

PROJECT PLAN



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Karl Green and Dave Leonard
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Subject: New Office Building 40 Mews Place Redesign Project Plan

Dear Mr. Green and Mr. Leonard,

Please accept the following proposal from APEX Engineering for the redesign of the New Office Building located at 40 Mews Place. This project plan is a requirement of ENGI 8700, as well as a tool to be utilized throughout the project by CHIMO Construction Limited and APEX Engineering.

The enclosed project plan provides a description of the project, methodology to be used throughout project execution, tasks associated with design, project schedule, and any other key items vital to delivering the project.

If you have any inquiries regarding this work plan, please do not hesitate to contact us.

Sincerely,

Apex Engineering

Alexander Byrne

Jamie Downey

Christopher Ryan

Thomas Wadden

cc: Dr. S. Bruneau; Dr. A. Hussein; Mr. J. Skinner



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1.0 Project Description

The New Office Building construction project was a design-build project completed by CHIMO Construction Limited (CHIMO) in October 2011. Located at 40 Mews Place in St. John's, the building was constructed to house the Government of Newfoundland and Labrador Service Canada Department.



Figure 1.1 – Completed New Office Building Project

This two-story building, shown in **Figure 1.1**, consists of a steel frame structure with a combination of metal siding, masonry and composite panel exterior. The structural design included moment frames and full-moment connections for all steel members to resist lateral loading. However, after CHIMO completed construction of this project, questions arose on whether this design was cost-effective.

As a result, CHIMO acquired APEX Engineering (APEX) to complete an alternative design, cost estimate and schedule of the New Office Building project. The new design will consist of replacing the rigid frames and full moment connections with an alternative.

2.0 Project Requirements

CHIMO has contracted APEX as the consultant for the re-design of the New Office Building project based on the following deliverables:

2.1 Building Design

APEX will complete a re-design of the commercial building. Initially, a new design concept will be required in which the majority of moment connections are eliminated. With this concept, all structural components such as structural steel, foundations, footings, floor system, masonry and miscellaneous concrete will have to be designed. Both hand calculations and structural analysis software, following applicable standards, will aid in determining these items.

2.2 Design Drawings

When building design has been completed, APEX will produce design drawings using AutoCAD. These drawings, which require CHIMO approval, will represent all structural components. This will include the building plan, profile and section views.

2.3 Cost Breakdown and Construction Schedule

APEX will work with CHIMO to produce a Class "A" construction estimate with an accuracy of $\pm 5\%$. Both Microsoft Excel spreadsheets and RS Means estimating software will be used extensively to determine an accurate estimate. Also, APEX will use Microsoft Project to break down tasks and develop a detailed construction schedule.

2.4 Final Report & Presentation

Upon completion of design requirements, cost estimation and scheduling a final report and presentation will be compiled describing conclusions and design recommendations by APEX.

3.0 Methodology

3.1 Project Approach

On January 15th, 2013, APEX was partnered with CHIMO to develop the design, drafting, cost estimation and schedule of the New Office Building re-design project. A project of this complexity requires extensive planning and preparation prior to completing any design work. This will ensure that all tasks required for project deliverables have been accounted for and assigned.

In the early stages of the project it is important to have a clear understanding of the goals set out by CHIMO. Within the first few weeks of the project, weekly meetings and email correspondence aided APEX to ensure all requirements were clear. From these requirements, APEX has created a preliminary schedule and assigned tasks to each team member in order to maximize optimal efficiency.

As this project is primary based on cost-effectiveness, APEX plan to budget time on different design options. It is important that the most cost-effective method be chosen prior to in-depth design and drafting. In order to achieve this, APEX will discuss all options with ENGI 8700 course instructor, Dr. Amgad Hussein, and CHIMO.

Once the design method has been chosen, the remaining tasks become very systematic. While time consuming, the design of the building should remain similar regardless of what design is chosen. Therefore, changes to APEX's schedule should be minimal and tasks assigned to team members will remain the same.

Throughout the drafting process, members of APEX will keep track of all material, which in turn will be used for the cost estimate. CHIMO will review the structural drawings and will assist APEX with the cost estimate and schedule.

The completion of the final report and presentation will be ongoing throughout the four-month term. All team members will contribute to both documents to evenly distribute the workload. If a problem in the schedule arises, APEX and CHIMO will meet and discuss possible solutions to remain focused on the project goal.

3.2 Organization and Team Roles

APEX has a core of hard working individuals that work well as an organization. Working together for several years, each member of APEX has acquired a specific role in project delivery. While major decisions, components, design stages and report writing will be conducted jointly by APEX, lead roles have been assigned and are shown below in **Figure 3.1**. Further detail on this topic is available from APEX's summary of qualifications (SOQ), attached in Appendix 'A'.

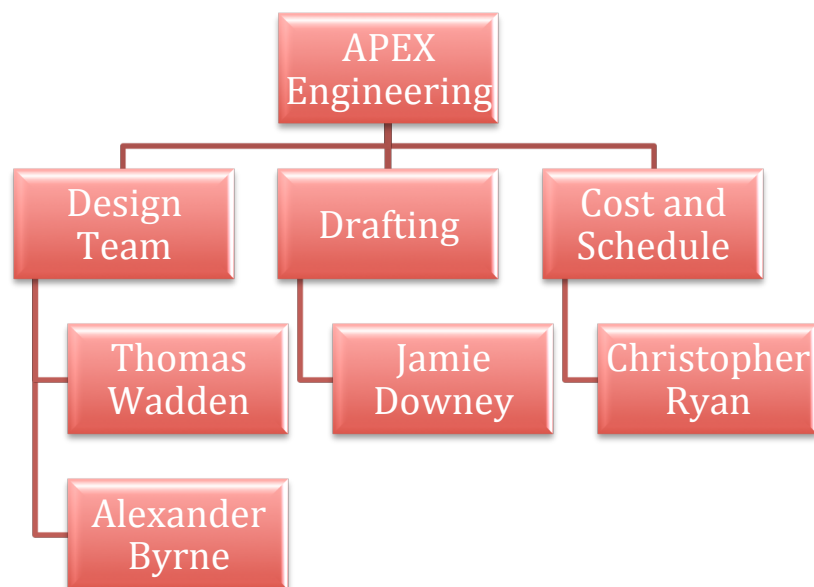


Figure 3.1 - Apex Engineering Organization Chart

3.3 Communication

Weekly internal meetings will be conducted within APEX to ensure all members have completed assigned tasks, track project progress and solve any problems occurred. Meeting notes for each team meeting will be recorded in each individual's logbooks.

Weekly external meetings between APEX and CHIMO will take place on Wednesday's from 1-2pm. These meetings will occur at 1 Crosbie Road, St. John's, NL, with Karl Green and/or Dave Leonard, depending on client availability. APEX will provide CHIMO a Meeting Agenda prior to each meeting and Meeting Minutes on the following Friday.

As an ENGI 8700 requirement, APEX will present weekly progress reports to colleagues and course instructors every Monday. These reports will summarize all APEX activity during the prior week.

For other immediate matters or concerns, the primary means of communication will be via clients email and a meeting can be put in place if any actions are required. Assigned course instructors will be carbon copied on all client correspondence.

CHIMO's role for the New Office Building Redesign project will be to provide guidance throughout each stage of the project design and be available if any information is required. Also, CHIMO will ensure that APEX's final design package is professional and well presented.

3.4 Design Principals

APEX strives to provide quality structural design and ensure that all components of the structure meet acceptable standards and guidelines. The New Office Building Re-Design project will incorporate limit state design principals, structural analysis, computer modeling and hand calculations using the following standards:

- National Building Code of Canada (NBCC), 2010
- Canadian Standards Association (CSA)-S16-01: Limit States Design of Steel Structures
- CSA A23.3-04: Design of Concrete Structures
- CSA A371-04: Masonry Construction for Buildings

3.5 Cost Breakdown

The redesign of the New Office Building is primary based on cost-effectiveness. As a result, APEX Engineering will perform a Class 'A' cost estimate (within 5% error). This level of accuracy will allow CHIMO to directly compare costs of the two design techniques.

3.6 Outcome

The principal goal for this project is to identify whether there is a cost-effective alternative design for the New Office Building project. APEX aims to design and analyze the most efficient alternative and compare directly with the original design. Also, APEX will ensure that all requirements and deliverables for CHMO are delivered on a timely and professional manner, in conjunction with the ENGI 8700 requirements.

4.0 Tasks

In an effort to approach the project in an effective manner, the project has been divided into tasks with individual team members assigned to each task based on their skill-set. Each task has been given a specific time allocation to ensure that responsible personnel complete tasks in a timely manner such that the project remains on schedule. Resources required to complete each task have also been outlined in the following **Figure 4.1** Task Breakdown:

Task	Sub-Task	Personnel	Time Allocation	Required Resources
Solution Analysis and Selection	N/A	TW CR JD AB	2 days	<ul style="list-style-type: none"> · National Building Code of Canada (NBCC) - 2005 · Internet · Client Communication
Structural Design	Load Selection	TW AB	3 Days	<ul style="list-style-type: none"> · NBCC - 2005 · Structural Building Systems notes · Client Support
	Steel Design Level 2	TW AB CR JD	5 days	<ul style="list-style-type: none"> · CSA S16-09 - Design of Steel Structures · NBCC - 2005
	Steel Design Level 1	TW AB CR JD	5 Days	<ul style="list-style-type: none"> · CSA S16-09 - Design of Steel Structures · NBCC - 2005
	Footing/Foundation Design	TW AB	4 Days	<ul style="list-style-type: none"> · CSA A23.3 -04 - Design of Concrete Structures · NBCC - 2005
	Structural Concrete (or Masonry) Design	TW AB	4 Days	<ul style="list-style-type: none"> · CSA A23.3 -04 - Design of Concrete Structures · CSA A371-04 – Masonry Construction for Buildings · NBCC - 2005
Drafting and Drawing Production	N/A	JD CR	8 Days	<ul style="list-style-type: none"> · AutoCAD
Construction Estimate and Schedule	Cost Breakdown	CR TW AB	4 Days	<ul style="list-style-type: none"> · RSMMeans · Client Support · Microsoft Excel
	Schedule	CR TW AB	3 Days	<ul style="list-style-type: none"> · Microsoft Project
Documentation and Reporting	Weekly Progress Reports	JD	Ongoing	<ul style="list-style-type: none"> · Microsoft Word
	Schedule/Milestone Tracking	CR	Ongoing	<ul style="list-style-type: none"> · Microsoft Project
	Final Report	ALL	1.5 Weeks	<ul style="list-style-type: none"> · Microsoft Word
	Final Presentation	ALL	4 Days	<ul style="list-style-type: none"> · Microsoft Power Point

Figure 4.1 – Task Breakdown

4.1 Solution Analysis and Selection

When CHIMO presented APEX with the project, the method and solution to achieve CHIMO's requirements was open for discussion. CHIMO's main requirement was to remove the costly moment frame rigid connections and replace with shear walls. This would be possible through the implementation of concrete or masonry shafts, either in the stairwells or central core of the building. Another option to remove the full moment connections would be to install cross bracing throughout the building. Given the layout of the building and lack of interior partitions, this would likely be an unappealing option from an architectural perspective. APEX is currently exploring different methods of introducing shear.

4.2 Structural Design

After determining the specific approach to redesigning the building to remove moment connections, the main priority becomes the structural design. The design of the structure has been subdivided into smaller tasks, which must be successively completed to obtain requirements for each subsequent component of the design. These tasks are as follows: load selection and calculation, structural steel design which has been separated into level 2 and level 1, concrete footing and foundation design, and finally structurally concrete or masonry design. The following describes the importance of the design sequence and the expected outcomes for each task.

4.2.1 Loads

Prior to beginning structural design loads must be calculated to complete the design of all structural components. The scope of this project requires the calculation of wind loads for the area as the client has already provided snow loads. With the load calculations complete, APEX will be able to select appropriate joist sizes to obtain all loads required to begin the design of the steel roof structure.

4.2.2 Structural Steel Design

Once acquiring all loads, the design team will be able to begin the design of steel members. This task has been subdivided into level two and level one. First the team will begin the design of steel roof beams and girders. Once these members have been designed, the team will be able to design the columns based on the load contribution from the roof structure. The first level will follow the same

sequence given that the dead load of the second floor has been provided. It is anticipated that cost savings may be achieved in this component of the design, as members will be designed to carry shear forces only, rather than both shear and moment forces. The resources that will be required to complete this task is: CSA S16-09 – Design of Steel Structures, NBCC, and S-Frame software.

4.2.3 Concrete Footing and Foundation Design

The completion of structural steel design will provide the design team with all vertical loads required to complete the design of concrete footings and foundations. This will consist of square pier footings for the piers connected to the first level columns, a strip footing around the perimeter of the building with a frost wall, and a footing for the concrete shaft(s), which will be introduced. This will likely be completed in conjunction with the design of the concrete shaft itself as the contributing load from the shaft will be a factor in the size and type of foundation required. The resources that will be used to complete this task are: CSA A23.3-04 – Design of Concrete Structures, NBCC, and S-Frame software.

4.2.4 Concrete or Masonry Design

This structural item depends on the moment connection replacement design, chosen by APEX. The concrete or masonry design will consist of concrete shaft(s) that will provide resistance to lateral forces. In this task, the calculated wind loads will be crucial to the design of the shaft. The resources that will be used to complete this task are: CSA A23.3-04 – Design of Concrete Structures, CSA A371-04: Masonry Construction for Buildings, NBCC, and S-Frame software.

4.3 Drafting

Prior to the completion of structural design, the drafting of the structural drawing set can begin. A separate team will be assigned to the drafting while the design is completed. The client will be provided with a complete set of structural drawings. The software to be used in completing this task is AutoCAD®. Client support and communication will also be an important element of this task.

4.4 Cost Breakdown

A detailed cost estimate will be completed for the project as a primary client requirement. Throughout the drafting stage, all materials used will be tracked within a spreadsheet. These quantities will then be used to calculate a Class 'A' estimate. Resources to be utilized in completing this task will be RS Means, Microsoft Excel, and client support.

4.5 Construction Schedule

Included with the cost breakdown will be a construction schedule. This schedule will allow the client to view the schedule impact of the structural redesign. Resources to be utilized in completing this task are Microsoft Project and client support.

4.6 Reports and Documentation

The following requirements of the course ENGI 8700 will be completed and submitted on the required dates:

4.6.1 Weekly Progress Reporting

All meetings with the client will require an agenda prior to the meeting and a set of meeting minutes following the meetings. These meetings along with project progress will be summarized in weekly progress reports, which will be presented in a weekly business meeting.

4.6.2 Schedule Updating

The project schedule completed prior to project commencement will be updated on a regular weekly basis and submitted with the final report submission. This will allow the team to track progress and ensure the project remains on time and the completion date is achievable.

4.6.3 Final Report

Once all client requirements have been satisfied, a final report will be completed highlighting the efforts of APEX in completing the project. This report will be submitted to the Faculty of Engineering at Memorial University on April 04, 2013.

4.6.4 Final Presentation

Included with the submission of the final project report will be a supplementing presentation to the ENGI 8700 class and instructors summarizing the effort of APEX to complete the project. This presentation will take place on April 04, 2013.

5.0 Project Schedule

Delivering a project in a timely manner is equally important as the quality of product delivered. In order to ensure that this goal is achieved, it is important to create a schedule and milestones that serves as a project timeline for the team. Major tasks have been subdivided into smaller more easily defined task in which a duration and begin date can be assigned.

This project schedule will allow APEX to accurately track the progression of the project and ensure that the project remains on schedule and the completion date remains achievable. The schedule will be updated with progress each week with the weekly progress report. Given that the durations and start dates for each task are estimates, actual start and finish dates will be recorded to ensure assist in maintaining the schedule.

The attached project has two major completion dates. The first date, March 25, 2013 is a date agreed upon between APEX and CHIMO representatives for completion of all project requirements and deliverables aside from the final presentation. This date allows sufficient time for a review process with the client, and flexibility in the schedule should any significant problems be encountered. The second major completion date is April 04, 2013 in which substantial completion of all deliverables is required as well as the project presentation. APEX will make every effort to meet the dates specified in the following schedule in **Figure 5.1**.

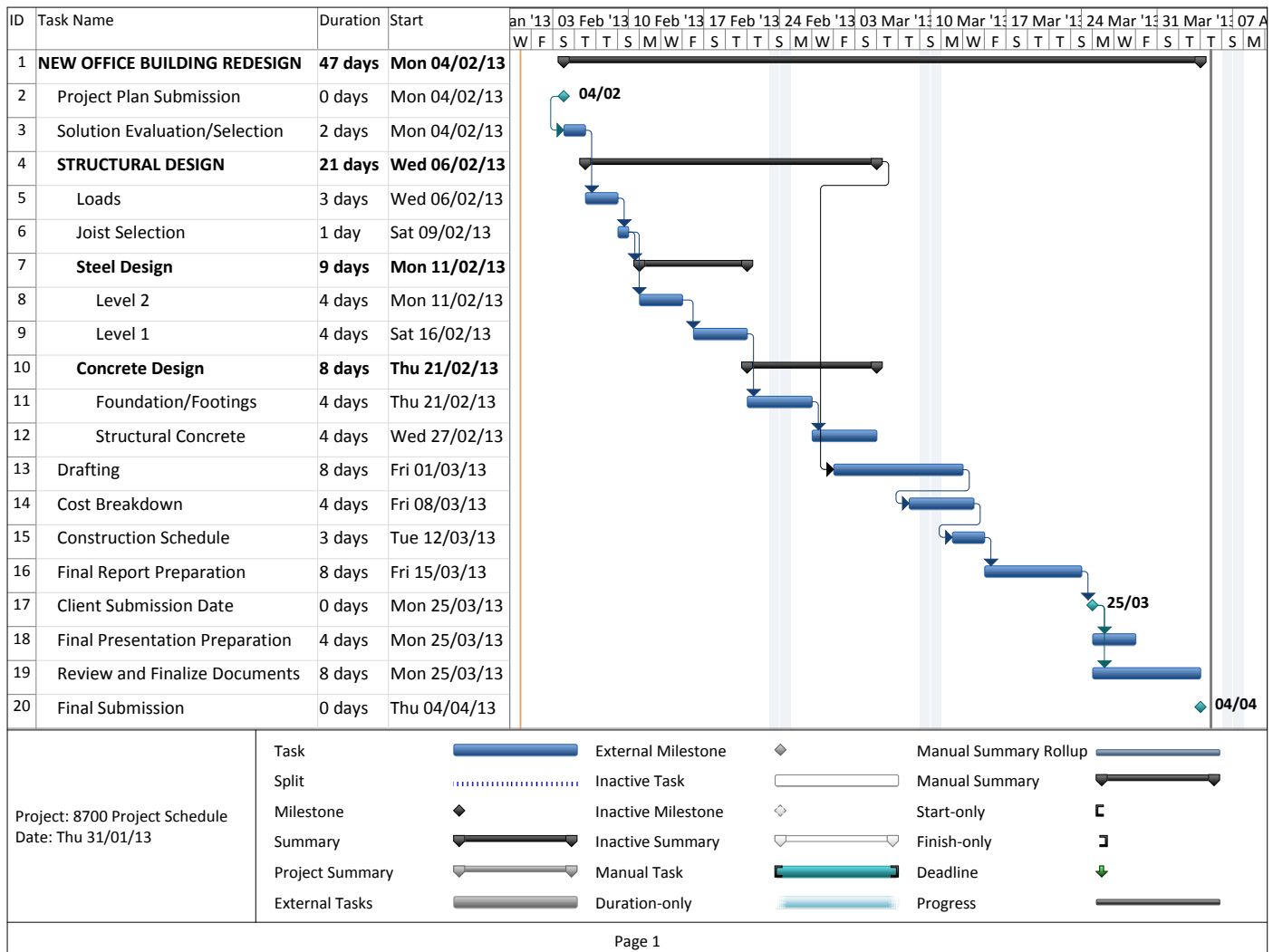


Figure 5.1 Project Schedule

6.0 Project Costs

The costs for project completion are minimal and will be allocated equally between group members. Associated costs include printing of engineering drawings, printing and binding of report deliverables, transportation related costs for site visits, and other miscellaneous supply costs including binders and logbooks. A break down of APEX's project costs is shown in **Figure 6.1**.

Item/Activity	Estimated Cost
Engineering drawing printing	\$65
Deliverables printing/binding	\$20
Transportation	\$20
Supplies	\$45

Figure 6.1 – Project Costs

7.0 Deliverables

There are several deliverables required from APEX for the re-design of the New Office project. These are listed below in **Table 7.1**.

Deliverable	Description	Date Due	Submission Method
Statement of Qualifications	A brochure, presented to all clients on match night, that includes the description, mission statement and experience of APEX	Jan. 10, 2013	Submit via email (PDF) to course instructors and hard copy to clients
Work Plan Report	A report that describes APEX's project, requirements, methodology, tasks, schedule, costs, deliverables and risks	Feb. 4, 2013	Submit via email (PDF) and hard copy to course instructors and client
Meeting Agendas and Minutes	Agendas are provided to the client prior to a meeting in order to describe what topics will be covered. Minutes will be taken throughout the course of the meeting, summarized and sent back to the client.	Weekly	Submit via email (PDF) to course instructors and client
Weekly Reports	Presented at an ENGI 8700 weekly status meeting, the report will provide project status, tasks completed, upcoming activities and issues	Weekly	Submit a hard copy to course instructors after weekly presentation
Structural Drawings	A full set of structural drawings (including structural steel, footings, foundation, etc.) are to be created with AutoCAD	Mar. 25, 2013	Submit electronically (AutoCAD) to client and hard copy to course instructors and client. This will also be presented in the Final report.
Structural Calculations	Includes all written calculations and computer structural analysis results	Mar. 25, 2013	Submit hard copy to course instructors and client. This will also be presented in the Final Report

Cost Estimate	A Class "A" estimate for the complete construction of the project is required	Mar. 25, 2013	Submit hard copy to course instructors and client. This will also be presented in the Final Report
Construction Schedule	A schedule for the construction of the project is required	Mar. 25, 2013	Submit hard copy to course instructors and client. This will also be presented in the Final Report
Final Report	Final report submission for the project to include all work completed by APEX	Mar. 25, 2013	Submit hard copy to the course instructors and client
Final Report Presentation	Summary of final report describing the project, design work and conclusions	Apr. 4, 2013	Presented in-person to both the instructor and client. A copy of the slides are to be submitted hard copy to course instructors
Project Binder	All loose work throughout the term (agendas, minutes, SOQ, etc.) compiled into a project binder	Apr. 4, 2013	Submit hard copy to course instructor
Log Books	All notes taken throughout the term to be recorded in a log book	Apr. 4, 2013	Submit hard copy to course instructor

Table 7.1 – Project Deliverables

8.0 Risks

APEX is committed to providing quality work in a timely, efficient manner using proper planning and time management techniques. However, it is important to highlight associated vulnerabilities in the project execution that may hinder deadlines.

8.1 Limited Access

Limited access to technical information and software will affect timelines and deadlines. As a result of costs or limited accessibility, software required by the APEX team may not be readily available. Also, if unforeseen circumstances take place and needed technical information becomes unavailable, project production may be hindered.

8.2 Software Familiarity

Software familiarity is one of the major issues that could slow productivity. The majority of the software programs to be used are relatively familiar to the group members. However, AutoCAD drafting software is generally a new program for all members and may need additional concentration to complete this requirement timely and efficiently.

8.3 Client Availability

Client availability throughout the project may become difficult. Being able to make contact with the client during weekends, evenings or during bad weather and awaiting information may cause delays in production. However to help reduce the risk, weekly updates and progress report will be used to maintain regular contact and track associated tasks.

APEX is aware of the risks involved in the execution of this project. It is important that work be properly allocated between all members and the team is confident that with close monitoring of the schedule, the project will be completed within all deadlines.

Appendix A - APEX Engineering SOQ