PART C

SECTION 4
EXECUTION PROPOSAL

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Part C – Section 4

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4 EXECUTION PROPOSAL

4.1 GENERAL

Subsequent to award of the Agreement, Consultant shall be required to prepare, in conjunction with Company and for Company's acceptance, a formal Execution Plan for the provision of Services and for the implementation of the Project.
The Technical Proposal shall include a detailed outline / summary of its proposed formal Execution Plan. The submission shall describe how the formal Execution Plan will encompass the Scope of Services as detailed in Part 2, Exhibit 3 and, in particular, shall describe how the requirements of the Coordination Procedures provided in Part 2, Exhibit 5 shall be encompassed. The submission shall provide sufficient detail so as to enable Company to fully assess Proponent's understanding of the Services and the Project, and to evaluate Proponent's approach, commitment and ability to provide the Services and to implement the Project.
As a minimum, the detailed outline / summary of the Execution Plan should address the items noted below.
Extracts from the Technical Proposal may form part of the Agreement.

Since 1980, SNC-Lavalin has been participating in discussions and actively following the progress of the Lower Churchill Project. With experience on the Project and executing other large EPCM Hydro Projects, SNC-Lavalin has significant and unique insight into the technical and practical aspects of bringing this Project through to commissioning and start-up.

This section describes the essence of SNC-Lavalin's execution strategy and approach for the Muskrat Falls Project. We will address the key points of our strategy in this section and provide more detail on methodology in the subsequent sections of this proposal.

4.1.1 Project Philosophy

"Our goal is for the Lower Churchill Project to be the Benchmark Project in the Energy industry. We will achieve this by providing Nalcor with the very best project management personnel and a team with the ideal experience to make this project a success. It will only include motivated individuals, striving for continuous improvement. We will accomplish this by planning all project activities, establishing our project culture and by an effective monitoring process to meet our dates."
"We will always work on the basis that safety comes first."

4.1.2 Quality Resources

SNC-Lavalin will staff this Project with key personnel who have worked on previous relevant hydroelectric projects. The engineering staff will originate mostly from the Canadian offices of SNC-Lavalin. Personnel will be transferred from other hydro projects that are nearing completion to the Lower Churchill Project. A number of the candidates nominated for Project Management, Engineering and Construction Management positions have worked on the Gull Island and Muskrat Falls Feasibility and Pre-FEED Studies. SNC-Lavalin will, throughout the project, actively source personnel in Newfoundland and Labrador to fill the various positions in the St. John's project office and at site. Section 6 provides a listing of the proposed key personnel. Their resumes are contained in Volume 2 – Resumes and Descriptions of Roles and Responsibilities.

4.1.3 Team Readiness

SNC-Lavalin's resources will be available as soon as the EPCM services contract is awarded. A select number of resources required at the start of services could be made available before the starting date, if necessary. There will **NOT be any delay** in the mobilization of our personnel assuming the award date is not later than the end of November 2010.

In addition, our current engineering offices in St. John's and elsewhere will be ready and available for our project staff and will continue to be until the proposed project office is operational.

SNC-Lavalin will use its best effort to ensure an immediate mobilization of its personnel as soon as the contract is awarded.

4.1.4 Motivated Resources

SNC-Lavalin is promoting a productivity enhancement program. Such a program will encourage project **personnel to set higher standards** throughout the project.

SNC-Lavalin intends to put in place a communications program designed to keep all project personnel continuously informed of project status, achievements and events. We have instituted this in the form of a comprehensive, well designed monthly newsletter, as well as a dedicated website, on other projects where it has been very well received.

These programs will create a better working atmosphere which is key to increasing the motivation of employees at work.

4.1.5 Safety Culture

Health and Safety is the responsibility of all our people. Nalcor will have the ***"We Care"*** commitment from all SNC-Lavalin's personnel and the assurance that they will fulfill their responsibilities in working safely and in passing that message to every worker on site. SNC-Lavalin's management will ensure that all its personnel have taken and passed a Health and Safety supervisory training course and that they will fulfill their tasks in verifying that site contractors' personnel have taken the necessary measures to work safely at all times. Section 9 provides the detail on the Health and Safety Program SNC-Lavalin intends to implement on the Lower Churchill Project.

4.1.6 Execution Plan

Subsequent to award of the Agreement, SNC-Lavalin will prepare in conjunction with Nalcor and for Nalcor's acceptance, a formal Project Execution Plan for the provision of services and for the implementation of the project according to the requirements as outlined in the RFP. See Guideline Table of Contents in Attachment 4.1.6-1.

4.2 SCOPE OF SERVICES

The Technical Proposal shall fully detail and explain:
a) How the implementation of the Project shall be organized and delivered;
b) How each of the Services will be provided;
c) When each of the Services will be started and completed;
d) Where each of the Services will be provided and completed;
e) Who, among Proponent, and if applicable, joint venture or consortium members, and candidate Subcontractors will have responsibility for each element of the Services; and
f) Proponent's mobilization plan.
The Technical Proposal shall be a clear narrative supported as necessary by schematics, organization charts, tables, and diagrams in sufficient detail for Company to assess Proponent's overall intent and capability, and shall clearly define responsibilities of joint venture or consortium members, and / or Subcontractors, as applicable.

This section comprises SNC-Lavalin's understanding of the scope of the EPCM:

- ❑ HSE considered at all times during design and construction;
- ❑ Implementation of the layouts developed earlier with possible refinement/ enhancement;
- ❑ Detailed Engineering;
- ❑ Procurement Services;
- ❑ Project Controls / Services;
- ❑ Construction Management;
- ❑ Project Completions.

4.2.1 a) Implementation

How the implementation of the Project shall be organized and delivered.

The project will be implemented from a project office that will be established in St. John's, NL. There will be a construction support office established in Happy Valley-Goose Bay, as well as a site construction office and satellite construction facilities (as required) located adjacent to respective construction areas. The project team in St. John's will be supported by specialist engineers as deemed required from other SNC-Lavalin offices.

SNC-Lavalin will also be using the services of local NL engineering companies through secondment of personnel to the project.

The details of the organizational set up are contained in Part C, Section 4, Subsection 4.3.3.c and Section 6.

4.2.2 b) How to Provide the Above Services

How each of the services will be provided.

4.2.2.1 Assumption

Following are the assumptions regarding this proposal:

- SNC-Lavalin shall be entitled to rely on the quality and accuracy of all data provided by or on behalf of Nalcor.
- If the requirement for additional data is discovered as the project develops, in particular through Phase 3, the manhour estimate and schedule presented in this proposal may have to be adjusted accordingly.
- Following SNC-Lavalin's detailed review of the work and documentation available from GATE 2 and early Phase 3, should it be discovered that the required project work is materially different from the basis of the proposal estimate, SNC-Lavalin reserves the right to revise such estimate and/or schedule to complete GATE 3 and subsequent phases.
- Nalcor will be the primary contact with regulatory bodies for all aspects of permitting.
- All vendors and contractors invited to tender, or to whom purchase orders or contracts have been awarded, have been the subject of due diligence investigations, were duly pre-qualified technically and commercially, and accepted by Nalcor to execute the scopes of work for which they were invited to tender, or for contracts they were awarded.
- For vendors and contractors already awarded work, their rate of progress relative to technical, commercial and schedule requirements is acceptable to Nalcor.

- SNC-Lavalin has assumed that the concept has been defined.
- SNC-Lavalin will be responsible for mechanical completion and pre-commissioning activities only. Nalcor will be responsible for commissioning with support from SNC-Lavalin as required.
- SNC-Lavalin will assume that all Nalcor's reviews will be complete within 15 days.

4.2.2.2 Consultants, Third Party Services and Subcontractors

SNC-Lavalin will be responsible for managing and coordinating the work of third party consultants and its own sub-consultants, as well as reviewing specialist work. SNC-Lavalin will interface as appropriate with contracts between Nalcor and other contractor(s).

Third party services will be engaged primarily during the construction phase. These contractors will be contracted directly through Nalcor and managed by SNC-Lavalin.

4.2.3 c) When Each of the Services will be Started and Completed

When each of the Services will be started and completed.

The services will commence upon the award of the contract and will continue through closeout as per the following table and as outlined in the schedule contained in Part C, Section 4.4.

Services	Start Date	Finish Date
Execution Plan	1-Nov-10	16-Dec-10
Organization Charts	1-Nov-10	1-Dec-10
Technical Interface Management Plan	1-Nov-10	30-Jan-11
Project Health and Safety Plan	1-Nov-10	31-Dec-10
Site Health and Safety Plan	6-Jan-11	30-Apr-11
Project Quality Plan	1-Nov-10	31-Dec-10
Purchasing Plan	1-Nov-10	1-Dec-10
Contracting Plan	1-Dec-10	30-Jan-11
Materials Management Plan	1-Dec-10	31-Dec-10
Logistics Plan	6-Jan-11	30-Jan-11
Cost Management Plan	1-Nov-10	1-Dec-10
Detailed Cost Estimate for the Services (Prelim)	1-Nov-10	31-Dec-10
Project Change Management Plan	1-Dec-10	31-Dec-10
Change Control Plan	1-Nov-10	1-Dec-10
Risk Management System and Criteria	1-Dec-10	31-Dec-10

Services	Start Date	Finish Date
Risk Assessment Plan	1-Dec-10	31-Dec-10
Review Plan for Company Documentation	1-Nov-10	1-Dec-10
Design Verification Plan	1-Dec-10	31-Dec-10
Engineering Management Plan	1-Dec-10	31-Dec-10
Operations and Maintenance Plan	1-Sep-11	1-Nov-11
Design-Construction Management Plan	1-Dec-10	31-Dec-10
Construction Management Plan	6-Jan-11	30-Jan-11
Site Security and Access Control Plan	6-Jan-11	30-Jan-11
Health Management Plan	1-Dec-10	31-Dec-10
Project Completions Philosophy	1-Sep-11	1-Nov-11
Invoicing and Payment Plan	1-Nov-10	1-Dec-10
Information Management Plan	1-Nov-10	1-Dec-10
Central Document Register (initial)	1-Dec-10	31-Dec-10
Regulatory Compliance Plan	6-Jan-11	30-Jan-11
Environmental Management Plan (EMP)	1-Dec-10	28-Feb-11
Project Environmental Protection Plan (EPP)	1-Dec-10	30-Jan-11
Schedule Development and Control Plan	1-Nov-10	1-Dec-10
Project Control Schedule	1-Nov-10	31-Dec-10
Design Criteria	6-Jan-11	6-Feb-11
Standard specifications	6-Jan-11	6-Feb-11
Early Works Plan	1-Nov-10	1-Dec-10
Long Lead Items Listing	6-Jan-11	20-Jan-11
Cost Estimate to AACEI Class 3 Equivalent	1-Apr-11	6-Jul-11
Schedule Estimate to AACEI Class 3 Equiv.	1-Apr-11	6-Jul-11
Shop Inspection/Testing Overall Plan	1-Apr-11	1-May-11
Bulk Material Management Plan	1-Apr-11	1-May-11
Fabrication shops Capability Report	1-Apr-11	1-May-11
Equipment Management/Storage Plan	1-Apr-11	1-May-11
Shop Inspection/Testing Overall Plan	1-Apr-11	1-May-11
Risk Register	1-Dec-10	31-Dec-10
Engineering Design	6-Jan-11	6-Feb-13
Engineering follow-up Services	1-Oct-12	31-Dec-16
Construction Management	1-Jul-11	31-May-17
Pre-commissioning/Assist Commissioning	1-Apr-16	31-May-17

4.2.4 d) Where Each of the Services will be Started and Completed

Where Each of the Services will be Started and Completed

The services will be provided from offices in St. John's, Happy Valley - Goose Bay, Cartwright and the construction sites. The Happy Valley - Goose Bay office will be a small construction support office, while the office in Cartwright will be for logistics purposes. Details of the proposed project office in St. John's are contained in Part C, Section 13. Details of the proposed facility in Happy Valley - Goose Bay and Cartwright will follow after the initial project team has been mobilized to St. John's.

Services	Where
Execution Plan	St. John's
Organization Charts	St. John's
Technical Interface Management Plan	St. John's
Project Health and Safety Plan	St. John's
Site Health and Safety Plan	St. John's
Project Quality Plan	St. John's
Purchasing Plan	St. John's
Contracting Plan	St. John's
Materials Management Plan	St. John's
Logistics Plan	St. John's
Cost Management Plan	St. John's
Detailed Cost Estimate for the Services (Prelim)	St. John's
Project Change Management Plan	St. John's
Change Control Plan	St. John's
Risk Management System and Criteria	St. John's
Risk Assessment Plan	St. John's
Review Plan for Company Documentation	St. John's
Design Verification Plan	St. John's
Engineering Management Plan	St. John's
Operations and Maintenance Plan	St. John's
Design- Construction Management Plan	St. John's
Construction Management Plan	St. John's
Site Security and Access Control Plan	St. John's
Health Management Plan	St. John's
Project Completions Philosophy	St. John's
Invoicing and Payment Plan	St. John's
Information Management Plan	St. John's*
Central Document Register (initial)	St. John's
Regulatory Compliance Plan	St. John's
Environmental Management Plan (EMP)	St. John's
Project Environmental Protection Plan (EPP)	St. John's
Schedule Development and Control Plan	St. John's*

Services	Where
Project Control Schedule	St. John's*
Design Criteria	St. John's*
Standard specifications	St. John's*
Early Works Plan	St. John's
Long Lead Items Listing	St. John's
Cost Estimate to AACEI Class 3 Equivalent	St. John's*
Schedule Estimate to AACEI Class 3 Equiv.	St. John's*
Shop Inspection/Testing Overall Plan	St. John's
Bulk Material Management Plan	St. John's
Fabrication shops Capability Report	St. John's*
Equipment Management/Storage Plan	St. John's
Shop Inspection/Testing Overall Plan	St. John's
Risk Register	St. John's
Engineering Design	St. John's*
Engineering follow-up Services	Site *
Construction Management	Site
Pre-commissioning/Assist Commissioning	Site

* = with specialist support from other SNC-Lavalin offices

4.2.5 e) Responsibility Matrix

e) Who, among Proponent, and if applicable, joint venture or consortium members, and candidate Subcontractors will have responsibility for each element of the Services;

SNC-Lavalin's proposal is based on lead responsibilities for Facilities / Areas as shown in the following table.

Scope of Services Responsibility

* where X = Primary Role, O = Specialist Support as required

Facility / Area / Services	Responsibility			
	Company	SNC-Lavalin		Others
		Other	St. John's	
Project Management				
Project Management			X	
Project Controls			X	
Engineering		O	X	
Procurement	O		X	
Construction Management			X	
Pre-Commissioning	O	O	X	

Facility / Area / Services	Responsibility			
	Company	SNC-Lavalin		Others
		Other	St. John's	
Hydroelectric Plant				
T/A		O	X	
E/M			X	
Civil			X	
On-site Infrastructure				
Potable water treatment and distribution			X	
Fresh and fire water systems			X	
Sewage treatment			X	
Waste water treatment			X	
Fire protection			X	
Plant communications and controls systems		O	X	
Area electrical sub-stations		O	X	
Site power distribution		O	X	
Emergency power supply			X	
On-site roads			X	
Laboratory			X	
Warehouse, workshops			X	
Administration			X	
Medical clinic			X	
Temporary and permanent communications		O	X	
Offsite Infrastructure				
Upgrades of access roads			X	
Site storm water drainage			X	
Solid waste disposal (incinerator and landfill)			X	
Fencing			X	
Gatehouse			X	
Quarry development			X	
Accommodations complex			X	
Telecommunications system		O	X	
Power supply to site			O	X
Main electrical substation			O	X
Geotechnical				
Rock mechanics		O	X	
Hydrogeology		O	X	
Foundation design criteria		O	X	
Environmental				
Environmental Impact Assessment (EIA)	X		O	

Facility / Area / Services	Responsibility			
	Company	SNC-Lavalin		Others
		Other	St. John's	
Permitting Plan	X		O	
Permitting Application	X		O	
Closure and Reclamation Plan			X	
Community Relations Plan	X		O	
Other				
Government & Community Relations (IEBA)	X		O	
Industrial Relations	X		O	
Labour Agreement	X		O	
Risk Management	X	O	O	
Capital Cost Estimate	X	O	O	
Operating Cost Estimate	X	O	O	

4.2.6 f) Proponent's Mobilization Plan

4.2.6.1 Engineering, Procurement and Project Services Personnel

SNC-Lavalin's resources will be available as soon as the EPCM services contract is awarded. The majority of the key (lead team members) resources required at the start of work could be made available earlier, if necessary. There will **NOT be any delay** in the mobilization of our personnel assuming the award date is not later than the end of November 2010.

Initially, personnel slated for long and medium term will travel and work from the project office on a business trip basis for the 1st month or two; and, thereafter, will relocate according to the manpower plan.

SNC-Lavalin will proceed to put in place its Human Resources Plan before award of the contract to ensure an immediate mobilization of its personnel as soon as the contract is awarded.

The project team will be mobilized on two fronts – St. John's and other SNC-Lavalin offices where the expertise resides, until the main project office is operational.

The core management team will immediately mobilize to St. John's upon award of the contract and will be located temporarily in the SNC-Lavalin office in Mount Pearl until the proposed project office is operational. Selected early work tasks may be undertaken in other Canadian offices for expediency due to the relatively short early 'deliverables'

time scale. Their main focus will be to review the project documentation and initiate the preparation of key documents outlined in Part 2, Exhibit 5, Section 1- Table 1.1.

Other key concurrent activities include:

- Prepare a Master Scope document and prepare for the official kick-off meeting;
- Review Project data;
- Alignment Workshop preparation and participation;
- Define / prepare and implement first Safety Leadership meeting;
- Establish roles and responsibilities;
- Start the review of the current Health and Safety Plan and Policies;
- Start the review of the current Environmental and Permitting Plans;
- Start the review and coordination/update of Project Procedures;
- Develop the HR Plan and prepare for mobilization of personnel;
- Start the development of HR Procedures;
- Start the Personnel Project Induction e-Learning Module.

Refer to Attachment 4.2.f-1 - Early Activity Schedule for the range of activities that will be addressed during the initial mobilization period.

4.2.6.2 Construction Personnel

After approval of the Project, SNC-Lavalin's construction management team will relocate to St. John's and commence multiple activities in parallel in order to develop the early activity program, overall construction plan and strategy with Engineering, Procurement and Nalcor.

The key members of the construction team will initially be located in St. John's to work with the engineering team from a constructability perspective and to undertake the overall construction planning. The construction group will eventually mobilize to the site on a gradual basis according to the overall construction plan.

A communication system will be defined and implemented at the beginning of the Project. The St. John's offices, other engineering centres (specialist engineering), Happy Valley - Goose Bay and site offices will be interconnected to ensure seamless exchange and transfer of information.

Once the site is established, key construction personnel will gradually mobilize on site to carry out early activities and to supervise, monitor and manage the first contracts (site access road, accommodations complex, clearing, surveyors, geotechnical, soil lab, etc.).

A temporary office will be established to support the early works until the main office is installed. Medical support, security, survey, geotechnical and EPCM personnel will

mobilize prior to mobilization of the initial site contractor(s). All early personnel, including contractors, will use the temporary installations until permanent offices are established for Construction Management and contractor personnel.

Power will be supplied by gen-set or connection to Newfoundland & Labrador Hydro service at the beginning of construction. All contractors will have to use their own gen-set for construction (small tools, etc.) until reliable construction power is in place.

4.2.6.3 Project Support Team

SNC-Lavalin's project management methodology has evolved over decades of successful implementation of major projects. In order to establish best practices on new projects, SNC-Lavalin's execution strategy features the mobilization of Support Teams at the initiation of every major project. The teams are comprised of a small number of senior SNC-Lavalin discipline and management specialists who bring extensive expertise and lessons learned pertaining to all aspects of project execution, including:

- Project and Construction Management;
- Procurement
- Project set-up;
- Project controls;
- Value improvement practices;
- Constructability;
- Mentoring / Training.

The Project Support Team (PST) will become involved with the Project during the initial weeks post award to help the EPCM project team establish the core principles to efficiently deliver a high-quality project using SNC-Lavalin's proven methodologies.

The specific requirements will be defined and agreed with Nalcor and the Project Team.

4.3 SPECIFIC REQUIREMENTS

The Technical Proposal shall specifically address:

4.3.1 a) Project Objectives

a) Project objectives (critical success factors);

The objectives of the work to be carried out under the EPCM Contract are:

- Provide engineering services for the Muskrat Falls Development (Component 1) to enable Nalcor to complete Phase 3 – Engineering and Procurement / Contracting of

the Lower Churchill Gateway Process. The achievement of Gate 3 (Refer to Figure 4.3.a-1) at the end of this phase will enable the project to be sanctioned.

- Provide full EPCM services for Phase 4 – Engineering, Procurement, Construction and Commissioning of Nalcor's Gateway Process. This is the execution phase of the project leading to a fully commissioned plant ready for start-up.
- Provide quality services to Nalcor to enable them to:
  - Deliver a commissioned generating plant and facilities that will achieve design capacity;
  - Meet all of the health, safety, environment and sustainable development commitments set for the project;
  - Achieve project delivery within the established control budget;
  - Maximize local content and First Nations' involvement and create a positive relationship with local communities in Labrador, and
  - Achieve Best Value for the Project and the chosen development option.

Be the "Project of Choice" in the Power Industry

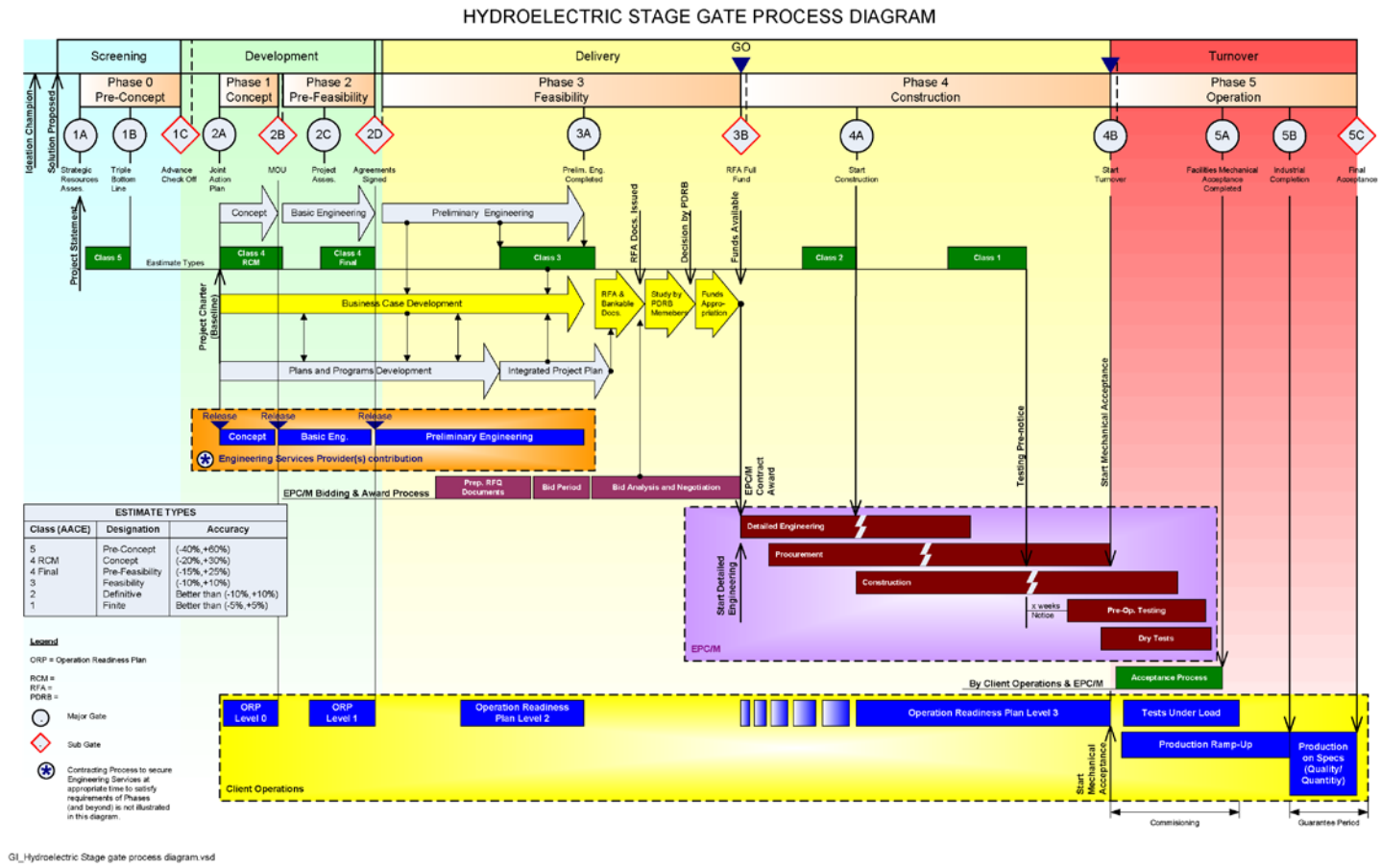
4.3.2 b) Risk Management Approach

b) Risk management approach and proponents view of key technical and execution risks for the Project;

For the Lower Churchill Project, SNC-Lavalin can provide personnel to assist in the preparation of a Risk Management Plan that will identify potential risks, the likelihood of an event, and the subsequent impact on the project. Risks to be considered would include technical, cost, logistics, completion, schedule and ramp-up rate, and how these and other project risks can be assessed, managed and mitigated. The Risk Management Plan would also involve the major contractors and other key project participants.

Typically risk identification is broken down in the following groups and specific project activities:

Figure 4.3.a-1 – Hydroelectric Stage Gate Process Diagram



Groups of risks would include:

- Financial risk to the Company
- Financial risk to the Contractor
- Third party risks
- Risk to life and limb during construction
- Construction risks
- Operational risks

Project risks may be identified in the following areas:

- Engineering
- Construction
- Project delivery
- Performance guarantees
- Availability of construction resources
- Health & safety
- Environment
- Foreseen natural occurrences
- Transportation logistics

Risk management would be focussed on the range of high-level risks which threaten project objectives and that were identified during the series of risk reviews leading up to the establishment of an Acceptable Risk Profile of the project. Those identified risks would be re-assessed and provision made for new reviews as part of an ongoing, continuous activity during the implementation of the project. Any new risks that have the potential to threaten project objectives would be managed.

Risks and associated controls are normally reported in a structured way on a monthly basis over the life of the project, and a Project Risk Register is created.

Risks outside the project (political, social, community, labour and security), which are managed in the course of the normal day-to-day business activities, would not be reported in the Project Risk Register.

Typically, new risk reviews should be conducted after contract award and mobilization as part of the project planning activities, or at any point where events result in significant changes to risk. Consistent with this, an ongoing risk management process would be established as part of the project execution plan.

To illustrate, a preliminary risk analysis table for the Muskrat Falls Hydroelectric Project was prepared during the 1998 Final Feasibility Study (see below). A new risk table would be produced in the initial stages of the project reflecting the risk profile of the project as it exists today.

MUSKRAT FALLS POWER DEVELOPMENT
RISK EVALUATION

RISK EVALUATION		COST VALUE (X $1000)	EXPOSURE %	EXPOSURE Value (X $1000)	PROB. %	CONTINGENCY (X $1000)
DIVERSION						
Tunnels	Rock Quality	23,000	50%	11,500	33%	3,800.0
Cofferdam	Quantity Variation	3,800	25%	950	50%	475.0
Inlet Gates	Gate Jammed	600	100%	600	10%	60.0
RCC DAMS						
RCC	Quantity	30,000	25%	7,500	25%	1,875.0
Foundations	Rock Quality/Foundation Prep./Gro	3,000	50%	1,500	50%	750.0
Roller Compacted Concrete	Cement Content	1,000	100%	1,000	50%	500.0
SPILLWAY						
Foundations	Rock Quality/Foundation Prep. Prep./Grouting	500	50%	250	50%	125.0
Structure	Change in Design	1,000	100%	1,000	25%	250.0
Structure	Dimensions	33,000	20%	6,600	25%	1,650.0
Mechanical/Electrical	Design Changes, Guides installed incorrectly	8,200	10%	820	20%	164.0
NORTH SPUR						
Excavation & Fill	Quantity Variation	18,000	40%	7,200	40%	2,880.0
POWERHOUSE						
Powerhouse/Intake Structure	Rock Quality/Foundation Prep./Grouting	10,000	50%	5,000	50%	2,500.0
	Overbreak/Backfill Concrete	36,000	20%	7,200	30%	2,160.0
	Modified Cement	10,000	100%	10,000	10%	1,000.0
	Turbines & Generators	145,000	10%	14,500	75%	10,875.0
	Spare Parts	6,800	50%	3,400	50%	1,700.0
Tailrace Plug Excavation	Rock Quality	6,000	20%	1,200	30%	360.0
COMMUNICATIONS						
Microwave		1,900	50%	950	50%	475.0
CAMP & SUPPORT FACILITIES						
Camp and Support Facility		112,000	25%	28,000	25%	7,000.0
Trans Lab Highway	Additonal Maintenance	6,300	50%	3,150	10%	315.0
MANAGEMENT		80,000	5%	4,000	15%	600.0
ENGINEERING		41,000	10%	4,100	20%	820.0
Field Investigation & Hydraulic Models		2,500	50%	1,250	50%	625.0
Contract Packaging		965,000	10%	96,500	25%	24,125.0
Labour	More Expensive Agreement	350,000	15%	52,500	15%	7,875.0
ENVIRONMENTAL						
Reservoir Clearing		37,600	20%	7,520	25%	1,880.0
Fisheries Compensation		5,000	100%	5,000	20%	1,000.0
TOTAL						75,839.0

There are several methods of handling risk which are generally employed in combination with one another. They include assumption, transfer, loss prevention and avoidance.

Assumption is the most common way of handling risk, which requires an awareness of the perils and hazards which may cause loss and financial provision to cover the eventuality of a loss.

Transfer, either through contractual arrangements or through insurance is a common way of handling risk.

Loss prevention may be defined as those activities designed to reduce, prevent, or otherwise control accidental events which produce loss. Such prevention is aimed at reducing both the frequency and severity of losses, thus reducing the financial impact of a loss should it occur.

Loss avoidance is the conscious decision of not doing something that one realizes has the potential of causing loss.

Attachment 4.3.b-1 (at the end of Section 4) provides Tables of Contents for SNC-Lavalin's Corporate Risk Management Procedure and Risk Management Requirements for Suppliers and Contractors. Figure 4.3.b-1 contains a flow chart of the risk management process.

Figure 4.3.b-1 – Risk Management Process

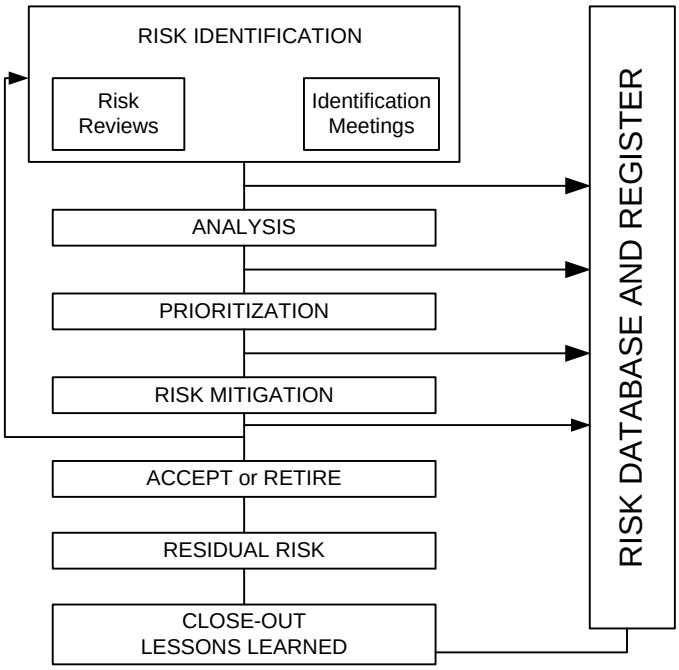


Figure 4.3.b-2 shows a typical risk matrix. Risks are assigned a degree of severity from very low to very high, as well as a probability of occurrence from very low to very high. Risks that fall within the red zone (high), or higher, require special attention.

FIGURE 4.3.b-2 - RISK MATRIX

PROBABILITY	Consequences					
		VL	L	M	H	VH
	VH	LOW	MEDIUM	HIGH	VERY HIGH	VERY HIGH
	H	LOW	MEDIUM	HIGH	HIGH	VERY HIGH
	M	LOW	LOW	MEDIUM	HIGH	HIGH
	L	VERY LOW	LOW	LOW	MEDIUM	MEDIUM
	VL	VERY LOW	VERY LOW	LOW	LOW	LOW

4.3.3 c) Project Organization and Execution Strategy

c) Project Organization and Execution Strategy

SNC-Lavalin will mobilize a project team of specialists and support staff as required to perform the EPCM services, generally as shown in the organization charts contained in Attachment 6.2-1 in Section 6 of this proposal.

All full time staff will be located in the St. John's project office or at the site. Personnel based outside of Newfoundland and Labrador will be relocated to the St. John's project office as required. Specialized staff working on a part time basis over the design period will generally be based in their home offices, but will carry out short-term assignments in St. John's.

Each contract package will have a staff member designated to be responsible for that package for the design and construction phases.

4.3.3.1 Resource Requirements

SNC-Lavalin has the necessary in-house resources to carry out Component 1. Peak numbers could reach 130 fulltime engineers and technical support staff in St. John's. Part time specialist staff from different centres of excellence within SNC-Lavalin will be available during the project time frame to support the full time team.

The peak staff will be required during the latter part of Phase 3 and the initial part of Phase 4, during which time it is expected that about two-thirds of the detailed engineering work will be completed.

4.3.3.2 Key Personnel

Personnel requirements are identified on the Organization Charts in Attachment 6.2-1 and in the listing of Key Personnel in Section 6. Detailed resumes for the Key Personnel are presented in Volume 2 – Resumes and Descriptions of Roles and Responsibilities.

4.3.3.3 Project Initiation and Staffing

Following the award of the EPCM contract, SNC-Lavalin will meet with Nalcor to initiate the work and to finalize the organization required for the work. This activity will include:

- The definition of the work;
- The plan and schedule for the work;
- The required names, number and location of the resources;
- The team organization and lines of responsibility for each package of the work;
- Communication protocols within the project management team; and
- Schedule of quality control and progress meetings.

Mobilization of local staff to the Project Office, along with staff to be relocated from outside the province, will be carried out in accordance with the Execution Plan and the time schedule for the work during Phases 3 and 4.

4.3.3.4 Specialist Personnel

SNC-Lavalin will be using specialist personnel as required. These specialists will work on the team full time for very short periods, while others will work over longer periods, but on a part time basis. As such, it may not be economical to relocate all of them to the Project office in St. John's. They may, in the interest of minimizing cost, work on short-term assignments out of other SNC-Lavalin offices.

Although not working in the St. John's project office, they will follow similar procedures as those who are, in connection with the team organization, communications and reporting. Modern telecommunications allow easy transfer of voice and data, and teleconferencing may also be used to facilitate face-to-face discussions. The final determination of staff designated as "Specialist Personnel" will be made during the start-up phase of the project.

4.3.3.5 Working Within the Project Management Team

The organization charts contained in Section 6, Attachment 6.2-1, depict the organization of the following functional groups within the context of the overall project organization:

- Engineering
- Procurement,
- Project Services,
- Construction Management,
- HSE,
- Quality,
- Information Management, and
- Commissioning.

All elements of the Project Organization must function as a fully integrated and cohesive team in order to deliver the project effectively. The functional groups will work together to install the required project management and control systems, develop the necessary design criteria and procedures, execute the design, prepare contract documents, tender the works, manage the construction and commission the plant.

The function of Engineering within the team will be to carry out the detailed design of the facilities and to review and finalize the list of contract packages and the proposed contract strategy. During the execution phase of the work, after detail design has been completed, selected engineering staff will be available to support work at the site as required for construction management.

In the case of Muskrat Falls, a close understanding must exist between Engineering and Procurement in order to finalize the content and interface limits of the contract packages so as to minimize interface problems and excess costs during construction. For example, foundation rock excavated in one contract package should be able to be stockpiled and processed for use as concrete aggregate for dam construction, being carried out under a second package, without re-handling. Similarly, foundation rock must be excavated such that concrete placed on those foundations as part of another contract package does not give rise to claims for concrete in over-break.

Close collaboration with Project Services will also be important, particularly with regard to the scheduling of events. Rock excavated from the spillway and tailrace areas must be stockpiled for convenient and timely use of the contractor building the dams. Material originating in one contract for use in another must have logistical and time coordination. Only by the functional groups working together as one team will such coordination be possible.

The SNC-Lavalin organization will have extensive knowledge of large hydro projects, and members of the various functional groups will have had prior experience in working together on such projects. Advice will be exchanged freely between the team members to the benefit of the project execution.

Selected members of the Engineering, Procurement and Project Controls groups will be available throughout the construction phase to support and participate in site activities such as Construction Management and Commissioning, as required. The work during all phases of the project will be supported by our world class HSE, Quality and Information Management systems.

4.3.3.6 Health, Safety & Environment

The preparation of design and specifications will take into consideration all relevant international standards, as well as Canadian and Newfoundland and Labrador regulations for safety, health and the environment. Requirements for conditions of safety of construction, operation and maintenance personnel will also be incorporated into all contract documents.

4.3.4 d) Proponent's Organization

d) Proponent's organization; (further detail regarding organization and Key Personnel shall be provided in response to question 6.0 herein);

SNC-Lavalin will draw the resources and expertise for the Lower Churchill Project from three of its business units, namely;

- The Hydro and Power Systems Division;
- The Transmission and Distribution Division; and
- BAE-Newplan Group Limited.

The high level technical expertise for the execution of the work will come from the divisions, whereas local resources and personnel would be drawn from our Newfoundland based subsidiary, BAE-Newplan Group Limited.

SNC-Lavalin will be the contracting entity for the project and will provide all of the services for the project from its own in-house resources, supported as required by a number of designated engineering subcontractors. The subcontractors will participate on a "loan of personnel" basis whereby they would second resources directly to the project team.

The general organization proposed for the project is shown in Figure 6.1 in Attachment 6.2-1. In developing this organization we have made a number of assumptions:

- The hydro projects will be developed consecutively with Gull Island following Muskrat Falls or vice versa. Therefore, the organization can be similar for both projects as the team proposed for the first will transition over time into the second project.
- One organization will be put in place for the entire project. Functions such as Quality Assurance, Health Safety and Environment, Labour Relations, Aboriginal Affaires, Newfoundland and Labrador Benefits, Project Services and Procurement will be common to all components. The primary organization will be put in place for the first hydroelectric development. Additional components such as the DC Specialties and Transmission Lines will be serviced by the same organization through the assignment of Component Coordinators and additional resources as required.
- The organization will be developed on an area matrix basis with support services reporting across all components to a functional manager. Within each component all services will roll up through the Area Managers to the Project Manager.
- The project will be executed out of a dedicated project office in St. John's with only limited specialized work to be done outside of this office. Subcontract support personnel will be seconded into this office and work under a common management organization with all other project personnel.
- SNC-Lavalin's proven engineering and project management systems and procedures will be utilized for the project. Senior Managers from within SNC-Lavalin will be assigned to the project team in St. John's and at the site to ensure that these systems and procedures are properly implemented and used effectively.
- Interfacing with Nalcor will be primarily through the Nalcor project organization housed in the same project office. It is suggested that the Nalcor organization mirror the SNC-Lavalin organization in every respect and that a common set of project execution and reporting procedures be established for the project.

Given the size and importance of this Project, Mr. Patrick Lamarre, Executive Vice-President will be the Corporate Sponsor for SNC-Lavalin. He will chair an Executive Committee comprised of the Senior Vice Presidents of the Business Units contributing to the project. An experienced Project Director will be appointed to oversee all components of the project. He will report directly to the Executive Committee and to Nalcor. Reporting to the Project Director will be Project Managers for each of the relevant project components.

SNC-Lavalin has nominated some of its best managers and supervisors to work on the Muskrat Falls Project. SNC-Lavalin will draw staff from its offices in St. John's and elsewhere to fill the initial required positions, including most of the key management positions. The balance of the positions will be filled by additional personnel from the St. John's office or through recruitment from a number of designated subcontractors.

As noted in subsection 4.2.6.3, SNC-Lavalin's project methodology has evolved over decades of successful practices on new projects. Our execution strategy features the mobilization of support teams at the initiation of every major project. In the case of

Muskrat Falls, a small number of senior SNC-Lavalin project management specialists will bring extensive expertise and lessons learned pertaining to all aspects of project execution including:

- Project management
- Project set-up
- Project controls
- Value improvement
- Regional considerations
- Technology integration
- Constructability

The Project Support Team (PST) will be involved with the project during the initial weeks after award to help the EPCM project team establish the core principles to efficiently deliver a high-quality project using SNC-Lavalin's proven methodologies. During the course of the project, the PST will visit the project regularly to assess the initial organization and methodologies and recommend additional value-improving measures as may be identified.

More detail of SNC-Lavalin's Corporate and Project Organizations are contained in Section 6.0.

4.3.5 e) Overall Roles and Responsibilities

e) Overall roles and responsibilities (Proponent, joint venture or consortium members, Subcontractors, Contractors, Suppliers);

SNC-Lavalin Inc. will be the sole proponent for the purposes of this proposal regarding the EPCM Services for Component 1 - Muskrat Falls Hydroelectric Development. The company will be responsible for the complete execution of the services including all aspects of the engineering, procurement and construction management. In essence, SNC-Lavalin will be responsible for the complete project management of the project.

The only sub-contractors envisaged at this time are sub-consultants for various engineering and specialty support services. In most cases, these contractors will be hired based on 'loan of personnel' agreements. Their staff will be assigned to the project team where they will fall under the management and control of SNC-Lavalin's management group. The responsibility for the work of these contractors will rest with SNC-Lavalin.

In the case of specialty services (survey, physical modeling, materials testing, etc.), these services would be awarded on a Service Contract basis. The subcontractor would be responsible for the execution of its work scope. SNC-Lavalin would provide quality control and due diligence for the contract. The subcontractor's services would be

invoiced to SNC-Lavalin and would form part of the out-of-pocket costs associated with the EPCM services.

Construction contracts would be awarded for the construction of the major civil works, site excavations, concrete structures, RCC and coffer dams, site infrastructure, early works (access roads and accommodations), mechanical and electrical equipment, substations and the power house. These contracts will be tendered by the procurement team on behalf of Nalcor. The contractors will be responsible for the complete execution and mechanical completion of their work scope. They will also play a role in the final commissioning of the works. Payment for their services would be through the issuance of regular progress claims to be reviewed and approved prior to being forwarded to Nalcor for payment. SNC-Lavalin would provide construction supervision, inspection and quality assurance for the work of these contractors.

Suppliers will be contracted to provide a large variety of goods and services to the project. Most of the smaller items would be incorporated into the construction contracts or would be procured by the EPCM contractor. Major contracts will be issued for the supply of the turbine – generator package, spillway, intake and draft tube gates, structural steel, overhead cranes, transformers and substation equipment. These contracts would be awarded on a competitive basis. The suppliers would be responsible for the supply and, in some cases, installation / installation supervision of their equipment. Major items would be paid for directly by Nalcor on a progress payment basis. Smaller items may be included as a cost under the EPCM contract. In all cases SNC-Lavalin would supply contracting, purchasing, expediting, inspection and quality services for the contracts and purchase orders.

4.3.6 f) General Process of Decision Making

f) General process of decision making within Project organization in consideration of all risks;

Within SNC-Lavalin, the decision making process is clearly defined and set out in our system of quality procedures. For every major function (i.e., engineering, procurement, construction management) undertaken by the company, there is a set of quality procedures which define how work is to be executed, the steps to be taken, the key decision points and who is responsible for the decisions.

Within the project organization, managers are vested with levels of responsibility based on their job description and years of experience. Decisions beyond a person's level of responsibility are referred to the next level of management authority for consideration. For major decisions affecting the expenditure of large sums of money, or which may carry significant risk for the company, more than one approval may be required.

The quality system proposed for use on the Muskrat Falls project is based on the SNC-Lavalin Quality System which is ISO 9000 certified. A set of quality procedures will be

developed for the project which will include flow charts depicting the decision making process to be used.

In addition to the procedures which define the processes to be followed, all major works are subject to a system of approvals. In the case of engineering, for example, all designs must be checked by someone other than the initial designer and approved by someone at a higher level of authority.

An authorization matrix will be developed for the project identifying the authority levels with the organization.

One of the key tools in the decision making process is the development and use of a risk register. SNC-Lavalin's risk management process was discussed in Section 4.3.2. In the early stages of the work, the project would be risk assessed to determine the major technical, financial, organizational, and other risks associated with the project. The risks would be assigned a priority ranking, and mitigation measures would be developed for each. Decisions on critical activities would take into account all associated risks. The risk register would be reviewed on a regular basis (monthly as a minimum) and risks that have been dealt with would be dropped from the list. New risks would be added as they arise.

Flow charts illustrating the decision making processes within engineering and procurement will be developed to support the overall risk programs.

4.3.7 g) Mobilization and Staffing Plan

g) Mobilization and staffing plan for all Project phases clearly identifying how personnel will be assigned to the various locations;

- ❑ Personnel will be identified according to the approved project organization charts.
- ❑ Personnel will be sourced from within SNC-Lavalin NL, other SNC-Lavalin offices and various NL Engineering companies throughout the Province.
- ❑ A 'Personnel Assignment Authorization Form' (PAA) will be prepared for each person and approved according to the project approval authority guide, including Nalcor.
- ❑ Assignment letter and conditions (pre-agreed with Nalcor) will be agreed with each employee prior to mobilization to the project.
- ❑ Staff from out of province will be assigned as follows:
  - Long term assignment (>6 months)
  - Short term assignment (< 6 months)
  - Business trip (specialist engineer, support team member)
- ❑ Personnel from within SNC-Lavalin (short and/or long term appointments) will be formally assigned to the Project by means of an approved PAA and will work out of the St. John's project office.

- Personnel provided by other NL Engineering companies will be seconded to the Project and will work out of the St. John's or construction project offices. The PAA process will also apply.
- Specialists (design, study, geotechnical, environmental, safety, archaeological, fauna and flora, review/ audit etc.) will be assigned from time to time throughout the project timeframe and will be approved through the PAA process

The initial estimate of the manpower build-up over the Project period for each discipline is provided in the histograms attached to Part B of this proposal. Once the Project is awarded, a manpower forecast loading (MFL) chart will be prepared to forecast staff mobilization and demobilization requirements on a discipline basis across the project.

4.3.8 h) Proponent's Approach for Managing the Site

h) Proponent's approach for managing the Muskrat Falls site or the Gull Island site;

During the construction of the Muskrat Falls Hydroelectric Plant, it will be necessary to manage site access and activities to avoid congestion, possible work delays and injury to workers. At peak, approximately 1500 personnel will be working at the site and the majority of them will be living in the site accommodations complex. With this number of personnel travelling around the work site, together with construction vehicles and transport vehicles delivering equipment and supplies, the control of site access will be of paramount importance.

Access to the site will be via a twenty kilometre long paved construction access road along the south side of the Churchill River. A gated security station and visitors' kiosk will be constructed on this road at the point where it joins the Trans Labrador Highway. All traffic in and out of the site will need to pass through this checkpoint. Site workers and other authorized personnel will be issued a security pass to allow them to pass through. Delivery vehicles will have to clear security and will have to provide authorization papers identifying their purpose and the name of the person they are to contact on site. Visitors will be required to check in and will be issued with temporary passes. They will have to be accompanied by a site representative prior to passing the checkpoint. The passes will be returned to security upon leaving the site. All personnel and visitors travelling to the site for the first time will receive a site indoctrination covering emergency and safety procedures to be followed while on site. The visitors' kiosk will maintain a supply of personal protective equipment (hard hats, safety glasses, boots, vests, etc.) on hand for visitors' usage. Site personnel will be issued their own safety equipment.

A second checkpoint will be established in the area of the accommodations complex. Personal vehicles belonging to personnel working on site will be parked in designated areas adjacent to the complex. Only authorized construction and transport vehicles will

be permitted beyond this point. Workers will be transported to the work areas by bus or by other authorized vehicles.

Construction activities will be coordinated initially by the early works contractor(s) in consultation with the SNC-Lavalin Construction Management Team. As the project progresses and the main civil works contractor is brought on board, he would normally coordinate all site construction activities. As the civil works near completion, the responsibility for coordinating the construction would switch to the contractor responsible for the power structures. All construction activities would be planned and coordinated in consultation with the Construction Manager and the Area Construction Managers responsible for the main project areas. Interfaces between contractors would be identified early on and critical works would be scheduled in order to avoid conflicts and delays. A key factor affecting the way in which the site will be managed is the contracting strategy to be employed. Meetings will be held with Nalcor in the first 90 days to discuss and formulate the contracting strategy to be put in place.

Offices for the Construction Management Team, Nalcor and the main contractors will be provided adjacent to the accommodations complex. Contractors' trailers would be located near the construction faces. Laydown areas, equipment work shops and parking areas would be established as required for each contract in consultation with the Construction Management Team.

In and around the site, signage would be posted identifying key construction and traffic areas. Signs would also be posted in designated areas restricting activities such as hunting, snowmobiling and other recreation activities in areas adjacent to construction locations and the accommodations complex.

4.3.9 i) Project Management Systems and Procedures

i) Project Management Systems and Procedures

4.3.9.1 Matrix Organization

SNC-Lavalin's proven project management approach for mega projects is based on a matrix approach, commonly used in the industry. Due to its size, the project will be broken down into manageable sized pieces or areas. Each area created for the Muskrat Falls Project will be under the responsibility of an Area Manager who will be responsible for the engineering, procurement and construction of the facilities which are included in the area.

The proposed EPCM general organization is provided in Figure 6.1 in Attachment 6.2-1 in Section 6 of this proposal. This chart shows the functional and line reporting of the Matrix organization.

Key assumptions for this Matrix organization to operate efficiently are:

- Nalcor will mirror image as much as possible SNC-Lavalin's organization by nominating managers for each area and each function as per SNC-Lavalin's structure.
- The project management of both Nalcor and SNC-Lavalin will be located in St. John's.
- The roles and responsibilities of every manager and lead in both the Nalcor and SNC-Lavalin organizations must be well understood by all team members. The means to ensure this understanding will be through specific project inductions carried out by the management team until every team member has clearly understood and acknowledged the workings of the structure.
- The management of the site work will also follow a matrix structure; the site organization is presented in Figure 6.4 in Attachment 6.2-1. In this structure, the organization of the project is broken down into the same area breakdown as for the project management and engineering organizations in Figures 6.2 and 6.3 in Attachment 6.2-1. The functional managers at site also have a reporting responsibility to their functional managers in the project office.

4.3.9.2 Key Project Management Principles

Scope Control

The Area Managers are fully responsible to control scope within their Areas. The Nalcor and SNC-Lavalin Area Managers must freeze that scope at the outset of the EPCM services award, since the completion of Gate 2 would have defined in sufficient degree the scope of each facility within their area. Scope control will be achieved by weekly coordination meetings within the areas and the functions. In addition, a rigorous trending system will be put in place from the start of the services to manage the scope and ensure that changes, if any, have been approved by management.

Purchase Order and Contract Packaging

The Packaging of all equipment, materials, pre-assemblies and site works will require intensive input from all project functions and the Area Managers. Detailed reviews by the Area Managers and overall by the team will be carried out to agree on the packaging, the deliverables for each package and ensure freezing the scope of each package. Any changes will need to be approved by the Area Managers and the Project Managers of both Nalcor and SNC-Lavalin.

Once the packaging has been frozen, the commitment package schedules will be elaborated. These will become the key documents to manage the project. Weekly area meetings will be attended by all concerned to review progress. A culture of meeting every date will drive the project team to meet the overall project schedule.

Package Dictionary

A dictionary will be created for each package and will summarize the scope, limits, exclusions, free issue materials, etc. Once frozen, only the Area Managers will be authorized to make changes to these dictionaries. These dictionaries are key to the SNC-Lavalin management approach.

Risk Management

SNC-Lavalin will assign its senior Risk Manager from its organization to set up the risk management system and procedures. Once the functional managers and area managers have bought into this activity, it will be run by management, both in the project office and at site. It is critical that management of risks is led by the team members.

Quality Assurance / Quality Control

The function of the QA/QC department within the project office and at site will be firstly to ensure that all team members have been inducted correctly, that the procedures are in place and that all team members have understood these procedures and are following them correctly. Continuous monitoring will be done throughout the project life to ensure that the team members follow the procedures rigorously.

The QA/QC aspects in the shops, fabrication yards and contractors work at site are the responsibility of specific departments. The QA/QC group will overview this work by mainly ensuring that the overall QA plan requirements are embedded in every contract and elaborated.

Project Support

SNC-Lavalin's execution strategy features the mobilization of Support Teams at the initiation of every major project. These Teams are comprised of a small number of senior SNC-Lavalin Project Management specialists who bring extensive expertise and lessons learned pertaining to all major aspects of project execution.

Communication

SNC-Lavalin will ensure that a rigorous communications program is put in place to inform all those working on the project on the status, progress and events. A monthly newsletter is appreciated by project people and improves the "esprit de corps" amongst the project team. Issuing of communications, project briefings and celebration of events are key to motivate all those working on the project.

Discipline

The management team expects strict discipline by all personnel in accepting and respecting the methods which will be put in place to manage the project. The management team will NOT tolerate the disrespect of procedures, rules, etc., which will have been set from the beginning and communicated.

There will be a zero tolerance policy with respect to illegal activities, drugs and alcohol, theft or abuse of project facilities.

SNC-Lavalin excels in management of EPCM projects. Its philosophy is to work as ONE team with a client by providing transparency in the performance of the services throughout the project. This is the commitment we are making to Nalcor.

4.3.9.3 Project Management Team

The Project Management Team will be centered in St. John's and supported by specialist engineers from other SNC-Lavalin locations and the Muskrat Falls construction team. Details of the organization are provided in Section 6.0 – Organization and Key Personnel.

4.3.9.4 Project Management Services

SNC-Lavalin will provide overall project management services for the scope of services under its responsibility, comprising the following:

- Identification of Project scope and requirements;
- Management of an integrated Project organization composed of suitably qualified and experienced personnel to deliver the proposed services;
- Adherence to Nalcor's health, safety and environmental policies, Sustainable Development Policy, norms and standards as well as SNC-Lavalin's principles for health and safety;
- Development and establishment of administrative procedures;
- Development of a project execution plan;
- Development of a detailed EPCM schedule;
- Development of detailed budgets, costs and planning schedules;
- Implementation of an integrated project management system to assist in managing scope, budget and schedule;
- Ensuring that appropriate resources are mobilized in a timely manner;
- Implementation of health, safety and environmental programs;
- Implementation of a risk management program;
- Monitoring and ensuring the progress and quality of the work;
- Management of third party subconsultants;
- Provision of cost control services;

- Management of trends and correcting deviations;
- Implementation of applicable quality assurance policies and procedures;
- Provision of regular progress and coordination meetings;
- Implementation and management of change control procedures as necessary;
- Maintaining open communication between all parties involved in the Project;
- Implementation of regular reporting and forecasting, as required by Nalcor;
- Management and coordination of all Project documentation;
- Preparing a Project Close Out Report; and
- Closing out of the Project.

4.3.9.5 Project Procedures

The procedures to be followed in the execution of the Project will be SNC-Lavalin standard guidelines/procedures modified to accommodate the needs of the Project. These will be set forth in the Project Execution Plan (PEP).

The PEP will contain all the information necessary for the execution of the work including:

- Project description;
- Scope of services;
- Project organization;
- Lines of authority and reporting including those of Nalcor and compliance thereto;
- Lines of communication, internal and external;
- Listing of all key personnel – Nalcor, SNC-Lavalin, Sub-Consultants, Contractors and Subcontractors as these become available;
- Design codes and standards to be followed.

The document will include Project procedures for the following areas:

- Project Management;
- Health and Safety;
- Environmental management;
- Engineering;
- Project Controls, including:
  - Monitoring and reporting of costs, schedules and planning;
  - Correspondence, communications, filing and record keeping;
  - Document Control, filing and record keeping.
- Quality and Quality Assurance, including:
  - Quality control plans and tests;
  - Materials and equipment certification, tagging and identification; and
  - As built data and Manufacturers Data Reports.
- Procurement;
- Contract administration;

- Accounting and general administration reporting;
- Reporting;
- Risk Management and HAZID reviews;
- Construction management and supervision, including:
  - Materials receipts, tracking, storage and preservation;
  - Control of sites including security and safety arrangements;
  - Acceptance of work and punch list control and completion;
  - Handover of completed Work to Company.
- Completions;
- Human Resource Management and Industrial Relations;
- Defect Notification Procedure

4.3.9.6 Project Status Reporting

SNC-Lavalin will work closely with Nalcor to establish a standardized, integrated reporting structure that will incorporate the following areas.

Meetings

Regular Project progress and coordination meetings will be held weekly and monthly with Nalcor. Monthly presentations to Nalcor management will be held at prescribed locations and intervals.

A quarterly review, to be attended by senior officials of both SNC-Lavalin and Nalcor, will also be established. The purpose of this review is to provide feedback to both SNC-Lavalin and Nalcor, review the success of the Project teams and solicit senior management input in resolving any identified weakness or required improvements. Project sponsors will ensure the timely resolution of issues.

A number of technical reviews will also be conducted by subject matter experts at appropriate points in the schedule.

Reports

A consolidated monthly Project report will be issued to Nalcor and will cover the following:

- Project status summary;
- General:
  - Project milestone status;
  - Significant events;
  - Commitments to date and forecast to complete;
  - Trends;
  - Progress measurement.
- Activity Reports:

- Project management;
- Project controls;
- Engineering;
- Construction activities;
- Procurement.

❑ Financial Report:

- Budget;
- Commitments;
- Cost reports.

❑ HSE Report;

❑ Any other items which Nalcor's Project Team may include.

Progress Measurement and Reporting

Progress curves will be prepared and updated monthly, as part of the monthly progress report, showing actual performance versus planned performance. A bar chart schedule will also be prepared that will show manpower required by time interval for each activity and shall reflect percent of schedule completion by time interval for each activity.

An Earned Value analysis will be provided monthly that will show earned value metrics on both cost and schedule performance.

4.3.9.7 Codes and Standards

The codes and standards to be used by all suppliers, engineers and contractors on the Project, including those engaged directly by Nalcor, will be based on recognized international standards and will include compliance with laws and regulations of Newfoundland and Labrador.

Professional Engineers will be registered with the Professional Engineers and Geoscientists of Newfoundland and Labrador in compliance with the Engineers and Geoscientists Act of Newfoundland and Labrador and as required by Nalcor.

The actual codes and standards to be used on the Project will be defined in the Project Design Criteria of each discipline.

4.3.9.8 Project Management Software PM+

SNC-Lavalin's ***PM+*** Project Management System will be utilized to monitor and control the work.

Further detail is provided in Attachment 4.3.i-1 at the end of Section 4.

4.3.10 j) Cost Control Methodology

j) Cost control methodology;

During the start-up phase and upon receipt of the latest capital expenditure (CAPEX) estimate for the project, SNC-Lavalin will perform a gap analysis of the estimate. If it is discovered that there is a need for adjustments, SNC-Lavalin will make those changes for Nalcor to approve.

Using the approved CAPEX, SNC-Lavalin will convert the control estimate into the project control budget by segregating all the costs into commitment packages in accordance with the agreed purchase order and construction package execution philosophy.

Working with the procurement buyer or the contracts administrator, the cost controller will establish a suitable price breakdown to be submitted with the Tender. The result of the price breakdown will be reflected in the format of payment certificate to be used for the invoicing of the PO or Contract when the commitment is posted into PM+.

The cost controller will be responsible for ensuring that all documentation has been received prior to preparing a Payment Authorization Request (PAS) for submittal to Nalcor.

If required, SNC-Lavalin can operate a project bank account in PM+, where funds are deposited by Nalcor and payment made by SNC-Lavalin maintaining a zero balance account.

Change control and monitoring methodology, in association with a trend program, will be used for the timely assessment of the impact of changes in scope relative to the project budget, schedule and the EPCM services contract. The methodology records and reports the overall effect of changes and provides a basis for obtaining agreement to budget adjustments.

A request for a change to the scope of the work may originate from any source within the project. However, the total funds contained within the project control budget can only be changed on the written approval of Nalcor through a Change Notice/Order.

Prior to incurring expenditures in excess of the amount provided for in the project control budget, SNC-Lavalin will notify Nalcor in writing and request their approval.

4.3.10.1 Trending

A trending program will be established at an early stage in the project in order that management can react quickly to cost deviations allowing corrective actions to be

implemented in a timely manner. The trending program is a team effort. SNC-Lavalin and the Nalcor project team members have an obligation to initiate trends if they are aware of any potential variation to the scope of work. The Project Controls Manager, supported by the Cost Engineer, will be responsible for the trending program.

Types of Trends

Trends are identified by the following five major categories:

- Changes in Project Scope: generally initiated by the Owner by adding, deleting or changing entirely, or partially, facilities, systems and performance specifications.
- Design Development: occur as a result of better engineering definition which might change layouts and/or civil and structural requirements and/or material and equipment specifications.
- Quantity Variance: occur when there has been a change increase/decrease to control estimate budgeted quantity.
- Price Variance: occur when there has been an increase/decrease in the budgeted price unit.
- Estimate error or omission.

Trend Impact

Trends are initially recorded at the order of magnitude level as a “Potential Trend”. If the decision is made to implement the trend, then the trend will be included in the final cost forecast as one of the foregoing cost categories.

4.3.10.2 Contingency Budget

During the execution of the project, contingency budget requirements will be analyzed on an ongoing basis and the contingency budget adjusted based on the percentage of scope of work complete. The process of drawing down on contingency will be discussed and formalized.

4.3.10.3 Estimating

When engineering has progressed enough, SNC-Lavalin will prepare a capital cost estimate (CAPEX). At this time it is expected purchase orders will have been placed for the early works and all major items of plant equipment, construction work will have commenced at the job-site and bulk materials will be better quantified.

The accuracy of the Class 3 definitive Estimate is expected to be in the range of -5% to +10%.

Prior to commencement of the estimate a detailed estimate plan will be prepared indicating the estimate basis and estimate methodology to be used.

Tender Check/Price Validation

During the construction phase, it will be necessary to validate contractors' submitted prices for changes, extras or an additional work package that is issued after the contract award. As part of the Contract Administrator's negotiating practice SNC-Lavalin estimators will prepare check estimates as requested and challenge the contractor price if it is deemed unreasonable.

4.3.11 k) Planning and Scheduling Methodology

k) Planning and scheduling methodology

SNC-Lavalin will use the industry standard Primavera P6 scheduling software for all Critical Path Method (CPM) Scheduling.

Under the direction of the Lead Project Planner, SNC-Lavalin will develop, monitor, and update all Project Schedules required for the execution of the project. The Lead Planner will ensure a consistency and accuracy for all work presented by the Area Planners.

The planning and scheduling team will be responsible for the development and regular update of the following supporting documents:

- List of Key Milestone Dates;
- Engineering & Construction Progress Curves;
- Manpower Forecast & Levelling Charts (MFL);
- Critical Items/Actions Lists;
- Early Activities Schedule;
- 90 day Look Ahead plans;
- Intermediate Milestones dates for P.O. & Contract Documents.

4.3.11.1 Scheduling Process and Schedule Hierarchy

The Scheduling process and schedule hierarchy are presented in Figure 4.3.k-1 and are described in more detail below.

Summary Milestone Schedule (Level 1)

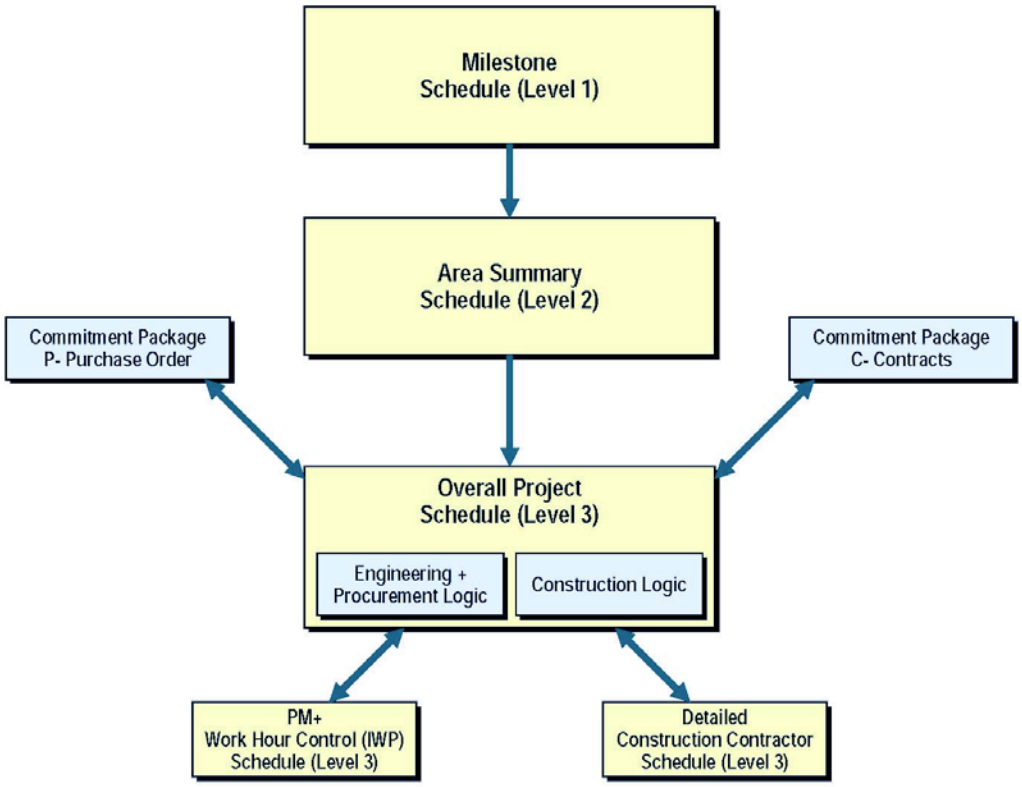
The base line Summary Milestone Schedule will be developed to meet Project goals and objectives and to ensure that the work will be performed expeditiously and economically in order to achieve an early return on investment.

Once established and approved by Nalcor, the Summary Milestone Schedule will be set as the baseline and be subject to change only by agreement with Nalcor or an approved Project Change Notice.

Summary Area Schedules (Level 2)

For some of the more complex power facilities, it is envisaged that a more detailed definition to the Level 1 Summary Milestone Schedule will be required. A further breakdown in these selected areas will be prepared in the Level 2 Summary Area Schedules

Figure 4.3.k-1 - Schedule Hierarchy Flow Chart



Project (CPM) Schedule (Level 3)

The Level 3 Project Schedule will cover all engineering, procurement and construction activities and constitute a comprehensive schedule for accomplishing the work. The Level 3 schedule will be based on the approved Summary Milestone Schedule. The logic of the Level 3 detailed schedule will reflect the relationships and interdependencies between engineering, procurement, construction, pre-commissioning, commissioning and start-up activities with a goal to achieve the project objectives of Nalcor.

The Level 3 schedule will identify task commencement dates, task duration and critical path(s) and will be broken down by Engineering Work Package, Purchase Order and Construction Installation Contract Packages.

Lead times identified on the schedule for equipment deliveries will be based on information obtained from suppliers and adjusted to experience on current similar projects.

Additional time will be added to the schedule delivery duration to take into account the time to move goods from their shop FOB location through ocean freight and where necessary clear customs.

Construction durations on the schedule will reflect the estimated hours for construction by sub-trade.

Level 3 Schedule reviews will be held on a regular basis with the Area Managers, Engineering, Procurement and Construction to ensure that planned project progress is in conformance with the schedule objectives.

Engineering Work Packages and Work Hour Control

The SNC-Lavalin estimate of work-hours is structured into the project management, engineering and procurement activities. PM+ will generate reports that provide a comparison of budget hours against actual hours spent and forecast man-hours at completion.

SNC-Lavalin will package all engineering deliverables into Engineering Work Packages (EWP). These EWP activities will be linked to budgeted durations for each activity and a corresponding list of physical deliverables, man-hours per deliverable, resources required and scheduling milestones will be confirmed and entered into the PM+ Internal Mandate module for progress measurement purposes. Procurement and contract packages will be confirmed and all of the engineering deliverables will be allocated to the appropriate EWP/commitment package. A monthly update will include hours expended by discipline, the status of each document and the forecast of hours to complete.

The earned value concept is used within PM+ Internal Mandate to determine engineering progress. The establishment of earned value milestones for the engineering deliverable is linked to PM+ Document Management System (DMS), where the issue of a document transmittal triggers the release of the pre-determined threshold of earned value.

Construction Contractor Schedules

The Level 3 schedule will provide sufficient detail to allow the SNC-Lavalin Area Planners to establish intermediate milestone dates to be included in the installation contract tender documents.

The installation contractor shall provide a detailed construction work plan and schedule to meet the requirements of the recommended intermediate milestones dates and the Level 3 schedule objectives. Once approved by SNC-Lavalin, the Contractors schedule shall become a contractual document and be subject to change only by agreement with Nalcor.

The contractor will be instructed to provide their construction installation schedule in a format that is compatible to the SNC-Lavalin Level 3 Primavera Schedule to facilitate an electronic update of the Level 3 schedule.

Other Planning and Scheduling Activities

Planning provides the procurement group with scheduling dates for the following:

- Contracts tender/award;
- Equipment purchases;
- On site requirement dates;
- Required dates for vendor data.

4.3.12 l) Information Management

l) Information Management / document control;

SNC-Lavalin's Information Management approach is based on the work being executed out of the following locations:

- Project Office – St. John's, NL
- SNC-Lavalin's (BAE-Newplan) Office – Mount Pearl, NL
- SNC-Lavalin Other Canadian and International Offices
- Project Construction Site – Muskrat Falls, Labrador, NL

All Muskrat Falls Project information will reside within a dedicated IT infrastructure that will be set up at the contributing project offices by the SNC-Lavalin group. This infrastructure will host all the project users located at any of the contributing project offices.

A common infrastructure will be provided for Nalcor, EPCM and other users participating in the Project where required. Collaboration tools will be used to improve data sharing between the project participants not residing on the SNC-Lavalin infrastructure.

4.3.12.1 Services

The following services will be available to SNC-Lavalin users:

- Office inter-connecting;
- File and printing services;
- Desktop and portable computers and software;
- E-mail Services;
- Internet and Intranet services;
- CADD services;
- Integrated Software Systems and Tools (e.g. PM+, GPS, P6, PDM, CADD);
- Security and Anti-Virus Services;
- Back-up and Restore Services;
- Videoconferencing;
- ETS-Electronic Time Sheet;
- Local and remote user infrastructure support.

The following services will be available to Nalcor and other required Project personnel:

- Remote view-only access via appropriate security permissions to PM+;
- Access to PDM via appropriate security permissions.

4.3.12.2 File and Printing Services

Users will be provided access to the LAN and information repository, based on pre-determined access levels. Colour and Black and White Multi-Function Devices and plotters will be made available in the project management offices and on site, according to specifications agreed upon with Nalcor.

4.3.12.3 Desktop and Portable Computers and Software

Users will be provided with up-to-date computers for this project. SNC-Lavalin IT has developed a robust set of hardware standards and the proven processes to image and

deliver PC's and Notebooks. In addition, SNC-Lavalin has over 150 specialized and leading engineering software tools, complemented by a large up-to-date catalogue of technical libraries and productivity software. SNC-Lavalin has the ability to match the hardware specifications delivered by a client; however, the configuration of the operating system must meet the strict guidelines of SNC-Lavalin.

All software purchase specifically by SNC-Lavalin on behalf of Nalcor shall be done so in accordance with an End User License Agreement (EULA) and will be transferred to the owner at project close-out.

4.3.12.4 E-mail Services

For day-to-day communications, conventional e-mail systems will be used. The standard will be Microsoft Outlook. All messaging data is secured and virus protected.

This Exchange infrastructure provides users not only the basic needs such as email, calendars and contacts, but also public folders to share and centralize information. In addition, users can access these items remotely via web access or wireless Email access services (Blackberry server).

4.3.12.5 Internet Service

Only authorized users will have access to the Internet from their workstations to ensure optimal productivity, performance and security.

4.3.12.6 Voice over IP (VoIP)

VoIP services will be made available at the St. John's office and at the Muskrat Falls Construction Site office.

4.3.12.7 Security and Anti-Virus Services

In order for the services to be effective, every user will follow a strict set of Security Directives, Policies, Procedures and Standards. These directives shall ensure that all aspects of the business are regulated in a secure manner. These shall also ensure that every modification of the production environment is rigorously tested, approved and communicated before being put into operation.

Security is a top priority. In order to ensure data integrity, a complete service offering through the SNC-Lavalin local and corporate resources will be put in place, to include:

- Network and user protection against intrusions, viruses and spyware;
- Information security policies and procedures;

- Vulnerability and threat management; and
- Information security incident handling and investigation.

All systems are monitored/protected by the latest anti-virus software (licensed McAfee virus software) programmed to automatically scan the entire system (server and workstations) on a weekly basis.

Data protection is a major priority. The latest technologies to obtain peak backup performance will be used in order to insure project data is both protected and available for restore to maximize project user functional uptime.

4.3.12.8 Video Conferencing and Internet Based Teleconferencing

Video-conferencing facilities will be provided in the St. John's project office and can be made available at the other Project Offices and Muskrat Falls Construction Site as required.

WebEx Internet based teleconferencing sessions will be supported by SNC-Lavalin. These sessions allow users to simultaneously view and collaborate on presentations or other material being broadcast, from the primary computer or any other participating computer in the session.

4.3.12.9 Metaframe Access to Project Management Systems

The PM+ users will access the SNC-Lavalin networks via an SSL encrypted Internet connection. Once on the SNC-Lavalin network, users will be able to connect to PM+ through a Metaframe Farm to perform their daily work. The Metaframe Farm provides load balancing and redundancy for the user connections.

4.3.12.10 Local and Remote User and Infrastructure Support

User and infrastructure support will be provided locally by a dedicated SNC-Lavalin project IT group in order to provide the best response time.

IT support personnel will be available for the duration of the project. These local resources will handle all requests. When needed, these on-site resources will communicate with the SNC-Lavalin Corporate Service Desk, which will assign the call to the appropriate level of expertise.

4.3.12.11 IT Services for Contractors On Site

SNC-Lavalin can provide on-site contractors a broad range of IT services:

- Email accounts;
- Intranet access;
- Internet access;
- End user computing services for non-SNC-Lavalin resources.

The default offering for non-SNC-Lavalin or client users will be an Internet connection in the DMZ. This will allow these users to connect remotely to their own infrastructure.

4.3.12.12 Organization

SNC-Lavalin has a team of IT expert resources worldwide supporting its core business with vast experience in project office setup, expansions, integrations, interconnections and demobilizations.

To ensure a high level of support for the project team, a structured IT support team will be mobilized to the project. This comprehensive team will include the necessary resources required to support all Project activities at all project offices and the Muskrat Falls site. In addition, the SNC-Lavalin corporate service desk will be available 24 hours a day, 7 days a week.

4.3.13 m) Interface Management

m) Interface management;

In today's environment, engineering and construction projects are increasingly complex, requiring the involvement of multiple stakeholders, each of which results in an interface which must be managed. Interface management is a key part of managing a project as poor interface management can jeopardize a project through cost overruns and delays resulting from inadequately defined interfaces between different scopes of work and failure to properly manage the inevitable conflicts.

It is not enough to simply track interfaces – they must be identified, defined and managed. The interface management process requires rigorous planning, early identification and prioritization of issues, and quick resolution to avoid negative impact on project cost, schedule and quality of systems.

SNC-Lavalin understands the importance and criticality of this function and will establish an interface management program that will address effective communication, coordination and responsibility across all project stakeholders.

4.3.13.1 Client Interfacing

The key to ensure the best possible interface between Nalcor and SNC-Lavalin is to mirror the project organization within the two organizations. As a minimum, we recommend that the following positions be mirrored:

- Project Manager
- Engineering Manager
- Project Services Manager
- Procurement Manager
- Construction Manager
- HSE Manager
- Aboriginal Affairs Manager
- Newfoundland Benefits Manager
- Labour Relations Manager
- Area Managers

By twinning these positions and by locating the respective managers of Nalcor and SNC-Lavalin in the same office, the interface between these two groups will provide clarity, transparency and be clearly improved over traditional interface setups. The counterparts in each group must have a good understanding of each other's role and responsibilities and the communication between them must be transparent for the project to operate efficiently and run smoothly.

4.3.13.2 Project Interfaces

In addition to interfacing with the client organization, within the Project there will be a requirement to interface between the four Components (i.e., the hydro development teams with the teams working on the DC Specialties and the transmission lines). There will also be interfaces between areas and between contractors, e.g. civil works contractors, turbine generator supplier and BOP suppliers.

An interface organization will be established within the project with representatives from all relevant groups to ensure that interface requirements are identified early on and that issues are sorted and delays avoided. The interface team will be led by an Interface Manager who will establish an interface log and who will schedule regular meetings of the team for the purpose of resolving interface issues before or as they arise.

4.3.13.3 Interface Management Program

A strong interface management program will contain essential elements of project management including:

- Clear organization charts and reporting structures;
- An overall framework for interface management;
- Adequate, timely, efficient communications that foster an understanding of requirements that cross physical, functional areas;
- Processes to identify and quickly resolve issues among the interfaces at the beginning of the project.

The interface management program will be developed by SNC-Lavalin at the outset of the Project and will be agreed to at the Project kick-off meeting.

The interface management program will be implemented at the outset of the Project to ensure proper management of all Areas as well as all contractors that will be engaged for construction.

4.3.13.4 Interface Communications

The Matrix structure requires Area meetings as well as functional meetings to ensure proper coordination within the Project. A "meetings" schedule will be developed to review and discuss interface issues within the various project teams.

Meeting Type	Attendees
Overall Project Management	Project Managers and Functional Managers
Area Meetings	PM's / AM's and Functional Managers
Engineering Meetings	Engineering Manager and Leads
Project Services Meetings	Project Services Manager and Leads
Procurement Meetings	Procurement Manager and Leads
Construction Meetings	Construction Manager, Area Construction Managers and Leads

4.3.14 n) Reporting

n) Reporting;

Among the first tasks after project award, SNC-Lavalin will prepare a Project Reporting Plan to be approved by Nalcor. The plan will detail all project report requirements, responsibility, frequency of issue, distribution list and timing for each report. The reports will include:

- Monthly Progress Report
- Cost Report
- Trend Register

- ❑ Schedule Update
- ❑ Weekly Job-Hour Report
- ❑ PM+ Progress Report
- ❑ Change Order Register
- ❑ Critical Items Report
- ❑ Commitment Package Status Report
- ❑ Local and Aboriginal Benefits Report.

Once the list of reports is finalized and approved by Nalcor, the list and the procedure for issuing the reports will be incorporated into the Project Execution Plan (PEP).

4.3.15 o) Procurement and Contracting

o) Procurement and contracting (further detail regarding procurement and contracting shall be provided in response to question 18.0 herein);

4.3.15.1 Procurement Policies and Principles

Procurement services will be performed generally in accordance with the SNC-Lavalin ISO 9001:2000 registered Corporate Procedures (refer to Section 18 for list of procedures), which cover the following procurement functions: contracts administration; purchasing; material management; expediting; quality surveillance & inspection; and traffic & logistics.

Bids will be solicited on a competitive basis except in instances where it is agreed with Nalcor that sole source or limited bidding is to the advantage of the project. It is SNC-Lavalin's commitment to strive to achieve total quality requirements on behalf of Nalcor with the objective to obtain maximum value for the project in compliance with the cost, quality, and schedule.

Transparency and attention to detail will be the cornerstones of the procurement effort.

4.3.15.2 Procurement Organization

Reporting to the Project Director, the Procurement Manager, will be located in the St. John's project office and be responsible for all procurement activities. The Procurement Manager will lead the procurement management team and the procurement resources assigned to the project and will ensure that all procurement activities meet project requirements. He will be supported by key personnel in the areas of: Purchasing,

Contracts Management, Expediting, Inspection, Materials Management, Traffic & Logistics, Pre-Assembly Yard Coordination and Benefits Coordination as shown in Attachment 6.2-1, Figure 6.5 in Section 6.

The Procurement Team will liaise with project management, engineering, project services, fabrication yards and the construction management groups located in the St. John's and at the project sites.

4.3.15.3 Procurement Plan

An overall contracting and purchasing plan will be developed by the Procurement Manager and his team. This Plan will address the project schedule, the location of the project site, an approach to the award and administration of fabrication contracts, and the approach to the key construction contracts. The plan will consist of:

- Detailed description of the equipment and material being purchased;
- The purchasing and contracting philosophies;
- Schedule of key dates;
- Sources of supply and proposed project bidders list;
- A logistics study and plan;
- Levels of signing authority;
- Authorities for approvals including authorities for commitments.

Individual purchasing and contract plans will be prepared as required.

Bids will be solicited on a competitive basis.

All bid submissions, evaluations and recommendations to award will be treated as strictly confidential.

Special emphasis will be made on ensuring that ***local sources of supply*** are considered and that regional and local suppliers are provided every opportunity to bid on the work.

As appropriate, and for certain categories of goods the option of low cost country sourcing may be judicious and would be investigated. The SNC-Lavalin corporate Global Procurement group provides in-depth, worldwide expertise on all sourcing categories required for a project. This expertise, which is available to the project procurement team, is the result of the systematic collection of vendor performance assessments completed by SNC-Lavalin projects worldwide, as well as intense vendor development activities, especially in emerging sourcing countries such as China, India

and Eastern Europe, where Global Procurement has dedicated staff to perform these critical activities on a full time basis.

Emerging country sourcing is an important element of SNC-Lavalin Global Sourcing strategies, driving major costs savings - typically in the range of 20 to 50% - as well as delivery lead time reductions for most sourcing categories.

Risks associated with emerging country sourcing are thoroughly mitigated through a stringent vendor qualification process as well as a best-in-class country sourcing risk management methodology, which not only masters risks but also accurately assesses the associated mitigation costs.

All these elements as well as logistics costs and lead times are taken into account by the Global Procurement Category Managers responsible for designated sourcing categories to help projects develop optimal Global Sourcing strategies tailored to the unique characteristics of a project, taking into consideration a worldwide view of the supply market.

Category Managers have developed a carefully selected set of preferred vendors for each sourcing category, with which they constantly optimize the business relationship in order to systematically obtain the best quality, price and delivery lead times.

4.3.15.4 Contracting & Purchasing Strategy Overview

Procurement will participate in establishing the package content, along with construction management, project controls and engineering. A conscientious effort will be made to establish packages with single discipline content as far as practical. In developing the content of the contract packages, the following will be taken into consideration; project labour requirements and manning levels, efficiency of construction, continuity of work, efficient utilisation of construction equipment and local contractor involvement.

In conjunction with planning and engineering, the purchasing and contract groups will participate in establishing a list of packages (see below for partial listing) which are to be purchased at the related phases of the project.

A-001	LS	Access Roads
A-002	LS	Site Development & Services
A-003	LS	Accommodations Complex & Offices
A-004		Upgrading of Existing Access Roads, Bridges
C-001	UR	Excavation for Structures
C-002	UR	Excavation for Dam and Cofferdams
C-003	UR	Diversion/Spillway
C-004	UR	Bulkhead Dam
C-005	UR	Intake and Powerhouse

C-006	UR	Cofferdams and Diversion
C-007	UR	RCC Dams
C-008	UR	Structural Steel Works
C-009	UR	Powerhouse Cladding & Roofing
G-001	UR	Catering and Janitorial
G-002	LS	Security
G-003	LS	Medical Services
G-004	UR	Reservoir Clearing
G-005	LS	Sewage
G-006	UR	Potable Water
G-007	LS	Site Communications
G-008	UR	Accommodations Maintenance
G-009	UR	Fuel
G-010	LS	HV/GB Office
G-011	UR	HV/GB Services
G-012	UR	Staff Transport
E-001	LS	Temporary Power Line & Distribution
E-002	LS	Generators and Auxiliaries
E-003	LS	Power Transformers
E-004	LS	Electrical Systems
E-005	LS	Electrical Balance of Plant
E-006	LS	Switchyard
E-007	LS	Communications
M-001	LS	Turbines & Governors
M-002	LS	Spillway gates, Hoists and Stoplogs
M-003	LS	Intake Gates, Trashracks, Hoists & Stoplogs
M-004	LS	Draft Tube Gates and Hoists
M-005	LS	PH Bridge Cranes
M-006	LS	Elevator
M-007	LS	Mechanical Systems
M-008	LS	Mechanical Installation
M-009	LS	Building Services

A typical package will include the following documentation:

- Instructions to Tenderers;
- Bid and price schedules;
- Terms and conditions;
- Statement of work;
- Technical specifications;
- Drawings.
- HSE Requirements
- Labour Management in particular regarding Aboriginal and Metis groups.

Performance bonds and guarantees shall be as per Nalcor requirements.

Co-ordination of the bidding process will be the responsibility of the Purchasing / Contracts Manager which includes site visit co-ordination and the convening of bid review meetings. This process will be governed by strict rules in regard to communication, times and procedures. All bid submissions will be treated as strictly confidential and the evaluations and recommendations to award will be handled on the same basis.

Dependant on the nature or value of the award, it may be desirable to convene a tender review meeting with the proposed successful bidder to review the project constraints and to clarify any outstanding points which may have surfaced during the bid evaluation stage. All official correspondence or communication with the bidders will be executed by a representative of the procurement group.

All bids will be evaluated by engineering and procurement and approved by project management and Nalcor. Engineering and procurement will jointly issue the final recommendation.

All commitments to contractors and suppliers and all awards on behalf of Nalcor will only be issued and confirmed by a representative of the procurement group after having obtained all required approvals. A pre-award meeting may be called to notify the contractor / supplier of the intent to proceed and to finalise scope understanding, mobilization / start dates and schedules prior to the issuance of the contract documents.

Following award, a confirmed purchase order or contract document will be prepared and issued to the supplier or contractor for signature. Thereafter all contractual documentation such as the signed purchase order or contract agreement, bonds, insurance certificates, etc. will be expedited from vendors and contractors, and all unsuccessful bidders will be notified by the Purchasing or Contracts manager as the case may be, or their delegates, following execution of the agreement for each package.

Purchase Order Administration

The buyer, SNC-Lavalin on behalf of Nalcor, remains responsible for the post-award administration of the purchase order ensuring that all correspondence affecting the contractual nature of the agreement is duly recorded and that all claims or extras are actioned and resolved. All changes to the contractual nature of the order must be confirmed by an approved amendment.

The buyer is supported by Expediting, Inspection & Logistics throughout the order time frame, but remains responsible until close out.

When the supplier has completed all work in accordance with the provisions set out in the purchase order document, the order will be reviewed to ensure completeness and a close-out check list will be completed and put on file. It is the responsibility of the buyer

to initiate the actions necessary for the final close out of the orders and to ensure that all outstanding issues have been resolved.

4.3.15.5 Site Contract Administration and Co-ordination

Upon award of the contract by procurement, contracts administration will transfer responsibility to the construction management team's Site Contracts Manager assigned to manage the agreement.

The Site Contracts Manager is responsible for the commercial administration of the construction contracts. Under the responsibility of the Site Contracts Manager is:

- Communications with the Contractors;
- Change Control and Management;
- Progress Payments;
- Acceptance of the Work and Release of Holdback;
- Contract Close-out.

Communications With The Contractors

- All contractual correspondence, commercial instructions or other formal written communications with the contractor will be issued by the Site Contracts Manager;
- Field transmittal memorandum will also be used for all drawings, specification. Acknowledgement of receipt by the contractor will be required;
- Regular progress meetings will be held with contractors and meeting minutes will be distributed by the Site Contracts Manager.

Change Control and Management

The Site Contracts Manager is responsible for monitoring and maintaining a log on all contractor claims, all engineering or site change notices sent to the contractor for pricing as a potential extra to the contract, all instructions issued to the contractor authorising extra work.

All contract changes must be authorised by a Contract Change Notice and amendment to the contract, issued by the site contracts administrator, supported by the applicable engineering or construction change details and an approved change requisition signed-off in accordance with the project procedure.

The Site Contracts Manager is responsible for tracking the evaluation of contractor claims and ensuring that the following steps are completed prior to issuing a response to the contractor.

- Analysis and study:
  - legitimacy of request from a contractual point of view;

- analysis of impact on contractor schedule contracts.

❑ Estimate and pricing:
- quantity survey from drawings or site investigation;
- estimate of manpower, material, equipment;
- indirect cost;
- fix fee;
- workers benefits;
- overhead and profit.

❑ Approval or rejection:
- provide review comments on validity of the claim;
- obtain overall recommendation on acceptance of claim from Project Manager / Nalcor;
- document agreed strategy and response to contractor;
- prepare response to contractor.

Progress Payments

Requests for progress payments shall be submitted by the contractor in accordance with the agreed format and item breakdown. Contractor's requests for progress payment shall be accompanied by the contractor's invoice, supporting documentation, and by statutory declarations completed by the sub contractors to the work, stating the amounts they have claimed and payments received from the prime contractor.

❑ Lump sum control:
- itemize and sign with contractor before first payment;
- progress based on quantities or percentages verified by the Construction Quantity Surveyor or Field Engineer.

❑ Documentation:
- detail work sheet dated and signed;
- statutory declaration(s) from sub-contractors;
- receipts for material delivered / claimed;
- time sheets for reimbursable hours or equipment usage.

Acceptance of the Work and Release of Holdback

Basic documentation for acceptance of contract work will include the following:

❑ Notice of completion by the contractor, stating that all work under the contract is complete, and that the contractor is requesting approval for final acceptance;

❑ Completion and acceptance certificate certifying that all work is complete in accordance with plans and specifications. This is to be signed by the contractor and by SNC-Lavalin;

❑ Release and waiver of lien submitted by the contractor is required prior to releasing final payment.

Prior to acceptance, SNC-Lavalin will ensure that all manuals and as-built drawings are received and approved. Acceptance of the Work may be Final, without any deficiencies,

or Interim, where the Work is essentially complete with a list of deficiencies remaining to be rectified. It is the responsibility of the site contracts administrator to ensure that in the case of an interim release sufficient monies from the holdback are retained to provide incentive to the contractor to rectify the outstanding items. Only after all deficiencies have been agreed and cleared by the engineer, will the site contracts administrator process the final acceptance and release of the remainder of the holdback.

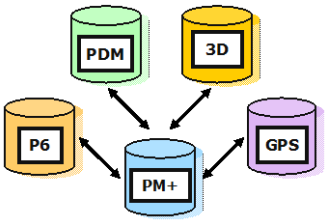
Contract Closure

When the contractor has completed all work in accordance with the provisions set out in the contract document, the contract will be reviewed to ensure completeness and a close-out check list will be completed and put on file. It is the responsibility of the site contracts administrator to initiate the actions necessary for the final close-out of the contract and to ensure that all outstanding issues and contract change notices and claims have been resolved.

Materials Coordination

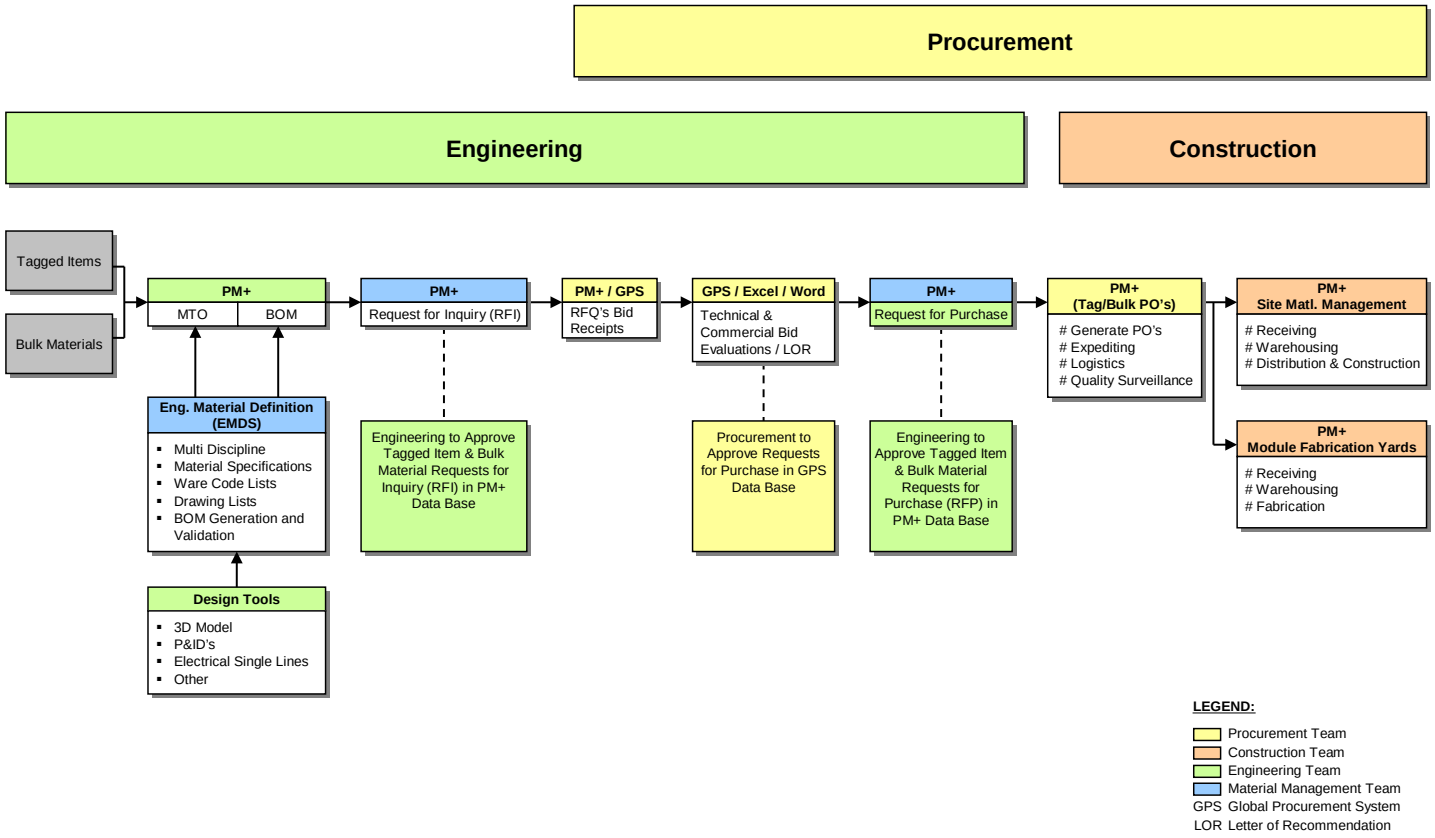
The Materials Co-ordinator shall, in conjunction with engineering, be responsible for the implementation of the PM+ control system and for the procedures and methods ensuring that equipment tag numbering, material commodity codes, and part numbers are established, recorded into the system, and applied throughout the project. The Materials Co-ordinator's responsibility also carries through to the material control functions on site.

The SNC-Lavalin PM+ Control System, in concert with the Global Procurement System (GPS), will be used for the control of material on the Project. These secure integrated systems are described in further detail in Attachment 4.3.i-1.



The Materials Management process is illustrated overleaf in Figure 4.3.o-1 and is described in more detail below.

Figure 4.3.o-1 - Materials Management Process Flow Chart



Engineering

In the PM+ Engineering Module, the multi discipline engineering team will build one large Tagged Items and Bulk Material data base organized into two partitions as follows:

Partition One

This partition includes all Tagged items, comprised of all uniquely identified major and standard equipment components to be defined, procured and eventually installed in the Muskrat Falls Power Plant. The quantity is always “ONE” and the list includes the following item types.

- Mechanical equipment major and standard;
- Electrical equipment major and standard;
- Instrumentation equipment and devices.

Most, if not all, Tagged items are electronically imported into PM+ from the Process and Instrumentation Flow diagrams and Electrical One Line diagrams.

Partition Two

The second partition includes all Bulk Material items which are imported from the 3D-CADD data base via a validation module called Engineering Material Definition System (EMDS). In this module all material items specified on a bill of material (BOM) for a Drawing are validated against various specification requirements and ware coding tables valid for the project. The bulk material data base includes all bulk materials to be procured for the project for all engineering disciplines.

The module further facilitates the development and control of Requests for Inquiry (RFIs). The RFI process includes the inclusion of budget and schedule information by Project Controls and Construction.

When an inquiry is ready to be processed by the purchasing team, the package engineer will approve the RFI. Once approved, the RFI passes the gate and is electronically available for purchasing action.

When the purchasing activities are complete in GPS as described under Procurement below, a commercially approved Request for Purchasing (RFP) is uploaded in the engineering module of PM+. The package engineer will perform a final review from a technical point of view and subsequently approve the RFP from a technical point of view. Following that approval a pending purchase order is created in the procurement module for action by the package buyer.

Procurement

An RFI approved by engineering is electronically downloaded into the Global Procurement System (GPS) and the appropriate information thereof is included in the Request for Quotation (RFQ).

The RFQ is posted electronically along with technical and commercial documentation to the approved bidders. Suppliers respond on line and place their bids in GPS.

Subsequent to bid closing the purchasing and engineering teams perform bid evaluations and decide on the successful supplier.

Once the purchase recommendation is completed and the Letter of Recommendation (LOR) is approved by the client, the package buyer completes and approves the RFP in GPS from a commercial point of view. The approved RFP is automatically transferred into the engineering module of PM+ as an RFP.

Once the RFP has received technical approval by the package engineer in PM+, the package buyer can complete and award the purchase order in the PM+ data base.

Expediting

As soon as a PO is awarded in PM+ the expediting team can commence the expediting functions in PM+ which consist of the following:

- Monitor and control the Vendor Document production and approval process using the Vendor document control module in PM+. This activity takes place in close collaboration with suppliers engineering and document control;
- Introduce PO Sub Items if PO items are fabricated and supplied in multiple items;
- Prepare a Scheduled Delivery data base(s) in PM+ if purchase orders are delivered in multiple deliveries;
- Conduct regular contacts with vendors to ensure that the forecast deliveries are in line with contractual delivery dates and Required at Site (RAS) dates of goods to the construction site;
- Issue Shipping Release Reports to vendors and the logistics team once a detailed packing list is received from suppliers. This function triggers the transportation activity to site and is completed in collaboration with the quality surveillance team to ensure that goods are fabricated following all approved fabrication drawings and specifications.

Quality Surveillance

As soon as a PO is awarded in PM+ the quality surveillance team can commence the inspection functions in PM+ which consist of the following:

- Plan all inspection visits;
- Log results of inspection visits;
- Log all Non Conformance Reports (NCR) and corrective action including resolutions;
- Prepare final inspection reports and Shipping releases in collaboration with the expediting team.

Logistics

Working in close collaboration with expediting the logistics team will have full access to the expediting and logistics module of PM+ and perform the following activities in PM+.

- Prepare detailed Shipment Manifests for each Scheduled Delivery that has been released based on the Vendor Packing list including, packaging, crating and container information;
- Prepare shipment itinerary for each shipment;
- Manage shipments to site.

Site Team

The site materials management team has access to PM+ and will be in position to view each Scheduled Delivery and Shipment Manifest available in the PM+ database.

The estimated time of arrival (ETA) on each Shipment Manifest allows the site team to be prepared to receive and unload each shipment effectively so that all goods and materials are properlly stored in the site warehouses and yards and that inventory is correctly maintained.

Upon inspection each Shipment Manifest can provide input to:

- Material Receiving Reports (MRR) for accepted goods and materials;
- Over-shipment and damage reports (OS&D) for rejected goods and materials;
- Issue slips to installation contractors by BOM.

4.3.15.6 Transportation & Logistics

A detailed Logistics Plan will be prepared which will include procedures for:

- Administration of carriers and/or forwarders;
- Tracking of equipment and materials to the final delivery destination;
- Monitoring of shipping dates;
- Transportation of hazardous goods;
- Customs broker administration;
- Shipping terms and policy.

SNC-Lavalin is intimately familiar with marine operations at all ports in Atlantic Canada, the eastern seaboard and various large overseas ports and is well qualified to plan, organize, direct and control the flow of equipment and material using state of the art materials management tools.

The main drivers are schedule, to ensure timely delivery of equipment and materials to site and module fabrication yards, and economies of scale to reduce freight costs.

The Project may require entering into “Supplier of Choice Agreements” (SCA) concluded with experienced transport operators that have prior experience in large engineering projects in Newfoundland and Labrador and are familiar with operating conditions, infrastructure and potential supplier’s facilities in Newfoundland & Labrador and overseas.

The scope of the Project may also require setting up marshalling areas outside the project site and/or Newfoundland in order to capitalize on existing transportation services currently operating between St. Lawrence ports and Newfoundland & Labrador. (A limited number of carriers operate scheduled services in Newfoundland & Labrador.)

Imported equipment and materials shipped on chartered vessels can be delivered directly to Goose Bay provided the port is homologated by the Canadian Border Services Agency (CBSA) as an “Alternate Service Site”. Charter size shipments from North American sources and from overseas suppliers can be marshalled at conveniently located port cities in the Atlantic Provinces, St. Lawrence River ports or ports in Europe (Northern Range) and Asia; schedule permitting.

Containerized freight can be delivered to the construction site on a “port to door” basis using commercial shipping lines from any overseas origin. It is likely containerized freight would transit through Halifax, NS, for furtherance to Goose Bay via St. John’s or Argentia.

Airfreight shipments (Excluding Charters) would transit from the airports of origin to a North American Hub for furtherance to Happy Valley-Goose Bay Airport and delivery by road. Chartered aircraft would land at the Happy Valley-Goose Bay Airport.

Road Transportation

Construction Phase equipment and materials will arrive overland by road and by sea. Interim storage of equipment and materials off-site may be required. In this event, potential locations near Happy Valley-Goose Bay will be investigated to act as a staging zone, temporarily holding/storing equipment and materials until they are required at site. Alternatively, trade offs could be made between the marshalling areas referred to above and site.

4.3.15.7 Inspection & Expediting

The project Inspection and Expediting group will be located in the Project Office. Inspection/expediting resources will be primarily based in offices closest to the location of vendors and contractors.

The Expediting and Inspection Supervisors will operate out of the project office, and will retain overall responsibility for the expediting, quality surveillance and inspection activities on the project. SNC-Lavalin has a wide network of expeditors and inspectors throughout the major centres in Canada, USA, Europe, and Asia with agreements established with affiliated companies.

During the initial 90 days of Phase 3, an expediting and inspection plan will be established. Key equipment and materials will be identified. In conjunction with engineering, the levels of expediting, quality surveillance and inspection will be established for each proposed piece of equipment or material purchase package. Schedule dates will be reviewed in conjunction with construction and required on site (ROS) dates will be recorded.

The Expediting and Inspection Supervisor will liaise with engineering, planning and construction on a regular basis ensuring that the delivery priorities are identified and are being met.

The Expediting and Inspection Supervisor will ensure that all orders requiring inspection and expediting are assigned to personnel fully familiar with the type of equipment and materials. They will be responsible for the preparation of personnel expediting and inspection assignments for all orders and contracts as required, maintaining them within pre-approved budgets, and ensure that reports are issued in the SNC-Lavalin format within a 24 hour time period.

Expediting

The expediting group's prime responsibility is to ensure that all shipments and deliveries occur as required by the project schedule. Expediting is responsible for all deliverables under the purchase order or contract, including engineering drawings and technical documents, material test certificates, final certified drawings and manuals, and for the delivery of the goods themselves.

Expediting will ensure that vendor/contractor progress for design, manufacturing and delivery is in accordance with contractual requirements to meet the project schedule.

Expediting services will be performed in a consistent manner in accordance with SNC-Lavalin procedures which incorporate the documents and forms identified therein, and if necessary adapted for project specifics.

Expediting will ensure the free flow of equipment and materials from the vendors and contractors to site. An expediting plan will be developed identifying all purchase orders and contracts, the level of expediting required for each using the parameters specified in the SNC-Lavalin procedures. These pre-planned expediting levels will be commensurate with the scheduling criticality of the equipment and materials and the latest required at site (ROS) dates. These levels will be reviewed on an ongoing basis and revised if appropriate.

Expeditors will obtain a detailed production/fabrication schedule from the vendors and ensure that the vendor's schedule conforms with the contractual delivery date and with the onsite project requirements, then monitor the vendor's progress to assure compliance with the required delivery dates. The expeditors are responsible for monitoring the fabrication schedule, equipment test dates and the co-ordination of visits with the assigned shop inspector and/or inspection supervisor.

Prior to the shipment of the goods the expeditors are responsible for co-ordinating the inspection release of the shipment with the inspector, issuing shipping releases when all contractual requirements have been met, and ensuring that all shipping details and documentation are forwarded to the logistics co-ordinator once shipping arrangements are in place for the transportation of goods to site.

Should there be a need for post-delivery follow-up requiring action with the vendor, or contractor resulting from an overshipment, shortage and damage (OS&D) report received from the jobsite, then the expeditor is responsible for obtaining any additional documentation or for the replacement or repair of goods delivered.

Quality Surveillance and Shop Inspection

Quality surveillance and inspection will be carried out in accordance with the guidelines specified in the SNC-Lavalin corporate procedures registered to ISO 9001:2000. The source inspection program will be initiated and maintained in accordance with these procedures which incorporate the inspection format and forms identified therein. These will be adapted / customized for the project and issued as project specific instructions or directives.

These procedures incorporate overall communication documents in order to keep the project aware of what equipment will be inspected, what levels of inspection will apply, where the equipment will be inspected, and in conjunction with the expediting group, in what timeframe it will be inspected.

The inspection team will be principally located in the project office and as necessary will be supplemented by additional resources drawn from the Toronto office, from global SNC-Lavalin resources in various geographical office locations, from our affiliated inspection agencies: ECA/Bureau Veritas, Intertek, and NBS Guthrie, or third party agencies such as SGS and Moody International, all of which are fully qualified to

perform the required work. Where possible, SNC-Lavalin will use qualified local inspection groups.

Inspection management will be responsible for the preparation of inspection assignments for all inspection personnel, whether they are inspectors from SNC-Lavalin, affiliated agencies, or third parties, and will check and monitor the flow of package documentation to ensure the assigned inspectors are working with the latest package information at all times. Subsequent to award, they will address all quality related matters, respond promptly to all vendor or contractor questions and coordinate required visits by the project and Nalcor to the vendor or contractor's facility.

The inspection manager will ensure that the following steps will be taken:

- In conjunction with the engineering disciplines a project Inspection and Test Plan (ITP) will be prepared which will pre-establish inspection levels for all equipment and materials based on the criticality levels as defined in the SNC-Lavalin procedure guidelines. The engineering Vendor Data Requirements (VDR) list forming part of all purchase orders and contracts, defines the deliverables required from vendors or contractors and requires the vendors or contractors ITP to be submitted in a format provided by SNC-Lavalin.
- Following receipt and review of vendors or contractors ITP, inspection in conjunction with the responsible package engineer will establish an inspection program and specify all required review, inspection, hold and witness points for the purchased goods. The ITP will then be submitted to Nalcor's responsible engineer for review in the event additional inspection points are desired. Upon completion, the ITP will be returned to the vendor or contractor to ensure the required notification requirements for all specified test, witness and hold points are met.
- The inspectors will issue shop inspection reports within 48 hours following their visits to a vendor's facility. All problems identified affecting the work will be reported ensuring all involved parties are advised immediately. Deviations in the work will be documented on a Non-Conformance Report (NCR) issued to engineering. The engineer will be responsible for the disposition of any non-conformances and, upon receipt of instructions from the engineer, the inspector will monitor the vendor for the resolution of the non-conformance, the re-work or the replacement of the work.
- No goods will be released from the vendor facilities until the NCR has been disposed and closed-out completely.
- The release of shipments from a vendor's shop are controlled by the inspector. A final inspection release authorising the vendor to ship will be issued after the inspector is satisfied that the work has conformed to the technical specifications, that the vendor has complied with the required quality assurance programs, that all required QA, inspection, test and material certificates have been provided. The inspector will also ensure that the shipping documentation is complete and in order, visually confirm the contents of the shipment, and verify that the materials and equipment are adequately packaged and protected for shipment. On completion of

the work the inspector will issue a copy of the inspection release for distribution in accordance with the document distribution matrix.

GPS and PM+ Support

SNC-Lavalin has dedicated support personnel who will provide training and support for these systems in every office as required.

4.3.16 p) Subcontractor Management

p) Subcontractor management (further detail regarding Subcontractor management shall be provided in response to question 5.0 herein);

Suppliers (of equipment and materials), engineering subconsultants, and contractors (for construction and/or installation) are pre-qualified, evaluated and selected on the basis of their demonstrated ability and performance, a satisfactory evaluation of their capacities and resources, and on their ability to meet the requirements specified for the relevant project packages, including quality. A list of suppliers/contractors approved by SNC-Lavalin is kept up to date for use on projects.

Section 5.0 – Subcontractors contains a list of subconsultants that may be drawn upon, if required, to provide engineering support to the project, including those that are commonly called upon to provide specialist services such as model testing, surveys, etc. These would only be utilized if deemed necessary by the Project Team.

4.3.17 q) Project Change Management

q) Project change management, including changes to the Services

The project will establish a change control procedure which will govern all changes on the project

Changes can normally be expected to be introduced throughout the project due to the nature of the work involved. Scope may be added to or removed from the Consultant's mandate or to/from a construction / supply contract after a contract or purchase order has been ratified. Each of these events can lead to a change and subsequently a budget change or transfer.

There are two major categories of changes in a project, as discussed below.

4.3.17.1 Project Scope Changes

A Project Scope Change is considered to be a change in the scope of the EPCM contract between the consultant and Owner that alters, deletes or adds to the official

scope of work of the project. These changes can be either client-initiated or project team-initiated but must be formally identified and approved as they could affect the contract cost and schedule. These changes will be identified, discussed and settled through normal protocol (scope change identification, discussion, justification, negotiation, agreement) between the two parties.

4.3.17.2 Package Scope Adjustments (Contracts / Purchase Orders)

At the package level, changes can be caused by a transfer of scope from one commitment package to another, splitting packages and/or combining several packages, adding work through the issue by Engineering of Site Change Notices and supply adjustments for various reasons. The majority of these changes require an adjustment to the package budget, but usually do not affect the overall project budget and are not considered to be a project scope change.

4.3.17.3 Change Management System

A change management procedure and system will be implemented on the project to deal with changes and transfers of scope and budget at commitment package level, regardless of the source of scope change, package or project level. The change management system will use various documentation and control forms for formal project scope changes, design changes, construction field and supply package changes. Each of these will require specific actions and approvals that will be outlined in the project procedures.

Refer to the attached flow diagram, Figure 4.3.q-1, on the following page.

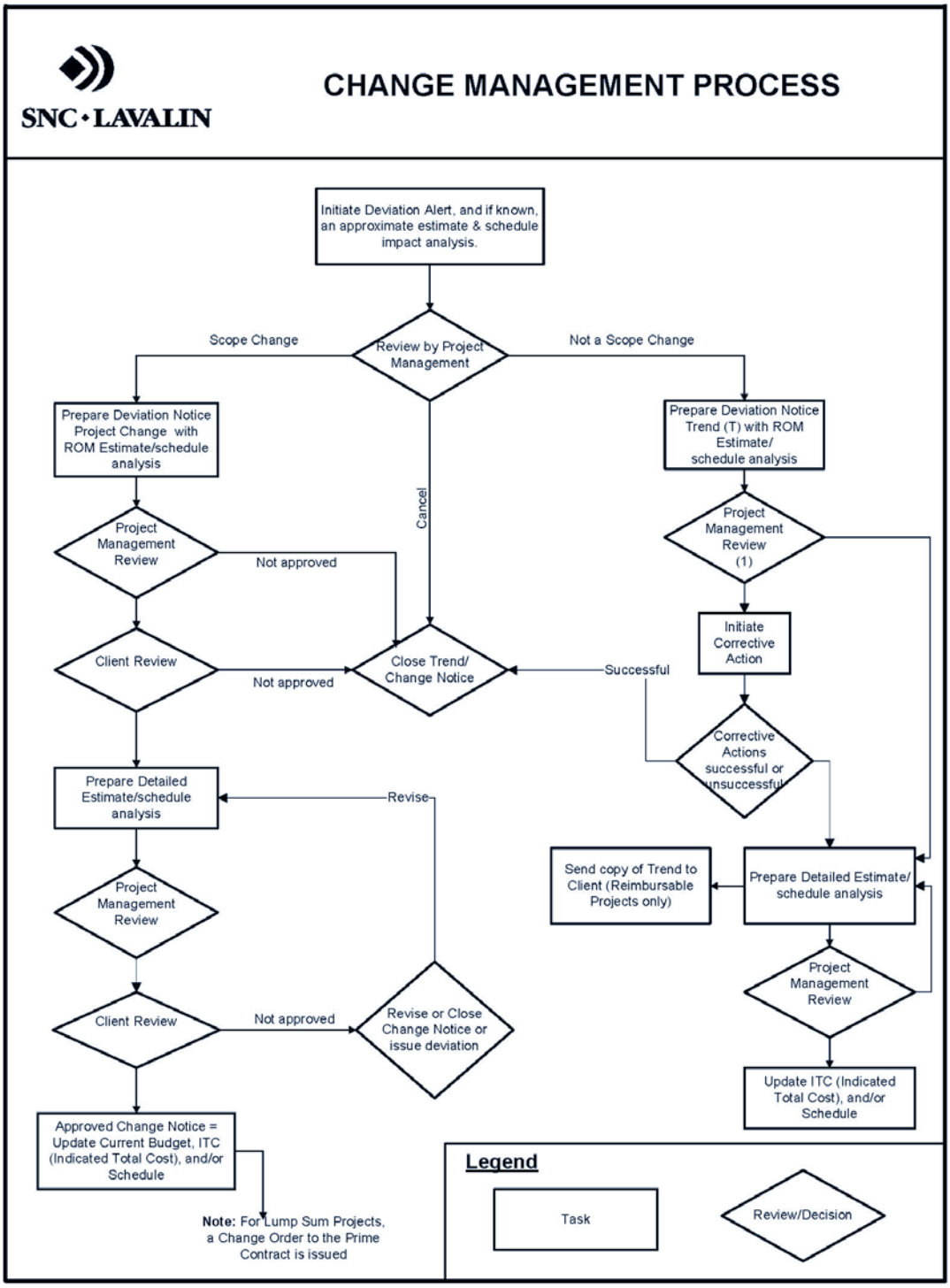
4.3.18 r) Accounting and Invoicing

r) Accounting and invoicing;

Project accounting and invoicing administration related to construction and service contracts and supply orders will follow established SNC-Lavalin project procedures.

Three procedures will be applicable – Financial Controls, Project Accounting and Vendor Accounts payable. These procedures will be modified to suit the particulars of the project and, in particular, payment of contractor and vendor invoices. It is understood that SNC-Lavalin will manage all EPCM financial matters and project accounting. Vendor accounts payable processes will exclude actual payment which will be by Nalcor; however, SNC-Lavalin will manage the process through to the payment requisition stage.

Figure 4.3.q-1 – Change Management Process



Computerized systems will be used to provide a common project management database at all project locations to plan and control engineering, procurement, construction and completions activities, as well as project management objectives of cost and schedule. The prime corporate proprietary software is the PM+ project management system. The PM+ cost control system with its accounting module will be used.

The Table of Contents for each of the procedures follows. Copies of the procedures can be made available on request, as well as details of the accounting module of PM+.

Table of Contents

Financial Controls

Project Accounting Overview

Vendor and Contractor Accounts Payable

1.0 PURPOSE
2.0 SCOPE
3.0 DEFINITIONS
4.0 RESPONSIBILITIES
5.0 REFERENCES
6.0 METHODOLOGY
6.1 Overview
6.2 Processing of Sub-Contractor's Progress Billings
6.3 Processing of Supplier's Invoices
6.4 Cost Accounting Files
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7.0 RECORDS
8.0 ATTACHMENTS
8.1 Payment Approval Slip
8.2 Progress Certificate
8.3 Funding Claim

4.3.19 s) Quality Assurance

s) Quality management (further detail regarding Quality management shall be provided in response to question 8.0 herein);

SNC-Lavalin is committed to providing quality services throughout the duration of the Muskrat Falls project through the application of our established Quality Management System (QMS). Quality is an essential part of our ***"We Care"*** policy that embodies SNC-Lavalin's key corporate values and beliefs.

Quality targets are achieved through the application of Quality Assurance and Quality Control procedures implemented at each and every level of project execution.

Quality Principles

The primary quality goal for a given project is defined as "meeting our client's contractual requirements". This goal is fully supported by the following four key objectives:

- Providing all deliverables and services as defined in the project scope;
- Providing all deliverables and services on or before scheduled target dates;
- Providing all deliverables and services on or below budget;

- Any detected performance or product shortfalls are expeditiously resolved, and corrective action is taken to prevent recurrence.

4.3.19.1 Strategy and Approach

SNC-Lavalin's QMS is certified to ISO 9001:2000 standards and covers the full range of services that SNC-Lavalin provides to clients, including project management, engineering, procurement, construction and commissioning services. The system will cover all aspects of SNC-Lavalin's services on the Muskrat Falls Project.

4.3.19.2 Quality Assurance Execution Strategy

The Quality Assurance Team, through proactive and effective leadership, will ensure that quality is an essential part of the Project services.

The Quality Assurance Team will be managed by the Quality Assurance Manager who will report to the Project Manager. He will be supported by QA Engineers in St. John's and at the site who will be responsible for the coordination/implementation of the QA activities at their respective locations.

The Project Execution Plan (PEP) will define the responsibilities and authority for quality of each group within the Project team and will cover the engineering, procurement, construction, and commissioning phases of the Project. The PEP will be supported by a Project Quality Plan (PQP) and a set of procedures and instructions for the planning, execution and verification of the work. The PEP will also include a detailed description of the Internal Quality Audit Process with key objectives to verify/evaluate the following;

- Verify conformance of the project activities with requirements of Nalcor;
- Assess conformance of the project activities with requirements the PEP;
- Evaluate the effectiveness of the project activities.

The Internal quality Audit process will also aim at early identification of improvement opportunities. Implementation of prompt corrective action and follow-up will prevent reoccurrence and can eliminate the causes of late design changes and/or costly field repairs/modifications.

EPCM Execution

Quality Assurance will ensure that there is a strong focus on:

Prevention

- The QA Team will work with project management for the development of the Project Execution Plan (PEP) and Project Quality Plan to help ensure that project

requirements are understood and clearly communicated to all personnel on the Project;
- QA Team will provide training and support for the Project team to ensure a unified effective approach during the implementation phase.

Controls

- The QA Team will review, check and verify the consistent and effective implementation through direct involvement in daily weekly and monthly activity reviews and inspections;
- The QA Team will work with the Project Manager and the Project Team to assure early identification of errors or mistakes through the interdisciplinary review process for early correction, mistake proofing and minimizing/elimination of late engineering changes;
- The QA Team will perform milestone process audits to ensure compliance with Nalcor and project specific requirements;
- The QA team will ensure that audit results are clearly communicated to the area managers responsible for timely corrective action.

Continuous Improvement

The Project QA Manager will review and analyze daily and weekly trends to ensure prompt corrective and preventive action is taken.

Lessons Learned at early stages of the project will be assessed and communicated during weekly progress review meeting.

The project management team will also reference the corporate Lessons Learned bank of information to ensure that applicable Lessons Learned are communicated and considered for the Muskrat Falls Project.

4.3.19.3 Quality Principles

The highest level of quality is achieved through an integrated ***Quality Management System (QMS)*** and the application of Quality Assurance (QA) and Quality Control (QC) procedures implemented at each and every level of project execution.

SNC-Lavalin will ensure that the work performed will meet or exceed the project specific targets and objectives for health & safety, quality, budget and schedule.

The primary quality goal for a given project is defined as "*meeting our client's contractual requirements*". This goal is fully supported by the following four key objectives:

- Providing all deliverables and services as defined in the project scope;
- Providing all deliverables and services on or before scheduled target dates;
- Providing all deliverables and services on or below budget;
- Any detected performance or product shortfalls are expeditiously resolved, and corrective action is taken to prevent recurrence.

4.3.19.4 Responsibility for Quality

The management of quality will flow downward from top management and the Project Manager through to the entire project organization. The independent responsibility for the Quality Assurance (QA) functions will be assigned to the QA Manager reporting directly to the Project Manager, and will extend to each discipline in the project team, including construction, to assure that quality is not compromised due to progress, schedule or budget considerations.

4.3.19.5 Project Quality System

The Project will use as a base, SNC-Lavalin's established Quality Management System (QMS). The QMS is certified to ISO 9001:2000 standards and covers the full range of services that SNC-Lavalin provides to clients, including project management, engineering, procurement, construction and commissioning services. The system will cover all aspects of SNC-Lavalin's services on the Project.

The framework of the QMS is described in SNC-Lavalin's Quality Policy Manual QM-3801, a copy of which can be made available for review. SNC-Lavalin's Quality System Procedures Manual QM-3802 is also available for review upon request.

4.3.19.6 Project Execution Plan

The Muskrat Falls Project Execution Plan (PEP) will clearly define the Scope of work, list the project specific Procedures required to complete the work, provide a ready reference for all key functions and activities to be undertaken to ensure that SNC-Lavalin meets Nalcor's defined expectations with regard to the quality of deliverables, and conformance to schedule and cost control objectives. The PEP will be developed and issued within the first 45 days of the award date.

4.3.19.7 Project Quality Plan

The Project Quality Plan (PQP) will define the project's key quality functions and control points, including any project-specific requirements. The PQP will be based on SNC-

Lavalin's standard model and will be modified to suit Nalcor's project specific activities and requirements.

4.3.19.8 Project Team Initiation Training

All members of the project team will undergo initial introductory training related to the content and the use of the PEP, including their particular role and involvement in the execution of the PQP. Specific emphasis in this training will focus on the key activities necessary to the success of the project.

The training topics will include, but not be limited to:

- Project Description;
- Scope of Work, Project Mandate and Schedule Milestones;
- Team communication and interaction between groups, offices and company;
- Document Coding Structure;
- Project Files and E-File directories;
- Unit of Measure, Language, Drawing Format and Title Block and Frame;
- Internal Audit Schedule (Planned and Unplanned);
- ***PM+*** and ***PDM*** software.

4.3.19.9 Continual Monitoring Process

Designated and qualified personnel will be responsible for performing and reporting on the following key activities:

- Inter-Discipline Coordination (IDC): Engineering technical documents, such as drawings, specifications, technical specifications and design criteria, shall be reviewed by all affected disciplines and comments incorporated / addressed.
- Technical Progress Reviews: The Project Engineering Manager shall coordinate technical progress review meetings. This will include participation of the responsible discipline leads to promote awareness of progress status and to prevent/resolve potential conflicts.
- Commitment Package Review. The Project Controls Manager will coordinate commitment packages schedule status review meetings to ensure awareness of progress status and to prevent/resolve potential delays.
- Vendor Document Review: The responsible Engineer shall identify the disciplines required to review and comment on the Vendor Document package. Discipline reviews and sign-off will be performed as per IDC process described above. Comments on Vendor Documents shall be incorporated/addressed by the responsible Engineer.
- Monthly Project Panel Review: it is proposed that senior representatives of Nalcor and SNC-Lavalin's management conduct project reviews, at defined intervals, to

evaluate the functional and operational performance of the project. The objective of such reviews is to provide support and resolution of any unfavourable trends or company concerns.

- ❑ Design Reviews: An independent technical review of the design concepts, methods, spot checks of calculations or analysis employed for solving problems and assessing the results against input requirements is undertaken by authorization of the project Technical Sponsor. Design reviews will include:
  - Hazop;
  - Layout;
  - Constructability;
  - Ergonomics.

4.3.19.10 Project Quality Audits

Assurance of quality will be achieved through independent monitoring and auditing of Project activities for compliance with the Project requirements.

Project Quality Audits will be scheduled to:

- ❑ Verify the effective implementation of project activities;
- ❑ Determine level of conformance;
- ❑ Identify opportunities for improvement;
- ❑ Take corrective and preventive measures.

A project-specific internal audit checklist shall be developed. Audits will be scheduled at 30%, 60% and 90% of Project completion and performed by independent and qualified personnel in accordance with documented procedures.

4.3.19.11 Corrective and Preventive Action

The corrective action process is designed to address quality problems experienced in the course of Project execution. The cause of the problem is identified, and the necessary action to reduce or prevent recurrence can be implemented by Project management/team.

The objective of the preventive action process is to identify the root cause of the problem, and eliminate the opportunity of occurrence on subsequent activities and/or projects.

4.3.19.12 Construction Phase

As part of the construction management team, Site Engineering will take responsibility for all engineering and design activities required at site in support of the Project's construction and implementation of the QA/QC program.

The Site Engineers will report to the Site Engineering Manager and provide guidance to the Area Construction Managers on site on all technical issues. The Site Engineering Manager will be the principal contact with the design office in St. John's.

The Site Engineering group will coordinate and supervise the survey and material testing requirements for the site. They will act as a liaison with the Project Office engineering teams, perform material take-off calculations and work verification, and recommend changes to facilitate construction.

SNC-Lavalin will be responsible for Quality Assurance and the construction contractors will be responsible for Quality Assurance/Quality Control of the work to assure conformance.

A QA Coordinator will be assigned to site, reporting to the Construction Manager with a functional responsibility to the Project QA Manager in the Project Office.

Contractors will be expected to follow their approved Inspection and Test Plans and QA/QC procedures and generate the specified inspection records, reports and appropriate documentation. The Site Inspection team, reporting to the Site QC Manager, will assure compliance during their Hold & Witness inspections and Contractor audits.

Coordination of the material testing programs will be the Site Engineering group's responsibility. Services include soils engineering, concrete inspection and testing, and other specialized requirements. Inspection will be provided directly by SNC-Lavalin while surveying and material testing may be contracted out.

Site Engineering Queries (SEQ) will be raised for all Contractor technical issues that require design responses. The SEQ's may relate to interpretations, specifications or cases involving re-work, such as clashes. The Site Engineering Manager will be the custodian of the SEQ's and will ensure that timely resolutions are made so the Contractor is not held up.

Site Engineers will provide the technical back up information for the Contracts Manager to submit Field changes to the Construction Manager for approval, before they are issued to the Contractors.

Contractor's as-built mark-ups of SNC-Lavalin drawings will be verified by Site Engineers. These will maintain a current set of working drawings at the job site,

available for all users and showing up-to-date revisions and field changes. As-built revisions will be produced in the Project Office from as-built mark-ups, provided by the Site Engineering group.

Contractors will complete their own documents and as-built drawings, get them verified through Site Engineering and submitted to SNC-Lavalin for review and recording.

SNC-Lavalin Site Engineering will be involved in final inspection and acceptance of the work, in conjunction with QA/QC and Nalcor representatives, and hand-over to pre-commissioning.

4.3.20 t) Health, Safety & Environment (HSE) Management

t) Health, Safety and Environmental (HSE) management (further detail regarding HSE management shall be provided in response to question 9.0 herein);

SNC-Lavalin's most valuable asset is its people. The safety, risk understanding and risk awareness of our work force is of paramount importance in each and every undertaking. We are committed to providing safe and healthy work environments for all our employees, in offices and on work sites.

We shall work continually to reduce the frequency and severity of incidents and injuries by eliminating unsafe or hazardous conditions. Each employee has a responsibility to take notice of unsafe conditions and report them immediately to the appropriate person so that proper corrective action can be taken. Each employee is responsible for maintaining safe operations and a healthy working environment while promoting our ***"We Care"*** core values.

4.3.20.1 Strategy and Approach

In order to establish 'health safety and environment (HSE) as a core value', an organization must shift HSE from the 'periphery' of the business outputs – where HSE is an issue of achieving 'numbers' - to be at the 'heart' of the business. SNC-Lavalin's emphasis is on HSE in operational objectives, which involves:

- The integration of HSE stewardship into all core business activities;
- The distribution of responsibility and accountability for HSE to all employees at all levels by establishing a leadership structure for communication, consultation and requirements of roles and responsibilities;

Winning the hearts and minds of all management and workers with HSE as the #1 Priority.

- The adoption of peer-driven HSE review processes within the established HSE Management System;
- Establishing risk competency, analysis and mitigation awareness and understanding for all personnel through safety risk assessment, risk registers & mitigation, job hazard analysis and worker step-back programs and pre-task plans;
- Continual focus on critical risk protocols (e.g. Mobile Equipment, Hazardous Material Management, Equipment Safe Guarding, Lockout / Tagout, Working at Heights, Lifting Operations, and Confined Space);
- Establishing a strong working relationship and approvals with local building trades, government organizations, and the Provincial Construction Safety Association.

4.3.20.2 Health & Safety Execution Strategy

Coordination

Located in St. John's, the HSE Manager will report directly to the Project Manager, and he will be responsible for HSE on the Project. He will have corporate support and a designated HSE Team in the field, which includes a Site HSE Coordinator, HSE Leads and specialized advisors as required.

During the initial start-up phase of the Project, all aspects of HSE and emergency response planning and implementation will be reviewed, analyzed and finalized to ensure a safe and successful Project.

Initial activities include but are not limited to:

- Reviewing Nalcor's HSE Plan to ensure compliance with local, provincial and federal legislation;
- Conducting a gap analysis between Nalcor's HSE Plan and SNC-Lavalin's HSE Plan to ensure all applicable and relevant legislation and HSE targets have been identified;
- Consolidating all the information into a Project Specific HSE Plan;
- Developing site specific HSE Procedures;
- Developing a site-specific Occupational Health and Safety Manual and a Rule Compliance and Personal Protective Equipment (PPE) booklet;
- Developing and establishing a risk registry;
- Developing the milestone incentive program "SNC-Lavalin Scratch Cards";
- Development of training requirements and the training program for the Project (including project orientation, job hazard analysis, skills training etc);
- Developing and establishing the HSE program rollout;
- Developing a Project Environmental Protection Plan (EPP).

EPCM Execution

Engineering

During Engineering, the SNC-Lavalin HSE Team will ensure that environmental awareness and safety are designed into the work by participating in constructability reviews and HAZOP analyses to ensure that codes and safe construction practices are incorporated.

Construction

√ Proactive Process

During Construction, the SNC-Lavalin HSE Team will work diligently to ensure that HSE will be put into action in a proactive rather than reactive way. The goal is that all management and working craft personnel understand that being proactive in the form of **Stop-Think-Plan-Proceed** is the process for all activities conducted on the Project Site.

SNC-Lavalin will establish a **5-Point Safety System** where each worker or small crew maintains a worksite observation card that must be completed at the work site, prior to the start of shift work activities.

The Five Point Safety System is made up of five basic steps to follow. The supervisors use these steps as he/she checks on his/her work crews and by the employees themselves as they travel to their workplace and conduct their assigned work activities. The steps are as follows:

- ❑ Check entrance and travel way to workplace;
- ❑ Is the workplace & equipment in good working order?
- ❑ Are employees working properly?
- ❑ Do an “act of safety”;
- ❑ Can and will employees continue to work properly?

√ Standardized Risk Rating

A standardized risk rating system will be implemented to rate risk and probability associated with specific steps on JHA’s. Elevated ratings will trigger additional participation and next step up in Line Management, to include sign-off of various levels of contractors’ supervision and SNC-Lavalin management.

√ Management Training

All SNC-Lavalin Management and all Sub-contractor Management including Line-Managers (Superintendents, Supervisors, Coordinators, and Foremen) will be required to participate in a **Supervisors’ Roles and Responsibilities Training Program** prior to working on the project site. The training program will focus on local legislative and

Project HSE reminders and awareness, and additional tools such as root cause analysis, incident protocols, Emergency Response Plan, procedural review, communication skills, StepBack program, observation skills, inspections, critical risk protocols and incident communication and reporting process.

√ Personnel Training

All personnel will be issued a **Project Training Passport** which the worker will carry on his/her person to identify specific training received and certification of competency to perform specific types of work (e.g. fire watch, aerial work platform, WHMIS, fall protection, confined space, etc.).

√ Daily Interaction

SNC-Lavalin Management and all Sub-contractors Line Management will not only focus on the standard Risk Management Principles to reduce incidents but will require a specialized interaction in the form of daily safety observations (DSO's).

All SNC-Lavalin Management personnel have a mandate to "be where the workers are and be there on a regular basis".

- Management, in conjunction with contractor supervision, will not only correct unsafe acts or conditions and recognize positive behaviours, but will also make the connection with each and every working craft that "We Care" about all aspects of the Project starting with each worker's safety.

Further detail is provided in Section 9.0.

4.3.20.3 Environment and Communities

SNC-Lavalin has corporate Environmental and Sustainable Development Policies that embody our ***"We Care"*** philosophy. This means that we integrate our commitment and the elements of our corporate "We Care" policy into all our business activities. This includes:

- Ensuring compliance with all applicable environmental laws and standards;
- Taking environmental protection and pollution prevention measures into our activities from the design phase to procurement, construction, and commissioning;

Protecting the health, safety and environment of its clients, employees, contractors and communities in which we operate.

- Focusing on continual improvement to ensure that our projects are environmentally sound;
- Providing training and awareness programs for all Project employees;
- Requiring project managers to report regularly on the compliance of their projects to our environmental policy and objectives.

4.3.20.4 Environmental Strategy and Approach

It is SNC-Lavalin's belief that effective environmental management during a project derives from true integration of engineering design, procurement, construction management, and environmental disciplines. SNC-Lavalin used this approach on the award-winning Voisey's Bay Mine/Mill Project, and we intend to implement a similar strategy for the Muskrat Falls Project in a detailed and transparent way.

This will include:

- Reviewing and providing input to engineering designs and drawings to ensure compliance with regulatory requirements, EA conditions and owner's commitments;
- Assisting and supporting EIA commitments;
- Preparing and implementing the Environmental Protection Plan for construction;
- Preparing and executing waste management plans;
- Providing on-site environmental monitoring;
- Implementing mitigation measures;
- Obtaining construction permits in a timely manner;
- Ensuring that all activities are carried in accordance with regulatory requirements and permit conditions;
- Assisting Nalcor with their Community Relations Plan and activities.

4.3.20.5 Environment Execution Strategy

Located in St. John's, a dedicated Environmental Team will assist in the provision of environmental compliance through the provision of environmental coordinators, environmental monitoring staff, as well as specialized advisors as required.

During the start-up phase of the Project, all aspects of Environmental Protection will be reviewed and analyzed with development initiated on key plans.

Initial activities include but are not limited to:

- Reviewing EIA documents, conditions of approval, and commitments made;
- Conducting a gap analysis between current Environmental Plans and documentation and what is required from the Nalcor EIS and Federal Environmental

Assessment Guidelines to ensure all applicable and relevant regulations and Health, Safety and Environmental targets have been identified;

- Initiating the development of required plans such as: Occupational Health and Safety Plan; Environmental Protection Plan, Emergency Response Plan, Waste Management Plan, Water Management Plan (including runoff and drainage), Environmental Effects Monitoring Plan, Fisheries Compensation Plan, Rehabilitation and Closure Plan, etc.;
- Developing Site specific environmental procedures in consultation with Health and Safety;
- Preparing Environmental Design Criteria and Environmental Specifications for engineering and procurement;
- Developing training requirements and providing input to the training program for the Project (including project orientation, job hazard analysis, skills training etc.);
- Reviewing and providing input to Nalcor's Community Relations Plan;
- Reviewing and updating Permits Register in accordance with the Construction activities and schedule.

EPCM Execution

Engineering

√ Environmental Compliance – Design Phase

During Engineering, the SNC-Lavalin Environmental Team will ensure that environmental compliance is designed into the work by participating in constructability reviews and HAZOP analyses to ensure that regulations and appropriate construction practices are incorporated. In addition, drawings will be checked against an "environmental notation check list" to ensure environmental protection and permit conditions are met. Environmental Design Criteria will be issued to the engineering team for incorporation in the design.

√ Environmental Plans

The most important of the environmental plans are the Environmental Protection Plan (EPP), Environmental Monitoring Plans (EMP) and Emergency Response Plan (ERP), which **must** be approved and in place before any construction work can start. These plans will be put on the critical path to be completed.

Procurement & Contracts

Environmental Specifications and EPP will be provided as part of the bid documents. Contractors will be required to acknowledge compliance with the Owner/EPCM HSE requirements, and the bid evaluation will include the contractor's HSE plans.

Construction

√ Environmental Compliance

During Construction, the SNC-Lavalin Environmental Team will work closely with the Construction Manager and Area Construction Managers to ensure that environmental compliance is met. This includes:

- A full-time Site Environmental Supervisor: who will be responsible for ensuring the project environmental requirements (EPP, EMP, ERP, etc.) are met;
- Environmental Site Monitors: who will be responsible for ensuring the above plans are implemented and permits condition met, attendance at daily job reviews, monitoring construction activities and reporting to the Environmental Supervisor who will communicate these activities to the Construction Manager as well as the HSE Manager in St. John's;
- Spills or Emergency Incidents: will be reported immediately to the Construction Manager, the HSE Manager and Environmental Lead in St. John's for proper mitigation action.

√ Permitting

Obtaining construction permits in a **timely** manner (that is tied to the construction schedule) is of extreme importance to achieving the project cost and schedule goals. Of equal importance is to ensure the construction activities are in compliance with the permit conditions and that appropriate monitoring is carried out. SNC-Lavalin developed a very successful permitting register and monitoring system for the previous Voisey's Bay Mine/Mill project and we propose to use the same system for the Muskrat Falls Project.

All permits will be tied to the construction schedule and will be monitored on a regular basis and reported weekly. Priority permits will be identified and communicated to Nalcor's Environmental Manager, the Project Manager, the Engineering Manager and the Construction Manager. All efforts will be made to ensure the relevant regulatory bodies are also aware of the criticality of obtaining such permits on time. Appropriate lead-times will be allowed for preparation of the permits, internal review by relevant engineering team members, review and approval by Nalcor and for the government processes by relevant department(s). A copy of each permit will be sent to the site and communicated to the Construction Manager, relevant contractors, and site monitors (a responsibility of the site environmental supervisor).

All permit applications will have to be made in accordance with the approved EPP. Every contractor will be given a copy of the Project EPP and will be required to adhere to it in all their activities. In addition, an EPP compliance checklist will be stamped on

each engineering drawing and signed off by the HSE Manager or Lead Environmental Engineer.

4.3.21 u) Regulatory Compliance

u) Regulatory compliance;

SNC-Lavalin is one of Canada's largest engineering and construction organizations. It carries out engineering projects in every province and territory of Canada. This requires that the company maintain an up to date library of all federal, provincial and municipal regulations, as well as the applicable codes and standards, for every jurisdiction where it is active. The responsibility for the maintenance of this library rests with the Vice President of Engineering, supported by the Managers of Engineering in all project offices. The maintenance of codes and standards is entrenched in our engineering procedures and is part of our Quality Assurance Program.

The Quality Management System is certified to ISO 9001-2000 and covers the full range of services that we provide to clients including project management, engineering, procurement, construction and commissioning services. Procedures are in place to ensure that all engineering work and construction activities are carried out in accordance with the latest Canadian and Provincial regulations. In fact, we have a legal obligation to do so in accordance with the Engineering Act as regulated by the Professional Engineers and Geoscientists of Newfoundland and Labrador (PEG). All engineers who are in a position of approving engineering designs and drawings will be members of the professional association.

Attachment 4.3.u-1 contains a master list of technical codes and standards which SNC-Lavalin routinely applies to its work. Our personnel are familiar with these requirements having worked for many years in the Province, including work on most of the recent major projects both on and offshore. Our St John's office maintains an up to date set of most Newfoundland and Labrador and Canadian standards, codes and regulations, and the firm itself is licensed to do engineering work in Newfoundland and Labrador. The quality procedures we apply to our work also ensure that the proper checks, balances and approvals processes are in place.

Part of the planning associated with the Muskrat Falls Project will be the development of design criteria which includes a review of applicable codes and standards. These will include such documents as the National Building Code of Canada, the National Masters Specification and internationally recognized standards organizations such as the Canadian Standards Association, ASTM International and the American National Standards Institute. Many of our engineers serve on standards development committees, including those concerned with the development of standards for hydroelectric work such as IEEE, the Canadian Dam Safety Association and the American Water Works Association, and so are very familiar with those standards.

4.3.21.1 Permitting

The Project will require federal, provincial and municipal approvals and permits for various activities during construction, operation and decommissioning. A compilation (Permit Register) of anticipated relevant legislation and associated permits required will be developed by SNC-Lavalin and managed during the Project. This Permit Register will be revised as detail design advances and additional project requirements are identified. Upon project approval, the Permit Register will be developed (or the one currently in use by Nalcor will be reviewed/updated) and integrated into SNC-Lavalin's ***PM+*** system. This will be done at an early stage of implementation to address all construction activities.

In some cases, Nalcor may submit the permit applications and obtain the permits. In such cases, SNC-Lavalin will assist Nalcor in the management of permits and approvals, including monitoring the compliance of employees, contractors and sub-consultants with permit requirements. This will require a link between the Permit Register and the construction schedule, so that all tasks associated with obtaining the permits (data acquisition, design, regulatory input, application, processing, formal approval, etc) are incorporated. By doing this, permits that may impact critical path items should not be a cause for delays.

4.3.21.2 Environmental Protection Plan

SNC-Lavalin will ensure compliance with Canadian and provincial legislation and consistency with international guidelines and best management practices and/or procedures (including monitoring, inspections and audits), including the environmental discharge and emission limits and criteria established for the Project. The procedures for regulatory compliance will be set out in the Environmental Protection Plan (EPP) as discussed in Section 4.3.20.

The policies for construction will include, but are not limited, to:

- Best management practices and procedures for protecting the environment during construction activities;
- Management of soils, dewatering and sediment;
- Protection of archaeological sites and vegetation;
- Protection of ocean and fresh water fisheries and habitat;
- Fuel offloading, storage and handling as well as spill clean-up;
- Waste management, storage and removal or use of secure landfill and/or incineration facilities;
- Hazardous material management; and
- Emergency Response Plan.

The Environmental procedures will also outline auditing and reporting measures to ensure that construction activities are conducted in compliance with all project policies, applicable EIA requirements, and environmental regulations and standards. Environmental mitigation measures will also be audited to ensure that they are properly implemented and functioning.

Regular reporting between the environmental staff and the Construction Manager will ensure that all non-compliances identified in the field are addressed in a timely manner, consistent with procedures and best practices.

4.3.22 v) Engineering Execution

v) Engineering execution (methodology, resources and tools available)

This section addresses the engineering execution for the Muskrat Falls Hydroelectric Development, which includes the following facilities:

- Access roads, temporary and permanent accommodations, reservoir clearing and replacement fish habitat;
- RCC concrete dams;
- River diversion;
- Spillway;
- Intakes;
- Powerhouse and tailrace;
- AC switchyard.

It is currently envisaged that the above works would be executed through a number of work packages. These packages are shown in a preliminary organization on Figure 4.3.v-1 - Organization Chart of Packages. These packages will be combined into the various contracts and purchase orders.

SNC-Lavalin has the resources, experience and familiarity with this project to provide all of the consultancy services for the work of this Component, for both the Phase 3 - Engineering and Procurement/Contracting, and Phase 4 - Engineering, Procurement, Construction and Commissioning.

INSERT FIGURE 4.3.v-1

4.3.22.1 Technical

The objectives of Engineering are to perform the design process with continuous control by:

- Reviewing all input data, respecting the control points identified in the processes established for the production of deliverables, and by carrying out the necessary final verifications before document issuance;
- Evaluating the impacts of deviations/changes and report them to Project Management and the Client;
- Providing the required engineering resources and controlling these in compliance with project requirements and the Execution Plan.

Planning of Engineering

Only engineering personnel with the necessary qualifications will be assigned to the project.

The engineering activities required to execute the work will be established. Supervision and management of the work will be done by the Discipline Leaders with the participation of the Area Engineers, Project Controls Manager and the Engineering Manager.

Technical Interfaces

As required, the interfaces between the different disciplines will be coordinated through the circulation of master documents via the PDM network.

The interfaces with the client will take place through meetings, general correspondence and the official issuance of documents for review, comments and approval, according to the specific requirements of each work package and the project.

Design Input Data

The design input data will come from the following sources:

- Client Supplied Data;
- New Data from 2010 Field Investigations;
- Other Ongoing Studies.

Client supplied data will usually be in the form of documentation including studies, technical reports, preliminary designs and drawings that are to be incorporated in the design. Once supplied by the client, such products will be deemed accurate and appropriate for the purposes of the project. If SNC-Lavalin has reason to believe data is faulty, the client will be advised.

Design Output Data

Design output data will be documented in design briefs, technical reports, specifications and drawings, as detailed in the lists of engineering deliverables, for each work package.

These engineering deliverables will be controlled for quality during all phases of their production by respecting the control points identified in the processes. Engineers are responsible for confirming that the deliverables meet quality requirements.

The Project Manager will approve engineering deliverables before their issuance for use in tendering and / or construction.

Design Review

Design reviews will be done and carried out by selected members of the Technical Review Committee or other designated specialist personnel during the execution of the work. The reviews will be done at approximately 30%, 60% and 90% completion of each work package.

A report will be prepared which will indicate discrepancies and corrective actions to be taken.

Design Verification

Design verification will be carried out by the engineers identified in the Engineering Document Verification Plans before issuing the preliminary reports/documents.

Engineering Document Verification Plans will be filed in the PDM network under the appropriate package folder.

Upon completion of the verification, the final Engineering Document Verification Plans will be converted to PDF format and filed in the PDM network.

Design Changes

Design changes will be identified, documented, reviewed and approved by the Engineering Manager.

Design changes will be subject to the same level of verification and approval as the original design.

Reference Processes and Procedures

All engineering documents will be produced in accordance with the following processes:

- 4030-E1 - Engineering Document Verification Plan;
- P-LC-01 - Preparation of Technical Reports (all disciplines);
- P-41-01E - Design Criteria (Civil/Structure);
- P-41-02E - Design (Civil/Structure);
- P-41-03E - Technical Specification (Civil/Structure);
- P-45-01E - Design Criteria (Mechanical);
- P-45-02E - Technical & Calculation Notes (Mechanical);
- P-45-06E - Technical Specification (Mechanical);
- P-47-01E - Design Criteria (Electricity);
- P-47-02E - Design Brief (Electricity);
- P-47-04E - Equipment Specification (Electricity);
- P-4D-01E - Preparation of Drawings (Drafting);
- P-4G-01E - Design Criteria (Geotechnical);
- P-4G-02E - Design Brief (Geotechnical);
- P-4G-03E - Preparation of Specifications (Geotechnical);
- P-4H-01E - Production of Hydraulic Deliverables (Hydraulic);
- P-4X-01E - Design Criteria (Geology);
- P-4X-02E - Design Brief (Geology);
- P-4X-03E - Preparation of Specifications and Drawings (Geology);
- P-40-02E - Interdisciplinary Coordination (all disciplines);
- P-40-04E - Engineering Planning & Management (all disciplines).

4.3.22.2 Project Execution Plan

One of the first tasks after award of the contract will be the preparation of a comprehensive Project Execution Plan (PEP). The PEP is a management control document issued to each team member. It contains procedures to be used in carrying out Project work. For most projects the existing procedures evolve or expand, or new procedures may be added as the project proceeds, thus the PEP requires updating on a periodic basis.

Many of the elements of the PEP would be discussed with the Nalcor during project implementation.

The PEP frequently contains an outline of the methodology for carrying out the agreed upon scope of work. We have prepared a brief outline of the methodology we would expect to employ on the engineering work, under the following headings:

- Hydrotechnical;
- Hydro Structures;
- Dam and Foundations;
- Infrastructure;
- Electromechanical;

Hydrotechnical

The purpose of the hydrotechnical group will be to carry out the work involving hydrology, hydraulic and energy assessments and computations. A brief outline of the work envisaged is presented below:

Hydrology

- Update flood statistics and confirm the diversion flood at Muskrat Falls.
- Extend long term flow series up to 2009, and derive long term daily inflow series into Churchill Falls reservoirs, and daily local inflow series to Muskrat Falls. This information will be used for power and energy studies, and for the evaluation of river flow-rates during construction and impounding.

Power and Energy

All energy studies of the Churchill Falls system have been performed on monthly time steps. However, it is anticipated that Lower Churchill will potentially supply an international market, with an emphasis on supplying daily peak power, and winter energy. All power and energy studies will therefore be carried on daily/hourly time steps in order to better reflect:

- The head losses, which will vary with hourly plant operating conditions;
- The reservoir operation when water level is close to full reservoir level (FRL);
- Peak and off-peak production;
- Energy losses based on the number of units and the installed capacity;
- Planned and unplanned outages;
- Plant infancy operating conditions.

Based on daily inflow series, operating scenarios (provided by Nalcor) and financial/economical criteria, the following studies will be performed:

- Optimal number of units and unit characteristics;
- Optimal reservoir levels and flows during operation;
- Installed capacity, due to head changes or changes to the operational strategy.

Hydraulic Design

Hydraulic design will include refining the final design of the main hydraulic structures and contributing in the optimization and selection of the final layout for the Muskrat Falls Project.

Over the last ten years, the Hydraulic Group at SNC-Lavalin has developed extensive experience in carrying out hydraulic studies with Flow3D, which is a three-dimensional

CFD software. This software readily provides detailed hydraulic conditions where flow conditions are complex and cannot be investigated by standard calculations. The results provide accurate evaluation of flow velocities, forces and moments, air and solid entrainment and likelihood of vortices formation or cavitation occurrence. The work process usually consists of optimizing and designing the structure (canal, sill, dissipation basin, etc.) with the Flow3D software, and confirming the behaviour of the final solution on a hydraulic model. This process results in cheaper overall costs, because the cost and duration of hydraulic model studies are considerably reduced and it provides a better assurance that the optimal solution is arrived at.

It will also be possible to use Flow3D to carry out other detailed hydraulic studies and perform detailed optimization of some key structures, prior to carrying out hydraulic modelling of those structures. This procedure will be faster, cheaper, and will result in a more reliable design.

Standard hydraulic studies will be carried out for detailed optimization of the structures and to support the final designs. They will consist of:

- Support to the design team for the optimization of the power systems at Muskrat Falls (size, number of units, general arrangement, etc.);
- Evaluating flow conditions, including spillway approach conditions and energy dissipation, overflow weir capacity and energy dissipation, river closure, etc;
- Evaluating flow rates during reservoir impounding;
- Trash and debris conditions in the reservoir.

Ice Studies

The Muskrat Falls project will be strongly affected by ice conditions in winter. The studies will start with a comprehensive review of ice data collected at the sites and ice studies carried out. Based on the results, further work will be carried out, in order to update the conclusions of the previous ice studies.

Water Temperature

The purpose will be to characterize the temperature regime in the Muskrat Falls Reservoir, Muskrat Falls tailrace, and Lake Melville, and to evaluate the anticipated deviations as compared to the present temperature regime.

The studies will be carried out with CE-QUAL-W2, a two-dimensional laterally-averaged hydrodynamic and water quality model. The approach will be as follows:

- Data collection (geometric data, initial conditions, boundary conditions, air and water temperature, hydraulic and kinetic parameters, etc.);
- Model calibration and study of existing conditions;
- Study of future conditions :

- Muskrat Falls,
- Muskrat Falls and Gull Island.

Dam Breach and Inundation Studies

The purpose of the inundation studies will be to evaluate the damage resulting from a dam breach at Muskrat Falls, to confirm the Inflow Design Flood selected for the spillway design (which is the PMF), and to provide input for Emergency Preparedness Plans. Calculations will be carried out for dam breach of the main dam, and for dam breach of the cofferdams under flood conditions.

Flood wave calculations will be carried out with the software MASCARET. The methodology will be as follows:

- ❑ Prepare breach scenarios for the main dam, intake structure and cofferdam.
- ❑ Evaluate flood conditions down to Lake Melville, where wave superelevation is less than 50 cm.
- ❑ Delineate inundated areas.

Hydro Structures

Layout optimizations arising from the latest studies in 2000-2009 are assumed to have been carried out for the Muskrat Falls project. For Muskrat Falls, a key early task of the optimizations will be to finalize the site layout. If Variant 10, Spillway Scheme 3B, is selected as the final layout, this layout will have to be optimized and modelled in 3D to establish the final centerline and configuration of the major structures.

The optimizations will include a number of “value engineering“ studies. The technical/cost/schedule implications will be determined in light of alternative operating scenarios to be provided by Nalcor.

The Hydro Structures Team will support other additional work where required, including cost, schedule analysis and risk analysis.

Prefabricated Elements

SNC-Lavalin has recently evaluated the use of prefabricated elements in hydraulic structures in order to increase construction efficiency. Prefabrication can be beneficial in the following ways:

- ❑ It can compress overall schedule by a reduction of work duration of the critical activities;
- ❑ It can save manpower time at site, reduce the need for qualified manpower at the site, and reduce camp costs;
- ❑ It can reduce the needs for temporary shelters during winter construction.

Prefabrication is promising, especially in the case of modular electrical cubicles and generator floor pre-cast or fabricated steel elements.

Software

Three Dimensional Design technology or 3D modeling will be used on all alternatives and final civil drawings, including all structures and dams. This technology enables the creation of accurate representations of the proposed layouts. The engineering process will be facilitated as follows:

- Helps in communication of design concepts to other members of the design team as well as Nalcor;
- Visualization of the structures helps to resolve problems in the early stages of the project that may not be apparent in a two dimensional environment, and which may prove costly to revise in later stages of the project;
- Better understanding of the individual structures and their relationship with adjacent structures or components increases project productivity by acceleration of the decision making process;
- Automated functions and associated updates within the three-dimensional design software make it faster and easier to change designs or create alternative layouts;
- Quantities for the various components being modeled can easily be extracted, which minimizes the number of errors that could occur when using other conventional methods to perform the same process;
- The ability to extract information directly from the model to assist in the creation of 2D drawings;
- Can be used to create hydraulic models that may be used by other specialized software for further analysis.

Dams and Foundations

The Muskrat Falls project is currently conceived as comprising Roller Compacted Concrete (RCC) dams flanking the main powerhouse spillway block and contributing to the total spillway capacity by allowing overflow. A temporary earth and rockfill cofferdam completes the structure. The principal item of geotechnical interest is the North spur of land which forms a natural dam filling the buried valley between the rock knob and the left (North) valley side.

Borrow areas are required to provide aggregates for the concrete, fill materials for the temporary cofferdams and for the freeboard dike, and filter materials for the protection works at the North spur. Several deposits have been identified for both granular material and glacial till but the assured quantities are still not proven. Additional field investigations are ongoing, after which potential quantities will have to be evaluated and a balance sheet prepared.

There may be some room for optimizing the location of the various structures, which is assumed to have been completed. Essentially, the river channel is on bedrock due to the high flow velocities but terrace deposits are to be found on the river banks. Confirmation of the nature and the extent of these deposits is currently ongoing in order to select the best cofferdam alignment and to establish the diversion sequence due to the presence of potentially erodable materials. The alignments of the RCC dams and access roads may also require reassessment based on the ongoing field program which will permit a more accurate calculation of quantities.

The construction work envisaged for the spur is limited to an upstream protective fill of granular material and rip-rap, and to an enhanced drainage system on the downstream side. Additional permeability tests and pumping tests will be required to finalize the design and augment the data base for future long term monitoring.

Infrastructure

A small infrastructure team will be required for the final design of the project infrastructure, such as port requirements at Happy Valley – Goose Bay and Cartwright, warehousing, access roads, including a review of all existing bridges en route to the site, laydown and storage yards, accommodations complex, and the logistics of reservoir clearing.

Work, already begun by Nalcor, on access roads and accommodations facilities will be completed for the main construction site, as well as for the associated reservoir clearing. Depending on the extent of reservoir clearing required, the logistics of accessing the areas to be cleared and the disposal of the cleared brush biomass will also be developed.

Electromechanical Design

In the previous studies for Muskrat Falls, the installed capacity, the number of generating units and transformers were optimized based on a particular set of criteria which may have since evolved. These studies need to be updated in accordance with the operating scenarios established by Nalcor, the corresponding installed capacity, the evolution of the unit costs of the civil works and equipment as well as recent developments in equipment technology, construction methods and construction equipment.

The following work plan is proposed:

- Review of previous studies.
- Validation and modification of the previous design criteria to reflect the operating scenarios. Any changes in the water conveyance system, flow rates, reservoir levels and operating constraints shall also be taken into consideration.

- Definition of alternatives satisfying the design criteria, determination of the equipment characteristics and preparation of layout drawings and material take-offs.
- Evaluation of the alternatives based on the civil works costs, the equipment costs, the energy and power production as well as operation and maintenance costs.
- Once the type and number of units of the powerhouse is finalized, the basic characteristics of the units together with the MV and the HV single line diagrams will be determined.
- The number, rating and type of step up transformers will be determined based on operating scenarios supplied by Nalcor, with consideration of size and / or load limits for transport to site.
- Preparation of Performance Specifications for the supply of the electromechanical components.

The Electromechanical team will work in close collaboration with the Hydrotechnical and Hydro Structures teams.

Power System Computing And Software Development

SNC-Lavalin has developed many system analysis and data processing computer programs for its own use. These programs have been put to the test and improved as a result of the firm's extensive experience in conducting major system studies. Analysis programs have also been obtained from major power authorities to gain access to state-of-the-art techniques in power system simulation. All of the power system analysis programs have been implemented on IBM Personal Computers, reducing both computing costs and study turn-around time.

SNC-Lavalin continues to keep abreast of new technologies and techniques in this field in order to continually improve its capability to efficiently and accurately analyze the performance of modern power systems.

Geology

At the Muskrat Falls site, the Churchill River flows through a broad valley containing various types of sediments. The site is dominated by a protruding rock knoll on the north side of the river and by thick accumulations of sediments that infill a pre-existing valley located immediately north of the knoll. Bedrock occurrence at the site is limited with outcrops exposed along the river channel and shoreline and occasional outcrops on the knoll.

The main geological features of the Muskrat Falls site are thus the presence of a rock knoll approximately 800 m long by 400 m wide which rises to 120 m height above river level, the presence of a spur of sediments connecting the rock knoll to the higher ground to the north, and near surface and exposed bedrock in the river channel and extending to the south abutment.

The investigations performed to date at the site have provided detailed information on site conditions including topography, bathymetry, geological and geotechnical conditions and construction materials availability. This information has allowed the feasibility of the project to be determined and a suitable layout to be developed. Ongoing (2010) investigations will be used to perform final optimization of the project layout, to perform final design, to evaluate quantities more precisely and to provide data for bidders.

4.3.22.3 Engineering Progress

The Area Managers must report the progress of engineering on the areas under their responsibility.

Measuring the engineering progress on the project will be done monthly. The cut-off date is normally the last Wednesday of each month.

To measure the progress of their activities, the Area Managers will get the following information (provided by the Project Controls Manager on a monthly basis):

- Physical progress of activities and/or deliverables for the preceding period;
- Remaining hours per activity and resource for the preceding period;
- Total of budgeted hours per activity and/or deliverable;
- Total of hours spent for the package at the date of the preceding period.

4.3.23 w) Construction Strategy & Construction Management

w) Construction strategy and Construction Management (methodology, resources and tools available) including recommendations on work shifts;

SNC-Lavalin has reviewed the information provided in the RFP and in the limited time available has prepared the following highlights that will form the first draft of the Construction Execution Plan that will be developed during Phase 3.

4.3.23.1 Overview

SNC-Lavalin's Construction Management team will provide the management to cover the overall construction activities for the project site. This team, as illustrated in Attachment 6.2-1, Figure 6.4 in Section 6, will provide service departments to cover the management, administration, monitoring, direction and supervision of all construction activities for the full duration of the project and with a full commitment to respect all project requirements and provide Nalcor with a safe and functional hydro plant.

4.3.23.2 Construction Management Team

The Construction Management team will be organized to facilitate an Area Management approach which, based on SNC-Lavalin's experience on projects of this size, is the best approach to deliver the project. Therefore, for ease of organization and construction execution, the work will be divided according to the relative areas, each with an Area Management Team led by a Construction Area Manager. These teams are supported by functional, technical and logistical site services groups.

Construction Manager

- The Construction Manager will manage the overall construction activities and is responsible for the global execution of the works in respect of schedule, cost, quality and HSE objectives.
- In conjunction with the HSE Manager the Construction Manager is responsible for leading, managing, assisting and monitoring the contractors to provide a safe environment for all personnel during the EPCM phase.
- The Construction Manager will ensure that provisions have been made for resources and training necessary to carry out the project safety program and ensure that the policies and procedures are communicated and applied throughout the project organization.

Area Construction Managers

Area Construction Managers are the construction managers in their respective areas and report to the Construction Manager. Area Construction Managers have responsibility for:

- All construction activities in their respective Areas;
- Interface with the project office for their respective Areas;
- In conjunction with the HSE Manager are responsible for leading, managing, assisting and monitoring the contractors to provide a safe environment for all site personnel during the EPCM phase for their respective Areas.

The SNC-Lavalin's Construction Management team will be comprised of members with excellent experience in construction based on the following criteria:

- Commitment to Health and Safety;
- Commitment to Productivity and Project Completion;
- Commitment for the duration of the Project;
- Relevant construction experience on large projects;
- Relevant and positive experience with Nalcor;
- Demonstrated experience in their discipline.

Key personnel from construction will be assigned to the project offices working with the Engineering, Procurement, and Contracts groups to provide construction input into designs.

The Construction Management Team will cover the following:

- Construction management;
- Site Engineering / Document control;
- QA/QC management;
- Project Control management,
- Contract management;
- Site material and warehousing;
- Site administration;
- Health and Safety / Security;
- Environmental compliance;
- Permitting preparation and management in conjunction with Nalcor;
- Industrial relations, human resources, community relations and local authority management;
- Local business and employment management;
- Construction up to Mechanical completion including construction testing;
- Transitional handover to commissioning;
- Construction close-out and documentation;
- Risk assessments.

Key interfaces for construction include:

- Nalcor personnel;
- Contractors and suppliers;
- Engineering and procurement teams (project offices);
- Permitting team;
- Environmental monitoring team;
- Commissioning team;
- Local authorities;
- Local community relations.

4.3.23.3 Construction Management Services

The SNC-Lavalin construction team will manage all of the construction activities of trade contractors in accordance with their specific contracts. SNC-Lavalin will administer, supervise, manage and monitor the trade contractors to procure performance and the completion of the applicable scopes of work on time and within budget. The Construction management team will provide service groups to cover the management, administration, monitoring, direction and supervision of all construction activities.

Service Groups

Each service group will be responsible for providing all necessary support to the Area Construction Managers. These functional site service groups are responsible for the maintenance of construction policies and procedures on a site wide basis for all construction activities. Their principal responsibilities are:

Health and Safety Group

The Health and Safety department will monitor all construction activities in order to ensure the physical well being of all hired personnel on the Project.

- To ensure a safe and healthy work environment for all personnel on site;
- Provide safety training for all site personnel;
- Committed to cultivating an environment that promotes health and safety at all levels;
- Implementation of an accident/incident investigation and reporting process;
- Implementation of a process for corrective and preventive action;
- Maintain safety records and statistics, and analyze the results to continuously improve the safety program;
- Ensure that contractors will develop and implement their own Health and Safety Plan for their respective contracts based on the Project Health and Safety Plan;
- Managing, assisting and monitoring site activities construction of contractors;
- Involved in safety meetings (kick-off, toolbox, safety committee, etc.);
- Implementation of the Emergency Response procedures including site evacuation procedures.

Security

Security on site will be performed by a specialized security service company which will be contracted through a tender process. The security company will perform their activities under the management of the site Health and Safety Management Team and will provide the following:

- Surveillance and control at the site entrance 24 hours a day, monitoring, every entry and exit of people, equipment, materials, inputs for construction, light and heavy vehicles, etc.;
- Implement training classes for site orientation (induction) for security on site;
- ID badge distribution/monitoring;
- General surveillance of construction facility (e.g. warehouse, EPCM offices) during the period outside normal working hours
- Surveillance and control at the camp 24 hours a day;
- Site wide, monitoring of site roads and traffic circulation including speed limits;
- Coordination with local Police in case of major incident/accident or unlawful activity.

Environmental Management Group

Environmental Management will be responsible for ensuring that environmental protection practices are implemented, all permits are in place and that all environmental compliance requirements are met or exceeded by providing the following:

- Compliance with applicable environmental laws and regulations;
- Ensure that contractors will develop and implement their own environment plan for their respective contracts based on the Project Environmental Plan;
- Waste management in accordance with local regulations;
- Manage special or hazardous waste for appropriate recycling or disposal;
- Environmental monitoring (permit requirements, fish and fish habitat, rare and endangered species, noise, emissions, effluents, etc);
- Provide and apply emergency and spill response procedures;
- Provide assistance for permitting;
- Community relations.

Industrial Relations Group

The Industrial Relations Manager will conduct a monthly meeting with local union and Trade Contractors to:

- Facilitate good Industrial Relations with the Building Trades Unions and the Trade Contractors;
- Resolve grievance issues;
- Participate in Building trades jurisdictional mark-ups;
- Resolve jurisdictional disputes.

Site Engineering Group

The site field engineering group responsibilities are:

- Keeping an updated document file and issuing drawings to construction personnel for QA procedures;
- Assisting construction personnel in the interpretation of engineering documents (specifications, drawings, etc.);
- Making decisions on minor changes that might be found necessary or advisable during construction, and keeping track of such changes;
- Facilitating two way communications between the site and project office engineering regarding design changes, site queries, and concession requests;
- Assisting in the planning and coordination of pre-commissioning activities;
- Coordination of vendor representatives;
- Preparation or mark up drawings for as-builts with area supervision and contractors to handover final documentation.

Site Documentation Control Group

The document control function is site based with a direct link to the project office. It will be the central reference service which will maintain complete, up-to-date records in an orderly fashion and will:

- Ensure proper timely distribution of documents to EPCM site personnel and contractors;
- Be responsible to maintain site libraries of technical data such as drawings, requisitions, standards, specifications, manuals and procedures.

Quality Management Group

Quality Management will be responsible to:

- Ensure that an effective quality management system will be prepared, approved and implemented in order to assure that the overall quality requirements of the Project will be met;
- ITP implementation, carry out surveillance checks in line with the Plan and witness hold points to ensure that inspection requirements are identified and achieved;
- Implement a corrective and preventive action procedure;
- Conduct audits and up-to-date documentation.

Project Controls Group

Project Controls will be responsible to:

- Monitor construction schedule and cost, issue reports, show trends;
- Track permits that are required for Construction;
- Reporting and change control;
- Progress measurement monitoring;
- Control of productivity;
- Monitor human resources required.

Contract Administration Group

Contract Administration will be responsible to:

- Resolve contractual issues;
- Manage all correspondences from contractors;
- Prepare monthly progress payments in conjunction with contractors;
- Evaluate claims and extras;
- Establish back charges where appropriate.

Site Material Control and Warehousing Group

Material Control will be responsible for:

- Controlling and reporting on all project supplied material;

- Receiving, storing, transferring material to respective contractor;
- Inspection, non-conformance report, shortage listing;
- Maintenance and preservation of stored equipment.

Site Office Administration Group

The site office administration will be responsible for all administration activities to support the site operations. This includes:

- General administration;
- Personnel transport;
- Travel of personnel;
- General maintenance.

Site Supervisors

There will be several Site Supervisors in each area and they will be responsible for:

- Coordination of construction activities;
- Interfacing with other areas / contractors;
- Site inspection, deficiencies, NCR;
- Work permits.

Pre-Commission Group

The Pre-Commissioning Team will be responsible for:

- Managing pre-commissioning activities;
- Executing pre-operational testing;
- Planning and coordination of vendor representative;
- Preparation of handover packages to commissioning;
- Interfacing with construction and the Nalcor commissioning group.

Testing Services Group

Testing Services and technical support to construction management will be required to check the results of tests done by the trade contractors for earth works, construction material, welding, and dimensional control requirements. The following resources will be required:

- Soils lab, geotechnical;
- Concrete lab, testing and quality control;
- NDE, weld quality, welding certification;
- Topography, surveyor, dimensional control for installation, as-builts surveys;
- FAT (Factory Acceptance Test);
- SAT (Site Acceptance Test).

4.3.23.4 Construction Plan

The overall construction strategy is to adopt a low-risk execution plan ensuring the turnover of the completed facilities in accordance with the Project Schedule. During the implementation phase of the Project, comprehensive construction procedures for the site works will be produced with particular emphasis on health, safety and environment controls. In parallel, site works will commence with installation of temporary facilities and commencement of critical path activities (early works – temporary facilities / services, accommodations complex, concrete batch plant and quarry supply, specific earthwork activities such as road and access, levelling of the site to allow main civil works to start).

The anticipated construction strategy of purchasing long lead time equipment for timely handover to the installation contractors, in coordination with the civil construction, is intended to meet the pre-commissioning target dates with the fewest interfaces consistent with the procurement policies of Nalcor. Logistics of delivery to site, sequencing, off-loading in Labrador, en route limitations, on-site handling and storage, all are key considerations, and will form a major part of the overall constructability process and procedures.

Area Management

The site will be divided into four (4) principal areas supported by functional site management departments for technical services, HSE, quality assurance and control (QA/QC), etc.

The four principal areas are:

- Dams and Spillways,
- Intake and Power House;
- Infrastructure;
- Substation.

At the appropriate time, construction works will be prioritized into systems and sub-systems in each area. System completion will be in accordance with the pre-commissioning schedule.

The overall strategy for the development of the Project will be designed to achieve the first power on schedule.

To respect this completion milestone, the SNC-Lavalin project team will manage services of engineering, procurement and construction in order to achieve the pre-commissioning, including mechanical completion and pre-operational testing, ready for handover for commissioning.

Scheduling of the works will be geared to the sequence of commissioning. All necessary facilities will be identified by system / sub-system which will be transferred to pre-commissioning with all quality checks and construction testing completed to the required standards within the required time frame.

Pre-commissioning, including mechanical completion and pre-operational testing, closing of critical punch list items and deficiencies, will progress in parallel until 100% of work is completed.

Pre-Commissioning

This stage commences after the mechanical completion handover and ends when the installation is operational.

Those activities will be performed by a team of specialists, managed by the EPCM team, under the responsibility of the Completions Manager.

Pre-commissioning checks include checking all permanent equipment and systems, structurally, mechanically, electrically, as well as the instrumentation and control status. A check list will be prepared for each piece of equipment, listing the requirements necessary to guarantee that the equipment fulfils project requirements.

When each check list is verified, the equipment will be handed over to the commissioning team.

Commissioning and start-up will be under the client's responsibilities. SNC-Lavalin will provide support as required.

4.3.23.5 Construction Contracts

The construction work for the project will be divided up into work packages that allow competitive pricing and that distribute risks associated with the construction of such a large project over several construction trade contractors.

Where possible, contracts will be fixed fee (lump sum), provided the engineering is sufficiently complete, or unit prices, where quantities cannot be predetermined exactly or variations may occur. Schedule of rates contracts will be used when the scope can be defined in detail while detail engineering continues to progress and quantities may vary due to the site conditions or the status of the engineering documents. The exception to this can be service contracts which may be reimbursed on a cost plus basis.

The project will promote the participation of the local community, including local labour and contractors in accordance with the Benefits agreement.

It is proposed to recruit as many personnel from Newfoundland and Labrador as is practicable with consideration primarily to those with pertinent experience. SNC-Lavalin is committed to provide training as required to locals interested and available to work on the project.

4.3.23.6 Sites Establishment

In relation to the master control schedule, the work breakdown structure and the contracts list, many and major contractors will mobilize on site and carry out their construction activities at the same time.

Initial sites establishment will include the following;

- EPCM office;
- Site office for contractors;
- Lay down for material for construction;
- Lay down for equipment;
- Washroom and toilet facilities;
- Waste bins;
- Site services/utilities.

Services connection points located on specific location will be required for site establishment and site construction activities. Contractors will connect their installations to these connection points for their purpose:

- Water supply
- Sewage
- Power supply

Laydown will be considered based on the number of contracts awarded, contractors in place, manpower level, local conditions, etc.

Accommodations

On-site accommodations are being considered and there will be a turn-key package to supply and operate the accommodations complex. The complex will be constructed in increments to match the peak workforce requirements on site.

It is expected that onsite bussing will be required to transport personnel from the accommodations complex and other worker parking lots to the construction sites, or, to a limited extent, from Goose Bay.

4.3.23.7 Initial Construction Activities

After approval of the Project, SNC-Lavalin's construction management team will start multiple activities in parallel in order to commence the project as quickly as possible.

Mobilization of key personnel to the St. John's office and to site will be required for the development of the construction plan with engineering and procurement and to prepare the site with some specific early activities.

Project Office

Some of the key activities for the construction team at the project office will be as follows:

- Development of Project Execution Plan and Project Schedule (early activities, main works activities) procedures and policies;
- Participation in Constructability procedure and review;
- Participation in work package and the construction contract tendering process for services contractors, construction contractors for early and main works activities;
- Preparation for site establishment, site development for temporary and permanent facilities;
- Preparation of site organization, sourcing and engagement of personnel;
- Mobilization of an expert team for modularization and pre-assembly in conjunction with Engineering and Procurement departments to develop a modularization plan at the early phase of the project;
- Preparation for Pre-commissioning by defining system and sub-system for early works activities and for the main construction activities;
- To provide full support to the site construction team performing the site preparation activities;
- After completion of these activities, personnel will gradually be mobilized to the site for their respective duration assignment.

Site

After approval of the Project, construction personnel will gradually mobilize to site to carry out some early activities for site preparation and to supervise, monitor and manage the first services and trades contractors.

A. Site Personnel

EPCM personnel (site supervision, HSE personnel, security and administration);
Services contractors such as surveyors, geotechnical, soils lab personnel;
Medical personnel (nurse);
Contractors (services and trades);

B. Services Contractors and Suppliers

Security agency
Medical personnel
Surveyors
Geotechnical
Soil testing
Snow removal
Waste management
Fuel supply
Rental (site vehicle)
Transportation (buses, etc.)
Canteen

C. Trade Contractors

Temporary buildings and utilities
Site clearing
Earthwork
Fencing

After approval of the project, a number of activities will start preparation prior to the main construction activities.

- ❑ Communication
- ❑ Transportation (buses / site vehicles)
- ❑ Office building (temporary / permanent)
- ❑ Power supply
- ❑ Safety and site security
- ❑ Service for direct construction
- ❑ Fuel station (supply / distribution)
- ❑ Sewage system (treatment plant and sewage disposal)
- ❑ Water supply (raw, potable, fire, etc.)
- ❑ Waste management system
- ❑ Mess room and accommodations
- ❑ Material handling and warehousing, lay down
- ❑ Travel agency
- ❑ Permit approval
- ❑ Port logistics team
- ❑ Crane supply and transportation
- ❑ Maintenance services

All of the above items will have to be done before construction in order to avoid any delays on schedule.

Communication

A communication system will be implemented at the beginning of the project between the St. John's office and the site offices.

Site communication (radio, mobile phone, etc.) will be provided at the site as early as possible.

Transportation (Buses, Site Vehicles)

Transportation procedures and protocols will be put in place from day 1 of construction and will be upgraded as manpower is increased on site.

Transportation on site for workers will be organized by the Contractors and SNC-Lavalin, so a minimum of personnel vehicles will be allowed to drive on site to minimize congestion. This provides more space for construction and less chance of accident or material damage.

All contractors will have to use the bus system for their workers and for people who do not need personal or project vehicles on site.

Schedules and itineraries will be produced and distributed to everyone to increase use of the service.

Individuals arriving by plane will use a shuttle system or taxis from airport to site.

Site vehicles for project personnel will be used.

Limited quantity of site vehicles / contractors will have access to the site.

Personal vehicles will be parked at established car parks.

Office Building (Temporary)

Temporary buildings will be installed at the site until a clear space (lay down) is built on site for construction offices.

- ❑ Construction office.
- ❑ Security office.
- ❑ Security gatehouse and fencing.
- ❑ Medical centre and ambulance.
- ❑ Storage area.
- ❑ Contractor offices.

Temporary offices and services will be installed to support the early works until the main offices are installed at the accommodations complex area. Earthwork, civil contractor,

medical center, security office, survey office, geotechnical and project individuals will use the temporary installations.

Strategic locations for the temporary offices will be determined so that they will not have to be moved during the course of construction.

All contractors will be responsible for their own temporary offices on site. The SNC-Lavalin Project Team will only supply connection points for power, potable water and sewage systems. Contractors will install their offices and connect to all the services supplied by the Project (electricity, water, sewage system, etc.).

Medical and emergency services will be the responsibility of SNC-Lavalin. Input will come from Nalcor. A defined area will be prepared for temporary installation until the permanent installation is ready. It will be important to avoid any interruption of the services during construction or during the move from the temporary to permanent installation.

Medical and fire service will have to consider the manpower and field dimension (km^2) to cover. This is required to organize their team and equipment and will affect the size of installation.

Survey Office

Surveying will mobilize from the beginning of construction.

Project Construction Office

Construction will establish a temporary office to meet the construction schedule before the permanent site office is ready.

Contractors

Contractors will have to supply their own equipment with the exception of the connection points for water, power, sewage systems (if they exist) and snow removal which will be supplied by the Project.

Areas for offices and lay down will be designated by SNC-Lavalin.

Power Supply

Power will be supplied by gen-sets at the beginning of construction. At that time, all contractors will have to use their own gen-sets for construction (small tools, etc.) until construction power is in place, which will be supplied by Nalcor.

Safety and Site Security

Site security will be the key factor to avoid problems on site. A security gate will be established at the entrance to the site to secure the site before any work starts. A guard house for access control will be installed at each access to the site for ID control and induction before entering on site.

Where possible, temporary or permanent fencing will be installed to control people and vehicles (workers, visitors, vendors, etc.) before they enter on site. Photo ID and information system (IT) will be installed from the beginning of construction. The system will be updated everyday to keep unauthorized personnel from entering the site.

Safety induction will be performed on site before entering the site. Every person will have to follow induction before receiving an ID badge.

Emergency Response

The emergency team on site will be present during construction and will be ready to respond to any emergency situation.

A nurse will stay on site during work hours and will be ready to evaluate and treat injuries. For serious incidents the injured person will be evacuated by ambulance or by helicopter to Goose Bay.

Fuel Station (Supply / Distribution)

A fuel supply contract may be established with a local supplier to supply fuel to the site.

Sewage System

All temporary facilities will be emptied regularly with waste sent to a treatment plant offsite until the accommodations complex is completed.

Water Supply

Water on site is needed at the beginning of construction. The Project team will be responsible to supply water for everyone on site. Initially potable water and raw water for construction will be made available with the use of bottled water and temporary tankers until a pumping system from an approved water supply is installed.

Waste Management System

Construction residue will be very important on site from the beginning. Earthwork will produce a large amount of unsuitable material (USM). Disposal areas will be identified on site.

Project construction works will generate a large amount of paper, wood, plastic and steel. A system will be put in place to treat all the waste material with segregation of waste streams to allow recycling wherever possible.

All hazardous waste will be collected by a certified waste disposal company and disposed of in accordance with Provincial regulations.

Material Handling/ Laydown and Warehousing

Construction will require the temporary storage of large quantities of construction materials and equipment on the site. Where possible with pre-assembled components and equipment, "Just in time" delivery is critical to reduce the laydown and warehousing requirements. Site planning, construction coordination and phasing of the work as well as offsite storage will be critical to controlling congestion on site.

Permit Approval

All permits have to be identified and applications completed by SNC-Lavalin. Nalcor will be responsible for submittal of the permit applications and co-ordination with the authorities having jurisdiction. SNC-Lavalin will attach required permit dates as milestones in the Construction Schedule and closely monitor these milestone dates so that approvals are provided on time for construction to start on site.

Crane Supply and Transportation

Crane supply contract to be awarded early in the Project in order to be available on site as required (unloading, transportation of material and equipment).

Maintenance Services

Maintenance services will be contracted as required.

4.3.23.8 Day-to-Day Construction Management Activities

Management of Contractors

Contractors will have a site management team located at the work site and supported by their respective head office management. Each contractor will be responsible for the supervision and management of his personnel and subcontractors. Contractors are required to appoint a senior site representative who reports to the project construction management team. The contractor's team will provide the necessary management including HSE, QA/QC, security, planning and scheduling, cost control, materials control, administration, labour training and site engineering to support the supervision of their work scopes.

Contractors' management functions will be performed in accordance with approved procedures prepared by the contractors using project guidelines. This ensures that key areas such as safety, quality, environment, schedule and site engineering receive consistent attention by all contractors.

Weekly progress meetings will be held with each contractor where information is exchanged, potential and actual problems are discussed and corrective action items are agreed and assigned. For special or critical subjects one-off meetings will be arranged with relevant contractors, specialists and project personnel. SNC-Lavalin will manage the Project using the information from contractors, regular reports and progress meetings. By developing and maintaining a close working relationship with contractors at all levels, SNC-Lavalin will ensure the quality of their data. Contractors will agree on weekly progress measurement with SNC-Lavalin before formally submitting or reporting progress. The site planning engineer responsible for monitoring contractors' progress will have regular contact with the contractors' planning personnel and project site supervision to verify progress milestones.

Management Meetings

The Construction Manager and the Area Construction Managers will conduct weekly meetings to ensure construction concerns are continually addressed. The agenda for the meetings will include:

- HSE
  - Incidents;
  - Statistics;
  - Interfaces, concerns;
  - Housekeeping;
  - Community relations.
- QA/QC
  - Concerns;
  - Status;
  - Audit;
  - Lessons learned.
- Work progress
  - Actual versus planned;
  - Manpower;
  - Concerns;
  - Productivity;
  - Rework.
- Planning
  - Detail schedule, look ahead schedule (short, long term);
  - Labour evaluation;
  - Cost, trend;
  - Change control;
  - Engineering deliverables;

- Material and equipment status, technical documentation;
- Interface;
- Concerns.

❑ Engineering
- Queries status;
- Problems, concerns;
- NCR status;
- Vendor information, site representative.

❑ Contract
- Mobilization of resources;
- Availability of resources;
- Progress;
- Documentation;
- Contractor's concerns outstanding issues.

A priority list of concerns/issues on a weekly basis with action responsibility / date will be generated. The priority list will be divided by area and discipline to facilitate the communication and resolution process. Formal meetings on site or at the project office will be planned as necessary.

The priority list will cover issues such as:

❑ Design issues;
❑ Deliverables (dwg IFC);
❑ "Holds" to be removed;
❑ FEQ status report;
❑ Procurement items (delivery).

4.3.23.9 Field Quality Assurance

A project specific Quality Plan will be developed by applying the SNC-Lavalin quality system. The plan will describe the procedures to be applied in order to deliver quality services to respect the Owner's objectives.

Although the Quality Plan is applied to all areas of activities, amongst some of the key quality assurance initiatives will be with the vendors and contractors.

They will be expected to submit their own project specific QA/QC programs that will be reviewed, approved and audited by SNC-Lavalin during the course of their activities.

The construction works will be completed and inspected in accordance with contractors/vendors inspection and test plans (ITPs) and all construction testing activities will be completed and certified to allow plant commissioning to commence.

The QA/QC department will also monitor, coordinate and control many specific activities on site that will be carried out by services contractors (Third Party):

- Field survey;
- Geotechnical;
- Soil;
- Concrete;
- NDT;
- Welding.

As-built drawings and information, properly submitted and reviewed, will also be required for the final handover.

The QA/QC department, in association with contractors/vendors, will ensure all documentation concerning quality will be properly filed and handed over for future audit.

Finally, throughout its duration, the project will be audited by internal and external auditors both at the project office and at the site.

Vendors

The SNC-Lavalin team will draw on their world wide network of experienced quality inspectors who will be responsible for conducting inspections at vendors' facilities daily or to a schedule depending on the complexity of the product or equipment.

They will ensure that vendors are following their own quality plan, sign off at hold and witness points, report regularly to the responsible manager, assist in processing concession requests, engineering queries, and reporting and closing out of non-conformances.

The inspectors will be responsible for final acceptance by signing off the inspection reports, assuming closure of all non-conformances and authorizing releases for shipment.

Contractors

At site, the SNC-Lavalin team will have a team of inspectors representing the various disciplines of the project. They will report to the Site QC Coordinators responsible for quality control.

They will ensure that contractors are following their own quality plan, sign off at hold and witness points, report regularly to the Area Construction Manager, assist in processing concession requests, engineering queries, and reporting all closing out of non-conformances.

They will be responsible for final acceptance of the works including all handover documentation from the contractor.

4.3.23.10 Project Deliverables

The SNC-Lavalin team will be responsible for the global execution of the works in line with the project objectives (HSE, schedule, budget and quality).

Key Performance Areas

- Achievement of the respective KPIs set for construction (including cost, time and quality).
- Ensuring that the site is in HSE compliance and that KPIs are achieved.
- Ensuring that a positive, effective and harmonious HR/IR and community relations environment is achieved.
- Ensuring that the works are designed with constructability issues identified, assessed and incorporated.
- Development of comprehensive effective construction procedures for the site works.
- Proper management of all Newfoundland & Labrador construction issues.
- Effective management of all relevant interfaces.
- Achievement of the requited transitional turnover of systems to the commissioning team, to the required standards and within the required timeframe/milestones.
- Construction close-out and documentation.

4.3.24 x) Project Completions

x) Project Completions (methodology, resources and tools required);

The project shall be executed generally following SNC-Lavalin Hydro & Power Division commissioning guidelines and procedures, start-up and data handover policies and procedures suitably amended to incorporate Nalcor's particular 'project completions' requirements.

Planning will take place early in the Phase 3 period to ensure that design, procurement and construction planning accommodates the overall plant commissioning requirements and commissioning work sequence.

Prior to the mobilization of the full Commissioning and Start-up team, alignment and planning sessions will be held with Nalcor to ensure scope and work method understanding.

Specific procedures will be prepared, addressing in particular the requirements of the RFP **Part 2, Exhibit 3, Section 3.4.4 and Exhibit 5 Section 13**, defining the overall

scope of work, work contained within a system and the method of bringing the system on line. These specific procedures will be accompanied by 'marked-up' drawings to define limits and boundaries of each system. The careful preparation and implementation of the project commissioning procedures will enable the facility to be brought on line safely and with the knowledge that a system has been fully tested.

SNC-Lavalin's overall completions philosophy for the Muskrat Falls Project is to consider the engineering, construction, mechanical completion and commissioning phases as a continuous integrated activity.

In support of this objective, a Completions Plan will be produced during the early stage of Phase 3 and further developed during the Phase 4 work as project information becomes more defined.

The Completions plan will describe the project completions strategy, methodologies and will identify key interfaces and responsibilities. The overall goal of the Completions plan is to ensure:

- The project is constructed, commissioned, certified and handed over ready for start-up, in a safe, structured and controlled manner
- The project is provided with a comprehensive electronic set of certification and records for use during the life of the asset.

4.3.24.1 Phase Completions Activities

At each stage of the completions process, all components and systems will be tested, inspected and verified to verify installation and functionality is in compliance with project design intent and specification. The completions process will comprise three stages – Mechanical Completion, Static and Dynamic Commissioning.

Mechanical Completion

Mechanical completion is defined as the point at which all construction and installation of equipment, piping, electrical services, instruments/controls and utilities are physically completed but not energized and that designated inspections, tests and checks are documented.

Dedicated site teams will be established to work in cooperation with overall commissioning management, site construction and operations teams to achieve Mechanical Completion.

Construction completeness and the achievement of Mechanical Completion will include the installation, inspection and testing activities as a minimum, including, but not limited to the completion of associated mechanical completion systems:

Electrical

- ❑ Generators and excitation system
- ❑ Power transformers
- ❑ AC station service
- ❑ Grounding system
- ❑ Communications system
- ❑ Lighting and service outlets
- ❑ Fire detection system
- ❑ Plant security system

Mechanical

- ❑ Turbines and governors
- ❑ Fire protection systems
- ❑ Overhead cranes
- ❑ Power intake gates and stoplogs
- ❑ Draft tube gates
- ❑ Spillway gates and stoplogs
- ❑ Elevator
- ❑ HVAC
- ❑ Cooling water
- ❑ Service water
- ❑ Domestic water
- ❑ Wastewater
- ❑ Drainage
- ❑ Draft tube dewatering
- ❑ Oil handling systems
- ❑ Compressed air system
- ❑ Machine shop

Structural / Architectural

- ❑ Concrete integrity
- ❑ Embedded parts
- ❑ Structural steel components and connections
- ❑ Siding and roofing
- ❑ Drainage

Mechanical Completion is achieved through the completion of all mechanical check sheets allocated against a system/sub-system and any outstanding items deemed non detrimental to safe operation, registered on an agreed punch list. At all stages of hand-over, an electronic master punch list will be utilized to record all outstanding items relating to systems/sub-systems at the time of the hand-over. Punch list items once input into the completions database will be signed off when completed, but not deleted, resulting in a full traceable history.

All outstanding punch list items entered into the completions management database will be allocated one of the following categories:

- *Category "A" Punch list*—signifies that the Punch list item, defect, or omission must be repaired or completed before issuance of a System Mechanical Completion Certificate. The component/subsystem/system shall not be energized until pertinent Category “A” items are corrected.
- *Category "B" Punch list*—signifies that the Punch list item, defect, or omission may be completed after Mechanical Completion and issuance of a System Mechanical Completion Certificate. All Category "B" items must be corrected before issuance of a turnover notice for the system.
- *Category "C" Punch list*—signifies that the Punch list item, defect, or omission can be repaired and/or completed after System Turnover, but this task must be achieved before issuance of the acceptance notice.

The punch list database will record punch list items from third parties, such as vendors or contractors. This practice has proven to be significantly advantageous on past projects, allowing a comprehensive project punch list database to be achieved and facilitating effective closeout of all project punch list items, irrespective of source.

4.3.24.2 Static Commissioning

Static Commissioning is defined as the discipline commissioning activities undertaken on achievement of mechanical completion but prior to commencement of dynamic commissioning in order to prove and validate the functioning of components. Static commissioning activities are intended to verify that components and associated control, shutdown and utility systems are ready for full dynamic commissioning.

Static commissioning activities will include, but not be limited to the following:

- Testing of bus bars and main breakers
- Injection tests on protection relays, C/Ts, MCBs, motor overloads and breakers
- IR and winding resistance tests on motors
- Voltage checks on battery banks
- No load/load runs of motors
- Phase rotation checks on switchboards and motors
- Discharge tests on battery backed emergency luminaries and equipment
- Earth loop impedance tests
- Lux. level checks for lighting circuits
- Trace heating function checks
- Completion of applicable static commissioning certification

This process allows system/sub-system turnover to commissioning confirming that all discipline static commissioning within a system/sub-system is complete and is available for dynamic system commissioning activities.

Once systems have been accepted by the Commissioning team, they will be controlled by the Commissioning group's lockout/tagout procedure. Systems under the control of Start-up will have their boundaries identified by green tags. Any isolations for rework /testing will be isolated by physical locks issued from the Control Room or other designated area. A list of qualified lockout specialists will be identified in the front of the lockout/tagout log.

Commissioning will complete the static (pre-commissioning) and dynamic checkout of all Plant systems within our scope of supply. All data including "as built" conditions of the equipment will be documented in the turnover packages. If Commissioning finds issue with 'as built' conditions, or drawings, they will issue an exception report to engineering with a question and/or suggested resolution. Response from Engineering of any changes will be in the form of a DCN.

The commissioning Start-up Team will submit a completed Turnover Package to Nalcor's representative for final acceptance.

The Turnover Package is the basis for system acceptance and will contain, as a minimum, the following information:

- S□ystem name and number
- Table of contents
- Scope or boundaries of the system (marked-up P&ID or Electrical SLD)
- Applicable Instrument, Equipment and Line Lists
- Commissioning reports, statistics and support data

Systems turned over to the Client fall under the Client's lockout /Tagout Procedures. Any rework on those systems must be scheduled and authorized through the Operations Group.

At the completion of the Commissioning phase, all redline mark ups generated by the Commissioning Team are sent to the responsible Engineer for the project. The Engineering group will submit final "As Built" drawings to the Client.

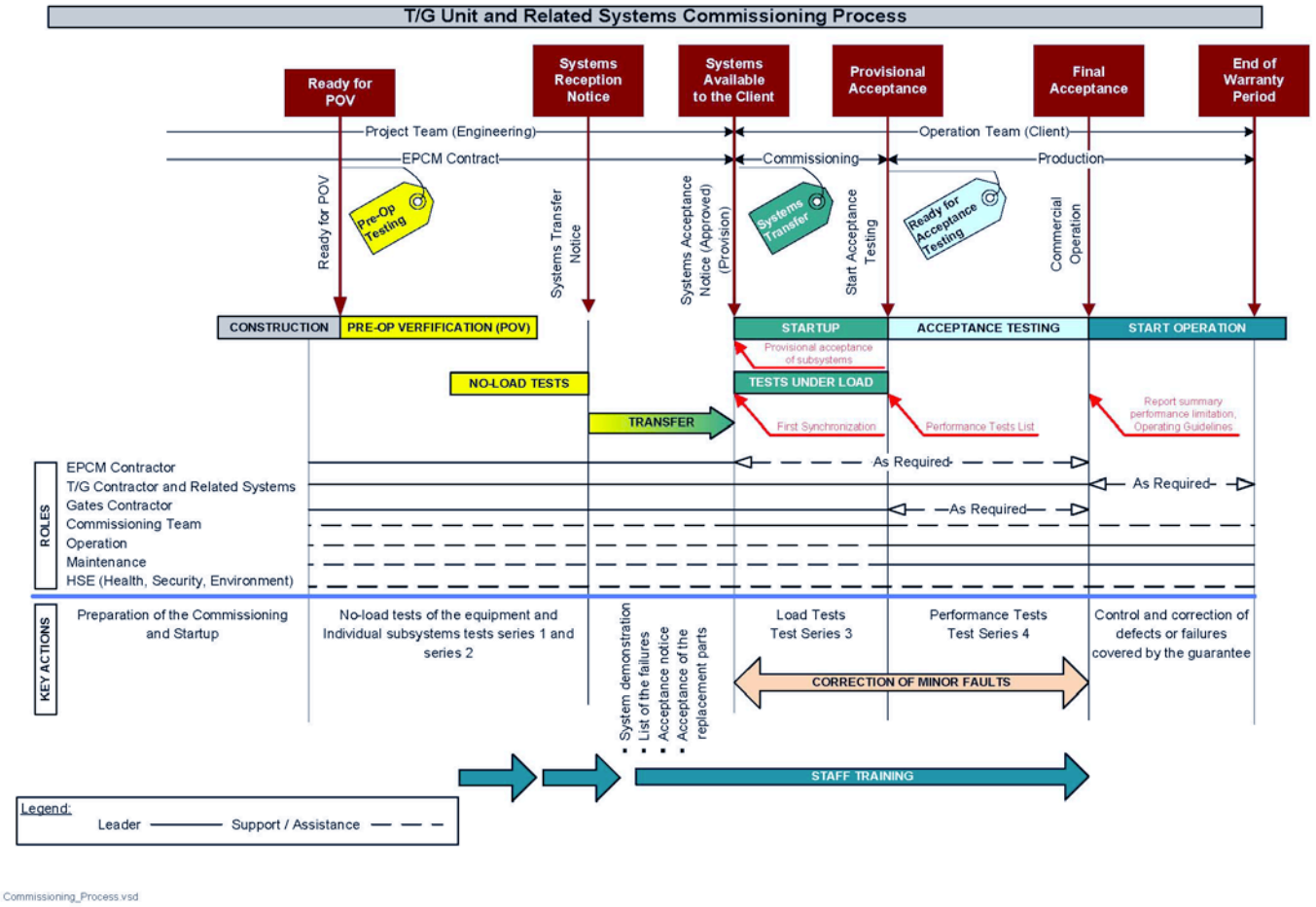
4.3.24.3 Commissioning Procedure

Typical Table of Contents

1.0 SCOPE OF COMMISSIONING SERVICES AND ACTIVITIES
1.1 Scope
1.2 EPCM Mandate

Refer to Figure 4.3.x-1 for sample commissioning process.

Figure 4.3.x-1


T/G Unit and Related Systems Commissioning Process
Ready for POV
Systems Reception Notice
Systems Available to the Client
Provisional Acceptance
Final Acceptance
End of Warranty Period
Project Team (Engineering)
Operation Team (Client)
EPCM Contract
Commissioning
Production
Ready for POV
Pre-Op Testing
Systems Transfer Notice
Systems Acceptance Notice (Approved) (Provision)
Systems Transfer
Start Acceptance Testing
Ready for Acceptance Testing
Commercial Operation
CONSTRUCTION
PRE-OP VERFIFICATION (POV)
STARTUP
ACCEPTANCE TESTING
START OPERATION
Provisional acceptance of subsystems
NO-LOAD TESTS
TESTS UNDER LOAD
TRANSFER
First Synchronization
Performance Tests List
Report summary performance limitation, Operating Guidelines
ROLES
EPCM Contractor
T/G Contractor and Related Systems
Gates Contractor
Commissioning Team
Operation
Maintenance
HSE (Health, Security, Environment)
As Required
KEY ACTIONS
Preparation of the Commissioning and Startup
No-load tests of the equipment and Individual subsystems tests series 1 and series 2
System demonstration
List of the failures
Acceptance notice
Acceptance of the replacement parts
Load Tests Test Series 3
Performance Tests Test Series 4
Control and correction of defects or failures covered by the guarantee
CORRECTION OF MINOR FAULTS
STAFF TRAINING
Legend:
Leader
Support / Assistance
Commissioning_Process.vsd

4.3.25 y) Project Completion Execution

y) Project completion execution (site survey, as-built drawings, data books and other final contract documentation);

The control of project information will take into full consideration the requirements outlined in the RFP document - Part 2 Exhibit 5 Section 16 Information Management and Scope of Services Section 3.2.13 Final Documentation.

SNC-Lavalin will prepare an Information Management (IM) plan including procedures, organizational charts, systems, training programs, etc. early in Phase 3 to address the following areas of IM:

- Administrative Records Management;
- Document Management/Control;
- Data Management;
- IS/IT;
- Information Security;
- Adherence to documents outlined in RFP Exhibit 6, MSD-IM-002, Lower Churchill Project Information Management Policy and MSD-IM-003, Lower Churchill Project Information Management Strategy;
- Provision of statistical and status reporting for documentation and data as required;
- IM related Standards and procedures agreed between Nalcor and SNC-Lavalin are followed by all contractors and suppliers;
- Inspections and assessments of IM processes and systems by Nalcor representative;
- Process improvement suggestions throughout the life of the Project where there are efficiencies to be gained;
- IM related issues;
- Final information hand-over requirements.

4.3.25.1 Data for Operations

When the start-up phase is complete, completion close-out will begin. This work will include preparation and handover of the complete documentation database and the project close-out report.

Operational documentation considered critical to facility operations will be marked-up with any changes during the start-up process. When completions activities are closed out, the marked drawings will be handed over to Nalcor operations.

The effort to define, structure and prepare data for operations materials will begin early in Phase 3 to allow for the most efficient assembly of the operational data over the course of the project. This will be an integral component of the IM plan.

The following general objectives will be followed:

- Data necessary for facility operations, maintenance and integrity management will be handed over in electronic format;
- Data formatting at handover will be consistent with the requirements for mapping to Operations management systems;
- Paper handover will be minimized where possible to eliminate cost and waste;
- Redundant or “design phase” data will be bulk-archived;
- Handover will be phased to allow integration of information into Operations and Maintenance system development programs that begin in the detailed engineering phase (Phase 4).

Handover at the end of the project will be simplified through the use of the document management system - PDM. During design, documents will be classified according Nalcor handover requirements. For example, files needed for the items listed below can be coded according to the lifecycle requirements of the deliverable.

- Design verification (e.g., material certification or welding test documents);
- Operations and maintenance (spare parts information, operating procedures, etc.);
- Future facility modifications (general arrangement drawings, isometrics, etc.).

At the completion of the project, the files can be sorted by this lifecycle code and handed over via electronic transfer, via CDs, or even printed and bound into hardcopy books.

One additional advantage of the electronic repository is the ability to link to other document repositories used by Nalcor, subcontractors, and vendors, if advantageous. The Project PDM system repository will remain the master repository; however, within different offices (Nalcor, subcontractors, vendors), existing document management practices can continue to be utilized during document development and/or review.

4.3.26 z) Other Processes

z) Processes for inclusion and incorporation of:
- *Safety in design*
- *Industry recognized value improvement practices*
- *Company’s asset management requirements*
- *Constructability reviews (further detail regarding constructability and construction execution planning shall be provided in response to question 7.0 herein);*
- *Productivity factors in construction planning and execution*

• *Any other specific topic that Proponent deems critical to achieving maximum overall value for Company.*

4.3.26.1 Safety in Design

The implementation of robust safety processes on a project site impacts the safety of workers and sub-contractors. However, it is easy to lose sight of the importance that design office activity can have in keeping all people safe. The success of a project actually starts with design activities.

Designs and technologies that remove hazards, reduce consumption and decrease the ecological footprint of a project are an important part of a project's success. The best place to prevent an incident and reduce overall lifecycle costs is in the mind of the design engineer at the beginning of the design process. SNC-Lavalin encourages all members of the design team to ask the question, "Are we acting on our WE CARE Value Statement by creating designs that are as safe as they can practically be?". Many unnecessary hazards can be identified during project design and can be "designed out" through the use of alternative components, systems or construction methods.

Designers are encouraged to explicitly consider the safety of construction and future maintenance workers in the design phases of a project. They must consider how the project's inherent risk to workers and future users may be affected. This includes worker safety considerations in the constructability review process. Design can introduce failsafe systems to prevent possible accidents from happening.

Some of the many examples of design issues that can improve safety and lifecycle implementation are:

- Providing work platforms with proper railings to eliminate the need for fall protection tie-offs;
- Providing anchor points for tie-offs that will protect workers during construction and maintenance activities when platforms cannot be provided or when the only way to protect the worker from falling is to use personal fall protection;
- Performing pre-fabrication in a controlled area. Hazards associated with working at high elevations can be drastically reduced by assembling portions of a structure on the ground and then lifting it into place as a single component;
- Providing adequate access to installation, operation and maintenance of all valves and controls and orienting equipment and controls so as not to obstruct walkways and work areas;
- Understanding the space required for tools like erection wrenches and torque guns; and
- Choosing non-toxic products that do not require respirators.

An additional benefit of using innovative technologies is that, with proper planning from the beginning of a project, there can be significant savings generated. SNC-Lavalin's safety conscious design and the selection of the best technologies and equipment will not only contribute to the reduction of incidents during construction, but also to the whole life cycle of the project, including operation and maintenance

4.3.26.2 Industry Recognized Value Improvement Practices

Key Concepts

Value Engineering is a conscious and explicit set of disciplined procedures designed to seek out optimum value for an Owner investment in a project. It requires an intensive analysis of all key facets of the proposed design with a goal of reducing both initial capital and long-term operational costs without compromising utility, function or performance.

In its application, Value Engineering is a team-based process that examines the necessity of each service or function of the project, and determines how the service or function contributes to the overall project goals, and at what cost.

Benefits

Effective use of Value Engineering can:

- Optimize and reduce capital and life-cycle costs (typical capital cost savings are in the range of 7-15%);
- Enhance facility functionality;
- Help provide early and clear team understanding, consensus and confidence on the project's objectives and scope;
- Identify issues early in the project's life cycle;
- Validate or amend underlying project assumptions;
- Identify ideas for future projects.

Approach to Value Engineering

In order to attain meaningful and timely results, a Value Management Plan that describes the procedures for how Value Engineering is to be done at the Muskrat Falls Hydroelectric Development Project will be developed.

Paralleling SNC-Lavalin's approach to other key aspects of project execution such as Quality and Safety, the Value Management Plan (VMP) will be developed as an element of the Project Execution Plan for the project. Since the Value Engineering Plan typically has a significant impact on engineering, estimating and related efforts, the

VMP will be developed early in the planning sequence, in close collaboration between SNC-Lavalin and Nalcor.

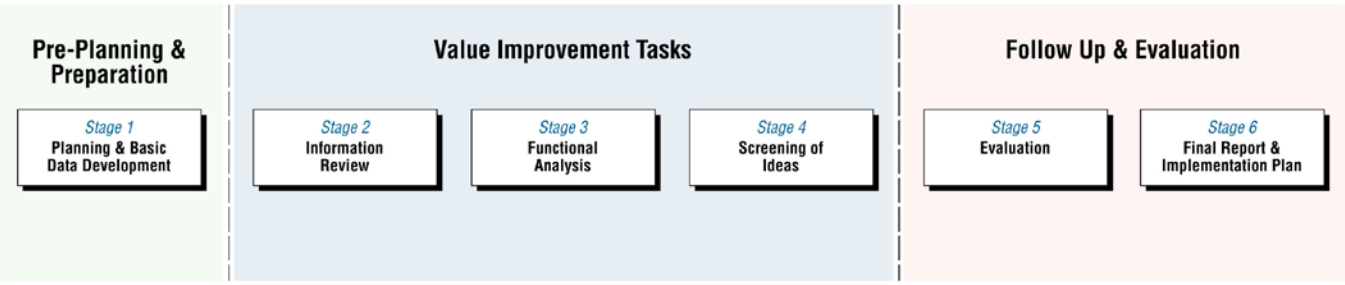
The VMP will address:

- Objectives and level of commitment to Value Management;
- Specific Value Improvement Practices (VIPs) to be employed, along with the breadth of application across the project (estimated number and duration of VE Reviews) and timing within the engineering sequence;
- Expected impacts on engineering schedule and manpower budget;
- Resources/ expertise, including in-house facilitators, discipline engineering, estimating, and, where required, external consultants;
- Documentation of results;
- Client participation, review and approval.

Value Engineering Process

The Value Engineering Process is a series of progressive stages that culminate in a final report of recommendations. Each stage is shown below and is described in the following subsections.

Value Engineering Process



Stage 1 - Planning and Basic Information Development

Objectives:

- Assign Value Engineering Review Team;
- Prepare Basic Data for Review.

Key Activities

- Define the scope of review;
- Select Facilitator;

- ❑ Determine makeup of Core and Review Teams;
- ❑ Gather Project data (e.g. PFD, Plot Plan, Design Basis, estimates, etc.);
- ❑ Develop Function Table (incl. Key Elements, Major Functions, Element Cost);
- ❑ Reformat project estimate to match Key Elements listed in the Function Table;
- ❑ Review Key Project Goals and Assumptions;
- ❑ Develop Function Evaluation Parameters;
- ❑ Review and approve plan with Owner.

Stage 2 - Information Review

Objectives:

- ❑ Review and validate any information developed or collected during Stage 1.

Key Activities:

- ❑ Review information developed or collected during Stage 1 with the Review Team;
- ❑ Test and validate the following information organized during Stage 1.
  - Key Project Goals;
  - Key Project Assumptions;
  - Project Elements;
  - Project Functions;
  - Total installed cost of each element.

Stage 3 - Functional Analysis

Objectives:

- ❑ Where possible, to generate alternative engineering or construction options to achieve each element's function, without compromising the Project goals.

Key Activities:

- ❑ Functional analysis (brain storming) of:
  - potential alternative scope options for achieving the function of each key element;
  - key elements that are not required;
  - key elements that may have been missed.
- ❑ Develop a methodology for evaluating the options in the next stage.

Stage 4 - Screening of Ideas

Objectives:

- ❑ To short-list the proposals developed in Stage 3 into a group of 'best' proposals (ideas).

Key Activities:

- ❑ Preliminary evaluation of each proposal (e.g. preliminary estimates, design analysis, schedule impact, other implementation considerations);

- Ranking of each proposal;
- Elimination of low-merit proposals;
- Develop follow up Action List items (including delegation of responsibility) along with a completion schedule;
- First draft of Value Engineering Review Report (based on above findings).

Stage 5 - Evaluation and analysis of ideas

Objectives:

- To fully review and analyze each proposal in the draft Value Engineering Review Report.

Key Activities:

- Action item follow up. This may include further design, estimating, scheduling, and implementation efforts.

Stage 6 - Develop Final Report

Objective:

- To make final proposal recommendations and complete Value Engineering Report.

Key Activities:

- Finalize Value Engineering Review Report;
- Create Implementation Plan.

Approval and Implementation Process

At the end of the value engineering exercise, the project team will submit their recommendation to Nalcor for approval and subsequent implementation.

4.3.26.3 Company's Asset Management Requirements

Company believes it is vital to consider the long-term asset management during the engineering and design phase of the Project. Company defines Asset Management as "the comprehensive management of asset requirements, planning, procurement, operations, maintenance, and evaluation in terms of life extension or rehabilitation, replacement or retirement to achieve maximum value for the stakeholders based on the required standard of service to current and future generations."
Consultant shall ensure that Company's Asset Management principles are clearly embedded within all engineering and design activities for the Project, and ensure that the final design achieves the desired balance between cost and reliability.

We Ensure Assets Last

SNC-Lavalin is a leader in long term Hydro facility asset management and over the years has assisted Hydro authorities with various maintenance issues by providing analysis and recommendations focused on maximizing the production output resulting in efficiency, cost savings and overall enhanced asset productivity.

Asset management consideration starts at the early design phase of a project, culminating in an enduring facility lasting decades given scheduled and appropriate maintenance.

We shall implement a process to identify major factors influencing maintenance and equipment life and to identify best practices in maintenance and plant asset performance and shall incorporate routine maintenance concerns into the plant design thus ensuring an optimal maintenance cost facility.

We have a proven methodology that has helped many companies improve their asset and resource productivity which has delivered both top-line and bottom-line improvements and by applying this methodology early in the project design phase we are able to avoid many future maintenance issues.

Engineering will take the following into consideration from a future asset management perspective:

- Incorporating consequential maintenance requirements (world-class standards) into the design specification;
- Setting a specified reliability and efficiency standard in the design criteria;
- Continuous duty application;
- Cyclic duty application;
- Lube oil cleanliness;
- Wear parts;
- Standby and running inspections and inspection intervals;
- Vibration level;
- Spare parts planning;
- OEM service and maintenance options;
- Design for ease of maintenance;
- Concrete additions to enhance durability;
- Use of all-weather housings to protect equipment otherwise exposed;
- Access to structures for future safety evaluations;
- Limit cracks and leakage in the waterways (by performing non-linear analysis for concrete);
- Provide enough lifting devices;
- Provide access for maintenance to avoid dismantling unit; and
- Provide removable sleeves for shaft seals.

Fixed Asset Register

Nalcor will also require the project costs regrouped into a Fixed Asset Register structure for capitalization and amortization of the assets in the client accounts.

The Fixed Asset Register requires the assignment of distributable costs, and this will be produced upon project completion; however, the requirements will be identified during the life of the project in order to ensure that actual costs will be captured in a way to ease the preparation of the Fixed Asset Register at the end of the project.

The Fixed Asset Register will be in the form of a spreadsheet with the actual cost transferred from the project management system (***PM+*** Cost Report) and distributed against the required format and coding structure agreed upon with the Client. The register will be sufficiently detailed to allow allocation of actual costs against each tagged equipment item or Buildings.

The preparation of the Fixed Asset Register will entail:

- ❑ Identification of all Tagged Equipment items and listing in the Fixed Asset Register;
- ❑ Identification of all Buildings and listing in the Fixed Asset Register;
- ❑ Allocation of Tagged Equipment supply cost from the Purchase Orders;
- ❑ Allocation of Tagged Equipment installation cost from the equipment installation contracts;
- ❑ Allocation of Buildings construction cost in the Fixed Asset Register;
- ❑ Allocation of foundation cost for the major process equipment for the construction contracts;
- ❑ Allocation of structural steel supports cost for the major equipment from the structural steel contracts;
- ❑ Allocation of the cost of freight and vendor's representatives to the equipment items;
- ❑ Cost distribution of the following categories against the installed cost of the equipment item and/or Buildings:
  - Mechanical equipment
  - Electrical and Instrumentation
  - Consultant services
  - Temporary facilities, utilities and construction services.

4.3.26.4 Constructability Reviews

Constructability reviews (further detail regarding constructability and construction execution planning shall be provided in response to question 7.0 herein)

SNC-Lavalin will plan and implement a 'Constructability in Design' program. The purpose of the plan will be to:

- ❑ Enhance safety;

- Improve construction efficiency;
- Reduce construction and operations risk;
- Reduce engineering re-work, field changes and requests for information during construction; and
- Facilitate smooth commissioning and facility start-up.

The plan will consist of:

- Assigning construction personnel into the engineering design team;
- Review of engineering designs;
- Identification, capture and deciding constructability ideas;
- Verification of inclusion in the design;
- Construction sequence of events;
- Equipment location and setting requirements;
- Site spatial relationships between permanent facilities and construction equipment/facilities; and
- Design simplification.

Experience on previous projects has shown that the key to a successful program will be continuous constructability input. Assigned construction representatives will participate daily with engineering, reviewing documents on a regular basis, actively participating in reviews, identifying and verifying implementation of ideas, and signing off package reviews as part of the squad check process.

Design discipline reviews will include CAD model / drawing reviews of discipline deliverables such as:

- Structural steel
- Architectural
- Piping
- Rotating equipment
- Electrical equipment
- Instruments
- Paint, insulation and fireproofing
- Vendor packages (major)

In addition to the above, consideration will be given to:

- Modularization and pre-assembly considerations to ease fabrication, transportation and installation;
- Construction equipment type to be used;
- Accessibility for materials and personnel;
- Construction in adverse weather conditions;
- Priority equipment delivery and installation;
- Flexibility in construction method selection or construction scheduling; and
- Temporary facilities.

The Constructability Program will also place a special focus on construction safety related design. To this end, the Constructability Team will address the following:

- Work height requirement;
- Temporary works equipment;
- Construction traffic (vehicular and pedestrian);
- Confined spaces;
- Potential electrical shock energy sources;
- Ergonomics (access, tasks, and tool and material handling);
- Noise;
- Lift equipment and overhead spacing;
- Environmental conditions;
- Hazardous materials; and
- Influence on design of sequencing the construction activity to avoid conflicts.

SNC-Lavalin has on past hydro projects implemented successful constructability reviews. Recent programs identified a number of cost, manhour and construction method savings such as:

- Additional access ways during construction of the power house to facilitate ingress and egress;
- Increased the scope of the investigation program in order to reduce unknowns;
- Simplified the contours of the powerhouse excavation in order to reduce overbreaks;
- Reworked all the construction joints in order to speed-up the closure of the PH before winter;
- Reorganised all the service rooms in the power house in order to simplify the wiring and piping;
- Removed the cable gallery which we found was mostly empty lost space;
- Relocated the junction between the temporary access gallery and the penstock in order to facilitate circulation;
- Reorganised construction packages to limit interfaces;
- Removal of columns from the downstream wall in order to simplify the concrete forms;
- Introduction of prefabrication for the downstream wall, the transformer deck, and the generator floor;

Modularity for the service room of the spillways (the complete service room was assembled remotely and transported to the site simplifying final mechanical and electrical hook-up).

4.3.26.5 Productivity Factors in Construction Planning and Execution

Productivity factors in construction planning and execution

SNC-Lavalin uses the Primavera Project Manager System for construction planning and progress measurement on major construction projects. This system is linked to the PM+ Project Management System and the other control modules within that system.

A methodology for updating the schedule has been developed whereby printed forms containing the data to be evaluated by people responsible for updating the deliverables are used. The updates consist of obtaining, for each activity, a physical percentage of progress, as well as an estimate of the man-hours and names of resources required for completion. The responsibilities and accountability of the people concerned are clearly defined.

The system tracks the following data:

- Actual Start Date
- Actual Finish Date
- Original Budget
- Budget Changes
- Working Budget
- Actual Hours
- Forecast Hours to Complete
- Original Duration
- Remaining Duration to Complete
- Percentage Complete
- Baseline Start
- Baseline Finish
- Deliverables
- Change Orders

Progress measurement reports are issued by the Project Manager(s) and senior staff on a monthly basis and used as discussion documents at Project Review Meetings. Strategies to overcome potential productivity issues are initiated and transmitted to the Area Managers and Discipline Leaders for immediate action.

To track productivity, or efficiency, of the various work packages, a system of productivity factors, or Key Performance Indicators (KPI), is utilized. The KPI's will clearly identify where there are problems, and it will be the responsibility of the Discipline Leads and Area Managers (Engineering) and Area Construction Managers (Construction) to take the necessary steps to correct the problem.

Figure 4.3.z-1 presents a list of Key Performance Indicators. All KPI's are definable, measurable and reportable.

The primary indicators are broken down by category as follows:

- HSE Performance:
  - Medical Aid Frequency (MAF)
  - Lost Time Frequency (LTIF)
  - Reportable Incident Frequency (RIF)

These statistics are calculated on the basis of reported incidents per 200,000 hours of project work. The target is 0 incidents in all three categories.

Figure 4.3.z-1 – Key Performance Indicators

KPI Category	Name of KPI	Formula / Calculation	Target	Target Range		
				Green	Yellow	Red
EH&S	Medical Aid Frequency (MAF)	(No. of Medical Aids x 200,000) ÷ Total Hrs worked to date	**0**	**0**	**1**	**> 1**
	Lost Time Frequency (LTIF)	(No. of Lost Time Incidents x 200,000) ÷ Total Hrs worked to date	**0**	**0**	**1**	**> 1**
	Reportable Incident Frequency (RIF)	(No. of Medical + First Aids x 200,000) ÷ Total Hrs worked to date	**0**	**0**	**1**	**> 1**
Financial	Cost Performance Index (CPI)	Earned value of work done ÷ Actual value work done	**1**	**≥ 1**	**.96-.99**	**≤ .95**
	Budget vs. Forecast (FFC)	Approved Budget ÷ Final Forecast	**1**	**≥ 1**	**.96-.99**	**≤ .95**
Schedule	Schedule Performance Index (SPI) – SLI Services	Earned Progress % ÷ Planned Progress %	**1**	**≥ 1**	**.96-.99**	**≤ .95**
	Key Contractual Milestones	Lags / Gaps (Days late)	**0 d**	**0 d**	**1-20 d**	**> 20 d**
	Schedule Performance Index – Construction	Earned Progress % ÷ Planned Progress %	**1**	**≥ 1**	**.96-.99**	**≤ .95**
Quality	Quality Monitoring / Audit	Number of non-conformances	**0**	**0**	**1**	**> 1**
Productivity	Services Performance Index	Earned hours of work done ÷ Actual hours of work done	**1**	**≥ 1**	**.96-.99**	**≤ .95**

Green On Target No Issues

Yellow On Target Warning

Red On Target Warning

- Financial or Cost Performance
  - Cost Performance Index (CPI)
  - Budget vs. Forecast (FFC)

  These factors measure earned value of work done versus actual value of work done (CPI) and approved budget versus final budget (FFC). They are expressed as a fraction, with the target being one (1) or greater.

- Schedule Performance
  - Schedule Performance Index (SPI) – Services
  - Schedule Performance Index (SPI) – Construction
  - Key Contractual Milestones

SPI tracks earned progress versus planned progress and is expressed as a fraction with the target being one (1) or greater.

Key Contractual Milestones are tracked based on lag time or gaps in the schedule expressed as a number of days. The target is zero (0) days.

- Quality Performance

  Quality is measured based on the number of non-conformances reported during regular audits by quality monitoring personnel. The target is zero (0) non-conformances.

Overall Productivity / Performance utilizes the combined SPI factor for the total project. The target is one (1).

In order to prioritize the level of urgency associated with the KPI's, the chart in Figure 4.3.z-1 presents a Target Range which is colour coded as follows:

- Green – On Target No Issues
- Yellow – On Target Warning
- Red – On Target Warning

The Project Management Team will always strive for the best possible efficiency with respect to the contract schedule. Project reports are provided monthly, or more frequently if a critical situation arises. At the project review meetings, KPI's are reviewed, problem areas are targeted, and corrective actions are taken in the following period to correct productivity issues. This is a regular part of the management of all SNC-Lavalin projects, and experience has shown that, in just about every case, productivity is improved over the life of the project as a result of actions taken.

4.3.26.6 Productivity Enhancement Program

Any other specific topic that Proponent deems critical to achieving maximum overall value for the Company.

SNC-Lavalin is committed to and believes strongly that a Productivity and Enhancement Program should be developed to provide "Best in Industry Practices" and to ensure that the Lower Churchill Project becomes a benchmark in the energy sector today. We agree that by recognizing and rewarding not only the EPCM Contractor but, more importantly, Trades Contractors, a significant higher level of safety and productivity can be achieved resulting in delivering the project on time and on budget.

Strategy

SNC-Lavalin proposes to develop in consultation with Nalcor, a Productivity and Enhancement Program that is inclusive of, but not limited to, the following key principles:

- Training programs where all workers have input into project learning and take ownership of how and why things are done on the project;
- Key focus on Labor Relations and cooperative approach with issue resolution before they become problems;
- Maximize pay-out to workers in an effort to enhance individual and work group productivity;
- Attractive accommodation and travel programs;
- Reduce turnaround times on out of province personnel working with the EPCM Contractor;
- Incentive programs with a focus on:
  - Safety;
  - Quality;
  - Cost / Productivity;
  - Schedule.

The Incentive Program should be **simple, visible and credible to the worker**; and tied to measurable Contract Work Packages (CWP's), with awards earned based on overall trades contract performance.

Trades Contractors Incentive Program

This program will motivate the trade contractor's management personnel and building trades members to aggressively pursue, safety and quality in the execution of their work in accordance with the schedule and budget. This program will be designed to set new targets for the industry in project execution.

The basis of the program is the use of a value based recognition program that will highlight the results of the contribution of different project contributors towards achieving and improving the project objectives.

Key performance indicators will be set for each CWP in four categories:

- Safety;
- Quality;
- Cost / Productivity;
- Schedule.

Safety

Safety is the number one priority. Through every step of the project, safety will be implemented via a risk based program.

For each work package, the key performance indicators will be calculated by auditing the risk identification process. This process will also provide identification of the need for any increase of the competence of the workforce involved with the risk. Training in risk awareness and prevention will be the primary tool in the overall safety performance of the group of employees involved in the construction of the specific CWP.

Actual statistics from the specific work scope will be used in developing the safety key performance indicator.

Quality

To promote the quality process, quality indicators will be developed by recording the cost of low quality or non-conformance (i.e. rework) compared to recognized project benchmarks. Established benchmarks that will be used for evaluation will be agreed with Nalcor before the implementation of the program. The percentage and cost of rework will be communicated to members of each CWP to produce the quality key performance indicators.

Productivity / Cost

Productivity and cost are directly tied to the schedule and the man-hours required meeting the schedule for each CWP. The productivity key performance indicators will be measured by comparing the actual man-hours and cost of the work completed against the value of the work planned for the same progress. This is commonly named the earned value concept and is widely used in the industry. For each CWP, an earned value table will be generated by SNC-Lavalin and the Trade Contractor prior to the award of the CWP. The progress and earned value on the work package will then be monitored on a monthly basis.

Schedule

Schedule performance is an important goal of the project, and we propose for each work package to control key milestone achievement or deviations as the key performance indicators of the CWP. These milestone dates will be set between SNC-Lavalin and trade contractors before award to reflect the needs of the project.

CWP Scorecard

The overall CWP's will be calculated with the distribution as proposed below:

	Weighting Factor	Rating Factor	Overall Score
Safety Risk Based System	25%	1	25%
Safety Competence Based System	25%	1	25%
Quality System	10%	1	10%
Quality Rework Indicators	10%	1	10%
Cost / Productivity KPI	20%	1	20%
Schedule	10%	1	10%
Total	**100%**		**100%**

Rating factors for evaluating CWP performance would typically be as follows:

- 1.0 Exceptional
- 0.8 Very Good
- 0.5 Satisfactory
- 0.3 Below Average
- 0.0 Poor

Labour Incentive Program

We normally propose a system of rewards, prizes and coupon payments to workers for meeting or exceeding safety, quality and productivity targets. This program can be developed after EPCM award and after a Project Agreement has been agreed in the future with the various building trades.

4.3.27 aa) Labour Relations

aa) Labour Relations

4.3.27.1 Strategy and Approach

SNC-Lavalin understands that a comprehensive and robust industrial relations policy and a practical implementation plan are vital to the success of the Project. SNC-Lavalin will assist Nalcor in developing an overall industrial relations plan and strategy for implementation on the Muskrat Falls Hydroelectric Development and will manage the implementation during construction.

An effective labour relations plan is developed with the unions on all levels, including; the project site "shop-floor", the regional level, and the national level

SNC-Lavalin recognizes the importance of harmonious relations with the unions working on the project and believes in solving the small problems before they develop into issues that affect the performance of the workforce and the completion of the work.

To leverage local knowledge and experience, the resources for development of the plan will draw upon people who have hands-on knowledge of the industrial relations issues from previous hydroelectric projects.

In recommending a labour strategy the following factors will be taken into account:

- Owner expectations;
- Workplace health and safety requirements;
- Skill requirements for the project;
- Labour productivity;
- Local content requirements / expectations;
- Methods of production (e.g., mix of onsite construction / fabrication versus the use of off-site modules);
- Current labour market considerations; and
- Options for retention of the work force during and beyond the development stage.

4.3.27.2 Project Labour Agreement

It is SNC-Lavalin's opinion that a Special Project Labour Agreement should be ratified with the Newfoundland and Labrador Building and Construction Trades Council (Local Building Trades Unions). This agreement will be a key element in the development of the Industrial Relations Plan.

The agreement will be binding on Nalcor and all of the building trades that are currently members of the Building Trades Union. The Special Project Labour Agreement will establish certain terms and conditions of employment for the construction workers employed by the trade contractors working on the project. These terms and conditions shall address, among other things, rates of pay, benefits, hours or work and other working conditions so as to promote orderly and productive relations and achieve uninterrupted completion of the project. SNC-Lavalin will be responsible for implementing and co-ordinating the Special Project Labour Agreement, ensuring that all trade contractors and unions comply with and abide by the labour agreement. SNC-Lavalin will participate in joint Labour/management liaison committees to promote harmonious labour relations.

SNC-Lavalin has a proven track record of executing large projects under this type of Special Project Labour Agreement and has done so locally, with the most recent being the Voisey's Bay Mine/Mill Project. The company is very familiar with the management of projects using the building trades unions in the local project area and has extensive experience and lessons learned on other large projects across Canada.

4.3.27.3 Execution Strategy

Coordination

Labour Relations will be managed by the Labour Relations Manager, who will report to the Project Manager. He will liaise with Nalcor's Labour Relations Manager, as well as SNC-Lavalin's Project Management and Construction Management groups to determine where potential problems may arise with labour relations. The Labour Relations Manager will be in constant contact with union management to provide a positive and cooperative working relationship, to identify potential problems early and coordinate solutions.

EPCM Execution

The Labour Relations Plan will provide the road map for dealing with the Trades Contractors and Building Trades Unions at site. SNC-Lavalin will ensure that the Trades Contractors abide by the conditions of the Project Agreement and provide effective labour relations with their workers.

To facilitate labour harmony, SNC-Lavalin will participate in the preparation and conducting of Building Trades Unions jurisdictional mark-ups and in the resolution of jurisdictional disputes. All grievances will be resolved quickly and in a cooperative atmosphere to resolve the problem and to identify and resolve recurring situations that produce grievances.

Further detail is provided in Section 24 – Labour Management.

4.4 PROJECT IMPLEMENTATION SCHEDULE

Proponent shall provide, in its Technical Proposal, a summary schedule for the implementation of each discrete Component for which it is submitting a Proposal to provide Services. The summary schedule(s) provided by Proponent in its submission shall provide sufficient detail so as to demonstrate a solid understanding of the elements that comprise the respective Component and the associated linkages and dependencies as related to implementation. The summary schedule(s) shall show start dates, finishing dates and durations for all key engineering, procurement and construction activities, and shall include and align with Company's Milestone Dates as provided in Part 2, Exhibit 7.

Proponent's submission shall provide a narrative containing a description of what Proponent deems to be the critical path for each Component.
Proponent shall also indicate, on its schedule(s), the point wherein Proponent would be able to produce, for the implementation of each Component, a cost and schedule estimate with an accuracy of AACEI Class 3 Equivalent.
Proponent's summary schedule as provided in its Technical Proposal shall form the basis for Consultant's Project Control Schedule described in Part 2, Exhibit 5, Section 18.

4.4.1 Summary Schedule

See attached Schedule, Figure 4.4.1.

4.4.2 Schedule Narrative Including Critical Path and Milestone Estimate (AACEI Class 3 Equivalent)

The Muskrat Falls Hydroelectric Development project implementation for both Scenarios A and B is planned to follow the following milestone dates:

Item	Description	Milestone Date
1	Award Purchase Order for supply and installation of Accommodations Complex for Muskrat Falls.	October 2010
2	Award EPCM Agreement for Project.	November 2010
3	Start Engineering and Detailed Design services under the EPCM Agreement.	January 2011
4.	Environmental Assessment Release for Generation Project obtained by Company.	May 2011
5	Start construction of south side access road for Muskrat Falls.	June 2011
6	Submit cost and schedule estimate.	July 2011
7	Project Sanction / Gate 3.	September 2011
8	Begin procurement for turbines and generators and other long lead manufactured items.	September 2011
9	Access road ready for south side access to Muskrat Falls site.	October 2011
10	Tendering for civil works contracts begins.	June 2012
11	Checkpoint 1.	June 2012
12	Accommodations Complex installed and operational.	August 2012
13	Spillway sluices open for river diversion.	July 2014
14	Cofferdams complete for controlled forebay.	October 2014
15	RCC dams complete.	December 2015
16	First power.	October 2016
17	Full power.	May 2017

The most critical components of the project are located on the south shore of the river, and will be constructed in the dry with only minimal local cofferdamming. It is planned that the approach channels, power intake and intake gates, bulkhead dam, spillway sluices and flow controls be installed and operational by the date the river is allowed to pass through the sluices. Once the north dam cofferdams are constructed to full height, the river diversion will be complete and capable of handling the full design diversion flood, and during the winter maintain the forebay at a minimum elevation of 24 m for ice control. The diversion facilities are required to be in place for one spring flood season and two summer and winter seasons.

The critical path, based on our current level of planning, runs through engineering, site access, the powerhouse, intake and spillway, and finally the installation of the turbine-generator units. Specifically, it follows a line described by the following bullets:

- Engineering for site access;
- Engineering for the spillway, intake and powerhouse;
- Procurement for the site access work;
- Procurement for the structure civil works (spillway, intake and powerhouse);
- Construction of site access;
- Construction excavation for the spillway, intake and powerhouse;
- Construction of the concrete works for the spillway and intake;
- Construction of the concrete works for the powerhouse beginning with the erection bay and unit 1;
- Spillway ready to pass diversion flows through sluices including gate installation, and completion of bulkhead dam and intake with intake gates to retain the forebay after completion of the upstream cofferdam;
- Construction of the upstream cofferdam to divert river through spillway, with the cofferdam to full height as required for the design diversion flows;
- Construction installation of Unit 1 turbine/generator with all auxiliaries to First Power, followed in turn by all of the remaining units.

Major elements of the project which are not currently shown to be on the critical path are:

- Engineering for Electrical and Mechanical (E&M) long lead items;
- Procurement of E&M long lead items;
- Manufacture of E&M long lead items;
- North and South Dams;
- Switchyard.

Adverse market conditions in the heavy manufacturing sector could shift the critical path through some of the E&M items, in particular the turbine and generator manufacturing.