
# Transaction Advisory Services for Office Accommodation Complex on a PPP Arrangement

**Prepared for:**

Securities and Exchange Commission

**Prepared by:**

CPCS

**In association with:**

**CBCL Limited**

**Fowler Bauld & Mitchell Ltd.**

**Utho Capital**

Solutions for growing economies

CPCS Ref: 13504

January 18, 2016

January 18, 2016 CPCS Ref: 13504

Dr. Adu Anane Antwi
Director General
Securities Exchange Commission
No. 30, 3rd Circular Road
P.O. Box CT 6181
Cantonments, Accra, Ghana

Dear Dr. Antwi,

**Re: <u>Final Feasibility Report Submission</u> for "Transaction Advisory Services for Office Accommodation Complex on a PPP Arrangement" (Contract No. MoF/PPP/C1.1/CS01/15)**

As per the Terms of Reference for the above-subjected mandate, CPCS is pleased to submit the Final Feasibility Report (Milestone Three). The Final Feasibility Report includes revisions based on comments received from the Project Delivery Team on November 9th, 2016 and from the World Bank on December 1st, 2016.

The following pages include two comments matrices which describe how each of the PDT's and World Bank's comments have been addressed.

In addition, further comments from the World Bank were received on January 18th, 2017 indicating that the conclusion of open items in Figure 8-8 in Chapter 8 (page 169) should also be reflected in the Executed Summary. This has been addressed.

We hope that the Final Feasibility Report is to SEC's expectations and look forward to taking this mandate to the Procurement Stage.

Yours very truly,

**CPCS Transcom International Limited**

Faisal Ladha
Project Manager

# Comment Record and Response

| Project Title: | Transaction Advisory Services for Office Accommodation Complex on a PPP Arrangement |
|---|---|
| **Deliverable under review:** | Draft Feasibility Report |

**Comments:**

| S/N | Report Section No. | Report Page No. | SEC / PDT Comment | How CPCS has addressed |
|---|---|---|---|---|
| 1 | Heading on Acronyms/Abbreviations | Page 7 | ECG must be described as Electricity Company of Ghana and not Electrical Company of Ghana | *We have reflected this change in the report* |
| 2 | Heading on Acronyms/Abbreviations | Page 8 | LIBOR should be stated as London Interbank Offer Rate not Offered Rate | *We have reflected this change in the report* |
| 3 | Heading on Acronyms/Abbreviations | Page 8 | MOF should be stated as MoF, Ministry of Finance | *We have reflected this change in the report* |
| 4 | Heading on Acronyms/Abbreviations | Page 9 | OCG should be stated as Office of Government Commerce, UK | *We have reflected this change in the report* |
| 5 | Heading on Acronyms/Abbreviations | Page 9 | RFI should be stated as RfI, Request for Information | *We have reflected this change in the report* |
| 6 | Executive Summary, line 1 | Page 11 | Should be stated as Securities and Exchange Commission instead of Ghana Securities and Exchange Commission and applicable throughout the document | *We have reflected this change in the report* |
| 7 | Minimum Performance Standards | Page 11 | Functions of SEC should be stated as operations of SEC | *We have reflected this change in the report* |
| 8 | Legal Due Diligence, line 7 under paragraph 2 | Page 12 | The word credit credit should be stated as credit risk | *We have reflected this change in the report* |
| 9 | Legal Due Diligence, line 7 under paragraph 2 | Page 12 | The word recommend should be stated as recommended | *We have reflected this change in the report* |
| 10 | Legal Due Diligence, under paragraph 5, line 3 | Page 12 | Should be stated as “that subleases shall be renewed by SEC upon expiration of the initial term subject to renewal by government’ | *We have reflected this change in the report* |
| 11 | Legal Due Diligence, line 7 under paragraph 2 | Page 12 | The word recommend should be stated as recommended | *We have reflected this change in the report* |
| 12 | Viability Assessment, Last Paragraph | Page 13 | The Value of Money (VFM) should be stated as Value for Money | *We have reflected this change in the report* |

## Comment Record and Response

| S/N | Report Section No. | Report Page No. | SEC / PDT Comment | How CPCS has addressed |
|---|---|---|---|---|
| 13 | Under 3.3.3.9, Domestic Hot Water | Page 52 | We recommend consideration of solar heating for domestic hot water | *We have a discussion under the section that describes such a system and how it could be incorporated as a consideration in the bid documents.* |
| 14 | Under 4.6.7, Building Commissioning, line 5 | Page 96 | Greed Building should be stated as Green Building | *We have reflected this change in the report* |
| 15 | 7.5.6 Concession Period and 7.5.7 Construction Period | Page 129 | Rephrase these two paragraphs, it should not be based on SEC request as stated in the draft report. We recommend that it should be based on further work done by the consultant | *We have reflected this change in the report* |
| 16 | Line 4 | Page 130 | A two year construction period should be stated 30 months construction period but maintain the estimated cost of US$300,000 | *We have reflected this change in the report* |
| 17 | Derived Viability Assessment | Page 133 | CPCS should create another scenario to include the following:<br>• Developer bears the basis fit-up responsibility<br>• SEC bears FFE<br>• SEC bears Moving Allowance/Swing Space Responsibility<br>• Concession Period is 25years | *This scenario has been created and added to the section* |
| 18 | | Page 135 | Indicate the components of the upfront project costs | *The components of upfront costs along with their estimates can be found on the first page of Appendix I – Building Costs.* |
| 19 | Under 7.6.4, Value for Money, line 1 | Page 135 | The value of Money should be stated as The Value for Money | *We have reflected this change in the report* |
| 20 | Value for Money, Section 7.6.4 | Page 135 | We propose that the write up from Page 135, 7.6.4 value for money, page 16 and to the conclusion on page 137 should be taken out of this report | *We have strengthened the language of our conclusions to describe that there is value-for-money in the preferred PPP option, relative to the alternatives that were analysed in the VfM analysis. However, we cannot remove this analysis as it is part of the Consultant's scope of works.* |
| 21 | Section 7.7.1 Tender and Development Risks, Under Unattractive Tender | Page 138 | Rephrase the availability of alternative land acquisitions. We believe land is not so easily available as the report alludes to | *The sentence has been rephrased however, it should be noted that the assertion that alternative land acquisition in the Cantonments area poses a tender risk is based on investigations completed by the CPCS Team (namely, the Team's Accra Real Estate expert) as well as based on consultations with developers* |

## Comment Record and Response

| S/N | Report Section No. | Report Page No. | SEC / PDT Comment | How CPCS has addressed |
|---|---|---|---|---|
| | | | | *and desktop research. Thus, the CPCS Team remains sufficiently confident that this assertion has merit.* |
| 22 | Section 7.7.2 Obtaining Building Permit, line 4 | Page 139 | Correct the sentence chapter error, reference source not found | *We have reflected this change in the report* |
| 23 | Section 7.7.2 Heading Allocation, line 2 | Page 139 | The word "agreen' to read 'agreed' | *We have reflected this change in the report* |
| 24 | Section 8.4.2, Tender Documentation | Page 151 | The last bullet point should be stated as experience in Accra, Ghana and or other developing or emerging economies | *We have reflected this change in the report* |
| 25 | Section 8.4.2, Tender Documentation | Page 151 | Last but one bullet point stated as Review of draft EPC and O&M agreements provided by bidders should be taken out of the report<br><br>The CPCS Team sought further clarification regarding the above comment and received the following:<br><br>*SEC/PDT questions the relevant of the EPC & O&M contracts for the assessment of bids, since these contracts would not have been agreed upon at the time of bidding.* | *It is recommended (and therefore common practice) under a PPP procurement process that bidders submit draft EPC and O&M contracts (or at least terms sheets of these) as part of their bids. Indeed, these contracts constitute the foundations of the construction and operation risks transfer effectiveness and therefore their review, even at a draft stage, is an important step of the evaluation process. Thus, we have not removed this point.* |
| 26 | Under 8.5.1, iii | Page 152 | Permits and Approvals La Dada-Kotopo should be corrected to La Dade Kotopon | *We have reflected this change in the report* |
| 27 | Under section8.7.2, Evaluation Process and line 2 | Page 158 | (1) Rent free floor space and parking made available to SEC, please correct the word Minima to minimum | *We have reflected this change in the report* |
| 28 | Under section 8.7.3, Evaluation Process | Page 158 | (2) Building design and operational plan, please include the following: the building usage, the maintenance and handover requirements | *We have reflected this change in the report* |
| 29 | | Page 159 | Please include concession period as an evaluation area | *We have reflected this change in the report* |
| 30 | Figure 8-6 | Page 159 | Exemple Weighing should be corrected as Example Weighing | *We have reflected this change in the report* |

## Comment Record and Response

| S/N | Report Section No. | Report Page No. | SEC / PDT Comment | How CPCS has addressed |
|---|---|---|---|---|
| 31 | Figure 8-6 | Page 159 | We recommend that it should be as follows: SEC rent free space and parking: 30%, Build design and operation plan: 25%, Financial sustainability: 20%, Risk Assessment 10%, Concession Period 15% | *We have reflected this change in the report however, as stated in the report, it is recommended that final weights only be considered when the evaluation process commences assuming that refinements do not alter the transparency, consistency and fairness of the evaluation process.* |
| 32 | Figure 8-7 | Page 160 | The word exemple should be corrected to example | *We have reflected this change in the report* |
| 33 | Section 8.7.5 - Negotiation Procedures | Page 161 | Please explain the last three paragraphs highlighted and why these should be used as a basis for evaluation | *These paragraphs are a negotiation procedure in that they seek to achieve bidders' approval of the PPP agreement ahead of negotiations. In turn, this leads to faster execution.*<br><br>*Allowing bidders to comment on and subsequently initial PPP documents also affords the evaluation committee the opportunity to assess how much of SEC's vision/objectives bidders' are willing to maintain and what aspects they will not agree with.* |
| 34 | Section 8.8, Heading | Page 162 | The words Net Steps should be corrected to Next Steps | *We have reflected this change in the report* |
| 35 | Figure 8.8 - Parameters Requiring SEC/PDT Decision | Pages 162/163 | Our decision is as follows:<br>Concession Period – Option 2<br>Building – Use pattern – Use Option 2<br>Minimum parking bays – 2.2 bays per 100SQ of leasable space<br>SEC's swing space/moving allowance – Option 1<br>SEC's minimum space allocation – 1,850SQM | *We have updated the report to show SEC/PDT's decisions.* |

# Comment Record and Response

| Project Title: | **Transaction Advisory Services for Office Accommodation Complex on a PPP Arrangement** |
|---|---|
| **Deliverable under review:** | Final Feasibility Report |
| **Comments Provided By:** | World Bank Group (WBG) |

## Comments:

| S/N | Report Section No. | Report Page No. | WBG Comment | How CPCS has addressed |
|---|---|---|---|---|
| **Project Structure and Financial Analysis** | | | | |
| 1 | Not Specified | | Revenue model not robust. While some items related to the PPP structure require discussion with the client, the team felt that the revenue model was not robust enough. According to the FS, the revenue model is contingent on the government's and SEC's firm commitment to sublease rental units for 25+25 years. Moreover, it is imperative that the market develops confidence that this commitment will be honored by the SEC. Therefore, the team suggests exploring the option of direct subleases between SEC and residents for the total length of the contract. This is proposed as a potential alternative to subleases between the private operator and residents for the first 25 years, and another sublease between SEC and residents for 25 years (after the asset has been transferred back to the government). The revenue received by SEC would be passed on to the private operator for the first 25 years. This suggestion might alleviate the need for 25+25 year leases and the associated lack of public confidence in the government's commitment to extend leases. | Prior to addressing this comment, it is important to clarify that the issue of a 50-year lease only pertains to an option whereby the private developer elects to develop **residential units** as part of the accommodation complex. Whereas the feasibility of this has been explored and established in the Final Feasibility Report, the other option that has been explored and established in the report is a full commercial building-use option.<br><br>Selling residential units outright under a Design-Build-Finance-Operate-Own-Maintain-Transfer (DBFOOMT) PPP model creates a legal issue which required a thorough investigation and is explained in great detail in Chapter 6, Section 6.5 – Outright Sale of Residential Units under Mixed-use Building.<br><br>Due to a contemplated fixed concession period of 20 to 30 years, at most, and prior to any legal recommendation from the Transaction Advisory, the developer could 'sell'[1] residential units for up to 20 to 30 years maximum. However, selling residential units to third parties for periods that are less than typical in Accra (i.e. a minimum 50 year period) may decrease the attractiveness to third party purchasers.<br><br>Since the private party is entitled to sell residential units by virtue of a sublease, albeit for a short period, the viability of this scheme can be markedly enhanced if the purchasers of residential units are assured that the subleases shall be renewed by SEC upon the expiration of the initial term which would terminate with the end of the proposed concession period.<br><br>In this regard, it is recommended that the sublease agreements for outright sale of residential units **should be executed between SEC and the Private Party on** |

[1] While the nomenclature used is a 'sale', what is invariably contemplated and acquired is a 'lease' in Ghana due to constitutional restrictions and the growing rate of urbanization in Ghana. Furthermore, typical sales in this case are a 50- or 99-year lease of the land.

## Comment Record and Response

| S/N | Report Section No. | Report Page No. | WBG Comment | How CPCS has addressed |
|---|---|---|---|---|
| | | | | **one hand** and the purchaser on the other hand. Such an agreement should contain clauses guaranteeing, inter alia, the renewal and continuation of the sublease for a further period following the expiration of the concession and the transfer of the facility back to SEC on terms to be agreed by the parties and with assurances from SEC that the continuation of the sublease shall not be unreasonably withheld.<br><br>The feasibility report, does not purport subleases between the private operator and residents for the first 25 years, and another sublease between SEC and residents for 25 years (after the asset has been transferred back to the government) as the comment suggests.<br><br>Finally, it should be noted that it is not possible for SEC to enter into a 50-year lease agreement at the onset of a PPP concession with buyers of residential units as it would not own the building until it is transferred to the Commission after the concession period.<br><br>A 50-year lease agreement directly with the Commission may be contemplated under a scenario whereby the developer designs, builds, finances and immediately transfers the accommodation complex to SEC such that the Commission owns the building at the onset. However, this would entail SEC guaranteeing unitary payments to the private developer to cover the developer's upfront capital costs in addition to a reasonable profit. As per the Needs Assessment at both the pre-feasibility and feasibility stages (Chapter 2 in the respective Final Reports), SEC does not have the financial capacity and thus, is looking to implement a PPP that minimizes its financial participation. SEC's financial constraints thus limit the PPP modality that can be implemented.<br><br>In addition, if transferred to SEC at the onset, SEC would also be tasked with selling residential units and renting commercial units (in excess of its own spatial needs) which would alter the Commission's value for money in implementing a PPP scheme. And, this is assuming that SEC has the capacity and appetite to do so which it does not. |
| 2 | Not Specified | | Revenues post-transfer. The revenue model post-transfer to SEC is unclear. The team kindly asks for clarification on the anticipated revenue after the asset has been transferred back to SEC. | Revenues post-transfer in absolute terms are dependent on how SEC/GoG elect to use the accommodation following the concession period. For example, SEC may have further office space needs following the concession period and therefore, may elect to use all of a further portion of the accommodation for its own purposes. As another option, SEC/GoG may elect to house other Ministries, Departments and Agencies in the proposed accommodation. |

## Comment Record and Response

| S/N | Report Section No. | Report Page No. | WBG Comment | How CPCS has addressed |
|---|---|---|---|---|
| | | | | Finally, SEC/GoG may elect to apportion the accommodation for its own needs as well as to further exploit commercial opportunities. This is advised as there are lifecycle cost considerations (see Figure 7-7 in the Feasibility Report as well as the discussion that precedes it) following the concession period that could be offset by continuing to use a portion of the accommodation complex for commercial purposes. If such is the case, on a per SQM basis, the Transaction Advisor's revenue estimate (in 2016 dollars) can be found in Figure 7-12 based on building-use type. |
| 3 | Not Specified | | Oversaturation of market. The FS notes that the IRR had to be revised from 14.5% to 12% after industry consultations. The revision is based on the risk of excess supply and potential oversaturation in the real estate market in Accra (p. 129). The team is concerned about how this might impact project viability since part of the financial analysis are based on the assumption that residential units will be sold during construction. The example of "One Airport City", which is in vicinity of SEC and was built in 2014, remains 35% unoccupied. | A distinction needs to be made on the building-use options in the Feasibility Report. Under a mixed-use pattern, residential units would be sold outright as per the business models of typical developers. It is the Transaction Advisor's opinion that the viability of selling residential units outright is sufficient following a thorough site investigation and stakeholder consultations in the Cantonments area. For example, Pearl in the City, a real estate development in Cantonments that offers high-end residential units (similar to the residential units envisaged in SEC's proposed eco-friendly accommodation) and is 1.4km from SEC's site, has sold 90% of its units and is still in the construction phase (commissioning to take place later this year).<br><br>Indeed, the saturation that is discussed in the feasibility report pertains largely to office space in Accra. One Airport Square, which is strictly a commercial accommodation (provides office space), is an example of this and is located in Airport City, Accra. However, as Cantonments is largely a residential neighbourhood, the same level of saturation in office space is not observed. Rather, there is only one notable recent development of Grade A commercial office space in the neighbourhood (and thus, a comparable to SEC's proposed eco-friendly accommodation) and that is Cantonments City. It was commissioned in 2015 and is at 95% capacity (see Appendix J - Market and Field Investigation Summary of the Feasibility Report for a profile of this accommodation).<br><br>To test project viability as well as to account for the wider saturation of commercial office space in Accra, our financial viability analysis has discounted commercial rents readily applied in the market. Using Cantonments City as a proxy (given its close proximity to SEC's proposed site), we have applied a discount to the market rent in the Cantonments area in the base case analysis (see discussion in Chapter 7, Section 7.5.4 Topline Estimates of the Final Feasibility Report for further discussion). |
| 4 | Not Specified | | Location choice. The FS lacks analysis on whether the location of the SEC building is attractive for potential lessees. Have the | The location's attractiveness or potential has been thoroughly investigated since the onset of the Transaction Advisor's mandate with a particular focus on site investigations of the Cantonments neighbourhood and market consultations with |

## Comment Record and Response

| S/N | Report Section No. | Report Page No. / WBG Comment | How CPCS has addressed |
|---|---|---|---|
| | | consultants sounded the market and considered strategies as to how to make the location more attractive? | key stakeholders in order to conduct an options analysis on preferred building-use patterns. The following stakeholders have been consulted with at both the pre-feasibility and feasibility stages in order to inform the likely building-use patterns given the location of the site:<br><br>- RMB Westport (real estate financier and developer in Accra)<br>- Broll Ghana (commercial property services company)<br>- Dream Realty (real estate developer in Accra)<br>- Goldkey Properties (real estate developer in Accra)<br>- La-Dadekotopon Municipal Assembly (urban planning authority in Cantonments, Accra)<br>- Stanbic Bank's Real Estate Finance Team (real estate financier on a project finance basis)<br>- Gaps Ghana Property Services (commercial and residential real estate and rental agency)<br>- World Trade Centre, Accra (commercial development in Accra)<br>- Alisa Hotel (hotel in Ridge, Accra)<br>- Golden Tulip Hotel (hotel in West Ridge, Accra)<br>- Villa Monticello Boutique Hotel (hotel in Airport Residential, Accra)<br><br>Site investigations and market consultations served to confirm that SEC's site is attractive for an accommodation complex and more importantly, the type of commercial activities best suited for the site. The Transaction Advisor's analysis as it relates to locational attractiveness can be found in:<br><br>- Chapter 4, Section 4.4.1 Market Consultations and Options Analysis in the Final Pre-Feasibility report and;<br>- Chapter 7, Section7.4 Preferred Building-use Option in the Final Feasibility Report<br><br>Land in Cantonments is fairly homogenous in that there are limited discernable physical attributes that make one site more attractive than the other. The Transaction Advisor explored other avenues to making SEC's site more attractive and for example, met with the Ghana Investment Promotion Centre (GIPC) at both the pre-feasibility and feasibility stages to determine if the proposed project could be eligible for preferential tax treatment.<br><br>Based on consultations with GIPC, the Transaction Advisor was informed that any preferential tax treatment for the proposed project could only be made by the Ministry of Finance. This may be further investigated based on the results of the Request for Expression of Interest and relatedly, feedback from potential bidders. |

## Comment Record and Response

| S/N | Report Section No. | Report Page No. | WBG Comment | How CPCS has addressed |
|---|---|---|---|---|
| 5 | Not Specified | | Commercial activities. Given the weak projected revenue streams, additional commercial value could be explored. The FS lacks a discussion of special measures to improve the revenue model. This includes an analysis of potential commercial opportunities to support the project's weak revenue stream. The team recommends assessing market appetite for additional commercial units such as offices for private businesses (e.g. financial consulting firms etc.), conference halls, restaurants, charging for parking and the like | The Project's Terms of Reference clearly state that the Transaction Advisor is to explore additional commercial opportunities for the facility to cross-subsidize project affordability to the Commission. This is reinforced by a thorough needs assessment that was conducted at both the pre-feasibility and feasibility phases (see Chapter 2 of both the Final Pre-Feasibility and Feasibility Reports and specifically Section 2.2.3 Structured under a PPP Framework) which concluded that due to limited financial resources, the SEC wishes to transfer certain risks to the private sector (namely construction and market risk) and envisions minimal financial participation, as the private sector will have scope to determine revenue-generation land-use patterns outside of SEC's own office space needs.<br><br>On this basis, the Transaction Advisor undertook considerable market consultations and site visits (see Appendix J – Market and Field Investigation Summary in the Final Feasibility Report) to inform the building design as well as likely building-use patterns based on market and locational context (see Chapter 4, Section 4.4.1 Market Consultations and Options Analysis in the Final Pre-Feasibility Report).<br><br>Based on the proposed building design at the feasibility stage, approximately 88% of the accommodation's net leasable area can be exploited for commercial opportunities. Furthermore, as mentioned in Section 7.4 Preferred Building-use Options of the Final Feasibility Report, a full commercial building-use option and mixed-use option are the preferred options for exploiting the commercial opportunities of the building that are outside of SEC's own space needs. The preferred options are based on extensive consultations with stakeholders (see discussion in comment S/N 4).<br><br>Under both options, the first floor would remain for retail purposes and likely opportunities include (1) restaurant, (2) bakery, (3) dry-cleaner, (4) pharmacy, or (5) medical or dental office.<br><br>Opportunities to charge for parking also form part of the revenue model and are discussed in Chapter 7, Section 7.5.5 of the Final Feasibility Report.<br><br>A conference centre was explored at the Pre-Feasibility stage (see Chapter 4, Figure 4-6: Scoring Building-use Options based on Market Consultations of the Pre-Feasibility Report) as a potential building-use pattern but was not carried into the Feasibility stage based for the following reasons:<br><br>- Market Context: There exists a surplus of conference centres in Accra with varying financial performance |

## Comment Record and Response

| S/N | Report Section No. | Report Page No. | WBG Comment | How CPCS has addressed |
|---|---|---|---|---|
| | | | | - Locational Context: Significant marketing costs given location and nature of the market (highly saturated). Marking/noise may also become an issue for bigger events given the residential nature of Cantonments.<br>- Certainty of revenues and control of operational/maintenance costs: Private developers are willing to consider a conference centre if SEC is the primary off-taker (minimum 60% usage rate per annum) |
| 6 | Not Specified | | Competitive dialogue. Based on the issues raised above and the need to better understand an adequate revenue model, the team recommends holding a competitive dialogue. Procurements like SEC have unique features and undertaking a dialogue might help develop solutions for the project and finalize the RFP. This might also help finalize any open project structure items and make the incoming bids more comparable. | A competitive dialogue commenced with potential bidders (and consortium partners) at both the pre-feasibility and feasibility stages. During both stages, the Transaction Advisor has consulted with consortium partners such as developers, property managers and real estate financiers (both locally and internationally) to understand the attractiveness of the project for private sector participation and to inform the shadow bid model.<br><br>In addition, the Transaction Advisory issued Request for Information (RfI) to over 130 potential consortium partners around the world as part of the feasibility study; including developers, EPC contractors, property/facilities managers, real estate investors, realties and associations. The purpose of the RfI was to disseminate information about the project, to test the commercial viability of the proposed PPP modality, and to ascertain the requirements and/or expectations of private actors on their potential participation in the project.<br><br>It is noted that responses to the RfI were not received although this is not an abnormal outcome. Given that bidders are cost-conscious, the risk of a low response rate is very common in the issuance of an RfI. Bidders tend to favour the submission of a formal response, once the bid stage is officially opened.<br><br>Further competitive dialogues will be held during the procurement phase in two stages as follows:<br><br>**<u>Request for Expression of Interest (REOI) Stage</u>**<br>The Transaction Advisor has completed the draft REOI inclusive of questions for bidders to respond to as part of the pre-qualification submission. It is recommended that either a bidders' conference be held at the REOI stage to discuss these questions or bidders be given the opportunity to formally respond to the questions in the REOI. Responses will inform the Request for Proposal.<br><br>**<u>Request for Proposal (RFP) Stage</u>**<br>As mentioned in Section 8.5.3 of the Final Feasibility Report, a Pre-Bid Conference is recommended once a shortlist is confirmed following the REOI evaluations. |

## Comment Record and Response

| S/N | Report Section No. | Report Page No. | WBG Comment | How CPCS has addressed |
|---|---|---|---|---|
| | | | | Such a conference would afford bidders the opportunity to further discuss key parameters of the project and as necessary, issue a revised RFP. |
| 7 | Not Specified | | Government entities as lessees. As other government units might also be in need of additional/new space, the team recommends assessing the appetite and possibility for co-locating government units. The team recommends assessing this option for the Ministry of Local Government building, which is looking for new space. | Government entities as lessees was debated at the kick-off meeting and again in the Draft Inception Report for SEC and the Project Deliver Team's consideration. The Transaction Advisor felt that rent paying government entities would only serve to make the project bankable and tenderable under a PPP and thus recommended that SEC and the Project Delivery Team source potential government entities looking for office space and with the financial resources to pay rent for Grade A office space.<br><br>However, following a meeting with SEC on 1/13/2016, the Transaction Advisor was requested to focus its efforts on ascertaining the potential for private sector tenants and not government tenants due to financial constraints in the public sector. Thus, the Transaction Advisor has not further investigated this avenue at the request of the Client. |
| **Risk Assessment** | | | | |
| 8 | Chapter 7, Section 7.7 | 138 | Risk mitigation. There are no details on costing the risk mitigation measures. At this stage, the costing of mitigation measures (e.g. insurance) are wide open. Therefore, it is recommended that once the financial structure and procurement model have been finalized, the risk costing for different mitigation measures should be devised, and reflected accordingly in the Financial Study. | Insurance that a real estate private developer will typically subscribe for in this type of scheme, has been actually priced and included as part of upfront capital costs as well reoccurring operational costs (please refer to Appendix I – Breakdown of Building Upfront, Operational and Lifecycle costs in the Feasibility Report).<br><br>Secondly, the costing of risk mitigation has been the key consideration while determining the cost and revenue forecasts for the financial analysis part of the Feasibility Study.<br><br>Construction, life-cycle and operation costs have conservatively been assessed twice (at pre-feasibility and at feasibility stage by the Technical team of the Transaction Advisor based on extensive benchmarks and experiences).<br><br>Regarding revenues, rental rates have been adjusted downward based on current market conditions (including excess supply for office space in Accra) and the outlook for real estate in Accra.<br><br>As per the financing structure, the 70:30 gearing ratio and 8% interest rate on USD dollar borrowing (to be considered alongside the 2% long term inflation rate) have been assessed as realistic-to-conservative in view of the Country's micro- and macro- economic forecasts. |

## Comment Record and Response

| S/N | Report Section No. | Report Page No. | WBG Comment | How CPCS has addressed |
|---|---|---|---|---|
| | | | | Finally, in order to test further the robustness of the financial study, sensitivities of the Project's key outcome, i.e. SEC's rent free space allocation, have been tested to the main project drivers, i.e. construction costs, cost of capital and commercial rents assumptions (please refer to Section 7.6.3 of the Final Feasibility Report). |
| 9 | Chapter 7, Section 7.7 | 138 | Lack of clarity on annuity payment mechanism. The risk allocation states that the operational risk will be borne by the private sector. However, according to the FS, the SEC will be paying for sewerage, electricity and more. The team recommends reassessing the risk allocation and considering the option of SEC paying an annuity to the private sector for services linked to the expenses. It is pertinent that, if there is a payment, it is clearly stated and priced. The team requests that it be calculated and added to the RFP. | Indeed, SEC will be paying to cover its operating costs and facilities management services as explained in Section 7.5.9 of the Final Feasibility Study (as is typical of any tenant occupying space in a building). Accordingly this will be clearly stated in the RFP. With regard to pricing, this services charge has been estimated at an annual rate of 34.3 USD per SQM for the purposes of the financial analysis and to inform SEC of its likely running costs in the new accommodation. |
| **Economic Feasibility** | | | | |
| 10 | Not Specified | | Economic benefits unclear. It is recommended that an economic analysis be conducted as to why the project will add economic benefit to the area and how it aims to improve the socio-economic milieu of the locale. In addition, the economic viability of the project was unclear to the team. | Please see Section 7.8 Economic Viability Assessment of Chapter 7 in the Final Feasibility Report. |
| 11 | Not Specified | | Economic impact. In a similar vein as #10, it is important to understand the role of this project in the local community and the larger economy. The FS could explore this more closely. | Please see Section 7.8 Economic Viability Assessment of Chapter 7 in the Final Feasibility Report. |
| 12 | Not Specified | | Environmental and social impact: The team did not receive an E&S study and requests clarification as to the cost implications and if they are reflected in the FS. | A draft E&S Study was submitted with comments received from the Ministry of Finance's Safeguards Specialist. The E&S Study was necessarily revised and a final version is submitted with this document. Cost implications are reflected in the Final Feasibility Report and specifically, are part of Site work and Demolitions (see Appendix I – Breakdown of Building Upfront, Operational and Lifecycle Costs of the Final Feasibility Report) |

## Comment Record and Response

| S/N | Report Section No. | Report Page No. | WBG Comment | How CPCS has addressed |
|---|---|---|---|---|
| **General Comments** | | | | |
| 13 | Chapter 4 | 67, 68, 71 | We were not able to access the figures mentioned on pages 67, 68, and 71. | This has been corrected |
| 14 | Executive Summary | 12 | Second paragraph, last sentence: The team suggests substituting the term "eliminating" for "reducing" in the sentence: "…thereby eliminating SEC's risk exposure, while realizing the proposed office accommodation complex." | This change has been made |
| 15 | Executive Summary | 14 | Second paragraph, first sentence: The word "risk" after "potential" is missing ("…in order to identify potential risk,…"). | This change has been made |
| 16 | Chapter 3 | 26 | Second to last bullet point: Take out "for" after "collaborative". | This change has been made |
| 17 | Chapter 3 | 27 | Second to last paragraph: Add space after "to" and before "Figure 3-9 | This change has been made |
| **Summary of Next Steps** | | | | |
| 1 | | | Is it feasible to do a PPP project that heavily relies on a potentially saturated real estate market? | Given that SEC's main objective (replace their current temporary office accommodation by a new, permanent and larger one) and constraint (no unitary payment to cover for the capital costs associated with this new office), the basic and primary question to answer when looking at the SEC PPP feasibility was: can SEC get enough rent-free space against its land to accommodate its business operations over the long term?<br><br>The Feasibility Study has approached this question from 2 different perspectives:<br>1) Defining the optimum real estate project on SEC land and looking at what amount of space of the building could be rented free of any capital unitary payment (this is developed in Section 7.5 and 7.6 of the Final Feasibility Report)<br>2) Assessing SEC land value and the potential stream of rental payments which could be paid against it (in Section 7.7 of the Final Feasibility Report)<br><br>For those quantitative analyses in the viability assessment, assumptions have been made on land value and the proposed accommodation's rental potential based on researched benchmarks, industry consultations and market sounding. |

## Comment Record and Response

| S/N | Report Section No. | Report Page No. | WBG Comment | How CPCS has addressed |
|---|---|---|---|---|
| | | | | The outcomes of those analysis are that, despite the currently saturated office market in Accra, there should enough potential on SEC's piece of land to feasibly implement this project as a PPP. |
| 2 | | | Have all sources of revenue generation including innovative avenues been analyzed? | We believe that while looking at retail, commercial and residential building-use patterns, all sources of revenues have been explored (see discussion in comment S/N 5). However, if the private bidders discover and propose other more innovative avenues for revenue generation, this would simply benefit the Project and help SEC achieving its goal. |
| 3 | | | What are the economic gains of this project? | Please see Section 7.8 Economic Viability Assessment of Chapter 7 in the Final Feasibility Report. |
| 4 | | | How would the risk transfer for the Government of Ghana materialize in terms of affordability if the risks are priced? | Given the non-payment of a unitary charge is a condition precedent to this transaction, the "affordability" measure for the Project is in the availability of sufficient rent-free office space for SEC.<br><br>Although it is believed that the risks have been adequately priced (see discussion in comment S/N 8), the private sector might take an even more conservative view which could materialize into rent free space bids below the minimum surface which SEC wants to see guaranteed before engaging into the project.<br><br>In other words, if the commercial risk (the most critical project risk) is priced more heavily than the Final Feasibility Study assumes, i.e. the rental assumptions are lower than expected, then the minimum required free space could not be reached and the Project will then become "unaffordable". |

## Acknowledgements

CPCS would like to acknowledge the kind assistance granted to them by the staff of Securities and Exchange Commission (SEC) as well as members of the Project Delivery Team. Any errors of fact or interpretation are ours.

CPCS Transcom International Limited
Suite G6
Welches Plaza
Welches
St. Michael, Barbados
www.cpcs.ca

## Table of Contents

**Acronyms/Abbreviations ... 7**

**Executive Summary ... 11**

**1 Introduction ... 17**

1.1 Introduction ... 18

1.2 Project Background ... 18

1.2.1 Project Objectives ... 19

1.3 Structure of this Report ... 19

**2 Needs Assessment ... 20**

2.1 Introduction ... 21

2.2 Needs Assessment ... 21

2.2.1 Existing Level of Service ... 21

2.2.2 SEC Strategic Objectives ... 21

2.2.3 Structured under a PPP Framework ... 22

2.2.4 Leadership in Energy and Environmental Design (LEED) Certification ... 22

**3 Minimum Performance Standards and Technical Requirements of SEC Space ... 23**

3.1 Introduction ... 24

3.2 SEC Space Planning ... 24

3.2.1 Functional Programming ... 24

3.2.2 Interior Design and Furnishings ... 24

3.2.3 International Best Practice for Functional Programming in the Public Sector ... 25

3.2.4 Current Layout and Observations and Space Use ... 26

3.2.5 Five Year Projection Program based on International Benchmarks and Space Allocation Guidelines ... 27

3.2.6 Additional SEC Space Consideration ... 35

3.2.7 Interior Furnishings ... 37

3.3 SEC Technical Requirements ... 44

3.3.1 Electrical ... 44

*3.3.1.1 Applicable Building Codes and Standards* ... 44

*3.3.1.2 Design Intent* ... 45

*3.3.1.3 Power Distribution Systems* ... 45

*3.3.1.4 Fire Alarm Systems* ... 46

*3.3.1.5 Lighting Control Systems* ... 46

*3.3.1.6 Interior Lighting Fixtures* ........ 48
*3.3.1.7 Emergency Lighting* ........ 48
*3.3.1.8 Exit Signs* ........ 49
3.3.2 SEC Fit-Up Structural Engineering Requirements ........ 49
3.3.3 Mechanical ........ 49
*3.3.3.1 Interior Heat Gain* ........ 50
*3.3.3.2 Ventilation Rates* ........ 51
*3.3.3.3 Design Intent* ........ 51
*3.3.3.4 Applicable Building Codes and Standards* ........ 51
*3.3.3.5 Building Heating, Ventilation, and Air Conditioning Systems* ........ 51
*3.3.3.6 Building Control System* ........ 52
*3.3.3.7 Plumbing Fixtures* ........ 52
*3.3.3.8 Domestic Water System (Potable)* ........ 53
*3.3.3.9 Domestic Hot Water* ........ 53
*3.3.3.10 Fire Protection Systems* ........ 54
3.3.4 Security ........ 54
*3.3.4.1 Physical Security – SEC Space* ........ 54
3.3.5 SEC Telecommunications ........ 55
*3.3.5.1 Telecommunications Room* ........ 55
*3.3.5.2 Data System* ........ 56
*3.3.5.3 Voice System* ........ 57
**4 Building Options, Minimum Performance Standards and Technical Requirements ........ 58**
4.1 Introduction ........ 59
4.2 Site Development Constraints ........ 59
4.3 Architectural Systems ........ 60
4.3.1 Site Development Options ........ 60
4.3.2 Note on Surrounding Developments ........ 62
4.3.3 Building Height Options ........ 65
4.3.4 Sub-Grade Parking ........ 67
4.4 Building Architecture ........ 70
4.4.1 Space Type Allowances ........ 70
4.4.2 Envelope ........ 74
4.4.3 Roof ........ 74

4.4.4 Windows .......... 75
4.4.5 Acoustics .......... 75
4.4.6 Building Services .......... 75
4.5 Site Development .......... 76
4.5.1 Surface Parking .......... 76
4.5.2 Storm Service .......... 76
4.5.3 Sanitary Service .......... 77
4.5.4 Landscaping .......... 77
4.5.5 Fire Protection .......... 77
4.5.6 Domestic Water Supply .......... 77
4.5.7 Utility Power Supply .......... 78
4.5.8 Telecommunications Service Supply .......... 79
4.6 Engineering Systems .......... 80
4.6.1 Structural .......... 80
*4.6.1.1 Building Substructure* .......... 80
*4.6.1.2 Building Superstructure* .......... 81
4.6.2 Building Mechanical .......... 81
*4.6.2.1 Interior Heat Gain* .......... 82
*4.6.2.2 Ventilation Rates* .......... 82
*4.6.2.3 Design Intent* .......... 83
*4.6.2.4 Applicable Building Codes and Standards* .......... 83
*4.6.2.5 Building Heating, Ventilation, and Air Conditioning Systems* .......... 83
*4.6.2.6 Building Plumbing Systems* .......... 85
*4.6.2.7 Building Fire Protection System* .......... 86
4.6.3 Building Electrical .......... 87
*4.6.3.1 Applicable Building Codes and Standards* .......... 87
*4.6.3.2 Design Intent* .......... 87
*4.6.3.3 Power Distribution Systems* .......... 87
*4.6.3.4 Fire Alarm Systems* .......... 91
*4.6.3.5 Lighting Control Systems* .......... 91
4.6.4 Telecommunications Systems .......... 94
*4.6.4.1 Telecommunications Rooms* .......... 94
*4.6.4.2 Data System* .......... 95

*4.6.4.3 Voice System* ..... 95
*4.6.4.4 Telecommunications Raceway System* ..... 96
4.6.5 Security ..... 96
*4.6.5.1 Physical Security Overview – Proposed SEC Site Development* ..... 96
*4.6.5.2 Physical Security – General Complex* ..... 96
*4.6.5.3 Security Personnel* ..... 97
4.6.6 Energy ..... 97
4.6.7 Building Commissioning ..... 98
**5 Sustainability Plan and Scorecard ..... 100**
5.1 Introduction ..... 101
5.2 LEED Sustainable Building Rating System ..... 101
5.2.1 Most Widely Used System ..... 101
5.3 LEED Certification Process ..... 102
5.3.1 Point-based Certification System ..... 103
5.3.2 LEED in Africa ..... 103
**6 Legal Due Diligence ..... 106**
6.1 Introduction ..... 107
6.2 Office Accommodation Project under PPP ..... 107
6.2.1 DBFOOMT Concession Modality ..... 107
6.2.2 Joint Venture Modality ..... 110
6.3 Fiscal Regime ..... 113
6.3.1 The Project Company ..... 113
6.3.2 Incorporation in Ghana ..... 113
6.3.3 Foreign Private Party ..... 113
6.3.4 Tax ..... 113
6.3.5 Foreign Investment Law ..... 114
6.3.6 Foreign Exchange Control ..... 115
6.4 Site and Related Infrastructure Enablement ..... 115
6.4.1 Heritage Rights ..... 116
6.5 Outright Sale of Residential Units under Mixed-Use Building ..... 116
6.5.1 Interest in Land in Ghana ..... 117
**7 Viability Assessment ..... 120**
7.1 Introduction ..... 121

7.2 Viability Assessment Methodology ..... 121
7.2.1 Discounted Cash Flow Model ..... 121
7.3 Preferred PPP Concession Modality ..... 122
7.4 Preferred Building-use Option ..... 122
7.5 Changes from Pre-Feasibility to Feasibility ..... 122
7.5.1 Costs ..... 122
7.5.2 Developer Business Models ..... 127
7.5.3 Typical Capital Structures and Cost of Capital Assumptions ..... 127
7.5.4 Topline Estimates ..... 129
7.5.5 Parking Allocations ..... 130
7.5.6 Concession Period ..... 131
7.5.7 Construction Period ..... 131
7.5.8 SEC's Allocated Space ..... 131
7.5.9 SEC Space Related Operating and Maintenance Budget ..... 132
7.6 Valuation Assessment ..... 133
7.6.1 Valuation Metrics ..... 133
7.6.2 Results ..... 133
7.6.3 Sensitivity ..... 136
7.6.4 Value for Money ..... 138
7.7 Risk Assessment ..... 143
7.7.1 Tender and Development Risks ..... 144
7.7.2 Development Risks ..... 145
7.7.3 Construction Risks ..... 146
7.7.4 Operation Risks ..... 147
7.7.5 Force Majeure ..... 148
**8 Implementation & Procurement Plan ..... 150**
8.1 Introduction ..... 151
8.2 Timetable and Key Milestones ..... 151
8.2.1 Revised Implementation Schedule ..... 151
8.3 Stakeholder Involvement ..... 155
8.3.1 Action Items Required ..... 156
8.4 Maximizing Bid Competition ..... 157
8.4.1 Robust Marketing Strategy ..... 157

8.4.2 Tender Documentation: Criteria for Credibility ........ 158
8.5 Information for Bidders ........ 159
8.5.1 Categories of Information ........ 159
8.5.2 Virtual and Physical Data Room ........ 159
8.5.3 Pre-Bid Conference ........ 160
8.6 Pre-qualification Process and Evaluation Parameters ........ 160
8.6.1 Pre-qualification Criteria ........ 160
8.6.2 Checklist ........ 162
8.6.3 Pre-qualification Procedures and Quality Assurance Processes ........ 162
8.7 Bid Process and Evaluation Parameters ........ 163
8.7.1 Overview ........ 163
8.7.2 Bid Process ........ 163
8.7.3 Evaluation Process ........ 165
8.7.4 Procedures and Quality Assurance Processes ........ 167
8.7.5 Negotiations Procedures ........ 168
8.8 Next Steps ........ 169
**Appendix A – Room Data Sheets ........ 172**
**Appendix B – Geotechnical Report ........ 188**
**Appendix C – Typical Sub-grade Parking Floor Layouts ........ 190**
**Appendix D – Retail, General Office and Residential Floor Layouts ........ 192**
**Appendix E – Typical Roof Layout ........ 196**
**Appendix F – PV Analysis Date ........ 198**
**Appendix G – Commissioning Process and Activities ........ 200**
**Appendix H – LEED Scorecard ........ 224**
**Appendix I – Breakdown of Building Upfront, Operational and Lifecycle Costs ........ 226**
**Appendix J – Market and Field Investigation Summary ........ 228**

# Acronyms/Abbreviations

| | |
|---|---|
| AASHTO | American Association of State Highway and Transportation Officials |
| ACS | Access Control System |
| AESL | Architectural & Engineering Services Limited |
| AGL | Above Ground Level |
| AIP | Approval in Principle |
| ASHRAE | American Society of Heating Refrigeration and Air Conditioning Engineers |
| AV | Audiovisual |
| BOT | Build-Operate-Transfer |
| CAPEX | Capital Expenditure |
| CCTV | Closed-circuit television |
| COTS | Commercial Off-The-Shelf |
| CRU | Commercial Retail Unit |
| CxA | Contracting/Commissioning Authority |
| DBFOOMT | Design-Build-Finance-Own-Operate-Maintain-Transfer |
| DCF | Discounted Cash Flow |
| DDC | Direct Digital Control |
| DMD | Debt Management Division |
| DVMS | Digital Video Management System |
| ECG | Electricity Company of Ghana |
| EMI | Electromagnetic Interference |
| EPA | Environmental Protection Agency |
| EPC | Engineering, Procurement and Construction |
| EUI | Energy Use Intensity |
| FFE | Furniture, Fixtures and Equipment |
| FTE | Full Time Employee |
| FVNR | Full Voltage Non Reversing |

| | |
|---|---|
| GCAA | Ghana Civil Aviation Authority |
| GHG | Greenhouse Gas |
| GIPC | Ghana Investment Promotion Centre |
| GoG | Government of Ghana |
| GSE | Ghana Stock Exchange |
| GSGDA | Ghana Shared Growth and Development Agenda |
| GSM | Gross Square Meters |
| GWCL | Ghana Water Company Limited |
| HD | High Definition |
| HVAC | Heating, Ventilation and Air Conditioning |
| IES | Illuminating Engineering Society |
| IM | Information Memorandum |
| IPD | Investment Property Data |
| IR | Infrared |
| IRR | Internal Rate of Return |
| JV | Joint Venture |
| LaDMA | La-Dadekotopon Municipal Assembly |
| LEED | Leadership in Energy and Environmental Design |
| LIBOR | London Interbank Offered Rate |
| LPD | Lighting Power Density |
| MCC | Motor Control Centre |
| MCR | Main (Tele)communications Room |
| MDA | Ministries, Departments and Agencies |
| MER | Main Electrical Room |
| MMDA | Metropolitan, Municipal and District Assemblies |
| MoF | Ministry of Finance |
| MoU | Memorandum of Understanding |
| MUTCD | Manual on Uniform Traffic Control Devices |
| NAO | National Audit Office |
| NDPC | National Development Planning Commission |

| | |
|---|---|
| NFPA | National Fire Protection Association |
| NIP | National Infrastructure Plan |
| NPV | Net Present Value |
| O&M | Operations & Maintenance |
| OGC | Office of Government Commerce, UK |
| OPEX | Operating Expenditure |
| PAU | PPP Advisory Unit |
| PCB | Polychlorinated Biphenyls |
| PDT | Project Delivery Team |
| PFA | Project and Financial Analysis |
| PID | Public Investment Division |
| PMU | Project Management Unit |
| PPIAF | Public-Private Infrastructure Advisory Facility |
| PPP | Public-Private Partnership |
| PSRE | Public Sector Research Establishment |
| PV | Photovoltaic |
| RCR | Remote (Tele)communications Room |
| REOI | Request for Expression of Interest |
| RER | Remote Electrical Rooms |
| RfI | Request for Information |
| RfP | Request for Proposal |
| RP | Recommended Practice |
| SDR | Social Discount Rate |
| SEC | Securities and Exchange Commission |
| SMACNA | Sheet Metal and Air Conditioning Contractors National Association |
| SOC | Security Operations Center |
| SPV | Special Purpose Vehicle |
| SQM | Square Meter |
| STPR | Social time preference rate |
| TVSS | Transient Voltage Surge Suppression |

| | |
|---|---|
| USGBC | United States Green Building Council |
| UV | Ultraviolet |
| VAT | Value added tax |
| VFD | Variable Frequency Drive |
| VFM | Value for Money |
| VOC | Volatile Organic Compounds |
| VOIP | Voice Over Internet Protocol |
| VRF | Variable Refrigerant Flow |

# Executive Summary

Securities and Exchange Commission (SEC) – regulator of Ghana's securities industry – is seeking to develop an office accommodation for itself, under a Public-Private Partnership (PPP) Procurement Model. SEC is located at No. 30, 3rd Circular Road, Cantonments, Accra where it has operated out of a temporary facility for the past eight years.

Based on a thorough assessment of SEC's current accommodation and existing level of service, as well as a review of the Commission's strategic objectives, a robust case has been made for a more long-term, permanent solution to SEC's office accommodation needs – including an anticipated growth in staff of 85% at the Commission over the next five years.

In order to bridge the gap in office space needs, SEC has engaged CPCS for transaction advisory services for an office accommodation complex under PPP arrangement. Based on the findings of the pre-feasibility study, this report presents an in-depth analysis of the technical, financial and legal viable options for delivering the key outcomes and outputs of the project, as well as options for the commercialization of opportunities of the facility. This report covers the feasibility phase of CPCS' mandate and is to provide a Pragmatic Viability assessment, which refines the financial and commercial viability estimates made at the pre-feasibility stage, and a proposed Management and Procurement Plan, to inform a successful PPP procurement model.

**Minimum Performance Standards and Technical Requirements of SEC Space and Building Options**

The feasibility phase commenced with the Project Team refining the analysis of the overall space requirements and operations of SEC, in order to inform the commercial viability of the project under a PPP approach. This Phase builds on information to ultimately define – in the bid documents to potential private sector proponents – the specific technical requirements of SEC's accommodation within the context of the overall financial feasibility of the project.

Towards refining the analysis of SEC's space program and building carried out at the pre-feasibility stage, the Project Team updated three key areas: (i) an additional 800 SQM of space was added to the recommended SEC program space of 1,400 SQM; (ii) an increase in building volume from approx. 17,000SQM to 19,330SQM; and (iii) and an increase in the number of parking bays from 141 (31 surface and 110 underground) to 341 (29 surface and 312 underground)

**Sustainability Plan and Scorecard**

The proposed building is intended to incorporate 'green' or 'eco-friendly' building techniques, as mandated by the World Bank in the transaction advisory services contract, and the Leadership in Energy and Environmental Design (LEED) standard has been selected the preferred certification method for SEC's proposed accommodation. We describe LEED as it relates to SEC's proposed accommodation with an opinion on LEED categories of focus to achieve the necessary certifications. Based on an analysis of completed LEED projects which have been certified in Africa, the current expectation is that the proposed project could achieve certified-level, with the potential to reach the Silver level of certification. Of note, as the project evolves, these expectations will continue to fluctuate during the design and construction period.

**Legal Due Diligence**

The aim of the legal chapter at the feasibility stage is to provide an overview of the legal constraints under applicable and relevant Ghanaian law – in particular, foreign investment law, land law, environmental law, planning and construction law, for the implementation of SEC's office accommodation project under a PPP arrangement based on a Design-Build-Finance-Own-Operate-Maintain and Transfer (DBFOOMT) modality.

The DBFOOMT concession modality – whereby a private sector partner is granted a contract to design, construct, finance, equip, operate and maintain the facility for a fixed period, after which the asset reverts back to SEC – was proposed at the pre-feasibility stage. This concession modality is strategically compared with a contractual arrangement between SEC and the private party vis-à-vis a joint venture (JV), such as the creation of a special purpose vehicle (SPV). It is found that a joint venture would not be appropriate for this project, and would entail the assumption of risk by the SEC (e.g. market risk, credit risk), as shareholders in the SPV. It is recommended that SEC enter into a PPP agreement with a private party through a DBFOOMT concession, thereby reducing SEC's risk exposure, while realizing the proposed office accommodation complex.

The legal due diligence includes a review of the fiscal regime applicable and relevant to the proposed accommodation and in particular, taxation, import duties and exchange control requirement, as well as site and related infrastructure enablement. Based on a review of the lease agreement, it can be safely assumed that SEC's land is not subject to any claims. The lease agreement has been duly executed and registered by the Lands Commission, and there is no indication that the location of the land is unsuitable for the project. If the need arises, an application for re-zoning will be made for a mixed use building (office and residential units). As applicable, the private party would will be liable to pay for lease registration fees and yearly ground rent for the duration of the concession.

One key issue addressed in the Feasibility Report is determining the legal basis for the private party to sell residential units outright to third parties/general public under a DBFOOMT model. This key consideration interacts with (i) the nature of the interest in land that a private party can acquire under Ghanaian law; (ii) the context of a mixed-use building, where residential units are sold outright; and (ii) the requirement for the private party to transfer the facility back to SEC at the end of the concession period, under a DBFOOMT modality. Upon analysis of the outright sale of residential units, in terms of interest in land in Ghana, the Project Team provides two recommendations.

First, the Project Team concludes that the private party is entitled to sell residential units to third parties under a DBFOOMT modality, by virtue of a sublease. It is noted that viability can be markedly enhanced if purchasers of residential units are assured that subleases shall be renewed by SEC upon expiration of the initial term subject to renewal by government. Second, it is recommended that sublease agreements for outright sale should be executed between SEC and the private party on one hand, and the purchaser on the other.

**Viability Assessment**

Further to the assessments made at the pre-feasibility stage for this mandate, the purpose of the Viability Assessment is to refine the financial and commercial viability estimates made at the pre-feasibility stage – as informed by market consultations and field investigations – in order to (i) determine the viability of the project based on the preferred concession modality and (ii) inform the bid strategy at the procurement stage.

The DBFOOMT concession modality has been carried through from the pre-feasibility to the feasibility stage as the preferred PPP concession modality. Based on further consultations with developers and related stakeholders, as well as field investigations in the Cantonments area, the commercial and mixed-use options remain the preferred building-use choices for SEC's proposed accommodation.

At the feasibility stage, the Project Team endeavored to increase the building size and volume, and increase the number of parking spots. The resulting impact on upfront, operational and lifecycle building cost estimates are provided. As informed by market consultations and field investigations, further refinements are made regarding developer business models; and typical capital structure and cost of capital assumptions.

A revised Valuation Assessment is carried out, which tested the viability based on both 1,400SQM and 2,200 SQM of space allocation to SEC for the full commercial and mixed-use accommodation – under a 25-year concession period.

Based on refinements to the proposed technical solution, as well as revised commercial parameters from pre-feasibility to feasibility (capital structure; cost of capital; developer business models; market rents and rent escalation), at a 1,400SQM space allocation for SEC, there is still further scope to increase SEC's space until viability metrics – namely, the equity rate of return over the project period – approaches the benchmark of 12%.

However, at 2,200SQM, the equity rate of return drops below the required benchmark indicating that between 1,400SQM and 2,200SQM, there is a spatial amount that results equity IRR equalling the 12% benchmark.

By back-solving for SEC's space allocation in the financial model, and assuming that SEC's fit-up, furniture, fixtures and equipment (FFE) costs as well as swing space and moving allowances are allocated to the developer, SEC's theoretical space allocation equates to 1,850 SQM under a full commercial building and 1,750SQM under a mixed-use building. Furthermore, by shifting responsibilities regarding the Commission's fit-up, FFE, swing space and moving costs, SEC's space allocation can be further increased, theoretically, to 2,700SQM.

It should also be noted that sensitizing the concession period (assumed to be 25 years in the base case), cost of capital, upfront project costs and commercial rents has significant impacts (both positive and negative) to SEC's theoretical space allocation.

The Value for Money (VFM) analysis consists of comparing the PPP option with alternative forms of procurement, along financial parameters, and while taking into account any differences in risk allocation. While the viability assessment shows that the PPP option could achieve the delivery of 1,850 SQM of rent free space for SEC over 25 years and the ownership of circa 20,000 SQM of rentable office afterwards – the alternative options could potentially deliver 950-1,200 SQM, and at best 1,700 SQM – which demonstrates VFM for the PPP option.

An extensive Risk Assessment is carried out, in order to identify potential risks, and outline potential mitigation strategies such as risk avoidance and risk transfer, as well as insurance implementation, in order to reduce or entirely avoid identified disturbances to the project. These include tender and development risks; development risks; construction risks; operation risks and force majeure.

**Implementation and Procurement Plan**

Should this mandate proceed to the bid phase, the Implementation Plan (project timetable, milestones and approvals) as well as Procurement Plan (strategic approach, tender documentation and quality assurance) should be conceived in a manner that is timely, efficient and transparent.

Based on achieving the above and in line with Ghana's National Policy on PPPs, the Project Team envisions a bid phase timetable of 34 weeks. However, this is subject to the following *potential* challenges:

- Risk of prolonged internal (SEC and Project Delivery Team) reviews and milestone approvals;
- Risk of prolonged external (Cabinet and Parliament) reviews and milestone approvals and;
- Risk of delays due to general elections in December 2016.

To that end, the Project Team will work closely with SEC and the Project Delivery Team to ensure milestone submissions are made in a timely manner. For external reviews and approvals, it is strongly advised that SEC and PDT work closely with governing arms to ensure that they are abreast of the transaction at all times during the bid phase in order to expedite reviews and approvals.

The main components of the Procurement Plan include (1) issuing a Request for Expression of Interest (REOI) in order to quickly and fairly determine if a certain bidder possesses the necessary financial and technical capabilities to enter into the formal bidding process and (2) issuing a Request for Proposal from bidders that are short-listed by way of the REOI.

Procedures and quality assurance processes at both the REOI and RfP stage are to be put in place to ensure efficiency and transparency. A simple pass/fail evaluation process is recommended at the REOI stage to ensure transparency while a quantitative scoring method is recommended at the RfP stage, based on weights in four recommended areas – (1) Rent free floor space and parking made available to SEC; (2) Building design and operational plan; (3) Financial sustainability and robustness; and (4) Risk assessment.

Final decisions on weighting and refinement of evaluation areas can be considered until the evaluation process commences, assuming that refinements do not alter the transparency, consistency and fairness of the evaluation process.

Following the evaluation of bidders' proposals and the selection and approval of a preferred bidder, SEC is to enter into a negotiation with the selected bidder, culminating in executing the PPP and other bid agreements.

**Next Steps**

Prior to completing the Final Feasibility Report and entering the bidding stage based on the necessary approvals detailed in Ghana's National PPP Policy, certain parameters were finalized with SEC/PDT based on the Project Team's analysis in this report. These parameters and SEC/PDT decisions are summarized in the figure below.

| Parameter | Commentary | SEC/PDT Decision |
|---|---|---|
| **Concession Period** | It is the Project Team's opinion that there are two options regarding the concession period for this project:<br><br>**Option 1** – Fix the period to 25 years<br><br>**Option 2** – Set a range that is between 20 and 30 years and score bidders accordingly (bid submissions indicating a concession period that is closer to 20 years would score more favourably) | Option 2 |
| **Building-use Pattern** | As described in 7.6 of Chapter 7, the fully commercial building indicates that, theoretically, a higher space allocation for SEC can be achieved relative to the mixed-use building pattern.<br><br>However, the sensitivity analysis in Section 7.6.3 of Chapter 7 shows that when certain parameters are sensitized, the mixed-use building pattern can provide more space to SEC, relative to the full commercial building.<br><br>Furthermore, consideration should also be building-use patterns that surround SEC's site (and Cantonments in general). Thus, two options are suggested.<br><br>**Option 1** – Fix the building-use pattern to commercial use only<br><br>**Option 2** – Give bidders flexibility in terms of building-use patterns and provide favourable scores to those bidders that propose a fully commercial building-use pattern | Option 2 |
| **Minimum Parking Bays** | 341 parking bays were estimated for the proposed technical solution presented in Chapter 4. This translates to 2.2 bays per 100 SQM of *leasable* space.<br>It is suggested that a minimum of parking bays be set per 100 SQM of *leasable* space with an evaluative criteria that scores bidders more favourably if they are able to provide a technical solution that is greater than the proposed minimum technical requirement | 2.2 Parking Bays per 100 SQM of *Leasable* Space |

| Parameter | Commentary | SEC/PDT Decision |
|---|---|---|
| **SEC's Swing Space / Moving Allowance** | In the viability assessment presented in Section 7.6 of Chapter 7, a scenario was presented whereby SEC's swing space / moving allowance is AND is not part of the developer's costs with corresponding impacts to SEC's space allocation. As such, two suggested options exist for SEC's consideration:<br><br>**Option 1** – SEC's swing space / moving allowance forms part of the developer's project costs<br><br>**Option 2** – SEC's swing space / moving allowance does not form part of the developer's project costs | Option 1 |
| **SEC's Minimum Space Allocation** | It is suggested that SEC set a minimum space allocation and subsequently, have developers bid on the additional space they would provide to SEC as compensation for leasing the land from the Commission.<br><br>The Project Team's analysis in the Value for Money assessment (see Section 7.7 of Chapter 7) provides alternatives to the proposed PPP option with results indicating that for the value of its land, the alternatives can achieve between 950SQM and 1,200SQM office space.<br><br>It is recommended that the Commission/PDT take the above into consideration when setting SEC's minimum, fully-fitted, space allocation. | 1,850 SQM |

# 1 Introduction

## 1.1 Introduction

The overarching objective of the feasibility study is to assess and articulate the strategic and operational benefits of the proposed project, as aligned with the Security and Exchange Commission's (SEC or "Commission") objectives and the national development agenda, towards refining the definition of the project following the pre-feasibility stage.

Based on the findings of the pre-feasibility study, the feasibility study presents an in-depth analysis of the technical, financial and legal viable options for delivering the key outcomes and outputs of the project, as well as options for the commercialization of opportunities of the facility. The report summarizes the underlying requirements which drive the key parameters and outcomes of the project in the Needs Assessment. The minimum performance standards, requirements and technical parameters of SEC Space and Building Options, and the Sustainability Plan and Scorecard are reviewed extensively, towards informing commercial viability and defining the accommodation's technical requirements in the bid documents. This is followed by a comprehensive Legal Due Diligence, which evaluates potential contractual arrangements, and a dynamic Market Study, which presents an overview of real estate in Accra. These inputs inform a pragmatic Viability Assessment, which refines the financial and commercial viability estimates made at the pre-feasibility stage. The report concludes with a proposed Management and Procurement Plan, and suitable institutional arrangements which promote transparency and quality assurance.

Our guiding approach to the feasibility study is the provision of targeted and well-informed analysis, based on the expertise of our multi-disciplinary team and on-site stakeholder consultations. This is towards refining the project definition based on both international best practice and pragmatic considerations.

Furthermore, an Environmental and Social Impact Assessment for this project is attached under separate cover.

## 1.2 Project Background

As Ghana's securities industry continues to expand, so too will the scope of the Securities and Exchange Commission, as a regulator of the industry. Currently, the organization operates in a temporary facility at No. 30, 3rd Circular Road, Cantonments, Accra, Ghana and has been resident in this location for the past eight years.

The temporary accommodation of SEC will soon become inadequate, especially as the organization expands its human resources to meet its widening scope as a regulator. Owing to the need for a more suitable, permanent and expanded head office, SEC has obtained assistance from the World Bank to fund the transaction advisory works for the procurement of a new office accommodation complex under a Public-Private Partnership (PPP) procurement strategy. The related contract was awarded to CPCS Transcom International Limited under a competitive, public tender.

### 1.2.1 Project Objectives

The main objective under this advisory mandate is to assist SEC to develop a well-structured and bankable PPP project, in accordance with the National Policy on PPPs, to enable the smooth and timely procurement of a suitable private developer to provide an office accommodation complex which:

i. Permits the rationalization of SEC's activities, leading to improvements in the organization's performance and providing net economic benefits to SEC and the country as a whole;

ii. Provides office space in excess of SEC's space needs to permit additional revenue streams, thereby reducing SEC's financial expenditures for developing the space on its own; and

iii. Achieves energy savings and improves efficiencies and employee working conditions.

In addition, the proposed building is intended to incorporate green building techniques, leveraging Leadership in Energy and Environmental Design (LEED) principles and adopting sustainability goals as part of the proposed facility's minimum performance standards.

Critical for the long-term sustainability of the project is the identification and selection of investors/operators whose goals align with the long-term objectives of the Commission. Therefore, essential to the success of this mandate will be the adoption of a procurement process which attracts credible and reputable private sector partners to develop SEC's proposed office accommodation.

## 1.3 Structure of this Report

The remainder of this report is structured as follows:

**Chapter 2** – Needs Assessment

**Chapter 3** – Minimum Performance Standards and Technical Requirements of SEC Space

**Chapter 4 –** Building Options, Minimum Performance Standards and Technical Requirements

**Chapter 5** – Sustainability Plan and Scorecard

**Chapter 6** – Legal Due Diligence

**Chapter 7** – Viability Assessment

**Chapter 8** – Implementation & Procurement Plan

Supporting materials are presented in the **Appendices**.

Please note that the **Environment and Social Impact Assessment** for this project is attached as a separate report.

# 2 Needs Assessment

## 2.1 Introduction

This chapter reviews the needs of the proposed project, and the underlying requirements which drive the key parameters and outcomes of the project. We review the existing level of service of the accommodation; the driving forces fueling the need for a more suitable, permanent and expanded head office; and the requirements surrounding both the procurement strategy and incorporation of green building techniques.

## 2.2 Needs Assessment

### 2.2.1 Existing Level of Service

SEC operates in a temporary facility at No. 30, 3rd Circular Road, Cantonments, Accra, Ghana. The Project Team carried out a thorough investigation of SEC's current facility in February 2016; a number of existing conditions related to the site were observed, and found to impede – among others – the following areas: (i) a supportive work environment and appropriate space assignments based on function; (ii) worker satisfaction, productivity, health and safety; (iii) fundamental aspects of environmental sustainability and; (iv) optimal space efficiency.

### 2.2.2 SEC Strategic Objectives

The need for a more suitable, permanent and expanded head office is fueled by two driving forces: (i) the expansion of Ghana's capital markets; and (ii) the expansion of SEC's mandate as a regulator of the securities industry.

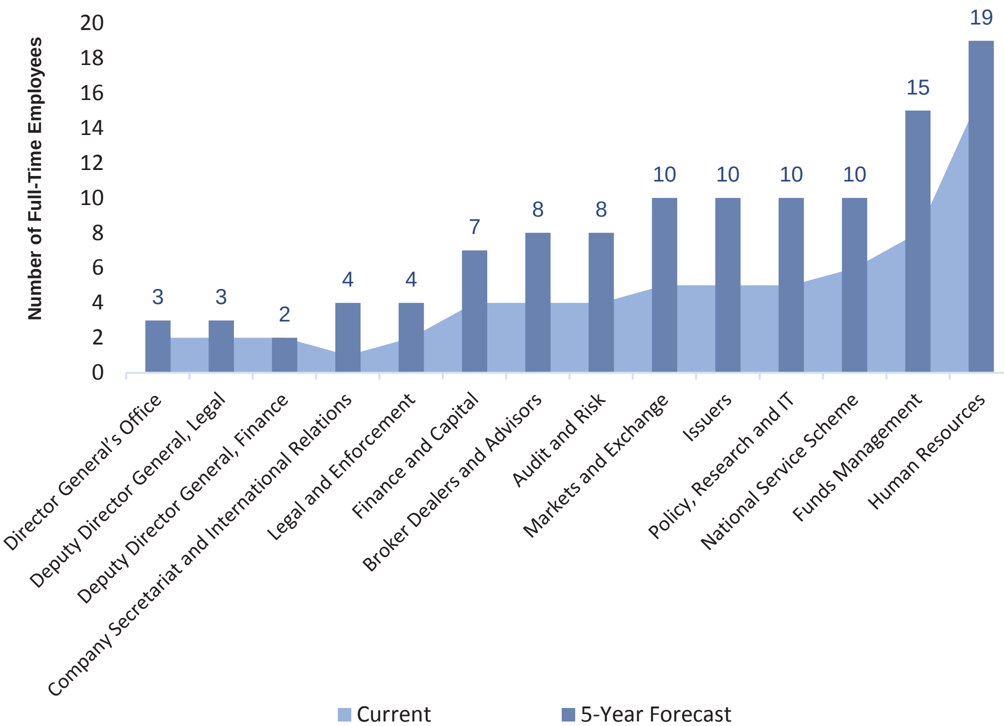
#### The Expansion of Ghana's Capital Markets

Ghana's capital markets have seen substantial growth over the past 25 years, during which market capitalization has increased from GH₵3.05 million in 1990 to GH₵62,183.49 million as at 31st October 2015. As part of our field mission in February 2016, the Project Team consulted representatives of the Ghana Stock Exchange. It was advised that expected growth in Ghana's capital markets implies a greater role for SEC, and presents a case for SEC to expand its base across human resources, capital resources and technology – especially towards the function of surveillance. Market confidence by way of physical presence in the industry was also found to contribute to the rationale for SEC to build a *permanent* office accommodation – thereby marketing the Commission as sufficiently equipped to serve as a trusted regulator in an expanding landscape.

#### The Expansion of SEC's Scope as a Regulator

Since enactment, the Securities Industry Act 1993 was amended in 2000, making fuller provisions for SEC to act as a regulator of the country's securities industry. The draft Bill, when passed into law, will further increase the scope of the Commission. SEC will be responsible for a new range of product lines and services, expected to translate into overall **personnel growth**. SEC has projected that their personnel will grow from approximately 61 full-time employees (FTE), to 113 FTEs, over the next five years. Therefore, there is a corresponding need for sufficient space which can accommodate expected growth across the Commission's offices and departments, and the projected overall personnel growth of 85% over the next five years.

**Figure 2-1: Five-Year Projected Growth in Full-Time Employees**




Source: Securities and Exchange Commission

### 2.2.3 Structured under a PPP Framework

Regarding the genesis of this project, SEC, through the Ministry of Finance (MoF), had initially tried to directly procure a new accommodation – an initiative which did not materialize due to funding constraints. Thus, SEC revised its approach by considering a PPP procurement strategy, and obtained assistance from the World Bank to fund the transaction costs under a PPP approach. SEC envisions a PPP scheme where construction, operations and maintenance (O&M), and revenue risk is completely transferred to the private sector – which is generally better suited to handle this risk.

### 2.2.4 Leadership in Energy and Environmental Design (LEED) Certification

The proposed building is intended to incorporate green building techniques, as mandated by the World Bank. The LEED standard is used to measure the level of environmental considerations given to building design, construction, and O&M. As part of the proposed facility's minimum performance standards, LEED principles must be leveraged and sustainability goals must be adopted. Chapter 4 of this report, Building Options, Minimum Performance Standards and Technical Requirements, describes how LEED principles will be implemented and integrated within each technical criteria, as related to (i) building architecture; (ii) site development; and (iii) engineering systems.

# 3 Minimum Performance Standards and Technical Requirements of SEC Space

## 3.1 Introduction

In order to assess the development of the PPP office accommodation for SEC, an analysis on the current and future requirements for the Commission was undertaken to determine the overall goals and expectations for the proposed accommodation.

The focus of the analysis is to determine the overall space requirements and functions of SEC in order to inform the commercial viability of the project under a PPP approach. This Phase builds on the information gathered to ultimately define – in the bid documents to potential private sector proponents – the specific technical requirements of SEC's accommodation within the context of the overall financial feasibility of the project.

## 3.2 SEC Space Planning

### 3.2.1 Functional Programming

In February 2016, the Project Team conducted interviews on site with the respective Head of each Department/Office of the Commission, in order to gather information regarding the functional program requirements of the Commission. These interviews covered the basic function of each Department; identified the current number of full time employees (FTEs) and their corresponding positions; assessed the conditions and user satisfaction of the current accommodation; and gathered information regarding a five-year forecast for FTEs, the associated positions, and needs of the Department.

Other support spaces and conditions were assessed including the usage of meeting space; requirements for storage and filing; the usage of office business machines; potential impacts from the development of the Commodity Exchange on the SEC's regulatory functions; security requirements which might impact space; and other special requirements which demand footprint space in the office layout.

The intent of this information gathering exercise was to define a functional program for SEC's proposed accommodation in a new building to be developed on the Commission's current site.

### 3.2.2 Interior Design and Furnishings

Space for SEC is defined as Usable Square Meters. As the proposed building is to include other uses (e.g., commercial office space), Usable Square Meters in this context includes all interior spaces of the building which are solely for the Commission's use. This includes the office areas, open office workstation areas, meeting rooms, kitchenettes, server closets, storage rooms, and circulation within the office suite area. It also includes structural elements (columns), openings for vertical cables, and vertical penetrations built for the private use of SEC.

Usable Square Meters does not include building vertical circulation (elevators and exit stairs), duct shafts, landlord common spaces (such as building entrance lobbies), elevator foyers, common corridors, washrooms, exit routes, and other common spaces shared by all tenants.

### 3.2.3 International Best Practice for Functional Programming in the Public Sector

Much work has been carried out by public sector agencies and departments in advanced economies in order to reform accommodation policies and fit-up[1] standards, with the goal of providing an appropriate quality and quantity of space to support the fundamental functional requirements of the occupant.

In countries such as the United Kingdom, United States, Australia and Canada, functional programming in the public sector is typically developed through space allocation guidelines which are established by parastatals responsible for real estate or accommodations. These guidelines represent international best practice in functional programming which continuously aim to achieve greater efficiency in space utilization, greater collaboration, and smaller individual workstations which integrate new technologies. Updated guidelines respond to new ways of working and are aligned with private sector trends in the provision of flexible work arrangements and optimal value to the organization.

In addition to the Project Team's experience in developing functional programs, we selected the United Kingdom, United States, Australia and Canada as reference countries to assess public sector space allocation guidelines which are applicable to SEC's space needs. The figure below provides a list of reference documentation for each country, accordingly.

**Figure 3-1: Reference Documentation**

**United Kingdom**

- Office of Government Commerce (OGC): Efficiency Standards for Office Space prepared by Investment Property Data Bank (IPD)
- British Council for Offices: Making Flexible Working Work 2010
- National Audit Office (NAO): Getting the Best from Public Sector Office Accommodation

**United States**

- Washington State Department of Enterprise Services: Space Allocation Standards Report Volume I/2011, Conclusions and Recommendations
- United Nations Space Planning Guidelines Update 2012

**Australia**

- Government of Queensland - Office Accommodation Workspace Fit-out Standards
- Government of South Australia: Fit-out Standards
- Government of Western Australia: Performance Examination: Room to Move: Improving the Cost Efficiency of Government Office Space

**Canada**

- Government of Canada: Workplace 2.0 Fit-up Standards 2012

[1] Fit-up is the construction necessary within the demising walls of a leased space, including partitions, finishes, fixtures, lighting, power, equipment, etc. allowing the space to be used for its leased purpose.

Across the board, the documentation referenced in the above figure purported a benchmark goal of 12 to 14 SQM per Full Time Employee, which includes all support space and circulation necessary to meet the functional program, as well as a high ratio of open office area workstations compared with built, private office space. Furthermore, these reference documents express similar objectives in adopting standardized space allocation guidelines, which include the following:

i. Achieving cost-effective and timely delivery of accommodation and accommodation services;
ii. Clearly defining accountabilities;
iii. Assuring a supportive work environment and appropriate space assignments based on function;
iv. Improving worker satisfaction, productivity, health and safety;
v. Ensuring equity and consistency in public sector accommodations;
vi. Incorporating the fundamental aspects of environmental sustainability and;
vii. Demonstrating value goals of benchmark guidelines.

Through market consultations with developers and facilities managers in Accra, the Project Team ascertained that for more recent commercial real estate developments, typical office space per FTE is between 9 and 11 SQM – considerably lower than the international best practice. In addition, research was conducted on emerging markets to determine if there were any standardized space allocation guidelines. Information was obtained from the South African government regarding space planning guidelines for office accommodations. This information was dated 2005 and yet indicated similar square meter allowances per person of 12 SQM, which is the lower limit of the recommendations currently identified.

Standards from other emerging markets such as Brazil and Singapore were not able to be sourced. Subsequent searches for relevant governmental space accommodation standards did not uncover any additional information that would adjust the contents as recommendations of the report.

The space planning exercise has taken the international standards and space allocation accommodation guidelines in Figure 3-1 as a basis for determining the new space allowances required for SEC's functional program.

### 3.2.4 Current Layout and Observations and Space Use

As indicated in the pre-feasibility report, the Project Team examined the Commission's current staffing and positions, space categories, layout, usage and circulation factors to draw comparisons with both local and international benchmarks.

This examination uncovered several conditions that impeded optimal space efficiency and thus, scope to better align SEC's space allocation in the proposed accommodation with the Commission's functional needs. Current impediments to optimal space efficiency include:

- On site requirements for washrooms, archival storage, common lounge area and other secondary functions that could potentially be provided as common tenant space by the landlord or at economical off-site locations;
- Additional circulation space to accommodate fragmented department locations;

- A high proportion of built space and dedicated support space vs. open office space, and multipurpose common support space; and
- Inefficient building proportions leading to rows of built offices on either side of a corridor, reducing access to natural light and ventilation.

The Project Team compared SEC's current layout, in terms of SQM per FTE. At 19.9 SQM per FTE, SEC's current accommodation exceeds both local (9-11 SQM/FTE) and international benchmarks (12-14 SQM/FTE).

### 3.2.5 Five Year Projection Program based on International Benchmarks and Space Allocation Guidelines

The focus of the analysis was to determine the overall space requirements and functions of SEC in order to inform the commercial viability of the project under a PPP approach.

Using the above international benchmarks as a guiding principle and their own applied expertise, the Project Team proposed a new accommodation program for SEC within the context of the overall financial feasibility of the project. In consultation with SEC, this program included a projected FTE growth of 85% over the next five years (from approximately 61 to 113 people) to the SEC's space accommodation requirement. The resultant space has been determined to be approximately 1,400 SQM (1,370 SQM) as further identified in Figure 3-2 below.

In striving towards the international benchmark of 12-14 SQM per FTE, the following measures were assumed in order to achieve optimal space use, flexibility and occupant comfort for this projected forecast:

- Standard SQM allocations are applied to private built offices and workstations according to the position of the FTE. There is a greater percentage of open office space to private built office space.
- Work stations in open office areas employ modular systems furniture.
- Mobile files also reduce SQM footprint.
- Large meeting rooms or training rooms can employ folding partitions for simultaneous meetings and multi-purpose activities.
- Space functions are positioned adjacent to concomitant functions or clustered to streamline circulation and facilitate security. Examples are:
    - Spaces used by external visitors such as meeting rooms, the Hearing Room, and the Commissioners Lounge, have controlled access to the entry Reception.
    - A greater percentage of contiguous open office and shared support space allow for growth and flexible arrangements.
    - Business machine centres and central storage rooms are in central locations.
- A SQM percentage of 5% is provided in open office areas for "collaborative" non-scheduled/impromptu meetings of a few colleagues to free up formal meeting rooms.
- Functions that demand limited activity are assumed by the developer's common space (e.g. general washrooms, drivers lounge).

Figure 3-2: Allocation of Space in SEC's Proposed Accommodation based on International Benchmarks

| Space Use | SQM | % of Total |
|---|---|---|
| **SEC Program Space** | **1370** | **100%** |
| FTE Occupied Area | 678.5 | 49% |
| Support Area Shared | 272.5 | 20% |
| Support Area Dedicated | 76.5 | 6% |
| Circulation | 342.5 | 25% |
| Total SQM per FTE | 12.1 | |

To further define and document the specific space requirements for the overall programming, interior design, adjacencies and space fit-up requirements, a series of supporting documentation is provided in the Appendices. This information includes the following:

### Adjacency Schematic

Figure 3-3 is intended to illustrate one overall result of department and sub-department locations within the tenant space that would satisfy adjacencies requested by SEC departments and sub-departments. The schematic suggests a gradient of *strong* to *less important* relationships. The adjacency schematic has no bearing on the relative square metre allotment of various program spaces.

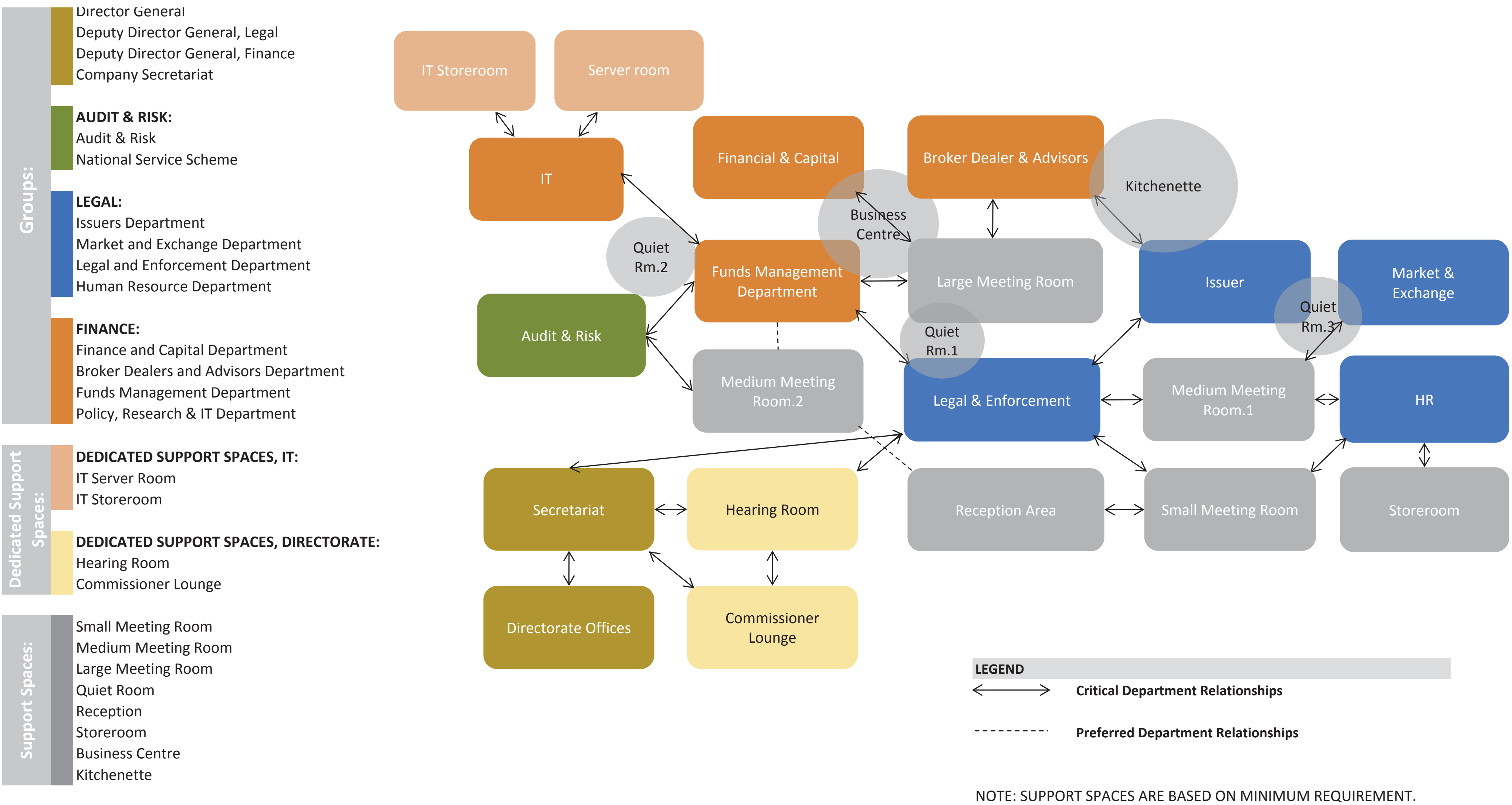
### Department Cover Sheets

Figure 3-4 to Figure 3-9 outline the quantity and sizes of each type of space required for each department and their sub-departments. The sheets indicate **'required'** minimum metrics. These are mandatory figures and must be met in the SEC accommodation program. The sheets also indicate **'requested'** metrics that have been requested by the Commission in addition to the minimum mandate and assigned to various functions in the SEC accommodation program. The **'adjacencies'** column (see Figure 3-3) shows the preferred placement of the department and sub-departments in relation to other functions and departments in the layout of SEC tenant space.

### Room Data Sheets

Room Data Sheets are available in Appendix A and describe the specifics of each room including the materials, make up and finish partitions, floors, ceilings, doors, hardware, built-in millwork, security, sound quality, infrastructure, equipment and furniture, as required for fully functional offices and support spaces as described in the program.

**Figure 3-3: Adjacencies Schematic**




Source: CPCS

Figure 3-4: Directorate Department Cover Sheet

| Directorate Department | | | |
|---|---|---|---|
| Sub Section: | **Director General's Offices** | Number of Staff: | **8 FTE** |
| **ROOM NAMES** | **Minimum Required** | **Additional Space Requested** | |
| Director General (18.5 SQM) | **3** | | |
| Director (14 SQM) | | | |
| Manager (10 SQM) | | | |
| Open Workstation (6 SQM) | | | |
| Open Workstation (4.5 SQM) | **5** | | |
| **SECURITY REQUIREMENTS** | | | |
| External Access: | | Employee Access: | |
| External Access Escorted: | **X** | Individual Access: | **X** |
| **Dedicated Support Spaces** | **Minimum Required** | **Additional Space Requested** | |
| **Private Washroom** | **1** | **-** | |
| **Secure Filing Cabinet** | **6** | **-** | |
| **ADJACENCIES** | | | |
| | | | |
| **SPECIAL REQUIREMENT** | | | |
| Comment: **Department is accommodated in an enclosed suite with secure access.** | | | |
| Sub Section: | **Company Secretariat** | Number of Staff: | **4 FTE** |
| **ROOM NAMES** | **Minimum Required** | **Additional Space Requested** | |
| Director General (18.5 SQM) | | | |
| Director (14 SQM) | **1** | | |
| Manager (10 SQM) | **1** | | |
| Open Workstation (6 SQM) | | | |
| Open Workstation (4.5 SQM) | **2** | | |
| **SECURITY REQUIREMENTS** | | | |
| External Access: | | Employee Access: | **X** |
| External Access Escorted: | | Individual Access: | |
| **Dedicated Support Spaces** | **Minimum Required** | **Additional Space Requested** | |
| **Hearing Room** | **1** | | |
| **Commissioner Lounge** | **1** | | |
| **Secure Filing Cabinet** | **2** | **2** | |
| **ADJACENCIES** | | | |
| **Director General Offices , Legal & Enforcement , Hearing Room , Commissioner Lounge.** | | | |
| **SPECIAL REQUIREMENT** | | | |
| Comment: | | | |

Source: CPCS

Figure 3-5: Finance and Capital Department (PART 1)

| Finance and Capital Department | | | |
|---|---|---|---|
| Sub Section: | Finance and Capital | Number of Staff: | 7 FTE |
| **ROOM NAMES** | **Minimum Required** | **Additional Space Requested** | |
| Director General (18.5 SQM) | | | |
| Director (14 SQM) | 1 | - | |
| Manager (10 SQM) | 1 | 1 | |
| Open Workstation (6 SQM) | 1 | 1 | |
| Open Workstation (4.5 SQM) | 4 | 3 | |
| **SECURITY REQUIREMENTS** | | | |
| External Access: | | Employee Access: | |
| External Access Escorted: | | Individual Access: | X |
| **Dedicated Support Spaces** | **Minimum Required** | **Additional Space Requested** | |
| **Secure Filing Cabinet:** | 8 | 2 | |
| **ADJACENCIES** | | | |
| **Meeting Room , Business Centre** | | | |
| **SPECIAL REQUIREMENT** | | | |
| Comment: **Enclosed Suite with secure access. Secure filing cabinets are located in the open office areas of the department.** | | | |
| Sub Section: | Broker Dealers and Advisors | Number of Staff: | 8 FTE |
| **ROOM NAMES** | **Minimum Required** | **Additional Space Requested** | |
| Director General (18.5 SQM) | | | |
| Director (14 SQM) | 1 | | |
| Manager (10 SQM) | 1 | 1 | |
| Open Workstation (6 SQM) | 1 | 1 | |
| Open Workstation (4.5 SQM) | 5 | 4 | |
| **SECURITY REQUIREMENTS** | | | |
| External Access: | | Employee Access: | X |
| External Access Escorted: | | Individual Access: | |
| **Dedicated Support Spaces** | **Minimum Required** | **Additional Space Requested** | |
| **Secure Filing Cabinet:** | 3 | 2 | |
| **ADJACENCIES** | | | |
| **Meeting Room , Business Centre** | | | |
| **SPECIAL REQUIREMENT** | | | |
| Comment: | | | |
| Sub Section: | Funds Management | Number of Staff: | 15 FTE |
| **Comment:** | **Minimum Required** | **Additional Space Requested** | |
| Director General (18.5 SQM) | | | |
| Director (14 SQM) | 1 | | |
| Manager (10 SQM) | 2 | 1 | |
| Open Workstation (6 SQM) | | 2 | |
| Open Workstation (4.5 SQM) | 12 | 7 | |
| **SECURITY REQUIREMENTS** | | | |
| External Access: | | Employee Access: | |
| External Access Escorted: | X | Individual Access: | |
| **Dedicated Support Spaces** | **Minimum Required** | **Additional Space Requested** | |
| **Secure Filing Cabinet:** | 4 | 8 | |
| **ADJACENCIES** | | | |
| **Legal , Audit & Risk , IT , Meeting Room** | | | |
| **SPECIAL REQUIREMENT** | | | |
| Comment: | | | |

Figure 3-6: Finance and Capital Department (PART 2)

| Finance and Capital Department | | | |
|---|---|---|---|
| Sub Section: **Policy, Research & IT** | | Number of Staff: | **10 FTE** |
| **ROOM NAMES** | **Minimum Required** | **Additional Space Requested** | |
| Director General (18.5 SQM) | | | |
| Director (14 SQM) | 1 | | |
| Manager (10 SQM) | 2 | 1 | |
| Open Workstation (6 SQM) | 1 | 1 | |
| Open Workstation (4.5 SQM) | 6 | 4 | |
| **Dedicated Support Spaces** | **Minimum Required** | **Additional Space Requested** | |
| **Filing Cabinets:** | 8 | | |
| **Storeroom** | 1 | | |
| **Server room** | 1 | | |
| **SECURITY REQUIREMENTS** | | | |
| External Access: | | Employee Access: | |
| External Access Escorted: | | Individual Access: | X |
| **ADJACENCIES** | | | |
| **Funds Management , IT Server Room , IT Storeroom.** | | | |
| **SPECIAL REQUIREMENT** | | | |
| Comment: | | | |

Source: CPCS

Figure 3-7: Legal Department (PART 1)

| Legal Department | | | |
|---|---|---|---|
| Sub Section: | Issuers | Number of Staff | 10 FTE |
| **ROOM NAMES** | **Minimum Required** | **Additional Space Requested** | |
| Director General (18.5 SQM) | | | |
| Director (14 SQM) | 1 | | |
| Manager (10 SQM) | 1 | 1 | |
| Open Workstation (6 SQM) | 1 | 1 | |
| Open Workstation (4.5 SQM) | 7 | 5 | |
| **SECURITY REQUIREMENTS** | | | |
| External Access: | | Employee Access: | X |
| External Access Escorted: | | Individual Access: | |
| **Dedicated Support Spaces** | **Minimum Required** | **Additional Space Requested** | |
| **Secure Filing Cabinets:** | 5 | | |
| **ADJACENCIES** | | | |
| **Brokers & Advisors , Legal & Enforcement** | | | |
| **SPECIAL REQUIREMENT** | | | |
| Comment: | | | |
| Sub Section: | Markets & Exchange | Number of Staff | 10 FTE |
| **ROOM NAMES** | **Minimum Required** | **Additional Space Requested** | |
| Director General (18.5 SQM) | | | |
| Director (14 SQM) | 1 | | |
| Manager (10 SQM) | 1 | 1 | |
| Open Workstation (6 SQM) | 1 | 1 | |
| Open Workstation (4.5 SQM) | 7 | 5 | |
| **SECURITY REQUIREMENTS** | | | |
| External Access: | | Employee Access: | |
| External Access Escorted: | | Individual Access: | X |
| **Dedicated Support Spaces** | **Minimum Required** | **Additional Space Requested** | |
| **Secure Filing Cabinet:** | 4 | 2 | |
| **ADJACENCIES** | | | |
| **Meeting Room** | | | |
| **SPECIAL REQUIREMENT** | | | |
| Comment: **Department is accommodated in an enclosed suite with secure access.** | | | |

**Figure 3-8: Legal Department (PART 2)**

| **Legal Department** | | | |
|---|---|---|---|
| Sub Section: | **Legal and Enforcement** | Number of Staff | **4 FTE** |
| **ROOM NAMES** | **Minimum Required** | **Additional Space Requested** | |
| Comment: | | | |
| Director (14 SQM) | **1** | | |
| Manager (10 SQM) | **1** | **1** | |
| Open Workstation (6 SQM) | **1** | **1** | |
| Open Workstation (4.5 SQM) | **1** | **4** | |
| **SECURITY REQUIREMENTS** | | | |
| External Access: | | Employee Access: | |
| External Access Escorted: | | Individual Access: | **X** |
| **Dedicated Support Spaces** | **Minimum Required** | **Additional Space Requested** | |
| **Secure Filing Cabinet:** | **8** | **2** | |
| **ADJACENCIES** | | | |
| Hearing Room | | | |
| Meeting Room | | | |
| **SPECIAL REQUIREMENT** | | | |
| Comment: **Department is accommodated in an enclosed suite with secure access.** | | | |
| Sub Section: | **Human Resource** | Number of Staff | **9 FTE** |
| **ROOM NAMES** | **Minimum Required** | **Additional Space Requested** | |
| Director General (18.5 SQM) | | | |
| Director (14 SQM) | **1** | | |
| Manager (10 SQM) | **1** | **1** | |
| Open Workstation (6 SQM) | | **2** | |
| Open Workstation (4.5 SQM) | **7** | **4** | |
| **SECURITY REQUIREMENTS** | | | |
| External Access: | | Employee Access: | **X** |
| External Access Escorted: | **X** | Individual Access: | |
| **Dedicated Support Spaces** | **Minimum Required** | **Additional Space Requested** | |
| **Filing Cabinets:** | | **14** | |
| **ADJACENCIES** | | | |
| **Meeting Room , Storeroom** | | | |
| **SPECIAL REQUIREMENT** | | | |
| Comment: | | | |

Source: CPCS

Figure 3-9: Audit & Risk Department

| Audit & Risk Department | | | |
|---|---|---|---|
| Sub Section: | Audit & Risk | Number of Staff | 8 FTE |
| **ROOM NAMES** | **Minimum Required** | **Additional Space Requested** | |
| Director General (18.5 SQM) | | | |
| Director (14 SQM) | 1 | | |
| Manager (10 SQM) | 1 | 2 | |
| Open Workstation (6 SQM) | 2 | 2 | |
| Open Workstation (4.5 SQM) | 4 | 7 | |
| **SECURITY REQUIREMENTS** | | | |
| External Access: | | Employee Access: | X |
| External Access Escorted: | | Individual Access: | |
| **Dedicated Support Spaces** | **Minimum Required** | **Additional Space Requested** | |
| **Secure Filing Cabinet:** | 7 | | |
| **ADJACENCIES** | | | |
| **Funds Management , Medium Meeting Room , Quiet Room** | | | |
| **SPECIAL REQUIREMENT** | | | |
| Comment: | | | |
| Sub Section: | National Service Scheme | Number of Staff | 10 FTE |
| **ROOM NAMES** | **Minimum Required** | **Additional Space Requested** | |
| Director General (18.5 SQM) | | | |
| Director (14 SQM) | | | |
| Manager (10 SQM) | | | |
| Open Workstation (6 SQM) | | | |
| Open Workstation (4.5 SQM) | 10 | 5 | |
| **ADJACENCIES** | | | |
| **SPECIAL REQUIREMENT** | | | |
| Comment: | | | |

Source: CPCS

### 3.2.6 Additional SEC Space Consideration

The 1,400 SQM of SEC program space identified in the previous section was identified and proposed in the Pre-Feasibility Study Report. Subsequently, SEC and the Project Delivery Team responded with a request for an additional 800 SQM of space to be added to the recommended program.

As such, the Project Team has developed a space program for the requested additional 800 SQM based on current workplace trends, management structure in the public sector and understanding of the existing SEC structure.

The following principles have been assumed:

- Director General and Deputy Directors and Senior Directors: This group would not be affected by the additional space request as their structure would remain as is in the proposed program, discussed in Section 3.2.5.
- Private offices: Deputy Chief Management would become responsible for a larger work force or possibly additional sub-departments and therefore additional positions at this level would be allocated in the requested additional space.

- Open Office Space: As the main production work force, additional positions would be assigned to Senior Managers in 6 SQM workstations, and Officers and Clericals in 4.5 SQM workstations.
- Shared Support Spaces: Based on the additional numbers of FTEs, a prorated space assignment has been allotted to add additional Meeting Rooms, Quiet Rooms, Kitchenettes and Business Centres.
- Dedicated Support Spaces; Filing: Additional space assignment to file footprint in Open Office Areas has been added to accommodate work material.
- Collaborative space and Circulation Factor percentages has been prorated to meet the additional workforce numbers.
- Room, workstation or footprint sizes presented in the initial proposal for 113 FTEs have not changed. This allows planning flexibility to easily assess swap outs of space assignment proposed here.
- Target of 12-14 SQM per FTE has not changed with the additional space allocation.

**Figure 3-10: Additional Request Space Assignment Summary One**

| SPACE FUNCTION | SQM of Unit Area | Additional Units | SQM. |
|---|---|---|---|
| **OFFICES** | | | |
| Deputy Chief Manger | 10 | 10 | 100 |
| **WORK STATIONS** | | | |
| Manger | 6 | 12 | 72 |
| Officers, Clerical | 4.5 | 48 | 216 |
| **SHARED SUPPORT SPACES** | | | |
| Small Meeting Rooms | 14 | 2 | 28 |
| Medium Meeting Rooms | 30 | 1 | 30 |
| Large Meeting Room | 30 | 1 | 30 |
| Quiet Rooms | 5 | 2 | 10 |
| Business Centres | 15 | 1 | 15 |
| Kitchenettes | 30 | 1 | 30 |
| Collaborative | Pro-rated | | 41 |
| **DEDICATED SUPPORT SPACES** | | | |
| Open Office Area Filing | **.5** | 32 | 16 |
| | | | |
| **TOTAL** | **588 SM** | | |
| NOTE: Circulation Factor not included | | | |

Source: CPCS

**Figure 3-11: Additional Requested Space Assignment Summary Two**

| AREA FUNCTION | SQM | PERCENT of SEC AREA | |
|---|---|---|---|
| | | ENCLOSED | OPEN |
| SUB-TOTAL FTE AREA | 1066.5 | 19% | 30% |
| SUB-TOTAL SUPPORT AREA | 549.5 | 25% | |
| SUB-TOTAL CIRCULATION | 550.0 | 25% | |
| **TOTAL SQM USAGE** | **2166.0** | 100% | |
| AREA USED PER FTE (173) | **12.5 SQM** | | |

Source: CPCS

### 3.2.7 Interior Furnishings

Based on the space planning allowances for SEC, as well as the financial viability results of the proposed building under a PPP procurement model, financial allocations *may* be made for the private developer to design, execute and supply fully finished spaces, suitable for the functions and adjacencies required of SEC's designated space.

Examples of furniture that may be provided include private office desks, open office modular workstations, work space chairs, filing cabinets, etc. Private offices will be focused spaces with freestanding desks and complementary storage units. Equipment, such as computers, printers, etc., are expected to be provided by SEC, and not the developer.

In general the following principles, specific to the interior design and construction, are expected to be met by the private developer should it be financially viable for the developer to do so:

i. Accessibility: Persons with disabilities should be provided the same level of access to, and use of, the entire facility as persons without disabilities.
ii. Access to natural light is to be maximized yet balanced with the control of solar heat gain.
iii. Materials are to be selected and provided for their durability, recycled content and recyclability, and low embodied energy.
iv. Materials are to be low toxicity and not contain friable asbestos, added urea-formaldehyde, polychlorinated biphenyls (PCB), lead, high levels of Volatile Organic Compounds (VOC) etc.
v. Materials must not contain components that support the growth of mold.

Additional details regarding the specific interior furnishing requirements can be found in the figures in the following page. Figure 3-12 on page 38 provide illustrations and further definition of furniture categories listed in the Room Data Sheets to indicate type size, materials and quality.

Figure 3-12: Furniture Definition

**Furniture Definition:**

**1. <u>Workstations 4.5 and 6 $m^2$: for Open Office Areas</u>**

**Integrated Panels:** Structural, modular panels with integrated connecting devices are the basis for systems work stations. They are configured to suit the size and height of station desired. The panels have integrated pathways and terminations for power and data access to the work surfaces. Hardware devices support work surfaces, storage units, work organizers, wire management devices and other components to support the work of the user. Panel cores should be sturdy structural metal capable of supporting hanging components and fastening devices safely and securely. Panel finishes should be offered in a variety of fabrics and hard surfaces. Stackable glass panels should be included in the product line.

1. **Work Surfaces:**
   Standards should include high pressure plastic laminate available in incremental depths and widths to suit panel modules. Panel hung surfaces should have adjustable height capability. System should be compatible with powered adjustable height surfaces for ergonomic comfort. Stations should be combination of a table to be Height Adjustable surface in 24" deep or 36" and a Fixed Surface in 24" or 36" deep. Work surfaces to be in laminate with grommet for wire management beneath work surface.
2. **Storage:**
   Panel hung upper storage bins, fixed pedestal cabinets and mobile pedestal cabinets with a variety of drawer sizes and inserts, high wardrobe and personal storage cabinets should be offered
3. **Components:**
   The system should offer a variety of optional components within their product line including but not limited to: white boards, tack boards, work organizers, filing rails and inserts for drawers and storage units, CPU holders, foot rests, monitor arms and docking stations
4. **Power Data Recommunication per work station:**
   - 3 standard electrical duplex receptacles
   - 1 voice/data/outlet
5. **Standards:**
   Systems furniture to comply to:
   **ANSI/BIFMA x 5.6 PANEL SYSTEMS Standard or international equivalent.**

<table>
<tr><td>2.</td><td><u>Desk Group:</u><br>This is a combination of case goods for built office spaces. Each set should include work surface and storage components with matching finishes and details from a single manufacturer to create the desired configuration for the user in a built office space. Recommended components:<ul><li>Working surface with adjustable table and mobile options.</li><li>Storage tower with wardrobe for personal use.</li><li>Credenza with a variety of configurations of drawer, file and cupboard storage.</li><li>Under/desk fixed or mobile pedestals and files</li><li>Bridge surfaces for contiguous connection of other work surfaces.</li><li>Grommets and wire management devices.</li></ul>Standards: Desk products to comply to:<br>ANSI/BIFMA x 5.5 DESK PRODUCTS Standard or international equivalent.</td><td></td></tr>
<tr><td>3.</td><td><u>Meeting Room Table:</u><br>Size and shape should suit the room setting. Bases should be offered in metal or panel, fixed or mobile options.<br><br>Standards: Desk products to comply to:<br>ANSI/BIFMA x 5.5 DESK PRODUCTS Standard or international equivalent.</td><td></td></tr>
</table>

| | | |
|---|---|---|
| 4. | **<u>Conference Tables w/power & data:</u>**<br>Table shape to suit the room configuration. Finishes to suit the aesthetic of the office. Base to have integrated technology for surface connectivity to data and power.<br><br>**Standards:** Desk products to comply to:<br>**ANSI/BIFMA x 5.5 DESK PRODUCTS Standard or international equivalent.** |  |
| 5. | **<u>Mobile Tables/flip Top:</u>**<br>For meeting rooms where seating options are required desires for audience or conference style settings. Adjustable features to be operated by users without additional tools or special expertise.<br><br>L-base or T-base on caster with flip top option (Laminated surface). |  |
| 6. | **<u>Task Chairs</u>**:<br>Caster 5-star metal base, upholstered or mesh fabric finishes. Ergonomic features to include adjustability in:<br>▪ Height<br>▪ Arm rest<br>▪ Seat pan depth<br>▪ Lumbar support<br>**Standards:** Task chairs to comply to:<br>▪ **ANSI/BIFMA x 5.1 OFFICE SEATING Standard or international equivalent.**<br>▪ **BIFMA G1 Ergonomics Guideline for Furniture or international equivalent.** |  |
| 7. | **<u>Guest Chairs:</u>**<br>These do not require the same ergonomic features as task and conference chairs so a variety of styles and finishes are acceptable to meet the aesthetic of the office. Caster basis are preferred for double duty at meeting tables.<br><br>**Standards:** Products to comply to:<br>**ANSI/BIFMA X5.4 LOUNGE AND PUBLIC SEATING Standard or international equivalent.** |  |

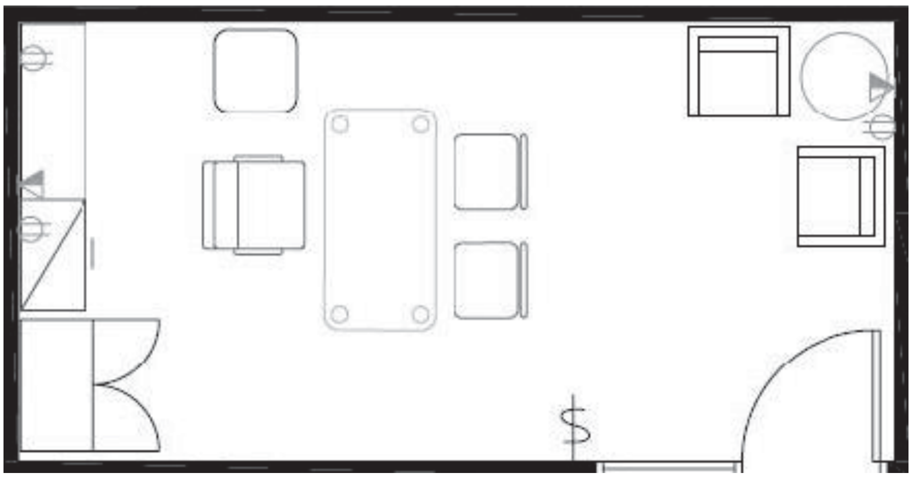
| | | |
|---|---|---|
| 8. | **<u>Lounge Seating:</u>**<br>Comfortable upholstered lower height seating groups made up of a combination of complimentary chairs and/or sofas for impromptu discussions and meetings. The style should complement the aesthetic of the office.<br><br>**Standards:** Lounge products to comply to:<br>**ANSI/BIFMA X5.4 LOUNGE AND PUBLIC SEATING Standard or international equivalent.** |  |
| 9. | **<u>Occasional Tables:</u>**<br>Lower height surfaces for lounge seating groups in offices or collaborative areas. The style should complement the aesthetic of the office. |  |
| 10. | **<u>Dining Table:</u>**<br>Size style and finishes to compliment the kitchen areas for comfortable relaxed dining. Preferred table top finish is high pressure laminate for maintenance, durability and cleanability. |  |
| 11. | **<u>Stacking Chairs:</u>**<br>For use in meeting rooms with mobile flip top tables where an audience style set up is required. Dollies should be included for storage purposes. |  |

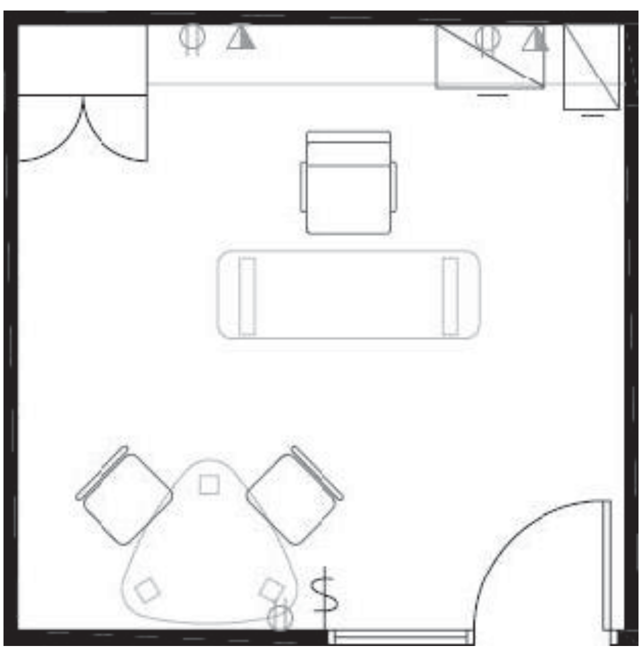
Source: CPCS

Figure 3-13: Furniture Layout Examples

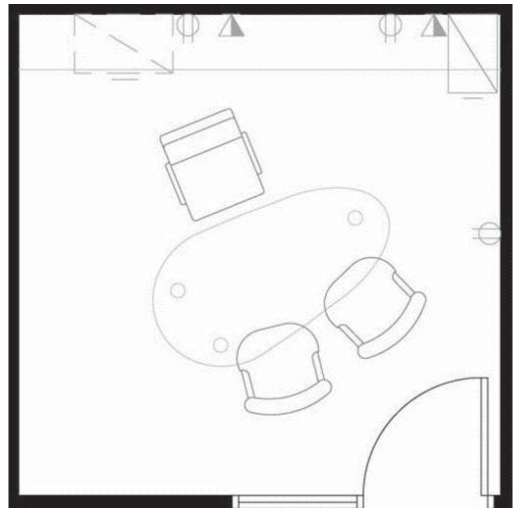
## A. Sample Detail Drawings of Enclosed Office Spaces:

### 1. Examples of Enclosed Office Layouts (18.5 SQM).

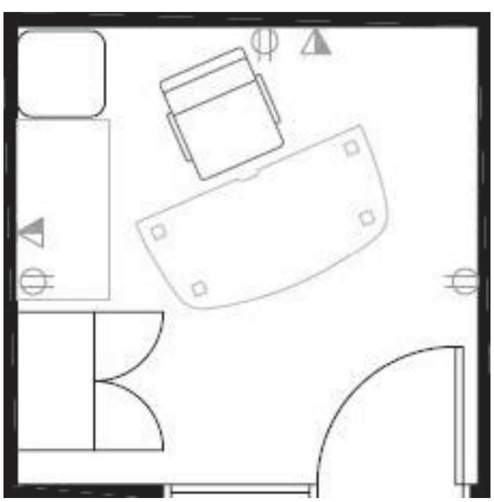


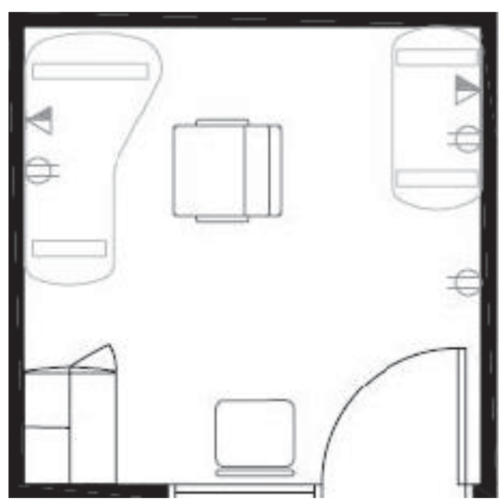


**2. Examples of Enclosed Office Layouts (14 SQM).**

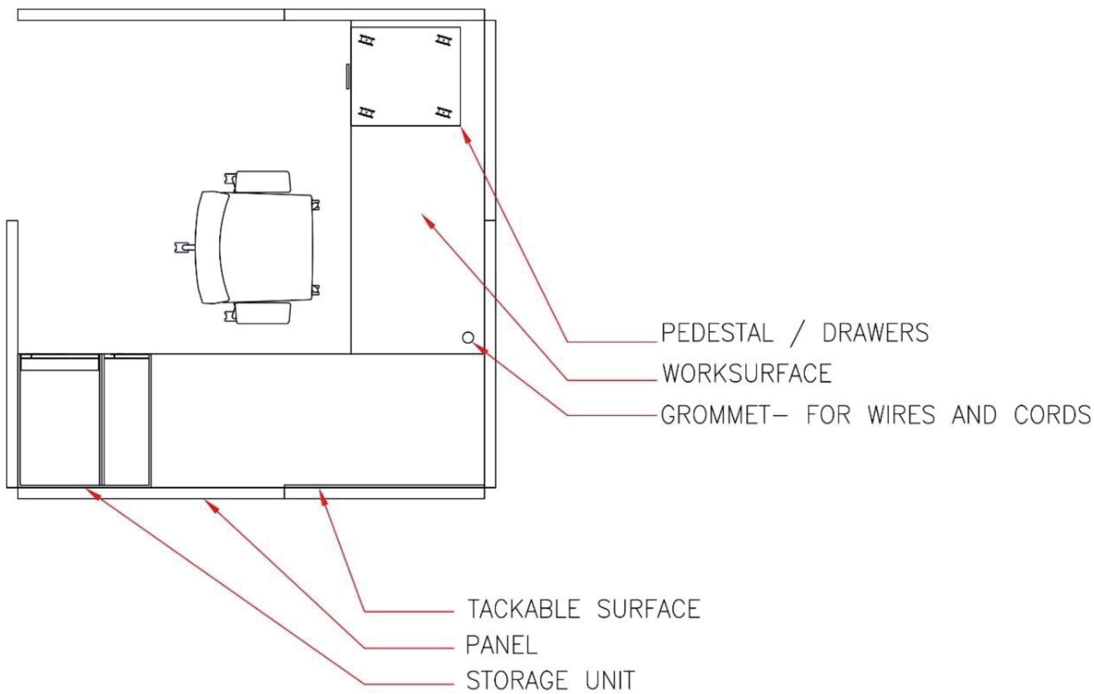


3. Examples of Enclosed Office Layouts (10 SQM).





**B. Sample Detail Drawings of Workstation 4.5 SQM:**




Source: CPCS

## 3.3 SEC Technical Requirements

An analysis of the current and future requirements for the Commission was undertaken in order to determine the overall goals and expectations for the proposed accommodation.

### 3.3.1 Electrical

In the headings hereunder, a summary of SEC's electrical systems under consideration for the proposed building are provided.

#### *3.3.1.1 Applicable Building Codes and Standards*

The following is a list of the most relevant codes and standards applicable to the building:

- ASHRAE/IES Standard 90.1-2012 – Energy Standard for Buildings except low rise residential
- BICSI TDM Manual
- IES – Applicable sections of the Illuminating Engineering Society (IES) Recommended Practices (RP)
- LEED – Leadership in Energy and Environmental Design Green Building Rating System, version 4.
- National Building Regulations, 1996. L.I. 1630

#### 3.3.1.2 Design Intent

The proposed SEC electrical systems will be designed to achieve a high level of energy efficiency, metering, monitoring, reporting and occupant control.

The system design and installation is to ensure safety of all personnel during operation and maintenance of the equipment, provide ease of maintenance of equipment which can be serviced by non-specialized personnel, be compatible with the other design elements, and provide flexibility as well as expansion and future growth allowance.

The building is targeting certification under the LEED Green Building rating system. This requires exceptional performance in almost all of the categories described in Section 2.2.4 of Chapter 2 in the Pre-Feasibility Report. Specific targeted points are documented elsewhere in this report but of particular concern to the building electrical systems will be the measurement and verification, energy efficiency of the lighting system and lighting control related credits.

The feasibility commentary identifies the minimum performance considerations and potential solutions for the base building electrical systems.

#### 3.3.1.3 Power Distribution Systems

**SEC Electrical Distribution**

Power distribution to SEC's space will be provided from a metered service from the base building electrical distribution system. Separation of the sub distribution panel boards within SEC's space facilitates ease of maintenance and reduces the potential for faults or interruptions in one specific system affecting another. Separate distribution panel-boards will be provided for each of the major SEC systems including the following:

- Lighting
- General use power
- Heating, Ventilation and Air Conditioning (HVAC)/Mechanical Equipment
- Process Loads (i.e. Data Center/Server Rooms)

**SEC Remote Electrical Rooms**

Remote electrical rooms (RER) shall be provided in SEC's space to house the required branch distribution panels for the Commission's electrical loads, lighting and associated Architectural and Mechanical equipment and receptacles. The RER shall also house the lighting control equipment and security equipment dedicated for SEC's space. It is anticipated that two (2) electrical rooms will be provided to service SEC's space, each sized to provide a minimum of 1m clearance of safe working are in front of all electrical equipment. Anticipated RER room sizes approximately 1.6m x 2.5m ($4.0m^2$) each.

**Emergency & Standby Power System**

An emergency power system will be provided for the building and will supply all loads within SEC's space. A dedicated emergency system for the Commission is not currently anticipated.

**Receptacle and General Use Power**

General use and specific use receptacles shall be provided throughout SEC's space including service spaces to facilitate operation of electrical and communications equipment as well as general cleaning and maintenance. Receptacles shall be installed at 450mm above finished floor unless specifically required by the associated equipment or service.

General use receptacles shall be specification grade. In common areas and open concept areas, receptacles shall be provided at less than 10.0m intervals where possible. Service rooms and other shall be provided with receptacles as appropriate but not less than the equivalent of one (1) duplex receptacle in each room.

Receptacles shall be provided above countertops shall be for all countertop equipment and general purpose receptacles installed at 1.5m intervals (maximum). Countertop receptacles shall be installed at 100mm above the counter unless specifically required by associated equipment.

Offices generally shall be provided with two (2) duplex receptacles at two (2) locations within the office to facilitate multiple work space/furniture layouts.

Open plan offices shall be provided with power to systems furniture or receptacles within working space as required; in general an allowance for two (2) duplex receptacles for each work station should be included.

Multi-function printer/scanners will be provided with dedicated receptacles fed from dedicated electrical circuits. Other printers, scanners and office equipment shall be provided with the quantity and type of receptacle as necessary to support the associated equipment.

Dedicated receptacles and circuits will be provided for each of the telecommunications racks as well as server room racks.

Receptacles installed within 1.5m of any water supply shall be protected by ground fault circuit interrupter either integral to the receptacle or in the overcurrent protection device supplying it.

Power shall also be provided to architectural, mechanical, security, intrusion alarm and other SEC devices as necessary via receptacles or direct connection to the associated equipment.

#### *3.3.1.4 Fire Alarm Systems*

A multiplexed addressable fire alarm control panel complete with LCD annunciation shall be provided for the building. SEC's spaces will be provided with appropriate signaling and initiating devices per the space function and use.

The server room/data centre shall have a standalone system integrated with the dedicated fire protection system. It shall be complete with control panel, initiating devices, signaling devices, manual activation controls, and manual override controls.

#### *3.3.1.5 Lighting Control Systems*

The interior SEC lighting shall be controlled by a lighting management system that includes computer-based software for control, configuration, monitoring, alerting and reporting of the lighting system. The lighting control system shall provide addressable zone lighting control.

The lighting control system shall have the ability to interface with the building automation system via standard communication protocol such as BacNet. The lighting control system shall also have the ability to interface with control systems and auxiliary equipment such as audiovisual (AV) control systems (Crestron), motorized shades, fire alarm system, security system and emergency power distribution system.

Control for the interior lighting system shall be provided by a number of sources including occupancy sensors, time clock, daylight sensors and local switching.

Areas with access to natural lighting shall be controlled via daylight sensors which will control the light output (dimming control) of the electric lighting system within the control zone. This may include but is not limited to individual office spaces, open office spaces and meeting room spaces.

Occupancy sensors shall be provided for lighting control in washrooms, private offices, remote telecommunications rooms (RCR), main electrical room, RERs and other services and storage spaces (excluding mechanical rooms).

Multiple controls may be provided in a number of locations depending on the use and access to natural lighting. This may include time clock control, occupancy sensor control, daylight sensor dimming control and manual control.

Lighting control panels and central control equipment shall be located in the remote electrical room in SEC's space.

**Figure 3-14: Proposed Lighting Control Methods**

| Space | Control Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Time Of Day Control | | | Manual Control | | | Occupancy Control | | Daylight Sensor | |
| | On | Off | Dim | On | Off | Dim | On | Off | On/Off | Dim |
| Administration and Private Offices (interior) | | | | X | X | X | | X | | |
| Administration and Private Offices (perimeter) | | | | X | X | X | | | | X |
| Corridors/Lobbies | X | X | X | | | | | | | X |
| Open Office Areas (interior) | | X | | | | | | X | | |
| Open Office Areas (perimeter) | | X | | | | | | X | | X |
| Multi-purpose Rooms | | | | X | X | X | | X | | X |
| Washrooms | | | | | | | X | X | | |
| Service Spaces | | | | X | X | | | | | |

### *3.3.1.6 Interior Lighting Fixtures*

The SEC area lighting power density (LPD) target is a LPD of 80 W/m², in order to be as efficient as possible while contributing towards credit EAc1 (Optimize Energy Performance) in the LEED rating system.

In order to minimize the overall lighting power density, lighting fixtures utilizing LED sources are proposed for the majority of lighting in the facility. Final fixture selection will be based on architectural layout, ceiling type and height, and room function. Most LED fixtures are capable of dimming without the extra cost of a specialty dimming driver, as is the case with fluorescent luminaires. The use of dimmable fixtures in association with appropriate controls will maximize energy savings obtained via daylight harvesting and user control.

A summary of the proposed fixture types and illuminance targets for various spaces in SEC's space is provided in the figure below. Exact fixture selection will be determined as the design progresses based on the architectural layout, ceiling heights, ceiling type, user requirements, and equipment layouts.

Note that the open office areas are identified with two (2) separate lighting levels, the base lighting in open office areas should meet the criterial for circulation spaces of 100 lux, while the higher lighting level of 300 lux shall be provided at the work surface (desk area). This can be accomplished through the use of a general overhead lighting system and task lighting at the individual work stations which provides both local control of lighting levels to the individual staff members as well as reduces the overall energy consumption of the general lighting system by not over-lighting the general open office area.

**Figure 3-15: Proposed Luminaire Types of Illuminance Targets**

| Space | Illuminance Target (Lux) | Proposed Fixture Type |
|---|---|---|
| Administration and Offices | 500 | Recessed or Suspended Semi-Direct LED |
| Corridors/Lobbies | 100 | Recessed LED Downlights<br>Recessed Semi-Direct LED<br>LED Cove/Accent Lighting |
| Open Office Areas | 100 (circulation spaces) 300 (task work surface) | Recessed or Suspended Semi-Direct Linear LED<br>LED Cove/Accent Lighting<br>LED Task Lighting |
| Multi-purpose Rooms | 300 | Recessed Linear LED |
| Washrooms | 100 | Recessed LED Downlights<br>Wall-mount LED Vanity Fixtures |
| Service Spaces | 200 | LED Linear Strips |

### *3.3.1.7 Emergency Lighting*

Exit lighting shall be provided along egress routing and exit doors to meet the requirements of the National and Regional Assembly requirements. This will be in the form of central battery-inverter cabinets which will power selected light fixtures throughout the building during a utility outage. These central inverters will be located in electrical rooms only and sized for a minimum of 90 minutes of operation. Emergency-power light fixtures will be controlled in unison with the other fixtures in the area, but will default to 100% light output during a utility power failure or fire alarm condition.

Individual battery based emergency units will be provided in the RERs, RCRs, as well as SEC's server room. These units shall be in addition to the above-mentioned inverter based emergency supported luminaires.

#### *3.3.1.8 Exit Signs*

Exit lights will be provided, directing occupants towards building egress and at egress/exit doors. Exit units shall be cast aluminum, LED light source and have internal battery backup or integrated with the inverter based emergency lighting system.

### 3.3.2 SEC Fit-Up Structural Engineering Requirements

The structural loading requirement for SEC's space is anticipated to be consistent with normal office occupancy. However, the weight of the server room equipment should be reviewed and should consider supplemental support, depending on the final configuration and point loads. Where heavier loads are identified, drops around columns or slab bands/beams can be placed in the concrete floor plates.

### 3.3.3 Mechanical

In this section, we provide an introduction to and summary of building mechanical systems under consideration for SEC's fit-up within the proposed building.

SEC's space comprises of private office space, meeting rooms, open office space, storage, washrooms, utility spaces and data centre. The proposed HVAC system that serves SEC's space will be provided by the base building system. All mechanical systems will be designed and documented to achieve conformance with the latest version of ASHRAE 55, Thermal Comfort Conditions for Human Occupancy.

The feasibility assessment identifies the minimum performance considerations and potential solutions for the base building mechanical systems. The mechanical systems will consist of HVAC systems and plumbing (including hot and cold domestic water, grey water, storm water and sewage).

**Figure 3-16: Project Location - Accra**

| | |
|---|---|
| Latitude | N 5.6° |
| Longitude | E 0.2° |
| Elevation | ~27 meters |

Figure 3-17: Exterior Design Conditoins - Closest ASHRAE Location: Accra

| Heating |
|---|
| Heating Design, ASHRAE 99.6%: 68°F DB |
| **Cooling** |
| Cooling Design, ASHRAE 0.4%: 91°F DB, 80°F MCWB |
| **Evaporation** |
| Evaporation Design, ASHREE 0.4%: 84°F WB, 88°F MCDB |
| **Dehumidification** |
| Dehumidification Design, 0.4%: 83°F DP, 86°F MCDB |

Figure 3-18: Interior Design Conditions

| | Temperature Dry Bulb, ºF | | Relative Humidity | | Noise Criteria |
|---|---|---|---|---|---|
| | Winter | Summer | Winter | Summer | |
| **All public and office spaces:** | 68 - 72 | 74 - 78 | No lower limit | Max 65% | Private: 30<br>Open: 35 |
| **Washrooms:** | 68 - 72 | 74 - 78 | No lower limit | Max 65% | 45 |
| **Utility Spaces** | 68 - 72 | 76 - 85 | No lower limit | Max 65% | >45 |

### 3.3.3.1 Interior Heat Gain

The building's interior heat gains from occupants, lights, computers and other plug-in equipment is important for determining the total energy consumption in the building, sizing the cooling plant and making a determination on the most appropriate HVAC system type. Internal heat gains are based on information about the building spaces and ASHRAE recommendations. Currently, the following values are assumed, as summarized in the two (2) figures below.

Figure 3-19: Interior Heat Gain Assumptions

| Space Type | Lighting Power Density (W/ft$^2$) | Electrical Equipment Power Density (W/ft$^2$) | People (ft$^2$/person) | Ventilation | |
|---|---|---|---|---|---|
| | | | | per person (CFM/ person) | per ft$^2$ (CFM/ ft$^2$) |
| **Cafeteria/Lunch** | 1.2 | 0.25 | 15 | 7.5 | 0.18 |
| **Offices** | 1.1 | 1.67 | 75 | 5.0 | 0.06 |
| **IT Room** | 1.5 | 65.38 | 200 | 0.0 | 0.06 |
| **Janitor's Closet** | 1.5 | 0.00 | 0 people | 100.0 CFM | 0.00 |
| **Washrooms** | 1.2 | 0.00 | N/A | 75 CFM/fixture | 0.00 |
| **Storage** | 1.5 | 0.25 | 200 | 0.0 | 0.12 |
| **Vestibule** | 1.5 | 0.00 | 0 people | 0.0 | 0.06 |

Figure 3-20: Occupant Loads

| | |
|---|---|
| Per Person Heat Gain:<br>(General office activity) | 200 Btu per Person Sensible, 250 Btu per Person Latent |

### 3.3.3.2 Ventilation Rates

Ventilation rates are determined for peak occupant density based on the requirements of ASHRAE standard 62.1 –2014.

### 3.3.3.3 Design Intent

The building mechanical systems will be designed to achieve flexibility, a high level of energy efficiency, longevity and occupant comfort/safety. The quality of materials, fixtures, and workmanship employed are of high importance. Equipment that can be locally purchased and maintained will be utilized. The system design and installation is to ensure safety of all personnel during operation and maintenance of the equipment, provide ease of maintenance of equipment which can be serviced by non-specialized personnel, be compatible with the other design elements, and provide flexibility as well as expansion and future growth allowance.

The building is targeting certification under the LEED Green Building rating system. This requires exceptional performance in almost all of the categories described in Section 2.2.4 of Chapter 2 and Chapter 5. Specific targeted points are documented elsewhere in this report but of particular concern to the building mechanical systems will be the measurement and verification, energy efficiency of the HVAC system, water efficiency and associated fixture selection as well as building system commissioning related credits.

### 3.3.3.4 Applicable Building Codes and Standards

The following is a list of the most relevant codes and standards applicable to the building:

- National Building Regulations, 1996. L.I.1630
- NFPA – Applicable sections of the National Fire Protection Association (NFPA) standards
- NFPA 10 – Standard for Portable Fire Extinguishers
- ASHRAE – American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE), Handbooks
- ASHRAE Standard 62.1-2007 – Ventilation for Acceptable Indoor Air Quality
- ASHRAE Standard 55-2007 – Thermal Environmental Conditions for Human Occupancy
- ASHRAE/IES Standard 90.1-2012 – Energy Standard for Buildings except low rise residential
- SMACNA - Applicable sections of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) standards
- LEED – Leadership in Energy and Environmental Design Green Building Rating System, Version 4.

### 3.3.3.5 Building Heating, Ventilation, and Air Conditioning Systems

**Heating**

No heating is required for this facility.

**Ventilation**

Ventilation systems for SEC's space will be supplied from the base building ventilation system and designed to meet the requirements of ASHRAE 62.1 and SEC specific layout requirements.

Sanitary exhaust will be provided as required by ASHRAE 62.1. All washrooms, janitor's closets, dedicated copy rooms, storage rooms and kitchens shall be served by dedicated exhaust fans. 75 cfm of sanitary exhaust will be allowed from every water closet, urinal, service sink and shower.

**Air Conditioning**

Space cooling will be achieved through a variable refrigerant flow (VRF) ductless split air conditioning system supplied by the base building. Refrigerant piping connects the condensing units to fan coil units serving each space. These fan coil units can be wall or ceiling mounted, or concealed and ducted.

Cooling for electrical and IT/Server rooms shall also be achieved through the VRF system.

**Humidification Systems**

Humidification systems are not anticipated for the SEC building area.

#### *3.3.3.6 Building Control System*

SEC's space will be controlled by the base building, building management direct digital control (DDC) system. The DDC system will consist of a network of standalone application specific and building controllers connected to new electronic devices.

The control system will interface with the air source heat pumps and provide energy monitoring of the building HVAC systems.

#### *3.3.3.7 Plumbing Fixtures*

Domestic plumbing fixtures will be water conserving type in order to minimize water consumption, associated cost, associated sanitary waste flow and to help achieve the LEED related water efficiency credits in the event that this is required. It is assumed that the majority of the washroom facilities will be provided in the base building common areas.

Water Closets

- Water closets to be wall mounted flush valve type with dual flush (6LPF/4.3LPF) operation and a minimum MaP test rating of 800.
- Water closets will be barrier-free[2] where required.

[2] Barrier free is a terminology frequently utilized in international building codes/standards and reflects a design/construction approach that facilitates approach, entry and/or use by a person with physical or sensory disabilities.

Lavatories

- Lavatories will be vitreous china semi counter type with sensor operated faucets and low water consumption aerators.
- Lavatories will be barrier free where appropriate.

Urinals

- Urinals will be wall hung, vitreous china ultra-low flow water flush type operating with 0.5 liters per flush.
- Urinals to utilize sensor operated flush valve controls for hands-free operation

Janitor's Sink

- Floor mounted terrazzo mop sinks will be provided complete with 12" high base, stainless steel end caps, and wall guard.

#### *3.3.3.8 Domestic Water System (Potable)*

The domestic water distribution system will be supplied by the base building system. All domestic cold water piping will be insulated with 1" (R3.3) thick fiberglass insulation. Exposed piping will be complete with a hammered finish Aluminium jacket or canvas. Concealed piping will be enclosed with all service jacket. Consideration will be given to self-adhesive jacketing products that provide mechanical protection and a robust vapour barrier.

#### *3.3.3.9 Domestic Hot Water*

Domestic hot water will be provided by electric water heaters and storage tanks within SEC's tenant space. All domestic hot water piping will be insulated with 1½" (R5) thick fibreglass insulation complete with vapour barrier and ASJ service jacket. Exposed piping will be complete with hammered finish Aluminium jacket or canvas. The distribution system will include recirculation of hot water back to the tank to ensure quick response at all the fixtures.

Using a solar domestic hot water system could be a viable means of reducing off site generated energy costs as an alternative to the proposed electric for the development.

The current proposed building solution however considers a photovoltaic system that occupies the majority of the usable rooftop area (in conjunction with allowances for rooftop mounted mechanical equipment) described elsewhere in this narrative.

With commercial office space being a very low consumer of domestic hot water a photovoltaic system will provide the most flexibility as any unused electricity could be sold back to the power utility or used elsewhere in the facility.

In addition, if the solar domestic hot water system isn't appropriately sized to match the proper load profile, there may be excess heat within the system that will have to be rejected by other means leading to losses in on site energy generation potential as well as maintenance issues. This is especially of concern in low volume users such as the proposed SEC space.

To permit the possibility of utilization of both a solar hot water system in conjunction with photovoltaic system, hot water supply and return piping could be run during construction from the domestic hot water storage tank location to the roof and capped at both ends for future use. As the SEC space is further occupied as staffing levels increase and domestic hot water usages increases, solar hot water panels and hot water storage could be added to meet the hot water loads without disrupting the tenant space.

#### *3.3.3.10 Fire Protection Systems*

The building and SEC's space will not include a dedicated sprinkler system. A dedicated dry chemical fire protection system shall be included for the Server Room within the SEC area including all associated initiating, signalling and suppressant supply devices. The system shall also be equipped with a manual release function as well as a manual/emergency off pushbutton located within the server room. Fire extinguishers shall be provided to the requirements of NFPA 10 and the local authorities having jurisdiction.

### 3.3.4 Security

#### *3.3.4.1 Physical Security – SEC Space*

SEC's space will be contained within the confines of the proposed building. Entrance/exits and doors determined to be required to be secured should be fitted with electronic contacts which should be tied to an Electronic Access Control System (ACS). These contacts can be hard-wired using structured cabling (e.g. CAT 6) or wirelessly routed to the network.

The ACS is a software-driven system which utilizes identity credentials to provide access to those who have permission to certain areas and limit access to those who do not. The process is to present an ID card to an ACS reader located at the entry point and have it vetted by the software before allowing or denying ingress. All doors providing ingress and egress to SEC's space should be equipped with an ACS reader or a door contact which will notify the operators of the system whenever they are opened (along with being forced, left open, etc.). Doors and applicable gates and doorways in the parking areas of the base building in which SEC will have access to should be compatible with SEC ID cards and managed through the proponent security system.

In association with the ACS, there should also be a Digital Video Management System (DVMS). The DVMS controls the video surveillance function by receiving the video feeds from closed-circuit television (CCTV) sensors throughout the complex and pulling them back to a central viewing platform. Both the ACS and DVMS can be integrated to allow for automated notification of 'alarm events,' and used to be proactive to possible breaches by enhancing coverage that a human operator cannot do in isolation.

Based on current and trending product enhancements, the CCTV utilized should be digital and where applicable make use of High Definition (HD) resolution. The use of panoramic, thermal, and/or infrared (IR) technology is recommended based upon the requirements of the specific location. For both the ACS and DVMS, products which are ONVIF[3] compliant should be chosen to

[3] ONVIF http://www.onvif.org

ensure ease of integration. As risk factors are not abnormally high, a Commercial Off-The-Shelf (COTS) system would be more than sufficient for both the ACS and DVMS.

As a separate entity, it will run its own security and as such should have its own standalone versions of ACS and DVMS systems. If there is a requirement (whether mandatory or desired) for the general complex and SEC to share some or all of the access control and/or video surveillance information, deployment of similar ACS and DVMS systems for both areas should be considered to facilitate that process. At a minimum, doors and applicable gates and doorways for the building entrances, elevators and in the parking areas of the base building in which the SEC will have access to should be compatible.

Per the description for the general complex, SEC's space should have equivalent door hardware and sensors as well as CCTV to cover its sensitive areas. To further enhance the security of SEC's specific areas, a 'two-factor' identification should be deployed (two verification methods to validate authorized access). As SEC is currently using a fingerprint scan for sensitive areas, the deployment of an ACS ID card containing this information will afford SEC the additional rigor to limit access to even a limited number of its own employees.

Security Personnel

It is not currently anticipated that the SEC itself requires dedicated security personnel, overall building security will be provided and controlled through the base building security personnel and systems.

### 3.3.5 SEC Telecommunications

A telecommunication cabling and raceway system will be provided for SEC's space, generally including but not limited to, racks (wall and/or floor mounted), cross connects, patch panels, BIX blocks, cable management, grounding, cable pathways, horizontal cabling, backbone cabling, line and patch cords, MDVOs and outlets. Active components including switches and phone systems (i.e. Centrix) are not included.

SEC's telecommunications will include a complete cable pathway and management system from the work outlets to SEC's server room/data centre including outlet boxes, conduit, cable trays, pull boxes, and cable management.

Telecommunications racks shall be industry standard 19" racks, floor mounted, complete with rack mounted power distribution bar and on-line UPS system sized to accommodate the SEC supplied active equipment for a minimum of 20 minutes of operation.

The telecommunications system will be standards compliant provided by a single manufacturer and backed by a 25-year manufacturer's warranty.

#### *3.3.5.1 Telecommunications Room*

SEC's main telecommunications room shall be integrated with the Server Room/Data Centre, house the horizontal cabling system termination sub systems, and shall serve as the connection point between backbone cabling and horizontal cabling. It shall house distribution and backbone cabling, distribution and backbone cross connects, telecommunications racks, rack and wall mounted hardware as well as telecommunications equipment (patch panels, switches, network equipment, etc.) as well as all SEC server equipment. The room shall be located as required such that no horizontal cabling length exceeds a total of 90m in length. The Server Room/Data Centre shall be provided with an on-line UPS suitably sized to support the operation of the SEC Data Centre equipment for a minimum of 20 minutes of continuous service. The UPS shall be expandable and equipped with a maintenance bypass switch to facilitate maintenance without interruption in the normal utility supply to the equipment.

A second communications room RCR is to be provided and supplied from the main telecommunications room with backbone cabling. The RCR shall house horizontal cabling system termination sub systems, and shall serve as the connection point between backbone cabling and horizontal cabling. It shall house distribution and backbone cabling, distribution and backbone cross connects, telecommunications racks, rack and wall mounted hardware as well as telecommunications equipment (patch panels, switches, network equipment, etc.). The room shall be located as required such that no horizontal cabling length exceeds a total of 90m in length. The RCR shall be sized in accordance with EIA/TIA 569-A recommendations based on the area in which it serves. The RCR shall be complete with 19mm thick plywood backing painted with two coats of fire-retardant paint on a minimum on one (1) wall. The RCR shall have a minimum of 2.44m clear height with no finished ceiling and minimum 915mm wide door.

Figure 3-21: Proposed RCR Size

| Usable Floor Area Served | Room Size |
|---|---|
| 1000 $m^2$ | 3.0m x 3.4m |
| 800 $m^2$ | 3.0m x 2.8m |
| 500 $m^2$ | 3.0m x 2.2m |

#### *3.3.5.2 Data System*

**Backbone Cabling System**

Data system backbone cabling system shall consist of hybrid fiber optic cabling and a minimum of two (2) CAT6 copper cabling originating in the floor area RCR. Fiber optic cabling shall terminate in fiber patch panels located in floor mounted telecommunications racks in the data centre/server room. Separate internal SEC system backbone shall interconnect the datacentre/server room with the RCR.

**Horizontal Cabling System**

Data system horizontal cabling system shall be a physical star topology and consist of CAT6A standards compliant copper cabling and termination equipment and distributed to the work area outlets throughout the SEC space.

In general, two (2) data cables will be provided to each office and work station location. The horizontal cabling system includes horizontal cables, work area outlet connections and all terminations, connections and patch cords.

The location of the horizontal cabling shall be separated from pathways and spaces that generate electromagnetic interference (EMI). Horizontal cabling shall not exceed 90m in total length in compliance with the Category 6A standards. Cabling shall be terminated in patch panels in the Server Room/Data Centre, RCR and MDVOs at the work area location.

### 3.3.5.3 Voice System

**Backbone Cabling System**

Voice system backbone cabling system shall consist of multi pair unshielded twisted pair copper cabling originating in the floor level RCR and distributed to the SEC Server Room/Data Centre or RCR. Voice backbone cabling shall be terminated in wall mounted BIX blocks and connected to the SEC provided PBX voice system. Note this assumes the SEC does not transition to a Voice over Internet Protocol (VOIP) phone system. Should this occur, no separate dedicated phone backbone or horizontal cabling system would be required.

**Horizontal Cabling System**

Voice system horizontal cabling system shall consist of CAT6A standards compliant copper cabling and termination equipment distributed to the work area outlets throughout the building. In general each office and work station will be provided with two (2) voice outlets and associated cabling infrastructure.

The horizontal cabling system includes horizontal cables, work area outlet connections and all terminations, connections and patch cords. The location of the horizontal cabling shall be separated from pathways and spaces that generate EMI. Horizontal cabling shall not exceed 90m in total length in compliance with the Category 6A standards. Cabling shall be terminated in patch panels MDVOs at the work area location.

# 4 Building Options, Minimum Performance Standards and Technical Requirements

## 4.1 Introduction

This chapter provides a thorough and integrated assessment of the building requirements and technical parameters, and articulates the relevant technical parameters, specifications and requirements as related to Building Architecture; Site Development; and Engineering Systems. This is developed alongside the relevant regulations and approvals, and with consideration to achieving compliance with LEED Certification scoring criteria.

All design, products and construction work for the facility must meet or exceed all applicable codes, regulations and standards including, but not limited to, latest editions: the Ghana Water Company Limited (GWCL), The Ghana National Building Regulations, The Town and Country Planning Department of Ghana, Ghana Standard Code of Practice, local Occupational Health and Safety Act, the National Fire Protection Association (NFPA), ULC, CSA, American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE), American Association of State Highway and Transportation Officials (AASHTO), Manual on Uniform Traffic Control Devices (MUTCD), and all local Accra municipal building by-laws.

All products and work are to be barrier-free, and designed to Accessibility to the Built Environment by-law. The design shall meet all local and applicable Department of Environment and Labour standards and conform to the standards and codes of other regulatory agencies, from which approval may be necessary.

## 4.2 Site Development Constraints

Based on the information provided by SEC, the existing site is zoned for commercial (educational) land use. Whilst one of the potential building uses envisaged is primarily commercial, the market sounding and information gathered indicates that there is a strong possibility that bidders would include residential development in the new complex, which has been included in the feasibility assessment. As such, a re-zoning of the site would be required to allow for this mixed use development, which would be done through La-Dadekotopon Municipal Assembly (LaDMA).

Additional restrictions for development of the site generally include the following:

i. Maximum building height – 24m, as determined by Ghana Civil Aviation Authority (GCAA)

**Airspace Safety Permit**

The GCAA has issued an Airspace Safety Permit to the SEC, on 10$^{th}$ February, 2016, for the proposed building in Cantonments, Accra. Following an aeronautical study conducted by the GCAA, it was concluded that the proposed structure would not have a substantial adverse effect on the safe and efficient use of navigable airspace, conditional on the adherence to a set of specified provisions. These provisions are summarized as follows:

i. The structure's height shall not exceed 24m (78.72ft) above ground level;
ii. The structure shall be provided with any mandatory obstruction marking and lighting, and perpetually maintained in accordance with lighting guidance provisions; and
iii. The determination is contingent on the specified coordinates and heights of the structure.

ii. Maximum site development – 75% of the total site area
iii. Minimum development set backs – 5m from all property lines
iv. Minimum excavation distances – 3m from all property lines (special cribbing may be required if excavation is closer to property lines to prevent undermining of adjacent property and structures

Measures that are subject to local authority approval include the following:

i. Approval of final building development drawings by LaDMA
ii. Number of parking spaces required subject to traffic impact study and approval
iii. Location of noise generating equipment such as electrical generator or air conditioning equipment to mitigate noise migration to adjacent properties

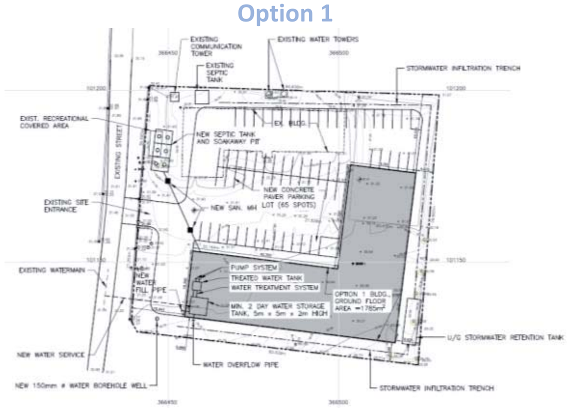
## 4.3 Architectural Systems

### 4.3.1 Site Development Options

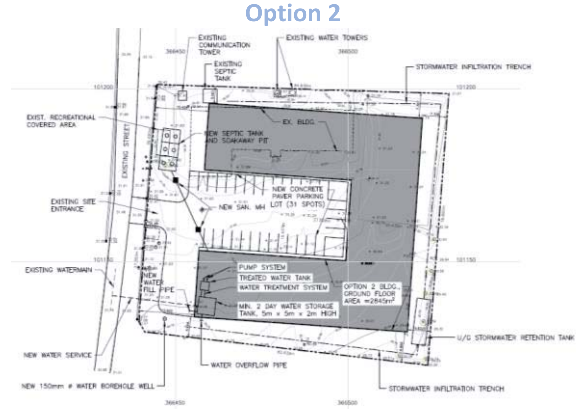
At the pre-feasibility level, two possible building options (see figure below) were considered for market consultation purposes with potential private developers and other relevant stakeholders.

**Figure 4-1: Pre-Feasibility Options**

Option 1



Option 2



Both options have an assumed floor to floor height at the ground floor to Level 2 (floor immediately above the ground level) of 4.0m. The remaining floor to floor heights are assumed to be 3.67m. This would place the assumed roof structure elevation at 22.35m above the ground floor, which is under the maximum height of 24m above ground level permitted by the GCAA. The remaining 1.65M is required for building features that extend beyond the roof structure, as described in Section 4.3.3 below.

The first presented option was an L shaped building (Option 1 in Figure 4-1) consisting of a ground floor area of 1,785 SQM or a building footprint that is approximately 30% of the total site area (of 6361.4m$^2$) and a total building gross floor area of 10,710 SQM.

The second option presented was a U-shaped building (Option 2 in Figure 4-1) with an open courtyard facing the street. The proposed building consists of a ground floor area of 2,845 SQM or a building footprint that is approximately 45% of the total site area (of 6361.4 SQM) and a total building gross floor area of 17,070 SQM.

Based on the feedback received from SEC and the Project Delivery Team, it was understood that Option Two (2), the larger of the two (2) presented options, was preferred and a request was made for the Project Team to examine opportunities to further enlarge the building.

At the pre-feasibility level it was recommended by the Project Team that, while the allowable site coverage is up to 75% of the total property area, the realistic development density for the site is less than this at 2,845 SQM. This recommendation was based on the following commercial and technical assessments:

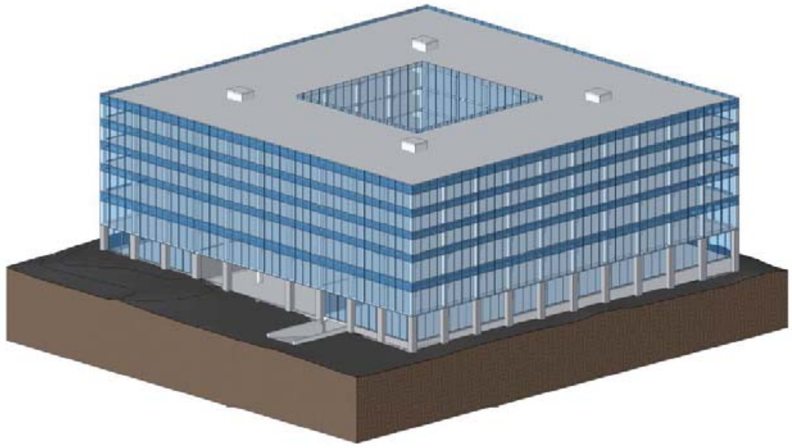
i. Assessment of adjacent properties;
ii. Relative massing of the building so that it will 'fit' on the site;
iii. Allowing for sufficient space for site services such as the septic system, bore hole(s), entrance/exits, driveways, surface parking, mechanical equipment and service access space and;
iv. Technical feasibility of excavating and constructing within the site perimeter.

A further assessment of the development density at the feasibility level of SEC's site area has increased the proposed development from the pre-feasibility level. The overall proposed site development footprint has increased from 2,845 SQM at pre-feasibility to 3,296 SQM as presented in this report or 51.8% of the total site (see Figure 4-2 below). This has brought the total building gross floor area from 17,070 SQM to 19,325 SQM[4] or an increase of approximately 13%.

This reflects an overall increase in the proposed site development area of 451 SQM or 15.8% (noting that the ground floor maintains the 2,845 SQM footprint as previously presented in the pre-feasibility stage for the reasons presented above). Subgrade development for the parking levels is proposed to be at the full size of the building perimeter which is 3,844 SQM however this would not necessarily need to be included in the overall site development assessment, as it would fall below grade and maintains the required setbacks from the property lines and facing street.

[4] It is noted that a building volume option of 20,000 SQM was requested from SEC and the Project Delivery Team following the submission of the pre-feasibility report.

Figure 4-2: Feasibility Stage Proposed Development – 3D View Looking Northeast



Source: CPCS

### 4.3.2 Note on Surrounding Developments

An important consideration in the determination of the overall site development density is the surrounding developments. Cantonments, Accra is not an urban high density/high rise development area and adjacent properties maintain a moderate setback from the property boundaries as well as the main road. The setbacks and overall development area proposed for the building footprint are very much respective of the medium density residential development on which this site is located.

This is evidenced in the figure below, where an aerial image of SEC's site and surrounding developments are presented. Structures are demarcated in green, while related perimeters are shown in red, in order to provide an indication of building footprint relative to total site area. SEC's proposed accommodation was supplanted onto the image (in white) to give an indication of its footprint mass relative to site area.

Figure 4-3: Aerial Image of SEC's site and Surrounding Developments


From pre-feasibility to feasibility, the Project Team examined a number of options seeking to find a balance between maximizing development area without proposing a development option that was not realistic, given the surrounding context. Whilst a larger development footprint option was initially examined by the Project Team, it was ruled out due to a number of factors including the (i) overwhelming massing on the site; (ii) reduced site development areas for additional site features; and (iii) fit/feel of the building volume within the existing neighbourhood.

Ultimately, what the Project Team has provided is what is realistically anticipated a developer would be able to successfully develop, build and occupy while respecting adjacent developments. A review of the adjacent property development densities as a percentage of site development compared to the overall site area was conducted; the summarized assessment is provided in the figure below.

Figure 4-4: Site Development Summary

| Property ID | Site Area ($m^2$) | Building Site Area ($m^2$) | % Site Development |
|---|---|---|---|
| SEC Existing Accommodation | 6,361.4 | 691.0 | 10.9% |
| SEC Pre-Feasibility Option 1 | 6,361.4 | 1,785.0 | 28.1% |
| SEC Pre-Feasibility Option 2 | 6,361.4 | 2,845.0 | 44.7% |
| SEC Feasibility Option | 6,361.4 | 3,296.0 | 51.8% |
| Average of Nearby Sites 1 - 48 | 5206.2 | 1,424.7 | 27.0% |

| Property ID | Site Area ($m^2$) | Building Site Area ($m^2$) | % Site Development |
|---|---|---|---|
| **Summary of Individual Site Development Density for Nearby Properties** | | | |
| Site 1 | 8,157.0 | 2,757.0 | 33.8% |
| Site 2 | 1,418.0 | 389.0 | 27.4% |
| Site 3 | 923.0 | 320.0 | 34.7% |
| Site 4 | 887.0 | 328.0 | 37.0% |
| Site 5 | 5,826.0 | 2,221.0 | 38.1% |
| Site 6 | 5,255.0 | 1,796.0 | 34.2% |
| Site 7 | 6,689.0 | 576.0 | 8.6% |
| Site 8 | 6,910.0 | 846.0 | 12.2% |
| Site 9 | 2,655.0 | 289.0 | 10.9% |
| Site 10 | 7,725.0 | 667.0 | 8.6% |
| Site 11 | 3,795.0 | 1,558.0 | 41.1% |
| Site 12 | 5,444.0 | 1,780.0 | 32.7% |
| Site 13 | 2,609.0 | 482.0 | 18.5% |
| Site 14 | 2,695.0 | 1,318.0 | 48.9% |
| Site 15 | 6,300.0 | 2,763.0 | 43.9% |
| Site 16 | 3,225.0 | 835.0 | 25.9% |
| Site 17 | 11,497.0 | 5,817.0 | 50.6% |
| Site 18 | 4,556.0 | 1,858.0 | 40.8% |
| Site 19 | 6,497.0 | 3,221.0 | 49.6% |
| Site 20 | 2,388.0 | 643.0 | 26.9% |
| Site 21 | 2,835.0 | 800.0 | 28.2% |
| Site 22 | 4,411.0 | 2,172.0 | 49.2% |
| Site 23 | 2,228.0 | 465.0 | 20.9% |
| Site 24 | 5,396.0 | 1,677.0 | 31.1% |
| Site 25 | 11,447.0 | 592.0 | 5.2% |
| Site 26 | 6,652.0 | 416.0 | 6.3% |
| Site 27 | 6,583.0 | 354.0 | 5.4% |
| Site 28 | 4,992.0 | 484.0 | 9.7% |
| Site 29 | 3,044.0 | 1,017.0 | 33.4% |
| Site 30 | 3,267.0 | 1,379.0 | 42.2% |
| Site 31 | 888.0 | 313.0 | 35.2% |
| Site 32 | 1,229.0 | 400.0 | 32.5% |
| Site 33 | 6,444.0 | 571.0 | 8.9% |
| Site 34 | 4,648.0 | 713.0 | 15.3% |
| Site 35 | 2,044.0 | 686.0 | 33.6% |
| Site 36 | 5,123.0 | 320.0 | 6.2% |
| Site 37 | 6,781.0 | 728.0 | 10.7% |
| Site 38 | 1,273.0 | 586.0 | 46.0% |
| Site 39 | 3,735.0 | 520.0 | 13.9% |

| Property ID | Site Area ($m^2$) | Building Site Area ($m^2$) | % Site Development |
|---|---|---|---|
| Site 40 | 4,640.0 | 358.0 | 7.7% |
| Site 41 | 4,151.0 | 1,102.0 | 26.5% |
| Site 42 | 30,018.0 | 1,393.0 | 4.6% |
| Site 43 | 14,092.0 | 6,483.0 | 46.0% |
| Site 44 | 7,372.0 | 2,500.0 | 33.9% |
| Site 45 | 2,063.0 | 514.0 | 24.9% |
| Site 46 | 2,139.0 | 308.0 | 14.4% |
| Site 47 | 1,169.0 | 604.0 | 51.7% |
| Site 48 | 5,782.0 | 1,731.0 | 29.9% |

### 4.3.3 Building Height Options

The building height has been developed at the feasibility phase to identify a total of six (6) storeys above grade as well as three (3) levels of subgrade parking. The height above grade of the building was determined based on several key factors including: (i) to provide suitable floor to floor heights within the finished commercial/office and residential spaces; (ii) to have the building 'fit' within the context of the surrounding developments; and (iii) to fall within the height limitations set by the Ghana Civil Aviation Authority.

The primary legislative limit on building height is driven by GCAA, which conducted an assessment of the site to determine the maximum development height on the property necessary to maintain the required flight path safety clearances for the nearby Kotoka International Airport. Based on the completed assessment, the overall development height of the site is limited to 24.0 meters above ground level (AGL).

The topographical survey completed and provided by SEC has identified a grade elevation of approximately 32.6m. As such, the vertical elevation limitation imposed by GCAA is set 24.0m above this, which equates to an elevation of 56.6m. All development on the site needs to be contained within this vertical limit. This includes all building features that extend beyond the roof structure.

Reasonable floor to floor heights have been assessed based on typical acceptable ceiling heights common in Ghana and other countries with similar commercial/office and residential spaces. The proposed building utilizes two (2) floor to floor height ranges to respect the different space functions and occupancies. Floor heights are given in ranges because of the multitude of floor combinations that exist between a full commercial and full residential building with the assumption that the ground floor remains for retail use.

The retail floor to floor dimension ranges between 4m and 4.2m, the office floor to floor ranges between 3.8m and 4.2m and residential floor to floor ranges between 3.2m and 3.67m. The difference in ceiling height versus floor to floor height is resultant of allowances for the building structural floor elements as well as the service space required for electrical, plumbing and HVAC distribution and equipment.

The building ground floor elevation has been set at 32.0m based on the floor to floor height requirements as well as the overall site grading/profile. The topographical survey indicates that the maximum elevation is 32.6m and minimum elevation is 29.3m with the site generally sloping from north to south. A ground floor elevation of 32.0m allows for site development to facilitate natural drainage away from the majority of the building perimeter and allows for the development of the proposed six (6) level development within the vertical development limit.

At the pre-feasibility stage, it was requested that a seventh floor be added, by assuming the floor to floor height on the first two floors was 3.7m, and the remaining four floor to floor heights at 3.2m. Thus, another floor with a floor to floor height of 3.2m could be added, bringing the total height of the building to 23.4m.

Although it may be possible to include an additional seventh floor by reducing floor to floor heights, this is not recommended for several reasons, as presented below.

1. Allowances have to be made for building features that extend beyond the floor structure which include:

    a. Elevator overruns – Elevators need to project through the roof according to both manufacturer's requirements and safety code requirements;

    b. Stairwells for roof access for service and maintenance personnel and equipment;

    c. Aviation warning lights;

    d. Mechanical HVAC equipment;

    e. Solar photovoltaic panels and;

    f. Building elements such as parapets;

    Typically, 1.5m to 2.4m in allowances are required for these additional elements above the roof structure, limiting the building height to between 21.6m and 22.5m.

2. The existing buildings in the surrounding context area of Cantonments should also be respected. While the majority of the existing developments within the surrounding area of SEC site are limited to two (2) or three (3) levels above grade plus pitched roof structure, some of the newer developments, including those directly adjacent the SEC property, are increasing in height above grade beyond the three (3) levels. This recent trend in higher vertical development than traditionally seen in this area, further supports the proposed 6 level development.

3. Floor to floor heights less than those identified above may make the space less desirable to potential tenants in both the commercial/office and residential spaces, additional floor levels will also require extra parking associated with the additional space, which has technical constraints, as further described in Section 4.3.4.

The building sections contained in pages 68 and 69 illustrate these floor to floor dimensions and building height limits.

### 4.3.4 Sub-Grade Parking

At the pre-feasibility level, it was assumed that a total of two (2) sub grade parking levels could be accommodated in the development before logistical challenges such as ground water and specialized building structural elements and excavation would be required. Furthermore, the size of each floor of underground parking was confined to the building footprint of 2,845 SQM, culminating in a total of 110 underground parking bays.

A geotechnical study was conducted which assessed the ground conditions as well as level of ground water at multiple locations across the site. A copy of this geotechnical investigation is included in the Appendix B. The geotechnical investigation identified the location of ground water at the time that the bore hole sampling took place as well as the level of water below the grade elevation approximately 24 hours afterwards. A summary of the investigation results is provided in the figure below.

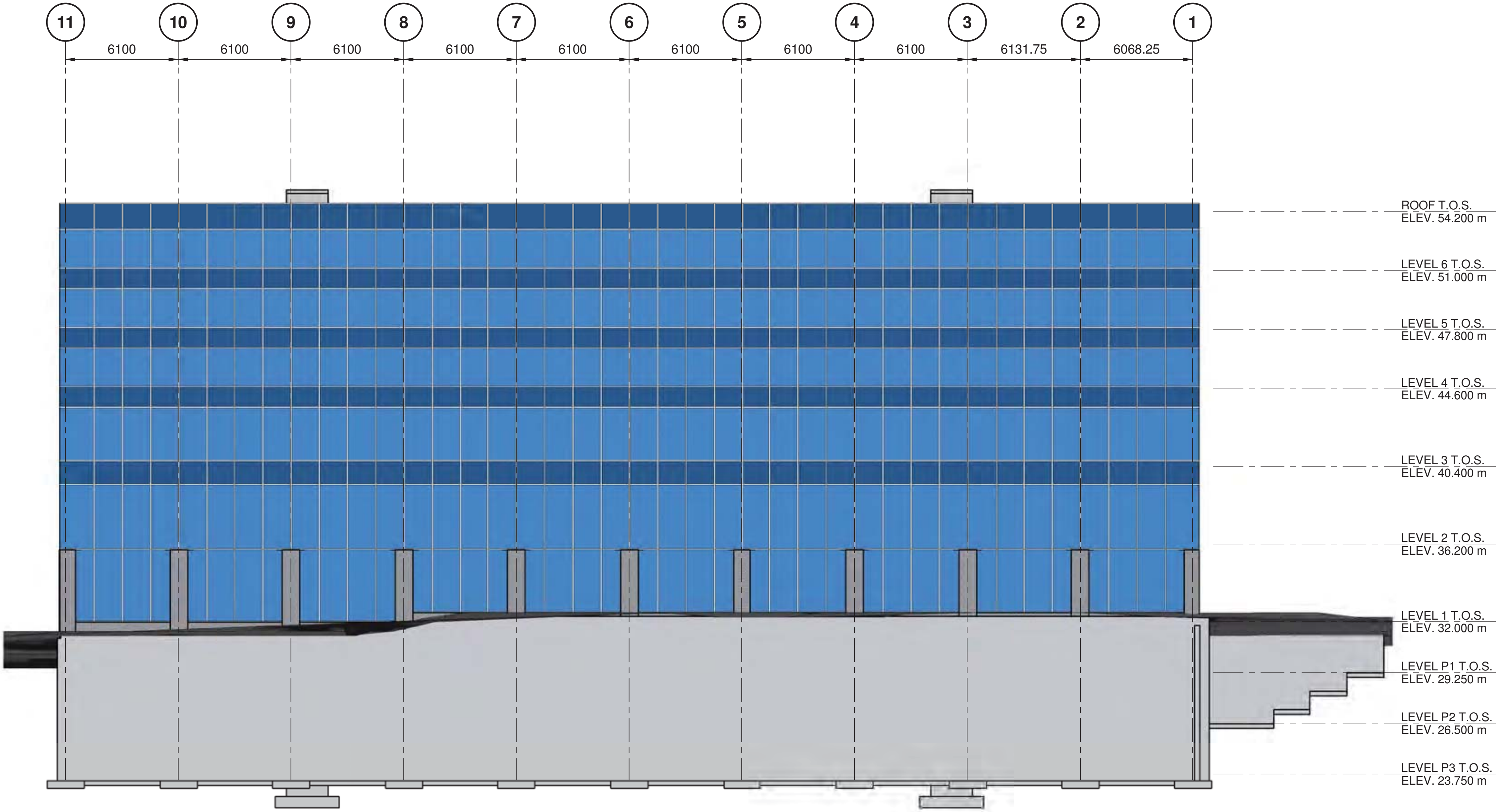
Figure 4-5: Borehole Summary from Geotechnical Investigation of SEC's Site

| Bore Hole ID | Surface Elevation (m) | First Water Strike Depth (m below grade) | Water Level after 24 hours (m below grade) | Water Level relative to P3 Floor Elevation |
|---|---|---|---|---|
| 1 | 30.9 | 9.0 | 10.2 | -3.1 |
| 2 | 29.5 | 6.0 | 7.3 | -1.6 |
| 3 | 31.0 | 6.0 | 8.5 | -1.3 |
| 4 | 31.1 | N/A | 8.7 | -1.4 |
| 5 | 31.9 | 10.0 | 6.7 | 1.5 |
| 6 | 31.2 | 8.2 | 8.6 | -1.2 |

Based on this investigation, and subsequent analysis, it was determined that it is feasible for a total of three (3) levels of sub grade parking to be developed assuming that there will be approximately 1.0m of water encountered during the excavation and construction of the base structural building elements.

Indeed, dewatering would be required until the building structure is completed to the level of existing grade (approximately 32.0m) in addition to foundation waterproofing as well as sump and associated pumps to ensure long term mitigation of water ingress in the lower parking levels – all with an incremental capital investment relative to a scenario where ground water was not found close to grade.

However, the above solution does escape more specialized construction techniques (which would add significant incremental capital costs to the building structural elements) should ground water have been located closer to the surface. Had this been the case, additional watertight construction methodologies and rock anchors may have been required.



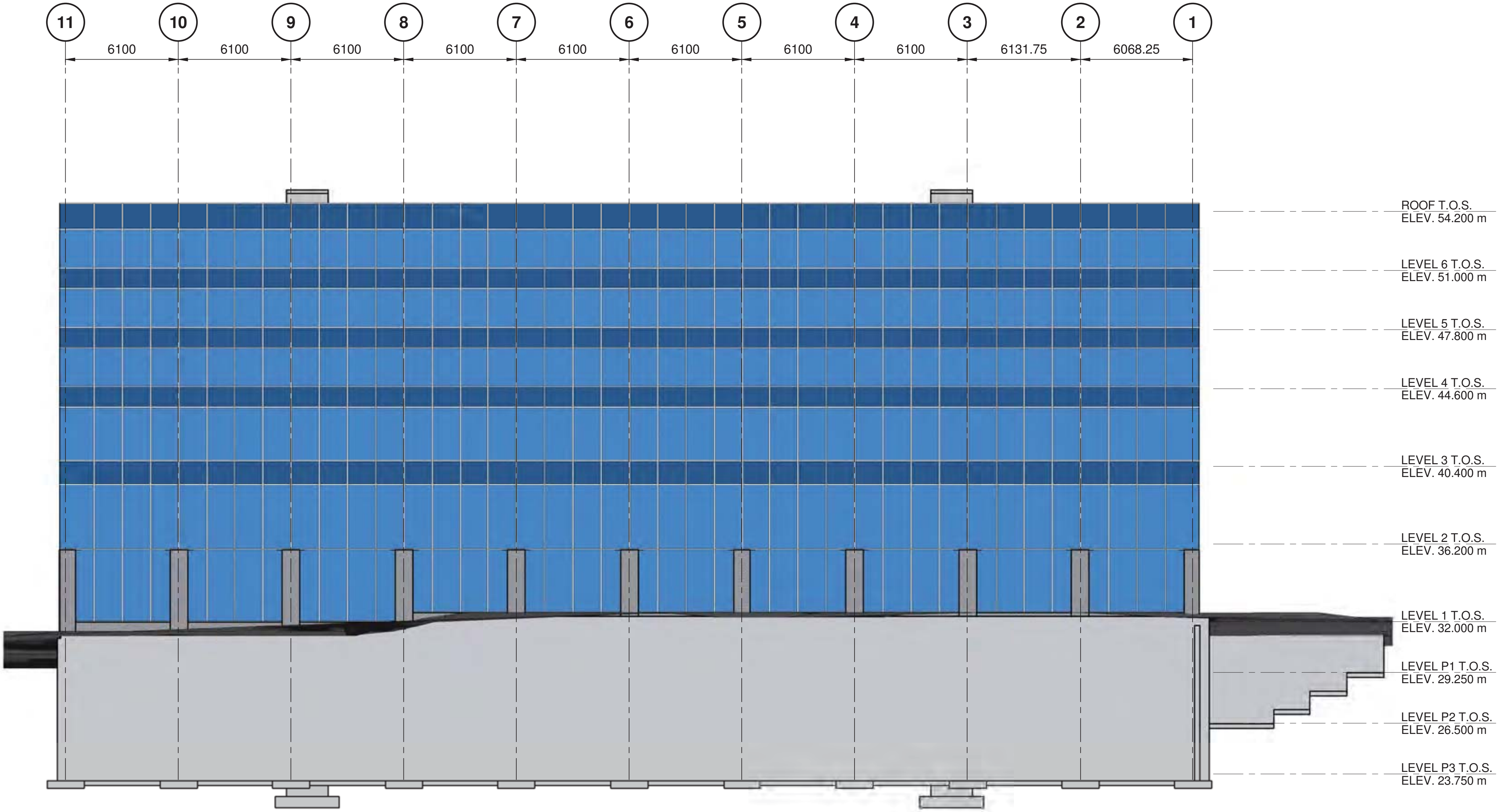

| Date | Scale | Designed | Drawn | Checked | Approved | CBCL No | Contract No |
|---|---|---|---|---|---|---|---|
| SEP 29/16 | 1 : 200 | | SWF | | | 150689.00 | |

CPCS IN ASSOCIATION WITH CBCL LIMITED Consulting Engineers

SEC ECO FRIENDLY OFFICE COMPLEX

NORTH ELEVATION

**SK10**




| Date | Scale | Designed | Drawn | Checked | Approved | CBCL No | Contract No |
|---|---|---|---|---|---|---|---|
| SEP 29/16 | 1 : 200 | | SWF | | | 150689.00 | |

CPCS IN ASSOCIATION WITH CBCL LIMITED Consulting Engineers

SEC ECO FRIENDLY OFFICE COMPLEX

NORTH ELEVATION

SK10

The proposed parking levels are based on the perimeter footprint of the overall building, which extends through the centre courtyard (see Figure 4-2 above). The total floor area per level is 3,844 SQM. The floor to floor heights have been determined to be 2.75m, this height allows for standard passenger vehicle traffic within the parking structure as well as allowances for sprinkler piping, drainage lines, plumbing services, ventilation, electrical services, lighting and structural elements that would support or be required to run through the parking structure. The total parking structure depth is approximately 8.5m below the building ground floor, with some excavation required below the lower level for foundations and footings. As the site slopes, the resultant excavation depth ranges from approximately 9.1m on the northern portion of the building footprint to 7.5m on the south eastern portion of the building footprint.

Approximately one hundred and eight (108) standard sized parking spaces can be accommodated in the parking area in addition to an allowance for a number of service spaces and equipment areas that will be used to service the building. Once there is an allowance for ramps between the parking levels and some inefficiency in final designs, a revised allowance of one hundred and four (104) parking spaces per level should be utilized in any further parking assessments (see Appendix C for typical sub-grade parking layout). For three levels of underground parking, this amounts to 312 bays with an additional 29 bays estimated in aboveground parking (see 4.5.1 Surface Parking).

In total, the proposed solution results in a feasibility estimate of 341 parking bays. For a building with a volume of 19,330SQM and with a net-leasable area of 15,464SQM, this results in 2.2 parking bays per 100SQM of leasable space. If it is assumed that 10% of the building will remain vacant for the duration of the concession (see discussion in Chapter 7, Section 7.5.4 for justification), the result is almost 2.5 parking bays per 100SQM of leasable space, less an assumed vacancy rate of 10%.

A separate vehicle entrance/exit with suitable parking control measures to facilitate monthly pass or pay station type service should be incorporated. The parking control will be complete with automatic gates and protective features to allow authorized vehicles to enter and exit whilst prohibiting unauthorized vehicles.

Protection and proper grading of the parking entrance will also be required to prevent surface water from entering the garage; this is assumed to include a series of trench drains on the entrance ramp as well as sloping of all site and access roadway away from the parking entrance ramp at a minimum of 2%. Additional a cover/canopy may be considered to further reduce the potential for site/surface water entering the garage.

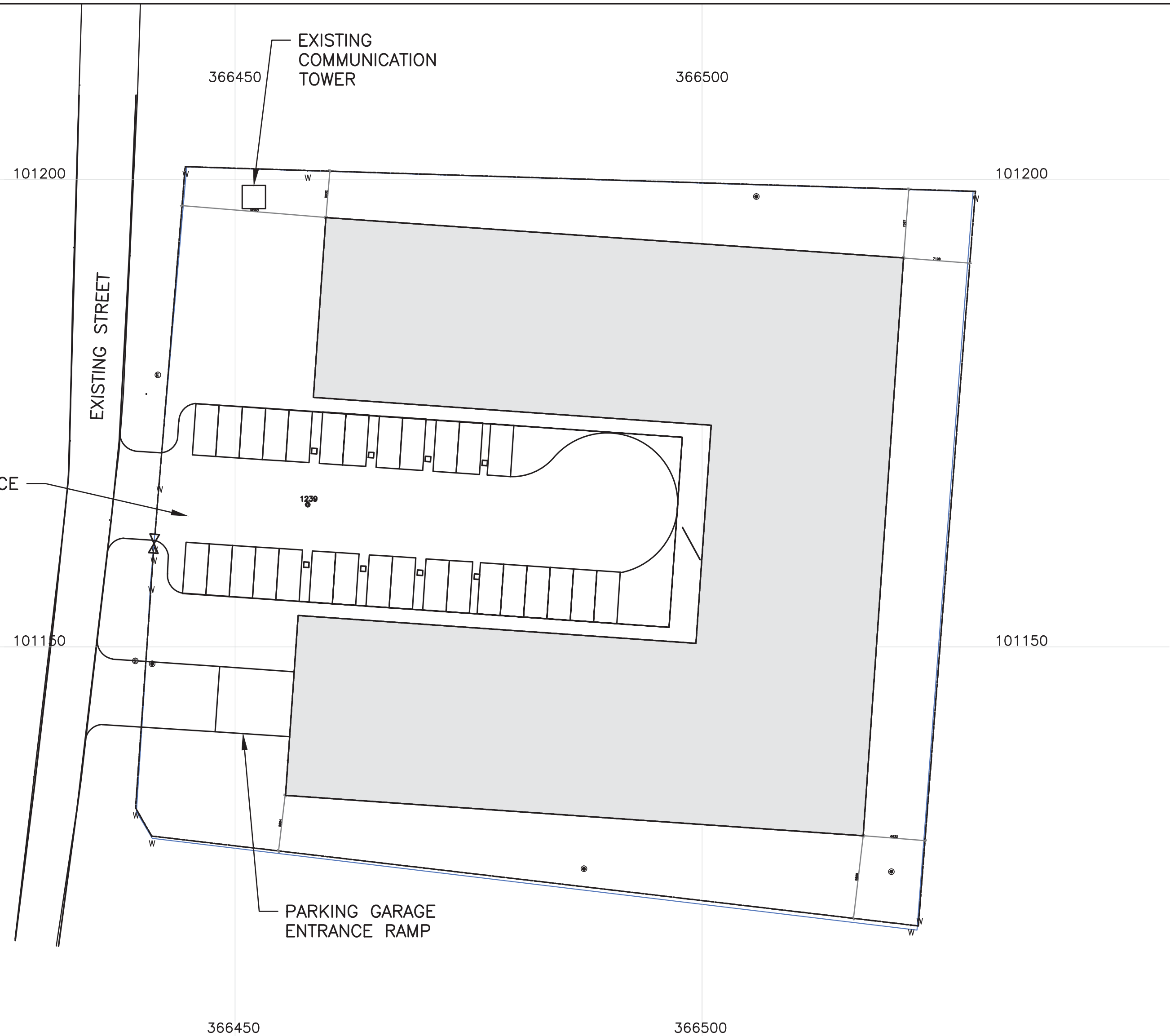
## 4.4 Building Architecture

### 4.4.1 Space Type Allowances

The building area for the proposed accommodation as illustrated on the following page, consists of a ground floor area of 2,845 SQM and five (5) upper level floors of 3,296 SQM each with a resulting finished gross building area of 19,325 SQM over the six (6) floors. Parking levels below are in addition to this.

The ground level is assumed to contain the lobby/lobbies (for the upper level functions, building common spaces, etc.). It is assumed to be flexible enough to permit a variety of uses to suit the neighbourhood and upper level uses such as commercial retail units (CRU) or 'line-shops' of various types, a possible multi-purpose convention centre, or other functions best suited to more public, ground level access and market demand as determined by prospective bidders.

At the feasibility level, the building-use occupancies for the upper five levels are assumed to be either all levels of general office space, suitable for a variety of tenants as either single tenant or multi-tenant floors, or a mixed-use with a combination of general office space and residential space. See Appendix D for assumed retail, general office and residential floor layouts.




# LEGEND

THESE STANDARD SYMBOLS WILL BE FOUND IN THE DRAWING.

- ○ MH (MANHOLE)
- BH (GEOTECHNICAL BOREHOLE)
- LP (LIGHT POLE)
- IL (INVERT LEVEL)
- Ⓔ E (ELECTRIC POLE)
- Ⓣ T (TELEPHONE POLE)
- TREE
- DRAIN
- ROAD EDGE
- UNPAVED AREA (BARE GROUND)

NB: PLAN COORDINATES ARE NATIONAL, HEIGHTS ARE ASSUMED

| Date | Scale | Designed | Drawn | Checked | Approved | CBCL No. | Contract |
|---|---|---|---|---|---|---|---|
| SEP 29/16 | 1:500 | #### | #### | #### | #### | 150689.00 | 150689.00 |

CPCS IN ASSOCIATION WITH CBCL LIMITED Consulting Engineers

GHANA, AFRICA

SITE PLAN – ABOVE GRADE SERVICES

Drawing

**SK3**

**Figure 4-9: Building-Use Options**

| Option A | | | | | | |
|---|---|---|---|---|---|---|
| **Levels** | **Name** | **Description** | | **Units** | **Gross (SQM)** | **Total (SQM)** |
| 1 Level | Ground Level, one level | | | - | 2,845 | 2,845 |
| 5 Levels | Upper Floors | Office Use*, Levels 2, 3 and 4 | | - | 9,888 | 9,888 |
| | | Residential Use, Levels 5 and 6 | 2 Bedroom Unit | 46 | 81 each | 6,592 |
| | | | 1 Bedroom Unit | 28 | 67 each | |
| | | | Plus Allowance for Circulation, Stairs, Common Areas, etc. | - | - | |
| | | | | | **Total Gross Area** | **19,325** |

*A portion of which will be dedicated for SEC use.

| Option B | | | | | | |
|---|---|---|---|---|---|---|
| **Levels** | **Name** | **Description** | | **Units** | **Gross (SQM)** | **Total (SQM)** |
| 1 Level | Ground Level, one level | | | - | 2,845 | 2,845 |
| 5 Levels | Upper Floors | Office Use*, Levels 2, 3, 4, 5 and 6 | | - | 16,480 | 16,480 |
| | | Residential Use, Levels | 2 Bedroom Unit | - | - | - |
| | | | 1 Bedroom Unit | - | - | |
| | | | Plus Allowance for Circulation, Stairs, Common Areas, etc. | - | - | |
| | | | | | **Total Gross Area** | **19,325** |

*A portion of which will be dedicated for SEC use.

The ground level rental spaces and the upper level spaces designed for general office/commercial use are to be designed and constructed to suit LEED Core and Shell requirements. For the purpose of this feasibility report it is anticipated and assumed that these spaces will be developed to a Class A rental space and completed with basic building services including:

i. Ceiling grid
ii. Perimeter walls
iii. Basic area lighting
iv. Base building HVAC
v. Housekeeping electrical outlets
vi. Emergency and exit lighting

All building common spaces and upper level residential spaces shall be fully finished and fit up, suitable for their intended use and/or occupancy. Residential units, based on the market sounding studies, are assumed to be one (1) or two (2) bedroom units with the following allowances:

**One (1) Bedroom Unit** – approximately 67m² each:

i. One bedroom
ii. One (1) bathroom
  - o Toilet
  - o Shower/tub
  - o Vanity
iii. Shared Kitchen and living area

- o Fridge
- o Oven/Stove top
- o Cabinets
- o Microwave c/w exhaust fan

iv. Laundry Facilities, complete with washer and dryer

v. Air conditioned

**Two (2) Bedroom Unit** – approximately 81m$^2$ each:

i. Two (2) bedrooms

ii. One (1) full bathroom
- o Toilet
- o Shower/tub
- o Vanity

iii. One (1) ½ bathroom
- o Toilet
- o Vanity

iv. Shared Kitchen and living area
- o Fridge
- o Oven/Stove top
- o Cabinets
- o Microwave complete with exhaust fan

v. Laundry Facilities with washer and dryer

vi. Air conditioned

Subject to commercial viability constraints, all spaces specific to the SEC will be fit up as described in Chapter 3.

### 4.4.2 Envelope

Exterior wall assemblies shall be of high quality and designed and constructed to be durable, especially at ground level areas, and easily maintained and serviced and replaced over the life of the building. A maximum U-value of 0.30 (minimum R-19, American) shall be provided in accordance with the Ghana National Building Regulations.

Exterior doors and fenestration openings shall be provided with exterior solar control devices, designed and sized to prevent solar heat gain from direct sun penetration.

### 4.4.3 Roof

Roof assemblies shall be designed and constructed to be durable, easily maintained, serviced and replaced over the life of the building. Roof assemblies shall have a maximum U-value of 0.25 (minimum R-23, American), in accordance with the Ghana National Building Regulations, to mitigate heat gain through the roof.

Roof assemblies shall be low-albedo (highly reflective), or of a vegetative type, to meet the requirements of LEED Heat Island Reduction credit requirements (see Appendix E for typical roof layout).

### 4.4.4 Windows

All exterior windows shall be designed and constructed to be durable and easily maintained, serviced and replaced over the life of the building. All framing materials are to aluminum, appropriately finished. Windows can be operable or fixed, compatible with the overall building systems' approach and design.

Glazing in exterior windows is to be double glazed sealed insulating units, with low emissivity (low-e) coatings to mitigate solar heat gain.

Fenestration design, sizing and location shall take into consideration the desire for access to natural light while balancing control of solar heat gain.

### 4.4.5 Acoustics

Appropriate SEC acoustic requirements, internal to their space, is to be as documented in the Room Data Sheets.

Partitions or enclosures around elevator shafts, on-floor mechanical rooms, base building service shafts, etc., and leasable spaces are to be constructed to meet STC 55.

Partitions between public spaces (lobbies, corridors, washrooms, etc.) and leasable tenant spaces shall be constructed to meet STC 48.

### 4.4.6 Building Services

Base building systems and services to be provided include, but are not limited to:

i. Elevators and elevator lobbies, sized and located appropriate for the building use(s), occupant loads, barrier-free accessibility, etc.
ii. Exit stairs, sized and located as appropriate for the building use(s), maximum travel distances, etc.
iii. Building Entrances and Public Lobbies, for access to all spaces located on upper levels
iv. Public corridors
v. Washrooms for public and/or tenant use, sized and designed to meet occupant loads and barrier-free requirements, complete with all accessories
vi. Drivers' Lounge
vii. Custodial spaces
viii. Security spaces
ix. Primary and Secondary Electrical and Telecommunication Rooms, sized and located to meet all building uses service requirements
x. Equipment spaces and maintenance spaces
xi. Provision for collection and removal of waste and recyclables
xii. Building Specialties, including but limited to:
    - Washroom equipment and accessories.

- Building Signage, including exterior road and building identification signage, lobby signage, and other directional and destination signage.

## 4.5 Site Development

### 4.5.1 Surface Parking

It is anticipated that the surface-level parking areas will be used by light traffic and delivery trucks. It is assumed the parking areas will be concrete or brick type paver stone, over locally accessible graded compacted granular base layer. This parking and associated access ways will be located on grade as well as over top of the sub grade parking structure.

All gravels and paver stone materials will meet applicable AASHTO Parking Lot Standards.

The quantity of surface-level parking spaces will be highly dependent on the overall shape, configuration and site area occupied by the new development and as proposed by prospective bidders. Based on the sample site layout drawing in on page 72, and with a ground floor area of 2,845 SQM, the total anticipated surface-level parking capacity for standard vehicles is approximately 29 parking bays utilizing standard 2.5m x 5.5m parking stalls. Suitable vehicle turning area is required behind each parking stall, however this turning area may be shared with opposite parking stalls.

Surface parking space allocation should consider priority locations for accessible parking, new and expecting mothers, as well as car pool or multi-occupant vehicles. These surface parking spaces should be considered as short duration spaces whilst the underground parking identified in section 4.3.4 would be longer term (full day, weekly for residents).

Where appropriate, surface parking spaces should be provided with shading from natural landscaping features, building or built shading structures utilizing photovoltaic (PV) panels to generate electricity on site. In the proposed facility, a portion of the surface parking is located under the upper levels of the building.

### 4.5.2 Storm Service

Storm flooding in Accra during the rainy season is an issue that this site will need to address, as mitigated by stormwater management design practices. Impervious and pervious areas will required by the proponent be calculated, along with design intensity of storm to calculate runoff. Grading design and selective pervious areas will need to provide space for stormwater retention, storage and/or infiltration, thus reducing the stormwater flows that pass through the site.

All site storm sewer drainage, including roof drains, will be required to be designed to collect rainwater and directed away from building. Design efforts will focus on directing all stormwater to street storm trenches if possible. It is anticipated that there will be a need for rainwater underground storage tanks and infiltration trenches to mitigate stormwater flows to neighbouring properties. Infiltration trenches and permeable stormwater piping design are anticipated to be required to accomplish quantity and quality of stormwater attenuation.

### 4.5.3 Sanitary Service

The site is to be serviced by a new onsite septic tank system located around the building footprint. A PVC DR 35 wastewater gravity service pipe, complete with sewer manholes will connect the building via gravity sewer to this onsite septic tank system. This sanitary service will pick up all internal plumbing. The building sewer is to have inspection manholes and ventilation pipes located close to the building.

The on-site sewage disposal system consisting of a three compartment septic tank, including a soak away pit. The septic tank and soak away pit shall be constructed in the general area of the existing septic tank and soak away pit, and at least 5m from any property boundary or building foundation drains.

The septic tank shall have approximate dimensions of 10m long, 4m wide, and 1.8m deep. Consideration for a larger system may be required depending on the final building occupancy and associated water consumption. The capacity of the first chamber shall be greater than 50% of the total septic tank capacity, excluding the soak away pit.

Materials and construction for the on-site sewage disposal system and applicable piping and manholes, where applicable, shall conform to the requirements of the applicable sections of the Ghana National Building Regulations, 1996.

### 4.5.4 Landscaping

The site and overall building development is to be complemented with an appropriate landscaping and hardscaping design solution. The building entrance is anticipated to have a combination of exterior seating and informal gathering areas as well as planters or gardens to create a soft feel for the entrance.

As per the sample site layout plan in page 72, it is anticipated that the majority of the site not occupied by the building will be hardscaped with permeable pavers to allow for surface parking maintenance and access.

All plantings and materials utilized are to be appropriate for use in Accra, they shall be indigenous or adaptive species that will require little to no supplemental irrigation. Consideration for the overall height and density of materials will be important, so as to not create any potential security threats.

### 4.5.5 Fire Protection

Dry Hydrants will be provided on the site in suitable and accessible locations and supplied from the raw water tank and associated fire water pumping system to provide connection for fire water for the fire services.

### 4.5.6 Domestic Water Supply

Based on the investigation into reliable water supply for a new facility, it is assumed that water is not sufficiently reliable in pressure, volume or supply from the municipal water authority, Ghana Water Corporation Limited, as the sole source of domestic water supply for the facility.

As such, it is anticipated that the facility will have multiple sources of domestic water as follows:

i. Piped water from the Ghana Water and Sewerage Corporation
ii. On-site borehole well
iii. Rainwater
iv. Delivery of bulk water

Water storage tanks (cisterns) shall be located in the underground level of the building and shall consist of a raw water storage cistern and a treated water storage cistern, with a total storage capacity equal to two days of water demand.

The raw water storage cistern shall be equipped with an overflow pipe to accommodate the rainwater source.

A water level control system located in the treated water storage cistern shall determine when raw water is to be treated and discharged to the treated water storage cistern. Water treatment equipment shall be selected to address the anticipated water quality issues based on raw water quality data of the sources, and shall consists of a mechanical filtration process that requires a low level of operation and maintenance. The treated water shall be disinfected using Ultraviolet (UV) disinfection prior to discharge into the building water distribution system.

A dedicated water level control system located in the raw water storage cistern shall determine when water is to be provided to the raw water storage tank from the piped water supply.

A borehole well shall be constructed a minimum of 30m from the existing and proposed on-site sewage disposal system. The borehole well shall be a minimum 150mm in diameter, and shall be at a depth suitable to provide the water demand of the building occupants. The borehole well shall include a submersible pump and a dedicated water level control system located in the raw water storage cistern shall determine when water is to be provided to the raw water storage tank from the borehole well.

The rainwater system shall discharge into the raw water storage cistern. The rainwater supply system shall include a first flush mechanism that shall discharge the initial runoff (may include materials that may have accumulated on the roof since the preceding rainfall event) away from the raw water storage tank.

The raw water storage cistern shall be constructed with a dedicated fill pipe for bulk water, and shall include a visual water level indicator to allow the operator to monitor and control the delivery process.

The selection of which water supply source to use shall be made on a manual basis.

Materials and construction, where applicable, shall conform to the requirements of the applicable sections of the Ghana National Building Regulations, 1996.

### 4.5.7 Utility Power Supply

The facility's electrical service will be supplied from a utility padmount transformer located on the site per the Electricity Company of Ghana's (ECG) utility standard requirements. The location of the transformer will need to be coordinated with the site development, architectural and landscaping considerations. The location selected will also need to provide consideration of any future site developments and uses.

The electrical services on the site will be underground and shall consist of underground ductbanks and electrical manholes as required. The padmount transformer will be supplied underground from a location to be coordinated with the utility supplier, ECG. There is currently an underground medium voltage feeder that supplies the existing building.

ECG was contacted and made aware of the potential project and is reviewing the existing feeder and substation capacity currently supplying the site and is to provide direction regarding if an upgrade of the existing feeder is required. Should it be determined that a new feeder is required, ECG will provide all infrastructure and cabling to the location of the site, switching cubicles and padmount transformers will be the responsibility of the developer. A capital contribution for any ECG upgrades will be required. It is anticipated that utility distribution system upgrades will be necessary to provide the required electrical services to the site.

Preliminary discussions indicate that ECG will also require a padmounted medium voltage switching cubicle to be located on the site. The location of this switch will be required to be coordinated, however the anticipated location would be adjacent to the padmount transformer near the property line adjacent the street. This switch will serve as the utility distribution point on the site.

### 4.5.8 Telecommunications Service Supply

The facility's telecommunications service for both voice and data will be supplied from the developer's preferred service provider, which is assumed to be Vodafone. It is assumed that the incoming voice service will be supplied via multi pair copper cabling and would be capable of supporting approximately one thousand (1000) individual lines.

Data service is assumed to be supplied via fiber optic cabling with an anticipated capacity of minimum of 50Mb/s. CATV/Cable TV will also be provided to the facility. Given the timeframe and industry shift in delivery of cable TV, it is presumed that this services will be supplied in the same cabling infrastructure as the data system for the building.

The voice and data services shall be supplied underground from a location to be coordinated with the service provider. All reasonable attempts should be made for coordination with the telecommunications service provider for utilizing a common trench for both telecommunications and primary Utility electrical service to minimize the trenching required for such services. The underground service shall consist of buried ductbank.

Consideration shall be given to the possibility that additional telecommunications services may be required in the future either within the development area. Additional buried ducts shall be provided to facilitate such future requirements to minimize unnecessary site excavation and disruption.

The incoming telecommunications ductbanks shall enter the building underground into the Main Communications Room (MCR) located in the basement/parking level. Approximate MCR dimensions are to be 6.1m x 4.6m with minimum 3m clearances. The room shall be provided with adequate cooling to prevent overheating of telecommunications and electronic equipment.

## 4.6 Engineering Systems

### 4.6.1 Structural

This section of the design development narrative includes all work required to complete the building substructure and superstructure. This includes the foundation system, the lowest building level floor slab on grade, the suspended floors/roof structure, and other key structural aspects of the building construction.

All reinforced concrete design and construction works will be performed in accordance with applicable codes and standards and appropriate for the environment in which the concrete is placed.

In accordance with the mandate of sustainable design for this project and for possible LEED certification, the amount of Portland cement for all of the concrete mixes to be used for this project shall be limited to, or below the base line amount. Portland cement, while important for the mix design in concrete, has a high embodied energy and greenhouse gas emissions (GHG) associated with its creation and portions of this material may be substituted for other industrial by products (such as flyash), thus reducing the overall environmental impact related to the structural concrete utilized on the project. For example, if the baseline amount of Portland cement for a 30MPa concrete mix is 375kg/m3, all 30MPa concrete mixes for this project must have less than 375kg of Portland cement per 1$m^3$ of concrete.

#### *4.6.1.1 Building Substructure*

The building substructure will consist of three (3) levels of underground parking under the entire perimeter footprint of the building.

The building foundations, including the perimeter foundation walls, will be designed in accordance with the specific recommendations of the geotechnical report. The building foundations will consist of conventional reinforced concrete. The interior concrete spread footings will be set to a depth below the underside of interior floor slab so as to provide both confinement for the bearing strata, and to allow for any mechanical piping to pass down the side of the building columns and turn under the slab without interfering with the spread footings.

All bearing strata and backfill material is to be free of organics and other deleterious substances. All excavation and fill operations will be required to be reviewed continuously by the geotechnical engineer’s onsite representative.

Depending on the subsurface conditions, a groundwater drainage system may be necessary to minimize any groundwater issues.

The lowest building level floor slab will be a conventional reinforced concrete slab-on-grade reinforced with welded wire fabric and will have shrinkage control joints and construction joints as appropriate to prevent undue shrinkage cracking of the concrete slab. The typical slab-on-grade thickness is to be 100mm, and in the mechanical/electrical areas the slab will be 150mm thick. If, during later stages of design, areas of heavier loads are identified, a thicker slab can be placed as required by the proponents final design.

The slab-on-grade will be underlain by an appropriate vapor barrier and a layer of compacted clean granular material such as a clear stone. The concrete slab-on-grade will have a machine trowel finish and areas of heavier loads may require a concrete hardener and/or sealer applied to it.

Curing procedures will be consistent with applicable codes and standards and appropriate for the environment in which the slab is poured.

#### *4.6.1.2 Building Superstructure*

The building superstructure consists of a ground floor level and six (6) levels above grade. The building is constructed with reinforced concrete columns and with flat plate slabs for the suspended floors and roof. If, during later stages of design, localized areas of heavier loads are identified, drops around columns or slab bands/beams can be placed. The reinforced concrete columns will be spaced at approximately 6.1m spacing so as to match the building architectural plans and to minimize the impact to the floor usage, such as in the underground parking areas.

In additional to dead (gravity) loads, the building will be designed to resist the anticipated live loads for commercial and /or residential use and occupancy. An appropriate suspended dead load allowance will be applied to the floor/roof slabs to account for suspended items, such as mechanical/electrical infrastructure, and suspended ceilings.

The building will also be designed to resist lateral loading from wind, and seismic loads prescribed in the applicable building code. This will be provided by reinforced concrete shearwalls strategically placed within the building so as to minimize the impact to the floor usage. Typically elevator shafts and stairwells are used as shearwalls. Additional shearwalls, if required, are typically located at corridors and between building tenants so that the impact to the floor space is minimal. Shearwalls can also aide as a fire/noise separation between adjacent spaces.

### 4.6.2 Building Mechanical

The following section of the report provides a summary of building mechanical systems under consideration for the SEC's new office building in Accra, Ghana.

The building comprises of core and shell office and retail space, office space, storage, washrooms, utility spaces and below grade parking. The proposed HVAC system will consist of exhaust fans, air intake dampers and a heat pump system to provide space cooling. All mechanical systems will be designed and documented to achieve conformance with the latest version of ASHRAE 55, Thermal Comfort Conditions for Human Occupancy.

This section of the narrative will describe the intent for the building mechanical systems. The mechanical systems will consist of HVAC systems and plumbing (including hot and cold domestic water, grey water, storm water and sewage).

**Figure 4-10: Project Location – Accra, Ghana**

| Latitude | N 5.6° |
|---|---|
| Longitude | E 0.2° |
| Elevation | ~27 meters |

**Figure 4-11: Exterior Design Conditions – Closest ASHRAE Location: Accra**

| **Heating** |
|---|
| Heating Design, ASHRAE 99.6%: 68°F DB |
| **Cooling** |
| Cooling Design, ASHRAE 0.4%: 91°F DB, 80°F MCWB |

| Evaporation |
|---|
| Evaporation Design, ASHREE 0.4%: 84°F WB, 88°F MCDB |
| **Dehumidification** |
| Dehumidification Design, 0.4%: 83°F DP, 86°F MCDB |

Figure 4-12: Interior Design Conditions

| | Temperature Dry Bulb, ºF | | Relative Humidity | | Noise Criteria |
|---|---|---|---|---|---|
| | Winter | Summer | Winter* | Summer | |
| **All public and office spaces:** | 68 - 72 | 74 - 78 | No lower limit | Max 65% | Private:30<br>Open: 35 |
| **Washrooms:** | 68 - 72 | 74 - 78 | No lower limit | Max 65% | 45 |
| **Utility Spaces** | 68- 72 | 76 – 85 | No lower limit | Max 65% | >45 |

### *4.6.2.1 Interior Heat Gain*

The building's interior heat gains from occupants, lights, computers and other plug in equipment is important for determining the total energy consumption in the building, sizing the cooling plant and making a determination on the most appropriate HVAC system type. Internal heat gains are based on information about the building spaces and ASHRAE recommendations. Currently, the following values are assumed as summarized in the two (2) figures below.

Figure 4-13: Interior Heat Gain Assumptions

| Space Type | Lighting Power Density (W/ft$^2$) | Electrical Equipment Power Density (W/ft$^2$) | People (ft$^2$/person) | Ventilation | |
|---|---|---|---|---|---|
| | | | | per person (CFM/ person) | per ft$^2$ (CFM/ft$^2$) |
| **Cafeteria/Lunch** | 1.2 | 0.25 | 15 | 7.5 | 0.18 |
| **Offices** | 1.1 | 1.67 | 75 | 5.0 | 0.06 |
| **IT Room** | 1.5 | 65.38 | 200 | 0.0 | 0.06 |
| **Janitor's Closet** | 1.5 | 0.00 | 0 people | 100.0 CFM | 0.00 |
| **Washrooms** | 1.2 | 0.00 | N/A | 75 CFM/fixture | 0.00 |
| **Storage** | 1.5 | 0.25 | 200 | 0.0 | 0.12 |
| **Vestibule** | 1.5 | 0.00 | 0 people | 0.0 | 0.06 |

Figure 4-14: Occupant Loads

| | |
|---|---|
| Per Person Heat Gain:<br>(General office activity) | 200 Btu per Person Sensible,<br>250 Btu per Person Latent |

### *4.6.2.2 Ventilation Rates*

Ventilation rates are determined for peak occupant density based on the requirements of ASHRAE standard 62.1 –2014.

#### 4.6.2.3 Design Intent

The building mechanical systems will be designed to achieve flexibility, a high level of energy efficiency, longevity and occupant comfort/safety. The quality of materials, fixtures, and workmanship employed are of high importance. Equipment that can be locally purchased and maintained will be utilized. The system design and installation is to ensure safety of all personnel during operation and maintenance of the equipment, provide ease of maintenance of equipment which can be serviced by non-specialized personnel, be compatible with the other design elements, and provide flexibility as well as expansion and future growth allowance.

The building is targeting certification under the LEED Green Building rating system. This requires exceptional performance in almost all of the categories described in Section 2.2.4 of Chapter 2 and Chapter 5. Specific targeted points are documented elsewhere in this report but of particular concern to the building mechanical systems will be the measurement and verification, energy efficiency of the HVAC system, water efficiency and associated fixture selection as well as building system commissioning related credits.

#### 4.6.2.4 Applicable Building Codes and Standards

The following is a list of the most relevant codes and standards applicable to the building:

- National Building Regulations, 1996. L.I.1630
- NFPA – Applicable sections of the National Fire Protection Association standards
- NFPA 10 – Standard for Portable Fire Extinguishers
- ASHRAE – American Society of Heating Refrigeration and Air Conditioning Engineers, Handbooks
- ASHRAE Standard 62.1-2007 – Ventilation for Acceptable Indoor Air Quality
- ASHRAE Standard 55-2007 – Thermal Environmental Conditions for Human Occupancy
- ASHRAE/IES Standard 90.1-2012 – Energy Standard for Buildings except low rise residential
- SMACNA – Applicable sections of the Sheet Metal and Air Conditioning Contractors National Association standards
- LEED – Leadership in Energy and Environmental Design Green Building Rating System, version 4.

#### 4.6.2.5 Building Heating, Ventilation, and Air Conditioning Systems

**Heating**

No heating is required for this facility.

**Ventilation**

Ventilation systems for the building will include a dedicated air handling unit to provide outdoor air to meet the requirements of ASHRAE 62.1.

Sanitary exhaust will be provided as required by ASHRAE 62.1. All washrooms, janitor's closets, dedicated copy rooms, storage rooms and kitchens shall be served by dedicated exhaust fans. 75 cfm of sanitary exhaust will be allowed from every water closet, urinal, service sink and shower.

Underground parking areas shall be served by exhaust fans and air intake ductwork capable of providing 0.75 cfm/ft$^2$ outside air. As the parking structure will be partially exposed in the southeast corner, this may be a suitable location for air intake and exhaust provide appropriate separations are maintained to prevent cross contamination of the ventilation air.

During construction of the base building, the ventilation systems shall all be installed, including main duct runs and air supply and return from the various open spaces within the building. It is expected that most washroom groups will be included as part of the base building, so dedicated washroom exhaust fans shall be installed. Ventilation systems serving tenant fit-ups shall be branched from the main ducts as required.

**Air Conditioning**

Space cooling will be achieved through a variable refrigerant flow (VRF) ductless split air conditioning system. This system shall include central outdoor condensing units. Refrigerant piping connects the condensing units to fan coil units serving each space. These fan coil units can be wall or ceiling mounted, or concealed and ducted. Multiple outdoor units will be incorporated into the refrigerant piping system. The total capacity of the outdoor units shall be such that if one unit is out of service at any given time, the remaining units are capable of meeting the building's cooling load.

Cooling for electrical, remote communication rooms and IT/Server rooms shall also be achieved through the VRF system.

All outdoor units shall be installed as part of the base building package and sized to accommodate future tenant fit-ups. Refrigerant piping shall be sized for anticipated future load. Temporary indoor fan coil units shall be installed for the base building. During tenant fit-ups the indoor units can be switched out as required to suit the needs of the tenant.

**Humidification Systems**

Humidification systems are:

- Expensive to install;
- Expensive to operate;
- Require regular maintenance;
- Increase the risk of poor indoor air quality due to standing water in duct systems or increased risk of condensation within the construction envelope; and
- Not necessary to meet the best practice standard for human occupant comfort ASHRAE standard 55-2004 and the associated LEED Thermal Comfort credit IEQc7.

For these reasons humidification has not been included for this building at this time.

**Building Control System**

The building will have a complete building management direct digital control (DDC) system. The DDC system will consist of a network of standalone application specific and building controllers connected to new electronic devices. All control points and programming will be accessible through the building controllers and via a dedicated IP server allowing access from any internet connected PC through a web browser. The DDC system shall be able to be expanded to accommodate upgrades as tenant fit-ups are completed.

The control system will interface with the air source heat pumps and provide energy monitoring of the building HVAC systems.

#### *4.6.2.6 Building Plumbing Systems*

This facility will include a water storage tanks installed in the parking garage area. Domestic water booster pumps will be installed in a mechanical room and will pump domestic water from the storage tank through a distribution system to plumbing fixtures throughout the facility. The booster pump system shall include duplex pumps operating in a duty/standby arrangement. This provides redundancy should one of the pumps be out of service.

Domestic hot water will be provided by electric domestic water heaters. The hot water tanks will be selected to provide storage and to satisfy the base buildings hot water demand. Tenant area hot water shall be provided by hot water tanks in each tenant area at the responsibility of the tenant.

It is anticipated that most washrooms will be included as part of the base building. Plumbing systems shall be sized to allow for additional fixtures that may be required as part of the tenant fit-ups.

**Plumbing Fixtures**

Domestic plumbing fixtures will be water conserving type in order to minimize water consumption, associated cost, associated sanitary waste flow and to help achieve the LEED related water efficiency credits in the event this is required.

Water Closets:

- Water closets to be wall mounted flush valve type with dual flush (6LPF/4.3LPF) operation and a minimum MaP test rating of 800
- Water closets will be barrier free where required

Lavatories:

- Lavatories will be vitreous china semi counter type with sensor operated faucets and low water consumption aerators
- Lavatories will be barrier free where appropriate

Urinals:

- Urinals will be wall hung, vitreous china ultra low flow water flush type operating with 0.5 liters per flush
- Urinals to utilize sensor operated flush valve controls for hands-free operation

Showers:

- Showers will be provided in the building and fitted with low flow shower heads to limit energy consumption due to water heating and for water consumption efficiency. The maximum water flow at the shower head will be 1.5 gpm

Janitor’s Sink:

- Floor mounted terrazzo mop sinks will be provided complete with 12” high base, stainless steel end caps, and wall guard

Wall Hydrants:

- Non-freeze wall hydrants will be provided for site maintenance

**Sanitary Sewer Piping System**

A complete sanitary sewer piping system will be provided to direct sanitary drainage to a point of connection to the civil site sanitary drainage system at the perimeter of the building. The mechanical contractor shall provide a complete sanitary sewer piping system to a point 1.5m outside the building for continuation by the civil contractor. Sanitary sewer piping below grade shall be PVC complete with solvent joints. Above ground sanitary sewer piping enclosed within shafts or walls or in ceiling spaces shall be Cast Iron with mechanical joints or coated PVC with solvent joints (to meet the NFPA 25/50 flame and smoke spread ratings). Standard PVC piping is not acceptable inside the building.

Condensate drainage from all mechanical equipment shall be insulated copper piping connected to the sanitary sewer via floor drains or indirect connections.

**Storm Sewer Piping, Rainwater Collection System**

Runoff from roof surfaces will be directed to roof drains and piped to the raw water storage tank and shall include first flush filters, and calming inlets.

Storm and sanitary sewer piping below grade shall be PVC complete with solvent joints. Above ground storm and sanitary sewer piping enclosed within shafts or walls, above ceilings or exposed shall be coated PVC (fire resistant, IPEX XFR or equivalent) complete with solvent joints or Cast Iron with mechanical joints. PVC piping is not acceptable inside the building.

All rain water leader piping shall be insulated with 1½" thick (R5) fibreglass and complete with vapour barrier. Exposed rainwater leader piping shall be complete with a hammered finish aluminium jacking.

**Non-Potable Water System**

A non-potable water system will be installed for distribution from the cistern to the urinals and water closets. This system will include particle and UV filters to treat the water. A make-up water system will also be included to supplement this system if the required volume is not available from storm water.

Non-potable water piping shall match the materials, insulation and jointing method of the potable water system, but shall be clearly marked "non-potable".

**Domestic Water System (Potable)**

Domestic hot water will be provided by electric water heaters and storage tanks.

All domestic hot water piping will be insulated with 1½" (R5) thick fibreglass insulation complete with vapour barrier and ASJ service jacket. Exposed piping will be complete with hammered finish Aluminium jacket or canvas. The distribution system will include recirculation of hot water back to the tank to ensure quick response at all the fixtures.

#### 4.6.2.7 Building Fire Protection System

The building will not include a dedicated sprinkler system. A standpipe system shall be included and fed from a dedicated fire water pump package from the raw water storage tank. Standpipes shall be included in the stairwell on each level of the building.

A dedicated dry chemical fire protection system shall be included for the Server Room within the facility.

Fire extinguishers shall be provided to the requirements of NFPA 10 and the local authorities having jurisdiction.

### 4.6.3 Building Electrical

The following section provides an introduction to building electrical systems under consideration for the Core and Shell services for the proposed base building. Tenant improvements are not included in the current design scope. Information regarding SEC tenant fit up space in the proposed building is described in Section 3.2.2 of Chapter 3.

#### *4.6.3.1 Applicable Building Codes and Standards*

The following is a partial list of codes and standards applicable to this building:

i. National Building Regulations, 1996. L.I. 1630.
ii. ASHRAE/IES Standard 90.1-2012 – Energy Standard for Buildings except low rise residential
iii. BICSI TDM Manual
iv. IES – Applicable sections of the Illuminating Engineering Society (IES) Recommended Practices (RP)
v. LEED – Leadership in Energy and Environmental Design Green Building Rating System, version 4

#### *4.6.3.2 Design Intent*

The proposed building electrical systems will be designed to achieve a high level of energy efficiency, metering, monitoring, reporting and occupant control.

The system design and installation is to ensure safety of all personnel during operation and maintenance of the equipment, provide ease of maintenance of equipment which can be serviced by non-specialized personnel, be compatible with the other design elements, and provide flexibility as well as expansion and future growth allowance.

The building is targeting certification under the LEED Green Building rating system. This requires exceptional performance in almost all of the categories described in Section 2.2.4 of Chapter 0 in the Pre-Feasibility Report. Specific targeted points are documented elsewhere in this report but of particular concern to the building electrical systems will be the measurement and verification, energy efficiency of the lighting system and lighting control related credits.

The feasibility commentary identifies the minimum performance considerations and potential solutions for the base building electrical systems.

#### *4.6.3.3 Power Distribution Systems*

**Main Service Entrance:**

The secondary service from the padmount transformer to the service entrance switchboard, located in the Main Electrical Room (MER), will be underground concrete encased ducts of quantity and configuration as necessary to match service ratings. The MER is anticipated to be sized approximately 5.80m x 12.15m (interior dimensions) and located on an exterior wall in the lower level of the building (parking level).

Consideration should be given for elevating the finished floor level of the main electrical room if there is a risk of flooding of the space, at a minimum, floor mounted equipment shall be installed on concrete housekeeping pads of 100mm or 150mm above finished floor.

Conceptual service calculations indicate a service size of 4.0MVA for the building volume/occupancies considered at the feasibility level.

This capacity is however, dependent on a number of factors including the mechanical system selection for the building, overall building area developed as well as the projected occupancy.

The buildings electrical service shall be provided to a service entrance rated switchboard. The switchboard shall be a circuit breaker type, service entrance rated, complete with withdrawable main breaker with LSIG trip settings, integral transient voltage surge suppression (TVSS) protection, a Utility metering section, an Owner's metering section with a digital power meter which shall be connected to an Owner's digital metering network via a data connection. The service entrance switchboard should be equipped with wireways and distribution sections as required. It shall also have provision for the addition of a tie-breaker to allow for connection to a future service entrance distribution switchboard.

**Future Growth Allowance of Main Service Entrance**

The building could be supplied from a second Utility supply similar to that being proposed for the current facility. The two (2) electrical services could be completely independent or they be provided with a tie breaker to allow for "backfeeding" either distribution system providing a level of redundancy to the electrical system. Under normal operation, the two systems would operate independently, however, if one of the Utility transformers fails or is removed for service, the associated building main breaker could be opened and the tie breaker could be closed thus supplying both services from a single Utility supply. With the dual Utility supply, there are options to consider with respect to service entrance equipment ratings and space considerations.

The proposed solution is for each service to be sized for the equipment and area in which it normally serves. In this scenario, load shedding (either automatic or manual) may be required in order to reduce the total combined load of both services to the rating of the supplying switchboard. This, however, does not require increasing the equipment capacity of either service, while providing some redundancy to both electrical services. Provision in the service entrance switchboard for connection of bus duct, to the distribution buswork, from a future tie-breaker shall be considered in the design and specifications; neither the bus duct or tie breaker shall be included in the current design.

**Building Distribution**

Power distribution throughout the building will be at 220V as necessary. Building distribution will originate from the service entrance switchboard. A high level of metering, monitoring and data logging is to be incorporated into the building distribution system. In general, distribution panels complete with an Owner's digital power meter will be connected to an Owner's digital metering network via a data connection. Separate distribution panelboards will be provided for each of the major building systems including the following:

i. Lighting

ii. General use power
iii. HVAC/Mechanical Equipment
iv. Process Loads (i.e. Data Center/Server Rooms)
v. Residential suites

Retail and tenant areas shall be supplied from distribution panel or meter center. Each retail space shall have the ability to be individually metered with an Owner's digital metering package connected to the Owner's digital metering network via a data connection.

**Dry Type Transformers**

Dry type transformers, if required will be provided for branch circuit panels and as otherwise required. 45kVA units and smaller shall be wall mounted above the associated panel in which they supply or installed on 100mm thick concrete housekeeping pads complete with vibration isolators. Transformers larger that 45kVA shall be floor mounted on concrete housekeeping pads.

Transformers shall meet or exceed the energy performance requirements for efficiency. Consideration will also be given to selection of dry type transformers with 115C or 80C temperature rise versus 150C temperature rise as lower temperature rise transformers generally incur lower no-load and load losses, thus reducing operational costs and excess heat generated and subsequently having to be extracted from the building.

**Remote Electrical Rooms**

Remote electrical rooms (RER) shall house building branch distribution panels for the general building loads, Commercial/Tenant supplies, Architectural and Mechanical equipment, lighting and receptacles. The RER's shall also house the lighting control equipment and fire alarm equipment. RERs shall be located as required and in general on each floor of the facility. It is anticipated that a minimum of four (4) remoted electrical rooms will be provided to service the various tenant spaces on each floor level, each sized to provide a minimum of 1.0m clearance of safe working are in front of all electrical equipment. Anticipated RER room sizes approximately 3.0m x 2.5m (7.5 SQM) each, would be located in the common core areas and would be vertically aligned to facilitate ease of cable routing.

Branch circuit panelboards for general building power, lighting, Architectural and Mechanical equipment will be supplied as necessary and installed in the various RERs. Branch circuit panelboards shall be copper bus, bolt on distribution breakers and main circuit breaker.

**Emergency and Standby Power System**

An emergency power system will be provided for the building. The emergency system shall consist of feeders, packaged diesel generators, synchronizing switchgear and open transition automatic transfer switches.

The emergency power system may be sized to accommodate the entire facility and will have an N+1 redundancy. It is anticipated that a total of three (3) generators and associated equipment will be required to supply the building. Each generator sized at 50% of the total building capacity thus allowing for any one of the generators to be taken out of service for maintenance with affecting the building standby supply.

The generator shall a packaged unit consisting of a diesel generator complete with control panel, sub base fuel tank suitable for a minimum of 3 hours of continuous operation at 100% rated load. Emissions shall be compliant with EPA Tier 2 Certification Standards or higher.

The automatic transfer switch will be an open transition type, solid neutral complete with maintenance bypass switch. The switch shall be free standing and installed in a NEMA Type 1 enclosure, in the Main Electrical Room.

**Motor Controls**

Individual motor starters, variable frequency drives (VFD), disconnect switches required for the control and disconnection of architectural and mechanical equipment shall be provided as necessary.

Motor control centres (MCC) shall be provided in the mechanical rooms to supply and control the various mechanical loads in the associated areas. The MCCs include circuit breakers, full voltage non reversing motor (FVNR) starters and variable frequency drives (complete with line and load filters) as required for the mechanical equipment. The MCCs shall be complete with a digital metering package complete with connected to the Owner’s metering network via a data connection.

**Metering System**

An Owner’s digital metering network will be provided for the facility. The network shall consist of revenue class digital metering equipment hardware and software.

The utilization of such a metering system can lead to many advantages for the building owner. The primary advantage that can lead to the most cost saving potential is peak energy demand reduction. By monitoring the existing peak the owner can re-sequence when motors, HVAC, and other large electrical equipment power up. This can reduce the overall peak demand which will in turn lower energy costs for the building.

The metering system will incorporate all of the electrical usage of the building from both a total building usage via meter in the service entrance switchboard as well as sub metering for all Retail tenants, MCC’s and distribution panelboards. By monitoring individual systems such as lighting, HVAC, and general purpose, the owner can target areas of high consumption and implement measures to reduce these specific loads.

All metering equipment will report and log data in the metering software package. It will be expandable to allow for additional equipment, tenants, buildings and facilities to be monitored. The use of this type of metering and software allows for automated billing to any tenant.

**Receptacle and General Use Power**

General use receptacles shall be provided throughout the facility including service spaces and stairwells. General use receptacles shall be specification grade. In common areas an open concept areas receptacles shall be provided at less than 10.0m intervals where possible. Service rooms, stairwells and other shall be provided with receptacles as appropriate.

Power shall also be provided to architectural, mechanical, security, intrusion alarm and other core and shell building system devices as necessary.

Receptacles for residential areas to be provided in all rooms and areas at appropriate locations to suit the final layout of the apartment suites.

### *4.6.3.4 Fire Alarm Systems*

A multiplexed addressable fire alarm control panel complete with LCD annunciation shall be provided. The fire alarm panel is to be located in the entrance vestibule and shall be single stage operation and be suitable for control and shutdown of air handling equipment and motorized dampers.

Audible signaling devices shall be temporal horn type. Semi-recessed type wall mounted devices shall be provided in areas with unfinished ceilings, exit stairwells and service spaces. Recessed cone type speaker/horn devices shall be provided in areas with finished ceilings.

Manual pull stations are to be installed at all exit doorways and at the entrances to all stairwells at each level and as otherwise required by Code. Manual pull stations shall be single stage, fully addressable and connected to the addressable fire alarm initiating loop.

Smoke detectors shall be combination ionization/photoelectric, addressable type and shall be located in all electrical rooms, communications rooms, elevator lobbies, top of stairwells, and as otherwise required by Code. Smoke detectors shall be connected to the addressable fire alarm initiating loop.

Duct mounted smoke detectors shall be installed in air handling equipment distribution (supply and return) ductwork on air handling units serving multiple levels, as required by Code. Detectors shall be addressable or equipped with an addressable input module and will be connected to the addressable fire alarm initiating loop.

Heat detectors shall be rate of rise type and addressable type or equipped with an addressable input module. Heat detectors shall be installed as required by Code and connected to the addressable fire alarm initiating loop.

Sprinkler supervisory and flow devices shall be equipped with an addressable input module and shall be connected to the addressable fire alarm initiating loop.

Addressable output relays shall be provided to control various items including mechanical air handling equipment and exhaust fans, as required by Code.

An addressable fire alarm output relay shall be connected to the lighting control system to switch the emergency lighting on at full output.

The fire alarm system shall monitor any standalone fire suppression systems (pre-action or chemical suppression system) by means of an addressable input module. The module will be connected to the addressable fire alarm initiating loop.

All fire alarm initiating, output and signaling wiring shall be installed in EMT conduit.

### *4.6.3.5 Lighting Control Systems*

**Lighting Control System**

The interior and exterior lighting shall be controlled by a lighting management system that includes a computer-based software for control, configuration, monitoring, alerting and reporting of the lighting system. The lighting control system shall provide addressable zone lighting control.

The lighting control system shall have the ability to interface with the building automation system via standard communication protocol such as BacNet. The lighting control system shall also have the ability to interface with control systems and auxiliary equipment such as AV control systems (Crestron), motorized shades, fire alarm system, security system and emergency power distribution system.

Control for the interior lighting system shall be provided by a number of sources including occupancy sensors, time clock, daylight sensors and local switching.

Areas with access to natural lighting shall be controlled via daylight sensors which will control the light output (dimming control) of the electric lighting system within the control zone. This may include but is not limited to individual office spaces, open office spaces and meeting room spaces.

Occupancy sensors shall be provided for lighting control in washrooms, private offices, remote telecommunications rooms, main electrical room, remote electrical rooms and other services and storage spaces (excluding mechanical rooms).

Multiple controls may be provided in a number of locations dependant on the use and access to natural lighting. This may include time clock control, occupancy sensor control, daylight sensor dimming control and manual control.

Exterior lighting control shall be provided through the lighting control system via an astronomical time clock functionality.

Lighting control panels and central control equipment shall be located in the remote electrical rooms.

### Interior Lighting Fixtures

The current lighting power density (LPD) target is a LPD of 0.8 $W/m^2$, in order to be as efficient as possible while contributing towards credit EAc1 (Optimize Energy Performance) in the LEED rating system.

In order to minimize the overall lighting power density, lighting fixtures utilizing LED sources are proposed for the majority of lighting in the facility. Final fixture selection will be based on architectural layout, ceiling type and height, and room function. Most LED fixtures are capable of dimming without the extra cost of a specialty dimming driver. The use of dimmable fixtures in association with appropriate controls will maximize energy savings obtained via daylight harvesting and user control.

A summary of the proposed fixture types and illuminance targets for various spaces in the building is summarized in the figure below. Exact fixture selection will be determined as the design progresses based on the architectural layout, ceiling heights, ceiling type, user requirements, and equipment layouts.

Figure 4-15: Lighting Fixture Selection and Illuminance Targets

| Lighting Fixture Selection and Illuminance Targets | | |
|---|---|---|
| Space | Illuminance Target (lux) | Proposed Fixture Type |
| Administration and Offices | 500 | Recessed or Suspended Semi-Direct LED |
| Corridors/Lobbies | 100 | Recessed LED Downlights<br>LED Cove/Accent Lighting |

| Lighting Fixture Selection and Illuminance Targets | | |
|---|---|---|
| **Space** | **Illuminance Target (lux)** | **Proposed Fixture Type** |
| | | Custom/Feature Luminaires |
| Open Exercise Areas | 300 | Recessed or Suspended Semi-Direct Linear LED<br>LED Cove/Accent Lighting<br>LED Task Lighting |
| Multi-purpose Rooms | 300 | Recessed Linear LED |
| Change Rooms | 150 | Recessed LED Downlights<br>Recessed Linear LED |
| Washrooms | 100 | Recessed LED Downlights<br>Wall-mount LED Vanity Fixtures |
| Service Spaces | 200 | LED Linear Strips |

### Emergency Lighting

Exit lighting shall be provided along egress routing and exit doors to meet the requirements of the National and Regional Assembly requirements. This will be in the form of central battery-inverter cabinets which will power selected light fixtures throughout the building during a utility outage. These central inverters will be located in electrical rooms only and sized for a minimum of 90 minutes of operation. Emergency-power light fixtures will be controlled in unison with the other fixtures in the area, but will default to 100% light output during a utility power failure or fire alarm condition.

Individual battery based emergency units will be provided in the remote electrical rooms (RER), remote communications rooms (RCR) as well as standby generator equipment locations. These units shall be in addition to the above mentioned inverter based emergency supported luminaires.

### Exit Signs

Exit lights will be provided directing occupants to the direction of building egress and at egress/exit doors. Exit units shall be cast aluminum, LED light source and have internal battery backup.

### Site Lighting

Exterior lighting shall consist of building mounted luminaires illuminating areas immediately adjacent to the building as well as pole mounted area lighting for access roadway and parking area lighting, as required. Exterior lighting fixtures will utilize LED sources.

The exterior lighting system shall be designed to meet the performance and illumination recommendations of IESNA RP-33, Lighting for Exterior Environments. Lighting zones and exterior lighting levels at the described site boundaries will be designed in accordance with the LEED Canada requirements for credit SSc8 (Light Pollution Reduction). Lighting power densities will be maintained at or below the requirements of the ASHRAE 90.1 recommendations.

**Pole-mounted Area Lighting:** Area lighting for the parking lot and driveway will consist of pole-mounted LED fixtures. The required lumen output and distribution will be determined based on the final site layout. All fixtures will be full cut-off type to reduce light pollution.

**Building-mounted Exterior Lighting:** Wall-mounted exterior lighting fixtures will be provided above all exterior doors to illuminate egress paths. These lights will be provided with emergency back-up from the central inverter units.

Recessed linear fixtures will be provided in the soffit above the main entrance walkway. Selected fixtures will be provided with emergency back-up from the central inverter units to provide limited illumination during a power outage.

**Lighting Poles and Standards:** Light poles for area lights will consist of steel poles. The mounting heights for these fixtures will be based on the lighting study and final site layout.

Light poles will be provided with concrete bases designed for the specific pole type, size, and mounting height. Pole bases in vehicular areas will be at least 900mm high to avoid damage to the poles.

**Aviation Obstruction Lighting:** The building and applicable structures located on the site will be provided with aviation obstruction lighting in accordance with GCAA's requirements. These fixtures will consist of L-810 steady burning and/or L-865 flashing luminaries in either single or double units and required. Single units may be permissible where maintenance access is easily accommodated. Double units will be required at locations where maintenance is prohibitive, in locations where used as a top light and areas where a single unit could cause the obstruction to be totally unlit.

### 4.6.4 Telecommunications Systems

A telecommunication cabling and raceway system will be provided for the base building, generally including but not limited to, racks (wall and/or floor mounted), cross connects, patch panels, BIX blocks, cable management, grounding, cable pathways, horizontal cabling, backbone cabling, line and patch cords, MDVOs and outlets. Active components including switches and phone systems (i.e. Centrix) are not included.

This will include a complete cable pathway and management system from the work outlets to the Main and Remote Telecommunication Rooms, including outlet boxes, conduit, cable trays, pull boxes, and cable management.

Telecommunications racks in the MCR and RCR shall be industry standard 19" racks, floor mounted, complete with rack mounted power distribution bar and on-line UPS system sized to accommodate the SEC supplied active equipment for a minimum of 20 minutes of operation.

The telecommunications system will be standards compliant, provided by a single manufacturer and backed by a 25-year manufacturer's warranty.

#### *4.6.4.1 Telecommunications Rooms*

A main telecommunications room (MCR) will house the voice and data service entrance as well as serve as the telecommunications backbone cabling distribution center for the remainder of the facility. The MCR shall be approximately 6.1m x 4.6m in size and located on the upper parking level of the building. The MCR shall have two (2) 915mm wide doorways (one active and one inactive leaf) to facilitate access and have a minimum of 2.44m clear height with no finished ceiling.

Remote telecommunications rooms (RCR) shall house the horizontal cabling system termination sub systems and shall serve as the connection point between backbone cabling and horizontal cabling. RCR's shall house distribution and backbone cabling, distribution and backbone cross connects, telecommunications racks, rack and wall mounted hardware, and telecommunications equipment (patch panels, switches, network equipment, etc.). RCRs shall be located as require such that no horizontal cabling length exceeds a total of 90m in length. RCRs shall be sized at 3.0m x 3.4m in accordance with BISCI and ANSI/TIA/EIA-569-A recommendations and aligned vertically to provide ease of cable routing. It is anticipated that four (4) base building RCR's will be provided on each floor level and located in the common core area. The RCR shall be complete with 19mm thick plywood backing painted with two coats of fire-retardant paint on a minimum on one (1) wall. The RCR shall have a minimum of 2.44m clear height with no finished ceiling and minimum 915mm wide door.

Communications rooms shall be air conditioned from the base building HVAC system to maintain suitable space temperature and humidity.

#### *4.6.4.2 Data System*

**Backbone Cabling System**

Data system backbone cabling system shall consist of hybrid fiber optic cabling and a minimum of two (2) CAT6 copper cabling originating in the MCR and distributed to each of the RCRs. Fiber optic cabling shall terminate in fiber patch panels located in floor mounted telecommunications racks in the RCRs.

**Horizontal Cabling System**

Data system horizontal cabling system shall be a physical star topology and consist of CAT6A standards compliant copper cabling and termination equipment originating in the RCRs and distributed to the work area outlets throughout the building.

The horizontal cabling system includes horizontal cables, work area outlet connections and all terminations, connections and patch cords located within the RCRs.

The location of the horizontal cabling shall be separated from pathways and spaces that generate EMI.

Horizontal cabling shall not exceed 90m in total length in compliance with the Category 6A standards. Cabling shall be terminated in patch panels in the RCRs and MDVOs at the work area location.

#### *4.6.4.3 Voice System*

**Backbone Cabling System**

Voice system backbone cabling system shall consist of multi pair UTP copper cabling originating in the MCR and distributed to each of the RCRs. Voice backbone cabling shall be terminated in wall mounted BIX blocks located in the RCRs.

**Horizontal Cabling System**

Voice system horizontal cabling system shall consist of CAT6A standards compliant copper cabling and termination equipment originating in the RCRs and distributed to the work area outlets throughout the building.

The horizontal cabling system includes horizontal cables, work area outlet connections and all terminations, connections and patch cords located within the RCRs.

The location of the horizontal cabling shall be separated from pathways and spaces that generate EMI.

Horizontal cabling shall not exceed 90m in total length in compliance with the Category 6A standards. Cabling shall be terminated in patch panels in the RCRs and MDVOs at the work area location.

#### *4.6.4.4 Telecommunications Raceway System*

Provide a complete cable pathway and management system from the work outlets to the Main and Remote Telecommunication Rooms and between the MCR and RCRs including outlet boxes, conduit, cable trays, pull boxes, and cable management.

Cable tray shall be provided within in the MCR and RCRs. Vertical and horizontal backbone cabling shall be installed in EMT where located above finished ceilings.

### 4.6.5 Security

#### *4.6.5.1 Physical Security Overview – Proposed SEC Site Development*

The proposed development is assumed to be a mix of both commercial and residential uses with an interior 'compound' which will house SEC's headquarters. The structure will also consist of an adjacent parking lot and sub grade parking garage. SEC's area will be somewhat autonomous and disassociated from the complex as a whole and as such should have a separate physical security system as described in section 3.3.5. It has been determined, that due to the relative safety of the area, there are no additional security risk factors to the complex as a whole. As such, hardening of the complex will not require above normal efforts.

#### *4.6.5.2 Physical Security – General Complex*[5]

Building entrances and fire exits should utilize steel or steel composite (e.g. glass insert) doors which will withstand conventional methods of breach (e.g. prying, blunt force). Doors should also be equipped with an exit control lock, frequently called 'request to exit' or 'REX' which will allow egress from the building in the event of fire or any other emergencies but will not allow an unauthorized person ingress. Doors should be fitted with electronic contacts which should be tied to an Electronic Access Control System (ACS). These contacts can be hard-wired using structured cabling (e.g. CAT 6A) or wirelessly routed to the network.

The ACS is a software-driven system which utilizes identity credentials to provide access to those who have permission to certain areas and limit access to those who do not. The process is to present an ID card to an ACS reader located at the entry point (the type of card to be issued and the amount of information to be gathered from users is dependent on the client's needs) and have it vetted by the software before allowing or denying ingress. All doors providing ingress and egress to the building (and applicable gates and doorways in the parking areas and external areas of interest (e.g. water supply)) should be equipped with an ACS reader or a door contact which will notify the operators of the system whenever they are opened (along with being forced, left open, etc.).

---

[5] The General Complex is also meant to include any alley ways, public areas and other areas of interest (e.g. water supply, waste water systems, and telecommunications equipment). Deployment of surveillance assets should correspond to the relative 'value' of the assets to be protected.

In association with the ACS there should also be a Digital Video Management System (DVMS). The DVMS controls the video surveillance function by receiving the video feeds from CCTV sensors throughout the complex and pulling them back to a central viewing platform. Both the ACS and DVMS can be integrated to allow for automated notification of ‘alarm events’ as well as be used to be proactive to possible breaches by enhancing coverage that a human operator cannot do in isolation.

Based on current and trending product enhancements, the CCTV utilized should be digital and where applicable make use of HD resolution. The use of panoramic, thermal, and/or infra-red (IR) technology is recommended based upon the requirements of the specific location. For both the ACS and DVMS, products which are ONVIF compliant should be chosen to ensure ease of integration. Due to risk factors not being abnormally high a Commercial Off-The-Shelf (COTS) system would be more than sufficient for both the ACS and DVMS.

#### *4.6.5.3 Security Personnel*

Within the general complex it would be expected that there would be a Security Operations Center (SOC). The SOC would be a secure area where the ACS and DVMS software user interfaces would be located. Normal SOC layouts would have desks with computers and desktop monitors as well as Video Walls which would show the CCTV video feeds. There would also be a centralized phone system where security and emergency-based calls could be routed and then acted upon.

Optimally, for a facility of this size, there would be two operators actively monitoring the surveillance feeds and a supervisor who could direct them in case of incidents. These operators would be supplemented by two to three guards responsible for walking the property and possibly one guard permanently posted at main entrances to the building and the parking complexes (unless there is an automated gate system driven by ACS identification).

### 4.6.6 Energy

The average energy use intensity (EUI) of an office building in Accra was estimated based on data from previous energy audit projects in similar climatic zones. The data for office buildings shows an average EUI of 270kWh/m²/yr. Other building uses, such as ground floor retail, or residential will result in a slightly different EUI for the project, however for the purposes of this feasibility report we have assumed an average energy intensity of 270kWh/m²/yr.

The project is planned to achieve LEED certification so the project EUI is assumed to exceed the benchmark by 25%, resulting in a target EUI of 194 kWh/m²/yr. Total annual consumption is therefore estimated as per the figure below.

**Figure 4-16: Estimate of Total Annual Energy Consumption**

| Total Building Area (Occupied) | Annual Consumption | Parking and Exterior Allowance | Total Annual Consumption |
|---|---|---|---|
| 19,325 SQM | 3,749MWh | 200MWh | 3,949MWh |

Wind Resource mapping in Ghana was done by the US National Renewable Energy Laboratory. The results show no Class 3 or higher wind regimes in the greater Accra area. The use of on-site wind turbines for project power generation is therefore not considered feasible.

A preliminary screening of the PV potential was conducted using PVSyst. The results are included in Appendix F of the report. The assumptions used in the preliminary screening were that a 3,296 SQM rooftop and unshaded site area was available for mounting of PV panels and mechanical equipment and that unshaded due south exposure was available. After allowing 20% for maintenance and equipment access and inefficiencies, a total area of approximately 2,635m$^2$ for mounting solar panels remained. The preliminary model predicts an array size of 395kW with an annual production of 592MWh.

Figure 4-17: PV Generation Potential

| Total Building Area (Occupied) | Total Annual Consumption | PV Generation | Percent Offset |
|---|---|---|---|
| 19,326 SQM | 3,749MWh | 592MWh | 15.8% |

Based upon a preliminary capital cost estimate of approximately $857,000 USD and a 20 year project life, the annual cost of energy production from this array is approximately $0.14USD/kWh.

The more energy efficient the building can be, the greater percentage of its annual consumption can be produced from the PV array. Suggested energy efficient technologies to be incorporated into the building include the following:

i. External window shading and reflective building finishes to reduce solar heat gain
ii. Minimum EER of 15 for ductless mini split AC systems
iii. Minimum EER of 12 for ducted split systems, consider VRF for large office areas with multi face exposures
iv. Building EMCS with occupancy and scheduled temperature setbacks
v. LED lighting for interior and exterior. Daylight sensors for exterior zone fixtures complete with auto dimming capability. Occupancy sensors for underground parking and utility areas. Exterior lighting control by solar timer and occupancy and security schedules
vi. DHW production by solar heater with electric backup or AC unit desuperheater with electric backup
vii. Windows shall be double pane low e glazing with thermally broken frames.
viii. Exterior wall minimum R value of 12, roof 30

### 4.6.7 Building Commissioning

In order to ensure proper functioning of all building system energy and water system, a systems commissioning shall be performed. The commissioning process is a systematic process of ensuring that all of the building systems perform interactively according to the design intent and the Owner's operational needs.

This project will be commissioned to meet the requirements of LEED V4 Green Building Rating system for Energy and Atmosphere prerequisite – Fundamental Commissioning and Verification. This process includes commissioning activities for mechanical, electrical, plumbing and renewable energy systems and assemblies in accordance with the ASHRAE Guideline 0-2005 and ASHRAE

Guideline 1.1-2007 for HVAC&R Systems specifically related to the energy, plumbing, durability and indoor environmental quality (IEQ).

The Contracting or Commissioning Authority (CxA) should be incorporated into the proponent's design team at an early stage of the design process to ensure that they are familiar with the building systems, design intent and have the opportunity to provide input to the design team to ensure the designed systems have the necessary commissioning, balancing and adjustment features installed in appropriate locations.

At a minimum, the CxA is required to be engaged by the end of the design development phase. The commissioning agent remains engaged in the project until all the building systems are properly installed, functioning and operating within the design parameters as verified and documented, training of building operation and maintenance staff has been completed as well as the building has been occupied for a minimum of ten (10) months (typically one year of occupancy).

The commissioning process includes activities in both the design and construction phase which can be found in Appendix G.

# 5 Sustainability Plan and Scorecard

## 5.1 Introduction

The proposed building is intended to incorporate 'green' or 'eco-friendly' building techniques, as mandated by the World Bank in the transaction advisory services contract. The Leadership in Energy and Environmental Design (LEED) standard has been chosen as the preferred certification method for SEC's proposed accommodation. This chapter describes LEED as it relates to SEC's proposed accommodation with an opinion on LEED categories of focus to achieve the necessary certifications.

## 5.2 LEED Sustainable Building Rating System

Leadership in Energy and Environmental Design (LEED) is a third party verified, green building rating system. The system was developed and is administered by the United States Green Building Council (USGBC) beginning in 1993. The USGBC is a not-for-profit organization which is 'committed to transforming the way our buildings are designed, constructed and operated.'[6]

The rating system encourages a whole-building approach to sustainable design, construction and operation and considers the triple bottom line approach. This approach includes consideration for the sustainability of the project from an environmental, social and economic perspective. It also encourages collaboration amongst the project team members through what is referred to as the integrative process.

While originally developed as a US-based system, which applied very specifically to the top 25% of highest performing office buildings, its widespread use has led to a significant restructuring of the rating program. The most recent version of LEED is referred to as Version 4 (V4), which has been in development for a number of years and released in 2015 for public use.

The process of developing the current version included six (6) rounds of public commentary in which over 23,000 individual comments and suggestions were received. All projects registering for the LEED rating system after October of 2016 will be required to do so under the V4 rating system, and this is assumed to apply to the project under consideration.

The LEED green building rating system has a number of different rating systems that have specific criteria suited to the project type; these include: New Construction and Major Renovation; Operations and Maintenance; Interior Fit-Up; Neighbourhood Development and Residential Homes.

### 5.2.1 Most Widely Used System

The most widely utilized system is related to new construction and major renovation – the system most applicable to the SEC Office complex development. Within the new construction framework, there are applications to suit twenty one (21) different building market types. Relevant to this project are those focused on core and shell, office and residential developments.

[6] The U.S. Green Building Council. http://www.usgbc.org/

While LEED was developed and widely utilized in the United States, recent changes in the LEED 2012 and subsequently in LEED V4 have made the system globally adaptable. Some of the features of this system include provisions for utilizing local codes or standards as well as rewarding projects for addressing sustainability issues within their specific geographical region. LEED is now utilized globally in 147 countries, and the international market outside of the United States represents a significant portion of new project registrations and certifications.

While the United States remains the country with the highest use of LEED on a square meter basis, additional development markets are increasingly incorporating LEED into the sustainable projects. The top ten countries in terms of use of the rating system, outside of the United States, are summarized in the figure below.

Figure 5-1: Top 10 Countries Outside of the United States using LEED

| Ranking | Country | Certified GSM | Certified and Registered GSM | Total Number of Projects |
|---|---|---|---|---|
| 1 | Canada | 26.63 | 63.31 | 4,814 |
| 2 | China | 21.97 | 118.34 | 2,022 |
| 3 | India | 13.24 | 73.51 | 1,883 |
| 4 | Brazil | 5.22 | 24.50 | 991 |
| 5 | Korea | 4.81 | 17.47 | 279 |
| 6 | Germany | 4.01 | 8.42 | 431 |
| 7 | Taiwan | 3.84 | 9.08 | 149 |
| 8 | United Arab Emirates | 3.13 | 53.44 | 910 |
| 9 | Turkey | 2.95 | 23.74 | 477 |
| 10 | Sweden | 2.54 | 4.20 | 197 |

Note that GSM represents Millions Gross Square Meters

## 5.3 LEED Certification Process

LEED certified projects have been developed in at least nine (9) countries in Africa with registrations in many more including two (2) registered LEED projects in Ghana.

The system follows a two-phase approach to successful acquisition of the LEED certification which begins with a registration phase and concludes with the certification phase. Registration generally occurs at the very initial phase of the project and identifies that the project is intending on pursuing the LEED rating system and allows the project team to access the various tools and support offered by the USGBC. There is a small administrative cost associated with registration of a project. Registration of a project however, does not commit the proponent to fulfill any certification obligations or certification costs.

The second and final phase is the certification process, during which the design and construction team provides the necessary documentation, information and supporting data to the administrators of the rating system for their evaluation and assessment. This is done through an online tool called *LEED On-Line*. LEED On-Line allows the users to register the project, access the various credit submission templates, request credit interpretations from the certification body, upload all required documentation, and provide feedback and reports from the project review team. At the time of certification, there is a fee to cover the administrative cost for the certification process. This cost varies depending on the rating system, the size of the building, and the certification path that is pursued.

### 5.3.1 Point-based Certification System

The LEED rating system is a point-based system with a number of minimum performance criteria, prerequisites and point scoring credits. Certification is obtained by achieving sufficient credits in the various categories. The system is a 100 base point system, with 10 bonus points available. Current certification levels and point totals are as follows:

- Certified – 40 to 49 points;
- Silver – 50 to 59 points;
- Gold – 60 to 79 points; and
- Platinum – 80+ points.

Credits in LEED are broken down into nine (9) categories, as reviewed during the Sustainability Seminar held on December 11th, 2015, and as described in Section 2.2.4 of Chapter 2 in the Pre-feasibility Report. The point allocation from highest to lowest is based on the followed desired outcomes:

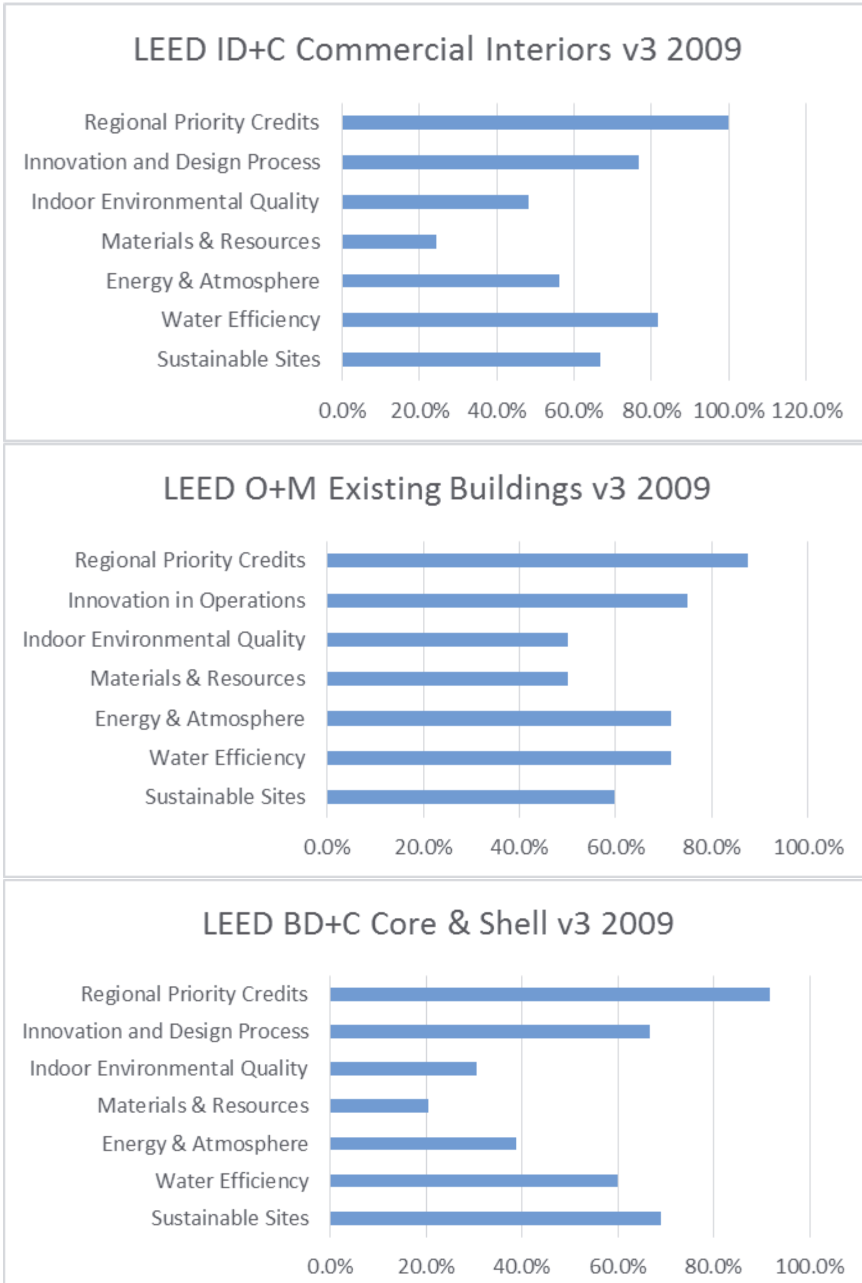
i. Climate Change;
ii. Human Health;
iii. Water Resources;
iv. Biodiversity;
v. Green Economy;
vi. Community; and
vii. Natural Resources.

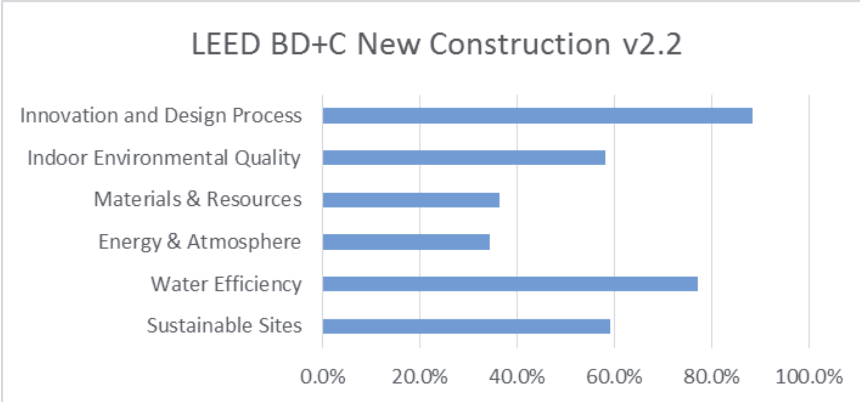
### 5.3.2 LEED in Africa

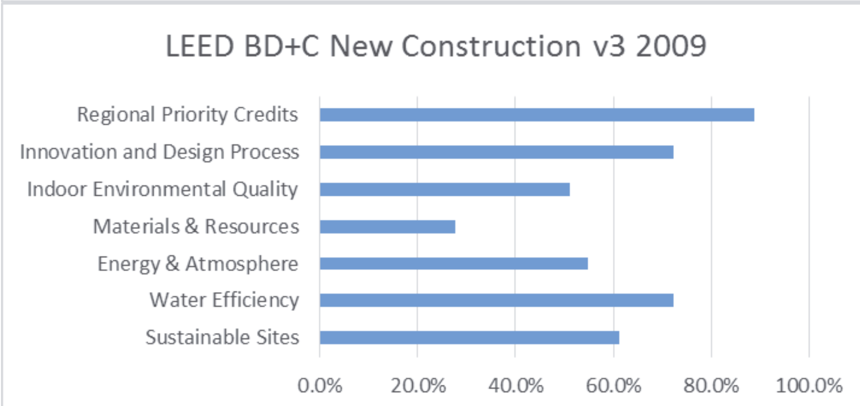
Based on the successfully completed LEED projects certified in Africa, the majority of points obtained emanate from the Regional Priority, Water Efficiency, Sustainable Sites, and Innovation categories. An assessment was carried out, based on 26 separate projects completed in Africa utilizing various LEED rating systems; the Summary Tables provided below indicate the percentage of available points in each credit category which have been achieved. The results of this assessment are indicative of the projected point distribution for the proposed project as shown in the LEED Scorecard provided in Appendix H.

Current expectation is that the project could achieve certified-level, with the potential to reach the Silver level of certification, with current points indicated at 48. However, this will fluctuate during the design and construction period, as the project evolves.

**Figure 5-2: LEED Summary Tables for Building Projects Completed in Africa**




LEED BD+C New Construction v2.2
Innovation and Design Process
Indoor Environmental Quality
Materials & Resources
Energy & Atmosphere
Water Efficiency
Sustainable Sites
0.0%
20.0%
40.0%
60.0%
80.0%
100.0%


LEED BD+C New Construction v3 2009
Regional Priority Credits
Innovation and Design Process
Indoor Environmental Quality
Materials & Resources
Energy & Atmosphere
Water Efficiency
Sustainable Sites
0.0%
20.0%
40.0%
60.0%
80.0%
100.0%

# 6 Legal Due Diligence

## 6.1 Introduction

The aim of the legal chapter is to provide an overview of the legal constraints under applicable and relevant Ghanaian law, in particular, foreign investment law, land law, environmental law, planning and construction law, for the implementation of SEC's office accommodation project under a PPP arrangement based on a Design-Build-Finance-Own-Operate-Maintain and Transfer (DBFOOMT) modality. A contractual arrangement between SEC and the private party vis-à-vis a joint venture modality will also be discussed followed by a recommendation as to which may be more feasible.

It will also discuss the legal basis/possibility for an outright sale in the event of a DBFOOMT Model where a mixed-use building is selected and residential units are sold outright. Recommendations will be provided regarding how to reconcile outright sales of residential units in such a scenario.

Further, a review of the fiscal regime applicable and relevant to the proposed accommodation and in particular, taxation, import duties and exchange control requirements, if any, will also be done as well as addressing site and related infrastructure enablement, suitability, ownership and availability issues – land claims, servitudes, long leases and so on.

It is pertinent to note that, to a very great extent, the legal constraints under environmental law, planning and construction law, which may pose impediments to the project have been comprehensively dealt with in the legal chapter of the pre-feasibility report.

## 6.2 Office Accommodation Project under PPP

The Securities and Exchange Commission – regulator of Ghana's securities industry is seeking to develop an office accommodation for itself, under a PPP Procurement model. The project has been authorised by the Ministry of Finance as a PPP project under the National Policy on PPP adopted by the Government of Ghana in June 2011 ("the National Policy").

At the pre-feasibility stage, a Design-Build-Finance-Own-Operate-Maintain-Transfer (DBFOOMT) concession modality was proposed.

### 6.2.1 DBFOOMT Concession Modality

Under this modality, a public authority grants a private party the right to design, build, finance, and operate an infrastructure asset owned by the public sector. The concession PPP contract is for a fixed period, for example 25–30 years, after which responsibility for operation of the asset reverts to the public authority. The private party recoups its investment, operating, and financing costs and its profit by charging members of the public a user fee (for example, a toll). Thus, a key feature is that the private party usually assumes the risk of demand for use of the asset, in addition to the risks of design, finance, construction, and operation. However, demand risk may be allocated in various ways; for example, the public authority may share the risk by underwriting a minimum level of usage. User charges may be either prescribed in the PPP contract or set by the concessionaire.

Typical examples of this type of PPP include toll roads, railways, urban transport schemes, ports, and airports.[7]

Under this scheme, a private sector partner, by virtue of a PPP agreement, will be awarded a contract to design, construct, finance, equip, operate and maintain an office accommodation complex on landed property owned by SEC for a fixed period/concession period, after which the office accommodation complex will be transferred back to SEC. In essence, SEC will grant ownership rights over land belonging to and currently being occupied by the Commission to a private party to design, construct and operate an office accommodation complex for a defined period of time as per the PPP agreement.

Since the office accommodation complex will be owned and operated by the private party for the duration of the PPP agreement, the private party must acquire a legal interest and/or rights over the land. Under Ghanaian law, this will entail SEC transferring the land to the private party by virtue of a notarial lease/sublease agreement following which the private party will acquire a legal interest in the land for the duration of the lease or sublease agreement.

The private party will be responsible for obtaining financing for the project, and for procuring the design and construction of the works and operating and maintaining the facility during the concession period. At the end of the concession period, the private party will transfer the complex back to SEC. The private party will receive revenues from the operations of the project to recoup its investment, operating, and financing costs and gain profit by charging rents and incidental charges from tenants for the use of the facility. Thus, the private party will bear the risk of demand for use of the facility, in addition to the risks of design, finance, construction, and operation.

**Contractual Structure**

In such a project, the public sector grantor grants the right to a private party to develop and operate what would traditionally be a public sector project. Since the private party will be responsible for obtaining financing for the project and for procuring the design and construction of the works as well as operating the facility for the period granted, the private party must possess or not lack access to resources sufficient to satisfy these obligations.

The private party may involve entities with experience in the management of such projects, such as working with diverse multicultural partners, given the particular risks specific to the project and co-ordinate the construction and operation of the project in accordance with the specifications of the PPP agreement.

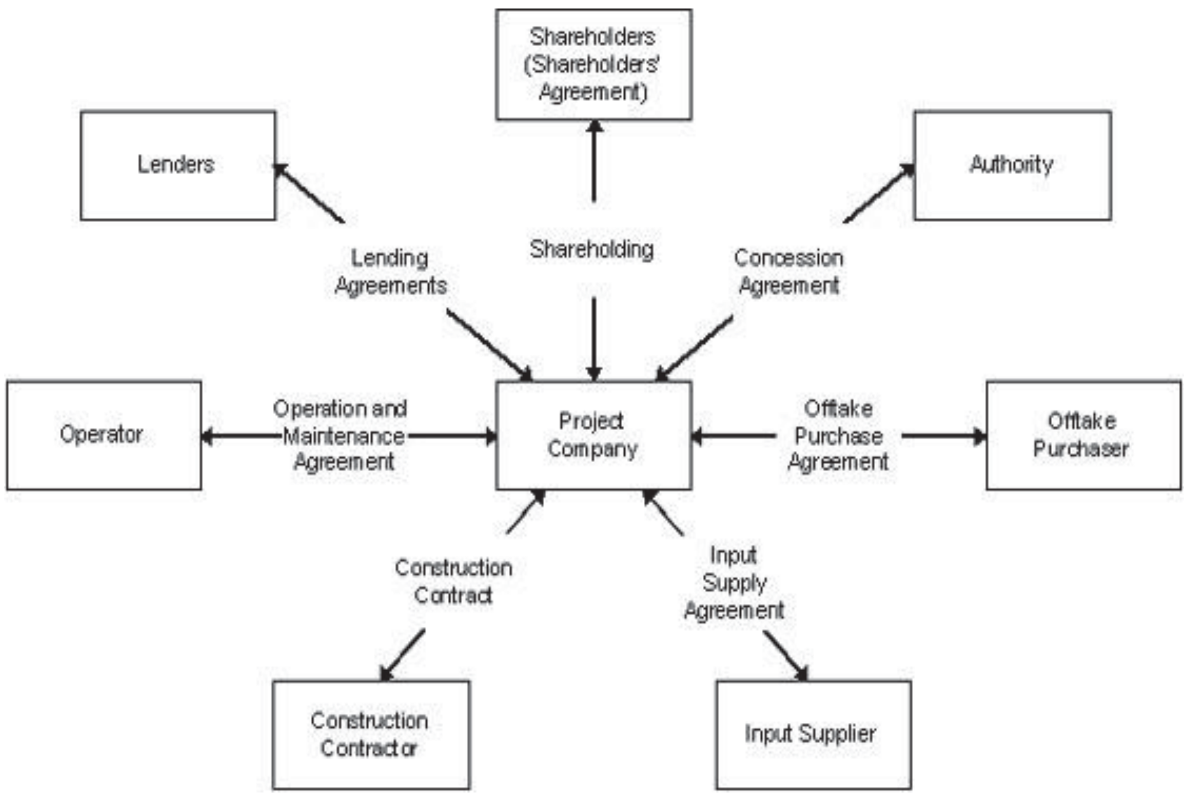
The chart below shows the contractual structure of a typical DBFOOMT project, including the lending agreements, the shareholder's agreement between the project company shareholders (where a special purpose company is created to undertake the project) and the subcontracts of the operating contract and the construction contract, which will typically be between the private party

[7] Attracting investors to African public-private partnerships: a project preparation guide (2009), p. 9. Prepared by World Bank, Commissioned by Infrastructure Consortium for Africa (ICA) and funded by the Public-Private Infrastructure Advisory Facility (PPIAF).

and other parties, as the case may be. The chart below shows the contractual structure of a typical Build-Operate-Transfer Project[8,9].

Each project will involve some variation of the contractual structure depending on its particular requirements and whether or not a special purpose company is created for the project. For instance, not all projects will require a guaranteed supply of input – therefore an input supply agreement may not be necessary. In this case, the payment stream will flow from the rents charged by the private party for use of the facility, which will be used to operate and maintain the facility. From the above, the implementation of the project will require a clear transaction structure that recognizes the role of the various entities.

Figure 6-1: Typical Contractual Structure under a Build-Operate-Transfer Modality




Source: Jeffrey Delmon, Private Sector Investment in Infrastructure. Project Finance, PPP Projects and Risk 2nd edition (2009)

### DBFOOMT under the National PPP Policy

The project is being considered to be undertaken under a PPP arrangement, in particular, a Design-Build-Finance-Own-Operate-Maintain-Transfer (DBFOOT) modality, under which a private sector partner is granted/awarded a contract to design, construct, finance, equip, operate and maintain

---

[8] Jeffrey Delmon, Private Sector Investment in Infrastructure. Project Finance, PPP Projects and Risk 2nd edition (2009) P. 99.

[9] A Design-Build-Finance-Operate-Own-Maintain-Transfer modality is an elaboration of the Build-Operate-Transfer (BOT) scheme.

an office accommodation complex on property owned by SEC for a fixed period of time after which it will be transferred to the Commission.

The National Policy does not identify and privilege any specific contractual form for PPP arrangements, however, the PPP policy recognizes that:

*"There are several well-defined models of PPPs, differing in purpose, service scope, legal structure and risk sharing, and increasingly, permutations and combinations of them. Specific forms of PPP are often referred to by special names. However, a single PPP can have the characteristics of several different forms and new types may emerge from time to time. One end of the spectrum could be an outsourcing or routine operation, while the other could involve the private sector conceiving, designing, building, operating, maintaining and financing a project, thereby assuming a considerable proportion of risks… "*

Therefore, it can be concluded that the DBFOOT modality is a recognized form of PPP under the National Policy which permits a combination and permutation of the various models of PPPs.

### 6.2.2 Joint Venture Modality

A joint venture (JV) is a business enterprise undertaken by two or more persons or organizations to share the expense and profit of a particular business project... It is an agreement between parties for a particular purpose and usually a defined time10. Joint ventures are a form of PPP.[11] According to the "the guidance note for public sector bodies forming joint ventures with the private" sector issued by HM Treasury, dated March 2010, ("Guidance Note") joint ventures are part of the different delivery models which may be used by public bodies to deliver infrastructure and public services in conjunction with the private sector. The Guidance Note, also, defines joint venture as follows:

*"The term joint venture can describe a range of different commercial arrangements between two or more separate entities. Each party contributes resources to the venture and a new business is created in which the* parties *collaborate together and share the risks and benefits associated with the venture. A party may provide land, capital, intellectual property, experienced staff, equipment or any other form of asset. Each generally has an expertise or need which is central to the development and success of the new business which they decide to create together. It is also vital that the parties have a 'shared vision' about the objectives for the JV".*

The Guidance Note further states that it is important to distinguish the formation of a joint venture from purely contractual arrangements, such as contracts for the provision of goods or services or a concession, whereby a public sector body gives a third party (the "concessionaire") the right to provide services to the public in consideration of payment.

The key factor in a joint venture partnership is its single, definable objective. The elements of a joint venture are (1) an express or implied agreement; (2) a common purpose that the group

---

[10] http://www.inc.com/encyclopedia/joint-ventures.html

[11] See https://ppp.worldbank.org/public-private-partnership/agreements

intends to carry out; (3) shared profits and losses; and (4) each member's voice in controlling the project.

It is similar to a business partnership with one key difference: a partnership generally involves an ongoing, long term business relationship whereas a JV is based on a single business transaction.

A JV could take the form of a company with its own legal identity separate from those of its shareholders, in which the parties will participate on an equity basis and where there is a limitation on liabilities. It is important to note that in JVs between the private and public sector, this is the preferred option. It could also take the form of a partnership arrangement – an arrangement with profit sharing between partners created for a specific purpose. Here, no separate legal entity is created and each of the partners has full legal responsibility for the project; generally, there is no limitation on liabilities unless this is formalized into a relationship.

It could also take the form of a contractual consortium where the parties contract to work together on a specific project. With this scenario, there is no concept of sharing of pool of profits as there is with partnerships and each party is likely to be remunerated for services provided to the consortium. In this case, no separate legal entity is created.

If it is determined that a joint venture model is the most appropriate model which may be used to carry out a PPP project the public body and the private entity can enter into a joint venture to carry out the PPP project by executing a joint venture agreement in addition to the PPP agreement, since the parties are at liberty to design the contractual structure, subject, however, to mandatory provisions of the PPP policy. However, it is important to note that in the absence of a concrete PPP arrangement between a public sector body and a private party – to which a joint venture is linked – a joint venture would not be a PPP. In other words, a standalone joint venture between a public sector body and a private party is not a PPP unless it is linked to a PPP agreement.

As earlier noted, in joint ventures between the private and public sector, the preferred option is where a company with its own legal identity separate from those of its shareholders is created to carry out a project. Thus, it is recommended that if the project is to be carried out as a joint venture, this scenario must be opted for. Therefore, once a PPP agreement is in place between a public body and the private entity the parties can enter into a joint venture to create a special purpose company to undertake the project, since the PPP policy permits that any of the typical PPP models and/or contractual forms or permutations and combinations of them may be used for a PPP project.

In this scenario, SEC and the private party will incorporate a limited liability company as shareholders in a special purpose company (or special purpose vehicle, "SPV") for the office accommodation project pursuant to a joint venture or a shareholders' agreement. The special purpose company and SEC will then execute a concession agreement granting rights to the special purpose company to build and operate the accommodation facility for the duration of the concession, and thereafter, the special purpose company will transfer the rights to the accommodation project under the concession back to SEC.

Given the likelihood that a special purpose company may be established by SEC and a private party under a joint venture to undertake the project, it is recommend that the SPV be established as a private company limited by shares.

It is important to note that joint ventures are not without complications as there are several key issues which ought to be considered, e.g. the different classes of shares, the initial and future contributions of the parties, corporate governance, minority protection, dividend policy, pre-emption rights, termination clauses, deadlock resolution, dispute resolution, risk, etc.

Further, according to the Guidance Note, joint venture involves **risk sharing** and thus it is suitable where a jointly-owned and managed business offers the best structure for the management and mitigation of risk and realization of benefits whether they involve asset exploitation, improved public sector services or revenue generation. Usually, for the public sector, the core reason for considering joint ventures is to mobilize complementary resources. The joint venture enables the complementary resources of the public and private sector parties to be integrated and this is achieved by creating a wholly new business. Typically the purpose of the joint venture would stem from one, or a combination of the following objectives:

- **Value Capture**: The desire to capture long term value from, say, property development or a commercialization/Wider Markets Initiative opportunity. A JV provides an alternative mechanism for capturing longer term value, as the public sector body will hold an equity stake in the JV;

- **Route to Market**: The need to establish a new route to market for intellectual property or other assets, such as through the formation of a spin-out company from a Public Sector Research Establishment (PSRE) to establish and run a self-standing business. This is generally coupled with a desire to share in value capture as above; and

- **Service Delivery Programmes:** The need to manage a long-term programme of service delivery and/or investment in order to improve the delivery and efficiency of public services and infrastructure justify the formation of a separate self-standing and sustainable organization.

**Recommendation**

In light of the above, it is recommended that a joint venture would not be appropriate for the project especially, as it will entail the assumption of risk by SEC as shareholders in the special purpose company under the joint venture. Rather, it is recommended that SEC enter into a PPP Agreement with a private partner by way of a DBFMOOT concession modality, thus eliminating SEC's exposure to various risks such as market and credit risk while still realizing the proposed office accommodation.

## 6.3 Fiscal Regime

### 6.3.1 The Project Company

The use of special purpose companies in Ghana to carry out PPP projects have become commonplace.[12] The practice has been that special purpose companies established for the purpose of PPPs in Ghana must be incorporated in Ghana. This practice has also been adopted in the draft PPP bill which provides in section 64 thereof as follows:

*"A private entity which seeks to enter into a partnership agreement as a special purpose entity solely for the purpose of a partnership project or take over the rights of an entity that previously participated in a partnership process shall be incorporated in Ghana."*

Thus, if the SEC enters into a PPP Agreement with a private partner in the form of a DBFOOMT, or even where the project is carried out as a joint venture, that private partner must be incorporated in Ghana. If the private partner is a foreign entity, it may incorporate a subsidiary in Ghana or it can be registered as an external company.

### 6.3.2 Incorporation in Ghana

Before any company can do business in Ghana it must be registered with the Registrar General's Department. The Companies Act 1963 (Act 179) regulates the organisation of companies in Ghana. Under section 24 of the Act, the incorporation of a company in Ghana establishes a legal identity for the company that is separate from the legal identity of its shareholders. The Act permits the incorporation of different types of companies. For the purpose of carrying on business for profit, the Act permits the establishment of a company limited by shares or unlimited company (both of which can be either a public company or private company).

### 6.3.3 Foreign Private Party

Section 302 of the Companies Act defines an external company as a body corporate formed outside Ghana which has an established place of business in Ghana. Where the private party is a foreign/external company, it may incorporate a subsidiary company in accordance with the Companies Act or register an external company/branch office.

An external company which establishes a place of business in Ghana is required to register with the Registrar General's Department, by delivering copies of its articles of association, nature of its business, the name of its local manager and other particulars for registration in accordance with section 303 of the Act. Section 306 of the Act also requires external companies to appoint a process agent on which legal processes and other documents may be served.

### 6.3.4 Tax

As earlier noted, a special purpose company may be used to carry out the project. This could be a wholly newly incorporated company or a branch office. Under Ghanaian law, companies (both local

[12] This conclusion was arrived at after interaction and consultations with an expert in the area.

and foreign) are liable to pay corporate tax of 25% on their profits and capital gains tax on dividends. A branch office is liable to pay branch profit tax of 10%.[13]

In addition, since the project envisages the provision of operation and maintenance services to prospective users of the office accommodation facility it will attract value added tax (VAT).[14]

As earlier noted, an SPV may be used to carry out the project. This could be a wholly newly incorporated company or a branch office. Under Ghanaian law, company (both local and foreign) are liable to pay corporate tax of 25% on their profits whereas a branch office is liable to pay branch profit tax of 10%.[15]

### 6.3.5 Foreign Investment Law

There is no shareholding percentage limit for foreign participation in companies incorporated in Ghana, however, the Ghana Investment Promotion Centre (GIPC) Act 2013, (Act 865) provides for a minimum capitalization requirement for companies with foreign participation and wholly foreign owned entities. The Act reserves certain activities for Ghanaians and Ghanaian owned companies and also requires minimum national participation for areas that foreign participation is not prohibited. The Real Estate sector is not caught by these restrictions. Thus, since the company to be incorporated by the private party and the special purpose company may be wholly or partially owned by foreigners, it will be subject to the stated minimum capital requirements specified in the act as follows:

- Wholly foreign-owned: US$500,000;
- Jointly owned Foreign/Ghanaian ownership: Minimum investment by the foreigner should not be less than US$200,000.

Section 24 of the Act, also, requires that companies with foreign participation incorporated in Ghana must register with the GIPC.

**Benefits of Registering with GPIC**

Persons/entities registered with the GIPC enjoy the following benefits:

- There is custom duty exemption for stated equipment and machinery imported for investment purposes.
- Guaranteed unconditional transferability through any authorized dealer bank in freely convertible currency of dividends or net profits attributable to the investment and the remittance of proceeds (net of all taxes and other obligations) in the event of sale or liquidation of the enterprise or any interest attributable to the investment, etc.
- Initial automatic maximum immigrant quotas as follows:

---

[13] Sections 58 & 60 of Income Tax Act, 2015 Act 896
[14] Section 5 of Value Added Tax Act, 2013 Act 870
[15] Sections 58 & 60 of Income Tax Act, 2015 Act 896

- Enterprise with a paid- up capital of $50,000 but less than $250,000: One person
- Enterprise with a paid up capital of $250,000 but less than $500,000: Two persons
- Enterprise with a paid up capital of $500,000 or $700,000: Three persons
- Enterprise with a paid up capital of $700,000 or more: Four persons

Where the entity seeks to engage more foreigners than the maximum immigration quota provided, it must make application to the Ghana Immigration Service justifying the need for exemption to engage more than the permitted quota. The permission is usually granted if the entity can demonstrate the required expertise required is not available in Ghana. The GIPC Act, in section 31, also grants protection against nationalisation and expropriation which is also guaranteed under the 1992 Constitution of Ghana. Any tax exemptions agreed under the PPP arrangement above those specified in the Ghana Investment Promotion Centre Act shall be subject to parliamentary ratification in accordance with Article 174 of the 1992 Constitution.

### 6.3.6 Foreign Exchange Control

The Foreign Exchange 2006 (Act 723) introduced a more liberal foreign exchange control regime which abolished the strict foreign exchange controls existing under the old Foreign Exchange Control Act. Currently, there are no foreign exchange controls or currency regulations so long as transactions are effected through the banking system. Repatriation of funds or dividends and payments in foreign currency is not prohibited.

Therefore, there are no restrictions on the transfer of foreign exchange earnings to an external account in convertible currency of dividends or net profits and for payments for the servicing of loans. As earlier stated, companies registered under the GIPC are guaranteed transfer of net profits in freely convertible currency subject to the payment of all tax liability. Two types of foreign accounts can be maintained by any person (including local subsidiaries and branch offices). These are foreign exchange accounts which can be credited with foreign exchange earnings not converted into cedi balances and foreign currency accounts for which may be credited with transfers in foreign currency from abroad or other foreign currency accounts.

## 6.4 Site and Related Infrastructure Enablement

The documentation available on SEC's land is the lease agreement between the President of Ghana and SEC dated 12th December, 2008 under which the land was granted to the Commission. In essence, SEC currently owns a leasehold interest in the land and in fact possession and occupation over the land is currently being exercised by it. Based on a review of the lease agreement, it appears that SEC has completed perfection of its title at the Lands Commission and the relevant fees paid.

Under the Lands Commission Act, 2008 (Act 767), the Lands Commission is responsible for, among others, the management of state acquired lands and lands vested in the President in conformity with approved land use plans on behalf of the government and registering deeds and instrument that affect land throughout the country. Therefore, generally, leases acquired from the Government of Ghana are litigation free and are not subject to adverse claims. Thus, it can be safely assumed that SEC's land is not subject to any claims especially as the lease agreement has been duly executed and registered by the Lands Commission.

In addition, and based on the work completed at the pre-feasibility stage, there is no indication that the location of the land is not suitable for the project. If the need arises, an application for re-zoning will be made for a mixed use building (office and residential units). Under the lease agreement, the ground fee for the first ten years has been fixed at GH₵1,449.00 per annum. Ordinarily, ground rent has to be paid to the Lands Commission every year. However, in the event that this has not been done, the Lands Commission will insist on payment of all outstanding ground rent before processing any documentation in respect of agreements conferring a leasehold interest to the private party under the PPP arrangement.

The private party will be required to pay the applicable and prescribed fees for the registration of the lease to be granted under the concession with the Lands Commission together with the assessed stamp duty. The private party will also be responsible for payment of the yearly ground rent for the duration of the concession which according to the terms of the lease granted to SEC shall be subject to revision every tenth year. In addition, it will be prudent that the sub-lease title be registered with the Land Title Registry.

### 6.4.1 Heritage Rights

There are no specific laws on heritage rights, however, the National Commission on Culture Act 1990, (P.N.D.C. Law 238) which establishes National Commission on Culture provides that National Commission on Culture is responsible for the preservation and promotion of Ghanaian culture and supervision of museums and monuments. Therefore, any archaeological finds on the project site will be dealt with by the state through the National Commission on Culture.

## 6.5 Outright Sale of Residential Units under Mixed-Use Building

As stated above, a DBFMOOT modality involves an arrangement *"where government concedes the right to ownership and management of the public service to a private partner for a specified duration, with ownership to be returned to the state at the end of the concession period the concession duration depends on a number of factors, the most important being the time required to recover initial investments made by the private partner (concessionaire)."*

As the private party will only be granted the right to build, own and operate the facility for a period, after which ownership and management/operation of the facility will be transferred back to SEC, the central issue to be resolved is whether the private party is entitled to sell residential units outright to third parties/the general public under a Build-Operate-Transfer (BOT) model.

Generally speaking, a sale means that the transfer of property or title in an asset from a seller (vendor) to a buyer (See Black's Law Dictionary 8th edition, p. 1364). Since the concession duration will be for a fixed period, the nature of the interest in land that a private party can acquire under Ghanaian law must be discussed, especially in the context of a mixed-use building where residential units are sold outright.

### 6.5.1 Interest in Land in Ghana

Land in Ghana is held from various traditional Stools (Skins) or families or clans which are the allodial owners. The state holds lands by acquisition from these traditional allodial owners because it has power to acquire land compulsorily from any proprietor of land in Ghana under section 1 of the State Lands Act, (1962) Act 125. The effect of such compulsory acquisition is to vest the allodial title and all other subordinate interests in the state free from all encumbrances.[16] The area where the land in question is located is an example of such lands acquired by the state.

Interests in land which a person can acquire in Ghana originate from Ghanaian customary law and tradition and some are derived from those parts of the English common law and equity which have been assimilated into the common law of Ghana (See Article 11 (2) of the 1992 constitution).

Section 19 of the Land Title Registration Act, (1986) P.N.D.C. Law 152 provides that the interests which can exist in land in Ghana are:

i. The allodial title;
ii. Freehold title or interest which may be either a customary freehold or common law freehold;
iii. A leasehold; and
iv. A lesser interest created by virtue of any right under contractual or share-cropping or other customary tenancy agreement.

The allodial title is the highest title capable of being held in Ghana. It confers on the holder complete and absolute freedom to deal with the land.

The freehold interest is held for an indefinite period and the owner of a freehold interest has the right of occupation of the land which may devolve on his successors ad infinitum.

A lease is for a fixed term and may be as short as one year or for as long as 99 years.

Article 267(5) of the 1992 constitution forbids the creation of freehold interests in any stool land in Ghana. So as from 7 January 1993, (the commencement date of the 1992 constitution) no one can acquire a freehold interest in any stool land in Ghana. Since the land in question is stool land acquired by the state a freehold interest could not have been granted to SEC hence a fifty year lease.

Article 266 (1) & (4) of the Constitution also prohibit foreign persons (both natural and artificial) from acquiring a freehold interest or leasehold interest exceeding fifty years in land in Ghana. In other words, foreign persons cannot acquire a lease in land in Ghana for a duration of more than fifty years.

With these constitutional restrictions and the growing rate of urbanization in Ghana, the invariable practice in most parts of the country, especially in Accra, is to grant a leasehold interest to a

[16] BJ Da Rocha and C.H.K. Lodoh, Ghana Land Law and Conveyancing, 2nd edition, (1999) at P. 3

purchaser of land and not a freehold, which is not for a fixed duration. Therefore, even where the nomenclature used is a 'sale,' what is invariably contemplated and acquired is a 'lease.' Since the private party will be granted a right and an interest over land belonging to SEC for 20 years, in law, the interest which will be granted to the private party over the land by SEC will be a lease or a sub-lease – because a lease is an interest in land which is created to last for a fixed period. Every lease must therefore have a date on which it commences and a date on which it must expire although, it may in certain circumstances, be terminated before the actual date fixed for its expiration.[17]

Under the common law of Ghana (see Article 11 (2) of the 1992 Constitution), leases are for a fixed term. Whatever the duration of a lease, it must be a term which is certain or capable of ascertainment before it takes effect, for there can be no lease unless it is for a certain duration (See Lace v Chantler [1944 1 KB 368]). A lease may be as short as one year or for as long as 99 years. As a matter of convenience, leases of 1 to 9 years duration are classified as short leases; those of 10 to 49 years' duration as medium term leases, and those of 50 to 99 years' duration as long term leases.

These classifications are necessary because certain covenants, for example, an express covenant absolutely forbidding assignment or subletting, which could be included in short term leases, could not be included in medium or long term leases where the lessee is expected to spend considerable sums of money in developing the land. Therefore, a lessee (in this case, the SEC) may create a sublease by granting a term shorter than the remainder of its term to the private party, even if less by one day, because under a DBFMOOT – the private party is required to transfer the facility back to SEC at the end of the concession period.

A sublease, being a derivative of a lease, will at least contain recitals of the lease from which it is to be granted, the consent of the lessor to the granting of the sublease and the fact the sublessor has agreed to grant the sublease to the sublessee for the purposes of the office accommodation project subject to the usual covenants, conditions and stipulations.

Now, if units are to be sold outright by the private party to the third parties under the DBFMOOT, in law, the sale will amount to a transfer of an interest in immovable property (i.e. the building unit) for a fixed term, depending on the completion date of the project. Thus, in this scenario, the sublease will begin at a commencement date and expire at a date before the expiration of the concession period. This is because, under Ghanaian law, the third party can only acquire or purchase a sublease interest from the private party, since a key feature of the DBFMOOT model is the requirement that the private party is required to transfer the facility back to the SEC upon the expiration of the concession period.

[17] BJ Da Rocha and C.H.K. Lodoh, Ghana Land Law and Conveyancing, 2nd edition, (1999) at P. 29

**Recommendation**

Given the above, it is possible for a developer to sell residential units to third parties under a DBFMOOT modality, provided what is being transferred to a third party under the sale is a sublease interest, as most land sale transactions in Ghana are invariably leases. However, selling residential units to third parties for periods that are less than typical in Accra (i.e. a minimum 50 year period) may decrease the attractiveness to third party purchasers.

Since the private party is entitled to sell residential units by virtue of a sublease, albeit for a short period, the viability of this scheme can be markedly enhanced if the purchasers of residential units are assured that the subleases shall be renewed by SEC upon the expiration of the initial term which would terminate with the end of the proposed concession period.

In this regard, it is recommended that the sublease agreements for outright sale of residential units should be executed between SEC and the Private Party on one hand and the purchaser on the other hand. Such an agreement should contain clauses guaranteeing, inter alia, the renewal and continuation of the sublease for a further period following the expiration of the concession and the transfer of the facility back to SEC on terms to be agreed by the parties and with assurances from SEC that the continuation of the sublease shall not be unreasonably withheld.

# 7 Viability Assessment

## 7.1 Introduction

Further to the assessments made at the pre-feasibility stage for this mandate, the purpose of this chapter is to refine the financial and commercial viability estimates made at the pre-feasibility stage, in order to (i) determine the viability of the project based on the preferred concession modality and (ii) inform the bid strategy at the procurement stage.

The Project Team's refinements to the viability assessment are based on:

1. Further discussions with real estate developers and the commercial banking institutions that they engage with to bring further accuracy to the likely capital structures for SEC's project. Further discussions with real estate developers were also held in order to better understand their business models as it relates to commercial and residential real estate developments.

2. Field investigations with a particular focus on residential and commercial properties under development or properties developed and commissioned in the past three years or less to further inform estimates regarding rents, rent escalation rates and vacancy rates.

3. Discussions with financiers and investors that have a particular focus on funding real estate developments to gain further insights on current market conditions and the outlook for Accra's real estate space.

Based on the above, in addition to the resulting changes in construction and operational costing estimates – based on changes to building size, volume and underground parking levels – refinements were made to the pre-feasibility viability assessment in order to bring it to a feasibility stage.

## 7.2 Viability Assessment Methodology

### 7.2.1 Discounted Cash Flow Model

In order to assess the commercial viability of procuring SEC's proposed accommodation under a PPP procurement model, a discounted cash flow (DCF) model (i.e., 'financial' or 'valuation' model) was developed by the Project Team.

Based on inputs such as rents, construction costs, building O&M expenditures, etc., the DCF model estimates cash flow projections in each forecast year and discounts them to arrive at the present value[18] estimate. In other words, the DCF model calculates the value of future cash flows in present terms.

[18] Present value is defined as the value in the present of a sum of money, in contrast to some future value it will have when it has been invested at compound interest. For example, $110 due in one year has the value of $100 today, if that present value amount can be invested at an annual rate of 10%.

The discounted cash flow model calculates important metrics that are compared to market benchmarks in order to make a viability assessment. The metrics used at the feasibility stage are discussed in Section 7.6.1 below.

## 7.3 Preferred PPP Concession Modality

The Design-Build-Finance-Own-Operate-Maintain-Transfer (DBFOOMT) concession modality has been carried through from the pre-feasibility to the feasibility stage as the preferred PPP concession modality. The relative importance of private investment in SEC's proposed accommodation combined with the favourable impact to the public sector's bursary (both at the construction and operational stages of the proposed accommodation) was also given consideration when bringing the DBFMOOT model as the preferred choice in the feasibility stage.

## 7.4 Preferred Building-use Option

Based on further consultations with developers and related stakeholders, as well as field investigations in the Cantonments area, the commercial and mixed-use options remain the preferred building-use choices for SEC's proposed accommodation.

For the purposes of this viability assessment, it was assumed that as per the legal due diligence in Chapter 6, sublease agreements for the outright sale of residential units be executed between SEC and the Private Party on one hand and the purchaser on the other hand, in order to make residential developments viable in the mixed-use option. However, in order to achieve its vision of a full commercial complex, it is recommended that the technical scoring criteria allocate *additional* points to those bidders that propose building-use patterns that are in-line with SEC's vision.

## 7.5 Changes from Pre-Feasibility to Feasibility

In this section, we cover changes made from the pre-feasibility to the feasibility stage based on comments made by SEC/Project Delivery Team (PDT) and further insights from market consultations and field investigations.

### 7.5.1 Costs

Based on comments received by SEC/PDT following the submission of the draft pre-feasibility report, the Project Team has endeavoured to:

1. Increase the size/volume of the building and;
2. Increase the number of parking spots.

These changes are described in Chapter 4 along with discussion on the upper limit to increasing building size/volume and the number of parking spots. SEC/PDT's comments necessarily have an impact on upfront, operational and lifecycle building costs which are provided in Appendix I with breakdowns provided below.

**Statement of Probable Costs**

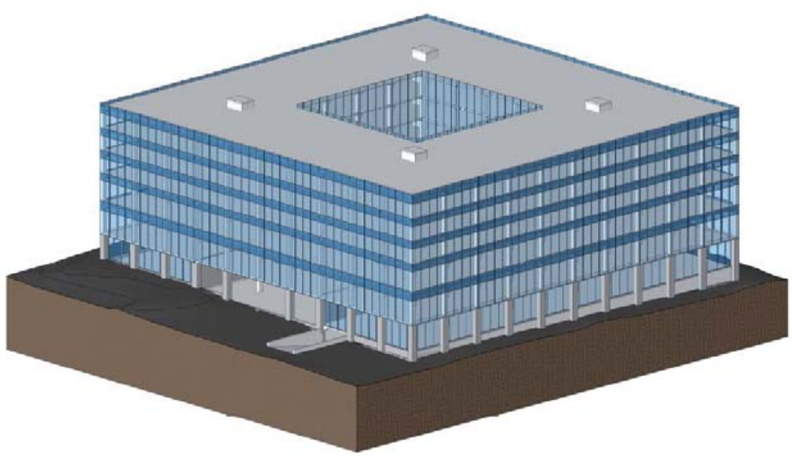
The Project Team has no control over the cost of labour and materials, the preferred bidder's/contractor's method of determining prices, or competitive bidding and market conditions. The opinion of capital and operational expenditures is made on the basis of experience, qualifications and best judgement of the professional consultant familiar with the construction industry. We cannot and do not guarantee that proposals, bids or actual construction costs will not vary from the estimates provided in this report or in subsequent phases of the project mandate.

**Changes in Above-Grade Upfront Construction Costs**

From pre-feasibility to feasibility, the Project Team examined a number of options seeking to find a balance between maximizing development area without proposing a development option that was not realistic given the surrounding context, and thus an option that a potential developer would not propose.

Whilst a larger development footprint option was initially examined by the Project Team, it was ruled out due to a number of factors including the overwhelming massing on the site, reduced site development areas for additional site features and fit/feel of the building volume within the Cantonments area (see Chapter 4, Section 4.3.2). However, by proposing the below design, the above-grade building volume has increased from 17,068 SQM at the pre-feasibility stage to 19,330 SQM at the feasibility stage, allowing for more leasable area and thus, further subsidising SEC's space over the concession period as per the figure below.

Figure 7-1: Feasibility Stage Proposed Development - 3D View Looking Northeast



Source: CPCS

The figure below describes the area comparison from pre-feasibility to feasibility, which is followed by a summary of incremental upfront construction costs in the face of this increase.

Figure 7-2: Pre-Feasibility to Feasibility Above-Grade Area Comparison (in SQM)

| | Pre-Feasibility | Feasibility | Additional Area |
|---|---|---|---|
| Floor One | 2,845 | 2,845 | 0 |
| Floor Two | 2,845 | 3,296 | 451 |
| Floor Three | 2,845 | 3,296 | 451 |
| Floor Four | 2,845 | 3,296 | 451 |
| Floor Five | 2,845 | 3,296 | 451 |
| Floor Six | 2,845 | 3,296 | 451 |
| **Total** | **17,068** | **19,330** | **2,255** |

Source: CPCS

Figure 7-3: Pre-Feasibility to Feasibility Above-Grade Construction Cost Comparison

| | **Pre-Feasibility** | **Feasibility** |
|---|---|---|
| Total Above-Grade Construction Cost | US$31,850,972 | US$35,791,410 |
| Cost per SQM | US$1,865 | US$1,852 |

Source: CPCS

Total above-grade construction costs have increased by approximately US$3.9M due to the increased building volume.

### Changes in Below-Grade Upfront Construction Costs

The number of underground parking spots proposed at the pre-feasibility stage (two underground parking floors with a total of 110 parking bays) was also considered insufficient for the building volume and thus, a request was made for additional parking spots. While the results of the geotechnical study (see Appendix B and Chapter 4 Section 4.3.4) indicate a high water table, it was determined that it is feasible for a total of three levels of below-grade parking to be developed (with 104 parking bays per level) without having to encounter specialized construction techniques (which would add significant cost to the building structural elements). Should ground water have been located closer to the surface, then additional watertight construction methodologies and rock anchors may have been required.

However, we do note that given the high water table, dewatering would be required until the building structure is completed to the level of existing grade. Foundation waterproofing as well as sump and associated pumps would also be required to ensure long-term mitigation of water ingress in the lower parking levels.

The figure below describes the area comparison from pre-feasibility to feasibility, which is followed by a summary of incremental upfront construction costs in the face of this increase. Note that the increase in below-grade area now extends beyond the building footprint.

Figure 7-4: Pre-Feasibility to Feasibility Below-Grade Area Comparison (in SQM)

| | Pre-Feasibility | Feasibility | Additional Area |
|---|---|---|---|
| Floor One | 0 | 3,844 | 3,844 |
| Floor Two | 2,845 | 3,844 | 3,844 |
| Floor Three | 2,845 | 3,844 | 3,844 |

| | Pre-Feasibility | Feasibility | Additional Area |
|---|---|---|---|
| **Total** | **5,690** | **11,532** | **5,842** |

Source: CPCS

**Figure 7-5: Pre-Feasibility to Feasibility Below-Grade Construction Cost Comparison**

| | Pre-Feasibility | Feasibility |
|---|---|---|
| Total Below-Grade Construction Cost | US$5,968,096 | US$9,613,152 |
| Cost per SQM | US$1,048.87 | US$833.75 |

Source: CPCS

Adding another level of parking, as well as the increase in area per floor, has increased below-grade construction costs by US$3.7M, although the cost per SQM has decreased. This is because increasing the footprint of the parking structure (currently rectangular) as compared to the prefeasibility development, by approximately 1,000SQM/floor level, allows for a more efficient development of the space. The increase in space results in proportionally less foundation wall as compared to the floor slab and additional columns that are required.

Furthermore, adding one level of parking structure with a slight reduction in overall underground floor to floor height from pre-feasibility to feasibility minimizes the additional excavation and column lengths but adds approximately 3,800 SQM of floor space. While there are costs for this space related to the suspend slab, mechanical and electrical services as well as interior walls and doors, the overall height reduction results in savings on a per SQM of foundation wall associated. The net result is a cost-efficient increase in parking area.

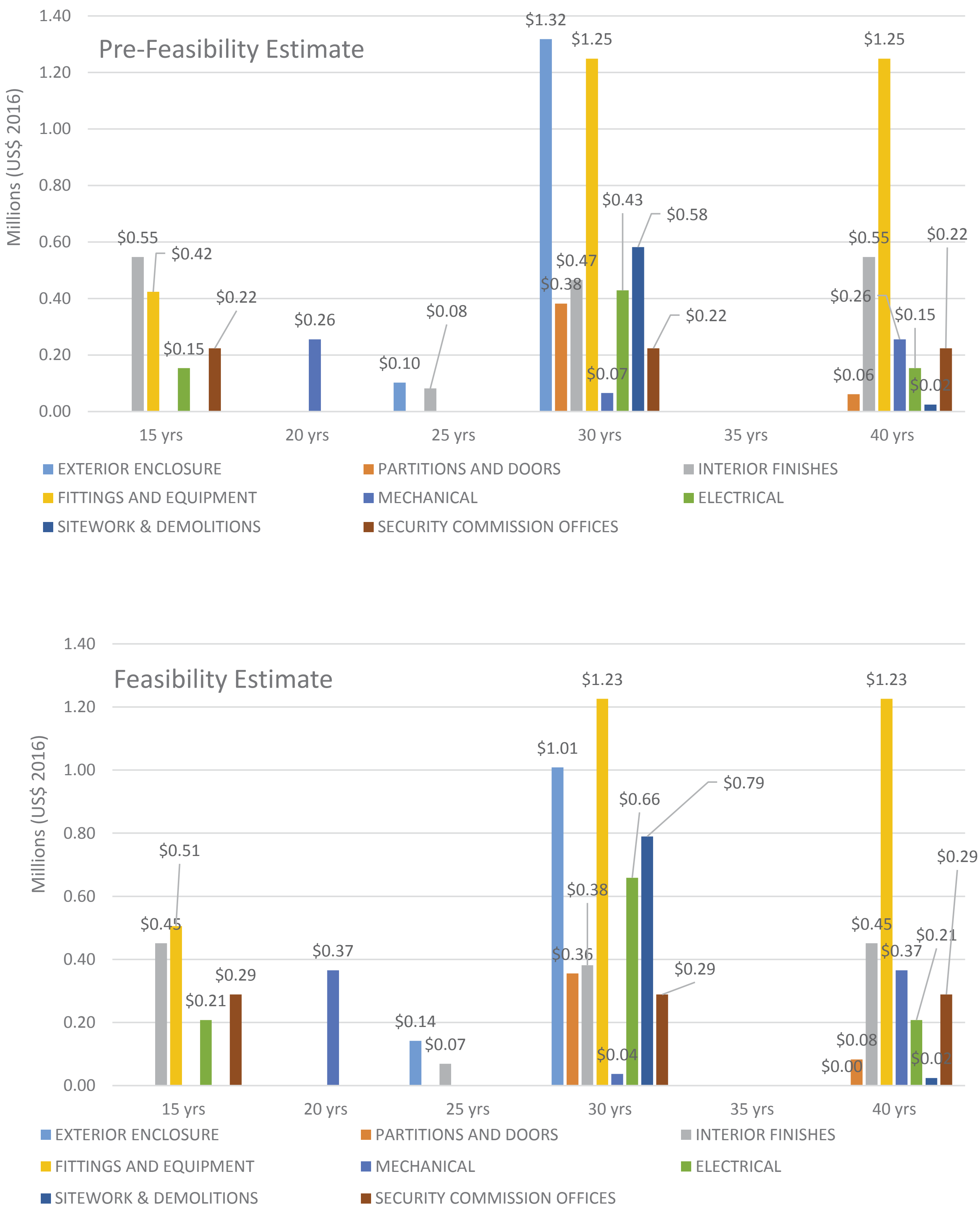
### Changes in Operational Costs

As per Appendix I, the yearly estimate for operating, maintenance and repair costs has increased from US$533K to US$625K (in 2016 dollars) due to the increase in above and below-grade building volume. The increase in electricity costs are offset by the installation of an on-site renewable energy system (specifically, a photovoltaic system covering approximately 70% of the usable roof area) and resulting in a reduction of electricity costs by approximately US$13K a month.

### Changes in Lifecycle Costs

Lifecycle costs refer to the total capital costs anticipated over the life of SEC's proposed accommodation. Appendix I provides a detailed breakdown of life cycle costs over a 40 year period, including items such as wall, window and roof replacements. A summary breakdown is provided below from pre-feasibility to feasibility.

**Figure 7-6: Pre-Feasibility to Feasibility Building Lifecycle Costs (in 2016 Dollars)**




Source: CPCS

In total, the sum lifecycle costs (in 2016 US dollars) over a 40-year period have increased from approximately US$9.0M to US$9.4M

### 7.5.2 Developer Business Models

At the pre-feasibility stage, the following assumptions were made regarding the business of residential, retail and commercial developers:

- **Residential**: Developers in the residential space develop units and sell some units while making other units available for rent;
- **Commercial**: Developers in the commercial space see commercial developments as a long-term investment and thus only rent commercial units; and
- **Retail**: Developers offering retail space within a commercial, residential or mixed-use building, offer retail units for rent only.

Our assumptions for commercial and retail business models have been confirmed through field investigations however, our assumption on the business model for residential developers has been updated. Unlike the commercial and retail models, developers in the residential space are looking to sell, outright, 100% of their residential units, and will go so far as to pre-sell them during the construction period in order to offset upfront construction costs. Thus, the Project Team has altered its assumption at the feasibility stage to reflect this revised understanding.

### 7.5.3 Typical Capital Structures and Cost of Capital Assumptions

**Gearing Ratio**

A project's gearing ratio is the ratio that compares equity that is invested in the project to borrowed funds. Among other considerations, a project's gearing ratio is typically a function of financial risk and more specifically the certainty and timing of a project's cash flows.

At the pre-feasibility stage, two separate gearing ratios were assumed for SEC's proposed accommodation, depending on the building-use option that was considered. A ratio of 70/30 (i.e., the project is 70% debt and 30% equity) was assumed in the full commercial case and 75/25 in the mixed-use case.

Subsequently, the Project Team met with Stanbic Bank's Real Estate Finance team to further discuss typical capital structures that are exhibited in Accra for real estate developments. It should be noted that Stanbic is a leader in financing real estate developments in Accra and some of its flagship deals include providing financing in the amount of US$31.2 million for One Airport Square, an office accommodation complex located at Casely Hayford Road, Accra and certified by Green Star Energy as an eco-friendly facility (see Appendix J – Market and Field Investigation Summaries for a building profile of One Airport Square).

Through its leadership in financing real estate developments in Accra, Stanbic was able to provide key insights in typical capital structures and cost of capital assumptions, in addition to the current and prospective outlook for the real estate market in Accra.

Regarding the capital structure, Stanbic explained that while each development case is unique, generally up to a maximum of 70% of upfront capital costs can be funded with debt depending on the track record of the developer and the proposed project's ability to achieve a critical mass of tenants before the project commences.

Based on the assumption that a credible bidder will be on-boarded to develop SEC's proposed accommodation, the maximum of 70% or a 70/30 debt-to-equity ratio (gearing ratio) was assumed at the feasibility stage.

### Cost of Capital

Debt

At the pre-feasibility stage, the below figure provides a summary of the debt term sheet that was assumed.

Figure 7-7: Pre-Feasibily Debt Term Sheet

| | Term |
|---|---|
| Tenor | 10 years |
| Grace Period | 2 years |
| Annual Interest Rate | 10% |
| Upfront Fee | 1.5% |
| Commitment Fee | 1.0% |

Source: CPCS

Based on further discussions with Stanbic's Real Estate Finance team, our understanding is that under a project finance scheme, Stanbic lends to credible developers at LIBOR[19] + 8.5% over a seven year term with an option to refinance for a further three years based on the credibility of the developer and equity partners in the project. Thus, under a scenario where SEC's development is funded under a project finance scheme, the rate is assumed to be 8%[20] with a further assumption that the developer will be able to refinance to the full ten years.

The below figure summarizes the updated term sheet.

Figure 7-8: Feasibility Debt Term Sheet

| | Term |
|---|---|
| Tenor | 10 years |
| Grace Period | 2 years |
| Annual Interest Rate | 8% |
| Upfront Fee | 1.5% |
| Commitment Fee | 1.0% |

Source: CPCS estimate based on market consultations

[19] London Interbank Offered Rate (LIBOR)
[20] The USD LIBOR rate (one month) is -0.40329%

Equity

At the pre-feasibility stage, the benchmark for the equity internal rate of return (IRR), which represents the time-adjusted shareholder earnings over the project life, was set at 14.5%. However, this has been revised downward to 12% based on industry consultations, and based on feedback from Stanbic which indicated that in the past five years, Accra's real estate market has become increasingly saturated with real estate vacancy rates on the rise. Thus, developers choosing to develop in Accra are accepting lower returns.

### 7.5.4 Topline Estimates

**Rental Rates**

At the pre-feasibility stage, the figure below summarized monthly rental rates per SQM by building-use type in 2016 prices (for a grade A accommodation). Rental rates presented below are inclusive of typical service charges used to recoup certain recoverable building O&M costs.

Figure 7-9: Monthly Rental Rates (Inclusive of Rental Charge) per Building-Use Type (US 2016 Prices)

| Building-Use Type | Monthly Rental Rate per SQM (USD) |
|---|---|
| Retail (Line Shops) | 50 |
| Residential | 40 |
| Commercial | 30 |

Source: CPCS Pre-Feasibility Estimate

Based on market and field investigations as summarized in Appendix J, at the feasibility stage, rental rates are summarized as per the figure below.

Figure 7-10: Monthly Rental and Service Charge Rates pe Building-Use Type (US 2016 Prices)

| Building-Use Type | Monthly Rental Rate per SQM | Service Charge Rate per SQM |
|---|---|---|
| Retail (Line Shops) | 42 | 8 |
| Residential | N/A[1] | 1.7 |
| Commercial | 35 | 4.5 |

Source: CPCS Feasibility estimate based on market and field investigations

1. At the feasibility stage, 100% of residential units are assumed to be sold outright under the mixed-use building option

It should be noted that the above are benchmarked based on advertised rates for various, related developments in Accra. For the residential estimate, advertised service charge rates from the Pearl in the City development (commissioning expected before the end of the current year), located on 5th Circular Road no: 19 P.O. Box ct. 8204, Cantonments, Accra were benchmarked.

For commercial rental and service charge rates, advertised rates from the recent commercial development in Cantonments City (see Figure 7-11 on the right) were benchmarked due to the similarity in construction quality and proximity to SEC's proposed accommodation.

Figure 7-11: Cantonments City

The estimates provided in Figure 7-10 were further revised following discussions with Stanbic's Real Estate Finance team and confirmed by rental agents in Accra. As mentioned above, in the past five years, Accra's real estate market has become heavily saturated with vacancy rates on the rise due to an oversupply of real estate and especially, commercial office space. A figure that is often noted, and repeated amongst knowledgeable experts in the sector is that, currently, Accra has an 116,000 SQM of excess commercial office space on the market. The downward trend in occupancy rates has resulted in some developments going unfinished as evidenced when perusing through areas in Accra such as Airport City and Airport Residential.

This excess supply has given prospective tenants sufficient bargaining power to negotiate better deals with commercial landlords. For example, advertised rates at One Airport City are US$38 per SQM per month but based on industry feedback, these rates can be negotiated down to the US$26 to US$30 range. It should also be noted that although One Airport City was commissioned in 2014 and is a development that is similar to that of SEC's proposed accommodation (eco-friendly commercial complex), it still remains 35% unoccupied.

Figure 7-12: Monthly Rental and Service Charge Rates pe Building-Use Type (US 2016 Prices)

| Building-Use Type | Monthly Rental Rate per SQM | Service Charge Rate per SQM |
|---|---|---|
| Retail (Line Shops) | 42 | 8 |
| Residential | N/A[1] | 1.7 |
| Commercial | 30 | 4.5 |

Source: CPCS Estimate based on Industry Feedback

1. At the feasibility stage, 100% of residential units are assumed to be sold outright under the mixed-use building option

**Rent and Service Charge Escalation**

Yearly rent and service charge escalation rates were set at 3.5% per annum at the pre-feasibility stage. However, based on similar a rationale to that of the above regarding the current and prospective real estate market in Accra, and the resulting increasing negotiating power of tenants, escalation rates have been revised to 2.5%.

### 7.5.5 Parking Allocations

At the pre-feasibility level, the Project Team initially determined that developers allocate parking bays to commercial tenants at 2.5 to 3.0 bays per 100 SQM and for residential tenants, one bay for one-bedroom units and 1.5 bays for two-bedroom units. However, with further market and field investigations conducted at the feasibility stage, the Project Team has come to understand that given the increased rate of urbanization in Accra, commercial developments that are three years or newer offer commercial tenants 1 to 1.5 parking bays per SQM and residential developments offer one bay for both one and two bedroom units. Furthermore, newer developments such as Stanbic Heights and One Airport Square charge tenants between US$50 and US$100 per month for additional parking bays. (see Appendix J – Market and Field Investigation Summary for commercial building profiles inclusive of parking information)

As such, the Project Team has revised its parking allocation for both the commercial and mixed-use building scenarios. Assuming that over-ground parking is allocated strictly for retail use and SEC is allocated 80 parking bays, we have assumed that 70% of the remaining bays would be rented at US$100 per month (2016 dollars). The breakdown is provided in the figure below.

Figure 7-13: Parkign Allocation by Building-Use at Feasibility Stage

| Allocation | Mixed-Use[1] | Full Commercial[2] |
|---|---|---|
| Total U/G Bays | **312** | **312** |
| Residential Tenants | 158 | 0 |
| Commercial Tenants | 62 | 88 |
| SEC Allocation | 80 | 80 |
| Available for Rent | 12 | 144 |

1. Assumes two floors of residential with a total of 74 one- and two-bedroom units per floor and three floors of commercial office space with a net leasable area of 7,908 SQM less median point of space allocation low/high estimate for SEC (1,800 SQM) or 6,108 SQM.
2. Assumes five floors of commercial office space with a net leasable area of 10,544 SQM less median point of space allocation low/high estimate for SEC (1,800) or 8,744.

Source: CPCS

### 7.5.6 Concession Period

At the pre-feasibility stage, a 40-year concession period was contemplated as real estate endeavours similar to that of SEC's proposed accommodation require significant upfront capital which is paid back over the longer-term from rents. Thus, it was envisaged that a 40-year period would afford a sufficient length of time for the developer to recoup its investments while also making a reasonable profit.

Moving to the feasibility stage, and based on a further study of developer business models and likely capital structures/costs in Accra's real estate market, the concession period was revised to 25-years which forms the base case in the valuation that is to follow.

### 7.5.7 Construction Period

A 24-month construction period was assumed at the pre-feasibility stage however, based on further studies and typical construction periods for real estate in Accra, the construction period was increased to 30 months.

### 7.5.8 SEC's Allocated Space

**Allocated Space**

One of SEC's primary objectives is to maximise the space that it is allocated from a private developer as against the granting of its land to a prospective private developer. At the pre-feasibility stage, based on a forecasted FTE count of 113, a space allocation of 1,400 SQM was contemplated as optimal for SEC to perform its functions and was tested for viability. Based on feedback from SEC/PDT, an additional 800 SQM was requested owing to further increases in SEC's staff count over the life of the concession. Thus, both 1,400 SQM and 2,200 SQM are tested in the valuation below.

**SEC Full Fit-up, Moving Allowance and Swing Space**

In the base case viability analysis at the pre-feasibility stage, SEC's fit-up, furniture, fixtures and equipment as well as swing space/moving allowance (see Technical Specification discussion in Chapter 3 Section 3.2.2 of this report), were not included in the developer's total project costs as developers typically do not bare such tenant costs. However, based on further discussions with the Commission, the Project Team was requested to include the above components as part of the developer's project costs.

SEC's full fit-up is broken down into (1) basic fit-up which is estimated at US$1,250 per SQM of space and (2) furniture, fixtures and equipment which is estimated at US$286 per SQM. The Commission's swing space and moving allowance have been estimated at a cost of US$300K[21] assuming a 30 month construction period.

The below figure breaks down SEC's full fit-up, moving allowance and swing space costs, which have been added to project costs.

Figure 7-14: Breakdown of SEC's Full fit-up, Moving Allowance and Swing Space (US$)

| Item | 1,400SQM | 2,200SQM |
|---|---|---|
| Basic Fit-up | 1,750,000 | 2,750,000 |
| Furniture, Fixtures and Equipment | 400,000 | 630,000 |
| Swing Space / Moving Allowance | 300,000 | 300,000 |
| **Total** | **2,450,000** | **3,680,000** |

Source: CPCS Estimate

### 7.5.9 SEC Space Related Operating and Maintenance Budget

To better inform SEC of its yearly O&M costs, the Project Team has developed an opinion of probable operations, maintenance and utility costs as well as general allowances for the Commission's specific portion of the building.

SEC's annual O&M budget has been estimated at approximately US$34.30 per SQM per year (in 2016 prices) and includes the following items:

- Electrical power supply
- Telecommunications fees
- Water and sewerage fees
- HVAC repairs (i.e. server room)
- Cleaning
- Garbage Removal
- Pest Control
- Fire Protection/maintenance (server room dry chemical system)
- Security, CCTV and access control equipment (equipment and software maintenance and renewal)
- General maintenance
- Glass and door repair
- Lighting replacement

[21] The allowance for swing space and moving is based on an assumption that the proposed developer will be able to utilize existing leasable space within their own portfolio in Accra area and or have access to reasonably price leasable space for the duration of the construction period that is of equal or higher quality than the existing SEC accommodations.

- Locksmith services
- Interior painting
- Ceiling system repairs
- Plumbing maintenance
- Updating and replacement of signage and directories
- Administrative and insurances related directly to SEC space O&M

SEC's budget has not changed at the feasibility level and has not been included as part of the developer's ongoing costs.

## 7.6 Valuation Assessment

### 7.6.1 Valuation Metrics

The below figure summaries the updated valuation metrics as per the above discussions on capital structure. Various scenarios were tested in the viability model and compared to metrics below as part of the financial assessment.

| Metrics | Description | Benchmark |
|---|---|---|
| Equity Internal Rate of Return (IRR) | • Represents the time-adjusted **shareholder earnings** over the project life<br>• Measures the returns for equity investments in SEC's proposed accommodation, after debt has been serviced | 12% per annum |
| Equity Net Present Value (NPV) | • Equity NPV is the is the present value of individual cash flows (both in and outflows) of a series of cash flows to shareholders (i.e., project cash flows after debt-servicing) | An equity NPV that is less than US$0 indicates that the returns to shareholders are less than the Equity IRR |
| Equity Payback Period | • Length of time required to recoup equity investments in SEC's proposed accommodation | 10 – 15 years |

### 7.6.2 Results

**Financial Assessment**

The project's financial viability was tested based on the updated assumptions as per Section 7.5 above. In addition, scenarios were developed that tested viability based on both 1,400S QM and 2,200 SQM of space allocation to SEC for the full commercial and mixed-use accommodation. The results are summarized in the figures below.

Figure 7-15: Viability Assessment with 1,400SQM of Space Allocated to SEC

| | Full Commercial | Mixed-Use |
|---|---|---|
| Concession Period | 25 Years | 25 Years |
| SEC Fit-up Responsibility | Developer | Developer |

| | | |
|---|---|---|
| SEC FFE Responsibility | Developer | Developer |
| SEC Moving Allowance/Swing Space Responsibility | Developer | Developer |
| Equity Internal Rate of Return | 12.65% | 12.48% |
| Equity Net Present Value (000) | +US$1,323 | +US$584 |
| Equity Payback Period | 13 Years | 13 Years |

Figure 7-16: Viability Assessment with 2,200SQM of Space Allocated to SEC

| | Full Commercial | Mixed-Use |
|---|---|---|
| Concession Period | 25 Years | 25 Years |
| SEC Fit-up Responsibility | Developer | Developer |
| SEC FFE Responsibility | Developer | Developer |
| SEC Moving Allowance/Swing Space Responsibility | Developer | Developer |
| Equity Internal Rate of Return | 11.52% | 10.86% |
| Equity Net Present Value (000) | -US$983 | -US$1,369 |
| Equity Payback Period | 14.5 Years | 14.5 Years |

As evidenced in the figures above, at a 1,400SQM allocation for SEC, there is still further scope to increase SEC's space until the equity IRR approaches 12% and equity NPV approach US$0. However, at 2,200SQM, equity IRR drops below the required equity rate of return and equity NPV is less than US$0. Results in the above figures indicate that between 1,400SQM and 2,200SQM, there is a spatial amount that results equity IRR equalling the 12% benchmark. This is presented in the figure below.

Figure 7-17: Derived Viability Assessment

| | Full Commercial | Mixed-Use |
|---|---|---|
| Concession Period | 25 Years | 25 Years |
| SEC Fit-up Responsibility | Developer | Developer |
| SEC FFE Responsibility | Developer | Developer |
| SEC Moving Allowance/Swing Space Responsibility | Developer | Developer |
| SEC Space Allocation (SQM) | 1,850 | 1,750 |
| Equity Internal Rate of Return | Approaches 12% | Approaches 12% |
| Equity Net Present Value (000) | Approaches US$0 | Approaches US$0 |
| Equity Payback Period | 13.50 Years | 13.50 Years |

1,850SQM and 1,750SQM of SEC space allocation under the full commercial and mixed-use building options, respectively, result in the financial assessment achieving the 12% equity rate of return.

Based on comments from the feasibility study presentation, which was held at the Commission on October 11th, 2016, a scenario was requested whereby SEC's swing space and moving allowance are no longer allocated to the developer. The corresponding results are presented below.

**Figure 7-18: Derived Viability Assessment**
**(Exclusive of SEC's Moving Allowance/Swing Space as part of the Developer's Project Costs)**

| | Full Commercial | Mixed-Use |
|---|---|---|
| Concession Period | 25 Years | 25 Years |
| SEC Fit-up Responsibility | Developer | Developer |
| SEC FFE Responsibility | Developer | Developer |
| SEC Moving Allowance/Swing Space Responsibility | SEC | SEC |
| SEC Space Allocation (SQM) | 1,930 | 1,830 |
| Equity Internal Rate of Return | Approaches 12% | Approaches 12% |
| Equity Net Present Value (000) | Approaches US$0 | Approaches US$0 |
| Equity Payback Period | 13.50 Years | 13.50 Years |

For illustrative purposes, the Project Team also conducted a viability assessment whereby SEC's fit-up and furniture, fixtures and equipment were not allocated to the developer. The results are presented in the figure below.

**Figure 7-19: Derived Viability Assessment**
**(Exclusive of SEC's Full Fit-up as part of the Developer's Project Costs)**

| | Full Commercial | Mixed-Use |
|---|---|---|
| Concession Period | 25 Years | 25 Years |
| SEC Fit-up Responsibility | SEC | SEC |
| SEC FFE Responsibility | SEC | SEC |
| SEC Moving Allowance/Swing Space Responsibility | Developer | Developer |
| SEC Space Allocation (SQM) | 2,600 | 2,200 |
| Equity Internal Rate of Return | Approaches 12% | Approaches 12% |
| Equity Net Present Value (000) | Approaches US$0 | Approaches US$0 |
| Equity Payback Period | 13.50 Years | 13.50 Years |

If *both* the full fit-up and SEC's swing space/moving allowance are no longer allocated to the developer's project costs, the resulting increases in the Commission's space allocation (relative to the figures above) are presented below.

**Figure 7-20: Derived Viability Assessment**
**(Exclusive of SEC's Full Fit-up and Swing Space/Moving Allowance as part of the Developer's Project Costs)**

| | Full Commercial | Mixed-Use |
|---|---|---|
| Concession Period | 25 Years | 25 Years |
| SEC Fit-up Responsibility | SEC | SEC |
| SEC FFE Responsibility | SEC | SEC |
| SEC Moving Allowance/Swing Space Responsibility | SEC | SEC |
| SEC Space Allocation (SQM) | 2,700 | 2,300 |
| Equity Internal Rate of Return | Approaches 12% | Approaches 12% |

| | Full Commercial | Mixed-Use |
|---|---|---|
| Equity Net Present Value (000) | Approaches US$0 | Approaches US$0 |
| Equity Payback Period | 13.50 Years | 13.50 Years |

If the developer only bears the cost of SEC's basic fit-up while SEC bears the cost of its FFE and swing space/moving allowance, the resulting increase in the Commission's space allocation (relative to Figure 7-17) is presented below.

**Figure 7-21: Derived Viability Assessment**
**(Exclusive of SEC;s FFE and Swing Space/Moving Allowance as part of the Developer's Project Costs)**

| | Full Commercial | Mixed-Use |
|---|---|---|
| Concession Period | 25 Years | 25 Years |
| SEC Fit-up Responsibility | Developer | Developer |
| SEC FFE Responsibility | SEC | SEC |
| SEC Moving Allowance/Swing Space Responsibility | SEC | SEC |
| SEC Space Allocation (SQM) | 2,075 | 1,950 |
| Equity Internal Rate of Return | Approaches 12% | Approaches 12% |
| Equity Net Present Value (000) | Approaches US$0 | Approaches US$0 |
| Equity Payback Period | 13.50 Years | 13.50 Years |

### 7.6.3 Sensitivity

Holding all else constant[22], the following variables have been sensitized in order to assess the impact to SEC's space allocation while achieving the targeted equity IRR:

- Concession Period;
- Cost of Capital;
- Upfront Project Costs and;
- Commercial Rents.

**Figure 7-22: Sensitivity to Concession Period**

| Concession Period | SEC Space Allocation under Full Commercial Building Option (Approximated to the Nearest 50 SQM) | SEC Space Allocation under Mixed-Used Building Option (Approximated to the Nearest 50 SQM) |
|---|---|---|
| 20 | 1,050 | 1,250 |
| 25 | 1,850 | 1,750 |
| 30 | 2,450 | 2,000 |

[22] SEC's swing space and moving allowance have been allocated to the developer's project costs in the sensitivity analysis

As per the figure above, there is a positive relationship between concession period and SEC's space allocation. Furthermore, although SEC's space allocation increases with increases in the concession period, space allocation increases at a decreasing rate to reflect that the present value of future cash flows to equity decrease as the concession period increases.

**Figure 7-23: Sensitivity to Cost of Capital**

| Cost of Debt | Cost of Equity | SEC Space Allocation under Full Commercial Building Option (Approximated to the Nearest 50 SQM) | SEC Space Allocation under Mixed-Used Building Option (Approximated to the Nearest 50 SQM) |
|---|---|---|---|
| 6% | 10% | 3,800 | 2,750 |
| 7% | 11% | 2,900 | 2,150 |
| 8% | 12% | 1,850 | 1,750 |
| 9% | 13% | 850 | 1,000 |
| 10% | 14% | No Space Allocation | 450 |

As evidenced in the figure above, there is a negative relationship between increases in the cost of capital and SEC's space allocation.

**Figure 7-24: Sensitivity to Upfront Project Costs**

| % Change in Upfront Project Costs | SEC Space Allocation under Full Commercial Building Option (Approximated to the Nearest 50 SQM) | SEC Space Allocation under Mixed-Used Building Option (Approximated to the Nearest 50 SQM) |
|---|---|---|
| +10% | 750 | 350 |
| +5% | 1,400 | 950 |
| 0% | 1,850 | 1,750 |
| -5% | 2,400 | 2,250 |
| -10% | 3,000 | 2,950 |

Similar to Figure 7-23, the above figure indicates a negative relationship between an escalation in upfront project costs and SEC's space allocation. The components of upfront costs and their estimates can be found on the first page of Appendix I.

**Figure 7-25: Sensitivity to Commercial Rent**

| % Change in Commercial Rent | SEC Space Allocation under Full Commercial Building Option (Approximated to the Nearest 50 SQM) | SEC Space Allocation under Mixed-Used Building Option (Approximated to the Nearest 50 SQM) |
|---|---|---|
| +10% | 2,600 | 2,200 |
| +5% | 2,350 | 2,100 |
| 0% | 1,850 | 1,750 |
| -5% | 1,450 | 1,450 |

| | | |
|---|---|---|
| -10% | 1,000 | 1,200 |

As per the figure above, there is a positive relationship between increases in commercial rent and increases in SEC's space allocation.

## 7.7 Value for Money

The Value for Money (VFM) analysis consists of comparing the PPP option with alternative forms of procurement, along financial parameters, and while taking into account any differences in risk allocation.

Therefore, the first question to answer when undertaking the VFM analysis is: *What are the alternative options that SEC could implement in order to realize the proposed office accommodation complex?*

SEC's primary constraint is achieving this objective without using its operating benefit or available reserves. Therefore, such alternative options are limited to renting or buying new office space, using the proceeds of the sale of its land and current accommodation.

**SEC Land and Current Accommodation Value**

Current advertisements on Ghana Prime Properties[23] rank the land values in Cantonments between US$1.85M and US$2.85M per acre. This brings the value of SEC's land, at 1.56 acres, between US$2.9M and US$4.4M, with an average of US$3.65M.

On the basis of its initial cost (US$1M), age (8 years) and nature (temporary accommodation), we would assume that the current accommodation is worth between US$350K and US$650K.

**Rental Option**

The proceeds of the SEC land and accommodation sale would be used to rent a new office space over the long term. The cost of 25 years of rent today can be assessed by calculating the NPV of the stream of rental payments, at a rate which corresponds to the potential sale proceeds generated. The Government of Ghana's long term US$ Eurobond proves a suitable benchmark for the discount rate; the Eurobond expiring in 2030 is currently priced at just above 10%.

The rent potential in space is then obtained by back-solving how many SQM of rental over 25 years, discounted at 10%, would be equal to the proceeds of the sale. The results are provided in the figure below.

**Figure 7-26: SEC Land & Accommodation Value and Corresponding Rental Capacity of  Capacity of 25 Years**

| Rental option evaluation | Range Value | | |
|---|---|---|---|
| | Low | Mid | High |
| SEC Property Value | US$3.25M | US$4.15 M | US$5.05 M |

[23] Visit http://www.ghanaprimeproperties.com/

| | | | |
|---|---|---|---|
| Rental capacity | 750SQM | 950 SQM | 1,150 SQM |

Source: CPCS Estimate

In accordance with this rationale and its underlying assumptions, SEC could anticipate renting an average of 950 SQM of new office space over 25 years. In this scenario, SEC would be required to pay a service charge (US$4.5 per SQM per month), which the Commission aims to avoid in the PPP option. In addition, the Commission will need to find and pay for a new accommodation in 25 years.

**Buying Option**

The alternative is to use the sale proceeds to buy office space. The Project Team's market sounding exercise provided information on the best price available, at US$250k for 85m$^2$ of office space (Octagon building in Central Accra). This is however a discounted opportunity, given the current saturation of the market; we estimate that the cost of office space is 15 to 20% higher.

Under these assumptions, the theoretical buying potential of SEC with its sale proceeds forecast is reflected in the figure below.

| Rental option evaluation | Range Value | | |
|---|---|---|---|
| | Low | Mid | High |
| **SEC Property Value** | US$3.25 M | US$4.15 M | US$5.05 M |
| **Rental capacity** | 900 SQM | 1,200 SQM | 1,700 SQM |

Source: CPCS Estimate

In accordance with this rationale and its underlying assumptions, SEC could forecast purchasing 1,200m$^2$ in average of new office space. In this scenario, SEC would need to pay a service charge (US$4.5 per m$^2$ per month) which it aims to avoid in the PPP option.

**Other Considerations**

In these alternative options, SEC loses the opportunity to own and operate the entire new building at the end of the concession period. If the quantitative valuation of such a right varies considerably, depending on the discount rate, concession length, and inflation rate, it shall be accounted for in the qualitative analysis of the VFM comparison.

**Conclusions**

The viability assessment indicates that the preferred PPP option *could* achieve the delivery of 1,850 SQM of rent free space for SEC over a 25 year period followed by full ownership of the accommodation. The alternative options assessed in the VfM analysis conclude that potentially, between 950 and 1,200 SQM, and at best, 1,700 SQM of office space could be delivered. The outputs in the alternative options demonstrate that there is value-for-money for the preferred PPP option.

## 7.8 Economic Viability Assessment

### 7.8.1 Key Concepts

The purpose of the economic analysis or economic viability assessment is to allow decision-makers to evaluate the project's different scenarios in terms of their economic feasibility, i.e. from the societal perspective of the Ghanaian government or the efficiency of use of the nation's resources. This is different from financial feasibility, which considers a project from the particular perspective of the project entity and can be affected by the financial structure of the project.

The objective of the economic analysis is to determine the net economic benefit (or cost) of each development scenario under consideration. In this case, the development scenarios under consideration include the 'Without Project' and 'With Project' scenarios, which can be defined as follows:

- **Without Project:** in this status quo scenario, SEC continues to occupy its temporary and current accommodation on the site (see Section 2.2.1 of Chapter 2).
- **With Project:** This scenario represents the permanent, expanded and LEED-certified accommodation on the Commission's site inclusive of office space for SEC. Given the commercial viability assessment for this Project, SEC would occupy a share of a total building or 'complex.' Specifically, it was assessed that SEC would occupy 12% of the net leasable space, with 88% to be used for commercial opportunities, in order to subsidize SEC's rent-free space.

It is important to note that this 88% share remains an undefined variable, in terms of the commercial and economic activity, and the building use to be selected (i.e. mixed-use vs. full commercial). Notably, we recommend that bidders be granted the flexibility to propose a building-use pattern which is financially sustainable and maximizes SEC's rent-free space. **Given that this 88% of building use has not been determined, it would not yet be possible to include this in the scope of an economic viability assessment.** For instance, the internal/external costs and benefits (defined below) associated with residential (e.g. apartment suites), commercial (e.g. office space) or retail (e.g. bank) units would all vary in nature based on the economic activity that is taking place. For example, retail tenants may include line shops such as a bank, restaurant, dry cleaner and/or pharmacy, all of which would have differing economic impacts. **Due to these unknown variables, our high-level assessment is contained to a qualitative discussion of economic impacts, and the scope of this high-level assessment is contained to SEC's 12% share of the net leasable space.**

Whereas the financial feasibility considers each scenario from the perspective of investor/operators and/or Governments, and is affected by the financial structure of each scenario (i.e., the preferred proportion of debt and equity used to develop and operationalize each scenario and the resulting cost of capital) as well as the PPP structure (i.e., the degree to which project risks are shared between the public and private sector), the economic analysis is unaffected by the project structure.

The economic analysis requires both financial costs and financial revenues to be adjusted for each scenario. On the cost side, conversion factors must be used to reflect the opportunity cost of the resources put forward. On the benefit side, the effects of the project development scenario (relative to the status quo scenario) – such as safety, time savings and air pollution – are considered. These streams of costs and benefits are then discounted using a **Social Discount Rate.**

**Social Discount Rate**

For the economic analysis, a social discount rate (SDR) is applied. The choice of the discount rate can be quite controversial, and rightly so, as it can have a significant impact on the results. Unlike the financial discount rate, which reflects the opportunity cost of capital, the economic discount rate (or social discount rate) should reflect how society values current costs and benefits versus future costs and benefits. A consensus is growing around the social time preference rate (STPR) approach. Following this approach, the formula most used to measure the SDR is as follows:

$$\begin{aligned}&\textit{Social discount rate}\\&= (\textit{Growth rate of public expenditure}) * (\textit{Elasticity of marginal social welfare})\\&+ (\textit{Rate of pure time preference})\end{aligned}$$

This approach relies on income growth, relative risk aversion and the pure rate of time preference. In general, income growth drives differences across countries.

According to the World Bank, Ghana's real GDP per capita growth rate averaged at 7% for 2005-2015, with a median of 6.4%.[24] Ghana's expected economic outlook is optimistic, assuming that the country's fiscal consolidation program remains on course and that the oil and gas sector picks up.[25] The World Bank has projected a growth rate of 7.5% by 2018, conditional to these fiscal reforms and the resolution of technical problems in oil and gas (World Bank, 2016); likewise, The Economist projects that Ghana will reach a GDP growth rate of 7.5% by 2017, owing to maturing investments in the oil production sector.[26]

In a 2008 article, Valentim and Prado computed social discount rates for 167 countries; for Ghana, they estimate a social discount rate between 6.4% and 8.4%, with a mean of 7.4%.[27] While this research provides an indicative range, a higher social discount rate at the upper bound of **8.5%** can be applied for Ghana, as aligned with optimistic GDP growth projections. This rate is consistent with the social time preference rate generally used in developing countries, but is lower than discount rates obtained through alternative approaches (e.g. cost of capital).

[24] World Bank Data: Ghana http://data.worldbank.org/indicator/NY.GDP.PCAP.KD.ZG?locations=GH
[25] World Bank: Ghana Overview. October 7 2016. http://www.worldbank.org/en/country/ghana/overview
[26] The Economist: The World in 2017. December 2016
[27] See Valentim, Joice and Jose Mauricio Prado (2008) "Social Discount Rates," Working Paper of the IMT Institute for Advanced Studies Lucca, May. Available online at http://www.imtlucca.biz/_documents/publications/005749-IBKC9-joice_mau.pdf, retrieved September 24, 2013

This rate of approximately 8.5% is also aligned with a publication by the Federal Reserve Bank for the social discount rate in developing countries.[28] This approach recommends that one may use a recent average of a Government's cost to borrow in U.S. dollars, as adjusted for U.S. inflation rates (FEDS Notes, 2014). For Ghana, this corresponds to a real rate of 8.75% – with its recent USD 1 billion bond priced at a yield to maturity of 10.75% and an average US inflation rate of 2%.[29] This approach therefore supports a social discount rate of approximately 8.5%.

### 7.8.2 Internal and External Costs and Benefits

There are types of costs/benefits: (i) internal costs, which are borne/captured by the project's entity; and (ii) external costs (also called externalities), which are not borne/captured by the project's entity. In general, internal costs and benefits are already included in the financial analysis of a project. While these must be adjusted to reflect their real economic value, data requirements generally remain limited. Externalities, on the other hand, can impose substantial data requirements on the analyst. Not only must they be identified and measured, but they must then be 'monetized.' In other words, transformed into a monetary value based on the economic value. The process of monetization must often rely on assumptions about how individuals value different alternatives which cannot be observed in markets.

The Viability Assessment presented in this Chapter demonstrates a positive Financial Analysis and a positive VfM Assessment. As our high-level economic assessment is contained to a comparison of the status quo (where SEC continues to operate out of a temporary accommodation) and the permanent, expanded and LEED-certified accommodation (SEC's 12% share), it is reasonable and intuitive to expect the 'With Project' scenario to provide a net positive impact. This rationale is tied to the expected impacts of the project, namely the expected reduction in emissions; the impact on SEC's role as a regulator in the economy; the market value of eco-friendly certification, and induced economic activity.

**Externalities**

*I. Reduction in Emissions*

The 'With Project' scenario (SEC's 12% share) is expected to bring a reduction in the emissions of local air pollutants and Greenhouse gases. The proposed building is intended to incorporate 'green' or 'eco-friendly' building techniques, as mandated by the World Bank, for which the LEED standard was selected. LEED-certified buildings consider the project from an environmental, social and economic perspective. Such considerations are to be incorporated in the facility's minimum performance standards, sustainable building design, construction and operations and maintenance (Chapter 4 – Building Options, Minimum Performance Standards and Technical Requirements). The impacts of incorporating LEED principles across building architecture, site development and engineering systems – such as maximizing water efficiency, maximizing energy

---

[28] Board of Governors of the Federal Reserve System: FEDS Notes. The Social Discount Rate in Developing Countries, Missaka Warusawitharana, October 2014. https://www.federalreserve.gov/econresdata/notes/feds-notes/2014/the-social-discount-rate-in-developing-countries-20141009.html

[29] Bloomberg, October 2015. https://www.bloomberg.com/news/articles/2015-10-07/ghana-said-to-sell-1-billion-of-15-year-eurobonds-at-10-75-

efficiency in the building's electrical systems, and minimizing the use of unsustainable materials such as Portland cement – would all have mitigating effects on emissions.

**Other Potential Impacts**

*I. The Role of SEC as a Regulator in the Economy*

In the 'With Project' scenario, the Commission is equipped with a more suitable, permanent and expanded head office, and therefore responsive to the expansion of Ghana's capital markets and the expansion of SEC's mandate as a regulator of the securities industry. This permanent accommodation would allow the Commission to increase its capacity in certain core functions, and to be well-resourced and sufficiently equipped to serve as a trusted regulator in an expanding landscape.

This permanent accommodation may also have an impact on generating market confidence by way of physical presence. As a regulator of Ghana's capital markets, a permanent accommodation would serve to legitimize SEC's role as a regulator and to promote SEC's ability to effectively carry out this role in the economy. As a whole, these impacts would serve to promote the continued growth of Ghana's capital markets and, in turn, real economic activity.

*II. Market Value of Eco-Friendly Certification in Ghana and West Africa*

This Project promotes eco-friendly certified real estate development opportunities in the country. LEED certified projects have been developed in about nine countries across Africa, with registrations in many more, including two registered LEED projects in Ghana. The marketing and successful close of a financially-attractive opportunity for a LEED-certified building would help to build the recognition, market value and perceived value-add of eco-friendly certifications – an important variable in the adoption of such practices. Indeed, this opportunity has been marketed among key stakeholders such as real estate developers, estate agents and property managers. In the long term, such initiatives would help to promote the agenda of sustainable infrastructure development and sustainable cities in Ghana and West Africa – a mandate which is very much aligned with Ghana's Sustainable Development Goals (SDGs).

III. *Induced Economic Activity*

While the building use for the total leasable space is not yet defined, the 88% share is to be used for commercial opportunities, to subsidize SEC's rent-free space. It is reasonable to assume that this addition of residential, commercial and/or retail units would lead to induced economic activity. We note that in terms of methodological considerations, estimating the value of this additional economic activity is extremely challenging.

Furthermore, there is the impact on employment from the capital and operating expenditure. The effects of these expenditures on employment are captured through the shadow price of labour. A shadow price below one (1) suggests that the project will have a beneficial impact on total employment, rather than simply displacing currently employed labour. Additional impacts on employment may also be realised through the new activity generated (induced economic activity) from the residential, commercial and/or retail units to comprise of the remaining 88% of net leasable space. However, it would only be possible to carry out a full economic assessment of the Project's internal and external costs and benefits once the building-use and tenant-type are determined.

## 7.9 Risk Assessment

The success parameters for any project are (i) time (in-time completion); (ii) cost (within specific budget); and (iii) quality (requisite performance/technical requirements). The major obstacles for their achievement are the risks and uncertainties in the project environment.

Risk identification is the process of determining which risks might impact the project at each stage of the project life cycle and to document their characteristics. This helps to adequately prepare mitigation strategies such as risk avoidance and risk transfer, as well as insurance implementation, in order to reduce or entirely avoid identified disturbances to the project.

Throughout the project life cycle, risks can materialise during various phases:

- The tender phase, prior to commercial and financial close, when the project is at risk of attracting *insufficient* private sector interest, capacities or financing;
- The development phase, after closing and before construction starts, when land and authorisation issues (e.g., zoning and permitting) must be satisfactorily resolved;
- The construction period, when technical difficulties may arise (e.g., issues related to design or inadequate building methods) leading to cost increases and delays;
- The operation period, when revenue forecasts are not met, service performance is below expectations, and/or operating expenses (OPEX) are in excess of what was initially scheduled; and
- Any time when unexpected variation in the economic and political context alter project development or execution.

### 7.9.1 Tender and Development Risks

**Unattractive Tender**

*Description:*

As pointed out at the pre-feasibility stage by the CPCS Team, there is the possibility that the proposed project will not attract sufficient private sector interest. This risk is mainly attributed to the current saturation of the commercial real estate market in Accra (currently 116,000 SQM of excess commercial office space on the market). In addition, based on further studies completed by the CPCS Team (namely, work of the Team's real estate expert) along with consultations with developers and desktop research, alternative land acquisition options in the Cantonments area may also pose additional competitive pressure on SEC's land value.

*Allocation:*

The risk that the private sector does not bid for the proposed project would be borne by SEC.

*Mitigation:*

The best way to mitigate this risk is to allow bidders the possibility of determining the space which they would agree to rent SEC for free, as compensation for the land that the SEC would sub-lease to them on a long-term basis.

This flexibility shall of course be limited by SEC's own constraints, which should mainly include the minimum office and parking spaces they want to acquire from the Project, before it is declared unsuccessful.

These minimum spaces should form the basis of SEC's output specifications, and not the optimal spaces that SEC is willing to obtain. Such bidding criteria could discourage the private sector's interest; on the other hand, leaving the bidders to maximize SEC space should foster creativity through competition. This is further discussed in Section 8.7 below.

**Financing Availability**

*Description:*

Assuming that real estate developers are sufficiently interested (in principle) in responding to SEC's request for proposals, the possibility of developers being unable to raise the required financing remains a risk – even if developers provide some of their own capital (equity) and develop a commercially attractive design, build and operating solution.

Furthermore, the availability of private financing is only confirmed once the project is fully developed. Selected funders always have the option to withdraw, until they finalize the technical, financial, contractual and market due diligence to their satisfaction.

*Allocation:*

Financing availability risk is typically shared between bidders and SEC. In the event of failure to arrange project financing, bidders lose the costs associated with preparing their bids and with respect to the preferred bidder, negotiations with SEC are not successfully concluded.

*Mitigation:*

This risk is mitigated with an in-depth assessment of the project's **bankability** through detailed financial modelling, which is based on financing, cost and revenue assumptions. Furthermore, these assumptions are thoroughly cross-checked with relevant experts and through market sounding consultations. Bidders will have to demonstrate their capacity to finance SEC's proposed accommodation, with specific requirements to be included in the tender documents (e.g., reference letters from financiers).

### 7.9.2 Development Risks

**Obtaining Building Permit**

*Description:*

The obtainment of required building permits is a systematic risk across all real estate projects, since it is handled by authorities external to the contracting authority (SEC) and the preferred bidder, and can therefore generate unexpected delays and additional costs.

The necessary approval and permitting processes are covered in Chapter 6; the analysis indicates that an Approval in Principle (AIP) is typically required by LaDMA and helps to clarify key areas such as zoning, building height and building use.

*Allocation:*

This risk is typically transferred to the preferred bidder. However, in order to increase the success of the project, it is commonly agreed upon, and often contractualized, that the contracting authority (SEC) will assist in this process to the extent possible.

*Mitigation:*

Obtaining an AIP from LaDMA (as described in Chapter 6) would significantly mitigate the risk associated with acquiring the required building permits.

**Other Consents and Authorisations**

*Description:*

All other necessary consents such as legal, regulatory, land-use, environmental etc. are necessary conditions for the commencement of the project. Any delay or failure in obtaining these consents can present a risk to the successful take-off of the project.

*Allocation:*

Again, if the responsibility of obtaining all required consents or authorisations falls to the developer, SEC may assist to the greatest extent possible.

*Mitigation:*

The potential developer will have to demonstrate its ability to secure all necessary approvals, with SEC's support to facilitate the process.

### 7.9.3 Construction Risks

**Design**

*Description:*

This risk emanates from design deficiencies, as it relates to fulfilling SEC's functional requirements, as well as the requirements for the rest of the building depending on its proposed use.

*Allocation:*

It will be the primary responsibility of the project developer under the PPP agreement to deliver space to the SEC that is in accordance with the Commission's functional requirements and to provide facilities management for these spaces over the duration of the contract.

*Mitigation:*

With respect to SEC, clear and comprehensive functional requirements and facilities management services performance criteria should be included in the tender documentation.

Detailed specifications should also apply to the final fit-up of SEC's space, subject to the funding allowances that are made by the developer for SEC's fit-up.

With respect to the remaining building, flexibility on the design should be left to the private partner to optimise its business case to the extent it does not alter SEC's functional space.

**Cost and Delay**

*Description:*

Possible risks likely to be encountered during the construction phase include delay in project completion and costs overruns. These can occur as a result of unexpected site conditions or technical issues in the design or construction methods, leading to implementation difficulties. It is not uncommon for building projects to face delays and overrun the initial cost estimates. In extreme cases, it can even result in the insolvency of the key contractor and the need to find a replacement – leading to major delays.

*Allocation:*

Construction cost and delay risks are borne by the private contractor. However, any delay in completion will have a direct impact on SEC's relocation time and the associated costs, unless the private developer agrees to take on this risk.

*Mitigation:*

With respect to site conditions, the Project Team has undertaken a full geotechnical study in order to ascertain water table levels on site. Results have been built-in to the technical solution for SEC's proposed accommodation.

During the procurement phase, the Project Team will conduct a thorough due diligence of each bidder's construction contractor to ensure that contractors have the ability to meet their commitments with respect to construction costs and scheduling.

The possibility of having the preferred bidder cover SEC's temporary relocation costs during the construction phase also increases as delays occur. Thus, the increase in relocation costs should be further explored, and presented as a risk which is allocated to bidders in the tender documentation.

### 7.9.4 Operation Risks

**Revenues**

*Description:*

Revenue risk is represented as the project's capacity to generate the expected revenues, as forecasted in the pre-feasibility and feasibility phases. Mitigating revenue risk is a key indicator of a project's bankability, since it is revenues that will cover initial capital expenditures (CAPEX) and financing costs.

Generating the revenues which were forecasted in the pre-feasibility and feasibility phases depends, to some degree, on the extent to which the project meets the assumptions underlying the revenue forecasts. These assumptions include rents (based on building use), rent escalation and occupancy rates.

*Allocation:*

The risk that the Project does not generate sufficient revenues is borne by the private developer.

*Mitigation:*

The bidders and their financiers will conduct extensive commercial and financial due diligence so as to ensure that they are comfortable with the business case's revenue assumptions and that the project is financially viable (i.e. bankable).

**Costs**

*Description:*

Operating and maintenance cost risk is based on the private developer's ability to meet its performance obligations within its operating budget over the project term. Although a significant challenge – especially given the long-term nature of this project – it is less of a risk than revenue risk in real estate projects, given the relatively small outlays for operating costs as compared to the large upfront capital expenditures and associated financing costs.

*Allocation:*

Building maintenance and operation charges are ultimately due by the building owner, i.e. the private developer, although the developer is able to recover part of these through rents and service charges.

*Mitigation:*

The developer could procure a long-term subcontract with experienced operators (e.g., facilities managers) in order to fix part of its costs for a certain duration.

Mitigation measures can also be found in the LEED certification of the building to the extent that it ensures a certain level of efficiency with respect to utilities consumption.

### 7.9.5 Force Majeure

*Description:*

Force Majeure is a term used to describe liability for natural and unavoidable catastrophes that interrupt the expected course of events and restrict participants from fulfilling obligations. These include floods, fire, earthquakes, riots, strikes, political factors change (political interference) and economic instability.

*Allocation:*

Force Majeure events consequences are usually shared between the public and private parties.

*Mitigation:*

The typical mitigation for Force Majeure consists in the PPP agreement requiring the private developer to secure a comprehensive insurance policy.

# 8 Implementation & Procurement Plan

## 8.1 Introduction

In this chapter we outline our proposed Management and Procurement Plan, which encompasses the following components and objectives:

**I. Implementation Plan: Project timetable, milestones and approvals**

(i) Present an updated project timetable, including key milestones and approvals required (including those required from Ministries, Departments and Agencies), and contingency plans for addressing any deviations in the timetable and budgets;

(ii) Identify all stakeholder involvement in the project;

(iii) Identify the capacity within SEC to implement the project;

**II. Procurement Plan: Strategic approach, tender documentation and quality assurance**

(iv) Identify mechanisms to maximize competition, and considerations to address key challenges;

(v) Present the categories of information to be developed and made available to bidders;

(vi) Present the proposed pre-qualification and bid evaluation parameters, and processes;

(vii) Provide quality assurance processes for bid documentation; and identify the means of establishing and maintaining an appropriate audit trail for the bid process.

## 8.2 Timetable and Key Milestones

- Transaction schedule up to transaction closure (signing of the contract)
- There are a number of activities on the critical path, with regard to the timing of evaluation and approvals, which can affect the timeline

Institutional arrangements, responsibilities, approvals and timelines for the procurement stage of this mandate are as per the procedures detailed in Ghana's National PPP Policy (See Figure 8-2 for detailed summary of PPP procedures and approvals).

### 8.2.1 Revised Implementation Schedule

Figure 8-1 summarizes the transaction implementation schedule for SEC's proposed accommodation under a PPP procurement model. The transaction schedule commences with the submission of the Feasibility Report and Draft Request for Expression of Interest (REOI). The Project Team envisions completing this mandate in the third week of July 2017, however this is subject to the following *potential* challenges:

- Risk of prolonged internal (SEC and Project Delivery Team) reviews and milestone approvals;

- Risk of prolonged external (Cabinet and Parliament) reviews and milestone approvals;
- Risk of delays due to general elections in December 2016.

The Project Team will work closely with SEC and the Project Delivery Team to make milestone submissions in a timely manner for internal review and approval. For external reviews and approvals, we advise that SEC and the Project Delivery Team work closely with Cabinet and Parliament and keep both governing arms abreast of how the transaction is progressing in order to expedite their reviews and approvals, to the extent possible.

As an added means of expediting external review processes, the Project Team advises that the draft REOI be submitted simultaneously with the Feasibility Study for the necessary approvals. As per the mandate's Terms of Reference, the REOI is to be submitted for approval approximately two months after the Feasibility Report is approved. However, this results in the addition of two months to the transaction schedule, which could otherwise be avoided.

In order to determine whether the proposed PPP is in the best interest of the Government, the National PPP Policy requires a set of five approvals. These five approvals present the key milestones of implementation schedule, and are summarized in Figure 8-2 below.

**Uncertainty in Procurement Timelines**

PPP Approvals II and IV require Cabinet and/or Parliament Approval (at the feasibility and procurement stage of the mandate). The requirement to obtain these two approvals may have a negative impact on the timeline of this project. While Approval II is expected to be given within 60 working days, Approval IV is expected to be given only after a minimum of 30 days. This time frame regarding Approval IV creates uncertainty about the project timeline in general.

In December 2016, Ghana will hold its general elections to elect the President of Ghana and Members of Parliament, which could put pressure on the project schedule for reviews and approvals during the election period.

**Figure 8-1: Revised Implementation Schedule**

| | Responsibility | 1-Nov-16 | 8-Nov-16 | 15-Nov-16 | 22-Nov-16 | 29-Nov-16 | 6-Dec-16 | 13-Dec-16 | 20-Dec-16 | 27-Dec-16 | 3-Jan-17 | 10-Jan-17 | 17-Jan-17 | 24-Jan-17 | 31-Jan-17 | 7-Feb-17 | 14-Feb-17 | 21-Feb-17 | 28-Feb-17 | 7-Mar-17 | 14-Mar-17 | 21-Mar-17 | 28-Mar-17 | 4-Apr-17 | 11-Apr-17 | 18-Apr-17 | 25-Apr-17 | 2-May-17 | 9-May-17 | 16-May-17 | 23-May-17 | 30-May-17 | 6-Jun-17 | 13-Jun-17 | 20-Jun-17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Request for Expression of Interest** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Issue Request for Expression of Interest (REOI) | SEC/MOF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Evaluate and Pre-Qualify Bidders | SEC/PDT/CPCS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Prepare and Submit REOI Evaluation Report | CPCS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Approval of Shortlisted Bidders | Contracting Authority / MOF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Request for Proposals** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Prepare Draft Contractual Framework Agreements (CFA) | CPCS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Review CFAs and Provide Comments | SEC/PDT | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Revise and Submit Final CFAs | CPCS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Approval of Final CFAs | Contracting Authority / MOF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Issue CFAs to Shortlisted Bidders | SEC/MOF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Bid Management** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Open up Data Rooms | CPCS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bidders' Conference (If Necessary and Upon SEC's Approval) | SEC/PDT/CPCS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Site Visits | SEC/PDT/CPCS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Deadline to Submit Comments to Concession Agreement | Bidders | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Review Bidder Comments and Revise Concession Agreement | SEC/PDT/CPCS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Approval of Revised Concession Agreement | MOF/Attorney General | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Re-Submit Adjusted Concession Agreement to Bidders | SEC/MOF | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Bid Evaluations** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Receive Bids | SEC/PDT/CPCS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Preliminary Evaluation of Bids | SEC/PDT/CPCS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bidders Invited to Accra to Present Proposals | Bidders | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Finalize Evaluation of Bids and Select Preferred/Reserve Bidder | SEC/PDT/CPCS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Conduct Due Diligence of Preferred and Reserve Bidder | CPCS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Prepare and Submit RFP Evaluation Report | SEC/CPCS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Approval of Shortlisted and Reserve Bidder | MOF/Attorney General | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Negotiations and Project Close** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Invite Preferred Bidder for Negotiations | SEC/PDT/CPCS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Review of Negotiated PPP Agreement/Concession and Due Diligenc | Attorney General and Ministry of Justice | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Final Approval of PPP Agreement/Concession | PPP Approval Committee, Cabinet, Parliament | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Signing of PPP Agreements/Concession | SEC/Preferred Bidder | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

**Figure 8-2: Ghana PPP Procedure, Approvals and Timelines**

| Stage | Process | Approval | Task | Responsible Institution(s) | Timeline |
|---|---|---|---|---|---|
| **1** | - | | Identify project | MDA/MMDAs supported by PAU shall identify PPP in line with NIP and GSGDA | |
| **2** | - | | Prepare pre-feasibility study/concept paper/business case | MDAs/ MMDAs and/or supported by consultants or appropriate groups | Within 60 working days before or after 1 |
| **3** | A | **Approval I** | Approve pre-feasibility/concept paper | PMUs of MDAs or **appropriate authority** | |
| | B | | Submit pre-feasibility/concept paper to MoF-PID | PMUs of MDAs or **appropriate authority** | After 3A |
| **4** | A | | Register of Project and co-concurrent review of pre-feasibility studies | MoF-PFA/DMD/Legal/Budget | Within 35 days |
| | B | | Screen PPPs to ensure consistency with NIP, PIP, GSGDA | | |
| | C | | Verify and justify the use of PPP option | | |
| | D | | Assess financing scheme and PPP type | | |
| | E | | Ensure compliance of PPP process | | |
| **5** | A | | Approve pre-feasibility and project viability | MoF-PFA/DMD/Legal/Budget/Approval Committee | |
| | B | | Request full feasibility | Contracting Authority (CA) | Depends on CA |
| **6** | A | **Approval II** | Review and Approve Full Feasibility Report | MoF-PFA | Within 30 working days |
| | B | | Subject to thresholds of Project Cost up to GHS 50,000,000 | Approval Committee | |
| | C | | Subject to thresholds of project cost above GHS 50,000,000 | Cabinet/ Parliament Approval | Within 60 working days |
| | D | | MMDAs approval ceilings | General Assembly of MMDAs | Depending on MMDAs schedule |
| **7** | A | **Approval IIIA** | Procurement | | |
| | B | | Procure for any prospective bidders, review project documents – draft PPP Agreement/Concession | MoF-PFA | Within 25 working days |
| | C | | Design fair, transparent, competitive, cost-effective procurement process | CA | Depends on CA |
| | D | | Undertake procurement under Public Procurement Act and scope of PPP Law | | |
| | E | | Involve use of local content and technology transfer | | |
| | | **Approval IIIB** | Procurement | | |
| | (i) | | Submit evaluation report | Contracting Authority | Depends on CA |
| | (ii) | | Review and Recommendation of Evaluation report | MoF/AG/MDAs | Minimum 10 days |
| **7*** | | | PPP Agreement / Concession review and Legal due diligence check | MoF / AG / MOJ | |
| **8** | A | **Approval IV** | PPP Agreements / Concession – Final Approval | Approval Authority – Approval, Committee/Cabinet/Parliament/MMDAs (as necessary) | Minimum 30 days |

Source: Ghana National Policy on PPP (2011) *with stage 7* added to reflect the role of AG / MOJ in reviewing the PPP Agreement/Concession and Legal Due diligence check prior to submission to Cabinet and Parliament

## 8.3 Stakeholder Involvement

The identification of stakeholders and the extent of their involvement in the project can be categorized by project phase: pre-bid, bid process and post-bid.

Figure 8-3: Stakeholders Involved in the Transaction Process

| **Pre-Bid** | |
|---|---|
| Stakeholder | Involvement |
| Securities and Exchange Commission | Contracting Authority and Project Proponent |
| Registrar General's Department | Project planning and oversight (PDT Representative) |
| Architectural and Engineering Services Limited (AESL) | Project planning and oversight (PDT Representative) |
| Attorney General's Department | Project planning and oversight (PDT Representative) |
| Ministry of Finance | Project planning and oversight (PDT Representative) |
| | |
| PPP Approval Committee[30] | Approval I of the pre-feasibility study |
| Cabinet or Parliament | Approval II of the full feasibility study |
| | |
| Director General of the GCAA | Approval of building height |
| **Bid Process** | |
| Stakeholder | Involvement |
| Evaluation Team Members | Prequalification and Bid Evaluation |
| Ministry of Finance | Approval of shortlisted bidders, approval of Contractual Framework Agreements (Approval IIIA), Review recommendations on preferred and reserve bidders |
| Attorney-General's Department | Ensure the conformity of all project agreements with Ghanaian law, prior to obtaining Approval IV<br><br>PPP Agreement / Concession review and Legal due diligence check |
| Ministry of Justice | PPP Agreement / Concession review and Legal due diligence check |
| Cabinet or Parliament | Final Approval IV on the PPP Agreement/Concession Agreement |
| **Post-Bid** | |
| Stakeholder | Involvement |
| Environmental Protection Agency | Grant necessary environmental permits |
| La-Dadekotopon Municipal Assembly | Application for Re-Zoning (if necessary) and Building Permit |
| Electricity Company of Ghana and Ghana Water Company Limited | Utility permits |
| Registrar General's Department | Bidder's company registration |
| Ghana Investment Promotion Centre | Bidder's company registration |

[30] The PPP Approval Committee is operated by the PFA Unit and includes the Minister of Finance; the Chairman of the National Development Planning Commission (NDPC); the Minister of Justice and Attorney General; the Minister of Trade and Industry; the Chief Executive of the Ghana Investment Promotion Centre (GIPC); the Chief Executive of Public Procurement Authority and the Head of the contracting entity.

| | |
|---|---|
| Ministry of Finance Public Investment Division (MoF-PID) | Contract oversight and monitoring |

### 8.3.1 Action Items Required

The outstanding consents and permits to be issued will fall under the responsibility of the Preferred Bidder. These outstanding action items, and any corresponding mitigation or expediting measures which can be undertaken, are summarized below.

**Building Permits**

The Local Government Act, 1993 requires that any physical developments carried out within its district receive a building permit from La Dade-Kotopon Municipal Assembly (LaDMA) (s. 49(1)). At the procurement stage, sufficient clarity and visibility will be required regarding the likely permitted use and size of the proposed building. Thus, it is recommended that SEC submit an Application in Principle to LaDMA for preliminary approval in key areas such as site zoning, building-use and building size. Obtaining an Approval in Principle (AIP) will serve to give bidders clarity in key areas that could impact the commercial and technical viability of the project, and would significantly mitigate the risk associated with acquiring building permits.

**Zoning Compliance**

Zoning compliance was also flagged as a potential issue, as SEC's site is currently zoned for commercial activities and as such, may require re-zoning if a mixed-use option is preferred. To mitigate this issue, it was recommended that SEC receive an Approval in Principle from the local planning assembly (LaDMA) prior to the procurement phase which would confirm zoning, but also acceptable building-size and height.

**Utility Permits**

Water and sewage connections will be provided by Ghana Water Company Limited (GWCL). Electricity connections from Electricity Company of Ghana (ECG) and solid waste removal will be provided by Municipal Assembly contractor, or private company, to be negotiated by building owner. The potential Developer will have to demonstrate its ability to secure all necessary approvals with SEC's support to facilitate the process.

**Environmental Consents**

The Environmental Protection Agency Act 1994, Act 490 and Ghana Environmental Assessment Regulations 1999, LI 1652 requires that undertakings likely to have significant impacts on the environment must register with the Environmental Protection Agency (EPA) and obtain environmental permits before commencement of construction and operations. The potential Developer will have to demonstrate its ability to secure all necessary approvals with SEC's support to facilitate the process.

## 8.4 Maximizing Bid Competition

### 8.4.1 Robust Marketing Strategy

Critical to the success of the project is the early and continuous engagement with credible private actors (developers, investors, operators, facilities managers, etc.), to help inform and shape a bankable project. Furthermore, given the challenge of market saturation, the execution of a robust marketing strategy is instrumental to determining the feasibility and commercial viability of the project, and towards generating private sector awareness and interest in this opportunity.

The Project Team has carried out extensive market consultations, including approaching real estate developers, estate agents, hoteliers and property/facility managers, with respect to investor appetite and investor preference. The opportunity has been promoted in strategic markets identified at the inception stage such as Accra and in South Africa in order to get feedback and revisit project structuring assumptions as necessary in order to form an attractive bid.

In Accra, the Project Team met with developers such as RMB|Westport, Dream Realty, and Gold Key Properties as well as facilities managers such as Broll Ghana in Ghana and in South Africa, the South African Property Association, Enza Construction, Focus Project Management, Group 5, Growth Point Properties, WBHO Construction, Vinci Construction and Murray and Roberts were consulted with.

Generally, while the above stakeholders indicated that Accra is looked at favourably in terms of its real estate sector, some stakeholders indicated that the risk was too high in terms of having to secure tenants, in addition to picking up the cost of SEC's space, both in terms of the full fit-up and forgone rents. Other developers indicated that the transaction size was too small.

In addition to direct consultations, a Request for Information (RfI) was issued to the public on behalf of the Commission in June 2016, and employed as a marketing document. In total, the Project Team sent the RfI to approximately 130 related stakeholders such as developers, Engineering, Procurement and Construction (EPC) contractors, property/facilities managers, real estate investors, realties and associations.

The purpose of the RfI was to disseminate information about the project under consideration; to test the commercial viability of the Design, Build, Financing, Marketing, Commercialization, Operations and Maintenance of the project; and to ascertain the requirements and/or expectations of private actors with regard to their potential participation in the project.

We note that while responses were not received, this is not an abnormal outcome. Given that bidders are cost-conscious, the risk of a low response rate is very common in the issuance of an RfI. Bidders tend to favour the submission of a formal response, once the bid stage is officially opened. Furthermore, we note that this was an important exercise towards the identification and selection of private actors, and the dissemination of information about the project.

Furthermore, in order to maximize bid competition, we will integrate the feedback gathered through market consultations towards developing responsive prequalification and tender evaluation criteria and documentation, while still including safeguards to avoid unrealistic or overly aggressive bids. This will prioritize the feedback provided from prospective private sector bidders, as a mechanism to manage tender risks. For instance, it was specifically expressed that bidders should be afforded the flexibility to determine how the land can be developed or commercialized, while meeting SEC's needs; this can be reflected accordingly in the tender documentation's minimum standards regarding building-use patterns.

### 8.4.2 Tender Documentation: Criteria for Credibility

Bidder due diligence is a key component of maximizing bid competition, while implementing safeguards against unrealistic or overly aggressive bids. Towards this objective, we will incorporate the following minimum standards and evaluation criteria which screen for credibility:

- Corporate experience and track record;
- Credible client base;
- Credible corporate qualifications;
- Robust balance sheet; and
- Experience in Accra, Ghana and/or other developing or emerging economies.

Provisions must also be implemented towards the objective of avoiding unrealistic bids. These may include the following:

- The prequalification of bidders will ensure that the bidders responding at the Request for Proposal (RFP) stage have the capability and resources to deliver the project;
- Bidders will have to demonstrate their capacity to finance SEC's proposed accommodation with specific requirements to be included in the tender documents (e.g., reference letters and terms sheets from financiers);
- Submission of Memoranda of Understanding (MoUs) with banks/parent companies, or bank/parent company guarantees;
- Signing a technical partner (property and facility managers);
- Review of draft EPC and O&M agreements provided by bidders;
- Further due diligence on the Preferred Bidder and Reserved Bidders will be carried out, by reaching out to their references, banks and parent companies to confirm lending arrangements, conditional commitments made, etc.

## 8.5 Information for Bidders

### 8.5.1 Categories of Information

We will provide a package of documents to bidders, which will be made available through our virtual and physical data rooms, further described below. This will include a Project Information Memorandum; Technical and Feasibility Reports (which have already been developed, or which are currently under development); as well as Permits and Approvals (which have already been obtained, or for which an application will be submitted in the future). The following categories of information will be made available to bidders:

#### I. Project Information Memorandum

The Information Memorandum (IM) will be prepared in order to provide background information on a confidential basis, to assist prospective bidders in making their own – independent – evaluation of key aspects of this opportunity. Drawing from both the *Pre-feasibility Study Report* and *Feasibility Study Report*[31], the IM serves as a marketing document, providing a selective overview of the features of Accra's real estate market and this specific project opportunity.

#### II. Technical Reports and other Relevant Documentation

- *Geotechnical Study, August, 2016*
- *Land Title Agreement*
- *ARC Designs, 2011*

#### III. Permits and Approvals

- *Ghana Civil Aviation Authority Airspace Safety Permit, February 2016*
- *La Dade-Kotopon Municipal Assembly (LaDMA) Approval in Principle (AIP)*[32]

### 8.5.2 Virtual and Physical Data Room

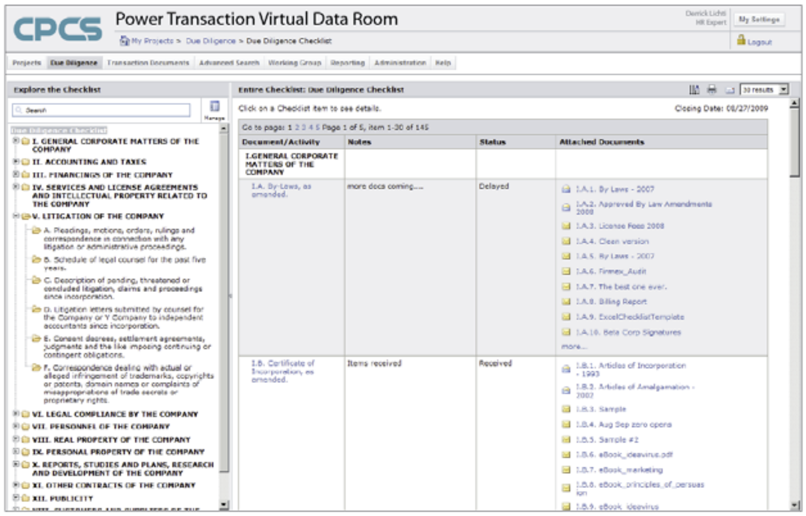
We will develop both a virtual and physical data room in order to store and manage confidential and sensitive information in a secured and controlled space. This has proven to be particularly effective in the management of bidding processes. For instance, we have created profiles and accounts for prequalified bidders to use a secure virtual data room management service for tender processes.

A physical data room is also created at an appropriate project office, containing all documents and data contained on the website, as well as the documents only available in paper format. This

[31] The Information Memorandum would exclude any sensitive language or excerpts which are specific to our mandate as Consultant to SEC.
[32] The timing of this application with LaDMA will be coordinated accordingly, so that the AIP may be shared with the bidders.

enables the effective management of resources and materials upon request, as well as the constant monitoring and updating of the data room as new information becomes available. The figure below presents an example of an online data room created for another transaction led by CPCS.

Figure 8-4: Example of a Data Room from Recent Nigeria Power Sector Transactions




### 8.5.3 Pre-Bid Conference

We will discuss with SEC the possibility of hosting a bidders' conference once a shortlist is confirmed following the REOI evaluations. Such a conference affords bidders the opportunity to meet with SEC and other Government of Ghana officials to discuss key parameters of the project and ask questions. We propose that the bidders' conference be held two weeks after the RFP is made available to pre-qualified bidders.

## 8.6 Pre-qualification Process and Evaluation Parameters

In this section, we review the proposed evaluation plan and criteria, as well as the quality assurance and audit considerations against the pre-qualification processes. The objective is to outline a transparent procedure to identify the shortlist of bidders to continue on in the tender process.

### 8.6.1 Pre-qualification Criteria

The evaluation criteria to prequalify bidders provides a quick, simple and fair determination of whether or not the bidder possesses the financial and technical capabilities sufficient to allow them to enter into the formal bidding process which will then require a further elaboration of specificity and evidence of these capabilities.

In order to be pre-qualified, the REOI will indicate that prospective bidders must be existing local/international private sector developers and must be able to demonstrate a successful track record in developing/maintaining/operating real estate, with a particular focus on developing real estate through PPPs.

Prospective bidders will be requested to provide a pre-qualification document (Expression of Interest) containing the following information:

Figure 8-5: Key Components of the REOI

| | |
|---|---|
| Bidding Entity | Full name of company and contact person, postal address, telephone/fax numbers, and e-mail addresses. |
| Structure of bidding entity | Any technical or professional associations for the purpose of submitting the pre-qualification document (Supporting documentation required, such as letters of association). |
| Ownership structure of bidding entity | Name(s) of major shareholders and percentage shareholding of participants in the bidding entity. |
| Financial Profile | Abridged signed audited financial statements for the past three (3) years (including auditor's letter to the Board of Directors).<br>Evidence of ample financial resources (including letters of support from reputable Ghanaian or international financial institutions). |
| Technical Profile | Technical and operational capabilities covering:<br>✓ Type of business engaged in by members of bidding entity<br>✓ Number of years in business |

Consistent with procurement practices, the evaluation criteria is to be adapted from the REOI advertisement. We propose the evaluation of the pre-qualification criteria to be carried out in the following format: (i) Basic Compliance, (ii) Financial Capacity, and (iii) Technical Capacity.

**Basic Compliance:**

Prospective bidders will be required to provide the following information:

- Bidding entity: Full name of company and contact person, postal address, telephone/fax numbers and e-mail addresses.
- Structure of bidding entity: Any technical or professional associations for the purpose of submitting the pre-qualification document (With supporting documentation such as letters of association).
- Ownership structure of bidding entity: Name(s) of major shareholders and percentage shareholding of participants in the bidding entity.

Bidders that do not provide all the information noted above should be disqualified from further participation in the process.

**Financial Capacity:**

The REOI will request that bidding entities provide a Financial Profile, to include abridged signed audited financial statements for the past three (3) years (including auditor's letter to the Board of Directors); and, Evidence of ample financial resources (including letters of support from reputable Ghanaian or international financial institutions. We propose that the 'financial capacity' be evaluated based on a combination of the following factors:

- Annual turnover
- Total assets
- Shareholders' equity
- Letter(s) of support from a recognized financial institution(s)

**Technical Capacity:**

The REOI will request that bidding entities provide a Technical Profile describing the type of business engaged in by members of the bidding entity; the number of years in business; and evidence of a successful track record and of relevant experience. We propose that the 'technical capacity' be evaluated against the following criteria:

- Evidence that the bidding entity is an existing local/international private sector developer
- Years of experience in real estate development
- Years of experience in facilities/property management
- Evidence of a successful track record of developing/maintaining/operating real estate, with a particular focus on developing real estate through PPPs

### 8.6.2 Checklist

We will develop an *Evaluation of Expressions of Interest Form* to be completed upon the review of each EOI. This will serve as a checklist to determine the shortlisted candidates, and a record of the results of the evaluation process. Note that to Pass, the EOI must receive a pass in each of the criteria listed.

### 8.6.3 Pre-qualification Procedures and Quality Assurance Processes

The following steps are proposed for the evaluation of the EOIs.

1. All EOIs should be brought together into a single room at SEC and opened in the presence of appropriate representatives.
2. A Secretary provided by SEC should note the name of the Bidding Entity submitting the EOI. The full list will be designated as the *List of EOIs Received.*
3. One copy of each EOI should be retained at SEC to enable the scanning and capture of the pages in the EOI containing the key Basic Compliance Information.

4. The other five copies should be placed into four stacks. The stacks of EOIs should then be moved to the evaluation rooms under the direction of the Chairman of the Evaluation Team.

5. The designated Secretary should count and confirm that the EOIs received in the Evaluation Rooms conforms to the List of EOIs Received. The five available copies of each EOI can then be accessed by the individual members of the Evaluation Team.

6. Each member of the team should review each of the EOIs and complete the Evaluation of Expressions of Interest Form.

7. After all of the evaluations are complete, the Chairman should collect the completed Evaluation of Expressions of Interest Forms from each member and compare the Overall Recommendation.

8. If all completed forms are unanimous and have recommended either a Pass or a Fail grade, the evaluation for that Bidding Entity shall be considered as complete and the Secretary should note the result of the evaluation.

9. All others where the evaluation results are not unanimous should be reviewed by the Evaluation Team under the leadership of the Chairman. At any point during the discussion, the dissenting member(s) may offer to change his/her evaluation to conform to the majority. If this results in a unanimous grade, then the evaluation for the Bidding Entity should be considered as complete and the Secretary should note the result of the evaluation.

10. If following this discussion, the Evaluation Team is unable to reach a unanimous decision, the final evaluation shall go to the Project Sponsor, SEC.

## 8.7 Bid Process and Evaluation Parameters

### 8.7.1 Overview

In this section, we review the tender process, bid content and the evaluation plan and criteria. The objective is to outline an efficient and transparent procedure to select the preferred bidder based on the best suitable proposal of the ones submitted by the shortlisted bidders.

### 8.7.2 Bid Process

**Overarching Approach**

Our approach will be to develop a tender process which ensures that prospective developers are granted sufficient flexibility while encouraging alignment with SEC's vision.

If priority areas include maximizing office space for the Commission in compensation for the land, we strongly recommend that potential bidders be granted flexibility in determining optimal building options. It is important not to adopt an overly prescriptive approach, with specifications for parameters such as building volume, the number of floors, or underground parking. Instead, bidders should be encouraged to develop their own options based on their assessment of which building options will render the project legally, technically and commercially viable, while meeting the minimum performance standards for both the building and SEC's floor space.

**Content of Request for Proposal (RfP)**

The RfP will include the following documentation:

- The Tender Notification and Rules presenting the Project purpose and structure, the timetable and required content for the bid submission, and the evaluation criteria and process,
- The Technical Output Specifications including:
    - the LEED Certification
    - minimum floor space and parking requirement
    - fit-up and swing space options
    - operations and maintenance scope and performance criteria
- Information on SEC Site including inter alia, information on land conditions, lease arrangements and existing accommodation,
- Draft PPP agreement,
- Draft Bid and Execution Bonds if any

This documentation should be made available together at the same time to all shortlisted bidders.

**Content of Bid**

The shortlisted bidders' response to the RfP will typically include:

- The Detailed Building Design conforming with the Technical Output Specifications and LEED Certification objectives in particular,
- The Construction Plan including works methodology and schedule,
- The Operation & Maintenance Programme conforming with the scope of facilities management services and performance criteria,
- The Commercial Strategy and Plan describing how the bidder is planning to operate the building and providing details on sales and rentals forecast,
- Comments on draft PPP Agreement

- Details of the bidder's structure with SPV bylaws and Shareholders Agreement in case of Consortium submission,
- Details of contractual structure with draft Project Agreements (EPC & O&M contracts and Tenancy agreement in particular)
- Description of financing structure and terms, including identification of financing providers and supported by original Term Sheet provided by them,
- The Bid and Performance Bonds, if any
- The Bid's Financial Model and related Assumptions Book providing evidence of the bid's economics sustainability assuming technical, financial and economic assumptions in accordance with the related Bid's documentation,
- Outline of key Bids components including space and parking made available to SEC and concession period length

The Bid components should be submitted together in a given form at a given place and before a given time as per the Tender Notification and Rules.

### 8.7.3 Evaluation Process

**Overarching Approach**

While the evaluation exercise is subjective, in that it requires professional judgement, there is the need to ensure that judgment is not arbitrarily exercised or subject to bias. Therefore, as indicated by the World Bank, transparency, consistency and fairness becomes the hallmark of a robust evaluation exercise.

Our approach will be to develop evaluation criteria that screen for technical adequacy and bankability of proposals, while encouraging alignment with SEC's key objectives. Provisions can be made to incentivize bidders to consider the Commission's vision in order to score more favourably in the evaluation. Points will be allocated where bidders demonstrate how their approach to develop and operationalize the project is aligned with one of SEC's main objectives.

**Evaluation Areas**

We would propose that the evaluation be split into four key areas:

1) **Rent free floor space and parking made available to SEC**

   It is proposed that each bidder be requested to offer and commit to deliver additional rent free office space and parking over the concession period above the minimum imposed in the tender's output specifications. These figures are key components of the bids. As such, special consideration should be given to them during the evaluation bearing in mind however that the evaluation should not be limited to this area only.

2) **Building design and operational plan**

The technical aspects of the bids need to be assessed thoroughly. Those include in particular the building architecture and sustainability, the construction methods and schedule and the facilities management services content and performance. Furthermore, they also include building usage, building maintenance and handover requirements.

3) **Financial sustainability and robustness**

This evaluation area relates to the credibility of the bidders' financing and business plans. It requires not only analyzing and reviewing the financing structure of each bid but also details of term sheets provided by the bidders' financiers in order to assess the implementation feasibility of each bid's financing scheme.

This evaluation area also requires assessing the feasibility of each bidder's commercial/marketing strategy and plan and looking into the assumptions, results and sensitivities of each bidders' financial models.

4) **Risk Assessment**

This evaluation area seeks to verify the exhaustive identification and allocation of project risks and to assess the practicality and pertinence of transferring these risks to the private sector. This assessment mainly involves reviewing and evaluating the amendments proposed by the bidders to the draft PPP agreement as well as other project agreements (EPC and O&M contracts, tenancy agreement in particular)

5) **Concession Period**

6) This evaluation area seeks to score bidders based on their ability to recover their capital and financing costs (along with a reasonable profit) in the shortest amount of time after which, the accommodation would be transferred to the SEC.

**Weighting and Scoring**

In order to proceed with a quantitative evaluation which remains the best way to ensure a transparent and equitable assessment process, we would propose that:

1) Each evaluation area is attributed a weight as a percentage with the weightings for the 4 evaluation areas mentioned above totalling 100% (see figure below).

**Figure 8-6: Example Weighting for Illustrative Purposes**

| **Evaluation area** | *Weighting (example for illustration)* |
|---|---|
| SEC rent free space and parking | *30%* |
| Building design and operation plan | *25%* |
| Financial sustainability | *20%* |
| Risk assessment | *10%* |
| Concessoin Period | *15%* |

| *Total* | *100%* |
|---|---|

2) The evaluation process leads to a scoring (on a 0 to 10 scale for instance) on each area and for each bid and global scoring is calculated by summing the scores per evaluation area multiplied by their respective weighting (see figure below).

**Figure 8-7: Example of Evaluation Scoring**

| **Evaluation** | **Bid 1** | **Bid 2** | **Bid 3** |
|---|---|---|---|
| SEC rent free space and parking (30%) | 3 | 5 | 7 |
| Building design and operation plan (25%) | 4 | 6 | 2 |
| Financial sustainability (20%) | 5 | 7 | 3 |
| Risk assessment (10%) | 6 | 6 | 5 |
| Concession Period (15%) | 5 | 7 | 4 |
| **Bid score** | **4.25** | **6.05** | **4.30** |

It should be noted that the calculations presented above are just for illustrative purposes. Final decisions on weighting and refinement of evaluation areas can be considered until the evaluation process commences, assuming that refinements do not alter the transparency, consistency and fairness of the evaluation process.

### 8.7.4 Procedures and Quality Assurance Processes

Throughout the bid processes, particularly related to the receipt, recording and sorting of proposals, we integrate quality assurance measures as part of an overarching framework which promotes transparency, consistency and a reliable audit trail.

**Receiving, Recording and Sorting Proposals**

Each bid package will be delivered in accordance with the RFP instructions. It is essential that the bid documents are handled in an efficient and completely transparent manner and that there are no opportunities for any interference with the documents or that any person in the future can possibly claim any interference.

We would therefore propose to follow the following procedure:

1. All bid packages received will be acknowledged as stated in the RFP and entered into the register.

2. At 5:00 pm (local time) of the proposal submission date, the Register shall be closed by the signing-of representative of SEC

3. All bid packages received will be stored under lock at SEC headquarters.

4. The day after the proposal submission date, the bid packages will be sorted, opened and recorded in a large room chaired by the Director General of SEC. The evaluation teams, the representatives of the bidders and other representatives should be present.

5. A designated Secretary from SEC will announce and record the name of the company submitting the bid.

6. The designated Secretary will confirm that the bid package contains the requested elements of the Bid in accordance with the RFP.

7. Copies of the bids (delivered by the bidders as requested by the RFP) will then be delivered to the evaluation team.

### 8.7.5 Negotiations Procedures

Negotiation will be held at a specified time and location, with the preferred bidder's representative(s). The preferred bidder must have a written Power of Attorney in order to negotiate and sign a contract on behalf of the preferred bidder. CPCS will prepare the minutes of the negotiations, which are to be signed by the Client and by the Consultant's authorized representative.

Some bidders may submit a bid conditional on a minor or insignificant issue. In order to allow additional room in the acceptance of bids, and not be overly rigid on otherwise technically qualified bidders on minor issues, SEC should consider bids conforming if:

- The condition identified would not affect the timeline;
- The condition identified is solely within the control of the SEC;
- The SEC is willing to offer this condition to all other preferred bidders (in the interest of fairness).

This will allow SEC the flexibility to differentiate between *minor* and *major* issues, increase the number of quality proposals that can be accepted, and show some flexibility to bidders. In the interest of transparency and fairness, the SEC should offer any condition accepted to all other preferred bidders as relevant.

One transaction expediting technique is the approval of transaction documents by bidders, in order to facilitate downstream negotiations. That is, the requirement for bidders to review and comment on the transaction agreements (Project Contractual Framework) as part of the bid process. Bidders' comments on the agreements would be returned at a pre-determined date before the submission deadline, after which a discussion is held to review these comments and agree to specific positions with the Client.

Reponses to bidders' comments would then be shared prior to submission of their proposals. Revised and finalized transaction agreements are then sent back to bidders to be included with the bid submission. Bidders would be expected to accept and initial each page of the transaction agreement when sending in their bids – essentially agreeing to the terms, conditions and clauses of the agreements.

The initialed copy of transaction agreements serves as the document that is used for negotiation when a bidder is identified as the preferred bidder. Since that bidder would be already familiar with the PPP Agreement, having already initialed each page of it, there would be no need for lengthy negotiations over the terms, conditions and clauses to the transaction documents. The only elements that are negotiated are the schedules in the transaction documents, which are frequently extracted from the Technical and Commercial proposal submissions of bidders, *and therefore require almost no negotiation.*

## 8.8 Next Steps

Prior to completing the Final Feasibility Report and entering the bidding stage based on the necessary approvals detailed in Figure 8-2, the parameters in the below figure would have to be decided upon and finalized by SEC/PDT based on the Project Team's analysis in this report.

**Decisions made by SEC/PDT based on comments to the Draft Feasibility Report are presented in the last column of the below figure.**

Figure 8-8: Parameters Requiring SEC/PDT Decision

| Parameter | Commentary | SEC/PDT Decision |
|---|---|---|
| **Concession Period** | It is the Project Team's opinion that there are two options regarding the concession period for this project:<br><br>**Option 1** – Fix the period to 25 years<br><br>**Option 2** – Set a range that is between 20 and 30 years and score bidders accordingly (bid submissions indicating a concession period that is closer to 20 years would score more favourably) | Option 2 |
| **Building-use Pattern** | As described in 7.6 of Chapter 7, the fully commercial building indicates that, theoretically, a higher space allocation for SEC can be achieved relative to the mixed-use building pattern.<br><br>However, the sensitivity analysis in Section 7.6.3 of Chapter 7 shows that when certain parameters are sensitized, the mixed-use building pattern can provide more space to SEC, relative to the full commercial building.<br><br>Furthermore, consideration should also be building-use patterns that surround | Option 2 |

| Parameter | Commentary | SEC/PDT Decision |
|---|---|---|
| | SEC's site (and Cantonments in general). Thus, two options are suggested.<br><br>**Option 1** – Fix the building-use pattern to commercial use only<br><br>**Option 2** – Give bidders flexibility in terms of building-use patterns and provide favourable scores to those bidders that propose a fully commercial building-use pattern | |
| **Minimum Parking Bays** | 341 parking bays were estimated for the proposed technical solution presented in Chapter 4. This translates to 2.2 bays per 100 SQM of *leasable* space.<br>It is suggested that a minimum of parking bays be set per 100 SQM of *leasable* space with an evaluative criteria that scores bidders more favourably if they are able to provide a technical solution that is greater than the proposed minimum technical requirement | 2.2 Parking Bays per 100 SQM of *Leasable* Space |
| **SEC's Swing Space / Moving Allowance** | In the viability assessment presented in Section 7.6 of Chapter 7, a scenario was presented whereby SEC's swing space / moving allowance is AND is not part of the developer's costs with corresponding impacts to SEC's space allocation. As such, two suggested options exist for SEC's consideration:<br><br>**Option 1** – SEC's swing space / moving allowance forms part of the developer's project costs<br><br>**Option 2** – SEC's swing space / moving allowance does not form part of the developer's project costs | Option 1 |
| **SEC's Minimum Space Allocation** | It is suggested that SEC set a minimum space allocation and subsequently, have developers bid on the additional space they would provide to SEC as compensation for leasing the land from the Commission.<br><br>The Project Team's analysis in the Value for Money assessment (see Section 7.7 of Chapter 7) provides alternatives to the proposed PPP option with results indicating that for the value of its land, the alternatives can achieve between 950SQM and 1,200SQM office space. | 1,850 SQM |

| Parameter | Commentary | SEC/PDT Decision |
|---|---|---|
| | It is recommended that the Commission/PDT take the above into consideration when setting SEC's minimum, fully-fitted, space allocation. | |

# Appendix A – Room Data Sheets

## Room Data Sheet for Executive Offices

| | | | | |
|---|---|---|---|---|
| Room Name: | EXECUTIVE OFFICE 18.5 SQM | | | |
| Area | Minimum Required: | 18.5 SQM | **Additional Requested:** | |
| Room Quantities | Minimum Required: | 3 | **Additional Requested:** | |

**FUNCTIONS**

**Enclosed partitioned offices for Director General and Senior Executive Directors. Offices to be in an enclosed suite area that includes open office space for staff work stations, file storage, a small waiting area, and a shared private washroom.**

**ARCHITECTURAL**

| **ACOUSTIC REQUIREMENTS** | |
|---|---|
| Sound transmission Class (STC) Rating: | 50 |
| Noise Criteria Rating | 35 |

| **SECURITY REQUIREMENTS:** | | | | |
|---|---|---|---|---|
| External Access: | | Employee Access: | | Comments: |
| External Access Escorted: | X | Individual Access: | X | |

| **WALL ASSEMBLY:** | | **LIGHTING FIXTURES:** | | |
|---|---|---|---|---|
| Gypsum Board/Stud | X | ACT Drop In | X | Comments: |
| Slab/Slab | X | Pot Light | | |
| Security Mesh | | Decorative Pendant | | |
| Acoustic Batt | X | | | |
| Demountable Wall | | | | |
| Slab to U/S ACT | | | | |

**ROOM FINISHES**

| **Floor** | | **Base** | | **Wall Finishes** | | **Ceiling** | | **Wall Protection** | |
|---|---|---|---|---|---|---|---|---|---|
| Carpet Tile | X | Rubber | X | Gypsum Board | X | Gypsum Board | | Crash Rail | |
| Sheet Flooring | | Ceramic Tile | | Paint | | Exposed | | | |
| Ceramic | | Special | | Acoustic Panels | | Acoustic Tile | X | | |
| Anti-Slip | | None | | Vinyl wall covering | X | Acoustic Baffles | | | |
| Static Dissipative Tile | | | | Ceramic Tile | | GWB coffer detail | | | |
| | | | | Plywood Backing | | | | | |
| | | | | Ceramic tile Backsplas | | Height (ft.) | 2590 mm | Other | |

Comments:

**DOORS**

| **Door** | | | | **Frame** | | **Finish** | | **Glazing** | |
|---|---|---|---|---|---|---|---|---|---|
| Swing Door | X | Solid Core Wood | X | Wood | | Painted | | Full | |
| Sliding Door | | Glass Door | | Steel | X | Wood Veneer | X | Partial | |
| Folding Door | | Acoustic Wood Door | | Aluminum | | Glazing | | Sidelight | X |
| | | Hollow Core Wood | | Acoustic | | | | | |
| **Door Hardware Function** | | | | **Other Requirement:** | | Comments: Privacy film on glazing. | | | |
| Office | | Washroom | | Fire Rate | | | | | |
| Passage | | Storeroom | | One Leaf | X | | | | |
| Security | X | | | Two Leaf | | | | | |

**ROOM FURNISHINGS**

| **Tables and Desk** | **QTY** | **Seating** | **QTY** | **Storage** | | | **QTY** | |
|---|---|---|---|---|---|---|---|---|
| Workstations 6 SQM | | Task chairs | 1 | Secure Document Storage | | | | |
| Workstations 4.5 SQM | | Guest chair | 4 Optional | Bookcases | | | 1 | |
| Desk Group (desk, bridge, credenza) | 1 Set | Conference Chair | | Storage cabinets | | | | |
| Height-Adjustable Desk | | Lounge Chair | 2 Optional | Steel Shelving | | | | |
| Occasional Tables | 1 Optional | Sofa | | File cabinets | | | | |
| Meeting Room Table | 1 Optional | Stacking chairs | | | | | | |
| Conference Tables w/power & Data | | Other | | Other | | | | |
| Mobile Tables/Flip Top | | **Window Treatment:** | | Rolling Shades | | | | |
| Dining Table | | Single Filtered Light | | X | Manual | X | Powered | |
| Operable Partitions | | Double Filtered Shades | | | Manual | | Powered | |

Comments: "Optional" indicates preference choices of the individual.

**EQUIPMENT**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Smart Board | | Screen/Monitor | | Printer | | Shredder | |
| White Board | | Projector | | MFD | | Scanner | |

## Room Data Sheet for Director Office

| | | | | |
|---|---|---|---|---|
| Room Name: | DIRECTOR OFFICE 14 SQM | | | |
| Area | Minimum Required: | 14 SQM | Additional Requested: | |
| Room Quantities | Minimum Required: | 10 | Additional Requested: | |

**FUNCTIONS**

Exclosed partitioned office for directors of departments within the open area that accomodates their staff unless noted.

**ARCHITECTURAL**

| ACOUSTIC REQUIREMENTS | |
|---|---|
| Sound transmission Class (STC) Rating: | 45 |
| Noise Criteria Rating | 35 |

| SECURITY REQUIREMENTS: | | | | |
|---|---|---|---|---|
| External Access: | | Employee Access: | | Comments: |
| External Access Escorted: | X | Individual Access: | X | |

| WALL ASSEMBLY: | | LIGHTING FIXTURES: | | |
|---|---|---|---|---|
| Gypsum Board/Stud | X | ACT Drop In | X | Comments: |
| Slab/Slab | X | Pot Light | | |
| Security Mesh | | Decorative Pendant | | |
| Acoustic Batt | X | | | |
| Demountable Wall | | | | |
| Slab to U/S ACT | | | | |

**ROOM FINISHES**

| Floor | | Base | | Wall Finishes | | Ceiling | | Wall Protection | |
|---|---|---|---|---|---|---|---|---|---|
| Carpet Tile | X | Rubber | X | Gypsum Board | X | Gypsum Board | | Crash Rail | |
| Sheet Flooring | | Ceramic Tile | | Paint | X | Exposed | | | |
| Ceramic | | Special | | Acoustic Panels | | Acoustic Tile | X | | |
| Anti-Slip | | None | | Vinyl wall covering | | Acoustic Baffles | | | |
| Static | | | | Ceramic Tile | | | | | |
| Dissipative Tile | | | | Plywood Backing | | | | | |
| | | | | Ceramic tile Backsplas | | Height (ft.) | 2590 mm | Other | |

Comments:

**DOORS**

| Door | | | | Frame | | Finish | | Glazing | |
|---|---|---|---|---|---|---|---|---|---|
| Swing Door | X | Solid Core Wood | X | Wood | | Painted | | Full | |
| Sliding Door | | Glass Door | | Steel | X | Wood Veneer | X | Partial | |
| Folding Door | | Acoustic Wood Door | | Aluminum | | Glazing | | Sidelight | X |
| | | Hollow Core Wood | | Acoustic | | | | | |

| Door Hardware Function | | | | Other Requirement: | | Comments: Privacy film on glazing. |
|---|---|---|---|---|---|---|
| Office | X | Washroom | | Fire Rate | | |
| Passage | | Storeroom | | One Leaf | X | |
| Security | | | | Two Leaf | | |

**ROOM FURNISHINGS**

| Tables and Desk | QTY | Seating | QTY | Storage | QTY |
|---|---|---|---|---|---|
| Workstations 6 SQM | | Task chairs | 1 | Secure Document Storage | |
| Workstations 4.5 SQM | | Guest chair | 3 | Bookcases | 1 |
| Desk Group (desk, bridge, credenza) | 1 Set | Conference Chair | | Storage cabinets | |
| Height-Adjustable Desk | | Lounge Chair | | Steel Shelving | |
| Occasional Tables | | Sofa | | File cabinets | 1 |
| Meeting Room Table | 1 | Stacking chairs | | | |
| Conference Tables w/power & Data | | Other | | Other | |
| Mobile Tables/Flip Top | | | | | |
| Dining Table | | | | | |
| Operable Partitions | | | | | |

| Window Treatment: | Rolling Shades | | | | |
|---|---|---|---|---|---|
| Single Filtered Light | X | Manual | X | Powered | |
| Double Filtered Shades | | Manual | | Powered | |

Comments:

**EQUIPMENT**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Smart Board | | Screen/Monitor | | Printer | | Shredder | |
| White Board | | Projector | | MFD | | Scanner | |

## Room Data Sheet for Manager Office

| | | | | |
|---|---|---|---|---|
| Room Name: | OFFICE 10 SQM | | | |
| Area | Minimum Required: | 10 SQM | **Additional Requested:** | |
| Room Quantities | Minimum Required: | 12 | **Additional Requested:** | 22 |

**FUNCTIONS**

**Exclosed partitioned office for managers of departments within the open area that accomodates their staff in work stations.**

**ARCHITECTURAL**

| **ACOUSTIC REQUIREMENTS** | |
|---|---|
| Sound transmission Class (STC) Rating: | 45 |
| Noise Criteria Rating | 35 |

| **SECURITY REQUIREMENTS:** | | | | |
|---|---|---|---|---|
| External Access: | | Employee Access: | | Comments: |
| External Access Escorted: | X | Individual Access: | X | |

| **WALL ASSEMBLY:** | | **LIGHTING FIXTURES:** | | |
|---|---|---|---|---|
| Gypsum Board/Stud | X | ACT Drop In | X | Comments: |
| Slab/Slab | X | Pot Light | | |
| Security Mesh | | Decorative Pendant | | |
| Acoustic Batt | X | | | |
| Demountable Wall | | | | |
| Slab to U/S ACT | | | | |

**ROOM FINISHES**

| **Floor** | | **Base** | | **Wall Finishes** | | **Ceiling** | | **Wall Protection** | |
|---|---|---|---|---|---|---|---|---|---|
| Carpet Tile | X | Rubber | X | Gypsum Board | X | Gypsum Board | | Crash Rail | |
| Sheet Flooring | | Ceramic Tile | | Paint | X | Exposed | | | |
| Ceramic | | Special | | Acoustic Panels | | Acoustic Tile | X | | |
| Anti-Slip | | None | | Vinyl wall covering | | Acoustic Baffles | | | |
| Static Dissipative Tile | | | | Ceramic Tile | | | | | |
| | | | | Plywood Backing | | | | | |
| | | | | Ceramic tile Backsplas | | Height (ft.) | 2590 mm | Other | |

Comments:

**DOORS**

| **Door** | | | | **Frame** | | **Finish** | | **Glazing** | |
|---|---|---|---|---|---|---|---|---|---|
| Swing Door | X | Solid Core Wood | X | Wood | | Painted | | Full | |
| Sliding Door | | Glass Door | | Steel | X | Wood Veneer | X | Partial | |
| Folding Door | | Acoustic Wood Door | | Aluminum | | Glazing | | Sidelight | X |
| | | Hollow Core Wood | | Acoustic | | | | | |

| **Door Hardware Function** | | | | **Other Requirement:** | | Comments: **Privacy film on glazing.** |
|---|---|---|---|---|---|---|
| Office | X | Washroom | | Fire Rate | | |
| Passage | | Storeroom | | One Leaf | X | |
| Security | | | | Two Leaf | | |

**ROOM FURNISHINGS**

| Tables and Desk | QTY | Seating | QTY | Storage | QTY |
|---|---|---|---|---|---|
| Workstations 6 SQM | | Task chairs | 1 | Secure Document Storage | |
| Workstations 4.5 SQM | | Guest chair | 2 | Bookcases | |
| Desk Group (desk, bridge) | 1 Set | Conference Chair | | Storage cabinets | |
| Height-Adjustable Desk | | Lounge Chair | | Steel Shelving | |
| Occasional Tables | | Sofa | | File Cabinet | 1 |
| Meeting Room Table | | Stacking chairs | | | |
| Conference Tables w/power & Data | | Other | | Other | |
| Mobile Tables/Flip Top | | | | | |
| Dining Table | | | | | |
| Operable Partitions | | | | | |

| **Window Treatment:** | **Rolling Shades** | | | | |
|---|---|---|---|---|---|
| Single Filtered Light | X | Manual | X | Powered | |
| Double Filtered Shades | | Manual | | Powered | |

Comments:

**EQUIPMENT**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Smart Board | | Screen/Monitor | | Printer | | Shredder | |
| White Board | | Projector | | MFD | | Scanner | |

## Room Data Sheet for Open Office

| | | | | |
|---|---|---|---|---|
| Room Name: | OPEN OFFICE | | | |
| Area | Minimum Required: | 363 SQM | Additional Requested: | 651 SQM |
| Room Quantities | Minimum Required: | - | Additional Requested: | - |

**FUNCTIONS**

Open work space for accommodation of staff in system furniture workstation.

See workstation sizes and quantities in each department cover sheet.

**ARCHITECTURAL**

| ACOUSTIC REQUIREMENTS | |
|---|---|
| Sound transmission Class (STC) Rating: | NA |
| Noise Criteria Rating | 40 |

| SECURITY REQUIREMENTS: | | | | |
|---|---|---|---|---|
| External Access: | | Employee Access: | X | Comments: Refer to Department Cover Sheets for security function. |
| External Access Escorted: | X | Individual Access: | | |

| WALL ASSEMBLY: | | LIGHTING FIXTURES: | | |
|---|---|---|---|---|
| Gypsum Board/Stud | | ACT Drop In | X | Comments: |
| Slab/Slab | | Pot Light | | |
| Security Mesh | | Decorative Pendant | | |
| Acoustic Batt | | | | |
| Demountable Wall | | | | |
| Slab to U/S ACT | | | | |

**ROOM FINISHES**

| Floor | | Base | | Wall Finishes | | Ceiling | | Wall Protection | |
|---|---|---|---|---|---|---|---|---|---|
| Carpet Tile | X | Rubber | X | Gypsum Board | X | Gypsum Board | | Crash Rail | |
| Sheet Flooring | | Ceramic Tile | | Paint | X | Exposed | | | |
| Ceramic | | Special | | Acoustic Panels | | Acoustic Tile | X | | |
| Anti-Slip | | None | | Vinyl wall covering | | Acoustic Baffles | | | |
| Static | | | | Ceramic Tile | | | | | |
| Dissipative Tile | | | | Plywood Backing | | | | | |
| | | | | Ceramic tile Backsplas | | Height (ft.) | 2590 mm | Other | |

Comments:

**DOORS**

| Door | | | | Frame | | Finish | | Glazing | |
|---|---|---|---|---|---|---|---|---|---|
| Swing Door | | Solid Core Wood | X | Wood | | Painted | | Full | |
| Sliding Door | | Glass Door | | Steel | X | Wood Veneer | X | Partial | |
| Folding Door | | Acoustic Wood Door | | Aluminum | | Glazing | | Sidelight | X |
| | | Hollow Core Wood | | Acoustic | | | | | |

| Door Hardware Function | | | | Other Requirement: | | Comments: Doors If required. |
|---|---|---|---|---|---|---|
| Office | | Washroom | | Fire Rate | | |
| Passage | | Storeroom | | One Leaf | | |
| Security | | | | Two Leaf | | |

**ROOM FURNISHINGS**

| Tables and Desk | QTY | Seating | QTY | Storage | QTY |
|---|---|---|---|---|---|
| Workstations 6 SQM | X | Task chairs | 1 PER WORKSTATION | Secure Document Storage | |
| Workstations 4.5 SQM | X | Guest chair | | Bookcases | X |
| Desk Group (Casegoods) | | Conference Chair | | Storage cabinets | |
| Height-Adjustable Desks | | Lounge Chair | | Steel Shelving | |
| Occasional Tables | | Sofa | | File cabinets | X |
| Meeting Room Table | | Stacking chairs | | | |
| Conference Tables w/power & Data | | Other | | Other | |
| Mobile Tables/Flip Top | | **Window Treatment:** | | Rolling Shades | |
| Dining Table | | Single Filtered Light | | X Manual | X Powered |
| Operable Partitions | | Double Filtered Shades | | Manual | Powered |

Comments: Refer to Department Cover Sheet for Filing Cabinet quantities. Additional information can be found in COLLABORATIVE SPACE Room Data Sheet.

**EQUIPMENT**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Smart Board | | Screen/Monitor | | Printer | | Shredder | |
| White Board | | Projector | | MFD | | Scanner | |

## Room Data Sheet for Collaborative Spaces

| | | | | |
|---|---|---|---|---|
| Room Name: | COLLABORATIVE SPACE | | | |
| Area | Minimum Required: | 69 SQM | Additional Requested: | 110 SQM |
| Room Quantities | Minimum Required: | - | Additional Requested: | - |

**FUNCTIONS**

Open space within the open office areas used as informal alternate work places for individuals or collaborative infromal meetings for staff.

**ARCHITECTURAL**

| ACOUSTIC REQUIREMENTS: | |
|---|---|
| Sound transmission Class (STC) Rating: | NA |
| Noise Criteria Rating | 40 |

| SECURITY REQUIREMENTS: | | | | |
|---|---|---|---|---|
| External Access: | | Employee Access: | X | Comments: |
| External Access Escorted: | | Individual Access: | | |

| WALL ASSEMBLY: | | LIGHTING FIXTURES: | | |
|---|---|---|---|---|
| Gypsum Board/Stud | X | ACT Drop In | | Comments: |
| Slab/Slab | | Pot Light | | |
| Security Mesh | | Decorative Pendant | X | |
| Acoustic Batt | X | | | |
| Demountable Wall | | | | |
| Slab to U/S ACT | X | | | |

**ROOM FINISHES**

| Floor | | Base | | Wall Finishes | | Ceiling | | Wall Protection | |
|---|---|---|---|---|---|---|---|---|---|
| Carpet Tile | X | Rubber | X | Gypsum Board | X | Gypsum Board | | Crash Rail | |
| Sheet Flooring | | Ceramic Tile | | Paint | X | Exposed | | | |
| Ceramic | | Special | | Acoustic Panels | | Acoustic Tile | X | | |
| Anti-Slip | | None | | Vinyl wall covering | | Acoustic Baffles | | | |
| Static Dissipative Tile | | | | Ceramic Tile | | | | | |
| | | | | Plywood Backing | | | | | |
| | | | | Ceramic tile Backsplas | | Height (ft.) | 2590 mm | Other | |

Comments:

**DOORS:**

| Door | | | | Frame | | Finish | | Glazing | |
|---|---|---|---|---|---|---|---|---|---|
| Swing Door | | Solid Core Wood | | Wood | | Painted | | Full | |
| Sliding Door | | Glass Door | | Steel | | Wood Veneer | | Partial | |
| Folding Door | | Acoustic Wood Door | | Aluminum | | Glazing | | Sidelight | |
| | | Hollow Core Wood | | Acoustic | | | | | |

| Door Hardware Function | | | | Other Requirement: | | Comments: NA |
|---|---|---|---|---|---|---|
| Office | | Washroom | | Fire Rate | | |
| Passage | | Storeroom | | One Leaf | | |
| Security | | | | Two Leaf | | |

**ROOM FURNISHINGS**

| Tables and Desk | QTY | Seating | QTY | Storage | | | | QTY |
|---|---|---|---|---|---|---|---|---|
| Workstations 6 SQM | | Task chairs | | Secure Document Storage | | | | |
| Workstations 4.5 SQM | | Guest chair | | Bookcases | | | | |
| Desk Group (Casegoods) | | Conference Chair | | Storage cabinets | | | | |
| Height-Adjustable Desks | | Lounge Chair | X | Steel Shelving | | | | |
| Occasional Tables | X | Sofa | X | File cabinets | | | | |
| Meeting Room Table | | Stacking chairs | | | | | | |
| Conference Tables w/power & Data | | Other | | Other | | | | |
| Mobile Tables/Flip Top | | **Window Treatment:** | | Rolling Shades | | | | |
| Dining Table | | Single Filtered Light | | X | Manual | X | Powered | |
| Operable Partitions | | Double Filtered Shades | | | Manual | | Powered | |

Comments:

**EQUIPMENT**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Smart Board | | Screen/Monitor | | Printer | | Shredder | |
| White Board | X | Projector | | MFD | | Scanner | |

## Room Data Sheet for Small Meeting Room

| | | | | |
|---|---|---|---|---|
| Room Name: | SMALL MEETING ROOM | | | |
| Area | Minimum Required: | 14 SQM | Additional Requested: | |
| Room Quantities | Minimum Required: | 1 | Additional Requested: | 3 |

**FUNCTIONS**

Enclosed partitioned space for enternal and external meetings.

**ARCHITECTURAL**

**ACOUSTIC REQUIREMENTS**

| | |
|---|---|
| Sound transmission Class (STC) Rating: | 45 |
| Noise Criteria Rating | 35 |

**SECURITY REQUIREMENTS**

| | | | | |
|---|---|---|---|---|
| External Access: | | Employee Access: | X | Comments: |
| External Access Escorted: | X | Individual Access: | | |

| WALL ASSEMBLY: | | LIGHTING FIXTURES: | | |
|---|---|---|---|---|
| Gypsum Board/Stud | X | ACT Drop In | X | Comments: Plywood reinforcement on walls for mounting equipment is required. |
| Slab/Slab | | Pot Light | X | |
| Security Mesh | | Decorative Pendant | | |
| Acoustic Batt | X | | | |
| Demountable Wall | | | | |
| Slab to U/S ACT | X | | | |

**ROOM FINISHES**

| Floor | | Base | | Wall Finishes | | Ceiling | | Wall Protection | |
|---|---|---|---|---|---|---|---|---|---|
| Carpet Tile | X | Rubber | X | Gypsum Board | X | Gypsum Board | | Crash Rail | X |
| Sheet Flooring | | Ceramic Tile | | Paint | X | Exposed | | | |
| Ceramic | | Special | | Acoustic Panels | | Acoustic Tile | X | | |
| Anti-Slip | | None | | Vinyl wall covering | | Acoustic Baffles | | | |
| Static Dissipative Tile | | | | Ceramic Tile | | | | | |
| | | | | Plywood Backing | | | | | |
| | | | | Ceramic tile Backsplas | | Height (ft.) | 2590 mm | Other | |

Comments:

**DOORS**

| Door | | | | Frame | | Finish | | Glazing | |
|---|---|---|---|---|---|---|---|---|---|
| Swing Door | X | Solid Core Wood | X | Wood | | Painted | | Full | |
| Sliding Door | | Glass Door | | Steel | X | Wood Veneer | X | Partial | X |
| Folding Door | | Acoustic Wood Door | | Aluminum | | Glazing | X | Sidelight | X |
| | | Hollow Core Wood | | Acoustic | | | | | |

| Door Hardware Function | | | | Other Requirement: | | Comments: |
|---|---|---|---|---|---|---|
| Office | | Washroom | | Fire Rate | | |
| Passage | X | Storeroom | | One Leaf | X | |
| Security | | | | Two Leaf | | |

**ROOM FURNISHINGS**

| Tables and Desk | QTY | Seating | QTY | Storage | QTY |
|---|---|---|---|---|---|
| Workstations 6 SQM | | Task chairs | | Secure Document Storage | |
| Workstations 4.5 SQM | | Guest chair | | Bookcases | |
| Desk Group (Casegoods) | | Conference Chair | 6 | Storage cabinets | X |
| Height-Adjustable Desks | | Lounge Chair | | Steel Shelving | |
| Occasional Tables | | Sofa | | File cabinets | |
| Meeting Room Table | 1 | Stacking chairs | | | |
| Conference Tables w/power & Data | | Other | | Other | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Mobile Tables/Flip Top | | Window Treatment: | Rolling Shades if required | | | | |
| Dining Table | | Single Filtered Light | X | Manual | X | Powered | |
| Operable Partitions | | Double Filtered Shades | | Manual | | Powered | |

Comments:

**EQUIPMENT**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Smart Board | | Screen/Monitor | | Printer | | Shredder | |
| White Board | X | Projector | | MFD | | Scanner | |

## Room Data Sheet for Medium Meeting Room

| | | | | |
|---|---|---|---|---|
| Room Name: | MEDIUM MEETING ROOM | | | |
| Area | Minimum Required: | 30 SQM | **Additional Requested:** | |
| Room Quantities | Minimum Required: | 2 | **Additional Requested:** | 3 |

**FUNCTIONS**

**Designated space for enternal and external meetings.**

**ARCHITECTURAL**

| **ACOUSTIC REQUIREMENTS** | |
|---|---|
| Sound transmission Class (STC) Rating: | 45 |
| Noise Criteria Rating | 35 |

| **SECURITY REQUIREMENTS** | | | | |
|---|---|---|---|---|
| External Access: | | Employee Access: | X | Comments: |
| External Access Escorted: | X | Individual Access: | | |

| **WALL ASSEMBLY:** | | **LIGHTING FIXTURES:** | | |
|---|---|---|---|---|
| Gypsum Board/Stud | X | ACT Drop In | X | Comments: **Plywood reinforcement on walls for mounting equipment is required.** |
| Slab/Slab | | Pot Light | X | |
| Security Mesh | | Decorative Pendant | | |
| Acoustic Batt | X | | | |
| Demountable Wall | | | | |
| Slab to U/S ACT | X | | | |

**ROOM FINISHES**

| **Floor** | | **Base** | | **Wall Finishes** | | **Ceiling** | | **Wall Protection** | |
|---|---|---|---|---|---|---|---|---|---|
| Carpet Tile | X | Rubber | X | Gypsum Board | X | Gypsum Board | | Crash Rail | X |
| Sheet Flooring | | Ceramic Tile | | Paint | X | Exposed | | | |
| Ceramic | | Special | | Acoustic Panels | | Acoustic Tile | X | | |
| Anti-Slip | | None | | Vinyl wall covering | | Acoustic Baffles | | | |
| Static Dissipative Tile | | | | Ceramic Tile | | | | | |
| | | | | Plywood Backing | | | | | |
| | | | | Ceramic tile Backsplas | | Height (ft.) | 2590 mm | Other | |

Comments:

**DOORS**

| **Door** | | | | **Frame** | | **Finish** | | **Glazing** | |
|---|---|---|---|---|---|---|---|---|---|
| Swing Door | X | Solid Core Wood | X | Wood | | Painted | | Full | |
| Sliding Door | | Glass Door | | Steel | X | Wood Veneer | X | Partial | X |
| Folding Door | | Acoustic Wood Door | | Aluminum | | Glazing | X | Sidelight | X |
| | | Hollow Core Wood | | Acoustic | | | | | |

| **Door Hardware Function** | | | | **Other Requirement:** | | |
|---|---|---|---|---|---|---|
| Office | | Washroom | | Fire Rate | | Comments: |
| Passage | X | Storeroom | | One Leaf | X | |
| Security | | | | Two Leaf | | |

**ROOM FURNISHINGS**

| **Tables and Desk** | **QTY** | **Seating** | **QTY** | **Storage** | | | **QTY** |
|---|---|---|---|---|---|---|---|
| Workstations 6 SQM | | Task chairs | | Secure Document Storage | | | |
| Workstations 4.5 SQM | | Guest chair | | Bookcases | | | |
| Desk Group (Casegoods) | | Conference Chair | 16 | Storage cabinets | | | X |
| Height-Adjustable Desks | | Lounge Chair | | Steel Shelving | | | |
| Occasional Tables | | Sofa | | File cabinets | | | |
| Meeting Room Table | | Stacking chairs | | | | | |
| Conference Tables w/power & Data | | Other | | Other | | | |
| Mobile Tables/Flip Top | 8 | **Window Treatment:** | | **ROLLING SHADES** | | | |
| Dining Table | | Single Filtered Light | X | Manual | X | Powered | |
| Operable Partitions | X | Double Filtered Shades | | Manual | | Powered | |

Comments:

**EQUIPMENT**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Smart Board | X | Screen/Monitor | X | Printer | | Shredder | |
| White Board | X | Projector | | MFD | | Scanner | |

## Room Data Sheet for Large Meeting Room

| | | | | |
|---|---|---|---|---|
| Room Name: | LARGE MEETING ROOM | | | |
| Area | Minimum Required: | 60 SQM | **Additional Requested:** | 30 SQM |
| Room Quantities | Minimum Required: | 1 | **Additional Requested:** | |

**FUNCTIONS**

Designated space for internal and external meetings.

**ARCHITECTURAL**

| **ACOUSTIC REQUIREMENTS** | |
|---|---|
| Sound transmission Class (STC) Rating: | 45 |
| Noise Criteria Rating | 35 |

| **SECURITY REQUIREMENTS** | | | | |
|---|---|---|---|---|
| External Access: | | Employee Access: | X | Comments: |
| External Access Escorted: | X | Individual Access: | | |

| **WALL ASSEMBLY:** | | **LIGHTING FIXTURES:** | | |
|---|---|---|---|---|
| Gypsum Board/Stud | X | ACT Drop In | X | Comments: Plywood reinforcement on walls for mounting equipment is required. |
| Slab/Slab | | Pot Light | X | |
| Security Mesh | | Decorative Pendant | | |
| Acoustic Batt | X | | | |
| Demountable Wall | | | | |
| Slab to U/S ACT | X | | | |

**ROOM FINISHES**

| **Floor** | | **Base** | | **Wall Finishes** | | **Ceiling** | | **Wall Protection** | |
|---|---|---|---|---|---|---|---|---|---|
| Carpet Tile | X | Rubber | X | Gypsum Board | X | Gypsum Board | | Crash Rail | X |
| Sheet Flooring | | Ceramic Tile | | Paint | X | Exposed | | | |
| Ceramic | | Special | | Acoustic Panels | | Acoustic Tile | X | | |
| Anti-Slip | | None | | Vinyl wall covering | | Acoustic Baffles | | | |
| Static Dissipative Tile | | | | Ceramic Tile | | | | | |
| | | | | Plywood Backing | | | | | |
| | | | | Ceramic tile Backsplas | | Height (ft.) | 2590 mm | Other | |

Comments:

**DOORS**

| **Door** | | | | **Frame** | | **Finish** | | **Glazing** | |
|---|---|---|---|---|---|---|---|---|---|
| Swing Door | X | Solid Core Wood | | Wood | | Painted | | Full | |
| Sliding Door | | Glass Door | | Steel | X | Wood Veneer | X | Partial | |
| Folding Door | | Acoustic Wood Door | X | Aluminum | | Glazing | X | Sidelight | X |
| | | Hollow Core Wood | | Acoustic | | | | | |

| **Door Hardware Function** | | | | **Other Requirement:** | | Comments: |
|---|---|---|---|---|---|---|
| Office | | Washroom | | Fire Rate | | |
| Passage | X | Storeroom | | One Leaf | X | |
| Security | | | | Two Leaf | | |

**ROOM FURNISHINGS**

| **Tables and Desk** | **QTY** | **Seating** | **QTY** | **Storage** | | | **QTY** | |
|---|---|---|---|---|---|---|---|---|
| Workstations 6 SQM | | Task chairs | | Secure Document Storage | | | | |
| Workstations 4.5 SQM | | Guest chair | | Bookcases | | | | |
| Desk Group (Casegoods) | | Conference Chair | 12 | Storage cabinets | | | X | |
| Height-Adjustable Desks | | Lounge Chair | | Steel Shelving | | | | |
| Occasional Tables | | Sofa | | File cabinets | | | | |
| Meeting Room Table | | Stacking chairs | 12 | | | | | |
| Conference Tables w/power & Data | | Other | | Other | | | | |
| Mobile Tables/Flip Top | 12 | **Window Treatment:** | | ROLLING SHADES | | | | |
| Dining Table | | Single Filtered Light | | X | Manual | X | Powered | |
| Operable Partitions | X | Double Filtered Shades | | | Manual | | Powered | |

Comments:

**EQUIPMENT**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Smart Board | X | Screen/Monitor | X | Printer | | Shredder | |
| White Board | | Projector | X | MFD | | Scanner | |

## Room Data Sheet for Quiet Room

| | | | | |
|---|---|---|---|---|
| Room Name: | QUIET ROOM | | | |
| Area | Minimum Required: | 5 SQM | Additional Requested: | |
| Room Quantities | Minimum Required: | 3 | Additional Requested: | 5 |

**FUNCTIONS**

Enclosed space for the shared use of staff. Used for private phone calls or for temporary work requiring a high level of concentration.

**ARCHITECTURAL**

| ACOUSTIC REQUIREMENTS | |
|---|---|
| Sound transmission Class (STC) Rating: | 45 |
| Noise Criteria Rating | 35 |

| SECURITY REQUIREMENTS | | | | |
|---|---|---|---|---|
| External Access: | | Employee Access: | X | Comments: |
| External Access Escorted: | | Individual Access: | | |

| WALL ASSEMBLY: | | LIGHTING FIXTURES: | | |
|---|---|---|---|---|
| Gypsum Board/Stud | X | ACT Drop In | | Comments: |
| Slab/Slab | | Pot Light | | |
| Security Mesh | | Decorative Pendant | X | |
| Acoustic Batt | X | | | |
| Demountable Wall | | | | |
| Slab to U/S ACT | X | | | |

**ROOM FINISHES**

| Floor | | Base | | Wall Finishes | | Ceiling | | Wall Protection | |
|---|---|---|---|---|---|---|---|---|---|
| Carpet Tile | X | Rubber | X | Gypsum Board | X | Gypsum Board | | Crash Rail | |
| Sheet Flooring | | Ceramic Tile | | Paint | X | Exposed | | | |
| Ceramic | | Special | | Acoustic Panels | | Acoustic Tile | X | | |
| Anti-Slip | | None | | Vinyl wall covering | | Acoustic Baffles | | | |
| Static Dissipative Tile | | | | Ceramic Tile | | | | | |
| | | | | Plywood Backing | | | | | |
| | | | | Ceramic tile Backsplas | | Height (ft.) | 2590 mm | Other | |

Comments:

**DOORS**

| Door | | | | Frame | | Finish | | Glazing | |
|---|---|---|---|---|---|---|---|---|---|
| Swing Door | X | Solid Core Wood | X | Wood | | Painted | | Full | |
| Sliding Door | | Glass Door | | Steel | X | Wood Veneer | X | Partial | |
| Folding Door | | Acoustic Wood Door | | Aluminum | | Glazing | | Sidelight | X |
| | | Hollow Core Wood | | Acoustic | | | | | |
| **Door Hardware Function** | | | | **Other Requirement:** | | Privacy film | | | |
| Office | | Washroom | | Fire Rate | | | | | |
| Passage | X | Storeroom | | One Leaf | X | | | | |
| Security | | | | Two Leaf | | | | | |

**ROOM FURNISHINGS**

| Tables and Desk | QTY | Seating | QTY | Storage | | | QTY | |
|---|---|---|---|---|---|---|---|---|
| Workstations 6 SQM | | Task chairs | | Secure Document Storage | | | | |
| Workstations 4.5 SQM | | Guest chair | | Bookcases | | | | |
| Desk Group (Casegoods) | | Conference Chair | | Storage cabinets | | | | |
| Height-Adjustable Desks | | Lounge Chair | 2 | Steel Shelving | | | | |
| Occasional Tables | 1 | Sofa | | File cabinets | | | | |
| Meeting Room Table | | Stacking chairs | | | | | | |
| Conference Tables w/power & Data | | Other | | Other | | | | |
| Mobile Tables/Flip Top | | **Window Treatment:** | | ROLLING SHADES | | | | |
| Dining Table | | Single Filtered Light | | X | Manual | X | Powered | |
| Operable Partitions | | Double Filtered Shades | | | Manual | | Powered | |

Comments:

## Room Data Sheet for Reception Area

| Room Name: | RECEPTION AREA | | | |
|---|---|---|---|---|
| Area | Minimum Required: | 10 SQM | Additional Requested: | |
| Room Quantities | Minimum Required: | 1 | Additional Requested: | |

**FUNCTIONS**

**Point of entry for all staff and visitors.**

**Waiting area for visitors.**

**ARCHITECTURAL**

| ACOUSTIC REQUIREMENTS | |
|---|---|
| Sound transmission Class (STC) Rating: | 42 |
| Noise Criteria Rating | 35 |

| SECURITY REQUIREMENTS | | | | |
|---|---|---|---|---|
| External Access: | X | Employee Access: | X | Comments: |
| External Access Escorted: | | Individual Access: | | |

| WALL ASSEMBLY: | | LIGHTING FIXTURES: | | |
|---|---|---|---|---|
| Gypsum Board/Stud | X | ACT Drop In | X | Comments: |
| Slab/Slab | | Pot Light | X | |
| Security Mesh | | Decorative Pendant | X | |
| Acoustic Batt | X | | | |
| Demountable Wall | | | | |
| Slab to U/S ACT | | | | |

**ROOM FINISHES**

| Floor | | Base | | Wall Finishes | | Ceiling | | Wall Protection | |
|---|---|---|---|---|---|---|---|---|---|
| Carpet Tile | | Rubber | | Gypsum Board | X | Gypsum Board | | Crash Rail | |
| Sheet Flooring | | Ceramic Tile | X | Paint | X | Exposed | | | |
| Ceramic | X | Special | | Acoustic Panels | | Acoustic Tile | X | | |
| Anti-Slip | | None | | Vinyl wall covering | | Acoustic Baffles | | | |
| Static Dissipative Tile | | | | Ceramic Tile | | | | | |
| | | | | Plywood Backing | | | | | |
| | | | | Ceramic tile Backsplash | | Height (ft.) | 2590 mm | Other | |

Comments:

**DOORS**

| Door | | | | Frame | | Finish | | Glazing | |
|---|---|---|---|---|---|---|---|---|---|
| Swing Door | X | Solid Core Wood | X | Wood | | Painted | | Full | X |
| Sliding Door | | Glass Door | | Steel | X | Wood Veneer | X | Partial | |
| Folding Door | | Acoustic Wood Door | | Aluminum | | Glazing | X | Sidelight | X |
| | | Hollow Core Wood | | Acoustic | | | | | |

| Door Hardware Function | | | | Other Requirement: | | Comments: |
|---|---|---|---|---|---|---|
| Office | | Washroom | | Fire Rate | | |
| Passage | | Storeroom | | One Leaf | X | |
| Security | X | | | Two Leaf | | |

**ROOM FURNISHINGS**

| Tables and Desk | QTY | Seating | QTY | Storage | QTY |
|---|---|---|---|---|---|
| Workstations 6 SQM | | Task chairs | | Secure Document Storage | |
| Workstations 4.5 SQM | | Guest chair | 1 | Bookcases | |
| Desk Group (Casegoods) | | Conference Chair | | Storage cabinets | X |
| Height-Adjustable Desks | | Lounge Chair | 4 | Steel Shelving | |
| Occasional Tables | | Sofa | | File cabinets | |
| Meeting Room Table | | Stacking chairs | | | |
| Conference Tables w/power & Data | | Other | | Other | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Mobile Tables/Flip Top | | Window Treatment: | ROLLING SHADES | | | | |
| Dining Table | | Single Filtered Light | X | Manual | X | Powered | |
| Reception Desk | 1 | Double Filtered Shades | | Manual | | Powered | |

Comments: **Reception desk could be millwork.**

## Room Data Sheet for IT Server Room

| | | | | |
|---|---|---|---|---|
| Room Name: | IT SERVER ROOM | | | |
| Area | Minimum Required: | 10 SQM | Additional Requested: | |
| Room Quantities | Minimum Required: | 1 | Additional Requested: | |

**FUNCTIONS**

**ARCHITECTURAL**

| | |
|---|---|
| **ACOUSTIC REQUIREMENTS** | |
| Sound transmission Class (STC) Rating: | - |
| Noise Criteria Rating | 35 |

| | | | | |
|---|---|---|---|---|
| **SECURITY REQUIREMENTS** | | | | |
| External Access: | | Employee Access: | | Comments: Security cameras are required for full visibilit |
| External Access Escorted: | | Individual Access: | X | |

| | | | | |
|---|---|---|---|---|
| **WALL ASSEMBLY:** | | **LIGHTING FIXTURES:** | | |
| Gypsum Board/Stud | X | ACT Drop In | X | Comments: Fire-rated plywood reinforcement on walls for mounting equipment is required. |
| Slab/Slab | | Pot Light | | |
| Security Mesh | | Decorative Pendant | | |
| Acoustic Batt | X | | | |
| Demountable Wall | | | | |
| Slab to U/S ACT | X | | | |

**ROOM FINISHES**

| **Floor** | | **Base** | | **Wall Finishes** | | **Ceiling** | | **Wall Protection** | |
|---|---|---|---|---|---|---|---|---|---|
| Carpet Tile | | Rubber | X | Gypsum Board | X | Gypsum Board | | Crash Rail | |
| Sheet Flooring | | Ceramic Tile | | Paint | X | Exposed | | | |
| Ceramic | | Special | | Acoustic Panels | | Acoustic Tile | X | | |
| Anti-Slip | | None | | Vinyl wall covering | | Acoustic Baffles | | | |
| Static Dissipative Tile | X | | | Ceramic Tile | | | | | |
| | | | | Plywood Backing | | | | | |
| | | | | Ceramic tile Backsplas | | Height (ft.) | 2590 mm | Other | |

Comments:

**DOORS**

| **Door** | | | | **Frame** | | **Finish** | | **Glazing** | |
|---|---|---|---|---|---|---|---|---|---|
| Swing Door | X | Solid Core Wood | X | Wood | | Painted | X | Full | |
| Sliding Door | | Glass Door | | Steel | X | Wood Veneer | | Partial | |
| Folding Door | | Acoustic Wood Door | | Aluminum | | Glazing | | Sidelight | |
| | | Hollow Core Wood | | Acoustic | | | | | |

| **Door Hardware Function** | | | | **Other Requirement:** | | Comments: |
|---|---|---|---|---|---|---|
| Office | | Washroom | | Fire Rate | | |
| Passage | | Storeroom | | One Leaf | X | |
| Security | X | | | Two Leaf | | |

## Room Data Sheet for IT Storeroom

| | | | | |
|---|---|---|---|---|
| Room Name: | IT STOREROOM | | | |
| Area | Minimum Required: | 10 SQM | Additional Requested: | |
| Room Quantities | Minimum Required: | 1 | Additional Requested: | |

### FUNCTIONS

Dedicated enclosed space for IT department.

### ARCHITECTURAL

| ACOUSTIC REQUIREMENTS | |
|---|---|
| Sound transmission Class (STC) Rating: | - |
| Noise Criteria Rating | 35 |

| SECURITY REQUIREMENTS | | | | |
|---|---|---|---|---|
| External Access: | | Employee Access: | | Comments: Security cameras are required for full visibilit |
| External Access Escorted: | | Individual Access: | X | |

| WALL ASSEMBLY: | | LIGHTING FIXTURES: | | |
|---|---|---|---|---|
| Gypsum Board/Stud | X | ACT Drop In | X | Comments: |
| Slab/Slab | | Pot Light | | |
| Security Mesh | | Decorative Pendant | | |
| Acoustic Batt | X | | | |
| Demountable Wall | | | | |
| Slab to U/S ACT | X | | | |

**ROOM FINISHES**

| Floor | | Base | | Wall Finishes | | Ceiling | | Wall Protection | |
|---|---|---|---|---|---|---|---|---|---|
| Carpet Tile | | Rubber | X | Gypsum Board | X | Gypsum Board | | Crash Rail | |
| Sheet Flooring | | Ceramic Tile | | Paint | X | Exposed | | | |
| Ceramic | | Special | | Acoustic Panels | | Acoustic Tile | X | | |
| Anti-Slip | | None | | Vinyl wall covering | | Acoustic Baffles | | | |
| Static Dissipative Tile | X | | | Ceramic Tile | | | | | |
| | | | | Plywood Backing | | | | | |
| | | | | Ceramic tile Backsplas | | Height (ft.) | 2590 mm | Other | |

Comments:

**DOORS**

| Door | | | | Frame | | Finish | | Glazing | |
|---|---|---|---|---|---|---|---|---|---|
| Swing Door | X | Solid Core Wood | X | Wood | | Painted | X | Full | |
| Sliding Door | | Glass Door | | Steel | X | Wood Veneer | | Partial | |
| Folding Door | | Acoustic Wood Door | | Aluminum | | Glazing | | Sidelight | |
| | | Hollow Core Wood | | Acoustic | | | | | |

| Door Hardware Function | | | | Other Requirement: | | Comments: |
|---|---|---|---|---|---|---|
| Office | | Washroom | | Fire Rate | | |
| Passage | | Storeroom | X | One Leaf | X | |
| Security | | | | Two Leaf | | |

### ROOM FURNISHINGS

| Tables and Desk | QTY | Seating | QTY | Storage | QTY |
|---|---|---|---|---|---|
| Workstations 6 SQM | | Task chairs | | Secure Document Storage | |
| Workstations 4.5 SQM | | Guest chair | | Bookcases | X |
| Desk Group (Casegoods) | | Conference Chair | | Storage cabinets | X |
| Height-Adjustable Desks | | Lounge Chair | | Steel Shelving | X |
| Occasional Tables | | Sofa | | File cabinets | |
| Meeting Room Table | | Stacking chairs | | | |
| Conference Tables w/power & Data | | Other | | Other | |
| Mobile Tables/Flip Top | | Window Treatment: | | NA | |
| Dining Table | | Single Filtered Light | | Manual | Powered |
| Operable Partitions | | Double Filtered Shades | | Manual | Powered |

Comments: Tape Storage Drawer is required.

## Room Data Sheet for Storeroom

| | | | | |
|---|---|---|---|---|
| Room Name: | STOREROOM | | | |
| Area | Minimum Required: | 10 SQM | Additional Requested: | |
| Room Quantities | Minimum Required: | 1 | Additional Requested: | |

### FUNCTIONS

### ARCHITECTURAL

**ACOUSTIC REQUIREMENTS**

| | |
|---|---|
| Sound transmission Class (STC) Rating: | - |
| Noise Criteria Rating | 35 |

**SECURITY REQUIREMENTS**

| | | | | |
|---|---|---|---|---|
| External Access: | | Employee Access: | | Comments: |
| External Access Escorted: | | Individual Access: | X | |

| WALL ASSEMBLY: | | LIGHTING FIXTURES: | | |
|---|---|---|---|---|
| Gypsum Board/Stud | X | ACT Drop In | X | Comments: |
| Slab/Slab | | Pot Light | | |
| Security Mesh | | Decorative Pendant | | |
| Acoustic Batt | X | | | |
| Demountable Wall | | | | |
| Slab to U/S ACT | X | | | |

**ROOM FINISHES**

| Floor | | Base | | Wall Finishes | | Ceiling | | Wall Protection | |
|---|---|---|---|---|---|---|---|---|---|
| Carpet Tile | | Rubber | X | Gypsum Board | X | Gypsum Board | | Crash Rail | |
| Sheet Flooring | X | Ceramic Tile | | Paint | X | Exposed | | | |
| Ceramic | | Special | | Acoustic Panels | | Acoustic Tile | X | | |
| Anti-Slip | | None | | Vinyl wall covering | | Acoustic Baffles | | | |
| Static Dissipative Tile | | | | Ceramic Tile | | | | | |
| | | | | Plywood Backing | | | | | |
| | | | | Ceramic tile Backsplas | | Height (ft.) | 2590 mm | Other | |

Comments:

**DOORS**

| Door | | | | Frame | | Finish | | Glazing | |
|---|---|---|---|---|---|---|---|---|---|
| Swing Door | X | Solid Core Wood | X | Wood | | Painted | X | Full | |
| Sliding Door | | Glass Door | | Steel | X | Wood Veneer | | Partial | |
| Folding Door | | Acoustic Wood Door | | Aluminum | | Glazing | | Sidelight | |
| | | Hollow Core Wood | | Acoustic | | | | | |

| Door Hardware Function | | | | Other Requirement: | | Comments: |
|---|---|---|---|---|---|---|
| Office | | Washroom | | Fire Rate | | |
| Passage | | Storeroom | X | One Leaf | X | |
| Security | | | | Two Leaf | | |

### ROOM FURNISHINGS

| Tables and Desk | QTY | Seating | QTY | Storage | | | QTY | |
|---|---|---|---|---|---|---|---|---|
| Workstations 6 SQM | | Task chairs | | Secure Document Storage | | | | |
| Workstations 4.5 SQM | | Guest chair | | Bookcases | | | | |
| Desk Group (Casegoods) | | Conference Chair | | Storage cabinets | | | X | |
| Height-Adjustable Desks | | Lounge Chair | | Steel Shelving | | | X | |
| Occasional Tables | | Sofa | | File cabinets | | | | |
| Meeting Room Table | | Stacking chairs | | | | | | |
| Conference Tables w/power & Data | | Other | | Other | | | | |
| Mobile Tables/Flip Top | | Window Treatment: | | NA | | | | |
| Dining Table | | Single Filtered Light | | | Manual | | Powered | |
| Operable Partitions | | Double Filtered Shades | | | Manual | | Powered | |

Comments:

## Room Data Sheet for Busineses Centre

| | | | | |
|---|---|---|---|---|
| Room Name: | BUSINESS CENTRE | | | |
| Area | Minimum Required: | 15 SQM | Additional Requested: | |
| Room Quantities | Minimum Required: | 1 | Additional Requested: | 2 |

**FUNCTIONS**

A shared space to accommodate business machine and associated storage.

**ARCHITECTURAL**

**ACOUSTIC REQUIREMENTS**

| | |
|---|---|
| Sound transmission Class (STC) Rating: | 35 |
| Noise Criteria Rating | 35 |

**SECURITY REQUIREMENTS**

| | | | | |
|---|---|---|---|---|
| External Access: | | Employee Access: | X | Comments: |
| External Access Escorted: | | Individual Access: | | |

| WALL ASSEMBLY: | | LIGHTING FIXTURES: | | |
|---|---|---|---|---|
| Gypsum Board/Stud | X | ACT Drop In | X | Comments: |
| Slab/Slab | | Pot Light | | |
| Security Mesh | | Decorative Pendant | | |
| Acoustic Batt | X | | | |
| Demountable Wall | | | | |
| Slab to U/S ACT | X | | | |

**ROOM FINISHES**

| Floor | | Base | | Wall Finishes | | Ceiling | | Wall Protection | |
|---|---|---|---|---|---|---|---|---|---|
| Carpet Tile | | Rubber | X | Gypsum Board | X | Gypsum Board | | Crash Rail | |
| Sheet Flooring | X | Ceramic Tile | | Paint | X | Exposed | | | |
| Ceramic | | Special | | Acoustic Panels | | Acoustic Tile | X | | |
| Anti-Slip | | None | | Vinyl wall covering | | Acoustic Baffles | | | |
| Static Dissipative Tile | | | | Ceramic Tile | | | | | |
| | | | | Plywood Backing | | | | | |
| | | | | Ceramic tile Backsplas | | Height (ft.) | 2590 mm | Other | |

Comments:

**DOORS**

| Door | | | | | Frame | | Finish | | Glazing | |
|---|---|---|---|---|---|---|---|---|---|---|
| Swing Door | | | Solid Core Wood | | Wood | | Painted | | Full | |
| Sliding Door | | | Glass Door | | Steel | | Wood Veneer | | Partial | |
| Folding Door | | | Acoustic Wood Door | | Aluminum | | Glazing | | Sidelight | |
| | | | Hollow Core Wood | | Acoustic | | | | | |

| Door Hardware Function | | | | | Other Requirement: | | Comments: Door is not required. |
|---|---|---|---|---|---|---|---|
| Office | | | Washroom | | Fire Rate | | |
| Passage | | | Storeroom | | One Leaf | | |
| Security | | | | | Two Leaf | | |

**BUILT-IN MILLWORK**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Cupboards Lower | X | Horizontal Finish | | Vertical Finish | | Counter Top | |
| Cupboards Upper | X | Plastic Laminate | X | Plastic Laminate | X | High Pressure Plastic Laminate | X |
| | | MDF Core | X | MDF Core | | Solid Surface | |
| | | Melamine Finish | | Melamine | | | |
| | | Plywood core | | Other | | Other | |

Comments:

**EQUIPMENT**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Smart Board | | Screen/Monitor | | Printer | | Shredder | X |
| White Board | | Projector | | MFD | X | Scanner | X |

## Room Data Sheet for Kitchenette

| | | | | |
|---|---|---|---|---|
| Room Name: | KITCHENETTE | | | |
| Area | Minimum Required: | 30 SQM | Additional Requested: | |
| Room Quantities | Minimum Required: | 1 | Additional Requested: | 2 |

### FUNCTIONS

Space for staff to prepare food, eat, lounge and/or meet.

### ARCHITECTURAL

**ACOUSTIC REQUIREMENTS**

| | |
|---|---|
| Sound transmission Class (STC) Rating: | 35 |
| Noise Criteria Rating | 35 |

**SECURITY REQUIREMENTS**

| | | | | |
|---|---|---|---|---|
| External Access: | | Employee Access: | X | Comments: |
| External Access Escorted: | | Individual Access: | | |

**WALL ASSEMBLY**

| | | | | |
|---|---|---|---|---|
| Gypsum Board/Stud | X | ACT Drop In | | Comments: |
| Slab/Slab | | Pot Light | X | |
| Security Mesh | | Decorative Pendant | X | |
| Acoustic Batt | X | | | |
| Demountable Wall | | | | |
| Slab to U/S ACT | X | | | |

**WALL ASSEMBLY** / **LIGHTING FIXTURES:**

| Floor | | Base | | Wall Finishes | | Ceiling | | Wall Protection | |
|---|---|---|---|---|---|---|---|---|---|
| Carpet Tile | | Rubber | X | Gypsum Board | X | Gypsum Board | | Crash Rail | |
| Sheet Flooring | X | Ceramic Tile | | Paint | X | Exposed | | | |
| Ceramic | | Special | | Acoustic Panels | | Acoustic Tile | X | | |
| Anti-Slip | | None | | Vinyl wall covering | | Acoustic Baffles | | | |
| Static Dissipative Tile | | | | Ceramic Tile | | | | | |
| | | | | Plywood Backing | | | | | |
| | | | | Ceramic tile Backsplas | | Height (ft.) | 2590 mm | Other | |

Comments:

**DOORS**

| Door | | | | Frame | | Finish | | Glazing | |
|---|---|---|---|---|---|---|---|---|---|
| Swing Door | | Solid Core Wood | | Wood | | Painted | | Full | |
| Sliding Door | | Glass Door | | Steel | | Wood Veneer | | Partial | |
| Folding Door | | Acoustic Wood Door | | Aluminum | | Glazing | | Sidelight | |
| | | Hollow Core Wood | | Acoustic | | | | | |

| Door Hardware Function | | | | Other Requirement: | | Comments: Door is not required. |
|---|---|---|---|---|---|---|
| Office | | Washroom | | Fire Rate | | |
| Passage | | Storeroom | | One Leaf | | |
| Security | | | | Two Leaf | | |

**BUILT-IN MILLWORK**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Cupboards Lower | X | **Horizontal Finish** | | **Vertical Finish** | | **Counter Top** | |
| Cupboards Upper | X | Plastic Laminate | X | Plastic Laminate | X | High Pressure Plastic Laminate | |
| | | MDF Core | X | MDF Core | | Solid Surface | X |
| | | Melamine Finish | | Melamine | | Sink | X |
| | | Plywood core | | Other | | Other | |

Comments: Plumbed Sink Required.

### ROOM FURNISHINGS

| Tables and Desk | QTY | Seating | QTY | Storage | QTY |
|---|---|---|---|---|---|
| Workstations 6 SQM | | Task chairs | | Secure Document Storage | |
| Workstations 4.5 SQM | | Guest chair | | Bookcases | |
| Desk Group (Casegoods) | | Conference Chair | | Storage cabinets | |
| Height-Adjustable Desks | | Lounge (Sofa) | | Steel Shelving | |
| Occasional Tables | | Stacking chairs | 16 | File cabinets | |
| Meeting Room Table | | | | | |
| Conference Tables w/power & Data | | Other | | Other | |
| Mobile Tables/Flip Top | | | | | |
| Dining Table | 4 | | | | |
| Operable Partitions | | | | | |

| Window Treatment: | | ROLLING SHADES, IF REQUIRED | | | |
|---|---|---|---|---|---|
| Single Filtered Light | X | Manual | X | Powered | |
| Double Filtered Shades | | Manual | | Powered | |

# Appendix B – Geotechnical Report

Table of Contents


EXECUTIVE SUMMARY ........ 1

1. INTRODUCTION ........ 1

    1.1. Project Overview ........ 1

2. PROJECT DETAILS ........ 1

    2.1. Site Location ........ 1

    2.2. Site Layout and Topography ........ 2

    2.3. The Proposed Structure ........ 2

    2.4. Geographical Information ........ 2

3. PURPOSE OF INVESTIGATIONS ........ 2

4. SCOPE OF INVESTIGATIONS ........ 3

5. INVESTIGATIONS METHODOLOGY ........ 3

    5.1. DESK STUDY ........ 3

    5.2. Sub-Surface Exploration Programme ........ 4

        5.2.1. Weather Conditions ........ 4

        5.2.2. Locations of Test Points ........ 4

        5.2.3. Site Conditions ........ 4

    5.3. Sub-surface Exploration ........ 5

        5.3.1. Trial Pitting and Borehole Drilling ........ 5

        5.3.2. Groundwater ........ 6

    5.4. Laboratory Investigations ........ 6

6. RESULTS OF INVESTIGATION AND ANALYSES ........ 7

    6.1. Surface Conditions ........ 7

    6.2. Physiography and Climate ........ 7

    6.3. Subsurface Conditions ........ 8

        6.3.1. Geology of the Project Site ........ 8

        6.3.2. Site Specific Soil Profile ........ 8

        6.3.3. Soil Composition ........ 10

        6.3.4. Strength Characteristics ........ 10

    6.4. Groundwater ........ 11

    6.5. Design Wind Speed ........ 12

    6.6. Subgrade Reaction Coefficient ........ 12

    6.7. In-situ soils for use in Pavement Construction ........ 12

7. RECOMMENDATION FOR FOUNDATION DESIGN AND CONSTRUCTION ........ 13

    7.1. Aseismic Design Considerations ........ 13

    7.2. Foundation Type and Depth ........ 13

    7.3. Allowable Bearing Capacity and Settlement ........ 13

7.4. Foundation Excavation ........ 14
7.5. Flexible Pavements ........ 14
7.6. Groundwater ........ 14
7.7. Concrete Slab-On-Grade Floors ........ 15
8. REFERENCES ........ 16

## EXECUTIVE SUMMARY

CPCS acting on behalf of the Ghana Securities and Exchange Commission (SEC) is investigating potential options for the development of an office accommodation complex on the property located at Plot No. 30, 3rd Circular Road within the Cantonments Area in Accra, Ghana.

The proposed structure is an office building supporting one or two buildings up to 5-storey in height and up to two levels of underground parking located at Cantonments in Accra, Ghana.

Geotechnical investigations have been undertaken at the site as per the scope of investigations, stipulated by the client, which consisted of drilling 6No. geotechnical boreholes down to target depth of 15m and excavation of 3No. Trial Pits to a depth of 3m in soil strata or down to refusal strata whichever is encountered first.

The site has been assessed as being generally suitable for the proposed development as inferred from the results of this investigation. The results also provide relevant geotechnical design parameters for the preparation of a safe and economic foundation design.

The following sections of this report describe the geologic setting of the project, the subsurface conditions, our conclusions and geotechnical recommendations for design and construction.

Also included in this report is an evaluation of the site with respect to potential problems and recommendations dealing with earthworks during construction.

## 1. INTRODUCTION

### 1.1. Project Overview

The geotechnical investigation has been done to ascertain the soil properties and to aid the design of viable foundations for the proposed office building.

## 2. PROJECT DETAILS

### 2.1. Site Location

The site for the proposed project is situated on Plot No. 30, 3rd Circular Road within the Cantonments Area in Accra, Ghana. The Site is bordered by the Third Circular Road to the west, Fourth Circular Road to the south and the Fifth Circular Road to the East.

The key map showing the location of the site is attached as Fig. 1.

## 2.2. Site Layout and Topography

The site is rectangular in shape and covers an approximate square area of 1.56 acres. The site is fenced with sandcrete blocks and has a gentle slope towards its southern part. There is an L-shaped building with a footprint area of approximately 15,000 square feet located at the northwest corner of the site.

## 2.3. The Proposed Structure

The proposed structure as per the client's information, will consist of 1No. or 2No. 5-storey office accommodation complex with two levels of basement car parking.

## 2.4. Geographical Information

The proposed site lies in:

a) Latitude : 5°35'2.44"N
b) Longitude : 0°10'3.57"W

# 3. PURPOSE OF INVESTIGATIONS

(i) The following data are required for the design of foundation system suitable both for the site and the proposed building structure:

a) Description of the type of foundation system;
b) Determination of the Depth below the ground level at which the foundation system is to be laid;
c) Definition of the foundation design parameters such as foundation bearing pressures at Serviceability and Ultimate Limit States, estimated total differential settlements and backfill pressure coefficients for any retaining structures;

(ii) Determination of the above factors requires the following information;

a) Subsurface soil profile indicating the thickness of the various soil strata, to a depth down to the influence zone below the foundations;
b) Engineering properties of the soil strata at various levels;
c) Physical characteristics of the soil strata;
d) Variation of the strength of the strata with depth.

(iii) The purpose of conducting field and laboratory investigations and analysis is to obtain adequate data for the parameters stated above and to develop engineering recommendations to guide the design and construction of the project.

## 4. SCOPE OF INVESTIGATIONS

The scope of the investigations as elaborated comprises of:

a) Sinking of 6No. boreholes down to target depth of 15m in soil strata or down to refusal strata whichever is encountered first.
b) Excavation of 3No. Trial Pits to a depth of 3m in soil strata or down to refusal strata whichever is encountered first;
c) Conducting standard penetration tests at intervals of 1.50m;
d) Recovery of disturbed and undisturbed soil samples from the various levels of the subsurface soil strata;
e) Recording ground water table levels;
f) Performing relevant laboratory tests on soil and water samples recovered;
g) Recommendations and specifications including grading and compaction requirements for backfills required within the building and in adjacent roadway/parking areas. Suitability of the native site material for use as a backfill material and provision of all soil design parameters for the proposed backfill materials;
h) Provision of moduli of subgrade reactions for the design of interior and exterior slabs on grade;
i) Preparation and submission of a technical report containing details of the tests carried out, their analysis and recommendations relating to the foundation system adopted.

## 5. INVESTIGATIONS METHODOLOGY

The strategy adopted for this investigations consisted of:

- Desk study of all pertinent published information on the project area and its environs;
- A sub-surface exploration programme consisting of the sinking of cable tool percussion boreholes in soft ground and the sinking of trial pits; and
- Laboratory testing of soil samples recovered from the boreholes and trial pits.

Details of the above activities are given in the following sections.

### 5.1. DESK STUDY

A comprehensive review of the pertinent literature relating to the **seismicity, geology** and **geotechnology** of the Cantonments area and the city of Accra was undertaken as part of the study. Information from company files and other sources of previous geotechnical investigations in the project area were also evaluated.

The findings of the desk study are presented in the relevant portions of this report.

## 5.2. Sub-Surface Exploration Programme

Fieldwork activities commenced on 20th June 2016 and completed on the 4th July 2016. The following sections describe the various activities carried out during the period.

### 5.2.1. *Weather Conditions*

The weather was generally fair throughout the period of field investigations.

### 5.2.2. *Locations of Test Points*

The investigation points as indicated on the site plan obtained from the Client were located and pegged before the commencement of the investigation. GPS location coordinates for the test points are shown in the in Table 1 below.

Table 1: Coordinates of Investigation Points

| Test Points(BH/TP) | GPS Coordinates | |
|---|---|---|
| | Latitude | Longitude |
| BH1 | 5°35'1.60"N | 0°10'3.88"W |
| BH2 | 5°35'1.54"N | 0°10'2.32"W |
| BH3 | 5°35'2.24"N | 0°10'2.37"W |
| BH4 | 5°35'1.95"N | 0°10'2.87"W |
| BH5 | 5°35'2.89"N | 0°10'3.22"W |
| BH6 | 5°35'3.27"N | 0°10'2.25"W |
| TP1 | 5°35'2.21"N | 0°10'3.11"W |
| TP2 | 5°35'2.06"N | 0°10'3.89"W |
| TP3 | 5°35'3.49"N | 0°10'4.01"W |

A Schematic site plan showing the location of the test points marked by the client is given in Fig. 2.

### 5.2.3. *Site Conditions*

The site has a security gatehouse and an L-shaped office building with pavement. The site has both paved and unpaved sections.

There is some underground utility line buried along and a few metres away from the eastern border of site.

The unpaved sections of the open areas of the site is landscaped and with a couple of small trees.

## 5.3. Sub-surface Exploration

Trial pitting and Boreholes drilling undertaken at specified location points were used for sub-surface exploration. Details of the various activities are given in the following sections.

All Field works were conducted in accordance with BS 5930, "Code of Practice for site Investigations" and by experienced geotechnical personnel under the supervision of a geotechnical engineer.

### 5.3.1. *Trial Pitting and Borehole Drilling*

a) 3No. Trial pits were sunk from existing ground level to a depth of 3m using a backhoe. Groundwater seepage was not encountered in any of the trial pits. Fill material was present from the existing ground level to a maximum depth of 0.40m.

b) 6No. boreholes were progressed from existing ground level to a depth of 15m. The 1.5-ton mobile cable percussion-boring rig ("Pilcon Wayfarer") was used for percussion drilling. This rig is fitted with standard accessories for sinking 150mm diameter boreholes, including in particular, a shell fitted with a bailer, chisel, steel casing and equipment for performing the standard penetration tests.

c) Depths at which groundwater was first encountered in each borehole and levels 24 hours after borehole completion were recorded.

d) The Standard penetration tests (SPT) were conducted in all boreholes at 1.0m intervals from 1m depth level to 5m, and thereafter at 1.5m intervals. SPT was performed in accordance with BS 1377: Part 9. E.

   The test involves driving a 50mm external diameter thick wall tube (split spoon sampler) into the bottom of the borehole with successive blows of a 63.5kg hammer falling freely through 750mm. The sampler is driven through 6 intervals of 75mm and the number of blows required to penetrate each interval is recorded. The initial 150mm interval is intended to ensure "seating" of the sampler such that it penetrates beyond the zone of influence of any soil disturbance at the base of the borehole:

e) The aggregate number of blows required to drive the sampler over the final 300mm is termed the "N" value and is considered indicative of the soil's in-situ relative density. Where a penetration of 300mm was not achieved, due to the densities of the soils encountered, the number of blows and distance driven are recorded on the borehole logs.

SPT in boreholes were deemed to have attained **refusal** when the blow count 'N' is equal to or exceeds a total of 50 blows applied in soft ground during the last four 75mm sampler advancement of the SPT, or when no apparent advancement of the sampler during application of 10 successive blows of the hammer.

f) Disturbed samples were recovered from appropriate levels from the boreholes and trial pits. The disturbed soil samples were placed in air-tight plastic bags.

g) Undisturbed samples were recovered in in thin walled tubes, (U100). The diameter of the soil samples was typically 100mm and has length of 45cm. The ends of the samples were sealed with wax to prevent loss/ingress of moisture content. Generally, all soil samples were described, labelled, carefully packed and transported to the laboratory. The entire sampling operation was carried out under the supervision of a qualified Geotechnical Engineer, and appropriate measures were taken to ensure that the samples arrived in the laboratory with the minimum amount of disturbance and moisture loss.

### 5.3.2. *Groundwater*

Groundwater was encountered in the various boreholes drilled. It is mainly in the form of gradual ingress at the level struck, and which is thought to accumulate at the bottom of the completed boreholes and rising to the recorded levels overnight prior to backfilling and plugging of the boreholes. Recorded water levels are given in Table 2 below.

Table 2: Records of groundwater levels in boreholes 24 hours after completion

| Borehole No. | Termination Depth from Existing Ground Level (m) | First water strike depth level (m) | Level after 24 hours (m) |
|---|---|---|---|
| 1 | 15.00 | 9.0 | 10.20 |
| 2 | 15.00 | 6.0 | 7.30 |
| 3 | 15.00 | 6.0 | 8.50 |
| 4 | 15.00 | | 8.70 |
| 5 | 15.00 | 10.0 | 6.70 |
| 6 | 15.00 | 8.2 | 8.60 |

## 5.4. Laboratory Investigations

Selected representatives of undisturbed and disturbed soil samples brought to the laboratory were used for the tests as appropriate.

(i) The soil samples were subjected to various tests to determine the following properties.

a) Type of soil and its gradation;
b) Soils natural density;
c) Soils natural water content;
d) Soils Consistency limits;
e) Soils strength characteristics.

(ii) The under-listed tests were performed to determine the above properties listed in **6.3 (i)**.
a) Sieve analysis on the course grained soil fraction;
b) Hydrometer analysis on the fine grained soil fraction;
c) The Atterberg limits;
d) Bulk Density Test;
e) Water content tests;
f) Specific gravity test;
g) Triaxial compression tests.
h) Resilience Modulus tests;
i) Compaction (MDD)/CBR

All laboratory tests were carried out in accordance with methods stipulated in the latest British Standards (BS 1377: 1990) and other pertinent standards for the testing of soils for civil engineering purposes.

The test results were used to assist in the classification of the subsurface strata and determination of their relevant physical and geotechnical properties.

## 6. RESULTS OF INVESTIGATION AND ANALYSES

### 6.1. Surface Conditions

The project site has a security gatehouse, an office building and some paved sections. Vegetation in the form of green grass and a couple of trees were observed at the site during the period of field investigations.

### 6.2. Physiography and Climate

The city of Accra falls within the coastal plain of Ghana with a topography varying from flat near the coast to gently rolling in the vicinity of the foothills of the Akwapim range lying to the northern part of the city. The Cantonments area is located on higher ground with an altitude of around 50m compared to 15m along the coast which is about 5km from the site.

There are two rainy seasons in Accra, one reaching its peak in May-June and the other in October. The rainfall in Accra varies considerably every year, but a range of 760 – 1020 mm can be considered average. The degree of saturation of surface soils in Accra reaches almost 100 percent in May-June. The major dry season begins in November and runs through to March. During this period, the area is subjected to the Northeast trade winds referred to as the Harmattan.

Temperatures are high with mean annual values around 27 ºC. The period from January to April has the highest mean monthly maxima of about 33 ºC to 35 ºC. The lowest average monthly temperatures occur before, during and just after the minor rainy season in June, July, September and October with values of mean monthly maximum dropping to around 30 ºC.

Humidities are relatively high throughout most of the year. Afternoon humidities are generally from 55 to 65% falling to around 40% during the main dry season, with values below 20% occasionally being recorded. On the coast, values may be from 10 to 22% or higher. Humidities rise to almost 100% at night almost throughout the year. Evaporation from open water surface is in the order of 1.5 – 1.8 m.

## 6.3. Subsurface Conditions

The following discussion of the sub-surface conditions at the project site are based on the results obtained from these investigations, supplemented with pertinent information acquired from previous investigations in the vicinity of the project area.

### 6.3.1. *Geology of the Project Site*

The geology of the project area generally, consists of Precambrian Togo series comprising mainly of quartzite, phylitones, quartz breccias, phillites or chloride schist with a well bedded and strongly jointed sequence.

The Togo Series is well folded and faulted; fold types vary from assymetrical to isoclinals and recumbent eastward towards the Dahomeyan contact.

The project site itself is documented to be underlain by chlorite schist which could be derived from shale or mudstone. The rock is foliated with white quartz elongated subparallel to foliation. The project site is located quite close to the contact between rocks of the Togo Series and Dahomeyan Series.

### 6.3.2. *Site Specific Soil Profile*

(i) A perusal of the soil profile revealed in the boreholes and trial pits and logged accordingly groups the penetrated soil into the following broad profiles:

a) Stratum I: - Reddish brown silty clayey sand

b) Stratum II: - Reddish brown lean clay with sand

c) Stratum III: -Mottled silty clayey sand – completely decomposed schistose rock – relic structure of schistose rock visible with quartzitic fragments/pebbles inclusions.

d) Stratum IV: - Mottled sandy lean clay highly decomposed/highly weathered schistose rock – pieces/fragments of schistose rock present.

The Strata I & II is lateritic and may contain fused lateritic gravel. The dominant reddish-brown coloration of these strata is as a result of iron oxidizing goethite and hematite of the laterites. Strata III & IV comprise of decomposed and weathered products of the schistose bedrock. These soil products are a combination of silty, sandy clays in various proportions as they occur. The schistose bedrock is known to have quartz veins running in the rock mass and accounts for the presence of quartz pebbles in the soil mass and relic structure of this bedrock. The mottled colorations are mix of reddish-brown/yellowish/grey/whitish/greenish in varying combinations.

**Stratum-I** in BH 3 however is found between 1.2m depth and 2.5m as a result of made ground occurring from ground surface to 1.2m depth.

**(ii)** The stratum thickness in each borehole is given in Table 3 below:

**Table 3: Stratum thicknesses**

| BH No. | (Depth in m: From - To) | | | |
|---|---|---|---|---|
| | Stratum I | Stratum II | Stratum III | Stratum IV |
| 1 | 0.0 - 2.5 | 2.5 - 8.0 | 8.0 - 13.5 | 13.5 - 15.0 |
| 2 | 0.0 - 4.0 | 4.0 - 8.0 | 8.0 - 13.5 | 13.5 - 15.0 |
| 3 | 1.2 - 2.5 | 2.5 - 7.5 | 7.5 - 12.0 | 12.0 -15.0 |
| 4 | 0.4 - 4.5 | 4.5 - 8.0 | 8.0 - 12.0 | 12.0 - 15.0 |
| 5 | 0.0 - 3.0 | 3.0 7.5 | 7.5 - 13.5 | 13.5 - 15.0 |
| 6 | 0.2 - 4.5 | 4.5 - 8.0 | 8.0 - 10.5 | 10.5 - 15.0 |

Details of the soil profiles revealed in the boreholes and trial pits are presented as Fig. 4 through to Fig. 18 of Appendix 2.

### 6.3.3. *Soil Composition*

**6.3.3.1.** Results of routine laboratory classification tests conducted on representative soil samples at various depths have been summarized and presented in Table 6 of Appendix 3. Their particle size distributing curves are presented as Figs 19 through 25, also in Appendix 3.

**6.3.3.2.** The general variations in the particle size distribution and plasticity of the soil strata revealed across the boreholes drilled on site are shown in Table 3A as follows:

Table 3A: Soil Composition and Consistency Limits

| Profile Name | Description | Group Symbol | Gravel % | Sand % | Silt % | Clay % | Atterberg Limits | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | LL (%) | PL (%) | PI (%) | Plasticity |
| **Stratum I** | Reddish-brown/white/grey silty clay sand with gravel | GC - GM | 10 - 30 | 41 - 45 | 9 - 13 | 11 - 16 | 27 - 29 | 20 - 22 | 7 - 9 | Low plasticity |
| **Stratum II** | Reddish-brown/light yellow/white/grey lean clay with sand | CL | 1 - 2 | 25 - 26 | 11- 17 | 43 - 55 | 33 - 44 | 18 - 26 | 14 - 16 | Medium plasticity |
| **Stratum III** | Reddish-brown/yellowish-grey/green clayey sand with decomposed rock schist | SC | 0 | 44 - 53 | 9 - 15 | 32 - 35 | 37 - 46 | 37 - 47 | 11 - 22 | Medium to high plasticity |
| **Stratum IV** | Reddish-brown/yellowish-grey/green sandy lean clay with traces of weathered rock schist | CL | 0 - 2 | 35 - 38 | 16 - 18 | 45 - 55 | 35 - 38 | 36 - 38 | 15 - 18 | Medium plasticity |

### 6.3.4. *Strength Characteristics*

The analyses below of bearing capacity are based on the Standard Penetration Tests (SPT).

The SPT tests were done using an automatic trip donut hammer and should be corrected to the $N_{60}$ values as detailed in "Performance and use of Standard Penetration Test in Geotechnical Engineering Practice"

$$N_{60} = N_{field}C_E$$

$N_{60} = N_{field}C_E$, where $C_E = 0.8$ to 1.3

Using $C_E = 1.0$ for the site, i.e no correction is required.

Bearing capacities have been calculated using the formulae given below:

$$q_{ult} = 1.3C_uN_c \text{ and } q_{allow} = q_{ult}/3 \text{ where;}$$

$q_u = 5N$ and $C_u = 0.5q_u$.

where;

| | | |
|---|---|---|
| $N_{60}$ | = | blow counts corrected for theoretical 60% of hammer energy |
| $N_{field}$ | = | field blow count N- value |
| $C_E$ | = | energy correction factor |
| $q_{ult}$ | = | ultimate soil bearing capacity |
| $q_{allow}$ | = | allowable soil bearing capacity |
| $C_u$ | = | Cohesion of Soil |
| $N_c$ | = | dimensionless bearing capacity factor |
| $q_u$ | = | undrained shear strength |

The Ultimate and Safe bearing capacities from the above formulae, have been estimated for different elevations as shown in table 4 below.

Table 4: Ultimate bearing capacities at different elevations

| **Elevation (m)** | **Ultimate Bearing Capacity (kPa)** | **Safe Bearing Capacity (kPa)** |
|---|---|---|
| **27.1** | 750 | 250 |
| **23.1** | 660 | 220 |
| **19.1** | 720 | 240 |

NB: No corrections have been applied to the N-Values observed

### 6.4. Groundwater

Chemical analyses of the sample of groundwater from the boreholes yielded the following results as indicated in Table 5 below.

Table 5: Groundwater chemical analyses

| Groundwater | pH | Chloride ($Cl^-$) (mg/l) | Sulphates (SO4) (mg/l) |
|---|---|---|---|
| | 6.60 | 43.7 | 117 |

The above results indicate that the pH value is slightly or marginally acidic and the sulphate content is of Class DS-1. These two factors normally are used to evaluate the aggressiveness of soils on concrete structures.

The Sulphate content obtained is low and generally, would have insignificant effect on the durability of concrete and therefore does not require the use of sulphate resisting cement for the construction of the foundation and substructure.

It is recommended that both the substructure and superstructure must be constructed using the Ordinary Portland Cement (OPC) with a dense mix and of good quality.

However, due to the location of the project site, exposure class XS1 (corrosion induced by chlorides from sea water for structures near to or on the coast) is deemed to be an appropriate assigned level.

### 6.5. Design Wind Speed

Findings from desk studies, indicate that the basic wind velocity at the maximum 3-second gust speed at a height of 10m above ground likely to be exceeded on the average not more than once in 50 years. The basic wind speed for Accra is 32m/s.

### 6.6. Subgrade Reaction Coefficient

Resilient Modulus test were conducted on undisturbed soil samples at the laboratory for different elevation ranges. Typical graphs of Resilient Modulus & Resilient micro-strain vs number of cycles, have been attached in Appendix 3. Estimate of modulus of sub grade reaction, k, for the design of interior and exterior slabs on-grade are given in the table 6 below;

Table 6: Modulus of subgrade reaction

| **Elevation range (m)** | **K-value (Mpa)** |
|---|---|
| **30.1 - 27.1** | 245 |
| **27.1 - 23.1** | 44 |
| **23.1 - 19.1** | 40 |

### 6.7. In-situ soils for use in Pavement Construction

Soil classification test results suggest that re-use in-situ soils should be limited to use as fill material only in pavement construction. Imported suitable gravel will be required as capping to this fill and for construction of the structural pavement layers.

Provision should be ensured for the off-site disposal of huge volume of excess material from the basement foundation excavation activity.

# 7. RECOMMENDATION FOR FOUNDATION DESIGN AND CONSTRUCTION

## 7.1. Aseismic Design Considerations

The extensive post-seismic damage survey carried out by the Gold Coast (Ghana) Geological Survey following the 1939 earthquake showed that, irrespective of the nature of the country rock, well designed and well-constructed structures survived the seismic event. However, with abundant evidence of the continued activity on the two causative fault systems as shown in Table A-1 and the relatively complex geologic structure at the site, it is recommended that adequate provision be made in the structural design to take account of the imposition of seismic forces. Local practice recommends for the imposition of a horizontal acceleration of 0.1g in the design of important structures within the city of Accra. JUNNER et al (1941) estimated that the maximum horizontal ground acceleration experience in Weija area was of order of 0.22g, which compares favourably with an estimate of 0.27g obtained from the empirical relationship developed by McGUIRE (1941) using a magnitured, M of 6.5 depth and a focal depth, of 13km. The use of an appropriate design horizontal ground acceleration is recommended, in addition to the adoption and enforcement of strict specifications relating to material quality and workmanship.

## 7.2. Foundation Type and Depth

The surficial soils underlying the project site may be classified as sufficiently competent to provide adequate support for the proposed structure with **basement type multilevel car park.**

Raft or mat is the recommended foundation type for the structure with an incorporated basement retaining wall adequately designed to preclude any form of groundwater.

Appropriately dimensioned Isolated column footings or pad with tie beams is feasible option to be considered if so desired. Provision for dealing with groundwater is an added necessity.

The foundation depth to accommodate the proposed two level basement type multilevel car park is feasible as the surficial soils offer adequate foundation conditions down to the 15m depth investigated.

## 7.3. Allowable Bearing Capacity and Settlement

Estimate of safe bearing capacity based on average results obtained from SPT N-values from the project site gives an allowable bearing pressure in excess of 220kPa. It is anticipated that dimensioning of the foundations of the proposed structures would be so done to impose net contact pressures below this magnitude in the soil, and thus will make the risk of foundation failure resulting from inadequate bearing capacity is considered negligible.

Settlement of the soil has been calculated using the empirical formula;

$$Q/S_e = N_{60}/0.75$$

where;

| | | |
|---|---|---|
| $Q$ | = | bearing pressure |
| $S_e$ | = | settlement |
| $N_{60}$ | = | average blow counts corrected for theoretical 60% of hammer energy. |

Settlement of the foundation is estimated at **5.08mm.**

Furthermore, for basement structures and multilevel car park, it is further recommended that, the inundation of basement foundations should be avoided in order to improve the competency of the structural foundations. A proper drainage system must be design for the basement foundations, taking cognizance of the presence of percolation groundwater that exists at the site.

### 7.4. Foundation Excavation

It is highly recommended that, all excavation works should be executed using mechanical plant or excavators at this site. Lateral support for foundation excavations, should be provided for safety reasons, particularly if the excavation is made in the rainy season since otherwise stable vertical slopes in residual soils sometimes undergo sudden collapse upon inundation or in the presence of any form of groundwater.

### 7.5. Flexible Pavements

Subgrade preparation for travel lanes and parking areas should include stripping of topsoil and any unsuitable soils and compaction of the subgrade immediately below the pavements before laying of subbase and base materials.

A design California Bearing Ratio (CBR) of 10% is recommended for the subgrade at the site. We recommend that concrete pavement should have a minimum thickness of 150mm reinforced concrete and should be supported by a minimum of 150mm crushed stone material. The compressive strength of the concrete should be a minimum of 30Mpa at 28days.

### 7.6. Groundwater

Chemical test results presented in section 6.4 of this report indicate that the pH value is slightly or marginally acidic and the sulphate content is of Class DS-1. The Sulphate content obtained is low and generally, would have insignificant effect on the durability of concrete and therefore does not require the use of sulphate resisting cement for the construction of the foundation and substructure.

It is recommended that provision for dewatering equipment be made throughout the period of foundation excavation and construction.

### 7.7. Concrete Slab-On-Grade Floors

For slab-on-grade foundations, all vegetation, topsoil and silty clayey sand material must be removed in areas of construction of slab-on- grade. This unsuitable material must be removed to an average depth of 1.00m. New imported gravel fill material should be placed in lifts not exceeding 200mm in loose thickness, and moisture conditioned to within +/- 2 percentage points of the optimum moisture content. It is recommended that each lift be compacted to a minimum of 95% of the maximum dry density obtained in accordance with the modified AASHTO standard.

Any soil placed as engineered fill should be an approved material, free of organic matter or debris, with a liquid limit below 40%, plasticity index less than 25% and not more than 30% passing the 75 microns BS 410 sieve. The material shall have a minimum CBR of 15%, preferably 40%.

A 100mm minimum thickness of clean crushed aggregate satisfying ASTM C33 should be placed below the floor slab. A minimum 10mil thick plastic membrane should be placed on the crushed aggregate layer to serve as vapour barriers.

## 8. REFERENCES


1 SANGLERAT, G (1972)

"The Penetrometer and Soil Exploration" Elsevier Scientific Publ. Co; Amsterdam, 1972.

2 HARRIS, N (1920)

"Geology of the Devonian Rocks, with special reference to the sub-surface investigations." Ghana Geological Survey Bull. No. 38.

3 BURKE, K. (1969)

"The Akwapim Fault, a Recent Fault in Ghana and related Faults of the Guinea Coast." Nigerian Journal of Mining and Geology. Vol. 4 Nos. 1 and 2, Dec. 1969.

4 D. W. Nelson and L. E. Sommer, "Total carbon, organic carbon, and organic matter," in Methods of Soil Analysis, A. L. Page, R. H. Miller, and D. R. Keeney, Eds., part II, pp. 539–577, American Society of Agronomy, Madson, Wis, USA, 2nd edition, 1982. View at Google Scholar

# APPENDIX 1

Fig. 1: Site Vicinity Map

Fig. 2: Location of Investigation Points

Fig. 3: General Geological Map of Project Area

Table A-1: Seismic History of Southern Ghana

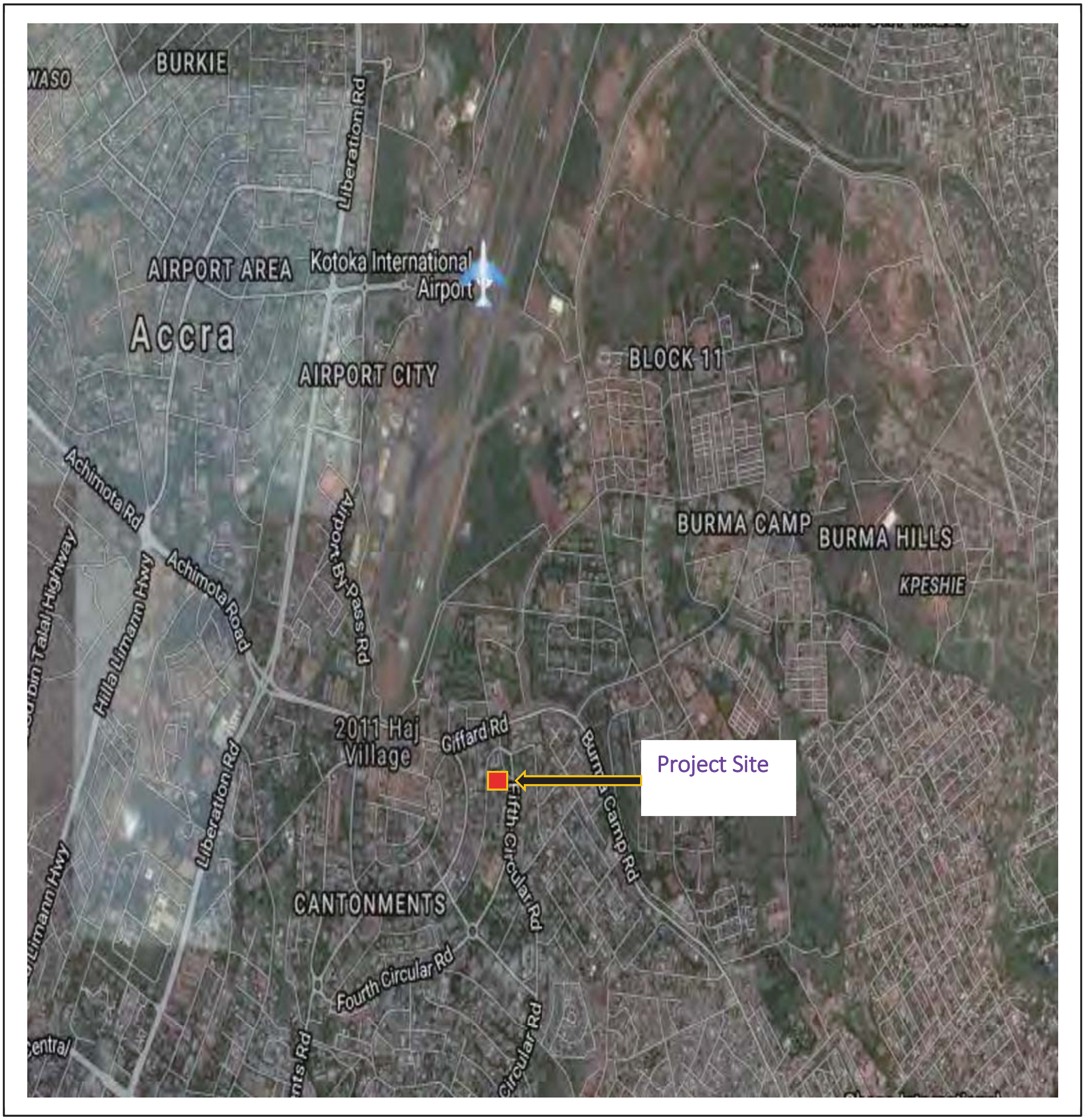



Fig. No. 1: Site Location Key Map

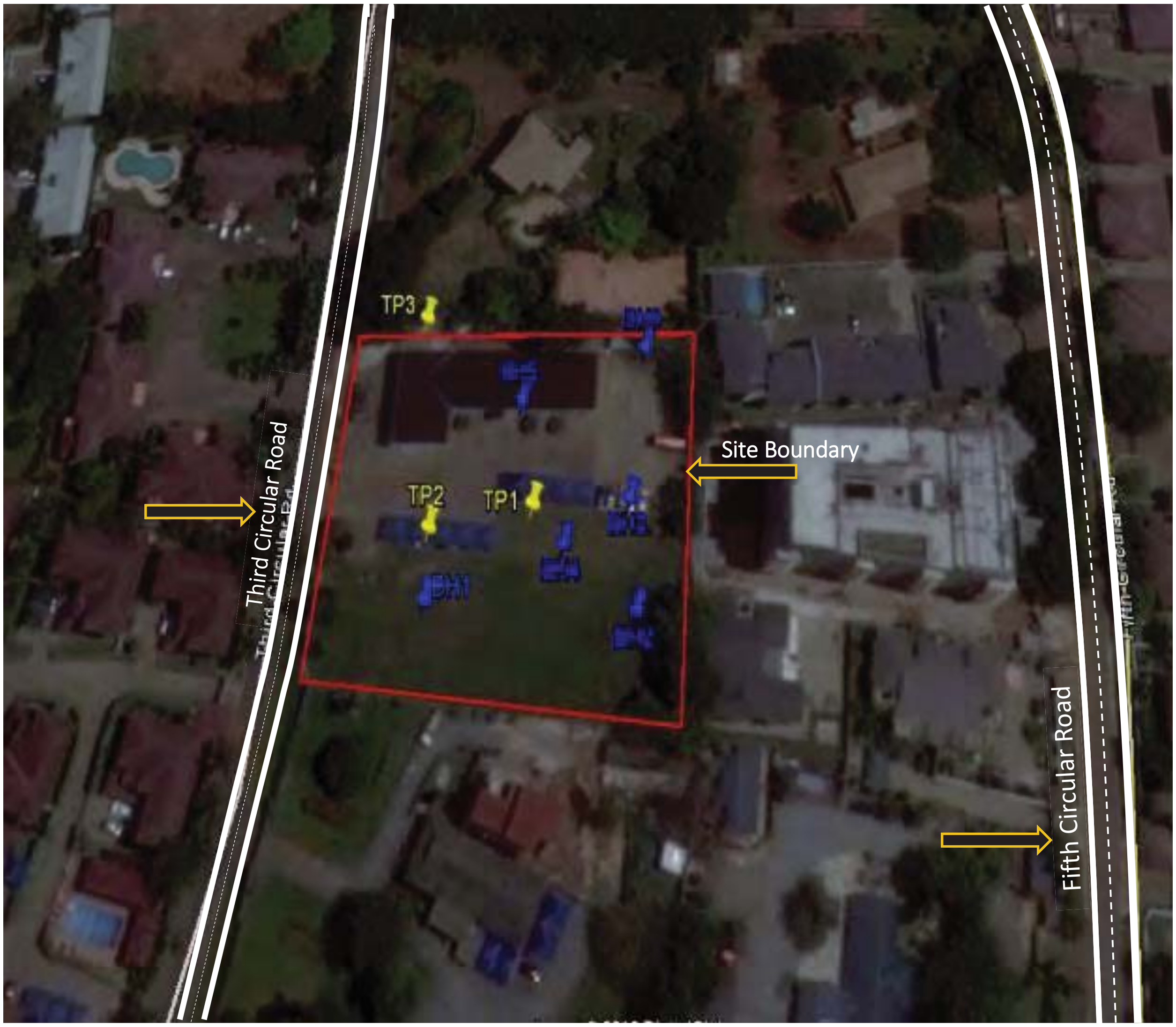



Fig. No. 2a: Location of Investigation Points

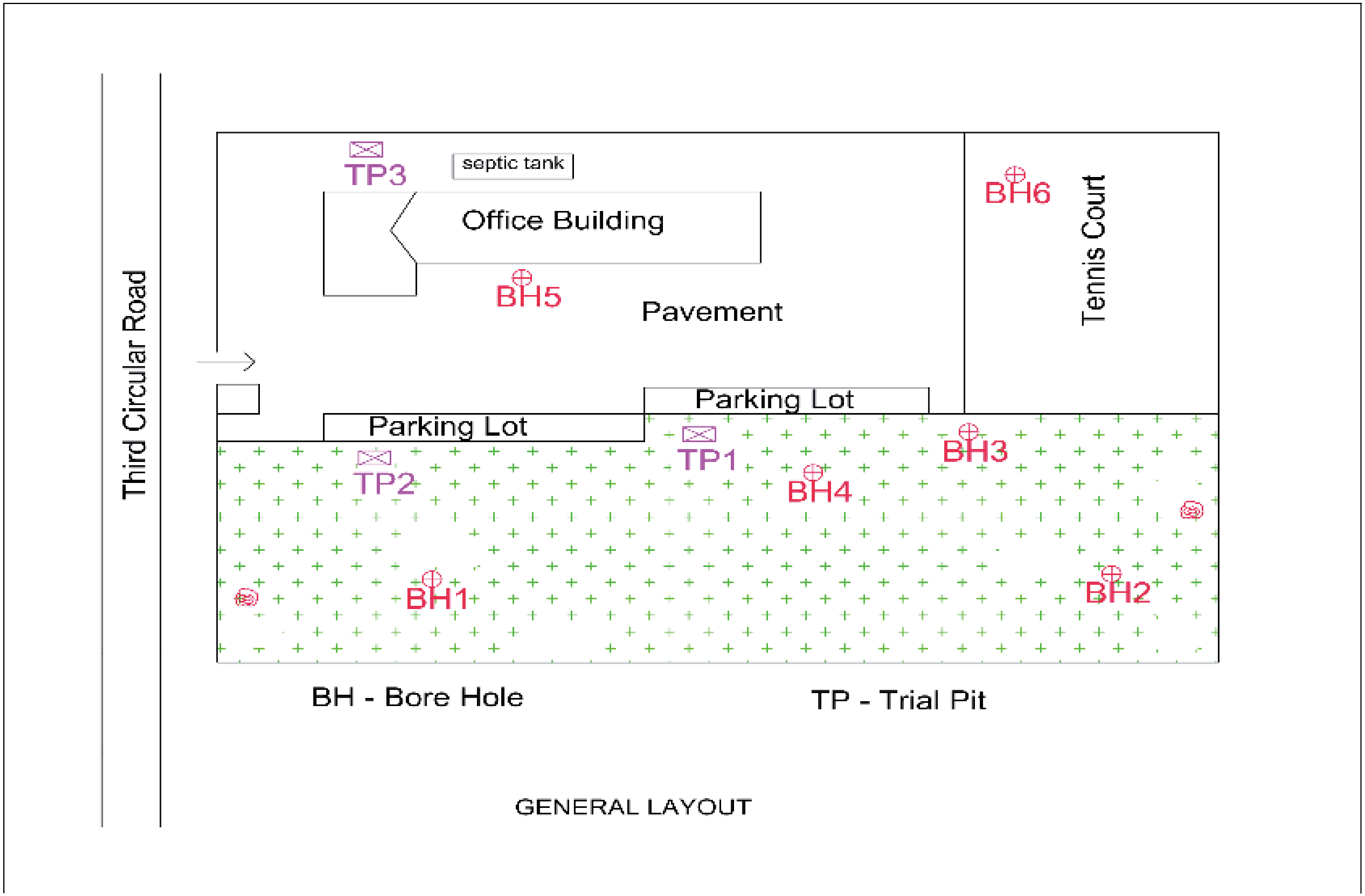



Fig. No. 2b: Location of Investigation Points

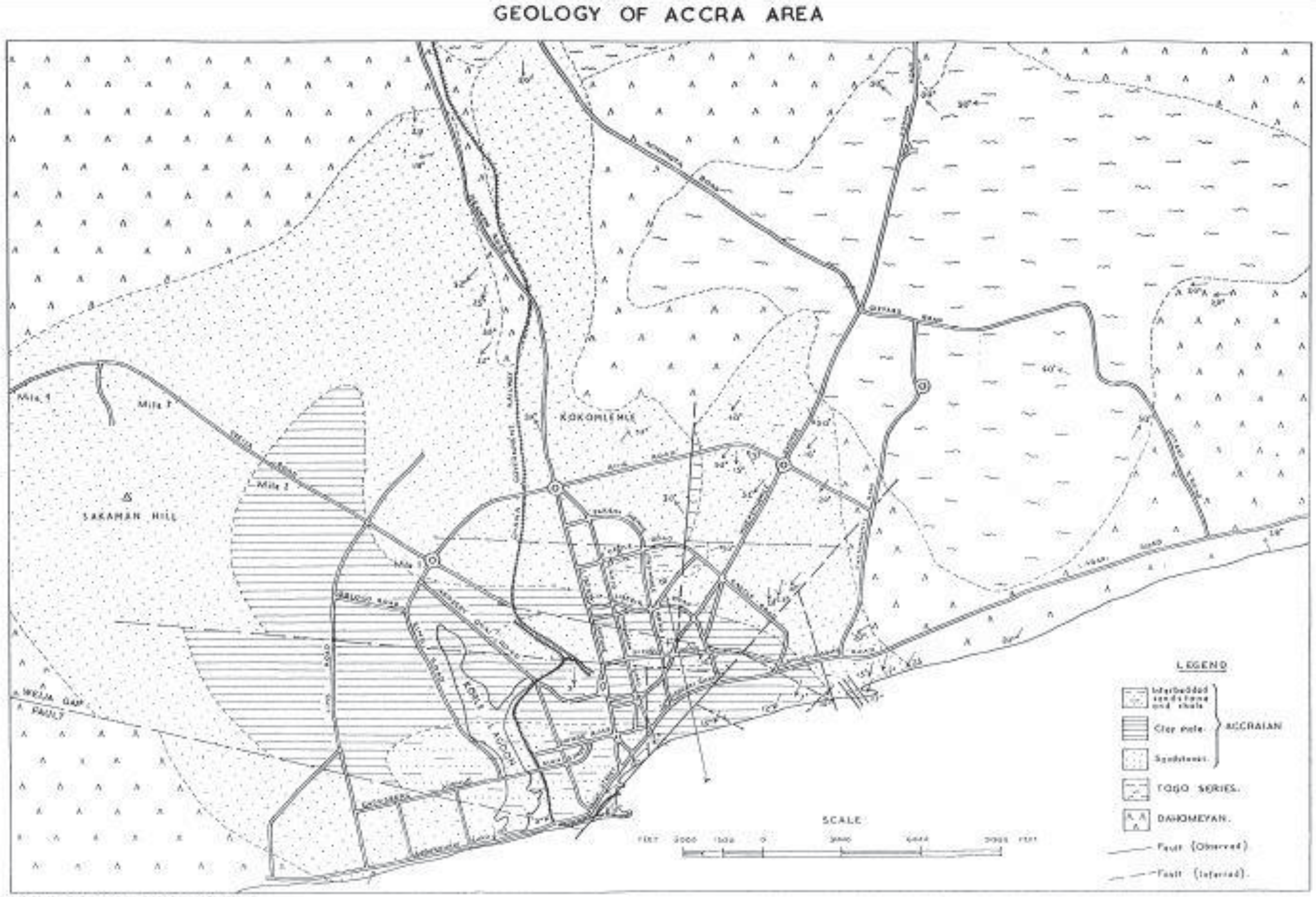



Fig. 3: Geology of Project Area

## Table - AI: HISTORICAL SEISMICITY OF SOUTHERN GHANA

| DATE | APPROXIMATE LOCATION OF EPICENTRE | AREA AFFECTED BY THE SHOCK | PROBABLE CAUSATIVE FAULT | REMA RKS |
|---|---|---|---|---|
| 1862 | Off-shore Near Accra | City of Accra and areas to the east as far as Anecho in Togo | Coastal Boundary Fault | City of Accra reported to be "almost completely destroyed" |
| 1906 | Along Akwapim Range, near Ho | Maximum intensity felt at Ho, Accra and other towns to the east of Akwapim Range | Akwapim Fault Zone | Extensive cracks in Govt. buildings. All forts in Accra cracked but not rendered |
| 1st Sept. 1923 | ? | ? | ? | The seismograph then in operation in Accra, recorded a shock with maximum amplitude of 9mm. It was not clear whether this was a local |
| 22nd June 1939 | 40km out to sea, SSE of Accra | Most of West Africa, covering an area of 77,000km$^2$ | Coastal Boundary Fault | Seismograph out of operation at time of shock, estimated at M=6.5. Maximum damage in city of Accra - event recorded by seismological stations all over the world. Main shock followed by numerous after- |
| 26th Dec. 1966 | Weija area | Accra and nearby villages up to 40km to the north. | Akwapim Fault Zone | Shocks attained intensity IV on the Modified Mercalli Scale in Accra. |
| 9th Feb. 1977 | Approx. 8km out of sea, south of Tema | City of Accra and its environs | Coastal Boundary Fault | M=4.9 event recorded by 22 other seismological stations in Europe and Canada. Several cracks developed in large |
| 1st March 1977 | 25km north of Accra along Akwapim Fault Zone | City of Accra and its environs | Akwapim Fault Zone | M=3.4 |
| 5th Sept. 1978 | 5km north of Weija | City of Accra and its environs | Akwapim Fault Zone | M=4.7. Main shock followed by two after-shocks. |
| 9th Jan. 1979 | Weija area | City of Accra | Akwapim Fault Zone | M=3.6 |
| 7th June 1980 | Weija area | City of Accra | Akwapim Fault Zone | M=3.6 |
| 10th May 1985 | Epicentral distance = | City of Accra and its environs | Akwapim Fault Zone | M=4.0 |
| 25th June 1985 | Epicentral distance = 15.66km | City of Accra | Akwapim Fault Zone | M=3.1 |
| 27th Feb. 1988 | 15km SW of Weija | City of Accra and its environs | Akwapim Fault Zone | M=3.4 |
| 14th April 1990 | Weija area | City of Accra and its environs | Akwapim Fault Zone | M=3.5 |
| 23rd Aug. 1991 | Weija area | City of Accra and its environs | Akwapim Fault Zone | M=3.9 |
| 28th Jan. 1995 (2 shocks within 1 minute) | Weija area | City of Accra and its environs | Akwapim Fault Zone | M=3.3 and M=3.4 |
| 1st Feb. 1995 | Weija area | City of Accra and its environs | Akwapim Fault Zone | M=3.8 |
| 9th March 1995 | Weija area | City of Accra and its environs | Akwapim Fault Zone | M=3.4 |
| 2nd Feb. 1996 | Weija area | City of Accra and its environs | Akwapim Fault Zone | M=3.6 |
| 8th Jan. 1997 | Weija area | City of Accra and its environs | Akwapim Fault Zone | M=3.8 |
| 14th Feb. 1997 | Weija area | City of Accra and its environs | Akwapim Fault Zone | M=4.1 |
| 6th March 1997 | Off-shore | City of Accra and its environs | Coastal Boundary Fault | M=4.8 |
| 18th May 2003 | Weija area | City of Accra and its environs | Akwapim Fault Zone | M=3.8 |

# APPENDIX 2

Fig. 4 – Fig. 18 : Borehole Logs

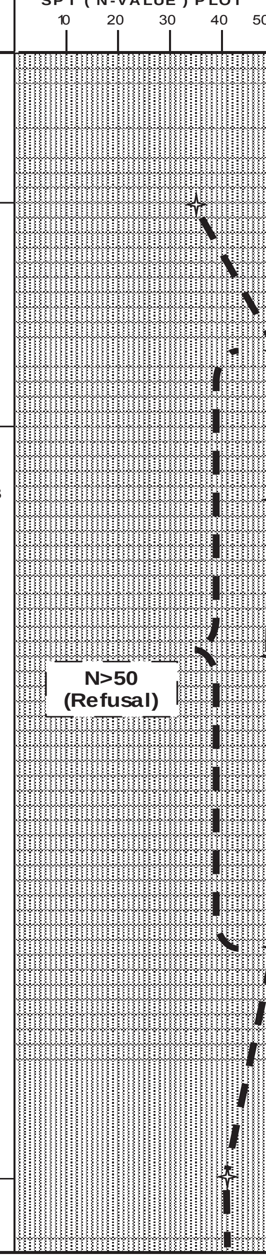
| PROJECT | LOCATION | BOREHOLE No. BH 1 |
|---|---|---|
| SEC CANTONMENTS PROPERTY DEVELOPMENT | ACCRA | Sheet 1 of 2 |

| Equipment & Methods | Ground Level: | Coordinates: | Date Begun: |
|---|---|---|---|
| Pilcon Wayfarer 1500 Percussion rig, CTB to 15m, 150mm diameter casing to 4.5m. | +30.9 | 5°35'1.60"N<br>0°10'3.88"W | 21/06/2016<br>**Date Completed:**<br>25/06/2016 |

**KE&T Consult** | **CLIENT: CPCS**

| Description | Reduced Level (m) | Legend | Depth (Thick) (m) | Samples/ Tests Depth (m) | Sample Type | Sample No. | Test | Field Records |
|---|---|---|---|---|---|---|---|---|
| Dense reddish brown silty clayey **SAND** with lateritic gravel inclusions | +30.9 | | 0.0 | | | | | |
| | | | 0.5 | | DS | 1 | | |
| | | | (1.0) | | | | | |
| | +29.9 | | 10 | (10-145) | DS | 2 | SPT 1<br>N=36 | 4,5 / 8,9,7,12 |
| Very dense mottled (reddish-brown/ white/ grey) silty clayey **SAND** with lateritc gravel | | | 1.5 | | DS | 3 | | |
| | | | (1.5) | | | | | |
| | | | 2.0 | (2.0-2.45) | | | SPT 2<br>N>50 | 6,6 /12,12,16,11 |
| | +28.4 | | 2.5 | | | | | |
| Very stiff mottled (reddish-brown/ light yellow) lean **CLAY** with sand and fused lateritic gravel inclusions with depth | | | | | DS | 4 | | |
| | | | 3.0 | (3.0-3.45) | | | SPT 3<br>N>50 | 12,12 / 17,22,27,28 |
| | | | 3.5 | | | | | |
| | | | | | DS | 5 | | |
| | | | 4.0 | | | | | |
| | | | 4.5 | (4.5-4.95) | | | SPT 4<br>N>50 | 12,14 / 12,16,15,20 |
| | | | 5.0 | | | | | |
| | | | (5.0) | | | | | |
| | | | 6.0 | (6.0-6.45) | | | SPT 5<br>N>50 | 6,8 / 10,12,15,16 |
| | | | 6.5 | | | | | |
| | | | | | DS | 6 | | |
| | | | 7.0 | | | | | |
| | +23.4 | | 7.5 | (7.5-7.95) | | | SPT 6<br>N=41 | 4,8 / 8,10,10,13 |
| Very stiff mottled (reddish-brown/ light yellow/ grey) lean **CLAY** with sand | +22.9 | | 8.0 | | | | | |

SPT ( N-VALUE ) PLOT




**Remarks:**

1. Very gradual groundwater ingress during drilling at 9.0m depth and stabilized at 10.2m after 24hrs of completion.
2. Water was added to aid drilling

**Water Record**

**Water / Caved Levels,m**

| Time of Day | 21/06/16 | 22/06/16 | 24/06/16 | 25/06/16 | 26/06/16 |
|---|---|---|---|---|---|
| Depth to water | Nil | Nil | Nil | 9.00 | 10.20 |
| Depth cased | 1.5 | 3.0 | 4.5 | 4.5 | 4.5 |
| Depth of hole | 5.00 | 7.00 | 9.00 | 14.0 | 15.0 |

**Notes:**

# FIG. 4

**Logged by:** ED | **Checked by:** JKK

| PROJECT | LOCATION | BOREHOLE No. BH 1 (Cont'd) |
|---|---|---|
| SEC CANTONMENTS PROPERTY DEVELOPMENT | ACCRA | Sheet 2 of 2 |

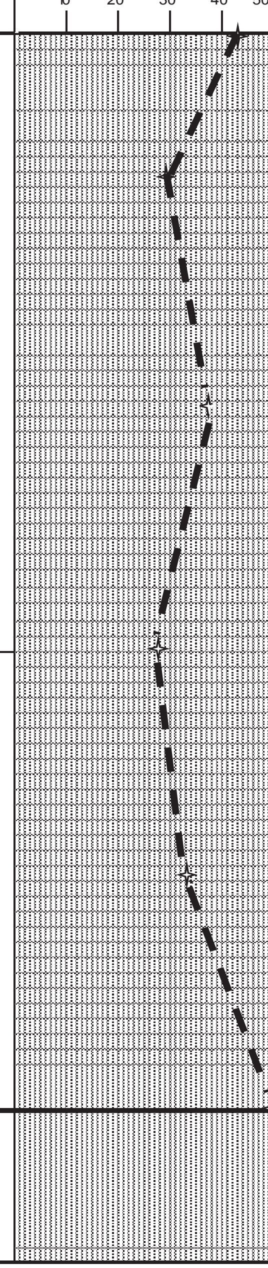
| Equipment & Methods | Ground Level: | Coordinates: | Date Begun: |
|---|---|---|---|
| Pilcon Wayfarer 1500 Percussion rig, CTB to 15m, 150mm diameter casing | +30.9 | 5°35'1.60"N<br>0°10'3.88"W | 21/06/2016<br>**Date Completed:**<br>25/06/2016 |

| KE&T Consult | CLIENT: CPCS |
|---|---|

| Description | Reduced Level (m) | Legend | Depth (Thick) (m) | Samples/ Tests: Depth (m) | Sample Type | Sample No. | Test | Field Records |
|---|---|---|---|---|---|---|---|---|
| | +22.9 | | 8.0 | | | | | |
| | | | 8.5 | | | | | |
| Very stiff mottled (reddish-brown/ light yellow / grey) lean **CLAY** with sand | | | 9.0 | (9.0-9.45) | | | SPT 7<br>N=28 | 3,4 / 5,7,7,9 |
| | | | (3.0) | | | | | |
| | | | 9.5 | | | | | |
| | | | 10.0 | | DS | 7 | | |
| | +20.4 | | 10.5 | (10.5-10.95) | | | SPT 8<br>N=37 | 6,6 / 12,12,16,11 |
| Dense reddish-brown clayey **SAND** with pockets of silt (highly to completely decomposed Schitose rock) relic structure of schitose rock visible | | | 11.0 | | DS | 8 | | |
| | | | (1.5) | | | | | |
| | | | 11.5 | | | | | |
| | +18.9 | | 12.0 | (12.0-12.45) | | | SPT 9<br>N=28 | 3,3 /5,7,8,8 |
| Dense mottled (reddish-brown/ light yellow / grey) clayey **SAND** - completely decomposed Schitose rock with quartz pebbles inclusions (relic structure of schitose rock visible) | | | 12.5 | | | | | |
| | | | (1.5) | | | | | |
| | | | 13.0 | | DS | 9 | | |
| | +17.4 | | 13.5 | (13.5-5.95) | | | SPT 10<br>N=34 | 5,4 / 6,5,8,15 |
| Hard mottled (light yellow / green) sandy lean **CLAY** with silt and schitose rock fragmants - highly decomposed Schitose rock with quartz inclusions | | | 14.0 | | | | | |
| | | | (1.5) | | | | | |
| | | | 14.5 | | | | | |
| | +15.9 | | 15.0 | (15.0-15.45) | | | SPT 11<br>N>50 | 6,8 / 10,12,15,16 |

**End of borehole drilling 15.0m**

SPT ( N-VALUE ) PLOT




**Remarks:**

1. Very gradual groundwater ingress during drilling at 9.0m depth and stabilized at 10.2m after 24hrs of completion.
2. Water was added to aid drilling

**Water Record**

| Water / Caved Levels,m | | | | | |
|---|---|---|---|---|---|
| Time of Day | 21/06/16 | 22/06/16 | 24/06/16 | 25/06/16 | 26/06/16 |
| Depth to water | Nil | Nil | Nil | 9.00 | 10.20 |
| Depth cased | 1.5 | 3.0 | 4.5 | 4.5 | 4.5 |
| Depth of hole | 5.00 | 7.00 | 9.00 | 14.0 | 15.0 |

**FIG. 5**

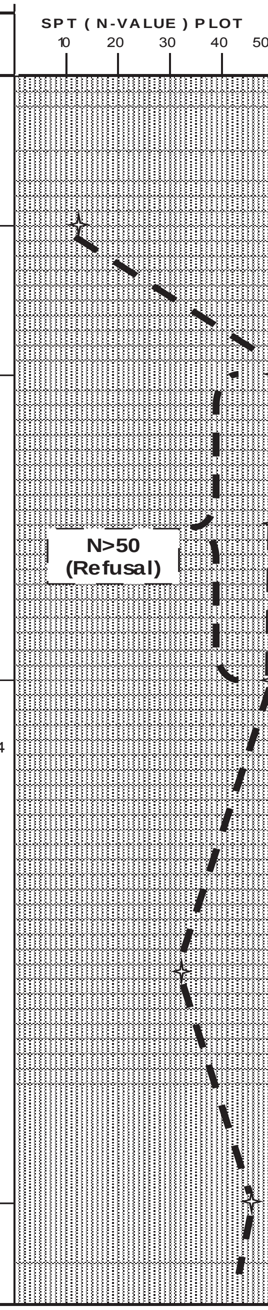
| Logged by: ED | Checked by: JKK |
|---|---|

| PROJECT | LOCATION | BOREHOLE No. BH 2 |
|---|---|---|
| SEC CANTONMENTS PROPERTY DEVELOPMENT | ACCRA | Sheet 1 of 2 |

| Equipment & Methods | Ground Level: | Coordinates: | Date Begun: / Date Completed: |
|---|---|---|---|
| Pilcon Wayfarer 1500 Percussion rig, CTB to 15m, 150mm diameter casing to 6m. | +29.5 | 5°35'1.54"N<br>0°10'3.32"W | 24/06/2016<br>25/06/2016 |

**KE&T Consult** — **CLIENT: CPCS**

| Description | Reduced Level (m) | Legend | Depth (Thick) (m) | Samples/ Tests: Depth (m) | Sample Type | Sample No. | Test | Field Records |
|---|---|---|---|---|---|---|---|---|
| Dense reddish brown silty clayey **SAND** with lateritic gravel inclusions | +29.5 | | 0.0 | | | | | |
| | | | 0.5 | | DS | 1 | | |
| | | | (1.0) | | | | | |
| | +28.5 | | 1.0 | (1.0-1.45) | | | SPT 1 N=13 | 4,3 / 4,3,3,3 |
| Medium dense mottled (reddish-brown/yellowish) silty clayey **SAND** with lateritc gravel | | | 1.5 | | DS | 2 | | |
| | | | (1.0) | | | | | |
| | +27.5 | | 2.0 | (2.0-2.45) | | | SPT 2 N>50 | 12,13 / 16,15,14,14 |
| Very dense reddish-brown lateritic gravelly silty clayey **SAND** | | | 2.5 | | DS | 3 | | |
| | | | 3.0 | (3.0-3.45) | | | SPT 3 N>50 | 12,14 / 16,20,18,20 |
| | | | (2.0) | | | | | |
| | | | 3.5 | | DS | 5 | | |
| | +24.5 | | 4.0 | | | | | |
| Hard mottled (reddish-brown/ white/ grey) lean **CLAY** with sand and lateritc gravel, becoming fused with depth and interspersed with quartzitic pebbles | | | 4.5 | (4.5-4.95) | | | SPT 4 N>50 | 12,20 / 28,37,45,44 |
| | | | 5.0 | | DS | 4 | | |
| | | | 5.5 | | DS | 5 | | |
| | | | (3.5) | | | | | |
| | | | 6.0 | (6.0-6.45) | | | SPT 5 N=33 | 7,6 / 6,7,9,11 |
| | | | 6.5 | | DS | 6 | | |
| | | | 7.0 | | DS | 7 | | |
| | +22.0 | | 7.5 | (7.5-7.95) | | | SPT 6 N=46 | 4,5 / 6,9,16,15 |
| Very stiff mottled (reddish-brown/ light yellow/ grey/ whitish) lean **CLAY** with silt | | | (0.5) | | | | | |
| | +21.5 | | 8.0 | | | | | |




**Remarks:**
1. Very gradual groundwater ingress during drilling at 6.0m depth and stabilized at 7.3m after 24hrs of completion.
2. Water was added to aid drilling

**Water Record**

| Water / Caved Levels,m | | |
|---|---|---|
| Time of Day | 24/06/16 | 25/06/16 |
| Depth to water | Nil | Nil |
| Depth cased | 3.0 | 6.0 |
| Depth of hole | 8.00 | 15.00 |

Notes:

**FIG. 6**

Logged by: ED | Checked by: JKK

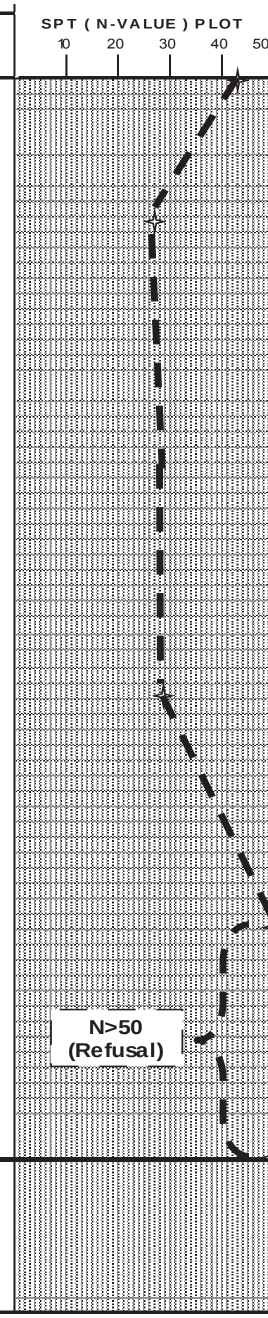
| PROJECT | LOCATION | BOREHOLE No. BH 2 (Cont'd) |
|---|---|---|
| SEC CANTONMENTS PROPERTY DEVELOPMENT | ACCRA | Sheet 2 of 2 |

| Equipment & Methods | Ground Level: | Coordinates: | Date Begun: / Date Completed: |
|---|---|---|---|
| Pilcon Wayfarer 1500 Percussion rig, CTB to 15m, 150mm diameter casing | +29.5 | 5°35'1.54"N<br>0°10'3.32"W | Date Begun: 24/06/2016<br>Date Completed: 25/06/2016 |

**KE&T Consult** — **CLIENT: CPCS**

| Description | Reduced Level (m) | Depth (Thick) (m) | Samples/ Tests Depth (m) | Sample Type | Sample No. | Test | Field Records |
|---|---|---|---|---|---|---|---|
| Very dense mottled (reddish-brown/ light yellow / grey/ whitish) clayey **SAND** with silt with increasing relic structure of decomposed shistose rock presence with depth | +21.5 | 8.0 | | DS | 8 | | |
| | | 8.5 | | DS | 9 | | |
| | | 9.0 | (9.0-9.45) | | | SPT 7 N=27 | 3,5/ 6,7,6,8 |
| | | (3.0) | | | | | |
| | | 9.5 | | | | | |
| | | 10.0 | | DS | 10 | | |
| | | 10.5 | (10.5-10.95) | UDS | 1 | U100 | 13,48,52 |
| | | 11.0 | | | | | |
| | | (1.5) | | | | | |
| | | 11.5 | | DS | 11 | | |
| | +18.9 | 12.0 | (12.0-12.45) | | | SPT 8 N=29 | 2,2 /4,6,8,11 |
| | | 12.5 | | DS | 12 | | |
| | | (1.5) | | | | | |
| | | 13.0 | | | | | |
| | +16.0 | 13.5 | (13.5-13.95) | | | SPT 9 N>50 | 3,3 / 6,11,18,16 |
| Hard mottled (light yellow / greenish) sandy lean **CLAY** with pockets of silt. Decomposed schitose rock fragmants occuring with increasing depth down bottom of borehole | | 14.0 | | | | | |
| | | (1.5) | | | | | |
| | | 14.5 | | | | | |
| | +14.5 | 15.0 | (15.0-15.45) | | | SPT 10 N>50 | 3,5 / 9,13,19,23 |

**End of borehole drilling 15.0m**




**Remarks:**

1. Very gradual groundwater ingress during drilling at 6.0m depth and stabilized at 7.3m after 24hrs of completion.
2. Water was added to aid drilling

**Water Record**

| Water / Caved Levels,m | | |
|---|---|---|
| Time of Day | 24/06/16 | 25/06/16 |
| Depth to water | Nil | Nil |
| Depth cased | 3.0 | 6.0 |
| Depth of hole | 8.00 | 15.00 |

**FIG. 7**

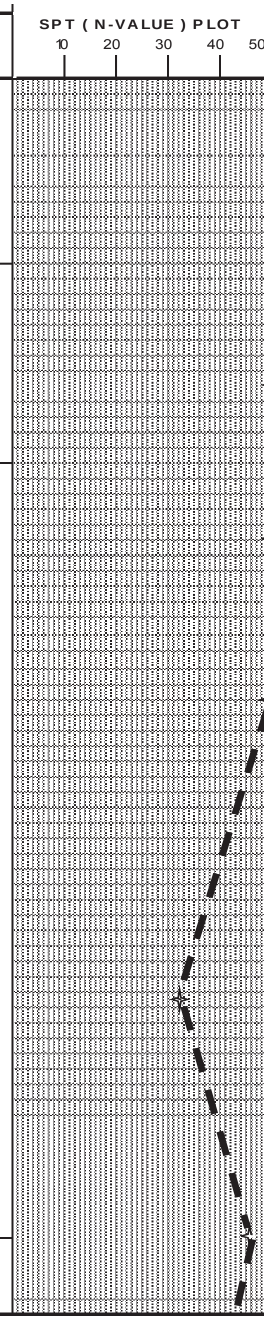
**Logged by:** ED — **Checked by:** JKK

| PROJECT | LOCATION | BOREHOLE No. BH 3 |
|---|---|---|
| SEC CANTONMENTS PROPERTY DEVELOPMENT | ACCRA | Sheet 1 of 2 |

| Equipment & Methods | Ground Level: | Coordinates: | Date Begun: |
|---|---|---|---|
| Pilcon Wayfarer 1500 Percussion rig, CTB to 15m, 150mm diameter casing to 6m. | +31.0 | 5°35'2.24"N<br>0°10'2.37"W | 27/06/2016<br>**Date Completed:**<br>28/06/2016 |

**KE&T Consult** | **CLIENT: CPCS**

| Description | Reduced Level (m) | Depth (Thick) (m) | Samples/ Tests: Depth (m) | Sample Type | Sample No. | Test | Field Records |
|---|---|---|---|---|---|---|---|
| Mixed rubble **FILL** (lateritic gravel/ pieces of sancrete blocks/ rock cobbles**)** | +31.0<br>+29.8 | 0.0<br>0.5<br>(1.2)<br>1.0<br>1.2 | | | | *No SPT in rubble fill at 1m* | |
| Medium dense to very dense reddish-brown silty clayey sand lateritc **GRAVEL** | | 1.5<br>(1.3)<br>2.0<br>2.5 | | DS | 1 | | |
| | | | | DS | 2 | | |
| | | | (2.0-2.45) | | | SPT 1<br>N>50 | 12, 10 / 11, 13, 14, 16 |
| very stiff mottled (reddish-brown/ yellowish) lean **CLAY** with sand and weakly fused lateritc gravel becoming dense with depth | | 3.0<br>3.5<br>4.0<br>4.5<br>(5.0)<br>5.0<br>5.5<br>6.0<br>6.5<br>7.0 | | DS | 3 | | |
| | | | (3.0-3.45) | | | SPT 2<br>N=19 | 6, 8 / 6, 6, 3, 4 |
| | | | | DS | 4 | | |
| | | | (4.5-4.95) | | | SPT 3<br>N=13 | 3, 2 / 3, 3, 4, 3 |
| | | | | DS | 5 | | |
| | | | (6.0-6.45) | | | SPT 4<br>N=24 | 4, 4 / 4, 6, 6, 8 |
| | | | | DS | 6 | | |
| Very dense mottled (reddish-brown/ light yellow / grey/ whitish) clayey **SAND** with silt. (Completely decomposed Schistose parent rock evident) | +23.5<br>+23.0 | 7.5<br>8.0 | (7.5-7.95) | | | SPT 5<br>N=41 | 4, 4 / 5, 11, 12, 13 |




**Remarks:**

1. Very gradual groundwater ingress during drilling at 6.0m depth and stabilized at 8.5m after 24hrs of completion.
2. Water was added to aid drilling

**Water Record**

| Water / Caved Levels,m | | |
|---|---|---|
| Time of Day | 24/06/16 | 25/06/16 |
| Depth to water | Nil | Nil |
| Depth cased | 3.0 | 6.0 |
| Depth of hole | 8.00 | 15.00 |

**Notes:**

**FIG.8**

**Logged by:** ED | **Checked by:** JKK

| PROJECT | LOCATION | BOREHOLE No. BH 3 (Cont'd) |
|---|---|---|
| SEC CANTONMENTS PROPERTY DEVELOPMENT | ACCRA | Sheet 2 of 2 |

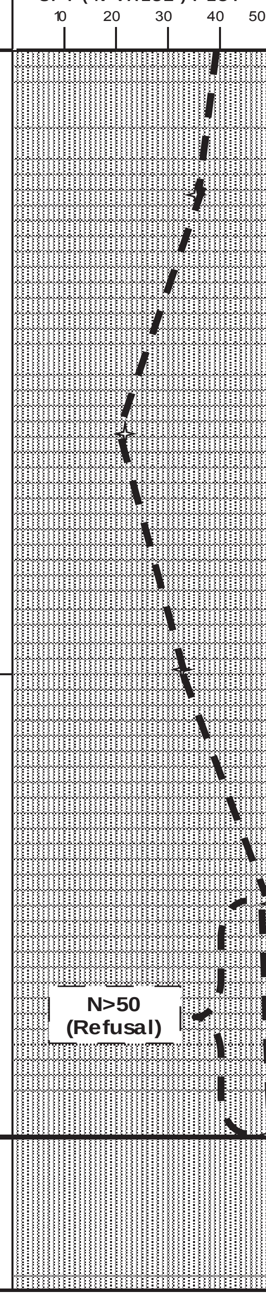
| Equipment & Methods | Ground Level: | Coordinates: | Date Begun: / Date Completed: |
|---|---|---|---|
| Pilcon Wayfarer 1500 Percussion rig, CTB to 15m, 150mm diameter casing | +31.0 | 5°35'2.24"N<br>0°10'2.37"W | Date Begun: 27/06/2016<br>Date Completed: 28/06/2016 |

KE&T Consult — CLIENT: CPCS

| Description | Reduced Level (m) | Legend | Depth (Thick) (m) | Samples/ Tests: Depth (m) | Sample Type | Sample No. | Test | Field Records |
|---|---|---|---|---|---|---|---|---|
| Dense to very dense mottled (reddish-brown/ light yellow / grey/ whitish) clayey **SAND** with silt with increasing relic structure of decomposed shistose rock presence with depth | +23.0 | | 8.0 | | | | | |
| | | | | | DS | 7 | | |
| | | | 8.5 | | | | | |
| | | | 9.0 | (9.0-9.45) | | | SPT 6<br>N=36 | 6,8/ 7,9,9,11 |
| | | | (3.0) | | | | | |
| | | | 9.5 | | DS | 8 | | |
| | (5.0) | | 10.0 | | | | | |
| | | | 10.5 | (10.5-10.95) | | | SPT 7<br>N=22 | 6,4/ 4,5,6,7 |
| | | | 11.0 | | DS | 9 | | |
| | | | (1.5) | | | | | |
| | | | 11.5 | | | | | |
| | +19.0 | | 12.0 | (12.0-12.45) | | | SPT 8<br>N=33 | 6,5 / 7,7,8,11 |
| Stiff to very stiff mottled (light yellow / greenish) sandy lean **CLAY** with pockets of silt. Decomposed schitose rock fragmants occuring with increasing depth down bottom of borehole | | | 12.5 | | | | | |
| | | | (1.5) | | | | | |
| | | | 13.0 | | | | | |
| | +17.5 | | 13.5 | (13.5-5.95) | | | SPT 9<br>N>50 | 5,7 / 11,12,14,16 |
| | | | 14.0 | | | | | |
| | | | (1.5) | | | | | |
| | | | 14.5 | | | | | |
| | +16.0 | | 15.0 | (15.0-15.45) | | | SPT 10<br>N>50 | 3,5 / 9,13,19,23 |

**End of borehole drilling 15.0m**

SPT ( N-VALUE ) PLOT




**Remarks:**
1. Very gradual groundwater ingress during drilling at 6.0m depth and stabilized at 8.5m after 24hrs of completion.
2. Water was added to aid drilling

**Water Record**

| Water / Caved Levels,m | | |
|---|---|---|
| Time of Day | 24/06/16 | 25/06/16 |
| Depth to water | Nil | Nil |
| Depth cased | 3.0 | 6.0 |
| Depth of hole | 8.00 | 15.00 |

**FIG.9**

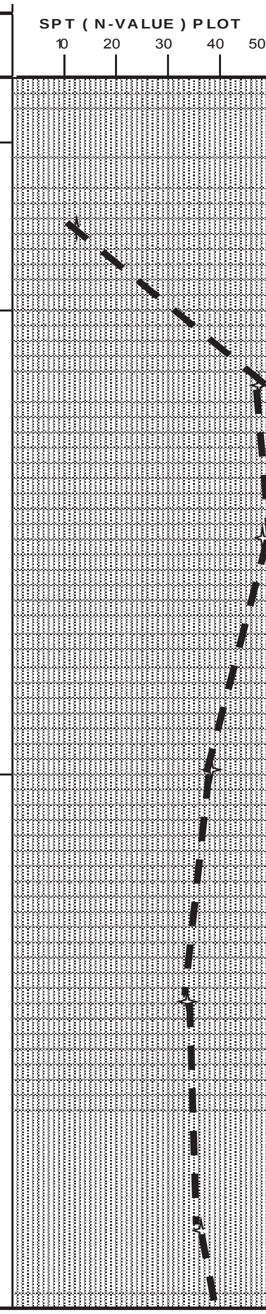
Logged by: ED — Checked by: JKK

| PROJECT | LOCATION | BOREHOLE No. BH 4 |
|---|---|---|
| SEC CANTONMENTS PROPERTY DEVELOPMENT | ACCRA | Sheet 1 of 2 |

| Equipment & Methods | Ground Level: | Coordinates: | Date Begun: |
|---|---|---|---|
| Pilcon Wayfarer 1500 Percussion rig, CTB to 15m, 150mm diameter casing to 6m. | +31.1 | 5°35'1.95"N<br>0°10'2.87"W | 29/06/2016<br>**Date Completed:**<br>30/06/2016 |

**KE&T Consult** — **CLIENT: CPCS**

| Description | Reduced Level (m) | Legend | Depth (Thick) (m) | Depth (m) | Sample Type | Sample No. | Test | Field Records |
|---|---|---|---|---|---|---|---|---|
| Mixed rubble **FILL** (lateritic gravel/ pieces of concrete and sancrete blocks) | +31.1<br>+30.7 | | 0.0<br>(1.2)<br>0.4 | | | | | |
| Medium dense to very dense reddish-brown silty clayey **SAND** with lateritc **GRAVEL** | +29.6 | | 0.5<br>(1.1)<br>1.0<br>1.5 | | DS | 1 | | |
| | | | | (1.0-1.45) | | | SPT 1<br>N=12 | 3,3 / 3,3,3,3 |
| Very dense mottled (reddish-brown/ yellowish) silty clayey **SAND** with fused lateritc gravel | +26.6 | | 2.0<br>2.5<br>3.0<br>(3.0)<br>3.5<br>4.0<br>4.5 | | DS | 2 | | |
| | | | | (2.0-2.45) | | | SPT 2<br>N=48 | 4,2 /9,14,11,14 |
| | | | | | DS | 3 | | |
| | | | | (3.0-3.45) | | | SPT 3<br>N=49 | 10,12 / 13,11,11,14 |
| | | | | | DS | 4 | | \| \| |
| | | | | (4.5-4.95) | | | SPT 4<br>N=39 | 4,3 / 3,5,13,18 |
| Very stiff mottled (reddish-brown/ light yellow / grey/ whitish) lean **CLAY** with sand and fused lateritic gravel inclusions | +23.1 | | 5.0<br>5.5<br>6.0<br>(3.5)<br>6.5<br>7.0<br>7.5<br>8.0 | | DS | 5 | | |
| | | | | (6.0-6.45) | | | SPT 5<br>N=34 | 5,5/ 5,5,10,14 |
| | | | | | DS | 6 | | |
| | | | | (7.5-7.95) | | | SPT 6<br>N=37 | 7,8 / 7,8,8,14 |




**Remarks:**
1. Very gradual groundwater ingress during drilling at 9.5m depth and stabilized at 8.7m after 24hrs of completion.
2. Water was added to aid drilling
3. Groundwater ingress signiificant at 12.5m depth

**Water Record**

| Water / Caved Levels,m | | |
|---|---|---|
| Time of Day | 29/06/16 | 30/06/16 |
| Depth to water | Nil | Nil |
| Depth cased | 4.5 | 6.0 |
| Depth of hole | 8.00 | 15.00 |

**Notes:**

**FIG.10**

**Logged by:** ED — **Checked by:** JKK

| PROJECT | LOCATION | BOREHOLE No. BH 4 (Cont'd) |
|---|---|---|
| SEC CANTONMENTS PROPERTY DEVELOPMENT | ACCRA | Sheet 2 of 2 |

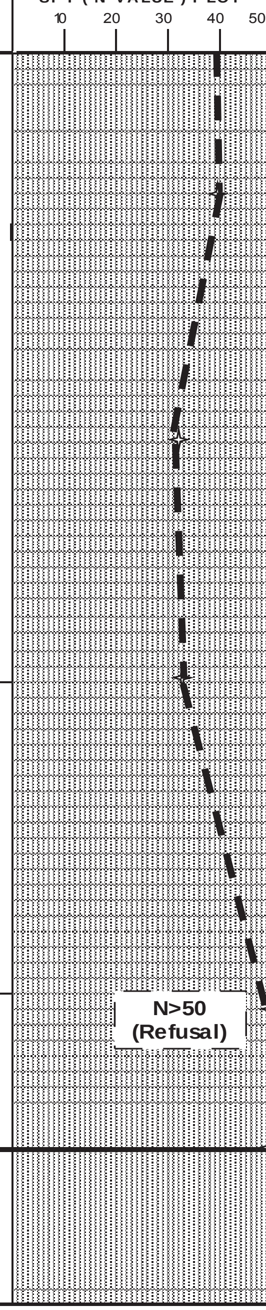
| Equipment & Methods | Ground Level: | Coordinates: | Date Begun: |
|---|---|---|---|
| Pilcon Wayfarer 1500 Percussion rig, CTB to 15m, 150mm diameter casing | +31.1 | 5°35'1.95"N<br>0°10'2.87"W | 29/06/2016<br>**Date Completed:**<br>30/06/2016 |

| KE&T Consult | CLIENT: CPCS |
|---|---|

| Description | Reduced Level (m) | Legend | Depth (Thick) (m) | Samples/ Tests Depth (m) | Sample Type | Sample No. | Test | Field Records |
|---|---|---|---|---|---|---|---|---|
| Stiff to very stiff mottled (reddish-brown/ yellowish) silty **CLAY** with sand fused with quartzitic gravel and schistose rock fragments | +23.1 | | 8.0 | | DS | 7 | | |
| | | | 8.5 | | | | | |
| | | | 9.0 | (9.0-9.45) | | | SPT 7 N=40 | 7,7/ 6,9,12,13 |
| | | | 9.5 | | | | | |
| | | | (4.0) | | | | | |
| | | | 10.0 | | | | | |
| | | | 10.5 | (10.5-10.95) | | | SPT 8 N=33 | 6,6/ 6,7,7,13 |
| | | | | | DS | 8 | | |
| | | | 11.0 | | | | | |
| | | | | | DS | 9 | | |
| | | | 11.5 | | | | | |
| | +19.1 | | 12.0 | (12.0-12.45) | | | SPT 9 N=33 | 5,6 / 7,7,8,11 |
| Dense to very dense mottled (reddish-brown/ light yellow) clayey **SAND** with pockets of sand silt, with schistose rock fragments in quartzitic gravel matrix | | | | | DS | 10 | | |
| | | | 12.5 | | | | | |
| | | | (1.5) | | | | | |
| | | | 13.0 | | | | | |
| | | | 13.5 | | | | | |
| | +17.1 | | 14.0 | (14.0-14.45) | | | SPT 10 N>50 | 10,11/ 8,10,16,18 |
| Stiff to very stiff mottled (light yellow / greenish) sandy lean **CLAY** with pockets of silt and schistose rock fragmants | | | 14.5 | | | | | |
| | | | (1.0) | | | | | |
| | +16.1 | | 15.0 | | | | | |

**End of borehole drilling 15.0m**

SPT ( N-VALUE ) PLOT




**Remarks:**
1. Very gradual groundwater ingress during drilling at 9.5m depth and stabilized at 8.7m after 24hrs of completion.
2. Water was added to aid drilling
3. Groundwater ingress signiificant at 12.5m depth

**Water Record**

| Water / Caved Levels,m | | |
|---|---|---|
| Time of Day | 29/06/16 | 30/06/16 |
| Depth to water | Nil | Nil |
| Depth cased | 4.5 | 6.0 |
| Depth of hole | 8.00 | 15.00 |

**FIG.11**

Logged by: ED | Checked by: JKK

| PROJECT | LOCATION | BOREHOLE No. BH 5 |
|---|---|---|
| SEC CANTONMENTS PROPERTY DEVELOPMENT | ACCRA | Sheet 1 of 2 |

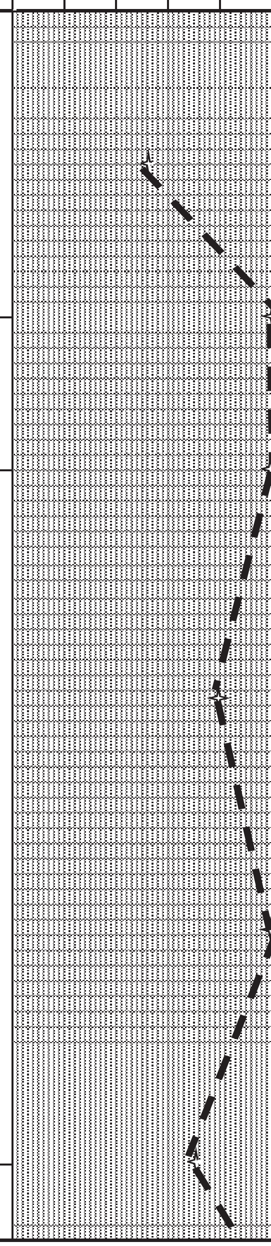
| Equipment & Methods | Ground Level: | Coordinates: | Date Begun: |
|---|---|---|---|
| Pilcon Wayfarer 1500 Percussion rig, CTB to 15m, 150mm diameter casing to 6m. | +31.9 | 5° 35' 2.89" N<br>0° 10' 3.22" W | 25/06/2016<br>**Date Completed:**<br>26/06/2016 |

| KE&T Consult | CLIENT: CPCS |
|---|---|

| Description | Reduced Level (m) | Legend | Depth (Thick) (m) | Samples/ Tests: Depth (m) | Sample Type | Sample No. | Test | Field Records |
|---|---|---|---|---|---|---|---|---|
| Dense reddish-brown silty clayey **SAND** (lateritc) | +31.9 | | 0.0 | | | | | |
| | | | 0.5 | | | | | |
| | | | (2.0) 1.0 | (1.0-1.45) | | | SPT 1 N=27 | 7,8 / 7,7,7,6 |
| | | | 1.5 | | | | | |
| | +29.9 | | 2.0 | (2.0-2.45) | | | SPT 2 N>50 | 4,17 / 24,21,25,26 |
| Very dense mottled (reddish-brown/ yellowish) silty clayey **SAND** with fused lateritc gravel | | | 2.5 (1.0) | | DS | 1 | | |
| | +28.9 | | 3.0 | (3.0-3.45) | | | SPT 3 N>50 | 15,18 / 25,28,31,28 |
| Very stiff/hard mottled (reddish-brown/ light yellow / grey/ whitish) lean **CLAY** with sand and traces of gravel occurance with depth (completely decomposed shictose parent rock) | | | 3.5 | | | | | |
| | | | | | DS | 4 | | |
| | | | 4.0 | | | | | |
| | | | 4.5 | (4.5-4.95) | | | SPT 4 N=40 | 9,11/ 11,14,12,13 |
| | | | 5.0 | | | | | |
| | | | (4.5) | | | | | |
| | | | 5.5 | | DS | 5 | | |
| | | | 6.0 | (6.0-6.45) | | | SPT 5 N>50 | 10,9/ 8,12,15,16 |
| | | | 6.5 | | DS | 6 | | |
| | | | 7.0 | | | | | |
| | +24.4 | | 7.5 | (7.5-7.95) | | | SPT 6 N=36 | 5,8 / 8,10,10,8 |
| Very dense mottled clayey **SAND** with traces of quartzitic rock fragments | | | (0.5) | | | | | |
| | +23.9 | | 8.0 | | | | | |

SPT ( N-VALUE ) PLOT

10 20 30 40 50



**Remarks:**
1. Gradual groundwater ingress during drilling at 10.0m depth and stabilized at 6.7m after 24hrs of completion.
2. Water was added to aid drilling
3. groundwater ingress signiificant at 12.5m depth

**Water Record**

| Water / Caved Levels,m | | |
|---|---|---|
| Time of Day | 25/06/16 | 27/06/16 |
| Depth to water | Nil | 10.0m |
| Depth cased | 4.5 | 6.0 |
| Depth of hole | 8.00 | 15.00 |

**Notes:**

**FIG.12**

**Logged by:** ED | **Checked by:** JKK

| PROJECT | LOCATION | BOREHOLE No. BH 5 (Cont'd) |
|---|---|---|
| SEC CANTONMENTS PROPERTY DEVELOPMENT | ACCRA | Sheet 2 of 2 |

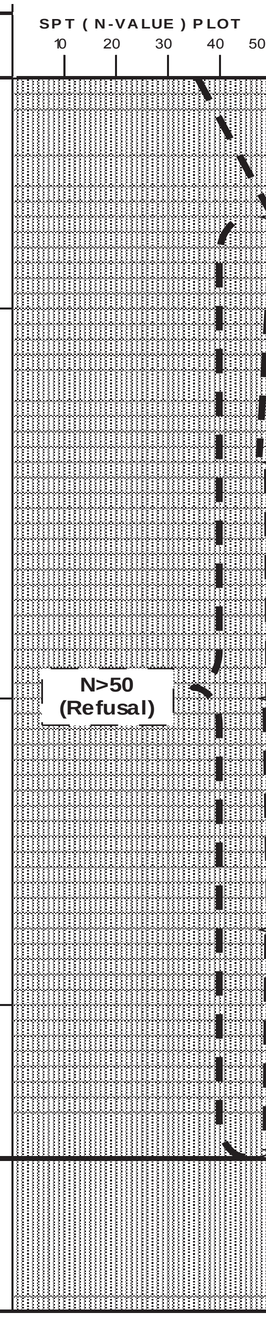
| Equipment & Methods | Ground Level: | Coordinates: | Date Begun: |
|---|---|---|---|
| Pilcon Wayfarer 1500 Percussion rig, CTB to 15m, 150mm diameter casing | +31.9 | 5° 35' 2.89" N<br>0° 10' 3.22" W | 25/06/2016<br>**Date Completed:**<br>26/06/2016 |

**KE&T Consult** — **CLIENT: CPCS**

| Description | Reduced Level (m) | Legend | Depth (Thick) (m) | Samples/ Tests: Depth (m) | Sample Type | Sample No. | Test | Field Records |
|---|---|---|---|---|---|---|---|---|
| Very dense mottled (reddish-brown/ yellowish/ whitish) clayey **SAND** with silt and quartzitic rock fragments | +23.9 | | 8.0 | | DS | 7 | | |
| | | | 8.5 (1.5) | | | | | |
| | | | 9.0 | (9.0-9.45) | | | SPT 7 N>50 | 8,8/ 10,10,13,20 |
| | | | 9.5 | | | | | |
| Very dense mottled (reddish-brown/ yellowish/ whitish) clayey **SAND** with sand (completely decomposed schistose rock with visible relic structure) | | | 10.0 | | | | | |
| | | | 10.5 | (10.5-10.95) | | | SPT 8 N>50 | 8,15/ 11,17,27,26 |
| | | | (2.5) | | DS | 8 | | |
| | | | 11.0 | | | | | |
| | | | | | DS | 9 | | |
| | | | 11.5 | | | | | |
| | +19.1 | | 12.0 | (12.0-12.45) | | | SPT 9 N>50 | 10,13 / 14,16,15,121 |
| Hard mottled (reddish-brown/ light yellow) sandy lean **CLAY** with quartzitic rock fragments inclusions (highly decomposed schistose rock with quarts veins) | | | | | DS | 10 | | |
| | | | 12.5 (1.5) | | | | | |
| | | | 13.0 | | | | | |
| | | | 13.5 | | | | SPT 10 N>50 | 8,8 / 13,15,13,15 |
| | +17.1 | | 14.0 | (14.0-14.45) | | | | |
| | | | 14.5 (1.0) | | | | | |
| | +16.1 | | 15.0 | | | | SPT 11 N>50 | 8,12 / 11,20,26,22 |

End of borehole drilling 15.0m

SPT ( N-VALUE ) PLOT




**Remarks:**
1. Very gradual groundwater ingress during drilling at 10.0m depth and stabilized at 6.7m after 24hrs of completion.
2. Water was added to aid drilling
3. groundwater ingress signiificant at 12.5m depth

**Water Record**

| Water / Caved Levels,m | | |
|---|---|---|
| Time of Day | 25/06/16 | 27/06/16 |
| Depth to water | Nil | 10.0m |
| Depth cased | 4.5 | 6.0 |
| Depth of hole | 8.00 | 15.00 |

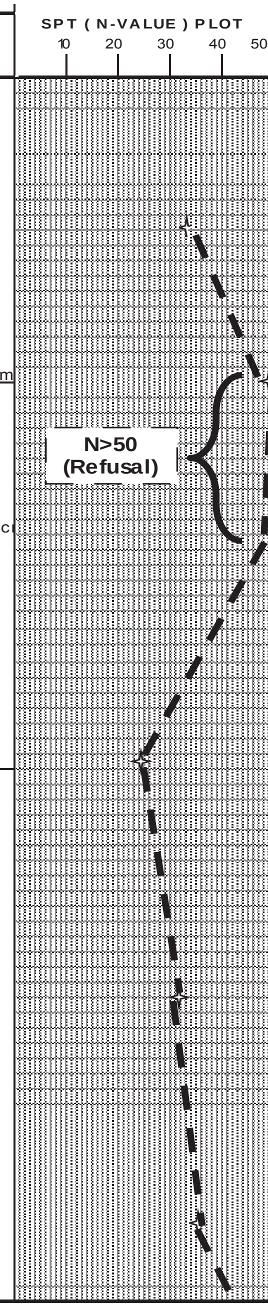
**FIG.13**

**Logged by:** ED **Checked by:** JKK

| PROJECT | LOCATION | BOREHOLE No. BH 6 | |
|---|---|---|---|
| SEC CANTONMENTS PROPERTY DEVELOPMENT | ACCRA | Sheet 1 of 2 | |
| **Equipment & Methods** | **Ground Level:** | **Coordinates:** | **Date Begun:** 01/07/2016 |
| Pilcon Wayfarer 1500 Percussion rig, CTB to 15m, 150mm diameter casing to 6m. | +31.2 | 5° 35' 3.27" N<br>0° 10' 32.25" V | **Date Completed:** 02/07/2016 |
| **KE&T Consult** | **CLIENT: CPCS** | | |

| Description | Reduced Level (m) | Legend | Depth (Thick) (m) | Samples/ Tests Depth (m) | Sample Type | Sample No. | Test | Field Records |
|---|---|---|---|---|---|---|---|---|
| Rubble **FILL** | +31.2<br>+31.0 | | 0.0<br>(0.2) | | | | | |
| Dense reddish-brown silty clayey **SAND** with lateritc gravel | | | 0.5 | | DS | 1 | | |
| | | | 1.0<br>(1.8) | (1.0-1.45) | | | SPT 1<br>N=34 | 6,8 / 6,6,9,9 |
| | | | 1.5 | | | | | |
| | +29.2 | | 2.0 | (2.0-2.45) | | | SPT 2<br>N>50 | Refusal/6 blows<1cm |
| Very dense/ very hard mottled (reddish-brown/ yellowish) silty clayey **SAND** with fused lateritc gravel (boring by chiselling adopted within this strata) | | | | | DS | 2 | | |
| | | | 2.5<br>(1.0) | | | | | |
| | +28.9 | | 3.0 | (3.0-3.45) | | | SPT 3<br>N>50 | Refusal/ 85 blows<15cm |
| | | | 3.5 | | DS | 3 | | |
| | | | 4.0 | | | | | |
| | | | 4.5 | (4.5-4.95) | | | SPT 4<br>N=25 | 6,5 / 5,5,6,9 |
| Firm to stiff mottled (reddish-brown/ grey/ whitish) sandy lean **CLAY** with silt, with fused lateritc gravel and occasional quartzitic fragments | | | 5.0 | | | | | |
| | | | (4.5)<br>5.5 | | | | | |
| | | | 6.0 | (6.0-6.45) | | | SPT 5<br>N=32 | 5,5/ 7,9,6,10 |
| | | | 6.5 | | DS | 4 | | |
| | | | 7.0 | | | | | |
| | | | 7.5 | (7.5-7.95) | | | SPT 6<br>N=36 | 11,10 / 10,16,18,18 |
| | +23.2 | | 8.0 | | | | | |

SPT ( N-VALUE ) PLOT




**Remarks:**

1. Very gradual groundwater ingress during drilling at 8.2m depth and stabilized at 8.6m after 24hrs of completion.
2. Water was added to aid drilling

**Water Record**

| Water / Caved Levels,m | | |
|---|---|---|
| Time of Day | 01/07/16 | 03/07/16 |
| Depth to water | Nil | 8.2m |
| Depth cased | 3.0 | 6.0 |
| Depth of hole | 7.50 | 15.00 |

**Notes:**

**FIG.14**

**Logged by:** ED **Checked by:** JKK

| PROJECT | LOCATION | BOREHOLE No. BH 6 (Cont'd) |
|---|---|---|
| SEC CANTONMENTS PROPERTY DEVELOPMENT | ACCRA | Sheet 2 of 2 |

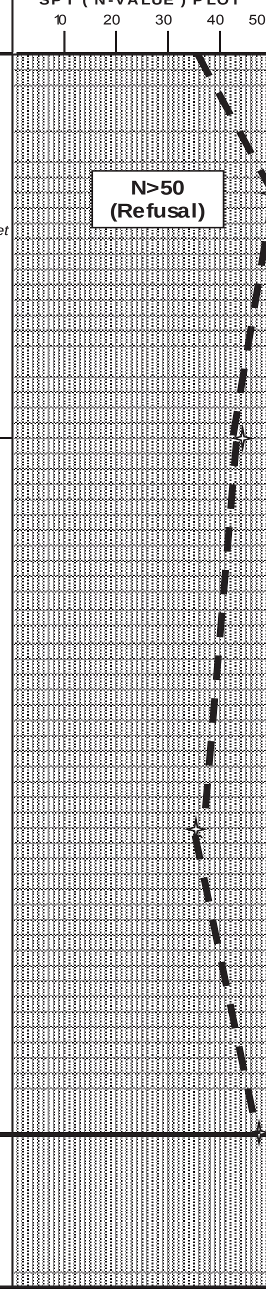
| Equipment & Methods | Ground Level: | Coordinates: | Date Begun: |
|---|---|---|---|
| Pilcon Wayfarer 1500 Percussion rig, CTB to 15m, 150mm diameter casing | +31.2 | 5° 35' 2.89" N<br>0° 10' 3.22" W | 25/06/2016<br>**Date Completed:**<br>26/06/2016 |

**KE&T Consult** | **CLIENT: CPCS**

| Description | Reduced Level (m) | Legend | Depth (Thick) (m) | Samples/ Tests Depth (m) | Sample Type | Sample No. | Test | Field Records |
|---|---|---|---|---|---|---|---|---|
| Dense/very dense mottled (reddish-brown/ grey/ whitish) silty clayey **SAND** with fused lateritc gravel and traces of quartzitic rock fragments with depth | +23.2 | | 8.0 | | DS | 5 | | |
| | | | 8.5 | | | | | |
| | | | 9.0 (2.5) | (9.0-9.45) | | | SPT 7 N>50 | 11,13/ 12,15,19,.... 35cm=90 blows Refusal at last count set |
| | | | 9.5 | | DS | 6 | | |
| | | | 10.0 | | | | | |
| | | | 10.5 | (10.5-10.95) | | | SPT 8 N=45 | 5,8/ 10,9,12,14 |
| Very stiff/hard mottled (reddish-brown/ yellowish/ whitish) silty sandy lean **CLAY** with quartzitic rock fragments inclusions (highly decomposed schistose rock with quarts veins) | | | 11.0 | | | | | |
| | | | 11.5 | | | | | |
| | | | 12.0 | (12.0-12.45) | UDS | 1 | U100 | 12,32,61....refusal |
| | | | 12.5 (4.5) | | | | | |
| | | | 13.0 | | | | SPT 9 N=37 | 7,6 / 6,9,10,12 |
| | | | 13.5 | | | | | |
| | +17.1 | | 14.0 | | | | | |
| | | | 14.5 | | | | | |
| | +16.1 | | 15.0 | (15.0-15.45) | | | SPT 10 N=49 | 1,2 / 6,8,20,15 |

**End of borehole drilling 15.0m**

SPT ( N-VALUE ) PLOT




**Remarks:**

1. Very gradual groundwater ingress during drilling at 8.2m depth and stabilized at 8.6m after 24hrs of completion.
2. Water was added to aid drilling

**Water Record**

| Water / Caved Levels,m | | |
|---|---|---|
| Time of Day | 01/07/16 | 03/07/16 |
| Depth to water | Nil | 8.6 |
| Depth cased | 3.0 | 6.0 |
| Depth of hole | 7.50 | 15.00 |

**FIG.15**

**Logged by:** ED | **Checked by:** JKK

PROJECT : PROPOSED SEC CANTONMENTS PROPERTY DEVELOPMENT
TRIAL PIT No: 1
Logged *in situ* by: ED on: 26/06/2016

LOCATION: CANTONMENTS, ACCRA
CLIENT: CPCS

# TP 1

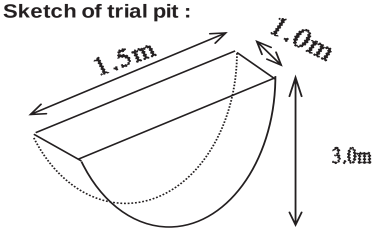
**Date excavated:** 26/06/2016
**Weather:** Sunny
**Excavator type:** JCB
**Bucket width:** 1.0m
**Pit support system:** Nil
**Pit Stability:** Stable

**Groundwater observations:** No groundwater
No groundwater

**Coordinates:**
5° 35' 2.21" N
0° 10' 3.11" W

**Ground level:**
+31.1

**Sketch of trial pit :**




**Trial pit log:**

| Depth (m) | Reduced level (m) | Sample Type | No. | Field Strength Test: Type | Field Strength Test: Strength (kg/cm$^2$) | Soil Description | Legend | Water Level (m) |
|---|---|---|---|---|---|---|---|---|
| 0 – 0.3 | +31.1 – +30.8 | DS | 1 | | | Mix **FILL** of organic topsoil and laterite | | |
| 0.5 | | DS | 2 | | | Dense black silty clayey **SAND** | | |
| 0.9 | +30.2 | DS | 3 | | | Medium dense reddish-brown silty clayey **SAND** (lateritic) | | |
| 1.0 – 1.5 – 1.8 | +29.3 | DS | 4 | | | Loose reddish-brown silty clayey **SAND** with pockets of soft clayey **SAND** with lateritic gravel | | |
| 2.0 – 2.5 – 3.0 | +28.1 | DS | 5 | | | Very dense mottled (reddish-brown/ yellowish) silty clayey **SAND** with fused lateritc gravel | | |
| 3.5 – 4.0 | | | | | | **END OF PITTING** | | |

**LEGEND:**
J =Jar sample
B (L) = Large bulk sample
B (S) = Small bulk sample
R = Rock sample
Vt = Hand vane test
Pt = Hand penetrometer test
W = Water sample
U = Undisturbed sample

**REMARKS:**
1) Pitting w as terminated at a depth of 3.0m
2) Groundw ater w as not

# FIG 16

KE&T CONSULT TRIAL PIT LOG

PROJECT : PROPOSED SEC CANTONMENTS PROPERTY DEVELOPMENT
TRIAL PIT No: 1 LOCATION: CANTONMENTS, ACCRA
**Logged** *in situ* by: ED on: 26/06/2016 CLIENT: CPCS

# TP 2

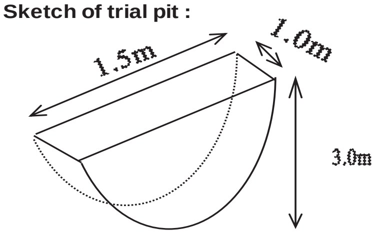
**Date excavated:** 26/06/2016
**Weather:** Sunny
**Excavator type:** JCB
**Bucket width:** 1.0m
**Pit support system:** Nil
**Pit Stability:** Stable

**Groundwater observations:** No groundwater
No groundwater

**Coordinates:**
5° 35' 2.06" N
0° 10' 3.89" W

**Ground level:**
+31.2

**Sketch of trial pit :**




**Trial pit log:**

| Depth (m) | Reduced level (m) | Sample Type | No. | Field Strength Test: Type | Field Strength Test: Strength (kg/cm$^2$) | Soil Description | Legend | Water Level (m) |
|---|---|---|---|---|---|---|---|---|
| 0 – 0.3 | +31.2 / +30.9 | | | | | Black organic **TOPSOIL** | | |
| 0.5 – 0.9 | +30.2 | DS | 1 | | | Loose black clayey silty **SAND** with lateritic gravel | | |
| 1.0 – 1.3 | +29.9 | DS | 2 | | | Loose reddish-brown silty, sandy, **CLAY** with pockets of soft clayey **SAND** with lateritic gravel | | |
| 1.5 – 2.0 – 2.4 | +28.8 | DS | 3 | | | Dense mottled (reddish-brown/ yellowish) silty clayey **SAND** with fused lateritc gravel | | |
| 2.5 – 3.0 | +28.2 | DS | 4 | | | Very dense mottled (reddish-brown/ yellowish) silty clayey **SAND** with fused lateritc gravel and veins of quartzite | | |
| 3.5 – 4.0 | | | | | | **END OF PITTING** | | |

**LEGEND:**
J =Jar sample
B (L) = Large bulk sample
B (S) = Small bulk sample
R = Rock sample
Vt = Hand vane test
Pt = Hand penetrometer test
W = Water sample
U = Undisturbed sample

**REMARKS:**
1) Pitting w as terminated at a depth of 3.0m
2) Groundw ater w as not

FIG 17

KE&T CONSULT TRIAL PIT LOG

| PROJECT : PROPOSED SEC CANTONMENTS PROPERTY DEVELOPMENT | | |
|---|---|---|
| TRIAL PIT No: 1 | LOCATION: CANTONMENTS, ACCRA | **TP 3** |
| **Logged** *in situ* by: ED on: 26/06/2016 | CLIENT: CPCS | |

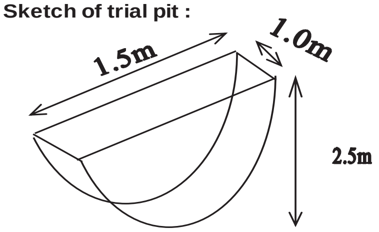
**Date excavated:** 26/06/2016
**Weather:** Sunny
**Excavator type:** JCB
**Bucket width:** 1.0m
**Pit support system:** Nil
**Pit Stability:** Stable

**Groundwater observations:** No groundwater
No groundwater

**Coordinates:**
5° 35' 3.49" N
0° 10' 4.01" W

**Ground level:**
+32.5

**Sketch of trial pit :**




**Trial pit log:**

| Depth (m) | Reduced level (m) | Sample / Test: Sample Type | No. | Field Strength Test: Type | Strength (kg/cm²) | Soil Description | Legend | Water Level (m) |
|---|---|---|---|---|---|---|---|---|
| 0 – 0.4 | +32.5 – +32.1 | | | | | Black organic **TOPSOIL** | | |
| 0.5 – 1.2 | +31.3 | DS | 1 | | | Medium dense black silty clayey **SAND** | | |
| 1.5 – 1.9 | +30.6 | DS | 2 | | | Medium dense reddish-brown silty clayey **SAND** (lateritic) | | |
| 2.0 – 2.2 | +30.3 | DS | 3 | | | Dense/hard mottled (reddish-brown/ yellowish) silty clayey **SAND** with fused lateritc gravel | | |
| 2.5 | +30.0 | DS | 4 | | | Very hard greyish-brown highly weathered schitose **ROCK** | | |
| 3.5, 4.0 | | | | | | **END OF PITTING** | | |

**LEGEND:**
J =Jar sample
B (L) = Large bulk sample
B (S) = Small bulk sample
R = Rock sample
Vt = Hand vane test
Pt = Hand penetrometer test
W = Water sample
U = Undisturbed sample

**REMARKS:**
1) Pitting was terminated at a depth of 3.0m
2) Groundwater was not

**FIG 18**

**KE&T CONSULT TRIAL PIT LOG**

# APPENDIX 3

Table 6: Laboratory Test Results

Table 2A: Summary of Test Results

| BH/TP | Depth (m) | Consistency Limits | | | Particle Size Distribution | | | NMC (%) | Specific Gravity | Triaxial Undrained Shear Test | | compaction Test | | CBR Test (96hrs soaked) | | | | Mr (Mpa) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | LL (%) | PL (%) | PI (%) | Fine (%) | Sand (%) | Gravel (%) | | | Phi (deg) | Cohesion (kPa) | MDD ($kg/m^3$) | OMC (%) | 100% | 98% | 95% | 93% | |
| BH1 | 2.50 - 3.00 | 33 | 22 | 7 | 52 | 38 | 10 | 9.9 | 2.79 | - | - | 2160 | 9.5 | 69 | 42 | 36 | 29 | 245 |
| BH2 | 10.50 - 10.95 | 47 | 18 | 15 | 48 | 47 | 5 | 14.5 | - | 7 | 8 | - | - | - | - | - | - | 44 |
| BH3 | 9.50 - 15.00 | 44 | 25 | 22 | 62 | 36 | 2 | 24.8 | 2.34 | 6 | 5 | - | - | - | - | - | - | |
| BH4 | 2.50 - 3.00 | 37 | 26 | 18 | 43 | 44 | 13 | 23.4 | 2.45 | - | - | - | - | - | - | - | - | |
| BH5 | 5.50 - 6.00 | 44 | 26 | 11 | 72 | 26 | 2 | 16.5 | - | - | - | - | - | - | - | - | - | |
| BH6 | 12.00 - 12.45 | 41 | 28 | 16 | 47 | 53 | 0 | 18.9 | - | - | - | - | - | - | - | - | - | 40 |
| TP2 | 1.30 - 2.40 | 29 | 23 | 18 | 29 | 41 | 30 | 27.0 | 2.47 | - | - | - | - | - | - | - | - | |

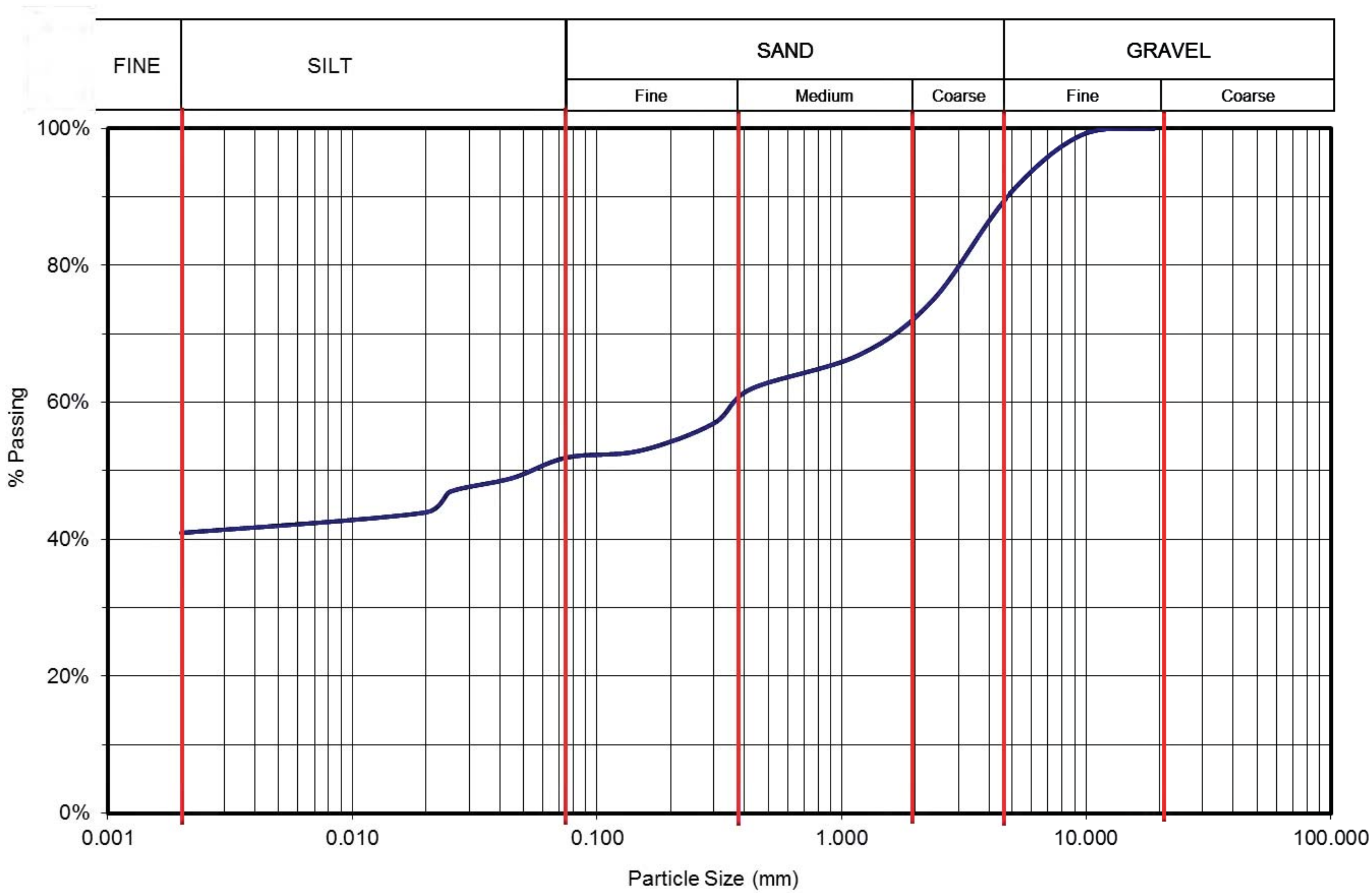



Fig. 19: Particle size analysis (BH1: 2.50 - 3.00m)

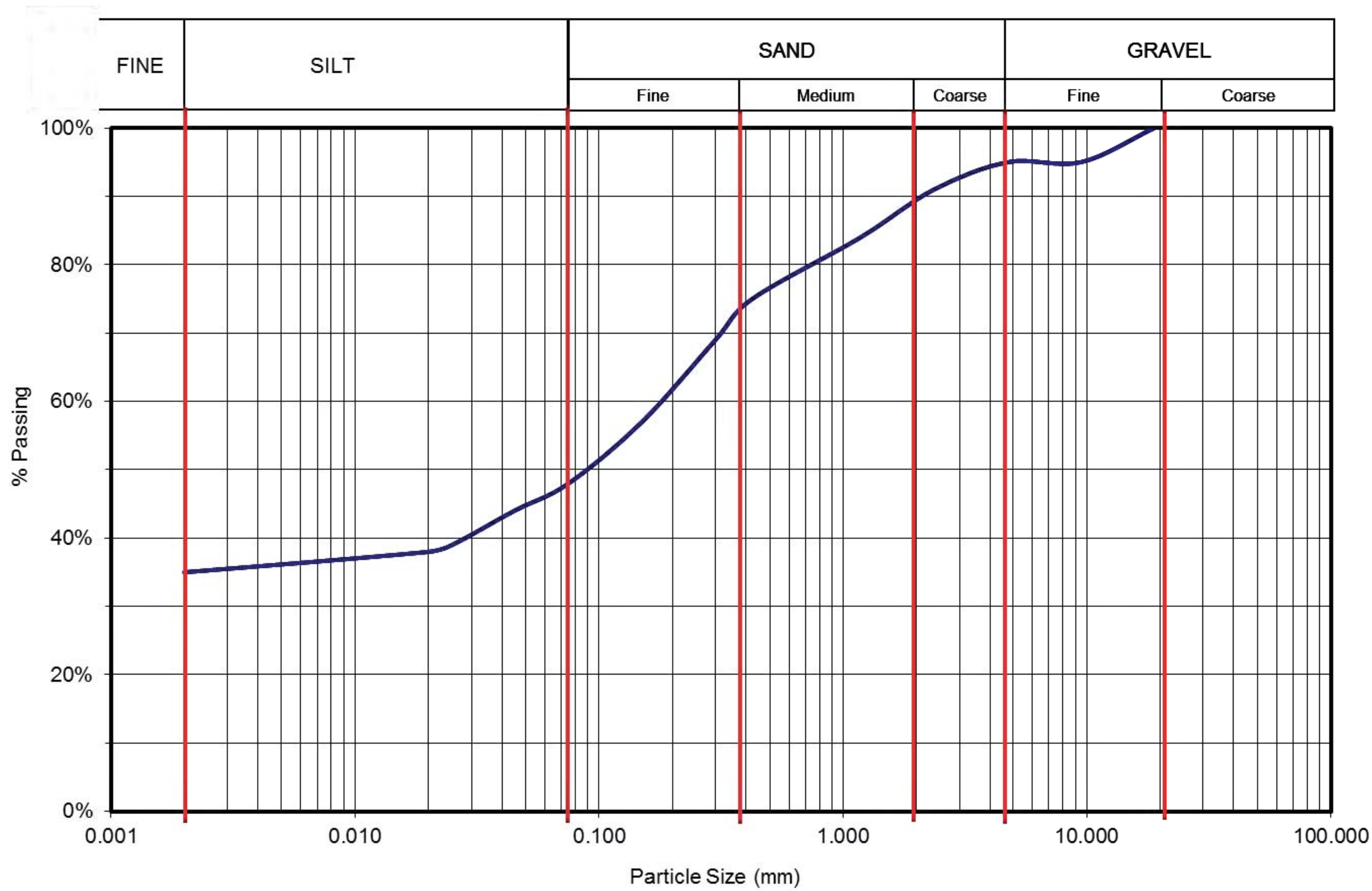



Fig. 20: Particle size analysis (BH2: 10.50 - 10.95m)

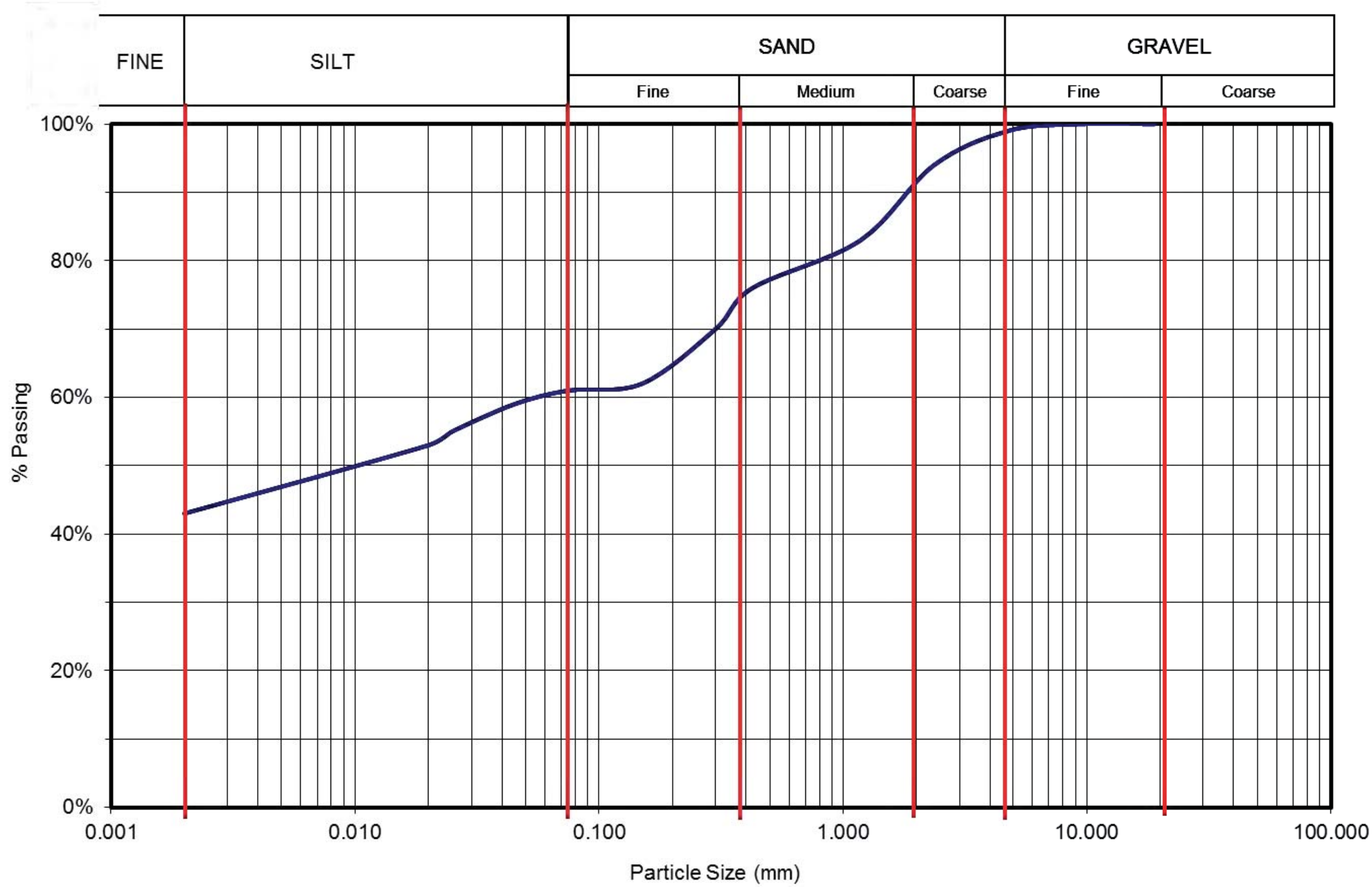



Fig. 21: Particle size analysis (BH3: 9.50 - 15.00m)

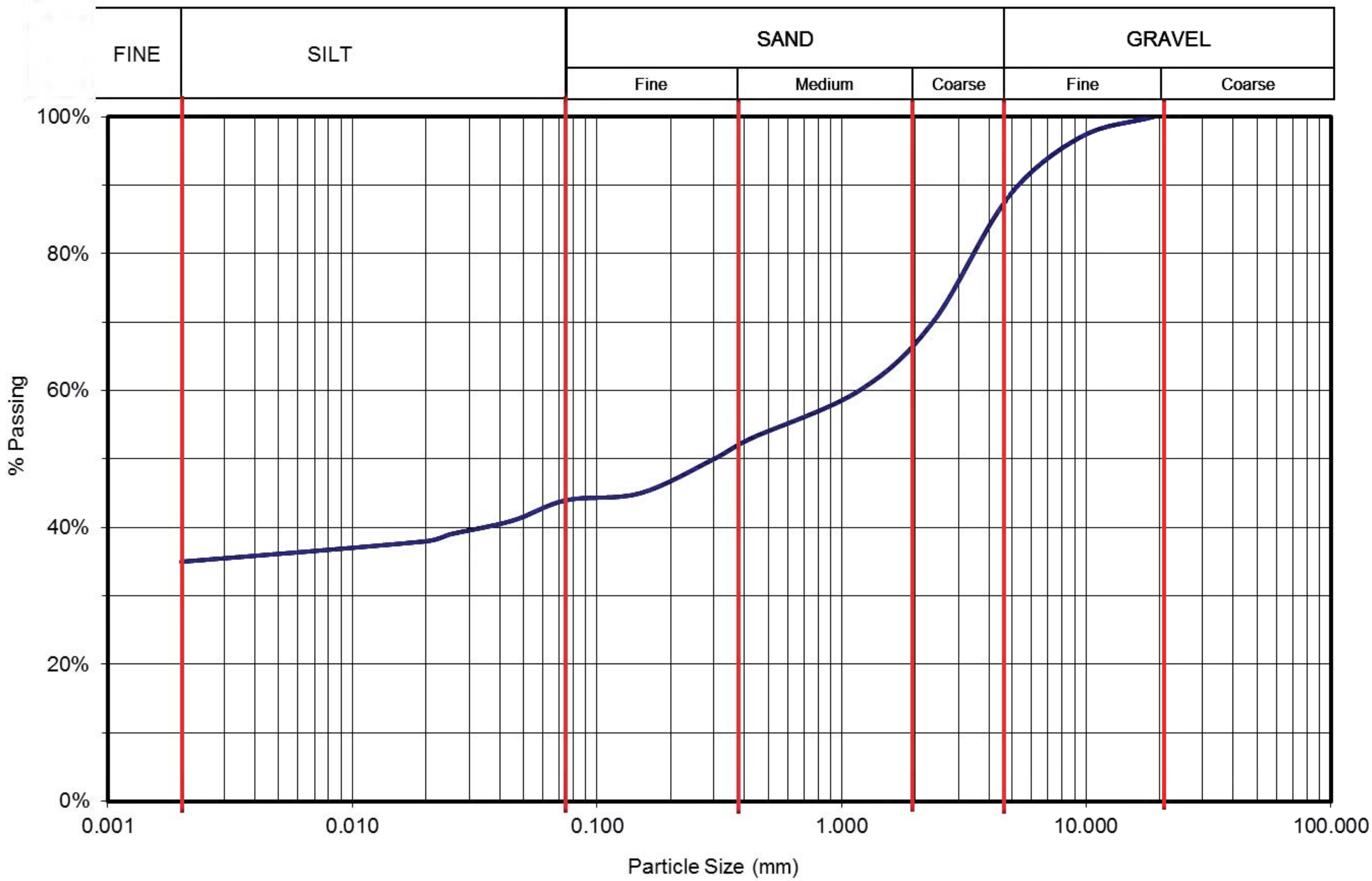



Fig. 22: Particle size analysis (BH4: 2.50 - 3.00m)

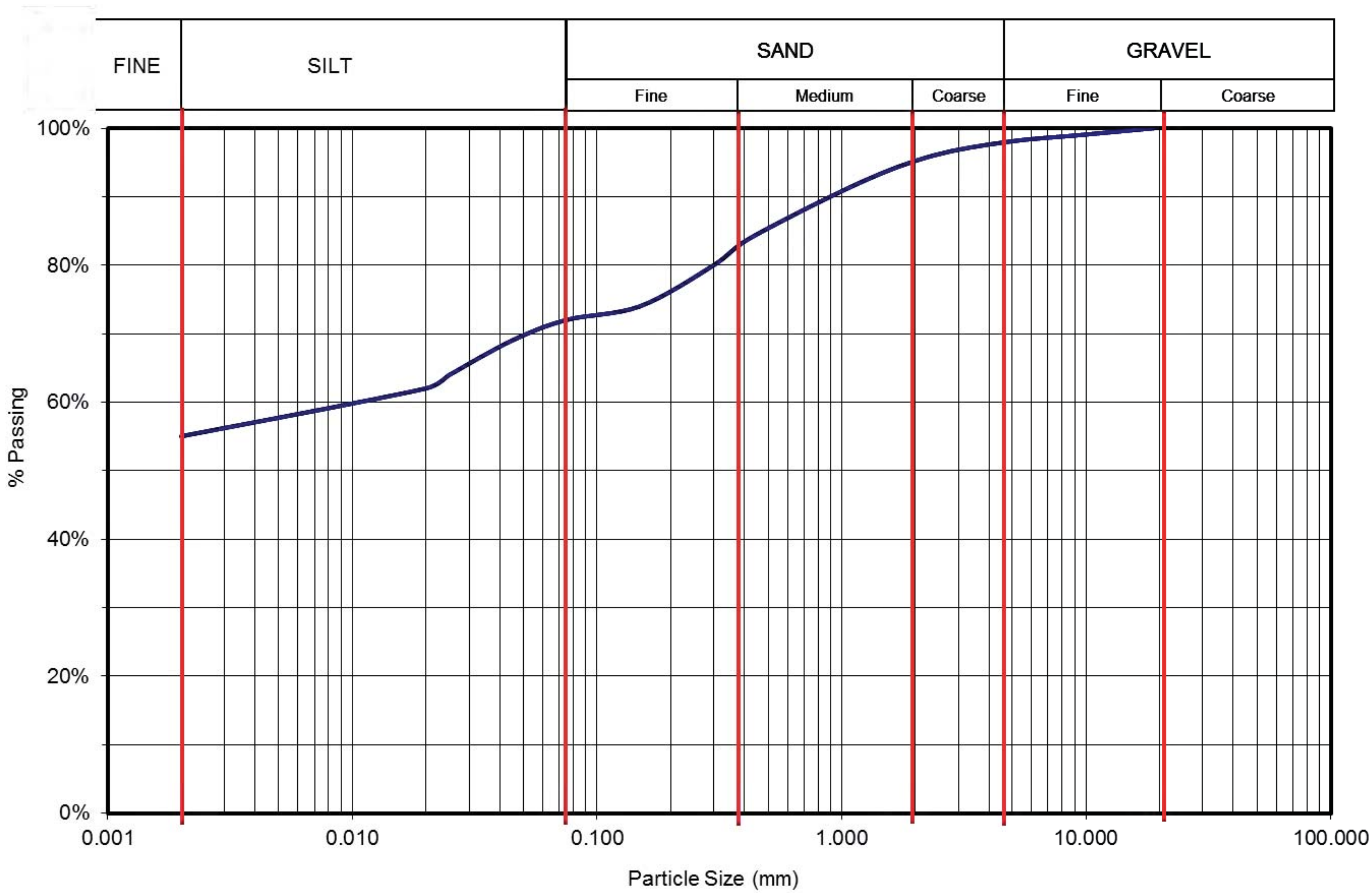



Fig. 23 : Particle size analysis (BH5: 5.50 - 6.00m)

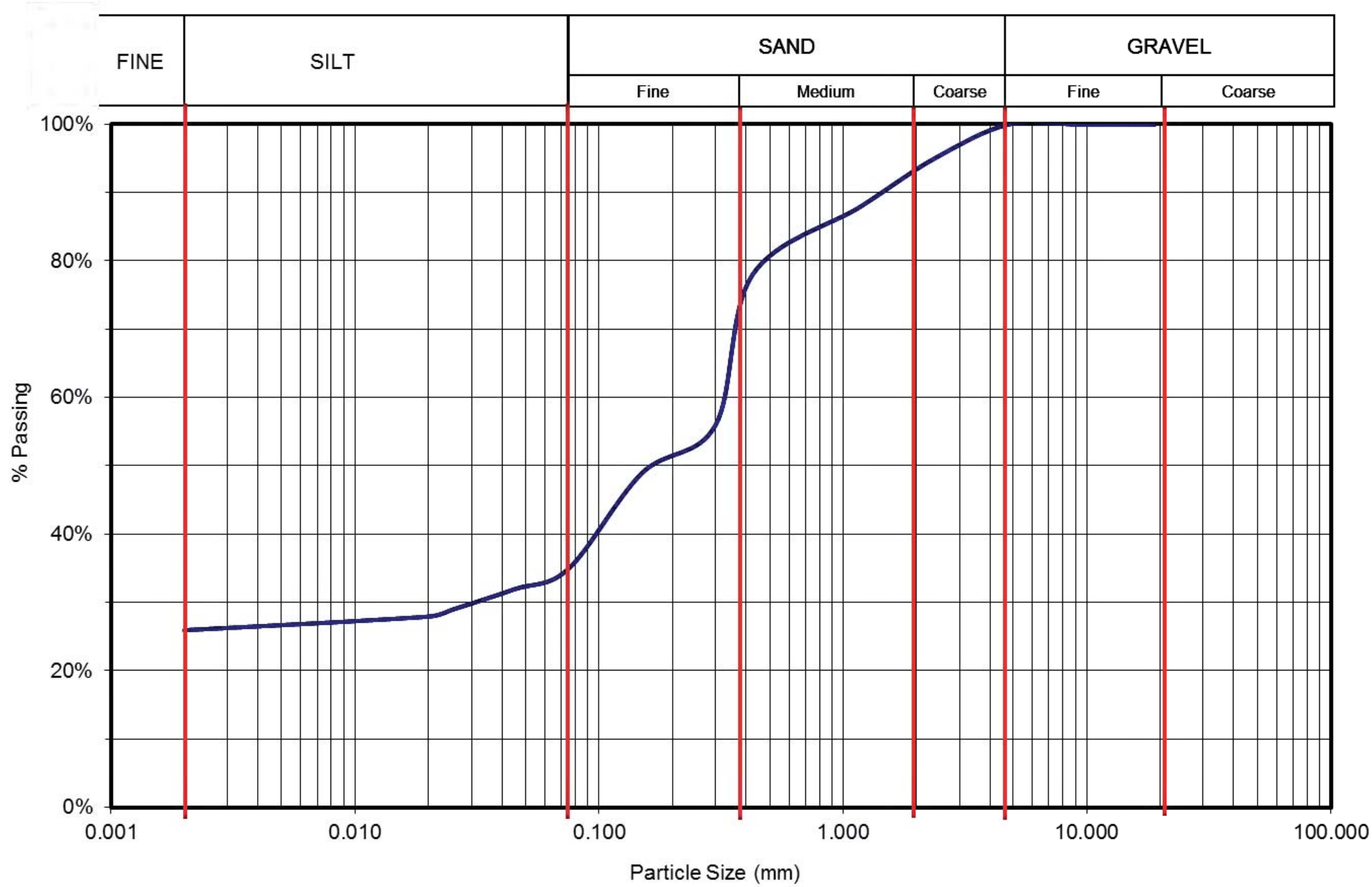



Fig. 24: Particle size analysis (BH6: 12.00 - 12.45m)

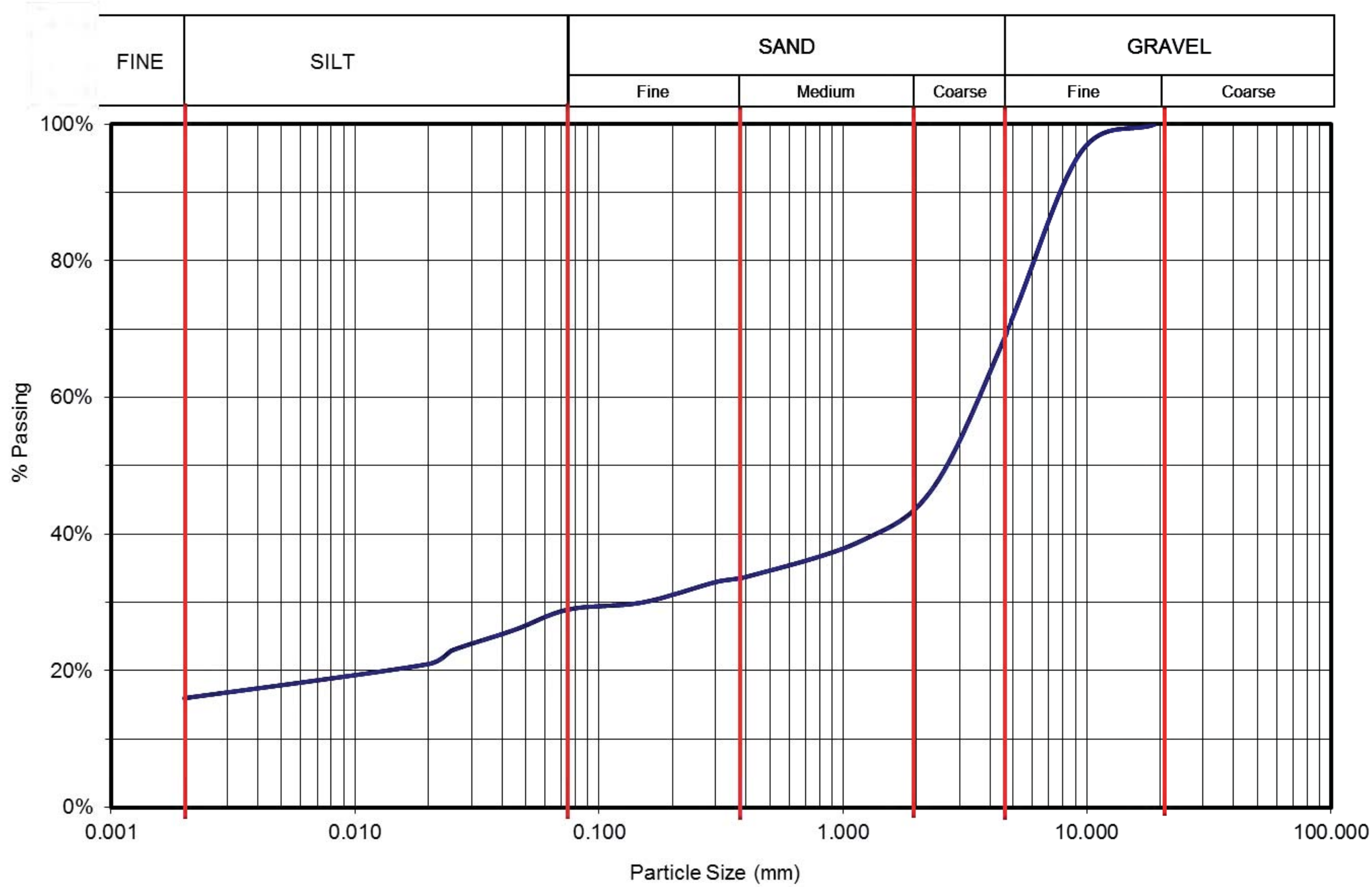



Fig. 25: Particle size analysis (TP2: 1.30 - 3.00m)

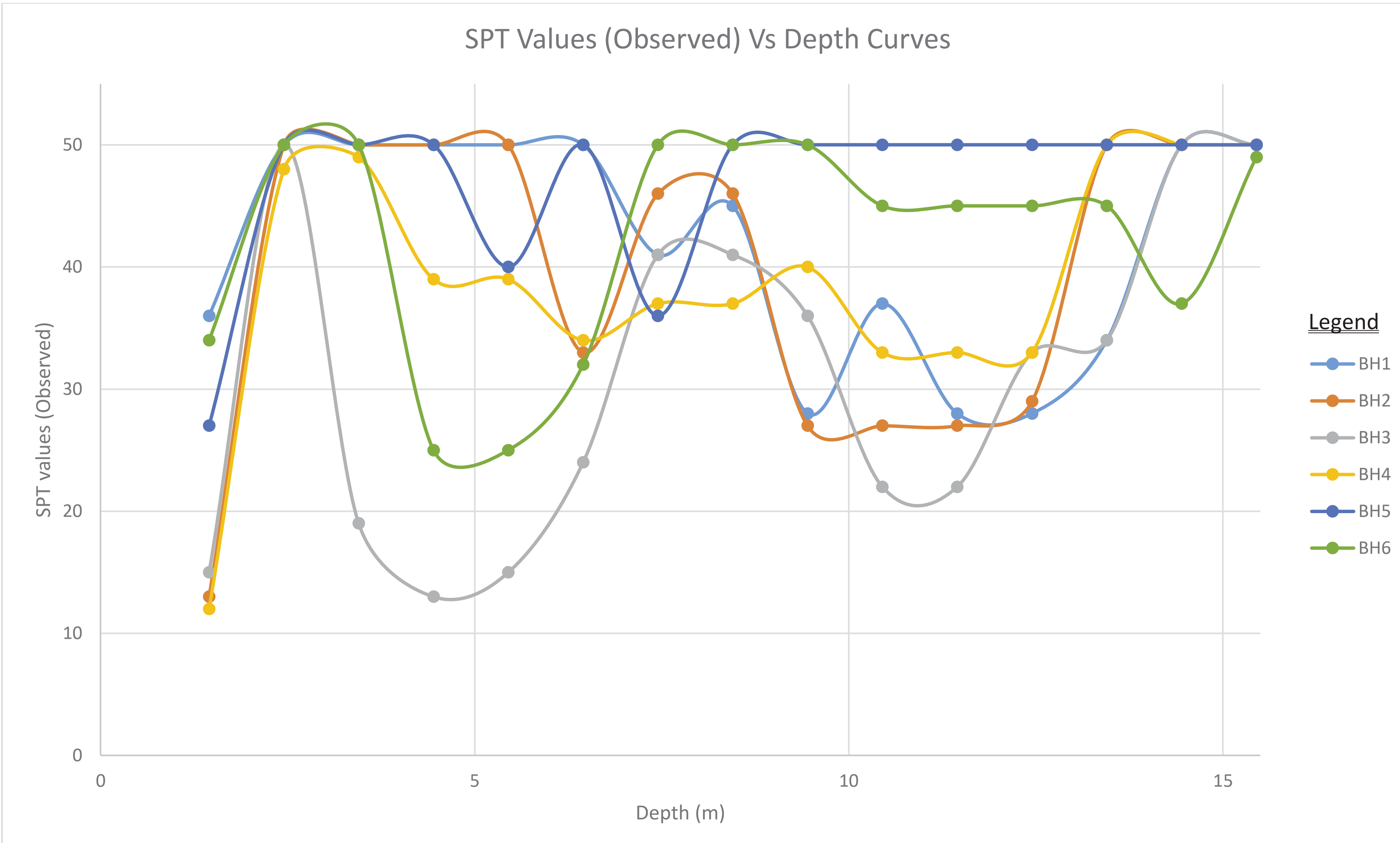
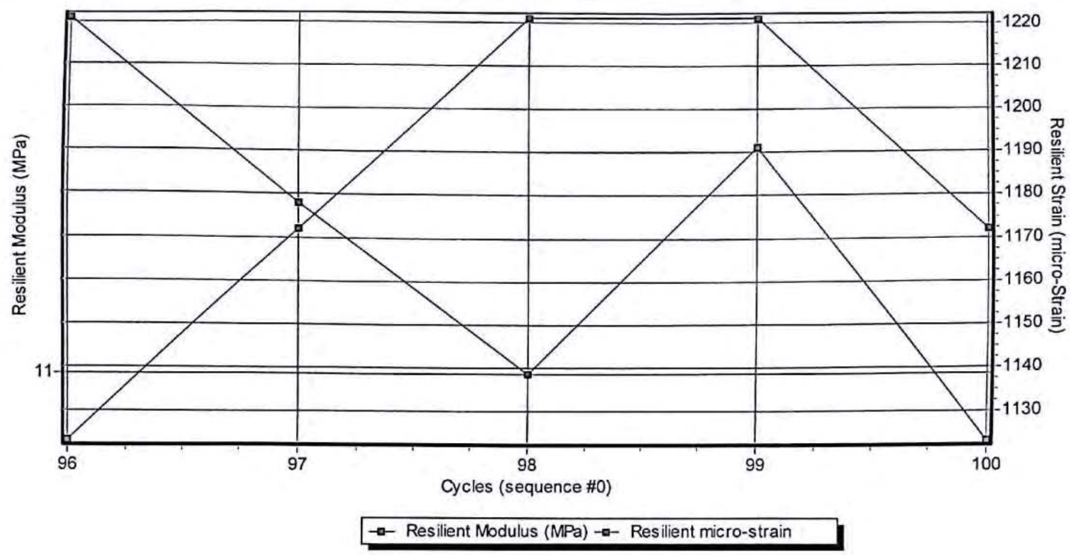



Fig. 26: Graph of SPT vs Depth

FileName: C:\UTM4\UTM_41\Data\Sec Cantonments Property Development [BH_06] BH_06_ ud_2.B41




Operator: Ekow
Test method: AASHTO DESIGNATION TP46-94 (Subgrade Soils)
Notes/comments: Firm Light Greyish Brown Silty CLAY

**Sequence Number: 0** Test start date and time: Wednesday, September 7, 2016, at 2:21 PM

| Cycle number | 96 | 97 | 98 | 99 | 100 | Average | Std Dev. |
|---|---|---|---|---|---|---|---|
| Resilient Modulus (MPa) | 12.0 | 11.5 | 11.0 | 11.6 | 10.8 | 11.4 | 0.460 |
| Resilient micro-strain | 1123.3 | 1172.2 | 1221.0 | 1221.0 | 1172.2 | 1181.9 | 40.863 |
| Confining pressure (kPa) | 40.4 | 40.7 | 40.4 | 40.7 | 40.7 | 40.6 | 0.161 |
| Maximum stress (kPa) | 203.0 | 203.0 | 203.0 | 203.0 | 202.2 | 202.8 | 0.334 |
| Cyclic stress (kPa) | 13.4 | 13.4 | 13.4 | 14.2 | 12.7 | 13.4 | 0.528 |
| Contact stress (kPa) | 189.5 | 189.5 | 189.5 | 188.8 | 189.5 | 189.4 | 0.334 |
| Permanent strain (%) | 0.002 | 0.000 | 0.000 | 0.003 | 0.000 | | |
| Maximum load (kN) | 0.399 | 0.399 | 0.399 | 0.399 | 0.397 | 0.398 | 0.001 |
| Cyclic load (kN) | 0.026 | 0.026 | 0.026 | 0.028 | 0.025 | 0.026 | 0.001 |
| Contact load (kN) | 0.372 | 0.372 | 0.372 | 0.371 | 0.372 | 0.372 | 0.001 |
| Average resilient def. (mm) | 0.056 | 0.059 | 0.061 | 0.061 | 0.059 | 0.059 | 0.002 |
| Axial 1 resilient def. (mm) | 0.112 | 0.117 | 0.122 | 0.122 | 0.117 | 0.118 | 0.004 |
| Axial 2 resilient def. (mm) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Actuator resilient def. (mm) | 0.117 | 0.125 | 0.117 | 0.117 | 0.117 | 0.119 | 0.003 |
| Average permanent def. (mm) | 0.002 | 0.000 | 0.000 | 0.003 | 0.000 | | |
| Axial 1 permanent def. (mm) | 0.005 | 0.000 | 0.000 | 0.005 | 0.000 | | |
| Axial 2 permanent def. (mm) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | | |
| Actuator permanent def. (mm) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | | |

**Specimen Information**
Identification: Sec Cantonments Property Development [BH_06]
Core/Sample Number: BH_06: ud_2

| Dimensions | Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Average | Std Dev. |
|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | 50 | | | | | | 50 | |
| Height (mm) | 100 | | | | | | 100 | |

Cross-Sectional Area: 1963.495
Volume: 196349.5

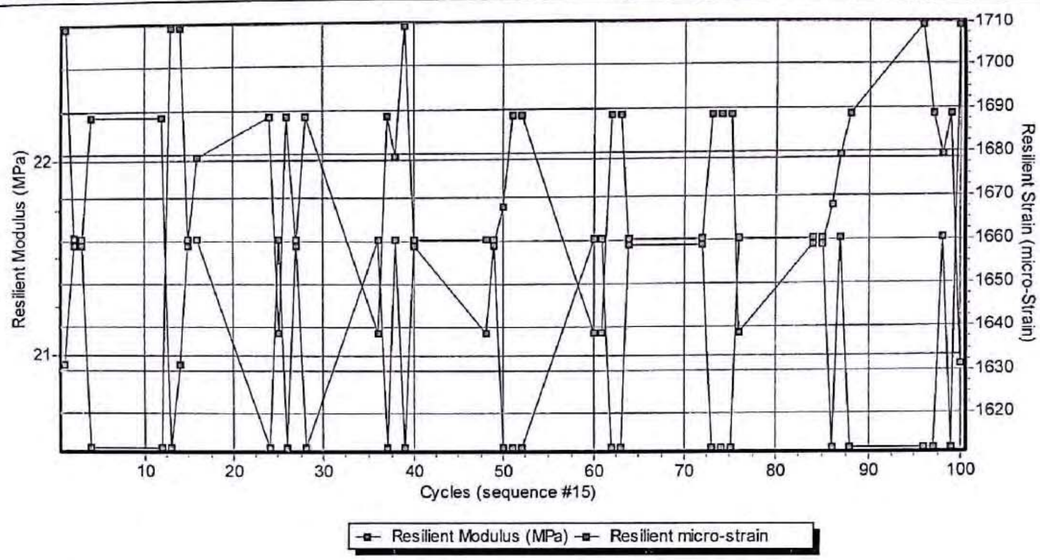
Comments/Properties: Sec Cantonments
BH_06
Depth: 12.0 - 12.45m
Wt: 2411g

10/3/2016 2:04:11 PM

**UTM_41 V1.01 Resilient Modulus Test**

Plate 1A: Typical Resilient Modulus Lab Result

FileName: C:\UTM4\UTM_41\Data\Sec Cantonments Property Development_[BH_02] BH_02_ ud_1.B41




Operator: Ekow

Test method: AASHTO DESIGNATION TP46-94 (Subgrade Soils)

Notes/comments: Medium Dense Light Reddish Brown Silty Clayey Gravelly CLAY

**Sequence Number: 15**

Test start date and time: Wednesday, September 7, 2016, at 1:43 PM

| Cycle number | 96 | 97 | 98 | 99 | 100 | Average | Std Dev. |
|---|---|---|---|---|---|---|---|
| Resilient Modulus (MPa) | 22.7 | 22.2 | 22.0 | 22.2 | 21.0 | 22.0 | 0.645 |
| Resilient micro-strain | 1611.7 | 1611.7 | 1660.6 | 1611.7 | 1709.4 | 1641.0 | 43.684 |
| Confining pressure (kPa) | 13.2 | 12.9 | 13.5 | 13.2 | 13.2 | 13.2 | 0.207 |
| Maximum stress (kPa) | 229.1 | 228.3 | 228.3 | 228.3 | 228.3 | 228.5 | 0.334 |
| Cyclic stress (kPa) | 36.6 | 35.8 | 36.6 | 35.8 | 35.8 | 36.1 | 0.409 |
| Contact stress (kPa) | 192.5 | 192.5 | 191.8 | 192.5 | 192.5 | 192.4 | 0.334 |
| Permanent strain (%) | 0.134 | 0.134 | 0.132 | 0.134 | 0.132 | | |
| Maximum load (kN) | 0.450 | 0.448 | 0.448 | 0.448 | 0.448 | 0.449 | 0.001 |
| Cyclic load (kN) | 0.072 | 0.070 | 0.072 | 0.070 | 0.070 | 0.071 | 0.001 |
| Contact load (kN) | 0.378 | 0.378 | 0.377 | 0.378 | 0.378 | 0.378 | 0.001 |
| Average resilient def. (mm) | 0.081 | 0.081 | 0.083 | 0.081 | 0.086 | 0.082 | 0.002 |
| Axial 1 resilient def. (mm) | 0.161 | 0.161 | 0.166 | 0.161 | 0.171 | 0.164 | 0.004 |
| Axial 2 resilient def. (mm) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Actuator resilient def. (mm) | 0.168 | 0.168 | 0.176 | 0.168 | 0.168 | 0.170 | 0.003 |
| Average permanent def. (mm) | 0.134 | 0.134 | 0.132 | 0.134 | 0.132 | | |
| Axial 1 permanent def. (mm) | 0.269 | 0.269 | 0.264 | 0.269 | 0.264 | | |
| Axial 2 permanent def. (mm) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | | |
| Actuator permanent def. (mm) | 0.271 | 0.271 | 0.271 | 0.271 | 0.271 | | |

Shear test start date and time: Wednesday, September 7, 2016, at 2:14 PM

| | | | |
|---|---|---|---|
| Shear test time (sec): | 40 | Current shear load (kN): | 0.494 |
| Confining pressure (kPa): | 26.7 | Maximum shear load (kN): | 0.494 |
| Actuator deformation (mm): | 0.945 | Current shear stress (kPa): | 251.5 |
| Actuator strain (%): | 0.945 | Maximum shear stress (kPa): | 251.5 |

**Specimen Information**

Identification: Sec Cantonments Property Development_[BH_02]

Core/Sample Number: BH_02_ud_1

| Dimensions | Point 1 | Point 2 | Point 3 | Point 4 | Point 5 | Point 6 | Average | Std Dev. |
|---|---|---|---|---|---|---|---|---|
| Diameter (mm) | 50 | | | | | | 50 | |
| Height (mm) | 100 | | | | | | 100 | |

Cross-Sectional Area: 1963.495

Volume: 196349.5

Comments/Properties: Sec Cantoments
BH_02
Depth:10.5 - 10.95m
Wt: 267.2g

10/3/2016 2:15:18 PM

UTM_41 V1.01 Resilient Modulus Test

Plate 1B: Typical Resilient Modulus Lab Result

# APPENDIX 4

## Plates 1 – 4: Typical Site Photographs


Plate 1 : Setting out at Location BH4


Plate 2 : Percussion drill rig positioning at location BH6


Plate 3 : Sinking of trial pit at TP1


Plate 4 : Soil profile at TP1

Plate 5 : Sinking of Trial Pit at TP3

Plate 6 : SPT showing reddish brown light yellowish silty clayey sand with lateralized gravel.

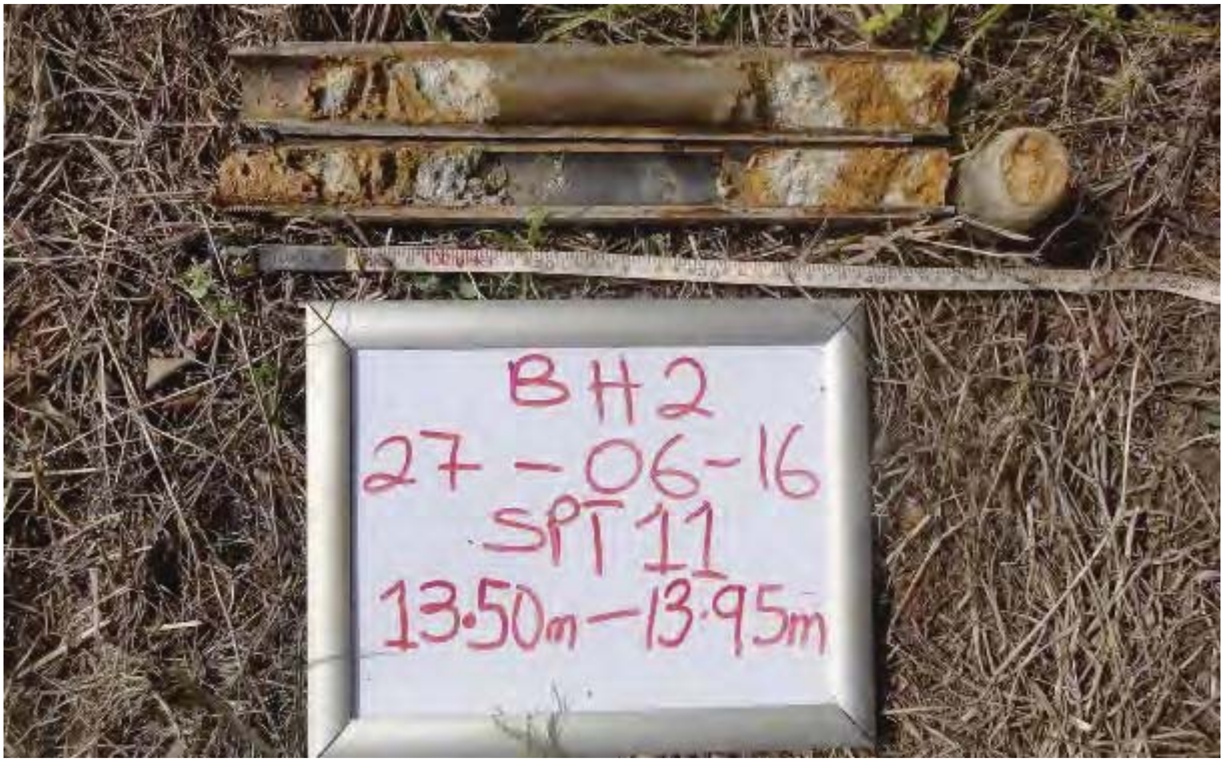


Plate 7: SPT showing Light yellow grey-greenish silty sandy clay with decomposed rock fragments

# APPENDIX 5

Copy of transmittal letter from GHA Lab.

# GHANA HIGHWAY AUTHORITY

In case of reply the number and date of this letter should be quoted

Our Ref. GHA/CML/TF.13/109

Your Ref. ..........................

Tel. 0302 -664627-9
0302 - 666591-4
0302 - 664620-3
Fax. 233 302 665571/664627

REPUBLIC OF GHANA

HEAD OFFICE
P.O.BOX 1641
ACCRA

03 - 10 - 16

**The Managing Director**
**K. E. & T Consult**
**Accra**

Dear Sir,

**<u>SEC CANTONMENTS PROPERTY DEVELOPMENT</u>**

Please find attached test results for the following:

a) Grading test on soil samples
b) Resilient Modulus test
c) Triaxial tests
d) Index properties of soil samples etc.

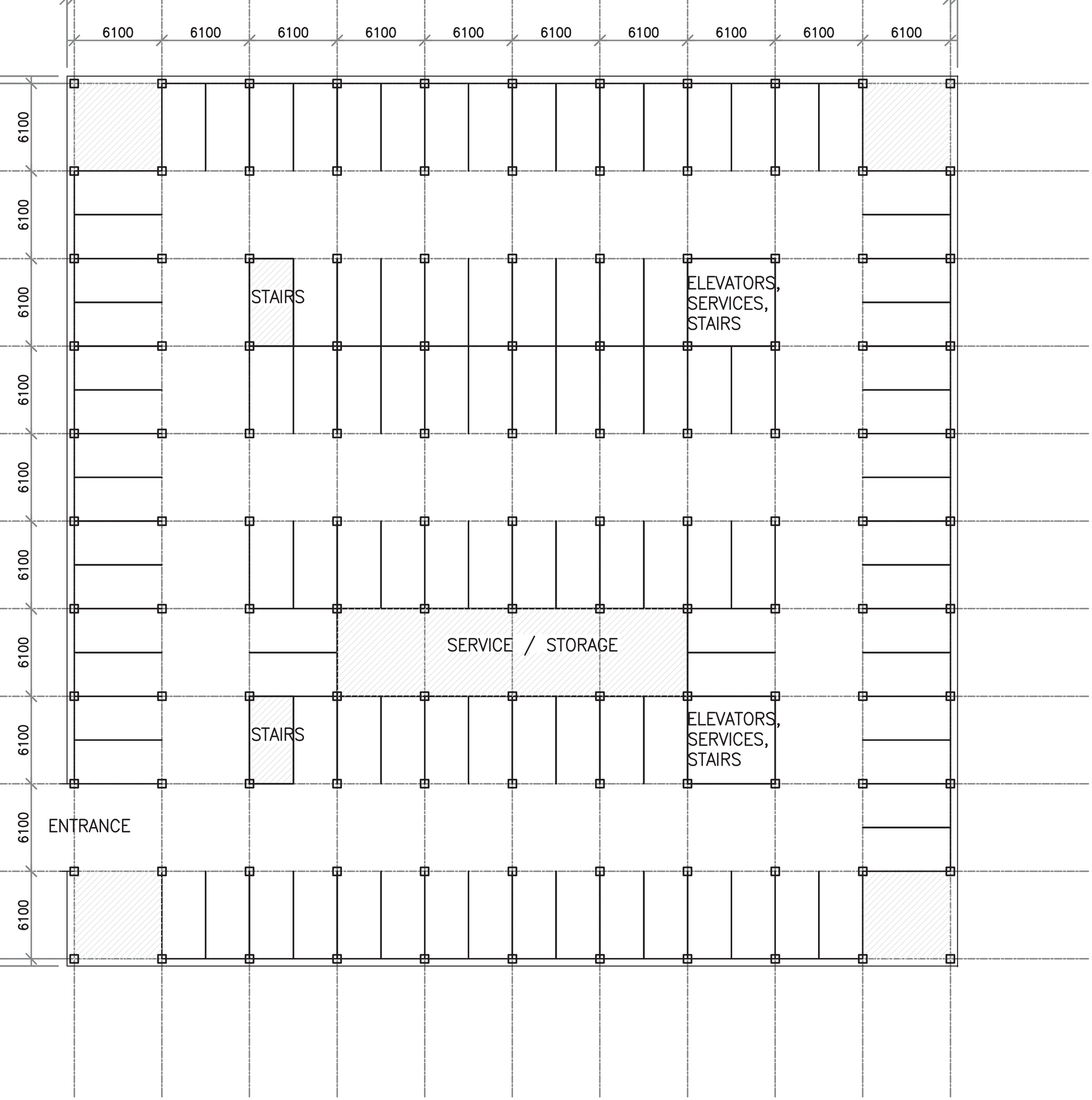
The test results are as requested

Yours faithfully,

**NANA KWESI AGYEPONG**
(Director of Materials)
**For: CHIEF EXECUTIVE**

Copies: Director of Materials
Director of Audit

# Appendix C – Typical Sub-grade Parking Floor Layouts



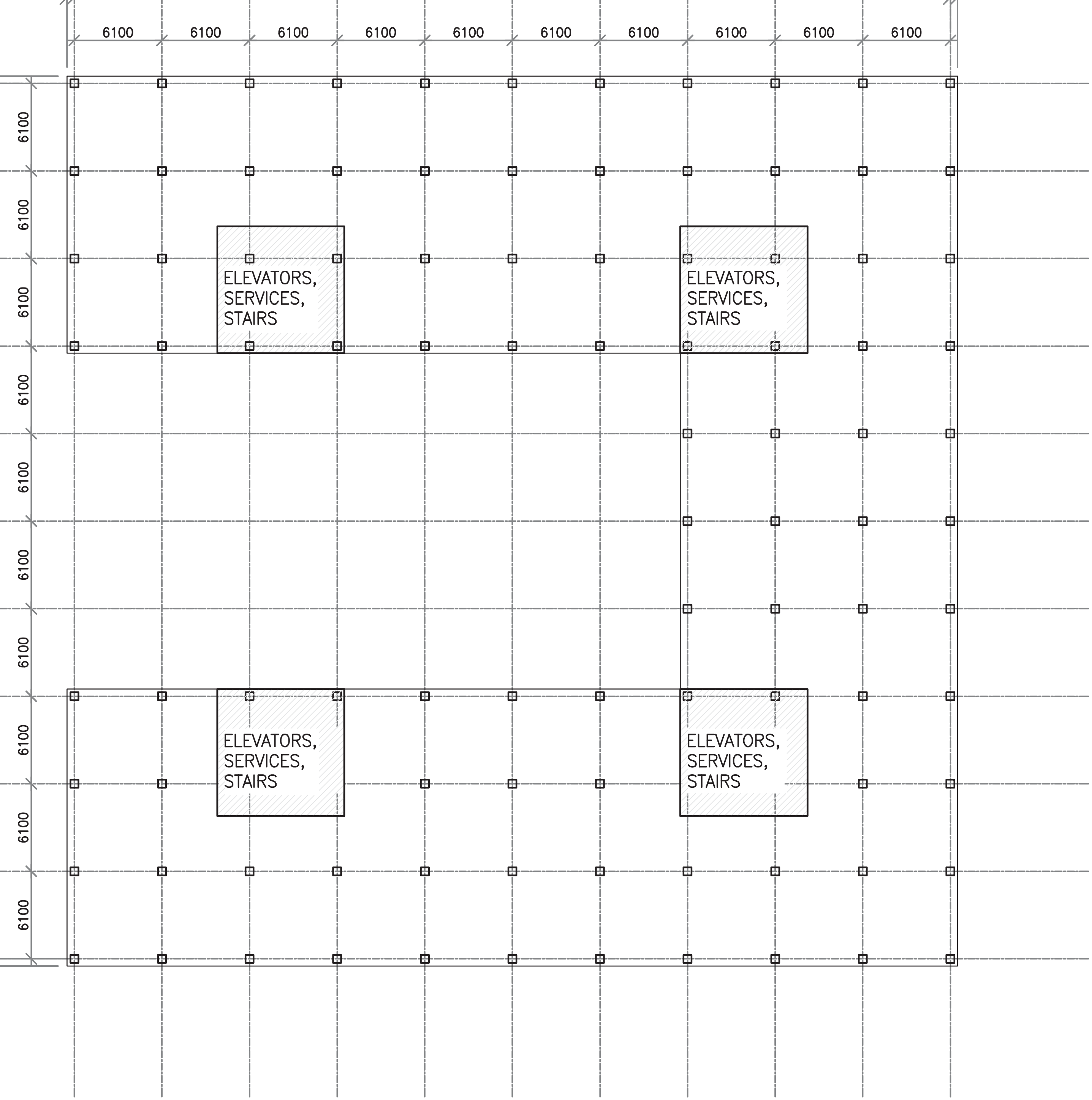

FEASIBILITY STUDY PLAN

TYPICAL PARKING FLOOR LAYOUT

| Date | Scale | Designed | Drawn | Checked | Approved |
|---|---|---|---|---|---|
| SEP 29/16 | 1:400 | #### | #### | #### | #### |

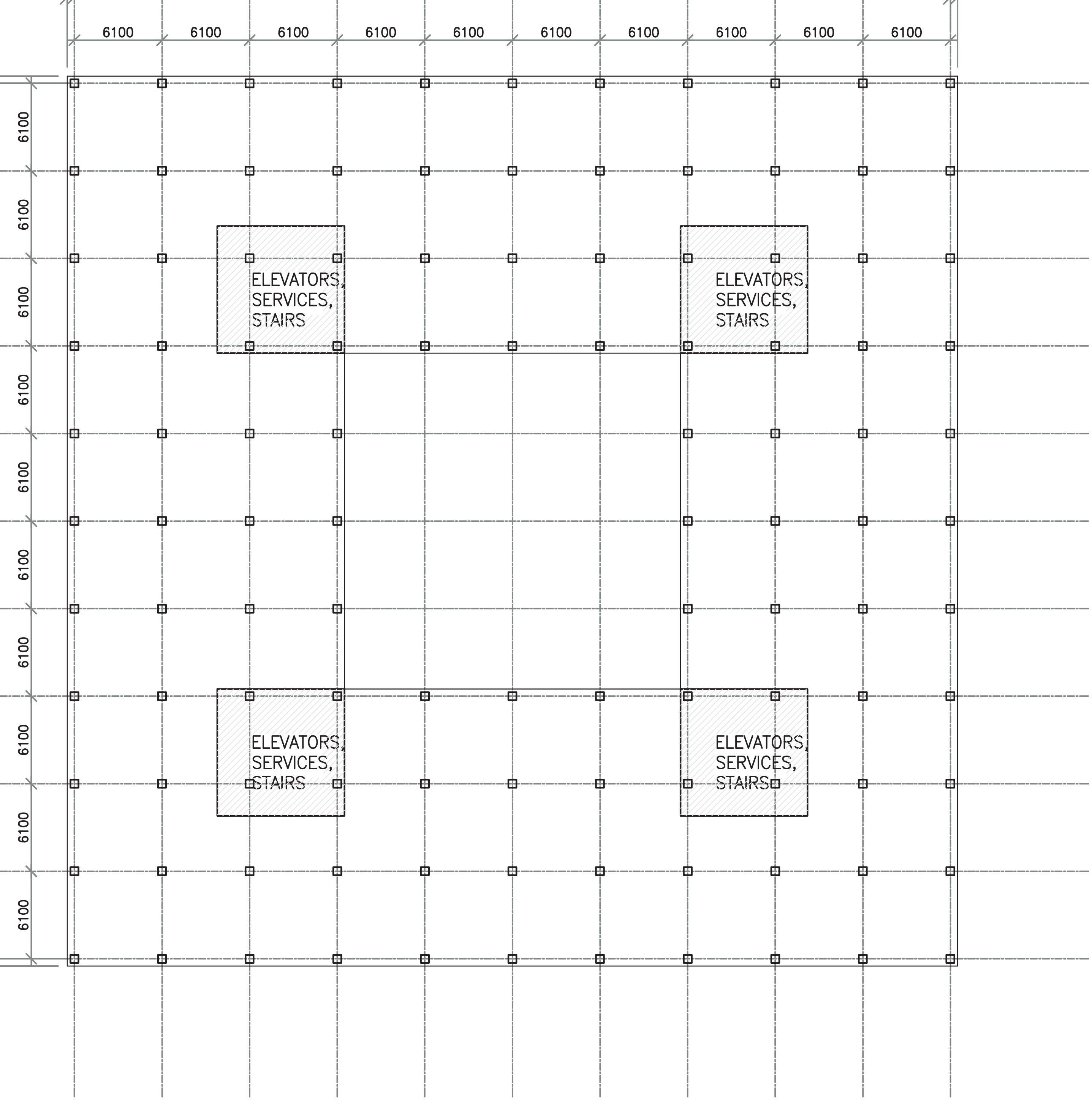
Sub-Grade Parking Layout

# Appendix D – Retail, General Office and Residential Floor Layouts




FEASIBILITY STUDY PLAN
LEVEL 1 FLOOR LAYOUT

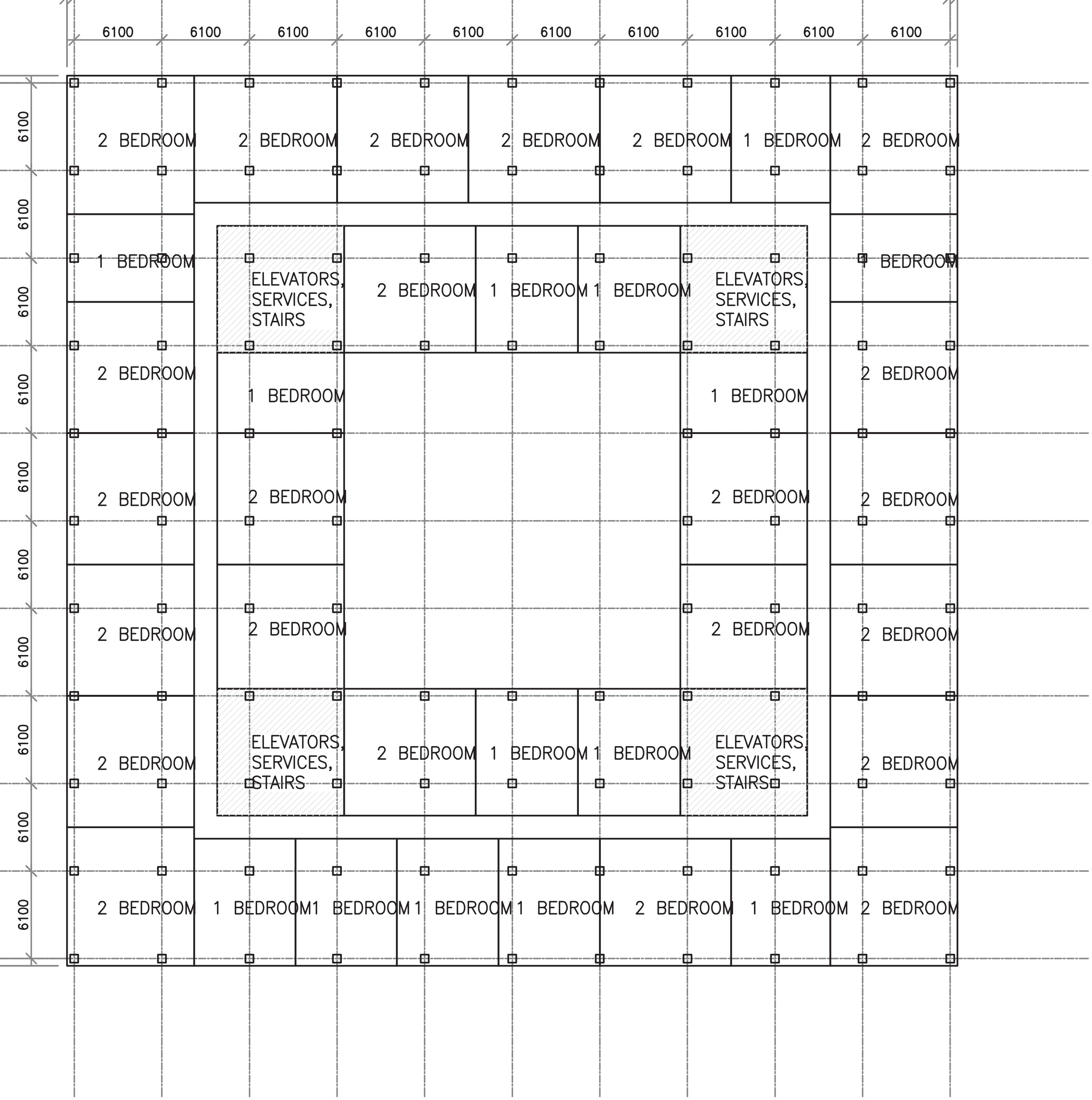
| Date | Scale | Designed | Drawn | Checked | Approved |
| --- | --- | --- | --- | --- | --- |
| SEP 29/16 | 1:400 | #### | #### | #### | #### |




FEASIBILITY STUDY PLAN

TYPICAL COMMERCIAL/OFFICE FLOOR LAYOUT

| Date | Scale | Designed | Drawn | Checked | Approved |
|---|---|---|---|---|---|
| SEP 29/16 | 1:400 | #### | #### | #### | #### |



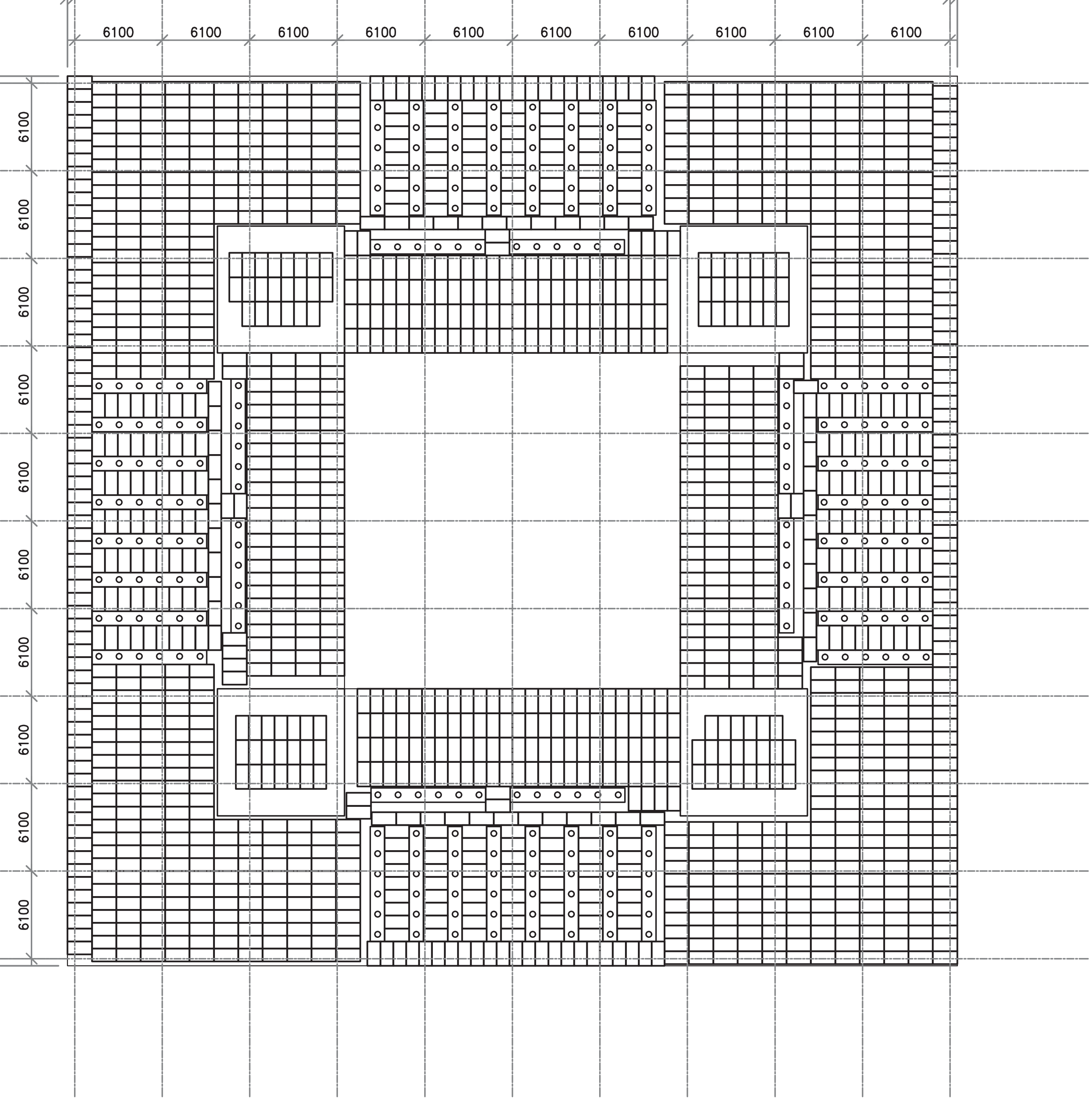

FEASIBILITY STUDY PLAN

TYPICAL RESIDENTIAL FLOOR LAYOUT

1 BEDROOM UNITS – 14

| Date | Scale | Designed | Drawn | Checked | Approved |
|---|---|---|---|---|---|
| SEP 29/16 | 1:400 | #### | #### | #### | #### |

# Appendix E – Typical Roof Layout




FEASIBILITY STUDY PLAN
TYPICAL ROOF LAYOUT

| Date | Scale | Designed | Drawn | Checked | Approved |
| --- | --- | --- | --- | --- | --- |
| SEP 29/16 | 1:400 | #### | #### | #### | #### |

# Appendix F – PV Analysis Date

**North Facing Array - 198 kwp**
**Accra - Ghana**

# Grid system presizing

| | | | | |
|---|---|---|---|---|
| **Geographical Site** | **Accra** | | Country | **Ghana** |
| **Situation** | Latitude | 5.6°N | Longitude | 0.2°W |
| Time defined as | Solar Time | | Altitude | 59 m |
| **Collector Plane Orientation** | Tilt | 15° | Azimuth | 180° |

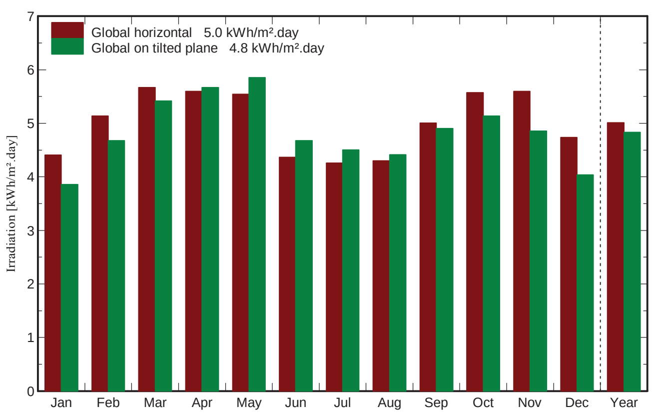
## PV-field installation main features

| | |
|---|---|
| Module type | Standard |
| Technology | Polycrystalline cells |
| Mounting method | Facade or tilt roof |
| Back ventilation properties | Ventilated |

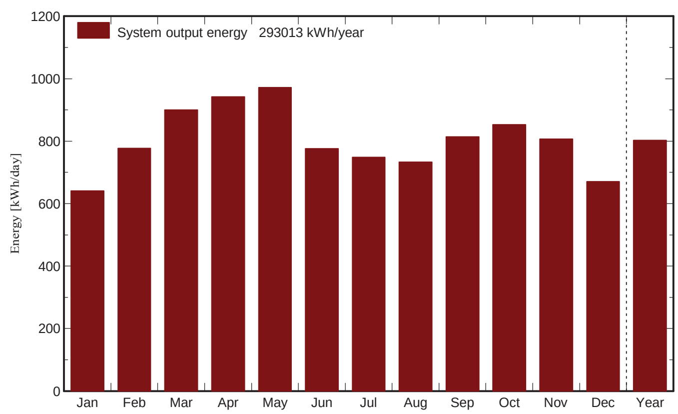
## System characteristics and pre-sizing evaluation

| | | | | | |
|---|---|---|---|---|---|
| PV-field nominal power (STC) | Pnom | 198 kWp | | | |
| Collector area | Acoll | 1318 m² | | | |
| Annual energy yield | Eyear | 293 MWh | Specific yield | 1483 | kWh/kWp |
| Economic gross evaluation | Investment | 482758 US$ | Energy price | 0.14 | US$/kWh |

### Meteo and incident energy




### System output




| | Gl. horiz. kWh/m².day | Coll. Plane kWh/m².day | System output kWh/day | System output kWh |
|---|---|---|---|---|
| **Jan.** | 4.41 | 3.86 | 641.0 | 19870 |
| **Feb.** | 5.14 | 4.68 | 777.0 | 21757 |
| **Mar.** | 5.67 | 5.42 | 899.7 | 27891 |
| **Apr.** | 5.60 | 5.67 | 942.0 | 28260 |
| **May** | 5.54 | 5.85 | 972.2 | 30139 |
| **June** | 4.37 | 4.68 | 776.6 | 23299 |
| **July** | 4.26 | 4.51 | 748.5 | 23203 |
| **Aug.** | 4.30 | 4.41 | 732.8 | 22718 |
| **Sep.** | 5.00 | 4.90 | 814.6 | 24438 |
| **Oct.** | 5.57 | 5.14 | 853.3 | 26452 |
| **Nov.** | 5.60 | 4.86 | 806.9 | 24207 |
| **Dec.** | 4.74 | 4.04 | 670.3 | 20778 |
| **Year** | 5.01 | 4.83 | 802.8 | 293013 |

**South Facing Array - 198 kWp**
**Accra - Ghana**

# Grid system presizing

| | | | |
|---|---|---|---|
| **Geographical Site** | **Accra** | Country | **Ghana** |
| **Situation** | Latitude 5.6°N | Longitude | 0.2°W |
| Time defined as | Solar Time | Altitude | 59 m |
| **Collector Plane Orientation** | Tilt 15° | Azimuth | 0° |

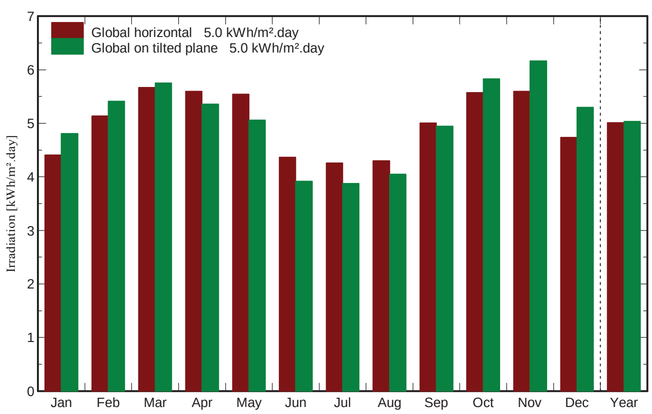
## PV-field installation main features

| | |
|---|---|
| Module type | Standard |
| Technology | Polycrystalline cells |
| Mounting method | Facade or tilt roof |
| Back ventilation properties | Ventilated |

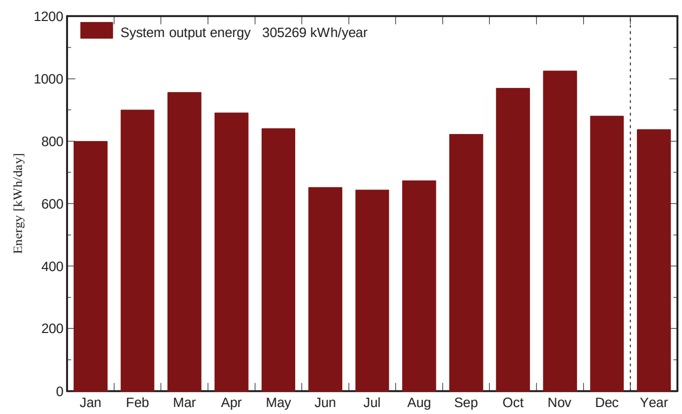
## System characteristics and pre-sizing evaluation

| | | | | | |
|---|---|---|---|---|---|
| PV-field nominal power (STC) | Pnom | 198 kWp | | | |
| Collector area | Acoll | 1318 m² | | | |
| Annual energy yield | Eyear | 305 MWh | Specific yield | 1545 | kWh/kWp |
| Economic gross evaluation | Investment | 482758 US$ | Energy price | 0.14 | US$/kWh |

### Meteo and incident energy




### System output




| | Gl. horiz. kWh/m².day | Coll. Plane kWh/m².day | System output kWh/day | System output kWh |
|---|---|---|---|---|
| **Jan.** | 4.41 | 4.81 | 798.4 | 24751 |
| **Feb.** | 5.14 | 5.41 | 898.7 | 25165 |
| **Mar.** | 5.67 | 5.75 | 955.2 | 29612 |
| **Apr.** | 5.60 | 5.36 | 889.5 | 26686 |
| **May** | 5.54 | 5.06 | 840.1 | 26043 |
| **June** | 4.37 | 3.92 | 650.9 | 19527 |
| **July** | 4.26 | 3.87 | 643.5 | 19949 |
| **Aug.** | 4.30 | 4.05 | 672.8 | 20857 |
| **Sep.** | 5.00 | 4.95 | 821.7 | 24651 |
| **Oct.** | 5.57 | 5.83 | 968.9 | 30035 |
| **Nov.** | 5.60 | 6.17 | 1024 | 30720 |
| **Dec.** | 4.74 | 5.30 | 879.8 | 27274 |
| **Year** | 5.01 | 5.04 | 836.4 | 305269 |

# Appendix G – Commissioning Process and Activities

## Commissioning Process and Activities

The commissioning process includes activities in both the design and construction phase. These activities generally include the following:

- Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
- Verify and document proper performance of equipment and systems.
- Verify that O&M documentation left on site is complete.
- Verify that the Owner's operating personnel are adequately trained.
- Conduct a review of the design prior to the construction documents phase.
- Conduct a review of the construction documents near completion of the construction document development and prior to issuing the contract documents for construction.
- Review the contractor submittals relative to systems being commissioned.
- Provide the owner with a single manual that contains the information required for re-commissioning building systems.
- Have a contract in place to review building operation with O&M staff, including:
- A plan for how occupants may report IAQ concerns, the subsequent investigation process and how they will be reported back to the occupant.
- A plan for resolution of outstanding commissioning-related issues within one year after construction completion date.

The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product in compliance with their contracts and the construction documents. It does however add additional requirements for the contractor to document and demonstrate the system operation.

The Commissioning Authority (CxA) needs to be a qualified professional with demonstrated experience. For the LEED EA prerequisite, the CxA can be a member of the design team organization or firm however should be independent from the design (i.e. cannot be the lead mechanical designer for the building). The CxA can also be an independent contractor/consultant, qualified employee of the Owner/Proponent or employee of one of the construction team firms. In all cases, they should report directly to the Proponent (or their representative) on all matters relating to commissioning of the building systems. Minimum qualifications for the CxA include:

- Documented commissioning process experience on a minimum of two (2) projects of similar scope and this experience must be demonstrated from early in the design process through a minimum of ten (10) months of occupancy.

Should the Proponent choose to pursue the LEED credit for Enhanced Commissioning, the CxA must be completely independent of the design and construction firm.

The members of the commissioning team consist of the Commissioning authority (CxA), the Project Manager (PM), the Construction Manager (CM), the architect and design engineers (particularly the mechanical engineer), the Mechanical Contractor (MC), the Electrical Contractor (EC), the Testing and Balancing (TAB) representative, the Controls Contractor (CC), any other installing subcontractors or suppliers of equipment. If known, the Owner's building or plant operator/engineer is also a member of the commissioning team.

The CM, according to established protocols, is responsible to schedule the commissioning activities and provide sufficient notice to the PM and CxA. The CM will integrate all commissioning activities into the master design and construction schedule. All parties will collaborate to address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

### Responsibilities

The responsibilities of various parties in the commissioning process are provided in this section. The responsibilities of the mechanical contractor, TAB, controls contractor and electrical contractor are typically identified in the Tender documentation.

All Parties are required to:

- Follow the Commissioning Plan.
- Attend commissioning scoping meeting and additional meetings, as necessary.

Architect (of A/E)

- Construction and Acceptance Phase
    - PM or Architect manages the CxA contract if not included directly on the Proponents team.
    - Attend the commissioning scoping meeting and selected commissioning team meetings.
    - Perform normal submittal review, construction observation, as-built drawing preparation, O&M manual preparation, etc., as contracted.
    - Provide any design narrative documentation requested by the CxA.
    - Coordinate resolution of system deficiencies identified during commissioning, according to the contract documents.

Mechanical and Electrical Designers/Engineers (of the A/E)

- Construction and Acceptance Phase
    - Perform normal submittal review, construction observation, and as-built drawing preparation, as contracted. One site observation should be completed just prior to system start-up.
    - Provide any design narrative and sequences documentation requested by the CA. The designers shall assist (along with the contractors) in clarifying the operation and control of commissioned equipment in areas where the specifications, control

drawings or equipment documentation is not sufficient for writing detailed testing procedures.

- Attend commissioning scoping meetings and other selected commissioning team meetings.
- Participate in the resolution of system deficiencies identified during commissioning, according to the contract documents.

- Commissioning Authority (CA): The CA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CA may assist with problem-solving non-conformance or deficiencies, but ultimately that responsibility resides with the Construction Manager and the A/E. The primary role of the CA is to witness the execution of a testing plan, observe and document performance—that systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. The Contractors will provide all tools or the use of tools to start, check-out and functionally test equipment and systems, except for specified testing with portable data-loggers, which shall be supplied and installed by the CA.

- Pre-Construction Phase.
  - Complete a design review prior to construction documents phase.
  - Complete a review of construction documents near the completion of the construction document development and prior to issuing contract documents for construction.
- Construction and Acceptance Phase
  - Witnesses commissioning activities and receives test forms from the CM for inclusion in the final commissioning plan being compiled for the Owner.
  - Revise, as necessary, the Commissioning Plan-Construction Phase.
  - Attend commissioning scoping meeting and other commissioning meetings organized by the CM.
  - Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures.
  - Before start-up, gather and review the current control sequences and interlocks and work with contractors and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.
  - Review and approve normal Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews.
  - Review and approve prefunctional tests and checklists.
  - Review and approve start-up and initial systems checkout plan with Subs.
  - Perform site visits, as necessary, to observe component and system installations. Attends selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitutions relating to the commissioning process. Assist in resolving any discrepancies.

- Witness all or part of the HVAC piping test and flushing procedure, sufficient to be confident that proper procedures were followed. Receive documentation on this testing and include the documentation in O&M manuals. Notify owner's project manager of any deficiencies in results or procedures.
- Witness all or part of any ductwork testing and cleaning procedures, sufficient to be confident that proper procedures were followed. Receive documentation on this testing and include the documentation in O&M manuals. Notify owner's project manager of any deficiencies in results or procedures.
- Review and approve prefunctional tests and checklist completion by reviewing prefunctional checklist reports and by selected site observation and spot checking.
- Review and approve systems start-up by reviewing start-up reports and by selected site observation.
- Review TAB execution plan.
- Oversee sufficient functional testing of the control system and approve it to be used for TAB, before TAB is executed.
- Approve air and water systems balancing by spot testing, by reviewing completed reports and by selected site observation.
- Review and approve the functional performance test procedures for equipment and systems. This may include energy management control system trending, stand-alone datalogger monitoring or manual functional testing.
- Analyze any functional performance trend logs and monitoring data to verify performance.
- Coordinate, witness and approve manual functional performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved. Perform actual functional testing without contractors on equipment so specified in Sections 01 91 34 and 01 91 38.
- Maintain a master deficiency and resolution log and a separate testing record. Provide the PM with written progress reports and test results with recommended actions.
- Review equipment warranties to ensure that the Owner's responsibilities are clearly defined.
- Approve the training of the Owner's operating personnel.
- Compile and maintain a commissioning record and building systems book(s).
- Review and approve the preparation of the O&M manuals.
- Work with the Owner's O&M personnel to develop a plan for how occupants may report IAQ concerns, the subsequent investigation process and how they will be reported back to the occupant.
- Work with the Owner's O&M personnel to prepare a plan for resolution of outstanding commissioning-related issued within one year after construction complete date.
- Provide a final commissioning report (as described in this section).

Manager-Owner's Representative (PM)

- Construction and Acceptance Phase

    - Facilitate the coordination of the commissioning work by the CA, and, with the CM and CA, ensure that commissioning activities are being scheduled into the master schedule.
    - Review and approve the final Commissioning Plan—Construction Phase.
    - Attend a commissioning scoping meeting and other commissioning team meetings.
    - Perform the normal review of Contractor submittals.
    - Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CA.
    - Review and approve the functional performance test procedures submitted by the CA, prior to testing.
    - When necessary, observe and witness prefunctional checklists, start-up and functional testing of selected equipment.
    - Review commissioning progress and deficiency reports.
    - Coordinate the resolution of non-compliance and design deficiencies identified in all phases of commissioning.
    - Sign-off (final approval) on individual commissioning tests as completed and passing. Recommend completion of the commissioning process to the Project Manager.
    - Assist the CM in coordinating the training of owner personnel.
- *Warranty Period*
    - Assist the CA as necessary in the seasonal or deferred testing and deficiency corrections required by the specifications.

Construction Manager (CM)

- *Construction and Acceptance Phase*
    - Facilitate commissioning work and report and provide documentation to the CA. Ensure that commissioning activities are being scheduled into the master schedule.
    - Include the cost of commissioning in the total contract price.
    - Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CA.
    - In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks and training.
    - Ensure that all Subs execute their commissioning responsibilities according to the Contract Documents and schedule.
    - A representative shall attend a commissioning scoping meeting and other necessary meetings to facilitate the Cx process.
    - Coordinate the training of owner personnel.
    - Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.
- Warranty Period
    - Ensure that Subs correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified.

Equipment Suppliers

- Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
- Assist in equipment testing per agreements with Subs. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor, except for stand-alone datalogging equipment that may be used by the CA. Through the contractors they supply products to, analyze specified products and verify that the designer has specified the newest most updated equipment reasonable for this project's scope and budget.
- Provide information requested by CA regarding equipment sequence of operation and testing procedures.
- Review test procedures for equipment installed by factory representatives.

### Terminology and Definitions

Acceptance Phase - phase of construction after start-up and initial checkout when functional performance tests, O&M documentation review and training occurs.

Approval - acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the Contract Documents.

Architect/Engineer (A/E) - the prime consultant (architect) and sub-consultants who comprise the design team, generally the HVAC mechanical designer/engineer and the electrical designer/engineer.

Basis of Design - The basis of design is the documentation of the primary thought processes and assumptions behind design decisions that were made to meet the design intent. The basis of design describes the systems, components, conditions and methods chosen to meet the intent. Some reiterating of the design intent may be included.

Commissioning Authority (CA) - an independent agent, not otherwise associated with the A/E team members or the Contractor, though he/she may be hired as a subcontractor to them. The CA directs and coordinates the day-to-day commissioning activities. The CA does not take an oversight role like the CM. The CA is part of the Construction team or shall report directly to the CM.

Commissioning Plan - an overall plan, developed before or after bidding, that provides the structure, schedule and coordination planning for the commissioning process.

Construction Manager (CM) – the firm responsible for overall planning, coordination and control of the project. The CM is responsible for:

- Specifying project objectives and plans including delineation of scope, budgeting, scheduling, setting performance requirements, selecting project participants.
- Maximizing resource efficiency through procurement of labour, materials and equipment.
- Implementing various operations through proper coordination and control of planning, design, estimating, contracting, and construction in the entire process.

- Developing effective communications and mechanisms for resolving conflicts.

Contract Documents - the documents binding on parties involved in the construction of this project (drawings, specifications, change orders, amendments, contracts, Cx Plan, etc.).

Contractor - the contractor or authorized representative.

Control System - the central building energy management control system.

Datalogging - monitoring flows, currents, status, pressures, etc. of equipment using stand-alone dataloggers separate from the control system.

Deferred Functional Tests - FTs that are performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions that disallow the test from being performed.

Deficiency - a condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not complying with the design intent).

Design Intent - a dynamic document that provides the explanation of the ideas, concepts and criteria that are considered to be very important to the owner. It is initially the outcome of the programming and conceptual design phases.

Design Narrative or Design Documentation - sections of either the Design Intent or Basis of Design.

Factory Testing - testing of equipment on-site or at the factory by factory personnel with an Owner's representative present.

Functional Performance Test (FT) - test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The Systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not functional testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. FTs are performed after prefunctional checklists and start-up are complete.

Indirect Indicators - indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100% closed.

Manual Test - using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the “observation”).

Monitoring - the recording of parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of control systems.

Non-Compliance - see Deficiency.

Non-Conformance - see Deficiency.

Over-written Value - writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 10°C to ¯25°C to verify economizer operation). See also “Simulated Signal.”

Owner-Contracted Tests - tests paid for by the Owner outside the CM’s contract and for which the CA does not oversee. These tests will not be repeated during functional tests if properly documented.

Phased Commissioning - commissioning that is completed in phases (by floors, for example) due to the size of the structure or other scheduling issues, in order minimize the total construction time.

Prefunctional Checklist (PC) - a list of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by the CA to the Sub. Prefunctional checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some prefunctional checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three phase pump motor of a chiller system). The word prefunctional refers to before functional testing. Prefunctional checklists augment and are combined with the manufacturer’s start-up checklist. Even without a commissioning process, contractors typically perform some, if not many, of the prefunctional checklist items. However, few contractors document in writing the execution of these checklist items. Therefore, for most equipment, the contractors execute the checklists on their own. The commissioning authority only requires that the procedures be documented in writing, and does not witness much of the prefunctional checklisting, except for larger or more critical pieces of equipment.

Project Manager (PM) - the contracting and managing authority for the owner over the design and/or construction of the project.

Sampling - functionally testing only a fraction of the total number of identical or near identical pieces of equipment. Refer to Section 01 91 13, for details.

Seasonal Performance Tests - FT that are deferred until the system(s) will experience conditions closer to their design conditions.

Simulated Condition - condition that is created for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box).

Simulated Signal - disconnecting a sensor and using a signal generator to send an amperage, resistance or pressure to the transducer and DDC system to simulate a sensor value.

Specifications - the construction specifications of the Contract Documents.

Start-up - the initial starting or activating of dynamic equipment, including executing prefunctional checklists.

Subs - the subcontractors to the CM who provide and install building components and systems.

Test Procedures - the step-by-step process which must be executed to fulfill the test requirements. The test procedures are developed by the CA.

Test Requirements - requirements specifying what modes and functions, etc. shall be tested. The test requirements are not the detailed test procedures. The test requirements are specified in the Contract Documents (Sections 01 91 34; 01 91 38, etc.).

Trending - monitoring using the building control system.

Vendor - supplier of equipment.

Warranty Period - warranty period for entire project, including equipment components. Warranty begins at Substantial Completion and extends for at least one year, unless specifically noted otherwise in the Contract Documents and accepted submittals.

### Reporting

The CxA is engaged directly by the Owner/Proponent and will report to them as well as the overall project manager (PM). Testing or review approvals and non-conformance and deficiency reports generated by the CxA are made regularly. A final summary report (about four to six pages, not including backup documentation) by the CxA will be provided to the PM, focusing on evaluating commissioning process issues and identifying areas where the process could be improved. All acquired documentation, logs, minutes, reports, deficiency lists, communications, findings, unresolved issues, etc., will be compiled in appendices and provided with the summary report. Prefunctional checklists, functional tests and monitoring reports will not be part of the final report, but will be stored in the Commissioning Record in the O&M manuals.

### Submittals

The Commissioning authority will review and approve submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the functional performance of the equipment and adequacy for developing test procedures. This review is intended primarily to aid in the development of functional testing procedures and only secondarily to verify compliance with equipment specifications. The Commissioning authority will notify the CM, PM or A/E as requested, of items missing or areas that are not in conformance with Contract Documents and which require resubmission. The CxA may request additional design narrative from the A/E and Controls Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.These submittals to the CxA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, though the CxA will review and approve them.

### Start-Up Pre-Functional Checklists and Initial Checkout

The following procedures would apply to all equipment to be commissioned. Some systems that are not comprised so much of actual dynamic machinery, e.g., electrical system power quality, may have very simplified PCs and start-up.

- General. Prefunctional checklists are important to ensure that the equipment and systems are hooked up and operational. It ensures that functional performance testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full prefunctional checkout. No sampling strategies are used. The prefunctional testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.
- Start-up and Initial Checkout Plan. The CxA shall review all equipment. The primary role of the CxA in this process is to ensure that there is written documentation that each of the manufacturer-recommended procedures have been completed. Parties responsible for executing functional performance tests are identified in the testing requirements portions of the specifications
    - The CM and Subs adapt, if necessary, the representative prefunctional checklists and procedures as necessary. These checklists indicate required procedures to be executed as part of start-up and initial checkout of the systems and the party responsible for their execution.
    - These checklists and tests are provided by the Contractor to the CxA. The Contractor determines which trade is responsible for executing and documenting each of the line item tasks and notes that trade on the form. Each form will have more than one trade responsible for its execution.
    - The subcontractor responsible for the purchase of the equipment develops the full start-up plan by combining (or adding to) the checklists with the manufacturer's detailed start-up and checkout procedures from the O&M manual and the normally used field checkout sheets. The plan will include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan. The full start-up plan could consist of something as simple as:
        - The example prefunctional checklists.
        - The manufacturer's standard written start-up procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.

            - The manufacturer's normally used field checkout sheets.
    - The subcontractor submits the full start-up plan to the CxA for review and approval.
    - The CxA reviews and approves the procedures and the format for documenting them, noting any procedures that need to be added.
    - The full start-up procedures and the approval form may be provided to the CM for review and approval, depending on management protocol.
- Sensor and Actuator Calibration: All field-installed temperature, relative humidity and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described below. Alternate methods may be used, if approved by the Owner before-hand. All test instruments shall have had a certified calibration within the last 12 months. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.
    - All procedures used shall be fully documented on the prefunctional checklists or other suitable forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.
    - Sensor Calibration Methods:
        - All Sensors. Verify that all sensor locations are appropriate and away from causes of erratic operation. Verify that sensors with shielded cable, are grounded only at one end. For sensor pairs that are used to determine a temperature or pressure difference, make sure they are reading within 0.2°C of each other for temperature and within a tolerance equal to 2% of the reading, of each other, for pressure. Tolerances for critical applications may be tighter.
    - Sensors Without Transmitters:
        - Standard Application. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS)) is within the tolerances in the table below of the instrument-measured value. If not, install offset in BAS, calibrate or replace sensor.
    - Sensors With Transmitters:
        - Standard Application. Disconnect sensor. Connect a signal generator in place of sensor. Connect ammeter in series between transmitter and BAS control panel. Using manufacturer's resistance-temperature data, simulate minimum desired temperature. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the BAS. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction. Reconnect sensor. Make a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS)) is within the tolerances in the table below of the instrument- measured value. If not, replace sensor and repeat. For pressure sensors, perform a similar process with a suitable signal generator.
        - Tolerances, Standard Applications:

| Sensor | Required Tolerance (+/-) | | Sensor | Required Tolerance (+/-) |
|---|---|---|---|---|
| | | | | |
| Dehumidification coil, chilled and condenser water temps | 0.4C | | Flow rates, water<br>Relative humidity | 4% of design<br>4% of design |
| AHU wet bulb or dew point | 1.0C | | | |
| Hot water coil | 1.0C | | | |
| Steam to hot water converter hot water temperature | 1.0C | | | |
| Outside air, space air, duct air temps | 0.4C | | | |
| Watt-hour, voltage & amperage | 1% of design | | Barometric pressure | 0.3 kPa |
| Pressures, air, water and gas | 3% of design | | | |
| Flow rates, air | 10% of design | | | |

- Valve and Damper Stroke Setup and Check
  - EMS Readout: For all valve and damper actuator positions checked, verify the actual position against the BAS readout. Set pumps or fans to normal operating mode. Command valve or damper closed, visually verify that valve or damper is closed and adjust output zero signal as required. Command valve or damper open, verify position is full open and adjust output signal as required. Command valve or damper to a few intermediate positions. If actual valve or damper position doesn't reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

- Execution of Prefunctional Checklists and Start-up:
  - Four weeks prior to start-up, the Subs and vendors schedule start-up and checkout with the CM and CxA. The performance of the prefunctional checklists, start-up and checkout are directed and executed by the Sub or vendor. When checking off prefunctional checklists, signatures may be required of other Subs for verification of completion of their work.
  - The CxA shall observe, the procedures for each piece of primary equipment.
  - For lower-level components of equipment, (e.g., heaters, sensors, controllers), the CxA shall observe a sampling of the prefunctional and start-up procedures. The sampling shall be randomly selected by the CxA.
  - The Subs and vendors shall execute start-up and provide the CxA with a signed and dated copy of the completed start-up and prefunctional tests and checklists.
  - Only individuals that have direct knowledge and witnessed that a line item task on the prefunctional checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.
  - Deficiencies, Non-Conformance and Approval in Checklists and Start-up.
    - The Subs shall clearly list any outstanding items of the initial start-up and prefunctional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures

form and any outstanding deficiencies are provided to the CxA within two days of test completion.

- The CxA reviews the report and submits either a non-compliance report or an approval form to the Sub or CM. The CxA shall work with the Subs and vendors to correct and retest deficiencies or uncompleted items. The CxA will involve the CM and others as necessary. The installing Subs or vendors shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CxA as soon as outstanding items have been corrected and resubmit an updated start-up report and a Statement of Correction on the original non-compliance report. When satisfactorily completed, the CxA recommends approval of the execution of the checklists and start-up of each system to the CM using a standard form.

### Functional Performance Testing

This sub-section applies to all commissioning functional testing for all systems.

The objective of functional performance testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems. In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.

Using the testing parameters and requirements the CM and Subs shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. The CxA shall review owner-contracted, factory testing or required owner acceptance tests which the CxA is not responsible to oversee, including documentation format, and shall determine what further testing or format changes may be required to comply with the Specifications. Redundancy of testing shall be minimized. The purpose of any given specific test is to verify and document compliance with the stated criteria of acceptance given on the test form. The test procedure forms shall include (but not be limited to) the following information:

.1 System and equipment or component name(s)
.2 Equipment location and ID number
.3 Unique test ID number, and reference to unique prefunctional checklist and start-up documentation ID numbers for the piece of equipment
.4 Date
.5 Project name
.6 Participating parties
.7 A copy of the specification section describing the test requirements

.8 A copy of the specific sequence of operations or other specified parameters being verified
.9 Formulas used in any calculations
.10 Required pre-test field measurements
.11 Instructions for setting up the test.
.12 Special cautions, alarm limits, etc.
.13 Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format
.14 Acceptance criteria of proper performance with a Yes / No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.
.15 A section for comments
.16 Signatures and date block for the CxA

Functional performance testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone dataloggers. The CxA may substitute specified methods or require an additional method to be executed, other than what was specified, with the approval of the PM and CM. The CxA will determine which method is most appropriate for tests that do not have a method specified.

Simulating conditions (not by an overwritten value) shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.

Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.

Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.
Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the AC compressor lockout work at an outside air temperature below 19°C, when the outside air temperature is above 19°C, temporarily change the lockout setpoint to be 1°C above the current outside air temperature.

Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification is completed during prefunctional testing.

Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Sub executing the test shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Sub shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.

Sampling multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by Subs is allowed in prefunctional checklist execution.

A common sampling strategy referenced as the "xx% Sampling—yy% Failure Rule" is defined by the following example.

xx = the percent of the group of identical equipment to be included in each sample.
yy = the percent of the sample that if failing, will require another sample to be tested. The example below describes a 20% Sampling—10% Failure Rule.

- Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the "first sample."
- If 10% (yy) of the units in the first sample fail the functional performance tests, test another 20% of the group (the second sample).
- If 10% of the units in the second sample fail, test all remaining units in the whole group.
- If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CxA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.

The Subs shall provide sufficient notice to the CxA regarding their completion schedule for the prefunctional checklists and start-up of all equipment and systems. The CM will schedule functional tests through the PM, CxA and affected Subs. The CxA shall direct, witness and document the functional testing of all equipment and systems. The Subs shall execute the tests and provide written documentation. In general, functional testing is conducted after prefunctional testing and start-up has been satisfactorily completed. The control system is sufficiently tested and approved by the CxA before it is used for TAB or to verify performance of other components or systems. The air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.

## Functional Performance Testing

This sub-section applies to all commissioning functional testing for all systems.

The objective of functional performance testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems. In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.

Using the testing parameters and requirements the CM and Subs shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. The CxA shall review owner-contracted, factory testing or required owner acceptance tests which the CxA is not responsible to oversee, including documentation format, and shall determine what further testing or format changes may be required to comply with the Specifications. Redundancy of testing shall be minimized. The purpose of any given specific test is to verify and document compliance with the stated criteria of acceptance given on the test form. The test procedure forms shall include (but not be limited to) the following information:

- .1 System and equipment or component name(s)
- .2 Equipment location and ID number
- .3 Unique test ID number, and reference to unique prefunctional checklist and start-up documentation ID numbers for the piece of equipment
- .4 Date
- .5 Project name
- .6 Participating parties
- .7 A copy of the specification section describing the test requirements
- .8 A copy of the specific sequence of operations or other specified parameters being verified
- .9 Formulas used in any calculations
- .10 Required pre-test field measurements
- .11 Instructions for setting up the test.
- .12 Special cautions, alarm limits, etc.
- .13 Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format
- .14 Acceptance criteria of proper performance with a Yes / No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.
- .15 A section for comments
- .16 Signatures and date block for the CxA

Functional performance testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone dataloggers. The CxA may substitute specified methods or require an additional method to be executed, other than what was specified, with the approval of the PM and CM. The CxA will determine which method is most appropriate for tests that do not have a method specified.

Simulating conditions (not by an overwritten value) shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.

Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.

Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.
Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the AC compressor lockout work at an outside air temperature below 19°C, when the outside air temperature is above 19°C, temporarily change the lockout setpoint to be 1°C above the current outside air temperature.

Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification is completed during prefunctional testing.

Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Sub executing the test shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Sub shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.

Sampling multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by Subs is allowed in prefunctional checklist execution.

A common sampling strategy referenced as the "xx% Sampling—yy% Failure Rule" is defined by the following example.

xx = the percent of the group of identical equipment to be included in each sample.
yy = the percent of the sample that if failing, will require another sample to be tested. The example below describes a 20% Sampling—10% Failure Rule.

- Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the "first sample."
- If 10% (yy) of the units in the first sample fail the functional performance tests, test another 20% of the group (the second sample).
- If 10% of the units in the second sample fail, test all remaining units in the whole group.
- If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CxA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.

The Subs shall provide sufficient notice to the CxA regarding their completion schedule for the prefunctional checklists and start-up of all equipment and systems. The CM will schedule functional tests through the PM, CxA and affected Subs. The CxA shall direct, witness and document the functional testing of all equipment and systems. The Subs shall execute the tests and provide written documentation. In general, functional testing is conducted after prefunctional testing and start-up has been satisfactorily completed. The control system is sufficiently tested and approved by the CxA before it is used for TAB or to verify performance of other components or systems. The air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.

### Documentation, Non-Conformance and Approval of Tests

The CxA shall witness the results of all functional performance tests using the specific procedural forms developed for that purpose. Prior to testing, these forms shall be provided to the CxA for review and approval. The CxA will include the filled out forms in the O&M manuals.

Non-Conformance:

- The CxA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted and reported to the PM.
- Corrections of minor deficiencies identified may be made during the tests at the discretion of the CxA. In such cases the deficiency and resolution will be documented on the procedure form.
- Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CxA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the PM.

- As tests progress and a deficiency is identified, the CxA discusses the issue with the executing contractor.
  - When there is no dispute on the deficiency and the Sub accepts responsibility to correct it:
    - The CxA documents the deficiency and the Sub's response and intentions and they go on to another test or sequence. After the day's work, the CxA submits the non-compliance reports to the CM for signature, if required. A copy is provided to the Sub and CxA. The Sub corrects the deficiency, signs the statement of correction at the bottom of the non-compliance form certifying that the equipment is ready to be retested and sends it back to the CxA.
    - The CM reschedules the test and the test is repeated.
  - If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:
    - The deficiency shall be documented on the non-compliance form with the Sub's response and a copy given to the CxA, CM and PM and to the Sub representative assumed to be responsible.
    - Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the Project Manager.
    - The CxA documents the resolution process.
    - Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CxA. The CM reschedules the test and the test is repeated until satisfactory performance is achieved.
    - Cost of Retesting:
      - The cost for the Sub to retest a prefunctional or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the CM.
      - For a deficiency identified, not related to any prefunctional checklist or start-up fault, the following shall apply: The CxA and PM will direct the retesting of the equipment once at no "charge" to the CM for their time. However, the CxA's and PM's time for a second retest will be charged to the CM, who may choose to recover costs from the responsible Sub.
      - The time for the CxA and PM to direct any retesting required because a specific prefunctional checklist or start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be backcharged to the CM, who may choose to recover costs from the party responsible for executing the faulty prefunctional test.
      - The Contractor shall respond in writing to the CxA and PM at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning.

Discussion shall cover explanations of any disagreements and proposals for their resolution.

- The CxA retains the original non-conformance forms until the end of the project.
- Any required retesting by any contractor shall not be considered a justified reason for a claim of delay or for a time extension by the prime contractor.

- Failure Due to Manufacturer Defect:
  - If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the CM or PM. In such case, the Contractor shall provide the Owner with the following:
    - Within one week of notification from the CM or PM, the Contractor or manufacturer's representative shall examine all other identical units making a record of the findings. The findings shall be provided to the CM or PM within two weeks of the original notice.
    - Within two weeks of the original notification, the Contractor or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
    - The CM or PM will determine whether a replacement of all identical units or a repair is acceptable.
    - Two examples of the proposed solution will be installed by the Contractor and the CM will be allowed to test the installations for up to one week, upon which the CM or PM will decide whether to accept the solution.
    - Upon acceptance, the Contractor and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.
- Approval:
  - The CxA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CA and by the CM, if necessary. The CxA recommends acceptance of each test to the PM using a standard form. The PM gives final approval on each test using the same form, providing a signed copy to the CxA and the Contractor.

### Operation and Maintenance Manuals

Standard O&M Manuals shall be provided and include all product data and operational and maintenance information necessary. Prior to substantial completion, the CxA shall review the O&M manuals, documentation and redline as-builds for systems that were commissioned and verify compliance with the Specifications. The CxA will communicate deficiencies in the manuals to the CM, PM or A/E, as requested. Upon a successful review of the corrections, the CxA recommends approval and acceptance of these sections of the O&M manuals to the CM, PM or A/E. The CxA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated. This work does not supersede the A/E's review of the O&M manuals.

Commissioning Record in O&M Manuals:

- The CA is responsible to compile, organize and index the following commissioning data by equipment into labelled, indexed and tabbed, three-ring binders and deliver it to the PM. Three copies of the manuals will be provided. The format of the manuals shall be:

  *Tab I-1* Commissioning Plan
  *Tab I-2* Final Commissioning Report
  *Tab 01* System Type 1 (HRV, boiler system, etc.)
  *Sub-Tab A* Design narrative and criteria, sequences, approvals for Equipment 1
  *Sub-Tab B* Start-up plan and report, approvals, corrections, blank prefunctional checklists
  *Coloured Separator Sheets—for each equipment type (fans, pumps, chiller, etc.)*
  *Sub-Tab C Functional tests (completed), trending and analysis, approvals and corrections, training plan, record and approvals, blank functional test forms and a recommended re-commissioning schedule.*
  *Tab 02 System Type 2......repeat as per System 1*
  *Tab 03 Re-commissioning Plan*

- The final commissioning report shall include an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope and a general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the disposition of the commissioning authority regarding the adequacy of the equipment, documentation and training meeting the contract documents in the following areas:

  .1 Equipment meeting the equipment specifications,
  .2 Equipment installation,
  .3 Functional performance and efficiency,
  .4 Equipment documentation and design intent, and
  .5 Operator training. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. shall also be listed. Each non-compliance issue shall be referenced to the specific functional test, inspection, trend log, etc. where the deficiency is documented. The functional performance and efficiency section for each piece of equipment shall include a brief description of the verification method used (manual testing, BAS trend logs, data loggers, etc.) and include observations and conclusions from the testing.

### Training of Owner Personnel

The CM shall be responsible for training coordination and scheduling and ultimately for ensuring that training is completed to properly demonstrate the operation and maintenance of the commissioned systems.

### Written Work Products

The commissioning process generates a number of written work products that will be described in various parts of the Contract Specifications developed by the Proponent. The Commissioning Plan—Construction Phase, shall lists all the formal written work products, describes briefly their contents, who is responsible to create them, their due dates, who receives and approves them and the location of the specification to create them. In summary, the written products generally required for:

| | Product | Developed By |
|---|---|---|
| .1 | Final commissioning plan | CxA |
| .2 | Meeting minutes | CM, regular job meetings |
| .3 | Commissioning schedules | CM and PM |
| .4 | Equipment documentation submittals | Subs |
| .5 | Sequence clarifications | Subs and A/E as needed |
| .6 | Pre-functional checklists | |
| .7 | Start-up and initial checkout plan | Subs |
| .8 | Start-up and initial checkout forms filled out | Subs |
| .9 | Final TAB report | TAB |
| .10 | Issues log (deficiencies) | CxA |
| .11 | Commissioning Progress Record | CxA |
| .12 | Deficiency reports | CxA |
| .13 | Functional test forms | Subs, approved by CxA |
| .14 | Filled out functional tests | CM |
| .15 | O&M manuals | Subs |
| .16 | Final commissioning report | CxA |
| .17 | Misc. approvals | CxA |

### Base Building Operation and Maintenance

The successful proponent will be required to fully operate and maintain the facility to a satisfactory level. Conditions surrounding the level of satisfaction will form part of the contract documentation and subsequent negotiations with the proponents. The conditions will be in the form of key performance indicators (KPI's) that can be reviewed on an annual or semi-annual basis.

KPI's will be evaluated on both response time to address identified base building issues as well as execution/performance of the facility. Dependant on the conditions of the final contract, performance penalties may be imposed for non-compliance with the operational and maintenance requirements of the facility. Some of the key categories may include but are not necessarily limited to:

- Electrical power supply
- Telecommunications services
- Water and sewerage services
- HVAC system and personal comfort
- Cleaning of common areas (Tenant areas to be negotiated between Proponent and individual Tenants)
- Garbage Removal
- Pest Control
- Fire Protection System
- Security, CCTV and access control equipment and personnel
- General maintenance
- Glass and door operation
- Lighting replacement
- Locksmith services
- Interior painting
- Ceiling system repairs
- Plumbing maintenance
- Updating and replacement of signage and directories
- Administrative and insurances related directly to SEC space O&M

These services will be required for the general building, common area and services supplied to the individual Tenants. With the exception of the SEC space, services within the Tenant commercial and retail spaces that are the responsibility of the Tenant are not to be included in the operational and maintenance requirements of the Proponent.

Costing for the base building and SEC operational and maintenance requirements are provided in Chapter 7.

### Base Building Operation and Maintenance

As buildings, and their associated system, age they deteriorate to a level where they require a complete renewal or replacement. This is in addition to the ongoing operational and maintenance activities described in prior section. At a minimum, the proponent should be made to provide a detailed plan outlining the building systems renewal and associated financing program to demonstrate at the bidding period what future considerations are included in the offer. While it may be in the proponent's best interest to keep the building systems updated, consideration for inclusion of building lifecycle renewal programs within the contractual requirements should be given along with the evaluation and verification of those systems into the future. These requirements could include pre-determined time and/or criteria used to determine when significant system replacements are necessary to occur.

The key building systems that would be considered for lifecycle renewal are identified in Chapter 7 along with associated costing.

# Appendix H – LEED Scorecard

# LEED v4 for BD+C: New Construction and Major Renovation

Project Checklist

Project Name: SEC ECO OFFICE COMPLEX - ACCRA, GHANA
Date: SEPT. 15, 2016

| ? | N | | | |
|---|---|---|---|---|
| | | Credit | Integrative Process | 1 |

| ? | N | | | |
|---|---|---|---|---|
| 1 | 29 | **Location and Transportation** | | **16** |
| | 16 | Credit | LEED for Neighborhood Development Location | 16 |
| | 1 | Credit | Sensitive Land Protection | 1 |
| | 2 | Credit | High Priority Site | 2 |
| | 5 | Credit | Surrounding Density and Diverse Uses | 5 |
| | 5 | Credit | Access to Quality Transit | 5 |
| | | Credit | Bicycle Facilities | 1 |
| | | Credit | Reduced Parking Footprint | 1 |
| 1 | | Credit | Green Vehicles | 1 |

| ? | N | | | |
|---|---|---|---|---|
| 2 | 1 | **Sustainable Sites** | | **10** |
| | | Prereq | Construction Activity Pollution Prevention | Required |
| | | Credit | Site Assessment | 1 |
| 2 | | Credit | Site Development - Protect or Restore Habitat | 2 |
| | 1 | Credit | Open Space | 1 |
| | | Credit | Rainwater Management | 3 |
| | | Credit | Heat Island Reduction | 2 |
| | | Credit | Light Pollution Reduction | 1 |

| ? | N | | | |
|---|---|---|---|---|
| 0 | 2 | **Water Efficiency** | | **11** |
| | | Prereq | Outdoor Water Use Reduction | Required |
| | | Prereq | Indoor Water Use Reduction | Required |
| | | Prereq | Building-Level Water Metering | Required |
| | | Credit | Outdoor Water Use Reduction | 2 |
| | | Credit | Indoor Water Use Reduction | 6 |
| 0 | 2 | Credit | Cooling Tower Water Use | 2 |
| | | Credit | Water Metering | 1 |

| ? | N | | | |
|---|---|---|---|---|
| 8 | 0 | **Energy and Atmosphere** | | **33** |
| | | Prereq | Fundamental Commissioning and Verification | Required |
| | | Prereq | Minimum Energy Performance | Required |
| | | Prereq | Building-Level Energy Metering | Required |
| | | Prereq | Fundamental Refrigerant Management | Required |
| 6 | | Credit | Enhanced Commissioning | 6 |
| 4 | | Credit | Optimize Energy Performance | 18 |
| | | Credit | Advanced Energy Metering | 1 |
| 2 | | Credit | Demand Response | 2 |
| 3 | | Credit | Renewable Energy Production | 3 |
| 1 | | Credit | Enhanced Refrigerant Management | 1 |
| 2 | | Credit | Green Power and Carbon Offsets | 2 |

| Y | ? | N | | | |
|---|---|---|---|---|---|
| 1 | 1 | 11 | **Materials and Resources** | | **13** |
| Y | | | Prereq | Storage and Collection of Recyclables | Requir |
| Y | | | Prereq | Construction and Demolition Waste Management Planning | Requir |
| | | 5 | Credit | Building Life-Cycle Impact Reduction | 5 |
| | | 2 | Credit | Building Product Disclosure and Optimization - Environmental Product Declarations | 2 |
| | | 2 | Credit | Building Product Disclosure and Optimization - Sourcing of Raw Materials | 2 |
| | | 2 | Credit | Building Product Disclosure and Optimization - Material Ingredients | 2 |
| 1 | 1 | | Credit | Construction and Demolition Waste Management | 2 |

| Y | ? | N | | | |
|---|---|---|---|---|---|
| 14 | 0 | 0 | **Indoor Environmental Quality** | | **16** |
| Y | | | Prereq | Minimum Indoor Air Quality Performance | Requir |
| Y | | | Prereq | Environmental Tobacco Smoke Control | Requir |
| 2 | | | Credit | Enhanced Indoor Air Quality Strategies | 2 |
| 3 | | | Credit | Low-Emitting Materials | 3 |
| 1 | | | Credit | Construction Indoor Air Quality Management Plan | 1 |
| 2 | | | Credit | Indoor Air Quality Assessment | 2 |
| 1 | | | Credit | Thermal Comfort | 1 |
| 2 | | | Credit | Interior Lighting | 2 |
| 1 | | | Credit | Daylight | 3 |
| 1 | | | Credit | Quality Views | 1 |
| 1 | | | Credit | Acoustic Performance | 1 |

| Y | ? | N | | | |
|---|---|---|---|---|---|
| 5 | 1 | 0 | **Innovation** | | **6** |
| 4 | 1 | | Credit | Innovation | 5 |
| 1 | | | Credit | LEED Accredited Professional | 1 |

| Y | ? | N | | | |
|---|---|---|---|---|---|
| 3 | 1 | 0 | **Regional Priority** | | **4** |
| 1 | | | Credit | Regional Priority: Specific Credit | 1 |
| 1 | | | Credit | Regional Priority: Specific Credit | 1 |
| 1 | | | Credit | Regional Priority: Specific Credit | 1 |
| | 1 | | Credit | Regional Priority: Specific Credit | 1 |

| Y | ? | N | | |
|---|---|---|---|---|
| 48 | 34 | 43 | **TOTALS** | Possible Points: 110 |

**Certified:** 40 to 49 points, **Silver:** 50 to 59 points, **Gold:** 60 to 79 points, **Platinum:** 80 to 110

# Appendix I – Breakdown of Building Upfront, Operational and Lifecycle Costs

CPCS

CBCL LIMITED
Consulting Engineers

**Opinion of Probable Cost**
**GHANA ECO FRIENDLY BUILDING, Accra**
**Final Feasibility Configuration**
**4 Sided Open Center Core**

Commercial Shell Only (19325M2) (SEC 1,400$m^2$) + U/G Parking 11,530$m^2$

| | |
|---|---|
| **DATE:** | 6-Oct-16 |
| **CBCL FILE No.:** | 1506890.00 |
| **PREPARED BY:** | AT |
| **EST. DESCRIPTION:** | Feasibility |

## SUMMARY

| | DESCRIPTION | GFA $m^2$ | Cost / $m^2$ | Estimated Amount | % of Total |
|---|---|---|---|---|---|
| 1 | BUILDING SHELL | 30,860 | $401.33 | $ 12,385,000 | 27.3% |
| 2 | INTERIORS | 30,860 | $213.87 | $ 6,600,000 | 14.5% |
| 3 | MECHANICAL | 30,860 | $158.72 | $ 4,898,000 | 10.8% |
| 4 | ELECTRICAL | 30,860 | $74.34 | $ 2,294,000 | 5.1% |
| 5 | SITEWORK & DEMOLITIONS | 30,860 | $97.21 | $ 3,000,000 | 6.6% |
| 6 | RESIDENTIAL UNITS INTERIORS | 30,860 | $0.00 | $ - | 0.0% |
| 7 | SECURITIES EXCHANGE COMMISSION OFFICE | 30,860 | $46.40 | $ 1,432,000 | 3.2% |
| 8 | GENERAL REQUIREMENTS & FEE | 30,860 | $70.61 | $ 2,179,000 | 4.8% |
| 9 | DESIGN DEVELOPMENT ALLOWANCE | 30,860 | $212.48 | $ 6,557,000 | 14.4% |
| 10 | ESCALATION (Based on 2016 Dollars) | 30,860 | N/A | Not Included | N/A |
| **11** | **TOTAL CONSTRUCTION AMOUNT** | **30,860** | **$1,275** | **$ 39,345,000** | **87%** |
| 12 | CONSTRUCTION CONTINGENCY | | $69.44 | $ 2,143,000 | 4.7% |
| **13** | **TOTAL CONSTRUCTON with CONTINGENCY** | | **$1,344** | **$ 41,488,000** | **91%** |
| 14 | DESIGN FEES & DISBURSEMENTS | | $99.19 | $ 3,061,000 | 6.7% |
| 15 | DESIGN & CONSTRUCTION OVERSIGHT | | $17.98 | $ 555,000 | 1.2% |
| **16** | **TOTAL PROJECT DESIGN & CONSTRUCTION** | | **$1,462** | **$ 45,104,000** | **99%** |
| 17 | SWING SPACE & MOVING ALLOWANCE | | $9.72 | $ 300,000 | 0.7% |
| **18** | **TOTAL PROJECT AMOUNT (without Tax)** | | **$1,471** | **$ 45,404,000** | **100%** |

| **Separate Cost - Additional to Base Budget** | | |
|---|---|---|
| 1. Additional 800$m^2$ SEC Office Fit-Up | Extra | $ 1,000,000 |
| 2. FFE for SEC 1400$m^2$ Office Space | Extra | $ 400,000 |
| 3. On-Site Renewable Energy System | Extra | $ 857,500 |
| 4. Residential Apartment Finishes c/w Applicances Per Floor | Extra | $ 4,388,000 |
| **Breakout Cost - Included in Base Budget** | | |
| 1. Parking Level P3 | Deduct | $ 3,339,000 |
| 2. Parking Level P2 (in addition to P3) | Deduct | $ 3,174,000 |
| 3. Parking Level P1 (in addition to P3 and P2) | Deduct | $ 3,100,000 |

This opinion of probable costs is presented on the basis of experience, qualifications, and best judgement. It has been prepared in accordance with acceptable principles and practices. Market trend chnanges, non competitve bidding situations, unforeseen labour and material adjustments, and the like are beyond the control of CBCL Limited and as such we cannot warrant or guarantee that actual cost will not vary significantly from the opinion provided.

* A Design Development Contingency Allowance is for growth of quanties, increase costs, as the work is better defined in the future

** A Construction Contingency is to allow for the cost of additional extra work over the original tendered construction contract price

*** The Escalation/Inflation allowance is provided for increases in construction costs from the time the budget is prepared to Tender date

**GHANA ECO FRIENDLY BUILDING, Accra**
**Final Feasibility Configuration**
**4 Sided Open Center Core**

Commercial Shell 19325m2 (SEC+1,400m2) + U/G Park 11,530m$^2$

| | |
|---|---|
| **DATE:** | 6-Oct-16 |
| **CBCL FILE No.:** | 150689.00 |
| **PREPARED BY:** | AT |
| **EST. DESCRIPTION:** | Feasibility |

## Element Summary

| GFA without Parking | 19,325 m$^2$ | Ratio to GFA | Elemental Amount | | Rate per Area | | |
|---|---|---|---|---|---|---|---|
| **GFA with U/G Parking** | **30,860 m$^2$** | | **Sub-total** | **Total** | **Sub-total** | **Total** | **%** |
| **A** | **SHELL** | | | **12,384,973** | | **401.33** | **27.3** |
| **A1** | **SUBSTRUCTURE** | | | 2,065,410 | | 66.93 | 4.5 |
| A11 | Foundations | 0.092 | $ 1,573,934 | | 51.00 | | 3.5 |
| A12 | Basement Excavation | 1.000 | $ 491,476 | | 15.93 | | 1.1 |
| **A2** | **STRUCTURE** | | | 5,186,213 | | 168.06 | 11.4 |
| A21 | Lowest Floor Construction | 0.092 | $ 168,979 | | 5.48 | | 0.4 |
| A22 | Upper Floor Construction | 0.875 | $ 4,569,378 | | 148.07 | | 10.1 |
| A23 | Roof Construction | 0.000 | $ 447,856 | | 14.51 | | 1.0 |
| **A3** | **EXTERIOR ENCLOSURE** | | | 5,133,350 | | 166.34 | 11.3 |
| A31 | Walls Below Grade | 0.019 | $ 351,000 | | 11.37 | | 0.8 |
| A32 | Walls Above Grade | 0.268 | $ 4,540,800 | | 147.14 | | 10.0 |
| A33 | Windows and Entrances | 1.000 | $ 100,000 | | 3.24 | | 0.2 |
| A34 | Roof Coverings | 0.107 | $ 141,550 | | 4.59 | | 0.3 |
| A35 | Projections | 0.000 | $ - | | 0.00 | | 0.0 |
| **B** | **INTERIORS** | | | **6,599,672** | | **213.86** | **14.5** |
| **B1** | **PARTITIONS AND DOORS** | | | 438,424 | | 14.21 | 1.0 |
| B11 | Partitions | 1.000 | $ 166,027 | | 5.38 | | 0.4 |
| B12 | Doors, Frames, Hardware | 1.000 | $ 272,397 | | 8.83 | | 0.6 |
| **B2** | **INTERIOR FINISHES** | | | 2,484,035 | | 80.49 | 5.5 |
| B21 | Floor Finishes | 0.626 | $ 1,623,988 | | 52.62 | | 3.6 |
| B22 | Ceiling Finishes | 1.000 | $ 415,874 | | 13.48 | | 0.9 |
| B23 | Wall Finishes | 1.000 | $ 444,173 | | 14.39 | | 1.0 |
| **B3** | **FITTINGS AND EQUIPMENT** | | | 3,677,213 | | 119.16 | 8.1 |
| B31 | Fittings and Fixtures | 1.000 | $ 1,069,213 | | 34.65 | | 2.4 |
| B32 | Equipment | 1.000 | $ 448,000 | | 14.52 | | 1.0 |
| B33 | Conveying Systems | 1.000 | $ 2,160,000 | | 69.99 | | 4.8 |
| **C** | **SERVICES** | | | **7,192,137** | | **233.06** | **15.8** |
| **C1** | **MECHANICAL** | | | 4,898,462 | | 158.73 | 10.8 |
| C11 | Plumbing and Drainage | 1.000 | $ 205,873 | | 6.67 | | 0.5 |
| C12 | Fire Protection | 1.000 | $ 372,188 | | 12.06 | | 0.8 |
| C13 | HVAC and Controls | 1.000 | $ 4,320,400 | | 140.00 | | 9.5 |
| C14 | Controls | 0.246 | $ - | | 0.00 | | 0.0 |
| **C2** | **ELECTRICAL** | | | 2,293,676 | | 74.33 | 5.1 |
| C21 | Services and Distribution | 1.000 | $ 959,635 | | 31.10 | | 2.1 |
| C22 | Lighting Devices and Heating | 1.000 | $ 709,780 | | 23.00 | | 1.6 |
| C23 | Systems and Ancillaries | 1.000 | $ 624,261 | | 20.23 | | 1.4 |
| **NET BUILDING SUBTOTAL - LESS SITE & RESIDENTIAL** | | | | **26,176,782** | | **848.24** | **57.7** |
| **D** | **SITE WORK, DEMOLITIONS & RESIDEN** | | | 4,430,667 | | 143.57 | 9.8 |
| **D1** | **SITEWORK & DEMOLITIONS** | | | 2,999,587 | | 97.20 | 6.6 |
| D11 | Site Development & Demoiltion | 1.000 | $ 243,542 | | 7.89 | | 0.5 |
| D12 | Mechanical Site Services | 1.000 | $ 401,785 | | 13.02 | | 0.9 |
| D13 | Electrical Site Services | 1.000 | $ 2,354,260 | | 76.29 | | 5.2 |
| **D2** | **SECURITY COMMISSION OFFICES and RESIDENTIAL UNITS** | | | 1,431,080 | | 46.37 | 3.2 |
| D21 | ~~42 1 Bedroom Units Included Item D22~~ | 0.000 | $ - | | 0.00 | | 0.0 |
| D22 | 42 - 1 Bedroom + 69 - 2 Bedroom Units | 0.000 | $ - | | 0.00 | | 0.0 |
| D23 | Securities Exchange Commission Offices | 0.000 | $ 1,431,080 | | 46.37 | | |
| **NET BUILDING SUBTOTAL - INCLUDING SITE** | | | | **30,607,449** | | **991.82** | **67.4** |
| **Z** | **GENERAL REQUIREMENTS AND ALLOWANCES** | | | 14,794,857 | | 479.42 | **32.6** |
| **Z1** | **GENERAL REQUIREMENTS AND FEES** | | | 2,179,250 | | 70.62 | 4.8 |
| Z11 | General Requirements and Overheads | 1.000 | $ 1,224,298 | | 39.67 | | 2.7 |
| Z12 | Contractors Profit | 1.000 | $ 954,952 | | 30.94 | | 2.1 |
| **Z2** | **ALLOWANCES** | | | 12,615,606 | | 408.80 | 27.8 |
| Z21 | Design Development Allowance | 1.000 | $ 6,557,340 | | 212.49 | | 14.4 |
| Z22 | Escalation Allowance | 1.000 | $ - | | 0.00 | | 0.0 |
| Z23 | Construction Contingency Allowance | 1.000 | $ 2,142,521 | | 69.43 | | 4.7 |
| Z24 | Design & Disbursements | 1.000 | $ 3,060,745 | | 99.18 | | 6.7 |
| Z25 | Design & Construction Oversite | 0.000 | $ 555,000 | | 17.98 | | 1.2 |
| Z26 | Swing Space Moving Allowance | 1.000 | $ 300,000 | | 9.72 | | 0.7 |
| **OTAL DESIGN & CONSTRUCTION PROJECT COST (TAXES EXTRA)** | | | | **$ 45,402,000** | | **$ 1,471** | **100%** |

## GHANA ECO FRIENDLY BUILDING, Accra, Ghana
### Final Feasibility Configuration
### 4 Sided Open Centre Core

| | |
|---|---|
| DATE: | 6-Oct-16 |
| CBCL FILE No.: | 150689.00 |
| EST. DESCRIPTION: | Feasibility |

| Element Summary | | | Elemental Replacement Costs in 2016 Dollars | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GFA without Parking | 19,325 $m^2$ | Elemental Amount | 5 yrs | 10 yrs | 15 yrs | 20 yrs | 25 yrs | 30 yrs | 35 yrs | 40 yrs | SubTotal | Elemental Totals |
| GFA with U/G Parking | 30,857 $m^2$ | Sub-total | | | | | | | | | | |
| **A** | **SHELL** | | $ - | $ - | $ - | $ - | $ 141,550 | $ 1,008,160 | $ - | $ - | | $ 1,150,000 |
| **A1** | **SUBSTRUCTURE** | | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | |
| A11 | Foundations | $ 1,573,934 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | |
| A12 | Basement Excavation | $ 491,476 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | |
| **A2** | **STRUCTURE** | | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | |
| A21 | Lowest Floor Construction | $ 168,979 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | |
| A22 | Upper Floor Construction | $ 4,569,378 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | |
| A23 | Roof Construction | $ 447,856 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | |
| **A3** | **EXTERIOR ENCLOSURE** | | $ - | $ - | $ - | $ - | $ 141,550 | $ 1,008,160 | $ - | $ - | $ 1,149,710 | |
| A31 | Walls Below Grade | $ 351,000 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | $ - | |
| A32 | Walls Above Grade | $ 4,540,800 | N/A | N/A | N/A | N/A | N/A | $ 908,160 | N/A | N/A | $ 908,160 | |
| A33 | Windows and Entrances | $ 100,000 | N/A | N/A | N/A | N/A | N/A | $ 100,000 | N/A | N/A | $ 100,000 | |
| A34 | Roof Coverings | $ 141,550 | N/A | N/A | N/A | N/A | $ 141,550 | | N/A | N/A | $ 141,550 | |
| A35 | Projections | $ - | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | |
| **B** | **INTERIORS** | | $ - | $ - | $ 956,758 | $ - | $ 69,312 | $ 1,962,856 | $ - | $ 1,759,771 | | $ 4,749,000 |
| **B1** | **PARTITIONS AND DOORS** | | $ - | $ - | $ - | $ - | $ - | $ 355,411 | $ - | $ 83,013 | $ 438,424 | |
| B11 | Partitions | $ 166,027 | N/A | N/A | N/A | N/A | N/A | $ 83,013 | N/A | $ 83,013 | $ 166,027 | |
| B12 | Doors, Frames, Hardware | $ 272,397 | N/A | N/A | N/A | N/A | N/A | $ 272,397 | N/A | N/A | $ 272,397 | |
| **B2** | **INTERIOR FINISHES** | | $ - | $ - | $ 451,020 | $ - | $ 69,312 | $ 381,708 | $ - | $ 451,020 | $ 1,353,061 | |
| B21 | Floor Finishes | $ 1,623,988 | N/A | N/A | $ 270,665 | N/A | N/A | $ 270,665 | N/A | $ 270,665 | $ 811,994 | |
| B22 | Ceiling Finishes | $ 415,874 | N/A | N/A | $ 69,312 | N/A | $ 69,312 | N/A | N/A | $ 69,312 | $ 207,937 | |
| B23 | Wall Finishes | $ 444,173 | N/A | N/A | $ 111,043 | N/A | N/A | $ 111,043 | N/A | $ 111,043 | $ 333,130 | |
| **B3** | **FITTINGS AND EQUIPMENT** | | $ - | $ - | $ 505,738 | $ - | $ - | $ 1,225,738 | $ - | $ 1,225,738 | $ 2,957,213 | |
| B31 | Fittings and Fixtures | $ 1,069,213 | N/A | N/A | $ 356,404 | N/A | N/A | $ 356,404 | N/A | $ 356,404 | $ 1,069,213 | |
| B32 | Equipment | $ 448,000 | N/A | N/A | $ 149,333 | N/A | N/A | $ 149,333 | N/A | $ 149,333 | $ 448,000 | |
| B33 | Conveying Systems | $ 2,160,000 | N/A | N/A | N/A | N/A | N/A | $ 720,000 | N/A | $ 720,000 | $ 1,440,000 | |
| **C** | **SERVICES** | | $ - | $ - | $ 208,087 | $ 365,205 | $ - | $ 696,159 | $ - | $ 573,292 | | $ 1,843,000 |
| **C1** | **MECHANICAL** | | $ - | $ - | $ - | $ 365,205 | $ - | $ 37,219 | $ - | $ 365,205 | $ 767,628 | |
| C11 | Plumbing and Drainage | $ 205,873 | N/A | N/A | N/A | $ 41,175 | N/A | N/A | N/A | $ 41,175 | $ 82,349 | |
| C12 | Fire Protection | $ 372,188 | N/A | N/A | N/A | N/A | N/A | $ 37,219 | N/A | N/A | $ 37,219 | |
| C13 | HVAC and Controls | $ 4,320,400 | N/A | N/A | N/A | $ 324,030 | N/A | N/A | N/A | $ 324,030 | $ 648,060 | |
| C14 | Controls | $ - | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | |
| **C2** | **ELECTRICAL** | | $ - | $ - | $ 208,087 | $ - | $ - | $ 658,940 | $ - | $ 208,087 | $ 1,075,114 | |
| C21 | Services and Distribution | $ 959,635 | N/A | N/A | N/A | N/A | N/A | $ 95,963 | N/A | N/A | $ 95,963 | |
| C22 | Lighting Devices and Heating | $ 709,780 | N/A | N/A | N/A | N/A | N/A | $ 354,890 | N/A | N/A | $ 354,890 | |
| C23 | Systems and Ancillaries | $ 624,261 | N/A | N/A | $ 208,087 | N/A | N/A | $ 208,087 | N/A | $ 208,087 | $ 624,261 | |
| | | | | | | | | | | | | |
| **D** | **SITE WORK, RESIDENTIAL, SEC OFFICES** | | $ 50,000 | $ 50,000 | $ 288,513 | $ 50,000 | $ 50,000 | $ 1,077,971 | $ 50,000 | $ 312,868 | | $ 1,929,000 |
| **D1** | **SITEWORK & DEMOLITIONS** | | $ - | $ - | $ - | $ - | $ - | $ 789,457 | $ - | $ 24,354 | $ 813,812 | |
| D11 | Site Development & Demoiltion | $ 243,542 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | $ 24,354 | $ 24,354 | |
| D12 | Mechanical Site Services | $ 401,785 | N/A | N/A | N/A | N/A | N/A | $ 200,892 | N/A | N/A | $ 200,892 | |
| D13 | Electrical Site Services | $ 2,354,260 | N/A | N/A | N/A | N/A | N/A | $ 588,565 | N/A | N/A | $ 588,565 | |
| **D2** | **SECURITY COMMISSION OFFICES and RESIDENTIAL UNITS** | | $ 50,000 | $ 50,000 | $ 288,513 | $ 50,000 | $ 50,000 | $ 288,513 | $ 50,000 | $ 288,513 | $ 1,115,540 | |
| D21 | | $ - | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | |
| D22 | 3 Floors 42 - 1 Bedroom + 69 - 2 Bedroom Units | $ - | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | |
| D23 | Securities Exchange Commission Offices | $ 1,431,080 | N/A | N/A | $ 238,513 | N/A | N/A | $ 238,513 | N/A | $ 238,513 | $ 715,540 | |
| D24 | Oversite & Verification of Ops & Maintainence | $ 400,000 | $ 50,000 | $ 50,000 | $ 50,000 | $ 50,000 | $ 50,000 | $ 50,000 | $ 50,000 | $ 50,000 | $ 400,000 | **Total** |
| | **YEARLY TOTALS of ELEMENTS** | | **$ 50,000** | **$ 50,000** | **$1,453,358** | **$ 415,205** | **$ 260,862** | **$ 4,745,146** | **$ 50,000** | **$ 2,645,930** | **$ -** | **$ 9,671,000** |

CPCS | CBCL LIMITED Consulting Engineers

**GHANA ECO FRIENDLY BUILDING, Accra**
**Feasibility Configuration Open Center Core**
**Yearly Operating, Maintenance, Repair Budget**

| | |
|---|---|
| **DATE:** | 6-Oct-16 |
| **CBCL FILE No.:** | 1506890.00 |
| **PREPARED BY:** | AT |
| **EST. DESCRIPTION:** | Feasibility |

| Account | Description | UoM | Qty | Unit Cost | Cost |
|---|---|---|---|---|---|
| | | | | | |
| 6360 | Power to Common Areas e.g Lobbies, Corridors, WF | sm | 9,258 | $ 29.04 | $ 269,000 |
| 6850 | Water Supply & Discharge | Mnth | 12 | $ 3,375 | $ 40,500 |
| 6374 | Fuel | LS | 1 | $ 4,050 | $ 4,050 |
| 7050 | Muzac | LS | 1 | $ 500 | $ 500 |
| 6366 | Energy Management System | LS | 1 | $ 2,000 | $ 2,000 |
| 6855 | Sprinklers | LS | 1 | $ 1,000 | $ 1,000 |
| | | | | **Total Utilities** | **$317,050** |
| | | | | | |
| 6830 | HVAC Repairs | LS | 1 | $ 3,000 | $ 3,000 |
| | | | | **Total HVAC** | **$3,000** |
| | | | | | |
| 6780 | Cleaning Supplies | Mnths | 12 | 300 | $ 3,600 |
| 6792 | Window Cleaning | Ea | 1 | 5,000 | $ 5,000 |
| 6795 | Floor and or Carpet Cleaning | sm | 19,498 | 0.22 | $ 4,000 |
| 6777 | Common Area Cleaning - Wages | Mnths | 12 | 500 | $ 6,000 |
| 6779 | Cleaning | Ea | 156 | 80 | $ 12,000 |
| 6950 | Garbage Removal | Weeks | 52 | 150 | $ 7,800 |
| 6960 | Pest Control | Mnths | 12 | 250 | $ 3,000 |
| | | | | **Total Cleaning, Pest & Refuse** | **$41,400** |
| | | | | | |
| 6810 | Snow removal | LS | N/A | N/A | N/A |
| 6820 | Landscaping | LS | 1 | $ 5,000 | $ 5,000 |
| | | | | **Total Landscaping & Snow Removal** | **$5,000** |
| | | | | | |
| 6860 | Elevator Contract | LS | - | $ - | $ - |
| 6861 | Elevator Maintainence | LS | 1 | $ 3,000 | $ 3,000 |
| | | | | **Total Elevator** | **$3,000** |
| | | | | | |
| 6420 | Fire protection | Mnths | 12 | 200 | $ 2,400 |
| 6440 | Security | Mnths | 12 | $ 1,500 | $ 18,000 |
| | | | | **Total Security** | **$20,400** |
| | | | | | |
| 6890 | Maintenance Materials | LS | 1 | $ 3,000 | $ 3,000 |
| 6891 | Glass & Screens | LS | 1 | $ 1,000 | $ 1,000 |
| 6892 | Lighting | LS | 1 | $ 1,200 | $ 1,200 |
| 6893 | Locks & Keys | LS | 1 | $ 1,000 | $ 1,000 |
| 6894 | Painting interior | LS | 1 | $ 3,000 | $ 3,000 |
| 6895 | Painting exterior | LS | 1 | $ 2,000 | $ 2,000 |
| 6896 | Plumbing | LS | 1 | $ 1,500 | $ 1,500 |
| 6898 | Signs & Directories | LS | 1 | $ 1,000 | $ 1,000 |
| 6910 | General Repairs | LS | 1 | $ 9,000 | $ 9,000 |
| 6800 | Superintendent | Mnths | 12 | $ 1,000 | $ 12,000 |
| 6915 | Maintenance - GWL | LS | 1 | $ 7,000 | $ 7,000 |
| 6685 | Amortization - Rec. Capital Exp | LS | 1 | | $ - |
| 6930 | Service Contract | LS | 1 | | Included |
| 6899 | Recoverable Bldg Repair | LS | 1 | | N/A |
| | | | | | $ - |
| | | | | **Total Repairs & Maintenance** | **$41,700** |

| | | | | | |
|---|---|---|---|---|---|
| 6150 | Insurance | LS | 1 | $ 100,000 | $ 100,000 |
| 6350 | License & fees | LS | 1 | 1000 | $ 1,000 |
| 6180 | Promotion General | LS | 1 | 5000 | $ 5,000 |
| 6390 | Miscellaneous | LS | 1 | 1000 | $ 1,000 |
| 6410 | Administration | LS | 1 | 20,000 | $ 20,000 |
| 6415 | Postage , delivery, courier | LS | 1 | 500 | $ 500 |
| | | | | **Total Administration & Miscellaneous** | **$127,500** |
| | | | | | |
| 6380 | Management fees | LS | 1 | 40,000 | $ 40,000 |
| | | | | **Total Management Fees** | **$40,000** |
| | | | | | |
| 6330 | Audit | LS | 1 | $ 2,000 | $ 2,000 |
| 6450 | Property Taxes | | | | $ - |
| | | | | | $ - |
| | | | | **TOTAL RECOVERABLE COSTS** | **$2,000** |
| | | | | | |
| **Other Recoverable Costs** | | | | | $ - |
| 7500 | Tenant cleaning | | 0 | $ - | $ - |
| 6365 | Tenant Power | | 0 | $ - | $ - |
| Specific Tenant | | | 0 | $ - | $ - |
| 6871 | Specific Tenant - Power | | 0 | $ - | $ - |
| 6872 | Specific Tenant - Fuel | | 0 | $ - | $ - |
| | | | | | $ - |
| | | | | **Total Other Recoverable Costs** | **$0** |
| | | | | | |
| **Non-recoverable:** | | | | | $ - |
| 6725 | Professional & Legal fees | LS | 1 | $ 5,000 | $ 5,000 |
| 6904 | Professional Fees - Non Recoverable | LS | 1 | $ 3,000 | $ 3,000 |
| | | | | **Total Legal & Professional** | **$8,000** |
| | | | | | |
| 6120 | Bad debts | | | | |
| 6110 | Commission/Leasing Expenses | LS | 1 | $ 10,000 | $ 10,000 |
| 7600-12 | Tenant Expenditures | | | | $ - |
| 6191 | Promo- Tenant | | | | $ - |
| | | | | **Total Leasing & Tenant Expenditures** | **$10,000** |
| | | | | | |
| 6897 | Roof Repairs | LS | 1 | $ 1,000 | $ 1,000 |
| 7700 | Base Building Expenses | LS | 1 | $ 3,000 | $ 3,000 |
| 7701 | Main Street Entrance | LS | 1 | $ 1,000 | $ 1,000 |
| 7702 | Masonry Repairs | LS | 1 | $ - | $ - |
| | | | | $ - | $ - |
| | | | | **Total Base Building** | **$5,000** |
| 6290 | Bank charges | | | | |
| 6376 | Parking | | | | $ - |
| 6906 | Misc. Non-Recoverable | | | | $ - |
| | | | | | $ - |
| | | | | **Total Misc Non-Recoverable** | **$0** |
| | | | | | |
| 6220 | Mortgage Interest | | | | $ - |
| 6225 | Property Tax Interest | | | | $ - |
| | | | | **Total Interest Expense** | **$0** |
| | | | | | |
| | | | | **Total Yearly MRO Expenses** | **$625,000** |

# Appendix J – Market and Field Investigation Summary

# Approach to Market Investigations

## Demand Study

The real estate demand study covers typical profiles of renters/owners of retail, residential and commercial properties in Accra as well as forecasted occupancy rates for all three sub-sectors in the real estate market.

Profiles of renters/owners of retail, residential and commercial properties were developed through prior experiences of the Project Team's Real Estate Expert – Mr. Ashie Galloway.

In addition, consultations with developers and property/facility in Accra formed the basis of the occupancy rates estimated in the feasibility valuation model. Developers and property/facility managers that were consulted include:

- Goldkey Properties (subsidiary of CH Group)
- DreamRealty
- Acacia Build Limited
- Laurus Development Partners
- Broll Ghana

## Supply Study

Field investigations formed the real estate supply study with a particular focus on residential and commercial properties under development or properties developed and commissioned in the past three years or less. In addition, properties with retail establishments were also prioritized. The following properties were investigated as part of this feasibility study.

**Property Field Investigations**

| Residential Properties | Commercial Properties |
|---|---|
| • Pearl In the City (Cantonments)[1]<br>• Silk Properties (Cantonments)<br>• Sloane House (Airport Residential)<br>• Villagio Primavera, Visa and Aqua (Airport Residential) | • One Airport Square (Airport City)[1]<br>• Cantonments City (Cantonments)<br>• The Octagon (Accra Central)[1]<br>• Ghana Airport Cargo Centre (Airport City)[1] |

1. Properties with retail space

# Real Estate Demand

## Typical Profile of Residential Tenants in Cantonments

Generally, owners/renters in Cantonments, Accra are high-end income earners who have a preference for living in the centre of Accra. Owners/renters in Cantonments' real estate look for modern or 'classy' developments with the following specifications/amenities (see figure below).

Description of Typical Specifications/Amenities for Residential Developments in Cantonments, Accra

| Service/Amenity | Description | |
|---|---|---|
| Size | 1 Bedroom | 70 – 100 SQM |
| | 2 Bedroom | 90 – 150 SQM |
| | 3 Bedroom | 140 – 25 SQM |
| | 4 Bedroom | 180 – 260 SQM |
| Fit-up | • As basic requirements, fully fitted kitchen including gas/electric cookers, microwaves, washing machines and dishwasher | |
| Parking | • One parking bay for a one and two bedroom apartment and up to two parking bays for a 3+ bedroom | |
| Recreation Facilities | • Communal gym, swimming pool or garden | |
| Access | • Access to good schools and shopping malls are a priority | |
| Security | • 24 security services | |

## Typical Profile of Commercial Tenants in Cantonments

Although Cantonments can be considered primarily as a residential suburb, commercial developments do also exist such as Cantonments City. Typically, commercial tenants in the area are major multinational firms, real estate companies, real estate investment trusts as well as investment funds such as the Social Security and National Insurance Trust and Enterprise Insurance. The figure below describes typical services/amenities that commercial tenants seek in Cantonments.

Description of Typical Specifications/Amenities for Residential Developments in Cantonments, Accra

| Service/Amenity | Description |
|---|---|
| Size | • Floor spaces that are typically requested range from 73SQM to 220SQM |
| Fit-up | • Developers typically provide a grey shell (see figure below) as tenants want freedom to fit out their commercial spaces as they see fit |

| | |
|---|---|
| | Figure 8-9: Grey Shell Example<br> |
| **Parking** | • While tenants would prefer to have one parking bay per employee, the finite nature of land has resulted in developers allocating 1 to 1.5 parking bays per 100SQM of space occupied.<br>• For more recent developments in Accra, developers charge tenants for parking bays that are in addition to the bays allocated in lease agreements. |
| **Security** | • 24 hour security services |

### Typical Profile of Retail Tenants in Cantonments

During field investigations, the Project Team noted that both residential and commercial developments in Accra (and to a limited degree, in Cantonments) include some form of a retail establishment as part of their building-use patterns. It is envisaged that should prospective bidders submit plans for a mixed-use building, retail space would be allocated on the ground floor with possible establishments including banks, cafés, restaurants, spas, gyms, dry cleaning services, dental office, etc. A description of specifications/amenities for retail establishments are provided below.

Description of Typical Specifications/Amenities for Retail Developments in Cantonments, Accra

| Service/Amenity | Description |
|---|---|
| **Size** | • Depending on the type of establishment, retail tenants look for floor space that is between 30SQM to 150SQM. |
| **Fit-up** | • Like commercial tenants, developers provide retail tenants with grey shell space so that retail tenants can fit out their spaces based on the services they provide (e.g., kitchen for a restaurant) |
| **Parking** | • Parking for retail developments is dependent on the type and size of establishment but typically includes |
| **Security** | • 24 hour security services |

## Field Investigation Summaries

The below tables summaries the Project Team’s field investigations.

### One Airport Square (Commercial Development)

| | |
|---|---|
| **Address** | Casely Hayford Road<br>Accra, Ghana |
| **Commissioning Year** | 2014 |
| **Current Occupancy Rate** | 65% |
| **Approximate Land Size (Acres)** | 2 Acres |
| **# of Floors and Approximate Height[1]** | 8 floors, 2.9m |
| **Amenities** | (1) Chiller plants and extractor fans<br>(2) Two underground basement parking<br>(3) motion censored energy saving lights<br>(4) sprinkler system<br>(5) 24 hour security and cleaning<br>(6) fire and water pumps<br>(7) Four lifts |
| **Proximity to Schools, markets, etc.** | One Airport Square is located in a very busy and prime area with easy access to the airport and other prime office buildings |
| **Aboveground Parking Bays** | 20 to 30 bays |
| **Underground Parking Levels** | 2 |
| **Tenant Parking Allocation** | 1.5 bays per 100SQM and US$100 per month for additional spots |
| **Rental Price (per Month)** | US$38/SQM |
| **Service Charge (per Month)** | US$4.5/SQM |
| **Services Included** | (1) Cleaning common areas<br>(2) Building maintenance and landscaping<br>(3) Security |
| **Typical Duration of Rental Agreement and Currency** | Agreements are typically 3-years in duration with payment made quarterly |

1. Height is floor-to-ceiling and is based on visual estimation



### Ghana Airport Cargo Centre (Commercial Development)

| | |
|---|---|
| **Address** | P.O. Box KA 9665 Kotoka International Airport<br>Accra, Ghana |
| **Commissioning Year** | October 2016 |
| **Current Occupancy Rate** | 40% |
| **Approximate Land Size (Acres)** | Over 2.25 Acres |
| **# of Floors and Approximate Height[1]** | 8 floors, 3.66M |
| **Amenities** | (1) Two underground basement parking<br>(2) sprinkler system<br>(3) modern lighting<br>(4) basement parking |
| **Proximity to Schools, markets, etc.** | Located in a prime area that is in the heart of the city with easy access to the airport |
| **Aboveground Parking Bays** | 70 spots |
| **Underground Parking Levels** | One underground parking level with 48 spots |
| **Tenant Parking Allocation** | To be determined |
| **Rental Price (per Month)** | US$45/SQM |
| **Service Charge (per Month)** | US$5/SQM |
| **Services Included** | (1) Cleaning common areas<br>(2) Building maintenance and landscaping<br>(3) Security |
| **Typical Duration of Rental Agreement and Currency** | Agreements are typically 3-years in duration with payment made quarterly |

1. Height is floor-to-ceiling and is based on visual estimation

**Stanbic Heights (Commercial Development)**

| | |
|---|---|
| **Address** | N Liberation Link<br>Accra, Ghana |
| **Commissioning Year** | 2013 |
| **Current Occupancy Rate** | 92% |
| **Approximate Land Size (Acres)** | Not Determinable |
| **# of Floors and Approximate Height[1]** | 9 floors, 3.66M |
| **Amenities** | (1) Back up water plants<br>(2) VRV air-conditioning systems<br>(3) Sewer treatment plants<br>(4) UPS system to all elevators<br>(5) Fibre optics IT installation<br>(6) Granite wall cladding to all lift foyers |
| **Proximity to Schools, markets, etc.** | Located in a prime area that is in the heart of the city with easy access to the airport |
| **Aboveground Parking Bays** | 43 bays |
| **Underground Parking Levels** | Two floors of underground parking with a total of 290 bays |
| **Tenant Parking Allocation** | 1.37 bays per 100SQM and US$50 per month for additional spots |
| **Rental Price (per Month)** | US$38/SQM |
| **Service Charge (per Month)** | US$4.5/SQM |
| **Services Included** | (1) Cleaning common areas<br>(2) Building maintenance and landscaping<br>(3) Security |
| **Typical Duration of Rental Agreement and Currency** | Agreements are typically 3-years in duration with payment made quarterly |

1. Height is floor-to-ceiling and is based on visual estimation



### Cantonments City (Commercial Development)

| | |
|---|---|
| **Address** | Rangoon Lane, Cantonments, Accra<br>Accra, Ghana |
| **Commissioning Year** | 2015 |
| **Current Occupancy Rate** | 95% |
| **Approximate Land Size (Acres)** | Not Determinable |
| **# of Floors and Approximate Height[1]** | 6 floors, 3.66M |
| **Amenities** | (1) Back up water plants<br>(2) VRV air-conditioning systems<br>(3) Sewer treatment plants<br>(4) UPS system to all elevators<br>(5) Fibre optics IT installation<br>(6) Granite wall cladding to all lift foyers |
| **Proximity to Schools, markets, etc.** | Located in a prime area that is in the heart of the city with easy access to the airport |
| **Aboveground Parking Bays** | 0 bays |
| **Underground Parking Levels** | Two floors of underground parking with a total of 160 bays |
| **Tenant Parking Allocation** | 1.00 bays per 100SQM |
| **Rental Price (per Month)** | US$35/SQM |
| **Service Charge (per Month)** | US$4/SQM |
| **Services Included** | (1) Cleaning common areas<br>(2) Building maintenance and landscaping<br>(3) Security |
| **Typical Duration of Rental Agreement and Currency** | Agreements are typically 3-years in duration with payment made quarterly |

1. Height is floor-to-ceiling and is based on visual estimation