correspond to the end of winter 2014. The start dates, for units from 1 to 4 and for the south and north service bays, will have a delay of roughly one month.

A synthesis of relevant dates for the execution of the intake and Powerhouse is reported in the following tables.

Intake		
Description (main activities)	**Start**	**Finish**
Unit 1		
Preliminary and Foundation Works	2 Apr 14	7 Oct 2014
Elevation Works	11 May 14	17 Sep 2015
Other Works	11 May 14	17 Sep 2015
Unit 2		
Preliminary and Foundation Works	4 Jun 14	11 Dec 2014
Elevation Works	6 Jul 14	10 Nov 2015
Other Works	6 Jul 14	10 Nov 2015
Unit 3		
Preliminary and Foundation Works	6 Jul 14	3 Mar 2015
Elevation Works	11 Aug 14	5 Jan 2016
Other Works	11 Aug 14	5 Jan 2016
Unit 4		
Preliminary and Foundation Works	5 Aug 14	6 May 2015
Elevation Works	16 Sep 14	18 Aug 2016
Other Works	16 Sep 14	18 Aug 2016

Powerhouse		
Description (main activities)	**Start**	**Finish**
South Service Bay		
Preliminary and Foundation Works	2 Apr 14	30 Sep 2014
Elevation Works	4 Jun 14	9 Nov 2014
Other Works	20 Sep 14	18 Apr 2015
North Service Bay		
Preliminary and Foundation Works	19 Jul 15	28 Sep 2015
Elevation Works	9 Aug 15	21 Nov 2015
Other Works	22 Nov 15	18 Mar 2016
Unit 1		
Preliminary and Foundation Works	28 Feb 14	10 Nov 2014
Elevation Works	10 Mar 14	6 Oct 2016
Draft Tube	10 Mar 14	15 Aug 2015
Turbine (phase 1)	13 Mar 14	25 Jun 2015
Turbine (phase 2)	24 Apr 16	6 Oct 2016
Other Works	2 Aug 14	18 Nov 2016
Unit 2		
Preliminary and Foundation Works	8 Apr 14	3 May 2014
Elevation Works	20 Apr 14	16 Nov 2016

Draft Tube	20 Apr 14	23 Sep 2015
Turbine (phase 1)	3 Jun 14	13 Sep 2015
Turbine (phase 2)	31 May 16	16 Nov 2016
Other Works	21 Oct 14	4 Jan 2017
Unit 3		
Preliminary and Foundation Works	7 May 14	1 Jun 2014
Elevation Works	20 May 14	13 Jan 2017
Draft Tube	20 May 14	22 Oct 2015
Turbine (phase 1)	25 Jun 14	4 Oct 2015
Turbine (phase 2)	7 Jul 16	13 Jan 2017
Other Works	12 Nov 14	28 Feb 2017
Unit 4		
Preliminary and Foundation Works	7 Jun 14	13 Mar 2015
Elevation Works	19 Jun 14	17 Feb 2017
Draft Tube	19 Jun 14	24 Nov 2015
Turbine (phase 1)	15 Jul 14	24 Oct 2015
Turbine (phase 2)	15 Aug 16	17 Feb 2017
Other Works	8 Dec 14	12 Apr 2017

The construction schedule of the Powerhouse complex has been defined in order to respect the correspondent Interface and Milestones schedule, in compliance with the document “Exhibit 9 – Interface and Milestone Schedule”, reported in the following table:

Milestone Interface No.	Description	Date
General		
M1	Contract Award	31 Jul 2013
I7	Powerhouse Site Ready for Start of Works	4 Nov 2013
M2	Substantial Completion of the Work	30 Jun 2018
I16	Draft Tube Hydro-Mechanical, Primary Anchors, Delivered to Site by Company Other Contractor (CH0032)	29 Mar 2014
I17	Turbine & Generator (All 4 Units), Primary Anchors, Delivered to Site by Company Other Contractor (CH0030)	29 Mar 2014
I21	Intake – Hydro-Mechanical Primary Anchors, Delivered to Site by Company Other Contractor (CH0032) and Available	15 Mar 2014
Service Bay Draft Tube Gallery		
M18	South Service Bay Enclosed and High Bay Lighting Installed and Ready for Start of Work by Company Other Contractors. This includes: South Service Bay Mezzanines, Ready for Start of Work by Company other Contractors. South Service Bay Structural Steel Ready for Setting Powerhouse Crane on Rails. Service Bay Draft Tube Gallery, Ready for Installation of Gantry Crane by Company Other Contractor (CH0032).	30 Apr 2015

Unit 1		
M24	Unit 1 – Generator Floor Completed, including Pit Free for Unit 1	30 Nov 2016
M28	Unit 1 – Intake Structure Complete and Ready for start of hydro-mechanical works by Company Other Contractor (CH0032)	31 Mar 2016
Unit 2		
M32	Unit 2 – Generator Floor Completed, including Pit Free for Unit 2	11 Jan 2017
M36	Unit 2 – Intake Structure Complete and Ready for start of hydro-mechanical works by Company Other Contractor (CH0032)	29 Jun 2016
Unit 3		
M40	Unit 3 – Generator Floor Completed, including Pit Free for Unit 3	5 Mar 2017
M44	Unit 3 – Intake Structure Complete and Ready for start of hydro-mechanical works by Company Other Contractor (CH0032)	27 Sep 2016
Unit 4		
M48	Unit 4 – Generator Floor Completed, including Pit Free for Unit 4	27 Apr 2017
M52	Unit 4 – Intake Structure Complete and Ready for start of hydro-mechanical works by Company Other Contractor (CH0032)	23 Dec 2016

E.5.3 MOBILIZATION AND LOCAL SITE ORGANIZATION

The Powerhouse complex represents the southernmost structure to be executed for the Muskrat Projects, as represented by the following Figure 113.

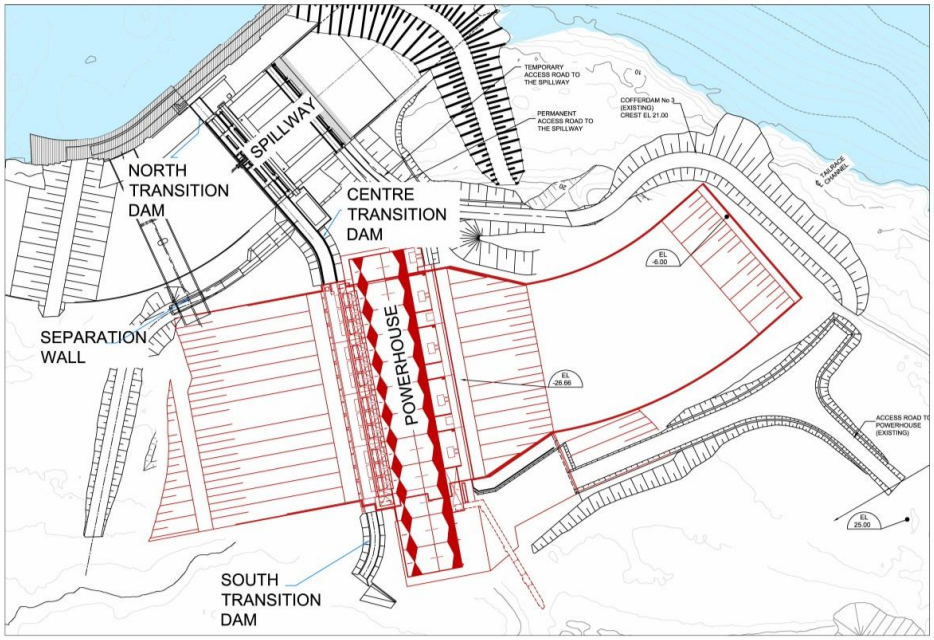

Figure 113: Plan view of the site area and relative position of the PH complex with respect to the other structures.

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E.5.3.1 ACCESS

Main access to the PH area will be by the construction road on the southern side of the site. From the main construction road, three main diversions are foreseen, as illustrated in the following

Figure 114:

- On the western side, for accessing the downstream sector of the Powerhouse;
- On the eastern side in order to provide access to the upstream sector (intake side) of the Powerhouse.

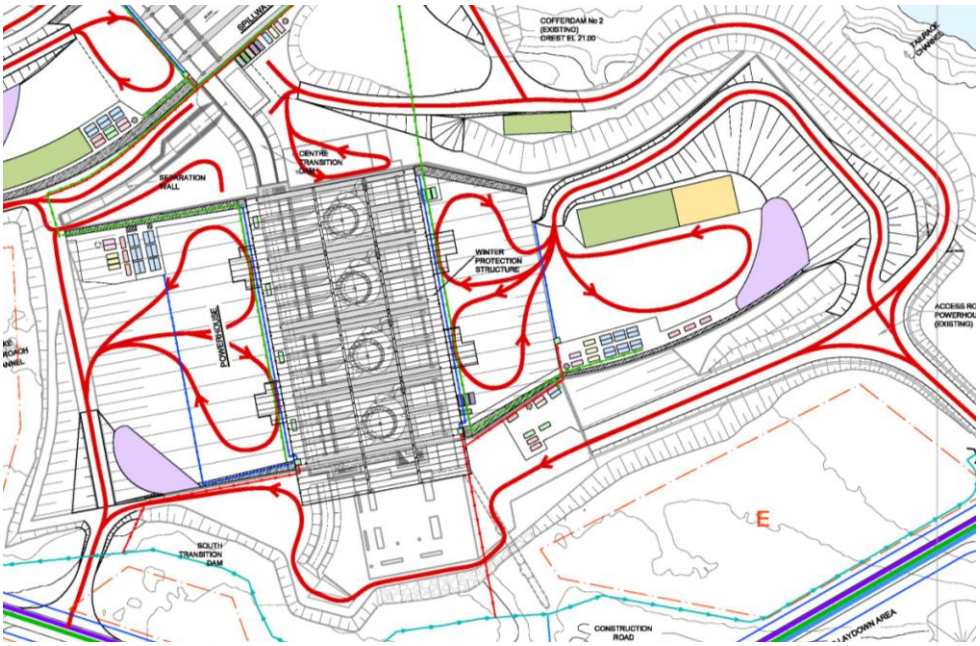

Figure 114: Construction site of the PH complex and access possibilities to the different sectors of the Powerhouse

With the proceedings of the works, the service areas and related access roads may need to be adapted to the construction stages of other structures (e.g. SOUTH TRANSITION DAM and CENTRE TRANSITION DAM) which may pose some interference with the activities in the PH area. A detailed program concerning the usage of access roads to avoid interferences of activities at different working sites, will be submitted before commencement of the works.

E.5.3.2 LIFTING DEVICES

The construction works of the Powerhouse complex will be completely performed under an overhead structure and the adopted solution for the lifting of the equipment has to take into account such condition. The following equipment will be used as lifting devices:

- N. 24 overhead travelled cranes, with a capacity of 5 tons each. The cranes will operate under the cover structure and will be used for lifting of steel reinforcement and of formworks. 8 cranes will be adopted for each of the sectors of the Powerhouse, i.e. intake, turbines and draft tube, as illustrated in the following Figure. The overhead travelled cranes operating in the intake sector will have a span of 33 m whereas those for the turbines and draft tubes sectors will have a span of 26.5 m;

- N. 1 overhead crane with capacity of 250 tons which will be used for installation of the draft tubes. This overhead crane will be assembled after the assembling of the steel structure.

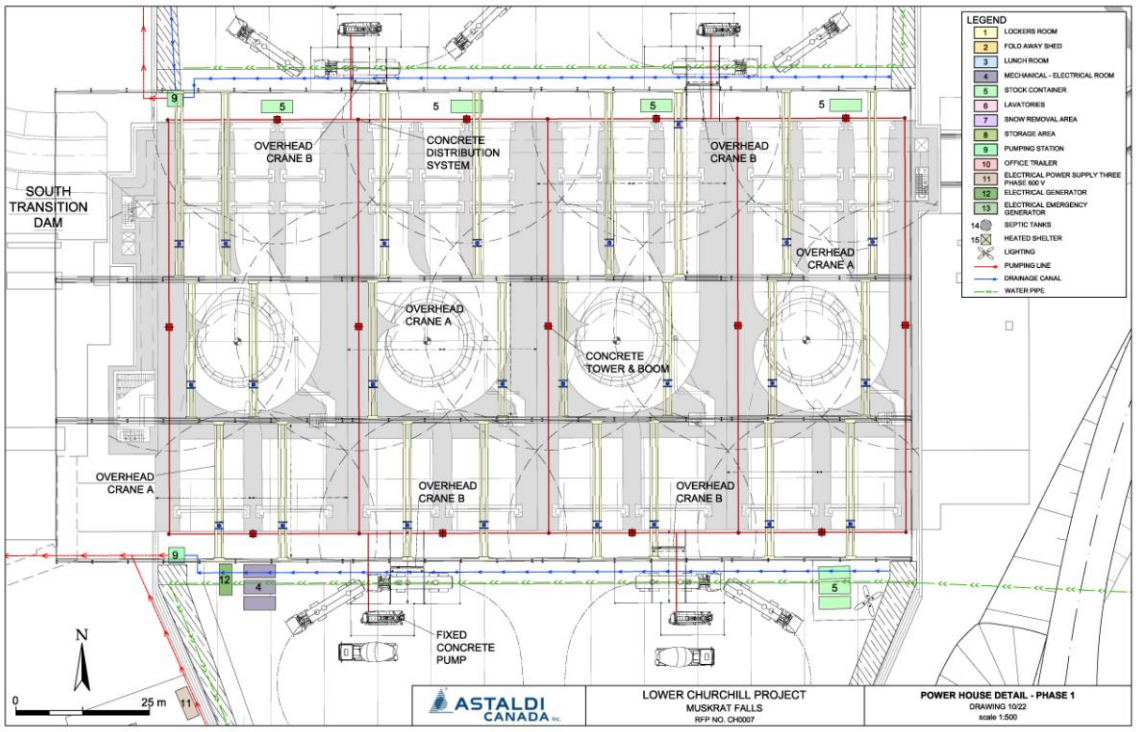

Figure 115: Plan view of the PH structure with definition of the lifting solution adopted for the construction of the PH complex with 24 overhead gantry cranes operating under the cover structure (from the left to the right; intake, turbines and draft tube section

Mobile cranes with capacity of 70 to 200 tons will be used during initial phases of the works for assembling and erection of the temporary steel cover structure.

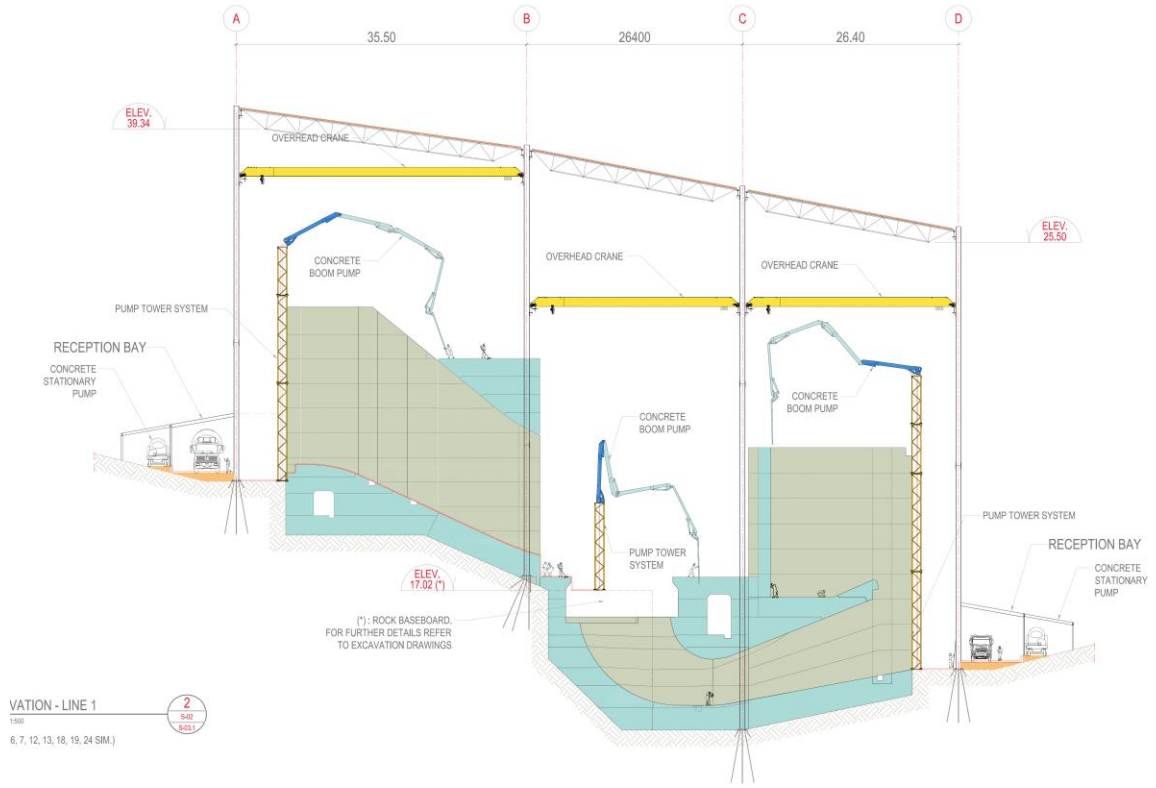

Figure 116: view of the overhead cranes and of the concrete towers with 24 meters log booms. The reception bays are represented on both sides of powerhouse.

Prefabricated walkways and climbing stair frames will be installed inside the working area and moved during the execution of the different activities.

E.5.3.3 MACHINERY AND EQUIPMENT

Cleaning of the overbreak areas and removal of sand will be performed by mean of excavators and wheel loaders and / or bobcat type equipment. Transports of material to the disposal areas will be done by Dumper Trucks type Mack GU813E 2013 or similar of 20 tons of capacity. Water and air cannon, as described in the following, will be adopted for cleaning of surfaces and cracks. Liqua blaster type of equipment is foreseen for joint treatment.

The transportation of all kinds of materials from the stock areas or warehouses to the construction area will be provided by mean of trucks and semi trailers, covered during the winter period, whereas for the transportation of the steel reinforcement the use of lowboy trucks with service cranes is foreseen.

The transport of concrete will be done by mean of “All weather/All terrain” LONDON or MACK

concrete truck mixers with 8 m3 of capacity, duly insulated for the winter season. All Truck and equipment will be equipped with the startup winter package.

The placement of the concrete will be executed by mean of concrete towers with booms of 25 m, with foreseen hourly capacity of about 90 m3. As shown in the following Figure 117, 5 concrete towers with booms will be used for the turbine sector, 4 towers and booms will serve for the intake and further four towers and booms will operate in the draft tube sector.

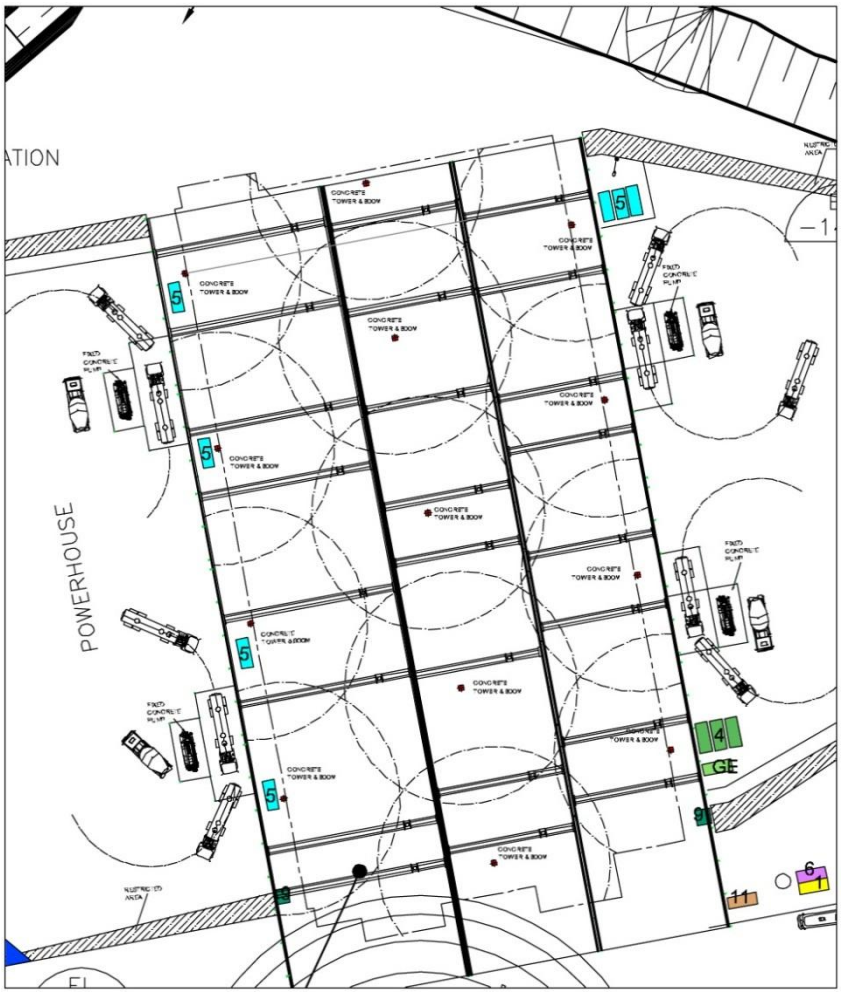

Figure 117: Plan view of the PH structure with position of concrete towers and of the fixed concrete pumps

N. 4 trailer mounted concrete pumps will be located on the eastern and western sides of the Powerhouse structure and will be fed by the concrete truck mixers. 5'' delivery pipes will ensure the supply in all the working areas.

E.5.3.4 FACILITIES AND INFRASTRUCTURES

Facilities and infrastructures in the Powerhouse area will be located in the three main service areas as described below and illustrated in the following picture

The main service area will be located in the southern bay service area. This area will host:

- Lockers
- Lunch room
- Lavatories
- Office trailers
- Mechanical and electrical room
- Stock containers

Additional facilities will be located in the service areas on the eastern and western side of the Powerhouse. These areas will host:

- Lockers
- Lunch room
- Lavatories
- Office trailers
- Stock containers
- Generators

Figure 118: Detailed plan view of the three main service areas around the Powerhouse with indication of installed facilities and infrastructures

Covered areas for parking of concrete pumps, parking of foreseen machinery and all will be required for the execution of the works in the winter conditions.

E.5.4 WINTER PROTECTION STRATEGY

As protection strategy against adverse climatic conditions, the Powerhouse will be completely realized under a cover structure built to insulate the working areas from outdoor climatic conditions, both during the winter and the spring/summer seasons. The structure follows the ideal subdivision of the concrete pouring sequences. Each section is incased in a covering insulated structure system.

Two main steps can be envisaged during the Powerhouse construction and accordingly two different types of cover structures will serve as protection:

1) A temporary steel cover structure, which will be erected at the beginning of the works. This temporary structure will be used for construction of the PH up to the elevation of 15.50 m (generator floor level). The covering structure corresponds to a steel framework structure composed by rising up trusses, steel columns and insulated panels covering the roof as well as the walls. Main elements of the cover structure has been described in the previous chapters and here briefly summarized for the sake of a better understanding:

   - The truss is made of beam roof elements, lattice girders, corrugated steel plate and insulated panels. The whole component should act then as an insulating element separating top part of working area from outside weather conditions;

   - Columns are made by steel sections elements of 5 m high (5.5 yards), using vertical bracing to join the columns together and to prevent buckling phenomenon in the columns. Span between columns should be of 6.74 m (7.4 yards) in order to avoid any interference between column position and contraction joints and to let the structural scheme being modular and easily produced without singularity;

   - Insulated panels creating controlled thermal conditions inside the structure and in the working areas.

E.5.5 PRELIMINARY ACTIVITIES

E.5.5.1 CLEANING OF ROCK FOUNDATION / SLUSH GROUT AND DENTAL CONCRETE

First operation for cleaning of rock foundations corresponds to the removal of the protective

sand layer placed on top of rock by the contractor that has been executing excavation activities. For a detailed description of the methods adopted for such operations please refer to the section describing the execution of the spillway structure.

Upon cleaning and scaling of the rock surfaces, any crack needs to be treated by mean of slush grout and eventually dental concreting. For a description of slush grouting and eventual dental concreting operations please refer to the section concerning the spillway structure.

E.5.5.2 DEWATERING

The water in excess derived from cleaning operations will be transported by gravity or by pumping, into a settlement pit to separate the solids from the clean water eventually pumped away once it has been determined that the water is characterized by minimum solid content and quality requirements indicated in technical specifications.

Small quantities of water remained on the rick surface will be removed by sponges or venturi type sucker pipes until the area is dry.

The same procedure will be adopted after drilling and grouting operations will be completed as well as dental concrete and lean concrete activities.

Final released water will be checked: laboratory tests will be performed to detect possible chemical contaminants and eventually treated in compliance with indications reported in Technical Specifications 311600 part 3.1.6.

E.5.6 FOUNDATION PREPARATIONS

E.5.6.1 LEAN CONCRETE

Although the placement of lean concrete is not foreseen neither in tender drawings nor in the technical specifications, according to the practice, lean concrete is widely used worldwide to place a layer of concrete which may incorporate the over break areas in order to form a nice and clean surface on top of which the steel reinforcement may be placed in a more appropriate way.

The lean concrete will also be useful when cleaning of the different surfaces will be carried out and the dirt accumulated in a suitable area to be eventually removed. If directly made on the raw rock surface, these operations would be more difficult (with a worse result) and time

consuming. A description of lean concrete procedure is presented in the Chapter related to the Spillway structure.

E.5.6.2 DRILLING AND GROUTING

In the Powerhouse, grouting activities are foreseen basically in the northern and southern service bays as well as in some areas which may require contact grouting as reported in the drawings.

Consolidation grouting shall be performed prior of placement of structural concrete. The rock, once excavated and cleaned, shall be protected with lean concrete before these operations are carried out, in order to protect the surface from drilling dust and injection slurries and grouts.

Holes for grouting are of 65 mm and approximately 25 m long for a foreseen total length of drilling of 800 m and will be executed by mean of hydraulic rig such as Atlas D7 or Casagrande C6 or similar equipment, which may ensure a penetration rate up to 50 m/hr.

The foreseen quantity of cement for grouting corresponds to 28,000 kg.

Water pressure tests will be used for final control of rock permeability. One rotary percussion drilled check hole of 25 m and one cored borehole of 25 m will be performed for final verifications of the results.

In the Intake structure consolidation grouting is foreseen after the placement of structural concrete.

Some 4'' diameter lined holes will be left in place in the structural concrete, to enable drilling and injection operations to be performed at a later stage.

The 75 mm grouting percussion drilled holes will be 25 m of length for a total foreseen quantity of 2,000 m of drilling. The amount of dry cement foreseen for grouting operations corresponds to about 70,000 kg. Water pressure tests will be realized for verification of the effectiveness of injection operations. Eventually, rotary percussion and cored boreholes shall be executed as additional testing.

Finally, 50 drainage holes, 75 mm in diameter and 16 m in length, will be drilled for a total length of 800 m and closed with PVC caps.

This activity will be performed from inside the 3 m high drainage gallery and therefore micro-drilling equipment shall be used with short rod extension. 40 uplift pressure gauges and respective thermostat will be installed as directed by the Engineer.

The injection plant will be located outside the gallery, upstream of the intake, in covered, insulated and heated shed. The plant will include mixers, injection pumps and related equipment for control of injection pressure, flows, timing etc.

A detailed method statement will be submitted before commencement of the works, in compliance with technical specifications.

According to the construction sequence of the foundation of the intake and in case of possibilities, drilling operations will be performed without the gallery in place, since this would allows the use of larger equipment and ensure higher drilling rates.

E.5.7 WORK SEQUENCES

As shown below, construction activities in the Powerhouse will proceed according to the following sequence:

- Draft tubes
- Intake
- Turbines

A synthesis of the sequence of activities in the three sectors of the Powerhouse is presented in the Figure 119.

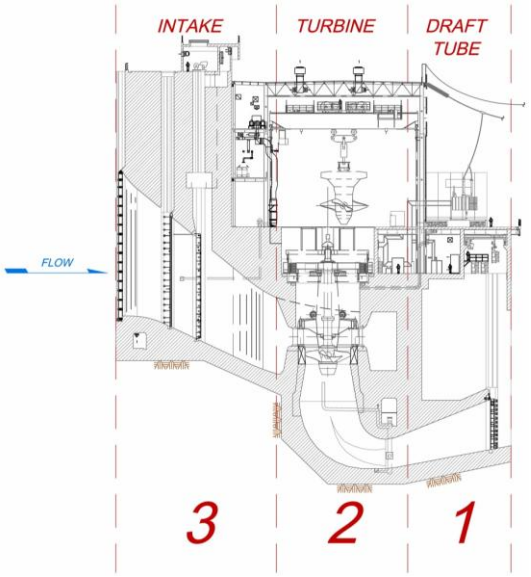

Figure 119: Section of the PH complex with sequence of construction: Draft Tube, Intake and Turbines sectors

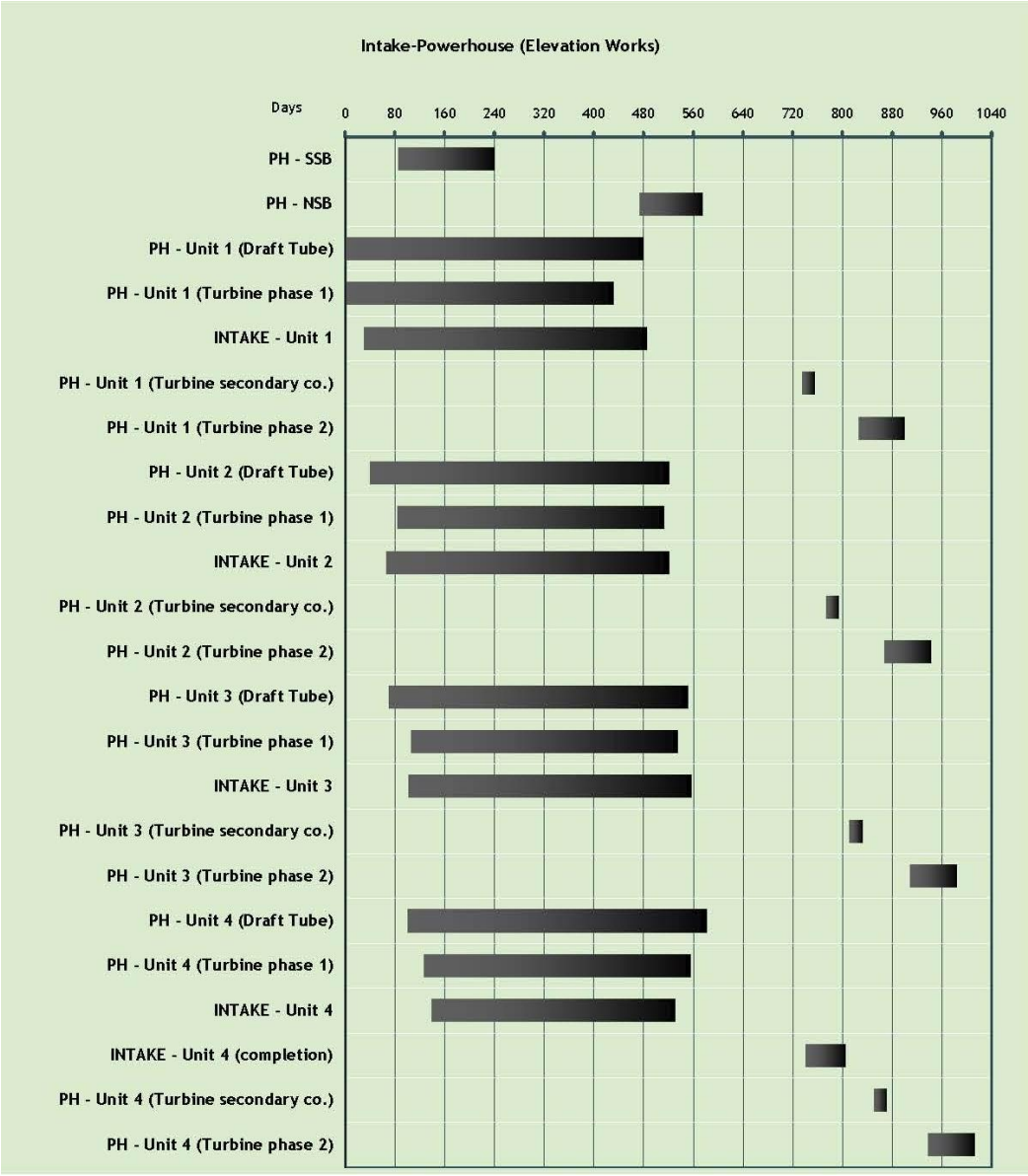

Figure 120: Synthesis of construction sequence for the different units and for the different sectors of the Powerhouse (draft tubes, intake and turbines)

In the following paragraphs the sequence of activities for the single sub-structures will be described in detail.

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E.5.7.1 DRAFT TUBES

Starting elevation for concreting of the draft tubes sector corresponds to -34.10 m whereas the final elevation is comprised between 15.50 and 16.10 m.

The sequence of activities for the Draft Tubes and for each of the four units, comprehends:

- Concrete slab construction
- Construction of walls and roof slab up to elevation -18.10 m and interface with E&M activities
- Construction of lateral walls and roof up to elevation – 8.90 m
- Construction of lateral walls and front walls up to elevation 5.50 / 6.50 m
- Construction of slabs and walls up to elevation 15.50 m
- Fire walls structures

N. 20 lifts are foreseen for the Draft tubes structure with an average lift height of 2.55 m. The sequence of lifts for the Draft Tube sector is illustrated in the following Figure 121.

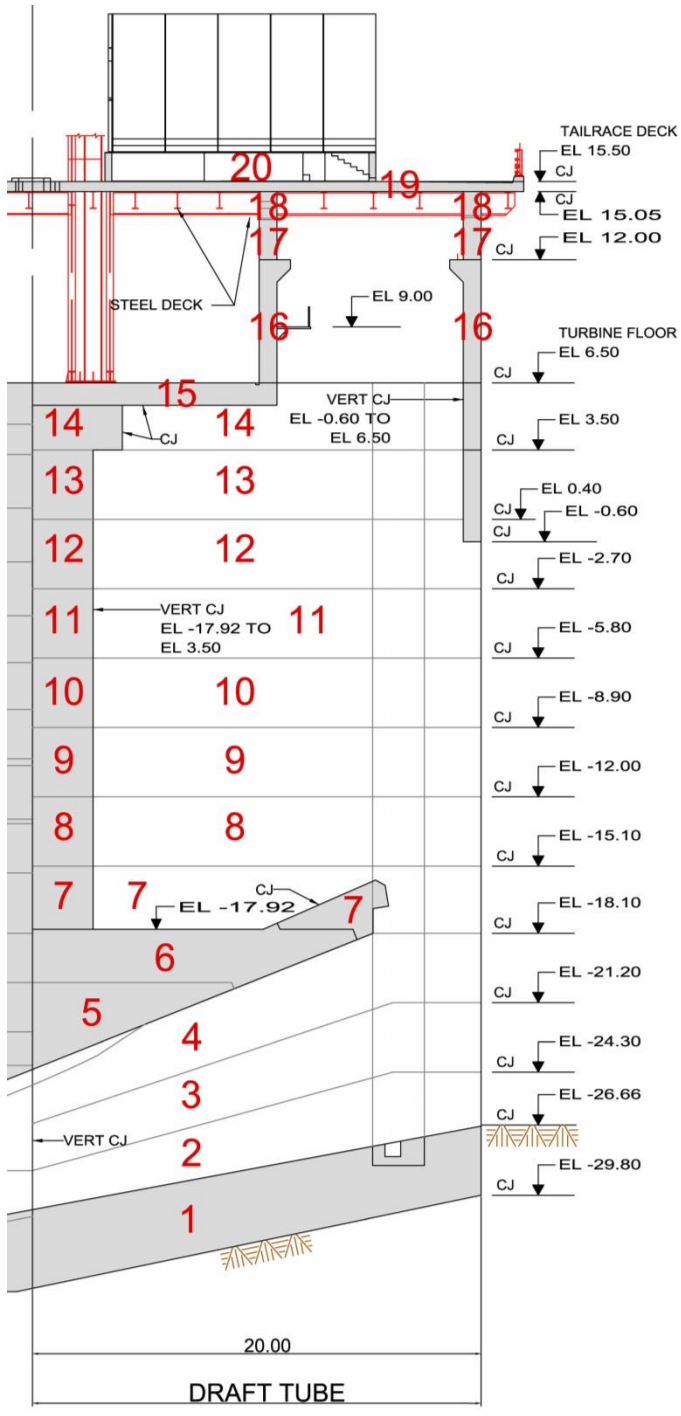

Figure 121: Vertical section of the draft tube sector with indication of the sequence of lifts

A synthesis of the construction times and of the sequence of operations in the four units of the PH is represented in the following diagram.

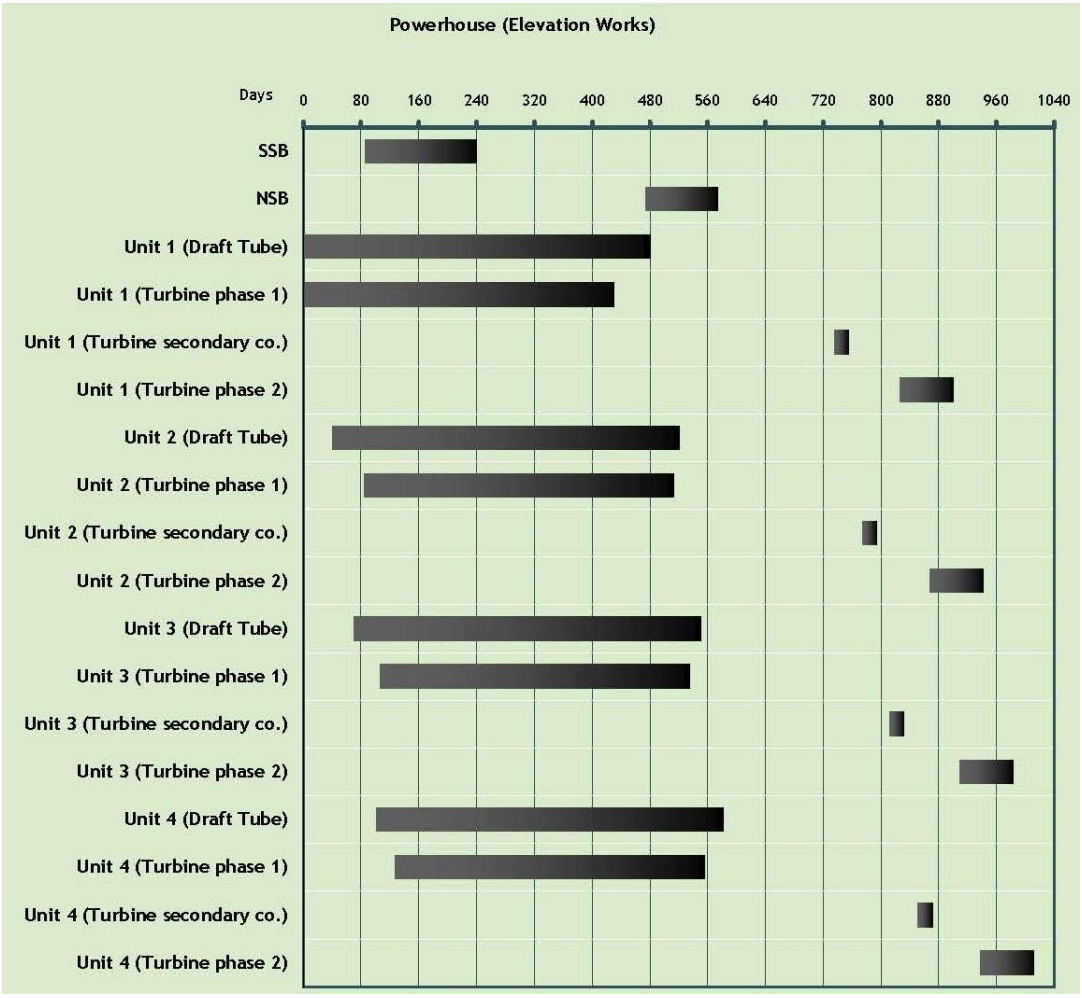

Figure 122: Foreseen construction time for the Powerhouse and sequence of operations in the four units for the draft tubes and turbine sectors

E.5.7.2 INTAKE

Starting elevation in the intake sector corresponds to -10.30 m whereas the final elevation of the structure corresponds to 45.50 m.

The sequence of activities for the Intake and for each of the four units, comprehends:

- Concrete slab construction
- Walls up to elevation 15.50 m (generator floor) and slab construction (zones A, B and C represented in the following Figure 123)

- Construction in Zone D up to elevation -1.70 m
- Walls in Zones E and F up to elevation 14.20 and 26.30, respectively
- Construction in Zone G up to the inspection gallery
- Construction in zones G and H with alternate lifts, up to elevation 45.50

N. 21 lifts are foreseen for the Intake structure with an average lift height of 2.66 m. The sequence of lifts for the intake is illustrated in the following Figure 124.

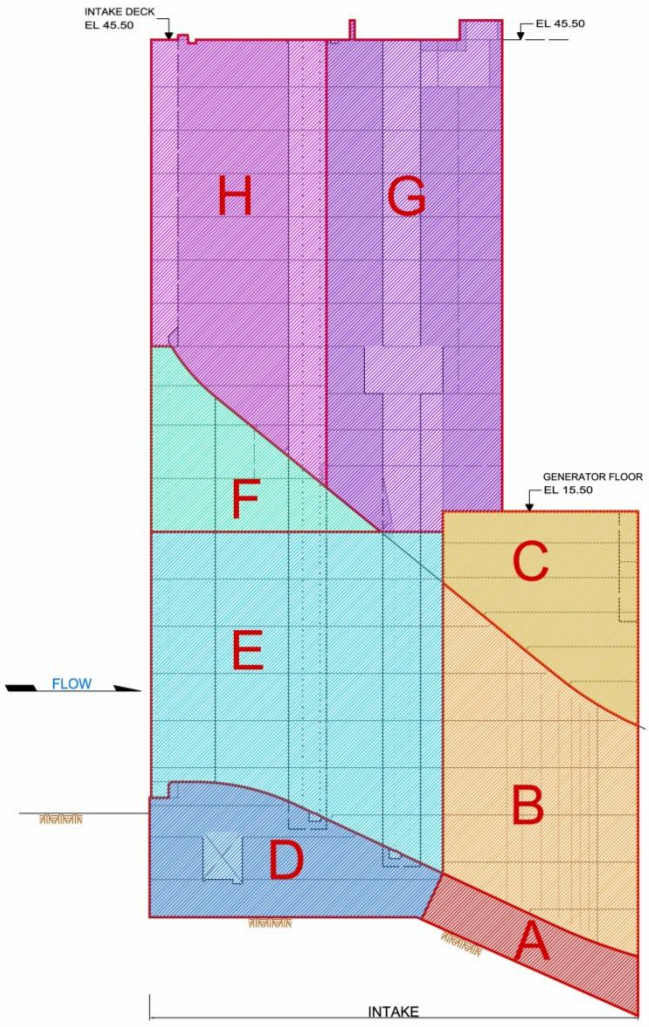

Figure 123: Section of the Intake structure with sequence of concreting works from A to H

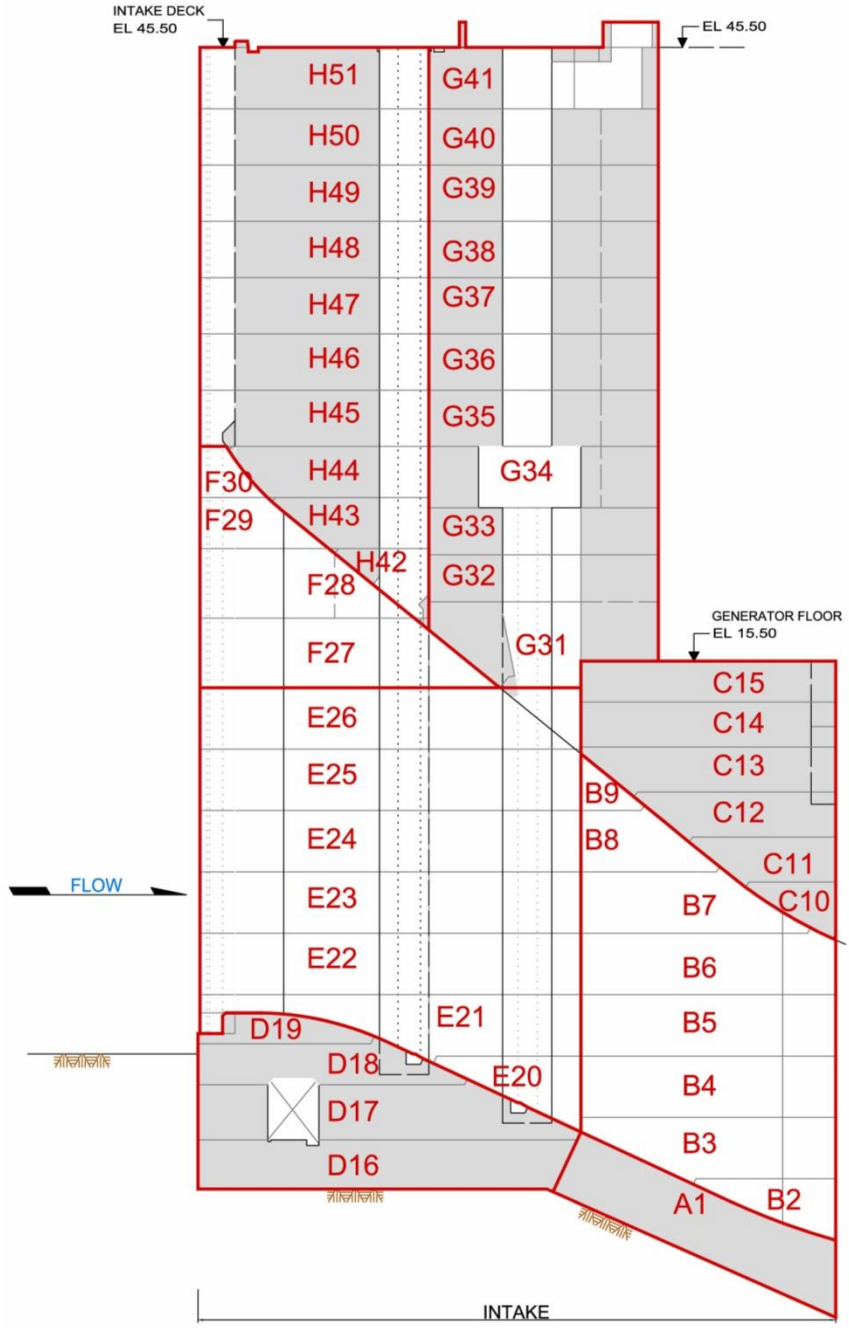

Figure 124: Sequence of foreseen lifts for the Intake and according to the zones from A to H illustrated above.

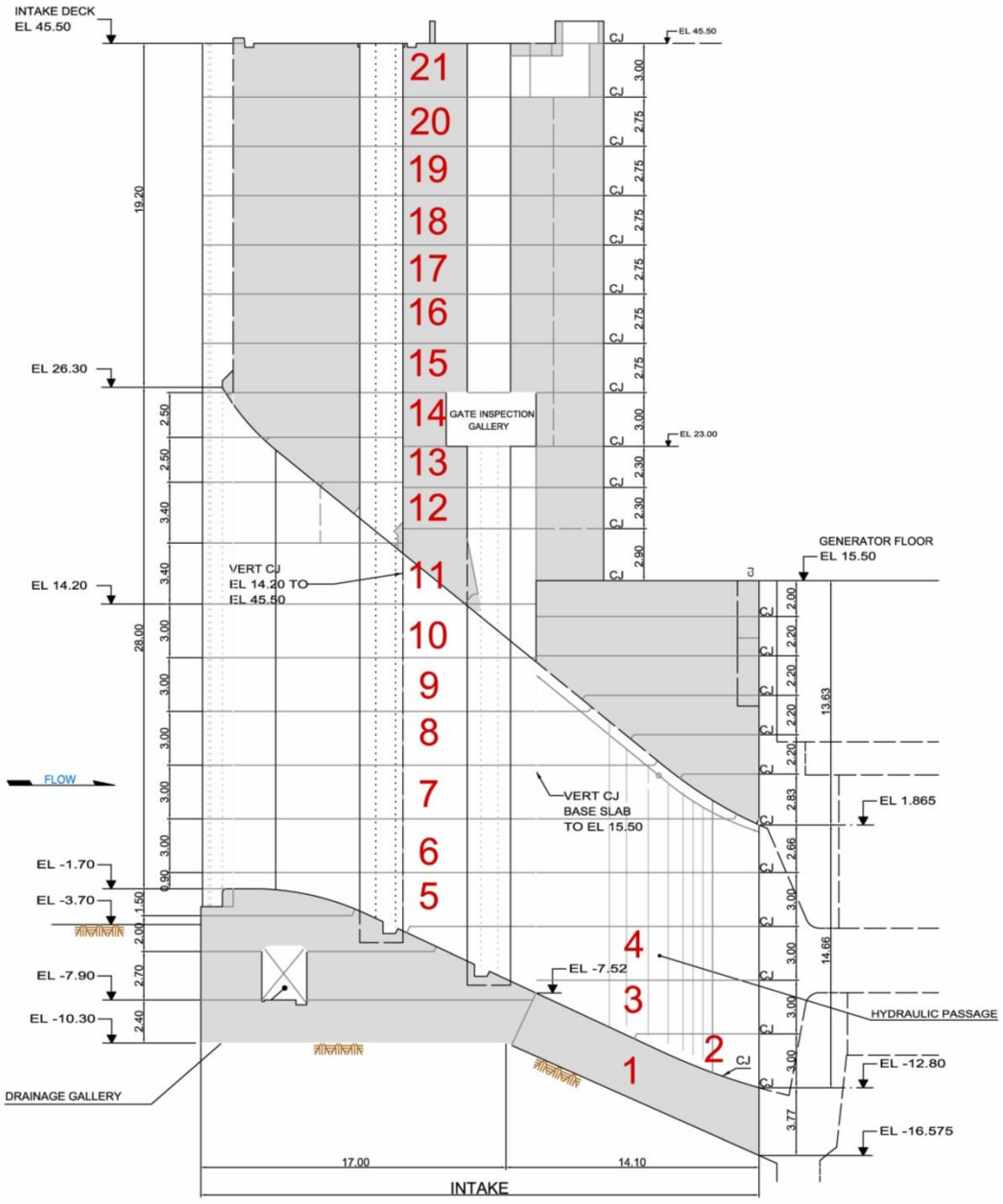

Figure 125: Sequence of foreseen lifts for the Intake and according to the zones from A to H illustrated above.

A synthesis of the construction times and of the sequence of operations in the four units for the Intake sector is represented in the following diagram.

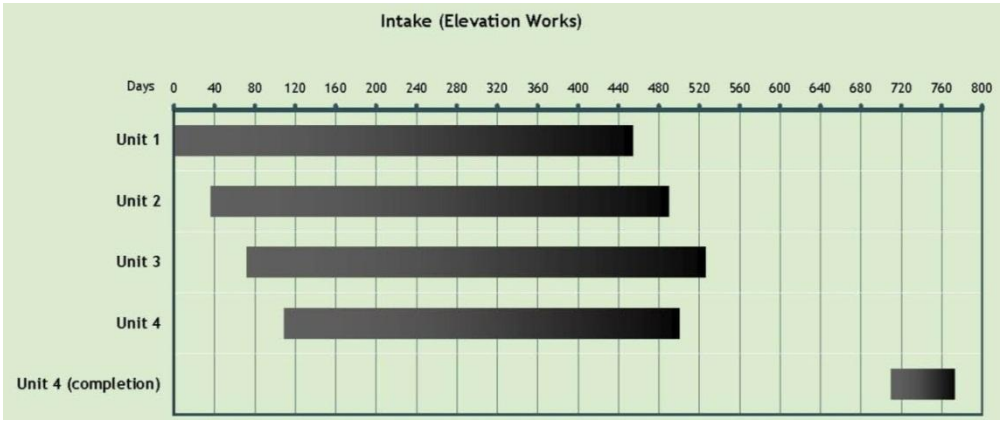

Figure 126: Foreseen construction time and sequence of operations for the four units in the intake sector

E.5.7.3 TURBINES

In the turbines sector the base elevation corresponds to -34.10 m and the top elevation corresponds to 15.50 m. The sequence of activities for the Turbines sector and for each of the four units, comprehends:

- Concrete slab construction
- Elevation up to elevation -11.80 m (for the draft tube cone)
- Interface with E&M activities
- Second phase concreting up to elevation – 0.90 for stay ring and upper pit liner
- Interface with E&M activities
- Construction up to elevation 15.50 m

N. 21 lifts are foreseen for the turbines sector; the sequence of lifts is illustrated in the following Figure 127.

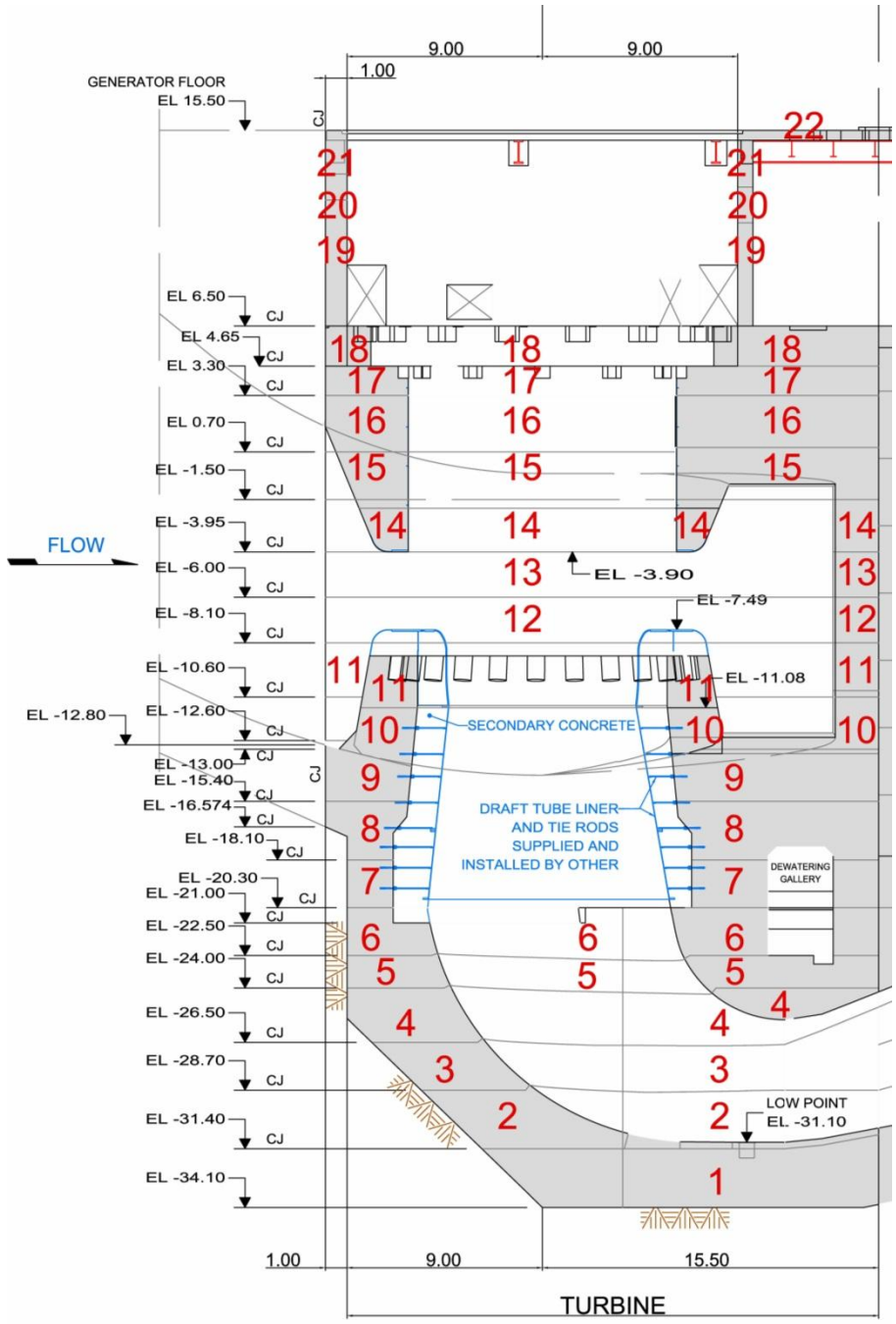

Figure 127: Sections of the turbine sector and sequence of lifts

A detailed description of the following activities:

- Standard form placing
- Special forms placing

- First and second phase forms for slots of electromechanical works
- Steel reinforcement assemblage and transport
- Placement of concrete
- Curing of concrete
- Concrete finishing procedures for unformed surfaces
- Concrete finishing procedures for formed surfaces
- Joint treatment
- Second phase concreting

is presented in other sections of the present document (please refer to section D/4).

E.5.8 EXPECTED PRODUCTION INCIDENCES

Assumed production incidences for the draft tubes, intake and turbines sectors of the Powerhouse are represented in the following Figure 128 to Figure 130. For each lift the following information is reported:

- Starting and completion date;
- Duration of the pour;
- General dimensions of the lift (volume, elevation).

The scatter diagram allows to better show the pattern of the production activity.

Powerhouse DT U1					
Concrete works from March 10th, 2014 to August 15th, 2015			dimensioning data		
			sector days	volume	elev.
	Starting Date	Ending Date		m3	m
1a	10-Mar-14	1-Apr-14	22	1263	-26.66
1b	2-Apr-14	22-Apr-14	21	1263	-26.66
2a	23-Apr-14	30-Apr-14	8	210	-24.3
2b	1-May-14	8-May-14	8	420	-24.3
3a	9-May-14	26-May-14	18	641	-21.2
4a	27-May-14	31-May-14	5	641	-18.1
5a	1-Jun-14	27-Jun-14	27	371	-20.30
5b	28-Jun-14	6-Jul-14	9	371	-20.30
6a	7-Jul-14	15-Jul-14	9	525	-17.92
6b	16-Jul-14	24-Jul-14	9	525	-17.92
7a	25-Jul-14	13-Aug-14	20	291	-15.1
7b	14-Aug-14	2-Sep-14	20	583	-15.1
8a	3-Sep-14	21-Sep-14	20	874	-12
9a	22-Sep-14	11-Oct-14	20	874	-8.90
7c	12-Oct-14	30-Oct-14	20	191	-15.72
10a	31-Oct-14	19-Nov-14	20	874	-5.80
11a	20-Nov-14	9-Dec-14	20	874	-2.70
12a	10-Dec-14	29-Dec-14	20	874	0.4
13a	30-Dec-14	18-Jan-15	20	874	3.5
13b	19-Jan-15	26-Jan-15	8	63	3.5
13c	27-Jan-15	3-Feb-15	8	65	3.5
14a	4-Feb-15	23-Feb-15	20	763	6.5
14b	24-Feb-15	8-Mar-15	13	197	6.5
15a	9-Mar-15	16-Mar-15	8	82	6.5
15b	17-Mar-15	24-Mar-15	8	82	6.5
16a	25-Mar-15	9-Apr-15	16	191	12
16b	10-Apr-15	25-Apr-15	16	191	12
17a	26-Apr-15	8-May-15	13	65	13.8
17b	9-May-15	21-May-15	13	65	13.8
18a	22-May-15	31-May-15	10	33	15.05
18b	1-Jun-15	10-Jun-15	10	33	15.05
19a	11-Jun-15	5-Jul-15	25	106	15.5
19b	6-Jul-15	22-Jul-15	17	106	15.5
20a	23-Jul-15	30-Jul-15	8	8	16.8
20b	31-Jul-15	15-Aug-15	16	8	16.8

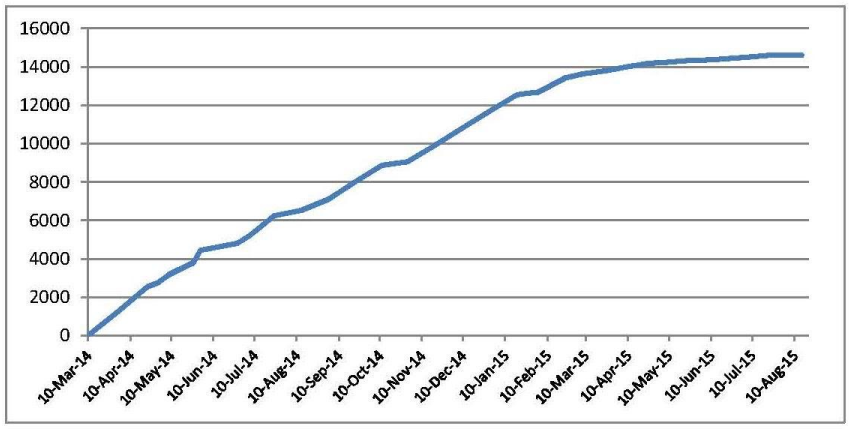

Figure 128: Foreseen production incidences for the draft tube sector. The table reports the incidences for the Unit 1. Same incidences are assumed for Units from 2 to 4

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Intake U1						
Concrete works from April 10th, 2014 to August 17th, 2015			dimensioning data			
			sector days	high	volume	elev.
	Starting Date	Ending Date		m	m3	m
Part A		10-Apr-14				
1a	10-Apr-14	27-Apr-14	17	3.8	840	-7.52
1b	28-Apr-14	15-May-14	17	3.8	840	-7.52
Part B		16-May-14				
2	16-May-14	26-May-14	10	3	145	-9.80
3	27-May-14	8-Jun-14	12	3	437	-6.80
4	9-Jun-14	22-Jun-14	13	3	546	-3.80
5	23-Jun-14	6-Jul-14	13	3	546	-0.80
6	7-Jul-14	20-Jul-14	13	3	546	2.20
7	21-Jul-14	2-Aug-14	12	3	437	5.20
8	3-Aug-14	13-Aug-14	10	3	156	8.20
9	14-Aug-14	24-Aug-14	10	2.8	105	10.97
Part C		25-Aug-14				
10	25-Aug-14	2-Sep-14	8	2.8	396	4.70
11a	3-Sep-14	11-Sep-14	8	2.2	341	6.90
11b	12-Sep-14	18-Sep-14	6	2.2	148	6.90
12a	19-Sep-14	27-Sep-14	8	2.2	404	9.10
12b	28-Sep-14	4-Oct-14	6	2.2	202	9.10
13a	5-Oct-14	14-Oct-14	9	2.2	623	11.30
13b	15-Oct-14	22-Oct-14	7	2.2	293	11.30
14a	23-Oct-14	2-Nov-14	10	2.2	623	13.50
14b	3-Nov-14	10-Nov-14	7	2.2	314	13.50
15a	11-Nov-14	21-Nov-14	10	2	623	15.50
15b	22-Nov-14	30-Nov-14	8	2	315	15.50
Part D		4-May-14				
16a	4-May-14	13-May-14	9	2.4	797	-7.90
16b	14-May-14	23-May-14	9	2.4	797	-7.90
17a	24-May-14	1-Jun-14	8	2.7	695	-5.20
17b	2-Jun-14	10-Jun-14	8	2.7	695	-5.20
18a	11-Jun-14	17-Jun-14	6	2	405	-3.20
18b	18-Jun-14	24-Jun-14	6	2	405	-3.20
19a	25-Jun-14	1-Jul-14	6	1.5	182	-1.70
19b	2-Jul-14	7-Jul-14	5	1.5	182	-1.70

Part E+F		8-Jul-14				
20	8-Jul-14	14-Jul-14	6	3.7	207	-3.80
21	15-Jul-14	24-Jul-14	9	3	532	-0.80
22	25-Jul-14	6-Aug-14	12	3	806	2.20
23	7-Aug-14	19-Aug-14	12	3	806	5.20
24	20-Aug-14	1-Sep-14	12	3	806	8.20
25	2-Sep-14	14-Sep-14	12	3	806	11.20
26	15-Sep-14	27-Sep-14	12	3	806	14.20
27	28-Sep-14	8-Oct-14	10	3.4	545	17.60
28	9-Oct-14	17-Oct-14	8	3.4	359	21.00
29	18-Oct-14	24-Oct-14	6	2.5	178	23.50
30	25-Oct-14	31-Oct-14	6	2.5	65	26.00
Part G		2-Dec-14				
31a	2-Dec-14	16-Dec-14	14	4.2	611	18.40
31b	17-Dec-14	23-Dec-14	6	4.2	191	18.40
32a	24-Dec-14	7-Jan-15	14	2.3	611	20.70
32b	8-Jan-15	14-Jan-15	6	2.3	191	20.70
33a	15-Jan-15	29-Jan-15	14	2.3	611	23.00
33b	30-Jan-15	5-Feb-15	6	2.3	191	23.00
34a	6-Feb-15	20-Feb-15	14	3	611	26.00
34b	21-Feb-15	27-Feb-15	6	3	191	26.00
35a	28-Feb-15	14-Mar-15	14	2.75	682	28.75
35b	15-Mar-15	22-Mar-15	7	2.75	333	28.75
36a	23-Mar-15	6-Apr-15	14	2.75	682	31.50
36b	7-Apr-15	14-Apr-15	7	2.75	333	31.50
37a	15-Apr-15	29-Apr-15	14	2.75	682	34.25
37b	30-Apr-15	7-May-15	7	2.75	333	34.25
38a	8-May-15	22-May-15	14	2.75	682	37.00
38b	23-May-15	30-May-15	7	2.75	12	37.00
39a	31-May-15	14-Jun-15	14	2.75	682	39.75
39b	15-Jun-15	22-Jun-15	7	2.75	333	39.75
40a	23-Jun-15	7-Jul-15	14	2.75	682	42.50
40b	8-Jul-15	15-Jul-15	7	2.75	333	42.50
41a	16-Jul-15	30-Jul-15	14	3	682	45.50
41b	31-Jul-15	7-Aug-15	7	3	331	45.50
Part H		22-Dec-14				
42a	22-Dec-14	4-Jan-15	13	2.4	150	21.00
42b	5-Jan-15	13-Jan-15	8	2.4	54	21.00
43a	14-Jan-15	28-Jan-15	14	2.5	305	23.50
43b	29-Jan-15	6-Feb-15	8	2.5	118	23.50
44a	7-Feb-15	21-Feb-15	14	2.5	608	26.00
44b	22-Feb-15	2-Mar-15	8	2.5	241	26.00
45a	3-Mar-15	17-Mar-15	14	2.75	608	28.75
45b	18-Mar-15	26-Mar-15	8	2.75	241	28.75
46a	27-Mar-15	10-Apr-15	14	2.75	608	31.50
46b	11-Apr-15	19-Apr-15	8	2.75	241	31.50
47a	20-Apr-15	4-May-15	14	2.75	608	34.25
47b	5-May-15	13-May-15	8	2.75	241	34.25
48a	14-May-15	28-May-15	14	2.75	608	37.00
48b	29-May-15	6-Jun-15	8	2.75	241	37.00
49a	7-Jun-15	21-Jun-15	14	2.75	608	39.75
49b	22-Jun-15	30-Jun-15	8	2.75	241	39.75
50a	1-Jul-15	15-Jul-15	14	2.75	608	42.50
50b	16-Jul-15	24-Jul-15	8	2.75	241	42.50
51a	25-Jul-15	8-Aug-15	14	3	608	45.50
51b	9-Aug-15	17-Aug-15	8	3	241	45.50

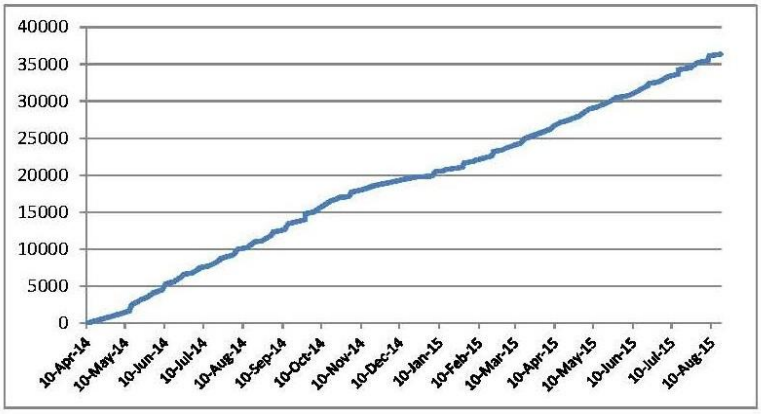


Figure 129: Foreseen production incidences for the Intake sector. The table reports the incidences of the Unit 1. Same incidences are assumed for Units from 2 to 4

Powerhouse T U1					
Concrete works from March 13th, 2014 to October 6th, 2016			dimensioning data		
			sector days	volume	elev.
	Starting Date	Ending Date		m3	m
1a	13-Mar-14	26-Mar-14	13	627	-31.4
1b	27-Mar-14	10-Apr-14	15	819	-31.4
2a	11-Apr-14	20-May-14	40	340	-28.7
2b	21-May-14	30-May-14	10	357	-28.7
3a	31-May-14	9-Jun-14	10	307	-26.5
3b	10-Jun-14	19-Jun-14	10	307	-26.5
4a	20-Jun-14	1-Jul-14	12	422	-24
4b	2-Jul-14	12-Jul-14	11	406	-24
5a	13-Jul-14	22-Jul-14	10	343	-22.5
5b	23-Jul-14	1-Aug-14	10	356	-22.5
6a	2-Aug-14	13-Aug-14	12	485	-20.3
6b	14-Aug-14	25-Aug-14	12	441	-20.3
7a	26-Aug-14	18-Sep-14	24	481	-18.1
7b	19-Sep-14	12-Oct-14	24	473	-18.1
8a	13-Oct-14	12-Nov-14	31	851	-15.4
8b	13-Nov-14	10-Dec-14	28	764	-15.4
9a	11-Dec-14	15-Jan-15	36	756	-13.2
9b	16-Jan-15	20-Feb-15	36	828	-13.2
10a	21-Feb-15	20-Mar-15	29	460	-11.08
10b	21-Mar-15	18-Apr-15	29	611	-11.08
11a	19-Apr-15	3-May-15	15	335	-8.1
11b	4-May-15	18-May-15	15	635	-8.1
12a	19-May-15	26-May-15	8	307	-6
12b	27-May-15	6-Jun-15	11	452	-6
13a	7-Jun-15	14-Jun-15	8	307	-3.9
13b	15-Jun-15	25-Jun-15	11	451	-3.9
14a	23-Jul-16	9-Aug-16	17	313	-0.9
14b	10-Aug-16	29-Aug-16	20	623	-0.9
15a	23-Jul-16	30-Jul-16	7	646	1.2
15b	31-Jul-16	6-Aug-16	7	694	1.2
16a	7-Aug-16	13-Aug-16	7	668	3.3
16b	14-Aug-16	21-Aug-16	8	923	3.3
17a	22-Aug-16	27-Aug-16	6	432	4.65
17b	28-Aug-16	2-Sep-16	6	508	4.65
18a	3-Sep-16	7-Sep-16	5	435	5.75
18b	8-Sep-16	12-Sep-16	5	498	5.75
18c	13-Sep-16	17-Sep-16	5	195	5.75
19	18-Sep-16	27-Sep-16	10	581	13.7
20	28-Sep-16	6-Oct-16	9	441	15.5

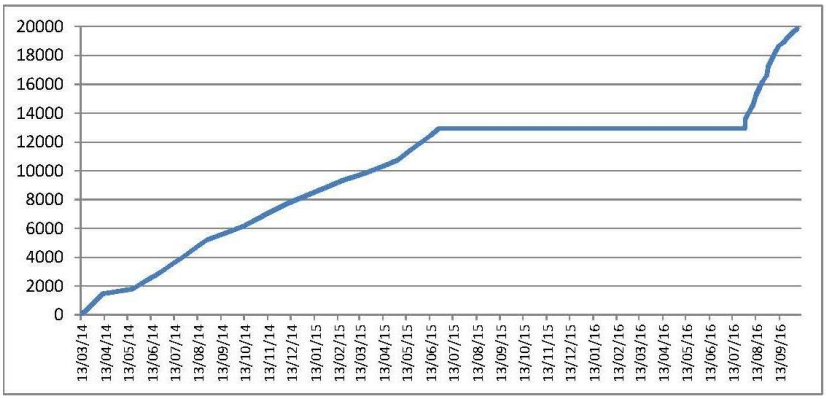


Figure 130: Foreseen production incidences for the turbines sector. The table reports the incidences for the Unit 1. Same incidences are assumed for Units from 2 to 4

ASTALDI CANADA Inc.

nalcor energy

NALCOR ENERGY
LOWER CHURCHILL PROJECT
MUSKRAT FALLS

CONSTRUCTION OF INTAKE AND POWERHOUSE, SPILLWAY
AND TRANSITION DAMS

PACKAGE CH0007
CORE TECHNICAL PROPOSAL

APPENDIX A13
EXECUTION PLAN

ATTACHMENT 1

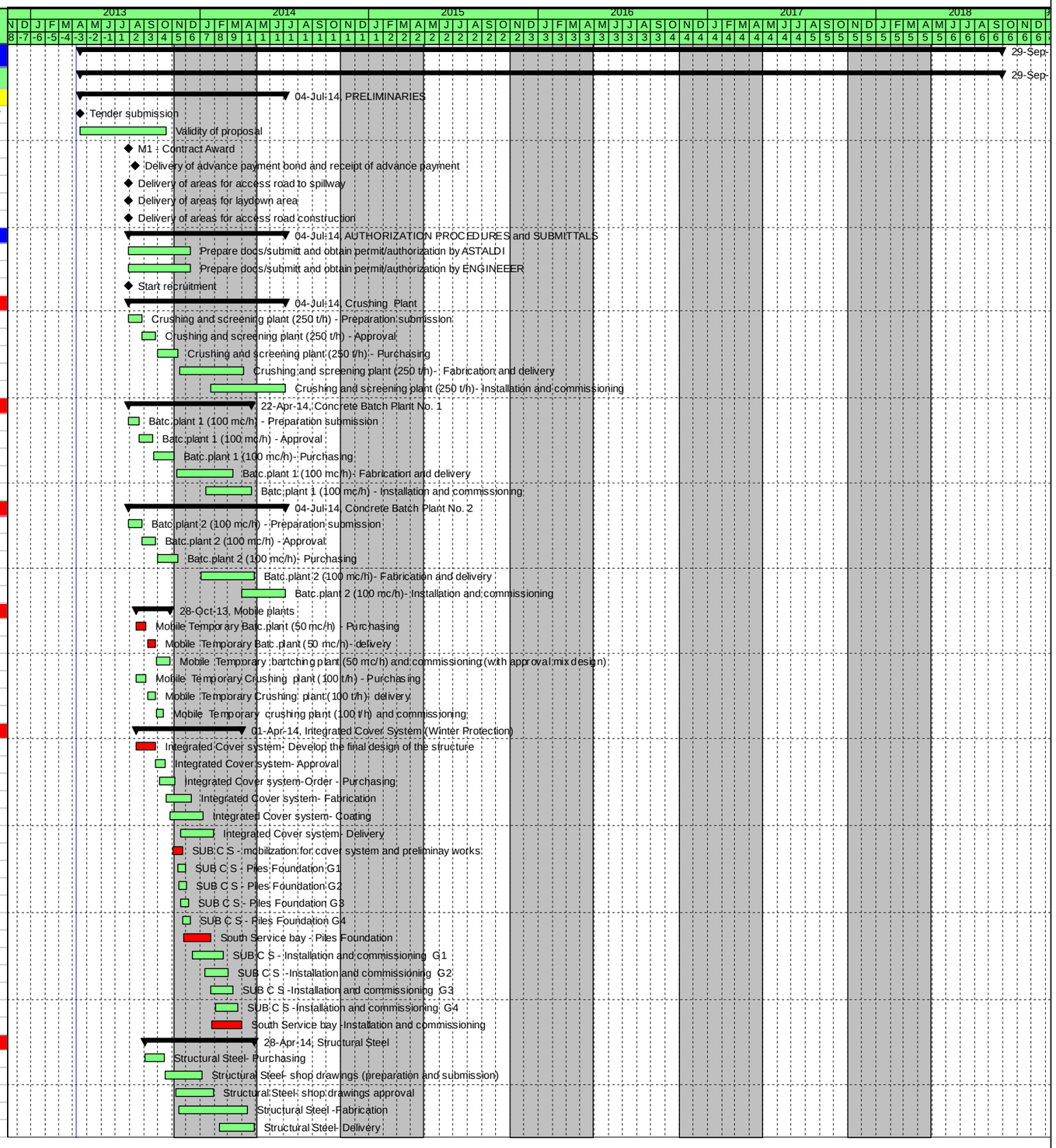
PROPOSED CONSTRUCTION SCHEDULE - APRIL 2013

April 16, 2013

ASTALDI CANADA Inc.

CH0007-MUSKRAT FALLS-PROPOSED CONSTRUCTION SCHEDULE

Activity ID	Activity Name	Original Duration	Total Float	Start	Finish
CH0007 - MUSKRAT FALLS PROJECT		1815	0	16-Apr-13	29-Sep-18
MUSKRAT FALL PROJECT		1815	0	16-Apr-13	29-Sep-18
PRELIMINARIES		403	41	16-Apr-13	04-Jul-14
CH0007-1020	Tender submission	0	0		16-Apr-13*
CH0007-1030	Validity of proposal	180	32	16-Apr-13	19-Oct-13
CH0007-1040	M1 - Contract Award	0	0	31-Jul-13*	
CH0007-1050	Delivery of advance payment bond and receipt of advance payment	0	7		14-Aug-13
CH0007-1070	Delivery of areas for access road to spillway	0	55	31-Jul-13*	
CH0007-1080	Delivery of areas for laydown area	0	30	31-Jul-13*	
CH0007-1090	Delivery of areas for access road construction	0	55	31-Jul-13*	
AUTHORIZATION PROCEDURES and SUBMITTALS		301	41	31-Jul-13	04-Jul-14
CH0007-1060	Prepare docs/submitt and obtain permit/authorization by ASTALDI	90	42	31-Jul-13	11-Dec-13
CH0007-4170	Prepare docs/submitt and obtain permit/authorization by ENGINEEER	90	21	31-Jul-13	11-Dec-13
CH0007-7400	Start recruitment	0	34	31-Jul-13	
Crushing Plant		301	41	31-Jul-13	04-Jul-14
CH0007-4135	Crushing and screening plant (250 t/h) - Preparation submission	20	32	31-Jul-13	28-Aug-13
CH0007-4136	Crushing and screening plant (250 t/h) - Approval	21	32	29-Aug-13	27-Sep-13
CH0007-4140	Crushing and screening plant (250 t/h) - Purchasing	30	32	30-Sep-13	14-Nov-13
CH0007-4150	Crushing and screening plant (250 t/h)- Fabrication and delivery	90	32	18-Nov-13	04-Apr-14
CH0007-4160	Crushing and screening plant (250 t/h)- Installation and commissioning	150	41	24-Jan-14	04-Jul-14
Concrete Batch Plant No. 1		232	33	31-Jul-13	22-Apr-14
CH0007-2625	Batc.plant 1 (100 mc/h) - Preparation submission	15	29	31-Jul-13	21-Aug-13
CH0007-2627	Batc.plant 1 (100 mc/h) - Approval	21	29	22-Aug-13	20-Sep-13
CH0007-2630	Batc.plant 1 (100 mc/h)- Purchasing	30	29	23-Sep-13	06-Nov-13
CH0007-2640	Batc.plant 1 (100 mc/h)- Fabrication and delivery	80	29	11-Nov-13	13-Mar-14
CH0007-2650	Batc.plant 1 (100 mc/h) - Installation and commissioning	90	33	14-Jan-14	22-Apr-14
Concrete Batch Plant No. 2		301	41	31-Jul-13	04-Jul-14
CH0007-4105	Batc.plant 2 (100 mc/h) - Preparation submission	20	66	31-Jul-13	28-Aug-13
CH0007-4106	Batc.plant 2 (100 mc/h) - Approval	21	66	29-Aug-13	27-Sep-13
CH0007-4110	Batc.plant 2 (100 mc/h)- Purchasing	30	66	30-Sep-13	14-Nov-13
CH0007-4120	Batc.plant 2 (100 mc/h)- Fabrication and delivery	80	41	03-Jan-14	28-Apr-14
CH0007-4130	Batc.plant 2 (100 mc/h)- Installation and commissioning	90	41	01-Apr-14	04-Jul-14
Mobile plants		73	17	15-Aug-13	28-Oct-13
CH0007-4310	Mobile Temporary Batc.plant (50 mc/h) - Purchasing	15	10	15-Aug-13	05-Sep-13
CH0007-4320	Mobile Temporary Batc.plant (50 mc/h)- delivery	15	10	09-Sep-13	27-Sep-13
CH0007-4330	Mobile Temporary bartching plant (50 mc/h) and commissioning (with appr	30	17	28-Sep-13	28-Oct-13
CH0007-4340	Mobile Temporary Crushing plant (100 t/h) - Purchasing	15	21	15-Aug-13	05-Sep-13
CH0007-4350	Mobile Temporary Crushing plant (100 t/h)- delivery	15	21	09-Sep-13	27-Sep-13
CH0007-4360	Mobile Temporary crushing plant (100 t/h) and commissioning	15	32	28-Sep-13	12-Oct-13
Integrated Cover System (Winter Protection)		198	70	15-Aug-13	01-Apr-14
CH0007-1440	Integrated Cover system- Develop the final design of the structure	30	12	15-Aug-13	26-Sep-13
CH0007-1450	Integrated Cover system- Approval	21	19	27-Sep-13	18-Oct-13
CH0007-1460	Integrated Cover system-Order - Purchasing	32	19	04-Oct-13	07-Nov-13
CH0007-1470	Integrated Cover system- Fabrication	50	19	19-Oct-13	12-Dec-13
CH0007-1480	Integrated Cover system- Coating	50	19	29-Oct-13	06-Jan-14
CH0007-1490	Integrated Cover system- Delivery	50	19	21-Nov-13	30-Jan-14
CH0007-1790	SUB C S - mobilization for cover system and preliminay works	19	12	04-Nov-13	24-Nov-13
CH0007-1800	SUB C S - Piles Foundation G1	16	32	14-Nov-13	30-Nov-13
CH0007-1810	SUB C S - Piles Foundation G2	16	70	16-Nov-13	03-Dec-13
CH0007-1820	SUB C S - Piles Foundation G3	16	98	21-Nov-13	07-Dec-13
CH0007-1830	SUB C S - Piles Foundation G4	16	111	24-Nov-13	11-Dec-13
CH0007-1840	South Service bay - Piles Foundation	40	12	26-Nov-13	24-Jan-14
CH0007-1850	SUB C S - Installation and commissioning G1	45	19	16-Dec-13	20-Feb-14
CH0007-1860	SUB C S -Installation and commissioning G2	45	49	11-Jan-14	02-Mar-14
CH0007-1870	SUB C S -Installation and commissioning G3	45	71	23-Jan-14	13-Mar-14
CH0007-1880	SUB C S -Installation and commissioning G4	45	77	03-Feb-14	24-Mar-14
CH0007-3460	South Service bay -Installation and commissioning	60	12	25-Jan-14	01-Apr-14
Structural Steel		205	50	03-Sep-13	28-Apr-14
CH0007-1500	Structural Steel- Purchasing	30	37	03-Sep-13	16-Oct-13
CH0007-1510	Structural Steel- shop drawings (preparation and submission)	60	50	17-Oct-13	04-Jan-14
CH0007-1520	Structural Steel- shop drawings approval	60	50	09-Nov-13	29-Jan-14
CH0007-1530	Structural Steel -Fabrication	120	50	16-Nov-13	13-Apr-14
CH0007-1540	Structural Steel- Delivery	70	50	11-Feb-14	28-Apr-14



Remaining Level of Effort | Actual Work | Critical Remaining ...
Critical Path | Remaining Work | Milestone

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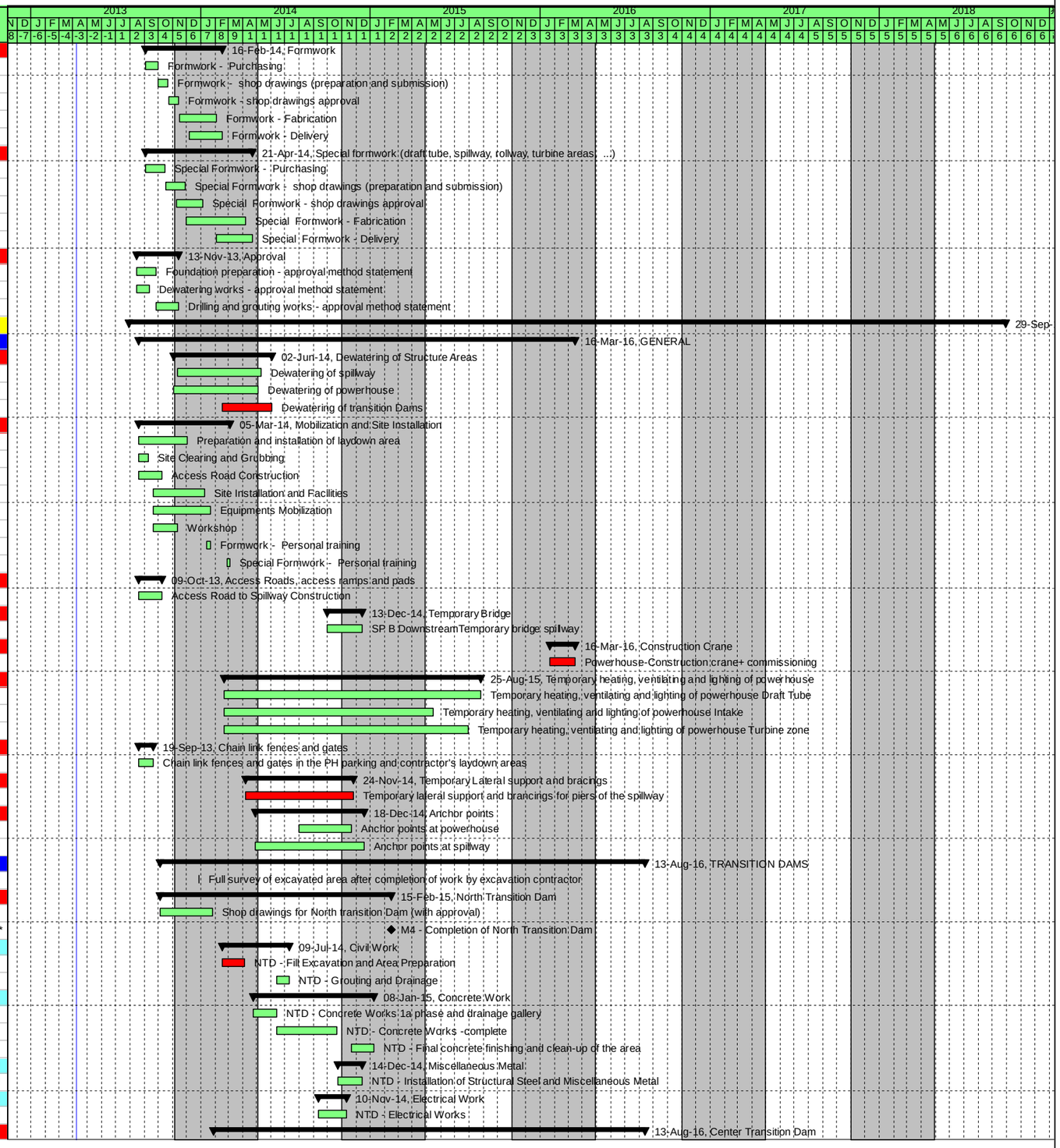
CH0007-MUSKRAT FALLS-PROPOSED CONSTRUCTION SCHEDULE

Activity ID	Activity Name	Original Duration	Total Float	Start	Finish
Formwork		140	52	03-Sep-13	16-Feb-14
CH0007-6630	Formwork - Purchasing	20	36	03-Sep-13	30-Sep-13
CH0007-6640	Formwork - shop drawings (preparation and submission)	20	52	01-Oct-13	21-Oct-13
CH0007-6650	Formwork - shop drawings approval	21	52	23-Oct-13	14-Nov-13
CH0007-6660	Formwork - Fabrication	60	52	15-Nov-13	04-Feb-14
CH0007-6670	Formwork - Delivery	50	52	07-Dec-13	16-Feb-14
Special formwork (draft tube, spillway, rollway, turbine areas, ...)		199	41	03-Sep-13	21-Apr-14
CH0007-6690	Special Formwork - Purchasing	30	30	03-Sep-13	16-Oct-13
CH0007-6700	Special Formwork - shop drawings (preparation and submission)	40	41	17-Oct-13	28-Nov-13
CH0007-6710	Special Formwork - shop drawings approval	40	41	09-Nov-13	05-Jan-14
CH0007-6720	Special Formwork - Fabrication	100	41	01-Dec-13	06-Apr-14
CH0007-6730	Special Formwork - Delivery	70	41	04-Feb-14	21-Apr-14
Approval		60	153	15-Aug-13	13-Nov-13
CH0007-7330	Foundation preparation - approval method statement	30	78	15-Aug-13	26-Sep-13
CH0007-7340	Dewatering works - approval method statement	20	52	15-Aug-13	12-Sep-13
CH0007-7350	Drilling and grouting works - approval method statement	30	153	27-Sep-13	13-Nov-13
CONSTRUCTION WORKS		1713	0	31-Jul-13	29-Sep-18
GENERAL		834	119	20-Aug-13	16-Mar-16
Dewatering of Structure Areas		179	71	04-Nov-13	02-Jun-14
CH0007-4370	Dewatering of spillway	150	52	12-Nov-13	10-May-14
CH0007-6910	Dewatering of powerhouse	150	100	04-Nov-13	03-May-14
CH0007-6920	Dewatering of transition Dams	100	12	16-Feb-14	02-Jun-14
Mobilization and Site Installation		169	41	20-Aug-13	05-Mar-14
CH0007-1160	Preparation and installation of laydown area	100	29	20-Aug-13	03-Dec-13
CH0007-1170	Site Clearing and Grubbing	20	39	20-Aug-13	09-Sep-13
CH0007-1180	Access Road Construction	50	34	20-Aug-13	09-Oct-13
CH0007-1190	Site Installation and Facilities	90	44	20-Sep-13	09-Jan-14
CH0007-1200	Equipments Mobilization	100	29	20-Sep-13	21-Jan-14
CH0007-3320	Workshop	50	44	20-Sep-13	11-Nov-13
CH0007-6680	Formwork - Personal training	7	52	14-Jan-14	21-Jan-14
CH0007-6740	Special Formwork - Personal training	7	41	27-Feb-14	05-Mar-14
Access Roads, access ramps and pads		50	34	20-Aug-13	09-Oct-13
CH0007-3280	Access Road to Spillway Construction	50	34	20-Aug-13	09-Oct-13
Temporary Bridge		70	44	30-Sep-14	13-Dec-14
CH0007-4380	SP B DownstreamTemporary bridge spillway	70	44	30-Sep-14	13-Dec-14
Construction Crane		50	11	21-Jan-16	16-Mar-16
CH0007-4390	Powerhouse-Construction crane+ commissioning	50	11	21-Jan-16	16-Mar-16
Temporary heating, ventilating and lighting of powerhouse		506	133	21-Feb-14	25-Aug-15
CH0007-4400	Temporary heating, ventilating and lighting of powerhouse Draft Tube	506	35	21-Feb-14	25-Aug-15
CH0007-6750	Temporary heating, ventilating and lighting of powerhouse Intake	409	230	21-Feb-14	16-May-15
CH0007-6760	Temporary heating, ventilating and lighting of powerhouse Turbine zone	480	159	21-Feb-14	29-Jul-15
Chain link fences and gates		30	29	20-Aug-13	19-Sep-13
CH0007-4410	Chain link fences and gates in the PH parking and contractor's laydown are	30	29	20-Aug-13	19-Sep-13
Temporary Lateral support and bracings		223	15	08-Apr-14	24-Nov-14
CH0007-4420	Temporary lateral support and brancings for piers of the spillway	223	15	08-Apr-14	24-Nov-14
Anchor points		223	512	29-Apr-14	18-Dec-14
CH0007-4430	Anchor points at powerhouse	109	536	31-Jul-14	20-Nov-14
CH0007-5930	Anchor points at spillway	223	50	29-Apr-14	18-Dec-14
TRANSITION DAMS		932	0	05-Oct-13	13-Aug-16
CH0007-7420	Full survey of excavated area after completion of work by excavation contra	1	62	28-Dec-13	28-Dec-13
North Transition Dam		436	0	05-Oct-13	15-Feb-15
CH0007-2765	Shop drawings for North transition Dam (with approval)	90	29	05-Oct-13	26-Jan-14
CH0007-2780	M4 - Completion of North Transition Dam	0	0		15-Feb-15*
Civil Work		135	134	16-Feb-14	09-Jul-14
CH0007-13	NTD - Fill Excavation and Area Preparation	45	12	16-Feb-14	05-Apr-14
CH0007-32	NTD - Grouting and Drainage	25	134	13-Jun-14	09-Jul-14
Concrete Work		235	33	24-Apr-14	08-Jan-15
CH0007-13	NTD - Concrete Works 1a phase and drainage gallery	49	33	24-Apr-14	12-Jun-14
CH0007-14	NTD - Concrete Works -complete	126	33	13-Jun-14	21-Oct-14
CH0007-42	NTD - Final concrete finishing and clean-up of the area	30	33	22-Nov-14	08-Jan-15
Miscellaneous Metal		50	33	22-Oct-14	14-Dec-14
CH0007-26	NTD - Installation of Structural Steel and Miscellaneous Metal	50	33	22-Oct-14	14-Dec-14
Electrical Work		60	63	11-Sep-14	10-Nov-14
CH0007-26	NTD - Electrical Works	60	63	11-Sep-14	10-Nov-14
Center Transition Dam		842	0	28-Jan-14	13-Aug-16



Remaining Level of Effort | Actual Work | Critical Remaining ...
Critical Path | Remaining Work | Milestone

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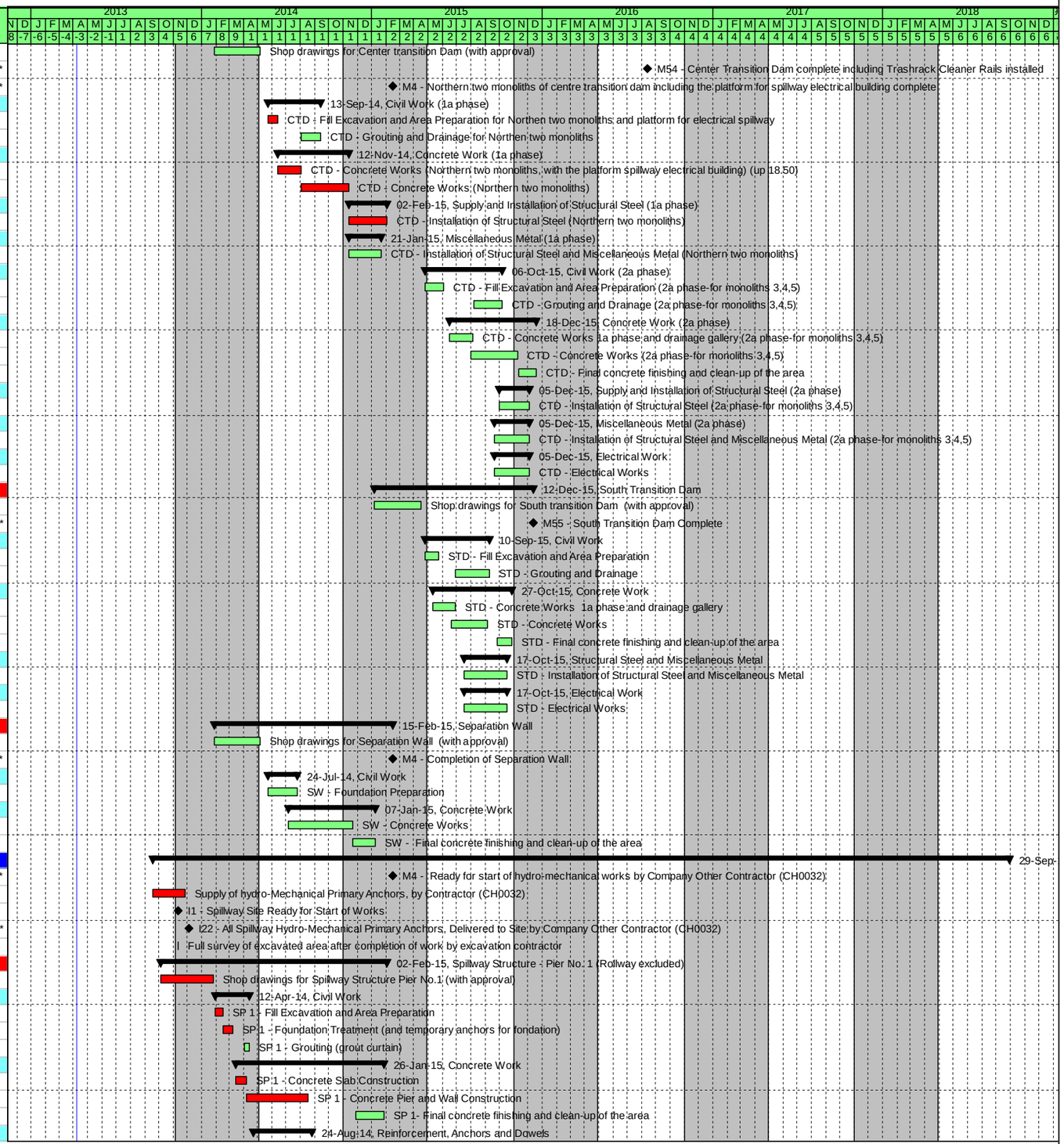
CH0007-MUSKRAT FALLS-PROPOSED CONSTRUCTION SCHEDULE

Activity ID	Activity Name	Original Duration	Total Float	Start	Finish
CH0007-1765	Shop drawings for Center transition Dam (with approval)	90	29	28-Jan-14	05-May-14
CH0007-1770	M54 - Center Transition Dam complete including Trashrack Cleaner Rails ii	0	0		13-Aug-16*
CH0007-4480	M4 - Northern two monoliths of centre transition dam including the platform	0	0		15-Feb-15*
Civil Work (1a phase)		109	130	24-May-14	13-Sep-14
CH0007-17	CTD - Fill Excavation and Area Preparation for Northen two monoliths and p	20	12	24-May-14	12-Jun-14
CH0007-17	CTD - Grouting and Drainage for Northen two monoliths	40	130	03-Aug-14	13-Sep-14
Concrete Work (1a phase)		147	12	13-Jun-14	12-Nov-14
CH0007-11	CTD - Concrete Works (Northern two monoliths, with the platform spillway	49	12	13-Jun-14	02-Aug-14
CH0007-11	CTD - Concrete Works (Northern two monoliths)	98	12	03-Aug-14	12-Nov-14
Supply and Installation of Structural Steel (1a phase)		60	12	13-Nov-14	02-Feb-15
CH0007-26	CTD - Installation of Structural Steel (Northern two monoliths)	60	12	13-Nov-14	02-Feb-15
Miscellaneous Metal (1a phase)		50	22	13-Nov-14	21-Jan-15
CH0007-27	CTD - Installation of Structural Steel and Miscellaneous Metal (Northern two	50	22	13-Nov-14	21-Jan-15
Civil Work (2a phase)		161	244	24-Apr-15	06-Oct-15
CH0007-17	CTD - Fill Excavation and Area Preparation (2a phase-for monoliths 3,4,5)	40	45	24-Apr-15	03-Jun-15
CH0007-32	CTD - Grouting and Drainage (2a phase-for monoliths 3,4,5)	60	244	07-Aug-15	06-Oct-15
Concrete Work (2a phase)		173	210	16-Jun-15	18-Dec-15
CH0007-11	CTD - Concrete Works 1a phase and drainage gallery (2a phase-for mono	49	40	16-Jun-15	06-Aug-15
CH0007-17	CTD - Concrete Works (2a phase-for monoliths 3,4,5)	98	210	02-Aug-15	10-Nov-15
CH0007-44	CTD - Final concrete finishing and clean-up of the area	30	210	12-Nov-15	18-Dec-15
Supply and Installation of Structural Steel (2a phase)		60	210	01-Oct-15	05-Dec-15
CH0007-26	CTD - Installation of Structural Steel (2a phase-for monoliths 3,4,5)	60	210	01-Oct-15	05-Dec-15
Miscellaneous Metal (2a phase)		70	210	21-Sep-15	05-Dec-15
CH0007-27	CTD - Installation of Structural Steel and Miscellaneous Metal (2a phase-fo	70	210	21-Sep-15	05-Dec-15
Electrical Work		70	210	21-Sep-15	05-Dec-15
CH0007-27	CTD - Electrical Works	70	210	21-Sep-15	05-Dec-15
South Transition Dam		318	0	06-Jan-15	12-Dec-15
CH0007-1719	Shop drawings for South transition Dam (with approval)	90	52	06-Jan-15	16-Apr-15
CH0007-1720	M55 - South Transition Dam Complete	0	0		12-Dec-15*
Civil Work		135	86	24-Apr-15	10-Sep-15
CH0007-27	STD - Fill Excavation and Area Preparation	30	45	24-Apr-15	24-May-15
CH0007-32	STD - Grouting and Drainage	71	86	29-Jun-15	10-Sep-15
Concrete Work		163	40	12-May-15	27-Oct-15
CH0007-27	STD - Concrete Works 1a phase and drainage gallery	46	40	12-May-15	28-Jun-15
CH0007-27	STD - Concrete Works	75	40	20-Jun-15	05-Sep-15
CH0007-44	STD - Final concrete finishing and clean-up of the area	30	40	27-Sep-15	27-Oct-15
Structural Steel and Miscellaneous Metal		90	40	17-Jul-15	17-Oct-15
CH0007-27	STD - Installation of Structural Steel and Miscellaneous Metal	90	40	17-Jul-15	17-Oct-15
Electrical Work		90	40	17-Jul-15	17-Oct-15
CH0007-27	STD - Electrical Works	90	40	17-Jul-15	17-Oct-15
Separation Wall		346	0	28-Jan-14	15-Feb-15
CH0007-1369	Shop drawings for Separation Wall (with approval)	90	51	28-Jan-14	05-May-14
CH0007-1370	M4 - Completion of Separation Wall	0	0		15-Feb-15*
Civil Work		60	34	24-May-14	24-Jul-14
CH0007-13	SW - Foundation Preparation	60	34	24-May-14	24-Jul-14
Concrete Work		163	34	07-Jul-14	07-Jan-15
CH0007-13	SW - Concrete Works	133	34	07-Jul-14	20-Nov-14
CH0007-44	SW - Final concrete finishing and clean-up of the area	30	34	21-Nov-14	07-Jan-15
SPILLWAY		1665	0	19-Sep-13	29-Sep-18
CH0007-1000	M4 - Ready for start of hydro-mechanical works by Company Other Contra	0	0		15-Feb-15*
CH0007-1010	Supply of hydro-Mechanical Primary Anchors, by Contractor (CH0032)	45	6	19-Sep-13	26-Nov-13
CH0007-1210	I1 - Spillway Site Ready for Start of Works	0	5	11-Nov-13*	
CH0007-1220	I22 - All Spillway Hydro-Mechanical Primary Anchors, Delivered to Site by C	0	0		04-Dec-13*
CH0007-7430	Full survey of excavated area after completion of work by excavation contra	1	73	11-Nov-13	11-Nov-13
Spillway Structure - Pier No. 1 (Rollway excluded)		424	12	05-Oct-13	02-Feb-15
CH0007-6810	Shop drawings for Spillway Structure Pier No.1 (with approval)	90	7	05-Oct-13	26-Jan-14
Civil Work		66	133	30-Jan-14	12-Apr-14
CH0007-12	SP 1 - Fill Excavation and Area Preparation	15	5	30-Jan-14	15-Feb-14
CH0007-12	SP 1 - Foundation Treatment (and temporary anchors for fondation)	20	5	16-Feb-14	09-Mar-14
CH0007-69	SP 1 - Grouting (grout curtain)	10	133	02-Apr-14	12-Apr-14
Concrete Work		287	17	15-Mar-14	26-Jan-15
CH0007-12	SP 1 - Concrete Slab Construction	21	5	15-Mar-14	06-Apr-14
CH0007-12	SP 1 - Concrete Pier and Wall Construction	126	12	08-Apr-14	16-Aug-14
CH0007-42	SP 1- Final concrete finishing and clean-up of the area	40	17	28-Nov-14	26-Jan-15
Reinforcement, Anchors and Dowels		120	29	22-Apr-14	24-Aug-14



Remaining Level of Effort | Actual Work | Critical Remaining ...
Critical Path | Remaining Work | Milestone

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CH0007-MUSKRAT FALLS-PROPOSED CONSTRUCTION SCHEDULE

Activity ID	Activity Name	Original Duration	Total Float	Start	Finish
CH0007-7(	SP 1 - Drill holes and grouting for Rock dowels and threaded rebars with c(	120	29	22-Apr-14	24-Aug-14
Miscellaneous Metal		60	12	07-Nov-14	26-Jan-15
CH0007-2(	SP 1 - Installation of Structural Steel and Miscellaneous Metal	60	12	07-Nov-14	26-Jan-15
Anchors and Embedded Parts provided by Others		251	12	29-Apr-14	02-Feb-15
CH0007-2(	SP 1 - Installation of Anchors and Embedded Parts provided by Others	126	50	29-Apr-14	06-Sep-14
CH0007-3(	SP 1 - Supply of Secondary Concrete	60	12	13-Nov-14	02-Feb-15
Electrical Work		60	27	28-Oct-14	16-Jan-15
CH0007-2(	SP 1 - Electrical Works	60	27	28-Oct-14	16-Jan-15
Spillway Structure - Pier No. 2 (Rollway excluded)		400	26	16-Oct-13	16-Jan-15
CH0007-7050	Shop drawings for Spillway Structure Pier No.2 (with approval)	90	23	16-Oct-13	07-Feb-14
Civil Work		72	127	16-Feb-14	04-May-14
CH0007-2(	SP 2 - Fill Excavation and Area Preparation	15	16	16-Feb-14	03-Mar-14
CH0007-2(	SP 2 - Foundation Treatment (and temporary anchors for fondation)	20	11	10-Mar-14	31-Mar-14
CH0007-6(	SP 2 - Grouting (grout curtain)	10	127	25-Apr-14	04-May-14
Concrete Work		257	26	08-Apr-14	16-Jan-15
CH0007-1(	SP 2 - Concrete Slab Construction	21	5	08-Apr-14	29-Apr-14
CH0007-1(	SP 2 - Concrete Pier and Wall Construction	126	6	30-Apr-14	07-Sep-14
CH0007-4(	SP 2- Final concrete finishing and clean-up of the area	40	26	19-Nov-14	16-Jan-15
Miscellaneous Metal		45	26	29-Oct-14	16-Dec-14
CH0007-2(	SP 2 - Installation of Structural Steel and Miscellaneous Metal	45	26	29-Oct-14	16-Dec-14
Anchors and Embedded Parts provided by Others		226	26	30-Apr-14	05-Jan-15
CH0007-2(	SP 2 - Installation of Anchors and Embedded Parts provided by Others	126	126	30-Apr-14	07-Sep-14
CH0007-3(	SP 2 - Supply of Secondary Concrete	45	26	03-Nov-14	05-Jan-15
Electrical Work		50	26	29-Oct-14	05-Jan-15
CH0007-2(	SP 2 - Electrical Works	50	26	29-Oct-14	05-Jan-15
Spillway Structure - Pier No. 3 (Rollway excluded)		411	5	26-Oct-13	10-Feb-15
CH0007-7060	Shop drawings for Spillway Structure Pier No.3 (with approval)	90	24	26-Oct-13	19-Feb-14
Civil Work		78	126	04-Mar-14	26-May-14
CH0007-2(	SP 3 - Fill Excavation and Area Preparation	15	27	04-Mar-14	20-Mar-14
CH0007-2(	SP 3 - Foundation Treatment (and temporary anchors for fondation)	20	19	01-Apr-14	21-Apr-14
CH0007-6(	SP 3 - Grouting (grout curtain)	10	126	16-May-14	26-May-14
Concrete Work		257	5	30-Apr-14	10-Feb-15
CH0007-1(	SP 3 - Concrete Slab Construction	21	5	30-Apr-14	21-May-14
CH0007-1(	SP 3 - Concrete Pier and Wall Construction	126	5	22-May-14	28-Sep-14
CH0007-4(	SP 3- Final concrete finishing and clean-up of the area	40	5	13-Dec-14	10-Feb-15
Miscellaneous Metal		45	5	20-Nov-14	23-Jan-15
CH0007-2(	SP 3 - Installation of Structural Steel and Miscellaneous Metal	45	5	20-Nov-14	23-Jan-15
Anchors and Embedded Parts provided by Others		226	5	22-May-14	29-Jan-15
CH0007-2(	SP 3 - Installation of Anchors and Embedded Parts provided by Others	126	60	22-May-14	28-Sep-14
CH0007-3(	SP 3 - Supply of Secondary Concrete	45	5	25-Nov-14	29-Jan-15
Electrical Work		50	5	20-Nov-14	29-Jan-15
CH0007-2(	SP 3 - Electrical Works	50	5	20-Nov-14	29-Jan-15
Spillway Structure - Pier No. 4 (Rollway excluded)		365	31	28-Nov-13	22-Jan-15
CH0007-7070	Shop drawings for Spillway Structure Pier No.4 (with approval)	90	24	28-Nov-13	23-Mar-14
Civil Work		81	135	24-Mar-14	16-Jun-14
CH0007-2(	SP 4 - Fill Excavation and Area Preparation	15	24	24-Mar-14	09-Apr-14
CH0007-2(	SP 4 - Foundation Treatment (and temporary anchors for fondation)	20	22	22-Apr-14	12-May-14
CH0007-6(	SP 4 - Grouting (grout curtain)	20	135	28-May-14	16-Jun-14
Concrete Work		220	21	22-May-14	22-Jan-15
CH0007-1(	SP 4 - Concrete Slab Construction	21	14	22-May-14	11-Jun-14
CH0007-1(	SP 4 - Concrete Pier and Wall Construction	126	21	05-Jun-14	12-Oct-14
CH0007-4(	SP 4- Final concrete finishing and clean-up of the area	40	21	24-Nov-14	22-Jan-15
Miscellaneous Metal		45	31	03-Nov-14	05-Jan-15
CH0007-2(	SP 4 - Installation of Structural Steel and Miscellaneous Metal	45	31	03-Nov-14	05-Jan-15
Anchors and Embedded Parts provided by Others		196	41	05-Jun-14	10-Jan-15
CH0007-2(	SP 4 - Installation of Anchors and Embedded Parts provided by Others	126	111	05-Jun-14	12-Oct-14
CH0007-3(	SP 4 - Supply of Secondary Concrete	45	31	08-Nov-14	10-Jan-15
Electrical Work		50	21	03-Nov-14	10-Jan-15
CH0007-2(	SP 4 - Electrical Works	50	21	03-Nov-14	10-Jan-15
Spillway Structure - Pier No. 5 (Rollway excluded)		346	40	10-Dec-13	11-Jan-15
CH0007-7080	Shop drawings for Spillway Structure Pier No.5 (with approval)	90	24	10-Dec-13	03-Apr-14
Civil Work		87	142	10-Apr-14	09-Jul-14
CH0007-2(	SP 5 - Fill Excavation and Area Preparation	15	24	10-Apr-14	25-Apr-14
CH0007-2(	SP 5 - Foundation Treatment (and temporary anchors for fondation)	20	23	13-May-14	02-Jun-14
CH0007-6(	SP 5 - Grouting (grout curtain)	10	142	29-Jun-14	09-Jul-14
Concrete Work		180	40	12-Jun-14	19-Dec-14

Remaining Level of Effort | Actual Work | Critical Remaining ...
Critical Path | Remaining Work | Milestone

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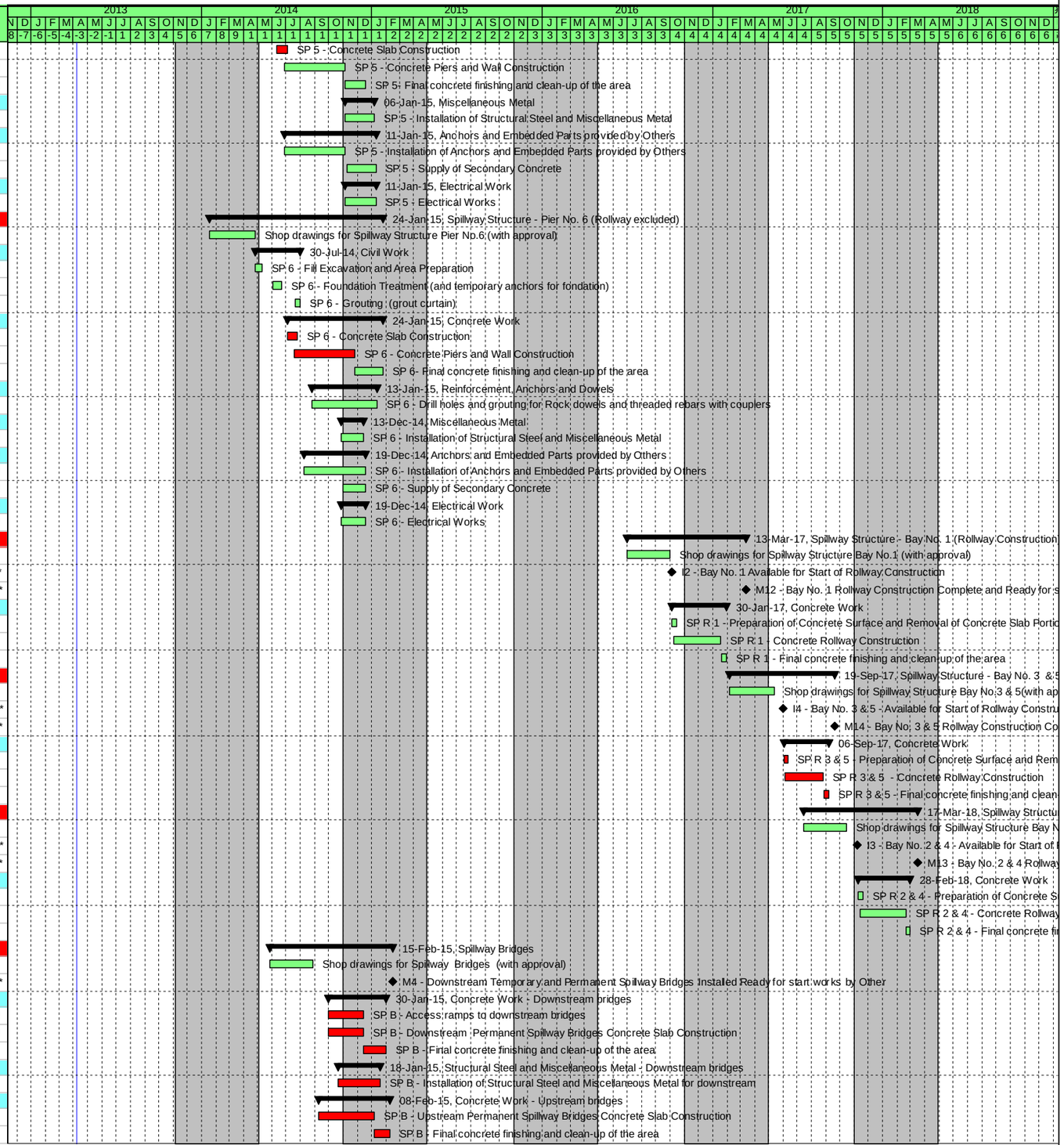
CH0007-MUSKRAT FALLS-PROPOSED CONSTRUCTION SCHEDULE

Activity ID	Activity Name	Original Duration	Total Float	Start	Finish
CH0007-13	SP 5 - Concrete Slab Construction	21	14	12-Jun-14	04-Jul-14
CH0007-13	SP 5 - Concrete Piers and Wall Construction	126	28	27-Jun-14	03-Nov-14
CH0007-42	SP 5- Final concrete finishing and clean-up of the area	40	40	04-Nov-14	19-Dec-14
Miscellaneous Metal		45	30	04-Nov-14	06-Jan-15
CH0007-30	SP 5 - Installation of Structural Steel and Miscellaneous Metal	45	30	04-Nov-14	06-Jan-15
Anchors and Embedded Parts provided by Others		176	40	27-Jun-14	11-Jan-15
CH0007-30	SP 5 - Installation of Anchors and Embedded Parts provided by Others	126	90	27-Jun-14	03-Nov-14
CH0007-30	SP 5 - Supply of Secondary Concrete	45	30	09-Nov-14	11-Jan-15
Electrical Work		50	30	04-Nov-14	11-Jan-15
CH0007-30	SP 5 - Electrical Works	50	30	04-Nov-14	11-Jan-15
Spillway Structure - Pier No. 6 (Rollway excluded)		337	29	17-Jan-14	24-Jan-15
CH0007-7090	Shop drawings for Spillway Structure Pier No.6 (with approval)	90	24	17-Jan-14	25-Apr-14
Civil Work		93	128	26-Apr-14	30-Jul-14
CH0007-33	SP 6 - Fill Excavation and Area Preparation	15	24	26-Apr-14	10-May-14
CH0007-33	SP 6 - Foundation Treatment (and temporary anchors for fondation)	20	24	03-Jun-14	22-Jun-14
CH0007-69	SP 6 - Grouting (grout curtain)	10	128	21-Jul-14	30-Jul-14
Concrete Work		180	19	05-Jul-14	24-Jan-15
CH0007-11	SP 6 - Concrete Slab Construction	21	14	05-Jul-14	25-Jul-14
CH0007-11	SP 6 - Concrete Piers and Wall Construction	126	14	19-Jul-14	25-Nov-14
CH0007-43	SP 6- Final concrete finishing and clean-up of the area	40	19	26-Nov-14	24-Jan-15
Reinforcement, Anchors and Dowels		120	29	25-Aug-14	13-Jan-15
CH0007-70	SP 6 - Drill holes and grouting for Rock dowels and threaded rebars with co	120	29	25-Aug-14	13-Jan-15
Miscellaneous Metal		45	49	26-Oct-14	13-Dec-14
CH0007-33	SP 6 - Installation of Structural Steel and Miscellaneous Metal	45	49	26-Oct-14	13-Dec-14
Anchors and Embedded Parts provided by Others		127	49	08-Aug-14	19-Dec-14
CH0007-34	SP 6 - Installation of Anchors and Embedded Parts provided by Others	126	50	08-Aug-14	18-Dec-14
CH0007-34	SP 6 - Supply of Secondary Concrete	45	49	31-Oct-14	19-Dec-14
Electrical Work		50	49	26-Oct-14	19-Dec-14
CH0007-34	SP 6 - Electrical Works	50	49	26-Oct-14	19-Dec-14
Spillway Structure - Bay No. 1 (Rollway Construction)		225	0	02-Jul-16	13-Mar-17
CH0007-1568	Shop drawings for Spillway Structure Bay No.1 (with approval)	90	32	02-Jul-16	01-Oct-16
CH0007-1570	I2 - Bay No. 1 Available for Start of Rollway Construction	0	0		04-Oct-16*
CH0007-1610	M12 - Bay No. 1 Rollway Construction Complete and Ready for start of hyd	0	0		13-Mar-17*
Concrete Work		93	38	06-Oct-16	30-Jan-17
CH0007-15	SP R 1 - Preparation of Concrete Surface and Removal of Concrete Slab F	10	38	06-Oct-16	16-Oct-16
CH0007-15	SP R 1 - Concrete Rollway Construction	80	38	09-Oct-16	18-Jan-17
CH0007-16	SP R 1 - Final concrete finishing and clean-up of the area	10	38	20-Jan-17	30-Jan-17
Spillway Structure - Bay No. 3 & 5 (Rollway Construction)		215	0	05-Feb-17	19-Sep-17
CH0007-1618	Shop drawings for Spillway Structure Bay No.3 & 5(with approval)	90	32	05-Feb-17	12-May-17
CH0007-1620	I4 - Bay No. 3 & 5 - Available for Start of Rollway Construction	0	0		31-May-17*
CH0007-1660	M14 - Bay No. 3 & 5 Rollway Construction Complete and Ready for start of	0	0		19-Sep-17*
Concrete Work		93	13	02-Jun-17	06-Sep-17
CH0007-16	SP R 3 & 5 - Preparation of Concrete Surface and Removal of Concrete Sl	10	13	02-Jun-17	11-Jun-17
CH0007-16	SP R 3 & 5 - Concrete Rollway Construction	80	13	05-Jun-17	26-Aug-17
CH0007-16	SP R 3 & 5 - Final concrete finishing and clean-up of the area	10	13	27-Aug-17	06-Sep-17
Spillway Structure - Bay No. 4 & 2 (Rollway Construction)		223	0	15-Jul-17	17-Mar-18
CH0007-1669	Shop drawings for Spillway Structure Bay No.2 & 4 (with approval)	90	40	15-Jul-17	15-Oct-17
CH0007-1670	I3 - Bay No. 2 & 4 - Available for Start of Rollway Construction	0	0		06-Nov-17*
CH0007-1710	M13 - Bay No. 2 & 4 Rollway Construction Complete and Ready for start of	0	0		17-Mar-18*
Concrete Work		93	17	08-Nov-17	28-Feb-18
CH0007-16	SP R 2 & 4 - Preparation of Concrete Surface and Removal of Concrete Sl	10	17	08-Nov-17	19-Nov-17
CH0007-16	SP R 2 & 4 - Concrete Rollway Construction	80	17	12-Nov-17	18-Feb-18
CH0007-17	SP R 2 & 4 - Final concrete finishing and clean-up of the area	10	17	19-Feb-18	28-Feb-18
Spillway Bridges		236	0	27-May-14	15-Feb-15
CH0007-1552	Shop drawings for Spillway Bridges (with approval)	90	16	27-May-14	27-Aug-14
CH0007-1560	M4 - Downstream Temporary and Permanent Spillway Bridges Installed Rea	0	0		15-Feb-15*
Concrete Work - Downstream bridges		100	14	30-Sep-14	30-Jan-15
CH0007-15	SP B - Access ramps to downstream bridges	70	14	30-Sep-14	13-Dec-14
CH0007-15	SP B - Downstream Permanent Spillway Bridges Concrete Slab Constructi	70	14	30-Sep-14	13-Dec-14
CH0007-42	SP B - Final concrete finishing and clean-up of the area	30	14	14-Dec-14	30-Jan-15
Structural Steel and Miscellaneous Metal - Downstream bridges		70	14	21-Oct-14	18-Jan-15
CH0007-30	SP B - Installation of Structural Steel and Miscellaneous Metal for downstre	70	14	21-Oct-14	18-Jan-15
Concrete Work - Upstream bridges		130	6	08-Sep-14	08-Feb-15
CH0007-42	SP B - Upstream Permanent Spillway Bridges Concrete Slab Construction	100	6	08-Sep-14	05-Jan-15
CH0007-42	SP B - Final concrete finishing and clean-up of the area	30	6	06-Jan-15	08-Feb-15



Remaining Level of Effort | Actual Work | Critical Remaining ...
Critical Path | Remaining Work | Milestone

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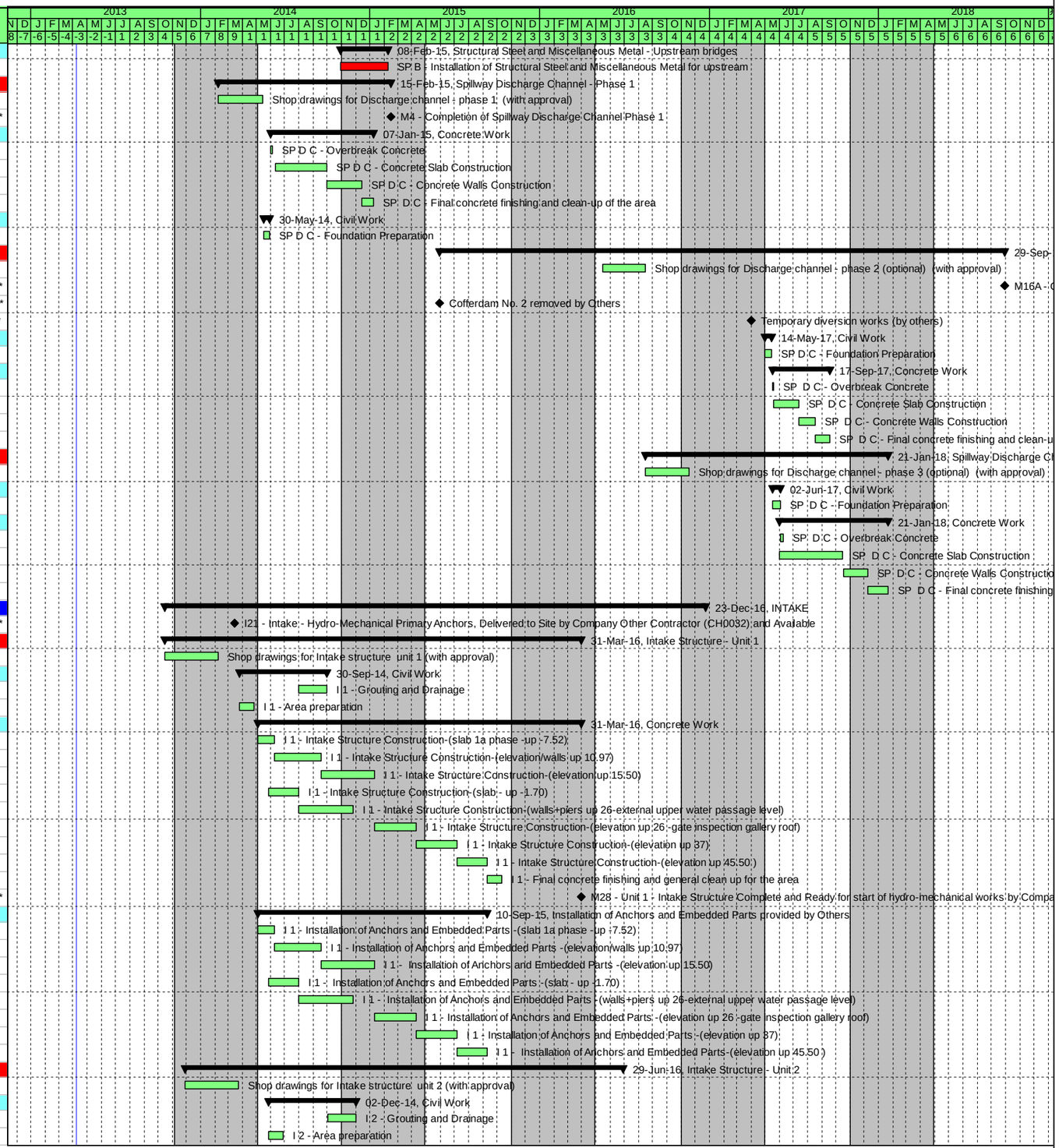
CH0007-MUSKRAT FALLS-PROPOSED CONSTRUCTION SCHEDULE

Activity ID	Activity Name	Original Duration	Total Float	Start	Finish
	Structural Steel and Miscellaneous Metal - Upstream bridges	80	6	29-Oct-14	08-Feb-15
CH0007-3(	SP B - Installation of Structural Steel and Miscellaneous Metal for upstream	80	6	29-Oct-14	08-Feb-15
	Spillway Discharge Channel - Phase 1	336	0	08-Feb-14	15-Feb-15
CH0007-2785	Shop drawings for Discharge channel - phase 1 (with approval)	90	40	08-Feb-14	15-May-14
CH0007-2790	M4 - Completion of Spillway Discharge Channel Phase 1	0	0		15-Feb-15*
	Concrete Work	198	34	31-May-14	07-Jan-15
CH0007-1(	SP D C - Overbreak Concrete	6	40	31-May-14	05-Jun-14
CH0007-1(	SP D C - Concrete Slab Construction	106	34	12-Jun-14	29-Sep-14
CH0007-1(	SP D C - Concrete Walls Construction	70	34	30-Sep-14	13-Dec-14
CH0007-3(	SP D C - Final concrete finishing and clean-up of the area	10	34	14-Dec-14	07-Jan-15
	Civil Work	14	40	16-May-14	30-May-14
CH0007-3(	SP D C - Foundation Preparation	14	40	16-May-14	30-May-14
	Spillway Discharge Channel - Phase 2 (Optional)	1116	0	30-May-15	29-Sep-18
CH0007-2615	Shop drawings for Discharge channel - phase 2 (optional) (with approval)	90	307	15-May-16	16-Aug-16
CH0007-2620	M16A - Completion of Phase 2 of Spillway Discharge Channel base slab	0	0		29-Sep-18*
CH0007-3140	Cofferdam No. 2 removed by Others	0	0		30-May-15*
CH0007-7370	Temporary diversion works (by others)	0	0		01-Apr-17*
	Civil Work	15	160	30-Apr-17	14-May-17
CH0007-31	SP D C - Foundation Preparation	15	160	30-Apr-17	14-May-17
	Concrete Work	121	265	16-May-17	17-Sep-17
CH0007-31	SP D C - Overbreak Concrete	3	265	16-May-17	18-May-17
CH0007-31	SP D C - Concrete Slab Construction	53	265	19-May-17	12-Jul-17
CH0007-31	SP D C - Concrete Walls Construction	35	265	13-Jul-17	17-Aug-17
CH0007-3(	SP D C - Final concrete finishing and clean-up of the area	30	265	18-Aug-17	17-Sep-17
	Spillway Discharge Channel - Phase 3 (Optional)	463	160	17-Aug-16	21-Jan-18
CH0007-6850	Shop drawings for Discharge channel - phase 3 (optional) (with approval)	90	307	17-Aug-16	18-Nov-16
	Civil Work	18	160	16-May-17	02-Jun-17
CH0007-31	SP D C - Foundation Preparation	18	160	16-May-17	02-Jun-17
	Concrete Work	211	160	31-May-17	21-Jan-18
CH0007-31	SP D C - Overbreak Concrete	7	160	03-Jun-17	09-Jun-17
CH0007-31	SP D C - Concrete Slab Construction	133	160	31-May-17	15-Oct-17
CH0007-31	SP D C - Concrete Walls Construction	48	160	16-Oct-17	07-Dec-17
CH0007-3(	SP D C - Final concrete finishing and clean-up of the area	30	160	08-Dec-17	21-Jan-18
	INTAKE	1043	0	16-Oct-13	23-Dec-16
CH0007-1900	I21 - Intake - Hydro-Mechanical Primary Anchors, Delivered to Site by Com	0	0		15-Mar-14*
	Intake Structure - Unit 1	793	0	16-Oct-13	31-Mar-16
CH0007-6860	Shop drawings for Intake structure unit 1 (with approval)	90	60	16-Oct-13	07-Feb-14
	Civil Work	182	450	25-Mar-14	30-Sep-14
CH0007-2(	I 1 - Grouting and Drainage	60	450	31-Jul-14	30-Sep-14
CH0007-41	I 1 - Area preparation	30	19	25-Mar-14	26-Apr-14
	Concrete Work	625	0	04-May-14	31-Mar-16
CH0007-4(	I 1 - Intake Structure Construction-(slab 1a phase -up -7.52)	35	30	04-May-14	08-Jun-14
CH0007-4(	I 1 - Intake Structure Construction-(elevation/walls up 10.97)	97	30	09-Jun-14	17-Sep-14
CH0007-4(	I 1 - Intake Structure Construction-(elevation up 15.50)	95	30	18-Sep-14	10-Jan-15
CH0007-4(	I 1 - Intake Structure Construction-(slab - up -1.70)	62	34	28-May-14	30-Jul-14
CH0007-4(	I 1 - Intake Structure Construction-(walls+piers up 26-external upper water	113	34	31-Jul-14	24-Nov-14
CH0007-4(	I 1 - Intake Structure Construction-(elevation up 26 -gate inspection gallery	80	30	11-Jan-15	10-Apr-15
CH0007-4(	I 1 - Intake Structure Construction-(elevation up 37)	84	30	11-Apr-15	07-Jul-15
CH0007-4(	I 1 - Intake Structure Construction-(elevation up 45.50)	63	141	08-Jul-15	10-Sep-15
CH0007-4(	I 1 - Final concrete finishing and general clean up for the area	30	141	11-Sep-15	10-Oct-15
CH0007-47	M28 - Unit 1 - Intake Structure Complete and Ready for start of hydro-mecl	0	0		31-Mar-16*
	Installation of Anchors and Embedded Parts provided by Others	454	141	04-May-14	10-Sep-15
CH0007-4(	I 1 - Installation of Anchors and Embedded Parts -(slab 1a phase -up -7.52)	35	30	04-May-14	08-Jun-14
CH0007-4(	I 1 - Installation of Anchors and Embedded Parts -(elevation/walls up 10.97)	97	30	09-Jun-14	17-Sep-14
CH0007-4(	I 1 - Installation of Anchors and Embedded Parts -(elevation up 15.50)	95	30	18-Sep-14	10-Jan-15
CH0007-4(	I 1 - Installation of Anchors and Embedded Parts -(slab - up -1.70)	62	34	28-May-14	30-Jul-14
CH0007-4(	I 1 - Installation of Anchors and Embedded Parts -(walls+piers up 26-exter	113	34	31-Jul-14	24-Nov-14
CH0007-4(	I 1 - Installation of Anchors and Embedded Parts -(elevation up 26 -gate ins	80	30	11-Jan-15	10-Apr-15
CH0007-4(	I 1 - Installation of Anchors and Embedded Parts -(elevation up 37)	84	141	11-Apr-15	07-Jul-15
CH0007-4(	I 1 - Installation of Anchors and Embedded Parts-(elevation up 45.50)	63	141	08-Jul-15	10-Sep-15
	Intake Structure - Unit 2	839	0	28-Nov-13	29-Jun-16
CH0007-7100	Shop drawings for Intake structure unit 2 (with approval)	90	80	28-Nov-13	23-Mar-14
	Civil Work	182	476	28-May-14	02-Dec-14
CH0007-2(	I 2 - Grouting and Drainage	60	476	01-Oct-14	02-Dec-14
CH0007-42	I 2 - Area preparation	30	19	28-May-14	27-Jun-14



Remaining Level of Effort | Actual Work | Critical Remaining ...
Critical Path | Remaining Work | Milestone

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CH0007-MUSKRAT FALLS-PROPOSED CONSTRUCTION SCHEDULE

Activity ID	Activity Name	Original Duration	Total Float	Start	Finish
Concrete Work		658	0	28-Jun-14	29-Jun-16
CH0007-47	I 2 - Intake Structure Construction-(slab 1a phase -up -7.52)	35	19	28-Jun-14	02-Aug-14
CH0007-47	I 2 - Intake Structure Construction-(elevation/walls up 10.97)	97	19	03-Aug-14	10-Nov-14
CH0007-47	I 2 - Intake Structure Construction-(elevation up 15.50)	95	19	12-Nov-14	12-Mar-15
CH0007-47	I 2 - Intake Structure Construction-(slab - up -1.70)	62	23	22-Jul-14	23-Sep-14
CH0007-47	I 2 - Intake Structure Construction-(walls+piers up 26-external upper water	113	23	24-Sep-14	07-Feb-15
CH0007-48	I 2 - Intake Structure Construction-(elevation up 26 -gate inspection gallery	80	19	13-Mar-15	04-Jun-15
CH0007-48	I 2 - Intake Structure Construction-(elevation up 37)	84	19	05-Jun-15	30-Aug-15
CH0007-48	I 2 - Intake Structure Construction-(elevation up 45.50)	63	174	31-Aug-15	03-Nov-15
CH0007-48	I 2 - Final concrete finishing and general clean up for the area	30	174	04-Nov-15	08-Dec-15
CH0007-48	M36 - Unit 2 - Intake Structure Complete and Ready for start of hydro-mecl	0	0		29-Jun-16*
Installation of Anchors and Embedded Parts provided by Others		454	174	28-Jun-14	03-Nov-15
CH0007-48	I 2 - Installation of Anchors and Embedded Parts -(slab 1a phase -up -7.52)	35	19	28-Jun-14	02-Aug-14
CH0007-48	I 2 - Installation of Anchors and Embedded Parts -(elevation/walls up 10.97)	97	19	03-Aug-14	10-Nov-14
CH0007-48	I 2 - Installation of Anchors and Embedded Parts -(elevation up 15.50)	95	19	12-Nov-14	12-Mar-15
CH0007-48	I 2 - Installation of Anchors and Embedded Parts -(slab - up -1.70)	62	23	22-Jul-14	23-Sep-14
CH0007-48	I 2 - Installation of Anchors and Embedded Parts -(walls+piers up 26-exter	113	23	24-Sep-14	07-Feb-15
CH0007-49	I 2 - Installation of Anchors and Embedded Parts -(elevation up 26 -gate ins	80	19	13-Mar-15	04-Jun-15
CH0007-49	I 2 - Installation of Anchors and Embedded Parts -(elevation up 37)	84	19	05-Jun-15	30-Aug-15
CH0007-49	I 2 - Installation of Anchors and Embedded Parts-(elevation up 45.50)	63	174	31-Aug-15	03-Nov-15
Intake Structure - Unit 3		896	0	17-Jan-14	27-Sep-16
CH0007-7110	Shop drawings for Intake structure unit 3 (with approval)	90	88	17-Jan-14	25-Apr-14
Civil Work		212	503	28-Jun-14	23-Feb-15
CH0007-24	I 3 - Grouting and Drainage	60	503	03-Dec-14	23-Feb-15
CH0007-41	I 3 - Area preparation	30	27	28-Jun-14	28-Jul-14
Concrete Work		710	0	03-Aug-14	27-Sep-16
CH0007-49	I 3 - Intake Structure Construction-(slab 1a phase -up -7.52)	35	22	03-Aug-14	08-Sep-14
CH0007-49	I 3 - Intake Structure Construction-(elevation/walls up 10.97)	97	217	09-Sep-14	20-Dec-14
CH0007-49	I 3 - Intake Structure Construction-(elevation up 15.50)	95	217	21-Dec-14	19-Apr-15
CH0007-49	I 3 - Intake Structure Construction-(slab - up -1.70)	62	230	27-Aug-14	29-Oct-14
CH0007-49	I 3 - Intake Structure Construction-(walls+piers up 26-external upper water	113	230	30-Oct-14	19-Mar-15
CH0007-49	I 3 - Intake Structure Construction-(elevation up 26 -gate inspection gallery	80	226	20-Apr-15	11-Jul-15
CH0007-49	I 3 - Intake Structure Construction-(elevation up 37)	84	226	12-Jul-15	05-Oct-15
CH0007-50	I 3 - Intake Structure Construction-(elevation up 45.50)	63	226	06-Oct-15	15-Dec-15
CH0007-50	I 3 - Final concrete finishing and general clean up for the area	30	226	16-Dec-15	02-Feb-16
CH0007-50	M44 - Unit 3 - Intake Structure Complete and Ready for start of hydro-mecl	0	0		27-Sep-16*
Installation of Anchors and Embedded Parts provided by Others		454	226	03-Aug-14	15-Dec-15
CH0007-50	I 3 - Installation of Anchors and Embedded Parts -(slab 1a phase -up -7.52)	35	22	03-Aug-14	08-Sep-14
CH0007-50	I 3 - Installation of Anchors and Embedded Parts -(elevation/walls up 10.97)	97	22	09-Sep-14	20-Dec-14
CH0007-50	I 3 - Installation of Anchors and Embedded Parts -(elevation up 15.50)	95	22	21-Dec-14	19-Apr-15
CH0007-50	I 3 - Installation of Anchors and Embedded Parts -(slab - up -1.70)	62	26	27-Aug-14	29-Oct-14
CH0007-50	I 3 - Installation of Anchors and Embedded Parts -(walls+piers up 26-exter	113	26	30-Oct-14	19-Mar-15
CH0007-50	I 3 - Installation of Anchors and Embedded Parts -(elevation up 26 -gate ins	80	22	20-Apr-15	11-Jul-15
CH0007-50	I 3 - Installation of Anchors and Embedded Parts -(elevation up 37)	84	22	12-Jul-15	05-Oct-15
CH0007-51	I 3 - Installation of Anchors and Embedded Parts-(elevation up 45.50)	63	226	06-Oct-15	15-Dec-15
Intake Structure - Unit 4		953	0	08-Feb-14	23-Dec-16
CH0007-7120	Shop drawings for Intake structure unit 4 (with approval)	90	105	08-Feb-14	15-May-14
Civil Work		242	520	29-Jul-14	29-Apr-15
CH0007-24	I 4 - Grouting and Drainage	60	520	24-Feb-15	29-Apr-15
CH0007-42	I 4 - Area preparation	30	34	29-Jul-14	28-Aug-14
Concrete Work		752	0	09-Sep-14	23-Dec-16
CH0007-51	I 4 - Intake Structure Construction-(slab 1a phase -up -7.52)	35	24	09-Sep-14	14-Oct-14
CH0007-52	I 4 - Intake Structure Construction-(elevation/walls up 10.97)	97	24	15-Oct-14	12-Feb-15
CH0007-52	I 4 - Intake Structure Construction-(elevation up 15.50)	95	24	13-Feb-15	25-May-15
CH0007-52	I 4 - Intake Structure Construction-(slab - up -1.70)	62	28	02-Oct-14	05-Dec-14
CH0007-52	I 4 - Intake Structure Construction-(walls+piers up 26-external upper water	113	28	07-Dec-14	25-Apr-15
CH0007-52	I 4 - Intake Structure Construction-(elevation up 26 -gate inspection gallery	80	24	26-May-15	16-Aug-15
CH0007-52	I 4 - Intake Structure Construction-(elevation up 37)	84	24	17-Aug-15	10-Nov-15
CH0007-52	I 4 - Intake Structure Construction-(elevation up 45.50)	63	93	07-Jun-16	11-Aug-16
CH0007-52	I 4 - Final concrete finishing and general clean up for the area	30	93	12-Aug-16	11-Sep-16
CH0007-52	M52 - Unit 4 - Intake Structure Complete and Ready for start of hydro-mecl	0	0		23-Dec-16*
Installation of Anchors and Embedded Parts provided by Others		629	93	09-Sep-14	11-Aug-16
CH0007-51	I 4 - Installation of Anchors and Embedded Parts -(slab 1a phase -up -7.52)	35	24	09-Sep-14	14-Oct-14
CH0007-51	I 4 - Installation of Anchors and Embedded Parts -(elevation/walls up 10.97)	97	24	15-Oct-14	12-Feb-15

Remaining Level of Effort | Actual Work | Critical Remaining ...
Critical Path | Remaining Work | Milestone

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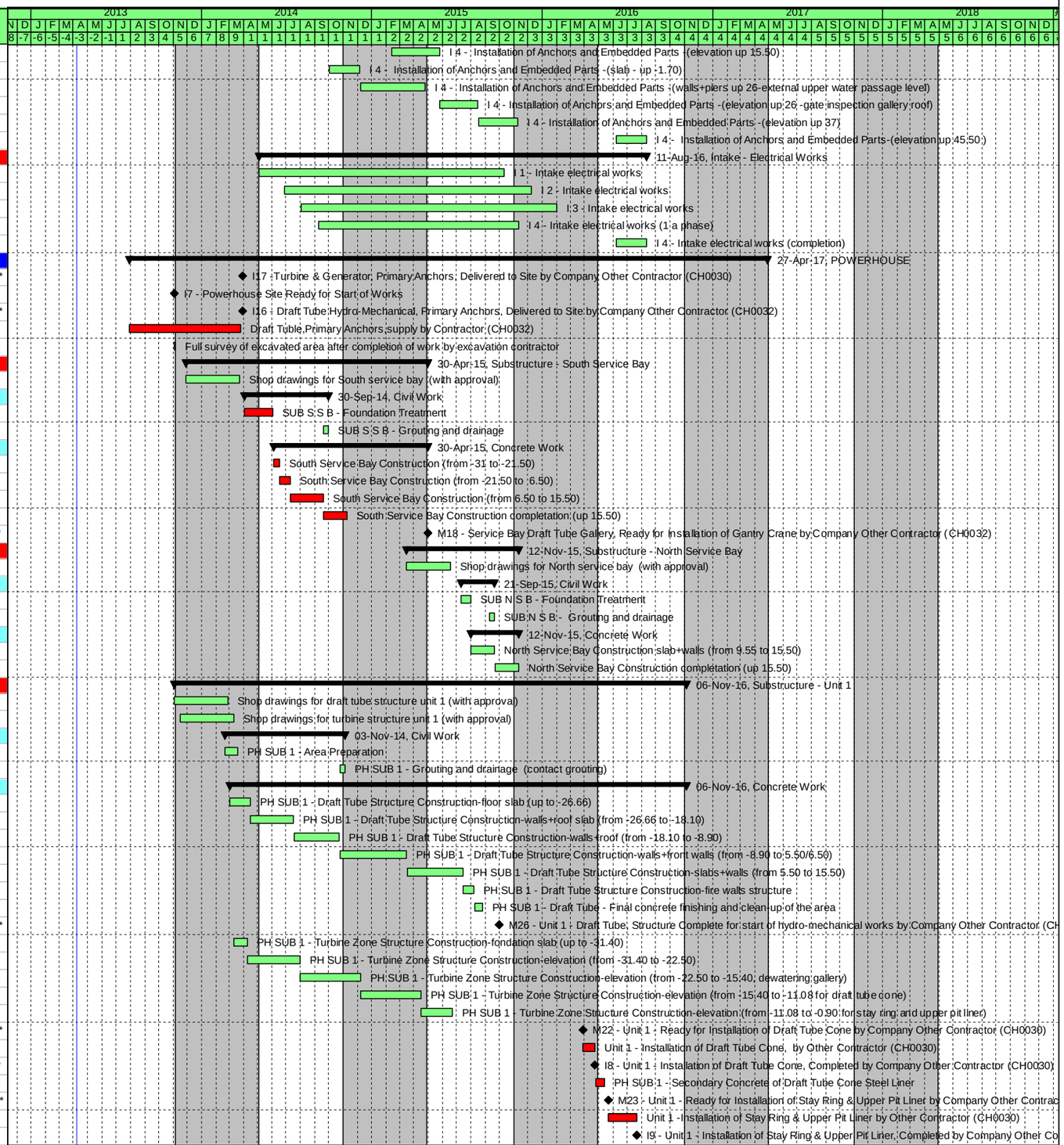
CH0007-MUSKRAT FALLS-PROPOSED CONSTRUCTION SCHEDULE

Activity ID	Activity Name	Original Duration	Total Float	Start	Finish
CH0007-51	I 4 - Installation of Anchors and Embedded Parts -(elevation up 15.50)	95	24	13-Feb-15	25-May-15
CH0007-51	I 4 - Installation of Anchors and Embedded Parts -(slab - up -1.70)	62	28	02-Oct-14	05-Dec-14
CH0007-51	I 4 - Installation of Anchors and Embedded Parts -(walls+piers up 26-exter	113	28	07-Dec-14	25-Apr-15
CH0007-51	I 4 - Installation of Anchors and Embedded Parts -(elevation up 26 -gate ins	80	24	26-May-15	16-Aug-15
CH0007-51	I 4 - Installation of Anchors and Embedded Parts -(elevation up 37)	84	268	17-Aug-15	10-Nov-15
CH0007-51	I 4 - Installation of Anchors and Embedded Parts-(elevation up 45.50)	63	93	07-Jun-16	11-Aug-16
Intake - Electrical Works		752	123	04-May-14	11-Aug-16
CH0007-5530	I 1 - Intake electrical works	484	141	04-May-14	10-Oct-15
CH0007-5620	I 2 - Intake electrical works	484	174	28-Jun-14	08-Dec-15
CH0007-5710	I 3 - Intake electrical works	484	226	03-Aug-14	02-Feb-16
CH0007-5800	I 4 - Intake electrical works (1 a phase)	392	297	09-Sep-14	12-Nov-15
CH0007-7360	I 4 - Intake electrical works (completion)	63	123	07-Jun-16	11-Aug-16
POWERHOUSE		1219	0	31-Jul-13	27-Apr-17
CH0007-1100	I17 -Turbine & Generator, Primary Anchors, Delivered to Site by Company (	0	0		29-Mar-14*
CH0007-1780	I7 - Powerhouse Site Ready for Start of Works	0	13	04-Nov-13*	
CH0007-1890	I16 - Draft Tube Hydro-Mechanical, Primary Anchors, Delivered to Site by C	0	0		29-Mar-14*
CH0007-4180	Draft Tuble,Primary Anchors,supply by Contractor (CH0032)	156	1	31-Jul-13	26-Mar-14
CH0007-7440	Full survey of excavated area after completion of work by excavation contra	1	127	04-Nov-13	04-Nov-13
Substructure - South Service Bay		453	0	29-Nov-13	30-Apr-15
CH0007-6890	Shop drawings for South service bay (with approval)	90	19	29-Nov-13	24-Mar-14
Civil Work		175	51	02-Apr-14	30-Sep-14
CH0007-19	SUB S S B - Foundation Treatment	60	12	02-Apr-14	03-Jun-14
CH0007-73	SUB S S B - Grouting and drainage	11	51	20-Sep-14	30-Sep-14
Concrete Work		296	0	04-Jun-14	30-Apr-15
CH0007-19	South Service Bay Construction (from -31 to -21.50)	14	12	04-Jun-14	17-Jun-14
CH0007-19	South Service Bay Construction (from -21.50 to 6.50)	20	12	18-Jun-14	09-Jul-14
CH0007-19	South Service Bay Construction (from 6.50 to 15.50)	70	12	10-Jul-14	19-Sep-14
CH0007-19	South Service Bay Construction completation (up 15.50)	50	12	20-Sep-14	09-Nov-14
CH0007-20	M18 - Service Bay Draft Tube Gallery, Ready for Installation of Gantry Cran	0	0		30-Apr-15*
Substructure - North Service Bay		232	28	16-Mar-15	12-Nov-15
CH0007-6900	Shop drawings for North service bay (with approval)	90	50	16-Mar-15	17-Jun-15
Civil Work		70	28	12-Jul-15	21-Sep-15
CH0007-32	SUB N S B - Foundation Treatment	20	28	12-Jul-15	31-Jul-15
CH0007-73	SUB N S B - Grouting and drainage	11	28	11-Sep-15	21-Sep-15
Concrete Work		100	28	01-Aug-15	12-Nov-15
CH0007-20	North Service Bay Construction slab+walls (from 9.55 to 15.50)	50	28	01-Aug-15	21-Sep-15
CH0007-20	North Service Bay Construction completation (up 15.50)	50	28	22-Sep-15	12-Nov-15
Substructure - Unit 1		987	21	04-Nov-13	06-Nov-16
CH0007-6870	Shop drawings for draft tube structure unit 1 (with approval)	90	24	04-Nov-13	27-Feb-14
CH0007-7130	Shop drawings for turbine structure unit 1 (with approval)	90	70	15-Nov-13	10-Mar-14
Civil Work		245	296	21-Feb-14	03-Nov-14
CH0007-32	PH SUB 1 - Area Preparation	25	22	21-Feb-14	19-Mar-14
CH0007-69	PH SUB 1 - Grouting and drainage (contact grouting)	11	296	24-Oct-14	03-Nov-14
Concrete Work		895	21	02-Mar-14	06-Nov-16
CH0007-46	PH SUB 1 - Draft Tube Structure Construction-floor slab (up to -26.66)	41	22	02-Mar-14	15-Apr-14
CH0007-46	PH SUB 1 - Draft Tube Structure Construction-walls+roof slab (from -26.66	89	33	16-Apr-14	17-Jul-14
CH0007-46	PH SUB 1 - Draft Tube Structure Construction-walls+roof (from -18.10 to -8	95	33	18-Jul-14	23-Oct-14
CH0007-46	PH SUB 1 - Draft Tube Structure Construction-walls+front walls (from -8.90	117	33	24-Oct-14	16-Mar-15
CH0007-47	PH SUB 1 - Draft Tube Structure Construction-slabs+walls (from 5.50 to 15	115	33	18-Mar-15	15-Jul-15
CH0007-47	PH SUB 1 - Draft Tube Structure Construction-fire walls structure	23	33	16-Jul-15	08-Aug-15
CH0007-47	PH SUB 1 - Draft Tube - Final concrete finishing and clean-up of the area	19	33	09-Aug-15	27-Aug-15
CH0007-47	M26 - Unit 1 - Draft Tube, Structure Complete for start of hydro-mechanica	0	0		30-Sep-15*
CH0007-59	PH SUB 1 - Turbine Zone Structure Construction-fondation slab (up to -31.	26	70	11-Mar-14	08-Apr-14
CH0007-59	PH SUB 1 - Turbine Zone Structure Construction-elevation (from -31.40 to	109	154	09-Apr-14	30-Jul-14
CH0007-59	PH SUB 1 - Turbine Zone Structure Construction-elevation (from -22.50 to	124	154	31-Jul-14	07-Dec-14
CH0007-59	PH SUB 1 - Turbine Zone Structure Construction-elevation (from -15.40 to	103	154	08-Dec-14	16-Apr-15
CH0007-59	PH SUB 1 - Turbine Zone Structure Construction-elevation (from -11.08 to	66	154	17-Apr-15	22-Jun-15
CH0007-60	M22 - Unit 1 - Ready for Installation of Draft Tube Cone by Company Other	0	0		28-Mar-16*
CH0007-60	Unit 1 - Installation of Draft Tube Cone, by Other Contractor (CH0030)	23	1	29-Mar-16	22-Apr-16
CH0007-60	I8 - Unit 1 - Installation of Draft Tube Cone, Completed by Company Other (	0	0		23-Apr-16*
CH0007-60	PH SUB 1 - Secondary Concrete of Draft Tube Cone Steel Liner	20	8	24-Apr-16	13-May-16
CH0007-60	M23 - Unit 1 - Ready for Installation of Stay Ring & Upper Pit Liner by Comp	0	0		22-May-16*
CH0007-60	Unit 1 -Installation of Stay Ring & Upper Pit Liner by Other Contractor (CH0	58	1	23-May-16	21-Jul-16
CH0007-60	I9 - Unit 1 - Installation of Stay Ring & Upper Pit Liner, Completed by Compa	0	0		22-Jul-16*



Remaining Level of Effort | Actual Work | Critical Remaining ...
Critical Path | Remaining Work | Milestone

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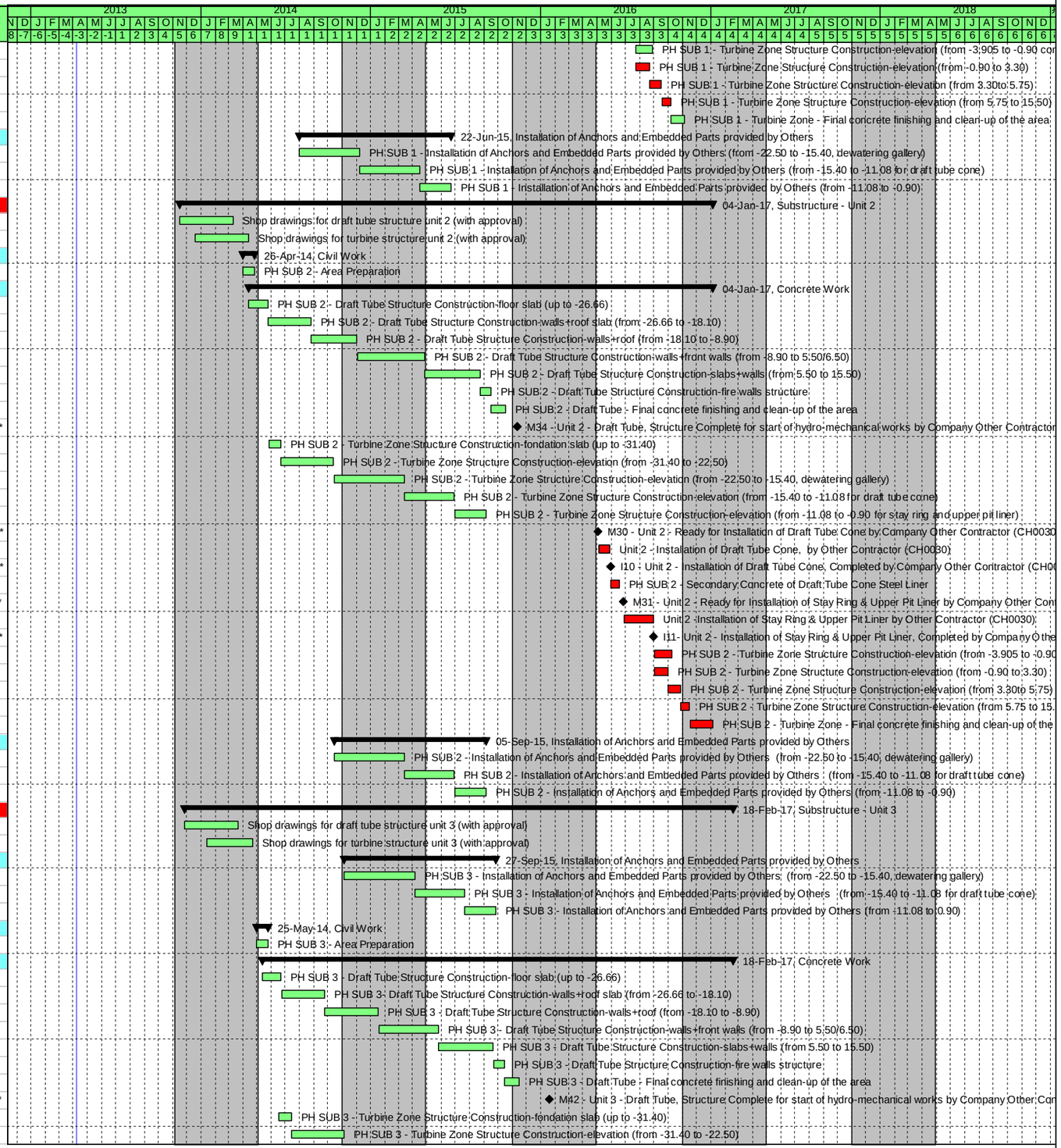
ASTALDI CANADA Inc.

CH0007-MUSKRAT FALLS-PROPOSED CONSTRUCTION SCHEDULE

Activity ID	Activity Name	Original Duration	Total Float	Start	Finish
CH0007-60	PH SUB 1 - Turbine Zone Structure Construction-elevation (from -3.905 to	37	25	23-Jul-16	29-Aug-16
CH0007-60	PH SUB 1 - Turbine Zone Structure Construction-elevation (from -0.90 to 3	29	11	23-Jul-16	21-Aug-16
CH0007-60	PH SUB 1 - Turbine Zone Structure Construction-elevation (from 3.30to 5.7	26	11	22-Aug-16	17-Sep-16
CH0007-61	PH SUB 1 - Turbine Zone Structure Construction-elevation (from 5.75 to 15	19	11	18-Sep-16	06-Oct-16
CH0007-61	PH SUB 1 - Turbine Zone - Final concrete finishing and clean-up of the area	30	21	07-Oct-16	06-Nov-16
Installation of Anchors and Embedded Parts provided by Others		293	244	31-Jul-14	22-Jun-15
CH0007-31	PH SUB 1 - Installation of Anchors and Embedded Parts provided by Other	124	244	31-Jul-14	07-Dec-14
CH0007-32	PH SUB 1 - Installation of Anchors and Embedded Parts provided by Other	103	244	08-Dec-14	16-Apr-15
CH0007-32	PH SUB 1 - Installation of Anchors and Embedded Parts provided by Other	66	244	17-Apr-15	22-Jun-15
Substructure - Unit 2		1016	6	15-Nov-13	04-Jan-17
CH0007-7140	Shop drawings for draft tube structure unit 2 (with approval)	90	46	15-Nov-13	10-Mar-14
CH0007-7150	Shop drawings for turbine structure unit 2 (with approval)	90	86	19-Dec-13	12-Apr-14
Civil Work		25	24	31-Mar-14	26-Apr-14
CH0007-32	PH SUB 2 - Area Preparation	25	24	31-Mar-14	26-Apr-14
Concrete Work		896	6	13-Apr-14	04-Jan-17
CH0007-52	PH SUB 2 - Draft Tube Structure Construction-floor slab (up to -26.66)	41	24	13-Apr-14	25-May-14
CH0007-53	PH SUB 2 - Draft Tube Structure Construction-walls+roof slab (from -26.66	89	24	26-May-14	25-Aug-14
CH0007-53	PH SUB 2 - Draft Tube Structure Construction-walls+roof (from -18.10 to -8	95	24	26-Aug-14	02-Dec-14
CH0007-53	PH SUB 2 - Draft Tube Structure Construction-walls+front walls (from -8.90	117	24	03-Dec-14	26-Apr-15
CH0007-53	PH SUB 2 - Draft Tube Structure Construction-slabs+walls (from 5.50 to 15	115	24	27-Apr-15	23-Aug-15
CH0007-53	PH SUB 2 - Draft Tube Structure Construction-fire walls structure	23	24	24-Aug-15	16-Sep-15
CH0007-53	PH SUB 2 - Draft Tube - Final concrete finishing and clean-up of the area	30	24	17-Sep-15	17-Oct-15
CH0007-53	M34 - Unit 2 - Draft Tube, Structure Complete for start of hydro-mechanica	0	0		11-Nov-15*
CH0007-61	PH SUB 2 - Turbine Zone Structure Construction-fondation slab (up to -31.	26	64	27-May-14	21-Jun-14
CH0007-61	PH SUB 2 - Turbine Zone Structure Construction-elevation (from -31.40 to	109	207	22-Jun-14	12-Oct-14
CH0007-61	PH SUB 2 - Turbine Zone Structure Construction-elevation (from -22.50 to	124	207	14-Oct-14	13-Mar-15
CH0007-61	PH SUB 2 - Turbine Zone Structure Construction-elevation (from -15.40 to	103	207	14-Mar-15	29-Jun-15
CH0007-61	PH SUB 2 - Turbine Zone Structure Construction-elevation (from -11.08 to	66	207	30-Jun-15	05-Sep-15
CH0007-61	M30 - Unit 2 - Ready for Installation of Draft Tube Cone by Company Other	0	0		04-May-16*
CH0007-61	Unit 2 - Installation of Draft Tube Cone, by Other Contractor (CH0030)	24	1	05-May-16	29-May-16
CH0007-61	I10 - Unit 2 - Installation of Draft Tube Cone, Completed by Company Other	0	0		30-May-16*
CH0007-62	PH SUB 2 - Secondary Concrete of Draft Tube Cone Steel Liner	20	7	31-May-16	19-Jun-16
CH0007-62	M31 - Unit 2 - Ready for Installation of Stay Ring & Upper Pit Liner by Comp	0	0		27-Jun-16*
CH0007-62	Unit 2 -Installation of Stay Ring & Upper Pit Liner by Other Contractor (CH0	62	1	28-Jun-16	30-Aug-16
CH0007-62	I11- Unit 2 - Installation of Stay Ring & Upper Pit Liner, Completed by Compa	0	0		31-Aug-16*
CH0007-62	PH SUB 2 - Turbine Zone Structure Construction-elevation (from -3.905 to	37	10	01-Sep-16	08-Oct-16
CH0007-62	PH SUB 2 - Turbine Zone Structure Construction-elevation (from -0.90 to 3	29	6	01-Sep-16	30-Sep-16
CH0007-62	PH SUB 2 - Turbine Zone Structure Construction-elevation (from 3.30to 5.7	26	6	01-Oct-16	27-Oct-16
CH0007-62	PH SUB 2 - Turbine Zone Structure Construction-elevation (from 5.75 to 15	19	6	28-Oct-16	16-Nov-16
CH0007-62	PH SUB 2 - Turbine Zone - Final concrete finishing and clean-up of the area	30	6	18-Nov-16	04-Jan-17
Installation of Anchors and Embedded Parts provided by Others		293	207	14-Oct-14	05-Sep-15
CH0007-32	PH SUB 2 - Installation of Anchors and Embedded Parts provided by Other	124	207	14-Oct-14	13-Mar-15
CH0007-32	PH SUB 2 - Installation of Anchors and Embedded Parts provided by Other	103	207	14-Mar-15	29-Jun-15
CH0007-32	PH SUB 2 - Installation of Anchors and Embedded Parts provided by Other	66	207	30-Jun-15	05-Sep-15
Substructure - Unit 3		1044	15	26-Nov-13	18-Feb-17
CH0007-7160	Shop drawings for draft tube structure unit 3 (with approval)	90	46	26-Nov-13	21-Mar-14
CH0007-7170	Shop drawings for turbine structure unit 3 (with approval)	90	86	14-Jan-14	22-Apr-14
Installation of Anchors and Embedded Parts provided by Others		293	222	04-Nov-14	27-Sep-15
CH0007-32	PH SUB 3 - Installation of Anchors and Embedded Parts provided by Other	124	222	04-Nov-14	05-Apr-15
CH0007-33	PH SUB 3 - Installation of Anchors and Embedded Parts provided by Other	103	222	06-Apr-15	21-Jul-15
CH0007-33	PH SUB 3 - Installation of Anchors and Embedded Parts provided by Other	66	222	22-Jul-15	27-Sep-15
Civil Work		25	28	30-Apr-14	25-May-14
CH0007-32	PH SUB 3 - Area Preparation	25	28	30-Apr-14	25-May-14
Concrete Work		906	15	12-May-14	18-Feb-17
CH0007-53	PH SUB 3 - Draft Tube Structure Construction-floor slab (up to -26.66)	41	33	12-May-14	22-Jun-14
CH0007-53	PH SUB 3- Draft Tube Structure Construction-walls+roof slab (from -26.66	89	43	23-Jun-14	23-Sep-14
CH0007-53	PH SUB 3 - Draft Tube Structure Construction-walls+roof (from -18.10 to -8	95	43	24-Sep-14	17-Jan-15
CH0007-54	PH SUB 3 - Draft Tube Structure Construction-walls+front walls (from -8.90	117	43	18-Jan-15	25-May-15
CH0007-54	PH SUB 3 - Draft Tube Structure Construction-slabs+walls (from 5.50 to 15	115	43	26-May-15	21-Sep-15
CH0007-54	PH SUB 3 - Draft Tube Structure Construction-fire walls structure	23	43	22-Sep-15	15-Oct-15
CH0007-54	PH SUB 3 - Draft Tube - Final concrete finishing and clean-up of the area	30	43	16-Oct-15	16-Nov-15
CH0007-54	M42 - Unit 3 - Draft Tube, Structure Complete for start of hydro-mechanica	0	0		20-Jan-16*
CH0007-64	PH SUB 3 - Turbine Zone Structure Construction-fondation slab (up to -31.	26	90	17-Jun-14	14-Jul-14
CH0007-64	PH SUB 3 - Turbine Zone Structure Construction-elevation (from -31.40 to	109	222	15-Jul-14	03-Nov-14



Remaining Level of Effort | Actual Work | Critical Remaining ...
Critical Path | Remaining Work | Milestone

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CH0007-MUSKRAT FALLS-PROPOSED CONSTRUCTION SCHEDULE

Activity ID	Activity Name	Original Duration	Total Float	Start	Finish
CH0007-64	PH SUB 3 - Turbine Zone Structure Construction-elevation (from -22.50 to	124	222	04-Nov-14	05-Apr-15
CH0007-64	PH SUB 3 - Turbine Zone Structure Construction-elevation (from -15.40 to	103	222	06-Apr-15	21-Jul-15
CH0007-65	PH SUB 3 - Turbine Zone Structure Construction-elevation (from -11.08 to	66	222	22-Jul-15	27-Sep-15
CH0007-65	M38 - Unit 3 - Ready for Installation of Draft Tube Cone by Company Other	0	0		10-Jun-16*
CH0007-65	Unit 3 - Installation of Draft Tube Cone, by Other Contractor (CH0030)	23	1	11-Jun-16	05-Jul-16
CH0007-65	I12 - Unit 3 - Installation of Draft Tube Cone, Completed by Company Other	0	0		06-Jul-16*
CH0007-65	PH SUB 3 - Secondary Concrete of Draft Tube Cone Steel Liner	20	8	07-Jul-16	26-Jul-16
CH0007-65	M39 - Unit 3 - Ready for Installation of Stay Ring & Upper Pit Liner by Comp	0	0		03-Aug-16*
CH0007-65	Unit 3 -Installation of Stay Ring & Upper Pit Liner by Other Contractor (CH0	64	1	04-Aug-16	08-Oct-16
CH0007-65	I13- Unit 3 - Installation of Stay Ring & Upper Pit Liner, Completed by Comp	0	0		09-Oct-16*
CH0007-65	PH SUB 3 - Turbine Zone Structure Construction-elevation (from -3.905 to	37	19	11-Oct-16	18-Nov-16
CH0007-65	PH SUB 3 - Turbine Zone Structure Construction-elevation (from -0.90 to 3	29	5	11-Oct-16	08-Nov-16
CH0007-66	PH SUB 3 - Turbine Zone Structure Construction-elevation (from 3.30to 5.7	26	5	09-Nov-16	09-Dec-16
CH0007-66	PH SUB 3 - Turbine Zone Structure Construction-elevation (from 5.75 to 15	19	5	10-Dec-16	13-Jan-17
CH0007-66	PH SUB 3 - Turbine Zone - Final concrete finishing and clean-up of the area	30	15	14-Jan-17	18-Feb-17
Substructure - Unit 4		1023	14	05-Feb-14	20-Mar-17
CH0007-7180	Shop drawings for draft tube structure unit 4 (with approval)	90	46	05-Feb-14	13-May-14
CH0007-7190	Shop drawings for turbine structure unit 4 (with approval)	90	46	11-Mar-14	13-Jun-14
Concrete Work		905	14	12-Jun-14	20-Mar-17
CH0007-54	PH SUB 4 - Draft Tube Structure Construction-floor slab (up to -26.66)	41	28	12-Jun-14	24-Jul-14
CH0007-54	PH SUB 4 - Draft Tube Structure Construction-walls+roof slab (from -26.66	89	28	25-Jul-14	24-Oct-14
CH0007-54	PH SUB 4 - Draft Tube Structure Construction-walls+roof (from -18.10 to -8	95	28	25-Oct-14	21-Feb-15
CH0007-54	PH SUB 4 - Draft Tube Structure Construction-walls+front walls (from -8.90	117	28	22-Feb-15	25-Jun-15
CH0007-54	PH SUB 4 - Draft Tube Structure Construction-slabs+walls (from 5.50 to 15	115	50	26-Jun-15	22-Oct-15
CH0007-55	PH SUB 4 - Draft Tube Structure Construction-fire walls structure	23	50	23-Oct-15	16-Nov-15
CH0007-55	PH SUB 4 - Draft Tube - Final concrete finishing and clean-up of the area	30	50	17-Nov-15	04-Jan-16
CH0007-55	M50 - Unit 4 - Draft Tube, Structure Complete for start of hydro-mechanica	0	0		02-Mar-16*
CH0007-62	PH SUB 4 - Turbine Zone Structure Construction-fondation slab (up to -31.	26	77	13-Jul-14	08-Aug-14
CH0007-63	PH SUB 4 - Turbine Zone Structure Construction-elevation (from -31.40 to	109	235	09-Aug-14	28-Nov-14
CH0007-63	PH SUB 4 - Turbine Zone Structure Construction-elevation (from -22.50 to	124	235	29-Nov-14	30-Apr-15
CH0007-63	PH SUB 4 - Turbine Zone Structure Construction-elevation (from -15.40 to	103	235	01-May-15	15-Aug-15
CH0007-63	PH SUB 4 - Turbine Zone Structure Construction-elevation (from -11.08 to	66	235	16-Aug-15	22-Oct-15
CH0007-63	M46 - Unit 4 - Ready for Installation of Draft Tube Cone by Company Other	0	0		19-Jul-16*
CH0007-63	Unit 4 - Installation of Draft Tube Cone, by Other Contractor (CH0030)	24	1	20-Jul-16	13-Aug-16
CH0007-63	I14 - Unit 4 - Installation of Draft Tube Cone, Completed by Company Other	0	0		14-Aug-16*
CH0007-63	PH SUB 4 - Secondary Concrete of Draft Tube Cone Steel Liner	20	6	15-Aug-16	03-Sep-16
CH0007-63	M47 - Unit 4 - Ready for Installation of Stay Ring & Upper Pit Liner by Comp	0	0		10-Sep-16*
CH0007-63	Unit 4 -Installation of Stay Ring & Upper Pit Liner by Other Contractor (CH0	57	1	11-Sep-16	07-Nov-16
CH0007-64	I15 - Unit 4 - Installation of Stay Ring & Upper Pit Liner, Completed by Comp	0	0		08-Nov-16*
CH0007-64	PH SUB 4 - Turbine Zone Structure Construction-elevation (from -3.905 to	37	1	09-Nov-16	04-Jan-17
CH0007-64	PH SUB 4 - Turbine Zone Structure Construction-elevation (from -0.90 to 3	29	14	09-Nov-16	12-Dec-16
CH0007-64	PH SUB 4 - Turbine Zone Structure Construction-elevation (from 3.30to 5.7	26	14	14-Dec-16	24-Jan-17
CH0007-64	PH SUB 4 - Turbine Zone Structure Construction-elevation (from 5.75 to 15	19	14	25-Jan-17	17-Feb-17
CH0007-64	PH SUB 4 - Turbine Zone - Final concrete finishing and clean-up of the area	30	14	18-Feb-17	20-Mar-17
Installation of Anchors and Embedded Parts provided by Others		293	235	29-Nov-14	22-Oct-15
CH0007-35	PH SUB 4 - Installation of Anchors and Embedded Parts provided by Other	124	235	29-Nov-14	30-Apr-15
CH0007-35	PH SUB 4 - Installation of Anchors and Embedded Parts provided by Other	103	235	01-May-15	15-Aug-15
CH0007-35	PH SUB 4 - Installation of Anchors and Embedded Parts provided by Other	66	235	16-Aug-15	22-Oct-15
Civil Work		248	324	31-May-14	05-Mar-15
CH0007-32	PH SUB 4 - Area Preparation	25	28	31-May-14	25-Jun-14
CH0007-70	PH SUB 4 - Grouting and drainage (contact grouting)	11	324	22-Feb-15	05-Mar-15
Superstructure (Intake and Powerhouse) - South Service Bay		306	0	25-May-14	30-Apr-15
CH0007-6880	Shop drawings for superstructure (powerhouse and intake) South service	90	46	25-May-14	25-Aug-14
Structural Steel		192	0	20-Sep-14	30-Apr-15
CH0007-19	I PH S S B - Structural Steel Construction for Setting PH Crane on Rails	40	22	20-Sep-14	30-Oct-14
CH0007-19	M18 - South Service Bay Structural Steel Ready for Setting Powerhouse Cr	0	0		30-Apr-15*
CH0007-19	I PH S S B - Structural Steel Construction (Mezzanines included)	80	62	10-Nov-14	22-Feb-15
CH0007-19	M18 - South Service Bay Mezzanines, Ready for Start of Work by Company	0	0		30-Apr-15*
Miscellaneous Steel		142	0	10-Nov-14	30-Apr-15
CH0007-20	I PH S S B - Miscellaneous Steel	100	12	10-Nov-14	16-Mar-15
CH0007-20	M18 - South Assembly Bay Enclosed and High Bay Lighting Installed and R	0	0		30-Apr-15*
Architectural Works		100	12	14-Dec-14	18-Apr-15
CH0007-33	I PH S S B - Architectural and Final Civil Works	100	12	14-Dec-14	18-Apr-15
Superstructure (Intake and Powerhouse) - North Service Bay		260	0	18-Jun-15	09-Apr-16

Remaining Level of Effort | Actual Work | Critical Remaining ...
Critical Path | Remaining Work | Milestone

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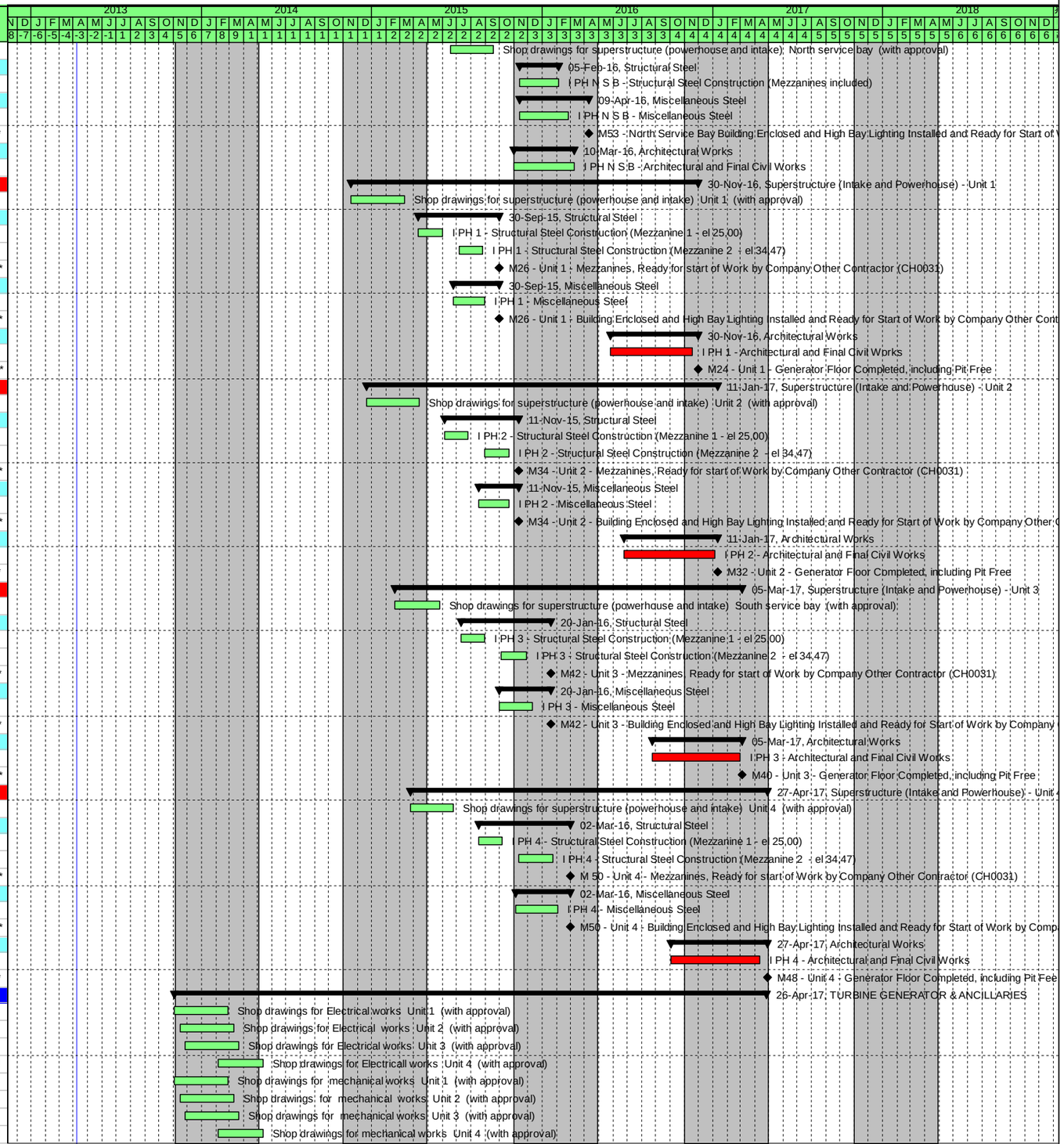
ASTALDI CANADA Inc.

CH0007-MUSKRAT FALLS-PROPOSED CONSTRUCTION SCHEDULE

Activity ID	Activity Name	Original Duration	Total Float	Start	Finish
CH0007-7230	Shop drawings for superstructure (powerhouse and intake) North service	90	70	18-Jun-15	19-Sep-15
Structural Steel		60	58	13-Nov-15	05-Feb-16
CH0007-32	I PH N S B - Structural Steel Construction (Mezzanines included)	60	58	13-Nov-15	05-Feb-16
Miscellaneous Steel		118	0	13-Nov-15	09-Apr-16
CH0007-2(	I PH N S B - Miscellaneous Steel	80	38	13-Nov-15	27-Feb-16
CH0007-2(	M53 - North Service Bay Building Enclosed and High Bay Lighting Installed	0	0		09-Apr-16*
Architectural Works		100	28	02-Nov-15	10-Mar-16
CH0007-33	I PH N S B - Architectural and Final Civil Works	100	28	02-Nov-15	10-Mar-16
Superstructure (Intake and Powerhouse) - Unit 1		668	0	17-Nov-14	30-Nov-16
CH0007-7220	Shop drawings for superstructure (powerhouse and intake) Unit 1 (with a	90	91	17-Nov-14	12-Mar-15
Structural Steel		167	0	11-Apr-15	30-Sep-15
CH0007-2(	I PH 1 - Structural Steel Construction (Mezzanine 1 - el 25,00)	50	64	11-Apr-15	01-Jun-15
CH0007-2(	I PH 1 - Structural Steel Construction (Mezzanine 2 - el 34,47)	50	30	08-Jul-15	27-Aug-15
CH0007-21	M26 - Unit 1 - Mezzanines, Ready for start of Work by Company Other Cor	0	0		30-Sep-15*
Miscellaneous Steel		95	0	25-Jun-15	30-Sep-15
CH0007-21	I PH 1 - Miscellaneous Steel	65	30	25-Jun-15	30-Aug-15
CH0007-21	M26 - Unit 1 - Building Enclosed and High Bay Lighting Installed and Ready	0	0		30-Sep-15*
Architectural Works		181	0	26-May-16	30-Nov-16
CH0007-23	I PH 1 - Architectural and Final Civil Works	170	11	26-May-16	18-Nov-16
CH0007-23	M24 - Unit 1 - Generator Floor Completed, including Pit Free	0	0		30-Nov-16*
Superstructure (Intake and Powerhouse) - Unit 2		662	0	21-Dec-14	11-Jan-17
CH0007-7210	Shop drawings for superstructure (powerhouse and intake) Unit 2 (with a	90	101	21-Dec-14	13-Apr-15
Structural Steel		154	0	05-Jun-15	11-Nov-15
CH0007-23	I PH 2 - Structural Steel Construction (Mezzanine 1 - el 25,00)	50	53	05-Jun-15	26-Jul-15
CH0007-23	I PH 2 - Structural Steel Construction (Mezzanine 2 - el 34,47)	50	19	31-Aug-15	21-Oct-15
CH0007-23	M34 - Unit 2 - Mezzanines, Ready for start of Work by Company Other Cor	0	0		11-Nov-15*
Miscellaneous Steel		84	0	17-Aug-15	11-Nov-15
CH0007-23	I PH 2 - Miscellaneous Steel	65	19	17-Aug-15	22-Oct-15
CH0007-23	M34 - Unit 2 - Building Enclosed and High Bay Lighting Installed and Ready	0	0		11-Nov-15*
Architectural Works		176	0	25-Jun-16	11-Jan-17
CH0007-23	I PH 2 - Architectural and Final Civil Works	170	6	25-Jun-16	04-Jan-17
CH0007-24	M32 - Unit 2 - Generator Floor Completed, including Pit Free	0	0		11-Jan-17*
Superstructure (Intake and Powerhouse) - Unit 3		669	0	19-Feb-15	05-Mar-17
CH0007-7200	Shop drawings for superstructure (powerhouse and intake) South service	90	101	19-Feb-15	25-May-15
Structural Steel		166	0	12-Jul-15	20-Jan-16
CH0007-24	I PH 3 - Structural Steel Construction (Mezzanine 1 - el 25,00)	50	56	12-Jul-15	31-Aug-15
CH0007-24	I PH 3 - Structural Steel Construction (Mezzanine 2 - el 34,47)	50	22	06-Oct-15	29-Nov-15
CH0007-24	M42 - Unit 3 - Mezzanines, Ready for start of Work by Company Other Cor	0	0		20-Jan-16*
Miscellaneous Steel		87	0	01-Oct-15	20-Jan-16
CH0007-24	I PH 3 - Miscellaneous Steel	65	22	01-Oct-15	11-Dec-15
CH0007-24	M42 - Unit 3 - Building Enclosed and High Bay Lighting Installed and Ready	0	0		20-Jan-16*
Architectural Works		165	0	24-Aug-16	05-Mar-17
CH0007-24	I PH 3 - Architectural and Final Civil Works	160	5	24-Aug-16	28-Feb-17
CH0007-24	M40 - Unit 3 - Generator Floor Completed, including Pit Free	0	0		05-Mar-17*
Superstructure (Intake and Powerhouse) - Unit 4		687	0	24-Mar-15	27-Apr-17
CH0007-7240	Shop drawings for superstructure (powerhouse and intake) Unit 4 (with a	90	108	24-Mar-15	25-Jun-15
Structural Steel		168	0	17-Aug-15	02-Mar-16
CH0007-25	I PH 4 - Structural Steel Construction (Mezzanine 1 - el 25,00)	50	58	17-Aug-15	06-Oct-15
CH0007-25	I PH 4 - Structural Steel Construction (Mezzanine 2 - el 34,47)	50	24	12-Nov-15	23-Jan-16
CH0007-25	M 50 - Unit 4 - Mezzanines, Ready for start of Work by Company Other Co	0	0		02-Mar-16*
Miscellaneous Steel		89	0	06-Nov-15	02-Mar-16
CH0007-25	I PH 4 - Miscellaneous Steel	65	24	06-Nov-15	04-Feb-16
CH0007-25	M50 - Unit 4 - Building Enclosed and High Bay Lighting Installed and Ready	0	0		02-Mar-16*
Architectural Works		174	0	03-Oct-16	27-Apr-17
CH0007-25	I PH 4 - Architectural and Final Civil Works	160	14	03-Oct-16	12-Apr-17
CH0007-25	M48 - Unit 4 - Generator Floor Completed, including Pit Fee	0	0		27-Apr-17*
TURBINE GENERATOR & ANCILLARIES		1126	1	04-Nov-13	26-Apr-17
CH0007-7250	Shop drawings for Electrical works Unit 1 (with approval)	90	24	04-Nov-13	27-Feb-14
CH0007-7260	Shop drawings for Electrical works Unit 2 (with approval)	90	54	15-Nov-13	10-Mar-14
CH0007-7270	Shop drawings for Electrical works Unit 3 (with approval)	90	81	26-Nov-13	21-Mar-14
CH0007-7280	Shop drawings for Electricall works Unit 4 (with approval)	90	68	05-Feb-14	13-May-14
CH0007-7290	Shop drawings for mechanical works Unit 1 (with approval)	90	24	04-Nov-13	27-Feb-14
CH0007-7300	Shop drawings for mechanical works Unit 2 (with approval)	90	54	15-Nov-13	10-Mar-14
CH0007-7310	Shop drawings for mechanical works Unit 3 (with approval)	90	81	26-Nov-13	21-Mar-14
CH0007-7320	Shop drawings for mechanical works Unit 4 (with approval)	90	68	05-Feb-14	13-May-14



Remaining Level of Effort | Actual Work | Critical Remaining ...
Critical Path | Remaining Work | Milestone

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ASTALDI CANADA Inc.

CH0007-MUSKRAT FALLS-PROPOSED CONSTRUCTION SCHEDULE

Activity ID	Activity Name	Original Duration	Total Float	Start	Finish
Electrical Works		1034	1	02-Mar-14	26-Apr-17
CH0007-2220	T&G - Unit 1 - Electrical Works -draft tube areas	510	22	02-Mar-14	08-Sep-15
CH0007-2270	T&G - Unit 1 - Electrical Works - turbine zone 1a phase	428	70	09-Apr-14	20-Jul-15
CH0007-2300	T&G - Unit 1 - Electrical Works - turbine zone completion	100	25	23-Jul-16	02-Nov-16
CH0007-3550	T&G - Unit 2 - Electrical Works -draft tube areas	510	24	13-Apr-14	17-Oct-15
CH0007-3600	T&G - Unit 2 - Electrical Works - turbine zone 1a phase	428	64	27-May-14	05-Sep-15
CH0007-3630	T&G - Unit 2 - Electrical Works - turbine zone completion	100	10	01-Sep-16	17-Dec-16
CH0007-3640	T&G - Unit 3 - Electrical Works -draft tube areas	520	33	12-May-14	28-Nov-15
CH0007-3690	T&G - Unit 3 - Electrical Works - turbine zone 1a phase	428	90	17-Jun-14	27-Sep-15
CH0007-3720	T&G - Unit 3 - Electrical Works - turbine zone completion	100	19	11-Oct-16	14-Feb-17
CH0007-3730	T&G - Unit 4 - Electrical Works -draft tube areas	520	40	12-Jun-14	15-Jan-16
CH0007-3780	T&G - Unit 4 - Electrical Works - turbine zone 1a phase	428	77	09-Aug-14	20-Nov-15
CH0007-3810	T&G - Unit 4 - Electrical Works - turbine zone completion	100	1	05-Jan-17	26-Apr-17
Mechanical Works		1034	1	02-Mar-14	26-Apr-17
CH0007-2130	T&G - Unit 1 - Mechanical Works -draft tube areas	510	22	02-Mar-14	08-Sep-15
CH0007-2180	T&G - Unit 1 - Mechanical Works - turbine zone 1a phase	428	70	09-Apr-14	20-Jul-15
CH0007-2210	T&G - Unit 1 - Mechanical Works - turbine zone completion	100	25	23-Jul-16	02-Nov-16
CH0007-3820	T&G - Unit 2 - Mechanical Works -draft tube areas	510	24	13-Apr-14	17-Oct-15
CH0007-3870	T&G - Unit 2 - Mechanical Works - turbine zone 1a phase	428	64	27-May-14	05-Sep-15
CH0007-3900	T&G - Unit 2- Mechanical Works - turbine zone completion	100	10	01-Sep-16	17-Dec-16
CH0007-3910	T&G - Unit 3 - Mechanical Works -draft tube areas	520	33	12-May-14	28-Nov-15
CH0007-3960	T&G - Unit 3 - Mechanical Works - turbine zone 1a phase	428	90	17-Jun-14	27-Sep-15
CH0007-3990	T&G - Unit 3 - Mechanical Works - turbine zone completion	100	19	11-Oct-16	14-Feb-17
CH0007-4000	T&G - Unit 4 - Mechanical Works -draft tube areas	520	40	12-Jun-14	15-Jan-16
CH0007-4050	T&G - Unit 4 - Mechanical Works - turbine zone 1a phase	428	77	09-Aug-14	20-Nov-15
CH0007-4080	T&G - Unit 4- Mechanical Works - turbine zone completion	100	1	05-Jan-17	26-Apr-17
WORK EXECUTED FOR COMPANY'S OTHER CONTRACTOR		1277	105	02-May-14	17-Mar-18
Supply of concrete to Company's other contractor		1277	105	02-May-14	17-Mar-18
CH0007-5880	Supply of secondary concrete - class A2- spillway	320	227	16-Feb-15	08-Feb-16
CH0007-5890	Supply of secondary concrete - class A2 -Powerhouse	124	782	01-Oct-15	02-Mar-16
CH0007-5900	Supply of secondary concrete - class A2 - Rollway	338	105	14-Mar-17	17-Mar-18
CH0007-5910	Supply of concrete - class A	220	1062	02-May-14	18-Dec-14
CH0007-5920	Supply of concrete - class B	220	1062	02-May-14	18-Dec-14
DEMOBILIZATION		1030	0	26-May-15	30-Jun-18
CH0007-2570	DEM -Downstream Temporary Bridge Removing	30	5	18-Mar-18	16-Apr-18
CH0007-2580	DEM -Integrated Cover System Dismantling (PH Winter Protection) intake	40	182	26-May-15	06-Jul-15
CH0007-2590	DEM - Integrated System Dismantling (PH Winter Protection) Draft tube	40	35	16-Jul-15	25-Aug-15
CH0007-2600	DEM -Integrated System Dismantling (PH Winter Protection) Turbine	40	154	23-Jun-15	03-Aug-15
CH0007-2610	DEM - Demobilization and Site Restoration	100	5	18-Mar-18	25-Jun-18
CH0007-4090	M2 - Substantial Completion of the Work	0	0		30-Jun-18*
CH0007-7410	Start to the period of the maintenance (36 months)	0	0		30-Jun-18*

Remaining Level of Effort | Actual Work | Critical Remaining ...
Critical Path | Remaining Work | Milestone

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NALCOR ENERGY
LOWER CHURCHILL PROJECT
MUSKRAT FALLS

CONSTRUCTION OF INTAKE AND POWERHOUSE, SPILLWAY
AND TRANSITION DAMS

PACKAGE CH0007
CORE TECHNICAL PROPOSAL

APPENDIX A13
EXECUTION PLAN

ATTACHMENT 2

PROJECT ORGANIZATION CHART

April 16, 2013

Astaldi S.p.A. 21/03/2013

PROJECT CONSTRUCTION : FUNCTIONAL - ORGANIZATIONAL CHART

Canada: Muskrat Falls Generation Station, Contract CH 0007 - Intake, Power House, Spillway and Transition Dam.

Astaldi
Canadians
Others
Consultants

MANAGEMENT

COMPANY
NALCOR

Astaldi Canada Inc.
Country Manager

Headquarter Services
Safety
Qality Assurance
Environment
Administ. & Finance
Project Man. & Control
Risks Management
Information Technologies
Legal & Contractual
Public Relation

Project Q. A.
QA/QC Supervisor 1
QA/QC Inspectors 3

PROJECT MANAGEMENT
Project Manager 1

Deputy P. Management
Deputy P. Manager 1

Secretariat
Secretary H.Lev. 1
Secretary H.Lev. 1

Contract Administr.
Contr. Adm. Resp. 1
Contr. Adm. Assistan 1

Project Control
Project Control Resp. 1
P. Control Assistant 1
Tech. Staff 2

Envirnoment
Envirnoment Resp. 1
Environ. Assistant 3

Risk Management
Risk Manag. Resp. 1
Risk Manag. Assist. 1

Public Relation
Public Relat. Resp 1
Public relation assist. 1

Healt & Safety
Healt & S. Resp. 1
Healt & S. Assistant 3

St. John Repres. Office
Repres. Office Resp. 1
Repres. Office Assist 1
Secretary 1
Clerk 1

Quality A. Q.C.
QA/QC Responible 1
QA/QC Assistant 3

Laboratory
External services

PRODUCTION Dpt.
Product. Manager 1

Deputy PRODUCT. Dpt.
Deputy Pr.Manager 1

Project Man. Office
P.M.O. 1

PLANT Dpt.
Plant Manager 1

PROCUREMENT
Procur. Manager 1

ADMIN. & FINANCE
Admin. Manager 1

Secretariat
Secretary 1

Management Total Staff 41 15%

LOGISTICS

Hoarding-Heat. Sy.
Section Chief 1
Hoard.Gen. Foreman 3

Concrete Prod. & Distribition
Section Chief 1

Re. Steel Yard.
Section Chief 1
General Foreman 3

Joinery
Section Chief 1
General Foreman 3

E.M.&M. Works
Section Chief 1

Technical Office
Tech. O. Respons. 1
Tech. O. Assistant 2
Tech. Staff 2
Draftman CAD 4

Q.S.Office
Q.S.O. Responsible 1
Q.S.O. Assistant 1
Draftman CAD 2

Planning
Planning Respons. 1
Planning assistant 1

Topography
Surveyor Responsible 1
Surveyor assistant 1

Permanent Materials
Perm. Mat. Resp. 1
P. Mat. Assistant 1

Construct. Methods
C. M. Responsible 1
C. M. Assistant 1
Draftman CAD 1

Mechan. W/Shops
Section Chief 1
G.F. Hydr./Cranes 3
G.F. Heavy Equip. 3
G.F. Light Equip. 3
G.F. Air Compress. 3
G.F. Mainten. 3
G.F. Autoelectr. 3

Steel Carpentry
Section Chief 1

Electric. W/Shops
Section Chief 1

Plants
Section Chief 1
General Foreman 1

Purchasing
Purch.Responsible 1
Clerk 2

Goose Bay Office
Office Resp. 1
Purchasers 1
Secretary 1

Subcontracts
Subcontract. Resp. 1
Accountant 1

Warehouse
Wareh. Resp. 1
Wareh. Assistant 1
Storekeepers 6
Accountants 2

ACCOUNTANCY
Chief Accountant 1

Accountancy
Accountants 2
Cashier 1
Clerks 2

Inform. Technologies
I.T. Assistant 2

GENERAL SERVICES
Gen .S. Responsible 1

Camp/Offices Maint.
Maint. Assistant 1
Clerks 2

Pers.Transportation
Transport. Assistant 1
Clerks 2

Human Res./ Payroll
H. R. Responsible 1

Union Peronnel
U. P. Responsible 1
U. P. Assistant 1
Clerks 2

Staff
Staff Responsible 1
Staff Assistant 1
Clerks 1

Logistics Total Staff 100 35%

OPERATIONAL

P6 Ativ.

Earthw. & Roads Maint.
Section Chief 1
General Foreman 1

Topography
Surveyor a.i.

Q.A./Q.C.
QA/QC Assistant a.i.
Healt & S. Assist a.i.

Earthworks & Road Maintenance 21

Spillway/North Tr. Dam
Section Chief 1
General Foreman (Concrete) 6

Hoarding-Heat. Sy.
Hoarding Specialist 3
Heat. El/Mech Forem. a.i.

Concrete
General Foreman 3

Steel / Formworks
Re-Steel Gen For. a.i.
Formw.Gen. Forem. a.i.

Technical Support
Tech Assistant 2

Topography
Surveyor 3

Electr. w/shop
El. W.Foreman a.i.

Q.A./Q.C.
QA/QC Assistant 3
Healt & S. Assist 3

Subcontract
Subc. Assistant 1

Admin. Support
Timekeepers 1
Adm. Assistant 1

Spillway & North Transition Dam 105

Power House-Intake Draft T.
Section Chief 3
General Foreman (Concrete) 6

Hoarding-Heat. Sy.
Hoarding Specialist 6
Heat. El/Mech Forem 3

Concrete
General Foreman 3

Steel / Formworks
Re-Steel Gen For. 9
Formw. Gen. Forem. 9

Technical Support
Tech Assistant 2

Topography
Surveyor 9

Electr. w/shop
El. W.Foreman 3

Steel Carpentry
G.F. St. Carpentry 3

Q.A./Q.C.
QA/QC Assistant 3
Healt & S. Assist 3

Subcontract
Subc. Assistant a.i.

Admin. Support
Timekeepers 1
Adm. Assistant 1

Power house & Intake 191

Power House Superstr.
Section Chief a.i.
General Foreman a.i.

E.M. & M. Works
EM&M Gen. Forem. 3

Topography
Surveyor a.i.

E.M & M.W.
P.M. Assistant a.i.

Steel Carpentry
G.F. St. Carpentry a.i.

Perm. Material Proc.
Proc. Assistant 1
Proc Quality Insp. 1

Subcontract
Subc. Assistant a.i.

Power house Superstructure 23

Centre Tr. Dam/S. Walls
Section Chief 1
General Foreman (Concrete) 6

Concrete
General Foreman a.i.

Steel / Formworks
Re-Steel Gen For. a.i.
Formw. Gen. Forem. a.i.

Topography
Surveyor 3

Electr. w/shop
El. W.Foreman a.i.

Q.A./Q.C.
QA/QC Assistant 3
Healt & S. Assist 3

Subcontract
Subc. Assistant a.i.

Admin. Support
Timekeepers a.i.
Adm. Assistant a.i.

Centre Trans. Dam & Separation Walls 24

E.M.& M.Works
Section Chief a.i.
General Foreman a.i.

E.M. & M. Works
EM&M Gen. Forem. 3

Topography
Surveyor a.i.

E.M & M.W.
P.M. Assistant a.i.

Electr. w/shop
El. W.Foreman a.i.

Steel Carpentry
G.F. St. Carpentry a.i.

Q.A./Q.C.
QA/QC Assistant 3
Healt & S. Assist a.i.

Perm. Material Proc.
Proc. Assistant a.i.
Proc Quality Insp. a.i.

Subcontract
Subc. Assistant a.i.

EM. Warehouse
Storekeeper 3

E.M. & M.Works 24

Crushing/Batching Plant
Plant Chief a.i.
General Foreman a.i.

Electr. w/shop
El. W.Foreman 3

Steel Carpentry
G.F. St. Carpentry a.i.

Crushing Plant
Cr.P. G. Forem. 3

Batching Blant
Batch.Pl. Gen.Forem. 3

Q.A./Q.C.
QA/QC Assistant 3
Healt & S. Assist 3

Laboratory
Laboratory Resp.

Subcontract
Subc. Assistant 1

Admin. Support
Timekeepers 1
Adm. Assistant 1

Crushing & Batching Plant

Site Organ. & Gen. Serv.
Site Install. Superintendet a.i.
General Foreman a.i.

Electr. w/shop
El. W.Foreman a.i.

Camps/Offices
Maint. Assistant a.i.
Transport. Assistant a.i.

Site Organiz. & Gen. Services

0

Operational Total Staff 141 50%
Total Indirect Staff 282 100%

Delivery Respons. Structure(as per W.B.S.)	Project Management Office	Procurement	Administration and Finance	Project Delivery

NALCOR ENERGY
LOWER CHURCHILL PROJECT
MUSKRAT FALLS

CONSTRUCTION OF INTAKE AND POWERHOUSE, SPILLWAY
AND TRANSITION DAMS

PACKAGE CH0007
CORE TECHNICAL PROPOSAL

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EXECUTION PLAN

ATTACHMENT 3

CURRICULUM VITAE - CONTRACTOR REPRESENTATIVE - EMMANUEL TRIASSI

April 16, 2013

EMMANUEL TRIASS
Contractor Representative

Mr. Emmanuel Triassi is an experienced business man in the construction industry in Canada. He has an impressive academic background and an extensive experience. He successfully executed projects on budget and schedule including apartment building, schools, sports complexes, public buildings, offices, hotels, and other infrastructures projects Mr. Triassi is the founder and president of TEQ Enterprise in Montreal, Quebec.

EDUCATION

Master in Engineering Building Studies-Project Management
Concordia University – 1979

Bachelor in Engineering

McGill University – 1974

Quantum Shift Fellow

Richard Ivey School of Business - 2007

Administrateur de sociétés certifié

Collège des administrateurs de sociétés, University of Laval - 2010

LANGUAGES

English, French, Italian

PROFESSIONAL ASSOCIATIONS

Ordre des Ingénieurs du Québec/Quebec Order of Engineers

Project Management Institute

Canadian Institute of Quantity Surveyors

Les Économistes en construction du Québec Inc.

Italian Chamber of Commerce in Canada - Montreal

AWARDS and DISTINCTIONS

2004 : Honourary title of *Grande Ufficiale, Ordine al Merito della Repubblica Italiana* awarded by the President of Italy.

1997 : Honoray titly of C*ommendatore, Ordine Al Merito della Repubblica Italiana* awarded by the President of Italy

1996 : Golden Seal for project management by the Canadian Construction Association.

1991 : Mention for the project *Quartiers de l'Héritage* by the Quebec Order of Architects

1990 : Governor General's award for *Quartiers de l'Héritage* by *Canadian Royal Institute of Architecture*

PROFESSIONAL EXPERIENCE

2012 – present	Chief Executive Officer **Astaldi Canada inc.**
1984 – present	President and Principal **GROUPE TEQ** Construction Project Management and General Contractor
December 2002 – March 2003	Interim President **ROYAL CANADIAN MINT**
1999 – 2002	President **ACMON INC. et** **LES ENSEMBLES URBAINS LTÉE** Important North American firm specialized in property management
1982 – 1985	Partner and Project Manager **DÉVELOPPEMENT GENDEV INC.** Developer/Constructor
1979 – 1981	President & Partner **ENTREPRISES T.T.S INC.** Developer/Constructor
1974 – 1976	Junior Engineer **MONTREAL ENGINEERING CO. LTD.** Consultants

RESEARCH & TEACHING

1992 – to 1998	Adjunct Professor, McGill University Department of Civil Engineering
1986 – 1988	Researcher & recipient of grant from C.M.H.C. for a project entitled “Project Management for the Small Housing Contractor”
1985 – 1988	Participant in the University/industry program for NSERC entitled “Advanced Computer Based Management Technologies for the Canadian General Contractor”
1983 – 1984	Researcher & recipient of grant from C.M.H.C. for a project entitled “Field Trial of Experimental Planning, Scheduling and Control for Highrise Housing Constuction”

RESEARCH & TEACHING

1982 – 1984	Co-supervisor on research entitled "Project Management Information Systems for Small Contractors", leading to thesis for Masters by Simon Lo, Concordia University
1976 – 1983	Lecturer Dawson College, Montréal Department of Civil Technology

NOMINATIONS

2009 - present	Board Member of Theatre du Nouveau Monde
October 2007 - present	Board of administration, Hydro-Québec Member of Audit, Finance and HR Committees
1999 - 2005	Chairman of Board of administration of Royal Canadian Mint
2005	Chairman, Strategic Planning Committee Royal Canadian Mint
1999, to date	Governor of the Italian-Canadian Community Foundation
2001 - 2004	Member, Board of administration Leonardo da Vinci Italian Community & Cultural Centre
2001 - 2003	Member, Board of World Association of Italian Chambers of Commerce
2002 to date	Chairman of board, Italian Chamber of Commerce of Canada
1996 - 2002	Member of board of Les Ensembles Urbaines Ltée
1995 – 2002	President, Italian Chamber of Commerce of Canada
1991 – 1995	Vice-President Italian Chamber of Commerce of Canada
1999 - 2001	Member of task group for SME for Ministry of Foreign affairs and International Business of Canada
1995 - 1999	President Council of North-American Italian Chambers of Commerce
1991	Member special Committee for the integration of parents at à Vanguard School

PHILANTHROPIC WORKS

2008 – present	Co-President of L'Institut de recherches cliniques de Montréal (IRCM) fund capital campaign raising 2007-2011
2008 - 2009	Co-President of St-Jean Ambulance fund raising campaign
2005	Member of Organisor Committee for The Red Cross fund raising,
2002 et 2003	President of *Bal des Gouverneurs*, fundraiser for the Italian Canadian Community Foundation
1998, 2000 et 2001	Honorary Chair and organizer with the Italian Chamber of Commerce, fundraiser to help finance the Leonardo da Vinci Community Cultural Center
1999	Honorary Chair and Organizer of fundraiser with Italian Chamber of Commerce 1999 for New Dimension Foundation for children with learning disabilities
1998	Honorary Chair of the *Ballo di Venezia*, the 1998 fundraiser event for *Virage*, support group for cancer victims and their families
1997	Honorary Chair and organizer with the Italian Chamber of Commerce for a fundraiser for the Santa Cabrini Hospital

PUBLICATIONS & ARTICLES

1. Triassi, E.	"The Building Contractor and Project Control: Case Study" Report N^0 CBS-74, Center for Building Studies, Concordia University, Montreal 1979
2. Russell, Alan D. & Triassi, E.	"General Contractor Project Control Practices and MIS" Journal of the Construction Division, ASCE, Vol. 108, N^0 CO3, Sept. 1982, pp. 419-437
3. Russell, Alan D. & Triassi, E.	"Requirements for Building Contractor Project Management Information Systems", Proceedings of the 6^{th} INTERNET Congress, Farmisch-Partemkirchen. 1979, Vol. 3, pp. 247-261
4. Russell, Alan D. & Triassi, E.	"Characteristics of the Building Contractor and Project Management Information Systems", Proceedings of the Canadian Society of Civil Engineers, Montreal, 1979, pp. 79-85
5. Triassi, E.	"Field Trial of Experimental Planning Scheduling and Control for High Rise Housing Construction", report submitted to C.M.H.C. for External Research Program, May 1984

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CURRICULUM VITAE - PROJECT START-UP TASK FORCE LEADER - GUIDO VENTURINI

April 16, 2013

GUIDO VENTURINI
Project Coordinator

Mr. Guido Venturini is a mining engineering and an engineering geologist with 21 years of experience in planning, study and execution of hydroelectric projects. Mr Venturini has experience in project and execution of traditional and EPC contracts for infrastructure projects in more than 9 countries including preparation of technical and feasibility study for the Santo Antonio Hydro Power Plant on the Rio Madeira in Brazil with a total installed capacity of 3150 MW.

Education and/or Professional Qualifications:

Engineering geologist – University of Turin (IT)
Doctor in Engineering Geology – University of Lausanne (CH)
Diploma in mining Engineering – University of Lausanne (CH)

Linguistic ability: English, French and Spanish

Professional Experience:

1996-To Date **Astaldi SpA – Rome (Italy)**

2012-to Date Technical manager for large infrastructure project Astaldi Canada

2009- 2011 Technical manager for the Cerro de Aguila Hydro Power Plant (under construction) (Peru)
- 1 concrete dam of 420.000 m3 (crest 293 meters)
- 11 kms of tunnels, under very high topographic covers (1.300 m)
- Underground powerhouse, valve chamber and transformer hall
- Surge tunks, tailrace tunnels

2008 - 2012 Technical advisor during bidding and construction for the St. Teresa hydro power plant (Peru)
- 5 kms of tunnels, under very high topographic covers (1.100 m)
- Underground powerhouse, valve chamber and transformer hall
- Surge tunks, tailrace tunnels

2007 - 2011 Technical advisor during bidding and construction for Hunza hydro power plant (Peru)
- 65.000 m3 concrete dam
- 10 kms of tunnels
- 700 meters high penstock
- Open air powerhouse (56.000 m3 concrete

2008 Technical advisor during bidding for Nido de Aguila hydro power plant (Chile)

2007 Technical advisor during bidding for Chacayes hydro power plant (Chile)

2006 - 2007 Technical advisor during bidding for Quitaracxa and Pucara hydro power plant (Peru)

2006 Technical advisor during bidding and for Tocoma hydro power plant (Venezuela)
- 1.150.000 m3 concrete in the powerhouse and intake, very similar as scheme to Muskrat Falls Project

2006 - 2007 Technical advisor for bidding and planning and for Santo Antonio hydro power plant (Brazil)
- 5.450.000 m3 concrete in the powerhouse and intake
- 32.000.000 m3 of earth works

2005 - 2007 Technical advisor for construction of Melito Dam (Italy)
- 11.000.000 m3 rockfill dam
- 112.000 m3 of concrete

2004 Technical advisor for construction of Premadio hydro power plant (Italy)

1996 – 2003 Technical manager of all the geoengineering issues related to the construction of Pont Ventoux Hydro Power Plant (Italy)
- 34 kms of tunnels (3 TBMs)
- Rockfill dam
- Concrete Dam 65.000 m3
- Underground powerhouse 72.000 m3 concrete

1993 – 1996 **Technical advisor for the construction of several hydro plants in Italy** (ENEL)

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CURRICULUM VITAE - PROJECT MANAGER - VITTORIO AGABIO

April 16, 2013

VITTORIO AGABIO
Project Manager

Mr. Vittorio Agabio is a certified professional project manager with more than 30 years of experience as project manager in projects in Italy and overseas. He has planned and built major infrastructure projects successfully. He has a strong commercial background in international law and implementation of project management methodologies, processes and procedures.

Education and/or Professional Qualifications:

Industrial Engineering, Politecnico de Torino (1975), Italy

Linguistic ability: English and Spanish

Certifications: Professional Project Manager (PMP) by PMI
Neuro Linguistic Programming (NLP) Master Practitioner

Professional Experience:

2011-2012 **Astaldi SpA – Rome (Italy)**
Huanza Hydroelectric Project (Peru)
Independent Consultant
Turnaround Management Projects (Project in Oman)
Start-up Management Projects (Project in Honduras)
Project Management and General Management Trainer (various)

2009 –2010 **Impregilo SpA – Milan (Italy)**
Senior Project Manager with the responsibility of the start-up of Infrastructure Projects in Tripoli and Misurata (Temporary Contract for 1 year finished in June)

2008 – 2009 **Orion Holding SC – Reggio Emilia (Italy)**
Operations Director/Portfolio Manager with the responsibility of Turnaround Management Project until June 2009 (reporting directly to the President). The first aim is to transform a “Functional Organization” into a “Strong/Project Matrix Organization” and to carry the financial and economic results to a satisfactory level for the shareholders

2001 – 2007 **Impregilo – Astaldi – Ghella Joint Venture - Country: Venezuela.**

2006 – 2007 Senior Manager of Technical and Contractual Department in the Italian Enterprises Group Joint Venture as General Contractor for Middle Venezuela Railways Construction.
Project amount: 2500 million US$

2001 – 2006 Senior Project Manager in the Contuy Medio JV as General Contractor for Caracas-Cúa Railways Construction.
Project amount expectation: 2500 million US$ (Amount managed: 1000 million US$).

1988 – 2000 Impregilo SpA
Project manager/General manager
General contractor for the Construction and the Commissioning of Public and Private Infrastructures in:
1999 – 2000: Dominican Republic
1996 – 1998: Ecuador
1993 – 1995: Chile
1992 – 1993: Dominican Republic
1991 – 1992: Mozambique
1990 – 1991: México

1988 – 1990: Dominican Republic
1987 – 1988: Cavanna SpA - Novara – Italy.

1985 – 1986 **Lis (Lavori Idraulici Stradali) Vercelli - Italy**
Project manager (accounting directly to the Owner)

1977 – 1985 **Cogefar SpA - Milan - Italy**

1982 – 1985 Project Plant Manager in Hydroelectric Plant construction (Tanzania)

1978 – 1982 Project Engineer in Hydroelectric Plant construction (Guatemala)

1977 – 1978 Project Engineer Deputy in Milan Office Headquarters

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CURRICULUM VITAE - CONSTRUCTION MANAGER - VITTORIO ROBIATI

April 16, 2013

VITTORIO A. ROBIATI
Construction / Production Manager

Mr. Vittorio A. Robiati is a world class construction / production manager with more than 45 years of experience in projects in more than 15 countries and four continents. Mr. Robiati has received recognition awards from clients and employers for his outstanding works and efficient management of projects during execution.

Education and/or Professional Qualifications:

Technical Civil Engineering – Cattaneo Civil Engineering Institute - 2000

Linguistic ability: English, Spanish, French

Professional Experience:

2012 to Date **Astaldi SpA – Central America**

Area Construction Manager for Panama, San Salvador, Honduras, Nicaragua, Guatemala, Costa Rica.

Responsible for project execution of dams in Central America. Supporting preparation of Muskrat Project RFP regarding project execution and construction methodology.

2010 - 2012 **Contractor – GUPC - Grupo Unido Por El Canal - Panama**
Sacyr, Impregilo, Jan De Nul, Cusa

Construction Manager.
Responsible for execution of construction activities in both sides of the projects (Atlantic and Pacific ocean). Contract Value: US $ 1,900 million. The work includes 17 million of m3 excavation, 2 million m3 of concrete, installation of 300,000 ton of reinforcing steel. The project consist a 2,300 m long structure, 4 Lock-heads, and 3 lock structures for a total jump of 27 meters. Canal with 55 meter wide and 30 meters high walls. It is expected the Canal may accommodate 250,000 ton ships during operation.

1998 - 2009 **Consortium Sembenelli – Astaldi**

Area Construction Manager

2008 – 2011 El Chaparral Hydroelectric Project, El Salvador
Responsible for construction works of the El Chaparral hydroelectric project in Salvador. Contract value: US $ 280 million.Project includes a 85 meters high RCC dam (300 m crest length), underground powerhouse, shafts, diversion tunnel (12 m diameter), spillway (32 meters high a 400 m long), discharge tunnel and other elements. Contract was suspended due to force majeure and geological problems.

2008 - 2007 **Pirris RCC Dam, Costa Rica**
Responsible for construction works for the Pirris RRC project in Costa Rica. Contract value: US $ 150 million. Project consisted of 800,000 m3 of roller compacted concrete (RCC), diversion tunnel, spillway, intake works, penstocks, gates and other minor elements.

2007 – 2004 **Construction of Highway Milano - Bergamo (4th lane), Italy**
Contract value: US $ 600 million.

Responsible for execution of the work. Project includes construction of the 38 km. long 4th lane of the Motorway Milano to Bergamo, demolition of 38

intersections, construction of 42 new intersections with spans between 54 and 58 m long.

2004 - 2002 Mr. Robiati did not participate in any construction project due to the fact that he took some time off.

2001 -1998 **Impregilo S.p.a. – Milano - Italy**

Project Manager

Kali Gandaki "A" Hydroelectric project - Nepal. Contract value: US $ 180 million. Project includes diversion dam, desander , power conduit, collector channel, intake, long circular headrace tunnel, concrete lined (10 m diameter), surge shaft, penstock shaft and power house with a total capacity installed of 150 MW.

1998 - 1997 **Astaldi, Federici, CMC, Condotte d'acque**

Project Manager

Porce II Hydroelectric Project, Medellin, Colombia
Responsible for construction execution of the works. Project includes a RCC dam – 128 meters high, 1,450,000 m3 and associated works, intake tower, crest spillway bottom discharge tunnels, etc.

1997 – 1987 **Icla – Napoli – Italy**

1997/1994 Construction of igh speed railway line between Rome - Napoli
Contract value: US $ 600 million.

Project Manager

Responsible for construction of the works. Project includes railway line (300 km/hr), 16 km of tunnels, 18 km of Viaducts including civil, mechanical and electrical works. Contract value: US $ 600 million.

1994/1992 Construction of four lane Highway Limassol – Paphos, Cyprus

Project Manager

Responsible for construction of the works. Project includes construction of 20 km of four lane highway, 12 bridges with span up to 60 meter long, 9 overpasses and 2 concrete lined tunnels excavated in limestone Contract value: US $ 70 million.

1992 - 1987 Area Construction Manager.

Construction of the Genova Voltri - Passi di valico 12 km long tunnel, with stations and underground connections. Contract value: US $ 250 Million.

Construction of motorway Calitri – Bisaccia (70 km) including tunnels, bridges and micelanneous works. Contract value: US $ 200 Million.

1987 – 1981 **LPI System - Milan – Italy (Minister or Public Works)**

Area Construction Manager

Responsible for construction of different projects in Italy.

Construction of cruise missile bases, hospitals, courts, housing, schools, university buildings, prefabrication factories, post office, post offices and other government facilities. Contract value: US $ 500 million.

1981 - 1977 **Cogefar of Milano - Italy**

Area Construction Manager

Construction of the Champagne Hydroelectric Project in the Island of Mauritus. The project includes a rock-fill concrete face dam, intake shaft, conduction tunnel (3 km long), surge shafts (220 m), superficial powerhouse and spillway. Contract value: US $ 45 Million.

Construction of the Song Lou hydroelectric project in Cameroon – Africa. Contract value: US $ 100 Million. Project includes concrete dams, intakes, gated spillways, open spillways and a rock-fill dam.

1977 – 1965 **Impresa Generale di Costruzioni – Giuseppe TORNO – Milano – Italy**

Project Manager

Saudi Arabia – Highway Project in the Ghassim area
Construction of 120 km long motorway project. Project includes 12 million m3 of excavations and fills, 15 km of bridges, 200 pre-fabricated Armco type culverts and 100 concrete box culverts, 12” crusher run base and 6” thick of various asphalt premixed courses. Contract Value: US $ 100 million.

South West Africa – Namibia – Cosint / Torno’s Branch)
Construction of the Cunene Hydroelectric project. Contract value: US $ 100 million. Project includes underground powerhouse, penstock, lining conduction tunnel, 4 penstocks, spillway and other facilities.

Zambia - Construction of a Military airport in Mumbwa. Work includes construction of 2500 meters long asphalt paved runway 60 meters wide, taxi areas, apron, dispersal areas, helicopter pads, firing butts, ammunition deposits, access roads and all related infrastructures including fuel deposits, lighting, etc.

Zambia – Aqueduct and access roads for the Mumbwa Military airfield, Contract value: US $ 10 Million. Project includes construction of access roads to the new project, pumping station, 20 km of 8” pipeline and distribution system including lined receiving reservoir.

Zambia - Lunkwakwa Army Dam. Contract value: US $ 15 million. Project includes construction of an earth-fill dam 40 meters high and 120 meters long, a 120 m long concrete spillway with a 60 meter long Ogee crest, and a semi-submerged shaft and one pumping station.

Zambia – Construction of the Great East Road.
Construction of 360 km highway from Chipata (Fort Jameson) to Nyimba .
Contract value: US $ 100 million. Work includes 7 million m3 between excavations and compacted embankments and 5 small bridges with spans up to 30 m long.

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CURRICULUM VITAE - DEPUTY PROJECT MANAGER - KEN CHRYSSOLOR

April 16, 2013

KEN CHRYSSOLOR
Deputy Project Manager

Mr. Ken Chryssolor is a civil engineer with more than 50 years of diversified construction background experience in heavy and underground construction projects in Canada, United States and Mexico. Mr. Chryssolor has been involved in projects from conception and feasibility stage through proposal preparation, design, construction, start-up, commissioning and turn-over to the client. He has particular experience in construction of hydroelectric projects with specific emphasis in powerhouses, dams and penstocks.

Education and/or Professional Qualifications:

Civil Engineer - McGill University, Canada (1960)

Linguistic ability: English and French

Professional Experience:

2011 – To Date	**C.G.C Consultants** Provides third party opinions on validations of estimates prepared by Contractors, Engineering firms, Consultants and other clients for civil engineering projects. Clients include J.V.P. (Joint Venture Panama, composed of SNC-T-avalin, Techinet of Chile and Gym Peru Ltd) Mina de Cobre Panama Project and others.
2005 – 2010	**Groupe Aecon Ltee** Participant in claim preparation for Eastman 1 powerhouse.
2003 – 2005	**Groupe Aecon Ltfce** Project manager for construction of Eastmain 1 powerhouse, intake structure and associated works.
2003	**Groupe Aecon Ltee** Consultant for review of estimate and tender preparation for construction of Eastmain 1 powerhouse, intale structure and associated works.
1979 – 2002	**Les Constructions du Saint-Laurent Ltee Saint-Lawrence Construction (Western) Ltd Saint-Lawrence Construction (USA) Ltd** Vice-president, Chief engineer and project manager
1977 – 1978	**Bechtel Quebec Ltd** Construction manager
1975 – 1976	**Walsh-Brais Construction Limited** Director, Vice-President of construction and General Manager
1969 – 1975	**Fitzpatrick Construction Ltd** Manager of heavy construction
1968 – 1969	**Perini Corporation**

Assistant to manager of the tunnel division

1966 – 1968 **Inspiration Ltd**

Project manager, heavy construction division

MAJOR PROJECT PARTICIPATION

1. Hydro electric developments with SEBJ.
2. James Bay Hydroelectric Eastmain-1.
3. Construction of Caniapiscau Reservoir (Dams, dykes. Diversion tunnels - KAl & KA3).
4. Construction of Caniapiscau reservoir (Dikes KA4 to KA13 including dam KA5).
5. Construction of Control structure Caniapiscau (Spillway).
6. Control structure LG4 site Construction of LG3 dikes and related works Construction of dykes, Fontanges site Excavation and concrete work of LG2A.
7. Powerhouse and access tunnels.
8. Fabrication of concrete supply LG4 (Brisay, James Bay - (excavation of intake canal),
9. Construction of Lac Robertson hydro electric development, dams, powerhouse and spillway.
10. Excavation and partial concrete works powerhouse.

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CURRICULUM VITAE - CONTRACTS ADMINISTRATOR - GIUSEPPE CALCAGNO

April 16, 2013

GIUSEPPE CALCAGNO
Contracts Manager

Mr. Giuseppe Calcagno is a professional engineer with more than 15 years of experience in commercial management of infrastructure projects. He has been responsible to perform contract administration in traditional and Design-Build contracts for private and public clients. In addition, Mr. Calcagno is well know by his strong knowledge of scheduling and time analysis.

Education and/or Professional Qualifications:

Geology Engineering – La Sapienza University of Rome(1985)

Other Training:

Linguistic ability: English, French

Professional Experience:

2011 to Date **Astaldi S.p.A.**

Area Contract Manager
Responsible for commerical management and contractual functions for Astaldi proejcts in Bulgaria and Romania.

2008 - 2013 Bulgaria

Construction of the Plovdiv-Svilengrad Railway Electrification and Upgrading of Corridors IV and IX.
Civil, Track and Electrification works for phase 2: Parmovai–Svilengrad – Turkish/Greek Borders: Executive design, construction, superstructure, electrification, testing and starting of a single truck railway between Svilengard, Parvomai and the Greek/Turkish border, for an extension of 104 Km approx.

2005 – 2008 Romania

Pitesti by-pass Project: Construction of 15.0 km. of new Motorway by-passing the town of Pitesti, including approximately 2,000 lm.of new Bridges and Overpasses with concrete and steel structures, and a railway Underpass.

2002 - 2005 Romania

Construction of Motorway AO2 Bucarest-Costanza - 1° Lot Bucarest-Fondulea Km 0+000 - 26+500: Construction of a 26,5 Km concrete motorway with designed speed : 120 km/hr. Platform width : 26 m, carriageway width : 2 x (2x3,75 m), bridges, overpasses: n°9 - n°2 motorways intercchanges, n° 1 maintenance and coordination center, n°1 parking and service area-Concrete pavement : 119.600 m3 - New bridges : 30.000 m2;

1998 – 2002 Romania

Rehabilitation of DN 19A Salaj County Boundary - Satu Mare Boundary: Widening and strengthening of 48 km of road, including the construction of one new bridge (70 m long), the rehabilitation of six bridges, the reconstruction of 14.000 sqm of existing road structure and the construction of no. 1020 new access culverts

Rehabilitation of DN 1F km 89+800 lm 123+012: Widening and strengthening of 33 km of existing road with the reconstruction of 25.000 sqm of existing road structure. rehabilitation of six existing bridges and construction of three new bridges;

Rehabilitation of DN 19A (km 54+577 to km 61+697): widening and strengthening of 7,1 km of existing road towards the Romanian – Hungarian border with the new construction of the 3rd lane in Petea and three new precast culverts

1996 – 1998 Romania

Rehabilitation of Arad-Timisoara-Moravita Highway: Road Rehabilitation of 70 km asphalting, widening and structures

1993 – 1995 Impregilo, Tanzania

Deputy Project Manager

Musoma-Sirari and Mukuyu-Isebania Road Project: The Project is located in Tanzania (82.5 km.) and Kenya (28.5 km.) and involved approximately 2,000,000 cu.mt. of earthworks, two bridges and Asphalt Concrete Pavement.

1992 – 1993 Cogerarimpresit, Zambia

Lusaka-Kabue Road Rehabilitation Project: Diversion of the traffic and reconstruction of the existing road including a double surface treatment and a slurry seal;

1991 – 1992 J.V. C.D.K. (Cogefar Impresit- Dywidag- Koekelberg), BELGIUM

Responsible for the implementation of the Quality Assurance Programme for the construction of the “Nouvel Immeuble destiné au Conseil des Ministres de la CEE”: The building is formed of two blocks with a mixed structure of concrete and steel carpentry for a total surface of 225,000 sqm.

1988 – 1991 Tanzania, Various Projects

Pemba North Feeder Road Project: reconstruction of 49 km of road, with a double seal surface.

In charge of the concrete laboratory and of the geological survey on the Zanzibar and Pemba Ports Rehabilitation Projects. In Zanzibar: construction of two new wharves with 750 lm. of driven piles. In Pemba: Jetty head in rock-fill, concrete and gabions.

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CURRICULUM VITAE - QUALITY MANAGER - GIANFRANCO PASTORE

April 16, 2013

GIANFRANCO PASTORE
QA – QC Manager

Mr. Gianfranco Pastore is a professional certified QA-QC with expertise in implementation of QA-QC systems in infrastructure projects. He has been responsible to implement successfully QA-QC system in different projects. He worked as the QA/QC Manager at the Grand Ethiopian Renaissance Dam Project in Ethiopia which is under execution and will be one of the largest hydro projects ever built.

Education and/or Professional Qualifications:

Geology Engineering – Napoli Engineering (1989)

Other Training:

- "Technical Norms for the constructions - (DM 14/09/2005) roles, responsibility and innovative aspects for enterprises in the sector of the constructions" held by the ICIC (Institute of Certification Undertook quality and services for Constructions) in Bologna - January 2007.
- Plain Concrete & Concrete Technology offered by Professor Collepardi in Treviso - September 2004 -
- "Quality System Management" Course at AICQ in Milan - December 2003
- "Earth embankments construction and laboratory tests" held by Prof. La Forgia (Bari University) at the Central Laboratory of the TREESSE Joint-Venture, Scarperia (Florence) - September 2003.
- "Cements and concrete technology and laboratory test" held by Prof. La Forgia (Bari University) at the Central Laboratory of the TREESSE Joint-Venture, Scarperia (Florence) - June 2003.
- "Asphalt roads technology and laboratory test" held by Prof. La Forgia (Bari University) at the Central Laboratory of the TREESSE Joint-Venture, Scarperia (Florence) - May 2003.
- Advanced course of computerized mix-design held by the Prof. Collepardi at the ENCO S.r.l. - February 2002.
- " Winch " course on the techniques of physician-scientific information - June 1990.

Linguistic ability: English, French, Turkey

Professional Experience:

2011 to Date **Astaldi Oman Branch**

Bid-Bid Sur Motorway, Oman

QA/QC Manager
Responsible for the QA/QC system for the project including management of audits and all related quality assurance and quality control activities. The project includes construction of 42 kilometres of new motorway and refers to the first phase of the project to double the BidBid-Sur road, one of the main stretches of Oman's road network which links the capital to the Country's eastern regions. Contract value: USD 324 million (Astaldi holds a 51% stake) of consortium with Ozkar (Turkey).

2011 **Salini Construttori S.p.A.**

Grand Ethiopian Renaissance Dam Project, Ethiopia

Responsible for all QA/QC taks associates with the contract. The project includes Construction of the for the Ethiopian Electric Power Corporation (EEPCo) on the Blue Nile in Ethiopia. Contract value: US $ 4,200 million. The dam is a 145 m high, 1800 m long gravity-type composed of Roller Compacted Concrete (RCC) and one powerhouse with 15 turbines and a total installed capacity of 5250 MW.

2009 - 2010 **Alstom Signaling** – ITALY

QA-QC Manager

Construciton of the High Speed Railway between Rome and Napoliagola

2008 **Todini Constructions S.p.A.** - DUBAI (UAE)

QA/AC Manager

Construction of the road link close to the Sheik Zayed road, Road and Transport Administration project R 881/3A. Contract value: US $ 115 million. 85 million of Euro.

Astaldi S.p.A. – Bulgaria

QA/QC Manager

Construction of the railway line among Parvomai and Svilengrad. Contrac value: US $ 210 million.

2000 - 2007 **CAVET** - Joint Venture Impregilo, CMC and Maire Technimont

QA/QC Specialist

Construction of high speed railway between Florence and Bologna. Contract value: US $ 4,000 million. He was responsible for activities as follows:

- Management of CAVET quality system issuing the quality manual, the procedures and operational instructions.
- Internal Audits to all joint-venture sites including the rail construction and the Technologies.
- External Audit to the suppliers and subcontractors.
- Audit to the Saturno joint-venture for the technologies among the societies Alstom Transport, Alstom Transport System, Ansaldo Signaling, Ansaldo Transports, Balfour Beatty Rail and Sirti.
- Management of the non conformity and corrective and preventive actions.

1996 - 2000 **Astaldi S.p.A**. – Turkey Branch.

QA/QC Specialist

Construction of the sketch 2 of the Gümüsova-Gerede highway between Istanbul and Ankara. Contract value: US $ 680 million. He was responsible for activities as follows:

- Relationships with the external laboratories and the Universities for material testing.
- Concrete mix designs studies and batching plant control, setting and monitoring.
- Quality control of beams and other products of the precast factory.
- Checking and control of the borrow areas and quarries for aggregates productions.
- Asphalt mix designs and checking during production by testing.
- NATM (New Austrian Tunneling Method) application and monitoring especially for fiber reinforced shotcrete.

1995 **Astaldi S.p.A.** – Algeria

QA/QC Specialist

AFT joint venture of Astaldi S.p.A., Federici S.p.A. & Todini S.p.A. for the construction of the Taksebt dam.

- Responsible for laboratory and management of activiites as follows: Relationships with the external laboratory.
- Concrete mix design and their quality control.
- Batching plant & crushing plant calibration and monitoring.
- Definition, characterization and acceptance of quarries.
- Cores controls and their geological descriptions.

1988 – 1994 **Passante S.c.a r.l.** – Italy
Temporary Association of enterprises Torno S.p.A., Cogefarimpresit S.p.A., Lodigiani S.p.A. & C.M.B. S.r.l., for the construction of the sketches 3p/5p/6p Railway Connection in Milan. Contract value: US $ 220 million.

QA/QC Specialist

Responsible for activities as follows:

- Concrete technology, mix design studies related to the railway station construction and Mitsubishi EPB shield (Earth Pressure Balanced shield).
- Check and monitoring of concrete supplier.
- Laboratory test on concrete and earths.
- Management of the EPB shield, diameter 8 m, for foam (Obayashi System) and extruded concrete.

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CURRICULUM VITAE - PROJECT CONTROLS MANAGER - JUAN CARLOS BASSI

April 16, 2013

JUAN CARLOS BASSI
Project Controls Manager

Juan Carlos Bassi is a Project Manager with over 25 years of experience in project management, program management, planning, construction and administration of projects in Colombia, Mexico, Malaysia, Bolivia, Puerto Rico, Chile, Russia, Canada, Turkey and the United States. Mr. Bassi has served as a project and program manager from the prospective of an engineer, a design builder, and a traditional construction contractor. He has planned, supervised, built and managed various hydro, mining, water, wastewater, oil pipeline, highways, bridges and other infrastructure projects in which he has brought effective coordination, management and efficient interaction between project members.

Education and/or Professional Qualifications:

Civil Engineer – National Autonomous University of Mexico (1984)
M.CE – Civil Engineering - National Autonomous University of Mexico (1994)
M.Sc. – Project Management - The University of Texas at Austin (1996)

Linguistic ability: English and Spanish

Professional Experience:

2010-to date **ASTALDI S.p.A. – Rome (Italy)**

2011-2012 **Project Director – Astaldi Turkey Branch, Turkey**

Suspension Bridge - Izmit Crossing

- Responsible in behalf of construction joint venture Nurol – Ozaltin – Makyol – Astaldi – Yuksel – Gocay (NOMAYG) for project execution of the Izmit Crossing Suspension Bridge (3,062 m) and South Viaduct connection (1,407 m). Budget: US $ 1.5 billion and schedule: 44 months.
- Responsible to prepare project execution plan (PEP), setup group teams, provide guideline and leadership for project execution, preparation and implementation of project management procedures, definition of responsibilities for project participants, setup and follow up of project budgets and schedules, definition and implementation of Management Information System (MIS) for both projects, lead contractual approach of JV with client and project participants, management of subcontractors (IHI and local Turkish firms) and sub-consultants (AECOM, Louis Berger, Scott Wilson, Capita Symonds, SETEC, SECOA and others).

Operations Manager - Astaldi Turkey Branch, Turkey

- Pulkovo 1 International Airport - St. Petersburg, Russia. The project includes construction of a new terminal, links and new aprons to update the operation capacity up to 14 million passengers per year. Scope f work includes also refurbishment of existing terminal, build new airways, de-icing facilities and commercial areas. Budget: US $910 million. Schedule: 36 months. The project is executed in JV (Astaldi S.p.A. - 50% and IC Ictas – 50%).

1998 – 2009 **BLACK & VEATCH, Overland Park, KS, USA**

2007 – 2009 **Project Manager, New Desalination Plant (NDP), Santiago, Chile. Minera Escondida Limitada (MEL) – BHP Billiton.**

- Project includes design of 3,200 l/s desalination plant, 180 km of pipeline 90” diameter, 4 high pressure pump stations, 5 substations and 180 km of

duplex transmission lines between Coloso port (0.00 m.a.s.l.) and La Escondida mine (3,100.00 m.a.s.l.)

- Coordinating professional services provided to MEL in KC, USA and Chile. Tasks include supervision of staff working under my responsibility (120 people). Project management tasks associated with engineering, estimating, procurement and construction management.
- Executed contract management between B&V and MEL. Tasks include claims preparation, payment applications, COs preparation and negotiations, etc.
- Responsible for project financing of the contract.

2005 – 2007 Program Manager, City of Toledo, Ohio. Toledo Waterways Program

- Program includes improvement of existing facilities including design and construction of Grit Facilities, Ballasted Flocculation, Equalization Basin and Effluent Pump Station to treat a maximum of 400 MGD. Program Budget: $115 million. Construction Schedule: 3 years.
- Performed project management for budget, schedule and contract administration for sub-consultants firms (six) and general contractors (four) involved with the program. Technical and management support to Owner when interaction with contractors, third parties and federal and state regulatory agencies.
- Reviewed, disputed, negotiated and closed claims issued by contractors (305 claims) in behalf of the Owner.
- Completion of program on schedule and under budget.
- Direction, coordination and management of daily site issues regarding the program.
- Implemented, trained and tracked program using contract administration tools via internet.

2003 - 2004 Commercial Manager, Program Management - Various

- South San Joaquin Irrigation (SSJID) – Program Management. System Project included Program Management activities for nine contractors and six consultants. The program included lake watershed protection, raw water facility, water treatment plant (40 MGD - membranes), 162,000 ft of water transmission lines of 30”, 36”, and 48” diameter, turnout pump stations facilities and steel storage tanks 1.0, 2.0 and 3.0 MGD. Coordinated construction activities, project controls and contract management tasks associated with the program.
- PRASA Program Management – Leading field activities regarding Wastewater - Water Treatment Plants Inspections in Puerto Rico. Inspected 20 WWTP’s, 51 WTP and 58 pump stations owned by PRASA (Puerto Rico Aqueduct and Sewer Authority). Identified issues affecting operability, capital improvement (CI) review, cost evaluation for CI and legal frame for facilities improvement in compliance with EPA and Health Department regulations.
- Toledo CSO Program - The City of Toledo, Ohio - Commercial, financing and program management tasks. Prepared sub-consultant contracts and also negotiated and closed contracts agreements with sub-consultants. Prepared program procedures and construction manuals as defined by contract services agreement. Prepared budget and schedule baseline, tracked and managed budget and schedules during project work. Prepared and implemented procedures for reporting, invoicing and risk evaluation.

2000 – 2002 **Construction Manager, Rio Taquesi Hydroelectric Project, Bolivia**

- Managed at-risk construction of two EPC hydroelectric projects "in cascade" (dams, tunnels, penstocks, powerhouses, switchyards, substation, access roads, jet grouting, turbine and generator erection, transmission lines) at isolated, remote mountainous site. Completed civil works on schedule by working around six-month design delay.
- Employed unusual construction methods demanded by site conditions, e.g. cableways, cyclopean concrete, hand-drilled tunneling, and placing concrete through chutes up to a half-mile long.
- Evacuated staff on foot when civilian roadblocks shut job down. Protected archaeological discoveries.
- Commercial and construction management of international contractors (Italy, Brazil, Austria, Bolivia) including management of local staff (Bolivia) and international partners (Switzerland and USA).
- Implementation and follow up of Information Management Systems during construction.

1998 – 1999 **Project Controls Manager, Construction Services, Kansas City, KS**

Project controls support for national and international water and hydro projects (California, South Carolina - Philippines, Switzerland, Bolivia and Puerto Rico) including contract negotiations and follow up, scheduling, budgeting, cash flow, etc.

1988 – 1998 **GRUPO ICA, Mexico City, Mexico**

1997 - 1998 **Construction Manager, Emergency Plan, Hermosillo, Mexico.**

The project included supply, installation and testing of 55 km of water pipe (8" – 60"), fittings and 14 pump stations.

- Responsible for planning and executing construction and commercial tasks. Prepare claims, new unit prices, backcharges, invoicing and associated commercial tasks. Field Staff: 325 people, claims prepared and approved by the owner: US $1.1 million.
- Prepared budget revisions and financial reports. Implemented and coordinated ISO 9000 standards. Implemented and followed up the environmental program. Environmental Baseline Survey report and "metrics score analysis". Implemented "Zero Accident Techniques" and safety regulations. Evaluation and subcontractors administration including construction performance and commercial management.

1996 – 1997 **Subcontractor Manager, Bakun Hydroele. Project, Sarawak, Malaysia**

- Prepared contract documents, estimates, subcontractors' administration, scheduling control, payment approval, safety and QA/QC management. Oversaw construction, arranged utility relocations for initial construction activites, including interferences and impact to project residents. Bakun was the largest hydroelectric project to be built in Asia. Construction suspended due to Owner's financial difficulties.

1995 - 1996 **Conducting Master in Science (Project Management).** The University of Texas at Austin

1993 – 1994 **Conducting Master in Civil Engineering - Construction Management.**
The National Autonomous University of Mexico

1990 – 1993 **Construction Manager, Aguamilpa Hydr. Project, Nayarit, Mexico.**

Project includes cofferdams, dam, tunnels, powerhouse, intake works, access roads, diversion tunnels, penstocks, spillway, bridges, and substation. Project budget: US $ 420 million. Site Staff: 3,850 (peak).

- Responsible for planning, inspecting and executing site activities. Construction and contract management tasks including production on site and management of cost, budget, cash flow, scheduling, etc.
- Claims preparation, negotiations and closing (US $22 million in claims approved by the owner). Responsible for production at intake works (2,200,000 m3 - rock excavation, 35,000 m3 - concrete, 115,000 m - rock bolts, 6,000 m3 - shotcrete, 5,000 ton - steel piping – Field Staff: 780 people), access roads (350,000 m3 - rock excavation – Field Staff: 125 people), penstocks (3 tunnels, 9.10 m diameter and 160 m length – Field staff: 125 people), rock fill dam (187 m high and 15,000,000 m3 of compacted embankment, grouting rock and rock support – Field Staff: 885 people).
- Intakes Work and Penstock Shafts. Finished civil and mechanical works on schedule by working around five-month delay due to unexpected geology conditions.

1989 **Field Engineer, Mexico City, Mexico.**

- Responsible for construction of tunnel and two stations for the Massive Transportation System in Mexico City (Subway) using a TBM. Activities included daily planning of construction tasks, evaluation of traffic and residents disturbances, preparation of monthly report and invoicing to the Client, cost and scheduling control, claims preparation and negotiations, inspection and supervision of construction staff, client management and administration of QA/QC and safety programs. Budget: $65 million. Field Staff: 165 people.

1988 -1989 **Field Engineer, Various Construction Projects, Colombia.**

- Responsible for excavation of 500,000 m3/month of coal at Cerrejon project in Colombia. Responsible for coordination of resources on site and management of schedule and budget for the contract.
- “El Silencio” water tank included 25,000 m3 - concrete, 7500 ton - reinforcing steel, 350,000 m3 - excavation. Site Staff: 215 workers. Responsible for construction management tasks including planning, construction and contract management.
- “La Palma” included dam - 125,000 m3, 8,000 m3 - concrete. Site Staff: 250 people. Responsible for construction management tasks including planning, construction and contract management. Budget: US $ 10 million.
- Caño - Limon - Coveñas Oil Pipeline. Responsible for pipeline installation and maintenance during operation. Maintenance and repair work based on damages caused by civil riots. Work included excavation, pipeline installation, backfill and testing. Specific tasks included coordination of construction staff, preparation of daily reports, site documentation, and claims preparation. Field Staff: 225 people. Budget: US $ 40 million

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CURRICULUM VITAE - ENVIRONMENTAL MANAGER - SANDRO CAPADONA

April 16, 2013

SANDRO CAPADONA
Environmental Manager

Mr. Sandro Capadona is a certified professional with more than 10 years implementing environmental systems in infrastructure projects. He was directly responsible for implementation of environmental management system for projects in Turkey since 2002. During last two years he has been involved in preparing environmental impact assessments for BOT projects in behalf of Astaldi Turkey Branch. In addition, Mr. Capadona is responsible to perform audits for all Astaldi projects in Turkey.

Education and/or Professional Qualifications:

Architect - University of Florence, Italy - 1990
M. Architecture - Middle East Technical University, Ankara, Turkey - 2001

Linguistic ability: English, Turkish, Greek, French

Professional Experience:

2002 – to Date **Astaldi Turkey Branch**

2011 **Enviromental, Quality and Safety Coordinator**

Construction of a New International Terminal in Milas Bodrum Airport mainly referred to: Earth Movement • Civil Works • Architectural Finishes • Electromechanical Works • Electronic Works • Security and Safety Works • Infrastructure • Apron • Viaduct • Parking Area • Landscaping

2007 – 2010 **Environmental, Quality and Safety Manager**

Kadiköy-Kartal Metro Supply Construction and Electro-mechanical Systems procurement, Installation and Commissioning Works: Heavy Metro System, total length of line 21km, section about 65m2, 17 km of tunneling (tunnel excavation by TBM), 16 underground stations: Heavy Metro System, total length of line 21,7km, section about 65mq, 17 km of tunneling (tunnel excavation by TBM), 16 underground stations. Execution of the Tunnel Excavation by TBM, signalization works and design works relevant to the 4,5Km Kartal-Kaynarks section which is the continuation of the 21,7 Kadikoy-Kartal Rail System Line. Two years for maintenance period.

2002 – 2007 **Environmental & QA/QC Manager**

Anatolian Motorway - Bolu Mountain Crossing: : Section 2 from Km 215+000 to Km 240+000: Design/construction of Bolu Mountain Crossing, for a total 25 Km, 3,2 km long twin tunnel.

2000 – 2001 **Ahmet Yagcioglu & Partner's Construction Company**

Architect: Ahmet & Mehmet Yağcıoğlu.
ARKAS Group Administration Building's Project (Alsancak - IZMIR)
1/200, 1/100, 1/50 Preliminary design drawings (around 8.000 m2).
Preparation of the Final Project Drawings and Municipality drawings.
Proposal for a housing development for 6 families, 1/100 (Narlıdere – IZMIR)

1999 – 2000 **Middle East Technical University**

Revolving Fund Administration
Recreational Center for the Turkish Republic Central Bank (Ümitköy-ANKARA)
Project Responsible: Arch. Prof. Dr. Murat Balamir

Preparation and submission of 1/500,1/200,1/100, 1/50 project drawings (65.000 m2).

1997 - 1998 **Uygur Architecture Company, Turkey**

Architects: Semra & Özcan Uygur
Republic of Turkey – Turkish National Assembly, Offices Project
Preparation and submission of project drawings (45.000 m2).
Republic of Turkey – Presidential Symphony Orchestra Project.
Preparation and submission of Chorus Buildings Acoustic Details Drawings

1994 - 1994 **Architect Can Cinici**

Republic of Turkey - Ministry of Public Works and Settlement
Trainee Architect
Proposal for the Ballet, Conference and Opera Building (Ankara)

1993 - 1993 **Tirnakli Construction Company**

Architect: Ferhat Tırnaklı
Trainee Architect
Commercial Building. Supervision and follow up at Construction Yard (Yenişehir - Izmir)

1992 – 1992 **Tirnakli – Capadona Construction Company, Turkey**

Architect: Ferhat Tırnaklı
Trainee Architect
Residential Building. Supervision and follow up at Construction Yard (Alsancak - Izmir)

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CURRICULUM VITAE - HEALTH, SAFETY - FEDERICO MORO

April 16, 2013

FEDERICO MORO
HSEC Manager

Mr. Federico Moro has more than 15 years of experience implementing and managing HSEC for infrastructure projects. In addition, he has responsible to perform audits to Astaldi projects in-country and overseas. He has an international HSEC certification for the EU and it is currently the HSEC manager for the Breshia Light Rightway.

Education and/or Professional Qualifications:

Safety Engineering - Escuela Carlo Bazzi (Milano in 1991)

Linguistic ability:

English

Training and Certifications:

- Fita Confindustria, Italy (in 05/2005). Course of Eco Audit for a sustainable development. UNI EN ISO 14000 Environmental Management System Auditer. CEPAS Qualified Auditor in Quality Management Systems.
- Chamber of Commerce of Caserta – ASIPS, Italy (in 06/2005) CEPAS Qualified Auditor in Quality Management Systems, Quality Management System Auditer.
- UNIFORM GROUP Consulenza & Formazione – ANGQ, Italy (02/2006).
  - Quality Master "*Esperti in Qualità, Qualità Ambientale e Sistemi di Gestione Aziendale ISO 9000, Vision 2000, ISO 14000. Emas Rules, L.D. 626/94, OHSAS 18001, BS 8800, SA 8000.*
  - *Expert assigned to Environment, Quality, Safety and Environment Systems. Course Certificate ANGQ qualified CEPAS as* Quality Management Auditor, *Course Certificate as Health and Safety* Management Auditor in situ, Course certificate of Environmental Systems Auditor, Course Certificate of OGC Model Auditor, Course Certificate of SA 8000 Model Auditor.

01/2004 – to date **Astaldi S.p.A.**

ITALY
Safety Manager
Brescia Light Railway: 1st functional lot "PREALPINO -S. EUFEMIA": Design/execution, Construction, Technical Management ,usual and unusual maintenance of the light railway at driving constrained in own place by integral automation; development of 14 Km about, with 18 stations and the warehouse including all the activities and the relatives functions to the management and the administration of the system. The layout is composed of 4,8 km in covered trench, 6,1 km in deep tunnel, 1,3 km at ground level and 1,8 km in viaduct.

10/2001 – 10/2004 **ITALY**
Safety Manager

- Regional underground railway system - 1st. Phase - Lot A: Section Padoue-Castelfranco Veneto: Construction of a bridge on Brenta river, elimination of no. 21 level crossings, rehabilitation works of no. 5 stations.
- Regional underground railway system - 1st. Phase - Lot B Mestre-Castelfranco Veneto: Elimination of no. 17 level crossings, rehabilitation works of no. 5 stations and Trebasalghe new railway stop.

- Regional underground railway system - 1st. Phase - Lot C : Treviso-Mestre and Mestre-Mira Buse: The project foresees 5 typologies of works: elimination of level crossings, 6 underpasses for cars, 3 underpasses for channel crossings, rehabilitation works of the stations and 2 railway stop of the underground, 2 new level crossings, electrification work of a single track railway line section between mestre and mira buse (approximately 8 km), realization of a new highway interchange in Borbiago di Mira Buse

04/2001 – 09/2004 **CONSORZIO CAVET, ITALY**
Assigned to Health and Safety Site Office
High Speed Railway line Milan – Naples: Bologan-Florence Section

04/1997 -09/2001 Safety Manager
Construction of the High Speed Railway, section Milan – Naples: Florence-Bologna stretch, Mugello worksite excavation of n° 3 railway tunnels: Firenzuola tunnel 6500 lin.m. and Osteto and Marzano adits 2500 lin.m.

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CURRICULUM VITAE - ADMINISTRATION AND FINANCIAL MANAGER - GABRIELE CASTELLUCCI

April 16, 2013

GABRIELE CASTELLUCCI
Administration & Financial Manager

Mr. Gabriele Castellucci has over 20 years of progressive experience in project financing and administration of infrastructure projects in Italy and overseas. Mr. Castellucci has specific experience in the admininstration of large projects. He has served as CFO of Astaldi in Turkey and the United States for the last 9 years. Additional relevant experience includes financing of BOT projects, tax law and human resources management.

Education and/or Professional Qualifications:

Economics Degree (Urbino University, in 1991)

Linguistic ability: English, Spanish

Professional Experience:

2004 – to date **Astaldi S.p.a.**

08/2010 to date **ASTALDI CONSTRUCTION CORPORATION (ASTALDI GROUP), FLORIDA**
Administrative Manager
Chief Financial Officer (also Secretary and Treasurer in the Board of Directors)
SR 862 - From West of SRS (US1) to East of Mcintosh Road (T4255): the improvements under this contract consist of the construction of 4 bridges, MSE walls, flexible and rigid pavement, milling and resurfacing, construction of ramps, a single track railway to Port Everglades, ponds, signals, signing and pavement marking, landscape, lighting, relocation of a water main and a force main on SR 862 Eller Drive Intermodal Container Facility (ICTF) from West of US-1/SR-5 to East of McIntosh Road, Broward County.

03/2004 07/2010 **TURKEY**
Administrative and Financial Manager
- Construction works for Halic Metro Crossing Bridge of Istanbul Metro in Golden Horn area
- Civil and Electro-Mechanical Works for Kadikoy - Kartal Metro, Phase II
- Realization and operation of the Gebze - Orhangazi - Bursa - İzmir Motorway
- Anatolian Motorway - Bolu Mountain Crossing: Section 2 from Km 215+000 to Km 240+000: Widening to three lanes of the motorway section from Km 45+170 to Km 50+856

06/1998 – 12/2003 **CARLI S.R.L., ITALY**
Administrative and Financial Manager
The company specialized in restoration works in public contracts.

1995 – 1998 **ASTALDI S.P.A.**

10/1995 – 05/1998	**TURKEY** Administrative Manager Anatolian Motorway - Bolu Mountain Crossing: Section 1 from Km 186+165 to Km 215+000 and Section 3 from Km 240+000 to Km 302+125
10/1993 – 10/1995	**HONDURAS** Assistant Administrative Director for Central America and Caribbean Area and Site Administrative Manager
07/1992 – 10/1993	**ITALY** Administrative Collaborator for the administrative direction of America Area in Italy

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CURRICULUM VITAE - PROCUREMENT MANAGER - ALDO DUSSI

April 16, 2013

ALDO DUSSI
Procurement Manager

Mr. Aldo Dussi is a professional with more than 35 years of experience in Procurement and Logistic for international projects. He has experience working overseas and also implementing successfully QA/QC systems in activities under his supervision. During last 3 years he was the Procurement Manager for the Kadikoy - Kartal Metro in Istanbul, Turkey which is tone of the most successful projects of Astaldi in recent years.

Education and/or Professional Qualifications:

Scientific Secondary School in Izmit, Turkey (1973)

Linguistic ability: English, French, Spanish and Turkish

Professional Experience:

1994 – to date **Astaldi Turkey Branch**

TURKEY
Procurement Manager

- Civil and Electro-Mechanical Works for: Kadikoy - Kartal Metro, Phase II: Heavy Metro System, total length of line 21km, section about 65m2, 17 km of tunneling (tunnel excavation by TBM), 16 underground stations.
- Anatolian Motorway - Gumusova-Gerede: Section 2 from Km 215+000 to Km 240+000 (Bolu Mountain Crossing): Design/construction and one year of maintenance of 25 Km (in seismic zone) having 3 lanes for carriageway including 4 double viaducts and 3 double bridges (total length 5,561 m).
- Anatolian Motorway - Gumusova-Gerede: Section 1 from Km 186+165 to Km 215+000 and Section 3 from Km 240+000 to Km 302+125: Design/construction and one year maintenance of Section 1 Gumosova – Uckopru and Section 3 Yumsukaya – Gerede of 91 km motorway (in Seismic zone) having 3 lanes for carriageway 2 carriageways), 12.000 m of viaductsHuanza Hydroelectric Project: Implementation of civil works of the hydroelectric power station of Huanza, construction of RCC dam (34,000 sq m) and by traditional concrete intake tower, a gallery of 10,500 ml, piezometric shaft, penstock of 600 m, the engine room. Conay intake tower and PVC pipes of 5 km.

1992-1994 **MAROCCO**
Purchasing Office Supervisor and Warehouse Responsible.

- Al Whada Earthfill dam hydroelectric power station and concrete arch dam: Earthfill dam: Height m 88,Crest lenght m 1.600 Volume -earth m3 27x106 -concrete m3 945,000 Reservoir: Volume m3 3.8x109 Surface ha 12,300 , Capacity m3/an. 1.2x106 Spillway: Capacity m3/s 13,000 Bottom outlet: Capacity m3/s 1,400 Lenght m 750 Concrete arch dam of 80.000m3, Height m 120 reservoir m3 317,000,000 Spillway for canals irrigation Destination: Agricultural irrigation.

1989 - 1992 **BURKINA FASO**
Purchasing Office Supervisor and Warehouse Responsible.

- Bagré Hydroelectric Power Plant earthfill dam: height m. 30; crest length m 4,300, backfill m3 2,300,000; concrete m3 60,000; volume of reservoir m3 1,700x106; electric power station Outdoor type adjacent to the dam, with 2 Units each of 8 MW power.

1987 – 1989 **TURKEY**
General services management

- Sewer trunk lines in Istanbul, Turkey.

1979 - 1987 **NIGERIA**
Purchasing office

- Shiroro Hydroelectric Power Plant: earthfill dam: height m 115; crest length m 700; excavation m3 6,800,000; backfill m3 4,000,000; concrete m3 666,000.

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CURRICULUM VITAE - TECHNICAL OFFICE MANAGER - ANTONIO PIZZIMENTI

April 16, 2013

ANTONIO D. PIZZIMENTI
Technical Office Manager

Mr. Antonio David Pizzimenti is a professional engineer with a PhD in Structural Engineering from the University of Catania, Italy. He has more than 8 years of continue experience as Technical Office Manager in infrastructure projects in Europe leading activities related to schedule, budget and particular emphasis of engineering works. During last two years, Mr. Pizzimenti has been the proposal manager lead of Astaldi for projects in Qatar and the Middle East.

Education and/or Professional Qualifications:

PhD - Structural Engineering - University of Catania (ITALY) - 2003
B.Sc - Civil Engineering – University of Reggio Calabria (ITALY) - 2000

Linguistic ability: English

Professional Experience:

2005-To Date **Astaldi SpA – Rome (Italy)**

2011 to Date **Astaldi Qatar Branch - Middle East**

Proposal Manager

- Responsible as JV Leader for the Bid submission and for the Pre-qualifications (technical and financial submission).
- Identify differentiators and winning strategies, agree them with the JVs Board of Directors and translate and communicate with the bid team.
- Identify Key drivers and ensure that these are captured within the Bid.
- Positively present the company to the Client in both bid and PQQ submission
- Decide the bid team structure and clearly communicate roles and responsibilities
- Ensure that bid costs are maintained in compliance with approved budges. Prepare proposal and project execution schedules.
- Ensure that all commercial aspects of the bid conform to the company procedures.
- Ensure effective time management of self and team members.

2009- 2011 **Astaldi Bulgaria Branch – Sofia**

Engineering Manager

DB Contract for the Civil Track & Electrification Works from Plovdiv to Svilengrad and to the Turkish/Greek Borders railway section (110km railway at 200 km/h) - European Corridor IV and IX. The system design project includes electrification of the upgraded line, new signalling systems with automatic train protection (ATP), renewal of the existing telecommunications and implementation of train radio and a SCADA control system. Contract value about 200€ million

- Responsible for planning, co-ordinating and executing all technical and constructional aspects, delivering to program to or below budget.
- Responsible for overall management of the infrastructure design services provided by others by managing a group of technical specialists.
- Responsible for managing the delivery of the design from the Preliminary to the Detailed by verifying consistency in the designs produced by the design consultants with respect to adherence to the design criteria and required standards.

- Manages the scope development and tendering process by the senior engineering staff for procurement of the design consultants as well as third party reviewers.
- Participates in the VE and manages all VE studies, constructability and other workshops; and drives the on-schedule submittal of the design deliverables.
- Keeps Project Management Team informed as to changes made to ensure timely processing of contract change orders.
- Manages the responses to design RFIs and review/comment on change orders.
- Ensures all infrastructure design works are comprehensive and discussed with the various engineers for the best implementation and installation of services in coordination with other parties and contractor.
- Responsible in participate in negotiations with regulatory agencies in public meetings to support the client. Liaising with Client stakeholders, Utility Approval Authorities, Engineer of Record, Construction, Contracts and Project Controls.
- Supports the Project Director in performing other tasks as deemed necessary related infrastructure aspects of the project.

2007 – 2009 **Astaldi Rumania Branch - Bucharest**

Technical Manager

Design and Construction of Basarab flyover/overpass (Bucharest, Romania), total length about 1500m. The project consisted in three different bridges structures typology: one single tower cable stayed bridge (cable stayed length 340m, maximum width 46m - 6lanes and 2 tramways), one Bow string arch bridge over river Dambovita (length 120m, width 22m) and multiple decks (roadway and tramway) pre-stressed concrete slab bridges. All the structures are seismically isolated (Viscous dampers and Lead-rubber bearings). Contract value: 160€ million.

- Coordinator of the design team during design and construction stage for the design of the seismically isolated bridges structures.
- Planning of site activities regarding materials procurement and management of contracts with subcontractors and suppliers.
- Assist review and follow up of in house development of design.
- Review and resolve interfaces between disciplines.
- Assist and conduct technical coordination meetings among engineers of different trades. Recommend value engineering solutions when required and applicable. Liaise and coordinate with procurement engineers to make sure that all the materials that will be ordered / purchased are conforming to specifications.

2005 – 2007 **Astaldi Rumania Branch – Bucharest**

Technical Manager

Construction of a 15 km motorway on the north side of Pitesti (Romania) and 1.6 km of connecting roads. The projects includes 2 interchanges and 10 double deck bridges. The main activities performed during the works were:
earth filling: 2 million cubic meter, asphalt mixture: 190000 tons, hydro-technical works: 4 km, bridges: 1000 m of pre-stressed concrete continuous beam bridges,

Launching of 4000 m of composite steel-concrete bridges, pre-casting yard production: 1000 post tensioned beams, 1700 precast deck slab. Contract value: 100€.

- Responsible for planning, co-ordinating and executing all technical and constructional aspects, delivering to program to or below budget.
- Responsible for overall management of the infrastructure design services provided by others by managing a group of technical specialists.
- Assist review and follow up of in house development of Design.
- Review and resolve interfaces between disciplines.
- Assist and conduct technical coordination meetings among engineers of different trades.
- Recommend value engineering solutions when required and applicable.
- Manages the responses to design RFIs and review/comment on change orders.
- Ensures all infrastructure design works are comprehensive and discussed with the various engineers for the best implementation and installation of services in coordination with other parties and contractor.
- Responsible for the observance of the technical specification for the works prepared by the Employer.

2003 – 2005 **Astaldi S.p.A. - Florence, Italy**

Technical Manager

Design and upgrading of a 9 km section in Metaponto-Reggio Calabria track during railway operability. The project consisted in design and construction of 5 new railway viaducts, 26 new culverts (using jacking technology under the embankment), 5 new road underpasses and 16 new pedestrian underpasses. Contract value: 60€ million.

- Responsible for planning, co-ordinating and executing all technical and constructional aspects, and delivering project on schedule and on budget. Responsible for overall management of the infrastructure design services provided by others by managing a group of technical specialists.
- Responsible for managing the delivery of the design from the preliminary to the detailed design by verifying consistency in the designs produced by design consultants with respect to adherence to the design criteria and required standards.
- Participates in the VE and manages all VE studies, constructability and other workshops; and drives the on-schedule submittal of the design deliverables.
- Keeps project management team informed as to changes made to ensure timely processing of contract change orders.
- Supports the Project Director in performing other tasks as deemed necessary related infrastructure.
- Responsible for the observance of the technical specification for the works prepared by the Employer.

2002 - 2003 **Senior Structural Engineer – Consultant - Calabria, Italy**

- Preparation of technical feasibility reports.
- Design and analysis of structures, bridges including the preparation of work for CAD and interaction with geotechnical engineers as appropriate.

- Preparation of calculations, written reports and checking of contract drawings site surveys and appraisals of various structures, earthworks and foundations as appropriate Liaison with clients, attending meetings on site, progress meetings, design review meetings including cost/commercial aspects of projects.
- Design of bridge structures (pre-stressed concrete beams with reinforced concrete deck) and drainage systems for the viability along the Calopinace and Prumo channel river. Contract value 10€ million.

2001- 2002 **Lecturer University of Reggio - Calabria, Italy**

- Professor Associate for Structural Engineering courses for undergraduate and graduate students.
- Researcher for the Italian National Research Program "Wind and Infra-structures: Dominating Eolian Risk For Utilities and Lifelines".
- Department of Mechanics and Materials, University of Reggio Calabria, ITALY, 1, Via Graziella, loc. Feo di Vito, I-89100 Reggio Calabria, ITALY.
- Wind Engineering, Structural Dynamics, Bridge Engineering

NALCOR ENERGY
LOWER CHURCHILL PROJECT
MUSKRAT FALLS

CONSTRUCTION OF INTAKE AND POWERHOUSE, SPILLWAY
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PACKAGE CH0007
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EXECUTION PLAN

ATTACHMENT 16

CURRICULUM VITAE - PLANT MANAGER - ENRICO MARIA VECCIA

April 16, 2013

ENRICO MARIA VECCIA
Plant Manager

Mr. Enrico Maria Veccia is a professional expert in electromechanical equipment including instrumentation and control systems. He is a certified engineer with expertise in electrical systems and safety design management for infrastructure projects. During last 3 years he has been the plant engineer for metro projects in Italy and Istanbul.

Education and/or Professional Qualifications:

Mechanical Engineer - University of Rome, "La Sapienza" in 1997.
Registered at the Order of Engineers of Rome, in 2001 and later at the Order of Engineers of Turin in 2009)

Linguistic ability: English

Additional Training: INGEGNERI ROMANI: Course of Plant Engineering and Electrical System in 2003
ORDER OF THE ENGINEERS OF TURIN: Safety Course in 2004

Languages: English

Professional Experience:

March 2003 – to date **Astaldi S.p.A.**

ITALY
Plant Manager
Coordinator of the design activities and erection of the mechanical equipment and hoisting system.
- Turnkey Design/Construction for new automatic Line 5 for Milan underground: Concession for Project Financing and 27 years management: Final and executive design, project management, civil works and technological works, rolled material supply and subsequent management and its possible extensions of the functional section of the M5 Line from Garibaldi station (National Railroads) to Bignani with a development of 5,645 m approx.

1999 – 2008 **ITALY**
Independent Consultant - Site Technical Office
Electromechanical Works Manager and Chief of the Plant
Design and Construction of the Pont Ventoux-Susa hydroelectric plant: Construction of: intake structure (capacity: 33 cu.m./sec),- storage tank (capacity: 560,000 m3); headrace tunnel (total length: 14 km, diameter: 4 m), pressure tunnel (total length: 4.5 km, diameter: 4 m), surge tank lined in r.c. (H= 80 m, diameter: 12 m) steel penstock (total length: 1.5 km, diameter: 4÷2.8 m), access tunnel to the plant (length: 1.3 km, size: 6x8 m), underground power station (size: 18x41x48 m) equipped with 2 Francis turbines (production: 150 MW) and a pump (flow: 13 cu.m./sec, discharge head: 500 m),technological installations, start-up and management of the plant for the initial period.

03/1999 – 06/1999 **MB PROGETTI**

ITALY
Designer

ENRICO MARIA VECCIA
Plant Manager

Realization of the project for optical fibre cable laying on FS (National Railway) Piling of Rome – Bari section

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ATTACHMENT 17

CURRICULUM VITAE - PROJECT MANAGEMENT OFFICE (ENGINEERING MANAGER) - MARCO GRINOVERO

April 16, 2013

MARCO GRINOVERO
Engineering Manager

Mr. Marco Grinovero will be the Engineering Manager (Technical Office Responsible) for the Muskrat Falls project. Mr. Grinovero is currently assigned as a Project Manager of the Arad Timisoara Motorway Project in Romania in behalf of the Joint Venture FCC Construccion and Astaldi SpA. His past experience includes management of engieneering works and technical office for different projects. Mr. Grinoveo also has significant construction management and start-up commissioning expertise. He has also coordinated large multidiscipline engineering teams as Technical Office Manager as well as Project Manager.

Education and/or Professional Qualifications:

Civil Engineering 110/110 - University of Roma.

Linguistic ability: English, Spanish, Portuguese, French and Dutch

Professional Experience:

1977 **With S.A.C.U.G. S.p.A., Roma**
Preliminary, Final, Construction and Execution design of structures, among which:
- Highway Viaducts, with pre-stressed precast elements;
- Road Arch and Cantilever Bridges;
- Arch and gravity concrete Dams.

1978 **With Girola S.p.A., Milano**
Assistant to Technical Department Manager, for design of site installations and production plants, with specific care for complete definition of the huge and complex production plants (conceptual and construction design) of the next Paute project.

1978- 1980 **With IMPREGILO S.p.a . - Paute Hydroelectric Project, Ecuador**
Chief of Technical Department
The permanent works basically consist in a 1,700,000 cm arch-gravity concrete dam, a 12 m diameter diversion tunnel with relevant inlet and outlet portals, a double main Intake, a main Bottom Outlet, a Spillway with Stilling Basin, the two Portals and Inlet tunnels for the steel Penstocks to the Powerhouse, a general banks protection of the reservoir. Preliminary works related to urbanization of villages and sites and connection roads.

1981 **With IMPREGILO S.p.a . - Yaciretá Hydroelectric Project, Argentina/Paraguay**
Responsible of Technical Office for Site mobilization

1981- 1982 **With IMPREGILO S.p.a . - Salto Grande Hydroelectric Project, Argentina/Uruguay**
Responsible for architecture, design and construction of permanent structures of Main offices, Deposits, Workshops and other buildings in precast and prestressed concrete structures and internal roads plus plant installations.

1982 - 1984 **With IMPREGILO S.p.a . - Betania Hydroelectric Project, Colombia**

Chief Engineer

Hydroelectric Project including, among others, the following:

- Main earth Dam, 6,000,000 cm, having a deep waterproofing curtain;
- Main Spillway in concrete, with gates control;
- Stilling Basin;
- Secondary earth Dam, including an additional spillway with free water discharge and relevant Stilling Basin;
- Additional earth dam and Dikes;
- Four concrete intake Portals with double gates control;
- Four 8 m diameter tunnels, up to the Power House;
- Four 20 m diameter Surge shafts;
- Powerhouse with four Francis Machines;
- Steel cast Penstock to the Powerhouse;
- Two Diversion Tunnel in reinforced concrete, 12 m diameter each;
- Two inlets, two outlets and two delivery channels in reinforced concrete, for the Diversion tunnels;
- Various galleries, in R.C. for instrumentation and inspection to the Dams;
- Electromechanical installations for the whole Project;
- Main Substation;
- Access and connection roads

1984 - 1986 **With Girola S.p.A., Milan**

In the Head Office Engineering Department, assisting design and construction overseas sites, with site application for mobilization and start up in different Project, among others:

- Ecuador (Paute C Project), Argentina (Piedra del Àguila Project)
- Argentina (Piedra del Aguila Project)
    - Tanzania Motorway
    - Argentina (Ushuaia Airport)

1987 **With Cogefarimpresit S.p.a. - Jiguey and Aguacate Hydroelectric Projects, Dominican Republic**

Chief Engineer

The Project basically includes the following:

Concrete Dam at Jiguey, incorporating spillway;
Stilling Basin;
Concrete Intake and two tunnels up to the Powerhouse;
Powerhouse with two machines;
Permanent cofferdam in R.C.C.;
Diversion tunnel in R.C. with relevant inlets and outlets;
Concrete Dam at Aguacate, incorporating spillway;
Stilling Basin;
Concrete Intake and two tunnels up to the Powerhouse;
Powerhouse with two machines;
Diversion tunnel in R.C. with relevant inlets and outlets;
2x87 km long Aqueduct in precast concrete rings up to the Capital.

1988 - 1991 **With Cogefarimpresit S.p.a. - Pehuence Power Plant, Chile**

Project Manager
The Project consists, among others, in:
Pressure water tunnel 12 m diameter, in reinforced concrete;
Pressure water shaft 12 m diameter, in reinforced concrete;
Two tunnels 8 m diameter each, in reinforced concrete and steel lining;
Valve Chamber;
Two tunnels 6 m diameter each, in reinforced concrete and steel lining, up to the Powerhose;
Underground Powerhouse, with two Francis Machines;
Two undeground gate shafts, downstrean the Powerhouse;
Two discharge tunnels in reinforced concrete, 14 m high;
External Portals and Discharge Channel, 800 m long;
Various Access Tunnels;
Permanent Access roads.

1992 - 1996 **With IMPREGILO S.p.a .**

Proposal Manager in the Head Office Tender Estimating Department and Site Manager for Project (either traditional and B.O.T.) mobilization of several Infrastructure and Highways Projects in Portugal, Spain, France, Switzerland, Monaco, U.K., Ireland, Sweden, Denmark, Poland, Czech Republic, Hungary, Romania, Greece, among which:

- D5 Motorway in Chech Republic
- Underground of Lisbon - Portugal
- Acheloos Project – Greece
- Gas Lavera – France
- Sauges Tunnels – Switzerland
- Evinos Project – Greece
- Butetown Underpasses – United Kingdom

1997 - 1998 **With IMPREGILO S.p.a .**

Project Manager for Motorway A2 in Poland: BOT Toll Motorway between the German border and East Poznan, 102 km turn key Project including Earthworks, Asphalt pavements, Bridges, Viaducts, culverts, artificial tunnels, rest and maintenance areas, Toll Plazas,etc. The Project includes maintenance and traffic operation.

1999 – 2001 **With IMPREGILO S.p.a . - Porto Light Railway System, Portugal**

Technical Director
The Contract refers a Finance, Design, Build and Operate Project for a whole Light Railway System in Porto and surroundings. It is a turn key, firm lump sum price Contract.
It basically consists in:
two underground sections (2,5 and 4 km respectively) to be excavated with an EPB TBM, 8,70 m excavation diameter, for two tracks to be installed;
Four Access Ramps;
One link tunnel in N.A.T.M.;
12 underground Stations, 7 nos. in cut & cover and 5 nos. as mined stations (with N.A.T.M.), including architecture;
58 surface stations;
Substations along the whole network;
11 km of new surface line, double track;

60 km of existing surface line, to be re-built (tracks from metric to Standard and trains from diesel to electric);
Two new Operational, Deposit and Maintenance main Centers;
Urban resettlements (utilities, roads, interfaces with existing buildings and monuments, landscaping);
New structures for the trains, as three Viaducts, four Underpasses, refurbishing of the National Monument Eiffel Bridge Luis I, Building for the Client's Main Office;
Trackway installation;
Our J.V. Partners are directly responsible for E&M works, System design and Operation, under our general interface coordination.

2001 - 2002

With IMPREGILO S.p.a . - S.Petersburg Metropolitain, Russia
Technical Advisor for tunnelling activities (design, procedures, start up, operation, health and safety, quality assurance).

The Works consist in the construction of a twin tunnel 800m long each. Excatation shall be carried out by a Hydroshield T.B.M. Excavation Diameter is 7m and lining is built by precast concrete segments 35cm thick.

2002 - 2003

With C.A.V.To.Mi. Consortium – Main Contractor for the High Speed Railway Project, linking Milano and Torino, Italy
Technical Director, Lot 3, in Novara Province.
The Project (4,000,000,000 Euros) basically consists in the construction of the railway system between Milano and Torino, including the Novara intermediate Station.
The Contract includes as well the divertion, demolition, rehabilitation and integration of all the roadway system, utilities and channels interfering with the Railway, including the new construction of part of the Motorway Milano-Torino and consequent new interchanges and accesses.

2003 – 2006

In Impregilo Concessioni Head Office
Manager for Coordination of Project
Financing Studies, acting as Contract Representative for Impregilo Italia Concessioni in Motorways Project, among which:
Autopista dos Emigrantes, Sao Paulo, Brasil
City Highway, Santiago, Chile Turnkey Churchill Hospitals PFI Project in Oxford, UK (33 years concession period).

2006 – 2009

Working as Consultant for italian and foreign companies
Design and technical, operational and contractual management of infrastructure Projects and public works, both in Italy and abroad (Ghana, Brasil, Emirates, Romania, Ukraina,Qatar), mainly infrastructure and road projects.

2009 – 2010

Project Manager - Design and Build Contract 6R1 Rehabilitation D79
Arad-Oradea, Romania for Astaldi S.p.A. group.

The Project - for a section of around 100 km of National Road - includes 15 new concrete bridges and one composite bridge.

From 2010 **Project Manager of the Arad Timisoara Motorway Project, Romania**
Representing the Joint Venture FCC Construccion-Astaldi SpA.
The Project consists in 32 km of Motorway, two Interchanges, one Maintenance Center and two Service Areas.
It includes also 11 bridges and 15 overpasses, plus 37 main culverts.

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Email : marco.grinovero@gmail.com

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MUSKRAT FALLS

CONSTRUCTION OF INTAKE AND POWERHOUSE, SPILLWAY
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EXECUTION PLAN

ATTACHMENT 18

MANAGEMENT INFORMATION SYSTEM - FLOW DIAGRAM FOR MUSKRAT FALLS PROJECT

April 16, 2013

MANAGEMENT INFORMATION SYSTEM (MIS)
FLOW DIAGRAM FOR MUSKRAT FALLS PROJECT – EXECUTION PHASE

BEGINNING THE "MIS" IMPLEMENTATION PROCESS

TASK 100 – DEFINITION AND UPGRADE PHASE

Activity 110 – MIS Preliminary Work

Identify Contract Requirements
Define Number of Users (Internal and External)
Identify Available IT Resources at Site
- Data Rates (Delay rating - min)
- File Sizes (Kilobytes)
- Format to be Used
- Identify Hardware and Software Supplier
- Contact Local Communication's Company

Activity 120 – MIS Schedule and Definition

Contact Owner's Program Representative to Define MIS's Arrangement (per contract)
Define Project Management Tools (MPT)
Define project Integrated Control System (ICS)
- Global Information System
- Project Information system

Define Project Web Site Access (Extranet)
Create Schedule for MIS Implementation
Add MIS requirements to Sub-consultants and Sub-Contractors & SNC/Nalcor

Activity 130 – MIS Training

Conduct Training for Astaldi Staff
Conduct Training for Client
Conduct Training as Needed for Other Users

Activity 140 – MIS Upgrades

Add New Users as Required
Back up Database and Program Files (daily)

TASK 200 – INITIAL IMPLEMENTATION PHASE

Activity 210 – Set up Hardware, Software and IT System

Hardware Procurement
Software Procurement
Set Up Network Connections in Project Office
Complete Network Testing
Include MIS Procedures in Program Management Plan

Activity 220 – Set Up Project Management Tools (PMT)

Create the WBS
Create the Program Management Plan
Create the Program Communication & Information Flow
Create the Schedule Control Procedure
Create the Cost Administration Procedure
Create MIS Contract Administration Procedures
Create Filling System
Define Technology Transfer Schedule (Training)
Define MIS Security Procedures
Define MIS Safety Data
Define MIS QA/QC Data

Activity 230 – Set up the Integrated Control System (ICS)

Install software
Create Program Web Site
Create Coding for Database
Create Coding for Schedule
Create Coding for Cost Control
Upgrade Program Filling System
Prepare Global Information System Procedures (GIS)
- Schedule
- Cost Reports
- Managerial Reports
- Other

Prepare Program Information System Procedures (PIS)
- Submittals & Engineering
- RFIs
- Meeting Minutes
- Safety Notices
- Daily Site Rports
- Field Work Directives
- Others

Create Procedures for Using Intranet
Create Procedures for Using Extranet

TASK 300 – FINAL IMPLEMENTATION PHASE

GLOBAL INFORMATION SYSTEM

Activity 310 – Project Schedule

Send Coding Schedule to Astaldi Sub-contractors
Request Schedule from Astaldi Sub-contractors
Add Schedules to Astaldi Project Master Schedule

Activity 320 – Cost Reports (Scheduling Tool)

Send Coding Cost & Schedule of Values or Cost Packages to Sub-contractors for Review and Comments
Receive Schedule of Values and/or Cost Packages from Sub-consultants and Sub-contractors
Add Information to Master Schedule

Activity 330 – Managerial Reports

Send Invoicing and Reporting Procedures to Sub-consultants and Sub-contractors

PROJECT INFORMATION SYSTEM

Activity 340 – Send Procedures to Sub-consultants, Sub-contractors for Using the MIS as applicable

Coding Definition for Project Directories & Options
Project Cells Definition
Project Access & IT

Activity 350 – Send Procedures to Sub-consultants, Sub-contractors for the MIS Tools

Extranet Access & IT Requirements

TASK 400 – OPERATION & FOLLOW UP PHASE

Activity 410 – Daily Information Update

Add project information on a daily basis as required
Print out hard copy of reports in compliance with data entry
File hard copies in filling system

Activity 420 – Daily Information Back up

Back Up Daily MIS Data Information

Activity 430 – Weekly / Monthly Meetings with MIS's

Weekly Meetings With Firms Incorporated into Project (for one month)
Monthly Meetings During Phase 400. (after initial month of weekly meeting)

Astaldi MIS Audits During Operation

"MIS" IN FULL OPERATION

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ATTACHMENT 19

SITE LAYOUT DRAWINGS - GENERAL ARRANGEMENT

April 16, 2013

Site internal travelling distances

from	to	meter
Industrial Area	Borrow pit	1.790
	Lay- down area	3.870
	Powerhouse DS	2.140
	Spillway DS	2.360
	Powerhouse US	2.530
	Spillway and Transition dams US	2.595
Lay- down area (new - ex disposal area)	Industrial area	3.870
	Borrow pit	5.390
	Powerhouse DS	2.580
	Spillway DS	2.800
	Powerhouse US	1.760
	Spillway and Transition dams US	1.852
Main Camp	Industrial area	8.990
	Borrow pit	10.780
	Lay- down area	12.860
	Powerhouse DS	11.130
	Spillway DS	11.350
	Powerhouse US	11.520
	Spillway and Transition dams US	11.585
Goosy bay (airport)	Main Camp	37.250
	Industrial area	46.240
	Borrow pit	48.030
	Lay- down area	50.110
	Powerhouse DS	48.380
	Spillway DS	48.600
	Powerhouse US	48.770
	Spillway and Transition dams US	48.835

BATCHING PLANT
CRUSCHING PLANT
SPILLWAY
POWERHOUSE
STOCK AREAS
CONTRACTOR'S AREA
Churchill River
McKenzie River
ACCOMMODATIONS COMPLEX
CONTRACTOR'S OFFICE AREA
TD-4
GD-7
TD-8
TD-7A
TD-6
TD-7
GD-11
GD-8
GD-5

LEGEND
- STEEL REINFORCEMENT
- AGGREGATES
- CONCRETE
- INTERNAL WORKING SITE ROADS
- AVAILABLE LAYDOWN AREAS
- LIMIT OF CLEARING
- TILL DEPOSIT
- GRANULAR DEPOSIT

N

0 625 1250 m

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GENERAL PLAN VIEW
DRAWING 1/22
scale 1:35.000

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APPENDIX A13
EXECUTION PLAN

ATTACHMENT 20

SITE LAYOUT DRAWINGS - SITE ROADS

April 16, 2013

LEGEND
- STEEL REINFORCEMENT
- AGGREGATES
- CONCRETE
- INTERNAL WORKING SITE ROADS
- AVAILABLE LAYDOWN AREAS
- DRAINAGE CANAL
- DITCH
- NATURAL STREAM
- CULVERT
- LIMIT OF CLEARING

647 500 E
648 000 E
648 500 E
649 000 E
649 500 E
650 000 E
650 500 E

BATCHING PLANT
CRUSCHING PLANT
C1
C2
SPILLWAY
POWERHOUSE
STOCK AREAS
A
B
D
E
F
G
SWITCHYARD
CONVERTER STATION
CONTRACTOR'S AREA
TO GRANULAR DEPOSIT (GD11)

N
0 250 500 m

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LOWER CHURCHILL PROJECT
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SITE ROAD PHASE 1
DRAWING 2/22
scale 1:10.000

FLOW

CHURCHILL RIVER

℄ SPILLWAY APPROACH CHANNEL

(EXISTING) CREST EL 21,00

NORTH TRANSITION DAM

CREST EL 26,00

SPILLWAY

COFFERDAM No 1 (EXISTING) CREST EL 21,00

COFFERDAM No 2 (EXISTING) CREST EL 21,00

COFFERDAM No 3 (EXISTING) CREST EL 21,00

℄ APPROACH CHANNEL

CENTRE TRANSITION DAM

SEPARATION WALL

WINTER PROTECTION STRUCTURE

POWERHOUSE

F

℄ INTAKE APPROACH CHANNEL

G

SEDIMENTATION POND No 2 (EXISTING)

ACCESS ROAD TO POWERHOUSE (EXISTING)

WATER PUMPED FROM WORK AREAS

SEDIMENTATION POND No 1 (EXISTING)

E

SOUTH TRANSITION DAM

TO SPOIL DISPOSAL AREA

CONSTRUCTION ROAD

TO CONTRACTOR'S LAYDOWN AREA

TO SWITCHYARD

PARKING TRUCKS

B

D

STEEL REINFORCEMENT SITE LOGISTICS

SWITCHYARD

H

N

0 125 m

LEGEND

- STEEL REINFORCEMENT
- AGGREGATES
- CONCRETE
- INTERNAL WORKING SITE ROADS
- AVAILABLE LAYDOWN AREAS
- PUMPING LINE
- DRAINAGE CANAL
- INDUSTRIAL WATER PUMP INTAKE
- INDUSTRIAL WATER PIPE
- DITCH
- NATURAL STREAM
- CULVERT
- LIMIT OF CLEARING

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LOWER CHURCHILL PROJECT
MUSKRAT FALLS
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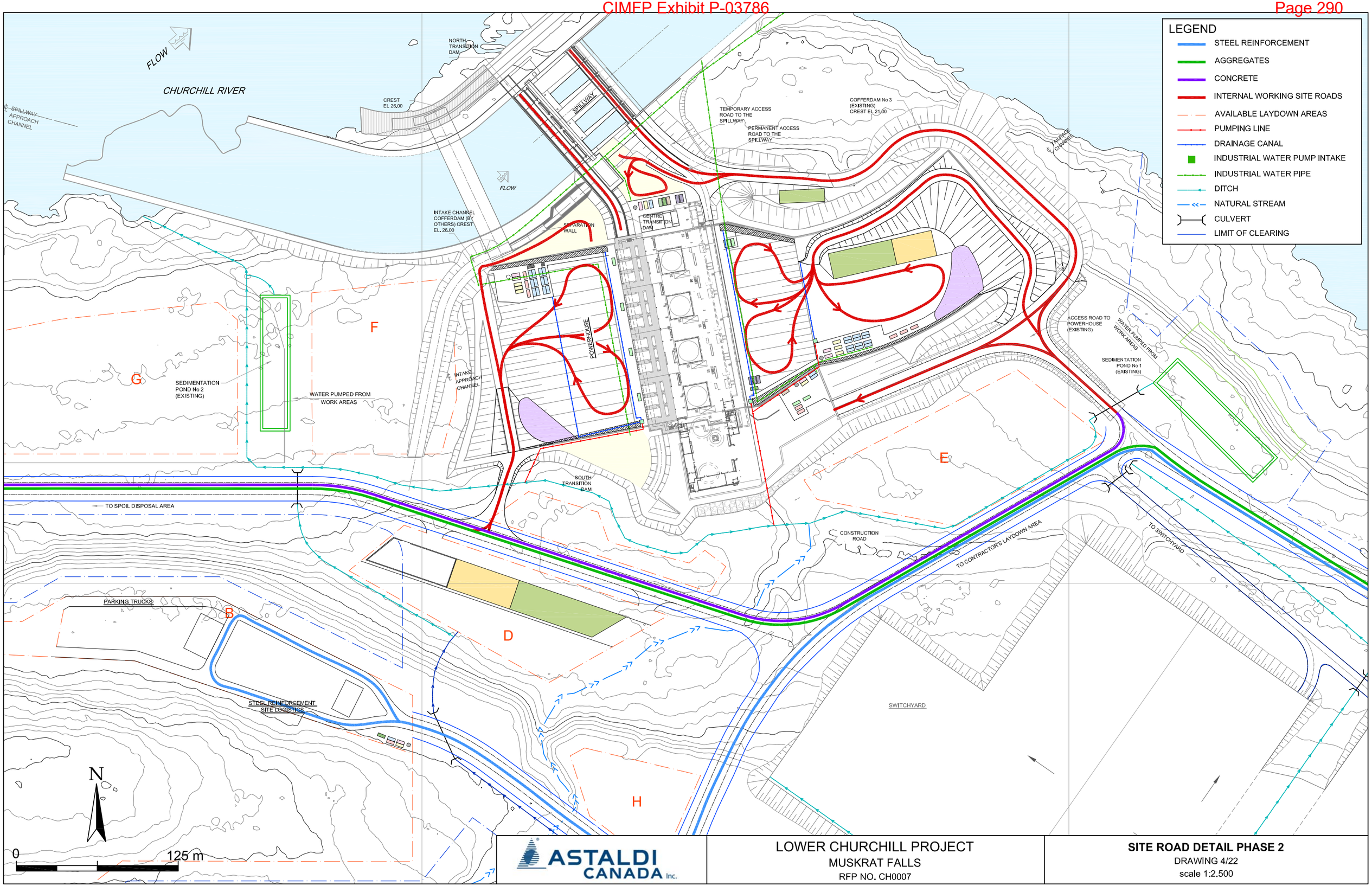
SITE ROAD DETAIL PHASE 1
DRAWING 3/22
scale 1:2.500



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LOWER CHURCHILL PROJECT
MUSKRAT FALLS
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SITE ROAD DETAIL PHASE 2
DRAWING 4/22
scale 1:2.500

NALCOR ENERGY
LOWER CHURCHILL PROJECT
MUSKRAT FALLS

CONSTRUCTION OF INTAKE AND POWERHOUSE, SPILLWAY
AND TRANSITION DAMS

PACKAGE CH0007
CORE TECHNICAL PROPOSAL

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EXECUTION PLAN

ATTACHMENT 21

SITE LAYOUT DRAWINGS - DRAINAGE

April 16, 2013

LEGEND
- DRAINAGE CANAL
- PUMPING STATION
- PUMPING LINE
- DITCH
- NATURAL STREAM
- CULVERT
- LIMIT OF CLEARING
- AVAILABLE LAYDOWN AREAS

FLOW
CHURCHILL RIVER
℄ SPILLWAY APPROACH CHANNEL
(EXISTING) CREST EL 21,00
NORTH TRANSITION DAM
CREST EL 26,00
SPILLWAY
COFFERDAM No 1 (EXISTING) CREST EL 21,00
COFFERDAM No 2 (EXISTING) CREST EL 21,00
COFFERDAM No 3 (EXISTING) CREST EL 21,00
℄ APPROACH CHANNEL
SEPARATION WALL
℄ CENTRE TRANSITION DAM
WINTER PROTECTION STRUCTURE
POWERHOUSE
℄ INTAKE APPROACH CHANNEL
ACCESS ROAD TO POWERHOUSE (EXISTING)
WATER PUMPED FROM WORK AREAS
SEDIMENTATION POND No 1 (EXISTING)
SEDIMENTATION POND No 2 (EXISTING)
SOUTH TRANSITION DAM
TO SPOIL DISPOSAL AREA
CONSTRUCTION ROAD
TO CONTRACTOR'S LAYDOWN AREA
TO SWITCHYARD
PARKING TRUCKS
STEEL REINFORCEMENT SITE LOGISTICS
SWITCHYARD
A
B
D
E
F
G
H
N
0
125 m

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DEWATERING SYSTEM
DRAWING 5/22
scale 1:2.500

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ATTACHMENT 22

SITE LAYOUT DRAWINGS - SPILLWAY

April 16, 2013

RIVERSIDE
RCC COFFERDAM
(EXISTING)
CREST EL 21.00

NORTH
TRANSITION
DAM

CREST
EL 26.00

SPILLWAY

TEMPORARY ACCESS
ROAD TO THE
SPILLWAY

PERMANENT ACCESS
ROAD TO THE
SPILLWAY

COFFE
(EXIST
CREST

FLOW

WORKING
AREA

INTAKE CHANNEL
COFFERDAM (BY
OTHERS) CREST
EL. 26.00

SEPARATION
WALL

RESTRICTED
AREA

WORKING
AREA

CENTRE
TRANSITION
DAM

CONCRETE
TOWER & BOOM

LEGEND

1	LOCKERS ROOM
2	FOLD AWAY SHED
3	LUNCH ROOM
4	MECHANICAL - ELECTRICAL ROOM
5	STOCK CONTAINER
6	LAVATORIES
7	SNOW REMOVAL AREA
8	STORAGE AREA
9	PUMPING STATION
10	OFFICE TRAILER
11	ELECTRICAL POWER SUPPLY THREE PHASE 600 V
12	ELECTRICAL GENERATOR WITH TANK
13	ELECTRICAL EMERGENCY GENERATOR WITH TANK
14	SEPTIC TANKS
15	HEATED SHELTER
	LIGHTING
	PUMPING LINE
	DRAINAGE CANAL
	WATER PIPE

N

0 25 50 m

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LOWER CHURCHILL PROJECT
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SPILLWAY - PHASE 2
DRAWING 8/22
scale 1:1.000

SOUTH TRANSITION DAM

OVERHEAD CRANE B

CONCRETE DISTRIBUTION SYSTEM

OVERHEAD CRANE B

OVERHEAD CRANE A

OVERHEAD CRANE A

CONCRETE TOWER & BOOM

OVERHEAD CRANE A

OVERHEAD CRANE B

OVERHEAD CRANE B

FIXED CONCRETE PUMP

LEGEND

1	LOCKERS ROOM
2	FOLD AWAY SHED
3	LUNCH ROOM
4	MECHANICAL - ELECTRICAL ROOM
5	STOCK CONTAINER
6	LAVATORIES
7	SNOW REMOVAL AREA
8	STORAGE AREA
9	PUMPING STATION
10	OFFICE TRAILER
11	ELECTRICAL POWER SUPPLY THREE PHASE 600 V
12	ELECTRICAL GENERATOR
13	ELECTRICAL EMERGENCY GENERATOR
14	SEPTIC TANKS
15	HEATED SHELTER
	LIGHTING
	PUMPING LINE
	DRAINAGE CANAL
	WATER PIPE

N

0 25 m

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POWER HOUSE DETAIL - PHASE 1
DRAWING 10/22
scale 1:500

NALCOR ENERGY
LOWER CHURCHILL PROJECT
MUSKRAT FALLS

CONSTRUCTION OF INTAKE AND POWERHOUSE, SPILLWAY
AND TRANSITION DAMS

PACKAGE CH0007
CORE TECHNICAL PROPOSAL

APPENDIX A13
EXECUTION PLAN

ATTACHMENT 23

SITE LAYOUT DRAWINGS - INTAKE / POWERHOUSE

April 16, 2013

RESTRICTED AREA

COFFERDAM No 3 (EXISTING) CREST EL 21.00

COFFERDAM No 2 (EXISTING) CREST EL 21.00

TAILRACE CHANNEL

WORKING AREA

SPILLWAY

STORAGE AND PARKING AREA

WORKING AREA

CENTRE TRANSITION DAM

CONCRETE TOWER & BOOM

SEPARATION WALL

RESTRICTED AREA

WORKING AREA

RESTRICTED AREA

WINTER PROTECTION STRUCTURE

FIXED CONCRETE PUMP

POWERHOUSE

INTAKE APPROACH CHANNEL

EL 19.00

EL -14.00

EL -26.66

ACCESS ROAD TO POWERHOUSE (EXISTING)

WATER PUMPED FROM WORK AREAS

SEDIMENTATION POND No 1 (EXISTING)

EL 25.00

WORKING AREA

EL -3.70

EL -10.30

SOUTH TRANSITION DAM

WORKING AREA

CONSTRUCTION ROAD

TO SWITCHY

'S LAYDOWN AREA

F

E

N

0

65 m

LEGEND

1	LOCKERS ROOM
2	FOLD AWAY SHED
3	LUNCH ROOM
4	MECHANICAL - ELECTRICAL ROOM
5	STOCK CONTAINER
6	LAVATORIES
7	SNOW REMOVAL AREA
8	STORAGE AREA
9	PUMPING STATION
10	OFFICE TRAILER
11	ELECTRICAL POWER SUPPLY THREE PHASE 600 V
12	ELECTRICAL GENERATOR WITH TANK
13	ELECTRICAL EMERGENCY GENERATOR WITH TANK
14	SEPTIC TANKS
15	HEATED SHELTER
	LIGHTING
	AVAILABLE LAYDOWN AREAS
	PUMPING LINE
	DRAINAGE CANAL
	WATER PIPE
	DITCH
	NATURAL STREAM
	CULVERT
	LIMIT OF CLEARING

ASTALDI CANADA Inc.

LOWER CHURCHILL PROJECT

MUSKRAT FALLS

RFP NO. CH0007

POWER HOUSE - PHASE 1

DRAWING 7/22

scale 1:1.300

SPILLWAY

FLOW

INTAKE CHANNEL COFFERDAM (BY OTHERS) CREST EL. 26.00

WORKING AREA

SEPARATION WALL

RESTRICTED AREA

WORKING AREA

CENTRE TRANSITION DAM

TEMPORARY ACCESS ROAD TO THE SPILLWAY

PERMANENT ACCESS ROAD TO THE SPILLWAY

COFFERDAM No 3 (EXISTING) CREST EL 21.00

CONCRETE TOWER & BOOM

TAILRACE CHANNEL

FIXED CONCRETE PUMP

POWERHOUSE

INTAKE APPROACH CHANNEL

WORKING AREA

EL -3.70

EL -10.30

EL -14.00

EL -26.66

SOUTH TRANSITION DAM

CONSTRUCTION ROAD

ACCESS ROAD TO POWERHOUSE (EXISTING)

WATER PUMPED FROM WORK AREAS

SEDIMENTATION POND No 1 (EXISTING)

EL 25.00

TO SWITCHY

'S LAYDOWN AREA

E

N

0 65 m

LEGEND

1	LOCKERS ROOM
2	FOLD AWAY SHED
3	LUNCH ROOM
4	MECHANICAL - ELECTRICAL ROOM
5	STOCK CONTAINER
6	LAVATORIES
7	SNOW REMOVAL AREA
8	STORAGE AREA
9	PUMPING STATION
10	OFFICE TRAILER
11	ELECTRICAL POWER SUPPLY THREE PHASE 600 V
12	ELECTRICAL GENERATOR WITH TANK
13	ELECTRICAL EMERGENCY GENERATOR WITH TANK
14	SEPTIC TANKS
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	LIGHTING
	AVAILABLE LAYDOWN AREAS
	PUMPING LINE
	DRAINAGE CANAL
	WATER PIPE
	DITCH
	NATURAL STREAM
	CULVERT
	LIMIT OF CLEARING

ASTALDI CANADA Inc.

LOWER CHURCHILL PROJECT

MUSKRAT FALLS

RFP NO. CH0007

POWER HOUSE - PHASE 2

DRAWING 9/22

scale 1:1.300

SOUTH TRANSITION DAM

OVERHEAD CRANE B

CONCRETE DISTRIBUTION SYSTEM

OVERHEAD CRANE B

OVERHEAD CRANE A

OVERHEAD CRANE A

CONCRETE TOWER & BOOM

OVERHEAD CRANE A

OVERHEAD CRANE B

OVERHEAD CRANE B

FIXED CONCRETE PUMP

LEGEND

1	LOCKERS ROOM
2	FOLD AWAY SHED
3	LUNCH ROOM
4	MECHANICAL - ELECTRICAL ROOM
5	STOCK CONTAINER
6	LAVATORIES
7	SNOW REMOVAL AREA
8	STORAGE AREA
9	PUMPING STATION
10	OFFICE TRAILER
11	ELECTRICAL POWER SUPPLY THREE PHASE 600 V
12	ELECTRICAL GENERATOR
13	ELECTRICAL EMERGENCY GENERATOR
14	SEPTIC TANKS
15	HEATED SHELTER
	LIGHTING
	PUMPING LINE
	DRAINAGE CANAL
	WATER PIPE

N

0 25 m

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LOWER CHURCHILL PROJECT
MUSKRAT FALLS
RFP NO. CH0007

POWER HOUSE DETAIL - PHASE 1
DRAWING 10/22
scale 1:500

ASTALDI CANADA Inc.

nalcor energy

NALCOR ENERGY
LOWER CHURCHILL PROJECT
MUSKRAT FALLS

CONSTRUCTION OF INTAKE AND POWERHOUSE, SPILLWAY
AND TRANSITION DAMS

PACKAGE CH0007
CORE TECHNICAL PROPOSAL

APPENDIX A13
EXECUTION PLAN

ATTACHMENT 24

SITE LAYOUT DRAWINGS - CONTRACTOR'S LAYDOWN AREAS

April 16, 2013

C1

OTHER CONTRACTOR'S AREA

CONCRETE LABORATORY

CONTRACTOR'S LAYDOWN AREA

STOCK PILE
20 mm x 5 mm

CRUSCHING PLANT

STOCK PILE
5 mm x 0 mm

STOCK PILE
40 mm x 5 mm

HEATING PAD

BATCHING PLANT

ENERGY POWER PLANT (900KVA)

WASCHING CONCRETE MIXER

LEGEND

1	LOCKERS ROOM
2	FOLD AWAY SHED
3	LUNCH ROOM
4	MECHANICAL - ELECTRICAL ROOM
5	STOCK CONTAINER
6	LAVATORIES
7	SNOW REMOVAL AREA
8	STORAGE AREA
9	PUMPING STATION
10	OFFICE TRAILER
11	ELECTRICAL POWER SUPPLY THREE PHASE 600 V
12	ELECTRICAL GENERATOR WITH TANK
13	ELECTRICAL EMERGENCY GENERATOR WITH TANK
14	SEPTIC TANKS
15	HEATED SHELTER
	LIGHTING
	AVAILABLE LAYDOWN AREAS
	PUMPING LINE
	DRAINAGE CANAL
	WATER PIPE
	DITCH
	NATURAL STREAM
	CULVERT
	LIMIT OF CLEARING

N

0 65 m

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LOWER CHURCHILL PROJECT
MUSKRAT FALLS
RFP NO. CH0007

CONTRACTOR'S LAYDOWN AREA
DRAWING 11/22
scale 1:1.300

TO SPOIL DISPOSAL AREA

DAM

Deposit waste area

3

8

D

PARKING TRUCKS

B

Wasching truck

STEEL REINFORCEMENT
SITE LOGISTICS

Warehouse

12 3 10 6 1 14

H

LEGEND

1	LOCKERS ROOM
2	FOLD AWAY SHED
3	LUNCH ROOM
4	MECHANICAL - ELECTRICAL ROOM
5	STOCK CONTAINER
6	LAVATORIES
7	SNOW REMOVAL AREA
8	STORAGE AREA
9	PUMPING STATION
10	OFFICE TRAILER
11	ELECTRICAL POWER SUPPLY THREE PHASE 600 V
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14	SEPTIC TANKS
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	LIGHTING
	AVAILABLE LAYDOWN AREAS
	PUMPING LINE
	DRAINAGE CANAL
	WATER PIPE
	DITCH
	NATURAL STREAM
	CULVERT
	LIMIT OF CLEARING

N

0 55 m

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LOWER CHURCHILL PROJECT
MUSKRAT FALLS
RFP NO. CH0007

STOCK AREAS
DRAWING 12/22
scale 1:1.100

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LOWER CHURCHILL PROJECT
MUSKRAT FALLS

CONSTRUCTION OF INTAKE AND POWERHOUSE, SPILLWAY
AND TRANSITION DAMS

PACKAGE CH0007
CORE TECHNICAL PROPOSAL

APPENDIX A13
EXECUTION PLAN

ATTACHMENT 25

SITE LAYOUT DRAWINGS - CONTRACTOR'S FACILITIES

April 16, 2013

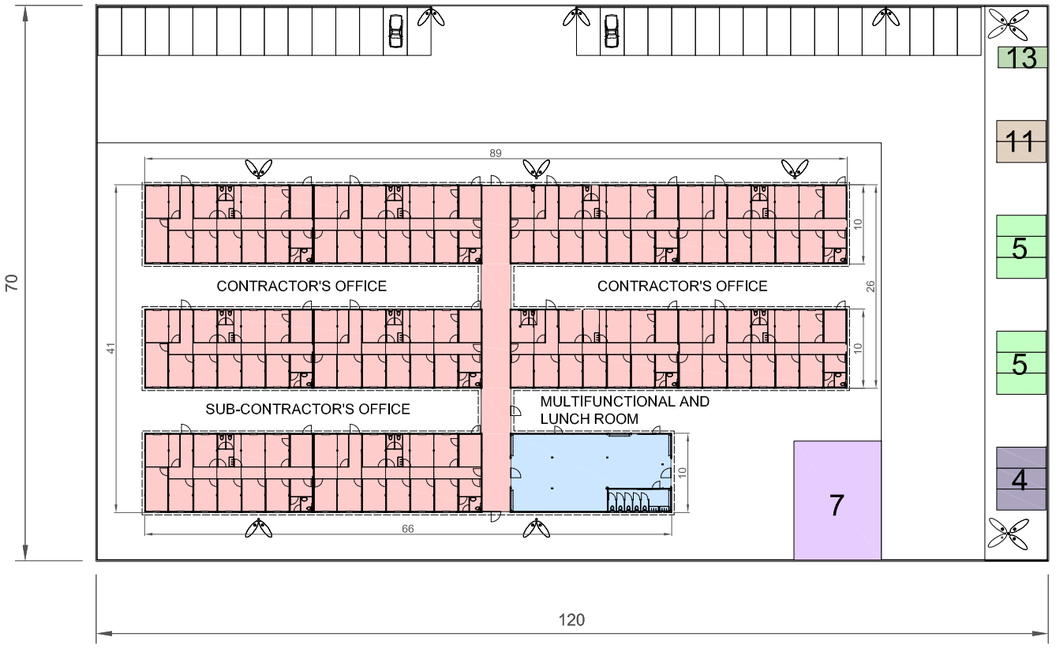
STORAGE FOR DANGEROUS PRODUCT
25
15
28
PICK UP PARKING AREA
15
12
20
20
20
JOINERY
35
STOCK CONTAINER
3
6
PASSAGE
6
3
STOCK CONTAINER
JOINERY
4
4
4
18
LUNCH ROOM
LUNCH ROOM
OFFICE
3
LAVATORIES
7
2
6
LOCKER ROOM
HEATED WAREHOUSE
35
COVERED AREA
20
20
35
MECHANICAL
3
12
MECHANICAL CONTAINER
PASSAGE
12
MECHANICAL CONTAINER
3
20
MECHANICAL
100
80
STORAGE AREA
25
50
20
SHED - NO ISOLATED
25
15
FUEL STORAGE ON PAD
11
12
13
200
N
0
25
50 m

ASTALDI CANADA Inc.

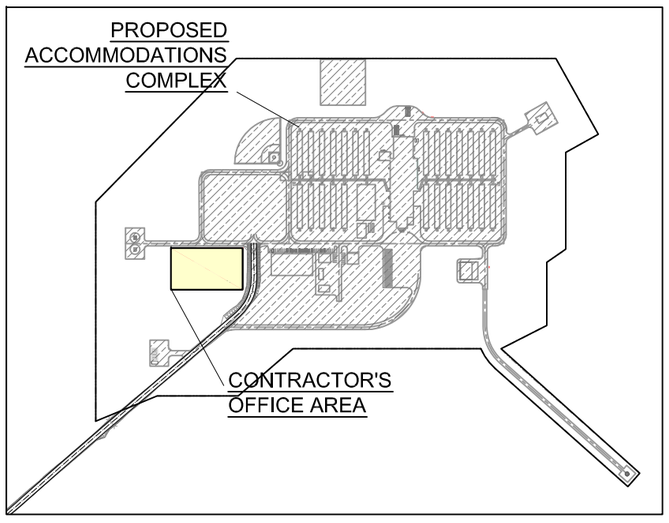
LOWER CHURCHILL PROJECT
MUSKRAT FALLS
RFP NO. CH0007

CONTRACTOR'S INDUSTRIAL AREA
DRAWING 13/22
scale 1:750

PROPOSED ACCOMMODATIONS COMPLEX



CONTRACTOR'S OFFICE AREA



LEGEND

1	LOCKERS ROOM
2	FOLD AWAY SHED
3	LUNCH ROOM
4	MECHANICAL - ELECTRICAL ROOM
5	STOCK CONTAINER
6	LAVATORIES
7	SNOW REMOVAL AREA
8	STORAGE AREA
9	PUMPING STATION
10	OFFICE TRAILER
11	ELECTRICAL POWER SUPPLY THREE PHASE 600 V
12	ELECTRICAL GENERATOR WITH TANK
13	ELECTRICAL EMERGENCY GENERATOR WITH TANK
	LIGHTING
	NATURAL STREAM
	CULVERT

N

0 25 50 m

ASTALDI CANADA Inc.

LOWER CHURCHILL PROJECT
MUSKRAT FALLS
RFP NO. CH0007

CONTRACTOR'S OFFICE AREA
DRAWING 14/22
scale 1:750

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LOWER CHURCHILL PROJECT
MUSKRAT FALLS

CONSTRUCTION OF INTAKE AND POWERHOUSE, SPILLWAY
AND TRANSITION DAMS

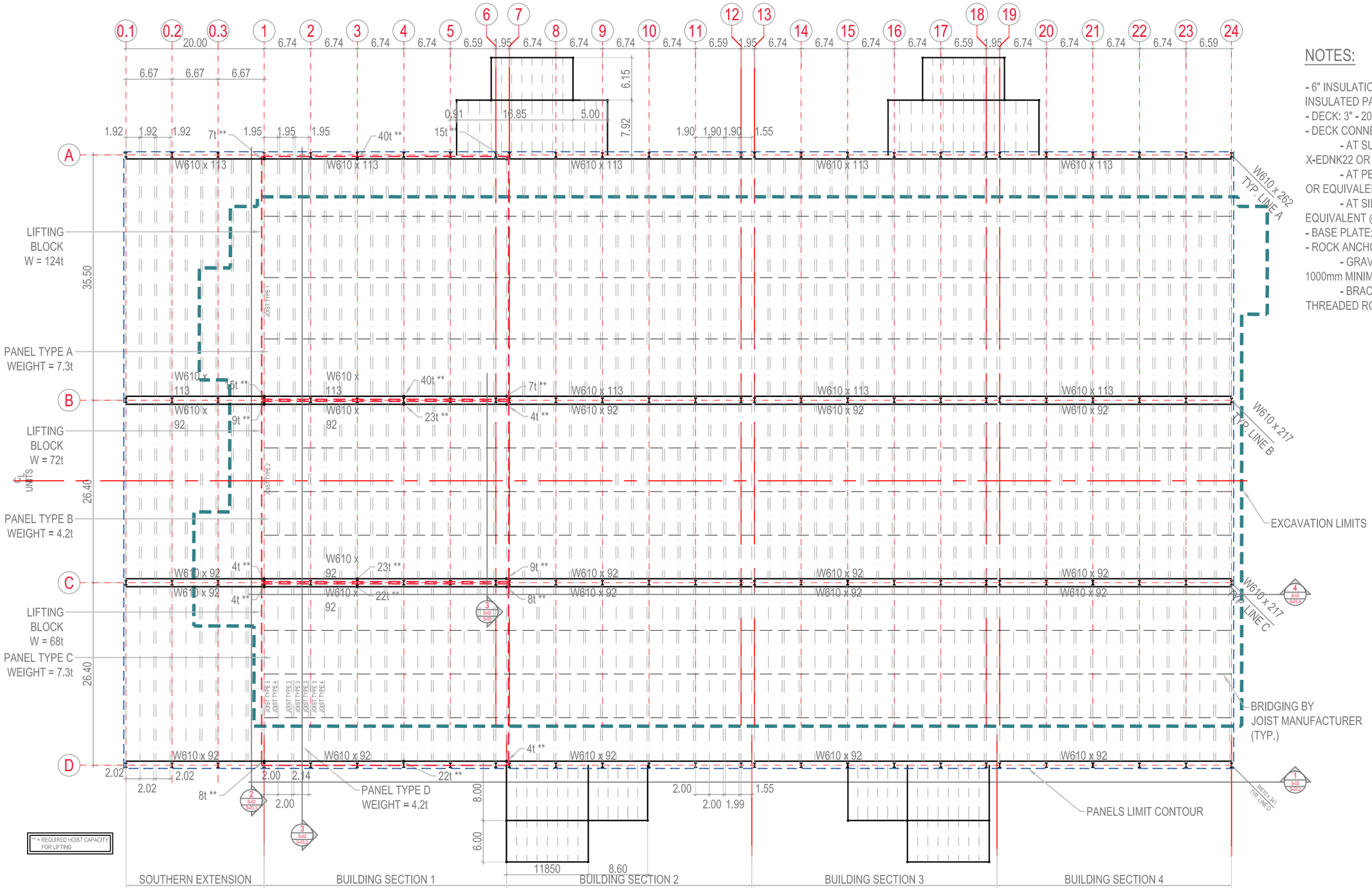
PACKAGE CH0007
CORE TECHNICAL PROPOSAL

APPENDIX A13
EXECUTION PLAN

ATTACHMENT 26

INTEGRATED COVER SYSTEM - GENERAL ARRANGEMENT

April 16, 2013



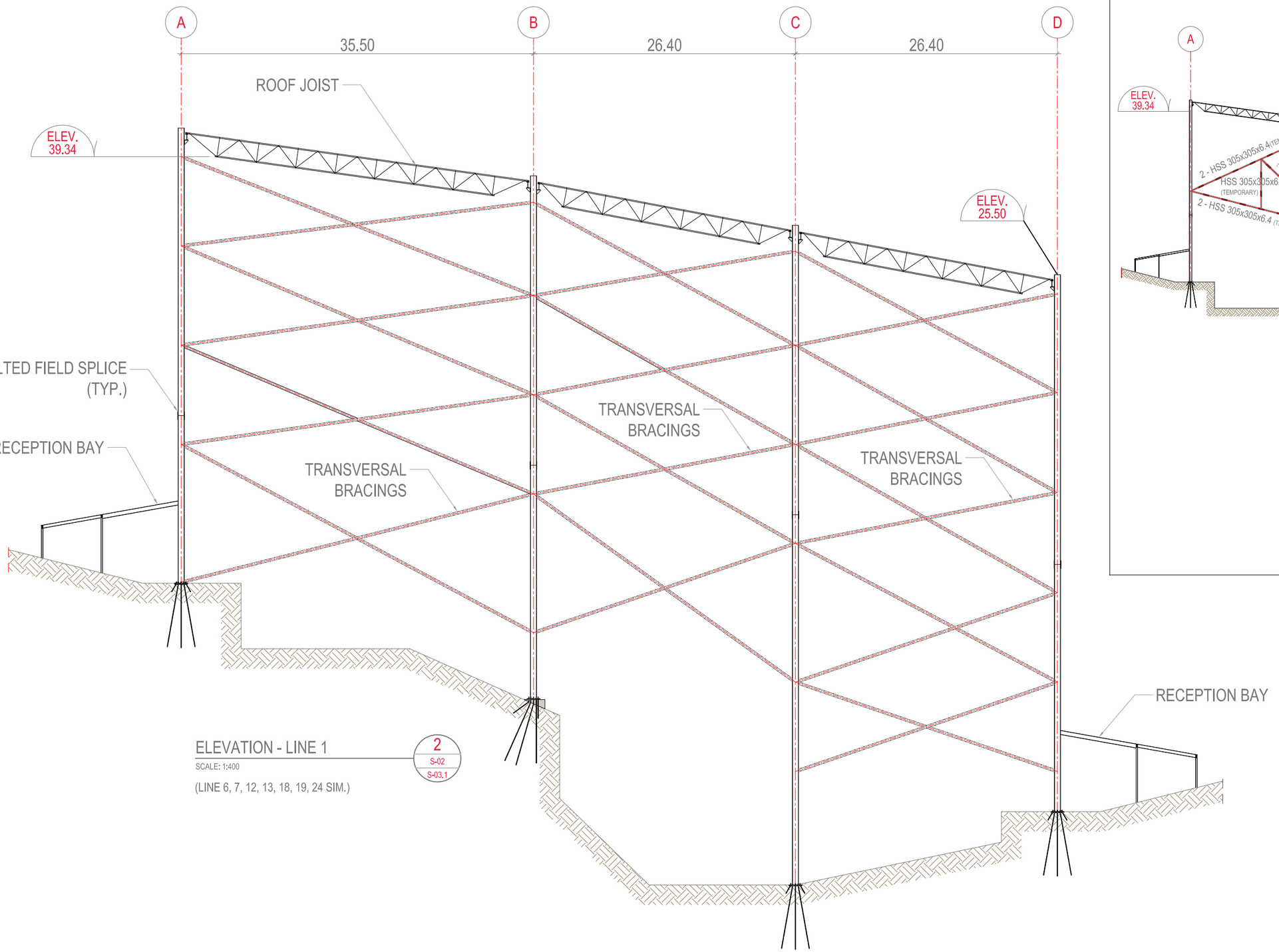
NOTES:

- 6" INSULATION PANEL FOR ROOF, LINE A & D WALLS (NO INSULATED PANEL IS CONSIDERED AT LINE 1 & 24)
- DECK: 3" - 20 ga.
- DECK CONNECTOR TYPE AND CONFIGURATION
  - AT SUPPORT (JOIST): 610/7 WITH HILTI X-EDN19 / X-EDNK22 OR EQUIVALENT
  - AT PERIMETER MEMBER: HILTI X-EDN19 / X-EDNK22 OR EQUIVALENT @ 300mm c/c
  - AT SIDE-LAP: #10 SCREW OR HILTI S-SLC-01 OR EQUIVALENT @ 300mm c/c
- BASE PLATE: PL 400x920x40 (TYP. FOR ALL COLUMNS)
- ROCK ANCHORS:
  - GRAVITY COLUMNS: 4 GRADE 60 SOLID REBAR 1"Ø, 1000mm MINIMUM ANCHOR IN ROCK
  - BRACING COLUMNS: 4 GRADE 87 HIGH IMPACT THREADED ROD 1 1/2"Ø 6500 MINIMUM ANCHOR IN ROCK

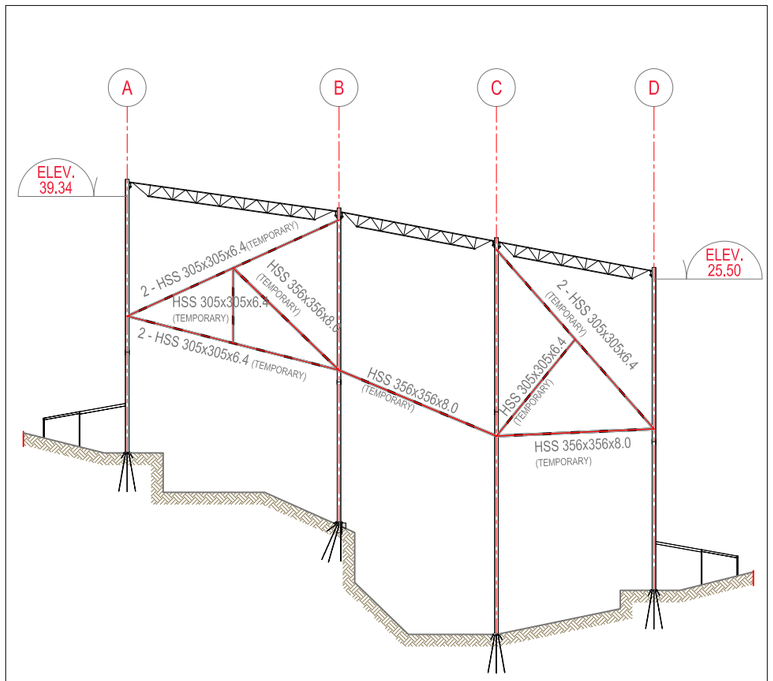
ASTALDI CANADA Inc.

LOWER CHURCHILL PROJECT
MUSKRAT FALLS
RFP NO. CH0007

POWER HOUSE - WINTER PROTECTION STRUCTURE PLAN VIEW
DRAWING 15/22
scale 1:500

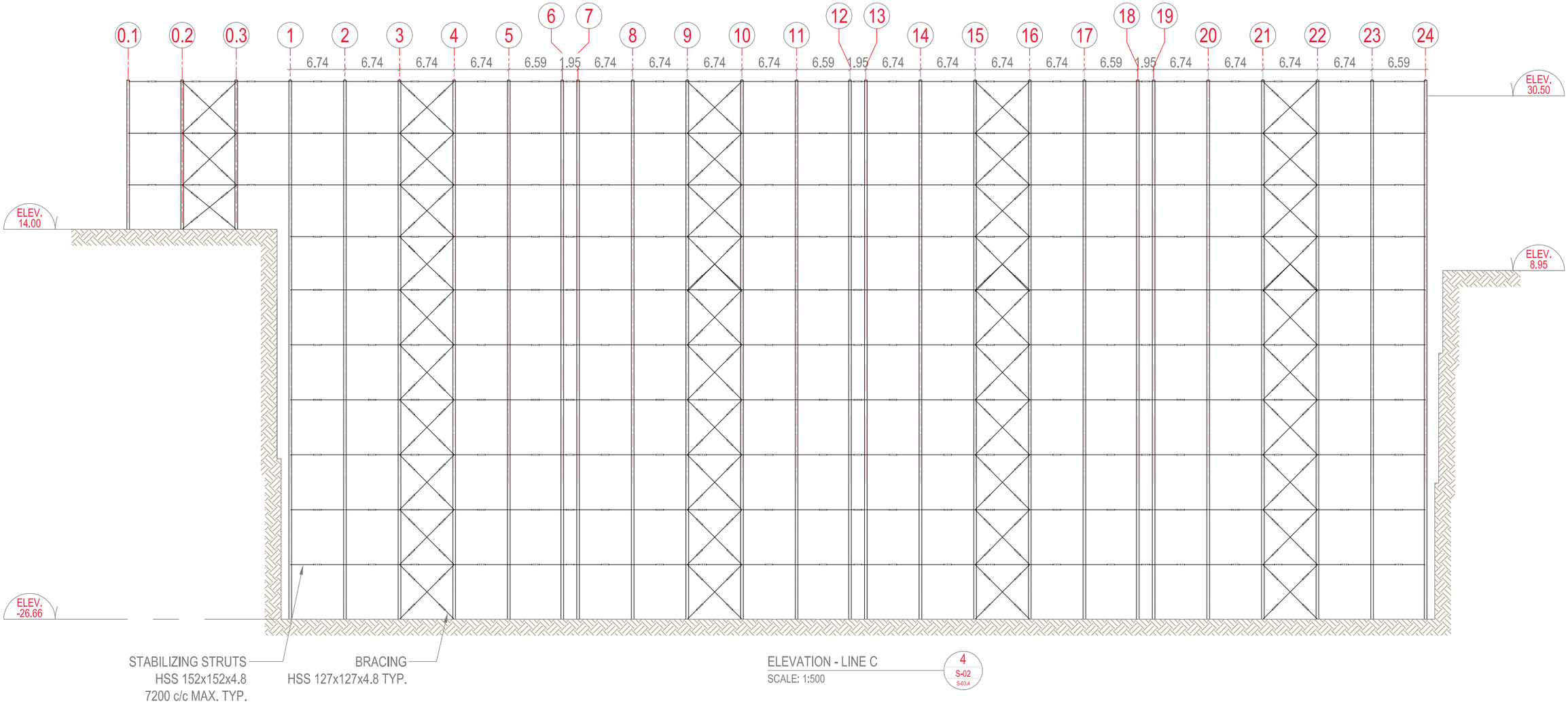


ELEVATION - LINE 1 — 2 (S-02 / S-03.1)
SCALE: 1:400
(LINE 6, 7, 12, 13, 18, 19, 24 SIM.)



ELEVATION - LINE 2 — 3 (S-02 / S-03.3)
SCALE: 1:1000
(ALL LINES EXCEPT 0.1, 1, 6, 7, 12, 13, 18, 19, 24)

ASTALDI CANADA Inc.	LOWER CHURCHILL PROJECT MUSKRAT FALLS RFP NO. CH0007	**POWER HOUSE - WINTER PROTECTION STRUCTURE SECTION VIEW ALONG LINE 1 AND 2** DRAWING 16/22 scale 1:400/1000



ELEVATION - LINE C (4 / S-02 / S-03.4)

SCALE: 1:500

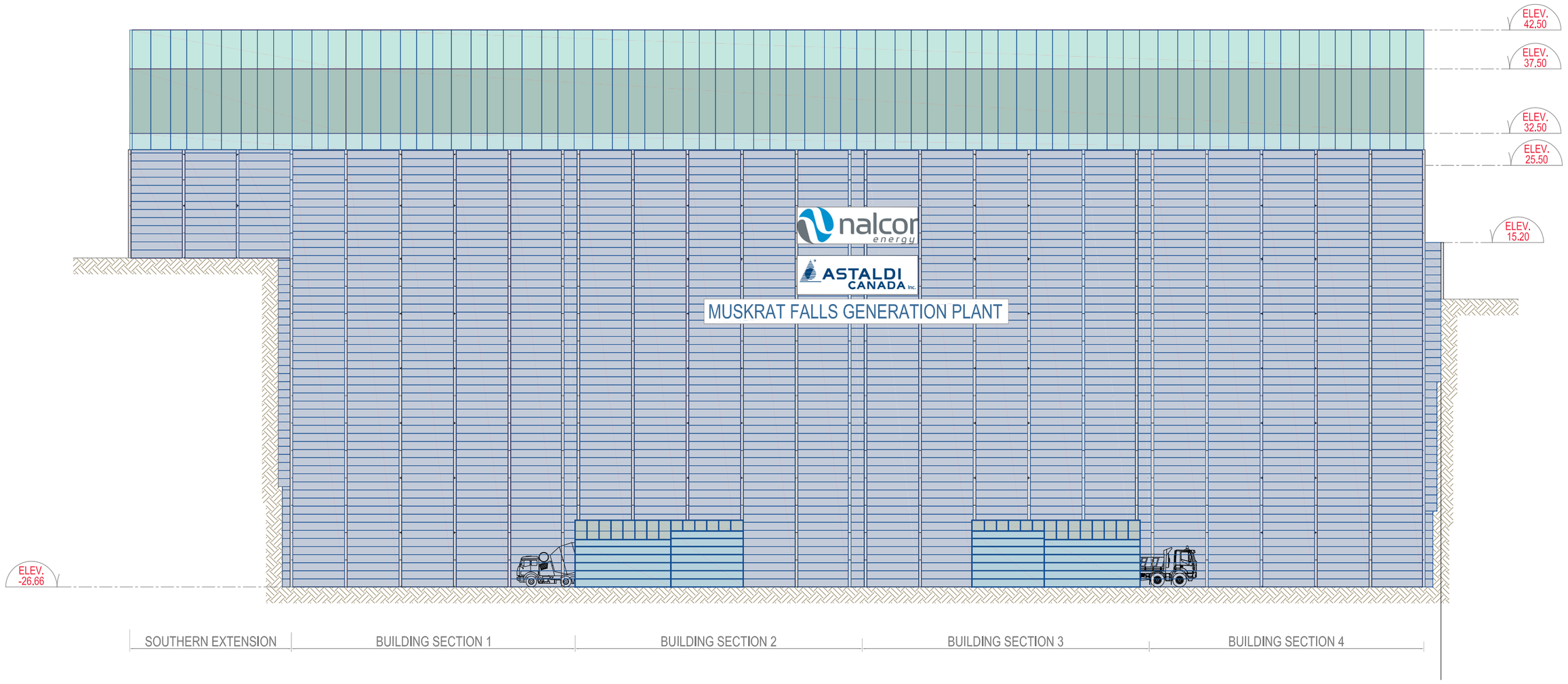
NOTES:

- 6" INSULATION PANEL FOR ROOF, LINE A & D WALLS (NO INSULATED PANEL IS CONSIDERED AT LINE 1 & 24)
- DECK: 3" - 20 ga.
- DECK CONNECTOR TYPE AND CONFIGURATION
  - AT SUPPORT (JOIST): 610/7 WITH HILTI X-EDN19 / X-EDNK22 OR EQUIVALENT
  - AT PERIMETER MEMBER: HILTI X-EDN19 / X-EDNK22 OR EQUIVALENT @ 300mm c/c
  - AT SIDE-LAP: #10 SCREW OR HILTI S-SLC-01 OR EQUIVALENT @ 300mm c/c
- BASE PLATE: PL 400x920x40 (TYP. FOR ALL COLUMNS)
- ROCK ANCHORS:
  - GRAVITY COLUMNS: 4 GRADE 60 SOLID REBAR 1"Ø, 1000mm MINIMUM ANCHOR IN ROCK
  - BRACING COLUMNS: 4 GRADE 87 HIGH IMPACT THREADED ROD 1 1/2"Ø 6500 MINIMUM ANCHOR IN ROCK

ASTALDI CANADA Inc.

LOWER CHURCHILL PROJECT
MUSKRAT FALLS
RFP NO. CH0007

POWER HOUSE - WINTER PROTECTION STRUCTURE
SIDE SECTION VIEW ALONG LINE C
DRAWING 17/22
scale 1:500

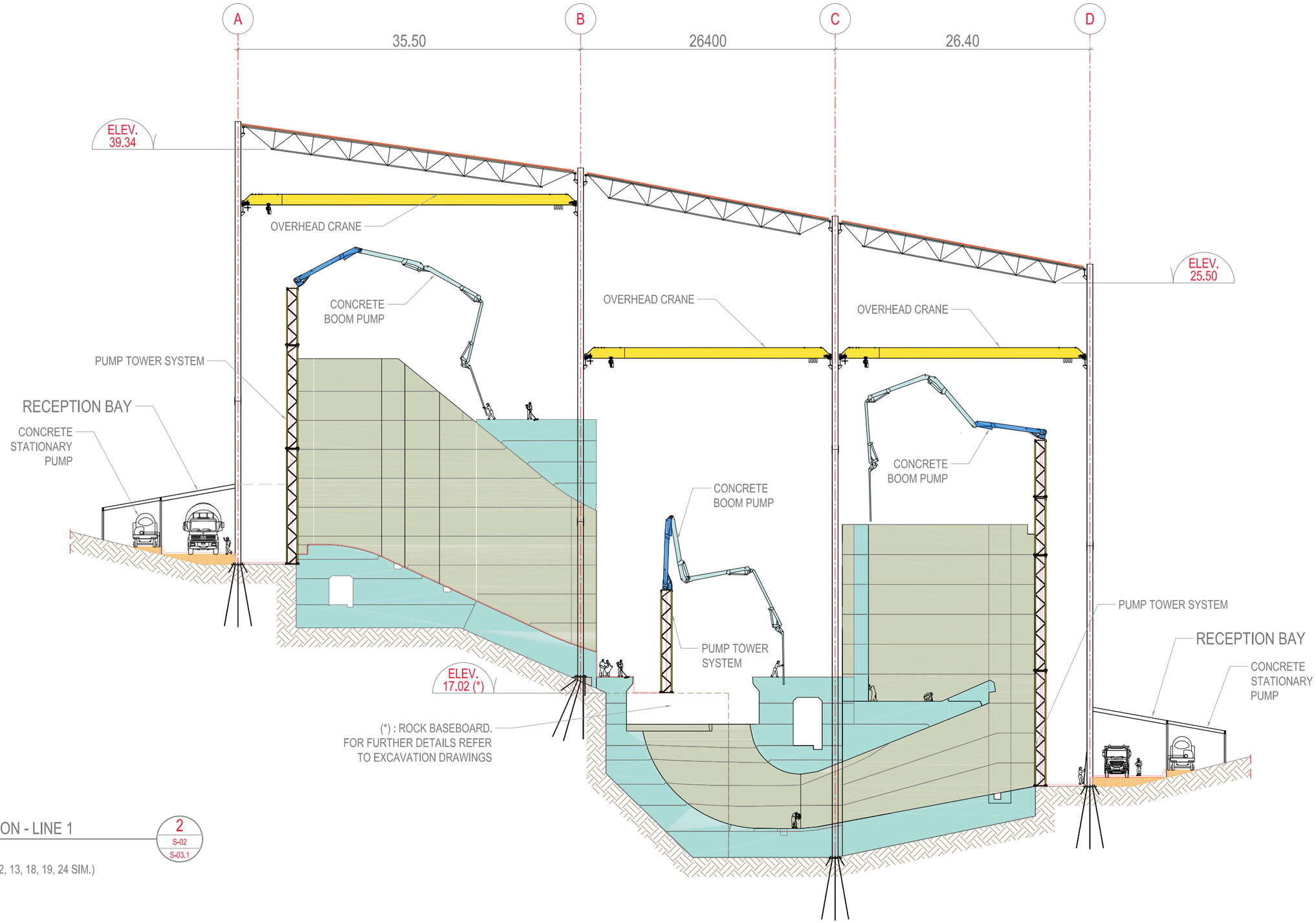


PANELS TYPOLOGICAL PARAMETERS
Panel Thickness: *6“*
Insulating Values (R):** *49*
Panel Width: *40”*
Panel Length: *from 8' to 50' maximum*
Insulation Material: *CFC-free foamed-in-place isocyanurate foam 2.2 to 2.5 pcf density*
Joint Configuration: *offset tongue and groove with concealed fastener*
Metal facings: *26ga galvanized steel (22ga, 24ga available)*
Coatings: *PVDF & SMP (other coatings available)*
Accessories: *fasteners, concealed fastener clips, sealants,brake formed flashings*
***R-Value tested in accordance with ASTM C518/C1363 at 40oF mean temperature, adjusted for a windspeed of 15 mph.*

ASTALDI CANADA Inc.

LOWER CHURCHILL PROJECT
MUSKRAT FALLS
RFP NO. CH0007

POWER HOUSE - WINTER PROTECTION STRUCTURE
SIDE VIEW FROM DRAFT TUBES SIDE
DRAWING 18/22
scale 1:500



ELEVATION - LINE 1

SCALE: 1:500

2
S-02
S-03.1

(LINE 6, 7, 12, 13, 18, 19, 24 SIM.)

ASTALDI CANADA Inc.

LOWER CHURCHILL PROJECT
MUSKRAT FALLS
RFP NO. CH0007

POWER HOUSE - WINTER PROTECTION STRUCTURE
SECTION VIEW ON INDOOR WORKING AREA
DRAWING 19/22
scale 1:400

NALCOR ENERGY
LOWER CHURCHILL PROJECT
MUSKRAT FALLS

CONSTRUCTION OF INTAKE AND POWERHOUSE, SPILLWAY
AND TRANSITION DAMS

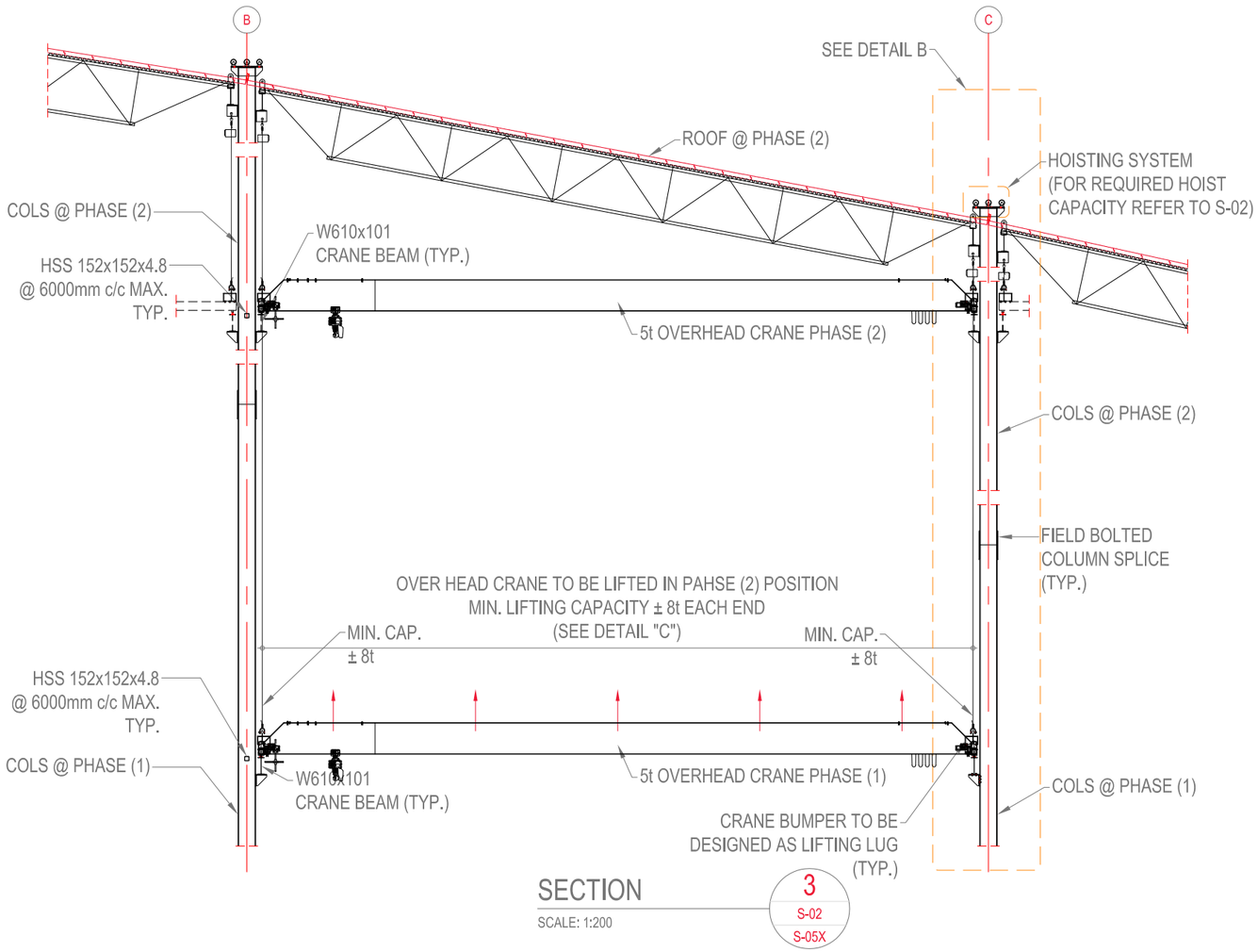
PACKAGE CH0007
CORE TECHNICAL PROPOSAL

APPENDIX A13
EXECUTION PLAN

ATTACHMENT 27

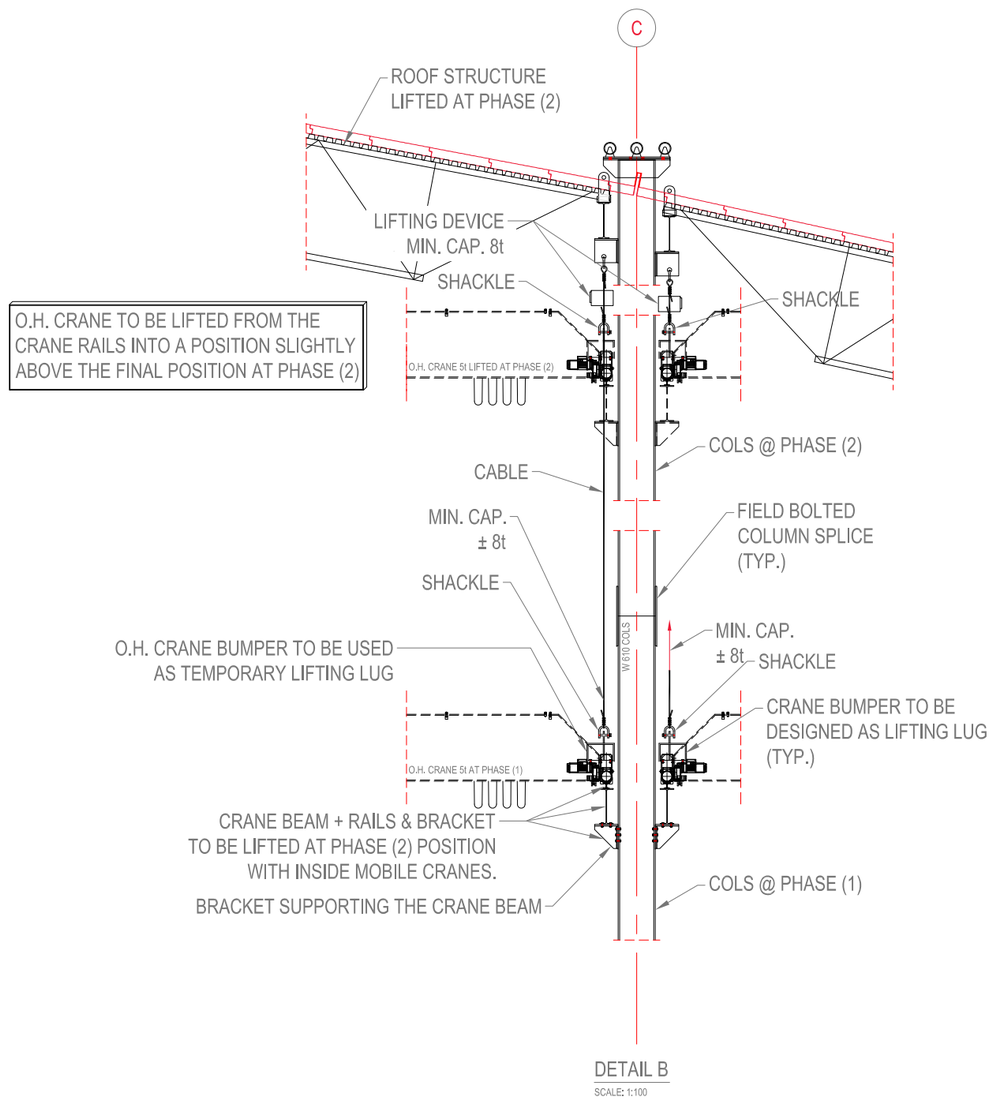
INTEGRATED COVER SYSTEM - DETAILS

April 16, 2013



SECTION
SCALE: 1:200

3
S-02
S-05X



DETAIL B
SCALE: 1:100

OVERHEAD CRANE LIFTING SCHEME

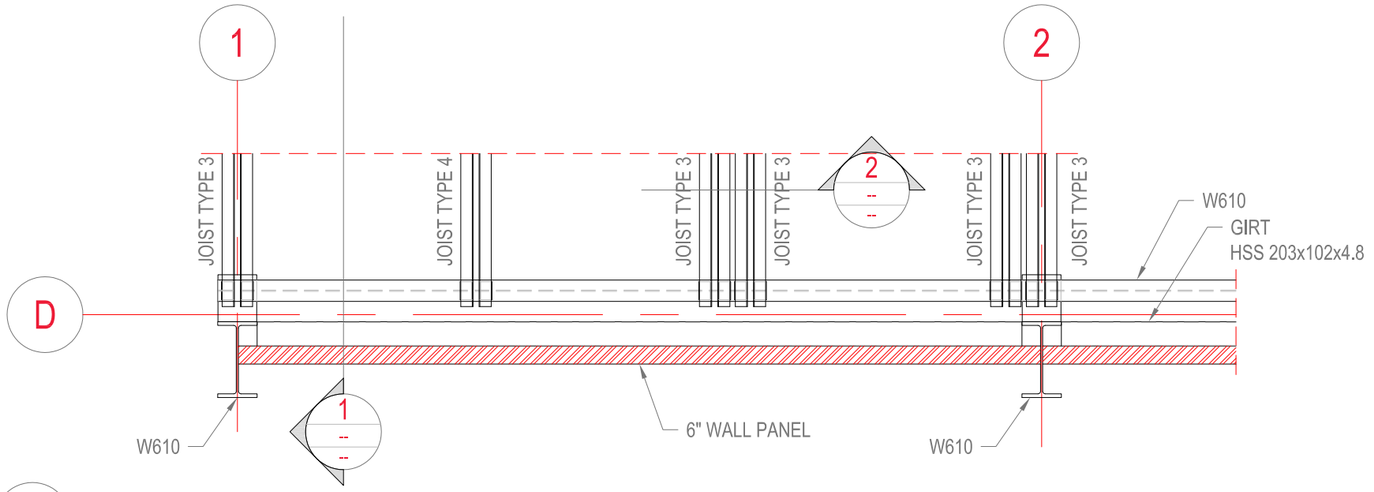
WHEN THE ROOF SECTION ARE POSITIONED AT PHASE 2 ELEVATION PROCEED TO THE FOLLOWING CRANE LIFTING PROCEDURES

1 - INSTALL A LIFTING DEVICE AT EACH END OF THE OVERHEAD CRANE FIXED TO BRACKETS SUPPORTING THE ROOF SECTIONS
2 - CONNECT THE CABLE OF THE LIFTING DEVICE TO THE LIFTING LUG ON THE O.H. CRANE BUMPER AT BOTH ENDS.
3 - LIFT THE O.H. CRANE TO A POSITION SLIGHTLY ABOVE THE FINAL POSITION AT PHASE 2
4 - DISCONNECT CRANE BEAM & BRACKET FROM BUILDING COLUMN AND RE-CONNECT AT FINAL POSITION (PHASE 2) AT BOTH ENDS
5 - LOWER THE O.H. CRANE WITH RAILS AT FINAL POSITION (PHASE 2)

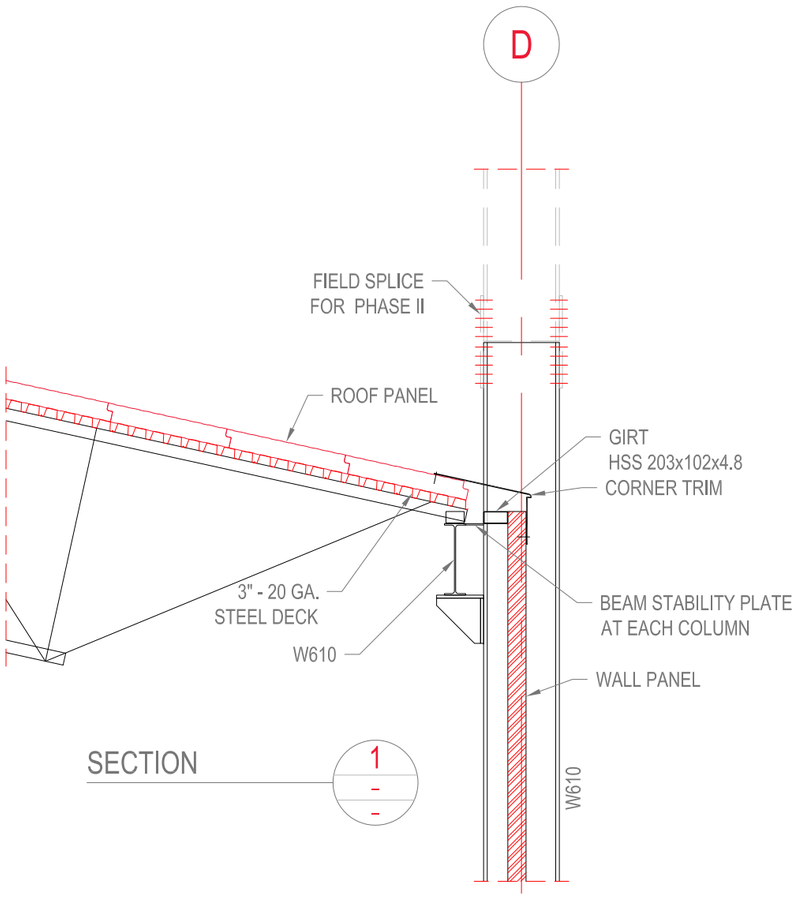
ASTALDI CANADA Inc.

LOWER CHURCHILL PROJECT
MUSKRAT FALLS
RFP NO. CH0007

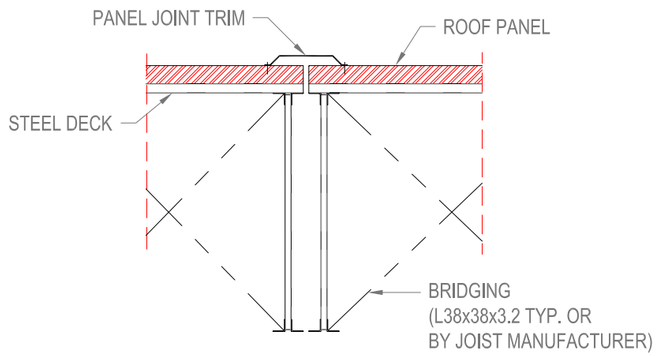
POWER HOUSE - WINTER PROTECTION STRUCTURE
OVERHEAD CRANE LIFTING PROCEDURES
DRAWING 21/22
scale 1:200/100



PARTIAL PLAN VIEW AT ROOF



SECTION 1 -- --



SECTION 2 -- --

ASTALDI CANADA Inc.

LOWER CHURCHILL PROJECT
MUSKRAT FALLS
RFP NO. CH0007

POWER HOUSE - WINTER PROTECTION STRUCTURE DETAILS
DRAWING 22/22
scale 1:50

NALCOR ENERGY
LOWER CHURCHILL PROJECT
MUSKRAT FALLS

CONSTRUCTION OF INTAKE AND POWERHOUSE, SPILLWAY
AND TRANSITION DAMS

PACKAGE CH0007
CORE TECHNICAL PROPOSAL

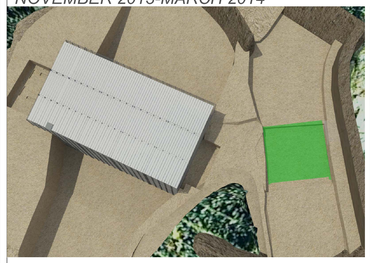
APPENDIX A13
EXECUTION PLAN

ATTACHMENT 28

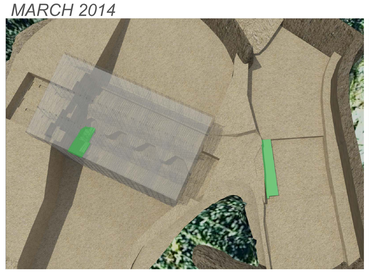
3D CONSTRUCTION SIMULATION - POSTER VIEW 1 - FROM DOWNSTREAM

April 16, 2013

NOVEMBER 2013-MARCH 2014



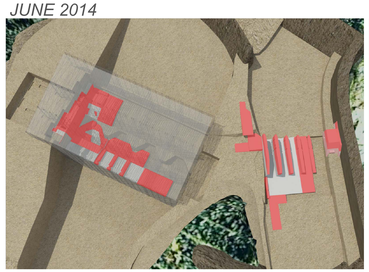
MARCH 2014



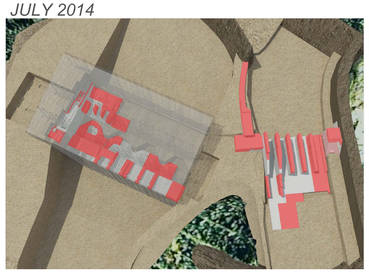
APRIL 2014

MAY 2014

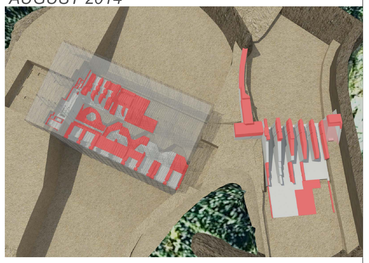
JUNE 2014



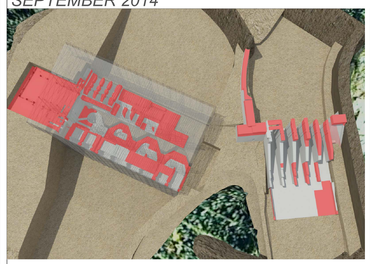
JULY 2014



AUGUST 2014

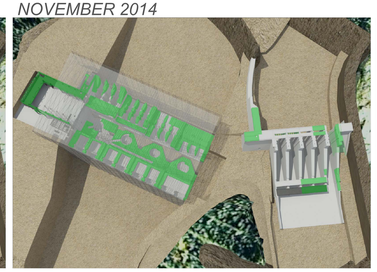


SEPTEMBER 2014

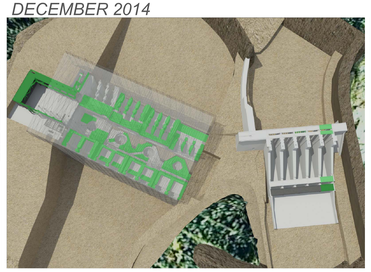


OCTOBER 2014

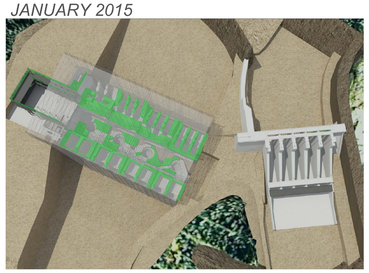
NOVEMBER 2014



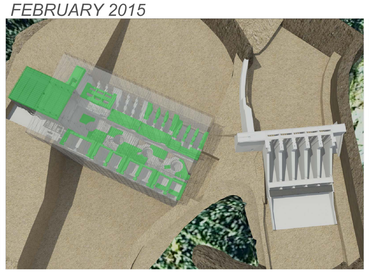
DECEMBER 2014



JANUARY 2015



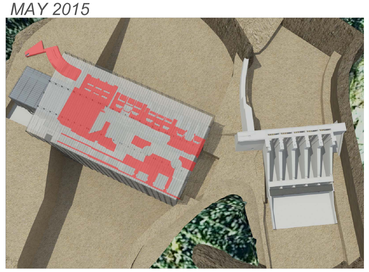
FEBRUARY 2015



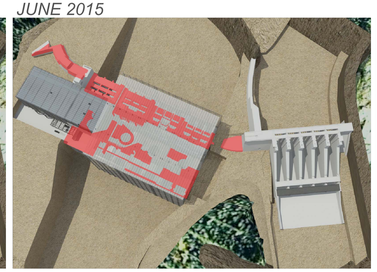
MARCH 2015

APRIL 2015

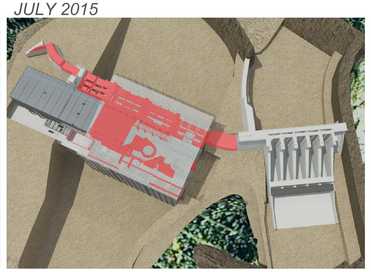
MAY 2015



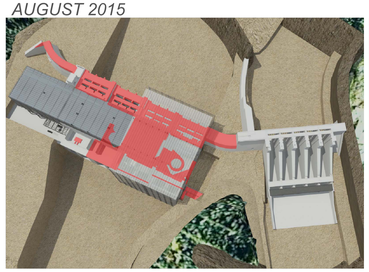
JUNE 2015



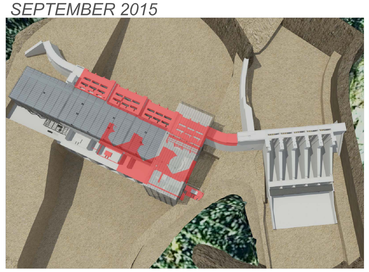
JULY 2015



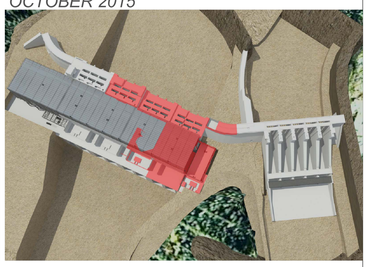
AUGUST 2015



SEPTEMBER 2015

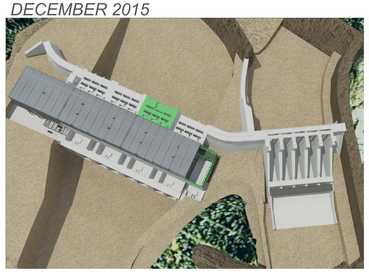


OCTOBER 2015

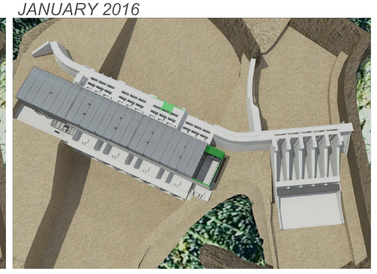


NOVEMBER 2015

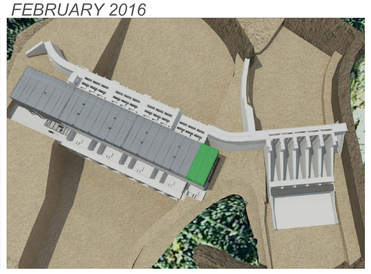
DECEMBER 2015



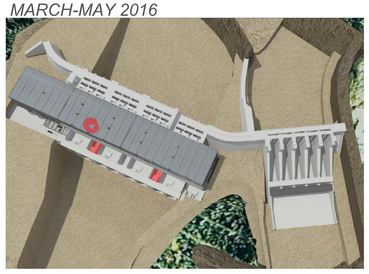
JANUARY 2016



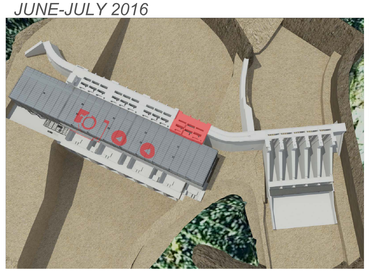
FEBRUARY 2016



MARCH-MAY 2016



JUNE-JULY 2016



AUGUST-SEPTEMBER 2016

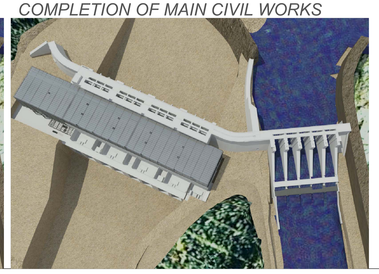
OCTOBER 2016-JANUARY 2017

FEBRUARY 2017

JUNE-AUGUST 2017

NOVEMBER 2017-FEBRUARY 2018

COMPLETION OF MAIN CIVIL WORKS



LEGEND

- NOVEMBER-APRIL
- MAY-OCTOBER

ASTALDI CANADA INC.

LOWER CHURCHILL PROJECT

MUSKRAT FALLS

RFP NO. CH0007

3D CONSTRUCTION SIMULATION

Poster view 1

From above downstream

NALCOR ENERGY
LOWER CHURCHILL PROJECT
MUSKRAT FALLS

CONSTRUCTION OF INTAKE AND POWERHOUSE, SPILLWAY
AND TRANSITION DAMS

PACKAGE CH0007
CORE TECHNICAL PROPOSAL

APPENDIX A13
EXECUTION PLAN

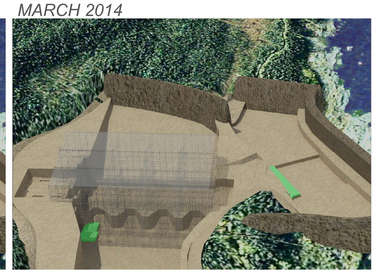
ATTACHMENT 29

3D CONSTRUCTION SIMULATION - POSTER VIEW 2 - FROM DOWNSTREAM ABOVE

April 16, 2013

NOVEMBER 2013-MARCH 2014

MARCH 2014

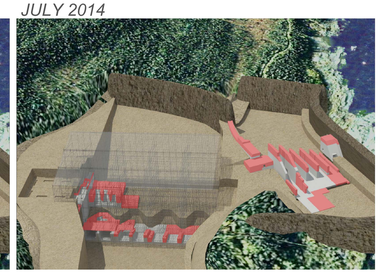


APRIL 2014

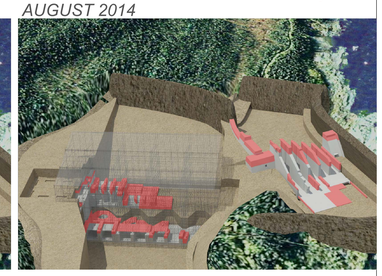
MAY 2014

JUNE 2014

JULY 2014



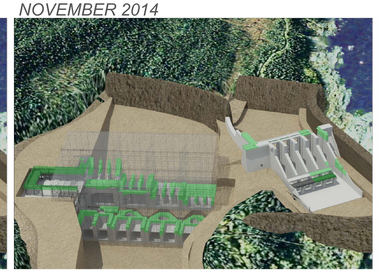
AUGUST 2014



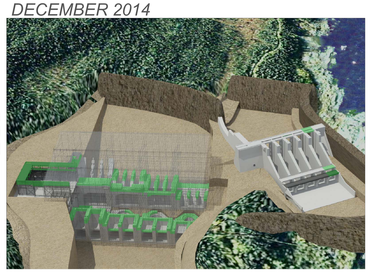
SEPTEMBER 2014

OCTOBER 2014

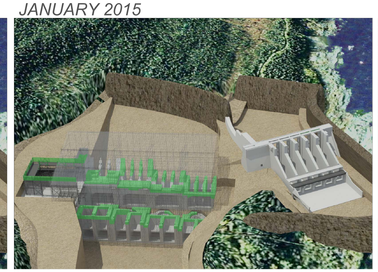
NOVEMBER 2014



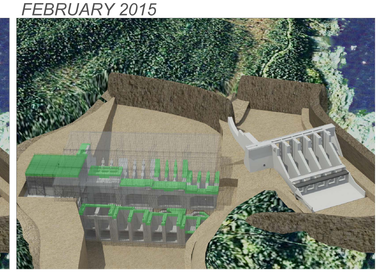
DECEMBER 2014



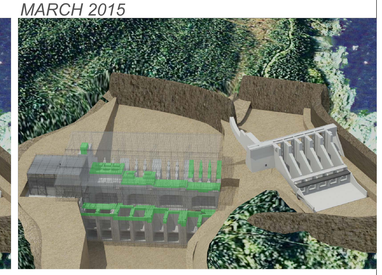
JANUARY 2015



FEBRUARY 2015

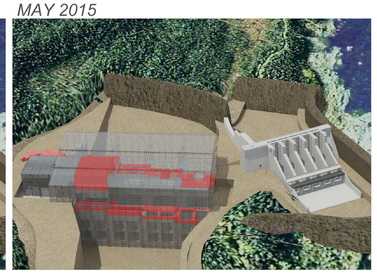


MARCH 2015

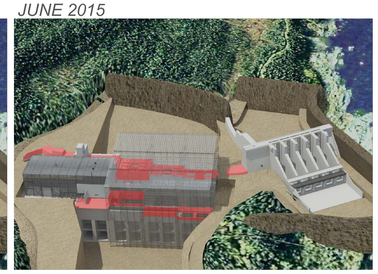


APRIL 2015

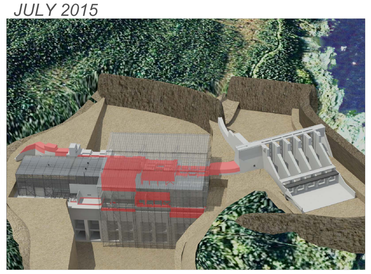
MAY 2015



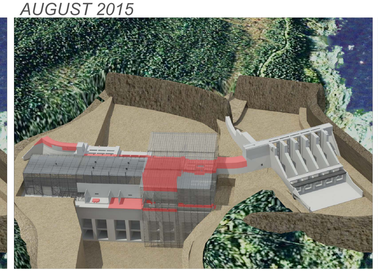
JUNE 2015



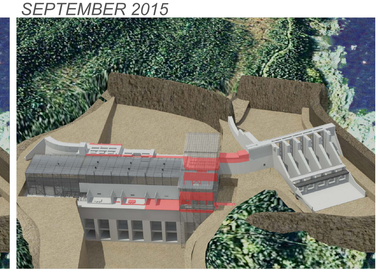
JULY 2015



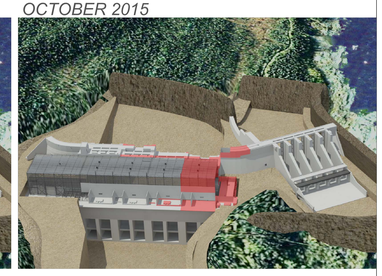
AUGUST 2015



SEPTEMBER 2015

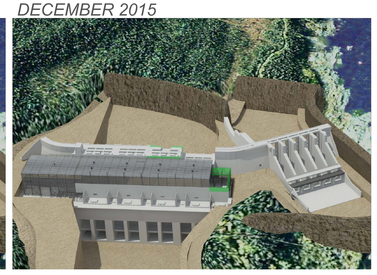


OCTOBER 2015

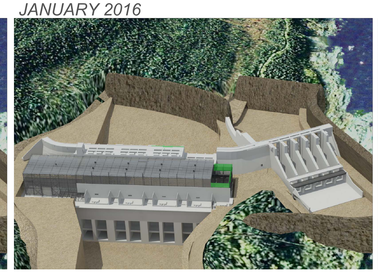


NOVEMBER 2015

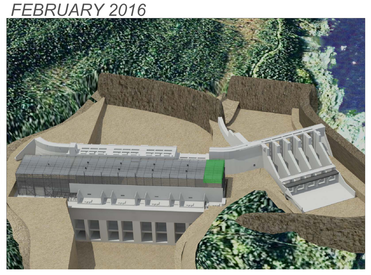
DECEMBER 2015



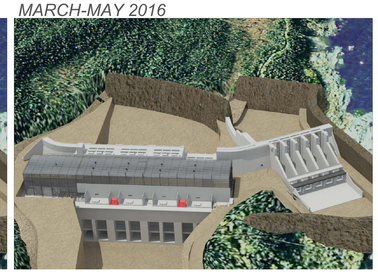
JANUARY 2016



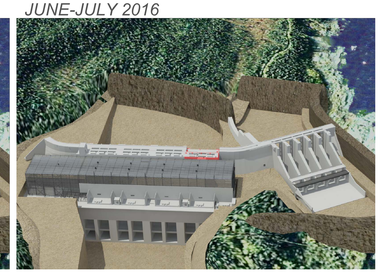
FEBRUARY 2016



MARCH-MAY 2016



JUNE-JULY 2016



AUGUST-SEPTEMBER 2016

OCTOBER 2016-JANUARY 2017

FEBRUARY 2017

JUNE-AUGUST 2017

NOVEMBER 2017-FEBRUARY 2018

COMPLETION OF MAIN CIVIL WORKS

LEGEND

- NOVEMBER-APRIL
- MAY-OCTOBER

ASTALDI CANADA INC.

LOWER CHURCHILL PROJECT

MUSKRAT FALLS

RFP NO. CH0007

3D CONSTRUCTION SIMULATION

Poster view 2

From downstream

NALCOR ENERGY
LOWER CHURCHILL PROJECT
MUSKRAT FALLS

CONSTRUCTION OF INTAKE AND POWERHOUSE, SPILLWAY
AND TRANSITION DAMS

PACKAGE CH0007
CORE TECHNICAL PROPOSAL

APPENDIX A13
EXECUTION PLAN

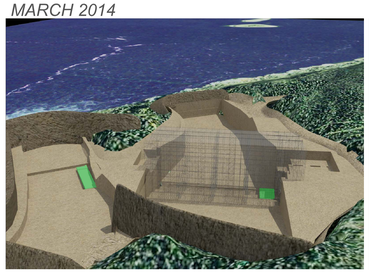
ATTACHMENT 30

3D CONSTRUCTION SIMULATION - POSTER VIEW 3 - FROM UPSTREAM

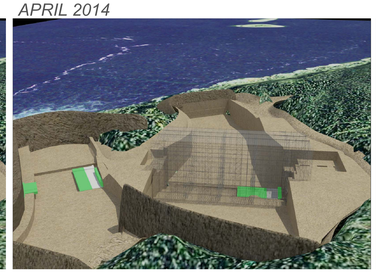
April 16, 2013

NOVEMBER 2013-MARCH 2014

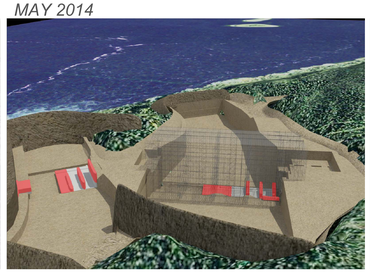
MARCH 2014



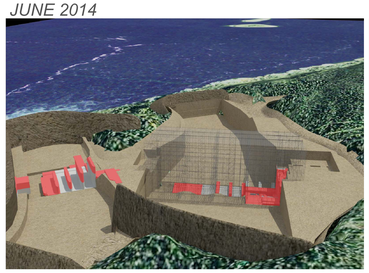
APRIL 2014



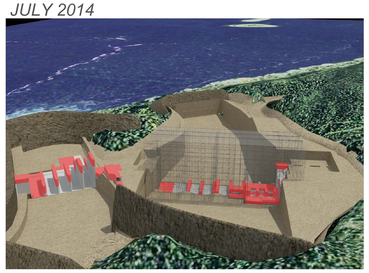
MAY 2014



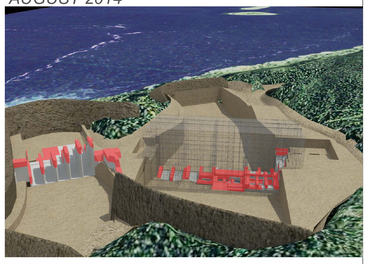
JUNE 2014



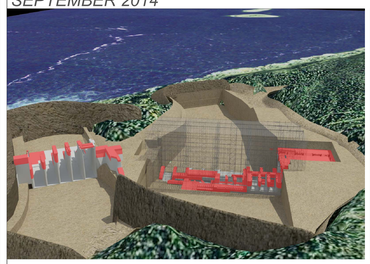
JULY 2014



AUGUST 2014



SEPTEMBER 2014

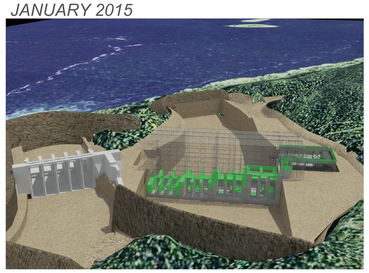


OCTOBER 2014

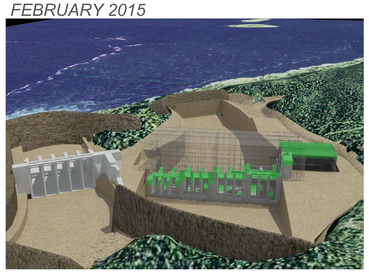
NOVEMBER 2014

DECEMBER 2014

JANUARY 2015



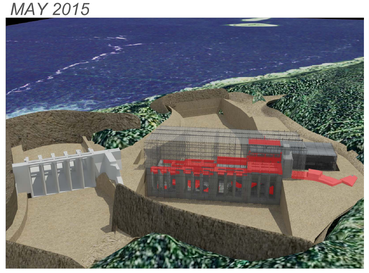
FEBRUARY 2015



MARCH 2015

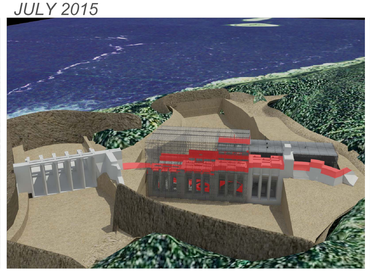
APRIL 2015

MAY 2015



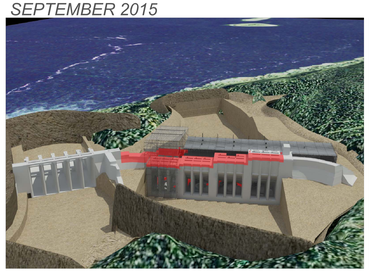
JUNE 2015

JULY 2015



AUGUST 2015

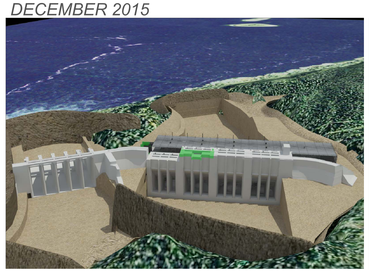
SEPTEMBER 2015



OCTOBER 2015

NOVEMBER 2015

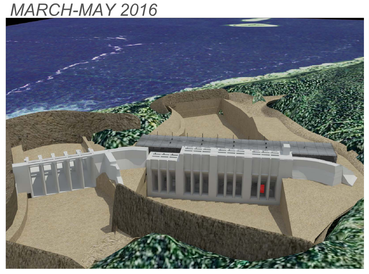
DECEMBER 2015



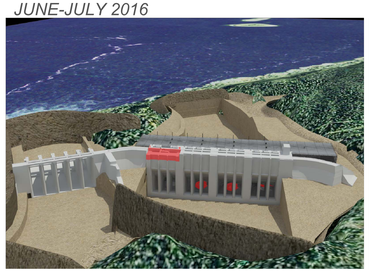
JANUARY 2016

FEBRUARY 2016

MARCH-MAY 2016

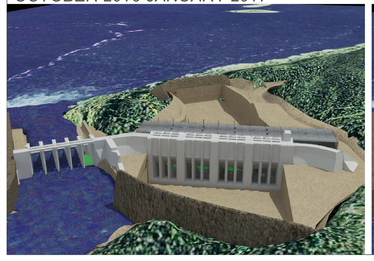


JUNE-JULY 2016

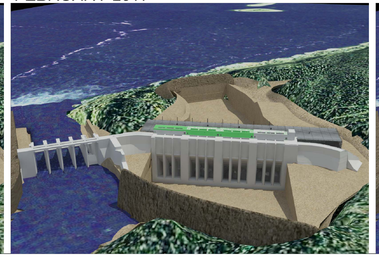


AUGUST-SEPTEMBER 2016

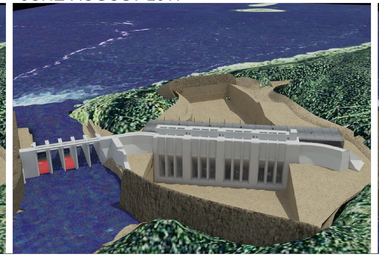
OCTOBER 2016-JANUARY 2017



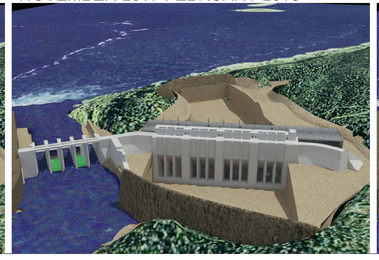
FEBRUARY 2017



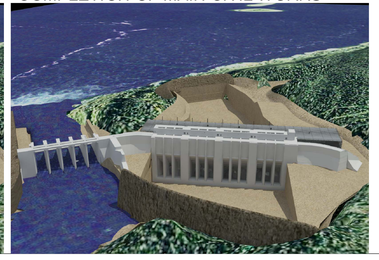
JUNE-AUGUST 2017



NOVEMBER 2017-FEBRUARY 2018



COMPLETION OF MAIN CIVIL WORKS



LEGEND

- NOVEMBER-APRIL
- MAY-OCTOBER

ASTALDI CANADA INC.

LOWER CHURCHILL PROJECT

MUSKRAT FALLS

RFP NO. CH0007

3D CONSTRUCTION SIMULATION

Poster view 3

From upstream

NALCOR ENERGY
LOWER CHURCHILL PROJECT
MUSKRAT FALLS

CONSTRUCTION OF INTAKE AND POWERHOUSE, SPILLWAY
AND TRANSITION DAMS

PACKAGE CH0007
CORE TECHNICAL PROPOSAL

APPENDIX A13
EXECUTION PLAN

ATTACHMENT 31

3D CONSTRUCTION SIMULATION - POSTER VIEW 4 - FROM UPSTREAM ABOVE

April 16, 2013

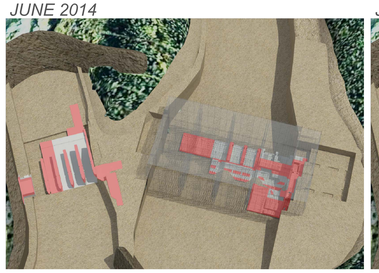
NOVEMBER 2013-MARCH 2014

MARCH 2014

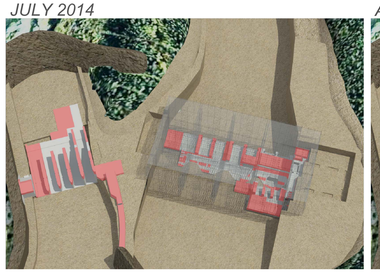
APRIL 2014

MAY 2014

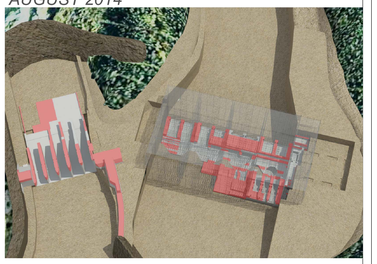
JUNE 2014



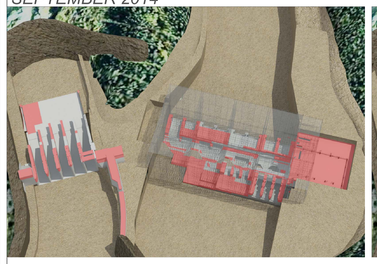
JULY 2014



AUGUST 2014

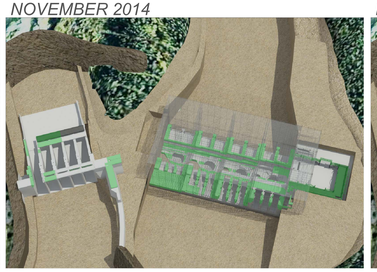


SEPTEMBER 2014

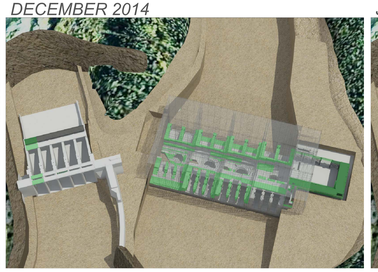


OCTOBER 2014

NOVEMBER 2014

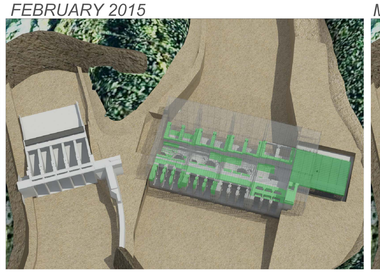


DECEMBER 2014

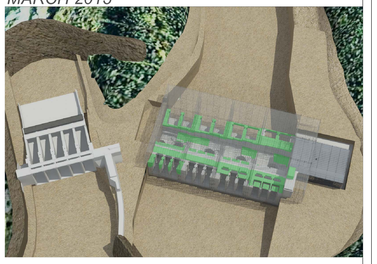


JANUARY 2015

FEBRUARY 2015



MARCH 2015



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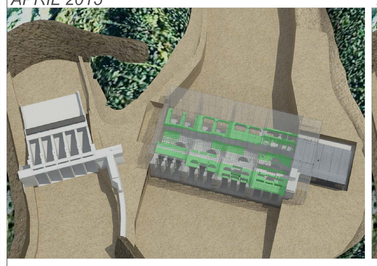
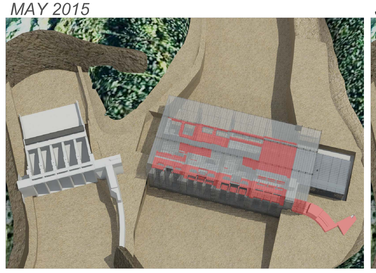
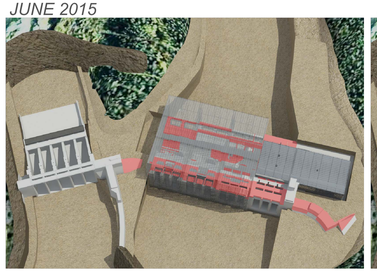


MAY 2015

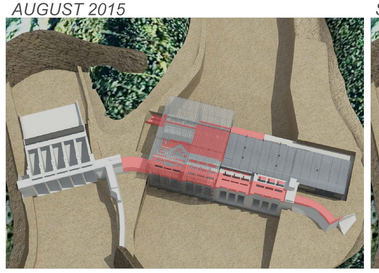


JUNE 2015

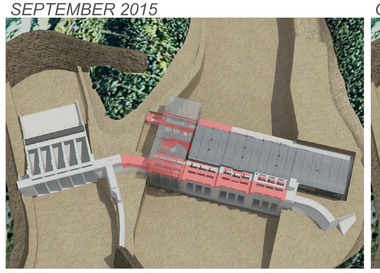


JULY 2015

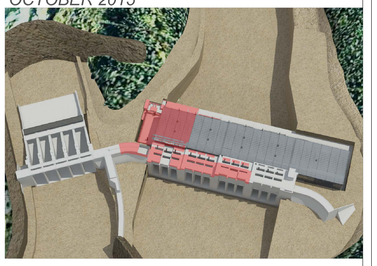
AUGUST 2015



SEPTEMBER 2015

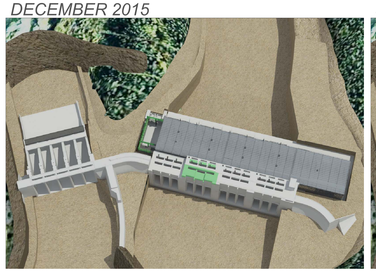


OCTOBER 2015



NOVEMBER 2015

DECEMBER 2015



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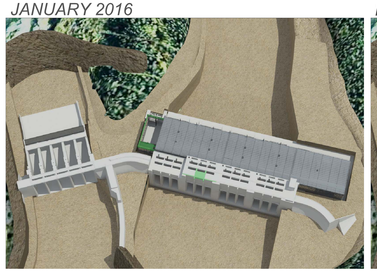
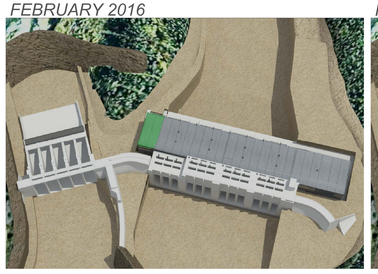
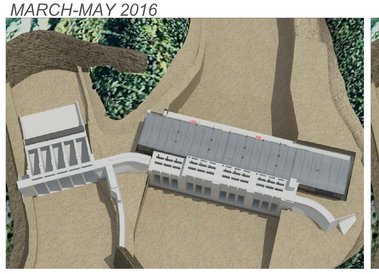


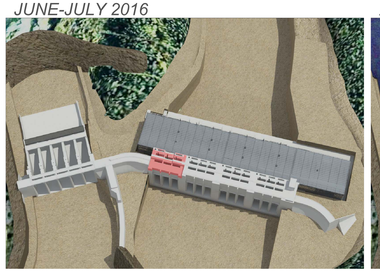
FEBRUARY 2016



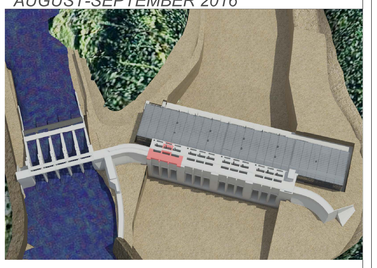
MARCH-MAY 2016



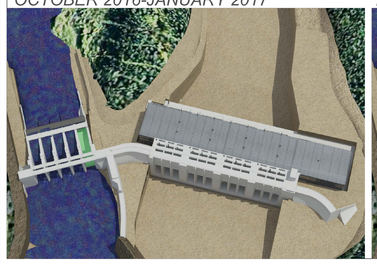
JUNE-JULY 2016



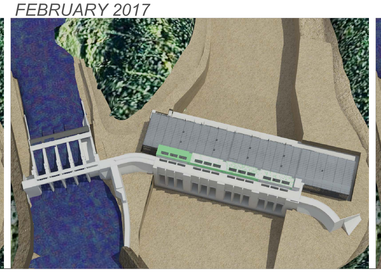
AUGUST-SEPTEMBER 2016



OCTOBER 2016-JANUARY 2017

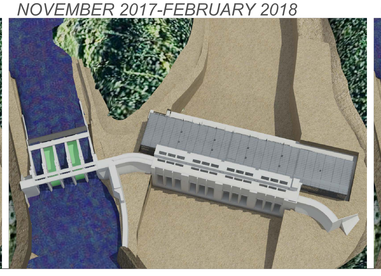


FEBRUARY 2017

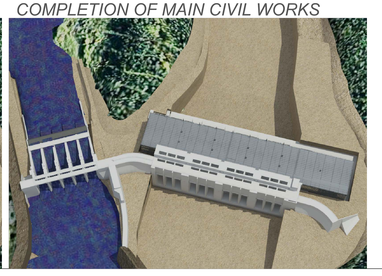


JUNE-AUGUST 2017

NOVEMBER 2017-FEBRUARY 2018



COMPLETION OF MAIN CIVIL WORKS



LEGEND

- NOVEMBER-APRIL
- MAY-OCTOBER

ASTALDI CANADA INC.

LOWER CHURCHILL PROJECT

MUSKRAT FALLS

RFP NO. CH0007

3D CONSTRUCTION SIMULATION

Poster view 4

From above upstream

ASTALDI CANADA Inc.

nalcor energy

NALCOR ENERGY
LOWER CHURCHILL PROJECT
MUSKRAT FALLS

CONSTRUCTION OF INTAKE AND POWERHOUSE, SPILLWAY
AND TRANSITION DAMS

PACKAGE CH0007
CORE TECHNICAL PROPOSAL

APPENDIX A13
EXECUTION PLAN

ATTACHMENT 32

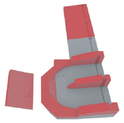
3D CONSTRUCTION SIMULATION - DETAILED COMBINED VIEWS

April 16, 2013

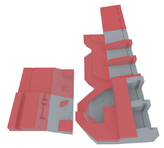
MARCH 2014

APRIL 2014

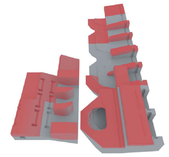
MAY 2014



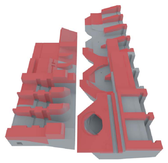
JUNE 2014



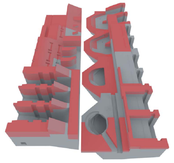
JULY 2014



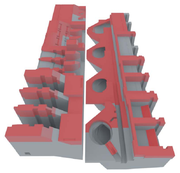
AUGUST 2014



SEPTEMBER 2014



OCTOBER 2014



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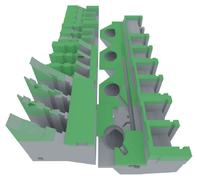
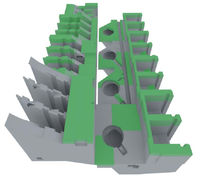
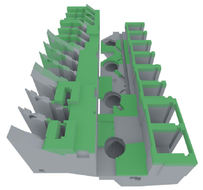


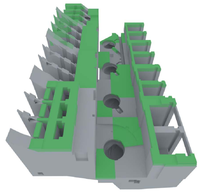
DECEMBER 2014



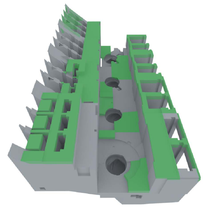
JANUARY 2015



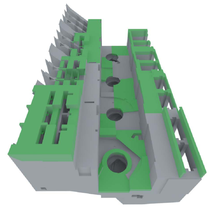
FEBRUARY 2015



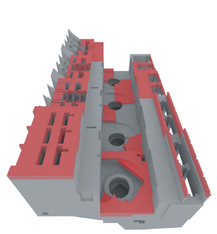
MARCH 2015



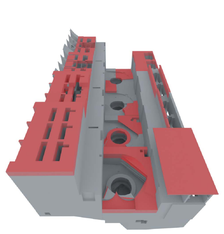
APRIL 2015



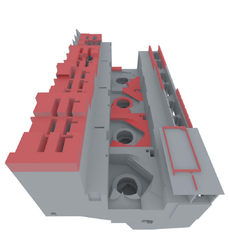
MAY 2015



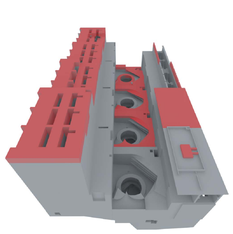
JUNE 2015



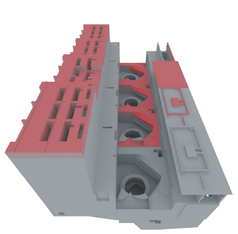
JULY 2015



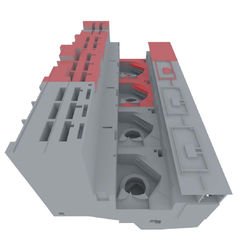
AUGUST 2015



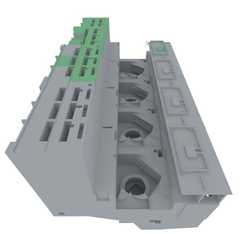
SEPTEMBER 2015



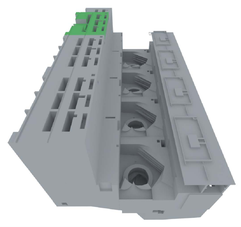
OCTOBER 2015



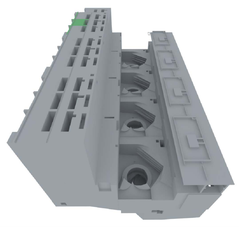
NOVEMBER 2015



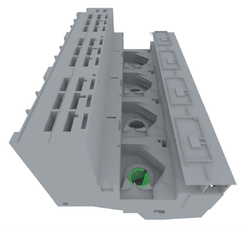
DECEMBER 2015



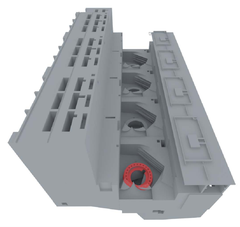
JANUARY 2016



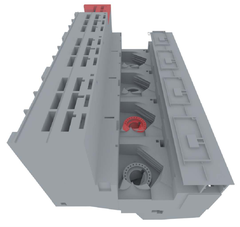
APRIL 2016



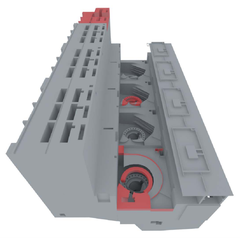
MAY 2016



JUNE 2016



JULY 2016



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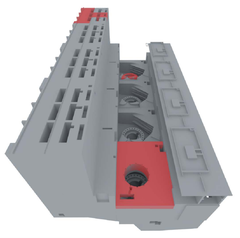

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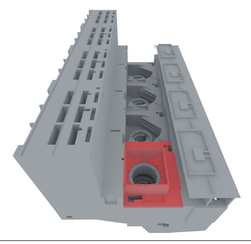

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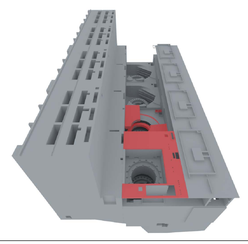

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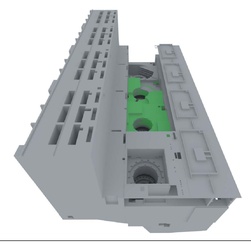

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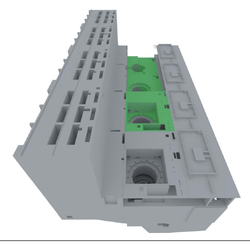

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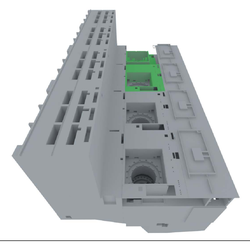

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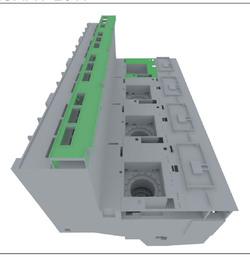


NOVEMBER-APRIL

MAY-OCTOBER

ASTALDI CANADA Inc.

LOWER CHURCHILL PROJECT

MUSKRAT FALLS

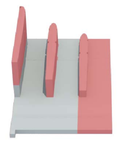
RFP NO. CH0007

3D CONSTRUCTION SIMULATIONIntake/powerhouse Detailed sequence

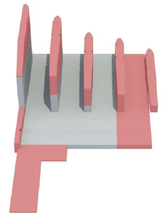
MARCH 2014

APRIL 2014

MAY 2014



JUNE 2014



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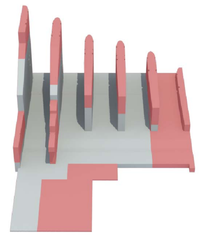

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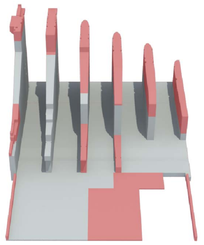
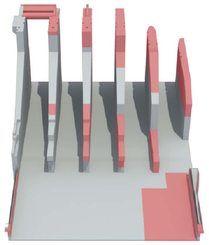


SEPTEMBER 2014



OCTOBER 2014

NOVEMBER 2014

DECEMBER 2014

JANUARY 2015

SEPTEMBER 2016

OCTOBER 2016

NOVEMBER 2016

DECEMBER 2016

JANUARY 2017

JUNE 2017

JULY 2017

AUGUST 2017

NOVEMBER 2017

DECEMBER 2017

JANUARY 2018

FEBRUARY 2018

COMPLETION OF MAIN CIVIL WORKS

NOVEMBER-APRIL

MAY-OCTOBER

ASTALDI CANADA Inc.

LOWER CHURCHILL PROJECT

MUSKRAT FALLS

RFP NO. CH0007

3D CONSTRUCTION SIMULATION

Spillway

Detailed sequence

ASTALDI CANADA Inc.

nalcor energy

NALCOR ENERGY
LOWER CHURCHILL PROJECT
MUSKRAT FALLS

CONSTRUCTION OF INTAKE AND POWERHOUSE, SPILLWAY
AND TRANSITION DAMS

PACKAGE CH0007
CORE TECHNICAL PROPOSAL

APPENDIX A13
EXECUTION PLAN

ATTACHMENT 33

FORMWORK - SPILLWAY

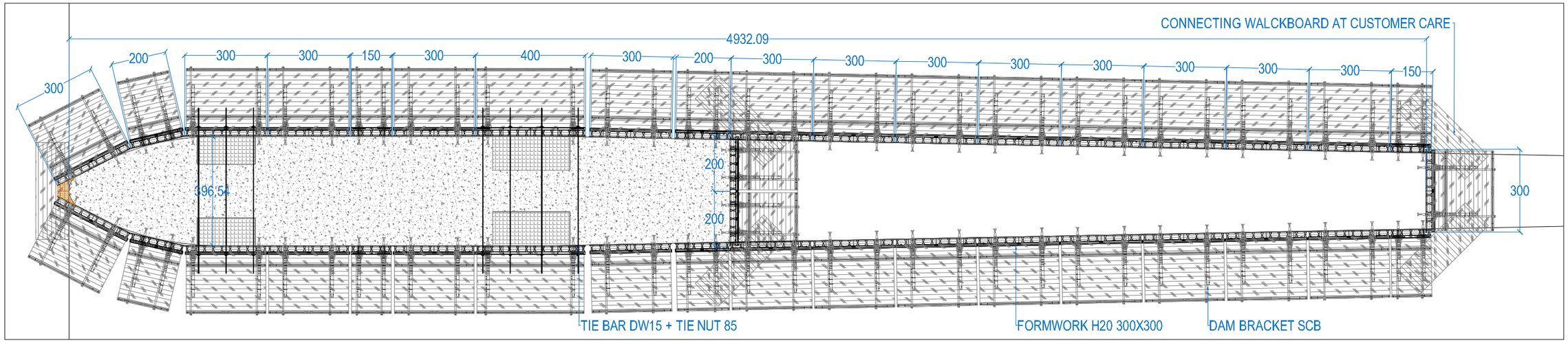
April 16, 2013

SPILLWAY

CIMFP Exhibit P-03786

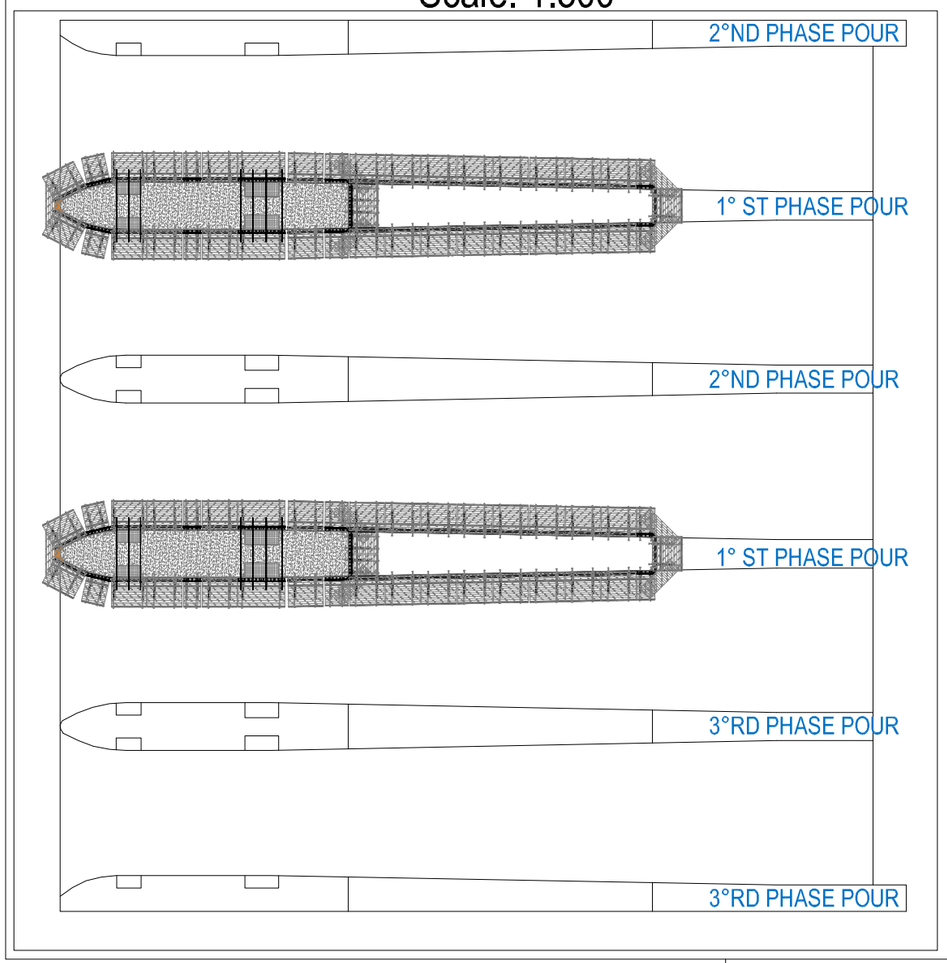
EQUIPMENT PLANT

Scale: 1:150



PLANT OF PROPOSED EQUIPMENT

Scale: 1:500



PROPOSED EQUIPMENT TWO WALLS		
DESCRIPTION		QUANTITY
H20 UNITS	MODULE 150X300	8
	MODULE 200X300	12
	MODULE 300X300	54
	MODULE 400X300	4
SCB UNITS (ONE PAIR BRACKETS)	MODULE 150	8
	MODULE 200	12
	MODULE 300	54
	MODULE 400	4

0	EMISSIONE		27/11/12	E.Martorella	A.Leone
Index	Revision		Date	drawn:	checked:

Preliminary drawing, not for construction

This drawing is valid only with the associated assembly instructions. Measurements have to be verified on site.

Scale:	1:150	A3	Client: ASTALDI SPA
	Date	Name	
drawn:	27/11/12	E.Martorella	DIGA QUEBEC
checked:	27/11/12	A.Leone	Project: LOWER CHURCHILL PROJECT
remark:	G.MARAN		SPILLWAY
			H20 - SCB

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CAD-File: G_0511112_003_P.dwg

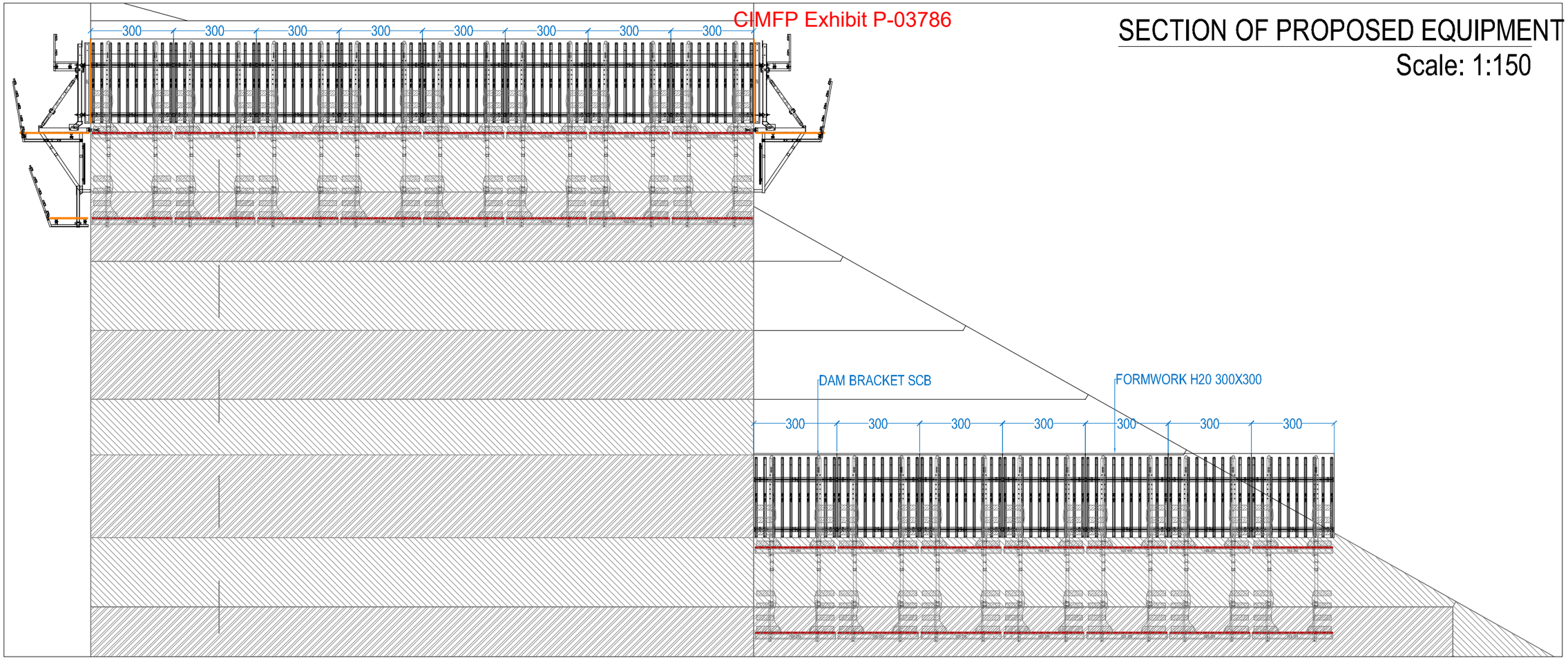
Drawing-No.: G_0511112_003_P 1/5

HARSCO

SPILLWAY

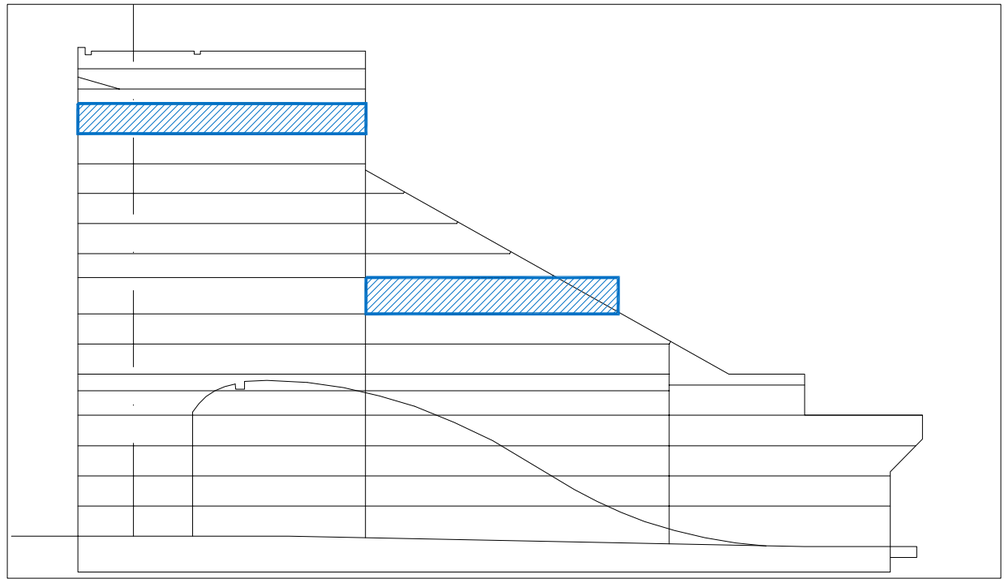
SECTION OF PROPOSED EQUIPMENT

Scale: 1:150



KEY SECTION

Scale: 1:500



0	EMISSIONE		27/11/12	E.Martorella	A.Leone
Index	Revision		Date	drawn:	checked:

Preliminary drawing, not for construction

This drawing is valid only with the associated assembly instructions. Measurements have to be verified on site.

Scale:	1:150	A3
	Date	Name
drawn:	27/11/12	E.Martorella
checked:	27/11/12	A.Leone
remark:	G.MARAN	

Client:
ASTALDI SPA
DIGA QUEBEC

Project:
LOWER CHURCHILL PROJECT
SPILLWAY
H20 - SCB

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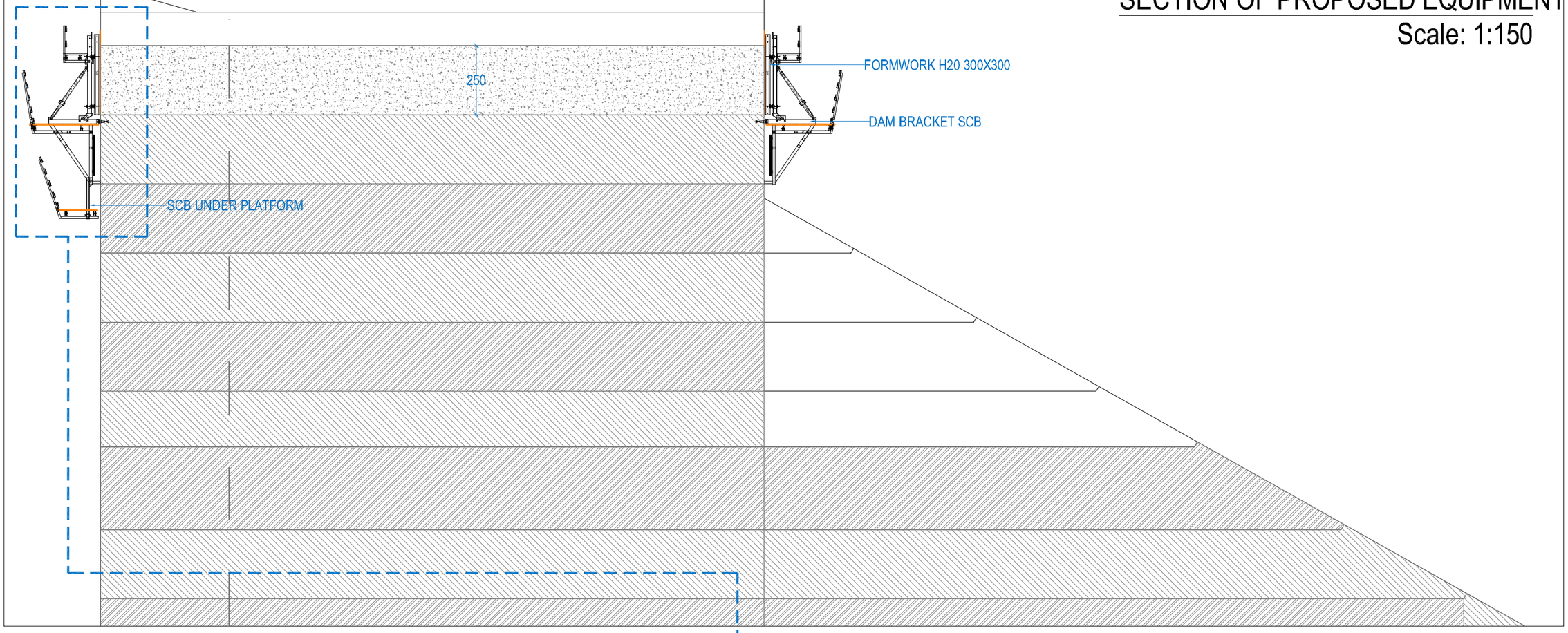
Drawing-No.: G_0511112_003_P 2/5

HARSCO

SPILLWAY

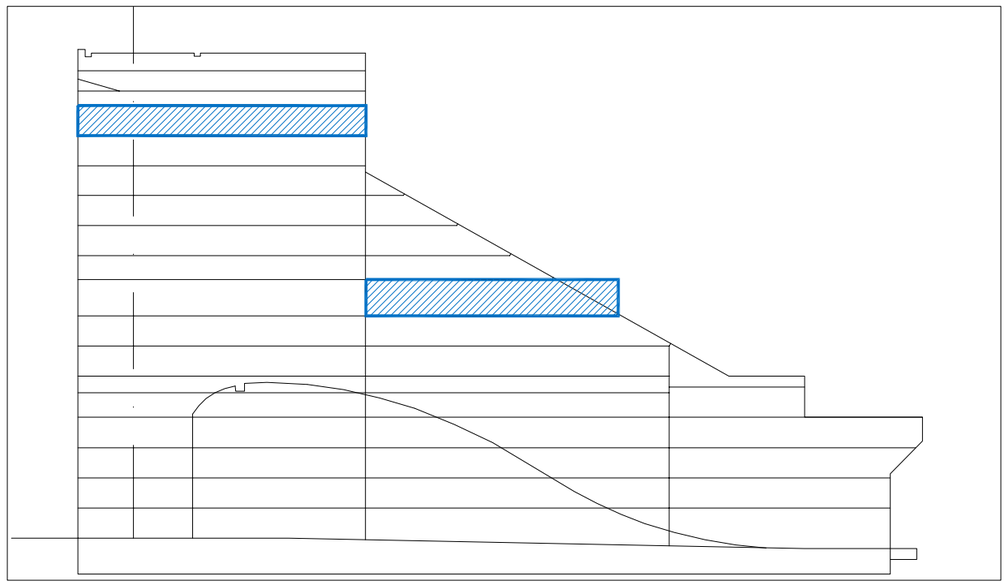
SECTION OF PROPOSED EQUIPMENT

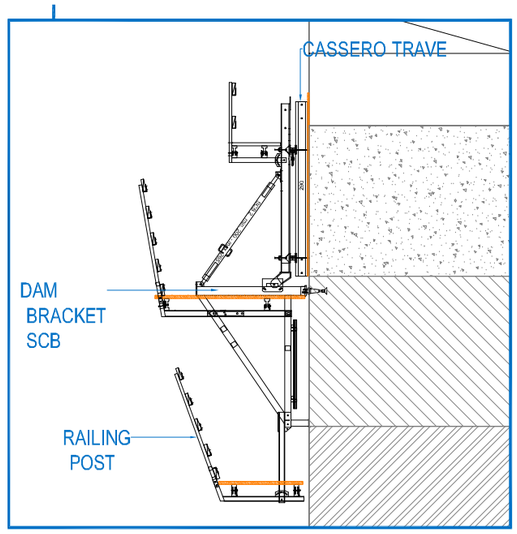
Scale: 1:150



KEY SECTION

Scale: 1:500





0	EMISSIONE	27/11/12	E.Martorella	A.Leone
Index	Revision	Date	drawn:	checked:

Preliminary drawing, not for construction

This drawing is valid only with the associated assembly instructions. Measurements have to be verified on site.

Scale:	1:150	A3
	Date	Name
drawn:	27/11/12	E.Martorella
checked:	27/11/12	A.Leone
remark:	G.MARAN	

Client:
ASTALDI SPA
DIGA QUEBEC

Project:
LOWER CHURCHILL PROJECT
SPILLWAY
H20 - SCB

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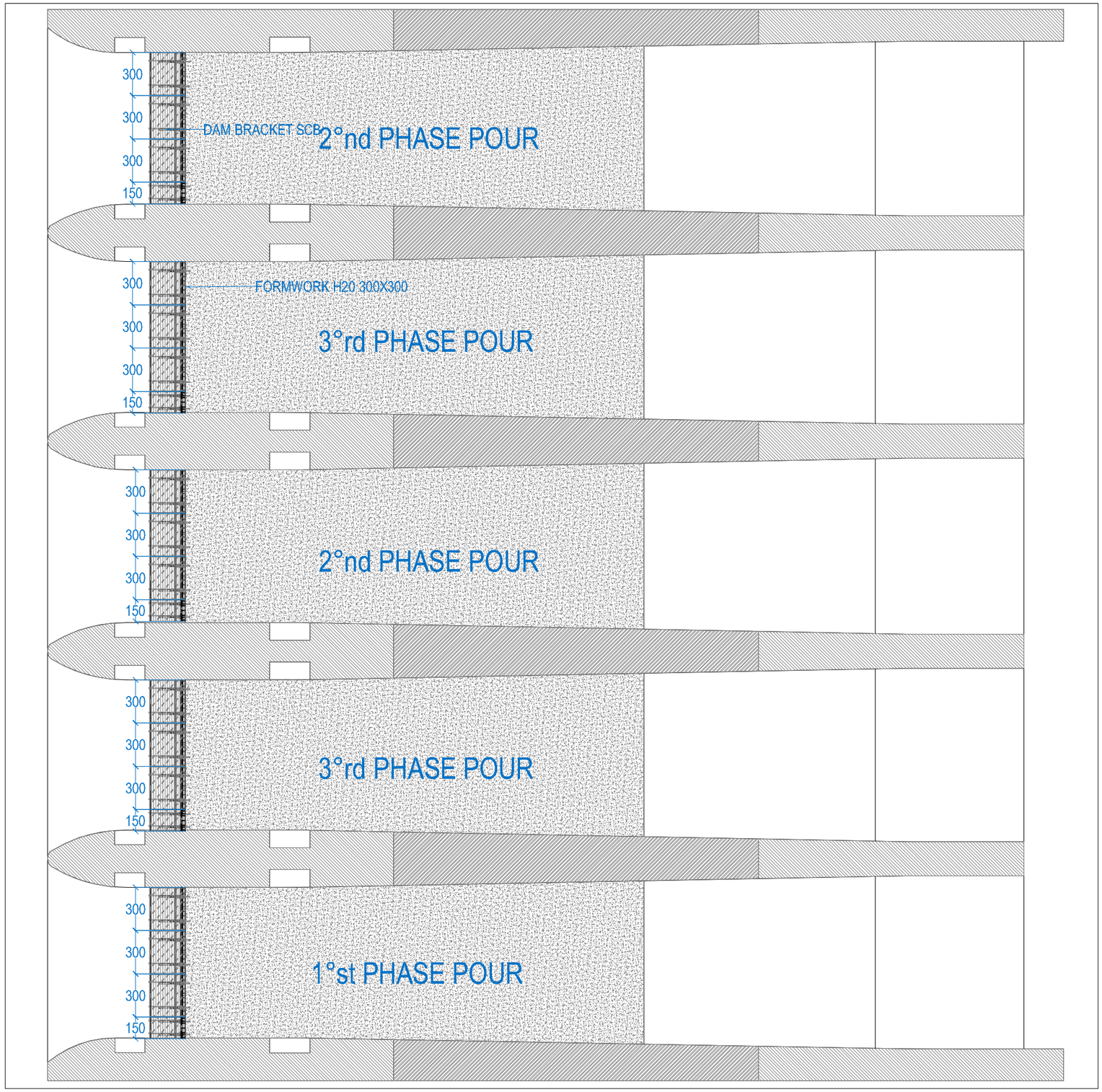
Drawing-No.: G_0511112_003_P 3/5

HARSCO

SPILLWAY

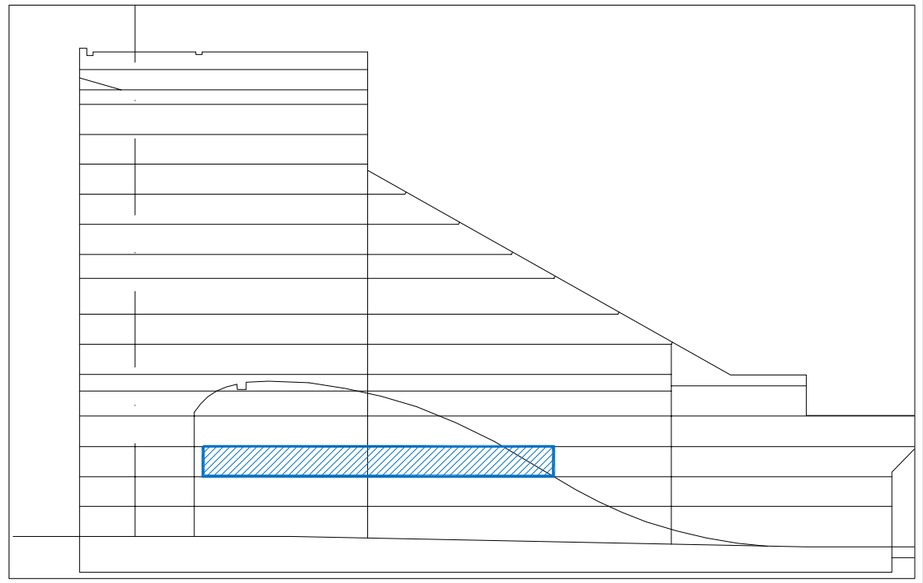
EQUIPMENT PLANT

Scale: 1:150



KEY SECTION

Scale: 1:500



0	EMISSIONE	27/11/12	E.Martorella	A.Leone
Index	Revision	Date	drawn:	checked:

Preliminary drawing, not for construction

This drawing is valid only with the associated assembly instructions. Measurements have to be verified on site.

Scale:	1:150	A3	Client: ASTALDI SPA
	Date	Name	
drawn:	27/11/12	E.Martorella	DIGA QUEBEC
checked:	27/11/12	A.Leone	Project: LOWER CHURCHILL PROJECT
remark:	G.MARAN		SPILLWAY
			H20 - SCB

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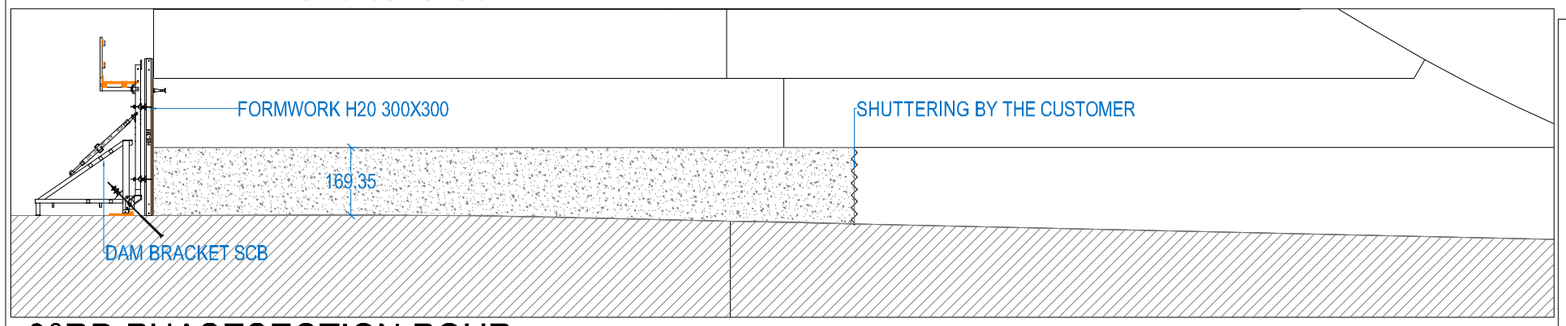
Drawing-No.: G_0511112_003_P 4/5

HARSCO

SPILLWAY

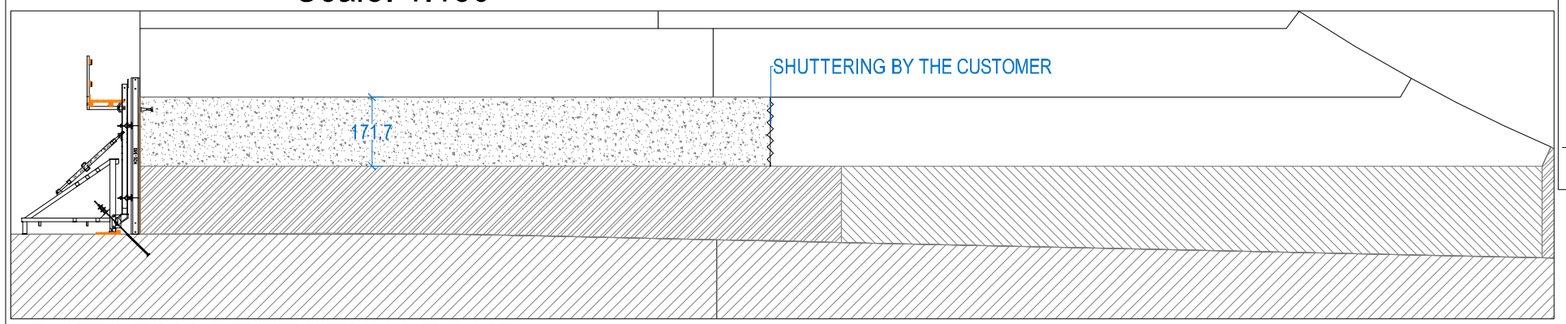
1°ST PHASESECTION POUR

Scale: 1:150



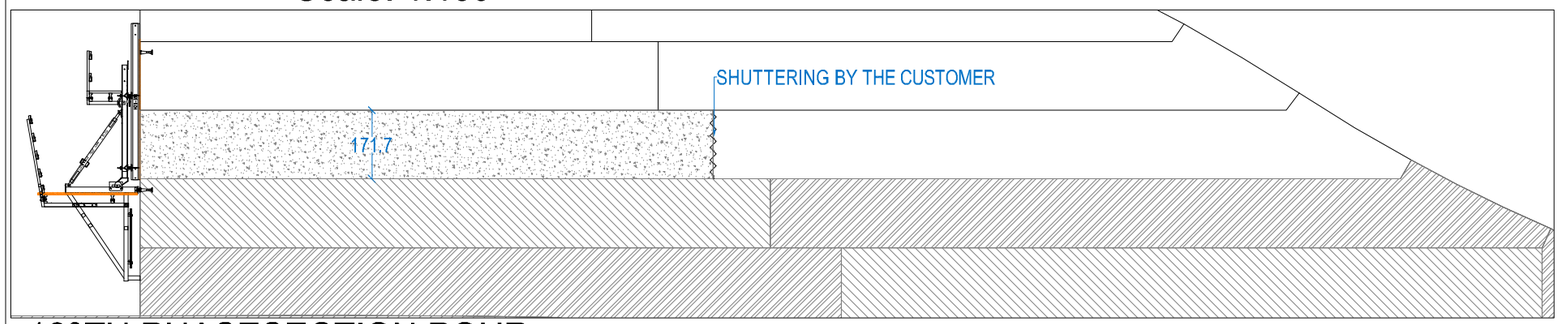
3°RD PHASESECTION POUR

Scale: 1:150



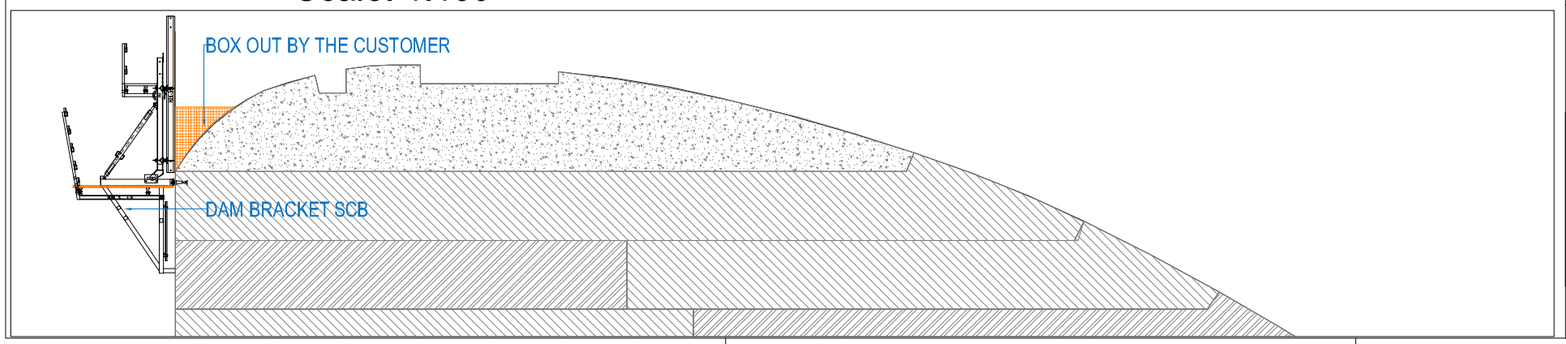
5/6TH PHASESECTION POUR

Scale: 1:150



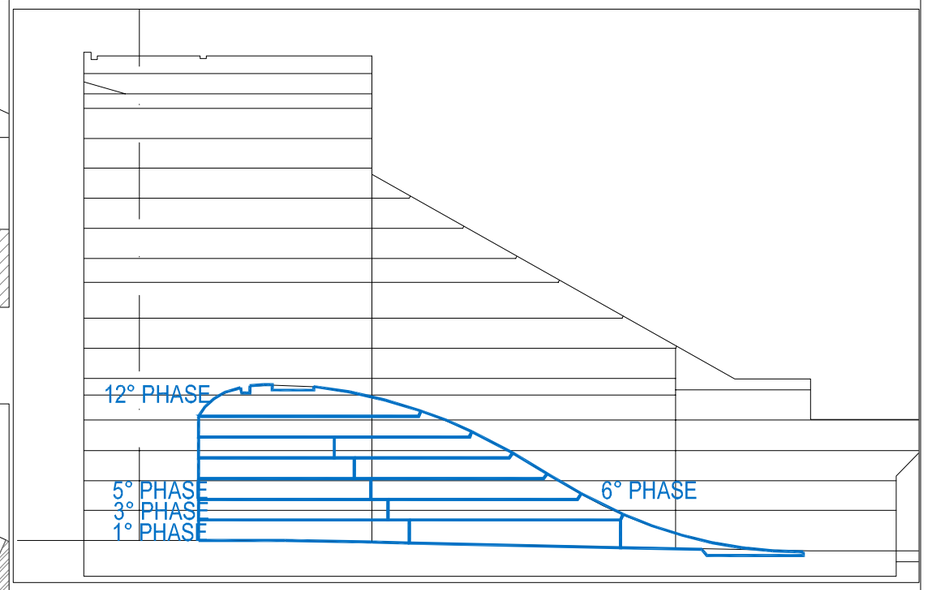
12°TH PHASESECTION POUR

Scale: 1:150



KEY SECTON

Scale: 1:500



Index	Revision	Date	drawn:	checked:
0	EMISSIONE	27/11/12	E.Martorella	A.Leone

Preliminary drawing, not for construction

This drawing is valid only with the associated assembly instructions. Measurements have to be verified on site.

Scale:	1:150	A3	Client: ASTALDI SPA
	Date	Name	DIGA QUEBEC
drawn:	27/11/12	E.Martorella	
checked:	27/11/12	A.Leone	Project: LOWER CHURCHILL PROJECT
remark:	G.MARAN		SPILLWAY
			H20 - SCB

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CAD-File: G_0511112_003_P.dwg

Drawing-No.: G_0511112_003_P 5/5

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NALCOR ENERGY
LOWER CHURCHILL PROJECT
MUSKRAT FALLS

CONSTRUCTION OF INTAKE AND POWERHOUSE, SPILLWAY
AND TRANSITION DAMS

PACKAGE CH0007
CORE TECHNICAL PROPOSAL

APPENDIX A13
EXECUTION PLAN

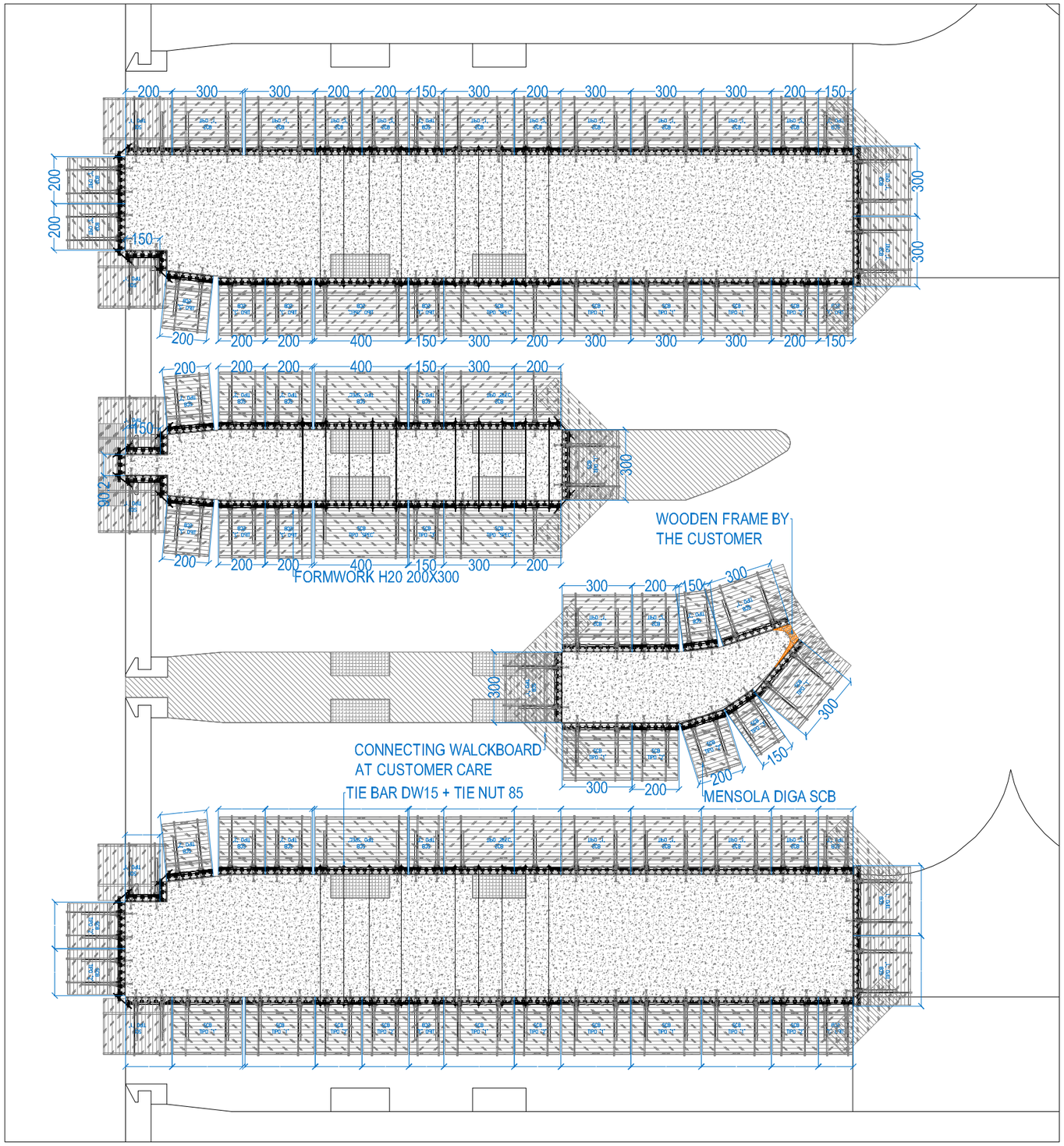
ATTACHMENT 34

FORMWORK - INTAKE

April 16, 2013

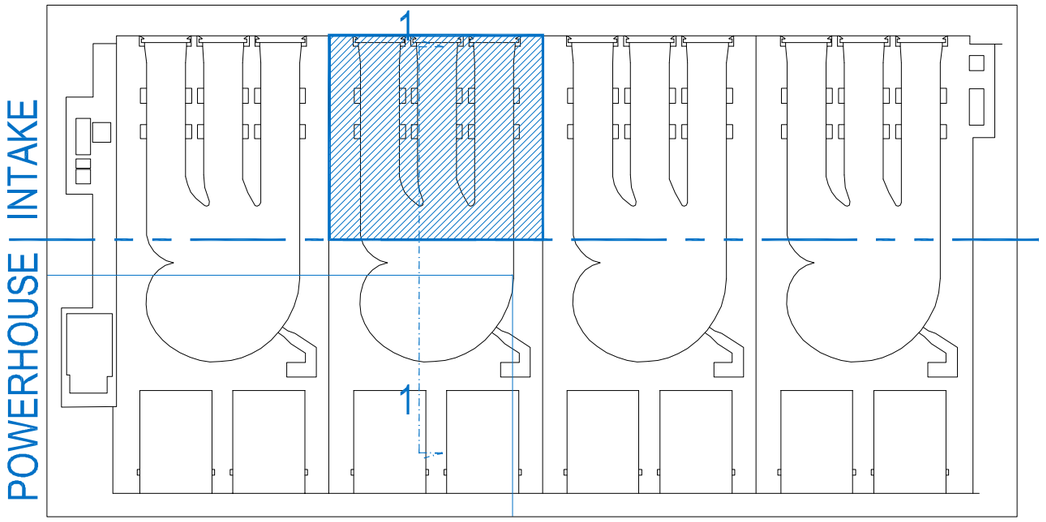
PLANT OF PROPOSED EQUIPMENT

Scale: 1:200



KEY SECTION

Scale: 1:1000



EQUIPMENT FOR ONE SET		
DESCRIPTION		QUANTITY
H20 UNITS	MODULE 150X300	16
	MODULE 200X300	34
	MODULE 300X300	36
	MODULE 400X300	4
SCB UNITS (ONE PAIR BRACKETS)	MODULE 150	12
	MODULE 200	30
	MODULE 300	34
	MODULE 400	8

Index	Revision	Date	drawn:	checked:
0	EMISSIONE	27/11/12	E.Martorella	A.Leone

Preliminary drawing, not for construction

This drawing is valid only with the associated assembly instructions. Measurements have to be verified on site.

Scale:	1:150	A3	Client: ASTALDI SPA
	Date	Name	
drawn:	27/11/12	E.Martorella	DIGA QUEBEC
checked:	27/11/12	A.Leone	Project: LOWER CHURCHILL PROJECT
remark:	G.MARAN		INTAKE
			H20 - SCB

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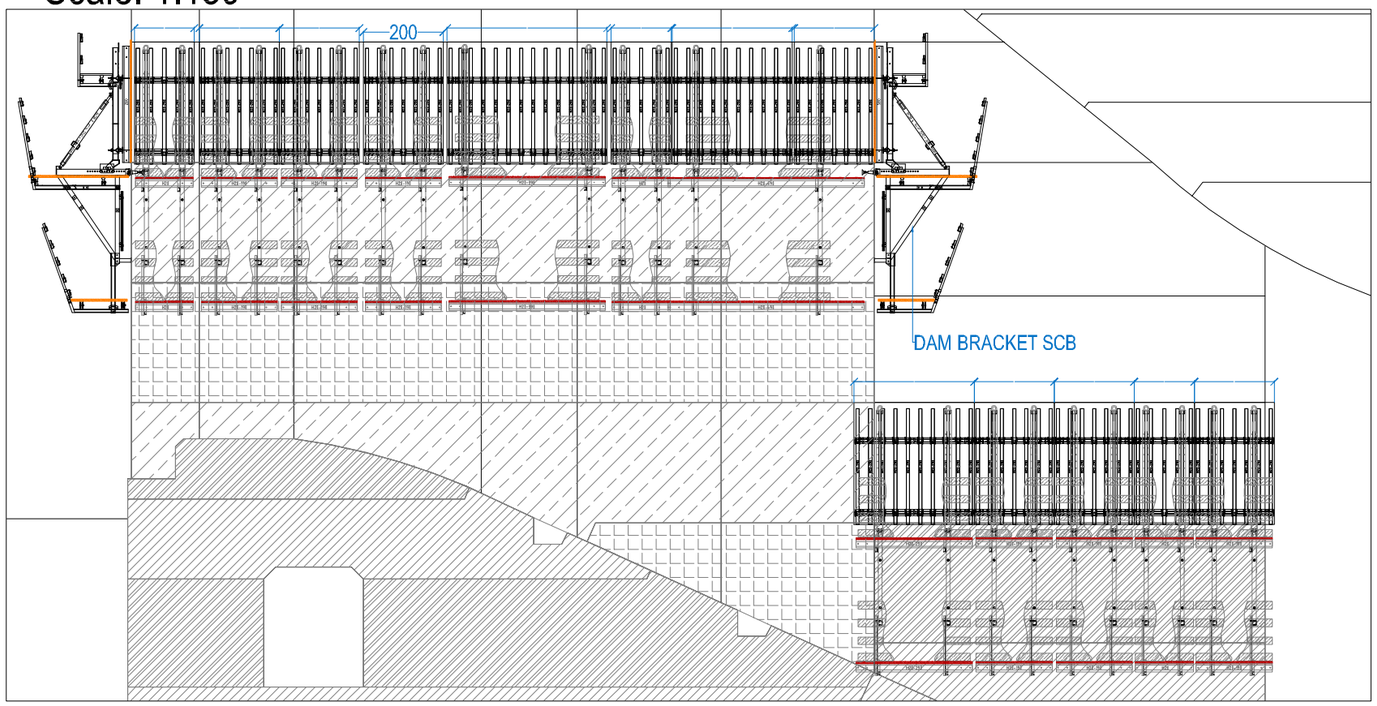
CAD-File: G_0511112_004_P.dwg

Drawing-No.: G_0511112_004_P 1/6

HARSCO

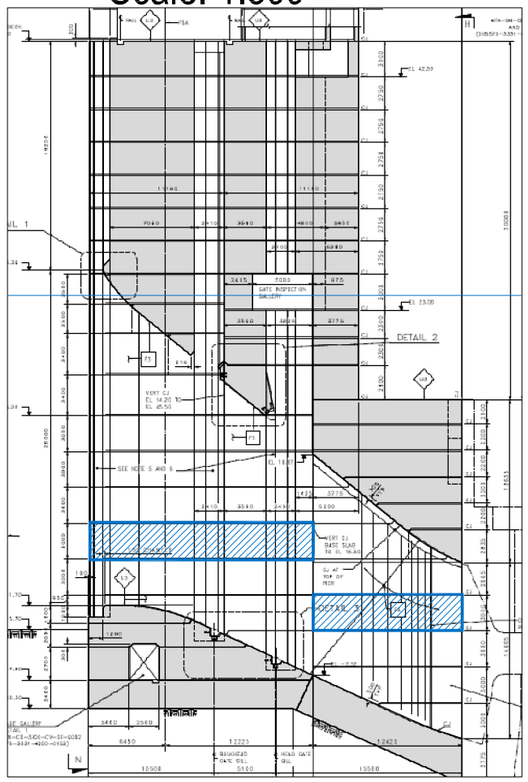
SECTION A-A

Scale: 1:150



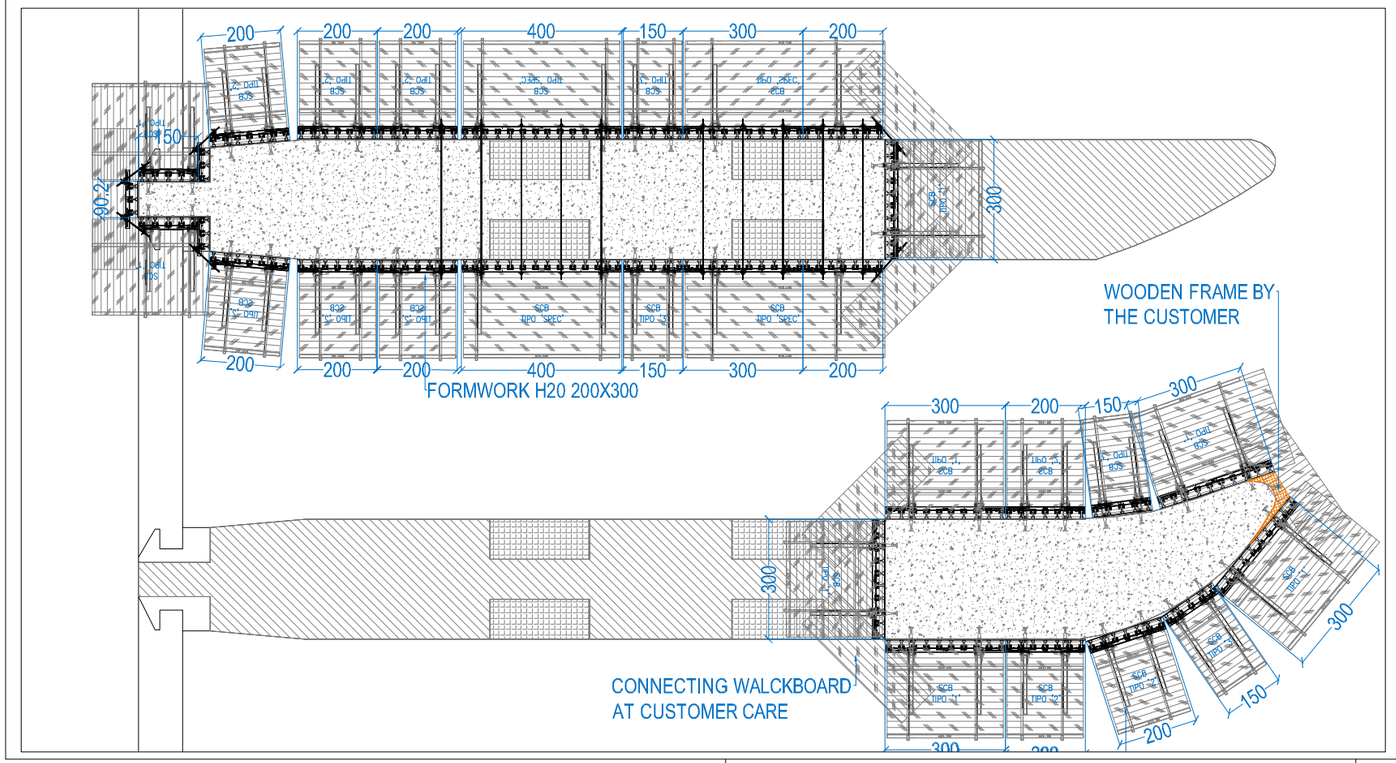
KEY SECTION

Scale: 1:500



EQUIPMENT PLANT

Scale: 1:150



0	EMISSIONE	27/11/12	E.Martorella	A.Leone
Index	Revision	Date	drawn:	checked:

Preliminary drawing, not for construction

This drawing is valid only with the associated assembly instructions. Measurements have to be verified on site.

Scale:	1:150	A3	Client: ASTALDI SPA
	Date	Name	
drawn:	27/11/12	E.Martorella	DIGA QUEBEC
checked:	27/11/12	A.Leone	Project: LOWER CHURCHILL PROJECT
remark:	G.MARAN		INTAKE
			H20 - SCB

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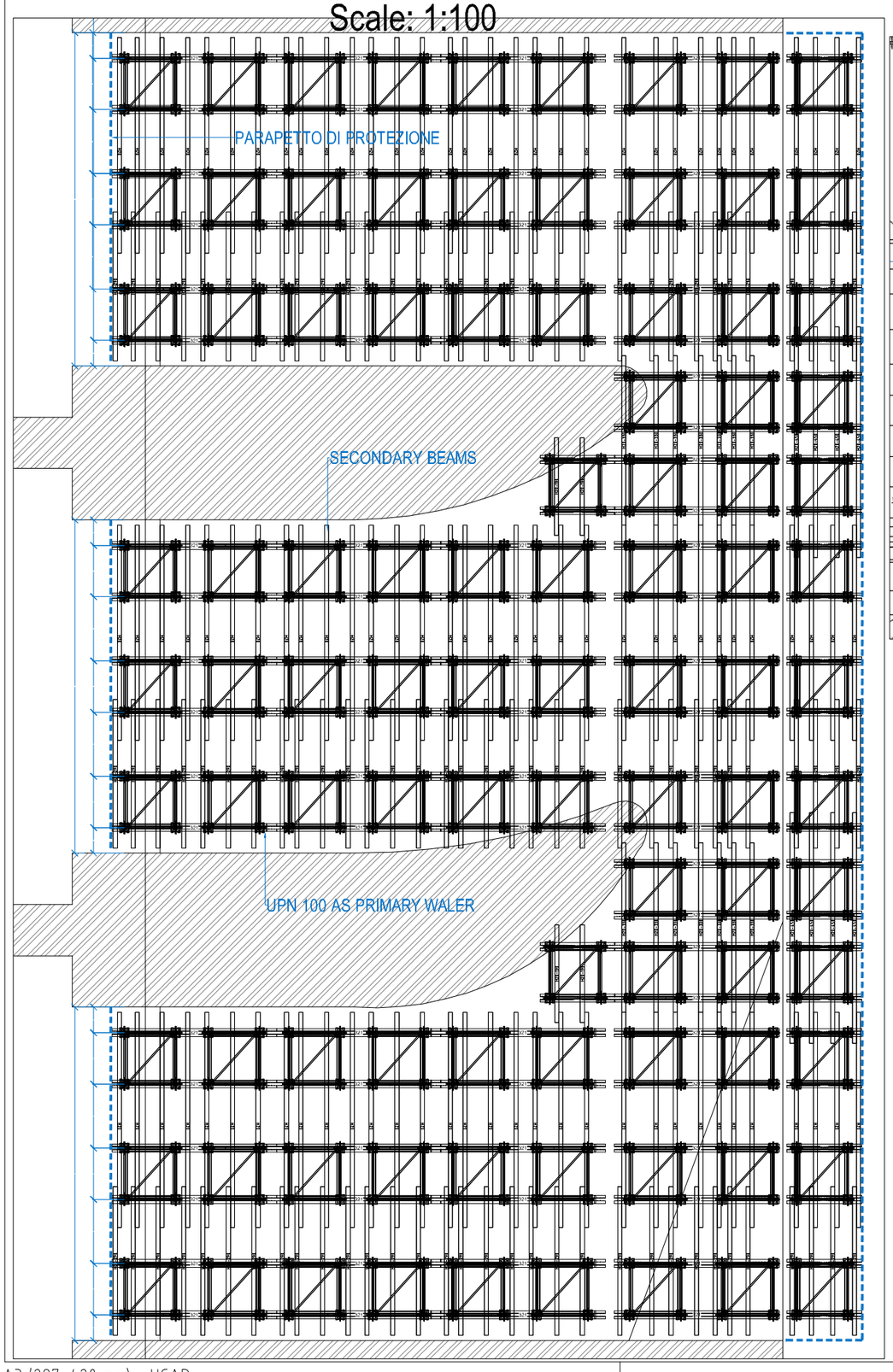
CAD-File: G_0511112_004_P.dwg

Drawing-No.: G_0511112_004_P 2/6

HARSCO

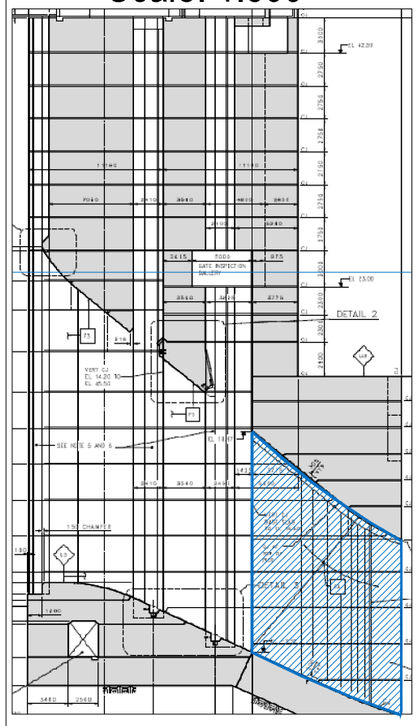
PLANT OF PROPOSED EQUIPMENT

Scale: 1:100



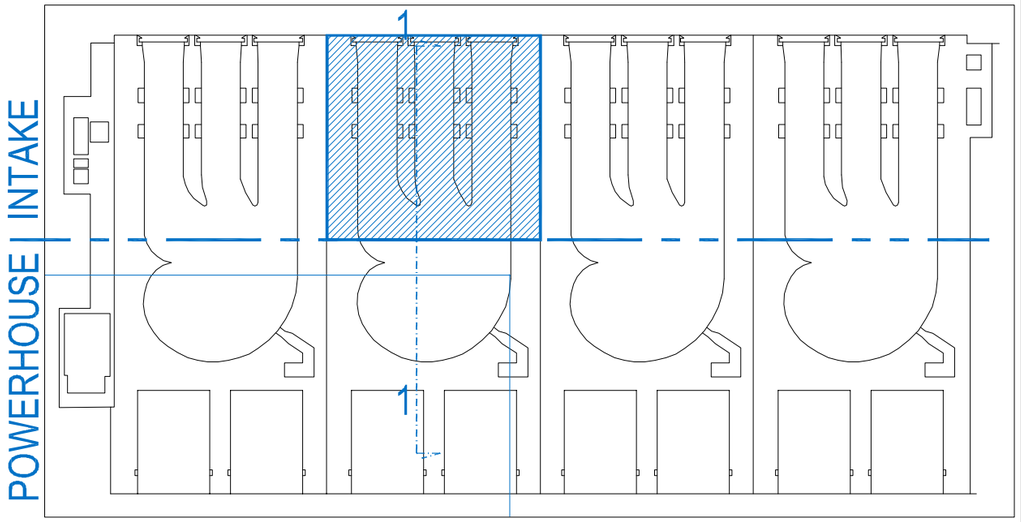
KEY SECTION

Scale: 1:500



KEY PLANT

Scale: 1:1000



EQUIPMENT FOR ONE SET		
DESCRIPTION	HEIGHT ml	QUANTITY
ID15 SUPPORT TOWERS	14,50	95
H20 BEAMS		780 ml
UPN 100		300 ml

0	EMISSIONE	27/11/12	E.Martorella	A.Leone
Index	Revision	Date	drawn:	checked:

Preliminary drawing, not for construction

This drawing is valid only with the associated assembly instructions. Measurements have to be verified on site.

Scale:	1:150	A3	Client: ASTALDI SPA
	Date	Name	
drawn:	27/11/12	E.Martorella	DIGA QUEBEC
checked:	27/11/12	A.Leone	Project: LOWER CHURCHILL PROJECT
remark:	G.MARAN		INTAKE
			H20 - SCB

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Drawing-No.: G_0511112_004_P 3/6

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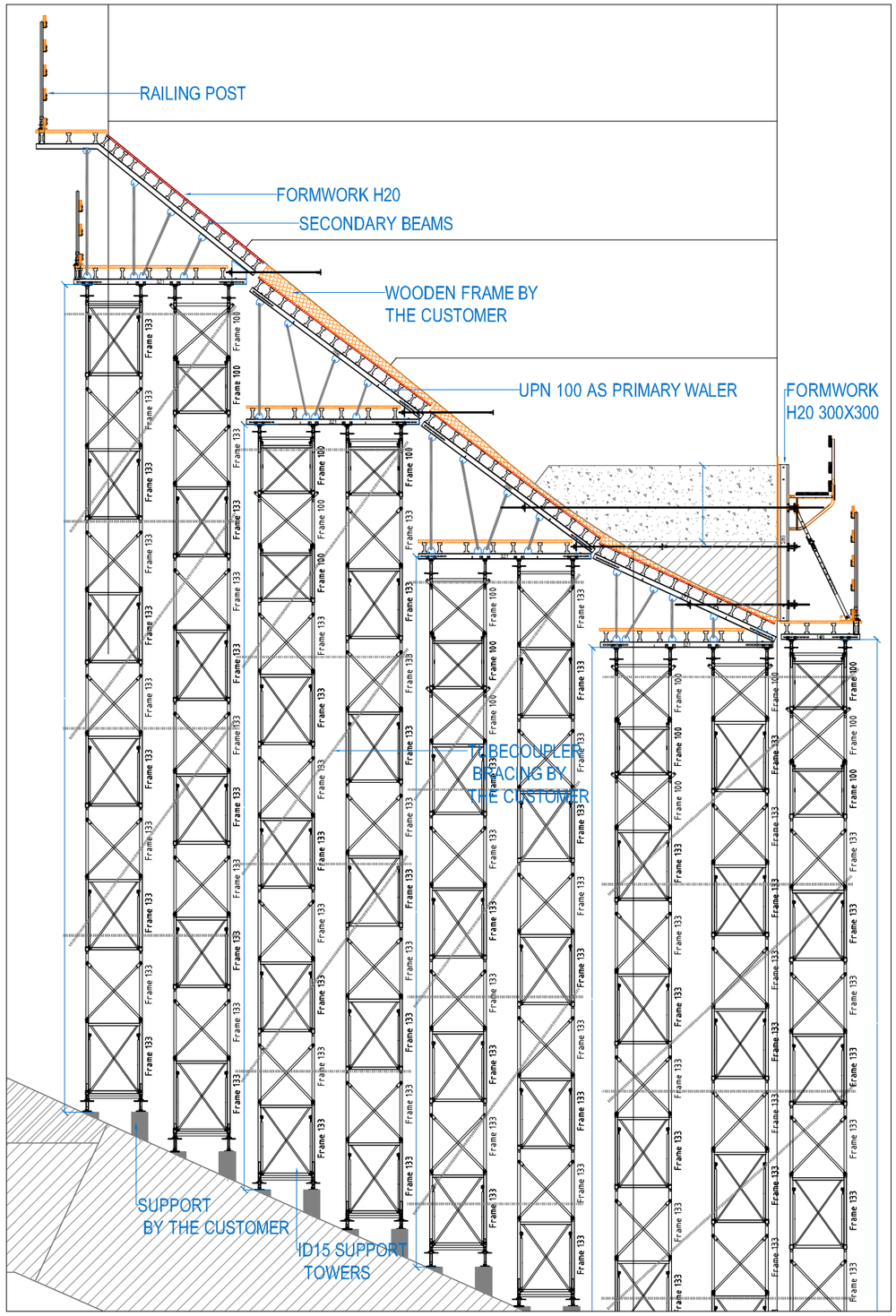
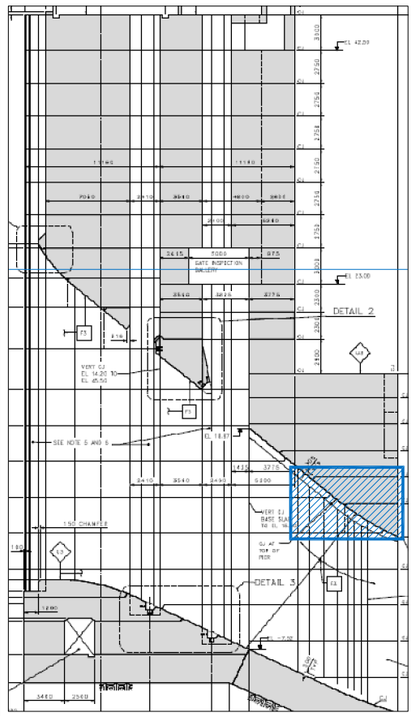
SECTION 1 - 1 - 2°ND PHASE POUR

Scale: 1:100



KEY SECTION

Scale: 1:500



KEY PLANT

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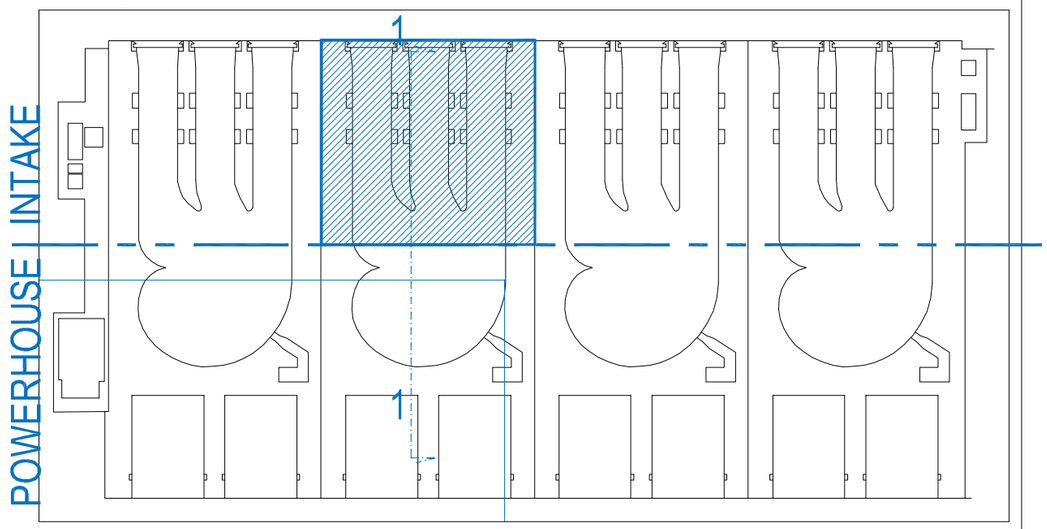

Index	Revision	Date	drawn:	checked:
0	EMISSIONE	27/11/12	E.Martorella	A.Leone

Preliminary drawing, not for construction

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Scale:	1:150	A3	Client: ASTALDI SPA
	Date	Name	DIGA QUEBEC
drawn:	27/11/12	E.Martorella	
checked:	27/11/12	A.Leone	Project: LOWER CHURCHILL PROJECT
remark:	G.MARAN		INTAKE
			H20 - SCB

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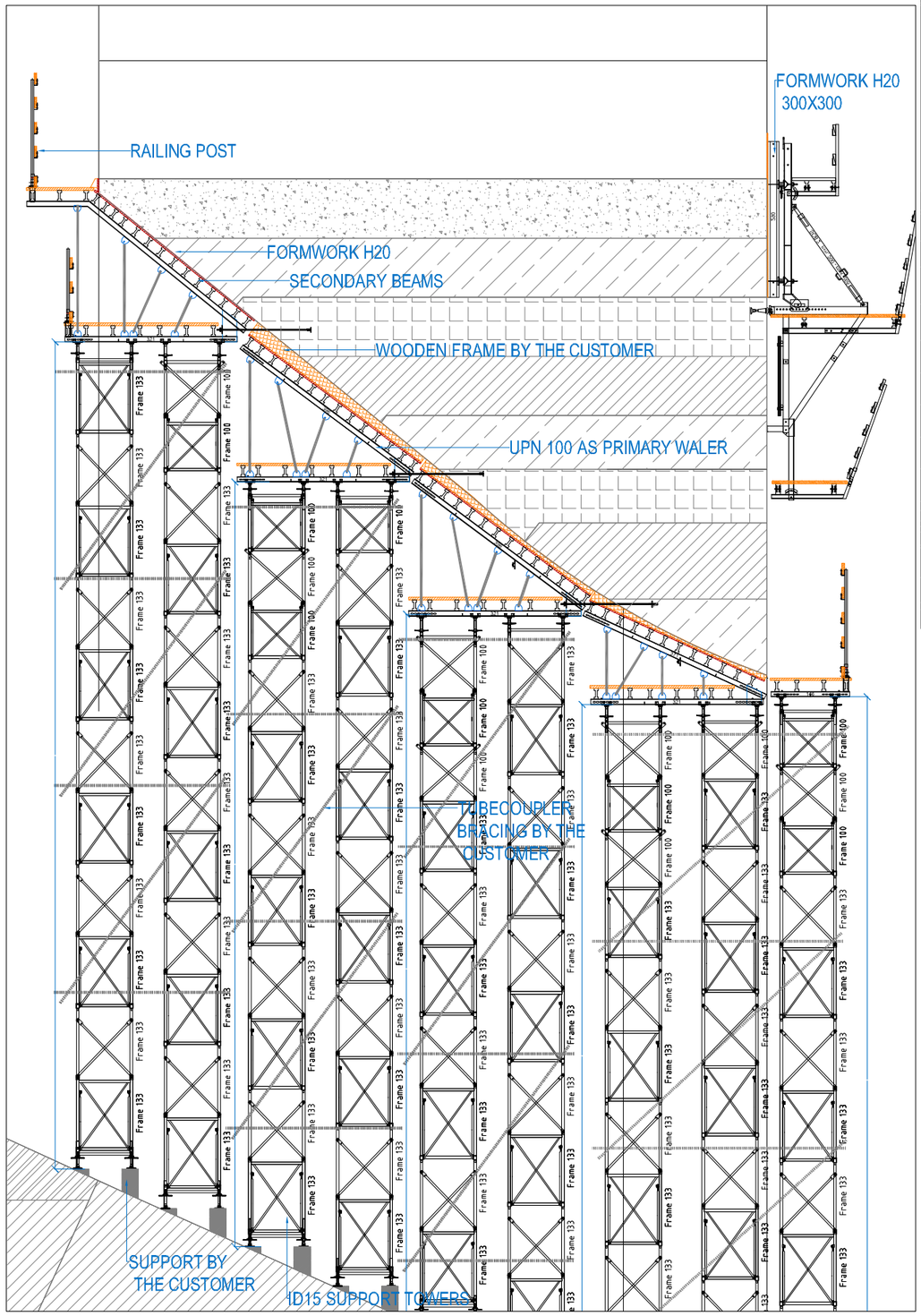
SECTION 1 - 1 - 8° TH PHASE POUR

Scale: 1:100



KEY SECTION

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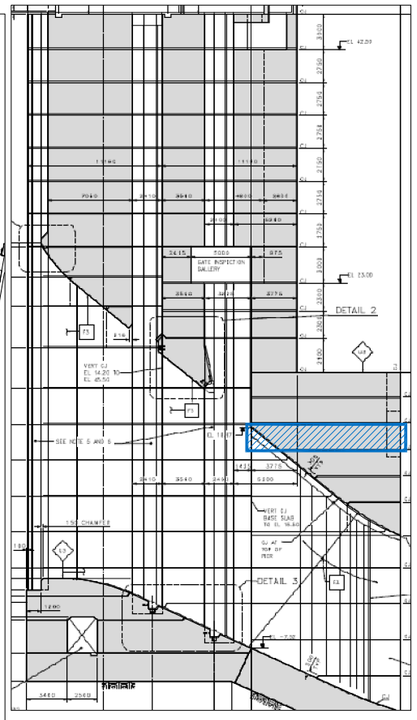

KEY PLANT

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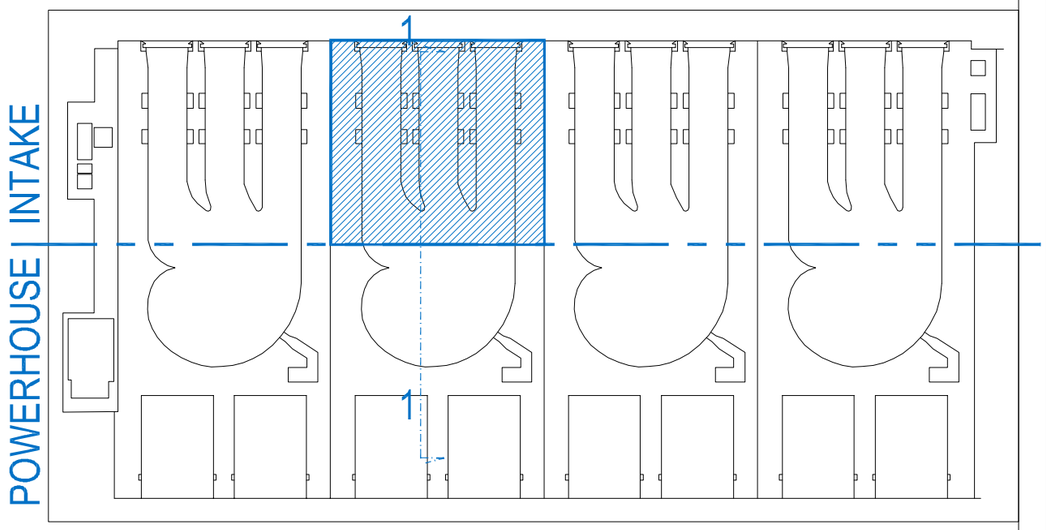

Index	Revision	Date	drawn:	checked:
0	EMISSIONE	27/11/12	E.Martorella	A.Leone

Preliminary drawing, not for construction

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	Date	Name	
drawn:	27/11/12	E.Martorella	DIGA QUEBEC
checked:	27/11/12	A.Leone	Project: LOWER CHURCHILL PROJECT
remark:	G.MARAN		INTAKE
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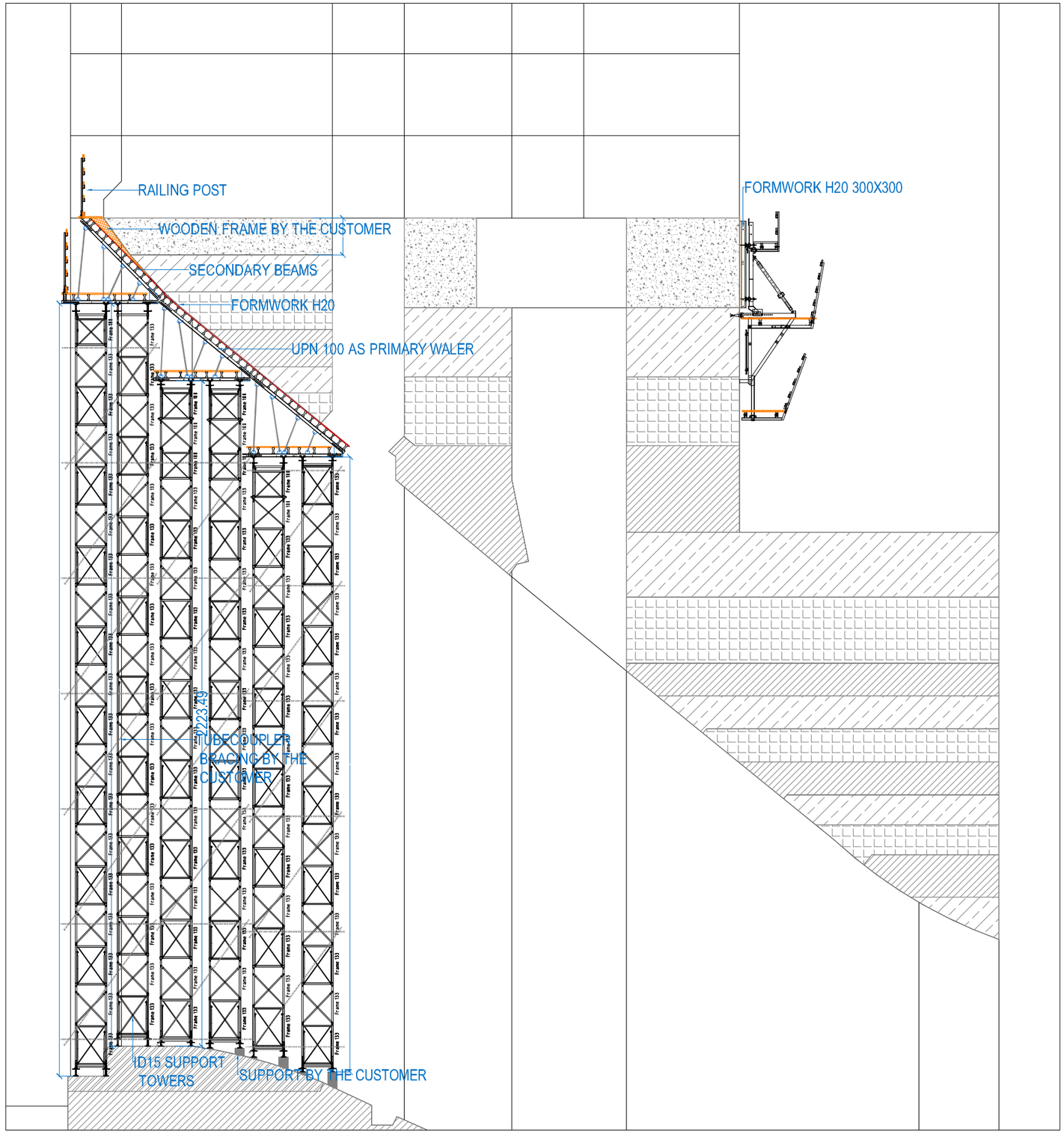
SECTION 1 - 1 - 16°TH PHASEPOUR

Scale: 1:150



KEY SECTION

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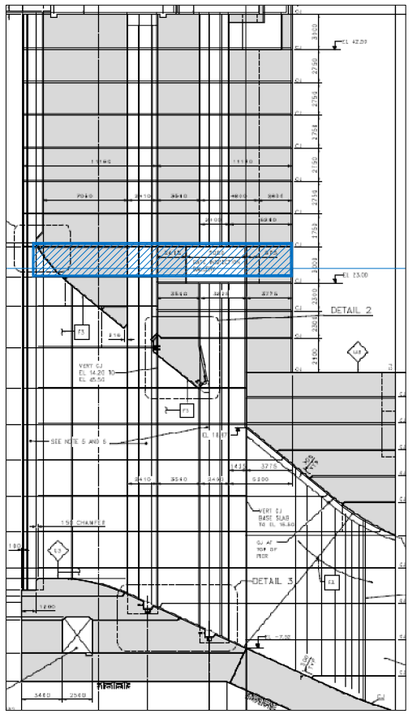

0	EMISSIONE	27/11/12	E.Martorella	A.Leone
Index	Revision	Date	drawn:	checked:

Preliminary drawing, not for construction

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Scale:	1:150	A3	Client: ASTALDI SPA
	Date	Name	
drawn:	27/11/12	E.Martorella	DIGA QUEBEC
checked:	27/11/12	A.Leone	Project: LOWER CHURCHILL PROJECT
remark:	G.MARAN		INTAKE
			H20 - SCB

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Drawing-No.: G_0511112_004_P 6/6

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ASTALDI CANADA Inc.

nalcor energy

NALCOR ENERGY
LOWER CHURCHILL PROJECT
MUSKRAT FALLS

CONSTRUCTION OF INTAKE AND POWERHOUSE, SPILLWAY
AND TRANSITION DAMS

PACKAGE CH0007
CORE TECHNICAL PROPOSAL

APPENDIX A13
EXECUTION PLAN

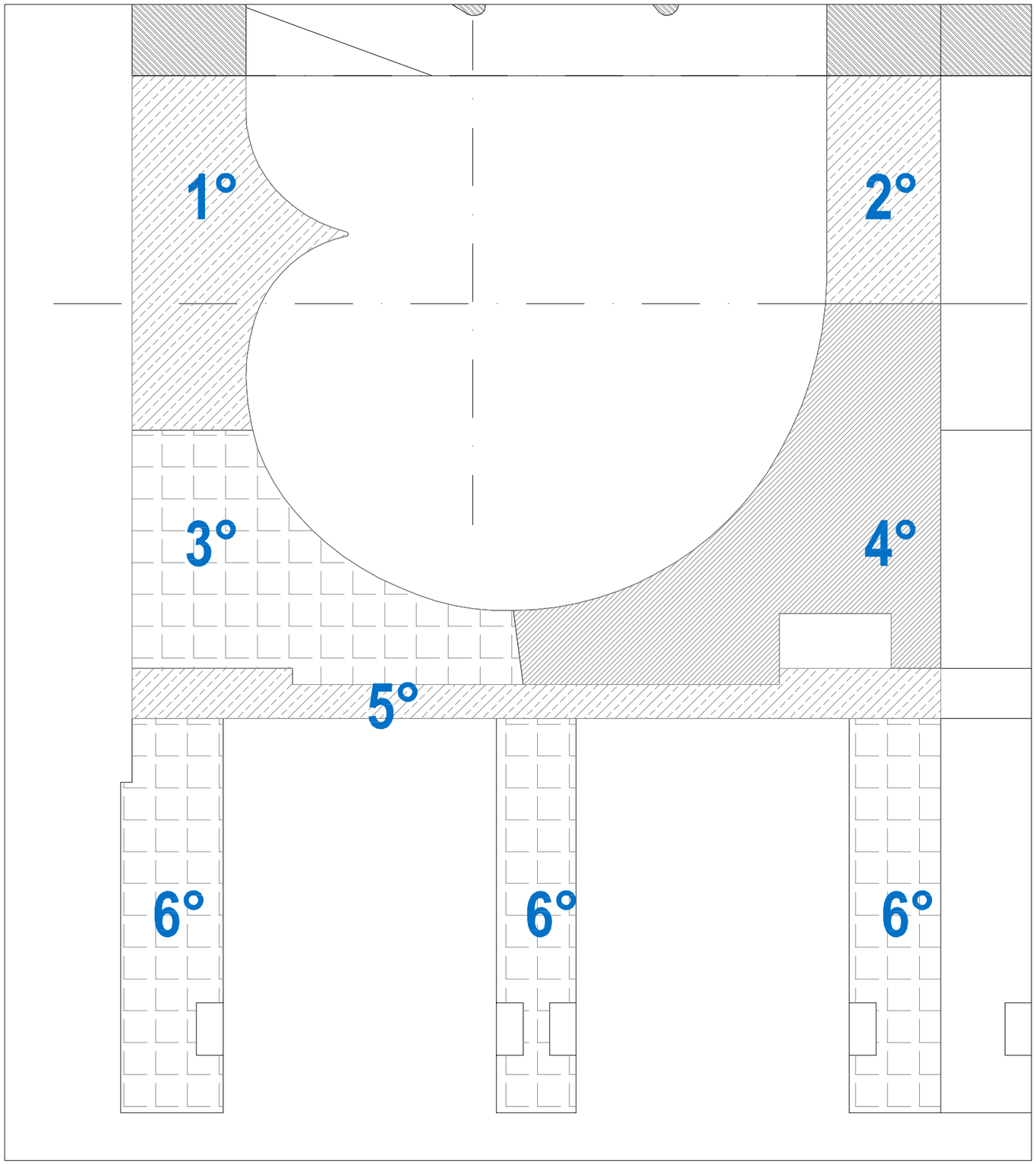
ATTACHMENT 35

FORMWORK - POWERHOUSE

April 16, 2013

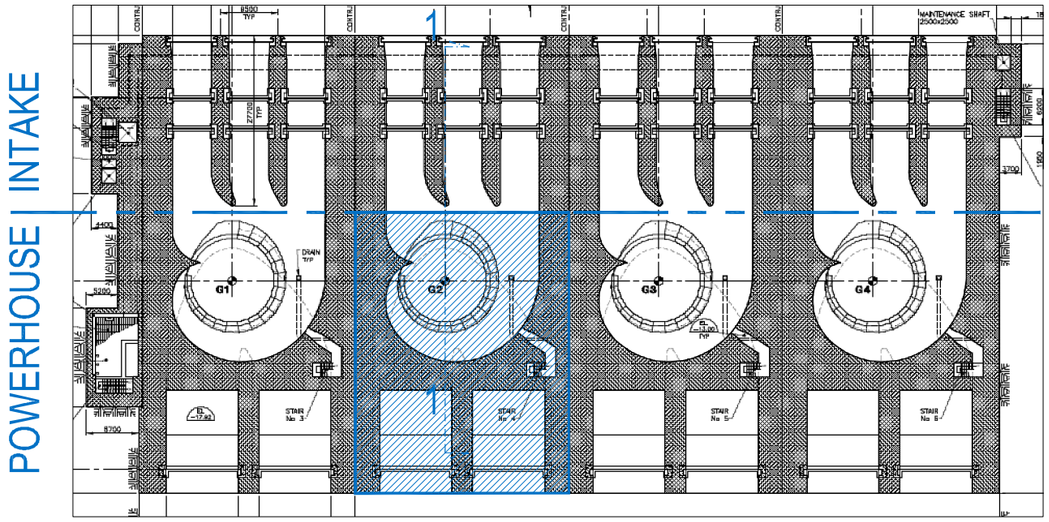
SUGGESTED SEQUENCE USNG PHASE 6°TH EQUIPMENT

Scale: 1:200



KEY PLANT

Scale: 1:1000



0	EMISSIONE	27/11/12	E.Martorella	A.Leone
Index	Revision	Date	drawn:	checked:

Preliminary drawing, not for construction

This drawing is valid only with the associated assembly instructions. Measurements have to be verified on site.

Scale:	1:150	A3	Client: ASTALDI SPA
	Date	Name	
drawn:	27/11/12	E.Martorella	DIGA QUEBEC
checked:	27/11/12	A.Leone	Project: LOWER CHURCHILL PROJECT
remark:	G.MARAN		POWERHOUSE
			H20 - SCB

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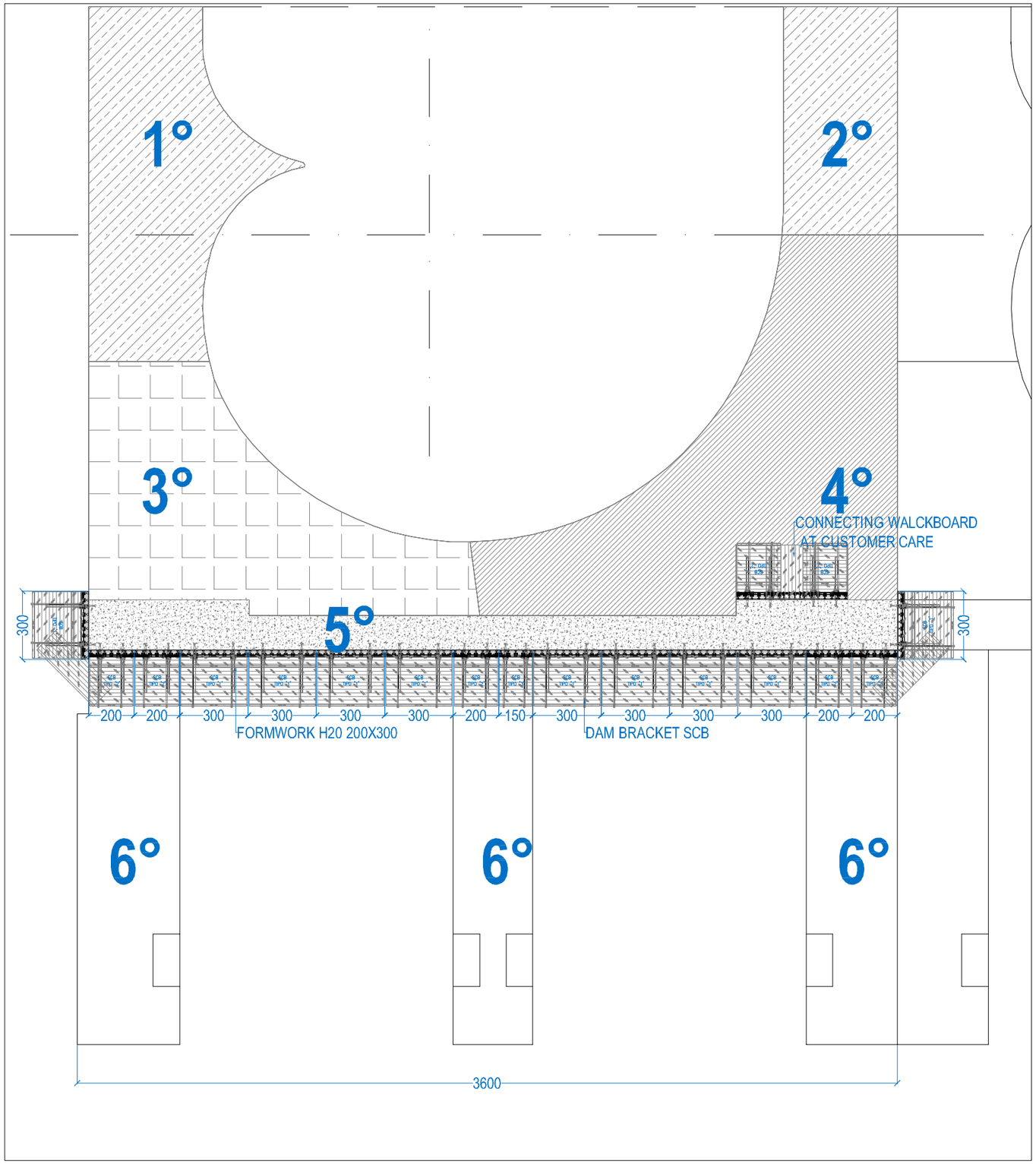
5°TH PHASE PLANT POUR

Scale: 1:200



KEY PLANT

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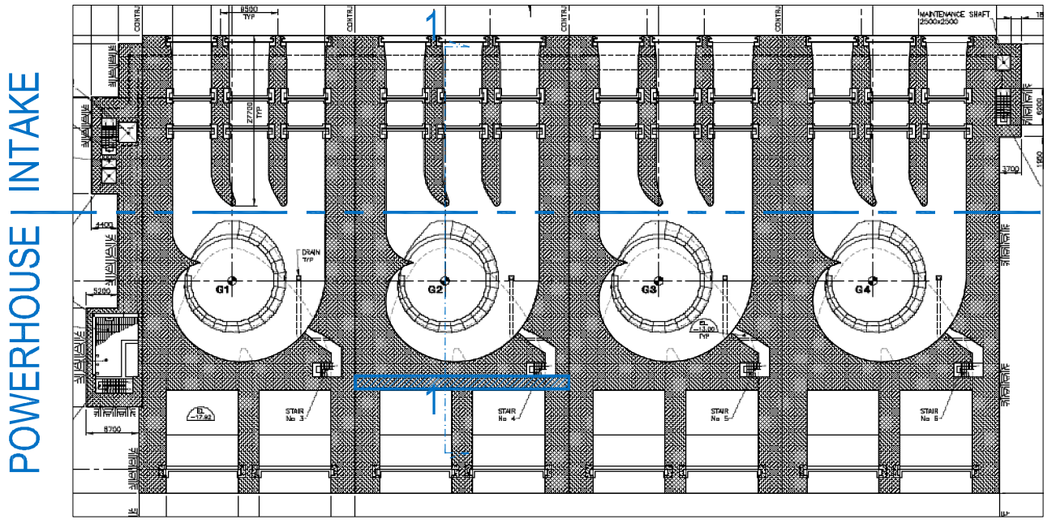

Index	Revision	Date	drawn:	checked:
0	EMISSIONE	27/11/12	E.Martorella	A.Leone

Preliminary drawing, not for construction

This drawing is valid only with the associated assembly instructions. Measurements have to be verified on site.

Scale:	1:150	A3	Client: ASTALDI SPA
	Date	Name	
drawn:	27/11/12	E.Martorella	DIGA QUEBEC
checked:	27/11/12	A.Leone	Project: LOWER CHURCHILL PROJECT
remark:	G.MARAN		POWERHOUSE
			H20 - SCB

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Drawing-No.: G_0511112_005_P 2/9

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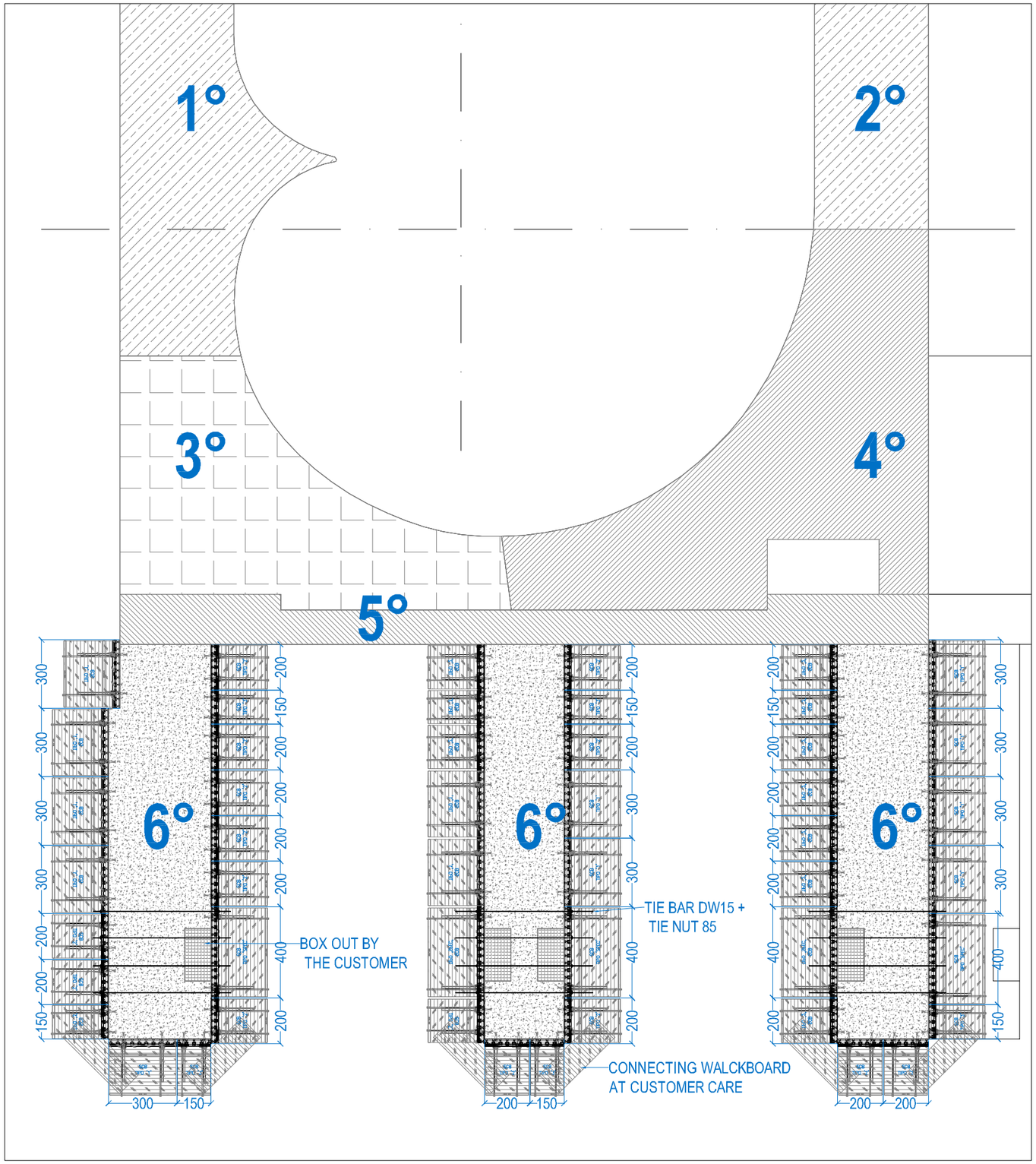
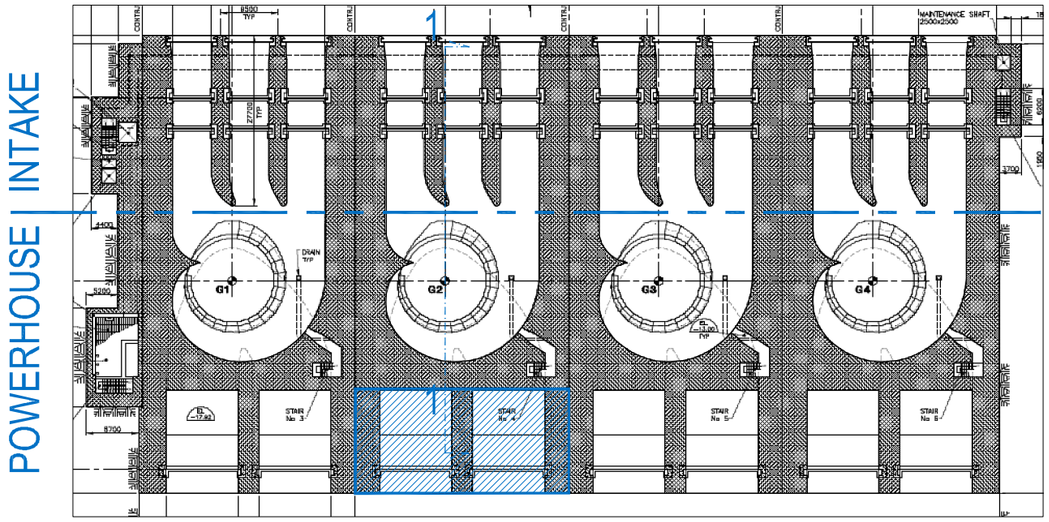
PLANT OF PROPOSED EQUIPMENT - 6°TH PHASE POUR

Scale: 1:200



KEY PLANT

Scale: 1:1000



EQUIPMENT FOR ONE SET		
DESCRIPTION		QUANTITY
H20 UNITS	MODULE 150X300	8
	MODULE 200X300	24
	MODULE 300X300	14
	MODULE 400X300	6
SCB UNITS (ONE PAIR BRACKETS)	MODULE 150	8
	MODULE 200	24
	MODULE 300	14
	MODULE 400	6

Index	Revision	Date	drawn:	checked:
0	EMISSIONE	27/11/12	E.Martorella	A.Leone

Preliminary drawing, not for construction

This drawing is valid only with the associated assembly instructions. Measurements have to be verified on site.

Scale:	1:150	A3	Client: ASTALDI SPA
	Date	Name	DIGA QUEBEC
drawn:	27/11/12	E.Martorella	
checked:	27/11/12	A.Leone	Project: LOWER CHURCHILL PROJECT
remark:	G.MARAN		POWERHOUSE
			H20 - SCB

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Drawing-No.: G_0511112_005_P 3/9

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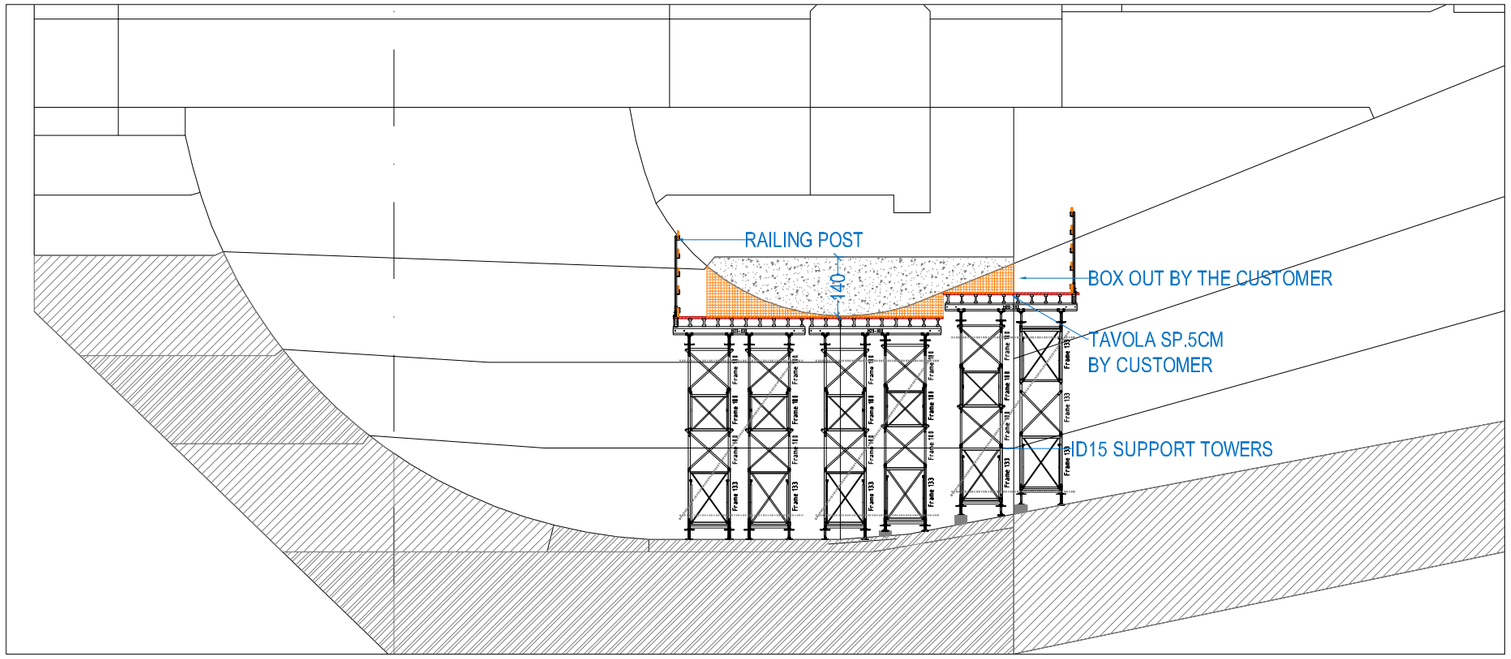
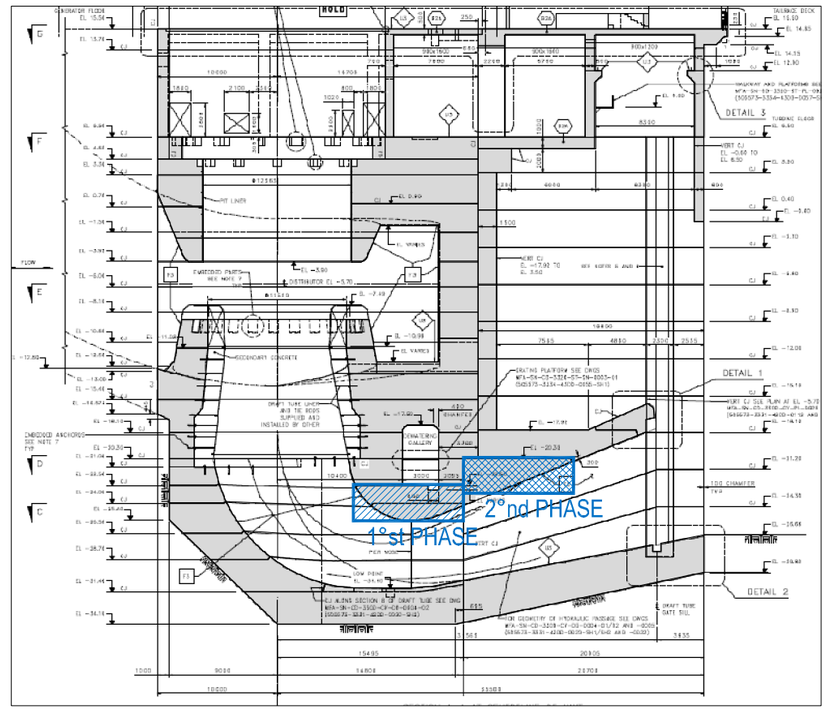
1°ST PHASE SECTION POUR

Scale: 1:150



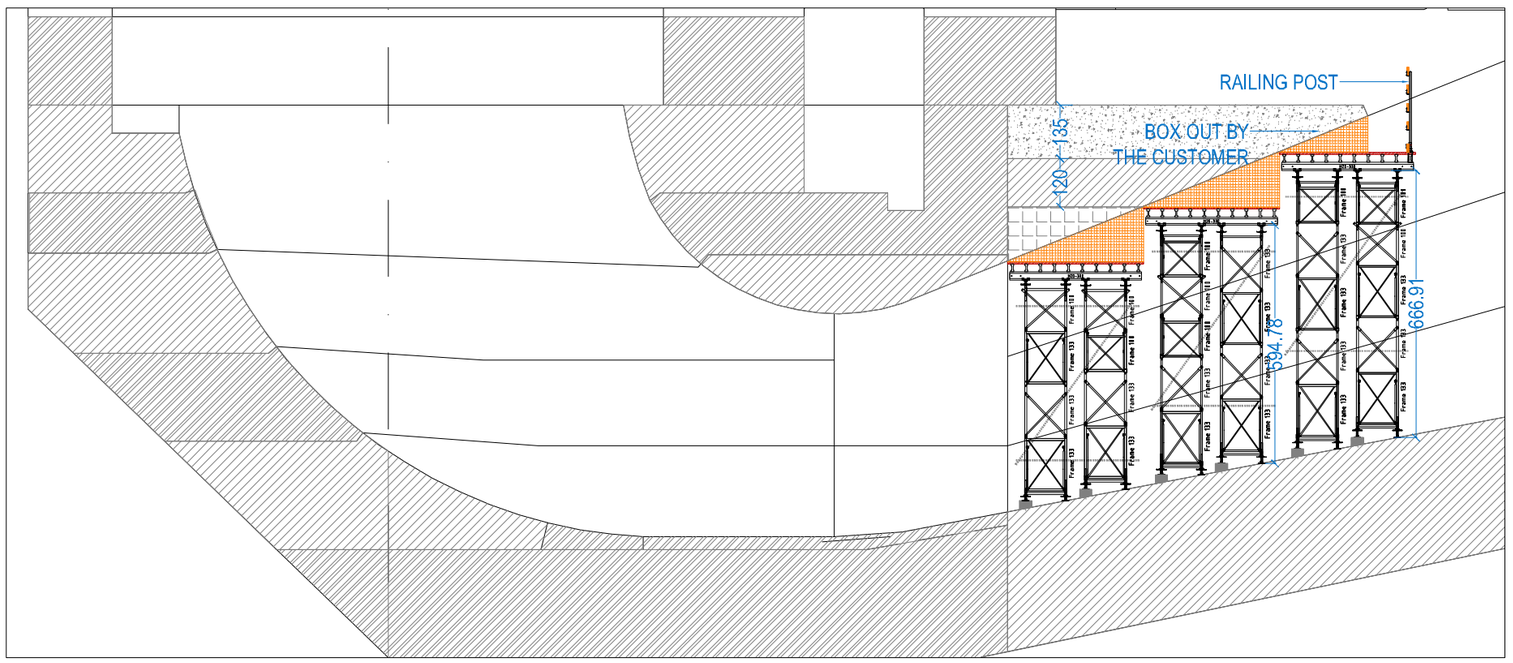
KEY SECTION

Scale: 1:500



2°ND PHASE SECTIONPOUR

Scale: 1:150



0	EMISSIONE	27/11/12	E.Martorella	A.Leone
Index	Revision	Date	drawn:	checked:

Preliminary drawing, not for construction

This drawing is valid only with the associated assembly instructions. Measurements have to be verified on site.

Scale:	1:150	A3	Client: ASTALDI SPA
	Date	Name	
drawn:	27/11/12	E.Martorella	DIGA QUEBEC
checked:	27/11/12	A.Leone	Project: LOWER CHURCHILL PROJECT
remark:	G.MARAN		POWERHOUSE
			H20 - ID15

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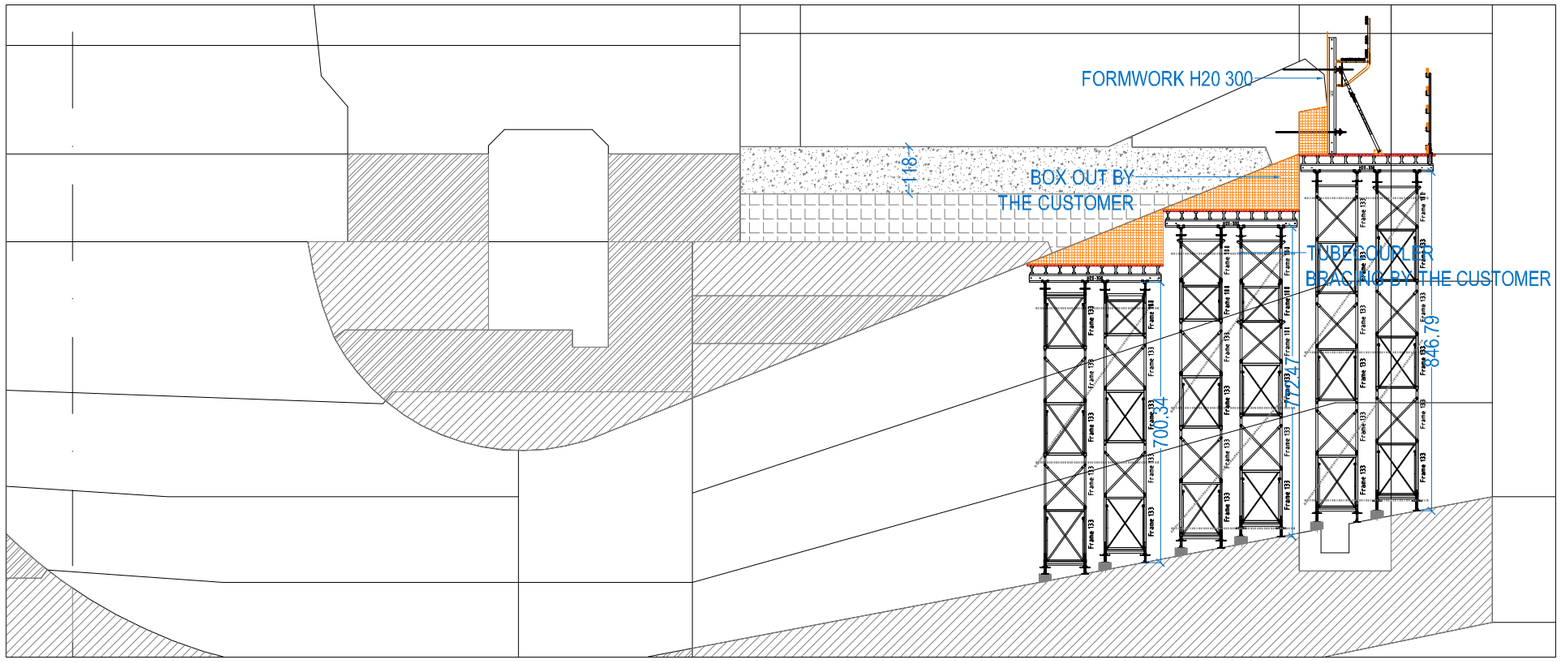
3°rd PHASE SECTION POUR

Scale: 1:150



KEY SECTION

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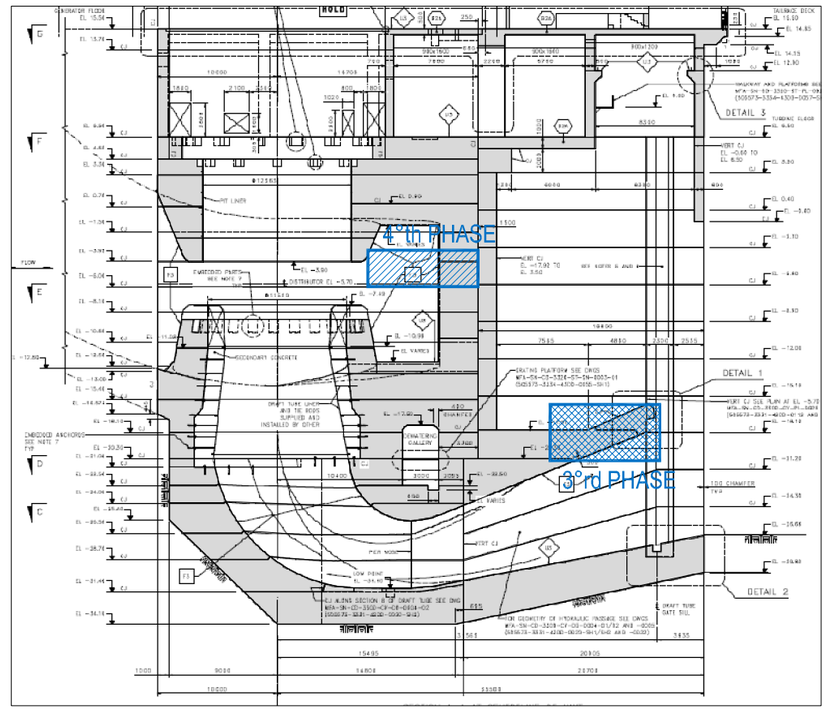
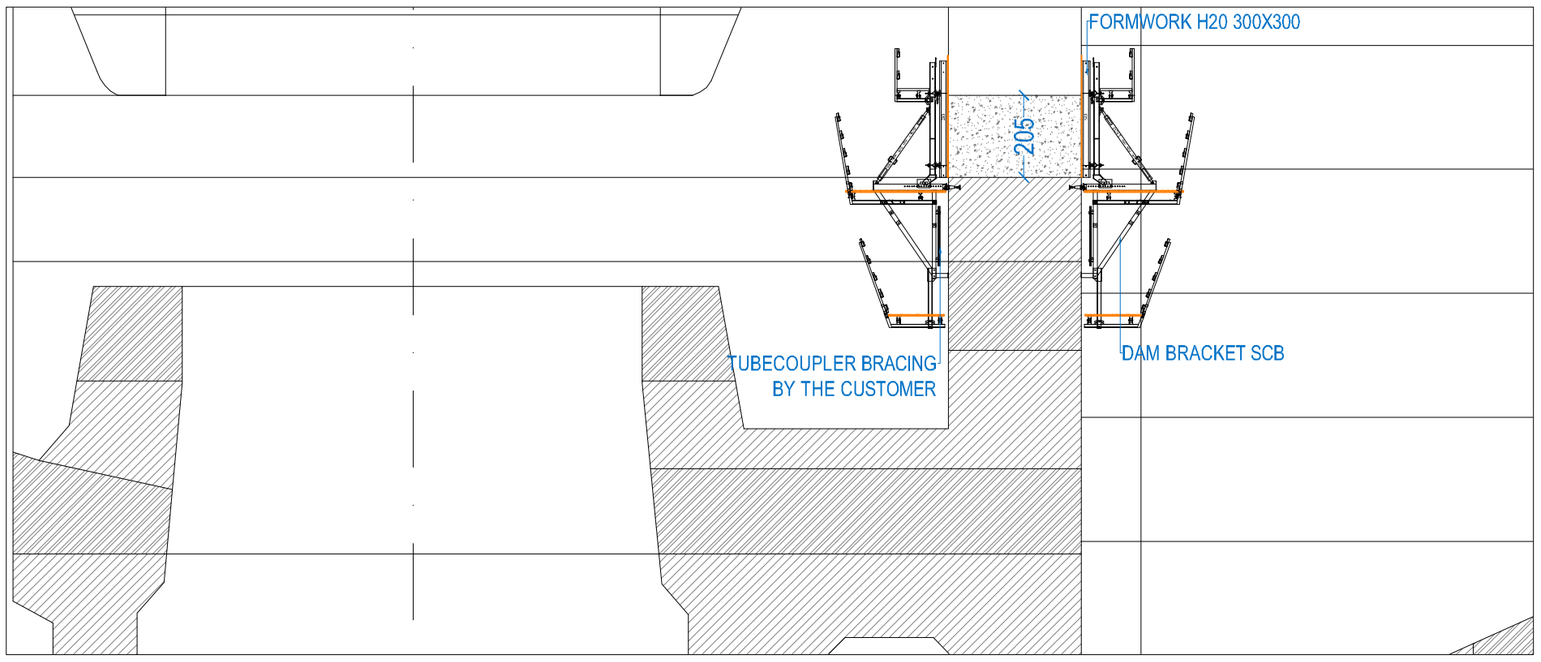


4°TH PHASE SECTION POUR

Scale: 1:150



EQUIPMENT FOR ONE SET		
DESCRIPTION	EIGHT ml	QUANTITY
ID15 SUPPORT TOWERS	8,50	72
H20 BEAMS		1200 ml

0	EMISSIONE	27/11/12	E.Martorella	A.Leone
Index	Revision	Date	drawn:	checked:

Preliminary drawing, not for construction

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Scale:	1:150	A3	Client: ASTALDI SPA
	Date	Name	DIGA QUEBEC
drawn:	27/11/12	E.Martorella	
checked:	27/11/12	A.Leone	Project: LOWER CHURCHILL PROJECT
remark:	G.MARAN		POWERHOUSE
			H20 - ID15 - SCB

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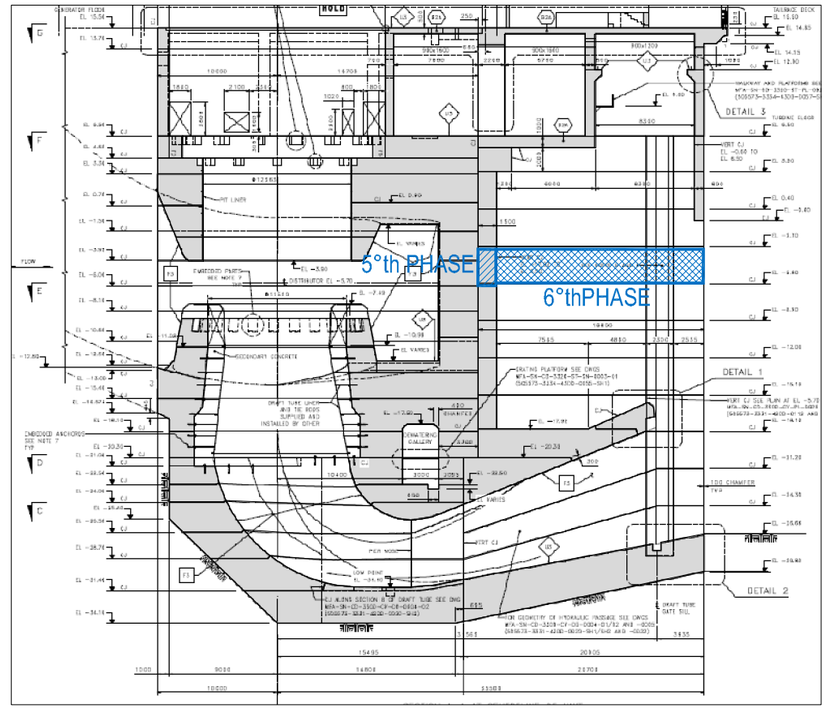
5°TH PHASE SECTION POUR

Scalea: 1:150

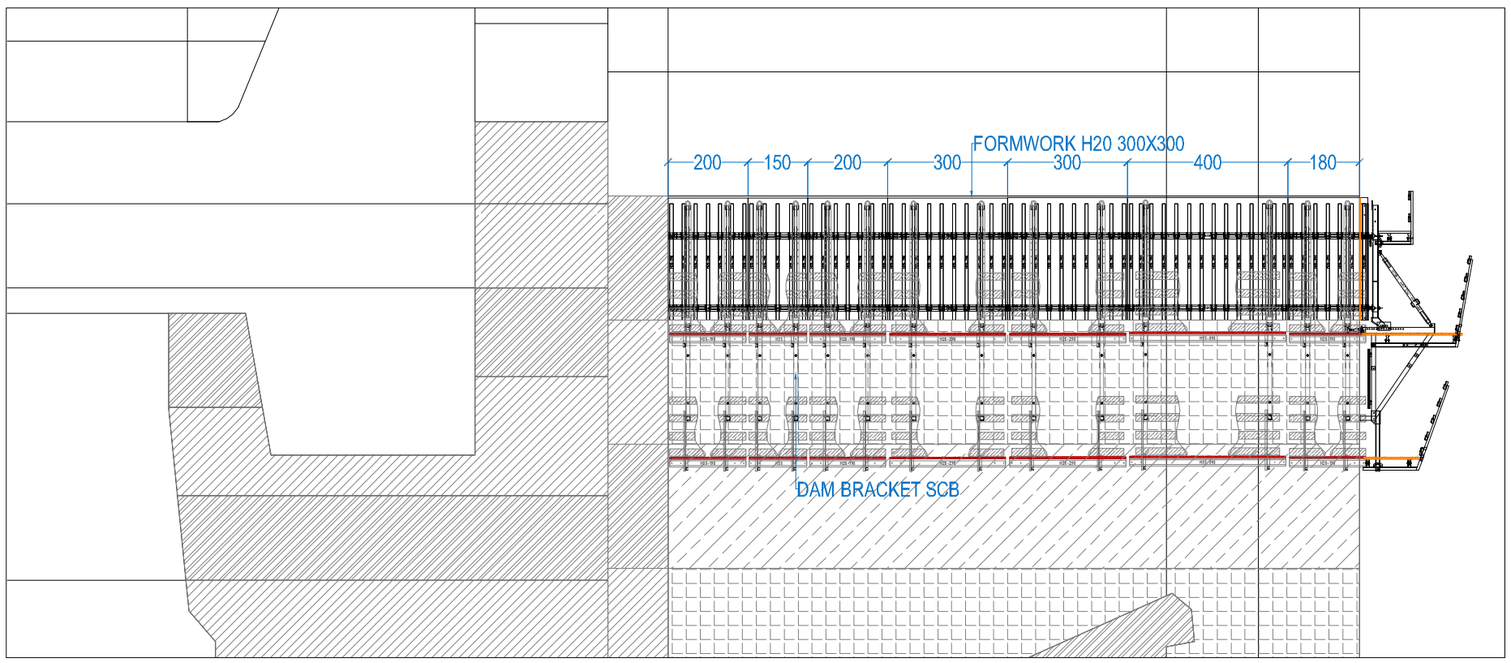
KEY SECTION

Scale: 1:500



6°TH PHASE SECTION POUR

Scale: 1:150



0	EMISSIONE	27/11/12	E.Martorella	A.Leone
Index	Revision	Date	drawn:	checked:

Preliminary drawing, not for construction

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Scale:	1:150	A3	Client: ASTALDI SPA
	Date	Name	DIGA QUEBEC
drawn:	27/11/12	E.Martorella	
checked:	27/11/12	A.Leone	Project: LOWER CHURCHILL PROJECT
remark:	G.MARAN		POWERHOUSE
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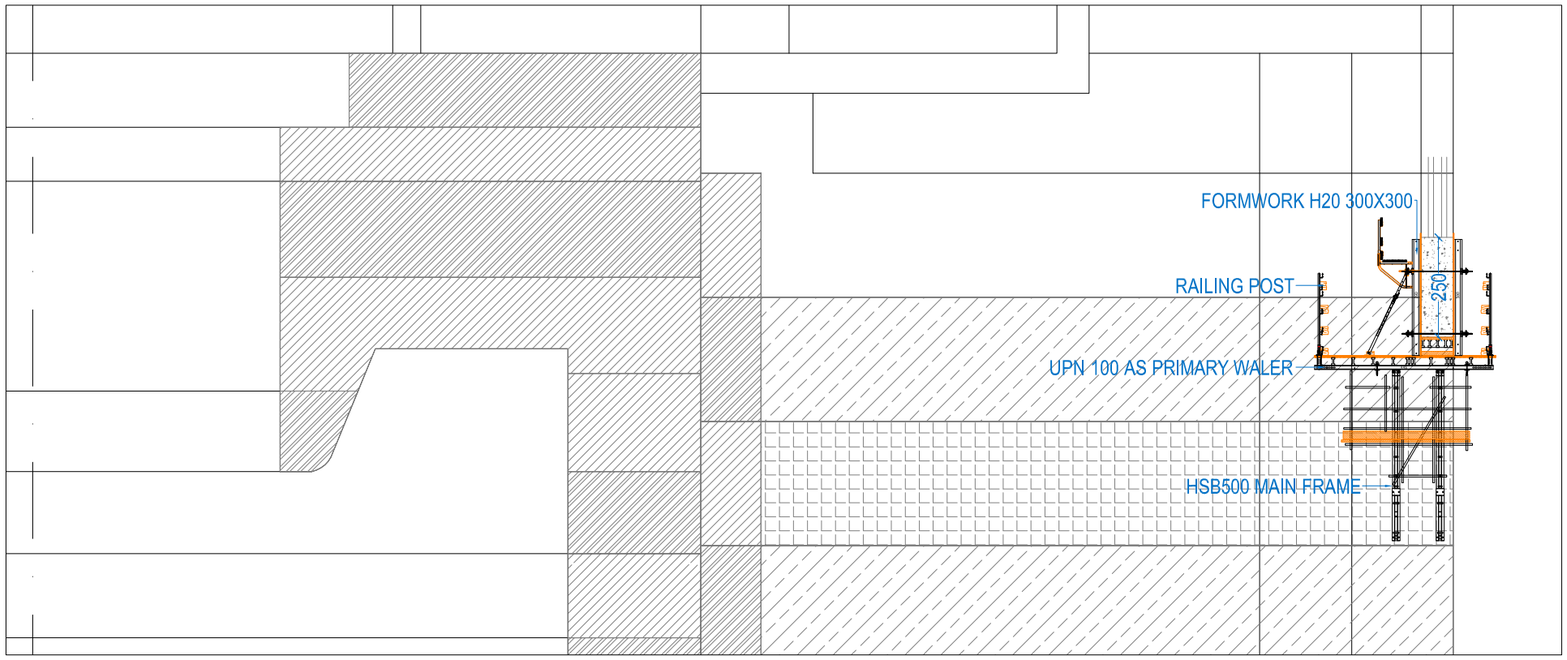
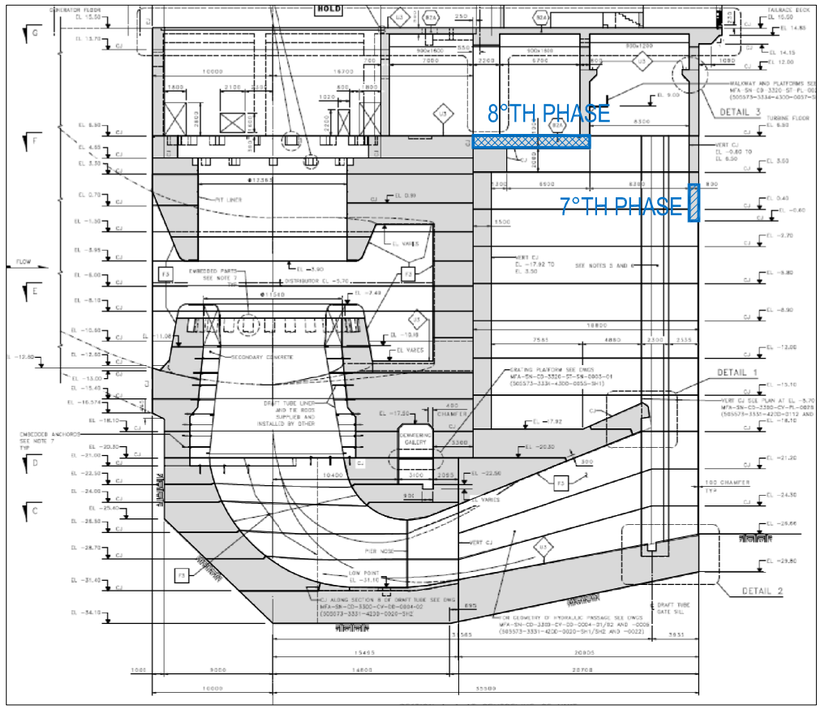
7°TH PHASE SECTION POUR

Scale: 1:150



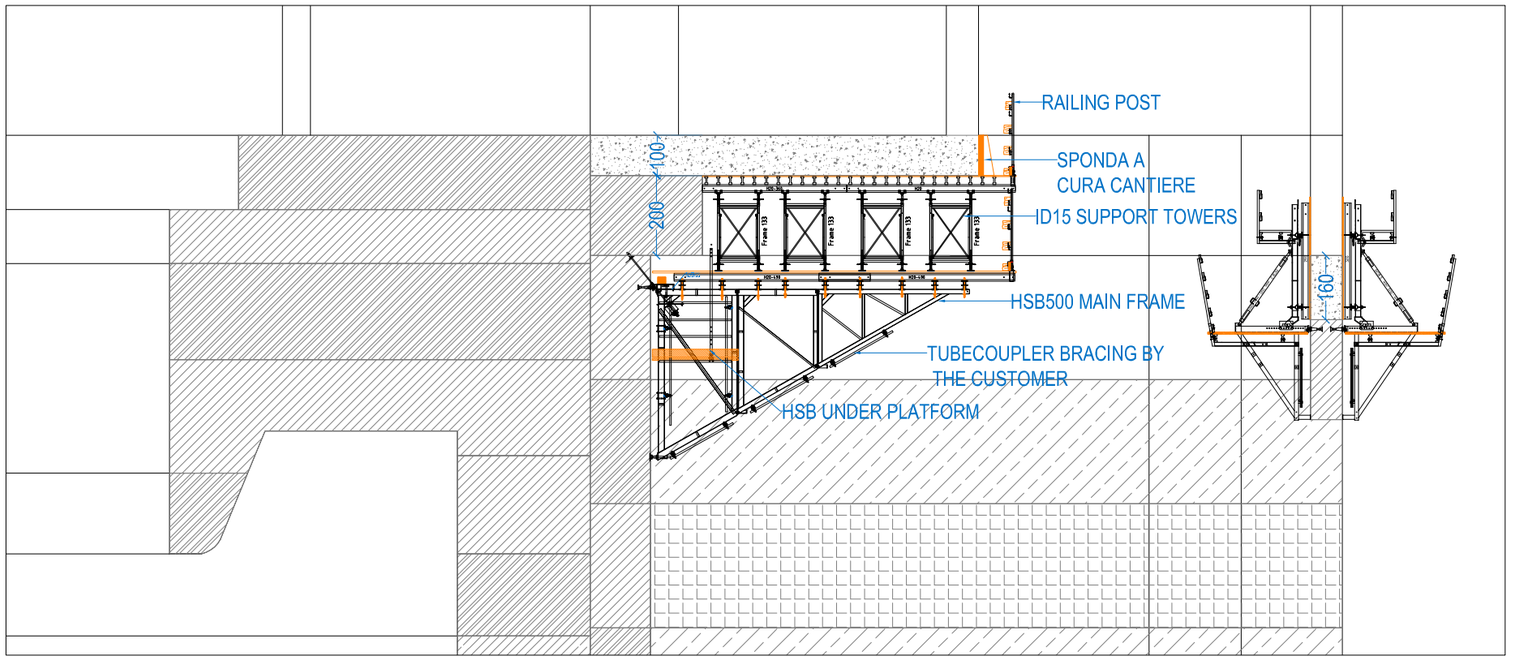
KEY SECTION

Scale: 1:500



8°TH PHASE SECTION POUR

Scale: 1:150



Index	Revision	Date	drawn:	checked:
0	EMISSIONE	27/11/12	E.Martorella	A.Leone

Preliminary drawing, not for construction

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Scale:	1:150	A3	Client: ASTALDI SPA
	Date	Name	DIGA QUEBEC
drawn:	27/11/12	E.Martorella	
checked:	27/11/12	A.Leone	Project: LOWER CHURCHILL PROJECT
remark:	G.MARAN		POWERHOUSE
			H20 - ID15 - HSB - SCB

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Drawing-No.: G_0511112_005_P 7/9

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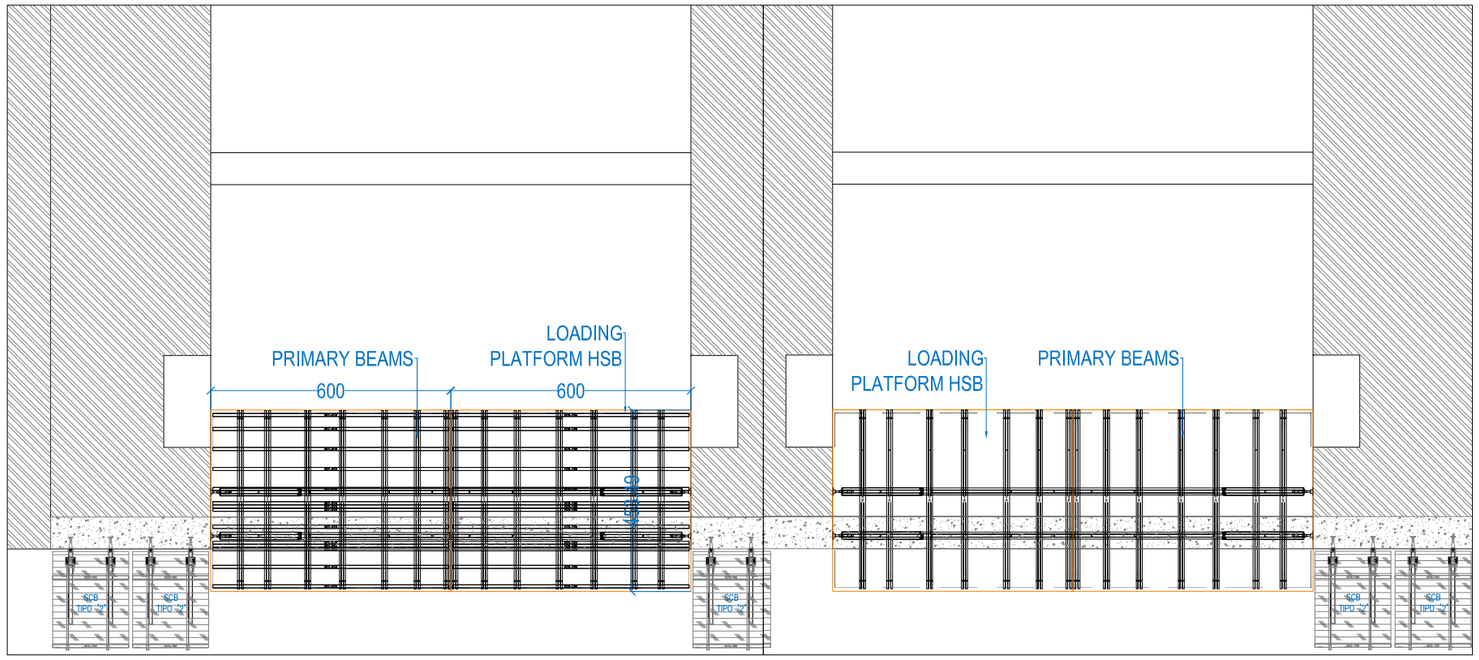
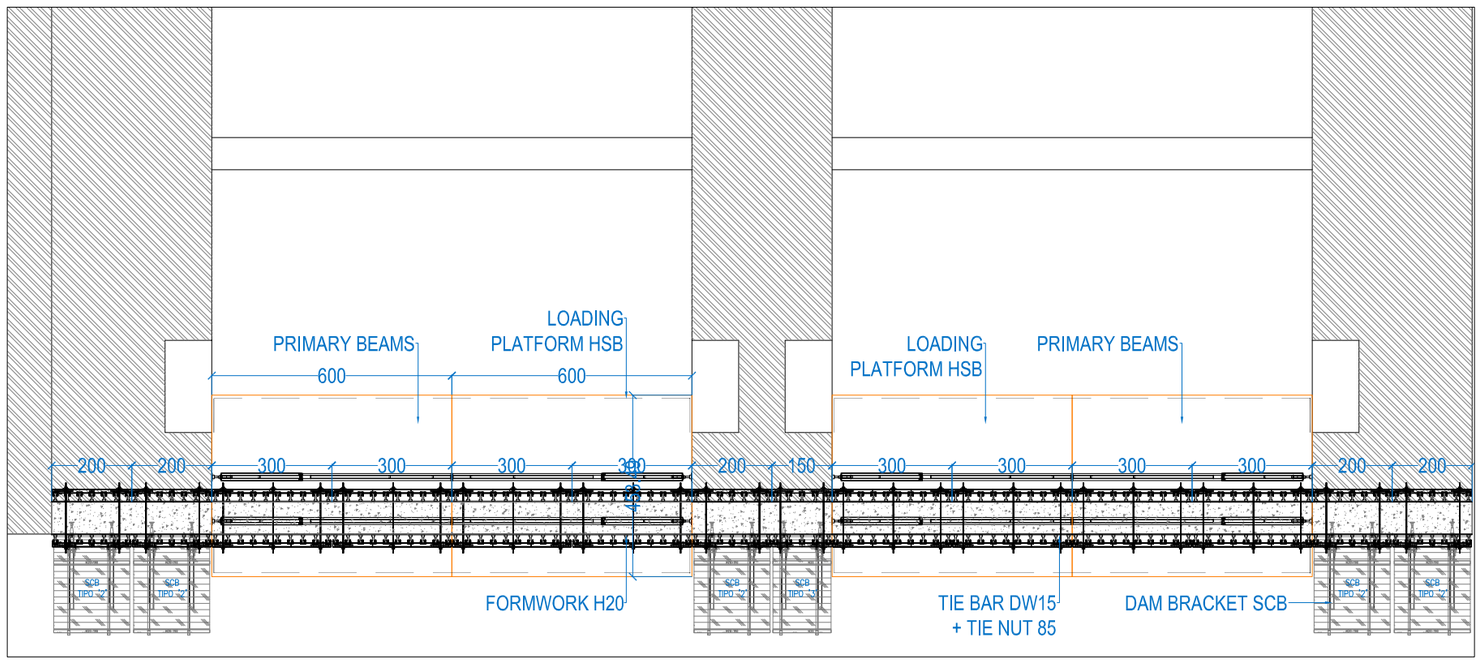
LOADING PLATFORM HAB - 7°TH PHASE

Scale: 1:150



7TH PHASE FORMWORK

Scale: 1:150



KEY SECTION

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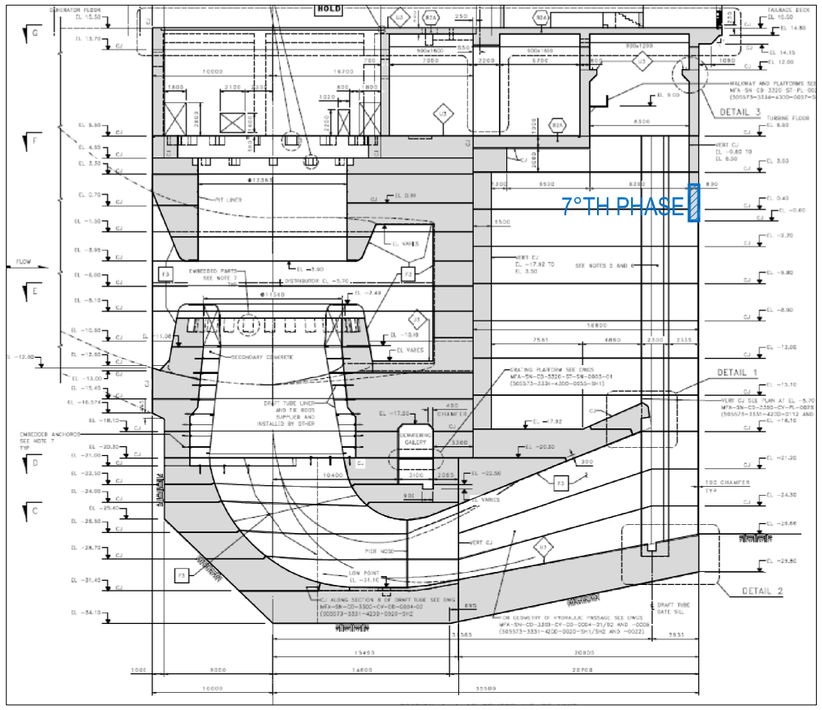

0	EMISSIONE	27/11/12	E.Martorella	A.Leone
Index	Revision	Date	drawn:	checked:

Preliminary drawing, not for construction

This drawing is valid only with the associated assembly instructions. Measurements have to be verified on site.

Scale:	1:150	A3	Client: ASTALDI SPA
	Date	Name	
drawn:	27/11/12	E.Martorella	DIGA QUEBEC
checked:	27/11/12	A.Leone	Project: LOWER CHURCHILL PROJECT
remark:	G.MARAN		POWERHOUSE
			HSB - H20 - SCB

Branch
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00185 Roma (RM)

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info@harsco-i.it
www.harsco-i.it

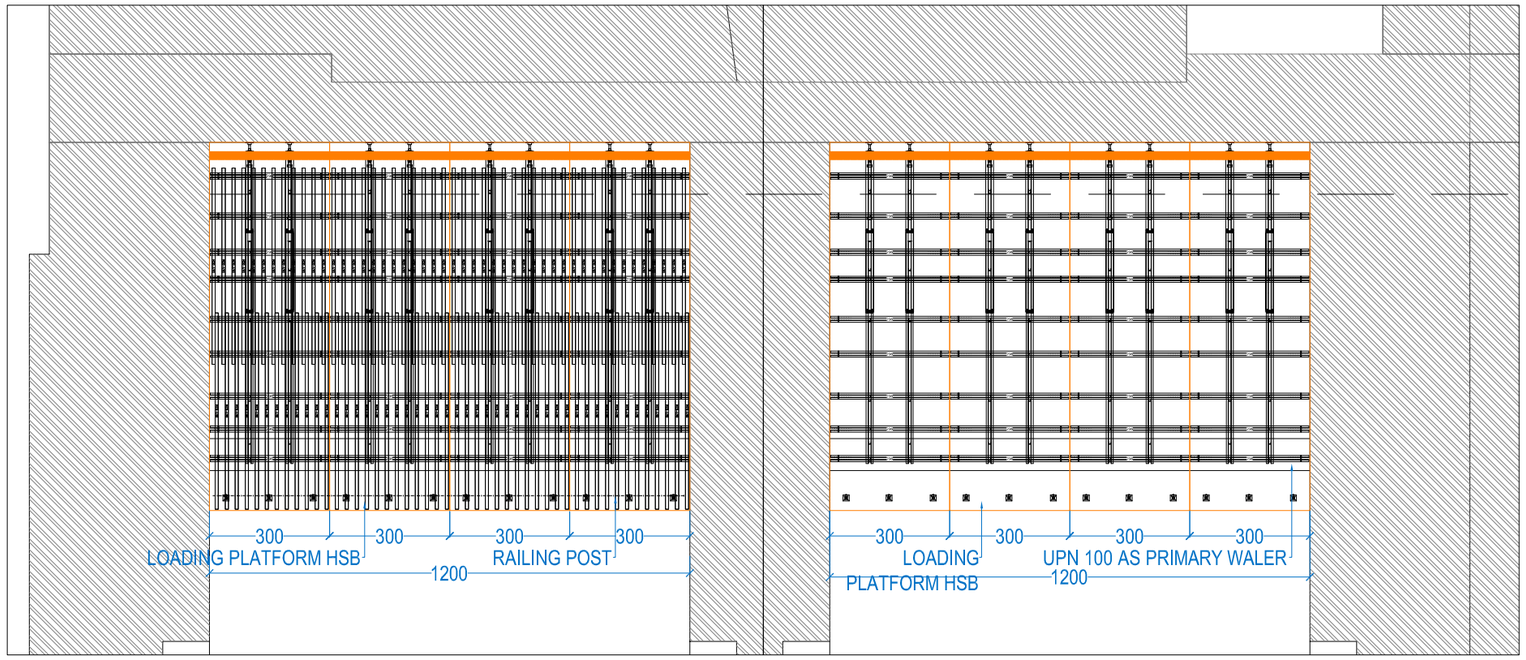
CAD-File: G_0511112_005_P.dwg

Drawing-No.: G_0511112_005_P 8/9

HARSCO

LOADING PLATFORM HSB - 8°TH PHASE

Scale: 1:150



KEY SECTION

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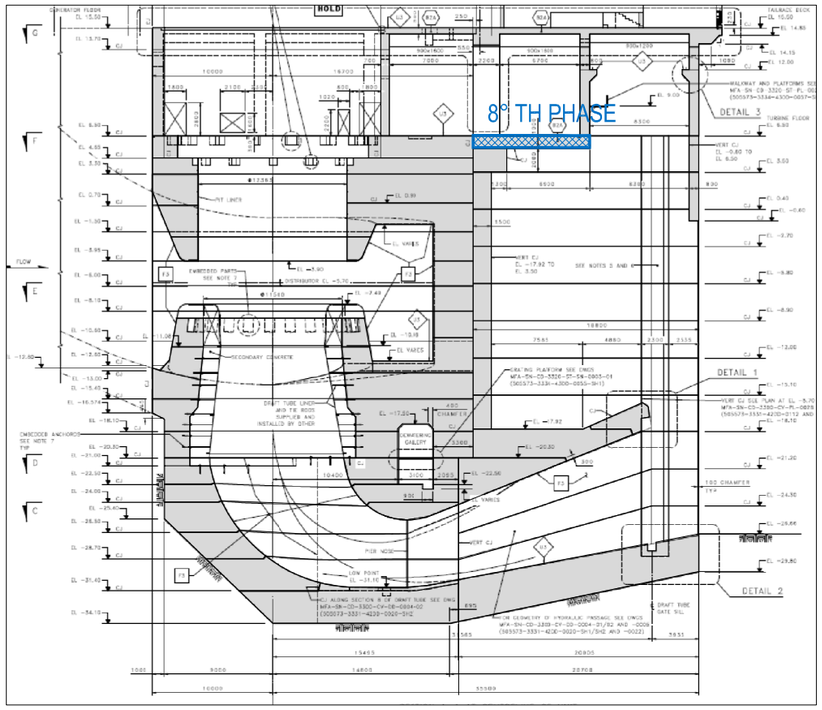
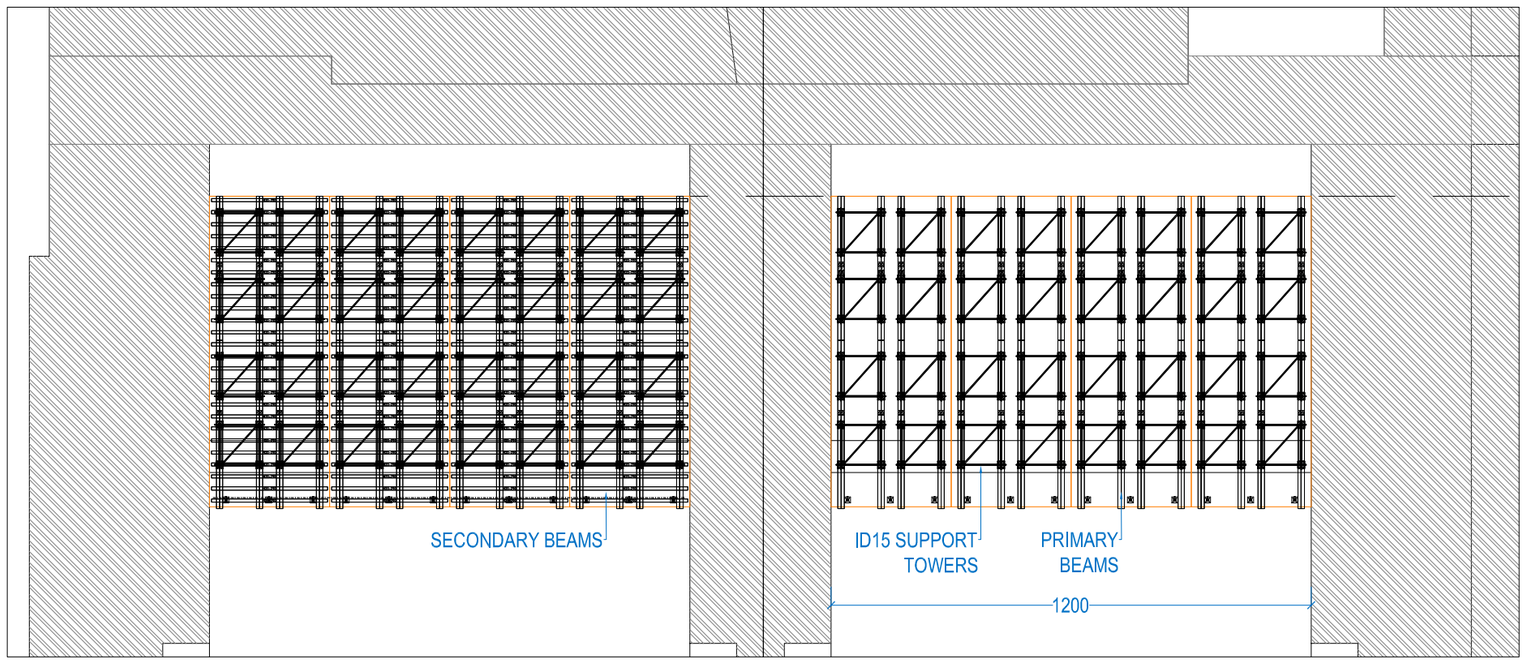


ID15 FRAMETOWERS COMPOSITION FLOOR PLANT 8° PHASE

Scale: 1:150



Index	Revision	Date	drawn:	checked:
0	EMISSIONE	27/11/12	E.Martorella	A.Leone

Preliminary drawing, not for construction

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Scale:	1:150	A3	Client: ASTALDI SPA
	Date	Name	
drawn:	27/11/12	E.Martorella	DIGA QUEBEC
checked:	27/11/12	A.Leone	Project: LOWER CHURCHILL PROJECT
remark:	G.MARAN		POWERHOUSE
			H20 - ID15 - HSB

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CAD-File: G_0511112_005_P.dwg

Drawing-No.: G_0511112_005_P 9/9

HARSCO

ASTALDI CANADA Inc.

nalcor energy

NALCOR ENERGY
LOWER CHURCHILL PROJECT
MUSKRAT FALLS

CONSTRUCTION OF INTAKE AND POWERHOUSE, SPILLWAY
AND TRANSITION DAMS

PACKAGE CH0007
CORE TECHNICAL PROPOSAL

APPENDIX A13
EXECUTION PLAN

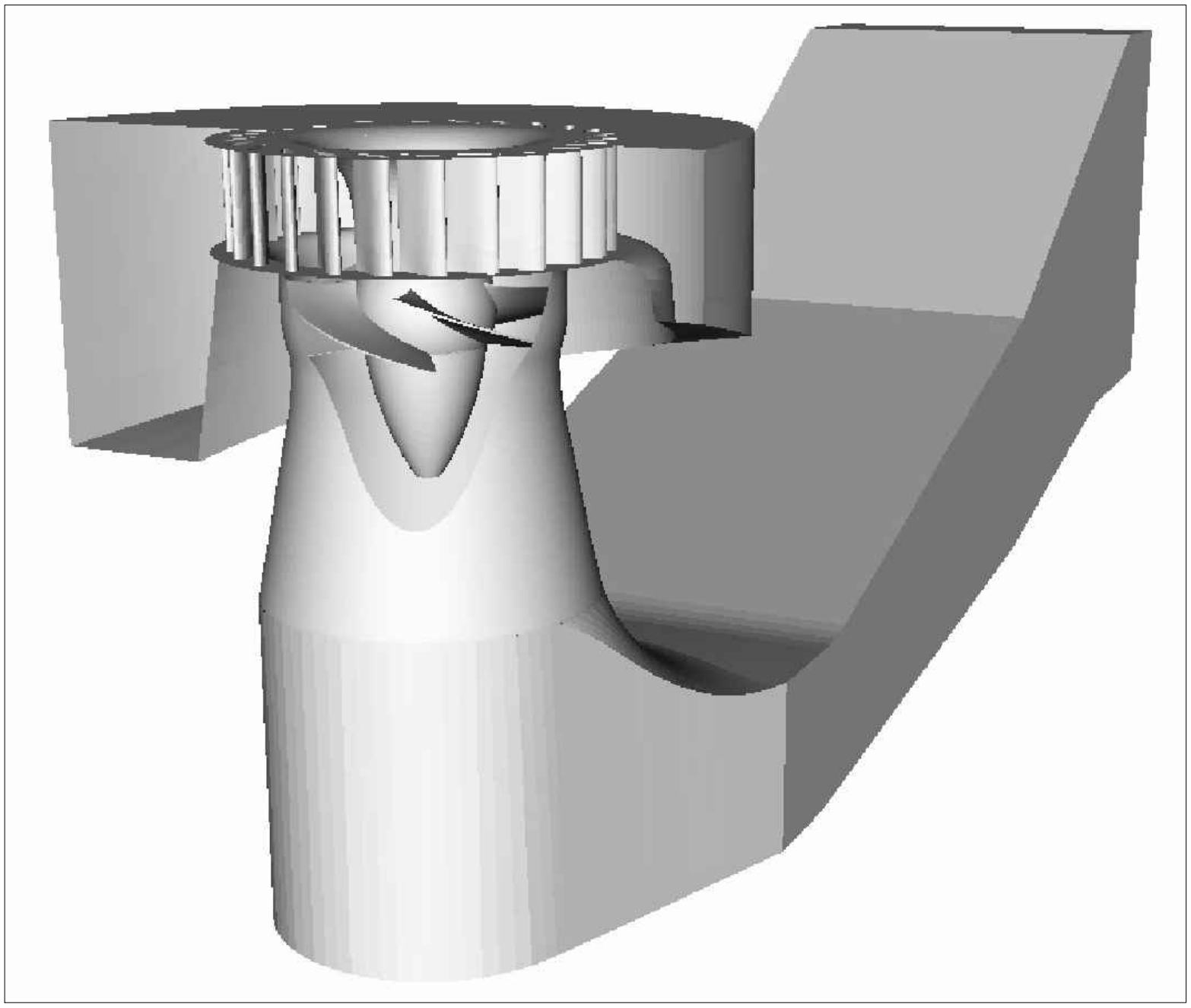
ATTACHMENT 36

FORMWORK - TURBINE DRAFT TUBE

April 16, 2013

LOWER CHURCHIL PROJECT - DRAFT TUBE

HARSCO INFRASTRUCTURE



0	Emissione	08/03/2013	E.Borghi	P.Colombo
Indice	Revisione	Data	Disegnato:	Controllato:

Disegno Preliminare

Le misure sono da verificare in cantiere.

I Prodotti Harsco Infrastructure Italia Spa restano di proprieta' della stessa e non sono divulgabili salvo autorizzazione.

Scala:	FS	Formato: A3	Cliente: ASTALDI SPA
	Date	Name	
Disegnato:	08/03/2013	E.Borghi	QUEBEC DAM
Controllato:	08/03/2013	P.Colombo	Progetto: LOWER CHURCHIL PROJECT
Approvato:	G.Maran		Draft TUBE
			Phases

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Harsco Infrastructure Italia Spa
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info@harsco-i.it
www.harsco-i.it

CAD-File: G_0511112Fasi da 1 a 3.dwg

Disegno-No.: G_0511112_010_P

Foglio 0/10

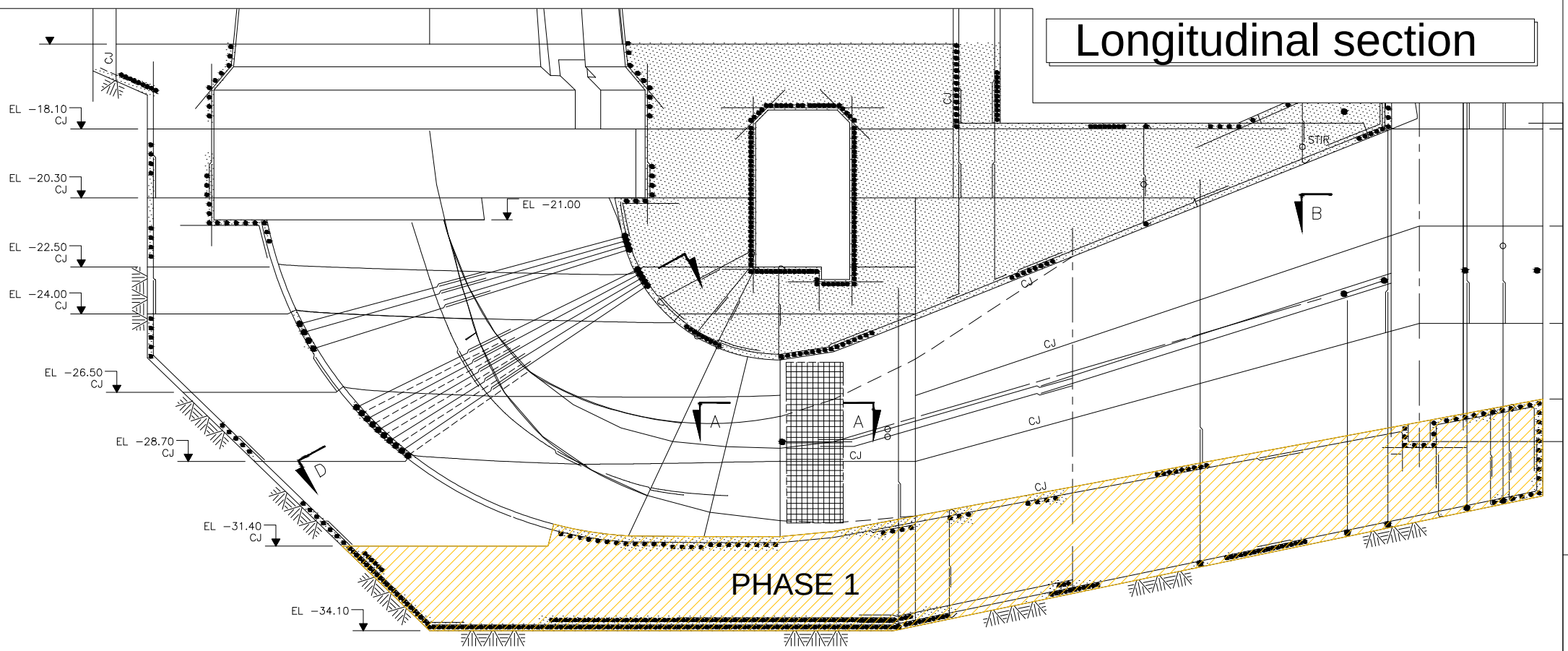
HARSCO INFRASTRUCTURE

A3 (420x297 mm) - HCAD

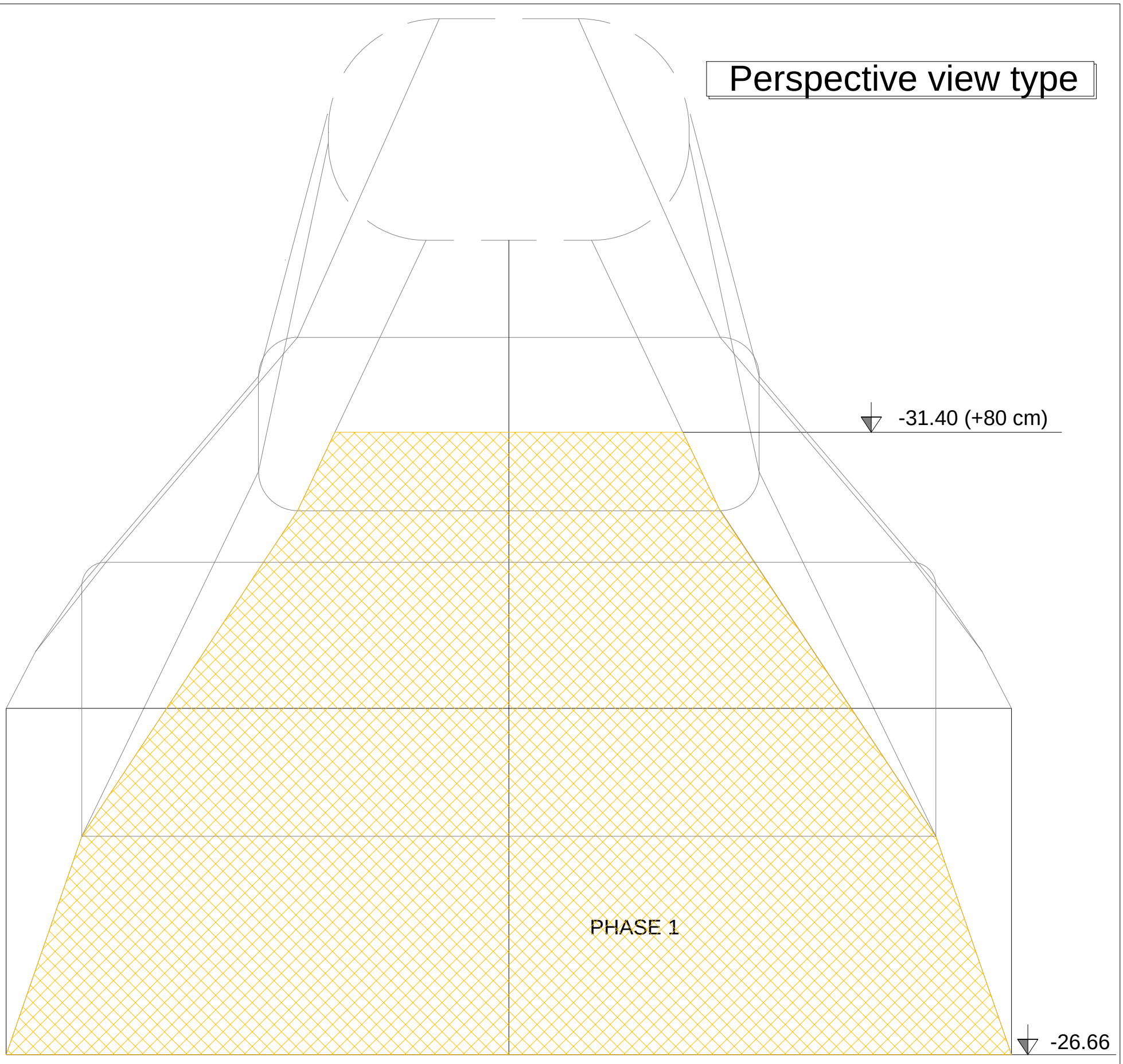
LOWER CHURCHIL PROJECT - DRAFT TUBE

HARSCO INFRASTRUCTURE

Longitudinal section



Perspective view type



PHASE 1

PHASE 1 : Casting slab bottom from Q.ta -26.66 a -31.40 (+ 80 cm)
without lateral zones curves fitting to the walls

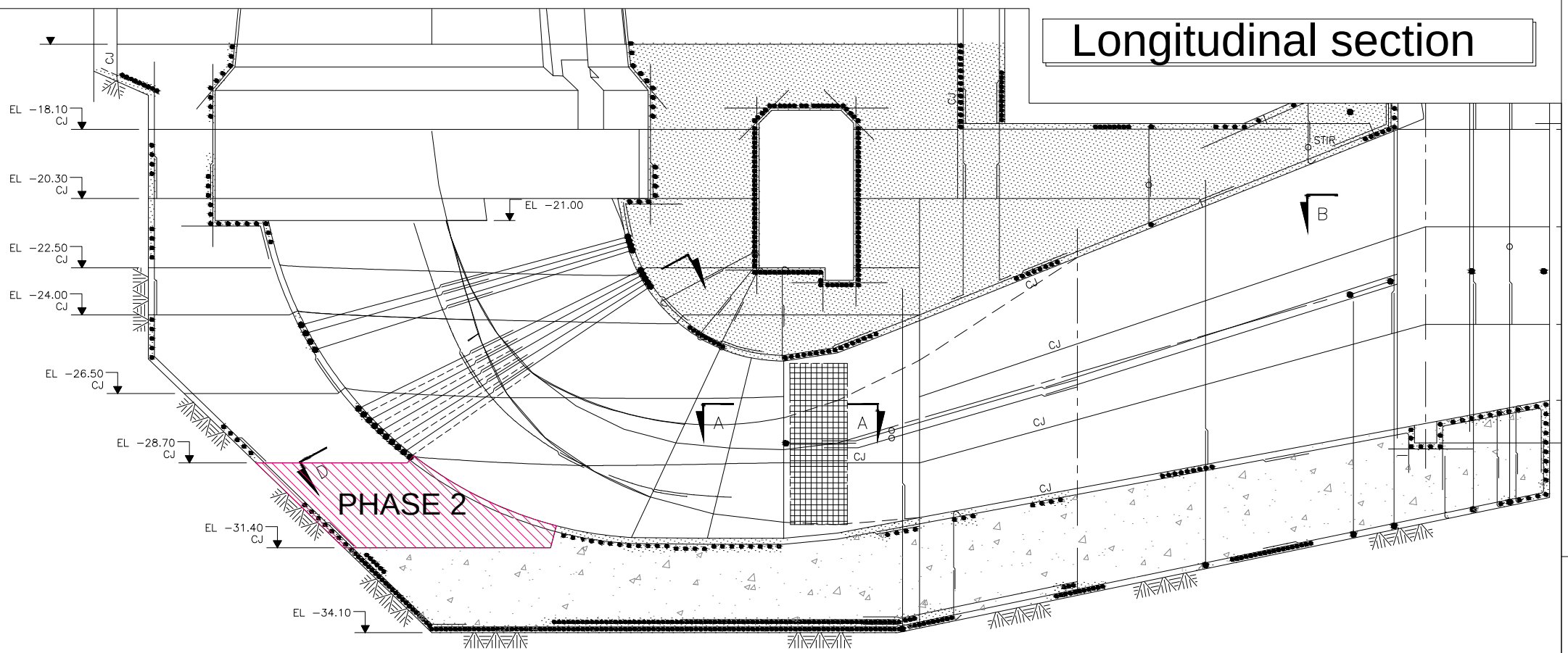
G_0511112_010_P Foglio 1/10

A3 (420x297 mm) - HCAD

LOWER CHURCHIL PROJECT - DRAFT TUBE

HARSCO INFRASTRUCTURE

Longitudinal section



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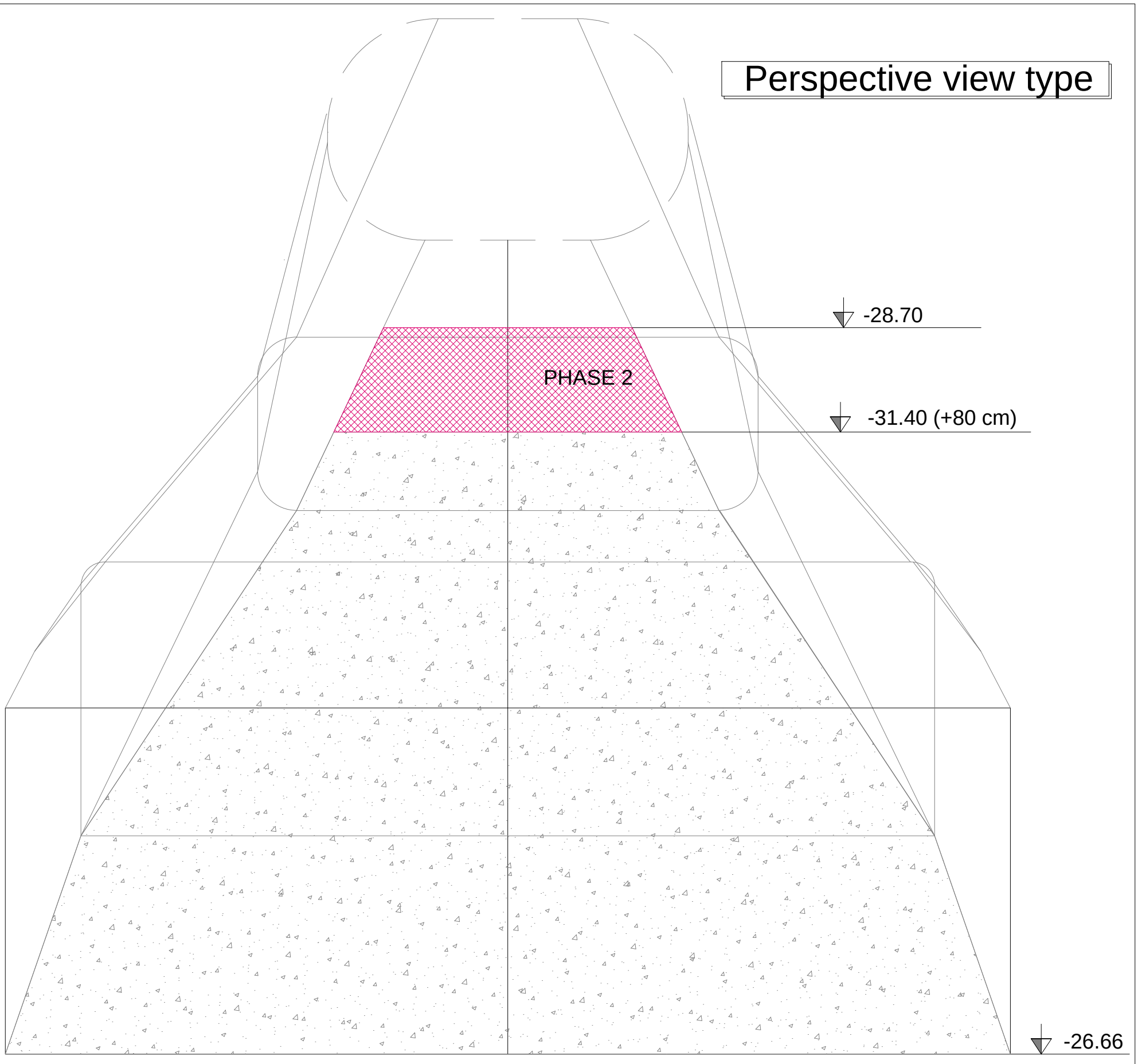


PHASE 2 : Casting slab bottom from Q.ta -31.40 (+ 80 cm) a -28.70
without lateral zones curves fitting to the walls

PHASE 2

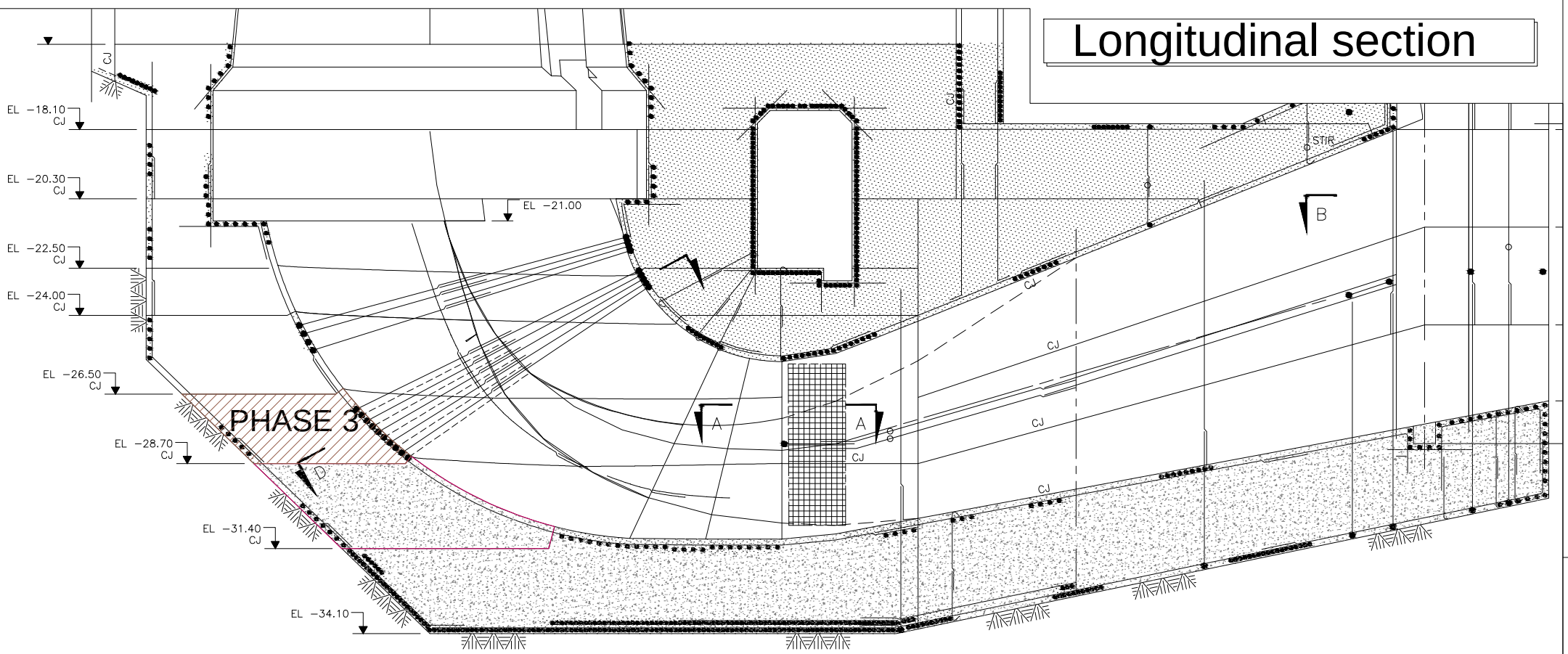
G_0511112_010_P Foglio 2/10

A3 (420x297 mm) - HCAD

LOWER CHURCHIL PROJECT - DRAFT TUBE

HARSCO INFRASTRUCTURE

Longitudinal section



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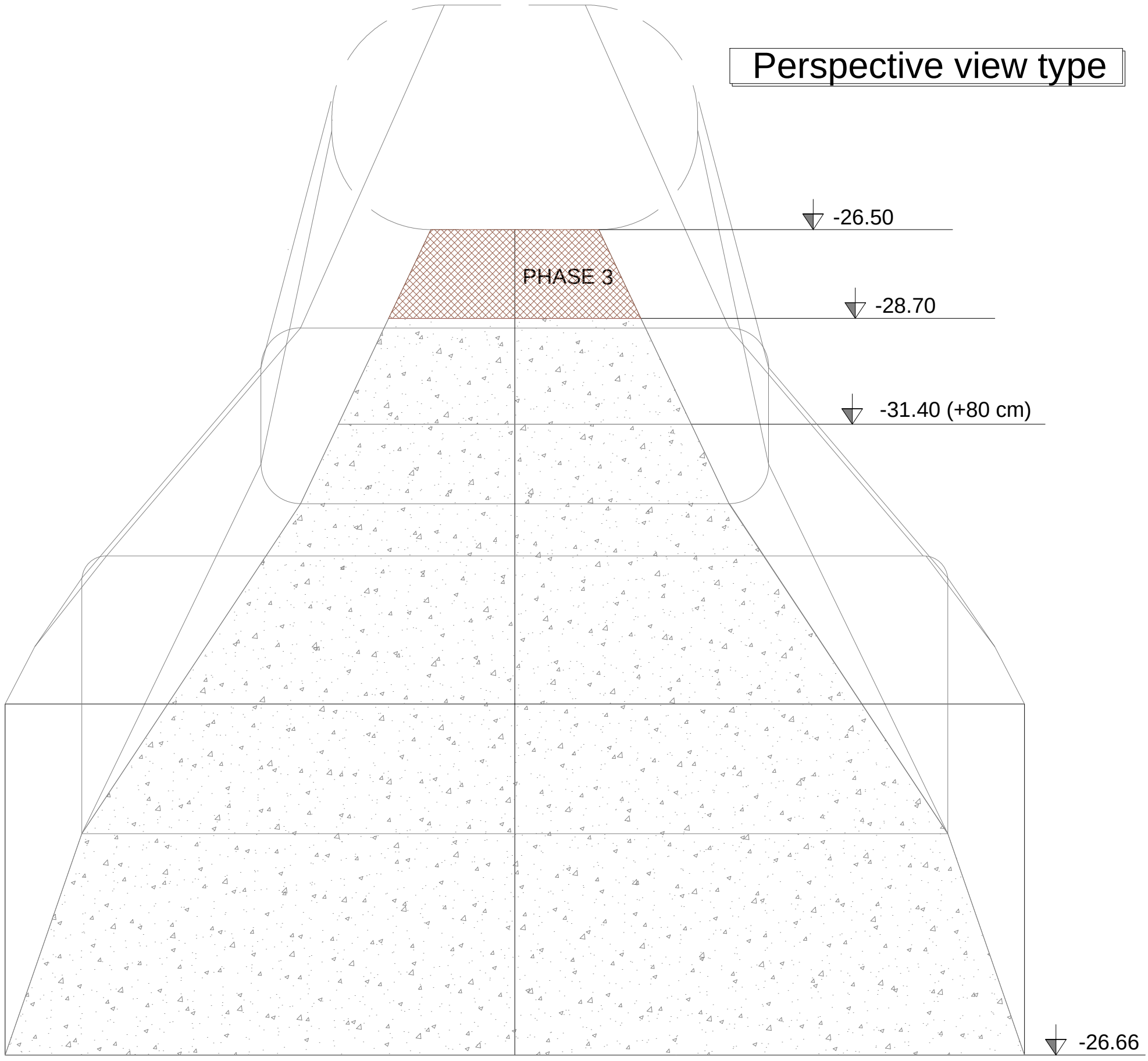


PHASE 3 : Casting slab bottom from Q.ta -28.70 a -26.50
senza zone laterali curve di raccordo alle pareti

PHASE 3

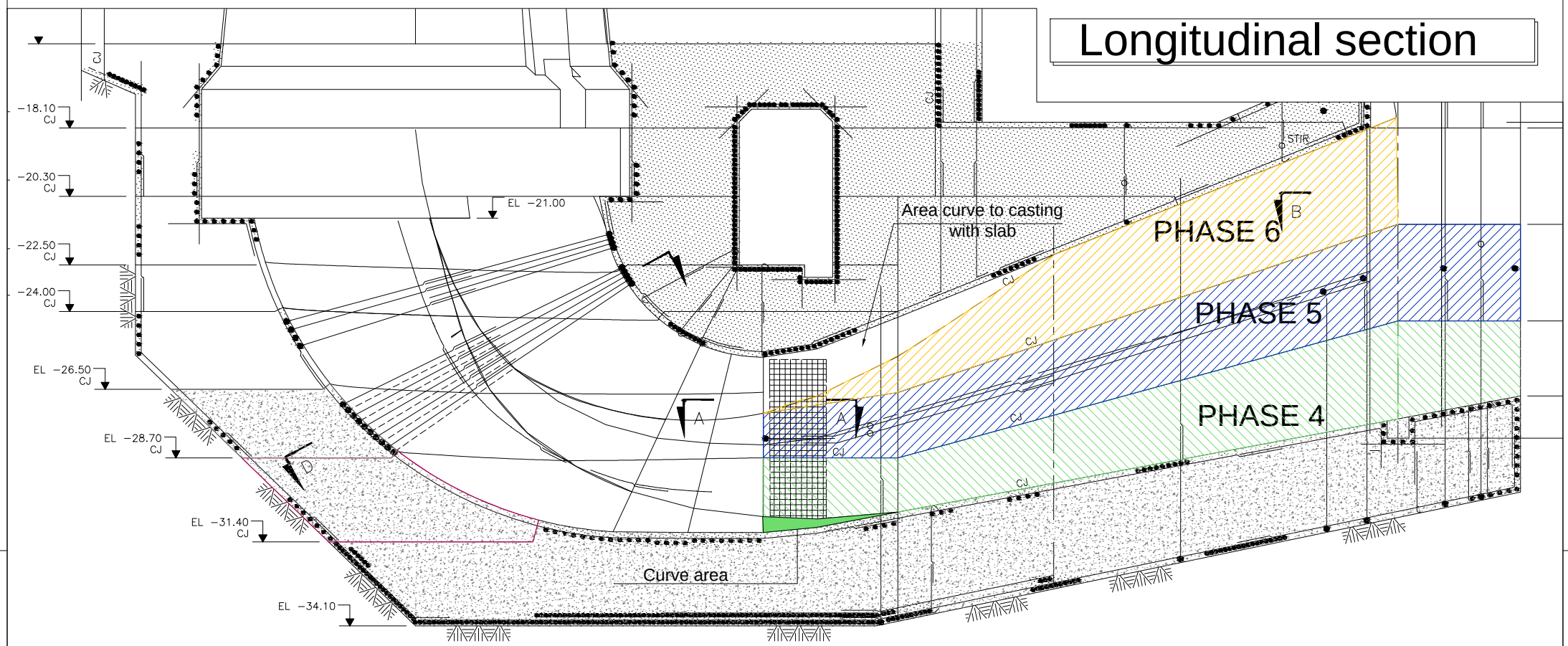
G_0511112_010_P Foglio 3/10

A3 (420x297 mm) - HCAD

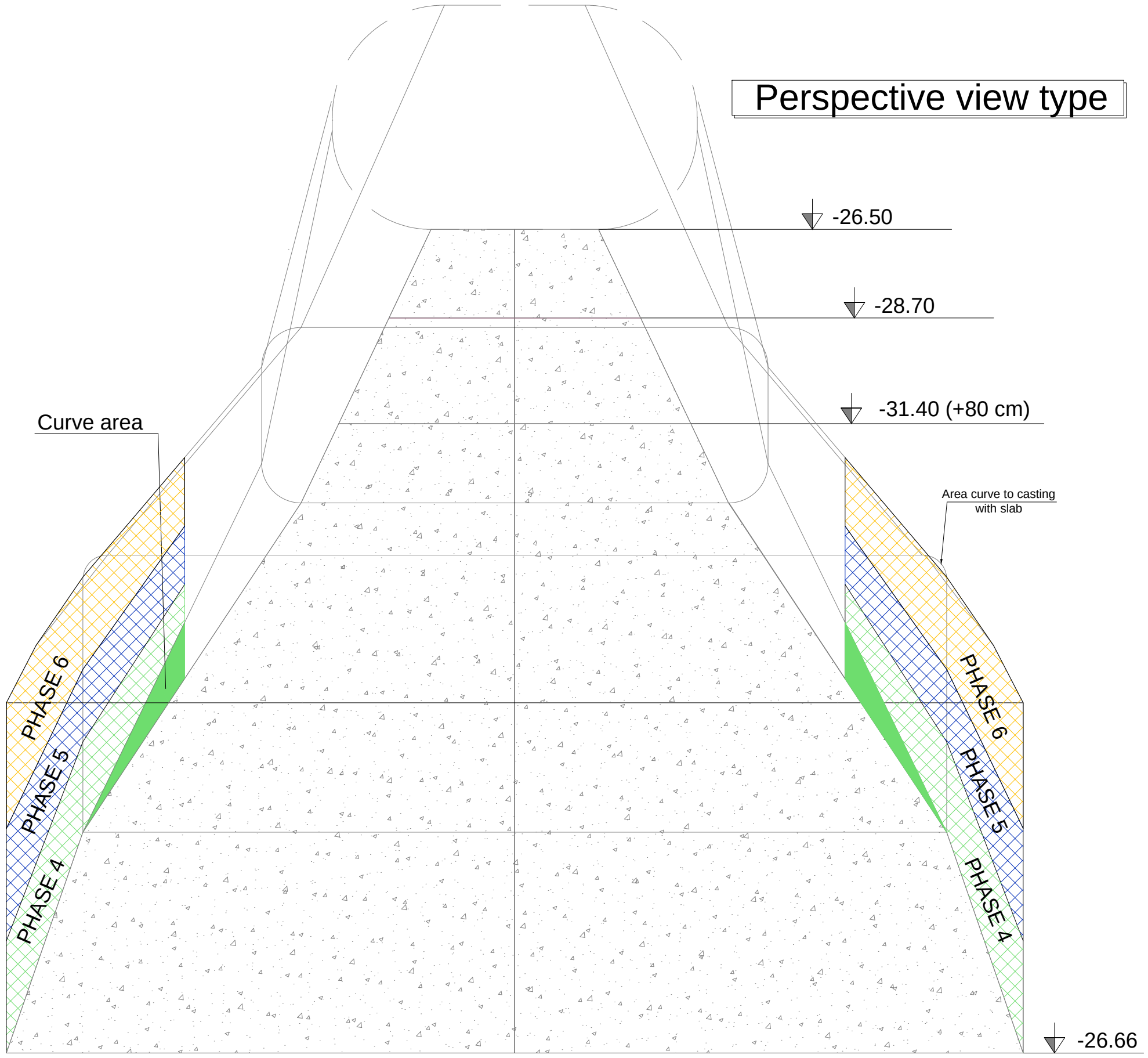
LOWER CHURCHIL PROJECT - DRAFT TUBE

HARSCO INFRASTRUCTURE

Longitudinal section



Perspective view type



PHASE 4 : Side walls and central Casting, the first step with a portion of the curved bottom

PHASE 5 : Side walls and central Casting, second step

PHASE 6 : Side walls and central Casting, third step

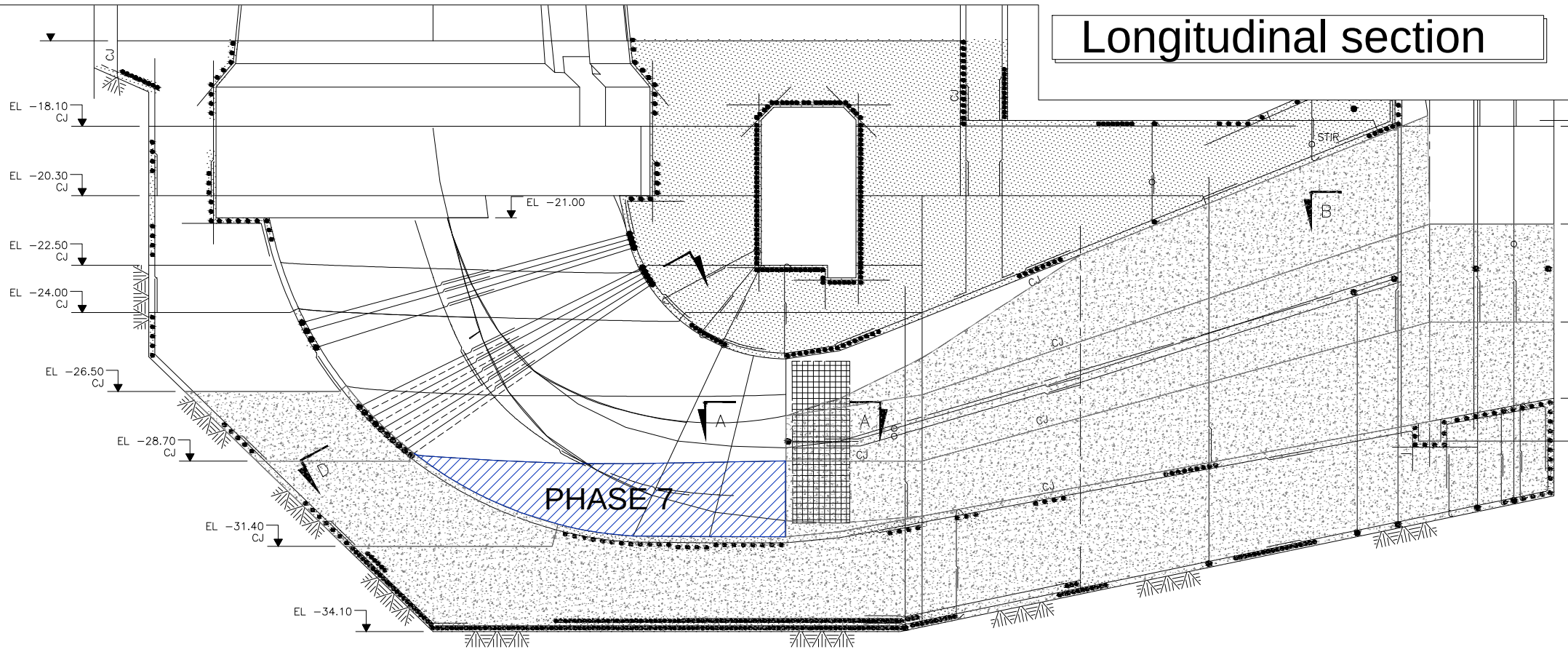
PHASE 4-5-6

A3 (420x297 mm) - HCAD

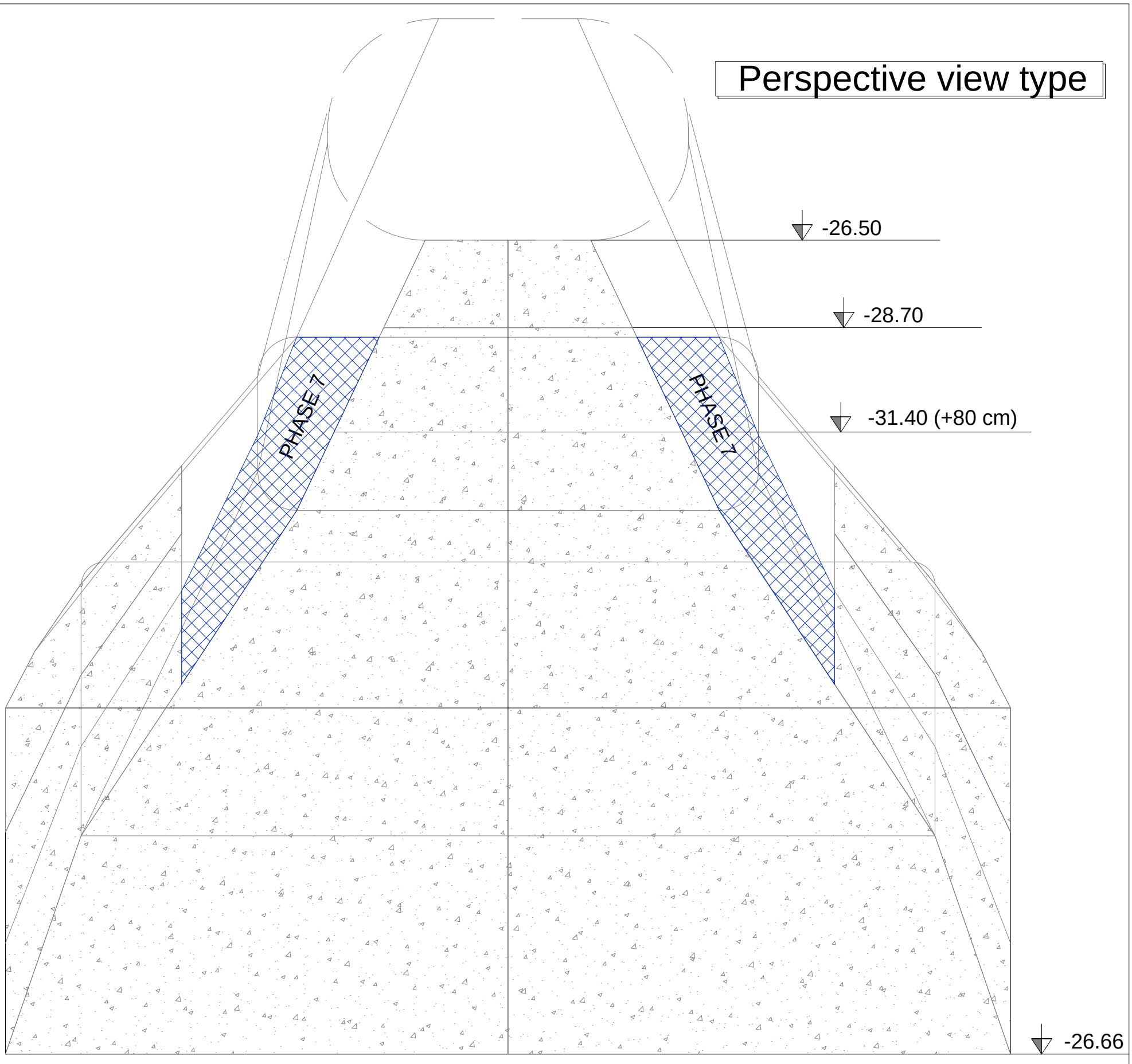
LOWER CHURCHIL PROJECT - DRAFT TUBE

HARSCO INFRASTRUCTURE

Longitudinal section



Perspective view type



PHASE 7 : Casting lateral walls of the curved bottom

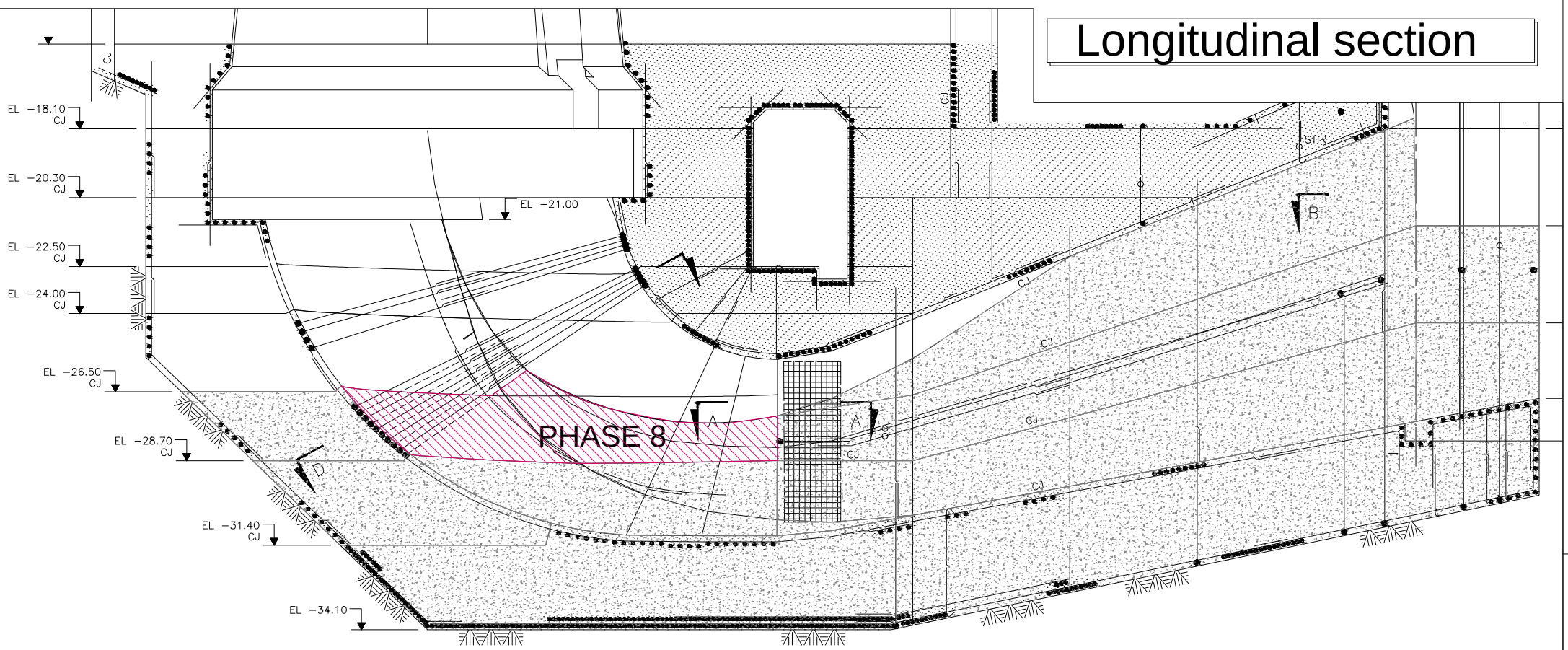
PHASE 7

A3 (420x297 mm) - HCAD

LOWER CHURCHIL PROJECT - DRAFT TUBE

HARSCO INFRASTRUCTURE

Longitudinal section



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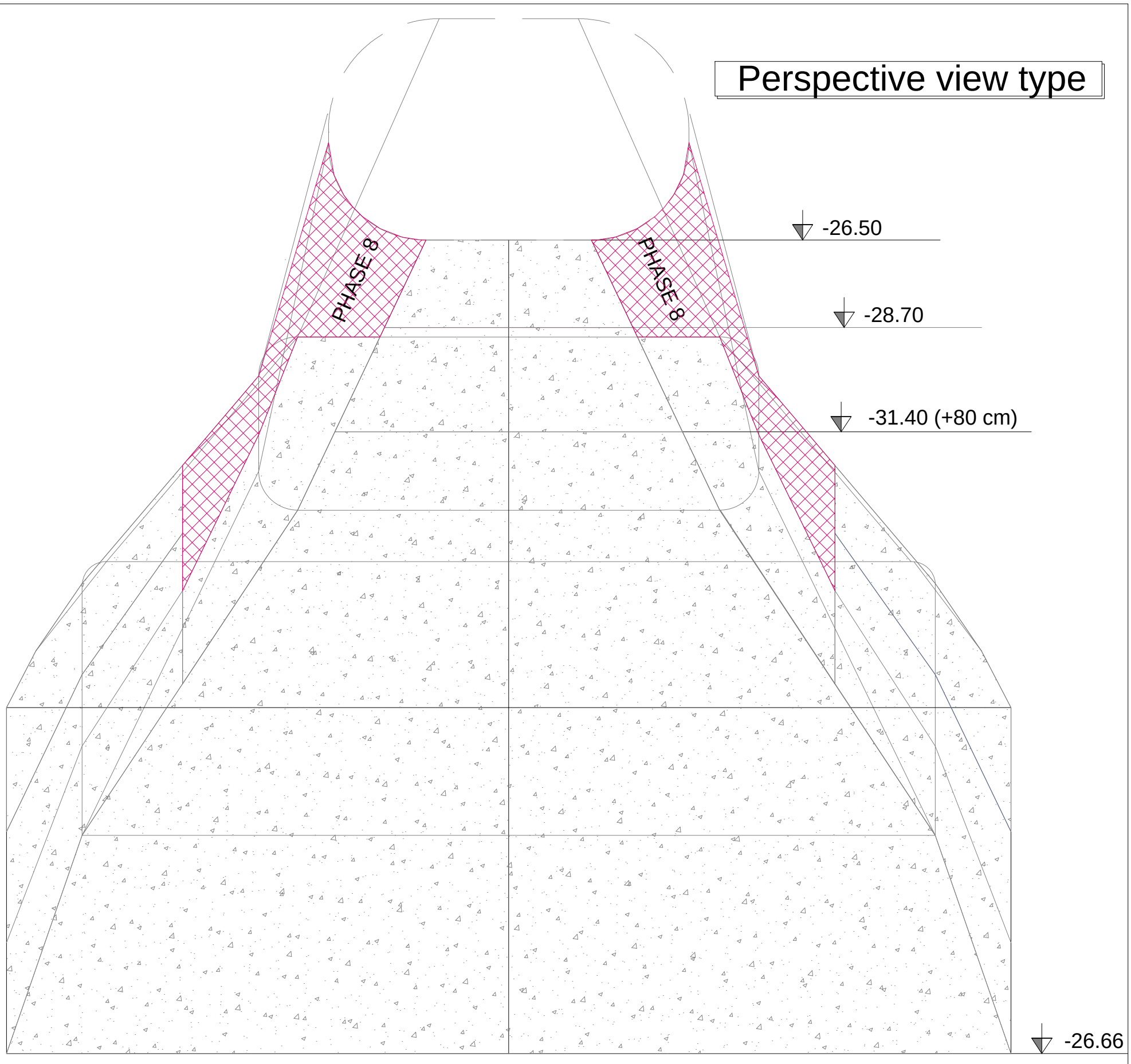


PHASE 8 : Casting lateral walls of the curved bottom

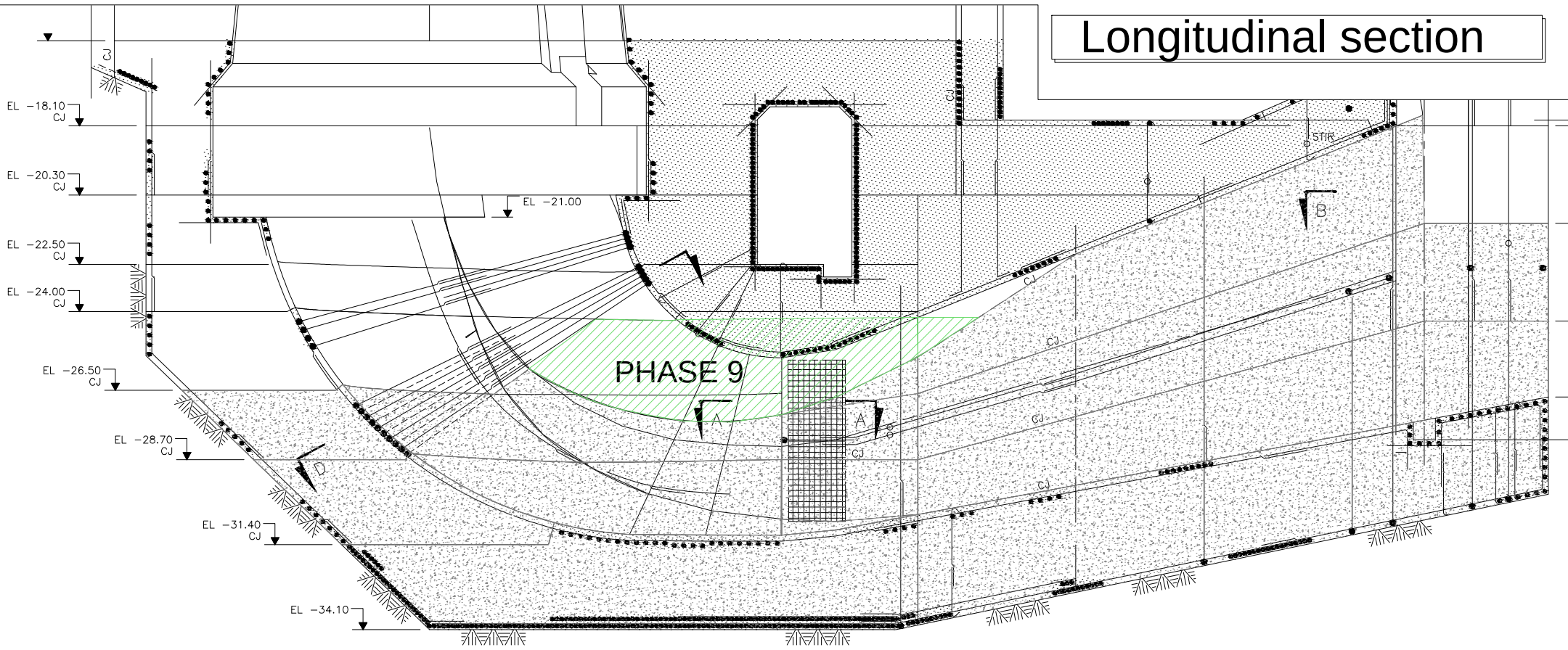
PHASE 8

A3 (420x297 mm) - HCAD

LOWER CHURCHIL PROJECT - DRAFT TUBE

HARSCO INFRASTRUCTURE

Longitudinal section



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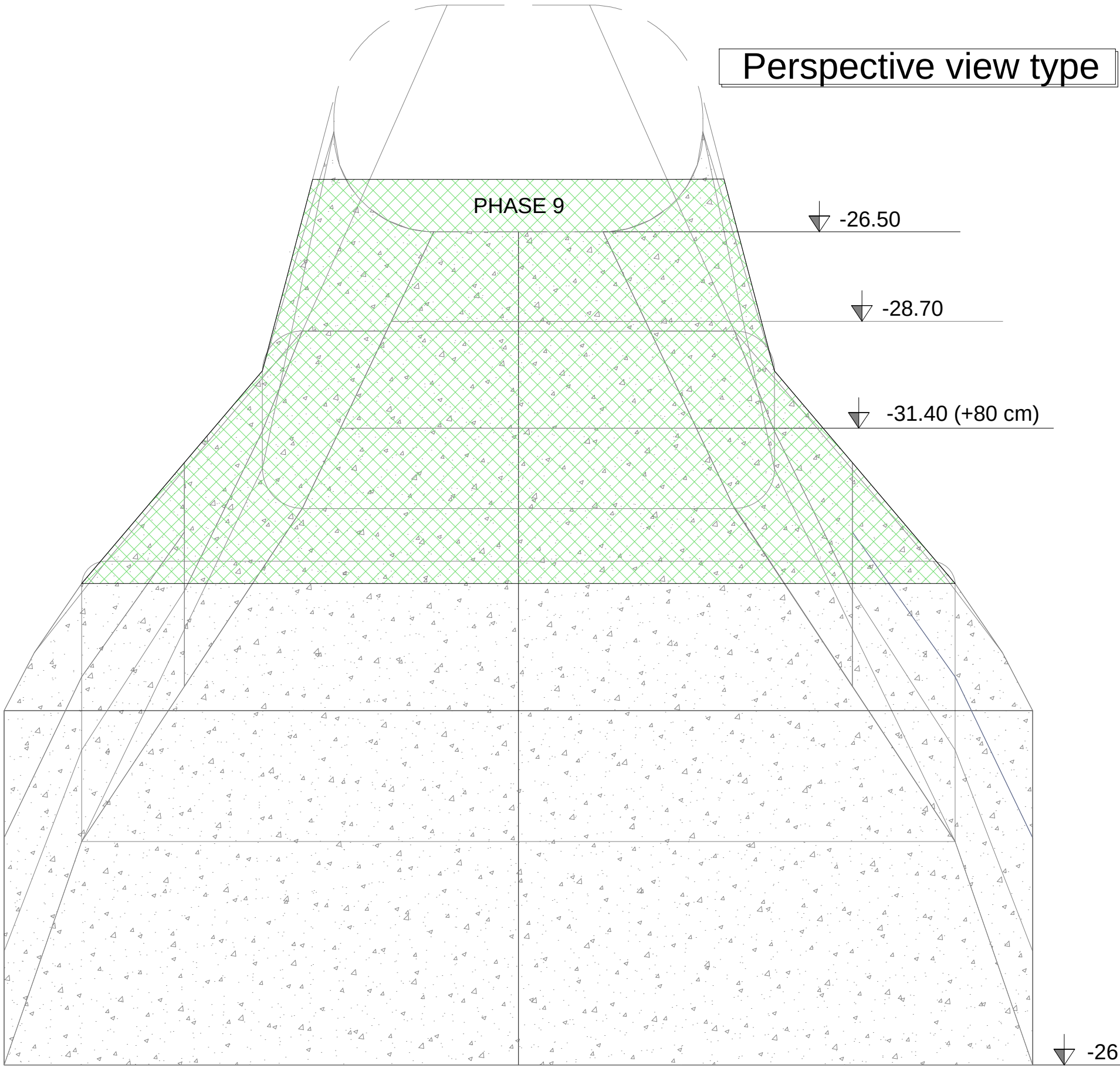


PHASE 9 : Casting walls and curved slab above

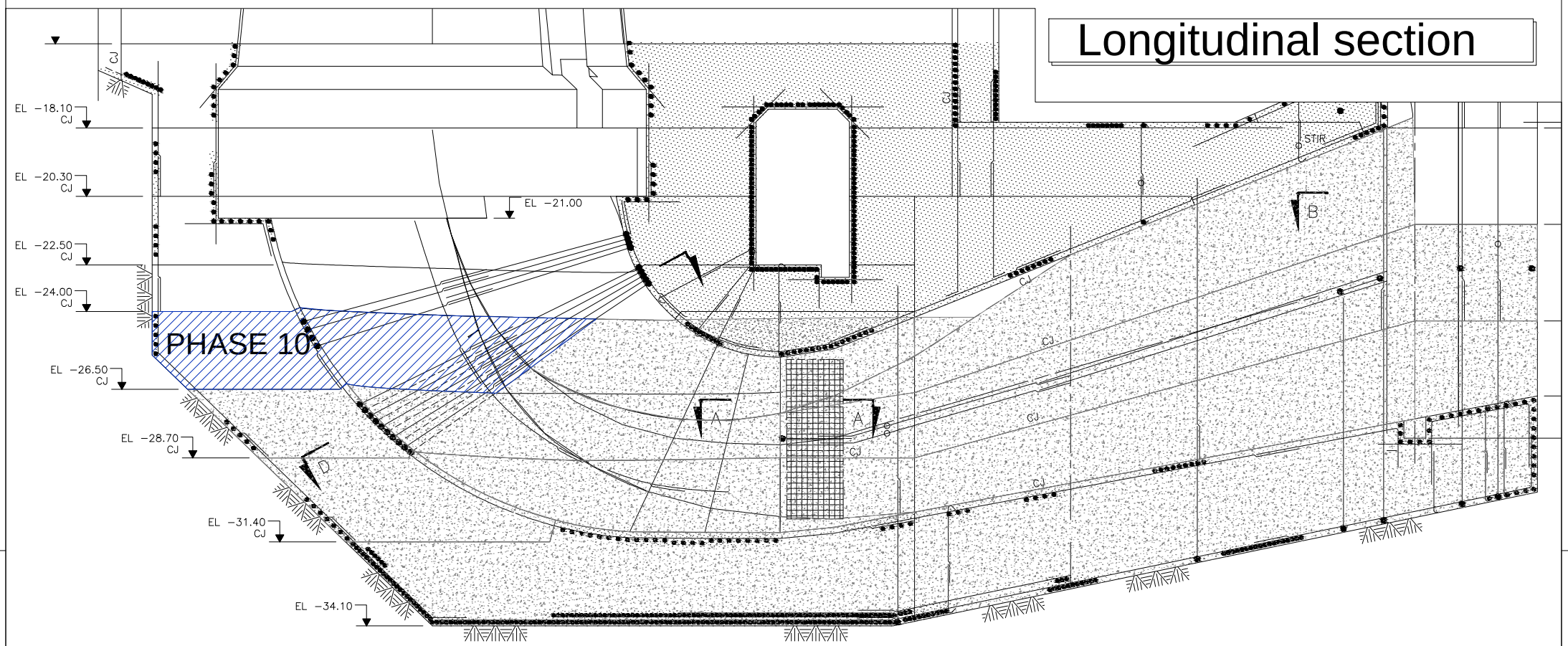
PHASE 9

A3 (420x297 mm) - HCAD

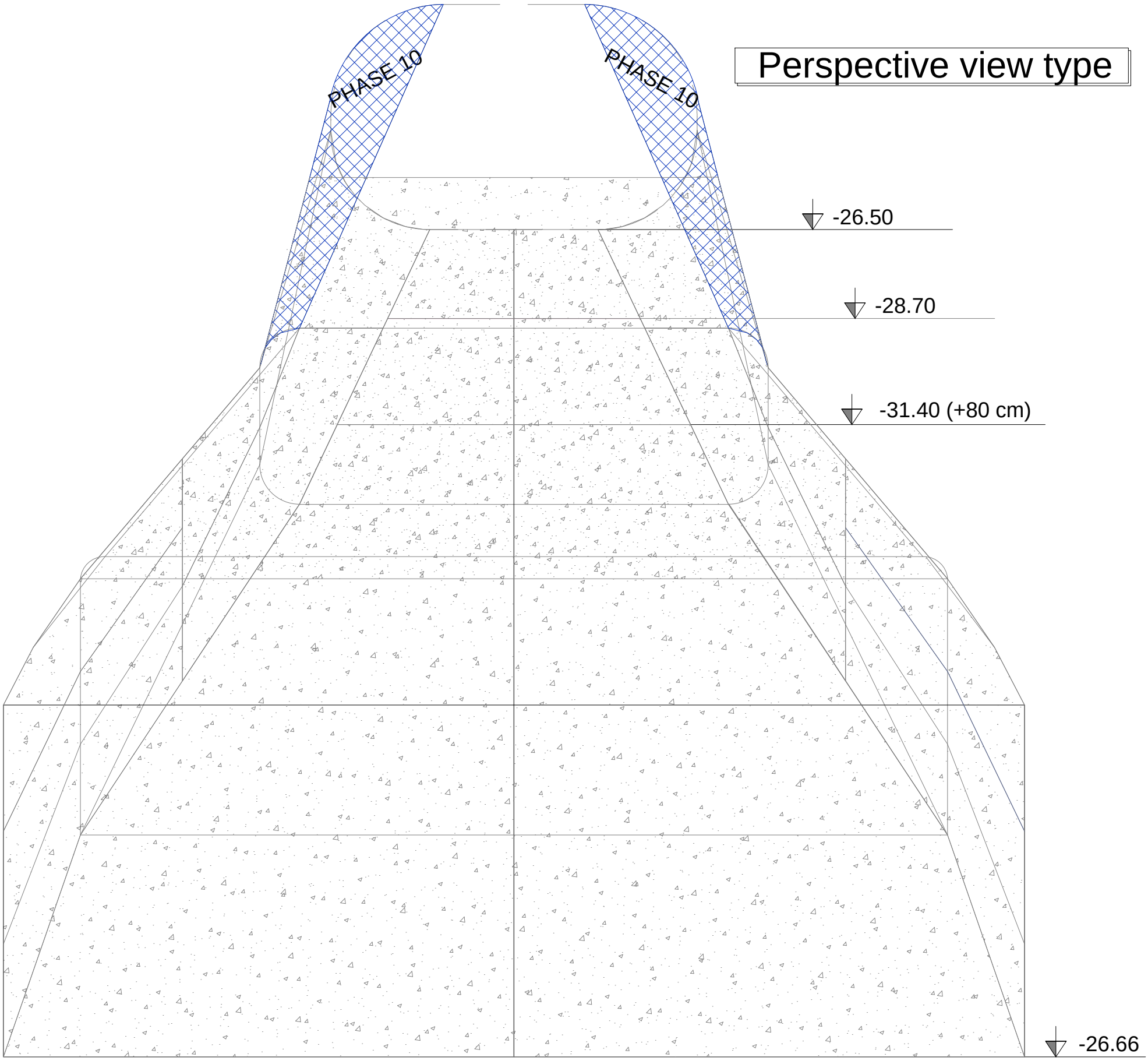
LOWER CHURCHIL PROJECT - DRAFT TUBE

HARSCO INFRASTRUCTURE

Longitudinal section



Perspective view type



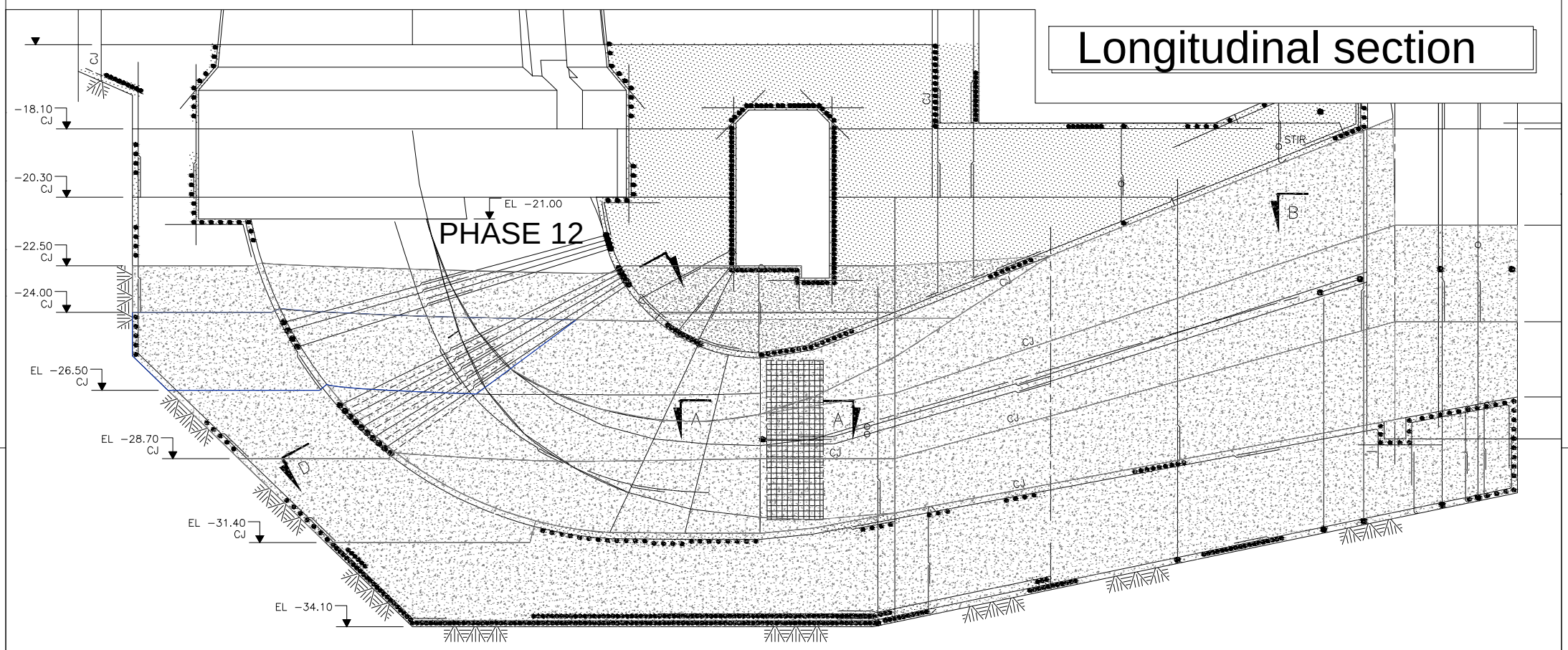
PHASE 10 : Casting upper walls curves

PHASE 10

A3 (420x297 mm) - HCAD

LOWER CHURCHIL PROJECT - DRAFT TUBE

HARSCO INFRASTRUCTURE



PHASE 12 : Casting till Q.ta -20.30

PHASE12

G_0511112_010_P Foglio 10/10

A3 (420x297 mm) - HCAD

NALCOR ENERGY
LOWER CHURCHILL PROJECT
MUSKRAT FALLS

CONSTRUCTION OF INTAKE AND POWERHOUSE, SPILLWAY
AND TRANSITION DAMS

PACKAGE CH0007
CORE TECHNICAL PROPOSAL

APPENDIX A13
EXECUTION PLAN

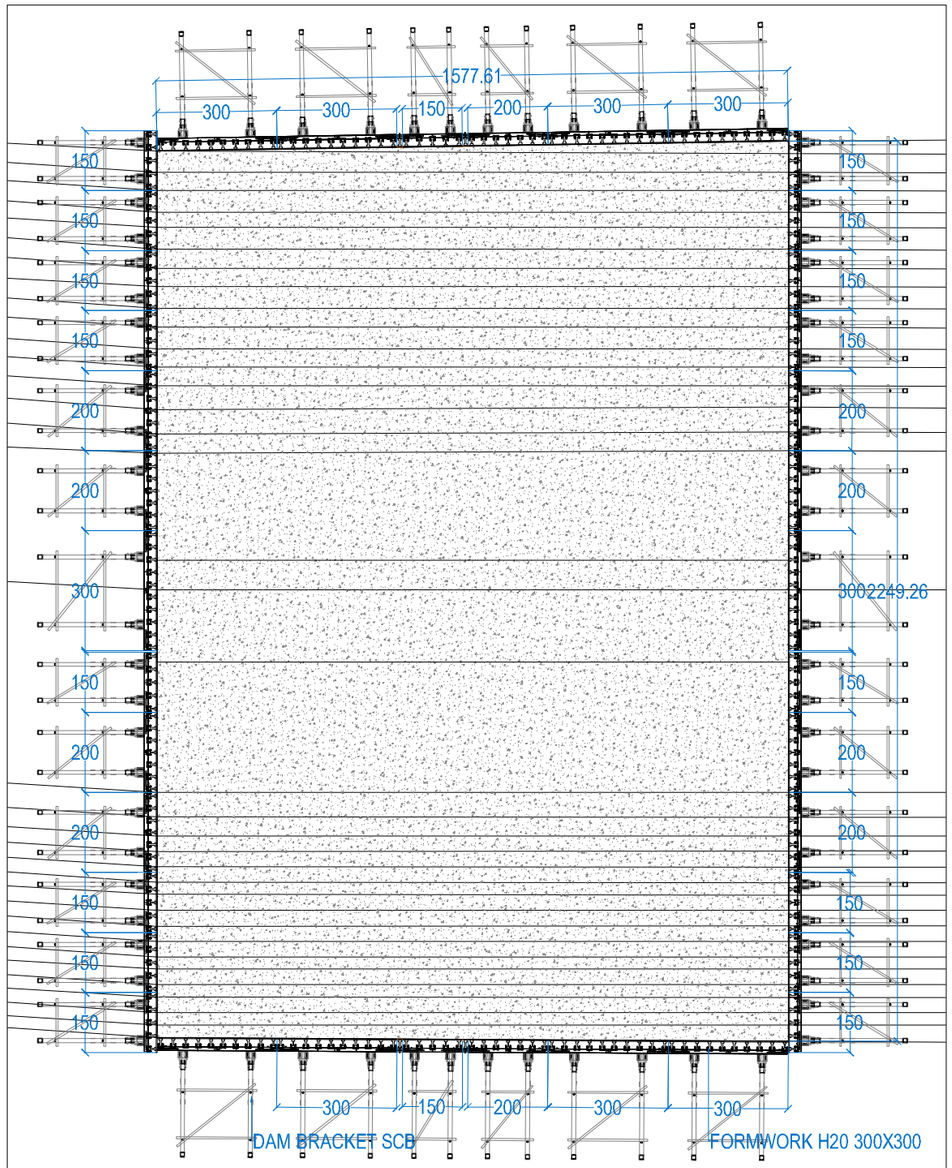
ATTACHMENT 37

FORMWORK - TRANSITION DAMS

April 16, 2013

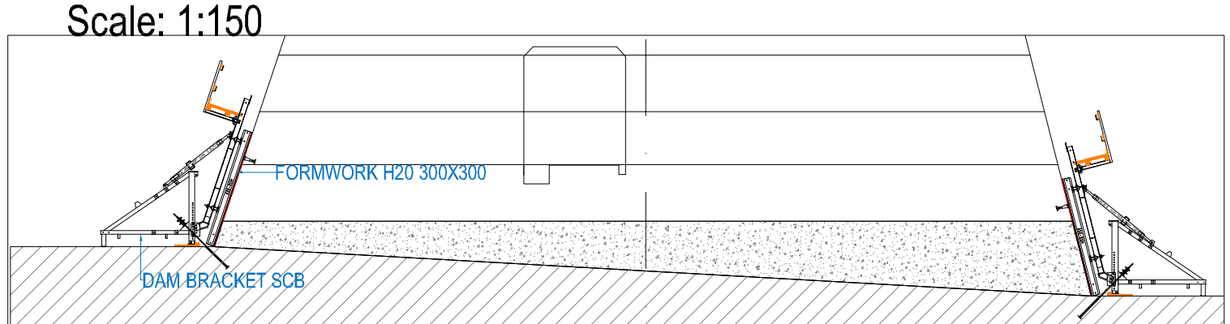
EQUIPMENT PLANT

Scale: 1:150



SECTION 1 - 1

Scale: 1:150



KEY PLANT

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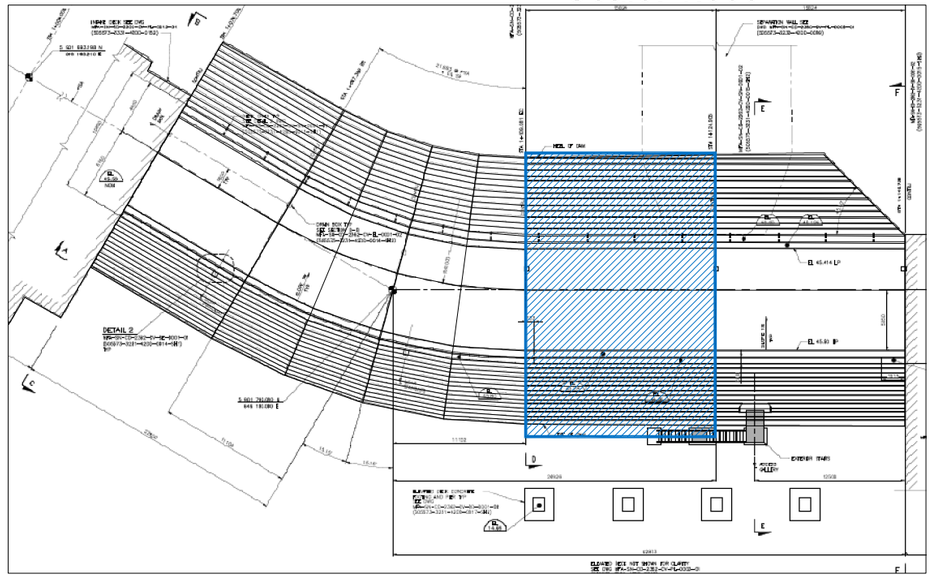

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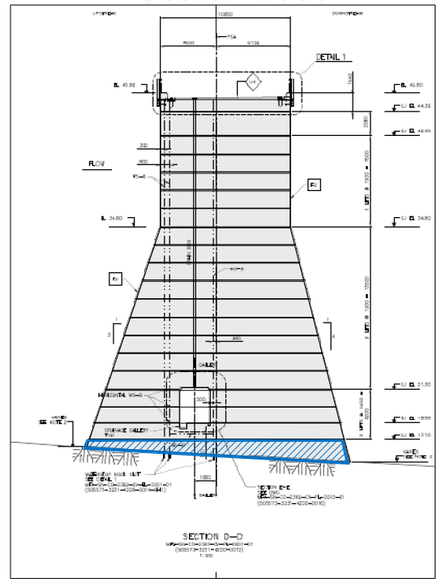

PROPOSED EQUIPMENT		
DESCRIPTION		QUANTITY
H20 UNITS	MODULO 150X300	18
	MODULO 200X300	10
	MODULO 300X300	10
SCB UNITS (ONE PAIR BRACKETS)	MODULO 150	18
	MODULO 200	10
	MODULO 300	10

Index	Revision	Date	drawn:	checked:
0	EMISSIONE	27/11/12	E.Martorella	A.Leone

Preliminary drawing, not for construction

This drawing is valid only with the associated assembly instructions. Measurements have to be verified on site.

Scale:	1:150	A3	Client: ASTALDI SPA
	Date	Name	
drawn:	27/11/12	E.Martorella	DIGA QUEBEC
checked:	27/11/12	A.Leone	Project: LOWER CHURCHILL PROJECT
remark:	G.MARAN		CENTRE TRANSITION DAMS
			H20 - SCB

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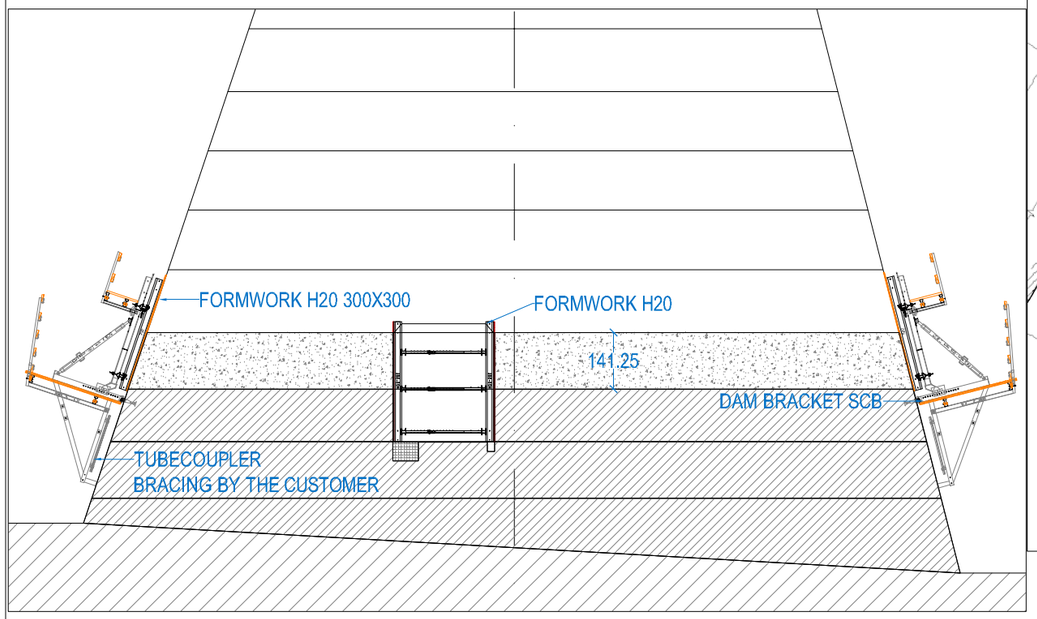
CAD-File: G_0511112_001_P.dwg

Drawing-No.: G_0511112_001_P 1/7

HARSCO

SECTION 1 - 1 - 4° PHASE

Scale: 1:150



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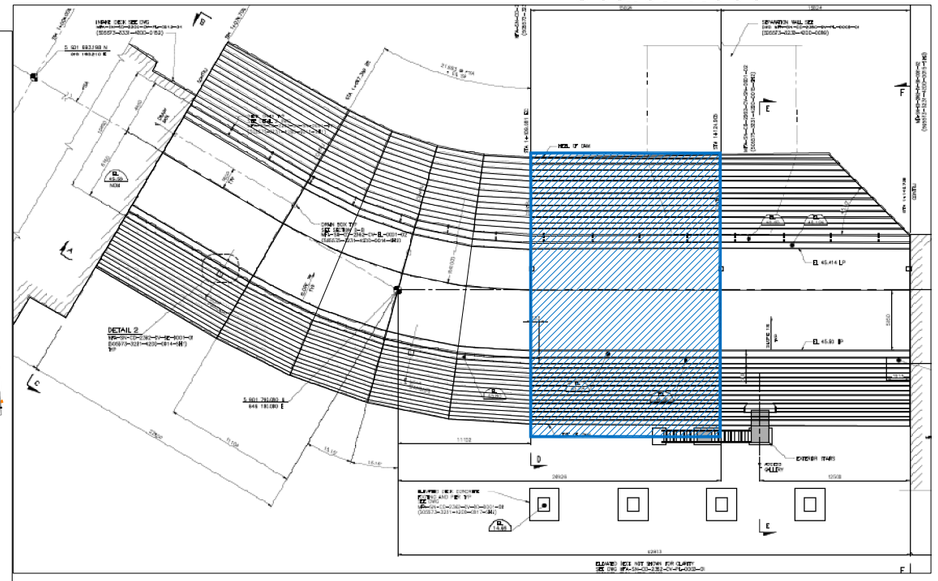

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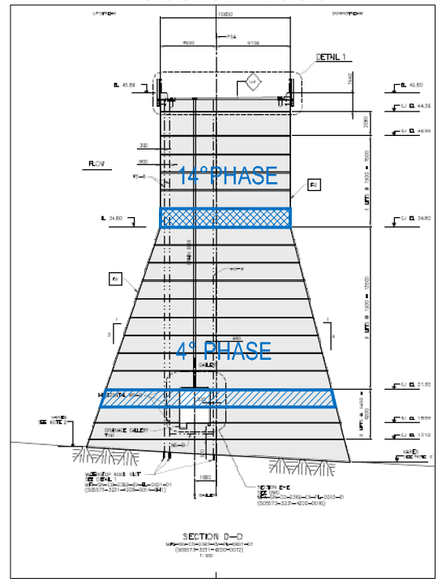

SECTION 1 - 1 - 14° PHASE

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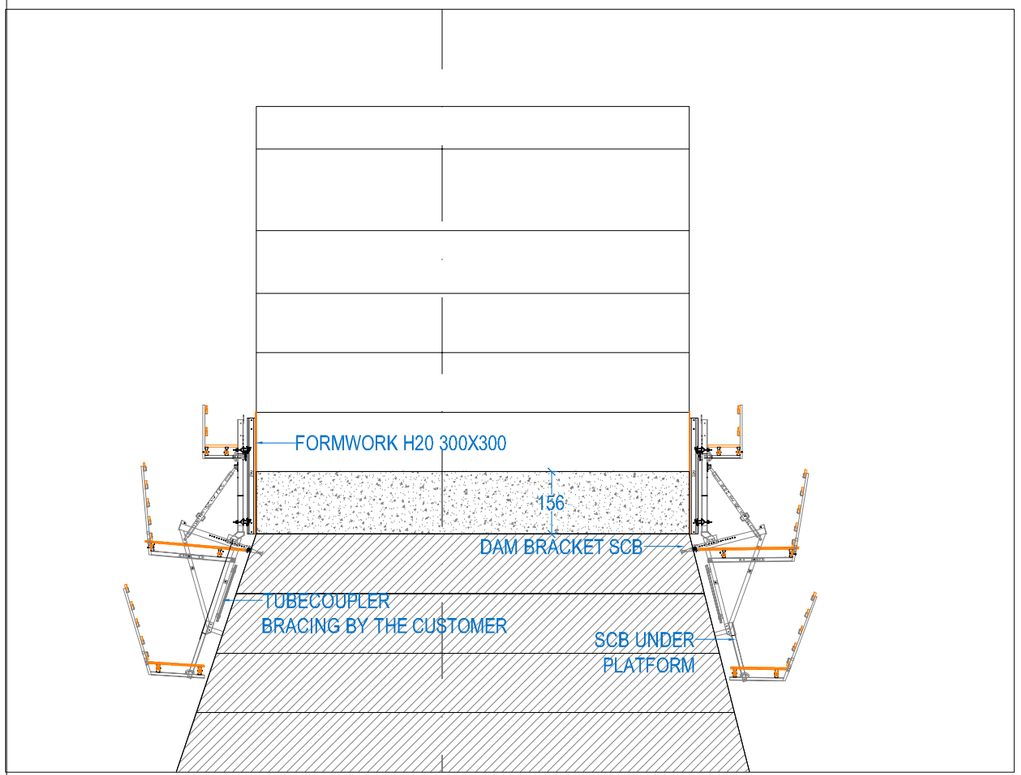

Index	Revision	Date	drawn:	checked:
0	EMISSIONE	27/11/12	E.Martorella	A.Leone

Preliminary drawing, not for construction

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	Date	Name	
drawn:	27/11/12	E.Martorella	DIGA QUEBEC
checked:	27/11/12	A.Leone	Project: LOWER CHURCHILL PROJECT
remark:	G.MARAN		CENTRE TRANSITION DAMS
			H20 - SCB

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www.harsco-i.it

CAD-File: G_0511112_001_P.dwg

Drawing-No.: G_0511112_001_P 2/7

HARSCO

SECTION 1 - 1 - 4° PHASE
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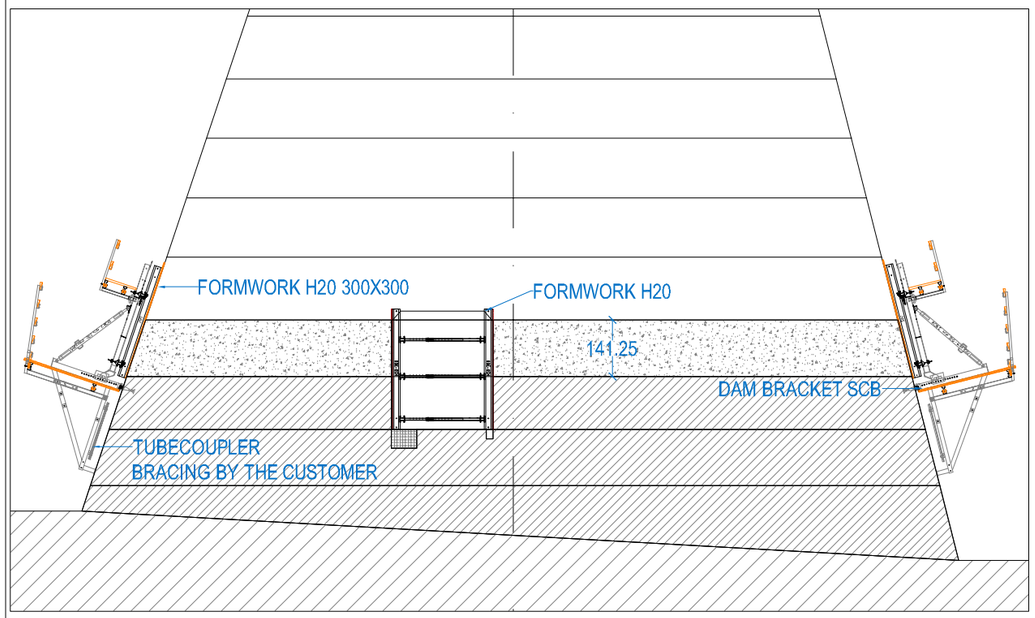

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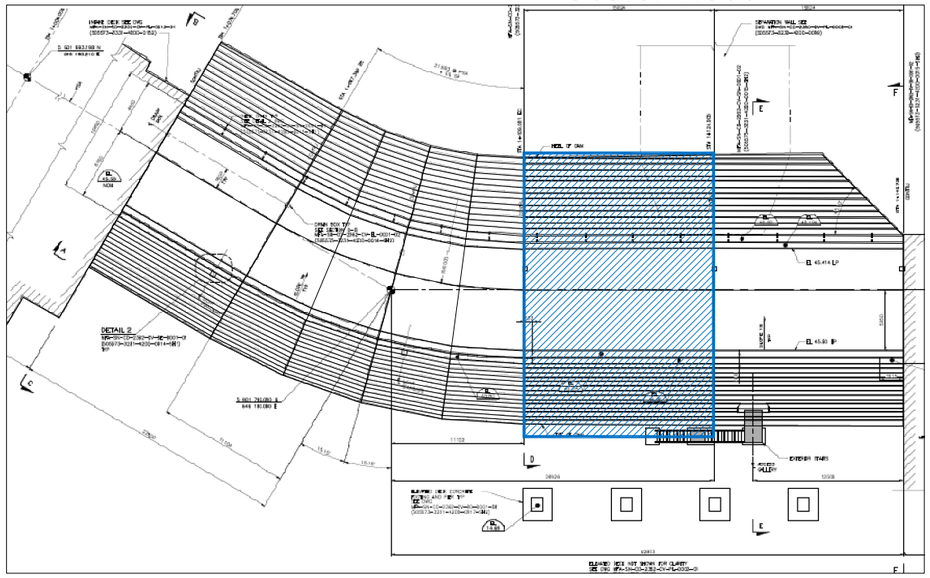

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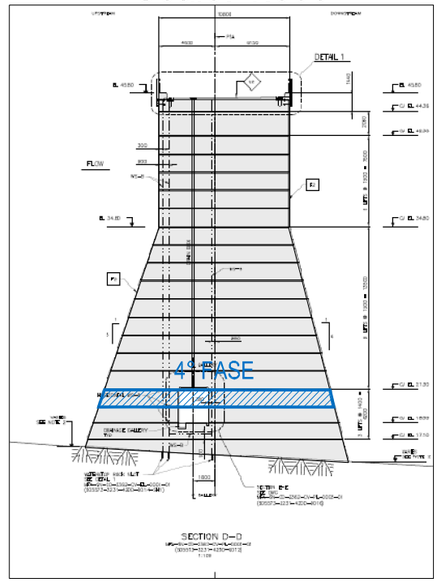
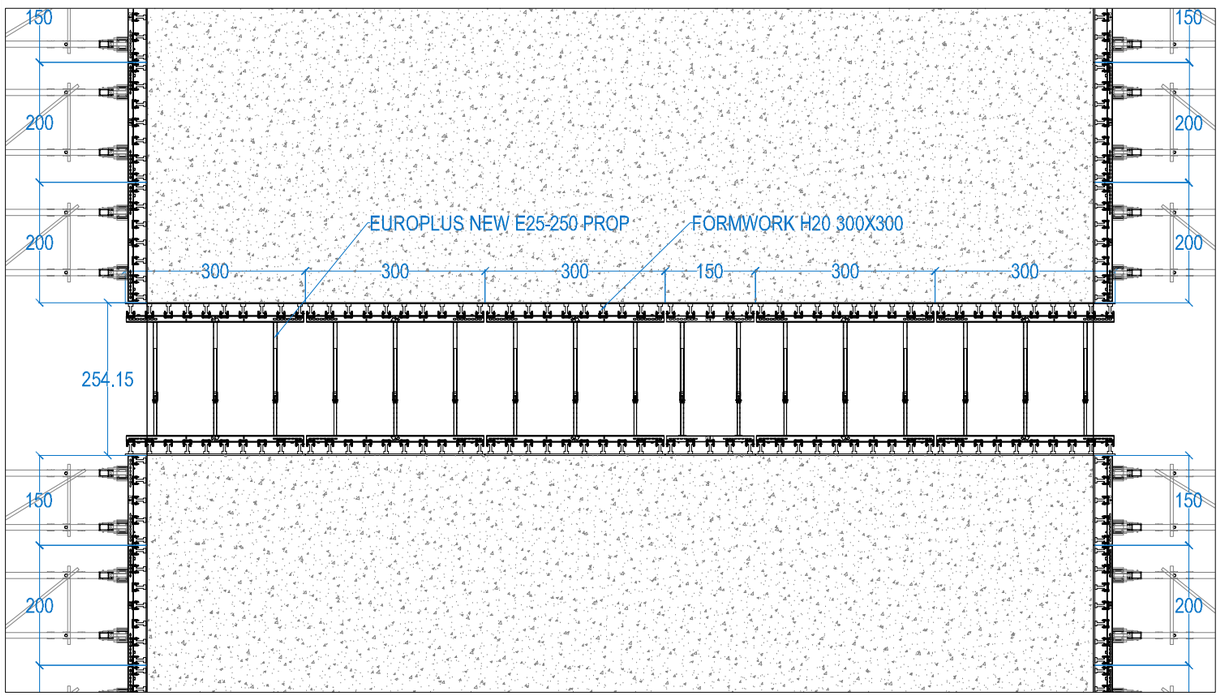


EQUIPMENT PLANT FOR TUNNEL
Scale: 1:100



PROPOSED EQUIPMENT		
DESCRIPTION		QUANTITY
H20 UNITS	MODULO 150X300	2
	MODULO 200X300	0
	MODULO 300X300	10
EUROPLUS NEW E25-250 PROP		60

Index	Revision	Date	drawn:	checked:
0	EMISSIONE	27/11/12	E.Martorella	A.Leone

Preliminary drawing, not for construction

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Scale:	1:150	A3	Client: ASTALDI SPA
	Date	Name	
drawn:	27/11/12	E.Martorella	DIGA QUEBEC
checked:	27/11/12	A.Leone	Project: LOWER CHURCHILL PROJECT
remark:	G.MARAN		CENTRE TRANSITION DAMS
			H20 - SCB

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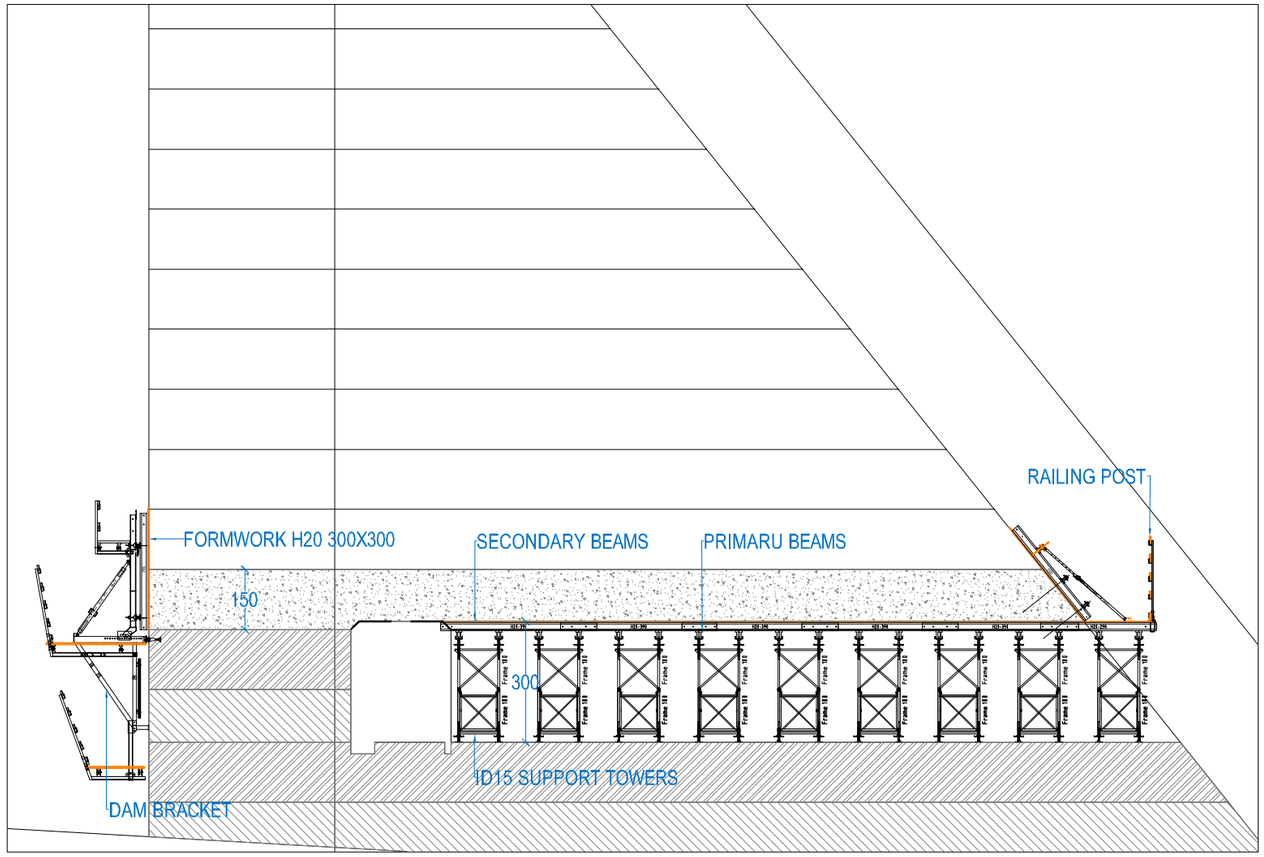
www.harsco-i.it

CAD-File: G_0511112_001_P.dwg

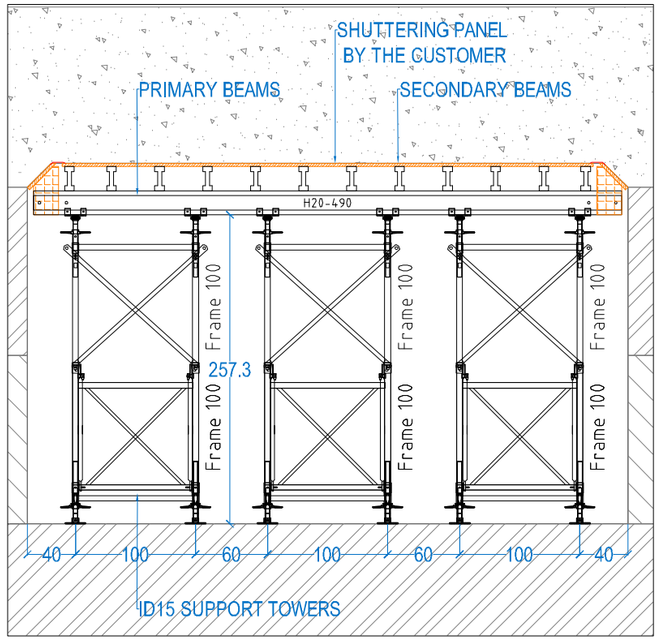
Drawing-No.: G_0511112_001_P 3/7

HARSCO

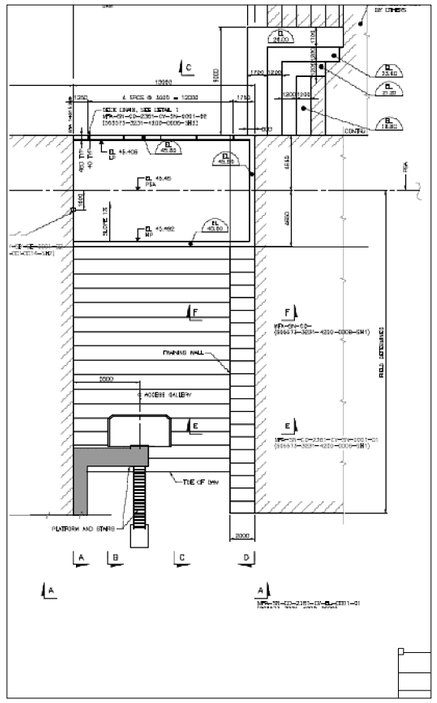
SECTION B-B
Scale: 1:150



SECTION 1-1
Scale: 1:50

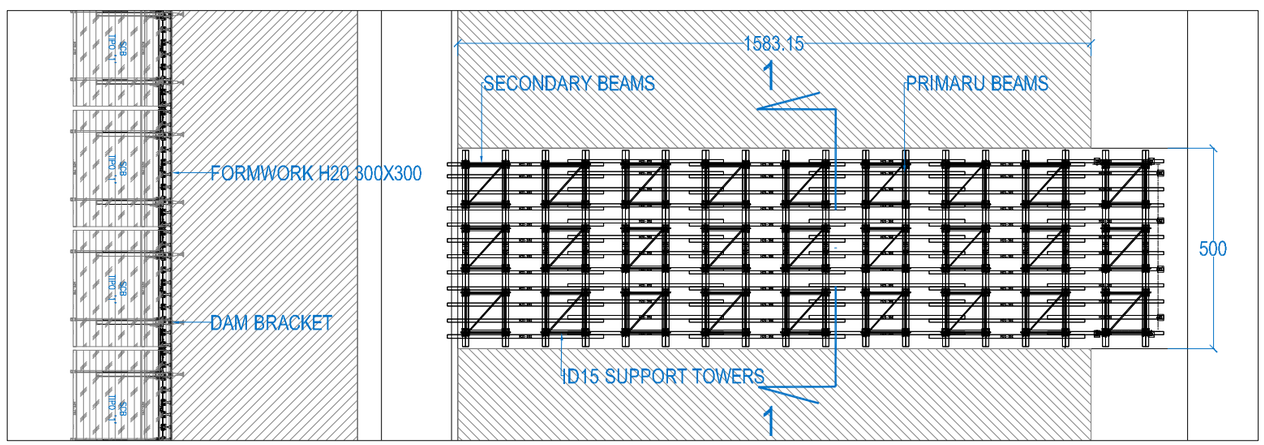


KEY PLANT
Scale: 1:500



PROPOSED EQUIPMENT		
DESCRIPTION	EIGHT ml	QUANTITY
ID15 SUPPORT TOWERS	2,57	27
H20		450 ml

ID15 SUPPORT TOWERS EQUIPMENT
Scale: 1:150



Index	Revision	Date	drawn:	checked:
0	EMISSIONE	27/11/12	E.Martorella	A.Leone

Preliminary drawing, not for construction

This drawing is valid only with the associated assembly instructions. Measurements have to be verified on site.

Scale:	1:150	A3	Client: ASTALDI SPA
	Date	Name	DIGA QUEBEC
drawn:	27/11/12	E.Martorella	
checked:	27/11/12	A.Leone	Project: LOWER CHURCHILL PROJECT
remark:	G.MARAN		NORTH TRANSITION DAMS
			H20 - SCB

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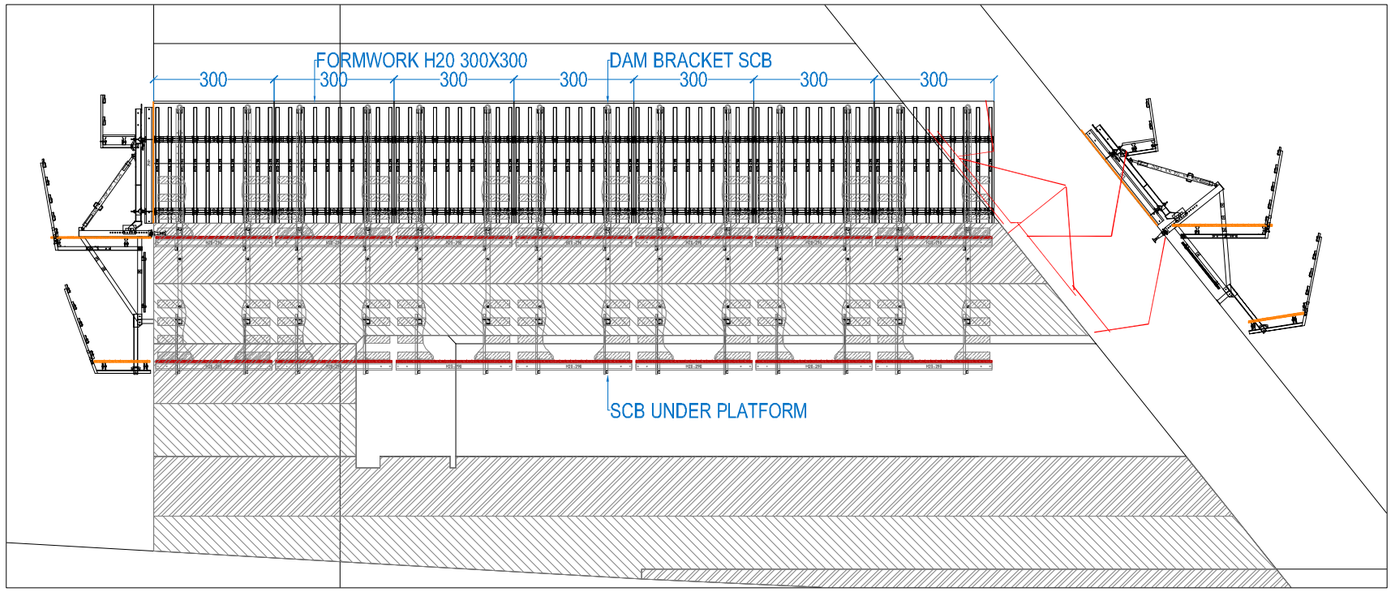
CAD-File: G_0511112_001_P.dwg

Drawing-No.: G_0511112_001_P 4/7

HARSCO

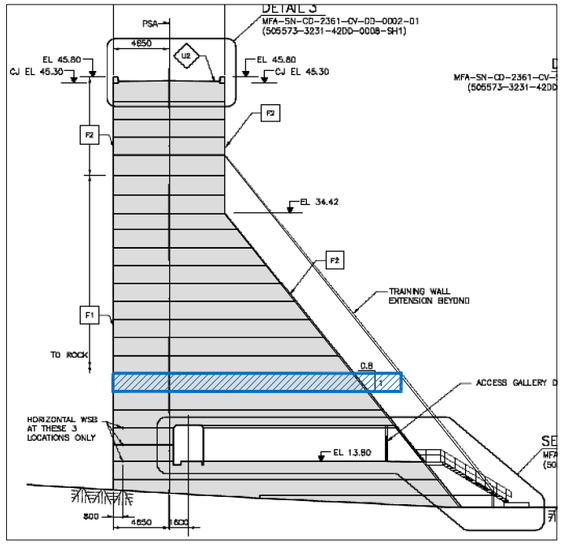
CLIMBING POUR - 8°TH PHASE

Scale: 1:150



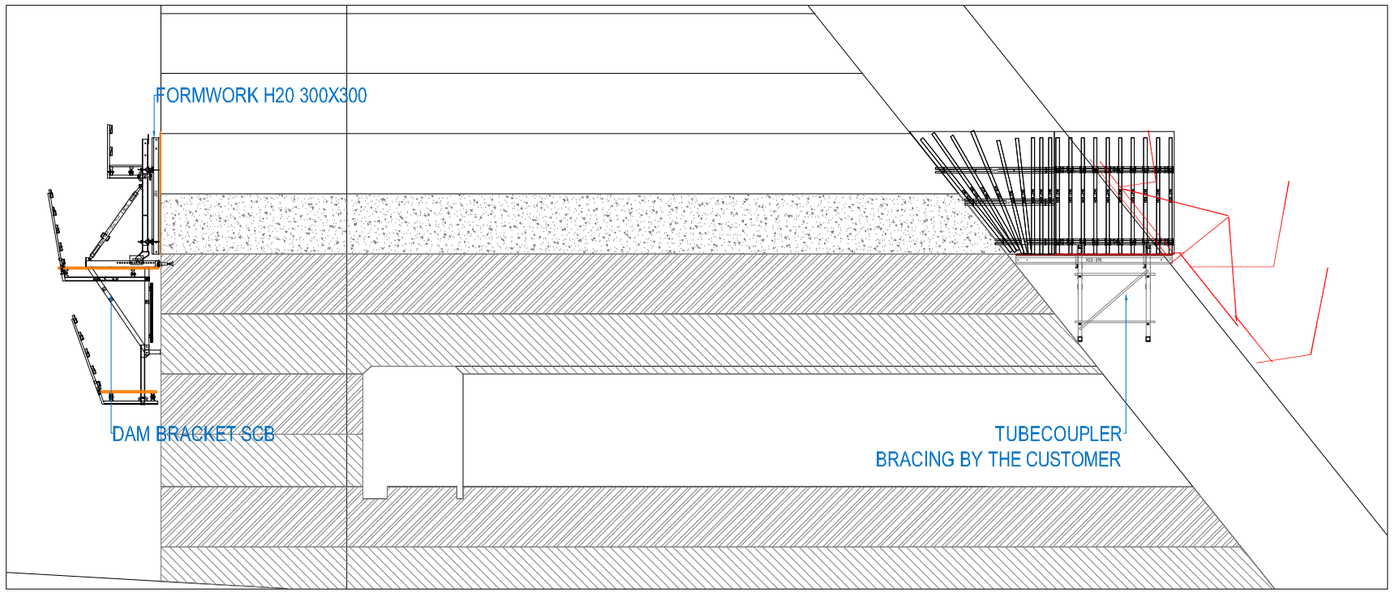
KEY SECTION

Scale: 1:500



CLIMBING POUR - 8°TH PHASE

Scale: 1:150



0	EMISSIONE	27/11/12	E.Martorella	A.Leone
Index	Revision	Date	drawn:	checked:

Preliminary drawing, not for construction

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Scale:	1:150	A3
	Date	Name
drawn:	27/11/12	E.Martorella
checked:	27/11/12	A.Leone
remark:	G.MARAN	

Client: ASTALDI SPA

DIGA QUEBEC

Project: LOWER CHURCHILL PROJECT

NORTH TRANSITION DAMS

H20 - SCB

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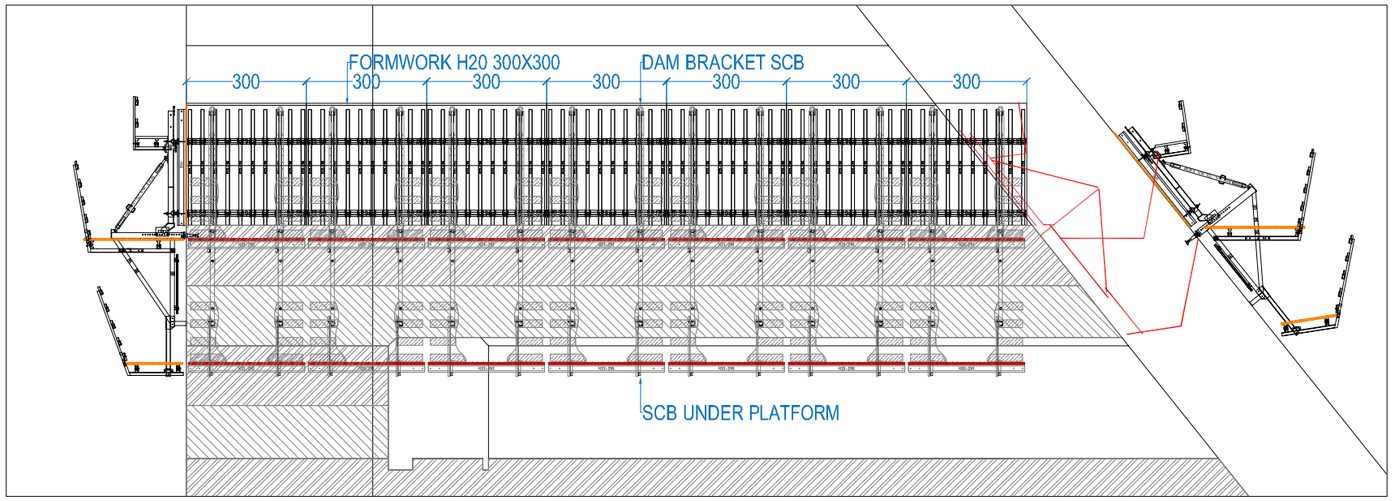
Drawing-No.: G_0511112_001_P 5/7

HARSCO

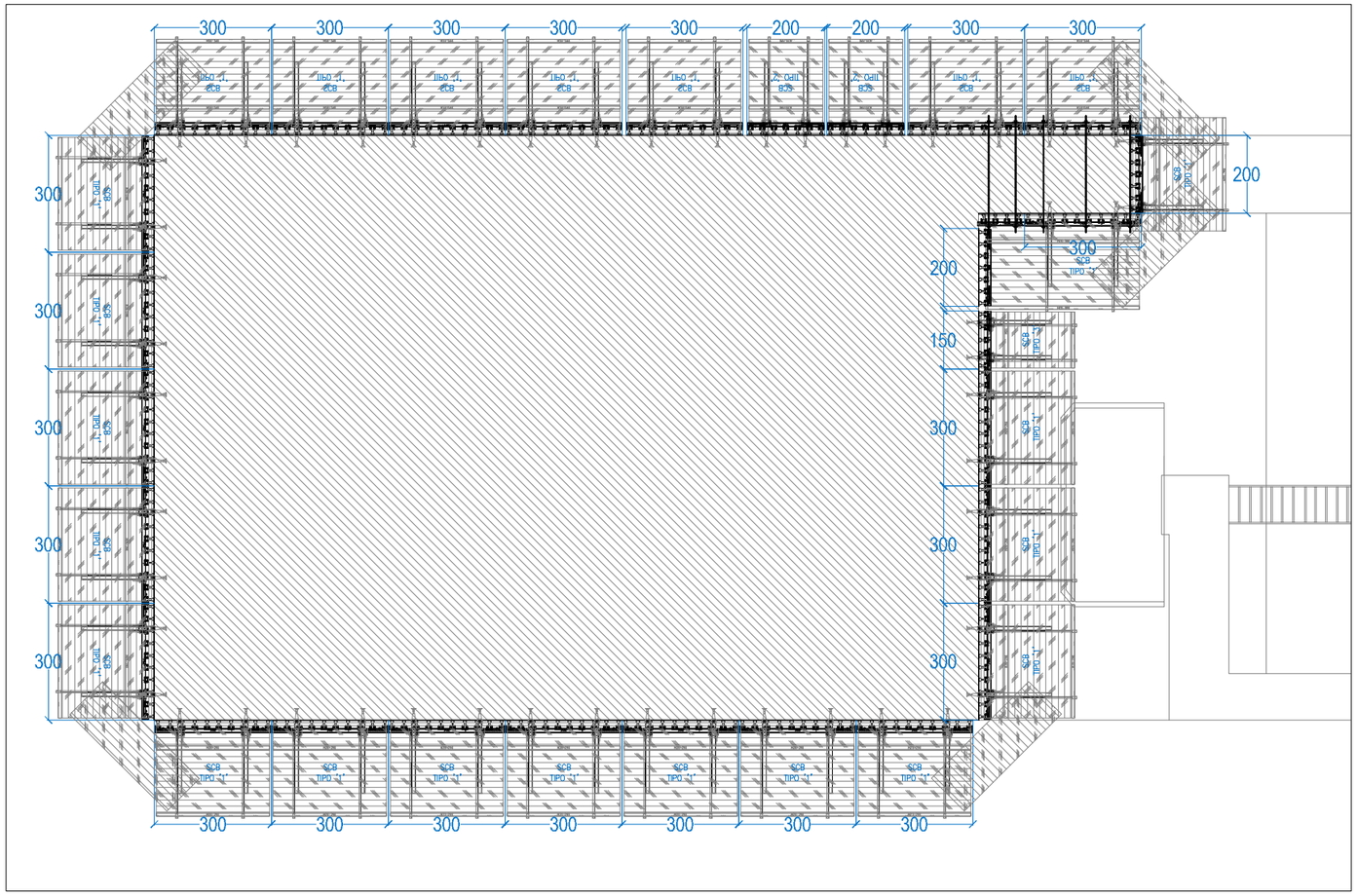
CLIMBING POUR - 8°TH PHASE

Scale: 1:150



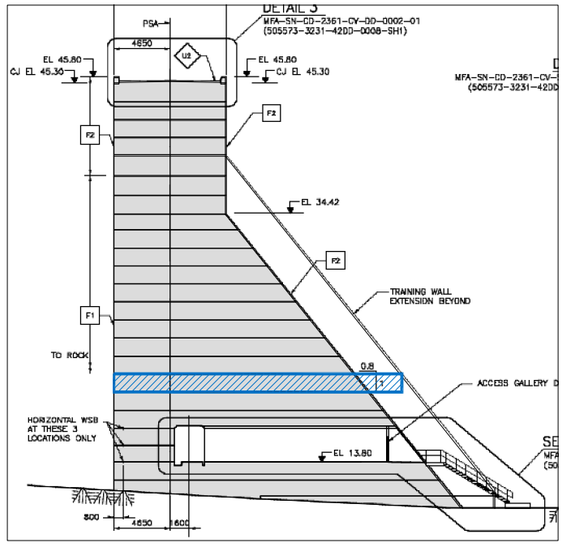
EQUIPMENT PLANT - 8°TH PHASE

Scale: 1:150



KEY SECTION

Scale: 1:500



PROPOSED EQUIPMENT		
DESCRIPTION		QUANTITY
H20 UNITS	MODULE 150X300	2
	MODULE 200X300	4
	MODULE 300X300	26
	MODULE 400X300	1
SCB UNITS (ONE PAIR BRACKETS)	MODULE 150	2
	MODULE 200	4
	MODULE 300	26
	MODULE 400	1

Index	Revision	Date	drawn:	checked:
0	EMISSIONE	27/11/12	E.Martorella	A.Leone

Preliminary drawing, not for construction

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Scale:	1:150	A3	Client: ASTALDI SPA
	Date	Name	DIGA QUEBEC
drawn:	27/11/12	E.Martorella	
checked:	27/11/12	A.Leone	Project: LOWER CHURCHILL PROJECT
remark:	G.MARAN		NORTH TRANSITION DAMS
			H20 - SCB

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Drawing-No.: G_0511112_001_P 6/7

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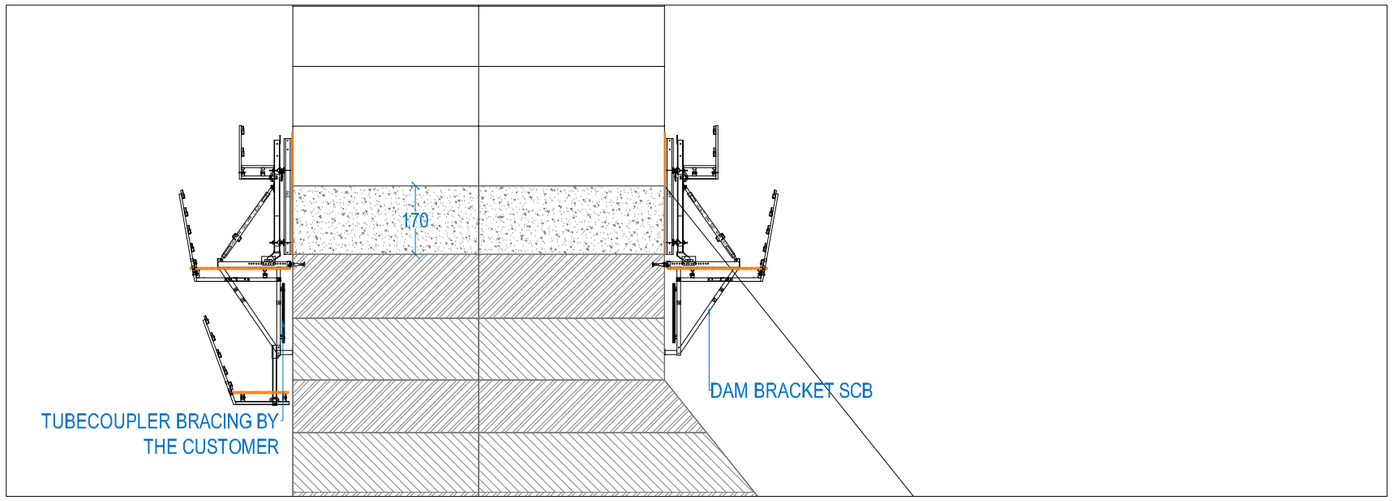
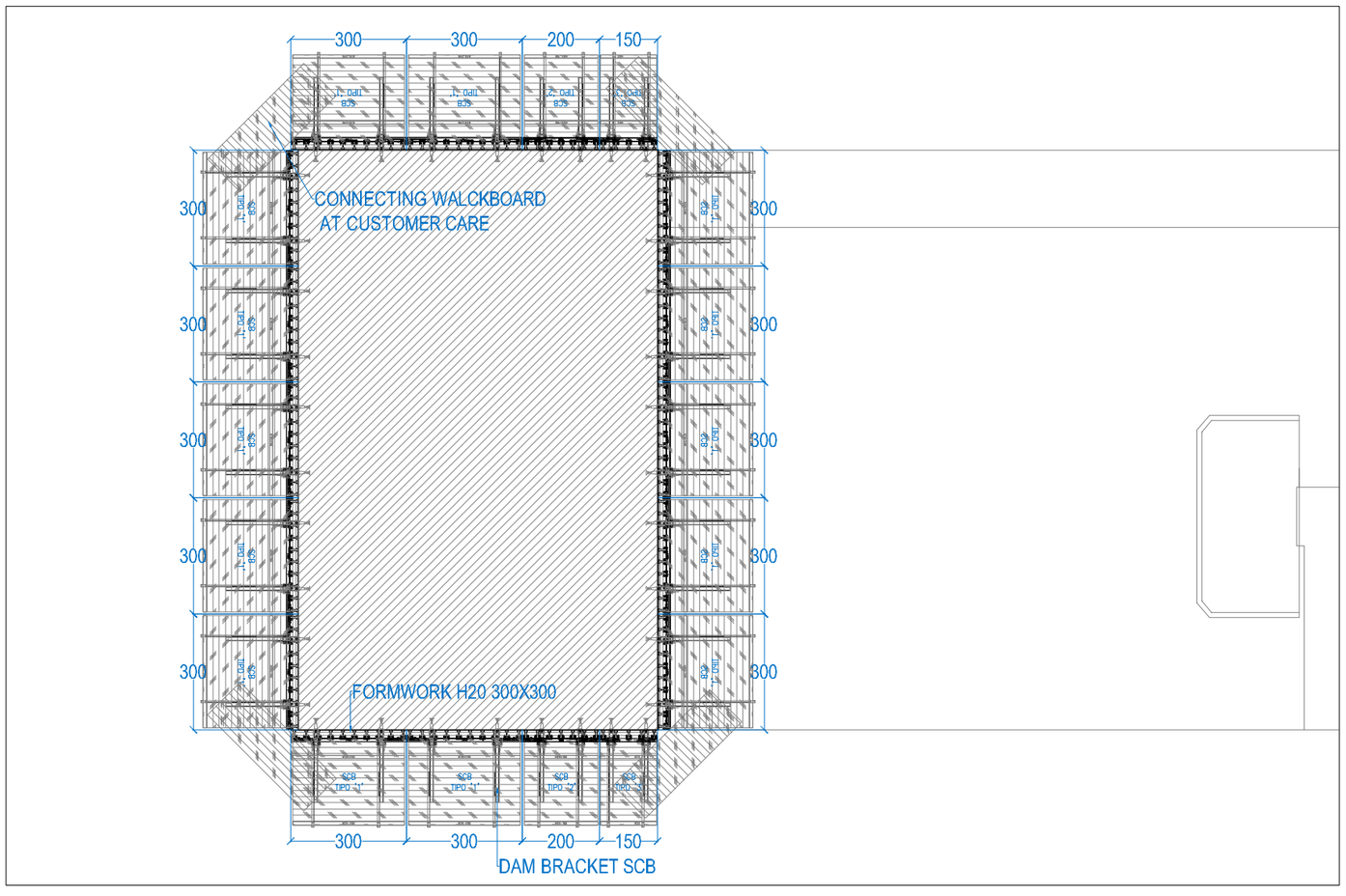
CLIMBING POUR - 20°TH PHASE

Scale: 1:150



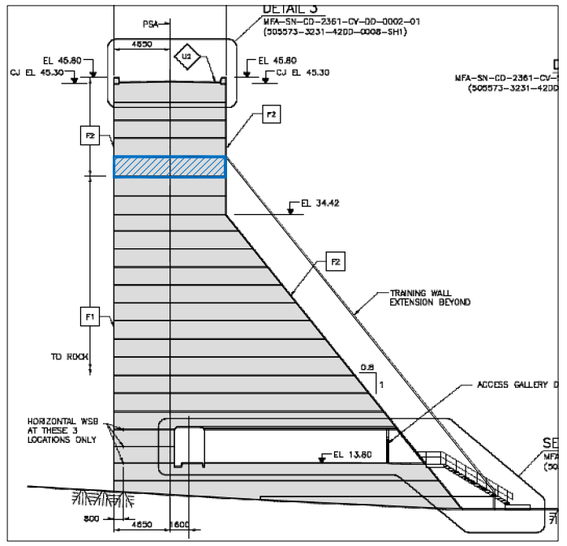
EQUIPMENT PLANT - 20°TH PHASE

Scale: 1:150



SEZIONE CHIAVE

Scala: 1:500



Index	Revision	Date	drawn:	checked:
0	EMISSIONE	27/11/12	E.Martorella	A.Leone

Preliminary drawing, not for construction

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Scale:	1:150	A3	Client: ASTALDI SPA
	Date	Name	
drawn:	27/11/12	E.Martorella	DIGA QUEBEC
checked:	27/11/12	A.Leone	Project: LOWER CHURCHILL PROJECT
remark:	G.MARAN		NORTH TRANSITION DAMS
			H20 - SCB

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Drawing-No.: G_0511112_001_P 7/7

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ASTALDI CANADA Inc.

nalcor energy

NALCOR ENERGY
LOWER CHURCHILL PROJECT
MUSKRAT FALLS

CONSTRUCTION OF INTAKE AND POWERHOUSE, SPILLWAY
AND TRANSITION DAMS

PACKAGE CH0007
CORE TECHNICAL PROPOSAL

APPENDIX A13
EXECUTION PLAN

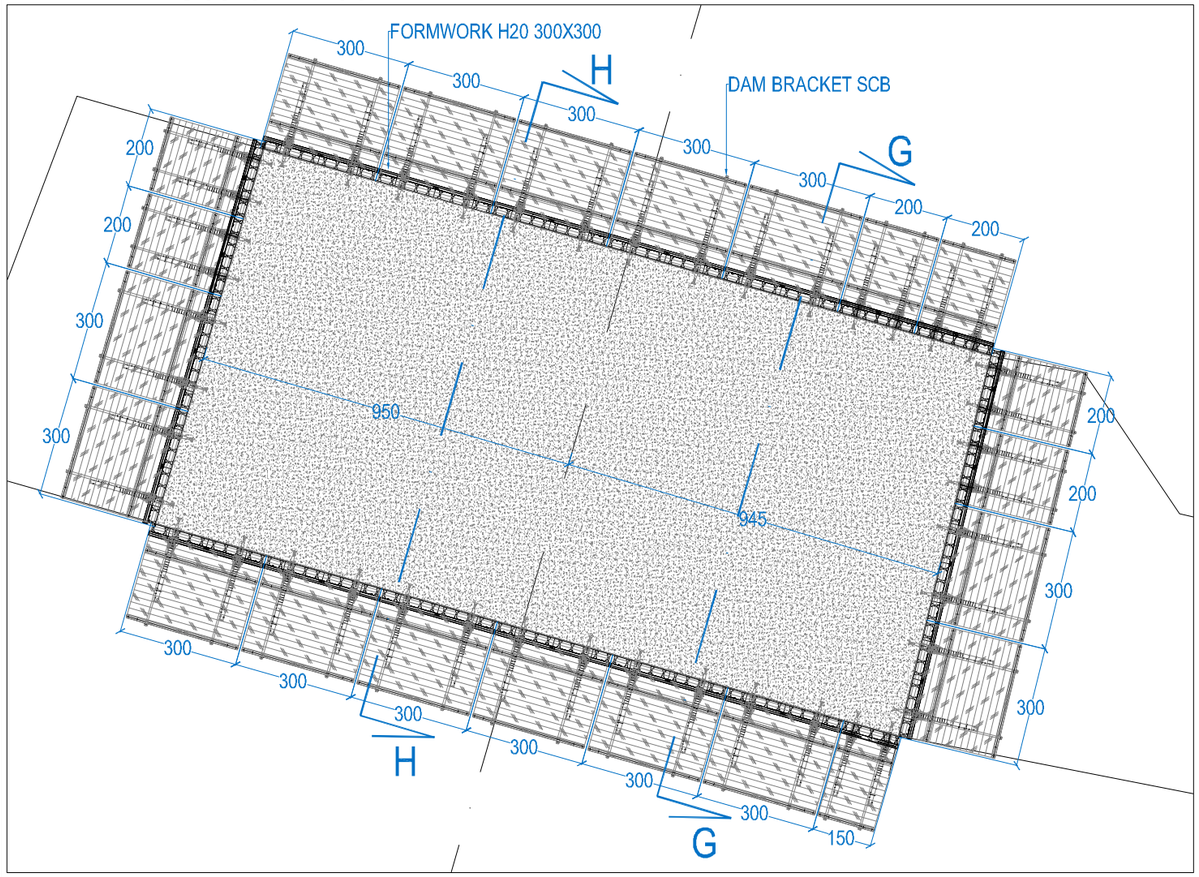
ATTACHMENT 38

FORMWORK - SEPARATION WALL

April 16, 2013

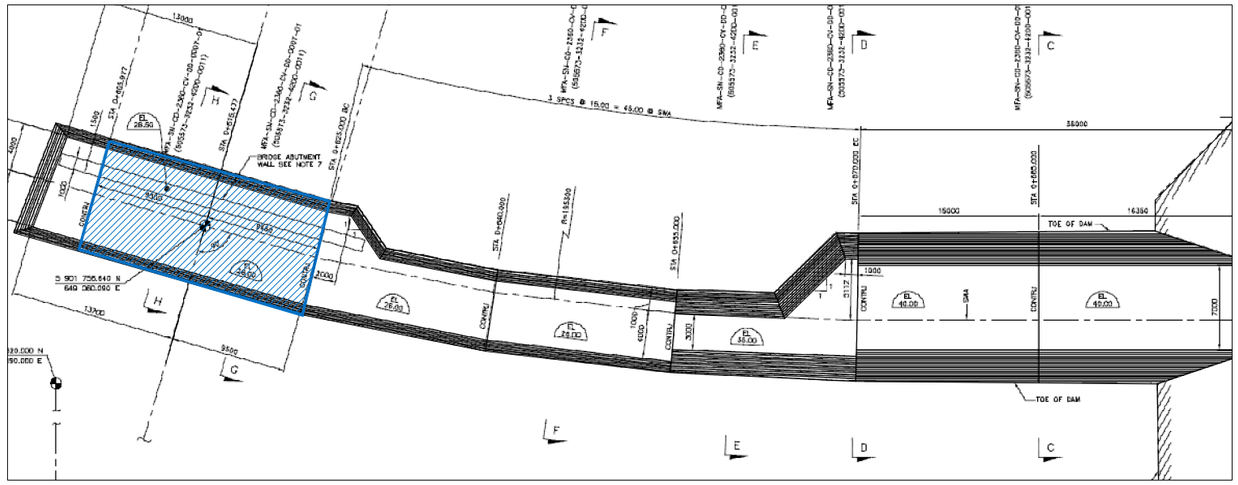
EQUIPMENT PLANT

Scale: 1:150



KEY PLANT

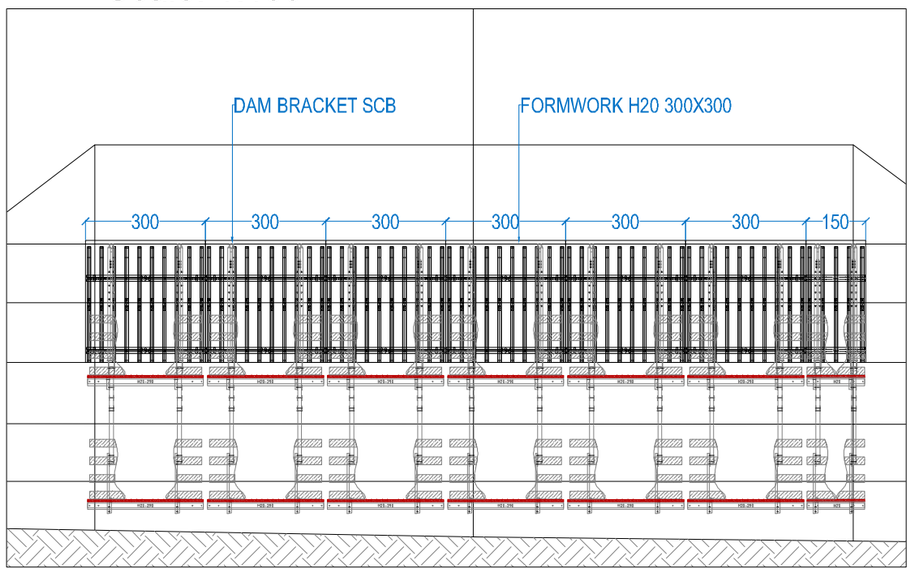
Scale: 1:500



EQUIPMENT		
DESCRIPTION		QUANTITY
H20 UNITS	MODULE 150X300	1
	MODULE 200X300	6
	MODULE 300X300	14
SCB UNITS (ONE PAIR BRACKETS)	MODULE 150	1
	MODULE 200	6
	MODULE 300	14

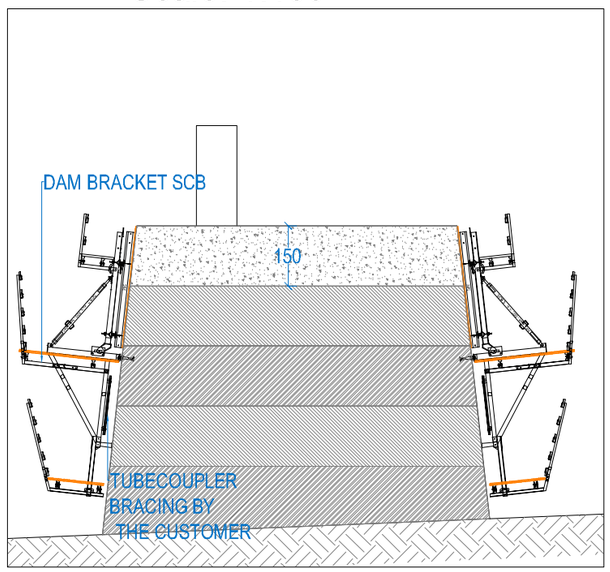
FRONT VIEW

Scale: 1:150



SECTION A-A

Scale: 1:150



Index	Revision	Date	drawn:	checked:
0	EMISSIONE	27/11/12	E.Martorella	A.Leone

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Scale:	1:150	A3	Client: ASTALDI SPA
	Date	Name	DIGA QUEBEC
drawn:	27/11/12	E.Martorella	
checked:	27/11/12	A.Leone	Project: LOWER CHURCHILL PROJECT
remark:	G.MARAN		SEPARATION WALL
			H20 - SCB

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Drawing-No.: G_0511112_002_P 1/2

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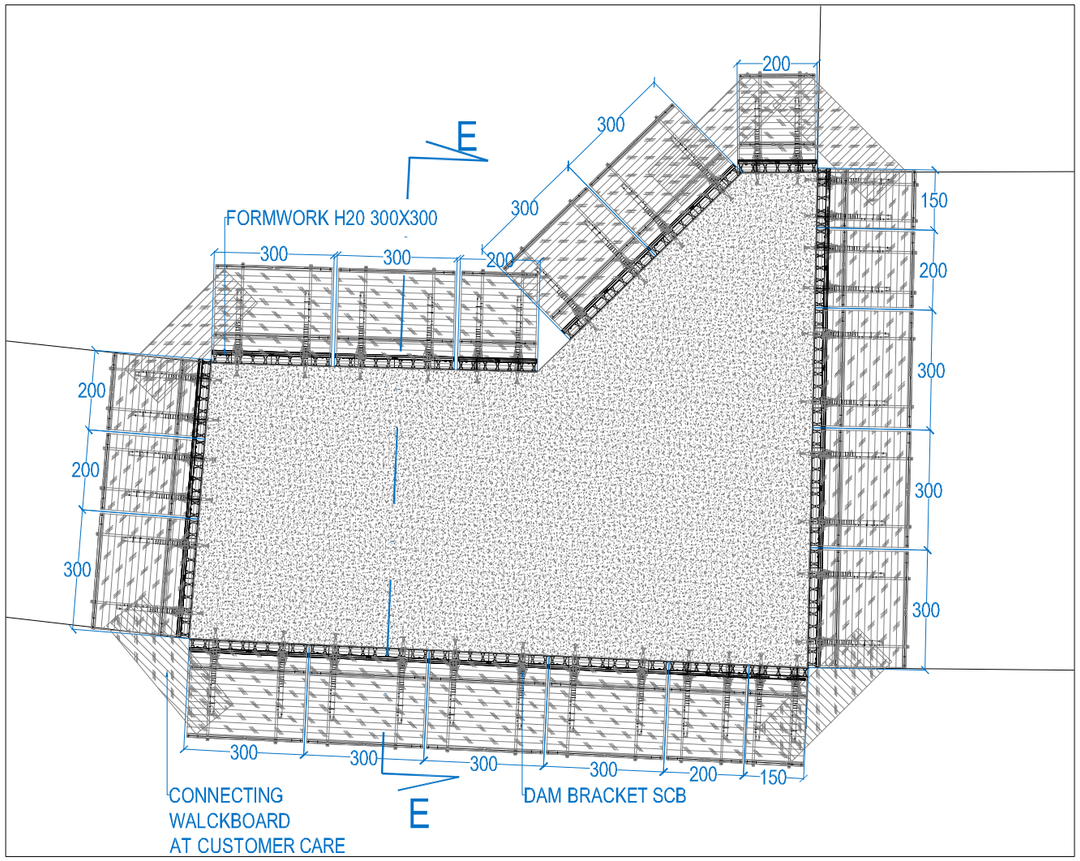
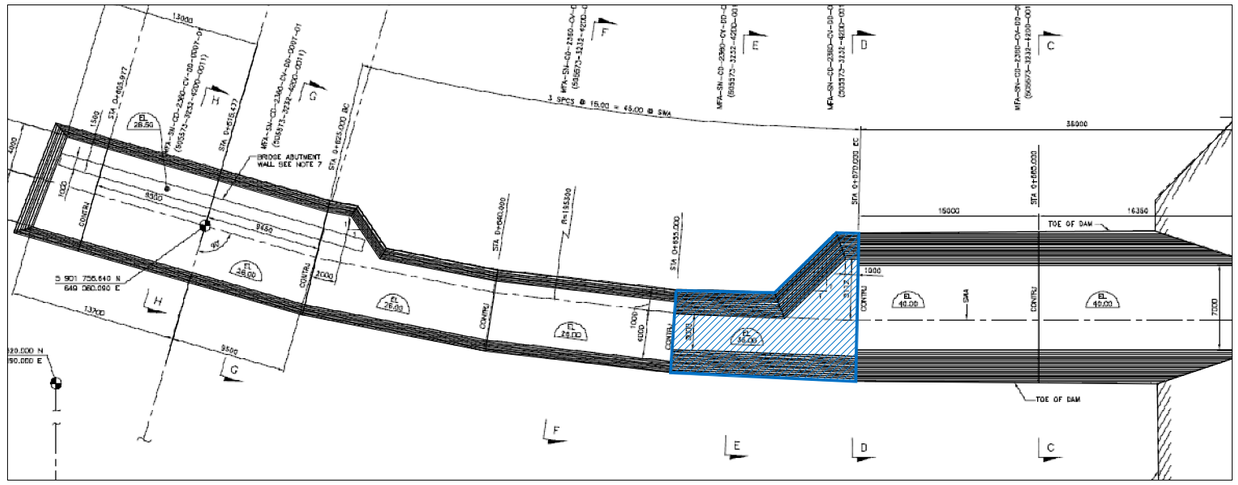
EQUIPMENT PLANT

Scale: 1:150



KEY PLANT

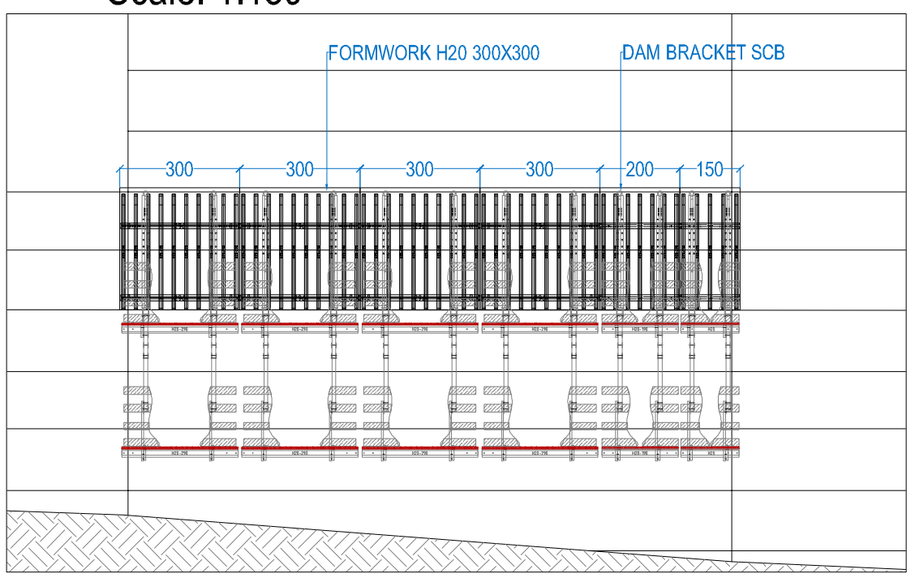
Scale: 1:500



EQUIPMENT		
DESCRIPTION		QUANTITY
H20 UNITS	MODULE 150X300	2
	MODULE 200X300	6
	MODULE 300X300	12
SCB UNITS (ONE PAIR BRACKETS)	MODULE 150	2
	MODULE 200	6
	MODULE 300	12

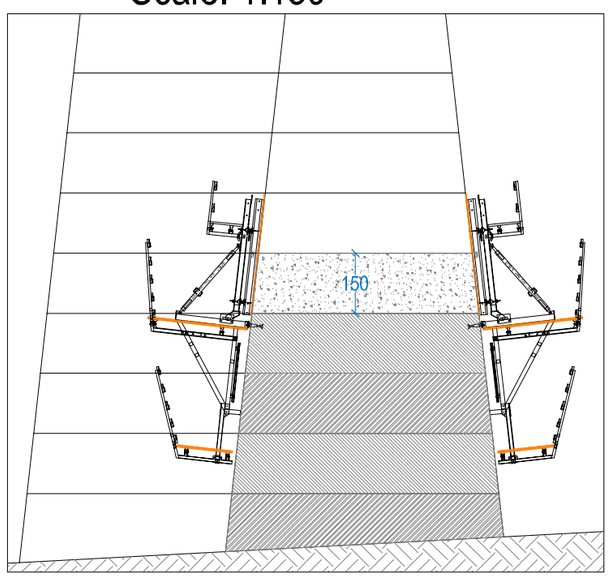
FRONTAL VIEW

Scale: 1:150



SECTION A-A

Scale: 1:150



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drawn:	27/11/12	E.Martorella	DIGA QUEBEC
checked:	27/11/12	A.Leone	Project: LOWER CHURCHILL PROJECT
remark:	G.MARAN		SEPARATION WALL
			H20 - SCB

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Drawing-No.: G_0511112_002_P 2/2

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MUSKRAT FALLS

CONSTRUCTION OF INTAKE AND POWERHOUSE, SPILLWAY
AND TRANSITION DAMS

PACKAGE CH0007
CORE TECHNICAL PROPOSAL

APPENDIX A13
EXECUTION PLAN

ATTACHMENT 39

3D CONSTRUCTION VISUALIZATION - VIDEO

April 16, 2013