The following Motions and Documents were considered by the GFC Facilities Development Committee at its Thursday, January 28, 2016 meeting:

Agenda Title: **Research and Collections Resource Facility (RCRF) – Design Development Report**

CARRIED MOTION: THAT the GFC Facilities Development Committee approve, under delegated authority from General Faculties Council, and on the recommendation of Planning and Project Delivery, the proposed Research and Collections and Resource Facility (RCRF) – Design Development Report (as set forth in Attachment 2) as the basis for further engineering and development of contract documents.

Final Item: 4

FINAL Item No. 4

OUTLINE OF ISSUE

Agenda Title: **Research and Collections Resource Facility (RCRF) – Design Development Report**

Motion: THAT the GFC Facilities Development Committee approve, under delegated authority from General Faculties Council, and on the recommendation of Planning and Project Delivery, the proposed Research and Collections and Resource Facility (RCRF) – Design Development Report (as set forth in Attachment 2) as the basis for further engineering and development of contract documents.

Item

Action Requested	☒Approval ☐Recommendation ☐Discussion/Advice ☐Information
Proposed by	Ben Louie, University Architect, Facilities and Operations
Presenter	Gerald Beasley, Vice-Provost and Chief Librarian, Libraries; Kelly Hopkin, Senior Campus Planner (Architecture), Office of the University Architect, Facilities and Operations; Emily Ball, Community Relations Officer, University Relations
Subject	Research and Collections Resource Facility (RCRF) – Design Development Report

Details

Responsibility	Vice-President (Facilities and Operations)
The Purpose of the Proposal is (please be specific)	To obtain approval for the design development report for RCRF; a new, purpose-built facility on South Campus. The facility will provide the required process and high-density storage capacity including expansion space for archival and library collections in an environmentally appropriate climate.
The Impact of the Proposal is	To provide needed infrastructure to ensure the collections of the university are maintained in a safe environment; easily accessible to the academy and all its affiliated institutions; and expandable to accommodate the short and mid-term needs of the facility, as well as the long term vision.
Replaces/Revises (e.g., policies, resolutions)	N/A
Timeline/Implementation Date	• Phased construction to start – Spring 2016 • Construction completion with move-in and occupancy to follow – late Summer 2017
Estimated Cost	N/A
Sources of Funding	N/A
Notes	N/A

Alignment/Compliance

Alignment with Guiding Documents	*Dare to Discover, Dare to Deliver;* Long Range Development Plan (LRDP); University of Alberta Comprehensive Institutional Plan (CIP)
Compliance with Legislation, Policy and/or Procedure Relevant to the Proposal (please quote legislation and include identifying section numbers)	1. ***Post-Secondary Learning Act* (*PSLA*):** The *PSLA* gives GFC responsibility, subject to the authority of the Board of Governors, over academic affairs (Section 26(1)) and provides that GFC may make recommendations to the Board of Governors on a building program and related matters (Section 26(1) (o)). Section 18(1) of the PSLA give the Board of Governors the authority to make any bylaws "appropriate for the management, government and control of the university buildings and land." Section 19 of the *Act* requires that the Board "consider the recommendations of the general faculties council, if any, on matters of academic import prior to providing for (a) the support and maintenance

	of the university, (b) the betterment of existing buildings, (c) the construction of any new buildings the board considers necessary for the purposes of the university [and] (d) the furnishing and equipping of the existing and newly erected buildings [.] […]" Section 67(1) of the *Act* governs the terms under which university land may be leased. 2. **GFC Facilities Development Committee (FDC) Terms of Reference – Section 3. Mandate of the Committee**: "[…] *2. **Delegation of Authority*** Notwithstanding anything to the contrary in the terms of reference above, the Board of Governors and General Faculties Council have delegated to the Facilities Development Committee the following powers and authority: **A. Facilities** 1. To approve proposed General Space Programmes (Programs) for academic units. 2. (i) To approve proposals concerning the design and use of all new facilities and the repurposing of existing facilities and to routinely report these decisions for information to the Board of Governors. (ii) In considering such proposals, GFC FDC may provide advice, upon request, to the Provost and Vice-President (Academic), Vice-President (Facilities and Operations), and/or the University Architect (or their respective delegates) on the siting of such facilities. (GFC SEP 29 2003) **B. Other Matters** The Chair of FDC will bring forward to FDC items where the Office of the Provost and Vice-President (Academic) and/or the Office of the Vice-President (Facilities and Operations), in consultation with other units or officers of the University, is seeking the advice of the Committee. […]" 3. **UAPPOL Space *Management Policy and Space Management Procedure*:** The respective roles of GFC FDC and the Vice-President (Facilities and Operations) with regard to institutional space management are set out in this Board-approved Policy and attendant Procedure. To access this policy suite on line, go to: www.uappol.ualberta.ca.

Routing (Include meeting dates)

Consultative Route (parties who have seen the proposal and in what capacity)	• Vice-Provost and Chief Librarian • Associate Vice-President (Planning and Project Delivery) • Community Open Houses – July 27, 2015 and November 24, 2015 • Courtesy review meetings with Dean, Faculty of Agricultural, Life and Environmental Sciences and Dean's Representative, Faculty of Physical Education and Recreation - November 20, 2015
Approval Route (Governance) (including meeting dates)	GFC Facilities Development Committee (January 28, 2016) – for approval

FINAL Item No. 4

Final Approver	GFC Facilities Development Committee

Attachments:

1. Attachment 1 (3 pages) :Briefing Note
2. Attachment 2 (232 pages) :University of Alberta Research and Collections Resource Facility – Design Development Report (January 11, 2016)

Prepared by: Kelly Hopkin, Senior Campus Planner (Architecture), Office of the University Architect, Planning and Project Delivery, Facilities and Operations, hopkin@ualberta.ca

Revised: 2/11/2016

UNIVERSITY OF ALBERTA

BRIEFING NOTES

Office of the University Architect
Planning and Project Delivery
Facilities and Operations

Research and Collections Resource Facility (RCRF) – Design Development Report

Background

Opened in 1994, the Book and Record Depository (BARD) is a high-density library storage facility that houses less frequently accessed library materials, research collections, and the University of Alberta Archives. The facility holds mostly books and journal volumes, but also microfilm, maps, audio discs, manuscripts, archives, and other formats normally collected by research libraries. The staff at BARD receives, process, and creates machine-readable records for newly deposited materials, provide circulation, and document delivery services. Together these constitute one of Canada's most significant, academic, and cultural resources. BARD has been located in the leased and adapted commercial facility located off of the University of Alberta (U of A) campus. The lease expires in 2017 and the projected growth of BARD cannot be appropriately accommodated at that location.

The projects previous approvals have included the following; funding by BFPC on November 2014 and BG on December 2014. The functional program was approved by GFC FDC on March 2015 and presentation of site options and concept plan to GFC FDC on July 2015 for discussion and advice as well as a Community Open House #1 (per Appendix 18 LRDP) on July 27, 2015.

In July 2015, a Design Build (DB) Team, led by Stuart Olson, was retained to proceed with Phase 1 of this project, namely the design phases. Phase 1, defined as the Validation Stage/Schematic Design in the original Request for Proposal documents, was to "translate the project requirements into space parameters, to explore preliminary design options and analyze them against priorities and program objectives". The Phase 1 proposed design solution in the format of a schematic design report, was presented to GFC FDC on November 6, 2015 and approved.

The Design Development Phase has advanced and refined the design with input from internal UAL stakeholders and been presented to the Community at the Open House #2 (per Appendix 18 LRDP) on November 24, 2015.

The goal of the project is to replace the existing BARD with a new, purpose-built Research and Collections Resource Facility (RCRF) to be built on South Campus. The BARD collections, and co-located with the University Archives, will be relocated and augmented by the volumes transferred off North Campus, to ease campus space pressure and accommodate new technological functions of Library Services.

The new RCRF facility will:

- provide proper environment in which to store materials protecting the irreplaceable collection and the University Archives;
- lower risk of stored material damage, decreasing the liability exposure;
- provide the required capacity and afford expansion space and future growth for related or complimentary use occupancies;
- offer improved access from the U of A campuses, including use of public transportation; and

- align with guiding documents of: Dare to Discover, Dare to Deliver, and Long Range Development Plan (LRDP), updated June 2013.

The RCRF objectives are:

- accommodate up to 5.1M volumes capacity to grow from the current 3.1M BARD print volumes projected over the next 20 years, and the backlog of unprocessed materials to the collection;
- accommodate up to 1.0M* items relocated from North Campus to free up valuable space for academic requirements;
- accommodate the University Archives, currently co-located with BARD;
- provide an appropriate, functional, and welcoming space for staff, students, and visitors for academic and special research purposes and goals;
- improve the proximity of the facility to North Campus, ideally accessible by LRT, for better access by students, staff, and researchers; and
- provide appropriate quantity, type, and function space for processing, storing, and digitizing materials in the collection.

The parcel of land allocated for RCRF siting was derived from the Sector 12 Plan. For the purpose of defining development boundary, the project site of 184 m x 81 m has been established, offering14,900 m² (3.68 acre) in area. The Site #3 of Sector 12, District 2 has been selected for reasons of: access, alignment with planned utility right of way, and manageable impact to current research and operations for the Faculty of Agricultural, Life and Environmental Sciences. The majority of parcel's buildable area is delineated by two rows of trees, acting as wind breakers. The site topography is uniform with a minimal northerly slope. The project aims to minimize development impact, respecting its current siting context and the land value, achieving a targeted floor area ratio (FAR) and site coverage, and maintaining significant open spaces on site.

The proposed design solution is in alignment with the Sector 12 – Campus Planning (development) and Design Guideline (architectural design principles) for Implementation (presented for Discussion at GFC FDC November 6, 2015).

Issues

The challenging aspects of the RCRF project are:

- meeting program requirements while aligning with campus planning guidelines;
- confirmation of 9.1 m (30') high-density storage capacity to accommodate the combined BARD collections, University Archives, and maps – achieved through the engagement of an expert racking designer and supplier (Space Saver) early in the validation phase to verify, optimize and develop project-specific overall reduced storage area, while meeting the 20 year capacity growth objective;
- balancing LRDP planning principles with shorter and longer term operational needs of RCRF – achieved through extensive analysis of siting options and design that is engaging while improving access for researchers, students, staff, and service from the east. Ample opportunity for future growth in the west part of the site for potential academic and/or collection expansion was addressed through realizing reduced site coverage; and
- ratification of the total building area (BGSM) – addressed through a critical review and prioritizing of all functional areas, increased use of shared and open spaces resulting in a reduced general circulation and economized size of all reviewed operational components. Space program update, rationalizing and validation process included participation of Library Services.

* This is included in the 5.1M total.

Development of Site #3 of Sector 12, District 2 brings an Academic/Research facility onto South Campus. The purpose designed RCRF provides safe, environmentally controlled high-density storage to establish a modern records depository with a holding capacity accommodating up to 20 years of managed growth projections. The design is conceived to provide for expansion opportunities to accommodate future academic and/or storage needs. Through a mindful approach to the new facility site placement and site coverage, both the operational shorter-term library and collections considerations and longer-term campus growth goals are balanced.

RCRF provides for a venue for advanced collections including digitization, archive access and research. It includes a dedicated reading room for pre-arranged study that is critical for academic success; augmented by secure, purpose designed library and archives staff services, sorting, and processing areas.

The opportunity for re-branding of the University's Research Collections and Resource endeavours through this facility.

Recommendation

THAT the GFC Facilities Development Committee (FDC) approve the proposed RCRF – Design Development Report.

UNIVERSITY OF ALBERTA RESEARCH & COLLECTIONS RESOURCE FACILITY

DESIGN DEVELOPMENT REPORT

SUBMISSION - JANUARY 11, 2016

Table of Contents

TATBLE OF CONTENTS

List of Illustrations

Opened in 1994, the Book and Record Depository (BARD) is a high density library storage facility that houses less frequently accessed library materials, research collections and the University of Alberta Archives. The Facility holds mostly books and journal volumes, but also microfilm, maps, audio discs, manuscripts, archives, and other formats normally collected by research libraries. Staff at BARD receive, process and create machine-readable records for newly deposited materials and provide circulation and document delivery services. Together these constitute one of Canada's most significant academic and cultural resources. BARD has been located in the leased and adapted commercial facility located off of the UA campus. The projected growth of BARD cannot be appropriately accommodated at that location, when the lease expires.

In July 2015, the Design Build (DB) Team, led by Stuart Olson, was retained to proceed to Phase 1 of this project, namely the design phases. The report contained herein formulates the *second* of two major submissions that the DB project team is to deliver during Phase 1, namely the Design Development Report. The Schematic Design Report was submitted on 9 November 2015. Consolidated and included within this report is a consolidation of all the material previously presented in Schematic Design AND all updated material as detailed through the completion of Design Development.

Phase 1, defined as the Validation Stage/Schematic Design in the original Request for Proposal documents, is to "*translate the project requirements into space parameters, to explore preliminary design options and analyze them against priorities and program objectives*".

In addition, the Design Development objectives were defined to: "*provide the stated requirements in sufficient detail so as to enable the Design-Builder to prepare and submit a Stipulated Lump sum Price to the University that meet UA governance requirements and create a comprehensive set of documents that in the event the project does not proceed could be utilized in the future using alternative procurement and construction delivery approach*". The following is a summary of the project highlights and the Design Build Team's work throughout this Phase 1.

1. Purpose of the Project

Replace the existing Book and Record Depository (BARD) with a new, purpose-built Research & Collections Resource Facility (RCRF) to be built on South Campus. The BARD collections, and co-located with it the University Archives, will be relocated and augmented by the volumes transferred off the North Campus, to ease campus space pressure and accommodate new technological functions of Library Services.

The new RCRF facility will:

- Provide proper environment in which to store materials protecting the irreplaceable collection and the University Archives;
- Lower the risk of stored materials damage, decreasing the liability exposure;
- Provide the required capacity and afford expansion space and future growth (20 years) for related or complimentary use occupancies;
- Offer improved access from the UA campuses, including use of public transportation;
- Align with Guiding Documents of: Dare to Discover, Academic Plan (Dare to Deliver) and Long Range Development Plan (updated June 2013).

2. Objectives of the Project

The Research Collection and Resource Facility (RCRF) objectives are:

- Accommodate up to **5.1M volumes total capacity** to grow from the current **3.1M** BARD print volumes, and including: **20 years growth projection of 50,000 items per year**, the backlog of unprocessed materials to the collection and accommodation of up to **1.0M items relocated from North Campus** to free up valuable space for academic requirements;
- Accommodate the University Archives, currently co-located with BARD;
- Provide an appropriate, functional and welcoming space for staff, students and visitors for academic and special research purposes and goals;
- Improve the proximity of the facility to North Campus, ideally accessible by LRT, for better access by students, staff and researchers;
- Provide appropriate quantity, type and function space for processing, storing and digitizing materials in the collection;
- Meet budgetary of $21.0M construction cost, including high density racking;
- Meet schedule requirements of mid-2017 facility takeover.

3. Deliverables

The Validation (Phase 1 – Schematic Design) deliverables are summarized in this report and include:

- The validation of the Functional Program (March 26, 2015), that was previously approved by FDC;
- Following an exploration of various design concept options, articulate the strongest and most feasible design concept, as developed by the DB team;
- A site analysis for the chosen Parcel D2-#3 on South Campus which includes a regulatory review, sector analysis, fire and life safety strategy, site services strategy, preliminary landscape solution, major utilities tie-in, site grading & drainage, etc.;
- Summaries and sketches of the conceptual system descriptions for structural, mechanical, electrical, civil and landscape;
- A detailed cost plan and project schedule.

RCRF EAST ELEVATION

In addition to the information noted in the paragraph above, the Design Development deliverables are summarized in this report and include:

- Further refinement of the floor plan layout and an updated space reconciliation table;
- An update to the site development considerations;
- More detailed system descriptions for structural, mechanical, electrical, civil and landscape scope of work, including drawings that are coordinated with the architectural scope;
- Note that the elemental cost plan and project schedule are not included and are being submitted under separate cover by the DB contractor.

4. Site

The parcel of land allocated to RCRF was derived from the Sector 12 Plan. For the purpose of defining development boundary, the project site of 184m x 81m has been established, offering14,900m² (3.68 acre) in area. The Site #3 of Sector 12, District 2 has been selected for reasons of: access, alignment with planned utility Right of Way and manageable impact to current research and operations for the Faculty of Agricultural, Life and Environmental Sciences. The majority of parcel's buildable area is delineated by two rows of trees, acting as wind breakers. The site topography is uniform with a minimal northerly slope. The project aims to minimize development impact, respecting its current siting context and the land value, achieving a low Floor Area Ratio (FAR) and site coverage, and maintaining significant open spaces on site.

With several site options considered, the main entrance and operational/services access location was placed facing east, and close to 115A Street, taking advantage of the existing vehicular access, and multi-use pedestrian/bicycle pathway connecting with the LRT station nearby. With the single storey "front of house" pavilion located along 115A Street edge, the high density storage massing shifts back towards the site centre, following the planning principle of graduating the growth density towards the South Campus centre. The northeast corner of RCRF provides for services and delivery dock access, while the southeast part is directed towards pedestrian access and public realm connectivity to follow future LRDP development of pedestrian and bicycle routes campus network. The west and possibly the south portion of the site is reserved for future expansion of the current facility or additional program development.

The RCRF will have limited staff parking in immediate proximity of the facility, utilizing the pool of staff parking areas provided on the South Campus. Limited numbers of short-term parking stalls, delivery/pickup dock and service and maintenance vehicles access is provided to the facility.

The current site constrains include:

- Below grade geotechnical conditions of highly plastic soil and a relatively high water table;
- Mature elm trees windbreaker within south part of the site;
- The proximity of Storage Garage to the north imposing limiting distance considerations;
- No underground storm water infrastructure.

5. Challenges

The challenging aspects of the RCRF project are:

- Meeting program requirements while aligning with campus planning guidelines.
- Confirmation of 9.1m (30') high density storage capacity to accommodate the combined BARD Collections, University Archives and Maps – achieved through the engagement of an expert racking designer and supplier (Space Saver) early in the validation phase to verify, optimize and develop project-specific overall reduced storage area, while meeting the 20 year capacity growth objective.
- Balancing LRDP Planning Principles with shorter and longer term operational needs of RCRF – achieved through extensive analysis of siting options and design that engages the public realm to improve researchers, students, staff and service access from the east. Ample opportunity for future growth in the west part of the site for potential academic and/or collection expansion was addressed through realizing reduced site coverage.
- Construction budget – projected higher cost, in large part due to geotechnical conditions confirmed to exist on site, and a higher cost of racking system priced in US Dollars, resulting from a less favourable CAD to USD exchange rate. This challenge has been addressed by a budget increase within the overall approved project funding amount.
- Engaging adjacent academic stakeholders (ALES and FPER) and neighbouring communities for input on impact of proposed project and design through Community Open House events. Open House #1 took place July 27, 2015 and Open House #2 on November 23, 2015.
- Initially undefined size of the total building area (BGSM) – addressed through a critical review and prioritizing of all functional areas, increased use of shared and open spaces resulting in a reduced general circulation and economized size of all reviewed operational components. Space program update, rationalizing and validation process included participation of Library Services.
- Site constraints – surface drainage, low elevation, existing trees/structures

6. Opportunities

Development of Site #3 of Sector 12, District 2 brings about the first Academic/Research facility onto South Campus. The purpose designed Research Collections and Resource Facility (RCRF) provides safe, environmentally controlled high density storage to establish a modern records depository with a holding capacity accommodating up to 20 years growth projections. The design is conceived to provide for expansion opportunities to accommodate future academic and/or storage needs. Through a mindful approach to the new facility site placement and site coverage, both the operational shorter-term library and collections considerations and longer-term campus growth goals are balanced.

RCRF provides for a venue for advanced collections and archive access and research. It includes a dedicated reading room for pre-arranged study that is critical for academic success, augmented by secure, purpose designed library and archives staff services, sorting and processing areas.

A rebranding of the University's Research Collections and Resource endeavors through this facility.

7. Design Principles

While balancing the needs of the facility program with campus-wide land use and design guidelines, a number of criteria and design principles were identified by the team and used as a means to develop the following design solution. This includes the following:

- Provide authenticity and derive typology;
- Provide an appropriate functional distribution of the major operations, as programmed;
- Provide a solution that is contextual within the existing fabric of South Campus;
- Provide maximum expansion potential;
- Provide appropriate massing and human scale through articulation;
- Provide a balance between the expression of the building from outside and an the experience of the occupant inside;
- Provide a significant point of arrival to the facility.

8. Concept Design

As presented at the first Community Open House, held on July 27, 2015, the approach to concept was the following:

Building design shall be contextual – compatible in form and scale to complement the adjacent buildings. In addition, building massing shall be a composition of forms and elements shaped by functionalities and arranged so as to facilitate ease of operations, readability, wayfinding and interpretation while creating interest, human scale, meaning and delight.

Buildings are to contribute to the campus-scape of South Campus while enhancing the adjacent public realm. They should be engaging and transparent to edges, pedestrian plazas, pathways and circulation corridors. Project siting to retain and enhance existing campus fabric, maximize future development expansion space and flexibility.

RCRF should complement and enrich buildings on South Campus.

Connectivity should be cohesive, barrier-free, engage existing and anticipate future planning.

Project is to incorporate sustainable design principles and be secure, durable and efficient construction. Building orientation to enhance natural daylighting and view corridors as well as reduce wind and energy impacts.

At a second Community Open House, held on 24 November 2015, the proposed design solution demonstrated how the concept has evolved into a viable design solution which encapsulates the objectives set forth.

9. Process

The Modified Design Build process afforded on-going engagement of the University personnel, accelerated key project decision and brought forward known issues to be avoided in the design. It encouraged generation, review and selection of early design options, progressively refining those, and created opportunity for effective dissemination of decisions communicated promptly as a timely input during the validation phase.

Library Services offered a dedicated on-campus space for weekly project team meetings, where focused presentations of a developing design, schedule and budgetary discussions were encouraged and allowed participation of all key stakeholders. In addition, during Design Development, Library Services introduced a Lean Management consultant to the project team. This expertise was sought out by the User Group in order to review current operational practices, find efficiencies and then ultimately transfer this knowledge for implementation at the new RCRF. This specific analysis and input provided a further update to the functional program assumptions.

Additional series of complementary working meetings with Library Services also occurred in the same “big room” space to advance understanding, updates and necessary modifications to the functional program implementation. In order to meet the timeline the University provided direct access to operations and project management personnel imbedded directly into the project during the validation phase. This process supported the transfer of information on site constraints, queries on South Campus LRDP, clarifications to concurrent planning of campus utilities infrastructure that could affect the project, potential impact to the neighbourhood and all other project inputs brought into decision process by all members of the integrated project delivery.

10. Design Solution

The design solution that is fully articulated throughout this report has been developed by an integrated team. The proposed solution follows the merits of the Functional Program but also improves upon found space and work flow efficiencies. Considerations of daylight and visibility have also been developed. By and large the LRDP guidelines are adhered to, acknowledging that the development of the Sector Plan for Sector 12 is being developed concurrently. Likewise, community input has been taken into account. There are some objectives, which were outlined at the Community Open Houses, which have not been achieved, such as:

- The preferred siting with the ‘front of house’ to the west was not practical, considering the existing infrastructure and the restrictions for the DB team to construct anything south of the tree line.
- Locating the facility between the existing tree lines challenges the proposed setbacks.
- The overall height of the building is closer to 40’ versus the original 60’.
- A two storey ‘front of house’ solution was not achievable from a work flow perspective. Operationally the work flow is better with a single storey layout. Alternatively, massing is used as a means to mitigate and reconcile two different building heights.
- Future expansion capability is limited to the west and potentially to the south.

11. Program Reconciliation

The original Functional Program was prepared by the University of Alberta in March 2015. It encompassed a brief of the project objectives and concluded with a space summary. At that time, it was anticipated that a facility of 4,840 component gross square meters (CGSM) was required to meet the 20 year growth goals of the Research & Collections Resource Facility. This figure did not include a factor for grossing the programmed space up to a complete building gross square meters (BGSM).

Through a process of engaging the key stakeholder group during Schematic Design, the Functional Program was validated and updated. The projected space requirements were discussed, reviewed and verified by the Library Services and the Design Build Team. While in general operationally and functionally aligned with the FDC-approved Functional Program of March 2015, it was determined that the facility, meets the project objectives and can accommodate the functional requirements of the Research & Collections Resource Facility within a reduced size of approximately 4,040 BGSM. Included in this total was 2,510 CGSM dedicated to the high density storage of 9.1m (30') racking height and housing BARD Collections, University Archives and Maps. A separate, dedicated and also environment-controlled programmed space of 130 CGSM accommodated Microfiche/Film stacked storage. The concept of an enclosed drive-in delivery dock was modified and replaced by a protected exterior enclosure. The resulting building grossing factor at the Schematic Design phase was 1.16 (or 16%).

Further refinement of the floor plan layout and coordination between consulting design disciplines during Design Development provides a resultant solution that, operationally and functionally, the facility continues to be aligned with the FDC-approved Functional Program of March 2015. The Research & Collections Resource Facility is now contained within a building sized at 4,195 BGSM although the CGSM has been maintained at 3,496m^2 – the same as at the Schematic Design phase. The increase in size is primarily attributed to a larger physical requirement for space to house mechanical equipment, which exceeded the space allowance presumed at that time. Further details of the changes in the space requirements are outlined in the Space Reconciliation section.

12. Facility and Site Operations & Maintenance

The integration of all project stakeholders in the modified Design Build process, and the Library Services in particular, provided for valuable input on operational and maintenance issues to be considered and addressed to support early planning decisions. More detailed functional layouts, including placement of fittings, furnishing and major equipment (FFE) has been advanced through Design Development and the current floor plans represent the most current accommodation, including service requirements.

Facility Operations & Maintenance considerations were incorporated into Schematic Design during the project validation phase through direct engagement and involvement of the University Technical team. This continued through Design Development. Information from concurrent of South Campus utilities planning informed RCRF design team of directions and services made available in support of the project.

At the Schematic Design and validation phase several value-added visits to BARD (current operation) and a similar high density storage recently brought into operation at the University of Calgary, provided tangible operational and maintenance issues that shaped the design from its earliest phase. The functional program parameters were translated early into several space layout options that confirmed operational necessity of implementing a single storey RCRF building with the main mechanical services located in a penthouse above. Implementation of functional zoning responds to the operational requirements for scheduled visits by researchers and students, with consideration given to balancing the on-site collections/archives access with the necessity of protecting and preserving valuable on-site resources. The design aims at creating both a visiting and working experience that encourages and supports academic pursuits and affirms importance of the facility to the University of Alberta. The design provides for environmentally purposed storage areas that offer lowered temperature and lower humidity to effectively protect the collections, archives, maps, microfiche, film and other repository items.

A relatively small contingent of Library Services personnel is provided with originally programmed and some added spaces to support the RCRF functions and to create a pleasant and welcoming work environment that offers space utilization flexibility, social space and access to daylight, where possible. A purposefully compact layout reduces travel distance and movement of book-carrying trucks, including a large NEOS sorting area. The main visitor entrance becomes a destination point and engages functionally and visually by both the pedestrian passer-by and public travelling the adjacent LRT line. The service access for deliveries and pick up functions and building services infrastructure is located separate from the visitor entrance.

Operational, maintenance and servicing access points were discussed and reviewed with the University technical teams and developed with advancement for all building systems described at the Design Development phase.

13. Community Consultation as per Consultation Protocol outlined in Appendix 18 – LRDP

The neighbouring South Campus communities have been invited to offer their input on impact of proposed project and design through Community Open House events. Through its Community Relations the University of Alberta works with residents in its neighbouring communities, the city of Edmonton and the province to ensure the community consultation process is respectful and transparent while meeting the university's primary goal of achieving its academic vision. Two open house events had been organized for the Research and Collections Resource Facility project. Open House #1 took place July 27, 2015 and Open House #2 on November 23, 2015. The University Relations Evaluation Summaries for these public events are enclosed in the Appendix.

14. Design Changes in Response to Stakeholder Input

In comparing the status of design between Schematic Design and Design Development, the following changes are noted:

- Pedestrian access to the facility has been modified so that a new road crossing is provided from the existing multi-use trail on the east side of 115A St. directly in front of the RCRF east entry door.
- The existing outdoor fuel tank storage shed on the adjacent property to the north will be relocated, as part of this project, in order to accommodate surface drainage on the north side of the site.
- While maintaining the programmed component gross total area some internal reallocation of space have been introduced by the RCRF User Group.
- Two exterior and partially covered bicycle racks locations have been provided.
- Consideration to improve sound attenuation of glazed exterior wall for the Reading and the Multi-Purpose Rooms.
- The overall building gross area has been increased by 3.8% to 4,195 BGSM in order to accommodate building services, which have been developed further.

15. Budget and Schedule Alignment & Reconciliation

At the completion of the Design Development phase, the RCRF building design, as described within this report, is within the project budget, as established by the UA Project Management Team. In addition, the project can be constructed within the established project schedule.

PAGE INTENTIONALLY LEFT BLANK

1.0 INTRODUCTION

Project Background

The Book and Record Depository (BARD) is a library storage facility located off of the UA campus. Opened in 1994, BARD is a high density storage facility that houses less frequently accessed library materials, research collections and the University Archives. The Facility holds mostly books and journal volumes, but also microfilm, maps, audio discs, manuscripts, archives, and other formats normally collected by research libraries. Staff at BARD receive, process and create machine-readable records for newly deposited materials, and provide circulation and document delivery services. Together these constitute one of Canada's most significant academic and cultural resources. Over the past several years, the University has been investigating options to relocate the collection from BARD. A new facility, the Research & Collections Resource Facility will be built on South Campus.

In July 2015, the Design Build Team, led by Stuart Olson, was retained to proceed to Phase 1 of this project, namely the design phases. The objective of the first design phase, defined as the Validation Stage in the original Request for Proposal documents is to "translate the project requirements into space parameters, to explore preliminary design options and analyze them against priorities and program objectives". As a result the Schematic Design Report was submitted and approved in November 2015.

The report contained herein formulates the final of two major submissions that the team was required to submit during Phase 1. Defined as the Design Development stage in the original Request for Proposal documents, the objective is to: "provide the stated requirements in sufficient detail so as to enable the Design-Builder to prepare and submit a Stipulated Lump sum Price to the University that meet UA governance requirements and create a comprehensive set of documents that in the event the project does not proceed could be utilized in the future using alternative procurement and construction delivery approach". The following is a summary of the Design Build Team's work through this phase.

Purpose and Scope

The purpose of the Design Development Report is to:

- provide the user group with an understanding of the scope of the project;
- provide the University with the operational and maintenance requirements of the facility;
- provide enough information in order that an elemental cost estimate can be generated;
- provide the design build team with direction to move directly into the preparation of Contract Document production and Construction.

WORKSHOP DESIGN SESSION, SEPTEMBER 17, 2015

Methodology

During this Phase, the Design Build Team met weekly in an integrated 'Big Room' format. During meetings the team shared ideas, presented concepts, debated options and generally collaborated on the development of the design solution. Additionally, the key stakeholder group continued to meet with the design team weekly to further refine the detailed requirements for the new facility. Other small working group meetings were held throughout the design phase, which were more focused in topic (i.e. building envelope, exterior materiality, etc.). Meeting minutes were generated for all formal meetings.

Participants

This document was prepared with the help and participation of many individuals. The members are listed below for reference:

University of Alberta, Planning and Project Delivery:
Pat Jansen, Associate Vice-President, Planning & Project Delivery, Facilities and Operations
Todd Werre, Director, Project Management Office
Keith Hollands, Associate Director, Design & Technical Services
Ben Louie, University Architect
Kelly Hopkin, Senior Campus Planner, Architecture
Shannon Loughran, Planning Officer, Space Management
Laurel Roblin, Utility Service Manager – Mechanical Utilities
David Roh, Utility Service Manager – Electrical Utilities

Graeme Alston, Acumen Cost Consulting (independent cost consultant for UA)

University of Alberta Libraries User Group:
Gerald Beasley, Vice-Provost & Chief Librarian
Sandra Shores, Associate University Librarian
CJ de Jong, Access Services Coordinator
Robert Desmarais, Special Collection Librarian
James Franks, Associate University Archivist
Geoff Harder, Associate University Librarian
Darryl Hopkins, Facilities/Mailroom
Tina James, Facilities
Vaughn Munro, BARD Operations Supervisor

Michel Handfield, Oil Country Engineering

Design Build Team:
Ryan Christensen, Stuart Olson Construction Ltd.
Sean Kangas, Stuart Olson Construction Ltd.
Joe Leonard, Stuart Olson Construction Ltd.
Russyl Workman, Stuart Olson Construction Ltd.
Atef Matta, Stuart Olson Construction Ltd.
Jason Franchuk, Stuart Olson Construction Ltd.
Janet Koshuta, HFKS Architects Inc.
Chris Filipowicz, HFKS Architects Inc.
Sergio Poles, HFKS Architects Inc.
Robert Timms, HFKS Architects Inc.
Alexander Llerena, HFKS Architects Inc.
Vincent Cole, HFKS Architects Inc.
David Brookes, HFKS Architects Inc.
Diana Chernenko, Chernenko Engineering Ltd.
Salvador Grandon, Chernenko Engineering Ltd.
Migo Kelada, KFR Engineering Ltd.
Mark Lafreniere, KFR Engineering Ltd.
Derek Ciezki, SMP Engineering Ltd.
Henry Chu, SMP Engineering Ltd.
Ted Muller, EDA Collaborative Inc.
Mike Shankaruk, Arrow Engineering Inc.
Maz Kitabwalla, Arrow Engineering Inc.
Stephani Carter, EcoAmmo Sustainable Consulting
Madeleine Drake, EcoAmmo Sustainable Consulting
Rej Boutin, Priority Mechanical Ltd.
DJ Coppens, Territorial Electric Ltd.
Lee Broadbent, Territorial Electric Ltd.

Sign-Off Sheet

In accordance with the Agreement, we are submitting for review and approval the Design Development Report. We respectfully request that copies of this report be circulate to the appropriate departments and individuals who are the key stakeholders in this project. The following report is intended to convey the project scope at this stage.

Approval of this report provides the Design Build team with the authorization to proceed to the next step of the planning process, namely Contract Documents and Construction. Comments can be made and noted on this report and the documents will be revised or amended accordingly, with the approval of the Client.

The undersigned have reviewed the Design Development Report contained herein and accept its contents as representing the requirements of the design phases and updated respectively during the planning process.

Pat Jansen
Associate Vice-President, Planning & Project Delivery, Facilities and Operations

SIGNATURE _____ DATE _____

Ben Louie
University Architect

SIGNATURE _____ DATE _____

Kelly Hopkin
Senior Campus Planner, Architecture

SIGNATURE _____ DATE _____

Gerald Beasley
Vice-Provost & Chief Librarian

SIGNATURE _____ DATE _____

Keith Hollands
Associate Director, Design & Technical Services

SIGNATURE _____ DATE _____

Todd Werre
Director, Project Management Office

SIGNATURE _____ DATE _____

PAGE INTENTIONALLY LEFT BLANK

2.0 ARCHITECTURAL DESIGN

Site Development

Existing Conditions

The parcel of land allocated to RCRF on South Campus was defined as Site #3 of Sector 12, District 2. For the purpose of defining a development boundary, the project site measuring 184m x 81m has been established, approximately 14,900m² (3.68 acre) in area, and coordinated with the South Campus planning (refer to the images to the right).

The site D-2 #3 has been selected for reasons of access, alignment with utility planned Right of Way and manageable impact to current research and operations for the Faculty of Agricultural, Life and Environmental Sciences (ALES). The specific zone for current development is delineated by two rows of trees, acting as wind breakers. The RCRF building is to be contained between those four elements to further minimize development impact and respecting its siting context. No construction activity is to take place south of the existing south tree line.

Other conditions impacting the site development is an existing General Storage facility and associated with it service yard and parking immediately adjacent to the north. This condition is noted in consideration of the limiting distance and the exposing walls, as defined and governed by Alberta Building Code. The General Storage building is a Butler-type metal structure with no openings facing south, however it does not appear to provide any fire rating, which should be considered in development of the RCRF.

There is a long, narrow storage shed to the east of the General Storage facility, which is used primarily by ALES research teams and Facilities and Operations to store gasoline and propane tanks. This is a semi-enclosed storage shed (three metal sides and a roof) with a lockable chain link fence across the front (north face) sitting on a concrete pad. It is proposed that this entire assembly be relocated to another location adjacent to the General Storage facility so it is no longer in close proximity to the RCRF building. This will also allow for the accommodation of a drainage swale on the north side of the trees (this is further described in this section and the Civil section). The relocation of the shed will be included as part of this project.

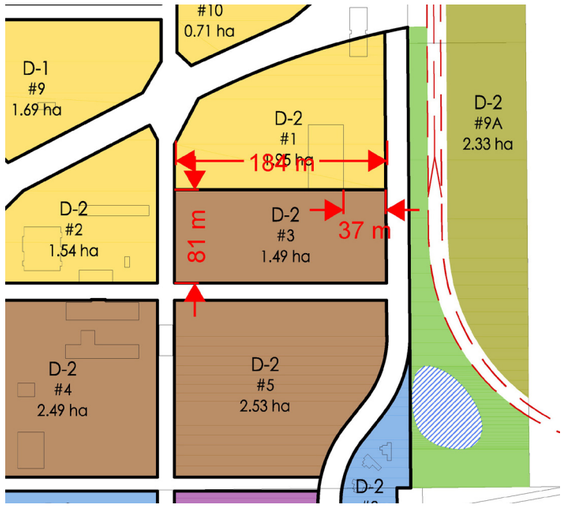
Figure 1:
Proposed Land Uses

Sector 12 Development Guidelines for Implementation

UA South Campus Land Use Plan from Sector 12 plan

Topography

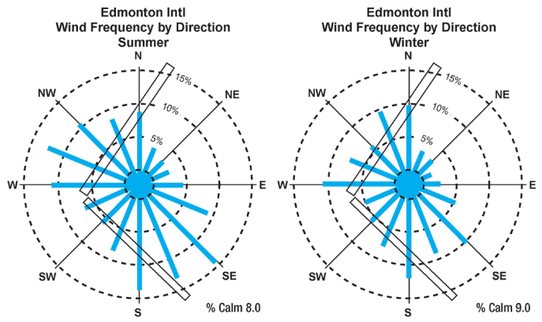
The site topography is almost flat with a minimal and uniform slope towards the north. This condition is noted in creating an effective surface drainage management around the new RCRF building and its landscaped areas. The present use appears to be one of the farmed land.



Parcel D-2 #3 Site Dimesions

Wind

Edmonton is in the zone of the upper level westerlies, a large-scale atmospheric circulation that generally streams in a west to east direction. In the winter, this flow shifts to northwesterly or northerly which allows for frequent invasions of clad Arctic air. In the summer, a more westerly or southwesterly upper flow allows for incursions of moist Pacific air. Winds are typically lighter in winter than those during the rest of the year. However, a combination of fresh snow, wind and cold temperatures may result in blizzard conditions, but these events are rare in Edmonton. The winds become somewhat stronger in the spring and summer and favour a west to northwest direction.



Wind Rose Data, Edmonton, AB (*Source: Nav Canada*)

Rainfall/ Precipitation

- Edmonton, Alberta is procured on average 461.1mm (18.2 in) of rainfall per year, or 38.4mm (1.5 in) per month.
- On average there are 122 days per year with more than 0.1mm (0.004 in) of rainfall (precipitation) or 10.2 days with a quantity of rain, sleet, snow etc. per month.
- The driest weather is in November when an average of 16.1mm (0.6 in) of rainfall (precipitation) occurs.
- The wettest weather is in July when an average of 94.3mm (3.7 in) of rainfall (precipitation) occurs.

Average Temperatures

- The mean temperature in Edmonton, Alberta, Canada is cool at 3.6 degrees Celsius (38.5 degrees Fahrenheit).
- Mean monthly temperatures have a variation of 30 °C (54°F) which is above moderate range.
- There is a variation/ range of daily average temperatures of 10.2 °C (18.4 °F).
- July is the warmest month (very mild) having an average temperature of 17.5 degrees Celsius (63.5 degrees Fahrenheit).
- January is the coolest month (very cold) having a mean temperature of -12.5 degrees Celsius (9.5 degrees Fahrenheit).

Site Geotechnical

The south campus site is located in an area containing high plastic soils and a relatively high water table. This poses a significant risk for swelling and shrinkage behaviour in the soil matrix with changes in soil moisture content. The initial six geotechnical test bores confirm this condition. In combination with a minimal slope of the existing site topography, the surface water and the soil moisture management are significant considerations reflected in the design of the RCRF building.

Site Specific Development Guidelines

The initial development parameters for the site D-2 #3 were applied as the guidelines informing RCRF project design siting and design. Based on the revised and reduced in size site area of 14,900m² (3.68 acre), at the Schematic Design and Design Development those resulted in the following outcome:

The noted Permeability for the "back" of the RCRF building is very low and reflects the functional requirement of effectively preventing the daylight (UV in particular) from reaching the collections area and in result damaging the stored material that requires protection. Only very limited and measured daylight access has been granted to the collections warehouse through strategic location of narrow windows, which correspond with the main racking aisles.

Landscape Concept

As an enhancement to the existing trees on the site's borders, namely the north and south wind breaks, there will be a development of softer landscape features predominately to the east. A more formal planting of trees, shrubs and grasses frame the Reading Room on the southeast edge. The full height glazing blurs the line between interior and exterior, inviting the garden into the building while enhancing the views out. A more garden-like arrangement is planned just north of the entry, providing views for the staff working inside the facility. At night, soft garden lighting will enhance the trees with the building as a backdrop.

Criterion	Site Specific Development Guidelines for D2-#3 (July 2015)	Site Specific Development Guidelines for D2-#3 (July 2015)	RCRF Schematic Design (Nov 2015)	RCRF Design Development (Jan 2016)
Floor Area Ratio (FAR)	1.0	0.35-0.7	0.27	**0.27**
Site Coverage	80%	70%	25%	**25%**
Setbacks				
Front:	15.0m	10.0m	10.5m	**10.5m**
North:	14.0m	10.0m	11.0m	**12.0m**
South:	22.0m	10.0m	23.0m	**22.0m**
Back:	53.0m	10.0m	79.0m	**79.0m**
Permeability				

Setbacks table

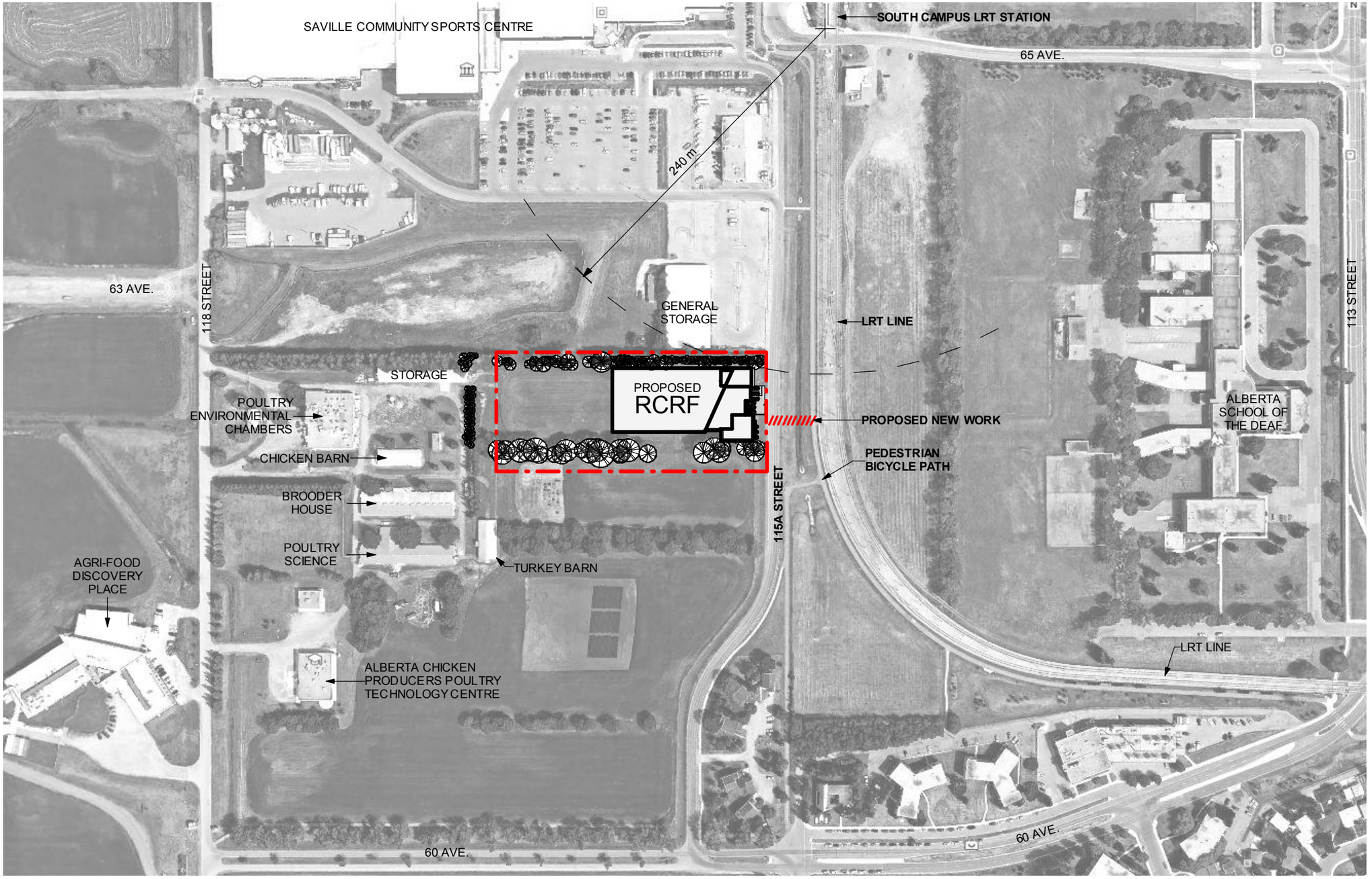
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Annual**
Average Precipitation mm (in)	23.3 (0.9)	16.8 (0.7)	17 (0.7)	22.1 (0.9)	43.5 (1.7)	79.9 (3.1)	94.3 (3.7)	67 (2.6)	41.6 (1.6)	17.3 (0.7)	16.1 (0.6)	22.2 (0.9)	**461.1 (18.2)**
Precipitation Litres/m² (Gallons/ft²)	23.3 (0.57)	16.8 (0.41)	17 (0.42)	22.1 (0.54)	43.5 (1.07)	79.9 (1.96)	94.3 (2.31)	67 (1.64)	41.6 (1.02)	17.3 (0.42)	16.1 (0.39)	22.2 (0.54)	**461.1 (11.31)**
Number of Wet Days (probability of rain on a day)	11 (35%)	11 (39%)	10 (32%)	8 (27%)	9 (29%)	13 (43%)	13 (42%)	12 (39%)	9 (30%)	7 (23%)	8 (27%)	11 (35%)	**122 (33%)**
Percentage of Sunny (Cloudy) Daylight Hours	37 (63)	39 (61)	46 (54)	51 (49)	55 (45)	49 (51)	61 (39)	58 (42)	49 (51)	50 (50)	41 (59)	35 (65)	**50 (50)**

Precipitation Table (*Source: ClimaTemps.com*)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Annual**
Average Max Temperature °C (°F)	-8.2 (17.2)	-4.2 (24.4)	1.1 (34)	10.5 (50.9)	17.5 (63.5)	21.3 (70.3)	23 (73.4)	22.1 (71.8)	16.6 (61.9)	11.3 (52.3)	-0.1 (31.8)	-6.3 (20.7)	**8.7 (47.7)**
Average Temperature °C (°F)	-12.5 (9.5)	-8.9 (16)	-3.6 (25.5)	4.9 (40.8)	11.6 (52.9)	15.6 (60.1)	17.5 (63.5)	16.6 (61.9)	11.1 (52)	5.9 (42.6)	-4.2 (24.4)	-10.5 (13.1)	**3.6 (38.5)**
Average Min Temperature °C (°F)	-17 (1.4)	-13.7 (7.3)	-8.4 (16.9)	-0.7 (30.7)	5.7 (42.3)	9.9 (49.8)	12 (53.6)	11 (51.8)	5.6 (42.1)	0.6 (33.1)	-8.4 (16.9)	-14.8 (5.4)	**-1.5 (29.3)**

Average Temperatures Table (*Source: ClimaTemps.com*)

SITE LOCATION
(INDICATED IN RED)
LOOKING NORTH



RCRF PROJECT SITE- CONTEXT

Design Concept

The design concept has been developed through the guidance of the campus wide land use and design guidelines, district specific design guidelines and site specific development guidelines. In addition, the approach to concept design was also informed by the parameters presented by UA at an Open House held on 27 July 2015 and then followed up at a second Open House on 24 November 2015.

Contextual Design

The building concept is formed both functionally and physically by a pattern of long and narrow farmland, framed by treed windbreakers punctuating the existing pattern of fields or former homesteads. A longitudinal plan composition implements a dialog between the edge of the Sector 12 and its future Public Realm development that in time will intensify towards the campus centre. The function of the facility informs its elongated configuration to occupy the land parcel that was shaped by farming tradition of working the field in the most economical pattern. A similar pattern of work and operation repeats itself within RCRF facility storage and enclosed protective environment. It evokes the function of a connection, transmitting evolutionary change of the land use from the edge towards the future centre.

A contextual, dominating form sources elements of practical, common sense farm facilities that store and protect the crops. The massing assembly sets the stage for public realm engagement along its east and west edges to balance unique operational requirements of RCRF with the specified site design guidelines. The main pedestrian entrance and service approach are located along the east edge of the building to take advantage of already established 115A Street access. The east-facing front of the house is not greater than two levels above grade to begin with and increases its volume towards the future campus centre. Such orientation supports design principles of the Winter Cities protecting pedestrian and delivery entry points from prevailing cold northern and northwestern winds.

Spatial Organization

The planning of the facility has been driven by the composition of three major components: the large Collections storage volume, a processing area and a reading room. The massing, scale and articulation of the three components is critical in defining the function and use of the facility, while providing an appropriate architectural expression in the context of South Campus. Architecturally, the front of house components has been developed as a low volume pavilion which sits in front of the Collections space. The use of materials and the lighting concepts support a building that will initially be viewed from the east, as they arrive at the adjacent South Campus/ Fort Edmonton Park transit station, as well as to the Saville Community Sports Centre. A description of the organization of the three major components is provided.

Collections Space:

The Collections space is approximately a three-storey volume and is located to the west. It accommodates 30' high racking for the proper storage of materials. This space is maintained under separate environmental controls. A large structure and volume is required to accommodate the Collections. In order to minimize the impact of such a large volume on the site, the architectural language is expressed to soften its impact on South Campus. The large, sweeping barrel roof provides a lower roof profile while ensuring that roof penetrations are minimized. Rainwater will not accumulate on a curved roof as it would on a flat roof. Gutters and exterior downspouts become part of the roof profile and elevation detailing on both the north and south facades, providing vertical articulation. A change in colour and materiality along the top portion of these two facades draws the eye up above the tree lines.

Reading Room:

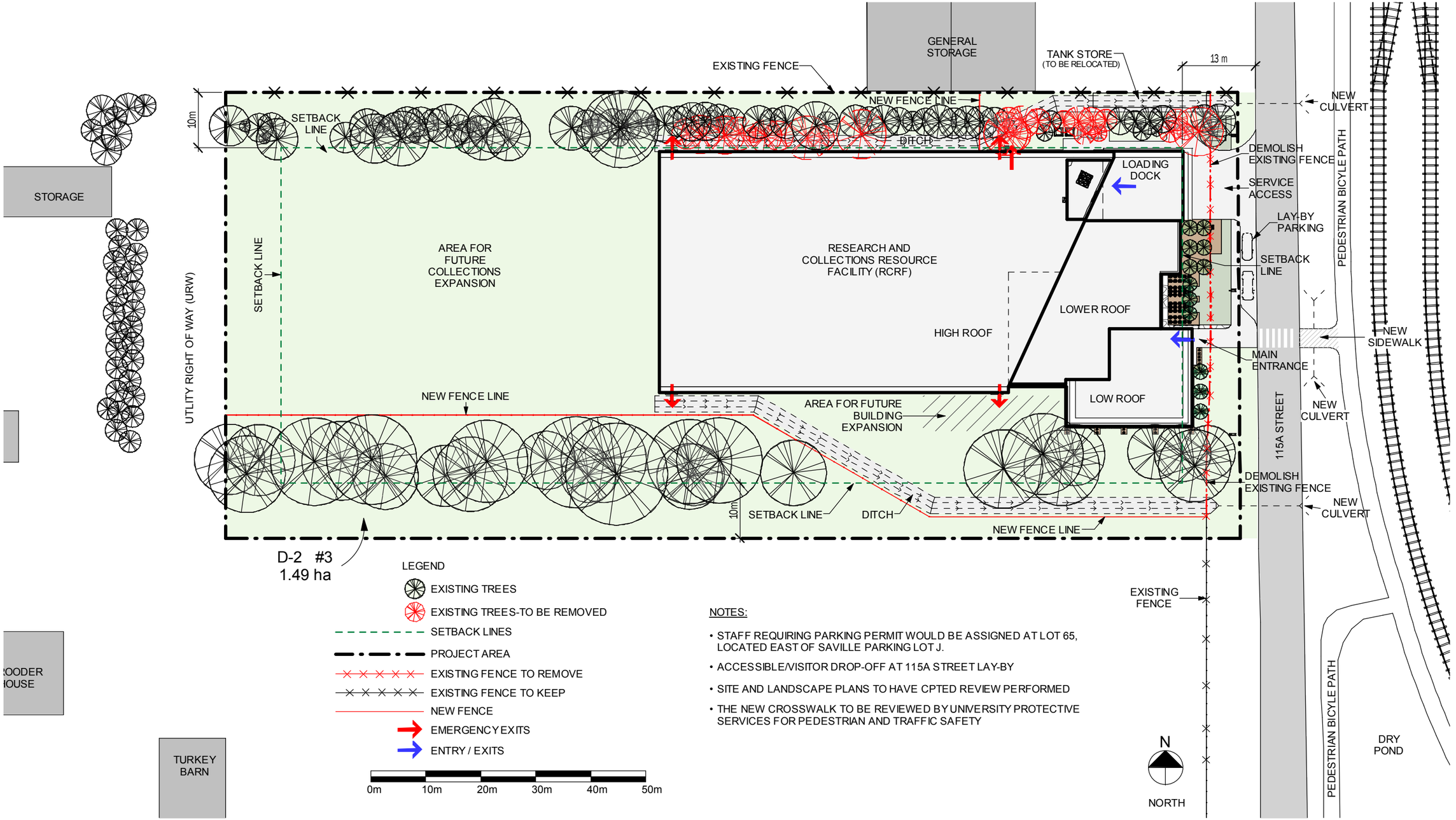
The east end of the building contains the 'front of house' components. This is not an open, public building but the Reading Room is a space that would have limited public engagement and support academic research on South Campus. Located at the southeast corner, this space is articulated as a one and a half storey volume. The glazed façade offers views to one of the current access points to South Campus and enough sun shading to practically provide protection to the items from the Collections space that will be viewed in this space by researchers. A low, long roof overhang provides additional shading during the day but there is also the opportunity to light the underside of the roof to provide a glow of the facility at night.

Processing Area:

The Processing Area is the working hub of the facility. There is a relatively low number of staff to be accommodated in this facility and most of their daily work occurs in the spaces within the Processing Area. This includes the receiving of the Collections material, the required cataloguing and then the proper storage. These activities also happen in reverse, when an item from the Collections is called for retrieval. The volume required to accommodate these functions is primarily one storey, with the exception of the loading dock, which is a one and a half storey volume. This space is accommodated to the northeast portion of the site. The roof canopy over the loading bay also provides a lighting opportunity, echoing a similar detail to the south and emphasizing the notion of a pavilion-like structure.

Main Entry:

The major entry point to the facility for staff, visitors and researchers is just north of the Reading Room on the east side of the building. The entry vestibule is pulled in to provide additional shelter for the entry. Directly to the north of the entry is a vertical element approximately two stories high which provides a marker for the entry. An operational access for staff and deliveries has been located in the north part of the building.



SITE PLAN
1 : 700

Program Analysis

The Research and Collections Resource Facility (RCRF) Functional Program document dated March 26, 2015, has been provided to the project team as the basis for further planning and design. During the validation phase a number of space programming parameters have been further analyzed and discussed with the User Group and the entire project team. The resulting modifications and adjustments aimed at optimizing and balancing the capital funding with the operational objectives and RCRF goals, which were stated in the Program as to:

- *Provide an appropriate, functional and welcoming space for staff, students and visitors for academic and special research purposes;*
- *Be located in a more suitable, low-risk location, free from a high-risk dangerous goods railway line, decreasing the liability exposure and risk profile, protecting the irreplaceable collection and the University Archives;*
- *Improve the proximity of the facility to North Campus, ideally accessible by LRT, for better access by students, staff and researchers;*
- *Accommodate growth and the backlog of unprocessed materials to the collection;*
- *Accommodate up to one million items relocated from North Campus to free up valuable space for academic requirements; and*
- *Provide appropriate quantity, type and function of space for processing, storing, and digitizing materials in the collection.*

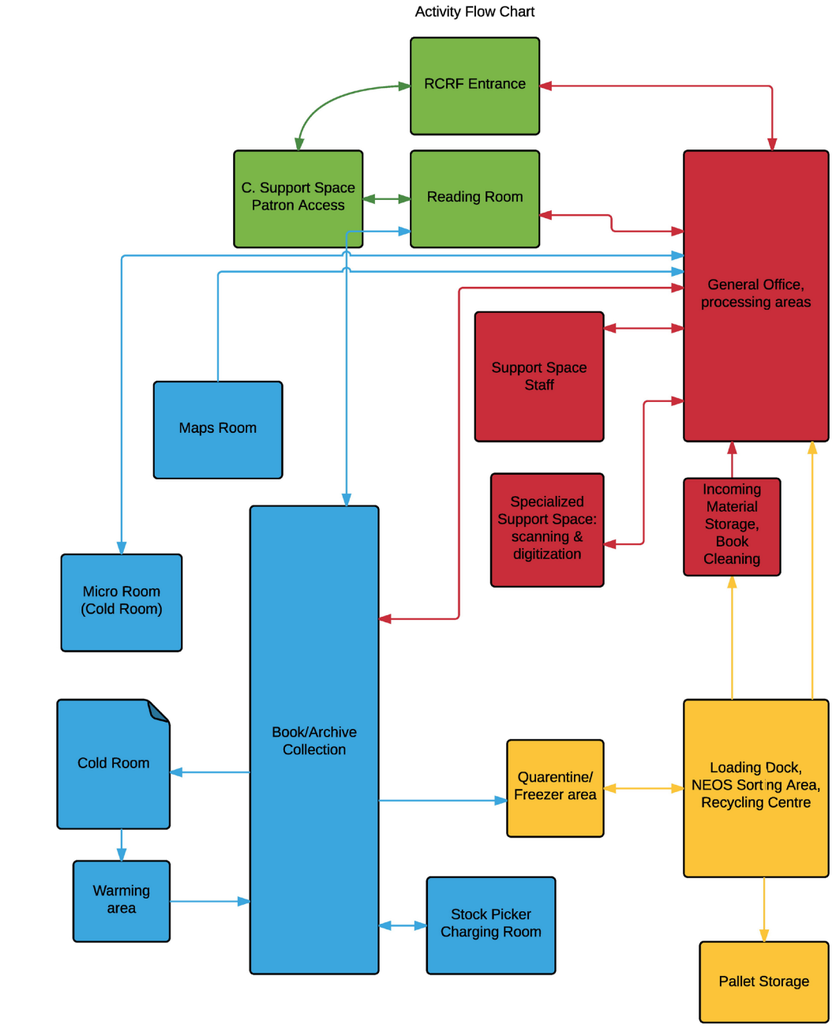
Design Exercise - Work Flow Mapping

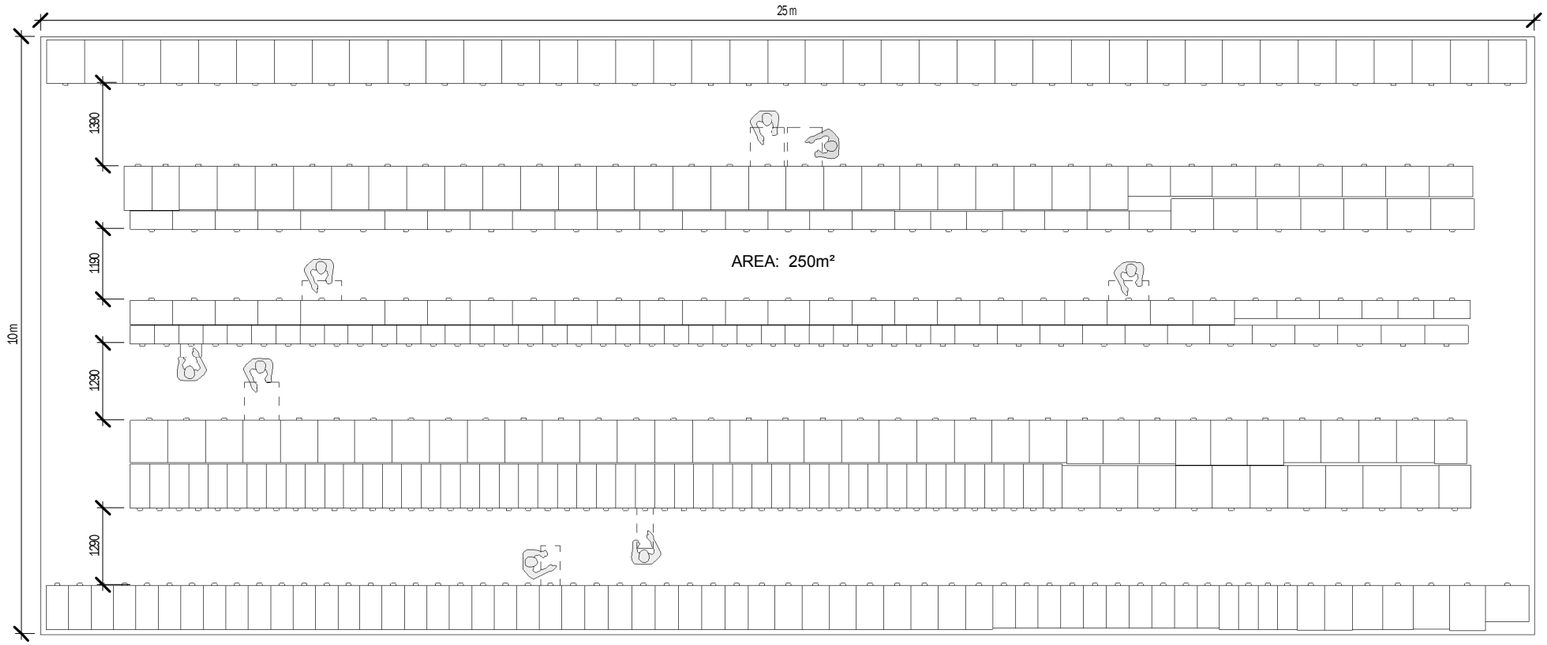
Program Overview

A high-density storage facility is considered a closed-stack storage model whereby it holds less-accessed research and reference materials not accessed by the public. Upon request, these items are delivered to other university library locations by an in-house delivery service. The University will maintain more frequently accessed materials in existing, but downsized open stack shelving in existing Library facilities across the University of Alberta (U of A) campuses. University of Alberta Libraries (UAL) is an active of member of NEOS (from the historical name: Networking Edmonton's Online Systems), which is a 17-Library consortium in central and Northern Alberta who share resources, technology and collections across the region.

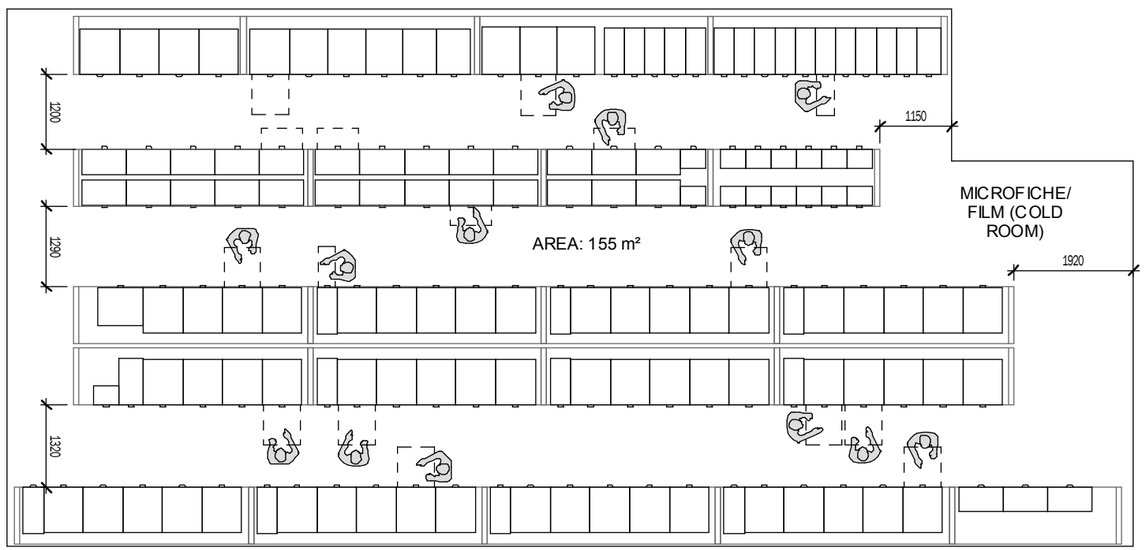
The Functional Program is largely based on the high-density storage requirements of 3,437 component gross square meters, validated and rationalized through engagement of the specialist racking planner to a smaller area, at both Schematic Design and Design Development. This number has been based on a volumetric capacity of 30 foot high shelving in an efficiently laid out warehouse of open rack shelving with a manned lift (picker) for retrieving trays from the shelves. The high-density storage facility in RCRF would need to accommodate the existing 3.1 million items from BARD, a relocation of one million items from North Campus, and a growth projection of 50,000 items per year for 20 years, for a total of 5.1 million items projected capacity over 20 years. The University Archives storage needs were programmatically expressed in terms of a total linear shelving length and were subsequently converted into an equivalent projected racking capacity, also added to accommodate future growth over 20 years. The entire inventory requires a temperature and humidity controlled environment, to be accommodated within a dedicated area of the high-density storage.

The warehouse support space, to be adjacent to the warehouse space and to accommodate: pallet storage, sorting and processing space for incoming inventory and space to maneuver and park forklifts (order pickers), including space for their batteries and charging stations. The indoor vehicle loading/unloading space was subsequently removed from the program requirements and replaced with a sheltered and protected exterior enclosure.





MICROFICHE / FILM COLD ROOM
ON LEVEL STORAGE PLAN.....250m² (ABOVE)
REDUCTION OF AREA TO INTRODUCE STACKED STORAGE.....150m² (BELOW)



Space is also required to accommodate additional items for intermittent retrieval including: microfiche, microfilm and map cabinets. These items would be relocated from North Campus and all require reinforced a floor due to their weight. Film will also need to be accommodated in a temperature controlled cold room (at 10°C).

Library Services and Information has identified a requirement for a second Digitization Area as the collection is actively being digitally archived, with one print copy kept in the collection. There is an existing digitization space on North Campus (Level 2, Cameron Library) but having a second one provides the ability to expedite the long process of digitizing the collection with two locations. Related to this, the need for a Media Migration Room to house equipment to transfer different types of film to digital records, will be accommodated within the space allocation for the Digitization Area.

Space is also required for staff, students and public use. The staff component includes office space for RCRF staff and Archives staff (most of it in an open work space concept), additional book processing space, a collaboration/meeting space, staff lockers, kitchenette, copy room and office supply storage.

Public support spaces are intended for the use of researchers and visitors wanting to access items from the University Archives, which must remain within the facility and are not able to be borrowed. Most researchers visit for full day time periods, so an Archives Reading Room is required, as well as a small waiting area, lockers for personal items (no backpacks allowed for collection security) and a small kitchenette for heating lunch, would be required.

Program Implementation Methodology

Program space requirements have been based on a variety of metrics. The individual office space components follow the UA space standards and guidelines that stipulate combination of enclosed and open space work areas. Warehouse storage requirements were programmatically based on a calculation of typical high-density book storage dimensions placed in to 'trays' which are placed on shelves, the capacity of shelves, the height of shelves and an approximate layout of shelving racks in an open warehouse. These factors resulted in an overall volumetric capacity, factored for a targeted volume and then translated to an approximate overall area requirement. Those parameters were subsequently further advanced by the project team that engaged a specialist racking sub-consultant to review and validate the initial programmed space allocation targets. More detailed collection racking system layouts were developed and assessed based on specific to the present and the projected RCRF storage space requirements, thus updating and further defining what and how a variety of items will be accommodated in the main high density warehouse space.

Other areas, such as the Digitization Area, Map Room, Microfiche and Microfilm areas are based on existing room areas in Cameron, Rutherford North and J.W. Scott Libraries. The remaining requirements such as loading dock, cold room and sorting spaces are based on existing space at the existing BARD and the now UA-owned Federal Archives Building.

All the diverse program components were discussed and reviewed with the User Group, who provided an updated description of the RCRF operation, allowing the design team to develop and present several planning options during interactive program validation sessions. Those in turn offered opportunities for combining some functional components, defining their process flows based on the required affinities and staffing model.

Space Reconciliation – Schematic Design

The Functional Program space requirements presented in the March 2015 document and its implementation at Schematic Design are provided in the following analysis spreadsheets along with the corresponding commentaries.

The following reference notes to the Functional Program were developed to reconcile space at the Schematic Design phase:

1. Includes book processing space of an additional 3.0 NSM for each Full Time (FT) personnel's work area and allocated in the Program under "Support Space".
2. Component Grossing Factor of 1.35 (35%) applied as per Program.
3. Listed with BARD and Archives staff enlarged work areas.
4. Collaboration/Meeting/Lunch Room increased in size to 50.0 NSM to accommodate up to 20 people, aligning with a smaller classroom capacity. Programmed space increase achieved through reallocation of space initially assigned to "Hold & Self Check", as directed by the User Group.
5. Lowered Component Grossing Factor of 1.15 applied (15%) responding to the type of functions included.
6. Programmed space allocation reduced by the User Group through validation process and rationalizing initially projected area.
7. Collections Reading Room space combined with Archives Reading Room as per User Group's updated functional requirements and to facilitate invigilation, for a total of 60.0 NSM.
8. "Hold & Self Check" area deleted from the operational requirements by the User Group. Programmed space allocation added to Collaboration/Meeting/Lunch Room, increasing its size.
9. Small negative space allocation variance with the initial Program results from conversion of CGSM listed as NSM, while retaining a required functionality. Lower Component Grossing Factor of 1.15 (15%) is applied.
10. Digitization area stated in the Program has been operationally rationalized by the User Group and reduced with the project team from 148.0 CGSM to 67.0 CGSM. This space allocation was in turn redistributed between Collection Processing (BARD Staff area increased by 42.0 CGSM) and Archive Processing (Archives Staff area increased by 25 CGSM).
11. The Programmed area allocation has been reduced by the User Group to 150 CGSM to be accommodated within the main Collections Racking space, utilizing the existing or new storage units.
12. Microfiche/Film Storage to be accommodated within a smaller stacked storage footprint and combined with the Cold Room to assure necessary lower temperature/humidity control environment, which is different from the high density storage warehouse. The area requires a small "warming vestibule" to condition stored items that transition between environments differing in temperature and humidity. Reduced CGSM area assumes implementation of two or three levels stacked storage cabinets to economize project space utilization within the higher ceiling. No mechanized lifting or access equipment is anticipated to be employed in this area that relies on warehouse-type access step ladders with handrails. This area will require an increased structural floor loading capacity.
13. The estimated Media Migration Room function to be accommodated within the reduced and re-distributed Digitization area, as operationally rationalized by the User Group during the Program validation.
14. Cold Room eliminated by the User Group during Program validation to be combined with Microfiche/ Film Storage function (also refer to note #12).
15. The addition of a dedicated Walk-in Freezer, at 11.0 CGSM, as requested by the User Group to allow for freeze-dry recovery of wet books.
16. Accommodation for an indoor drive-in loading dock has been deleted from in operational validation process reducing the area by approximately 71.0 CGSM. An enclosed and weather-protected exterior area will be provided to shelter from the elements, with further details to be developed.
17. Unidentified in the Functional Program operational area added during validation phase to support operation of RCRF and related to the Loading Dock/ Sorting functions.
18. Reduction of project programmed area (CGSM) attributable to the enhanced User Group engagement and operational review, resulting in optimized space allocations within the Specialized Work/Storage and the Loading Dock. The initial programming assumptions were re-visited by the project team and vetted from the perspective of maximizing efficiencies, and increasing opportunities for co-sharing of spaces where operationally feasible, including facility maintenance. Opportunities to maximize open area spaces were explored and realized at the Schematic Design level, to be further advanced during Design Development through the identification and placement of furniture and equipment. The User Group reconfirmed operational benefits of maintaining all functional components at a single, at-grade level, except for the elevated Mechanical/Electrical service space located in the penthouse above. The validation process also benefited from the project capital parameters and its imposed limitations.
19. The Program designation of 40' high racking has been reconfirmed as a 30' height requirement. Significant reduction in the initial high density storage warehouse was accomplished through consolidation of the Collections with Archives and Maps storage, validated through engagement of the specialized racking consultant, with more detailed shelving layout to follow. The proposed racking layout has been contained within approximately 2,500 CGSM floor space of a high density warehouse space. At the Schematic Design phase it consists as 12 double-sided aisles that accommodate 936 vertical sections (ladders) that could potentially accommodate up to 7,100,000 volumes based on a continuation of the current mix of collection size at BARD (i.e. tray and book sizes). This is to be confirmed by the User Group.
20. Building Gross Area includes several elements referenced to, but sized in the Functional Program, which were defined at Schematic Design. Those areas typically include general circulation, washrooms, janitorial services, stairs and other building service areas (M&E) that support its function and operation. The Gross Building Area includes also the exterior walls, which may significantly add to the overall size of the facility.
21. The effective Building Grossing Factor achieved at Schematic Design is 1.16 (16%) and reflects aimed by the project team increased efficiency of the RCRF layout.

Space Reconciliation – Design Development

The Functional Program space requirements presented in the March 2015 document, implementation at Schematic Design and further advanced during Design Development are presented in the following analysis spreadsheets along with the corresponding commentaries. The evolution of program implementation was supported by the lean management analysis of present operational model at BARD and projected modifications and opportunities as seen by the RCRF user group. Some space re-allocations have resulted and had no material impact to the overall functional components' areas. A minor (3.8%) increase to overall building area occurred in the M&E allocated service components reflecting the Design Development Phase inputs.

The following reference notes were developed to reconcile space from the Schematic Design phase to the Design Development phase:

A. Office net area increase to account for operationally required access from both the internal processing and the public entry zones.
B. Three operationally programmed work stations are located within the Inter-library Loan (I.L.L.) Sorting Area, combined with internal space re-allocation.
C. Space re-allocation from programmed I.L.L. Sorting - to be included within Processing and Preparation Area corresponding with the lean management analysis.
D. Partial space re-allocation from Scanning and Digitization, to be included within Archive Processing and Scanning, and corresponding with the lean management analysis.
E. Increase in CGSM for General Office component is attributable to re-allocation of programmed space from Support Space and Loading Dock and corresponding with the lean management analysis.
F. Staff Kitchenette size increased to accommodate small table eating area, as per user requirements.
G. Locker size allocation revised to account for a combination of half- and full-size locker size, as per user requirements.
H. General office supplies storage area reduced, as per revised and updated user requirements.
I. Component Gross Square Meters (CGSM) factor has been reduced to 1.12 to account for higher planning efficiency achieved.
J. An overall increase in Office component area (CGSM) reflects an internal re-allocation of programmed space from Support Space and Loading Dock. This user-requested re-allocation resulted from the operational lean management analysis that more accurately defined personnel work areas and work flow, with corresponding space utilization patterns.
K. Public Nutrition Nook and Public Locker area reduced to reflect projected utilization and more efficient space use.
L. Reading Room for Archives and Public allocations have been combined into one space of 60 NSM. An additional CGSM area has been allocated towards accommodating perimeter heating fin radiation enclosure along the exterior wall that also acts as an additional feature element.
M. Component Gross Square Metres (CGSM) factor has been updated and increased to 1.20 to account for required higher level of internal circulation and furnishing arrangement flexibility.
N. Minor reduction of Public Accessed Support Space allocation (CGSM) resulted from rationalizing the size of the Nutrition Nook and Public Locker size.
O. With reduction of the original programmed area, an increase from the Schematic Design Phase occurred. Further operational review of Digitization and Scanning Area, including lean management assessment performed by the users, resulted in establishing necessary equipment and workstation components during the Design Development Phase.
P. With reduction of the original programmed area, an increase from the Schematic Design Phase occurred to improve anticipated re-use or partial re-use of various types of currently utilized storage cabinets. It is anticipated that storage cabinets within the environmentally controlled area will be stacked and placed on a metal racking system.
Q. The originally programmed Sorting Space has been reduced and internally transferred to Processing/ Prep Area. This user-requested re-allocation resulted from the operational lean management analysis that more accurately defined personnel work areas and work flow, with corresponding space utilization patterns.
R. User-requested update of the required pallets storage resulted in some reduction of space and operationally improved layout.
S. Significant internal re-allocation of the Loading Dock programmed space was requested by the users to reflect operational lean analysis and following further Design Development layout definition. Reduction in the overall number of book recycling storage bins was requested by the user and implemented accordingly.
T. Minor re-allocation of space between Book Quarantine and Book Cleaning in result of Design Development plan revisions and fit.
U. An overall further reduction in "front of the house" CGSM programmed space for both the Staff Accessed and the Non-Warehouse was introduced at the Design Development Phase. It resulted from a combination of re-allocation of functional components brought about by the lean management analysis implemented by the RCRF user group and allocation of additional components towards an overall building operational gross areas, which are listed under the Building Gross Square Metres (BGSM).
V. The overall CGSM of combined Warehouse and Non-warehouse space allocation remains the same at both Schematic and Design Development Phases.
W. The increase of combined BGSM areas reflects inclusion of the mechanical penthouse HVAC equipment mezzanine in the overall space calculation and progressively more detailed overall Design Development.
X. The Effective Building Grossing Factor of 1.20 (20%) includes a total of additional spaces listed under Building Gross Square Metres (BGSM) and a total of the building exterior walls area, as reflected at Design Development Phase combined floor layouts.
Y. The RCRF total building gross area, measured along the face of exterior envelope has marginally increased by 3.8% or 155m² between the Schematic Design (4,040 BGSM) and Design Development (4,195 BGSM). The increase area is attributable to further developed design of the Mechanical Penthouse and minor adjustments to other building gross spaces.

Research and Collections Resource Facility (RCRF)
Space Programme Requirements

* January 15,2015; Incorporates feedback from Gerald Beasley and Kathryn Arbuckle from December 8, 2014 and email exhange with Kathryn in January 2015 as a follow up.

Research and Collections Resource Facility (RCRF)
Schematic Design Space Programme Update

Research and Collections Resource Facility (RCRF)
Design Development Space Programme Update

Division / Space Type	Occupants OR Based On	Location of Existing Space: Room No.	Location of Existing Space: No. Occ.	Location of Existing Space: Area (Nasm)	Projected Need (2035): No. Occ.	Projected Need (2035): Unit Allow.	Projected Need (2035): Area (Nasm)	Schematic Design Programme Implementation: No. Occ.	Schematic Design Programme Implementation: Unit Allow.	Schematic Design Programme Implementation: Area (Nasm)	Schematic Design Programme Implementation: Component Grossing Factor	Schematic Design Programme Implementation: CGSM	Schematic Design Programme Implementation: CGSM Variance	Schematic Design Programme Implementation: Notes	Design Development Programme Implementation: No. Occ.	Design Development Programme Implementation: Unit Allow.	Design Development Programme Implementation: Area (Nasm)	Design Development Programme Implementation: Component Grossing Factor	Design Development Programme Implementation: CGSM	Design Development Programme Implementation: CGSM Variance	Design Development Programme Implementation: Notes
A. General Office																					
BARD STAFF																					
1 Qty 1, Manager	Qty 1, FT	BARD	-	-	1	12.0	12.0	1	15.0	15.0					1	15.0	18.6				*Ref. A*
2 Qty 5, Staff, FT Permanent	Qty 5, FT	BARD	-	-	5	6.0	30.0	5	9.0	45.0				*Ref. 1*	5	9.0	45.0				
3 Qty 3, Staff, PT, Casual	Qty 3, PT	BARD	-	-	3	3.0	9.0	3	3.0	9.0					3	9.0	27.0				*Ref. B*
4 Qty 3, FUTURE, PT, Casual	Qty 3, PT Future	BARD	-	-	3	3.0	9.0	3	3.0	9.0					3	3.0	9.0				
5 Processing/Sorting/Preparation Area					n/a		0.0	n/a		0.0					1	27.0	27.0				*Ref.C*
								NASM Subtotal		78.0	*1.35*	105.3		*Ref. 2*	NASM Subtotal		126.6	*1.35*	170.9		
ARCHIVES STAFF																					
5 University Records Archivist	FT	BARD	-	-	1	12.0	12.0	1	15.0	15.0				*Ref. 1*	1	15.0	16.9				
6 Achivist Librarian	FT, Future	BARD	-	-	1	9.0	9.0	1	12.0	12.0					1	10.5	10.5				
7 Assistant	FT	BARD	-	-	1	6.0	6.0	1	9.0	9.0					1	9.0	9.0				
8 Volunteer, Casual	Qty Varies, PT	BARD	-	-	1	3.0	3.0	1	3.0	3.0					1	3.0	3.0				
9 Archives Processing/Scanning Area					n/a		0.0	n/a		0.0					1	27.0	27.0				*Ref. D*
				NASM Subtotal Staff (Office)			90.0	NASM		39.0	*1.35*	52.7		*Ref. 2*	NASM Subtotal		66.4	*1.35*	89.6	**170.6**	*Ref. E*
B. Support Space (Office)																					
1 Extra Book processing/book cart space (added to FT Wkstns)	Qty 9 FT @ 3.0sqm	-	-	-	9	3.0	27.0	0	0.0	0.0				*Ref. 3*	0	0.0	0.0				
2 Kitchenette (adjacent or part of Collaboration/Mtg. Rm)	new	-	-	-	1	8.0	8.0	1	8.0	8.0					1	8.0	12.9				*Ref. F*
3 Collaboration/Meeting/Lunch Area	new	-	-	-	12	2.5	30.0	20	2.5	50.0				*Ref. 4*	20	2.5	50.0				
4 Locker Area for staff	new	-	-	-	15	0.6	9.0	15	0.6	9.0					15	0.6	5.6				*Ref. G*
5 General Storage/Supply/Copy Room	new	-	-	-	1	20.0	20.0	1	20.0	20.0					1	20.0	13.6				*Ref. H*
				NASM Subtotal Support Space (office)			94.0	NASM Subtotal		87.0	*1.15*	100.1		*Ref. 5*	NASM Subtotal		82.1	*1.12*	92.0		*Ref. I*
				NASM Subtotal (Office)			184.0	NASM Office		204.0					NASM Office		275.1				
				CGSM Subtotal (Office)			**248.4**			**258.0**	**CGSM Subtotal (Office)**	**258.0**	**9.6**				**352.5**	**CGSM Subtotal (Office)**	**352.5**	**104.1**	*Ref. J*
C. Support Space (Public Accessed)																					
1 Waiting Area c/w mail drop counter	new	-	-	-	1	12.0	12.0	1	8.0	8.0					1	8.0	8.0				
2 Nutrition Nook (for public) c/w microwave, sink, etc.	new	-	-	-	1	8.0	8.0	1	4.0	4.0				*Ref. 6*	1	2.0	2.0				*Ref. K*
3 Lockers for Public (backpacks, purses not allowed in Archives)	new	-	-	-	15	0.6	9.0	15	0.3	4.5				*Ref. 6*	15	0.1	1.5				*Ref. K*
4 Reading Room for Archives, locked after hours, based on 5.0sqm/person for large layout tables (5'x3.5') and boxes, etc.	For 4 people	-	-	-	4	5.0	20.0	4	5.0	20.0				*Ref. 7*	4	5.0	60.0				*Ref. L*
5 Reading Room for Public, open after hours	For 8 people				8	5.0	40.0	8	5.0	40.0					8	5.0					
6 Hold and Self-Check Area	new	-	-	-	1	16.0	16.0	0	0.0	0.0				*Ref. 8*	0	0.0	0.0				
				CGSM Subtotal (Public Accessed)			**105.0**	NASM Subtotal		76.5	*1.15*	88.0		*Ref. 5*	NASM Subtotal		71.5	*1.2*	85.8		*Ref. M*
											CGSM Subtotal (Public Accessed)	**88.0**	**-17.0**	*Ref. 9*				**CGSM Subtotal (Public Accessed)**	**85.8**	**85.8**	*Ref. N*

	Division / Space Type	Occupants OR Based On	Location of Existing: Room No.	Location of Existing: No. Occ.	Location of Existing: Area (Nasm)	Projected Need (2035): No. Occ.	Projected Need (2035): Unit Allow.	Projected Need (2035): Area (Nasm)	Schematic Design Programme Implementation: No. Occ.	Unit Allow.	Area (Nasm)	Component Grossing Factor	CGSM	CGSM Variance	Notes	Design Development Programme Implementation: No. Occ.	Unit Allow.	Area (Nasm)	Component Grossing Factor	CGSM	CGSM Variance	Notes
D.	**Support Space (Specialized Work/Storage and Loading Dock) Specialized Spaces**																					
1	Digitization Area (scanning, storage, prep), based on Cameron Level 2 Digital Archiving Studio of 123.6sqm plus 20% = 156.0	Level 2 Cameron +20%	-	-	-	1	148.3	148.3	1	67.0	67.0		**67.0**	**-81.3**	***Ref.10***	1	91.0	91.0		**91.0**	**-57.3**	***Ref. O***
2	Map Room, based on 4.20A (108.6sqm) plus open area Level 4 Cameron (~54 sqm), possibilty to stack map chests, floor loading).	Level 4 Cameron	-	-	-	1	162.6	162.6	0	0.0	0.0		**0.0**	**-162.6**	***Ref. 11***	0	0.0	0.0		**0.0**	**-162.6**	
3	Microfiche/film cabinet storage, based on JWScott Library 2K4.21 (207.6 sqm), possibility of higher cabinets, floor	John W. Scott Library 2K4.21	-	-	-	1	207.6	207.6	1	130.0	130.0		**130.0**	**-77.6**	***Ref. 12***	1	130.0	155.2		**155.2**	**-52.4**	***Ref. P***
4	Media Migration Room, estimated size	new	-	-	-	1	20.0	20.0	0	0.0	0.0		**0.0**	**-20.0**	***Ref. 13***	0	0.0	0.0		**0.0**	**-20.0**	
5	Cold Room for Film, based on Fed. Archives of approx. 55 sqm, floor loading	Fed Archives/new	-	-	-	1	55.0	55.0	0	0.0	0.0		**0.0**	**-55.0**	***Ref. 14***	0	0.0	0.0		**0.0**	**-55.0**	
6	Walk-in Freezer	new							1	11.0	11.0		**11.0**	**11.0**	***Ref. 15***	1	11.0	11.4		**11.4**	**11.4**	
	Loading Dock Related																					
7	Sorting Space, based on ~125 sqm at BARD +20%	~125 sqm at BARD +20%	-	-	-	1	150.0	150.0	1	150.0	150.0		**150.0**	**0.0**		1	150.0	79.0		**80.7**	**-69.3**	***Ref. Q***
8	Pallet Storage (based on: 1 row of 6 bays, 3 shelves high), each Bay is 12'x8'=96sqft=8.9sqm; adjacent to sorting space so no additional circulation required.	8.9sqm/bay x 6 bays	-	-	-	1	53.6	53.6	1	53.6	53.6		**53.6**	**0.0**		1	53.6	24.5		**24.0**	**-29.6**	***Ref. R***
9	Loading Dock (approximation based on Fed Archives): To include space for 20 big recycle bins and indoor loading dock. Based on Fed Archives 1-117 (181.5sqm) + 1.118 indoor driveway (70.55 sqm) = 252.1 sqm.	Fed Archives	-	-	-	1	252.1	252.1	1	181.5	181.5		**181.5**	**-70.6**	***Ref. 16***	1	181.5	46.7		**46.7**	**-205.4**	***Ref. S***
10	Book Quarantine Room	new							1	10.0	10.0		**10.0**	**10.0**	***Ref. 17***	1	10.0	12.8		**12.8**	**12.8**	***Ref. T***
11	Book Cleaning Room (with Vacuum Table)	new							1	15.0	15.0		**15.0**	**15.0**	***Ref. 17***	1	15.0	12.2		**12.2**	**12.2**	***Ref. T***
12	Pickers (2) Battery Charging Room	new							1	22.0	22.0		**22.0**	**22.0**	***Ref. 17***	1	22.0	23.0		**23.0**	**23.0**	
					CGSM Subtotal (Staff Accessed)			**1,049.2**				**CGSM Subtotal (Staff Accessed)**	**640.1**	**-409.1**	***Ref. 18***				**CGSM Subtotal (Staff Accessed)**	**457.0**	**-592.2**	***Ref. U***
					CGSM Subtotal (Non-warehouse)			**1,402.6**				**CGSM Subtotal (Non-warehouse)**	**986.1**	**-416.5**	***Ref. 18***				**CGSM Subtotal (Non-warehouse)**	**895.3**	**-507.3**	***Ref. U***
E	**Book Collection, in 40' racking, incl. growth projections** (See Note 4 below for details on collection size)				included in 3,437.4 below				included in 2,510.0 below							included in 2,601.0 below						
F	**Archives** (Based on 9.3km, converted to 183,136 Book volumes equivalent @ 40' high). Requires lower height and diff. environmental conditionas and a separate 'picker' at ~$50K plus).				included in 3,437.4 below				included in 2,510.0 below							included in 2,601.0 below						
	Based on 37,000 sq.ft = 3437.4 sqm				**CGSM Subtotal (Warehouse)**			**3,437.4**	**2,510.0**			**CGSM Subtotal (Warehouse)**	**2,510.0**	**-927.4**	***Ref. 19***	**2,601.0**			**CGSM Subtotal (Warehouse)**	**2,601.0**	**-836.4**	
					CGSM GRAND TOTAL			**4,840.0**				**CGSM GRAND TOTAL**	**3,496.1**	**-1,343.9**					**CGSM GRAND TOTAL**	**3,496.3**	**-1,343.7**	***Ref. V***
									Additional Spaces within Building Gross Square Metres (BGSM)							Additional Spaces within Building Gross Square Metres (BGSM)						
									A	General Building Circulation			53.5			A	General Building Circulation			73.0		
									B	Public Entrance Vestibule			5.5			B	Public Entrance Vestibule			6.3		
									C	Air Lock to Collections Space			8.5			C	Air Lock to Collections Space			10.3		
									D	Janitorial Room			10.0			D	Janitorial Room			3.7		
									E	Public & Staff Washrooms			11.5			E	Public & Staff Washrooms			13.6		
									F	Mechanical Room (Fire Pump)			52.0			F	Mechanical Room (Fire Pump)			59.1		
									G	Electrical Room (Main Floor)			20.0			G	Electrical Room (Main Floor)			16.7		
									H	Access Stair to Mechanical Penthouse			12.5			H	Access Stair to Mechanical Penthouse			8.2		
									I	TeleComm Room (within Penthouse)			13.0			I	TeleComm Room			13.7		
									J	Mechanical Penthouse			250.0			J	Mechanical Penthouse			351.7		
										BGSM additional spaces Subtotal			**436.5**		***Ref. 20***		**BGSM additional spaces Subtotal**			**556.3**		***Ref. W***
										Effective Building Grossing Factor:		***1.16***			***Ref. 21***		*Effective Building Grossing Factor:*		***1.20***			***Ref. X***
										SCHEMATIC DESIGN GRAND TOTAL BGSM			**4,040.0**	*43,488 sqft*			**DESIGN DEVELOPMENT GRAND TOTAL BGSM**			**4,195.0**	*45,156 sqft*	***Ref. Y***

Notes:

1 NASM: Net Assignable Square Metres.
2 CGSM: Component Gross Square Metres (based on industry standard of 35% gross up factor for circulation within a suite).
3 Does not include sqm for building gross up factors such as washrooms, stairs, weather vestibules, etc.
4 Collection growth is based on the following. In Millions of Physical Items:
Existing BARD Collection 3.1M + Relocation from Ruth N. 0.5M + Relocation from other North Campus Libraries 0.5M + Cumulative growth of 1.0M over 20 yrs = 5.1M.
(Cumulative growth is based on 50K titles per year; Other Libraries includes Law, Medicine and Education).
5 Existing Archives at 7.3 km; Archives growth is projected at 100m/year, so 2.0km over 20 years for a total of 9.3 KM.
6 All program numbers to be confirmed prior to design start-up. Design layout to be as efficient and open as possible.

Fire and Life Safety

This code analysis will coordinate both the requirements of the 2014 Alberta Building Code (2014, ABC) and the requirements of the University of Alberta Fire and Life Safety Office. Discussions have begun with Mario Poser, building inspector, for the Inspections Group (the representative Code Authority Having Jurisdiction on behalf of the University) to fully review and vet the assumptions captured within this section. This is an ongoing process that will carry into Design Development, and the Contract Document phases.

Classification and Building Use

The Building Code establishes the basic fire protection requirements based on the area, height and use or function of the building. As height and/or area increases, so does the degree of fire protection. The Code identifies building use categories within designated groupings of occupancy. In mixed use occupancies, if a category is deemed a "major" occupancy and exceeds 10% of a floor area, the more restrictive category will apply.

The RCRF building is basically a Warehouse Type Facility (Group F, Division 2, defined as a medium-hazard industrial occupancy, due to the combustible content of the collections area being greater than 50kg/m2), with the other major occupancy being support offices (Group D, defined as Business and personal services occupancy) the most restrictive occupancy, in this case is the Group F Division 2, and thus will govern.

2014 Alberta Building Code

Article: 3.2.2.77,

For this Group F, Division 2 occupancy, the following requirements prevail:

- The RCRF building is to be sprinklered throughout.
- The building under article 3.2.2.77 cannot be more than four (4) storeys in building height.
  The RCRF building is 1 storey in height, with a second floor mech. penthouse (not counted as a storey).
- The building area cannot exceed 9,600 square meters, if the building is one storey in height.
- The building is permitted to be of combustible construction or non-combustible construction, used singly or in combination.
- Floor assemblies shall be fire separations with a fire resistance rating not less than 45 minutes.
  Mechanical penthouse is rated 1 hour – so floor assembly to be one hour.
- Mezzanines shall have, if of combustible construction, a fire resistance rating not less than 45 minutes.
  No mezzanines at this time
- Load bearing walls, columns and arches supporting a fire separation, shall have a fire resistance rating not less than that required for the fire separation. Any structure supporting the mechanical penthouse is to be rated 1 hour.

3.2.4.1 A Fire Alarm System shall be installed in buildings in which an automatic sprinkler system is installed.

Other fire and sprinkler related cade items include:

- Siamese connections for sprinklers
- Standpipe system required by NFPA 13
- Fire Pump
- Emergency power for the fire pump and mechanical systems.

Occupant Load

Due to the specialized nature of the RCRF Building, the maximum number of staff, visitors and students that can be present at any given time in the building anticipated to be no more than 20 persons. This occupant load will be further reviewed to establish any "worse case scenarios" with the University of Alberta, and the authorities having jurisdiction. If 20 persons is deemed acceptable, the occupancy load will be posted in a conspicuous location in each building area as per 3.1.17.1(2).

Fire Separations/sprinklers for specialty rooms/areas

- 3.3.1.21.(3) Janitors' Room - No rating required in a sprinklered building.
- 3.6.2.5 Storage Rooms for combustible refuse - One (1) hour rating.
- Server Rooms - Recommend One (1) hour.
- 3.6.2.1.(1) Mechanical Rooms with fuel fired appliances - One (1) hour rating.
- Staircase to the mechanical room - One (1) hour rating.
- 3.6.2.1.(6) Electrical Rooms (not elect. vault) - One (1) hour rating.
- Loading Dock Canopy, NFPA 13, to be protected with a dry system or glycol sprinkler system.
- Main Entrance Canopy, NFPA 13, to be protected with a dry system or glycol sprinkler system.
- The Microfiche & Microfilm Storage Room (Cold Room) may contain flammable material, depending on the age and type of film stored. At this time, it would be recommended that this room have a one (1) hour rating.

Exiting

3.4.3.2 The Minimum Exit Width (for doorways), from a main floor area, shall be determined by multiplying the occupant load by 6.1mm of exit width per person.

- Table 3.4.3.2.A minimum width of an exit corridor is 1,100mm.
- Doorways are to have a minimum clear width of 850mm to meet barrier free accessibility.
- 3.4.2.4.(3) Travel Distance: 50m maximum travel distance from any point in a service space. This refers to the mechanical penthouse at the RCRF.
- 3.4.2.6 Location of Exits: 45m maximum travel distance in an F2, medium hazard industrial occupancy. The F2 space is the collections (warehouse) area of the RCRF.
- 3.4.2.6 Location of Exits: 40m maximum travel distance in a D, business or personal services occupancy. The D Occupancy is the office area of the RCRF.

Washroom Facilities

The University of Alberta will review their perceived low occupant load with the design team and the authorities having jurisdiction, to determine the number of water closets required. For example, the possible occupant load is no more than 30 persons.

Table 3.7.2.2.B states that for up to 25 persons of each sex, 1 water closet is required. Two water closets are required for populations of 26 to 50 persons of each sex.

Barrier Free Requirements

The project will be designed and constructed in compliance with the 2014 Alberta Building Code, Section 3.8 Barrier-Free Design including the related provisions for entrances, doorways, barrier-free path of travel and washrooms as well as accessibility signage.

Partial Plan - Spatial Separation & Exposure Protection
(not to scale)

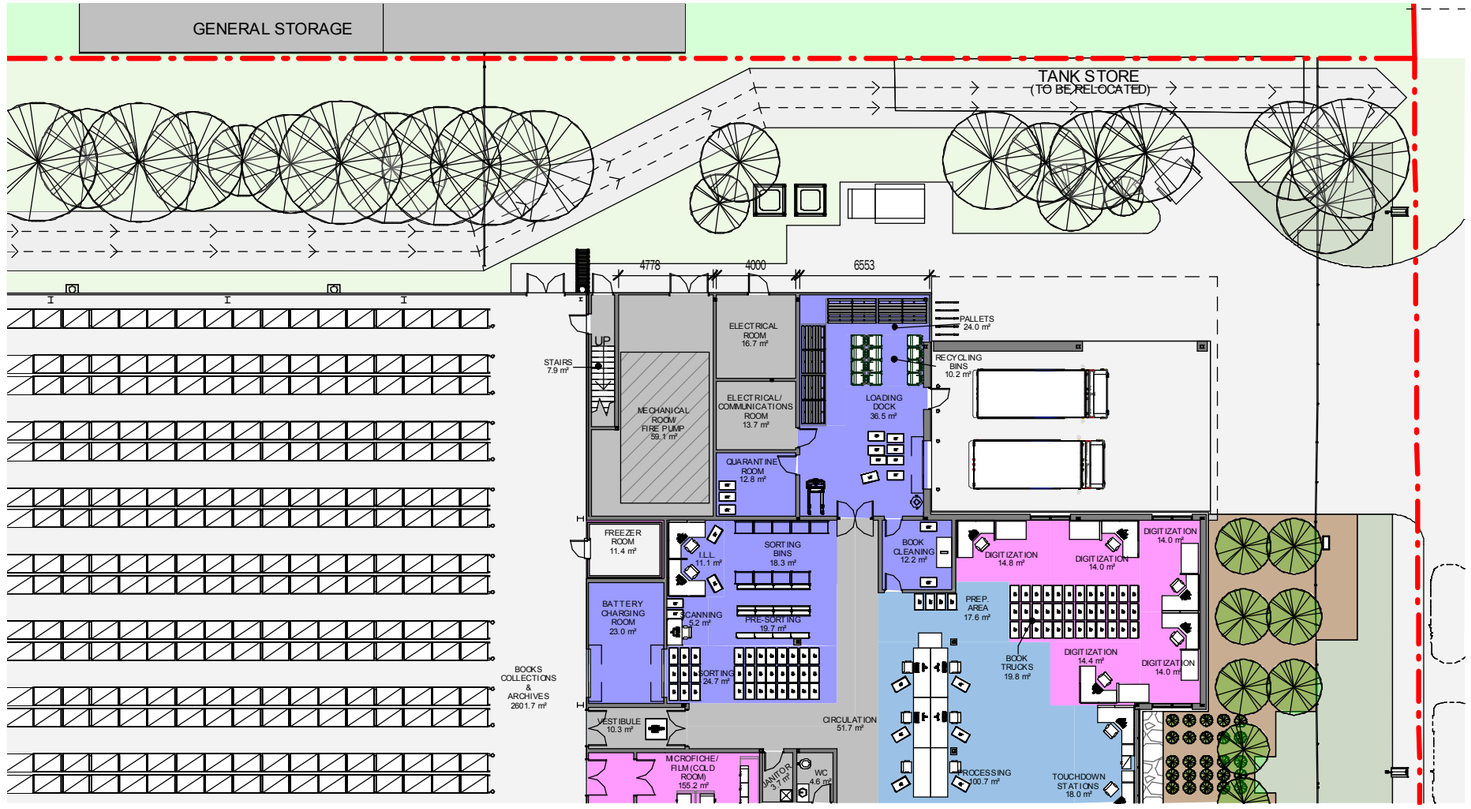


Table 3.2.3.1.E.
Unprotected Opening Limits for a Building or Fire Compartment that is Sprinklered Throughout
Forming Part of Article 3.2.3.1.

Exposing Building Face Max. Area, m²	Area of *Unprotected Opening* for Groups E and F, Division 1 and 2 *Occupancies*, %																	
	Limiting Distance, m																	
	0	1.2	1.5	2.0	2.5	3	4	5	6	7	8	9	10	11	12	13	14	15
10	0	8	12	20	34	50	96	100										
15	0	8	10	16	26	36	68	100										
20	0	8	10	14	22	30	54	86	100									
25	0	8	10	14	18	26	44	70	100									
30	0	8	8	12	18	24	40	60	88	100								
40	0	8	8	12	16	20	32	48	68	94	100							
50	0	8	8	10	14	18	28	40	58	76	100							
60	0	8	8	10	12	16	24	36	50	66	86	100						
80	0	8	8	10	12	14	20	30	40	52	66	84	100					
100	0	8	8	8	10	12	18	26	34	44	56	70	84	100				
150	0	8	8	8	10	12	16	20	26	32	40	50	60	72	84	98	100	
200 or more	0	8	8	8	8	10	14	18	22	28	34	42	50	60	68	80	92	100

Table 3.2.3.7.
Minimum Construction Requirements for Exposing Building Faces
Forming Part of Sentences 3.2.3.7.(1) and (2)

Occupancy Classification of *Building* or *Fire Compartment*	Maximum Area of *Unprotected Openings* Permitted, % of *Exposing Building Face* Area	Minimum Required *Fire-Resistance Rating*	Type of Construction Required	Type of Cladding Required
Group A, B, C, D, or Group F, Division 3	0 to 10	1 h	*Noncombustible*	*Noncombustible*
	> 10 to 25	1 h	*Combustible* or *Noncombustible*	*Noncombustible*
	> 25 to 50	45 min	*Combustible* or *Noncombustible*	*Noncombustible*
	> 50 to < 100	45 min	*Combustible* or *Noncombustible*	*Combustible* or *Noncombustible*(1)
Group E, or Group F, Division 1 or 2	0 to 10	2 h	*Noncombustible*	*Noncombustible*
	> 10 to 25	2 h	*Combustible* or *Noncombustible*	*Noncombustible*
	> 25 to 50	1 h	*Combustible* or *Noncombustible*	*Noncombustible*
	> 50 to < 100	1 h	*Combustible* or *Noncombustible*	*Combustible* or *Noncombustible*

Spatial Separation & Exposure Protection 3.2.3

An existing storage building is located approximately 11m north of the proposed RCRF building. A discussion has begun with the authorities having jurisdiction to determine the best course of action to address the exposure of this existing building to the proposed new RCRF. Since the RCRF is imposing upon the existing building it is the RCRF that will need to meet the limiting distance requirements.

Limiting Distance calculations for the RCRF Building

The north face of the proposed RCRF building is composed of seven compartments, they are (starting from the west):

COLLECTIONS AREA:

- The north face of the Collections Area is 12m high X 63m long which equals 756m² in area, refer to Table 3.2.3.1.E. (example is shown in tables below).
  The 756m² relates to the "200m² or more" line item. Follow the table to find the 12m limiting distance from the proposed RCRF to the existing general storage building. The collections area is allowed to have 68% unprotected openings.
- The 68% unprotected openings is then located in Table 3.2.3.7, which states that a 1 hour rating is required to the north wall to protect the existing general Storage building.
- To achieve the 1 hour rating to the north wall of the Collections area - we discussed with the Inspections Group the possibility of increasing the sprinkler protection to the inside face of the north wall of the Collections area to achieve a one hour rating equivalency. A variance proposal will need to be submitted by the sprinkler consultant. The increase in sprinkler protection is a common approach for achieving a 1 hour rating, and should meet with approval.

STAIRCASE (to the Mechanical Penthouse)

- The north face of the staircase is 6m high X 1.4m wide which equals 8.4m² in area, refer to Table 3.2.3.1.E.
- The 8.4m² relates to the "10m²" line item. Follow the table to find the 12m limiting distance from the proposed RCRF to the existing general storage building. The staircase is allowed to have over 100% unprotected openings. No rating is required.

MECHANICAL ROOM (main floor)

- The north face of the Mech. Room is 6m high X 5m wide which equals 30m² in area, refer to Table 3.2.3.1.E.
- The 30m² relates to the "30m²" line item. Follow the table to find the 12m limiting distance from the proposed RCRF to the existing general storage building. The mech. room is allowed to have over 100% unprotected openings. No rating is required to the mechanical room's north wall.

ELECTRICAL ROOM

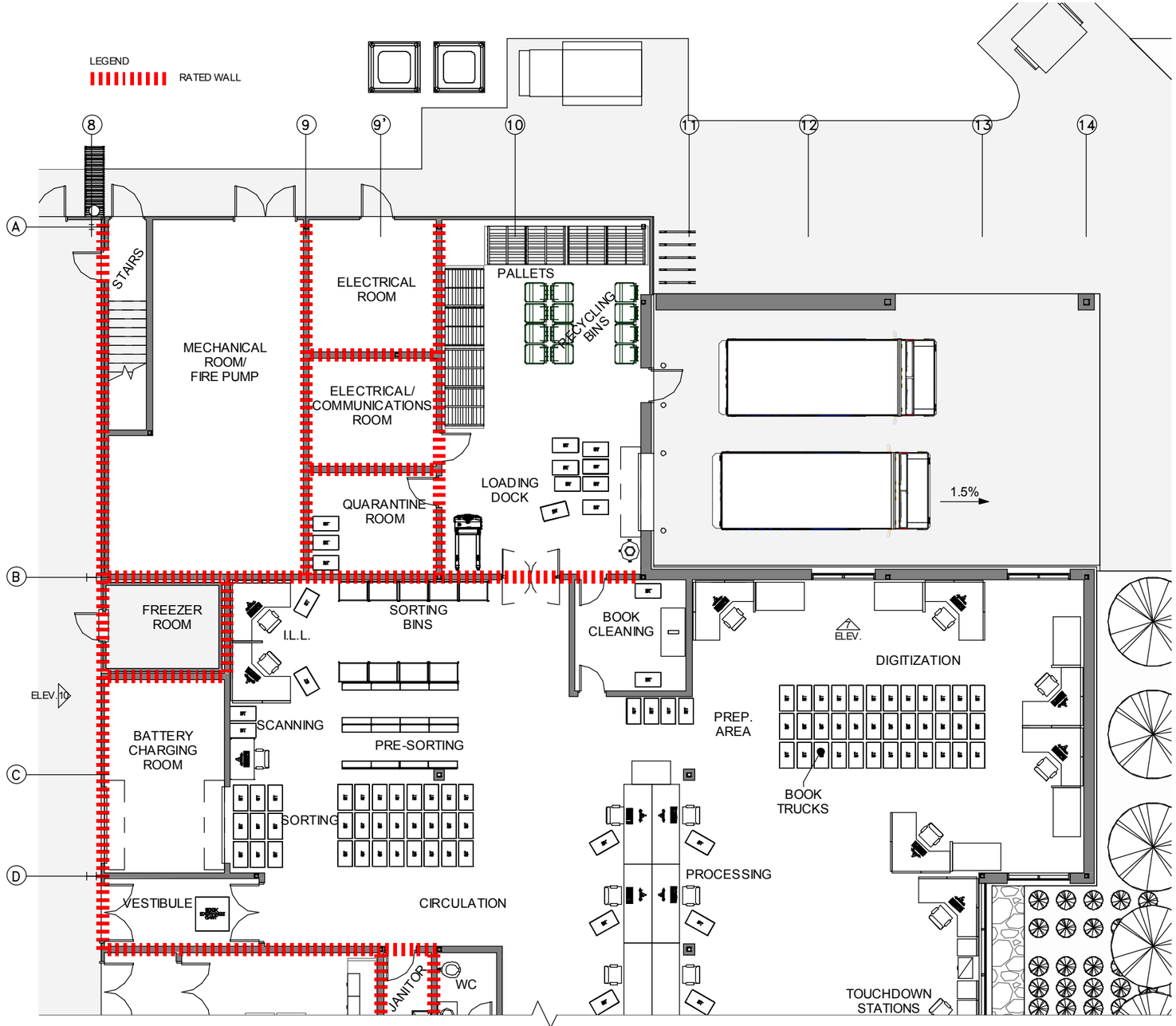
- The north face of the Elect. Room is 6m high X 4m wide which equals 24m² in area, refer to Table 3.2.3.1.E.
- The 24m² relates to the "25m²" line item. Follow the table to find the 12m limiting distance from the proposed RCRF to the existing general storage building. The electrical room is allowed to have over 100% unprotected openings. No rating is required to the electrical room's north wall.

LOADING DOCK (interior area)

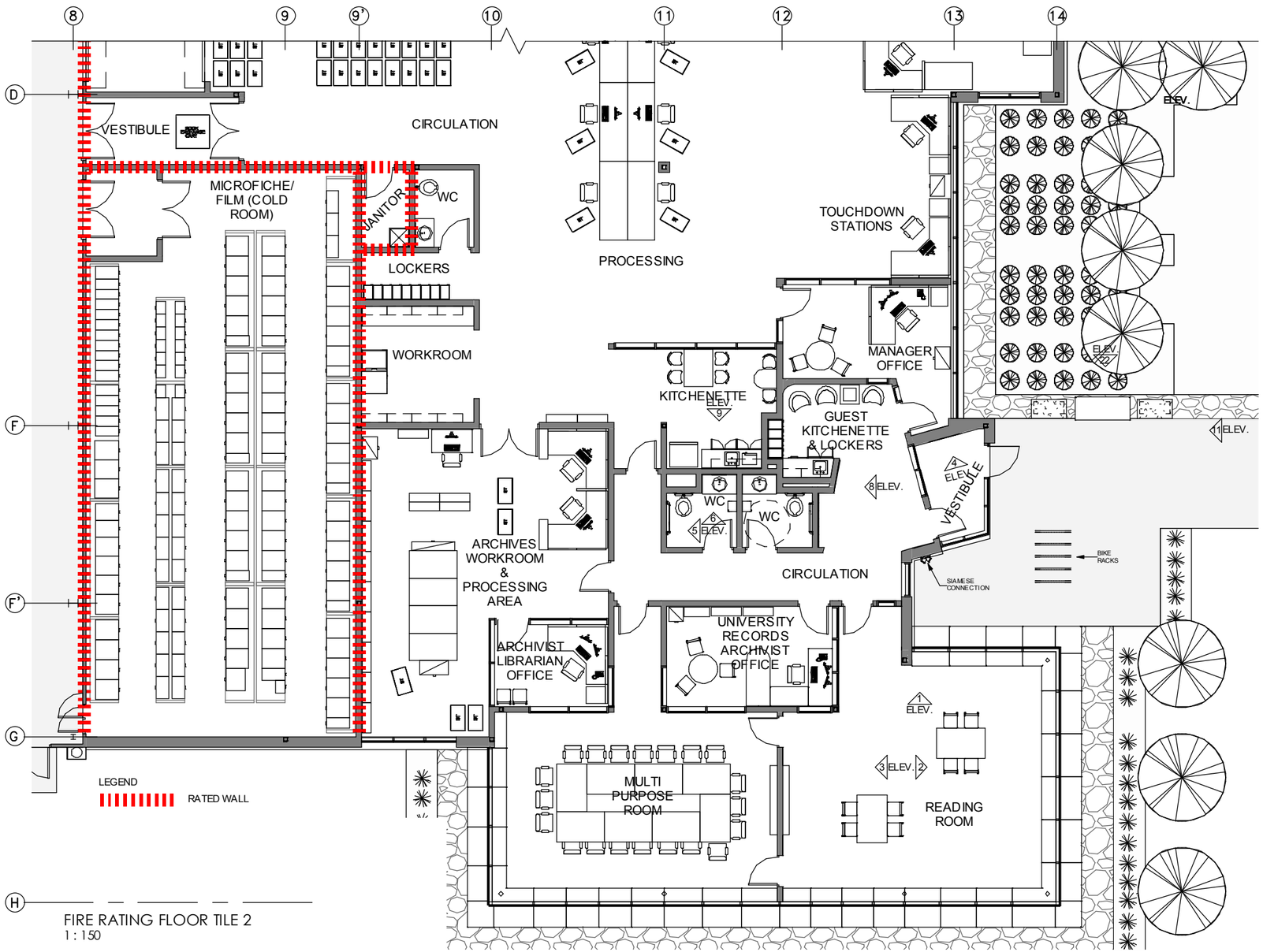
- The north face of the interior portion of the Loading Dock is 6m high X 6m wide which equals 36m² in area, refer to Table 3.2.3.1.E.
- The 36m² relates to the "40m²" line item. Follow the table to find the 12m limiting distance from the proposed RCRF to the existing general storage building. The Loading Dock is allowed to have over 100% unprotected openings.

LOADING DOCK (exterior portion)

- The north face of the exterior portion of the Loading Dock is 6m high X 20.7m wide which equals 125m² in area, refer to Table 3.2.3.1.E.
- The 125m² relates to the "150m²" line item. Follow the table to find the 12m limiting distance from the proposed RCRF to the existing general storage building. The Loading Dock is allowed to have over 72% unprotected openings. A one (1) hour rating is required to the Loading Dock north wall.



MAIN FLOOR PLAN TILE 1 SHOWING FIRE SEPARATIONS



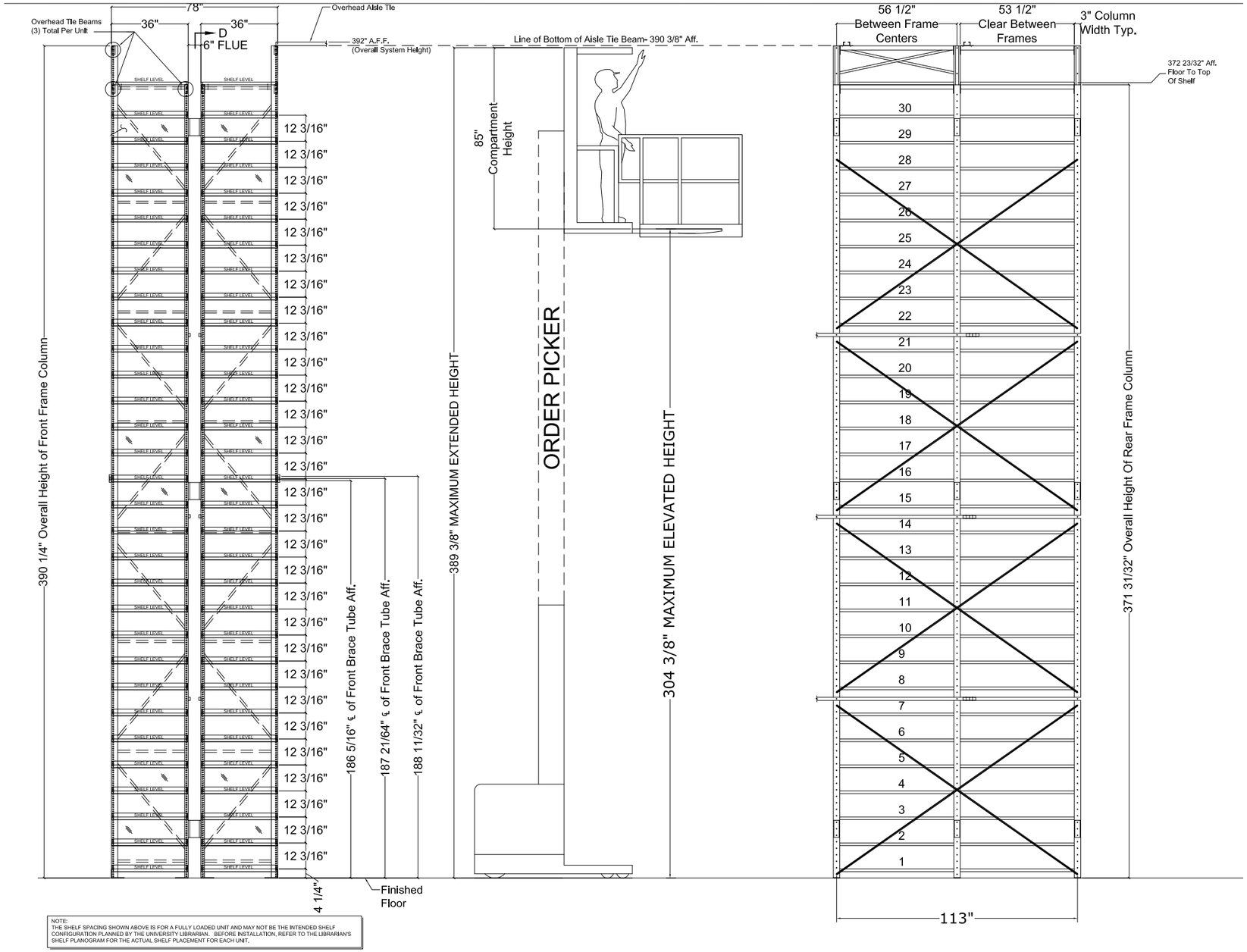
MAIN FLOOR PLAN TILE 2 SHOWING FIRE SEPARATIONS

MECHANICAL ROOM (upper floor)

- The north face of the Mech. Room is 6m high X 10.6m wide which equals 64m² in area, refer to Table 3.2.3.1.E.
- The 64m² relates to the "80m²" line item. Follow the table to find the 11m limiting distance from the proposed RCRF to the existing general storage building. The upper mechanical room is allowed to have over 100% unprotected openings. No rating is required to the upper mechanical room's north wall.

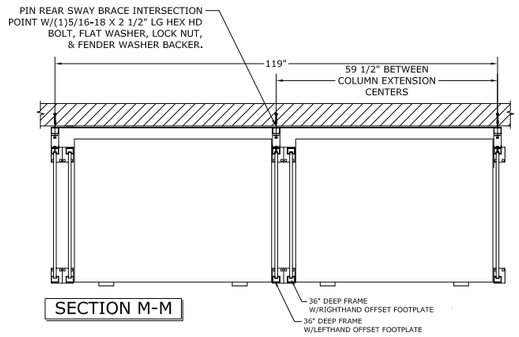
Soil Gas Control

Air entering a building through below-grade leaks in the envelope may increase the water vapour content of the indoor air and may also bring in a number of pollutants picked up from the soil. This mixture of air, water vapour and pollutants is sometimes referred to as *soil gas*. One pollutant found in soil gas is radon. New requirements in the Alberta Building Code require infrastructure be provided for radon gas extraction. The mechanical consultant has incorporated a detail into the mechanical drawings which is comprised of a series of 100mm diameter PVC pipes penetrating below the slab. This will allow for future connection to an exhaust fan should future testing indicate the presence of radon gas. In addition, an air barrier system, installed below the slab addresses the protection from all soil gases.

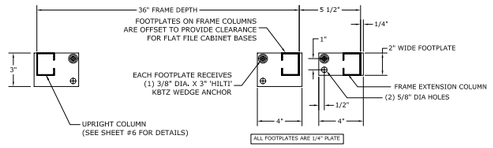


NOTE:
THE SHELF SPACING SHOWN ABOVE IS FOR A FULLY LOADED UNIT AND MAY NOT BE THE INTENDED SHELF CONFIGURATION PLANNED BY THE UNIVERSITY LIBRARIAN. BEFORE INSTALLATION, REFER TO THE LIBRARIAN'S SHELF PLANOGRAM FOR THE ACTUAL SHELF PLACEMENT FOR EACH UNIT.

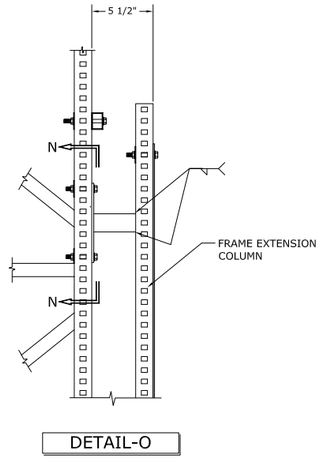
30 SHELF STATIC UNITS



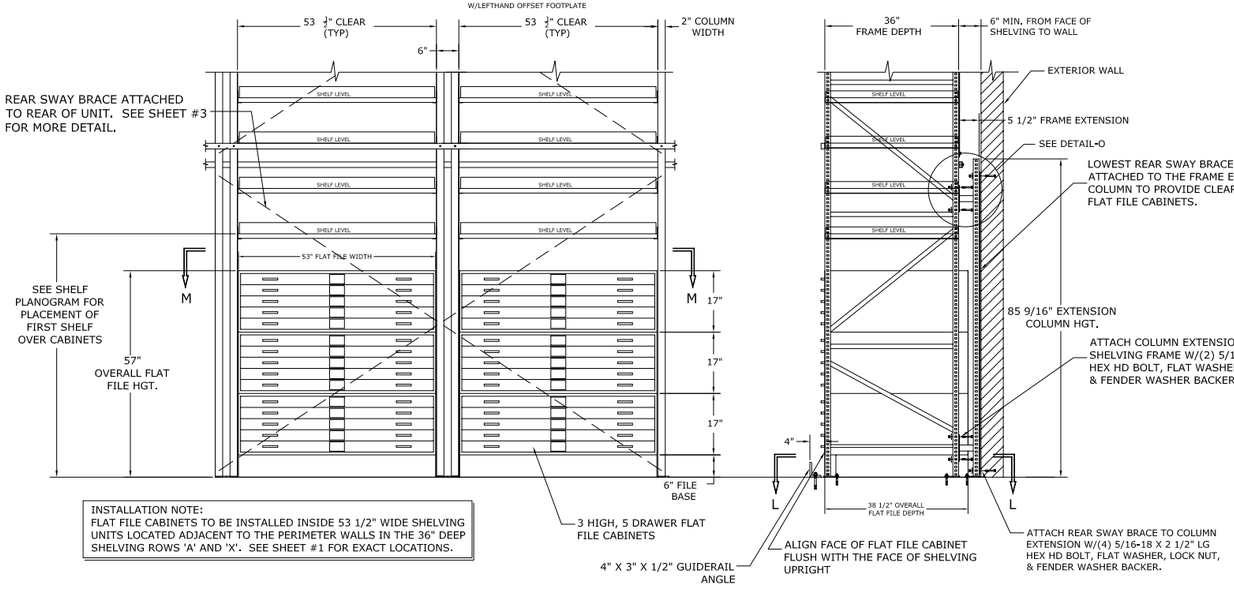
SECTION M-M

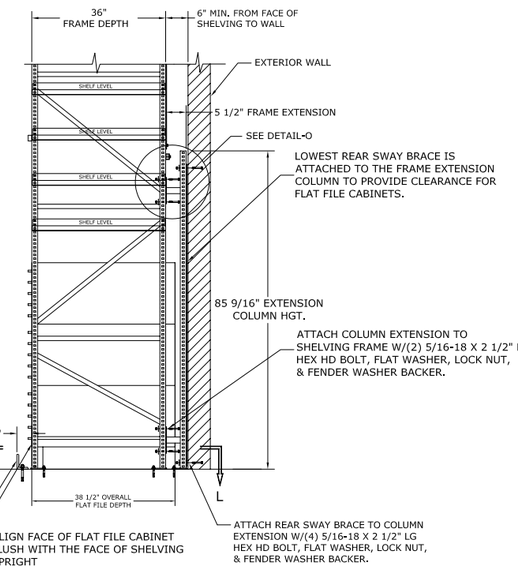


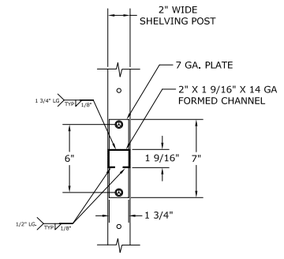
SECTION L-L



DETAIL-O







SECTION N-N

1/9 FLAT FILE CABINET / SHELVING UNIT INTERFACE

SCALE: 1/2" = 1'-0"

Rev.	Revision Description	Date	By

APPROVAL
This Drawing Approved By

Dated

www.spacesaver.com
Spacesaver
A division of SI

Project Name

STATIC XTEND STORAGE SHELVING SYSTEM
FLAT FILE CABINET/ SHELVING UNIT INTERFACE

Project No.	
Drawn By	
Date	
Scale AS NOTED	Revision

Floor Plan Layouts

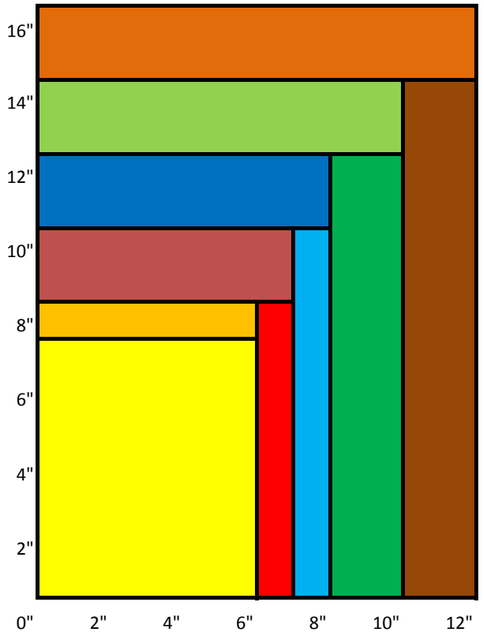
The composition of the three main functional components (Collections depository space, processing area and reading room) was the major driver in the development of the floor plans at the schematic design stage. Through the Design Development Phase, additional refinement to the layout has been developed in collaboration with a key stakeholder group. Modifications have been captured in the Space Reconciliation table. It is important to note that the building footprint on the main level has not changed between schematic design and design development; only the configurations of the interior space have been modified to suit the functional requirements. The functional and physical description of the spaces is provided below:

Book Collection & Archives

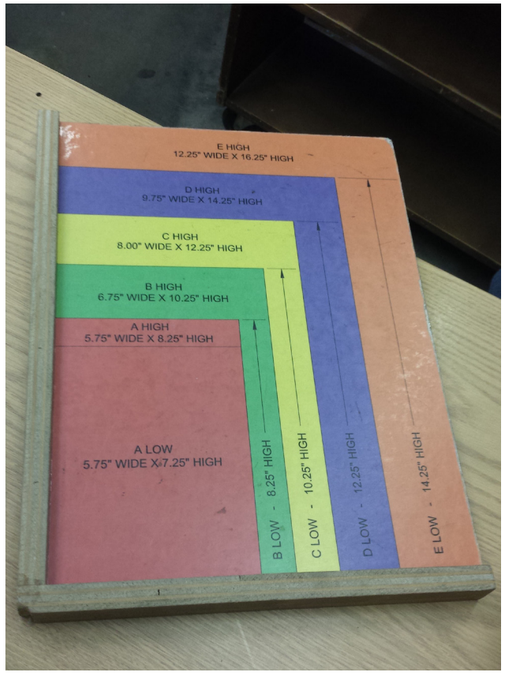
The space is environmentally controlled and maintained so that the collection stored within is both secured and protected from temperature, moisture, UV light, humidity, etc. Twenty-four ranges are accessed by twelve aisles. Each range holds 39 ladders, each 9.144m (30 feet) high for a total of 936 ladders. Both the book collection and the UA Archives will be housed in this space. The DB team has partnered with Spacesaver to assist in determining the most efficient layout of racking for the current and projected collection. Within additional input from the staff at BARD, a calculation has resulted in the projected accommodation of an estimated 5,709,563 million volumes. This is based on the approximate book tray quantities, as best understood at this time. Also accommodated in this space is the map collection. At this time, it has been determined that new custom map cabinets will be purchased to fit on the lower portion of some of the ladders. This would be the most efficient way to accommodate this portion of the collection. A significant 'next step' in the design process is for Spacesaver to work with the BARD staff to further develop a 'Planograph' which looks at even more detail to determine the appropriate shelf heights. The collection is mapped out in detail, based on a set of parameters and defined assumptions. This activity will occur during Phase 2 of this project.

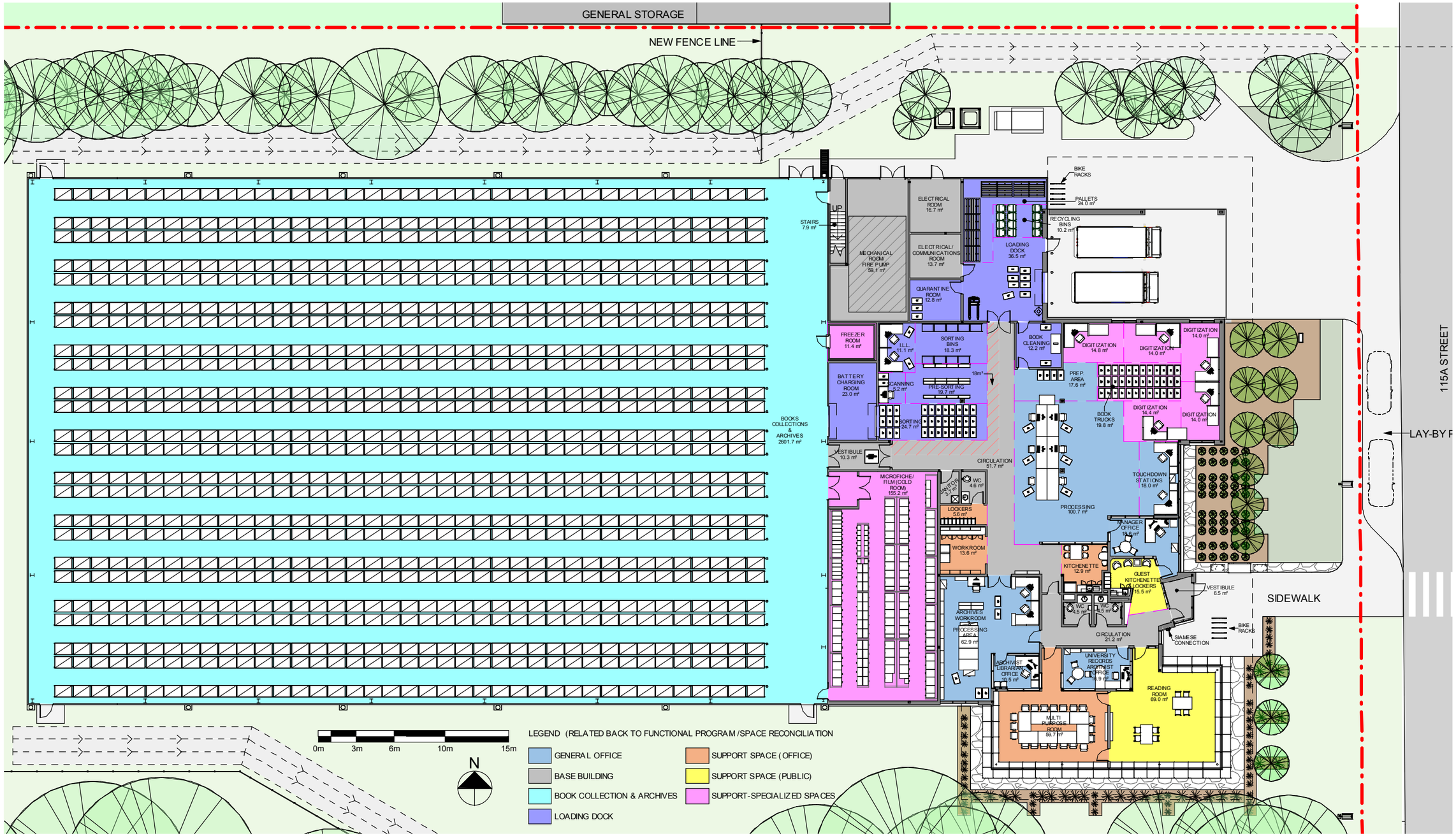
Perimeter steel columns support a clear span steel truss – there are no columns within the collections space. There are four emergency exits (directly to the exterior) from this space – the north east is a double door configuration so that larger equipment could be brought in to the facility in the future. The finishes of this space are easily maintained: sealed concrete floor, insulated metal panel and painted steel. Light fixtures are run on an occupancy sensor and will illuminate as staff enter an aisle (an override switch is also being provided). There are no roof or floor penetrations within this space. As part of the picker system, a guide wire will be installed down the centre of each aisle. This is done after the racking is installed and the picker equipment purchased.

BOOK SIZING TEMPLATE



A-LOW	5.75" WIDE	X	7.25" HIGH
A-HIGH	5.75" WIDE	X	8.25" HIGH
B-LOW	6.75" WIDE	X	8.25" HIGH
B-HIGH	6.75" WIDE	X	10.25" HIGH
C-LOW	8" WIDE	X	10.25" HIGH
C-HIGH	8" WIDE	X	12.25" HIGH
D-LOW	9.75" WIDE	X	12.25" HIGH
D-HIGH	9.75" WIDE	X	14.25" HIGH
E-LOW	12.25" WIDE	X	14.25" HIGH
E-HIGH	12.25" WIDE	X	16.25" HIGH





OVERALL FLOOR PLAN 1:300

General Office

There are two distinct work spaces: those for the UA Archives staff and those for BARD staff. Although originally programmed as traditional office space, the functional requirements are unique and the current layout reflects the specific processing requirements accordingly.

The Archives requires an enclosed office for the University Records Archivist, accommodating a workstation, small meeting area and space for bookshelves/file cabinets. In addition, this office must have invigilation capability associated with the adjacent Reading Room. When a researcher is scheduled to review material, it is the responsibility of Archives staff to oversee and monitor this activity. Other Archives staff workspaces include an office for an Archivist Librarian (future), a workstation for an administrative assistant and a workstation for casual staff and volunteers (future). These personnel will be co-located in an adjacent Archives Workroom and Processing Area. The remaining space accommodates layout tables, bookshelves and file cabinets for reference materials and a scanning workstation. Since the archival materials can be rare and delicate, it is important that this space be separate and secured at the end of the work day.

The staff members working on tasks related to processing the materials flowing in and out of the depository do not all sit in traditional offices and work stations. There is one enclosed office for a Manager and two open touchdown workstations (shared) for the remaining staff to check email and return phone calls. Otherwise, staff move within the open processing area to complete the necessary tasks associated with the Collection storage. The most significant processing area is in the centre of the open space, in which the collection is received, bar-coded, sized, put into trays and further prepared to move into the depository for storage. In order to provide enough future flexibility, this space is designed to have ample space to accommodate up to six (6) modular, adjustable workstations and a number of book trucks. Recessed floor boxes will provide power and data connections for related support equipment (computers, scanners, etc,).

Finishes within these spaces is carpet tile (offices) and sealed concrete (processing area), acoustic ceiling tile and painted gypsum wallboard partitions. Wall protection and corner guards are provided in areas that accommodate book trucks. For both interior and exterior windows, sun shades and privacy film should be provided.

Office Support Space

In order to support staff needs, shared amenities have been programmed and implemented into the layout. This includes a kitchenette, staff lockers, a workroom (office supplies and photocopier) and a collaboration/meeting room.

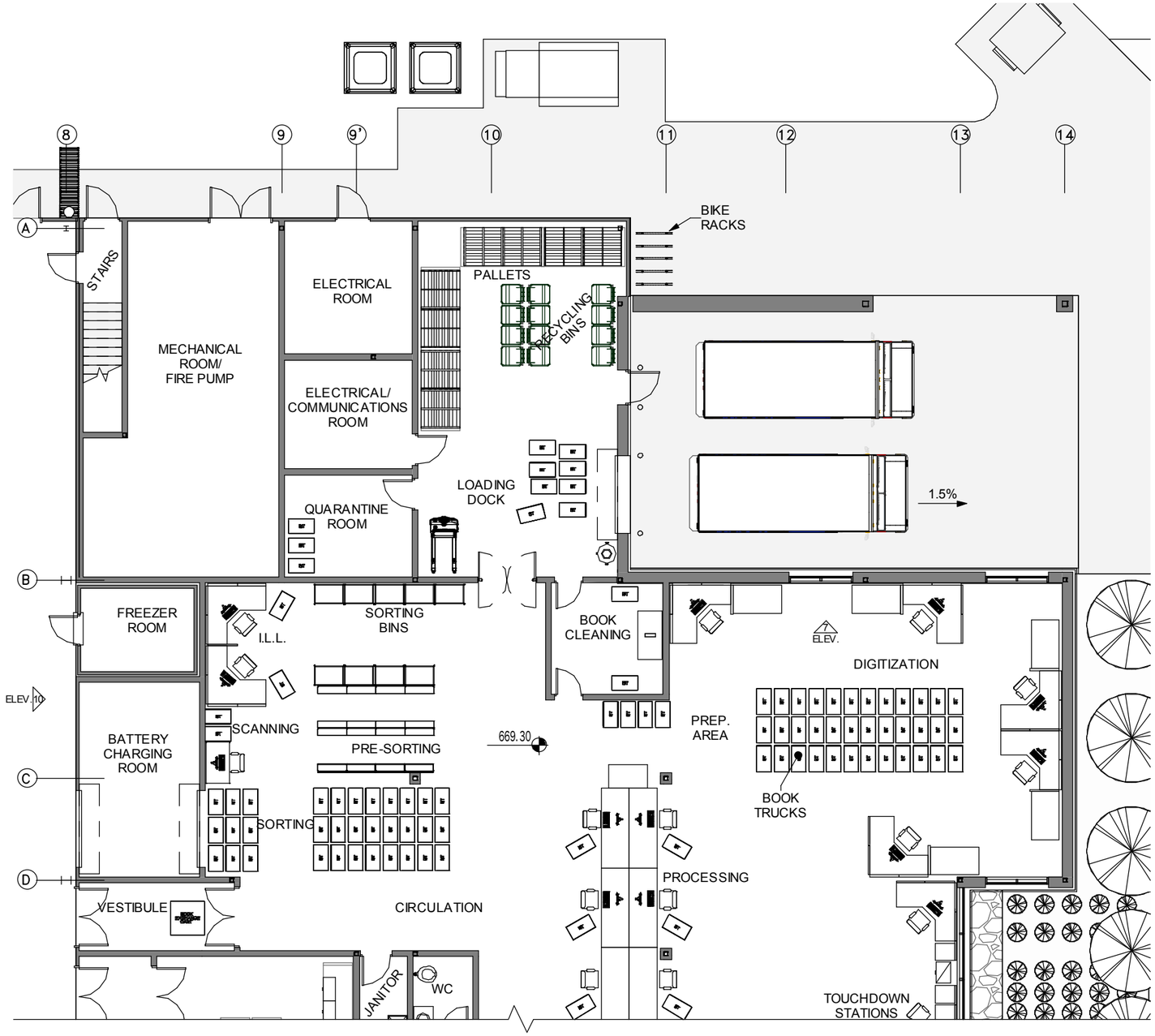
The staff kitchenette includes a custom millwork cabinet with a sink, microwave shelf, counter space for a coffee pot, kettle, etc. and cupboards for supply storage. A full sized fridge is required. Tables and chairs for 4-6 people is accommodated within a semi-enclosed room. Staff and public washrooms are located close by. This space is finished with porcelain floor tile, acoustic ceiling tile and painted gypsum wall board partitions.

Staff lockers, a total of 10-12 full height, are in an alcove within the processing area. There is another staff washroom in close proximity. This space is finished with sealed concrete floor, acoustic ceiling tile and painted gypsum wall board partitions.

The workroom is a shared space, housing a multi-use printer/ photocopier, a custom millwork cabinet with upper and lower storage cabinets and space for additional file cabinets or bookshelves. This space is close to the processing area as well as the Archive workroom. This space is finished with sealed concrete floor, acoustic ceiling tile and painted gypsum wall board partitions.

Through the design phase, the function of the collaboration/ meeting room has evolved be a space that could also be used for events, presentations or even classes/lectures. It is connected to the Reading Room so that there is the ability to move from one space to the other or use it as 'overflow' to the Reading Room functions. This room can accommodate 20 people in various formats. For flexibility, recessed electrical floor boxes will be provided in the centre of the room. It is presumed that flexible furniture will be purchased, such as stackable chairs and mobile/flip-up tables; this allows the room to be configured in different ways, depending on the function. There is a fireplace feature on the east wall in addition to interconnecting doors to the adjacent Reading Room. This space is finished with carpet tile, acoustic ceiling tile with access wood ceiling perimeter and painted gypsum wall board partitions. Additional features in this room include full height (5.5m) exterior glazing on the west and south walls, interior glazing to the adjacent Archives offices (for invigilation) and a raised perimeter plinth along the west and south walls.

SEE PAGES 60-61 FOR ELEVATIONS



FLOOR PLAN TILE 1
1 : 150

Public Accessed Support Space

There is limited access to the building for the public and would be by appointment only. Spaces that require access is the Reading Room, waiting area, kitchenette, lockers and washroom(s).

The Reading Room is a key feature for the facility. Located in the southeast corner, this space is one of the few that will be available for use by visiting academics and researchers. This room will be booked so that researchers can review any material that is held in the Archives or the Collection that cannot be removed from the premises. Key considerations for this room include: security and invigilation, flexibility to accommodate different needs of researchers, UV protection of light sensitive documents, acoustics and aesthetics. The key stakeholder group plans to set up a focus group to assist in further establishing the specific requirements of the room, including the furniture, finishes and general layout.

For flexibility, recessed electrical floor boxes will be provided in the centre of the room as well as along the perimeter. There is a fireplace feature on the east wall in addition to interconnecting doors to the adjacent Collaboration/ Meeting Room. This space is finished with carpet tile, acoustic ceiling tile with access wood ceiling perimeter and painted gypsum wall board partitions. Additional features in this room include full height (5.5m) exterior glazing on the east, north and south walls, interior glazing to the adjacent Archives office (for invigilation) and a raised perimeter plinth along the east, north and south walls. This plinth is expressed on the exterior as well as carrying through to the interior. In addition to promoting the aesthetic of a pavilion, the plinth also accommodates fin radiation and perimeter power and data.

Adjacent the main entry vestibule, there is a waiting area with half lockers (total of 8). Visitors to the facility will not be able to bring bags, backpacks, coats or food & drink into the Reading Room. A small kitchenette (counter, sink, half fridge, etc.) and a few chairs will provide the visitors with adequate break-out amenities. A public washroom(s) is located close by.

Specialized Support Spaces

Specialized support areas include the Digitization Area, Microfiche/Film Storage (cold room) and a Freezer Room.

At this time, it is presumed that the Digitization Area will need to accommodate between three (3) – five (5) workstations. The digitization workstations would accommodate a Scribe, a fold out station, a work surface and a supply shelf. There are different configurations that accommodate different media. A wide format sheet fed scanner for maps should be accommodated in this area. In addition to the workstations there is the requirement for a preparation area, which is used for all digitization related projects for various vendor streams and not just Internet Archive Scribe projects. Space is required for shelving, work table and book trucks. This space is located adjacent to the processing area in open plan, allowing flexibility for growth. Finishes within these spaces is sealed concrete, acoustic ceiling tile and painted gypsum wallboard partitions. Wall protection and corner guards are provided in areas that accommodate book trucks. For both interior and exterior windows, sun shades and privacy film should be provided. In addition, this area should have multi-level lighting capability.

The microfiche/film storage room requires a controlled temperature of 10°C and 37% relative humidity. Access to this space is from the Collection space. Because there is a temperature difference of approximately 5°C between the two spaces, a warming room is provided to act as vestibule or air lock. This space is to accommodate existing microfiche and film storage cabinets as they are transferred from other library facilities. Most of these cabinets are low (915 – 1,219mm or 3 – 4 feet high) and as noted in the space reconciliation, the most efficient layout presumes a 'stacked' configuration using either palette racking or some other racking system. A rolling ladder would be used for retrieval. The finishes of this space are easily maintained: sealed concrete floor, insulated metal panel and painted steel. Due to the material being stored in this space (primarily film) a one hour fire separation is provided.

The freezer room is also accessed from the Collections space. This would be installed as a self-contained package unit and operate at -20°C. The purpose of the room is to use this in the case of an emergency and documents are exposed to moisture. Freezing the material becomes part of the process in recovering the items from further damage.

Loading Dock Spaces

An important function of RCRF is the loading dock and the efficiency of processing volumes in and out of the collections space. Included in the related loading functions is a sorting space, pallet storage, the loading bay, a quarantine room, book cleaning room and battery charging room.

The sorting space is required to support the functions related to transferring collections materials to and from other library facilities. A series of sorting bins, shelves and scanning equipment is co-located in an open area that is close to both the loading dock and the collections space. Functions related to inter-library loans is managed in this space.

The loading bay is located on exterior but sheltered from the elements on the south and north (partially) sides. There is a large overhang extended above the bay. The width can accommodate two trucks but there is only one overhead door and a single man door. Note that there is no 'dock' or elevated platform but an at-grade overhead door. There have been discussions with the key stakeholder group regarding a scissor lift being installed on the exterior in front of the door to assist in transferring materials from the truck, to grade and into the facility. This has not been concluded and should be reviewed further during Phase 2.

Just inside the overhead door is a staging area for materials moving in/out of the facility. Pallet racking for storage of the corrugated cardboard trays is accommodated in this space. Also, rolling recycling bins (total of 12) would be held in this space. The bins are used primarily for book recycling and needs to remain secured until it is picked up and disposed of. Also accommodated within this space is the walkie-stacker for charging. Double-doors to the processing area provides a secure separation and helps to protect the working spaces from the impact of weather.

A quarantine room is accessible from the loading/staging area. This space is used to accommodate any suspect materials that come into the facility. These items would be stored until it can be picked up and removed from the site. The canister and motor for the vacuum system used in the book cleaning room would be housed in this room.

Also directly accessed from the loading/staging area is the book cleaning room. A vacuum table is the key equipment accommodated here. It is intended that all new material will be cleaned before it is put onto book trucks and processed through the system.

In order to support the pickers required in the collections space a dedicated battery charging room in located adjacent to both the depository and the sorting area. Overhead doors into both spaces will accommodate the initial delivery to the facility but also if equipment needs to be replaced or maintained/repaired. This room will have a water source and an eyewash station.

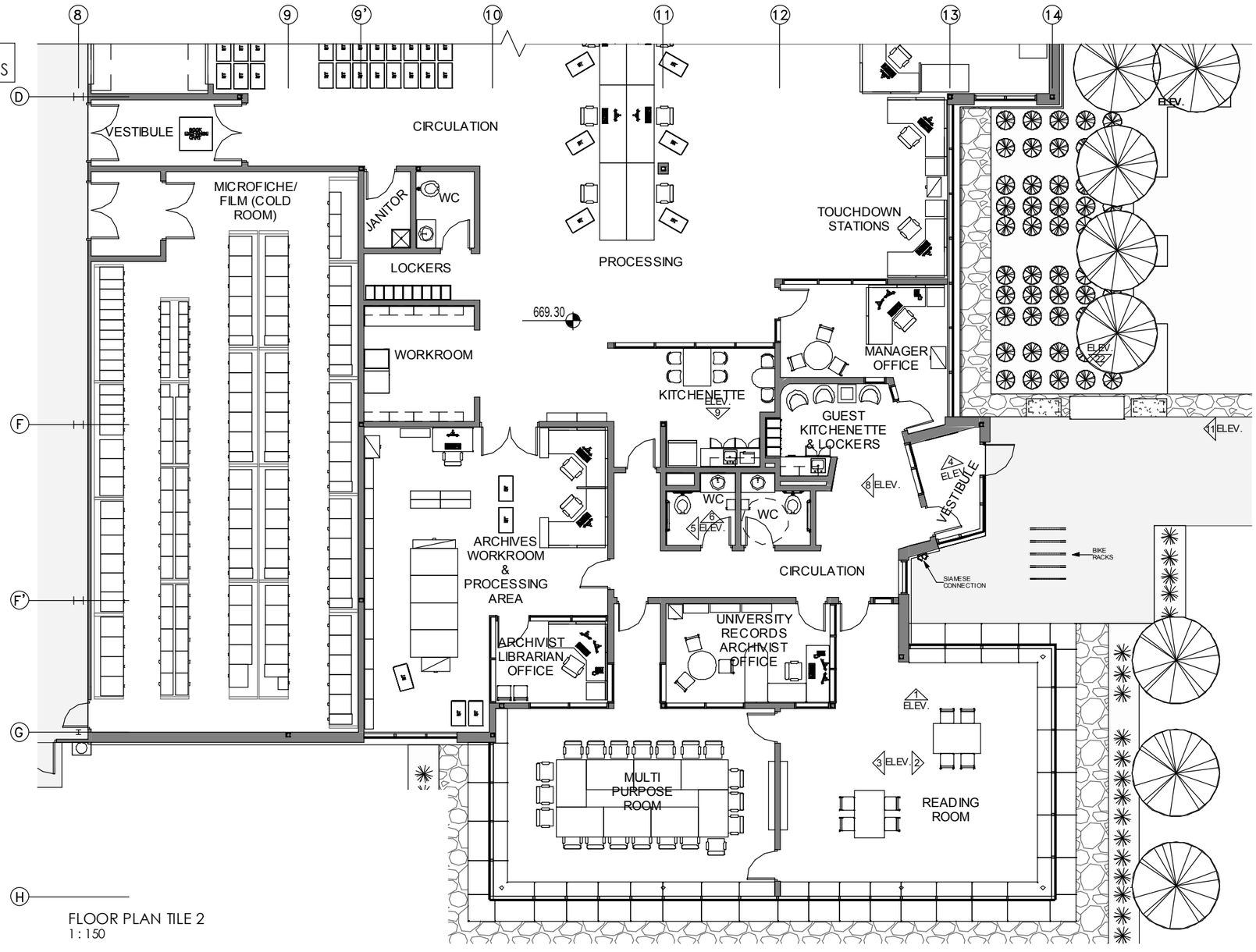
Finishes within all of these spaces is sealed concrete, acoustic ceiling tile and painted gypsum wallboard partitions. Wall protection and corner guards are provided in areas that accommodate book trucks.

Base Building Components

There are several spaces that are typically not programmed but required for the full function of the building. This would include washrooms, corridors, entry/exit vestibule, stair, janitor room, mechanical and electrical spaces. These spaces are captured in either the component gross or the building gross of a new facility. These spaces have been accommodated in the current layouts and reconciled within the space reconciliation. The following design parameters have been considered:

- There are three washrooms within the facility: two are shared public and staff and one is dedicated for staff. Each washroom is designed to meet current barrier free guidelines. All are finished with porcelain floor tile, gypsum wallboard partitions and ceilings. Standard washroom accessories to be provided.
- There are minimal corridors within the building. Wherever there is cart or book truck traffic, wall protection and corner guards are provided. The main corridor adjacent the entry is secured to keep the public from entering the processing and collection areas.
- There is one entry vestibule in the southeast portion of the building near the Reading Room. During daytime hours, people are able to enter the vestibule but the inside door is secured. A door chime system will notify staff that someone has arrived. Also accommodated in the vestibule is an in-wall mounted electric fan space heater and the building's annunciator panel.
- The janitor room has a floor mounted mop sink, mop rail, shelf and space for cleaning equipment.

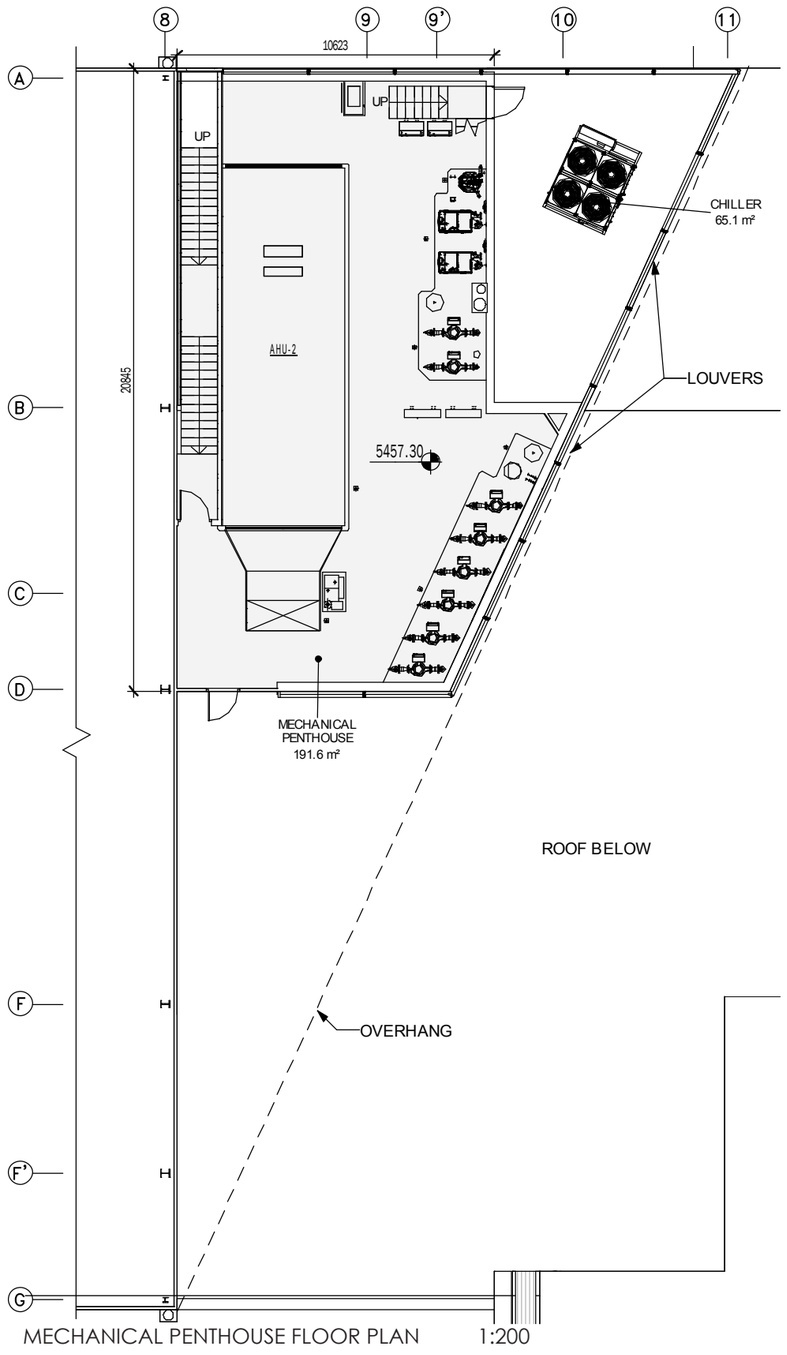
SEE PAGES 60-61 FOR ELEVATIONS



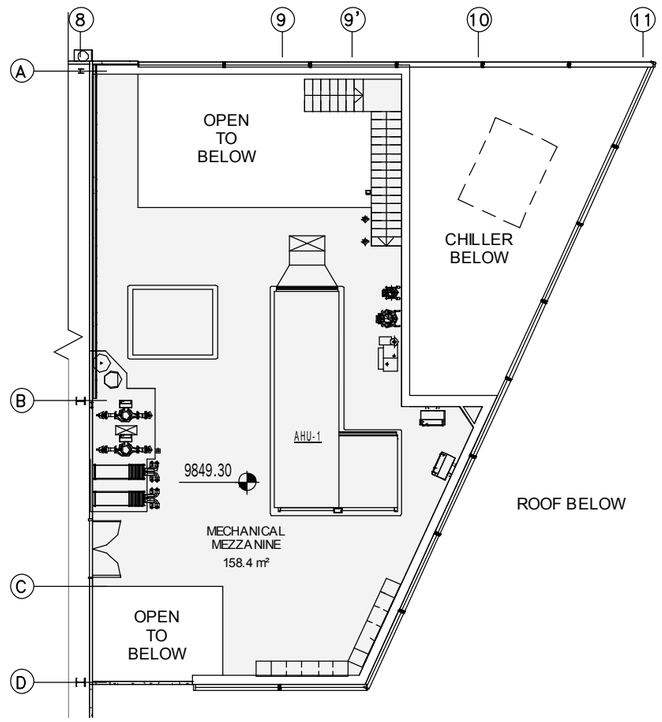
FLOOR PLAN TILE 2
1 : 150

Level 2

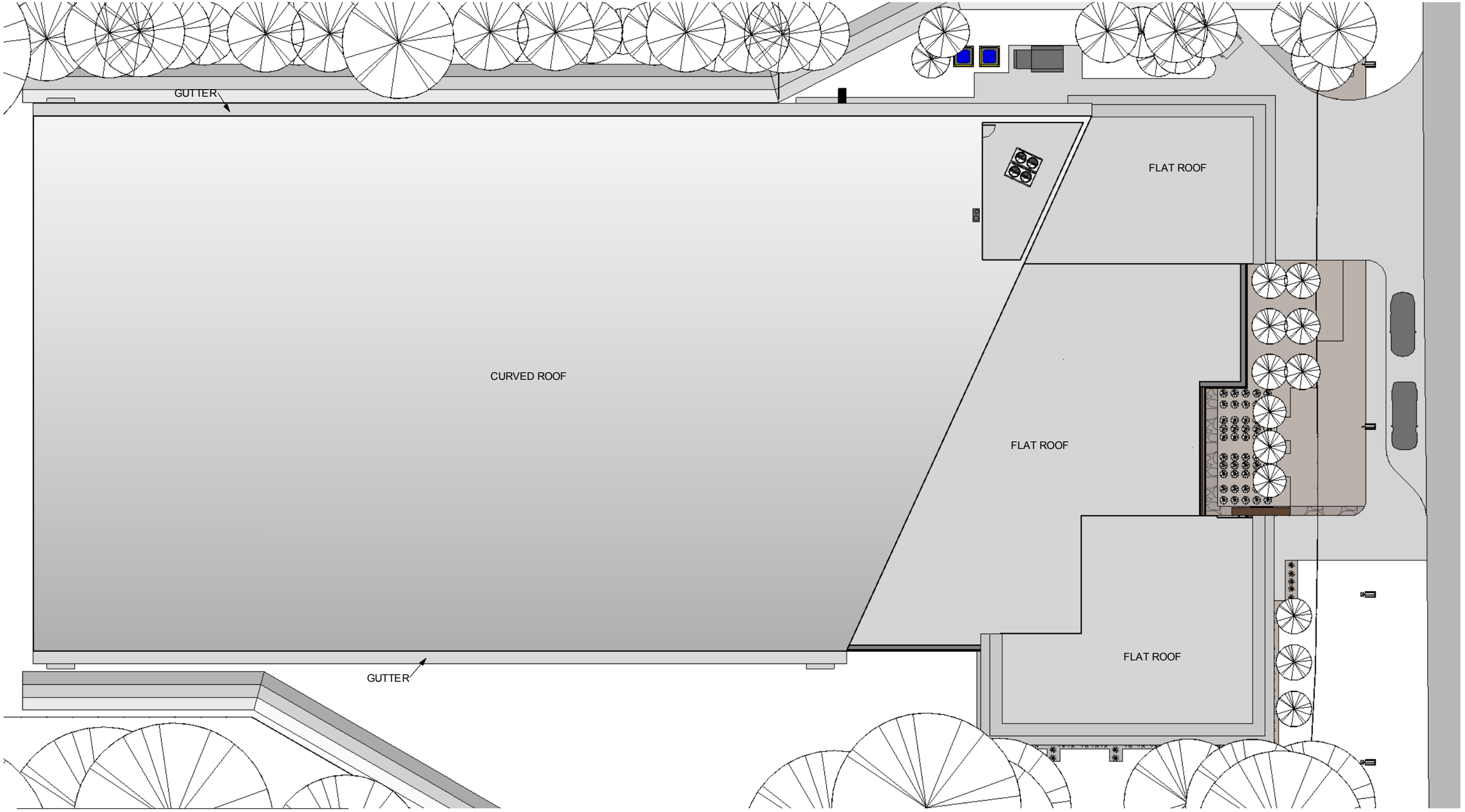
There is a second level in this facility, which accommodates mechanical and electrical functions. In order to provide supply air ductwork in the Collections space at the highest possible elevation (integrated within the building structure) the mechanical space on the second level has an integral mezzanine. This concept reduced the overall footprint of the mechanical space but maximized the volume to better accommodate the mechanical components. During schematic design, the mechanical space was assigned a placeholder of 250m^2. Through design development, further detail has been coordinated and as a result, the overall area of the mechanical space (including the mezzanine) has increased the area beyond the 250m^2 allowance and it currently sits at approximately 350m^2.



MECHANICAL PENTHOUSE FLOOR PLAN 1:200



MECHANICAL PENTHOUSE MEZZANINE FLOOR PLAN 1:200



ROOF PLAN 1:300

Reflected Ceiling Plans

Key elements influencing the development of the reflected ceiling plans are the height, lighting quality and materiality. Ceiling heights have been coordinated with structural and mechanical systems to ensure there are appropriate clearances of mechanical duct runs. Where possible, the ductwork will run within the web of the structural girders, but below the steel beams.

There are five major ceiling types within the facility, each described in the following section.

Open Ceiling

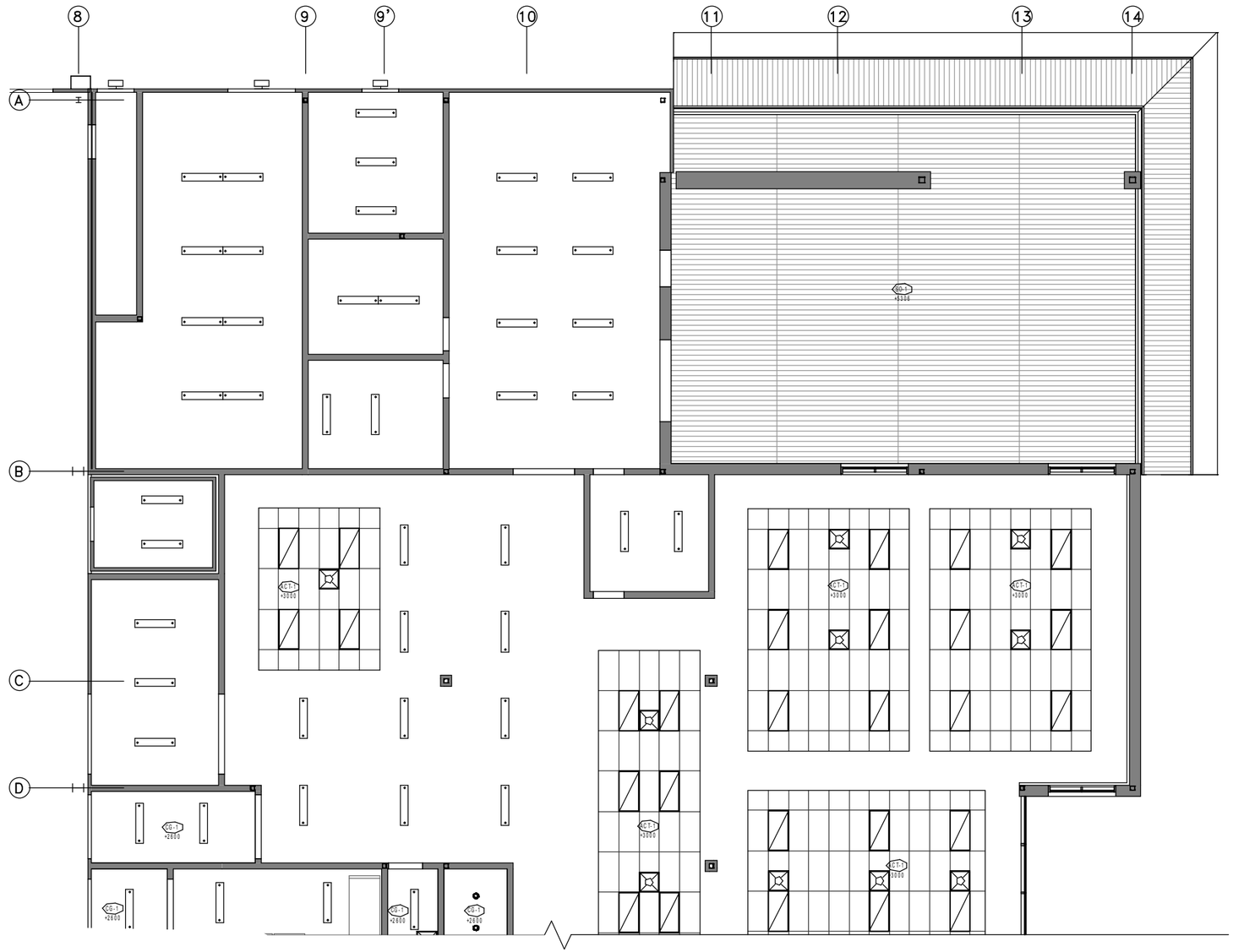
There are several spaces that do not require a finished ceiling and in fact, for access to mechanical and electrical equipment, it is preferred that there is no ceiling. For these spaces, the underside of structure would be painted and exposed ductwork and conduit either be painted or finished in some manner. Spaces that have no ceilings include: Collections & Archives Space, Microfiche & Film Storage (cold room), mechanical and electrical rooms, loading dock, battery charging room, book cleaning room and the Processing Area.

Ceiling Clouds

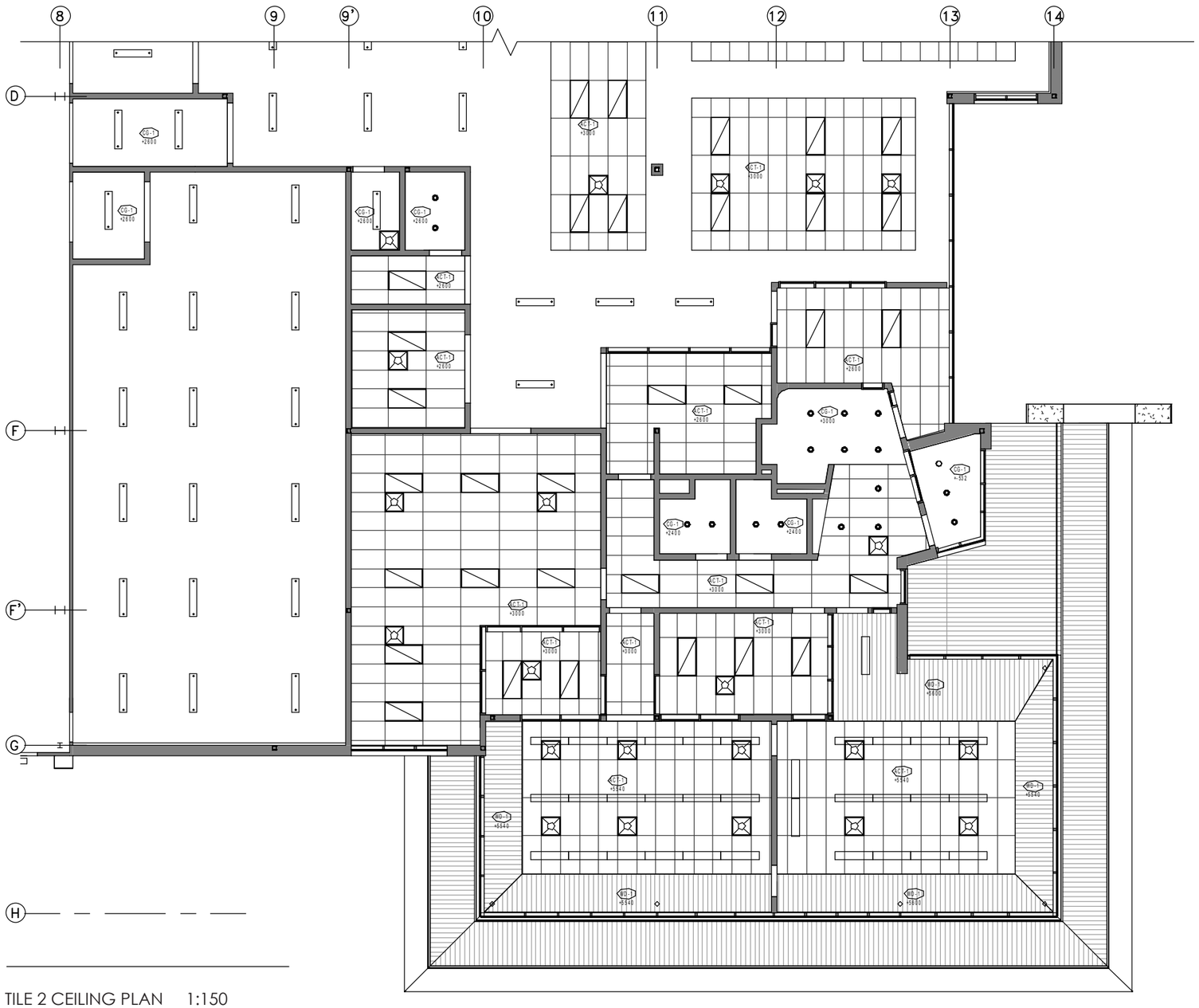
Within the open ceilings of the Processing Area, there are zones that require a brighter work area/surface. Five (5) ceiling clouds (proprietary system with edge trim and drop in 2'x4' acoustic tile) are suspended from the structure above and provide a lower acoustic ceiling tile grid above desks and workstations at a height of 3m. Light fixtures, supply diffusers and sprinkler heads are incorporated into the ceiling clouds. Due to the space above the clouds, sprinkler coverage is also required above. Spaces within the Processing Area that have ceiling clouds include: digitization area, processing tables, sorting area and touchdown workstations.

Acoustic Ceiling Tile

A 2'x4' acoustic ceiling tile in a suspended grid is provided in offices, workrooms, corridors, staff kitchenette and main entry. Heights vary depending on the function of the space. Recessed light fixtures, supply diffusers and sprinkler heads are incorporated into the ceilings.



TILE 1 CEILING PLAN 1:150



TILE 2 CEILING PLAN 1:150

Acoustic Ceiling Tile with Wood Accent Perimeter

In the Reading Room and Collaboration/Meeting Room, a 2'x4' acoustic ceiling tile in a suspended grid is used in combination with a perimeter wood-look ceiling, particularly at the exterior windows. The elevation of the ceiling is approximately 5.5m and matches the elevation of the exterior soffit. The concept is to blur the line between interior and exterior space by using a similar wood-look material for the soffit and the ceiling. A proprietary suspended ceiling system is proposed, using either a metal linear panel or a drop-in wood veneer panel. Light fixtures in these rooms are suspended direct/indirect type, providing a soft glow in the room at night.

Gypsum Wallboard

A painted gypsum wallboard ceiling is provided either for cleanliness or for accent. This includes washrooms, janitor room, entry vestibule and the visitor waiting area/kitchenette.

Exterior and Materiality

Materiality

A clean, simple palette of materials is proposed for RCRF. As the largest volume, the Collections space has the most stringent environmental controls and it is important that the exterior envelope be designed and detailed in such a way that the cladding system is cleanly installed and easily maintained. An insulated metal wall system is proposed, whereby modular 40 foot sections can be installed, minimizing the number of joints. This system is considered an all in one system as interior finish, insulation and exterior finish are integral to the panels. The proposed system offers a high performance solution, engineered to provide a stringent R-value and meet energy bridging requirements. It is considered the most cost effective cladding system for this large volume. It is possible to modulate the cladding panels and finishes on the exterior. For example, it is planned to change the colour and finish of the upper portion of the north and south elevations (above the tree line) for visual interest.

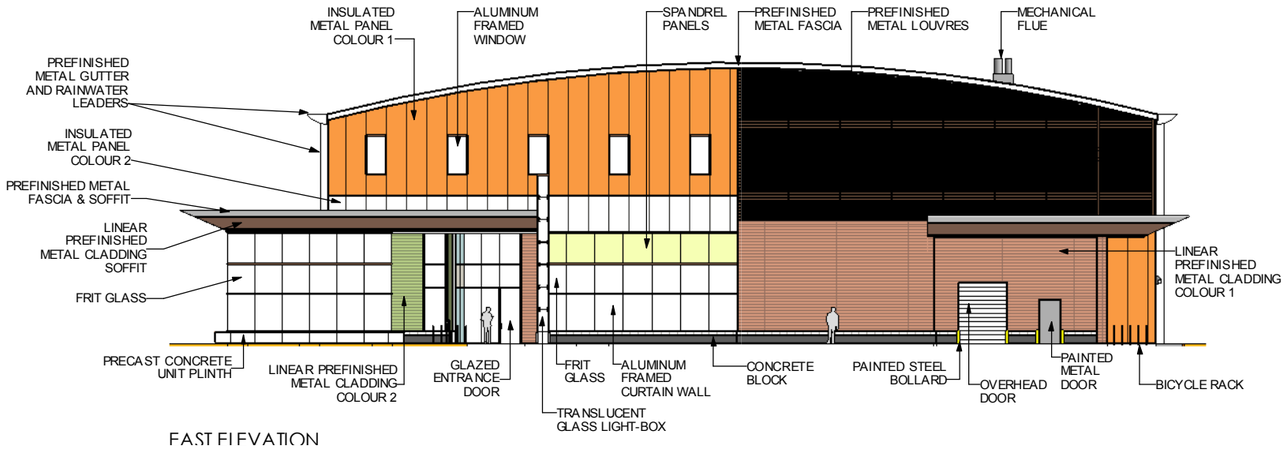
The front of house pavilion is planned to be a combination of curtain wall (both vision and spandrel panels and ceramic frit glass) and a wood-look metal panel. The soffit material would also be a wood-look metal system. The other dominant material is a metal louvre at the upper level mechanical room. Other architectural features are emphasized in the articulation at the Reading Room in the southeast corner of the facility. The oversized roof overhang tapers to a clean edge, framing the full height exterior glazing. Low reflectivity in the glass is key to de-emphasizing the distinction between inside and out – the appearance at night is that the pavilion is a key architectural element and the large storage volume recedes. At the base, an exterior plinth (seat height) is expressed on both the interior and the exterior. This detail provides a strong, grounded base for the reading room feature. The use of precast concrete sections is envisioned on the exterior and on the interior, a finished wood tops a framed base. The interior detail also integrates fin radiation and electrical receptacles.

The vertical entry feature is envisioned as an opaque glass-clad structure that is lit from within, providing additional glow at the entry to the building. Steel framing with the use of point support glass spider fittings and silicon sealed glass joints are part of the architectural detailing.

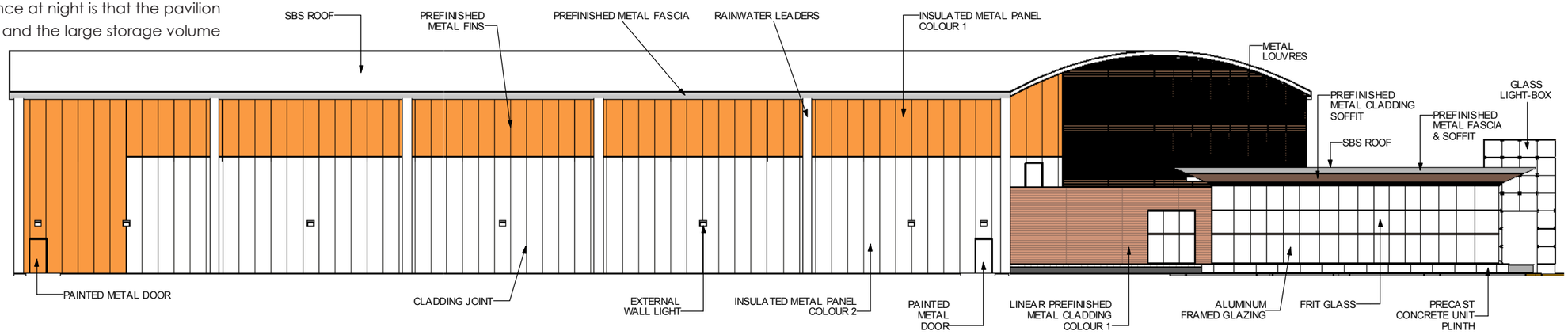
Finishes/Colour Palette Options

At the Design Development stage, two optional exterior colour & finishes palettes have been developed. It is intended that these palettes be reviewed further and a final selection is made early in Phase 2. A preliminary list of the considered products has been developed through coordination with the DB contractor, for the purposes of preparing a more detailed cost plan.

The following building elevations note the type, location and extent of the finishes.



EAST ELEVATION

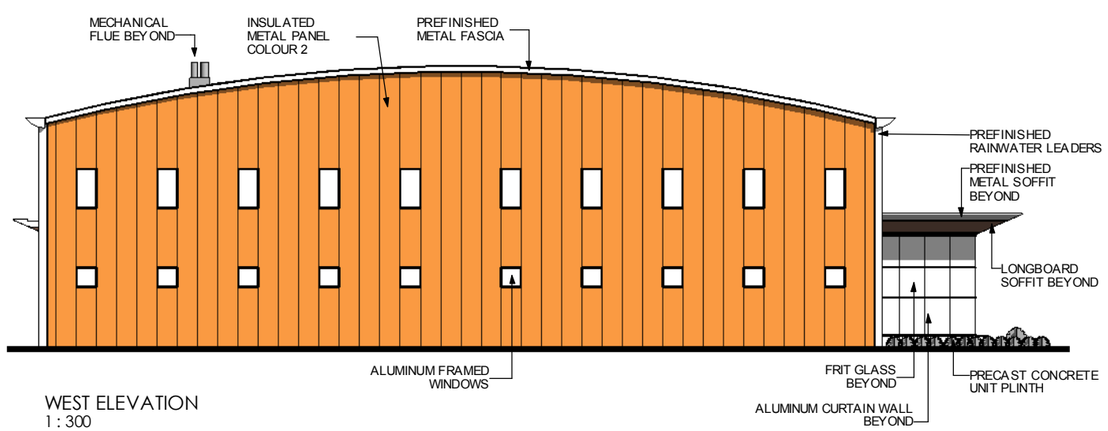


SOUTH ELEVATION
1 : 300

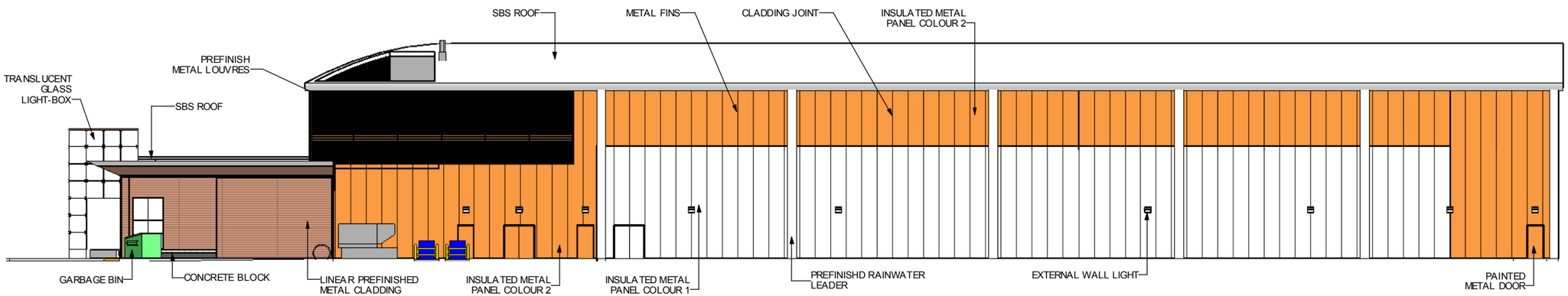
15-16 University of Alberta RCRF

Exterior Finishes List

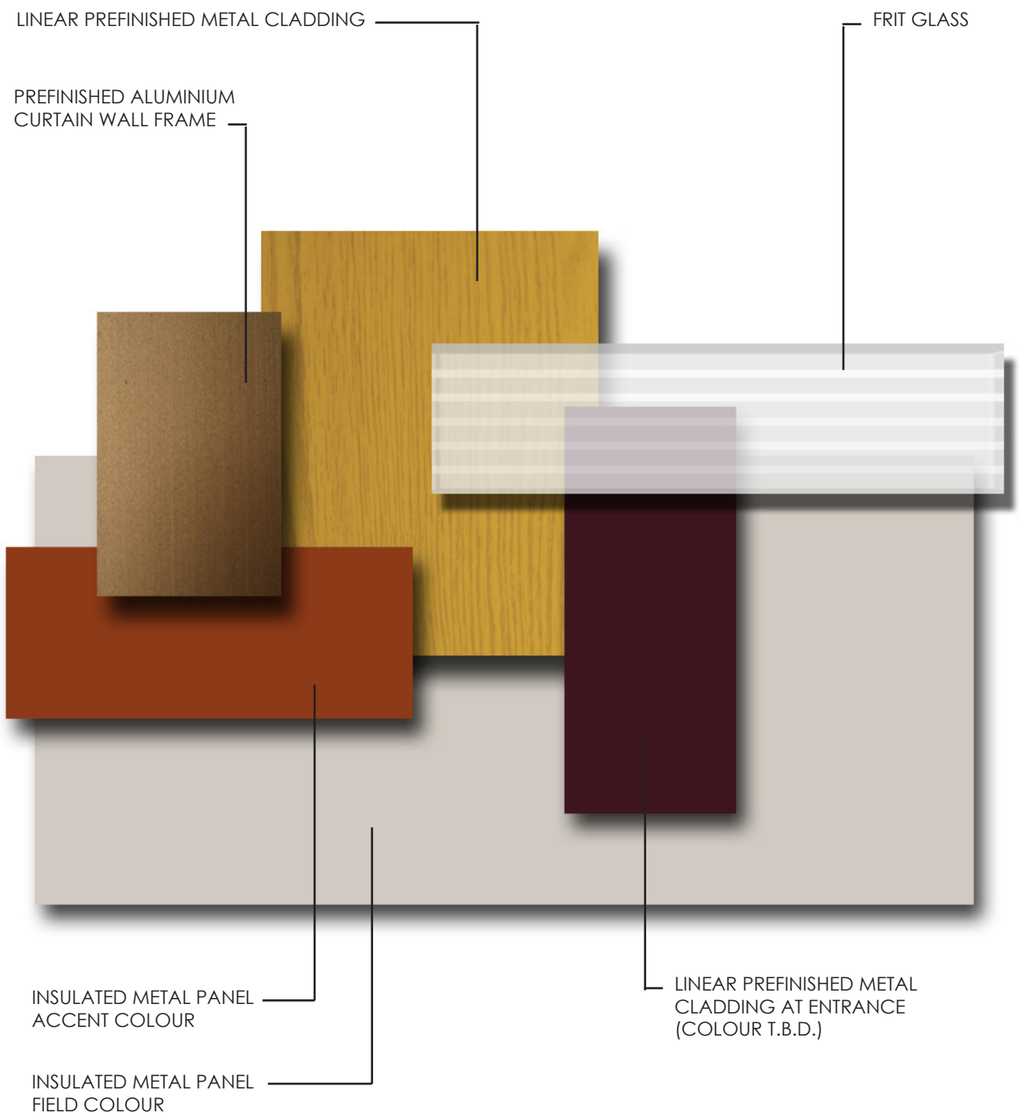
FINISH	FINISH NAME	FINISH SPECIFICATION
DOORS & WINDOWS		
W1	Aluminum Framed Curtain Wall	Kawneer Clearwall System
W2	Aluminum Framed Window	Kawneer
D1	Metal Door	Painted Insulated Metal Door
D2	Glazed Entrance Door	As part of curtain walling system
D3	Overhead Door	Painted Insulated Metal Overhead Door with vision panel
GLASS		
GL1	Glass	Glass – triple glazed or double glazed Triple: 6mm glass, outside and centre to have Low-E coating, 2 cavities 95% argon filled Double: 6mm glass, outside to have Low-E coating, 95% argon filled cavity
GL2	Glass shading system	Frit glass (Vitrum glass)
GL3	Lightbox	Translucent glass – Starphire 65% Diffused white – (Vitrum glass)
CLADDING		
CL1	Linear Prefinished Metal Cladding	Longboard Color 1(field color Light Cherry 1406/01-716)
CL2	Linear Prefinished Metal Cladding	Longboard Color 2 (green accent at entrance – Dark Ivy ID #YK204U)
CL3	Insulated Metal Panel	Vicwest or Kingspan (field color – Vicwest Regent Grey 56082)
CL4	Insulated Metal Panel	Vicwest or Kingspan (accent color – Vicwest Oak Brown 56158)
MASONRY		
BK1	Precast Concrete Unit	Precast Concrete Plinth
WOOD		
WD1	Wood capping at plinth	Wood capping
METAL		
MT1	Louvre	Prefinished Metal louvres
MT2	Flashing	Prefinished metal flashing
MT3	Exterior fins	Prefinished metal fins to North/South elevations
MT4	Rainwater Leader	Prefinished metal rainwater leader box



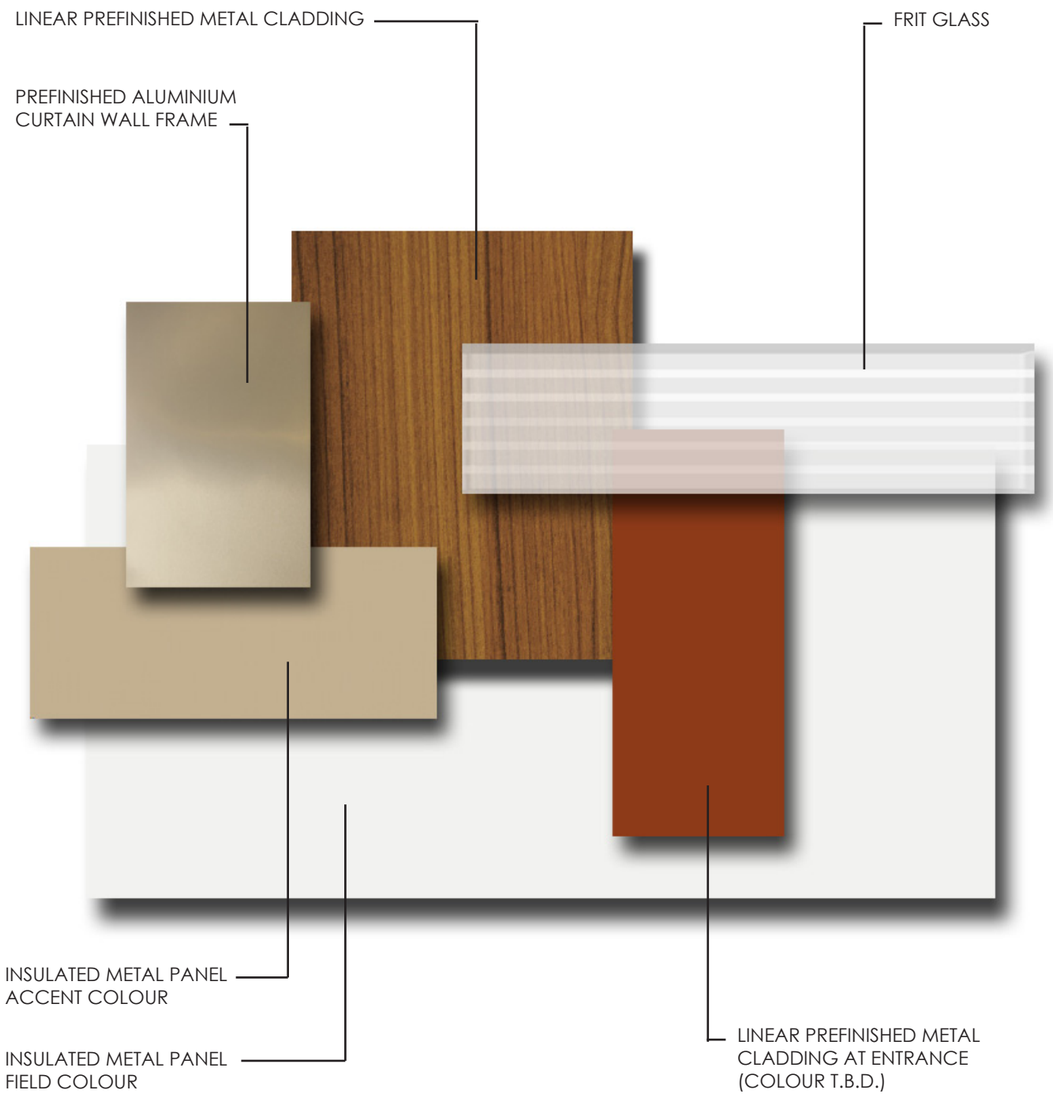
WEST ELEVATION
1 : 300



NORTH ELEVATION
1 : 300



EXTERIOR FINISHES CONCEPT OPTION 1



EXTERIOR FINISHES CONCEPT OPTION 2

ALL COLOURS & FINISHES TO BE APPROVED SUBJECT TO FURTHER CONSULTATION PROCESS

EAST VIEW AT NIGHT

Lighting Concepts

This building has been developed for its functional requirements, but also how it will be perceived by those individuals who live and work in and around South Campus. Particular attention will be paid to the lighting methodologies that can be incorporated in order to enhance this building as day turns to night. The initial concept is to have the large volume recede as evening falls and then skillfully light the remaining pavilion-like structure. This building will be seen by neighboring facilities as well as the LRT passenger.

As previously mentioned, some lighting features that are further developed include:

- Wall-washing LED wall packs on the exterior elevations, all sides.
- Pavilion lighting along the east façade at the Reading Room canopy – a wash of light from fixtures on the interior.
- Soffit lighting at the main east entry and the loading bay canopy.
- Vertical entry feature as a 'lantern' using LED light fixtures.
- Garden lights using a custom bollard housing.
- All possible lighting methods will be cognizant to avoid increasing 'light pollution'.

EAST ELEVATION

SOUTH-EAST VIEW

NORTH-EAST VIEW

SOUTH-WEST VIEW

EAST VIEW IN SNOW

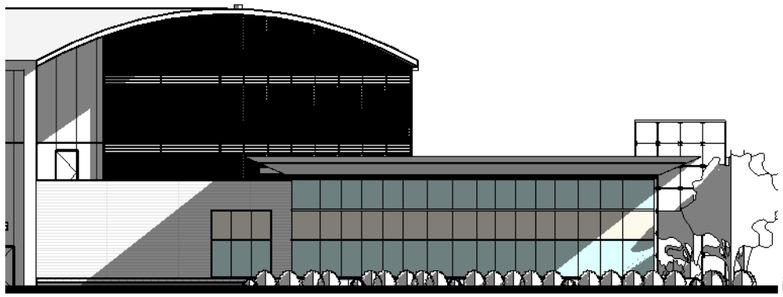
NB: FURTHER CONSULTATION REQUIRED FOR FURNITURE LAYOUT AND COLOURS/FINISHES

INTERIOR OF READING ROOM

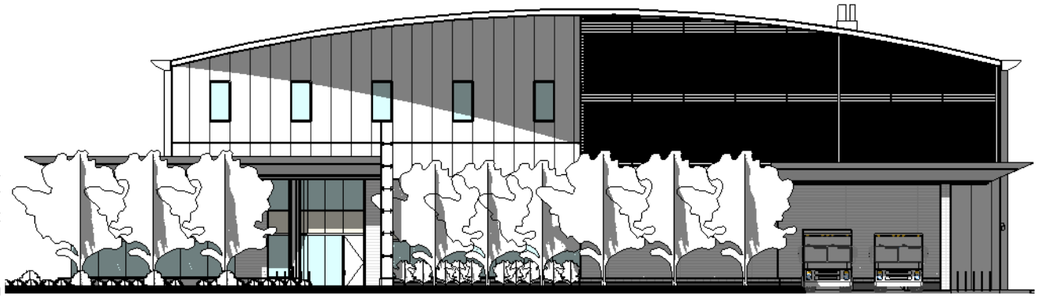
Sun Studies

Using the architectural model, a series of sun studies were undertaken to assess the sun exposure to the building at different times of the year and day. These studies were used to inform the design team of the effectiveness of the roof overhang and sun shading materials (frit glass) and modify the details accordingly. These models have discovered the impact of the existing deciduous trees to the south and the proposed new landscape that will mature in time.

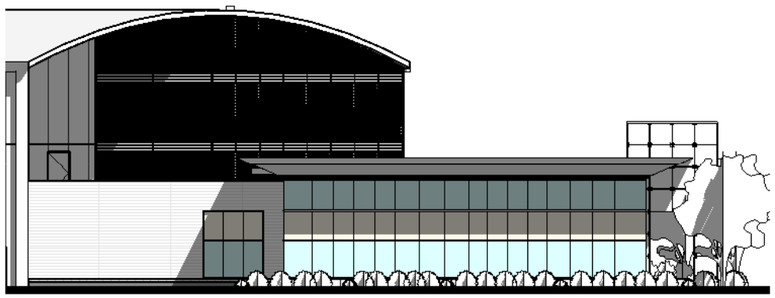
The studies show the extreme differences in daylight between the summer solstice in the month of July and the height of winter in December. The study shows that in summer the roof and frit glass provide adequate shade to the reading room whilst in winter the sun is lower in the sky and will allow light to penetrate into the reading room. The addition of trees to the south will also help to shade in the spring/ summer months.



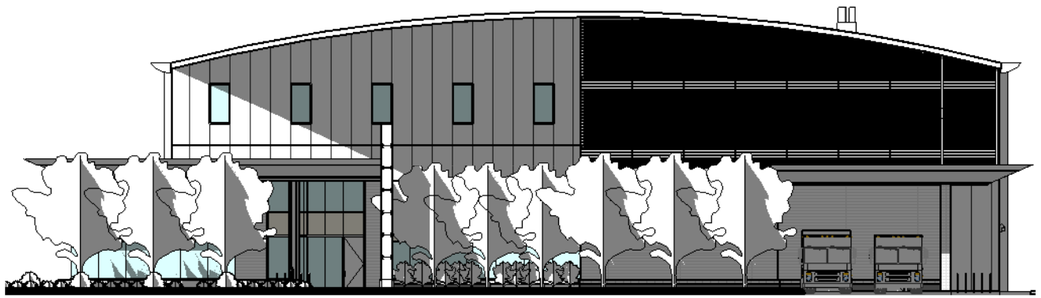
JULY 10:00 AM
1 : 300



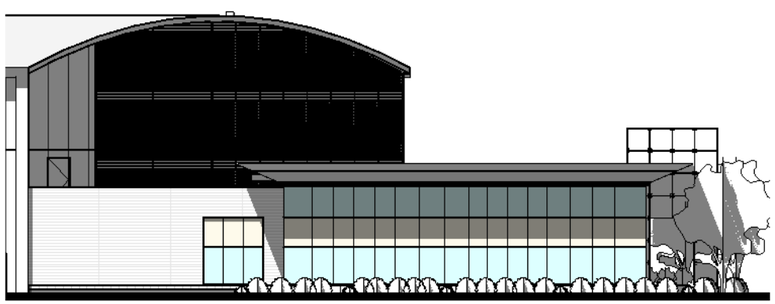
JULY 10:00 AM
1 : 300



JULY 12:00 PM
1 : 300

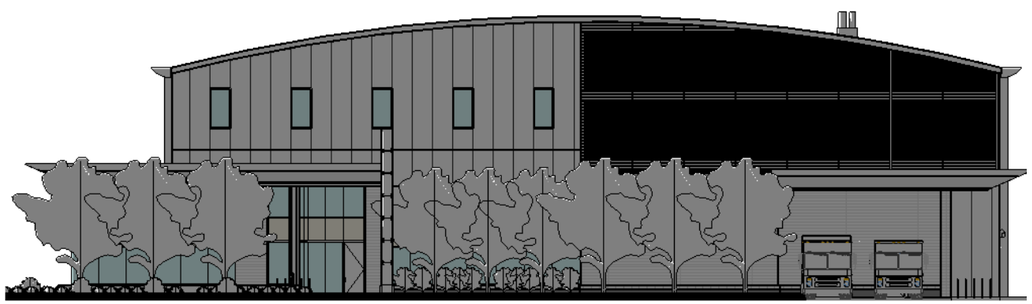


JULY 12:00 PM
1 : 300



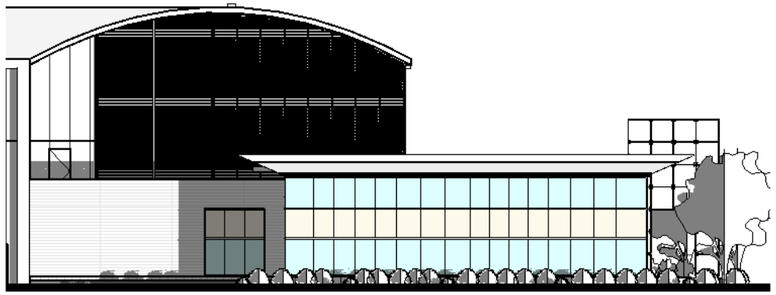
JULY 3:00 PM
1 : 300

SOUTH FACING ELEVATION (PARTIAL)

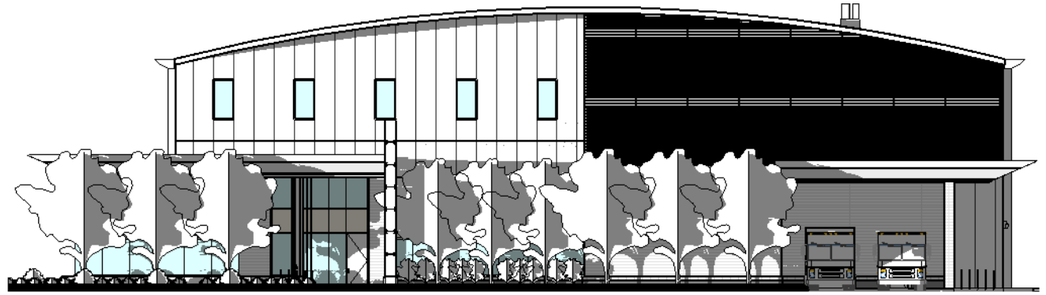


JULY 3:00 PM
1 : 300

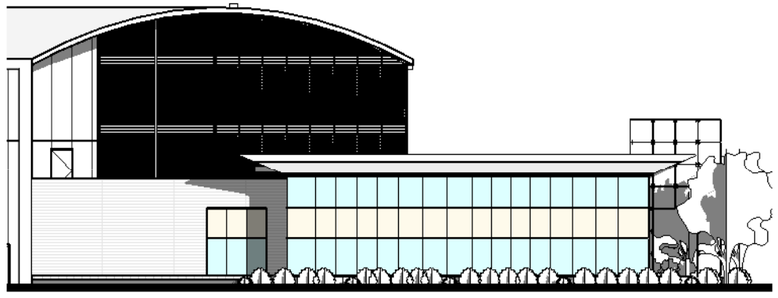
EAST FACING ELEVATION



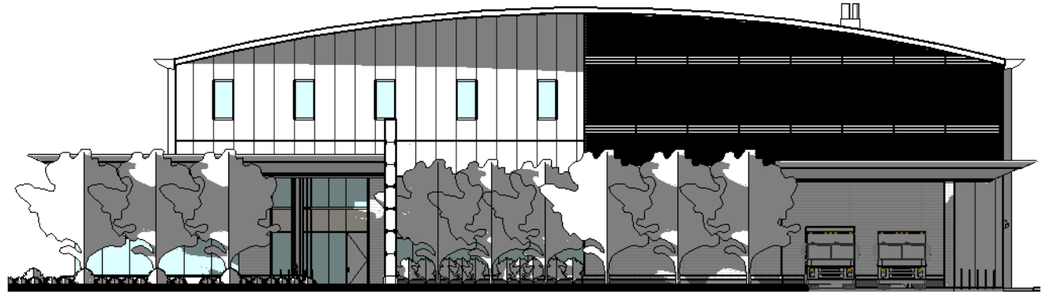
DECEMBER 10:00 AM
1 : 300



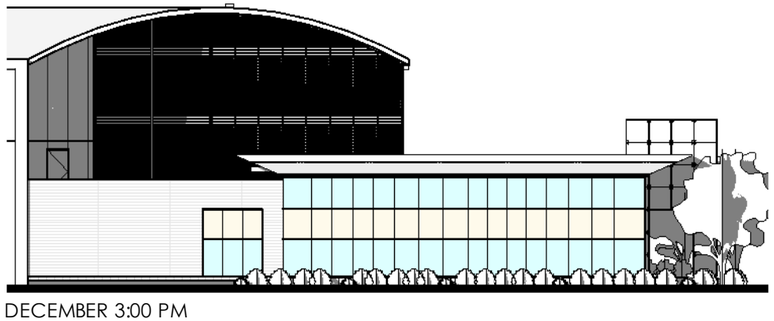
DECEMBER 10:00 AM
1 : 300



DECEMBER 12:00 PM
1 : 300



DECEMBER 12:00 PM
1 : 300

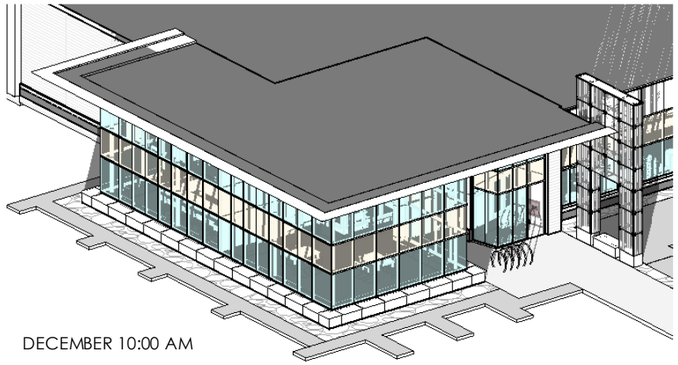


DECEMBER 3:00 PM
1 : 300

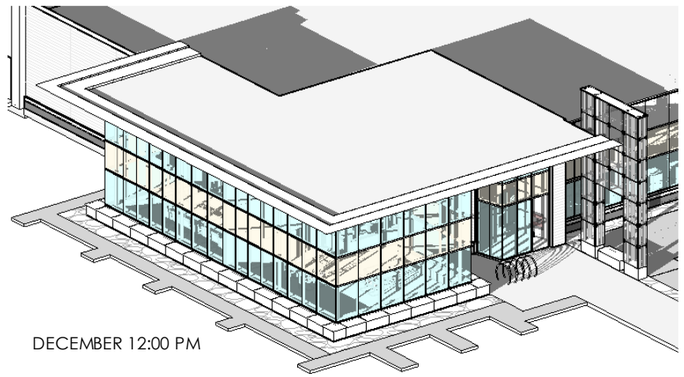
SOUTH FACING ELEVATION (PARTIAL)

DECEMBER 3:00 PM
1 : 300

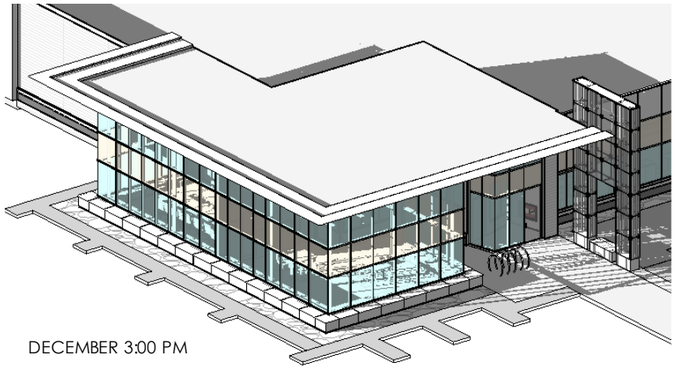
EAST FACING ELEVATION



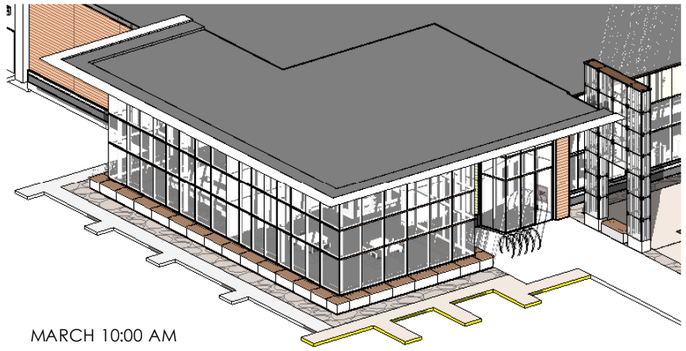
DECEMBER 10:00 AM



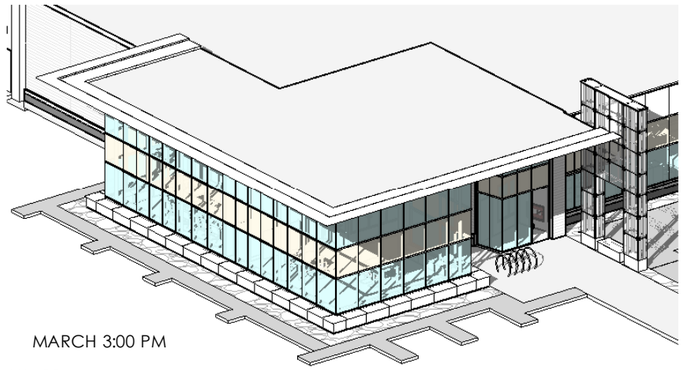
DECEMBER 12:00 PM



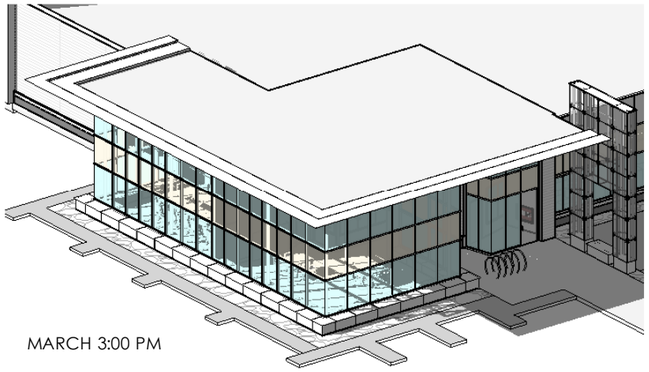
DECEMBER 3:00 PM



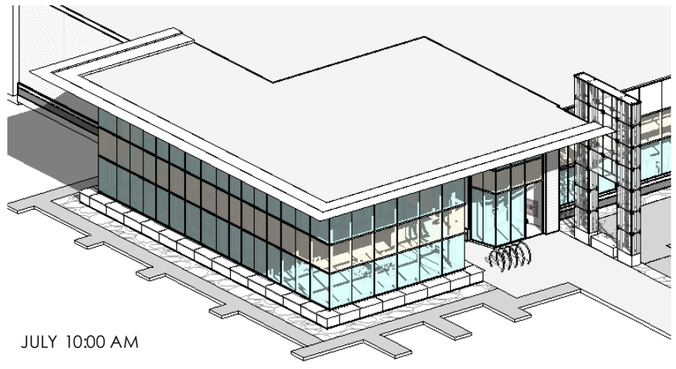
MARCH 10:00 AM



MARCH 3:00 PM

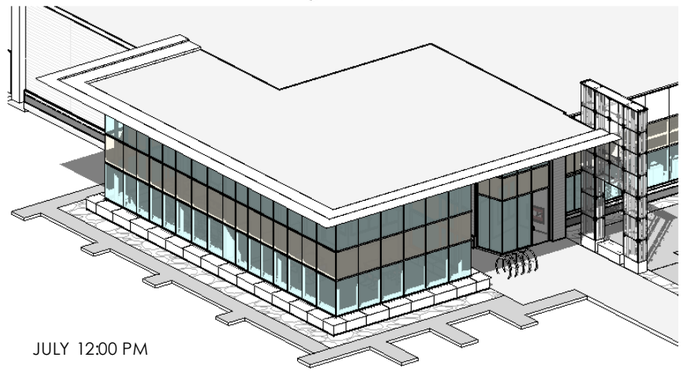


MARCH 3:00 PM



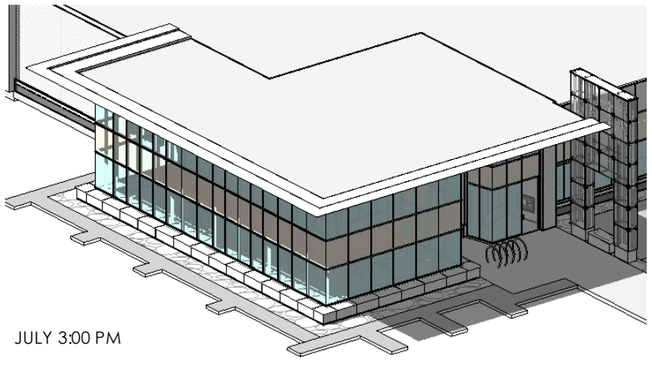
JULY 10:00 AM

SOUTH-EAST VIEW



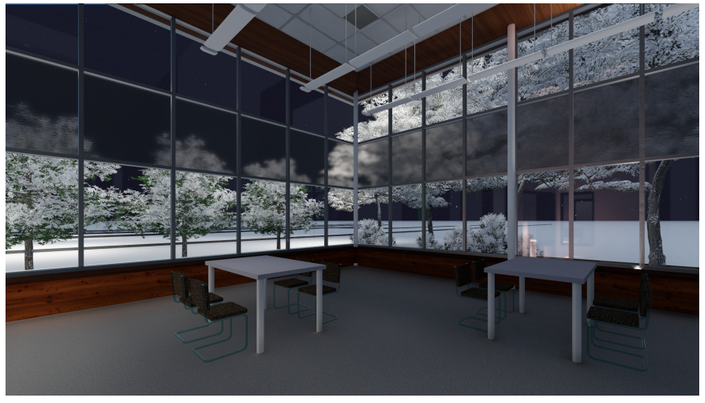
JULY 12:00 PM

SOUTH-EAST VIEW



JULY 3:00 PM

SOUTH-EAST VIEW



9am - December

12pm - December

3pm - December

9am - July

12pm - July

3pm - July

FURTHER CONSULTATION REQUIRED FOR FURNITURE LAYOUT AND COLOURS/FINISHES

SUN STUDY OF READING ROOM INTERIOR

Interior Design Concept

Guided by a concept of bringing the "inside out and the outside in", the proposed interior finishes palettes incorporate warm, natural tones. A simple, clean colour palette provides spaces that are easy to maintain and will have longevity. Similar to the exterior finishes, two optional colour palettes have been developed with the intent that a final selection is made early in Phase 2.

There are three distinct functional zones which have specific functional requirements:

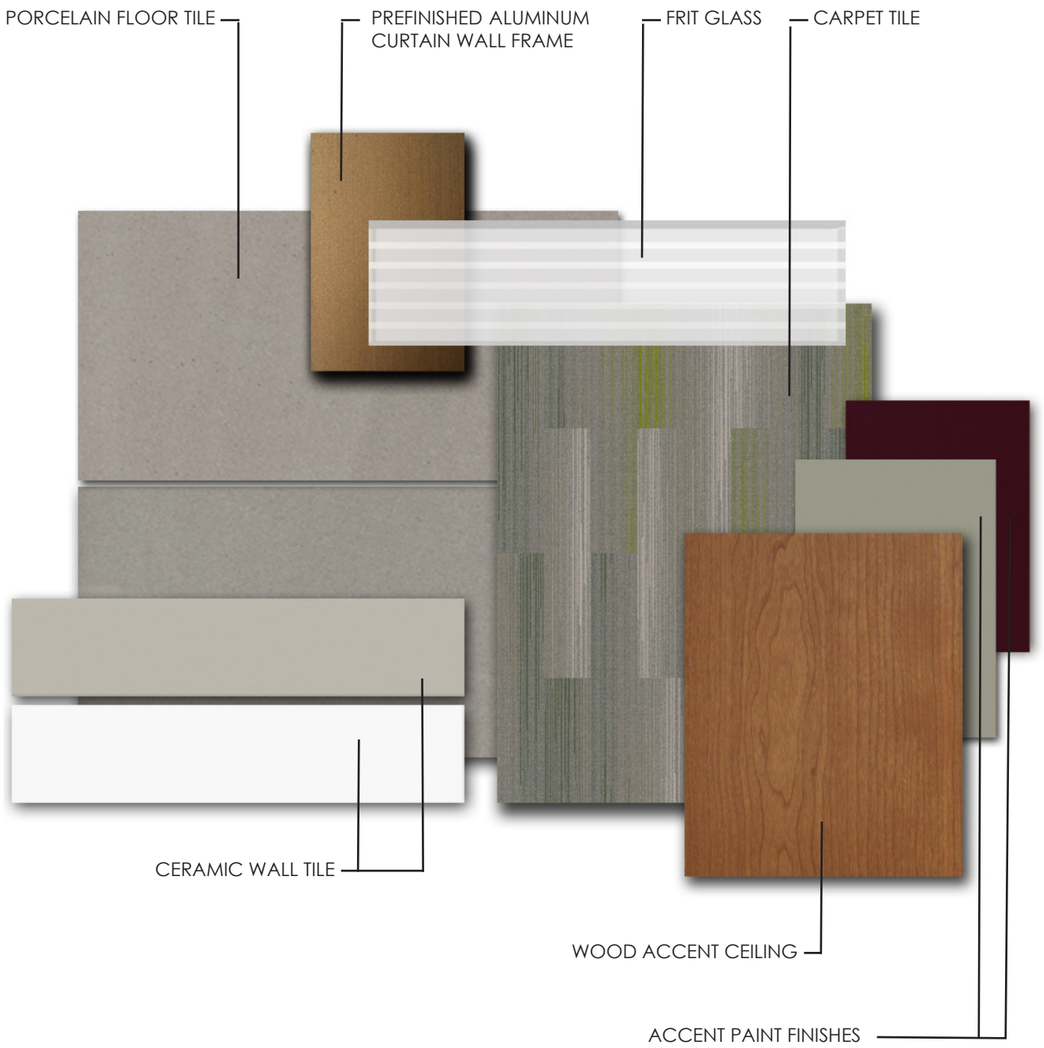
1. Publicly-Accessed Spaces (Reading Room & Collaboration/Meeting Room)
    - These spaces will reflect the character of the facility and should be warm, comfortable and suitable for various events. Good acoustics and flexibility in the layout are two significant factors in these rooms. A Focus Group will be established by the key stakeholder group during Phase 2 to further inform the use of these spaces and ultimately the best layout.
    - Use of materials include: carpet tile and porcelain tile; acoustic ceiling tile with wood-like perimeter accent; curtain wall glazing with ceramic frit glass and incorporating window shades.
2. Staff Work Areas
    - The spaces are varied from offices to open workspaces to loading dock and require flexibility. Easy to maintain finishes that are not susceptible to damage from carts and book truck traffic is critical.
    - Use of materials include: a combination of sealed concrete floor/ carpet tile/porcelain tile; open ceilings and acoustic ceiling tile (clouds); painted gypsum wallboard partitions with wall protection and corner guards.
3. Book Depository/Collections Space
    - This large space is needs to be maintained efficiently and retain the required level of environmental controls.
    - Use of materials include: sealed concrete floor; painted structure; metal insulated panel (prefinished white).

The following floor plans note the type, location and extent of the various finishes. The tables provide a preliminary list of the considered products that been developed through coordination with the DB contractor, for the purposes of preparing a more detailed cost plan.

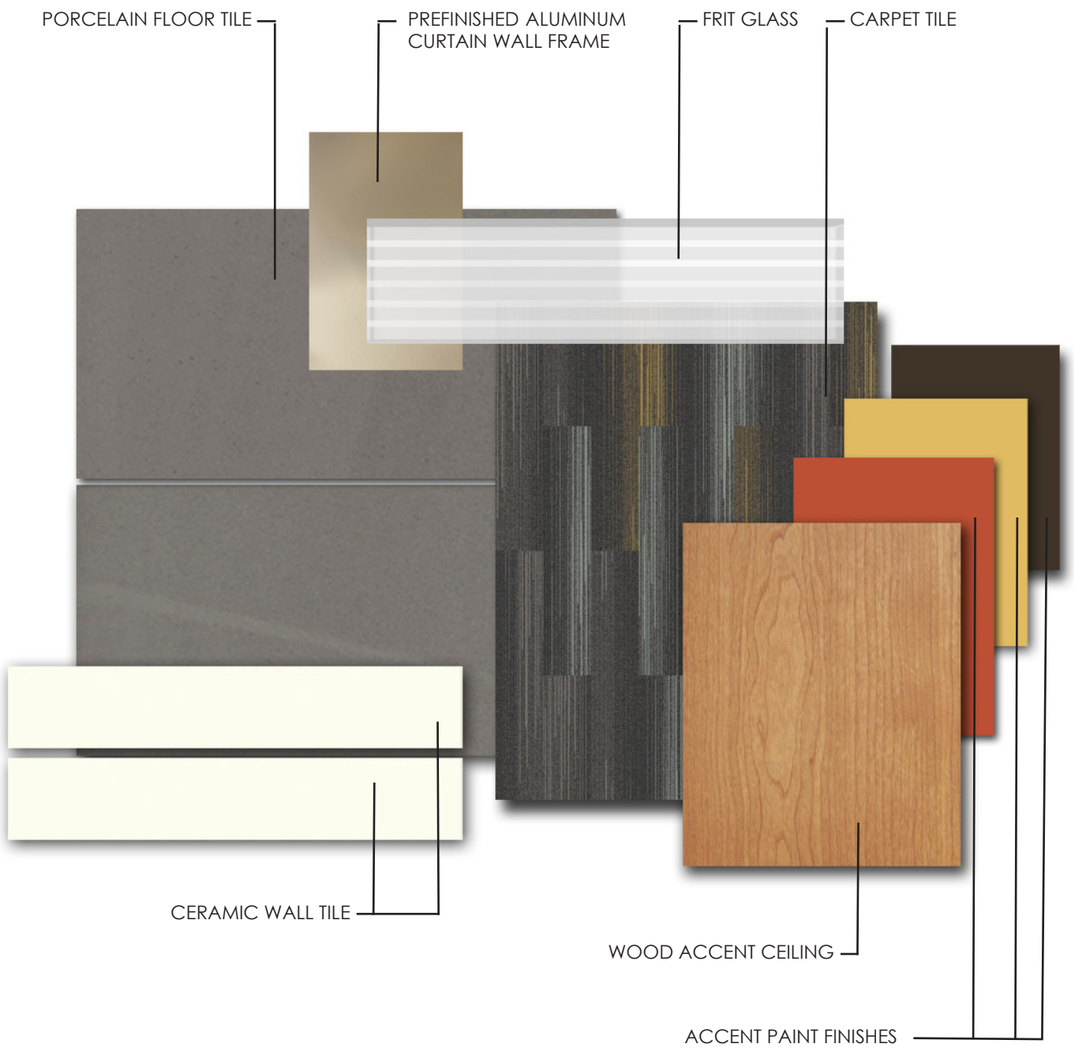
Sustainable Design

As per the UA project objectives, there is a target established for the team to achieve 4 (four) Green Globes certification, providing a sustainable building initiative. As of the writing of this report, the design team has completed an initial project questionnaire. Some architectural considerations include:

- Efficiency in the building envelope
- Siting and orientation of the building
- Energy model targets
- Selection of products and materials that meet sustainable design criteria
- Consideration in developing a Building Service Life Plan



INTERIOR FINISHES PRELIMINARY CONCEPT OPTION 1



INTERIOR FINISHES PRELIMINARY CONCEPT OPTION 2

ALL COLOURS & FINISHES TO BE APPROVED SUBJECT TO FURTHER CONSULTATION PROCESS

· Finishes Matrix

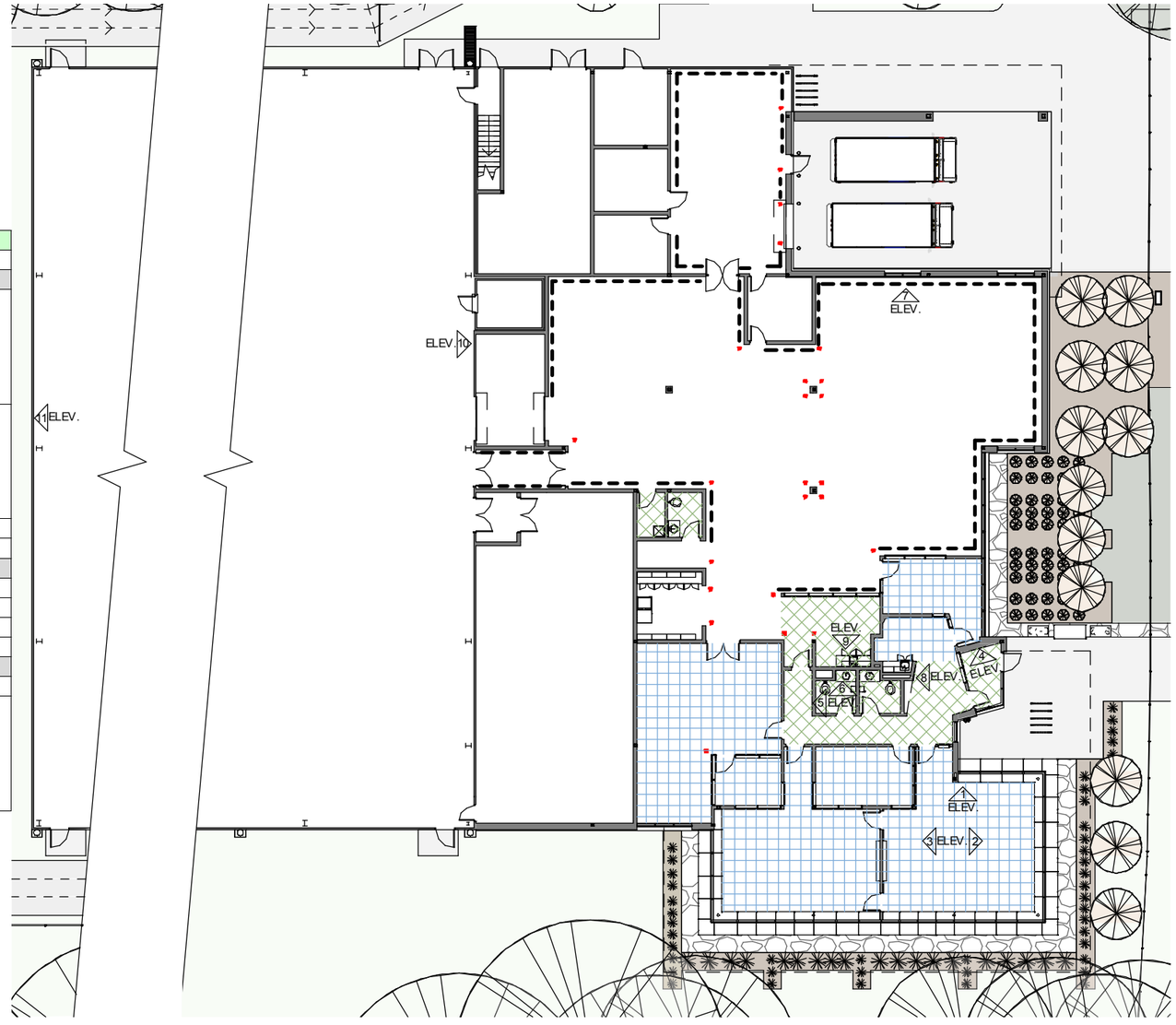
ROOM TYPE	FLOOR			BASE			WALLS				CEILINGS					SPECIALITY			MILLWORK			
	Ceramic Tile	Carpet Tile	Sealed Concrete	Ceramic Base	Wood Base	Rubber Base	Paint	Porcelain/Ceramic Tile	Wall Protection Sheet	Solid Surface Backsplash	ACT-1 2x4 (2x2 scored)	ACT -2 (2x2)	ACT-3 - (2x2 Cloud)	Painted GWB	Wood Ceiling	Roller Shades (Exterior Windows)	Stainless Steel Corner Guard	Frosted Film on Interior Glazing	Plastic Laminate Counter	Solid Surface Counters	Wood Top to Mechanical cabinet	Plastic Laminate Vertical
Legend: ● = Proposed																						
1.0 Support (Public)																						
Vestibule	●			●			●							●				●				
Guest Kitchenette / Lockers		●			●		●			●				●				●		●		●
Reading Room		●			●		●					●			●			●			●	
Circulation Corridor	●			●			●				●											
2.0 Bard Staff																						
Assistant's Office		●			●		●				●							●	●			●
Manager's Office		●			●		●				●					●		●	●			●
Archivist Librarian		●			●		●				●							●	●			●
Archives Offices and Processing		●			●		●				●					●		●	●			●
Processing			●			●	●					●				●	●	●	●			●
3.0 Support (Office)																						
Collaboration Meeting Room		●			●		●					●			●			●	●		●	●
Kitchenette	●			●			●			●	●							●		●		●
Storage Supplies			●			●	●				●						●		●			●
Lockers			●			●	●				●						●		●			●
4.0 Support (Specialized)																						
Microfiche			●			●	●		●								●		●			●
Microfiche Lobby			●			●	●		●										●			●
Freezer			●			●	●															

ROOM TYPE	FLOOR			BASE			WALLS				CEILINGS					SPECIALITY			MILLWORK			
	Ceramic Tile	Carpet Tile	Sealed Concrete	Ceramic Base	Wood Base	Rubber Base	Paint	Porcelain/Ceramic Tile	Wall Protection Sheet	Solid Surface Backsplash	ACT-1 2x4 (2x2 scored)	ACT -2 (2x2)	ACT-3 - (2x2 Cloud)	Painted GWB	Wood Ceiling	Roller Shades (Exterior Windows)	Stainless Steel Corner Guard	Frosted Film on Interior Glazing	Plastic Laminate Counter	Solid Surface Counters	Wood Top to Mechanical cabinet	Plastic Laminate Vertical
5.0 Loading Dock																						
Sorting			●			●	●		●				●				●		●			●
Loading Dock			●			●	●		●								●		●			●
Quarantine			●			●	●		●								●					
Battery			●			●	●		●								●					
Books Cleaning			●			●	●		●								●					
6.0 Books Collection and Archives																						
Storage Warehouse			●			●			●								●					
7.0 BGSM																						
Washrooms	●			●				●						●						●		●
Electrical Room			●			●																
Mechanical Room			●			●																
Janitor			●			●	●	●	●					●			●					

15-16 University of Alberta RCRF

Room Finish Legend and Notes

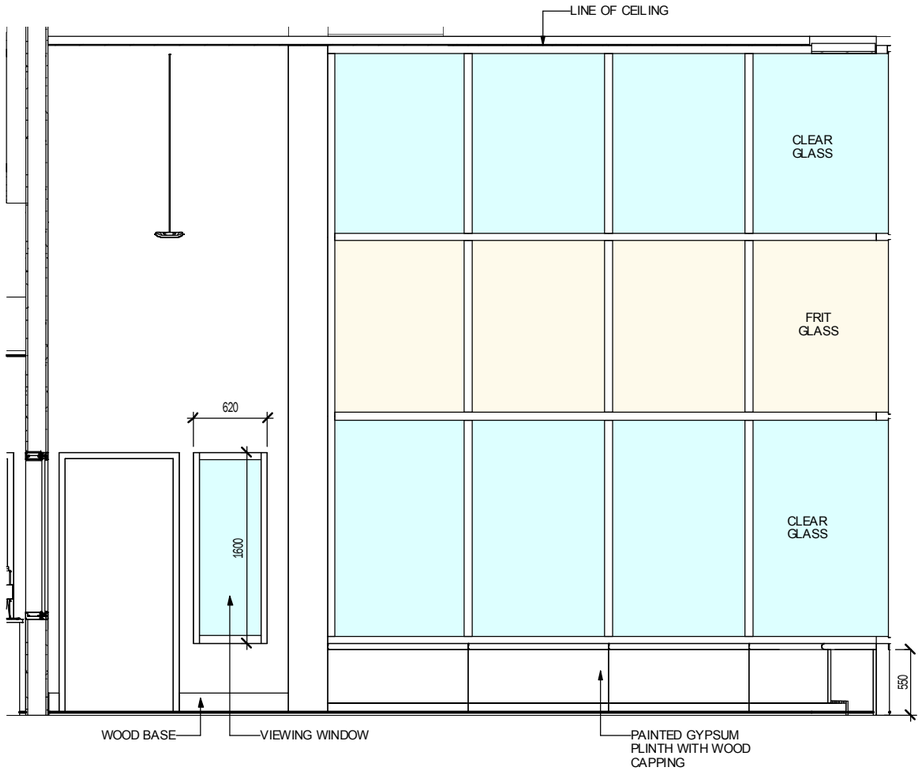
FINISH	FINISH NAME	FINISH SPECIFICATION
FLOOR		
CFT1	Porcelain Floor Tile	**Ames** Option 1: Word Up Series, Color Cement or Color Grey, 12" x 24" Full Body Porcelain – Rectified Matte Option 2: Flow Series, Color Grey, 12" x 24" Matte Color Body Porcelain - Rectified **Stone Tile** Betontech, Color Mud or Grey, 30cm x 60cm Honed
CPT1	Carpet tile	**Interface** Option 1: Shiver Me Timbers, Color Cyprus or Beech, 25cm x 100cm Plank Option 2: Cubic Colors, Color Dimensions or Height, 50cm x 50cm Tile Option 2: The Standard, Color Seashell or Standard, 50cm x 50cm Tile **Shaw** Color at Work, Series Achromatic, Color Silver, 18" x 36" Plank
SC1	Sealed Concrete Floor	
BASE		
CCT	Coved Ceramic Tile	Ames
RB1	Rubber Base	Johnsonite Rubber Base
WB1	Wood Base	150mm x 20mm softwood base
WALLS		
PT1	Paint	Benjamin Moore
CWT1	Ceramic Wall Tile	**Ames** Soho, Color White or Sand, Matte or Gloss, 4" x 16" Subway, Rectified **Stone-Tile** Touch, Color Silver, Matte, 10cm x 30cm **Olympia Tile** Color and Dimensions, Color Bright Warm White, Matte or Glossy, 4" x 16"



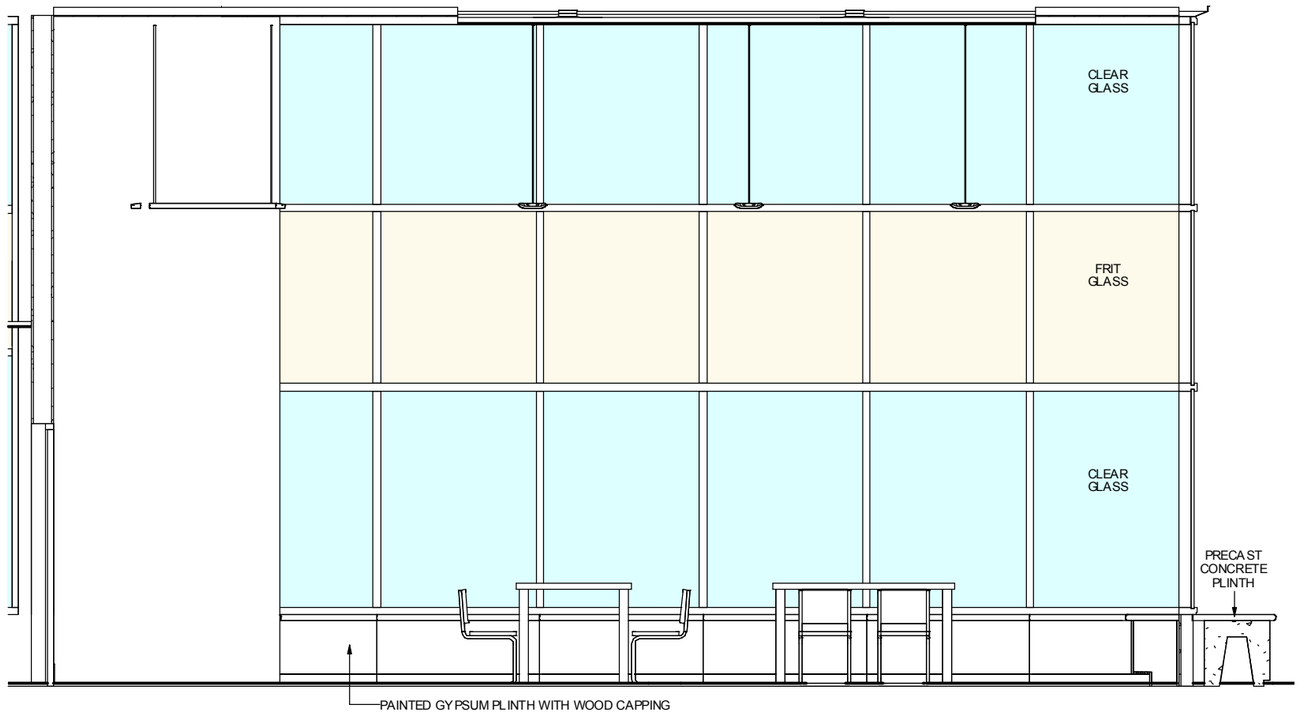
FINISHES FLOOR PLAN
1 : 300

LEGEND

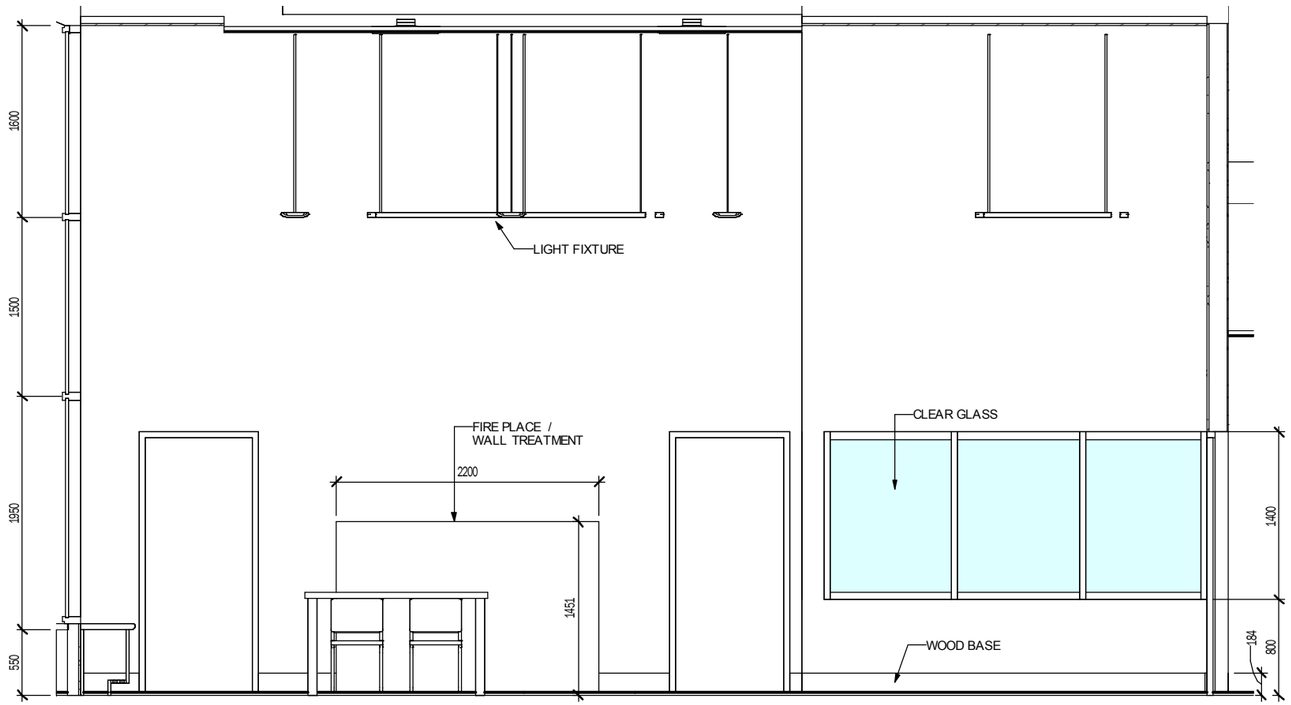
SEALED CONCRETE — 3,387 m²
CERAMIC TILE — 65 m²
CARPET TILE — 245 m²
MECHANICAL PENTHOUSE & MEZZANINE CONCRETE — 367 m²
STEEL CORNER PROTECTION
WALL PROTECTION



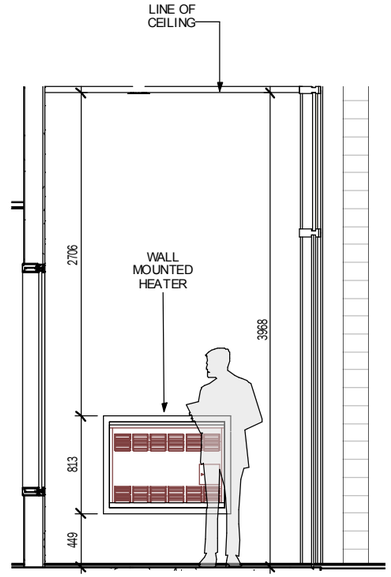
READING ROOM NORTH WALL
INTERIOR ELEVATION 1
1 : 50



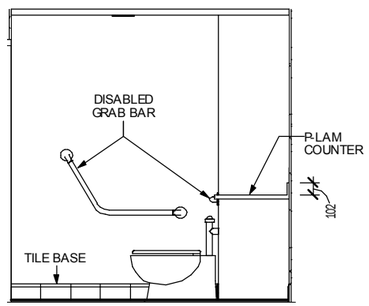
READING ROOM EAST WALL
INTERIOR ELEVATION 2
1 : 50



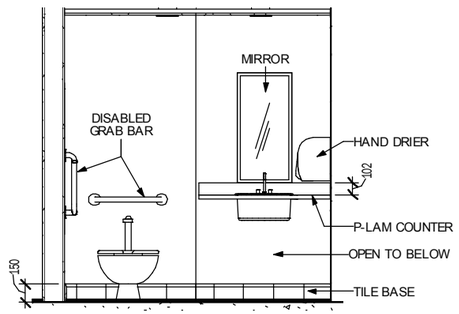
READING ROOM WEST WALL
INTERIOR ELEVATION 3
1 : 50



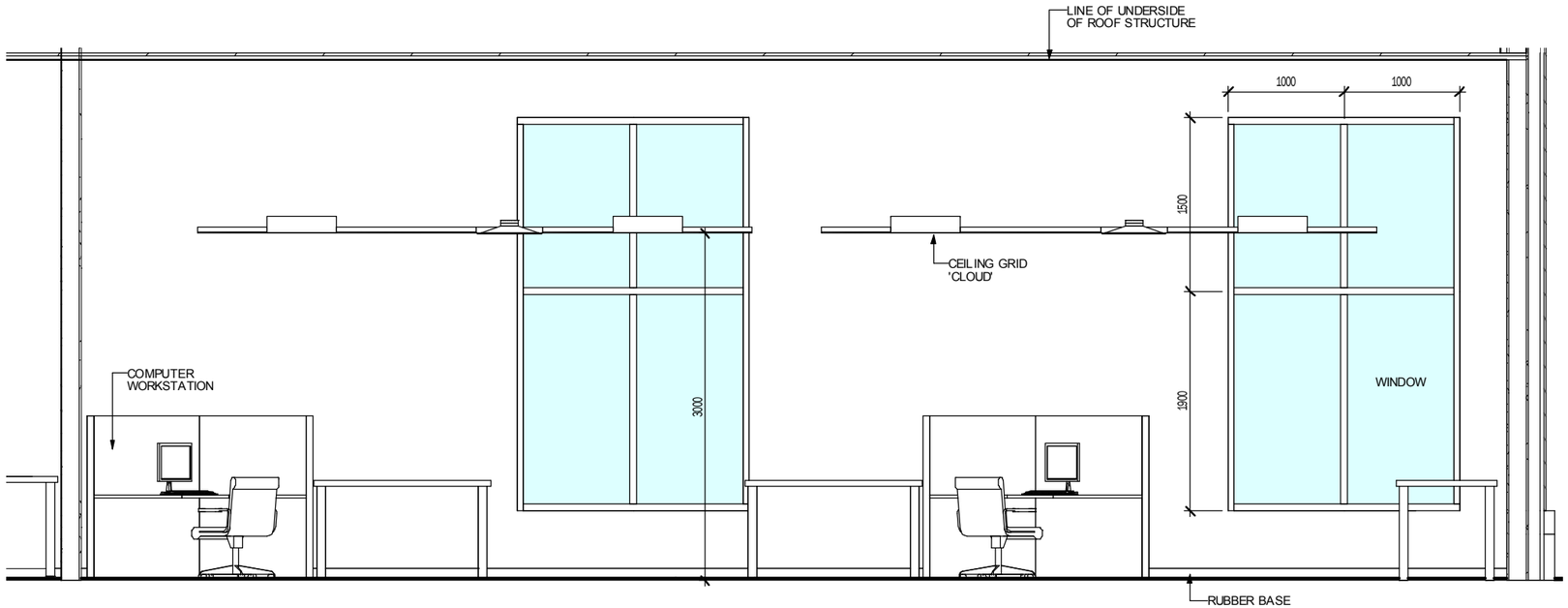
ENTRANCE LOBBY NORTH WALL
INTERIOR ELEVATION 4
1 : 50



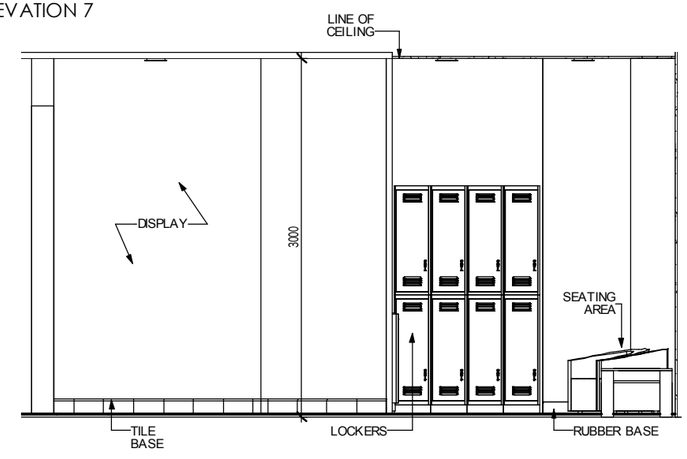
TYPICAL BARRIER FREE WASHROOM
INTERIOR ELEVATION 5
1 : 50



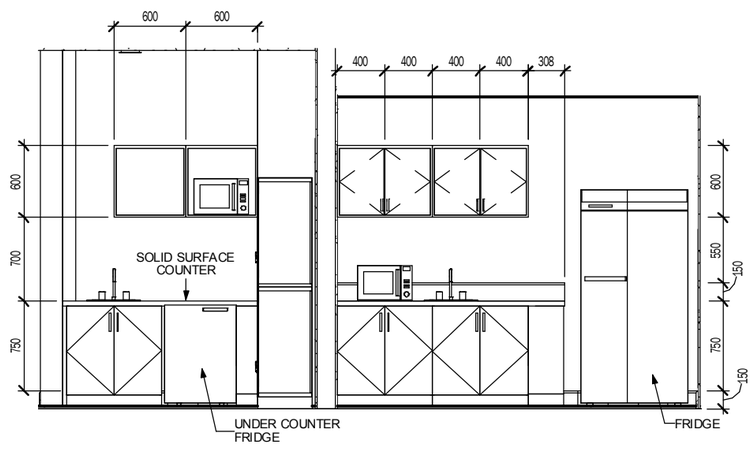
TYPICAL BARRIER FREE WASHROOM
INTERIOR ELEVATION 6
1 : 50



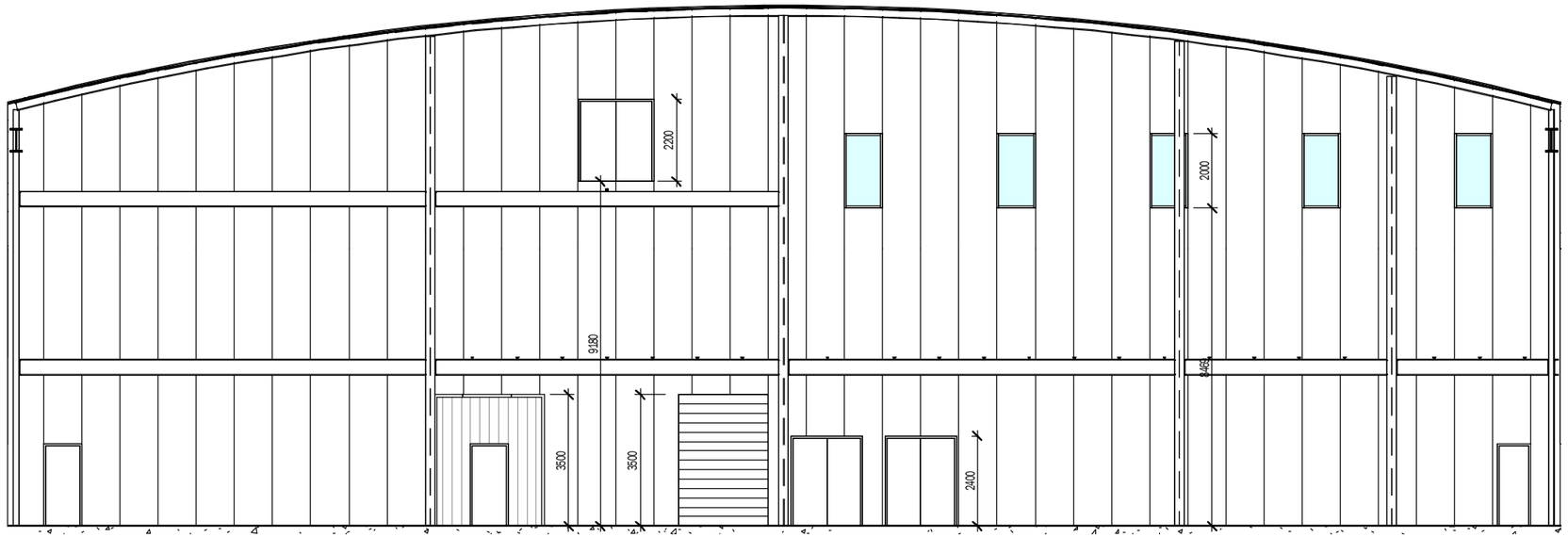
DIGITIZATION NORTH WALL
INTERIOR ELEVATION 7
1 : 50



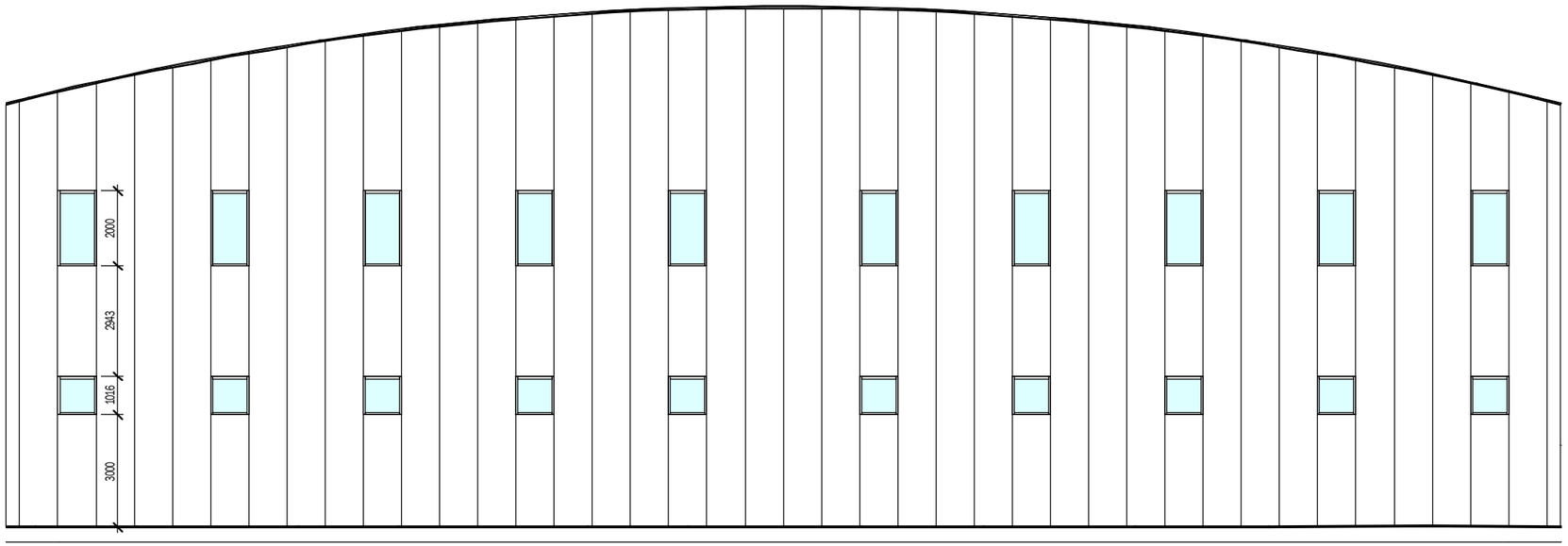
WAITING AREA WEST WALL
INTERIOR ELEVATION 8
1 : 50



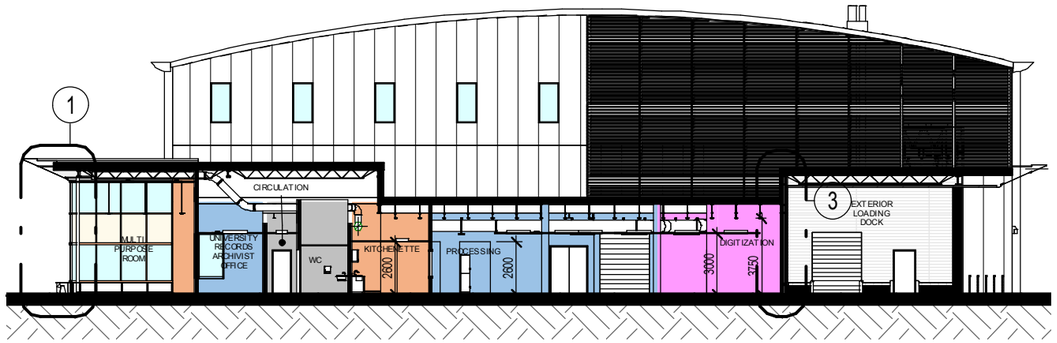
KITCHENETTE WEST WALL
INTERIOR ELEVATION 9
1 : 50



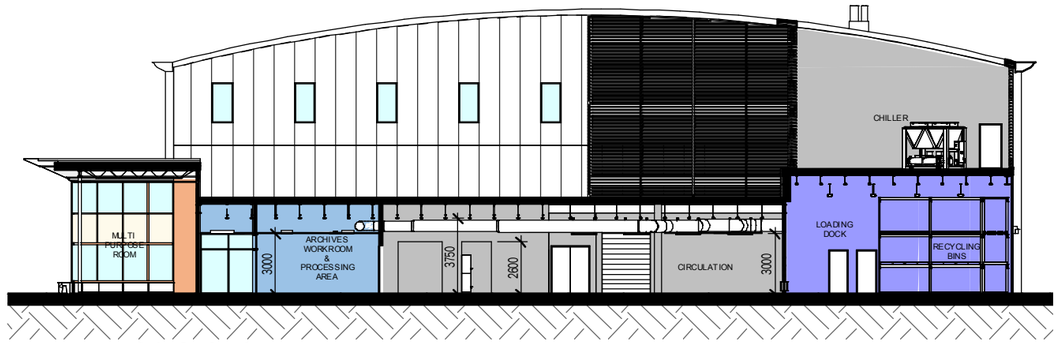
INTERIOR ELEVATION 10
1 : 150



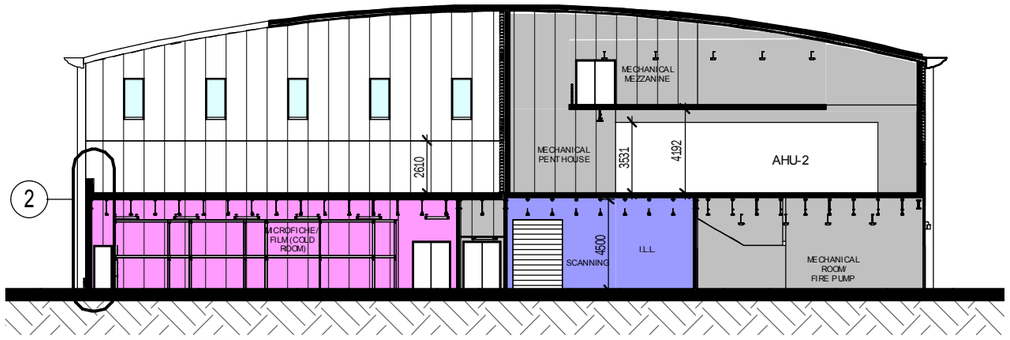
INTERIOR ELEVATION 11
1 : 150



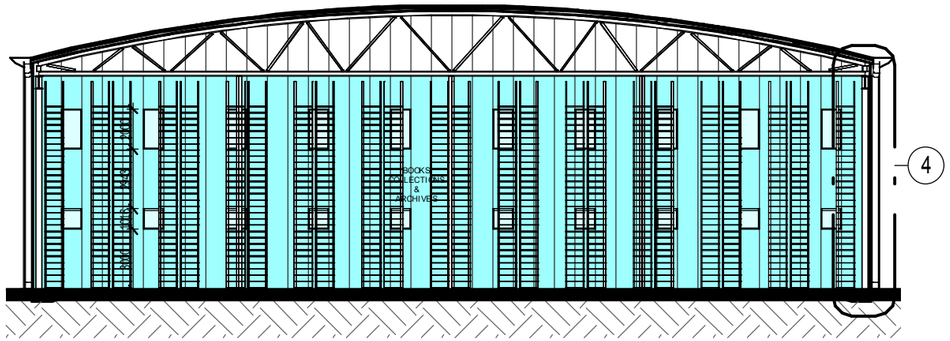
BUILDING SECTION 1
1 : 300



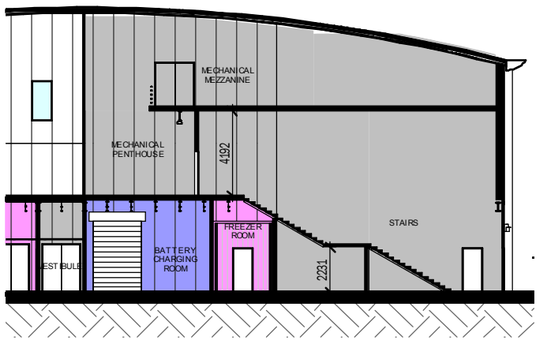
BUILDING SECTION 2
1 : 300



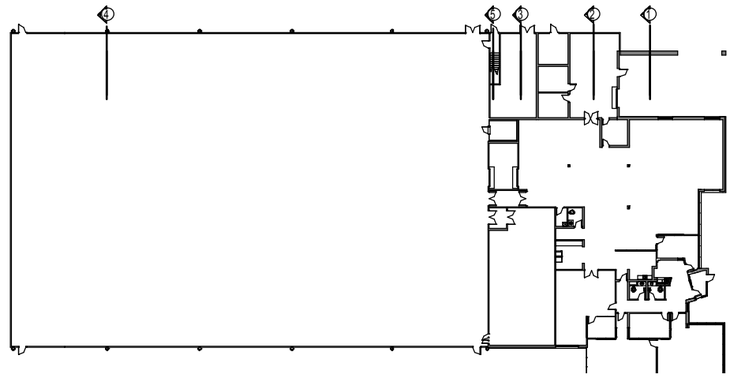
BUILDING SECTION 2
1 : 300

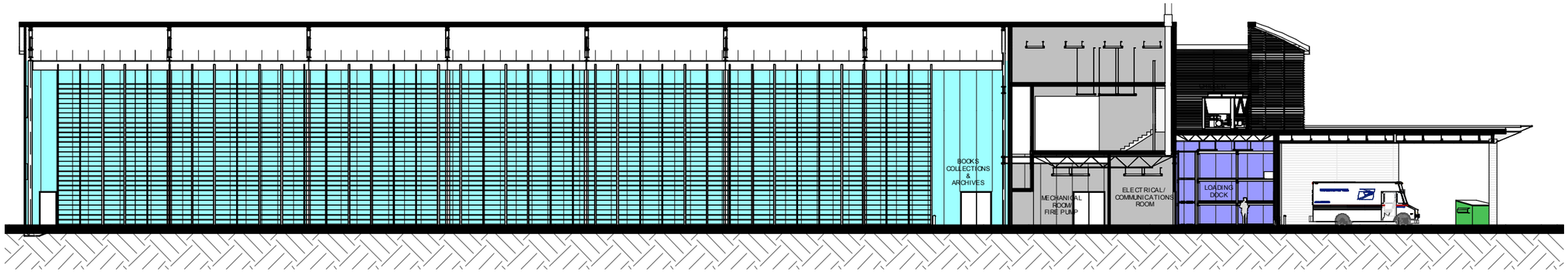


BUILDING SECTION 4
1 : 300

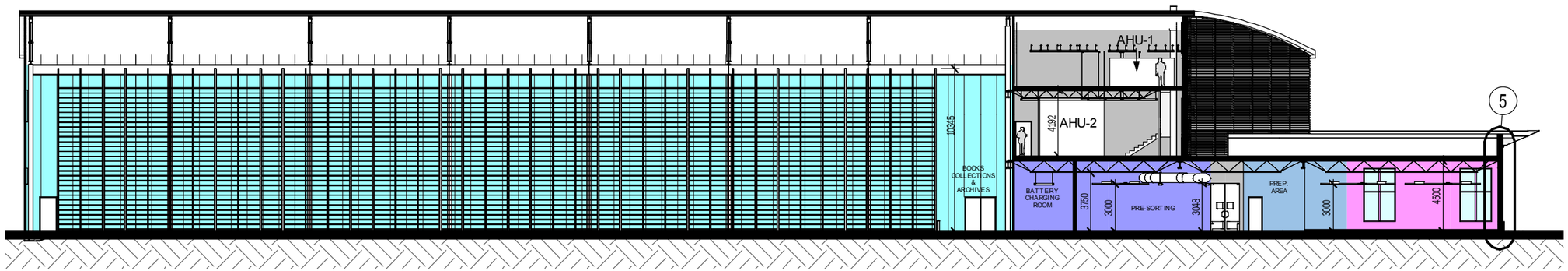


BUILDING SECTION 5

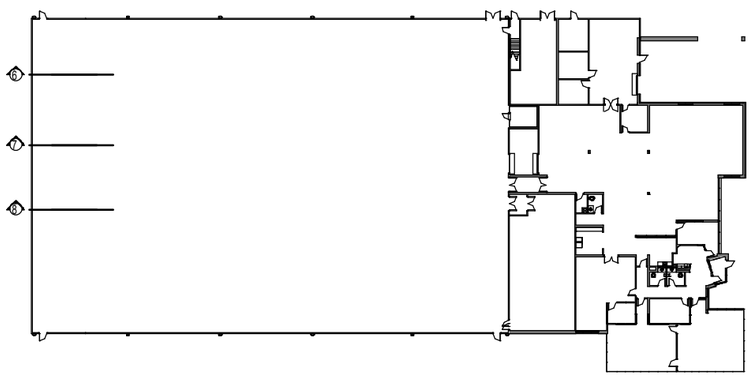




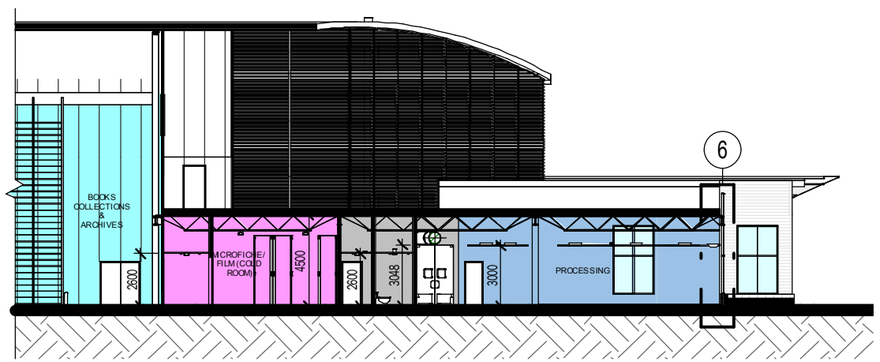
BUILDING SECTION 6
1 : 300



BUILDING SECTION 7
1 : 300



KEYPLAN
1 : 800



BUILDING SECTION 8

PAGE INTENTIONALLY LEFT BLANK

3.0 STRUCTURAL DESIGN

Introduction

The structural design for the RCRF shall conform to the 2014 Alberta Building code and the latest edition of the applicable CSA Standards. The facility is divided into two structurally distinct areas: the archive storage area and the administration/processing area.

The archive storage warehouse is designed for a high roof and large uninterrupted spans to accommodate high density storage racking. The roof is supported on deep trusses with a barrel vault profile supported by perimeter beams and columns. The truss profile provides synergistic benefits with the building envelope concerns as well as with the mechanical systems. The barrel profile mitigates water ponding and eliminates the need for interior roof drains that pose risks of water infiltration to the archive material. The deep roof trusses optimizes shell utilization by accommodating the mechanical ducting with the truss system.
The administrative portion of the building is a standard steel post and beam frame system with open web steel joists supporting the roofs and mechanical floors.

South campus is located on highly plastic soils with a relatively high water table creating swelling soil conditions. A structural slab on belled piles was determined to be the optimal system for the archive storage area due to the sensitivity of the racking system to differential foundation movement. The administration/processing area is less sensitive to foundation movements, and therefore, the more economical grade supported slab is utilized. The columns for the administration area are supported on piles for structural compatibility with the archive area.

1. Codes and CSA Standards

The structural design shall conform to the following Codes and CSA Standards:

1. National Building Code of Canada 2010
2. Alberta Building Code 2014
3. CSA Standard A23.3-04 Design of Concrete Structures
4. CSA Standard S16-09 Design of Steel Structures
5. CSA Standard O86-09 Engineering Design in Wood
6. CSA Standard S304-14 Design of Masonry Structures
7. CSA Standard S136-12 North American Specifications for the Design of cold-Formed Steel Structural Members

2. Design Loads and Design Considerations

The facility is comprised of two primary structural load conditions. The warehouse space is design to house a high density storage system for archival material while the front of house area where the material is processed and/or viewed is designed for a much lighter floor load.

The warehouse storage system is a series of continues rows of racking approximately 9.1 metres high that forms high bands of load approximately 2.0 metres wide alternating with relatively low band floor loads approximately 1.5 metres wide. The facility is sprinklered and, therefore, the supporting floor is design for a saturated racking load condition. The design load between the racking is designed to support a lift.

Seismic loads are rarely governing load criteria in the Edmonton area for low-rise structures. Although it will not govern the building structure, it will impact the racking system which will have a seismic design load component.

The front of house comprises of a space to service a number of functions and includes administrative office and library user space, processing, microfilm racking space and mechanical/electrical rooms. The microfilm storage facility will contain racking approximately 14 metres high. The lift will travel between the warehouse and the receiving/loading dock area. Overhead monorails and trolleys will be provided where necessary to facilitate extraction of mechanical equipment components for maintenance operations.

The design loads for the various rooms are identified below:
The design load criteria for the facility are summarized as follows:
2.1. Environmental Loads:

2.1.1. Snow: Ss = 1.7 kPa

Sr = 0.1 kPa

Snow drifts as noted on roof drawings

2.1.2. Wind: q1/50 = 0.45 kPa

q1/10 = 0.35 kPa

2.1.3. Seizmic: Sa(0.2) = 0.10

Sa(0.5) = 0.06

Sa(1.0) = 0.3

Sa(2.0) = 0.1

PGA = 0.4

2.2. Live Loads:

Archive spaces:

2.2.1.	Racking:	100 kPa
2.2.2.	Microfilm room:	50.0 kPa

Administration area

2.2.3.	Drive Isle:	4.8 kPa
2.2.4.	Loading area:	7.2 kPa
2.2.5.	Office	2.4 kPa
2.2.6.	Mechanical rooms:	4.8 kPa
2.2.7.	Mechanical lift beam:	2000 kg
2.2.8.	Axle load (loading dock):	18,000 kg

2.3. Dead Loads: Self-weight of building components

3. Foundation System

The south campus site is located in an area containing high plastic soils and relatively high water table. This poses a significant risk for swelling and shrinkage behaviour in the soil matrix with changes in soil moisture content. The racking system is sensitive to differential movement of the supporting floor system which drives the design towards a structural slab foundation system. The geotechnical report identifies good bearing capacities for end bearing piles at a depth of 12 metres and defines the support for the structural slab system. The foundation system for the warehouse area and the microfilm storage room in the front of house will be structural slab supported on belled piles.

A grade supported slab is proposed for the front of house area except for the microfilm room which will be structural slab on belled piles. The grade supported slab thickness is sized to accommodate the governing floor loads in the loading area and has been maintained for remainder of the administration area to simplify construction and reduce costs. The operation in this space is not as sensitive to differential movement of the floor system. A 300mm granular base is provided under the interior grade supported slab to minimize differential slab movement. The slab on grade will be dowelled into the structural slab along the interface in order to avoid differential slab elevations at these transitions. In addition, weeping tile will be used around the processing and administration area to mitigate water infiltration below the slab reducing the potential for expansion of the plastic soil. Interior columns are supported by piles and the perimeter of the building is supported on a pile and grade beam system. All plumbing lines under this slab and/or near this slab shall have welded seams to preclude the potential for leaks that would cause the soils to swell.

The exterior concrete sidewalks and driveways will be will be subject to high vertical movement due to seasonal moisture changes in the soil as well freezing and thawing cycles. This poses a risk to impeding door swing, the slab binding up against exterior cladding and developing significant cracking in the slabs and tripping hazards. This is mitigated by designing all exterior concrete sidewalks and driveways adjacent to the building as a structural slab system on piles.

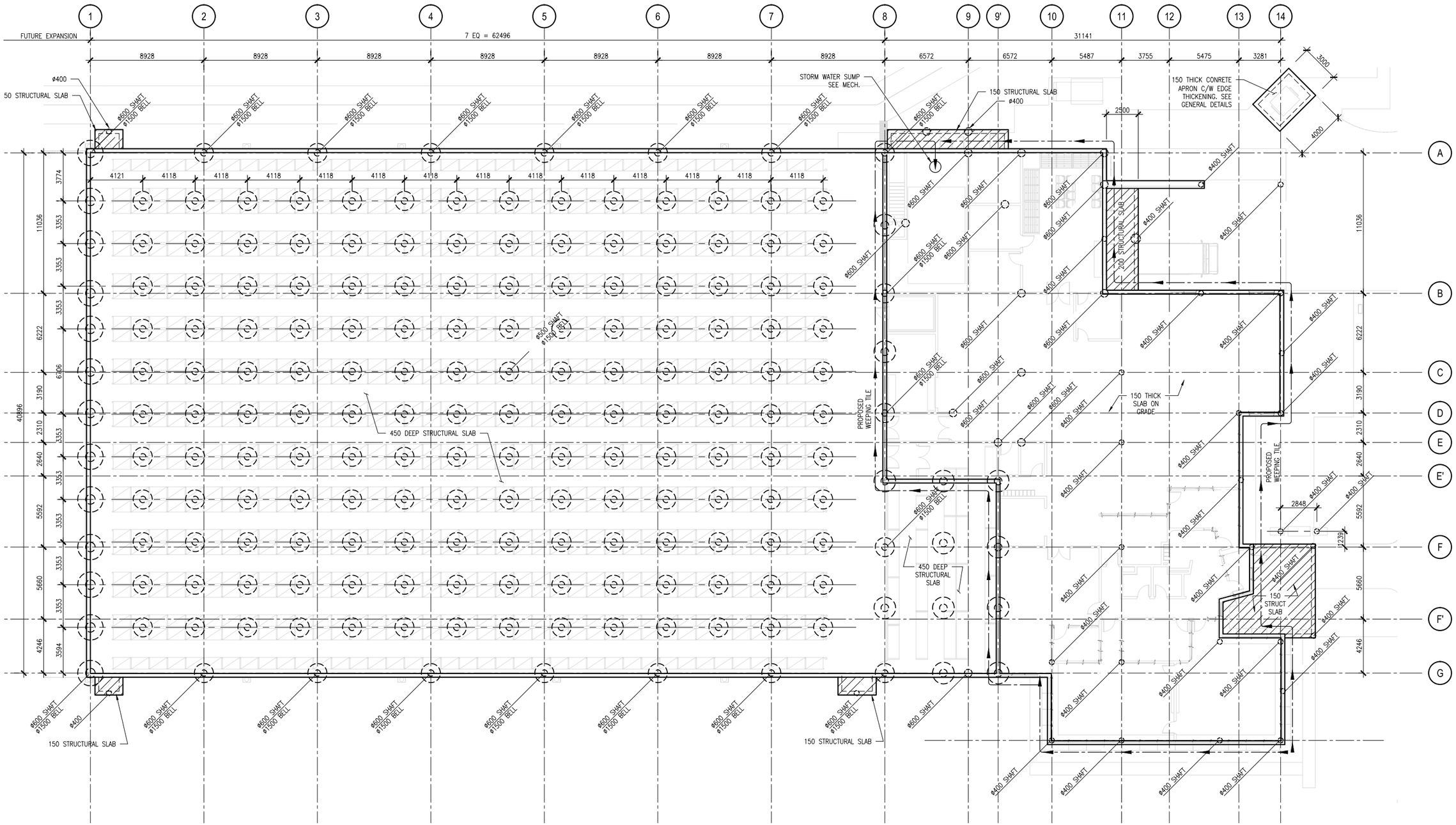
4. Superstructure Framing

The superstructure shall utilize traditional steel post and beam construction throughout the facility. Structural wood elements may be employed to enhance and serve as architectural features in selected areas. Masonry may be used in selected areas for fire rating, sound attenuation and as elements that work with the building envelope.

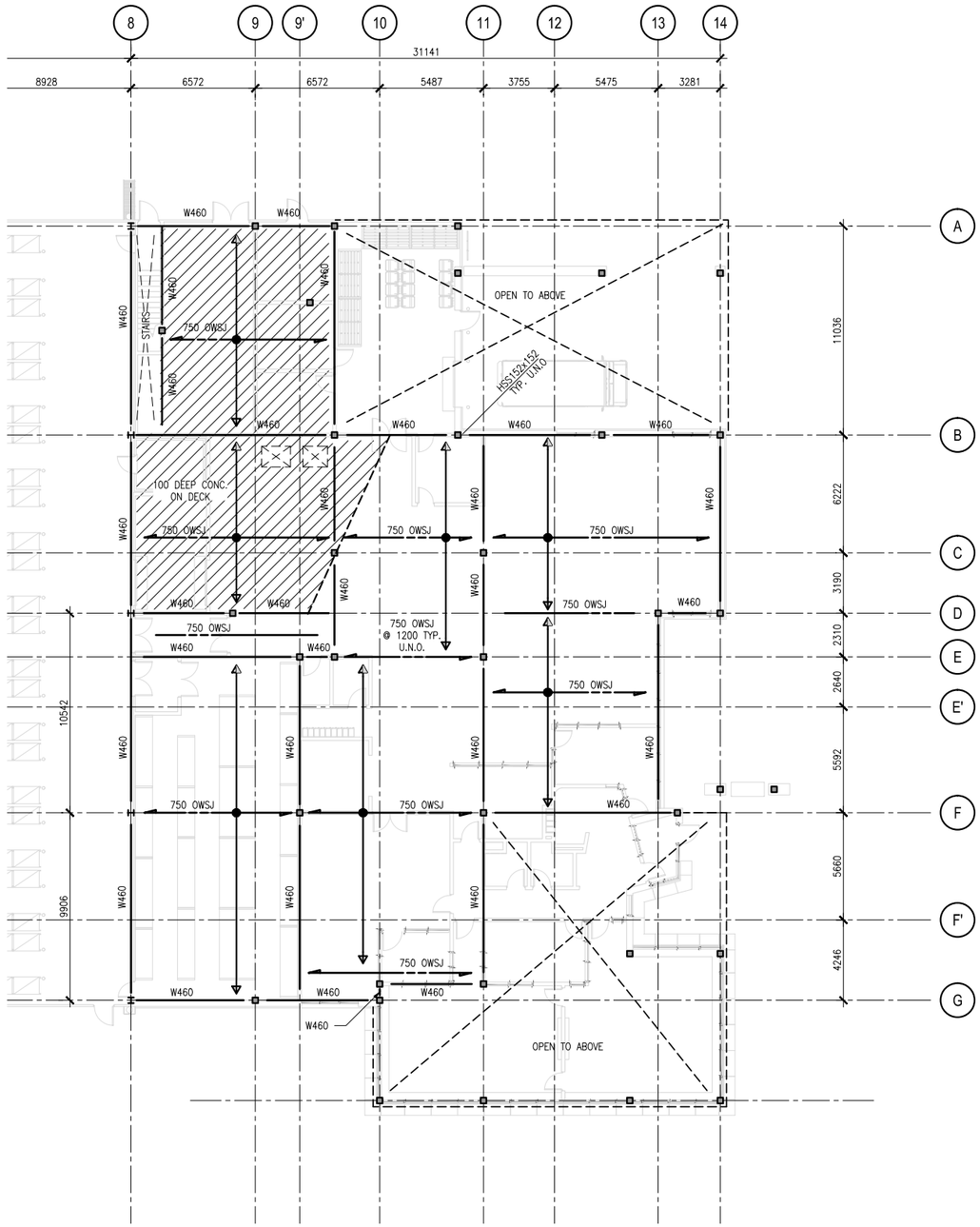
The warehouse roof has a barrel vault profile that provides a synergistic effect for the structural roof framing, the building envelope and the mechanical systems. This profile was chosen to mitigate water ponding on the roof and the need for roof drains that pose a risk of water infiltration into the warehouse space, to optimize the weight of the steel roof trusses and to develop a depth in the roof trusses with ample space for the large mechanical ductwork to pass through the truss system.

The roof structure over the front of house will comprise of steel deck supported on open-web-steel joists on steel beams and columns. The elevated floor system supporting the mechanical rooms shall utilize open-web-steel joists supported on steel beams and columns with concrete floor on steel deck.

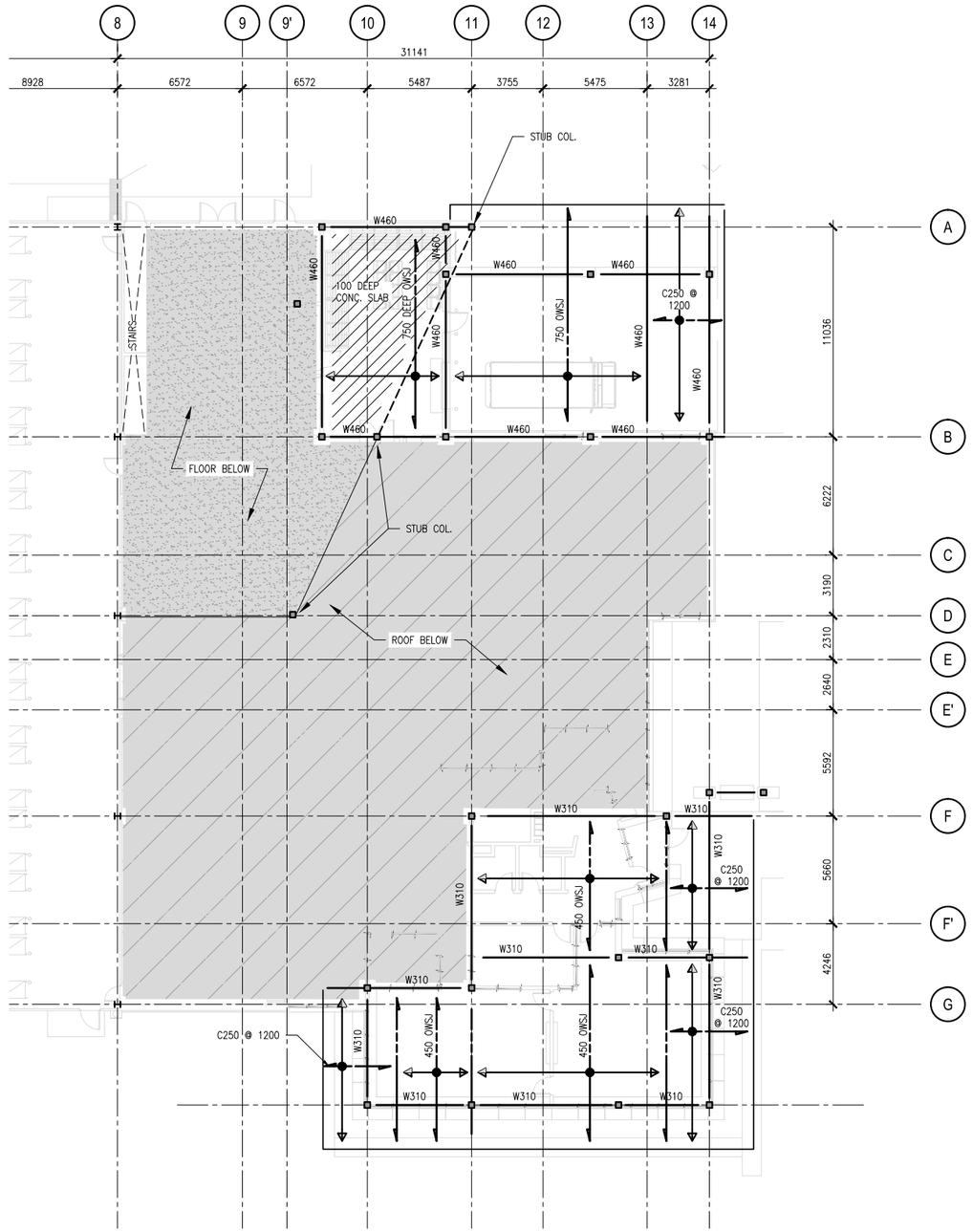
Wind forces are resisted with cross bracing throughout the facility. The warehouse has a horizontal truss system along the bottom chords spanning between the west and east walls to transfer wind loads to the vertical cross bracing contained in these walls.



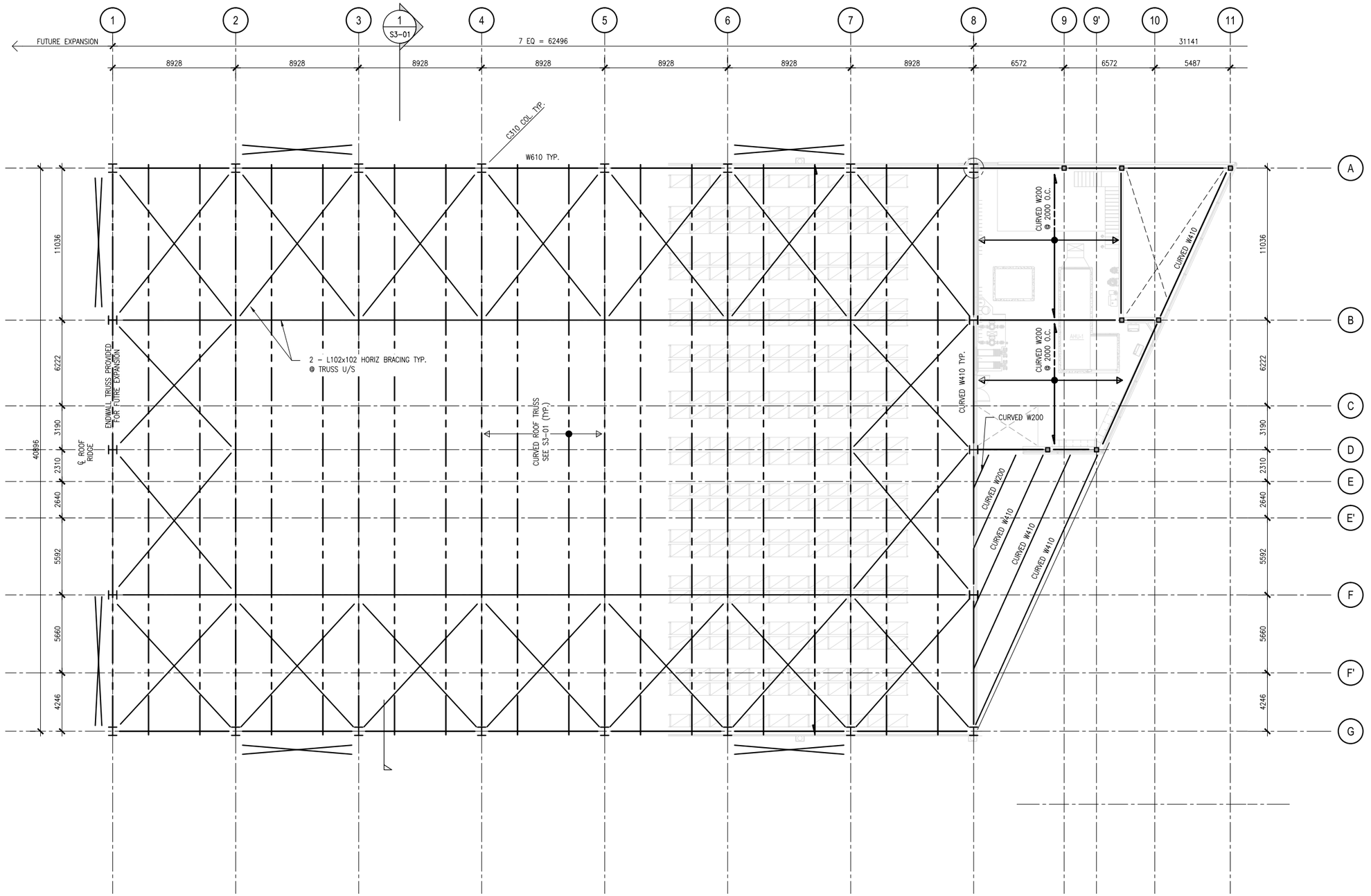
FOUNDATION PLAN
SCALE: 1:150
T.O. SLAB = 100.000 U.N.O.



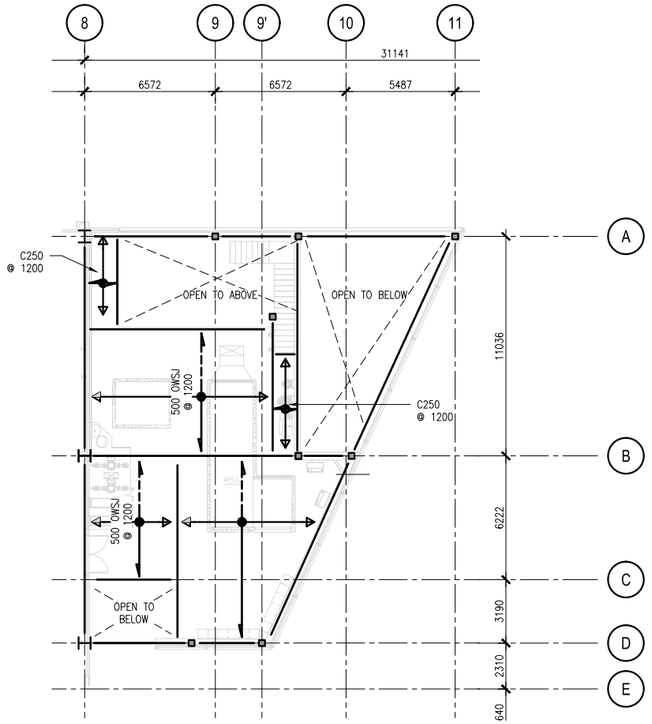
FRAMING PLAN @ EL. 104.800
SCALE: 1:150



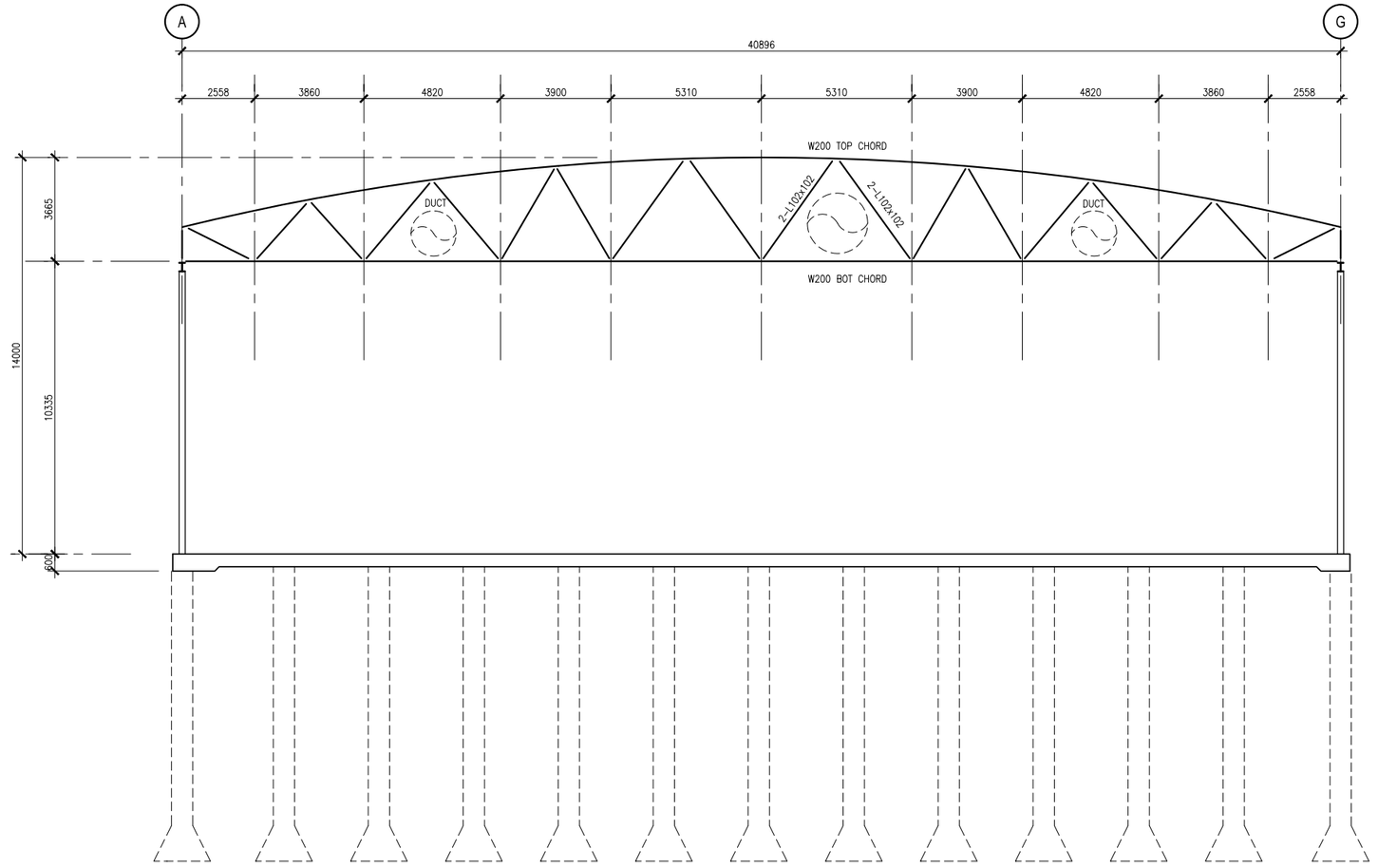
FRAMING PLAN @ EL. 106.200
SCALE: 1:150



ROOF FRAMING PLAN
SCALE: 1:150
T.O. STEEL EL. = VARIES (SEE SECTION)



MECH MEZZANING FRAMING PLAN @ EL. 109.200
SCALE: 1:150



1 SECTION
S-1 SCALE: 1:100

PAGE INTENTIONALLY LEFT BLANK

4.0 MECHANICAL DESIGN

Introduction

The mechanical systems will be designed to meet specific space conditions to ensure document protection and occupant comfort conditions are met. The systems will utilize high efficient chillers and condensing boilers to minimize energy consumption and optimize mechanical systems operation. Fan wall air systems will be utilized to ensure that noise and vibration are minimized while providing some level of integral system redundancy. Low flow plumbing fixtures will be utilized to reduce water consumption. Fire protection will be provided to meet NFPA 13 requirements for high bay records storage.

Design Criteria

Requirements from the following Codes and Standards as they relate to the mechanical systems work will be incorporated into the design.

- 2014 Alberta Building Code
- National Energy Code for Buildings
- Alberta Fire Code
- National Plumbing Code
- ASHRAE Guides and Standards
  - ASHRAE 55 – Thermal Environmental Conditions for Human Occupancy
  - ASHRAE 62.1 – Ventilation for Acceptable Indoor Air Quality
  - ASHRAE 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings
- NFPA 13 – Standard for the Installation of Sprinkler Systems
- NFPA 10 – Standard for Portable Fire Extinguishers
- NFPA 14 – Standard for the Installation of Standpipe & Hose Systems
- NFPA 70E – Safety requirements related to Batteries and Battery Rooms
- NFPA 909 – Protection of Cultural Resource Properties – Museums, Libraries, and Places of Worship
- CSA B149.1 – Natural Gas and Propane Installation Code
- CSA B52 – Mechanical Refrigeration Code

Estimates of mechanical system capacities have been based on program needs and areas as well as preliminary architectural layouts. System capacities will be finalized with heating and cooling load calculations through the contract document phase and in conjunction with the details of building envelope construction to be developed by the Architectural Team. Capacity allowances for potential future expansions will not be provided.

Safety: The mechanical systems will support and enhance a safe environment for the building occupants, maintenance personnel and the surrounding community.

Reliability: The mechanical systems will perform their functional purpose under varying operating conditions, both thermal and operational.

Maintenance and Accessibility: the mechanical systems shall be readily accessible for inspection, service or replacement without requiring removal of other systems.

Functional Environment: As much as possible, the mechanical systems shall be simple to understand, simple to operate and simple to maintain.

Human Comfort: The mechanical systems will provide comfort cooling, heating, humidification, and ventilation to maintain appropriate interior conditions for the building occupants.

Flexibility and Expansion: The mechanical systems shall be able to respond to changes in function or in load with only minor modifications.

Sustainable Design: The mechanical systems will minimize the impact on the environment by reducing energy consumption, intelligent selection of materials and careful oversight during construction. Mechanical systems are to be designed to meet Green Globes certification.

Minimize Impact: The new facilities will minimize the negative impact on the existing facilities and site.

Preliminary load calculations and schematic design have been based on the following envelope design conditions:

- Roof – R-30
- Walls – R-20
- Glazing – R-4 low E

Basic design requirements for the facility are:

Space Use	Indoor Design Temp. (°C)	Indoor Relative Humidity	Outdoor Design Conditions	Notes
SUMMER			28°C (82°F) DB/19°C (66°F) WB To ASHRAE 2.5% July Design Day	
Reading Room	24	N/A		
Collaboration Meeting Room	24	N/A		
Office	24	N/A		
Archives Processing	24	N/A		
Kitchenette/Lockers	24	N/A		
Mail/Waiting/Lockers	24	N/A		
Processing	24	N/A		
Circulation	24	N/A		
Storage/supplies	24	N/A		
Book Cleaning	24	N/A		
Janitor	24	N/A		
Battery	24	N/A		
Loading Dock Sorting/Pallets/ Recycling Space	24	N/A		
Quarantine	24	N/A		
Main Floor Mech Room	24	N/A		
Electrical Room	24	N/A		
Second Floor Mech Room	24	N/A		
Microfiche/film cabinet storage	10	35%		
Book Collection & Archives	15	35%		only calculated to 30' high, rack volumes removed from overall volume (391,230 ft³)
WINTER			-33°C (-27°F) To ASHRAE 1% January Design Day	
Reading Room	22	15%		
Collaboration Meeting Room	22	15%		
Office	22	15%		
Archives Processing	22	15%		
Kitchenette/Lockers	22	15%		
Mail/Waiting/Lockers	22	15%		
Processing	22	15%		
Circulation	22	15%		
Storage/supplies	22	15%		
Book Cleaning	22	15%		
Janitor	22	15%		
Battery	22	15%		
Loading Dock Sorting/Pallets/ Recycling Space	22	15%		
Quarantine	22	15%		
Main Floor Mech Room	22	N/A		
Electrical Room	22	N/A		
Second Floor Mech Room	22	N/A		
Microfiche/film cabinet storage	10	35%		
Book Collection & Archives	15	35%		only calculated to 30' high, rack volumes removed from overall volume (391,230 ft³)

Site Services

The proposed new facility would be constructed on the University of Alberta South Campus, south of the existing Vehicle Pool Garage and north of the existing Turkey Barn. The proposed utility right of way will be located to the west of the proposed site.

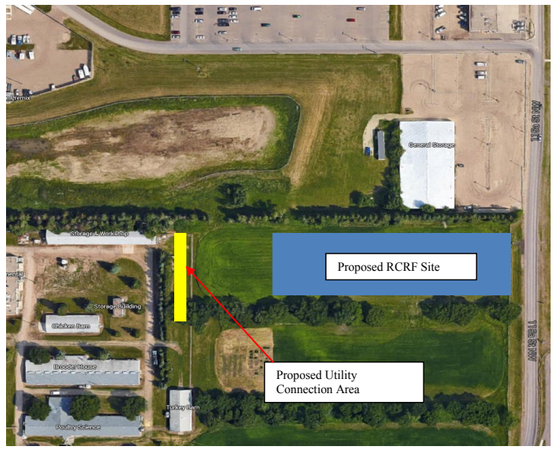
It is proposed that a new 150 mm diameter sanitary sewer line leave the new building to the south then travel west. This will allow for an opportunity to tie in to the proposed sanitary main in the utility corridor. Exact tie-in location and routing is to be determined by Civil.

All storm sewers will splash to grade. Site grading will drain to the south and dump into a storm water retention pond.

A new 200 mm diameter water service for the building will enter into the north side of the building. Exact tie-in location and routing is to be determined by Civil. A branch from this main will be required to service a new fire hydrant to be located within 45m of the main entrance.

A medium pressure gas line will tie-in to the main located in the service utility corridor. The medium pressure line will travel west to the loading dock area where a gas meter and regulator will be located. The gas pressure will reduce to low pressure before being distributed within the building.

For more details on site services, refer to the Civil section of the design development report as well as the mechanical site plan.



Plumbing

It is proposed that domestic cold water for the building be served from the incoming domestic cold water service to be located in a southwest meter room. A cold water line will be extended to the new penthouse mechanical room to feed a high efficient condensing domestic water heater. A domestic hot water line along with a cold water line will be extended from this mechanical room through the building for distribution to washrooms, janitor rooms and coffee rooms. A domestic hot water recirculation line will be provided with the domestic hot water line. This will enable domestic hot water to be constantly circulated using a DHWR pump so that end-of-line dead legs are minimized. A DHWR pump equipped with an integral variable speed drive will be utilized to vary the speed based on return water temperature. This will assist in minimizing energy usage in low demand periods.

A new 150 mm diameter sanitary sewer line will leave the new building under slab to the south.

Structural has indicated that weeping tile is not required. As a result, no weeping tile pits will be provided.

Piping shall be indicated with system and direction of flow with colour labels. All domestic water piping shall be type 'L' copper, cleaned and flushed of debris before being placed in service. All piping, components and equipment subject to sweating, heat loss or freezing shall be insulated with appropriate thickness of fibreglass insulation with a fire-resistant jacket.

Water closets will be floor mounted tank type, low flow. Lavatories will be equipped with low flow, solar powered (with battery back-up) infrared trim. The water system shall be designed to prevent water hammer conditions by providing air chambers for individual fixtures and shock arrestors for quick closing valves and batteries of fixtures.

A new natural gas line will be extended from the new building entry point. The line will extend through to the new mechanical room to serve the boilers and domestic water heater. A line will also be extended to the gas fireplace to be located in the reading room.

New requirements in the Alberta Building Code require infrastructure be provided for radon gas extraction. This will be comprised of a series of 100mm diameter PVC pipes penetrating below the slab. This will allow for future connection to an exhaust fan should future testing indicate the presence of radon gas.

Heating System

The building will be equipped with a standalone full new heating plant installed in the mechanical room.

Heating will be provided through two 2,500 MBH (input) high efficient condensing boilers located in the mechanical room. One boiler is provided for 100% redundancy. Each boiler will be pumped through a primary loop. Two secondary pumps each sized for 100% of the load will circulate through a cascading secondary piping loop which will consist of:

- A perimeter heating & reheat coil loop: This loop will circulate 90oC (195oF) heating water to terminal heating elements to provide perimeter heat in each zone. This loop will also provide heating water to the new terminal reheat coils that will be provided for the new air systems.
- Heating coil glycol heat exchangers: This loop will circulate 73.8oC (165oF) water to two glycol heat exchangers (100% redundant) for the air handling units' preheat and heating coils. On the secondary side of the heat exchanger a 50% propylene glycol solution will be circulated with two pumps (100% redundant) to the air handling unit's preheat and heating coils. A 17°C (30°F) temperature drop will be used for the preheat and heating coils.

Although the boilers will provide 90oC (195oF) heating water in the worst winter situations, the control system will reset the supply water temperature based on outdoor air temperature. This will allow the condensing boilers to provide lower water temperatures and increase the overall heating plant operating efficiencies.

All piping will be routed in a reverse return configuration to aid in balancing the system. Force flows will be provided at any entrances. Unit heaters will be provided in appropriate service spaces as well as the loading dock area.

The collections and archives storage as well as the microfiche room will not have any supplementary hydronic heat. The heat for the space will be provided via the space air system.

All pumps will be isolated with neoprene vibration isolators.

Cooling System

A new 86 ton air cooled chiller will be mounted on the roof. The chiller will be equipped with a low ambient winter cooling package to allow the chiller to operate in the winter.

Chilled ethylene glycol will be circulated using two pumps each sized for 100% of the cooling flow requirement. Chilled glycol will be circulated to the cooling coils located in the new air systems. Chilled water pumps will utilize variable speed drives to minimize pumping energy during low flow periods.

Three fan coil units will be provided to provide cooling to high heat gain and critical zones as follows:

- Electrical room to deal with heat and transformer loads
- Communications room to manage server loads (20 kW estimated)
- Microfiche room – the space conditions required for this room are lower than the collections storage area (10oC ±2oC and 37% R.H. ± 3%).

Ventilation System Description

The following descriptions apply to the proposed ventilation system design:

<u>Office Air System</u>

The office area shall be served by a single duct variable volume medium velocity air system. The supply air unit will be composed of:

- 30% prefilter (removable during winter months to avoid frost build-up)
- Glycol hot water preheat coil.
- Filtration (85% cartridge filter). Space will also be provided in front of the filters to allow the 30% prefilter to be installed during winter months.
- Chilled glycol cooling coil.
- Heating coil.
- Stainless steel drain pans with minimum 12" P-trap to indirect drain.
- "Fan Wall" plenum fan array with variable frequency high efficiency motors for supply and return air sections.
- Gas fired humidifier.

One supply air unit sized for 7,080 L/s (15,000 cfm) will be provided. Variable air volume boxes with reheat coils will be provided for each zone within the office space. Modulating the reheat coil control valve will control the supply air temperature based on the room thermostat setting.

The office area air system will be designed to ensure a maximum noise criteria (NC) level within the office area of NC-30.

Collections Area Air System

The collections area shall be served by a single constant volume low velocity air system. The supply air unit will be composed of:

- 30% prefilter
- Filtration (85% cartridge filter).
- Heating coil.
- Space will be provided for a future carbon filter.
- Chilled glycol cooling coil.
- Stainless steel drain pans with minimum 12" P-trap to indirect drain.
- "Fan Wall" plenum fan array with variable frequency high efficiency motors for both the supply and return air sections.
- Gas fired humidifier

One supply air unit sized for 28,320 L/s (60,000 cfm) will be provided. The unit will only be capable of a minimum amount of outdoor air (2,000 cfm), as the space is minimally occupied. In addition, larger volumes of outdoor air may make it difficult to control the humidity in the collections area. An outdoor air desiccant de-humidifier will be provided to serve the outdoor air for AHU-2. This dehumidifier will be equipped with a bypass for use during low humidity periods.

The collections area air system will be designed to ensure a maximum noise criteria (NC) level within the office area of NC-35.

Supply, exhaust and return air ductwork will be galvanized and constructed to SMACNA Standards.

Fire Protection

The building will be fully sprinklered to NFPA-13 requirements. A sprinkler main line will be extended from the incoming water service in the water meter room. A 125 Hp fire pump (approximately 2,000 USgpm at 60 psi boost) with associated control panel and jockey pump will be installed in this meter room. A fire pump test header will be required to discharge to the exterior. This will require coordination with civil and landscape to ensure that the high flow volumes can be managed.

The Collections Storage area will be equipped with ESFR (Early Suppression Fast Response) sprinkler heads. This eliminates the need for in-rack sprinklers. Zone valves will be provided throughout as required. Sprinklers will be distributed as per NFPA-13 requirements.

Fire extinguisher cabinets will be located throughout in accordance with NFPA-10.

NFPA-13-2002 code states that hose stations are required in all storage occupancies exceeding 12 ft. in storage height. Spacing of hose stations is 100 ft. hose, plus 30 ft. hose stream.

The outdoor portion of the loading dock will require sprinklers under the overhang. These will be served with a dry system with the valve and compressor to be located in the fire pump room.

Appropriate drainage for the sprinkler system will be provided for maintenance purposes. This drainage will occur outside the collections space.

A fire department connection will be provided near the main entrance. Civil will provide a new fire hydrant within 45m of the fire department connection as required by code.

Control System

The building control system (BCS) will be a fully BacNet compatible, direct digital control (DDC) system. The system will communicate with the University's central campus control system located in the General Services Building control room. The BCS will be operated from the University's Tridium Niagara Supervisor software interface residing on servers physically located in the RCMS Shop. The server will also communicate with the vendor specific servers located in the RCMS shop.

The system will monitor all mechanical central systems and control the systems to maintain facility conditions to meet design criteria. These conditions will include:

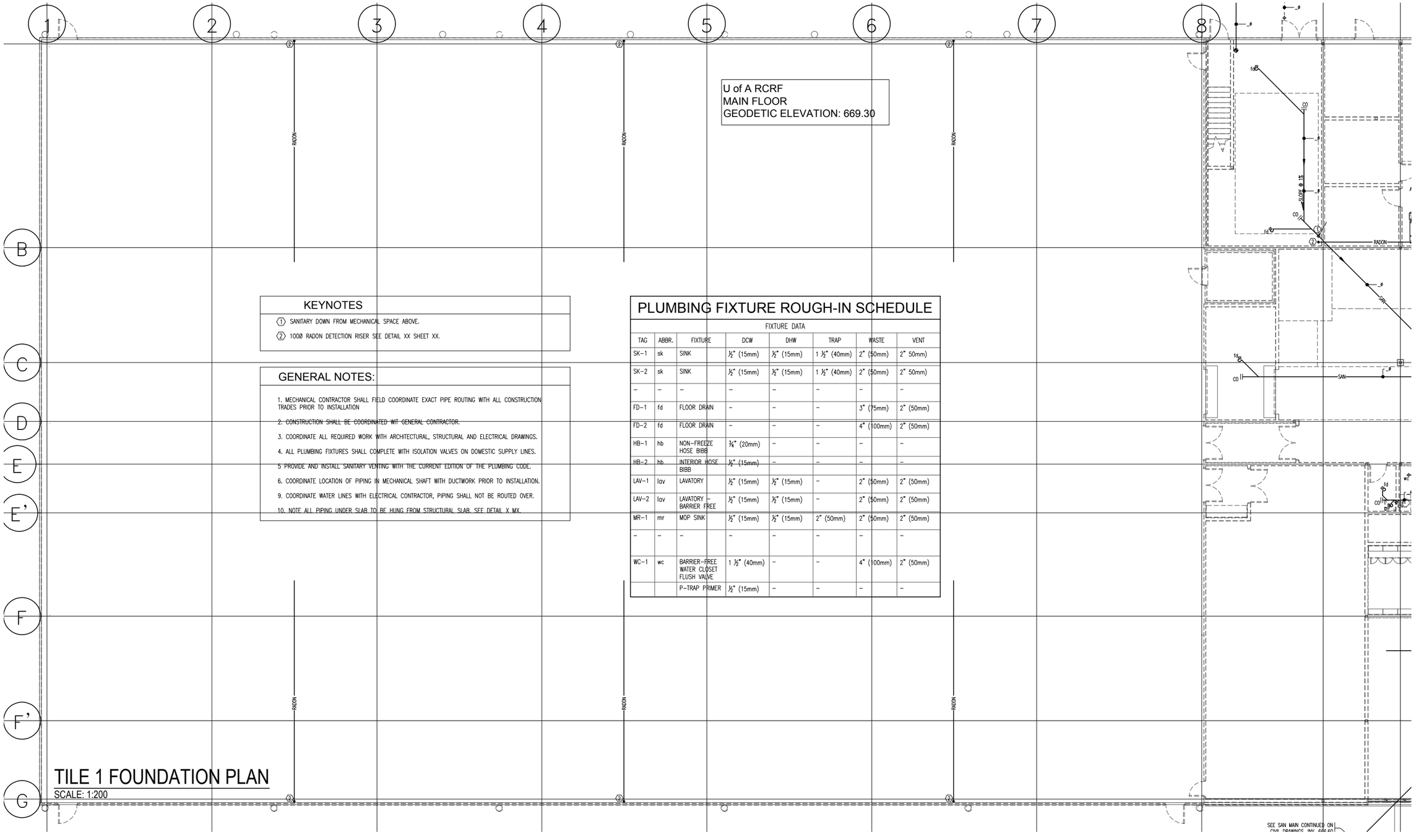
- Supply air temperature, humidity and volume
- Perimeter heating water supply temperature
- Chilled glycol supply temperature
- Space temperature conditions
- Building pressurization
- Domestic water system

The building boilers will be equipped with dedicated manufacturer boiler controls. These will operate and control the boilers in stand-alone fashion. Alarming will be provided to the BCS which will be automatically communicated to the University's operations centre via the Niagara Supervisor. Similarly, the chiller will operate on stand-alone controls with alarming to the operations centre via the BCS and Niagara Supervisor.

Sustainable Design Strategies

The following sustainable design strategies will be implemented in the mechanical design based on good design practice:

- Low flow water closets, lavatories and urinals with infrared sensors are to be installed in all new washrooms
- A high efficiency condensing domestic water heater is to be used to reduce gas consumption
- A DHWR pump equipped with an integral variable speed drive will be utilized to vary the speed based on return water temperature. This will assist in minimizing energy usage in low demand periods.
- Variable speed drives are to be utilized on the supply and exhaust air systems to reduce power consumption
- Variable speed drives are to be utilized on the heating and chilled water systems to reduce power consumption
- High efficiency condensing boilers are to be used to reduce gas consumption
- Low NOx and low CO emissions from the boilers
- Temperature reset control on the perimeter heating water loop to reduce heating water supply temperatures during low demand periods
- Occupancy sensors to shut down air and cooling to specific zones when unoccupied
- Sustainable choice of refrigerants in all cooling equipment
- High efficient magnetic bearing chiller to reduce energy consumption
- Fan Wall fan systems are to be used in the two main air systems to reduce the noise developed, thus reducing the requirements for acoustic silencers. This, in turn, will reduce the static pressure and reduce the horsepower required for the fans.



KEYNOTES

1. SANITARY DOWN FROM MECHANICAL SPACE ABOVE.
2. 100Ø RADON DETECTION RISER SEE DETAIL XX SHEET XX.

GENERAL NOTES:

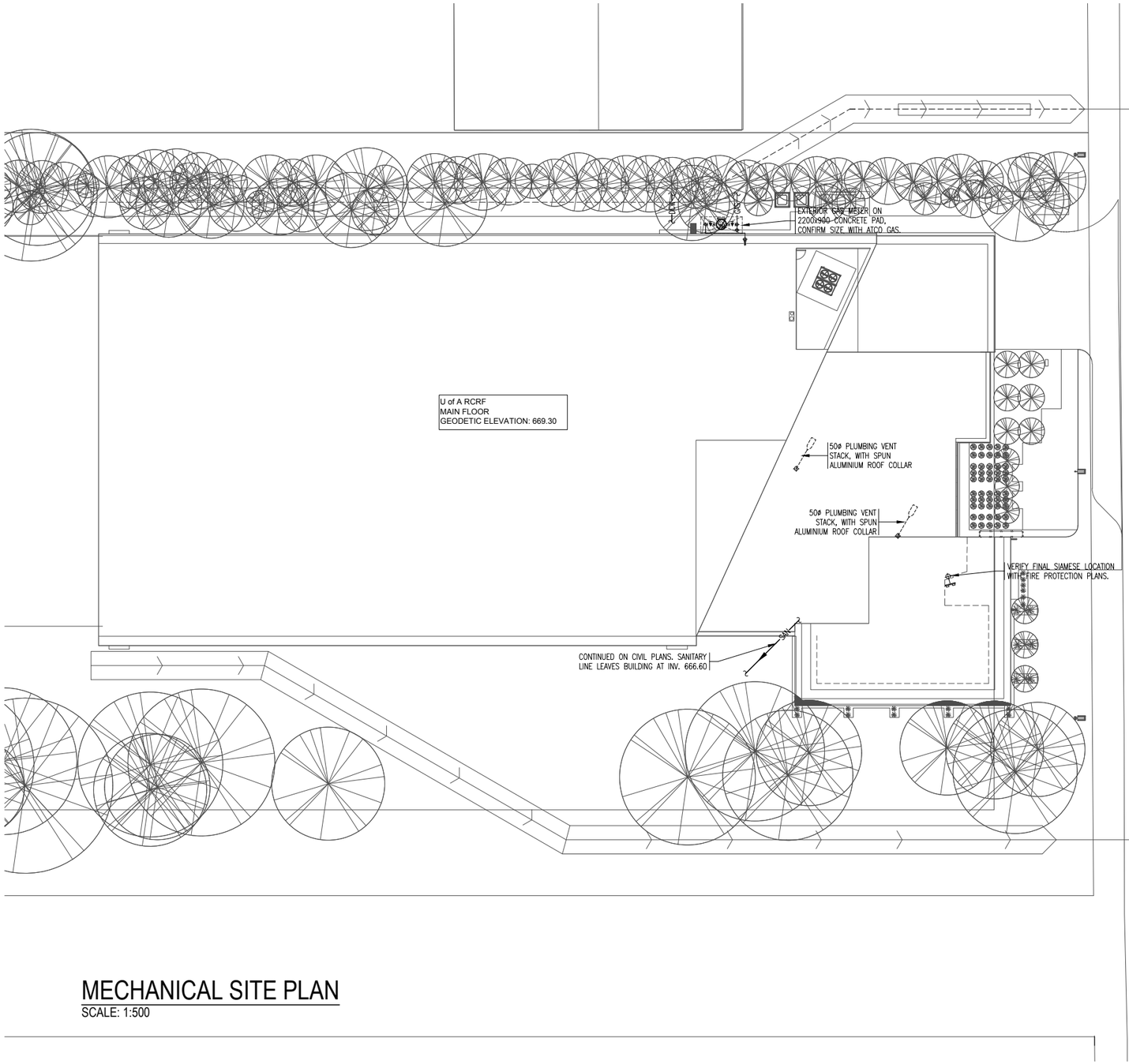
1. MECHANICAL CONTRACTOR SHALL FIELD COORDINATE EXACT PIPE ROUTING WITH ALL CONSTRUCTION TRADES PRIOR TO INSTALLATION
2. CONSTRUCTION SHALL BE COORDINATED WIT GENERAL CONTRACTOR.
3. COORDINATE ALL REQUIRED WORK WITH ARCHITECTURAL, STRUCTURAL AND ELECTRICAL DRAWINGS.
4. ALL PLUMBING FIXTURES SHALL COMPLETE WITH ISOLATION VALVES ON DOMESTIC SUPPLY LINES.
5 PROVIDE AND INSTALL SANITARY VENTING WITH THE CURRENT EDITION OF THE PLUMBING CODE.
6. COORDINATE LOCATION OF PIPING IN MECHANICAL SHAFT WITH DUCTWORK PRIOR TO INSTALLATION.
9. COORDINATE WATER LINES WITH ELECTRICAL CONTRACTOR, PIPING SHALL NOT BE ROUTED OVER.
10. NOTE ALL PIPING UNDER SLAB TO BE HUNG FROM STRUCTURAL SLAB. SEE DETAIL X MX.

PLUMBING FIXTURE ROUGH-IN SCHEDULE

			FIXTURE DATA				
TAG	ABBR.	FIXTURE	DCW	DHW	TRAP	WASTE	VENT
SK–1	sk	SINK	½" (15mm)	½" (15mm)	1 ½" (40mm)	2" (50mm)	2" 50mm)
SK–2	sk	SINK	½" (15mm)	½" (15mm)	1 ½" (40mm)	2" (50mm)	2" 50mm)
–	–	–	–	–	–	–	–
FD–1	fd	FLOOR DRAIN	–	–	–	3" (75mm)	2" (50mm)
FD–2	fd	FLOOR DRAIN	–	–	–	4" (100mm)	2" (50mm)
HB–1	hb	NON–FREEZE HOSE BIBB	¾" (20mm)	–	–	–	–
HB–2	hb	INTERIOR HOSE BIBB	½" (15mm)	–	–	–	–
LAV–1	lav	LAVATORY	½" (15mm)	½" (15mm)	–	2" (50mm)	2" (50mm)
LAV–2	lav	LAVATORY – BARRIER FREE	½" (15mm)	½" (15mm)	–	2" (50mm)	2" (50mm)
MR–1	mr	MOP SINK	½" (15mm)	½" (15mm)	2" (50mm)	2" (50mm)	2" (50mm)
–	–	–	–	–	–	–	–
WC–1	wc	BARRIER–FREE WATER CLOSET FLUSH VALVE	1 ½" (40mm)	–	–	4" (100mm)	2" (50mm)
		P–TRAP PRIMER	½" (15mm)	–	–	–	–

TILE 1 FOUNDATION PLAN

SCALE: 1:200



MECHANICAL SITE PLAN
SCALE: 1:500

LEGAL ADDRESS

PROJECT NAME: U of A RESEARCH AND COLLECTION RESOURCE FACILITY LOT _, BLOCK ___, PLAN_____	ADDRESS EDMONTON, ALBERTA

GAS COMPANY INFORMATION

MINIMUM DISTANCE BETWEEN GAS LINE AND UNDERGROUND SERVICES 2000mm (6'-8") MAXIMUM DISTANCE BETWEEN INCOMING GAS LINE ABOVE MECHANICAL ROOM FLOOR 150mm (6")	DOWNSTREAM FROM METER PRESSURE REQUIRED 2 PSI (13 kPa)		
EQUIPMENT TAG	MBH	Kw	?
BOILER B-1	2500		
BOILER B-2	2500		
HUMIDIFIER HU-1	100		
HUMIDIFIER HU-2	100		
DOMESTIC HOT WATER TANK	120		
MISCELLANEOUS (10% of total load)	430		
EXISTING BUILDING LOAD	0		
TOTAL	5750		

GENERAL NOTES

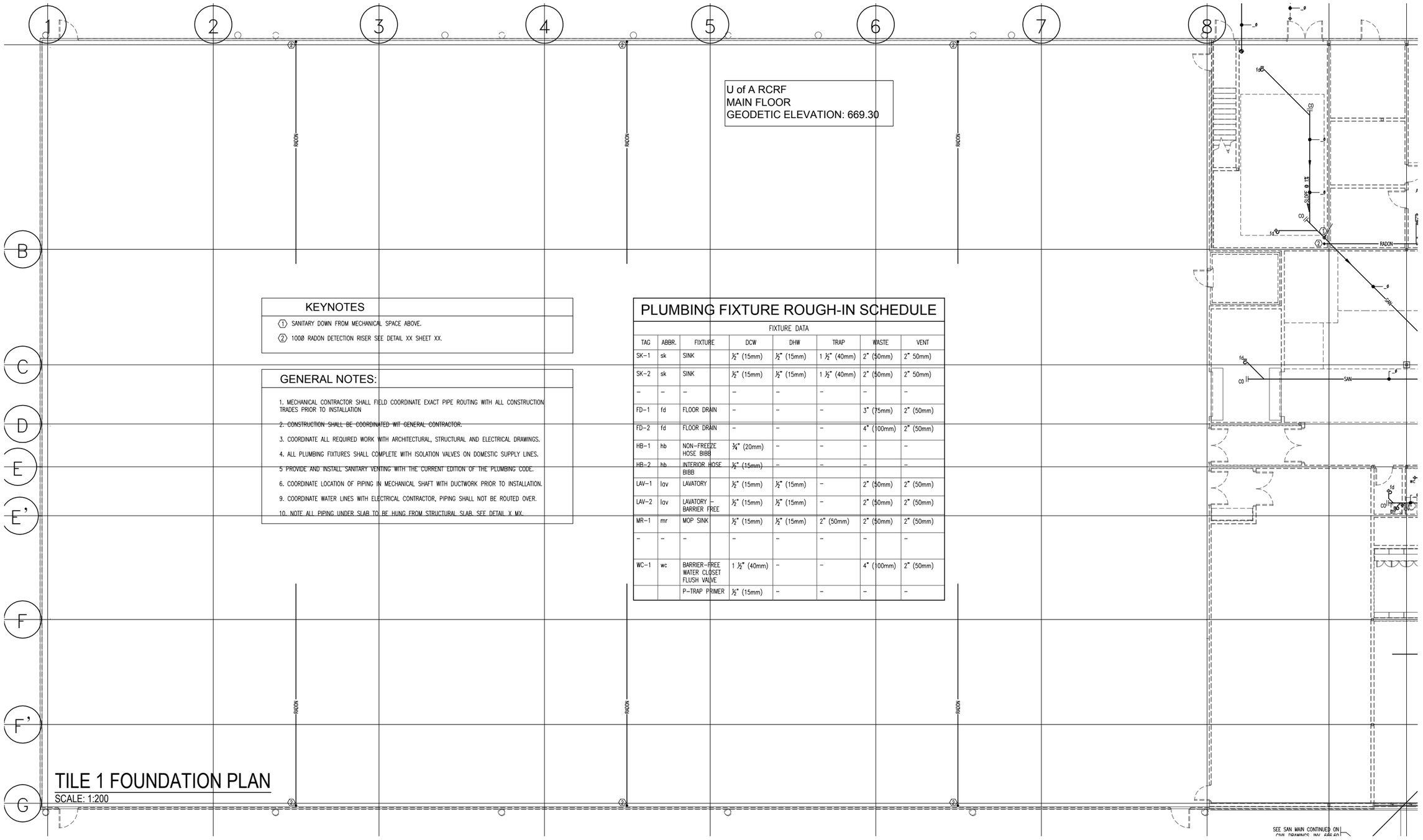
1. PRIOR TO COMMENCING INSTALLATION WITHIN THE BUILDING, VERIFY THE LOCATION AND INVERT ELEVATIONS OF SERVICE LINES INCLUDING SANITARY SEWER, STORM SEWER, WATER MAINS, AND GAS MAINS WITH AUTHORITIES HAVING JURISDICTION TO ENSURE SERVICES CAN BE INSTALLED AS SHOWN.
2. DEMOLITION AND CONSTRUCTION SHALL BE COORDINATED WITH GENERAL CONTRACTOR.
3. COORDINATE ALL REQUIRED WORK WITH ARCHITECTURAL, STRUCTURAL AND ELECTRICAL DRAWINGS.
4. CONTRACTOR SHALL CONFIRM/COORDINATE ALL WORK AS SHOWN OR DESCRIBED ON DRAWINGS ON SITE PRIOR TO CONSTRUCTION.
5. EQUIPMENT & ASSOCIATED ACCESSORIES, DUCTING AND PIPING DESIGNATED AS DELETED IMPLIES REMOVAL FROM SITE, UNLESS OTHERWISE NOTED. REVIEW DISPOSAL REQUIREMENTS OF ALL EXISTING EQUIPMENT WITH CLIENT.
6. THE ROUTING AND LAYOUT OF ALL SERVICES, DUCTWORK, PIPING, ETC. IS SCHEMATIC. THIS CONTRACTOR IS RESPONSIBLE FOR FIELD MEASURING ALL MATERIAL PRIOR TO INSTALLATION AND TO OFFSET AS REQUIRED TO AVOID CONFLICTS WITH STRUCTURAL OR OTHER TRADES WORK IN ALL AREAS.
7. MECHANICAL CONTRACTOR SHALL MAINTAIN A MINIMUM OF 1800mm (6'-0") OF EARTH COVER ON ALL SITE SERVICES PIPING UNLESS NOTED OTHERWISE.
8. UTILITIES NOTES:
   - 8.1 CONTRACTOR SHALL VERIFY POINT OF CONNECTION TO SITE UTILITY SERVICE PRIOR TO STARTING ANY NEW WORK.
   - 8.2 CONTRACTOR SHALL ADJUST LOCATION & DEPTH OF SITE SERVICES AS REQUIRED TO UTILITY LOCATIONS.
   - 8.3 CONTRACTOR SHALL MAKE FINAL CONNECTIONS TO SITE UTILITY SERVICES UNLESS OTHER PROVISIONS HAVE BEEN MADE.
   - 8.4 CONTRACTOR'S FAILURE TO PROPERLY CO-ORDINATE SERVICES SHALL NOT BE A JUSTIFICATION FOR ANY EXTRA CHARGES.

MECHANICAL LEGEND

ELBOW RISING	
TOP TAKEOFF	
BOTTOM TAKEOFF	
ELBOW DROPPING	
PIPING TEE	
SHUTOFF VALVE	
GLOBE VALVE	
CHECK VALVE	
PLUG VALVE	
2-WAY CONTROL VALVE	
3-WAY CONTROL VALVE	
PRESSURE REDUCING VALVE	
RELIEF VALVE	
STRAINER	
FLOW SWITCH	
BACKFLOW PREVENTOR	
P-TRAP	
SOLENOID VALVE	
STEAM TRAP	
FLOW INDICATOR	
CONCENTRIC REDUCER	
UNION OR FLANGE	
FLEXIBLE CONNECTION	
AUTOMATIC AIR VENT	
ANCHOR/GUIDES	
EXPANSION JOINT c/w GUIDES	
CAP OR PLUG	
PUMP	
THERMOMETER	
PRESSURE WELL	
PRESSURE GAUGE/PRESSURE TAP	
FLOW METER	
FLOW DIRECTION	
CHILLED GLYCOL SUPPLY	CHGLYS
CHILLED GLYCOL RETURN	CHGLYR
GLYCOL WATER HEATING SUPPLY	GLYS
GLYCOL WATER HEATING RETURN	GLYR
CHILLED WATER SUPPLY	CHWS
CHILLED WATER RETURN	CHWR
CONDENSATE	COND.
HEATING WATER SUPPLY	HWS
HEATING WATER RETURN	HWR
SANITARY DRAIN	SAN
STORM DRAIN	STM
VENT PIPE	V
SOFTEN WATER	SW
DOMESTIC COLD WATER	DCW
DOMESTIC HOT WATER	DHW
DOMESTIC HOT WATER RECIRC.	DHWR
NATURAL GAS	GAS
REFRIGERANT LIQUID	RL
REFRIGERANT VAPOR	RV
LOW PRESSURE STEAM (0 TO 100 kPa)	LPS
LOW PRESSURE CONDENSATE	LPC
PUMPED CONDENSATE	PC
PIPE SLOPE	
HEAT TRACE	
SUPPLY DUCT (UP & DOWN)	
RETURN DUCT (UP & DOWN)	
EXHAUST (UP & DOWN)	
ROUND DUCT (UP & DOWN)	
FLEXIBLE DUCT CONNECTION	
BALANCING DAMPER	
OPPOSED BLADE DAMPERS	OBD
MOTORIZED DAMPER	M
BACK DRAFT DAMPER	BDD
SUPPLY OUTLET	
SQUARE CONE DIFFUSER	
ROUND CONE DIFFUSER	
RETURN OR EXHAUST INLET (WALL TYPE)	
ACOUSTIC LINED DUCTWORK	
FIRE DAMPER (HORIZONTAL)	1/4 or 1/2
FIRE DAMPER (VERTICAL)	1/4 or 1/2
SMOKE DAMPER (HORIZONTAL)	1/4 or
SMOKE DAMPER (VERTICAL)	1/4 or 1/2

MECHANICAL LEGEND

TURNING VANES	
ACCESS DOOR	AD
VARIABLE VOLUME BOX with REHEAT COIL	
RADIANT PANEL	
RADIATION	
FIRE HYDRANT	
SIAMESE CONNECTION	
SIAMESE CONNECTION (FLUSH MOUNTED)	
FIRE EXTINGUISHER	
FIRE EXTINGUISHER WITH RECESSED CABINET	
FIRE HOSE CABINET	
SPRINKLER HEAD - PENDANT	
SPRINKLER HEAD - UPRIGHT	
SPRINKLER HEAD - SIDEWALL	
SPRINKLER HEAD - CONCEALED	
SPRINKLER HEAD - DRY PENDANT	DP
SPRINKLER HEAD - DRY SIDEWALL	DP
FIRE LINE	F
SPRINKLER LINE	SPR
HOSE BIBB	HB
NON FREEZE HOSE BIBB	NFHB
CLEANOUT (ABOVE GRADE)	C.O.
CLEANOUT (BELOW GRADE)	C.O.
CATCH BASIN	CB
MANHOLE	MH
FLOOR DRAIN	FD
FUNNEL FLOOR DRAIN	FFD
ROOF DRAIN	RD
CO_2 SENSOR	CO_2
HUMIDITY SENSOR	H
THERMOSTAT/THERMOSTAT c/w GUARD	T
SENSOR	S
SWITCH	$
REVISION NUMBER	
KEYNOTE	
AIR OUTLET OR INLET	QUANTITY; TYPE; SIZE (mm) or (Inch); CAPACITY (l/s) or (CFM)
RADIATION	QUANTITY; TYPE; LENGTH OF FIN (mm) or (Inch); CAPACITY (kW) or (MBH)
PHOTO TAG (FROM DIRECTION OF CAMERA)	
EQUIPMENT TAG	
PLUMBING FIXTURE TAG	
SECTION FLAG	SECTION LETTER; DRAWING REFERENCE
DETAIL FLAG	DETAIL NUMBER; DRAWING REFERENCE
RADIANT PANEL	(APPROX. LENGTH OF RADIANT PANEL) (mm) or (Inch); QUANTITY; 1200 TYPE; CAPACITY (kW) or (MBH)



KEYNOTES

1. SANITARY DOWN FROM MECHANICAL SPACE ABOVE.
2. 100Ø RADON DETECTION RISER SEE DETAIL XX SHEET XX.

GENERAL NOTES:

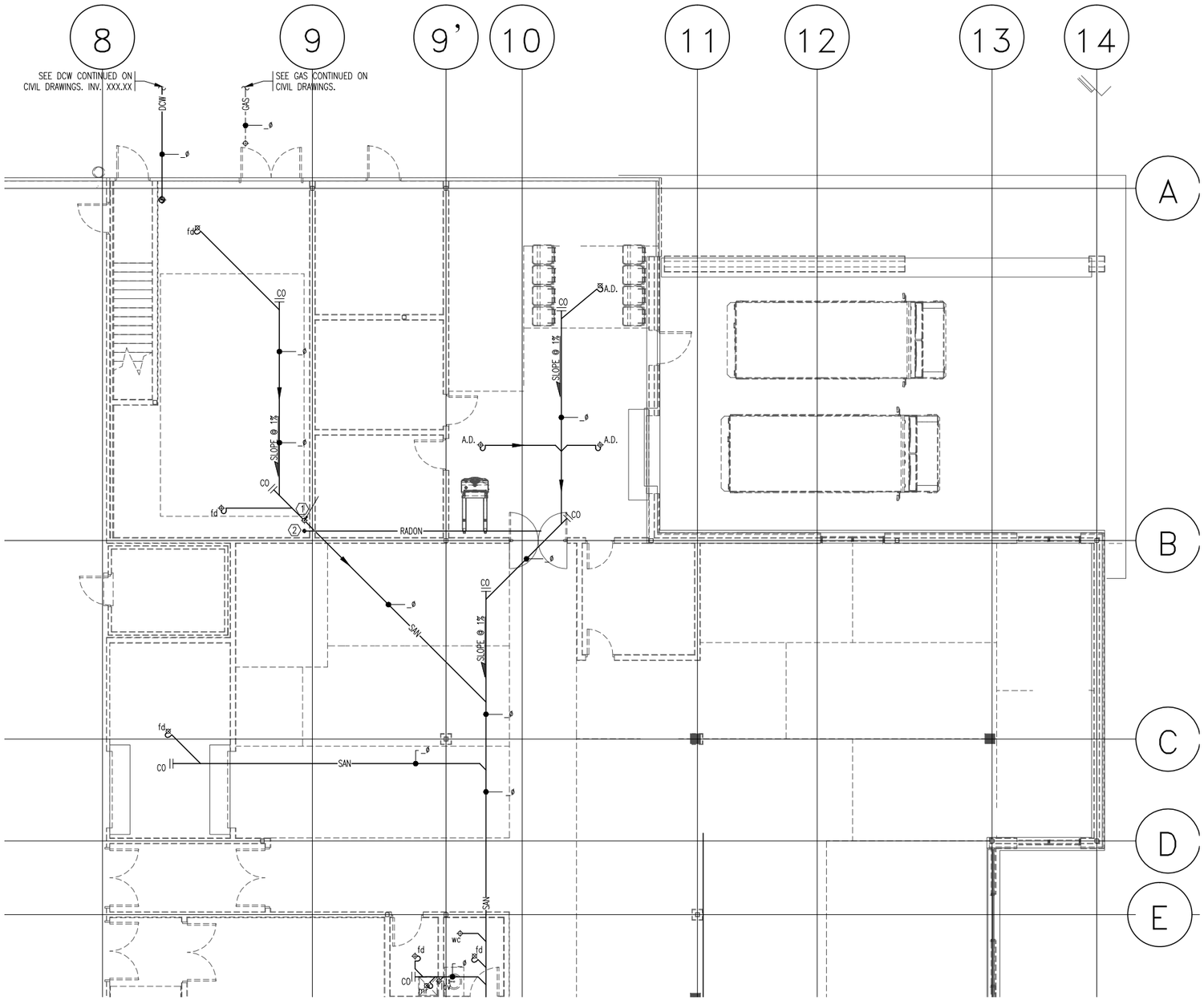
1. MECHANICAL CONTRACTOR SHALL FIELD COORDINATE EXACT PIPE ROUTING WITH ALL CONSTRUCTION TRADES PRIOR TO INSTALLATION
2. CONSTRUCTION SHALL BE COORDINATED WIT GENERAL CONTRACTOR.
3. COORDINATE ALL REQUIRED WORK WITH ARCHITECTURAL, STRUCTURAL AND ELECTRICAL DRAWINGS.
4. ALL PLUMBING FIXTURES SHALL COMPLETE WITH ISOLATION VALVES ON DOMESTIC SUPPLY LINES.
5 PROVIDE AND INSTALL SANITARY VENTING WITH THE CURRENT EDITION OF THE PLUMBING CODE.
6. COORDINATE LOCATION OF PIPING IN MECHANICAL SHAFT WITH DUCTWORK PRIOR TO INSTALLATION.
9. COORDINATE WATER LINES WITH ELECTRICAL CONTRACTOR, PIPING SHALL NOT BE ROUTED OVER.
10. NOTE ALL PIPING UNDER SLAB TO BE HUNG FROM STRUCTURAL SLAB. SEE DETAIL X MX.

PLUMBING FIXTURE ROUGH-IN SCHEDULE

FIXTURE DATA							
TAG	ABBR.	FIXTURE	DCW	DHW	TRAP	WASTE	VENT
SK–1	sk	SINK	½" (15mm)	½" (15mm)	1 ½" (40mm)	2" (50mm)	2" 50mm)
SK–2	sk	SINK	½" (15mm)	½" (15mm)	1 ½" (40mm)	2" (50mm)	2" 50mm)
–	–	–	–	–	–	–	–
FD–1	fd	FLOOR DRAIN	–	–	–	3" (75mm)	2" (50mm)
FD–2	fd	FLOOR DRAIN	–	–	–	4" (100mm)	2" (50mm)
HB–1	hb	NON–FREEZE HOSE BIBB	¾" (20mm)	–	–	–	–
HB–2	hb	INTERIOR HOSE BIBB	½" (15mm)	–	–	–	–
LAV–1	lav	LAVATORY	½" (15mm)	½" (15mm)	–	2" (50mm)	2" (50mm)
LAV–2	lav	LAVATORY – BARRIER FREE	½" (15mm)	½" (15mm)	–	2" (50mm)	2" (50mm)
MR–1	mr	MOP SINK	½" (15mm)	½" (15mm)	2" (50mm)	2" (50mm)	2" (50mm)
–	–	–	–	–	–	–	–
WC–1	wc	BARRIER–FREE WATER CLOSET FLUSH VALVE	1 ½" (40mm)	–	–	4" (100mm)	2" (50mm)
		P–TRAP PRIMER	½" (15mm)	–	–	–	–

TILE 1 FOUNDATION PLAN

SCALE: 1:200



KEYNOTES

1. SANITARY DOWN FROM MECHANICAL SPACE ABOVE.
2. 100Ø RADON DETECTION RISER SEE DETAIL XX SHEET XX.

GENERAL NOTES:

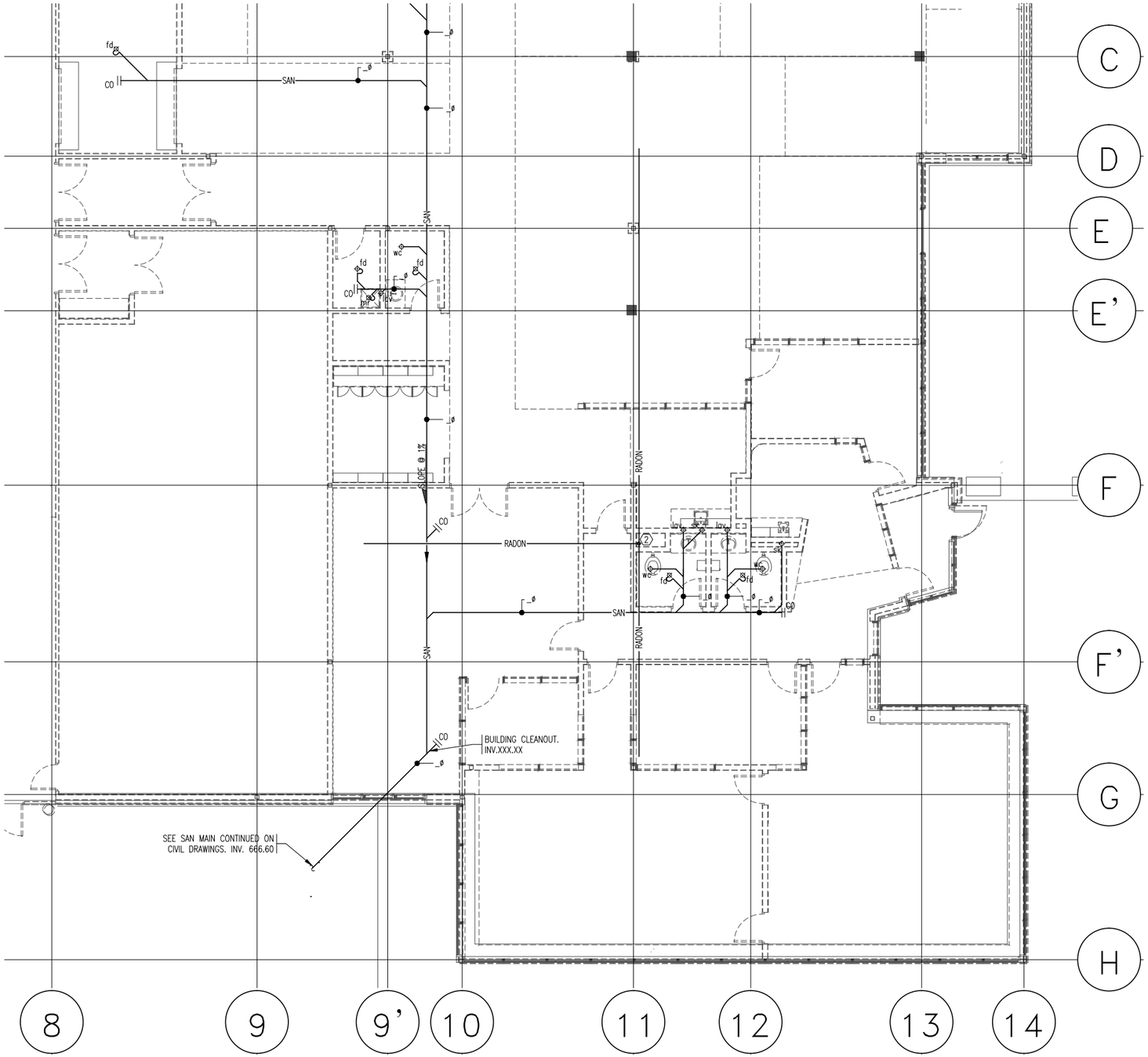
1. MECHANICAL CONTRACTOR SHALL FIELD COORDINATE EXACT PIPE ROUTING WITH ALL CONSTRUCTION TRADES PRIOR TO INSTALLATION
2. CONSTRUCTION SHALL BE COORDINATED WIT GENERAL CONTRACTOR.
3. COORDINATE ALL REQUIRED WORK WITH ARCHITECTURAL, STRUCTURAL AND ELECTRICAL DRAWINGS.
4. ALL PLUMBING FIXTURES SHALL COMPLETE WITH ISOLATION VALVES ON DOMESTIC SUPPLY LINES.
5 PROVIDE AND INSTALL SANITARY VENTING WITH THE CURRENT EDITION OF THE PLUMBING CODE.
6. COORDINATE LOCATION OF PIPING IN MECHANICAL SHAFT WITH DUCTWORK PRIOR TO INSTALLATION.
9. COORDINATE WATER LINES WITH ELECTRICAL CONTRACTOR, PIPING SHALL NOT BE ROUTED OVER.
10. NOTE ALL PIPING UNDER SLAB TO BE HUNG FROM STRUCTURAL SLAB. SEE DETAIL X MX.

PLUMBING FIXTURE ROUGH-IN SCHEDULE

FIXTURE DATA							
TAG	ABBR.	FIXTURE	DCW	DHW	TRAP	WASTE	VENT
SK–1	sk	SINK	½" (15mm)	½" (15mm)	1 ½" (40mm)	2" (50mm)	2" 50mm)
SK–2	sk	SINK	½" (15mm)	½" (15mm)	1 ½" (40mm)	2" (50mm)	2" 50mm)
–	–	–	–	–	–	–	–
FD–1	fd	FLOOR DRAIN	–	–	–	3" (75mm)	2" (50mm)
FD–2	fd	FLOOR DRAIN	–	–	–	4" (100mm)	2" (50mm)
HB–1	hb	NON–FREEZE HOSE BIBB	¾" (20mm)	–	–	–	–
HB–2	hb	INTERIOR HOSE BIBB	½" (15mm)	–	–	–	–
LAV–1	lqv	LAVATORY	½" (15mm)	½" (15mm)	–	2" (50mm)	2" (50mm)
LAV–2	lqv	LAVATORY – BARRIER FREE	½" (15mm)	½" (15mm)	–	2" (50mm)	2" (50mm)
MR–1	mr	MOP SINK	½" (15mm)	½" (15mm)	2" (50mm)	2" (50mm)	2" (50mm)
–	–	–	–	–	–	–	–
WC–1	wc	BARRIER–FREE WATER CLOSET FLUSH VALVE	1 ½" (40mm)	–	–	4" (100mm)	2" (50mm)
		P–TRAP PRIMER	½" (15mm)	–	–	–	–

TILE 2 FOUNDATION PLAN

SCALE: 1:150



KEYNOTES

1. SANITARY DOWN FROM MECHANICAL SPACE ABOVE.
2. 100Ø RADON DETECTION RISER SEE DETAIL XX SHEET XX.

GENERAL NOTES:

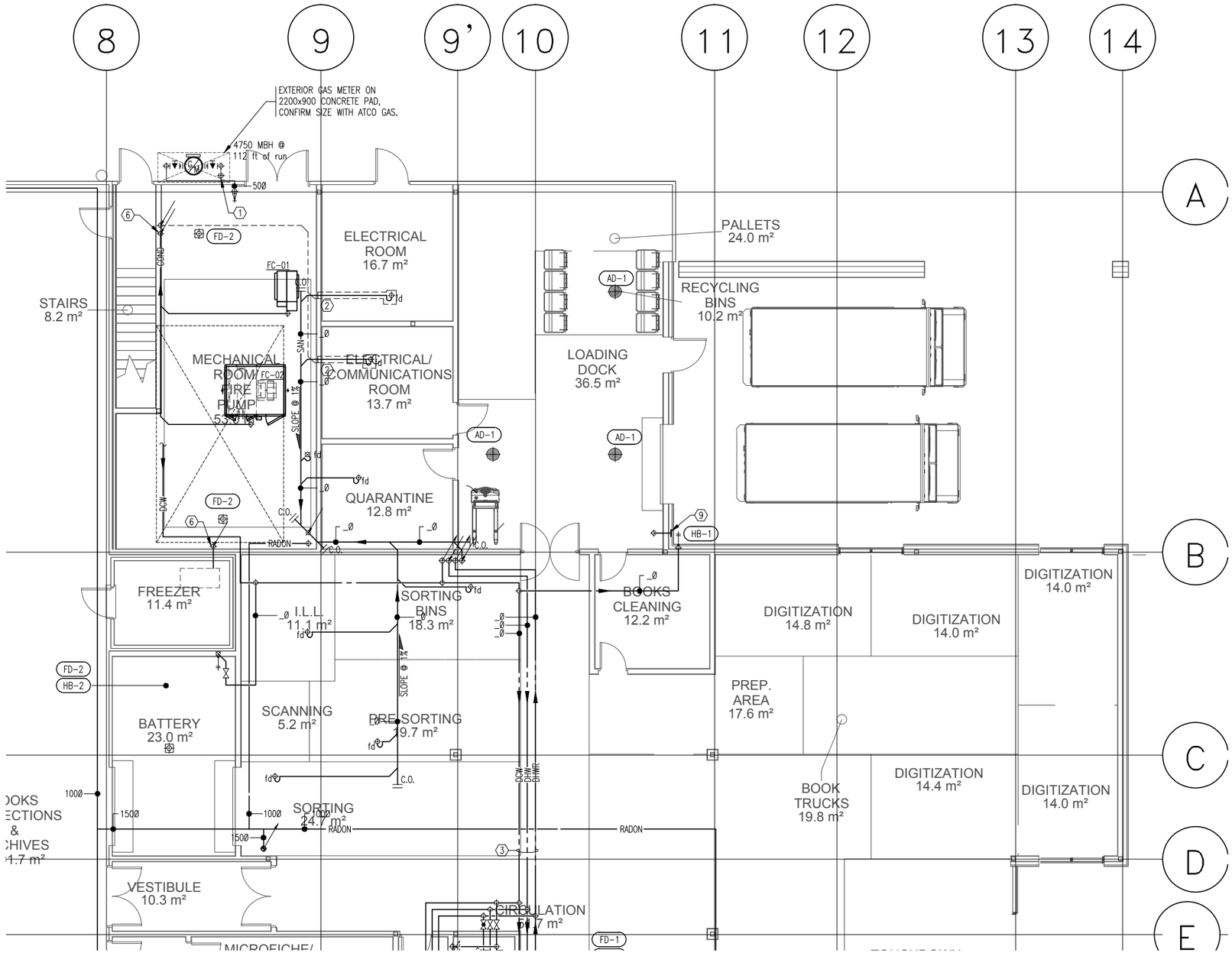
1. MECHANICAL CONTRACTOR SHALL FIELD COORDINATE EXACT PIPE ROUTING WITH ALL CONSTRUCTION TRADES PRIOR TO INSTALLATION
2. CONSTRUCTION SHALL BE COORDINATED WIT GENERAL CONTRACTOR.
3. COORDINATE ALL REQUIRED WORK WITH ARCHITECTURAL, STRUCTURAL AND ELECTRICAL DRAWINGS.
4. ALL PLUMBING FIXTURES SHALL COMPLETE WITH ISOLATION VALVES ON DOMESTIC SUPPLY LINES.
5 PROVIDE AND INSTALL SANITARY VENTING WITH THE CURRENT EDITION OF THE PLUMBING CODE.
6. COORDINATE LOCATION OF PIPING IN MECHANICAL SHAFT WITH DUCTWORK PRIOR TO INSTALLATION.
9. COORDINATE WATER LINES WITH ELECTRICAL CONTRACTOR, PIPING SHALL NOT BE ROUTED OVER.
10. NOTE ALL PIPING UNDER SLAB TO BE HUNG FROM STRUCTURAL SLAB. SEE DETAIL X MX.

PLUMBING FIXTURE ROUGH-IN SCHEDULE

FIXTURE DATA							
TAG	ABBR.	FIXTURE	DCW	DHW	TRAP	WASTE	VENT
SK–1	sk	SINK	½" (15mm)	½" (15mm)	1 ½" (40mm)	2" (50mm)	2" 50mm)
SK–2	sk	SINK	½" (15mm)	½" (15mm)	1 ½" (40mm)	2" (50mm)	2" 50mm)
–	–	–	–	–	–	–	–
FD–1	fd	FLOOR DRAIN	–	–	–	3" (75mm)	2" (50mm)
FD–2	fd	FLOOR DRAIN	–	–	–	4" (100mm)	2" (50mm)
HB–1	hb	NON–FREEZE HOSE BIBB	¾" (20mm)	–	–	–	–
HB–2	hb	INTERIOR HOSE BIBB	½" (15mm)	–	–	–	–
LAV–1	lav	LAVATORY	½" (15mm)	½" (15mm)	–	2" (50mm)	2" (50mm)
LAV–2	lav	LAVATORY – BARRIER FREE	½" (15mm)	½" (15mm)	–	2" (50mm)	2" (50mm)
MR–1	mr	MOP SINK	½" (15mm)	½" (15mm)	2" (50mm)	2" (50mm)	2" (50mm)
–	–	–	–	–	–	–	–
WC–1	wc	BARRIER–FREE WATER CLOSET FLUSH VALVE	1 ½" (40mm)	–	–	4" (100mm)	2" (50mm)
		P–TRAP PRIMER	½" (15mm)	–	–	–	–

TILE 3 FOUNDATION PLAN

SCALE: 1:150



KEYNOTES

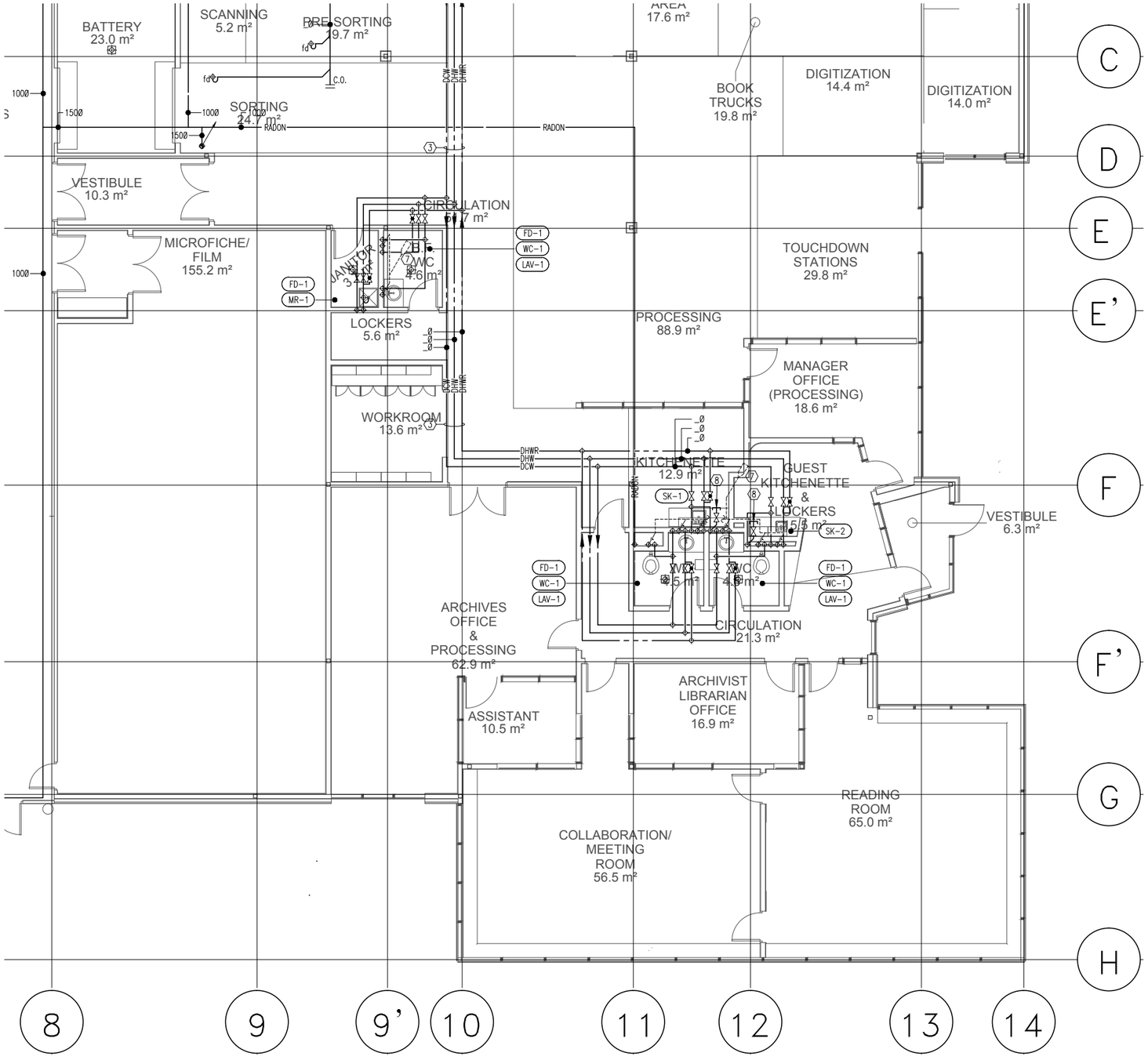
1. REGULATOR VENT TO TERMINATE MIN 3 ft FROM ALL DOORS & 10 ft FROM FRESH AIR INTAKE ABOVE.
2. SANITARY PIPING ABOVE ELECTRICAL EQUIPMENT TO BE PROTECTED BY DRAIN PAN FOR ENTIRE LENGTH OF RUN. PROVIDE DRAIN LINE TO NEAREST FLOOR DRAIN IN MECHANICAL SPACE ADJACENT.
3. RUN PIPING MAINS AS CLOSE TO UNDERSIDE OF STRUCTURE AS POSSIBLE. KEEP MAINS ABOVE CORRIDOR.
4. 6"Ø XFR PIPE FOR RADON CONTROL UP TO MECHANICAL SPACE ABOVE. SEE MECH ROOM FOR CONTINUATION.
5. EYEWASH WITH RECESSED WALL BOX FOR THERMOSTATIC VALVE.
6. CONDENSATE LINES DOWN TO NEAREST FLOOR DRAIN IN MECHANICAL SPACE.
7. SANITARY VENT UP THROUGH ROOF.
8. CAPPED CONNECTION FOR COFFEE MACHINE IN MILLWORK.
9. 2"Ø PVC EXHAUST PIPE FROM OWNER SUPPLIED BOOK CLEANING UNIT. TERMINATE WITH WEATHER HOOD.

GENERAL NOTES:

1. MECHANICAL CONTRACTOR SHALL FIELD COORDINATE EXACT PIPE ROUTING WITH ALL CONSTRUCTION TRADES PRIOR TO INSTALLATION
2. CONSTRUCTION SHALL BE COORDINATED WIT GENERAL CONTRACTOR.
3. COORDINATE ALL REQUIRED WORK WITH ARCHITECTURAL, STRUCTURAL AND ELECTRICAL DRAWINGS.
4. ALL PLUMBING FIXTURES SHALL COMPLETE WITH ISOLATION VALVES ON DOMESTIC SUPPLY LINES.
5 PROVIDE AND INSTALL SANITARY VENTING WITH THE CURRENT EDITION OF THE PLUMBING CODE.
6. COORDINATE LOCATION OF PIPING IN MECHANICAL SHAFT WITH DUCTWORK PRIOR TO INSTALLATION.
9. COORDINATE WATER LINES WITH ELECTRICAL CONTRACTOR, PIPING SHALL NOT BE ROUTED OVER.

PLUMBING FIXTURE ROUGH-IN SCHEDULE

FIXTURE DATA							
TAG	ABBR.	FIXTURE	DCW	DHW	TRAP	WASTE	VENT
SK-1	sk	SINK	½" (15mm)	½" (15mm)	1 ½" (40mm)	2" (50mm)	2" 50mm)
–	–	–	–	–	–	–	–
FD-1	fd	FLOOR DRAIN	–	–	–	3" (75mm)	2" (50mm)
HB-1	hb	NON-FREEZE HOSE BIBB	¾" (20mm)	–	–	–	–
HB-2	hb	INTERIOR HOSE BIBB	½" (15mm)	–	–	–	–
LAV-1	lav	LAVATORY	½" (15mm)	½" (15mm)	–	2" (50mm)	2" (50mm)
MR-1	mr	MOP SINK	½" (15mm)	½" (15mm)	2" (50mm)	2" (50mm)	2" (50mm)
UR-1	ur	URINAL	¾" (20mm)	¾" (20mm)	–	2" (50mm)	1 ½" (40mm)
SH-1	sh	SHOWER	½" (15mm)	½" (15mm)			
–	–	–	–	–	–	–	–
WC-1	wc	WATER CLOSET FLUSH VALVE	1 ½" (40mm)	–	–	4" (100mm)	2" (50mm)
–	–	–	–	–	–	–	–
WC-2	wc	BARRIER-FREE WATER CLOSET FLUSH VALVE	1 ½" (40mm)	–	–	4" (100mm)	2" (50mm)
		P-TRAP PRIMER	½" (15mm)	–	–	–	–



KEYNOTES

1. REGULATOR VENT TO TERMINATE MIN 3 ft FROM ALL DOORS & 10 ft FROM FRESH AIR INTAKE ABOVE.
2. SANITARY PIPING ABOVE ELECTRICAL EQUIPMENT TO BE PROTECTED BY DRAIN PAN FOR ENTIRE LENGTH OF RUN. PROVIDE DRAIN LINE TO NEAREST FLOOR DRAIN IN MECHANICAL SPACE ADJACENT.
3. RUN PIPING MAINS AS CLOSE TO UNDERSIDE OF STRUCTURE AS POSSIBLE. KEEP MAINS ABOVE CORRIDOR.
4. 6"Ø XFR PIPE FOR RADON CONTROL UP TO MECHANICAL SPACE ABOVE. SEE MECH ROOM FOR CONTINUATION.
5. EYEWASH WITH RECESSED WALL BOX FOR THERMOSTATIC VALVE.
6. CONDENSATE LINES DOWN TO NEAREST FLOOR DRAIN IN MECHANICAL SPACE.
7. SANITARY VENT UP THROUGH ROOF.
8. CAPPED CONNECTION FOR COFFEE MACHINE IN MILLWORK.
9. 2"Ø PVC EXHAUST PIPE FROM OWNER SUPPLIED BOOK CLEANING UNIT. TERMINATE WITH WEATHER HOOD.

GENERAL NOTES:

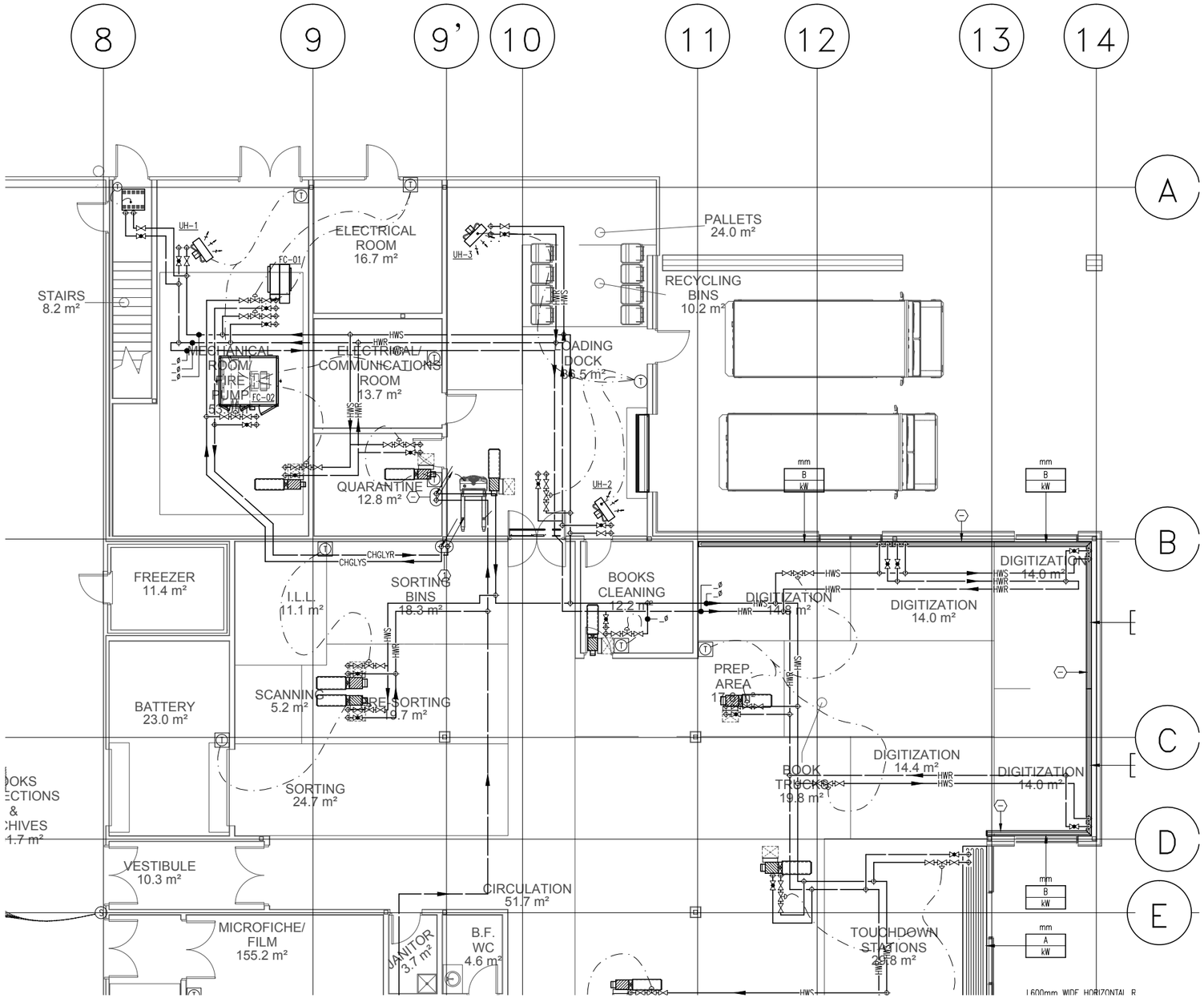
1. MECHANICAL CONTRACTOR SHALL FIELD COORDINATE EXACT PIPE ROUTING WITH ALL CONSTRUCTION TRADES PRIOR TO INSTALLATION
2. CONSTRUCTION SHALL BE COORDINATED WIT GENERAL CONTRACTOR.
3. COORDINATE ALL REQUIRED WORK WITH ARCHITECTURAL, STRUCTURAL AND ELECTRICAL DRAWINGS.
4. ALL PLUMBING FIXTURES SHALL COMPLETE WITH ISOLATION VALVES ON DOMESTIC SUPPLY LINES.
5 PROVIDE AND INSTALL SANITARY VENTING WITH THE CURRENT EDITION OF THE PLUMBING CODE.
6. COORDINATE LOCATION OF PIPING IN MECHANICAL SHAFT WITH DUCTWORK PRIOR TO INSTALLATION.
9. COORDINATE WATER LINES WITH ELECTRICAL CONTRACTOR, PIPING SHALL NOT BE ROUTED OVER.

PLUMBING FIXTURE ROUGH-IN SCHEDULE

FIXTURE DATA							
TAG	ABBR.	FIXTURE	DCW	DHW	TRAP	WASTE	VENT
SK-1	sk	SINK	½" (15mm)	½" (15mm)	1 ½" (40mm)	2" (50mm)	2" 50mm)
–	–	–	–	–	–	–	–
FD-1	fd	FLOOR DRAIN	–	–	–	3" (75mm)	2" (50mm)
HB-1	hb	NON-FREEZE HOSE BIBB	¾" (20mm)	–	–	–	–
HB-2	hb	INTERIOR HOSE BIBB	½" (15mm)	–	–	–	–
LAV-1	lav	LAVATORY	½" (15mm)	½" (15mm)	–	2" (50mm)	2" (50mm)
MR-1	mr	MOP SINK	½" (15mm)	½" (15mm)	2" (50mm)	2" (50mm)	2" (50mm)
UR-1	ur	URINAL	¾" (20mm)	¾" (20mm)	–	2" (50mm)	1 ½" (40mm)
SH-1	sh	SHOWER	½" (15mm)	½" (15mm)			
–	–	–	–	–	–	–	–
WC-1	wc	WATER CLOSET FLUSH VALVE	1 ½" (40mm)	–	–	4" (100mm)	2" (50mm)
–	–	–	–	–	–	–	–
WC-2	wc	BARRIER-FREE WATER CLOSET FLUSH VALVE	1 ½" (40mm)	–	–	4" (100mm)	2" (50mm)
		P-TRAP PRIMER	½" (15mm)	–	–	–	–

TILE 3 PLUMBING PLAN

SCALE: 1:150

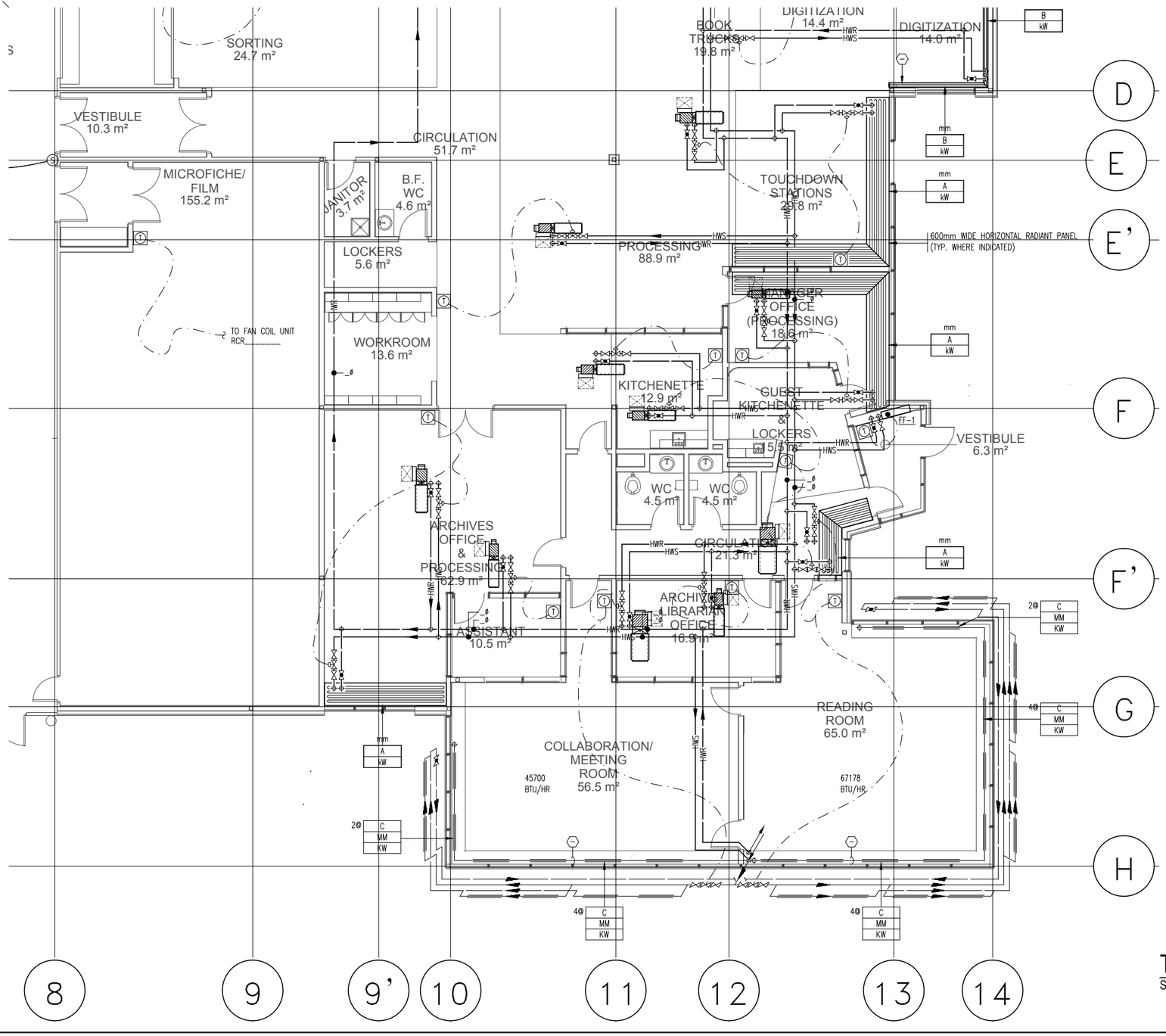


GENERAL NOTES:

1) ALL THERMOSTATS TO BE WHITE IN COLOUR
2) THERMOSTAT MOUNTING TO BE MOUNTED 1500MM A.F.F. TO BOTTOM OF THERMOSTAT.
3) ALL HEATING WATER SUPPLY & RETURN BRANCH PIPING TO BE 20ø UNLESS NOTED OTHERWISE.

TILE 2 HEATING PLAN

SCALE: 1:150

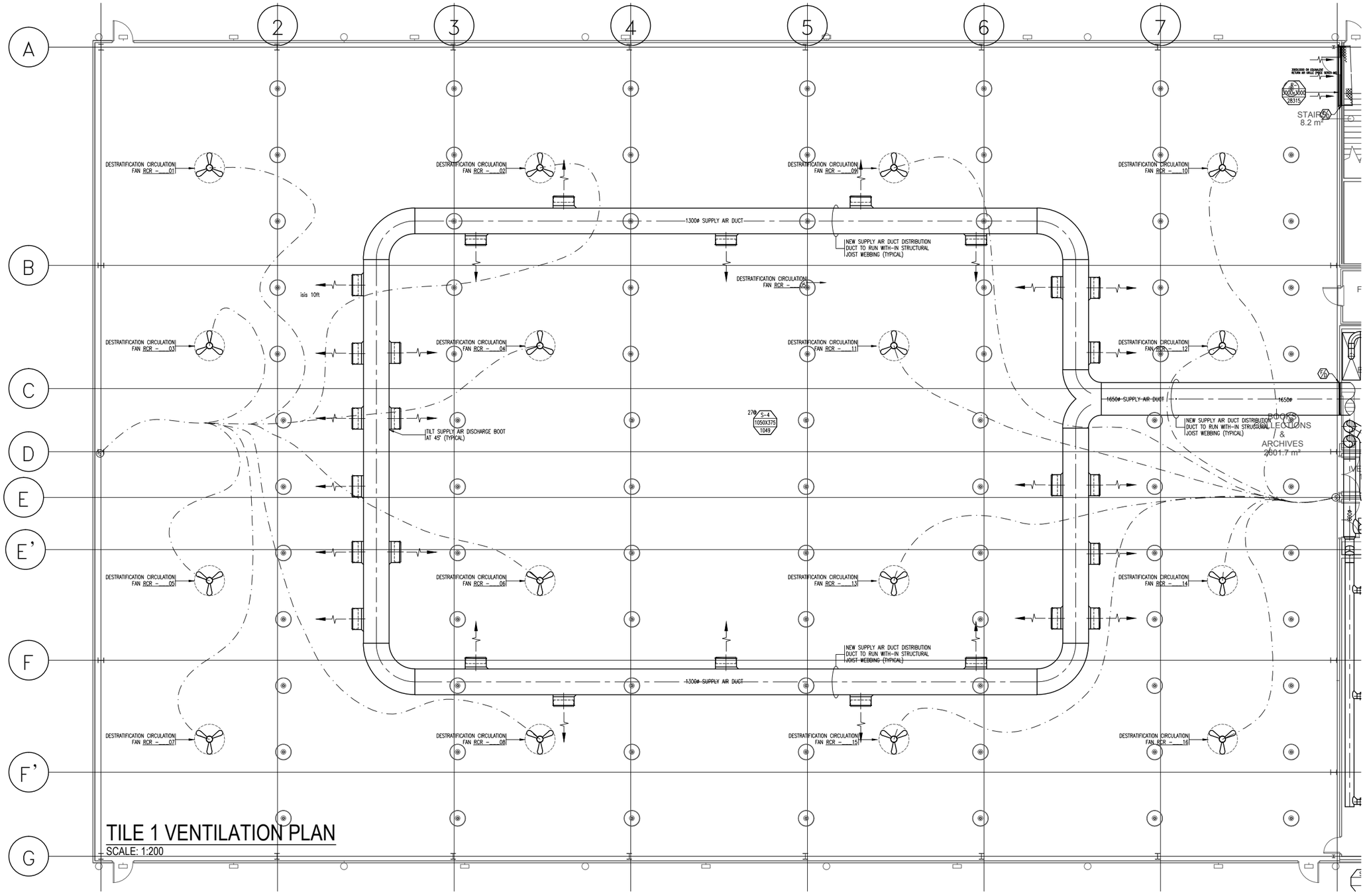


GENERAL NOTES:

1) ALL THERMOSTATS TO BE WHITE IN COLOUR
2) THERMOSTAT MOUNTING TO BE MOUNTED 1500MM A.F.F. TO BOTTOM OF THERMOSTAT.
3) ALL HEATING WATER SUPPLY & RETURN BRANCH PIPING TO BE 20ø UNLESS NOTED OTHERWISE.

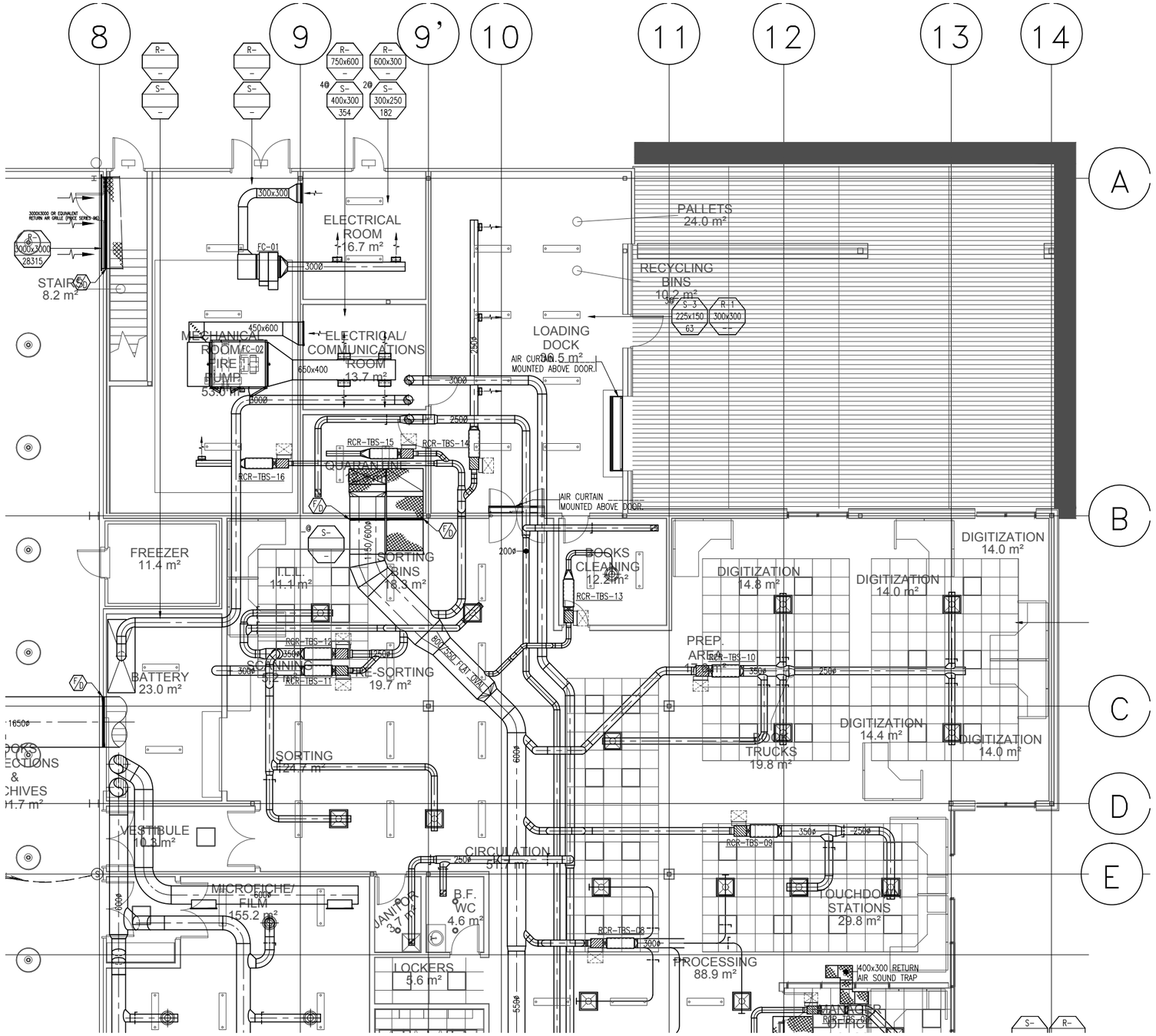
TILE 3 HEATING PLAN

SCALE: 1:150



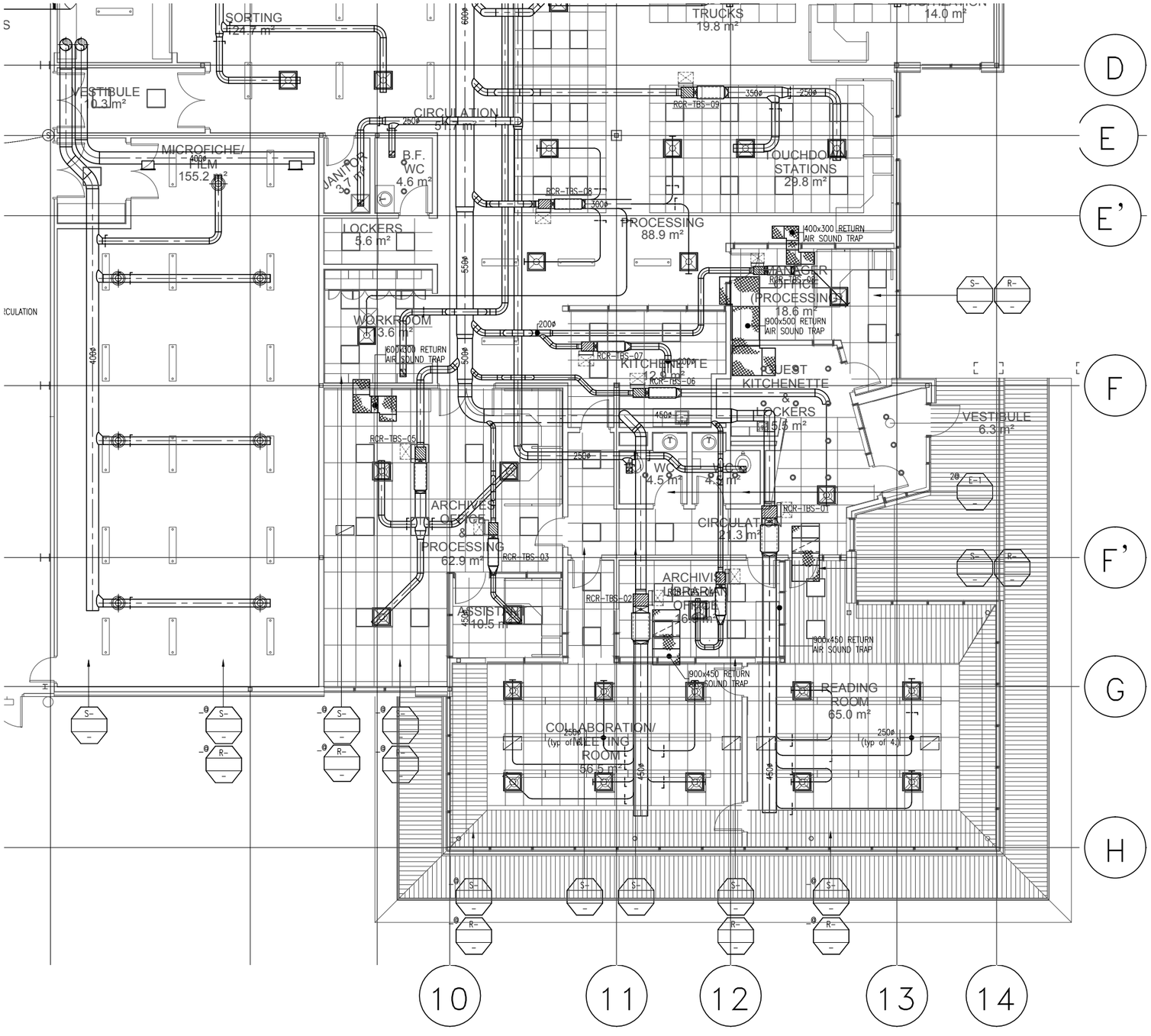
TILE 1 VENTILATION PLAN

SCALE: 1:200



TILE 2 VENTILATION PLAN

SCALE: 1:150



TILE 3 VENTILATION PLAN

SCALE: 1:150

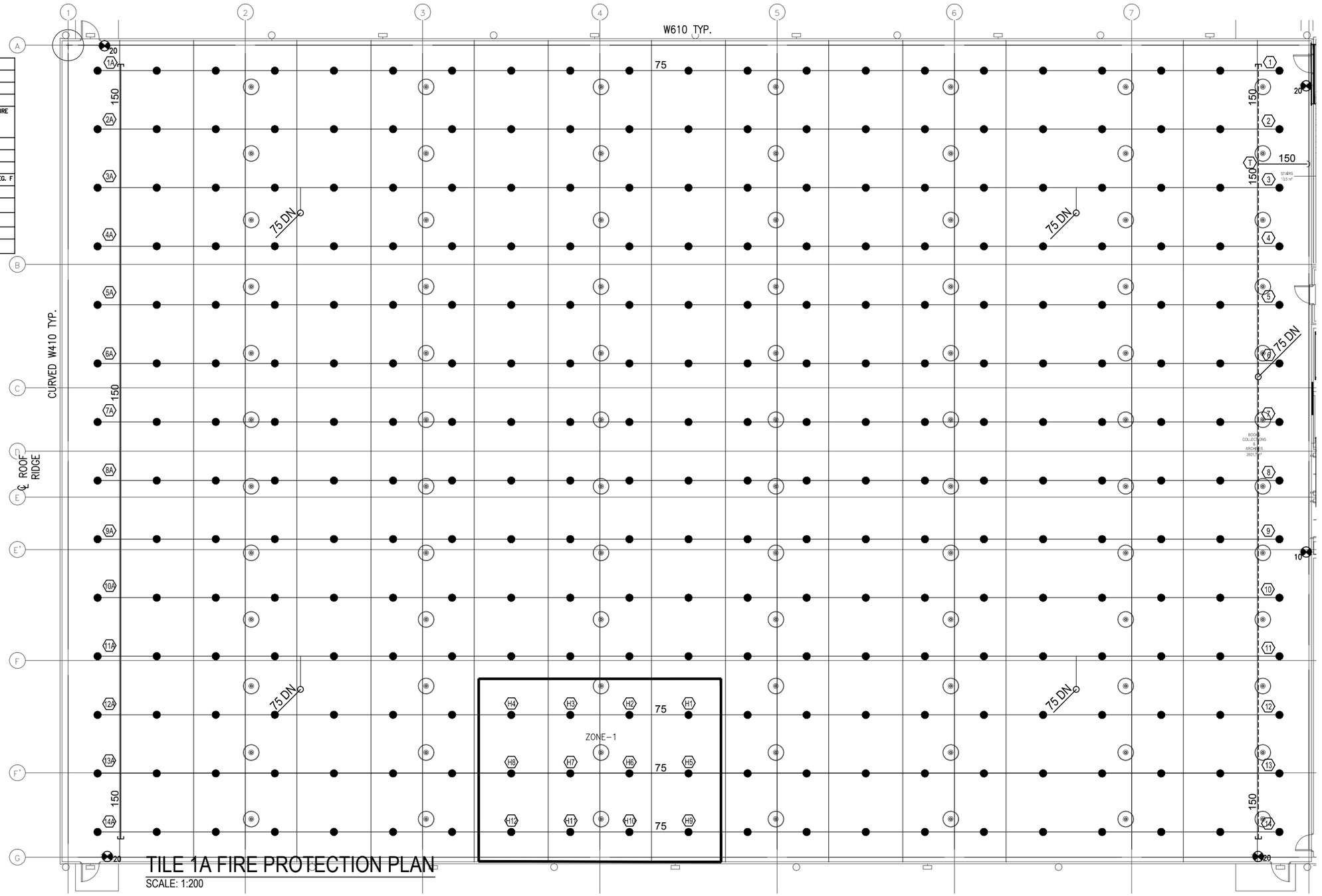
DESIGN CRITERIA

AREA	HIGH BAY RECORDS STORAGE
USE	
RACKING	
HEIGHT	40 FT MAX. STORAGE, 45 FT CEILING
DESIGN CRITERIA	K-25 ESFR, 40 PSI OPERATING PRESSURE 12 HEADS FLOWING 100 SQ.FT. MAX. 10 FT. MAX. SPACING
HOSE STREAM	250 GPM
IN-RACKS	NOT REQUIRED
HOSE STATIONS	NONE
CEILING SPRINKLER TYPE	~~VIGT. V4404 ESFR-25, K=25.2, 165 DEG. F~~
CALCULATION #	# 1
CEILING SPRINKLER DEMAND (USGPM)	1921 USGPM.
I/O HOSE ALLOW (GPM)	100 USGPM. INSIDE HOSE 150 USGPM. OUTSIDE HOSE
TOTAL (USGPM)	XXX USGPM.
REQ. PRESSURE (PSI) AT F.P. DISCHARGE	XXX PSI.

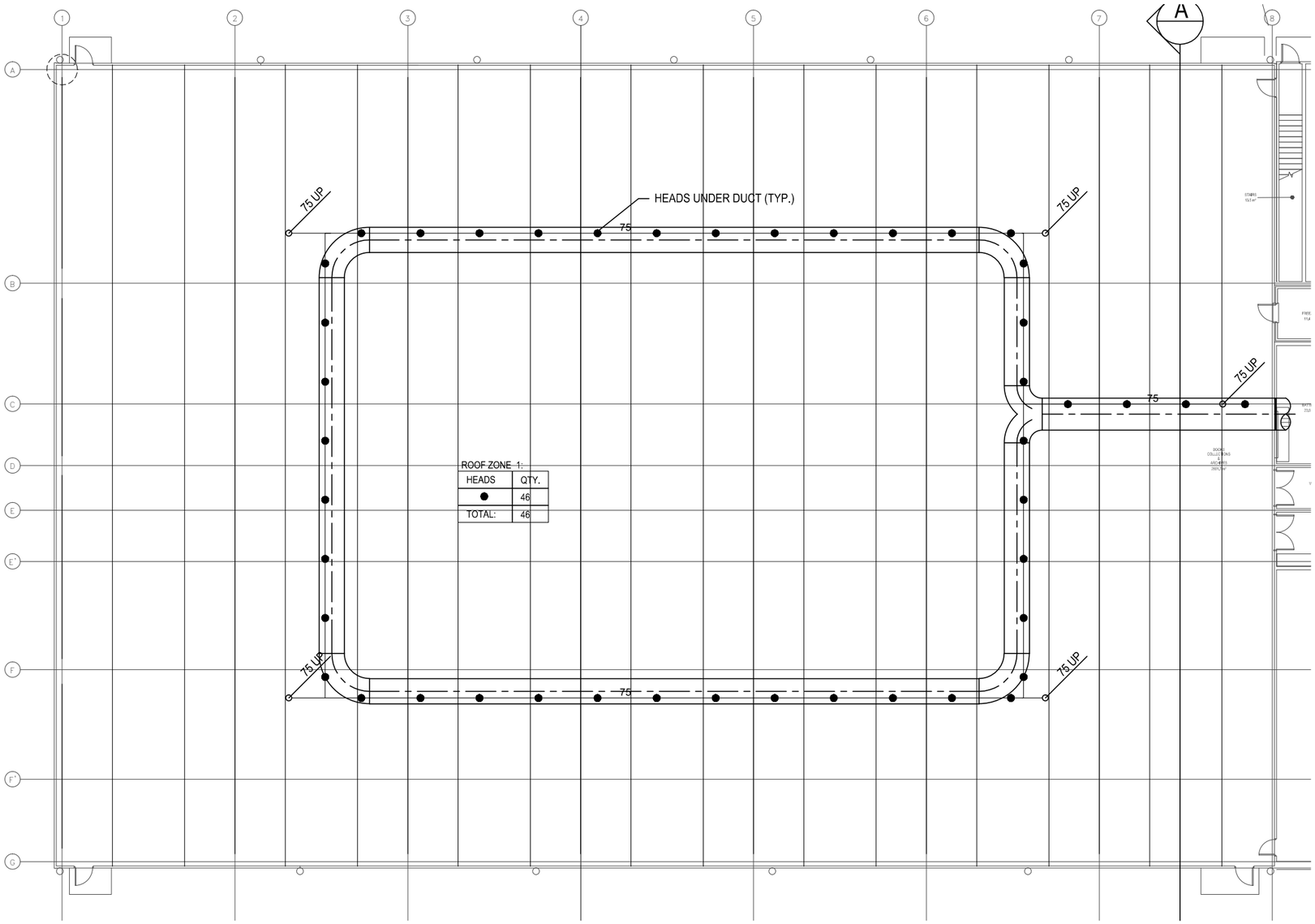
SYM	DESCRIPTION	NPT	ORIF.	TEMP.	K	CLR.	QTY.
●	ESFR. PEND.	1"	-	165°	25.2	BRS	XXX
⊗	STD. U/R	1/2"	1/2"	212°	5.6	BRS	X
○	STD. U/R	1/2"	1/2"	155°	5.6	BRS	XX
◕	QR. PEND.	1/2"	1/2"	155°	5.6	WHT	XX
◉	QR. CONCEALED PEND.	1/2"	1/2"	155°	5.6	WHT	XX
	TOTAL THIS SHEET						

ROOF ZONE 1:

HEADS	QTY.
●	294
TOTAL:	294



TILE 1A FIRE PROTECTION PLAN
SCALE: 1:200



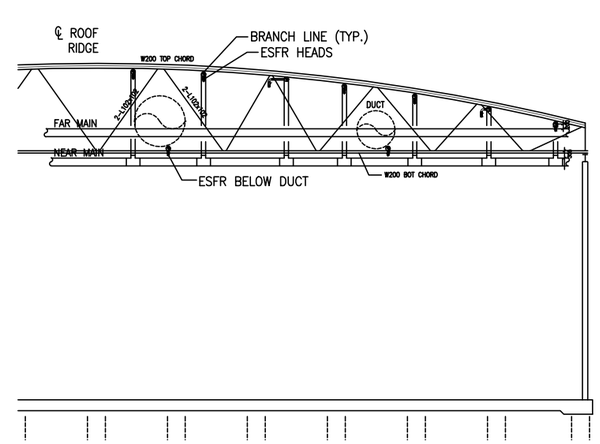
ROOF ZONE 1:

HEADS	QTY.
●	46
TOTAL:	46

DESIGN CRITERIA

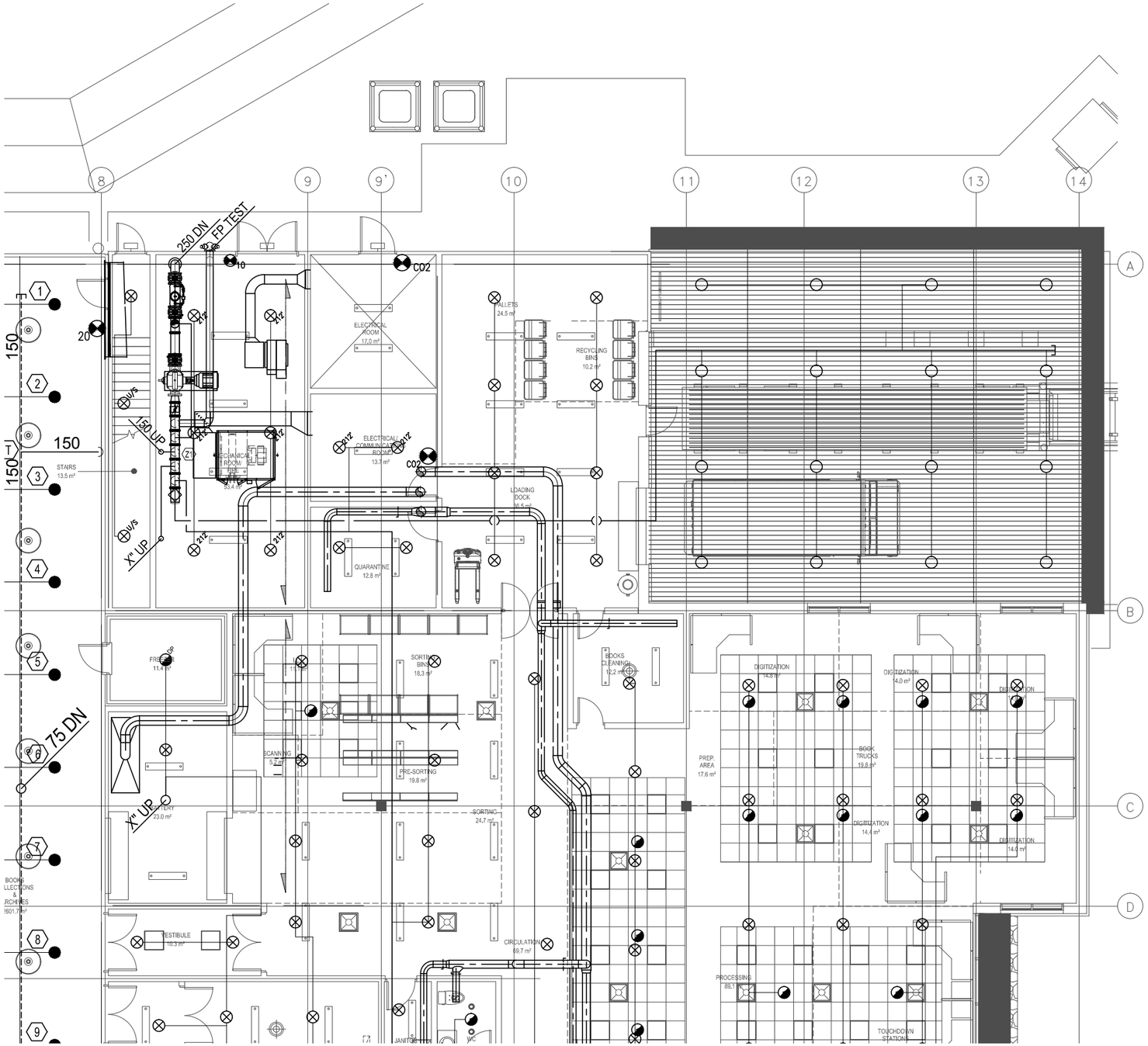
AREA	HIGH BAY RECORDS STORAGE
USE	
RACKING	
HEIGHT	40 FT MAX. STORAGE, 45 FT CEILING
DESIGN CRITERIA	K-25 ESFR, 40 PSI OPERATING PRESSURE 12 HEADS FLOWING 100 SQ.FT. MAX. 10 FT. MAX. SPACING
HOSE STREAM	250 GPM
IN-RACKS	NOT REQUIRED
HOSE STATIONS	NONE
CEILING SPRINKLER TYPE	~~VIC. V4404~~ ESFR-25, K=25.2, 165 DEG. F
CALCULATION #	# 1
CEILING SPRINKLER DEMAND (USGPM)	1921 USGPM.
I/O HOSE ALLOW (GPM)	100 USGPM. INSIDE HOSE 150 USGPM. OUTSIDE HOSE
TOTAL (USGPM)	XXX USGPM.
REQ. PRESSURE (PSI) AT F.P. DISCHARGE	XXX PSI.

SYM	DESCRIPTION	NPT	ORIF.	TEMP	K	CLR.	QTY.
●	ESFR. PEND.	1"	–	165°	25.2	BRS	XXX
◇	STD. U/R	1/2"	1/2"	212°	5.6	BRS	X
○	STD. U/R	1/2"	1/2"	155°	5.6	BRS	XX
◕	QR. PEND.	1/2"	1/2"	155°	5.6	WHT	XX
◉	QR. CONCEALED PEND.	1/2"	1/2"	155°	5.6	WHT	XX
	TOTAL THIS SHEET						



TILE 1B FIRE PROTECTION PLAN

SCALE: 1:250



LOADING ZONE 3:

HEADS	QTY.
○	16
⊗	8
TOTAL:	24

OFFICE ZONE 2:

HEADS	QTY.
◒	36
⊗212	8
⊗	67
⦿	13
◒DP	1
TOTAL:	XXX

DESIGN CRITERIA

AREA	HIGH BAY RECORDS STORAGE
USE	
RACKING	
HEIGHT	40 FT MAX. STORAGE, 45 FT CEILING
DESIGN CRITERIA	K-25 ESFR, 40 PSI OPERATING PRESSURE 12 HEADS FLOWING 100 SQ.FT. MAX. 10 FT. MAX. SPACING
HOSE STREAM	250 GPM
IN-RACKS	NOT REQUIRED
HOSE STATIONS	NONE
CEILING SPRINKLER TYPE	~~VICT. V4404~~ ESFR-25, K=25.2, 165 DEG. F
CALCULATION #	# 1
CEILING SPRINKLER DEMAND (USGPM)	1921 USGPM.
I/O HOSE ALLOW (GPM)	100 USGPM. INSIDE HOSE 150 USGPM. OUTSIDE HOSE
TOTAL (USGPM)	XXX USGPM.
REQ. PRESSURE (PSI) AT F.P. DISCHARGE	XXX PSI.

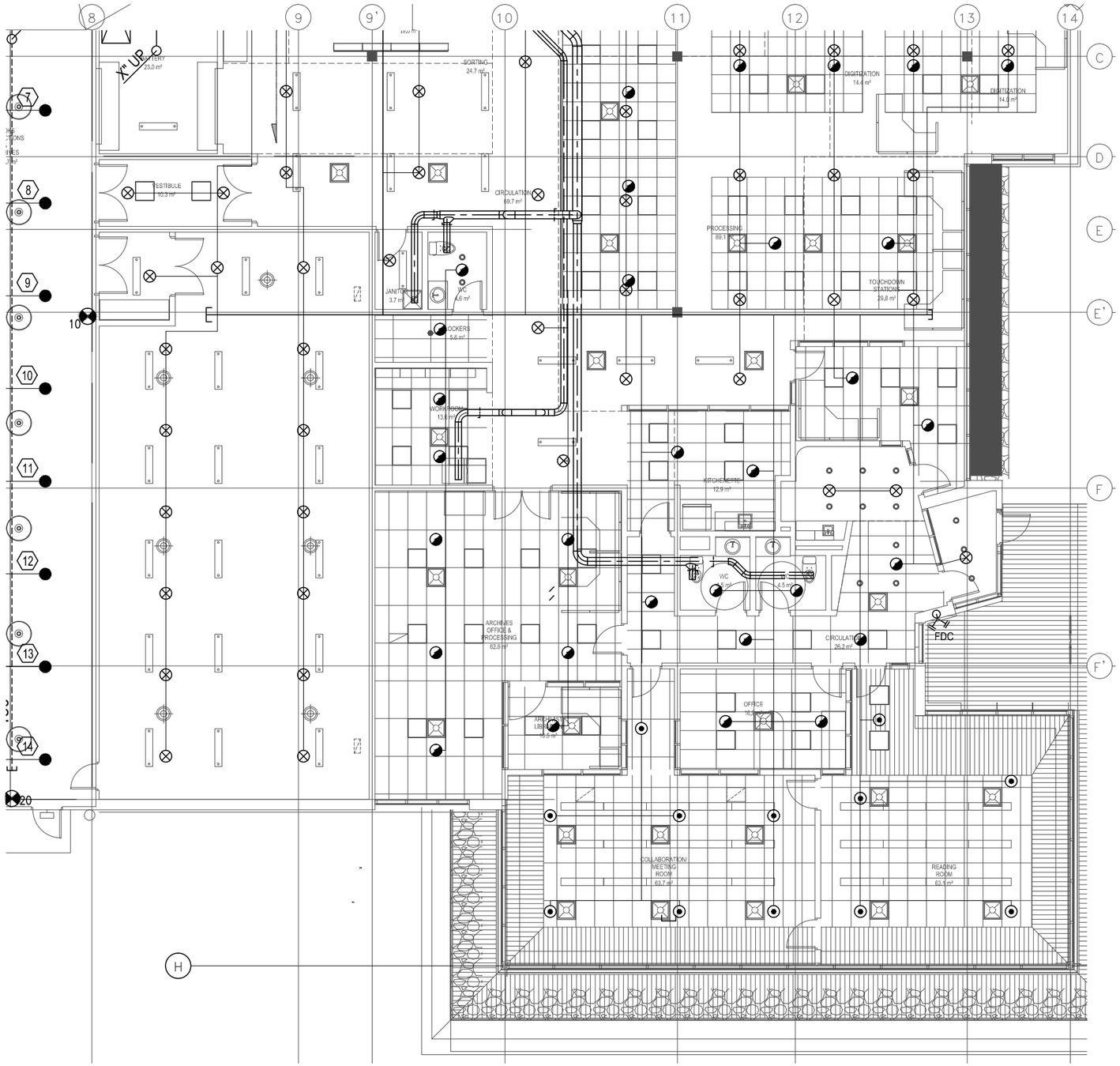
SYM	DESCRIPTION	NPT	ORIF.	TEMP.	K	CLR.	QTY.
●	ESFR. PEND.	1"	–	165°	25.2	BRS	XXX
⊗212	STD. U/R	1/2"	1/2"	212°	5.6	BRS	X
○	STD. U/R	1/2"	1/2"	155°	5.6	BRS	XX
◒	QR. PEND.	1/2"	1/2"	155°	5.6	WHT	XX
⦿	QR. CONCEALED PEND.	1/2"	1/2"	155°	5.6	WHT	XX
						TOTAL THIS SHEET	

LEGEND

①	10" ZURN 350A BACKFLOW PREVENTOR /W OS & Y
②	FIRE PUMP
③	JOCKEY PUMP (ELECTRIC)
④	FIRE DEPARTMENT CONNECTION
⑤	8" FIRE PUMP TEST HEADER C/W 8"x2 1/2"Ø HOSE VALVE
⑥	OS. & Y GATE VALVE
⑦	10" CHECK VALVE
⑧	10" BUTTERFLY VALVE C/W TAMPER SWITCH
⑨	10" BUTTERFLY VALVE C/W TAMPER SWITCH (N.C.)
⑩	DRY PIPE VALVE C/W STD. TRIM
F	FLOW SWITCH
T	TAMPER SWITCH
⧗	TEST & DRAIN
⊘	PRESSURE GAUGE
Ⓐ	AIR PRESSURE ALARM SWITCH
Ⓟ	WATER PRESSURE ALARM SWITCH
AMD	AIR MAINTENANCE DEVICE

TILE 2 FIRE PROTECTION PLAN

SCALE: 1:150



OFFICE ZONE 2:

HEADS	QTY.
●	36
⊗ 212	8
⊗	67
◉	13
◕ DP	1
TOTAL:	XXX

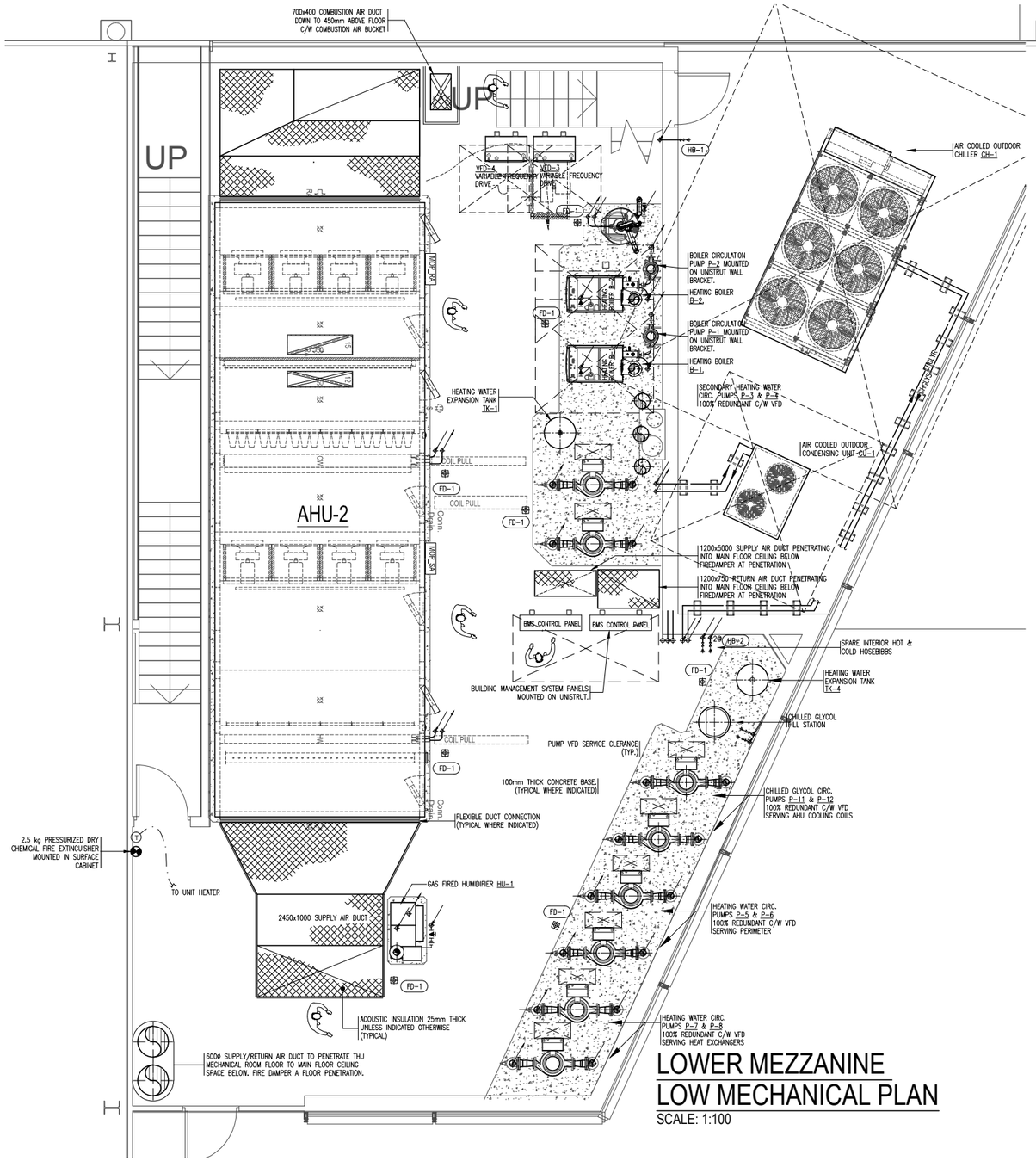
DESIGN CRITERIA

AREA	HIGH BAY RECORDS STORAGE
USE	
RACKING	
HEIGHT	40 FT MAX. STORAGE, 45 FT CEILING
DESIGN CRITERIA	K-25 ESFR, 40 PSI OPERATING PRESSURE 12 HEADS FLOWING 100 SQ.FT. MAX. 10 FT. MAX. SPACING
HOSE STREAM	250 GPM
IN-RACKS	NOT REQUIRED
HOSE STATIONS	NONE
CEILING SPRINKLER TYPE	~~VICT. V4404~~ ESFR-25, K=25.2, 165 DEG. F
CALCULATION #	# 1
CEILING SPRINKLER DEMAND (USGPM)	1921 USGPM.
I/O HOSE ALLOW (GPM)	100 USGPM. INSIDE HOSE 150 USGPM. OUTSIDE HOSE
TOTAL (USGPM)	XXX USGPM.
REQ. PRESSURE (PSI) AT F.P. DISCHARGE	XXX PSI.

SYM	DESCRIPTION	NPT	ORIF.	TEMP.	K	CLR.	QTY.
●	ESFR. PEND.	1"	–	165°	25.2	BRS	XXX
⊗ 212	STD. U/R	1/2"	1/2"	212°	5.6	BRS	X
○	STD. U/R	1/2"	1/2"	155°	5.6	BRS	XX
◕	QR. PEND.	1/2"	1/2"	155°	5.6	WHT	XX
◉	QR. CONCEALED PEND.	1/2"	1/2"	155°	5.6	WHT	XX
	TOTAL THIS SHEET						

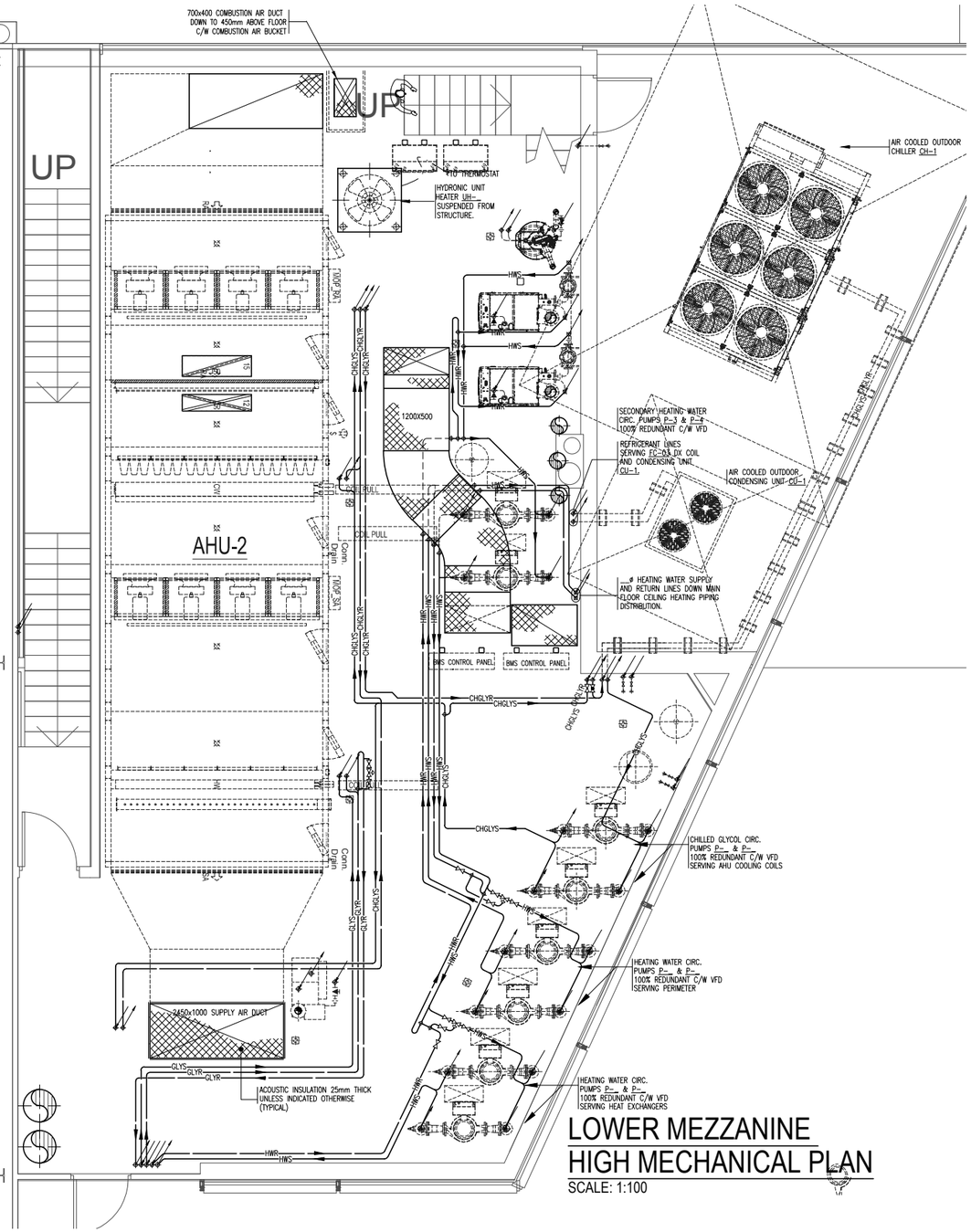
TILE 3 FIRE PROTECTION PLAN

SCALE: 1:150



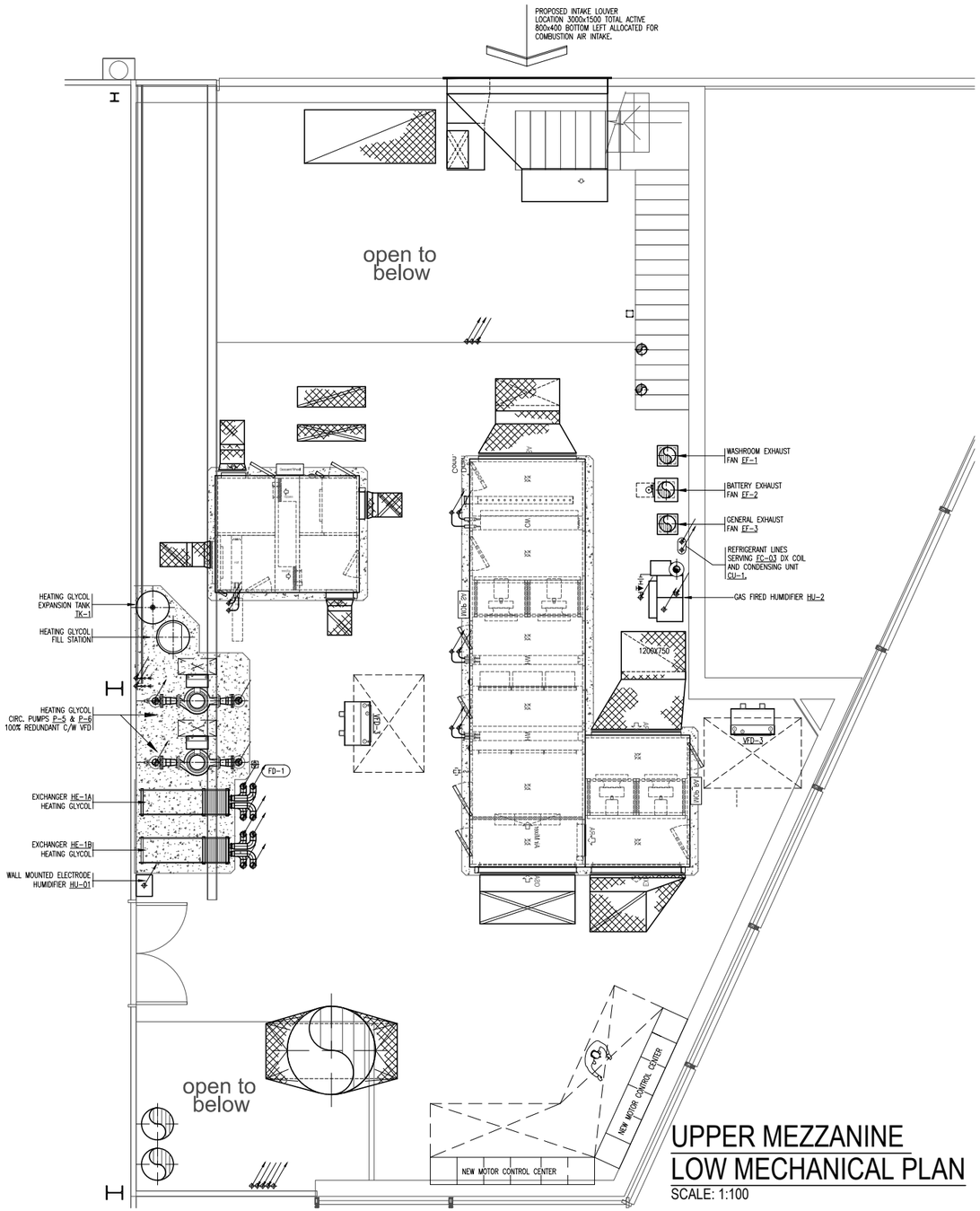
LOWER MEZZANINE LOW MECHANICAL PLAN

SCALE: 1:100



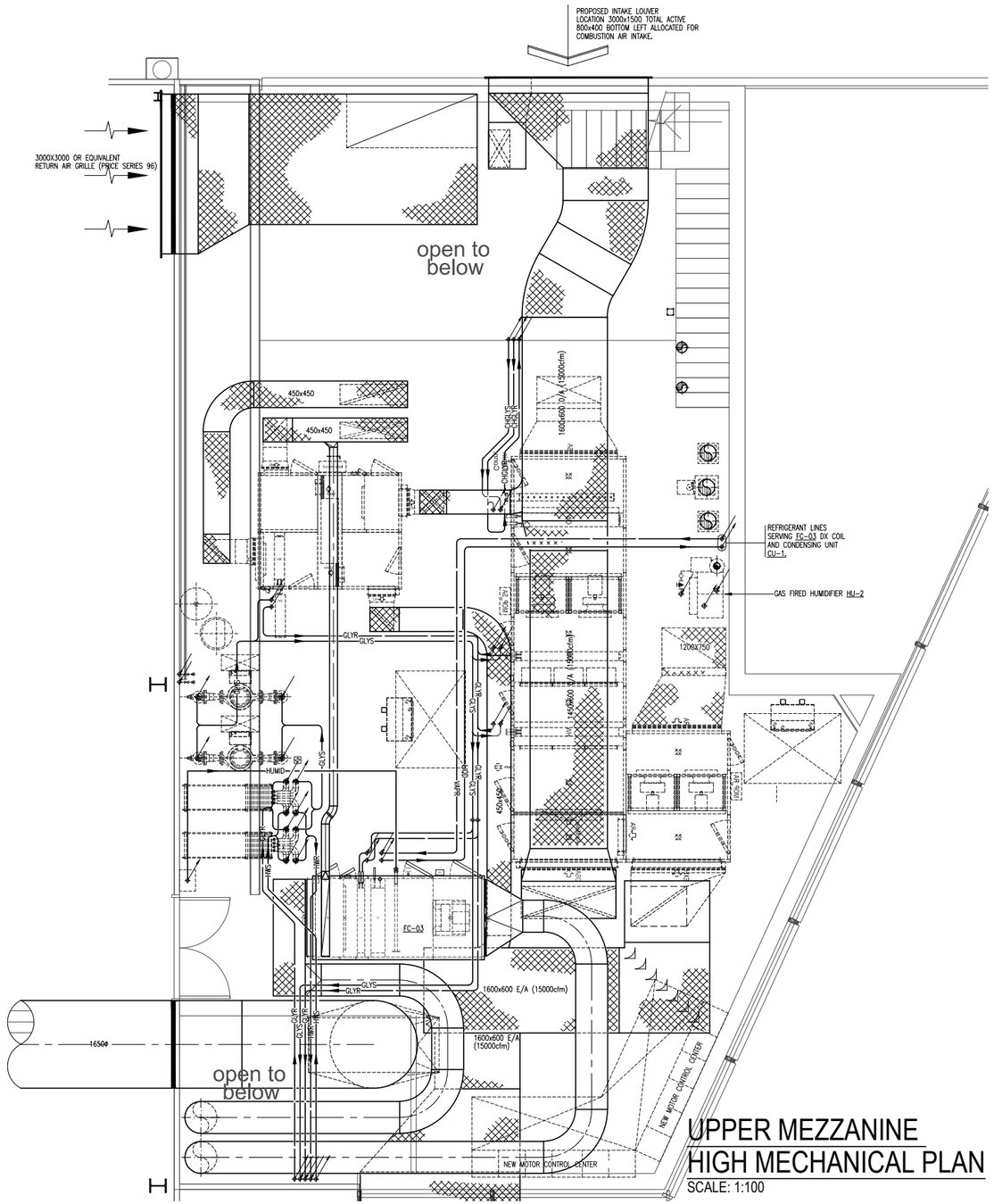
LOWER MEZZANINE HIGH MECHANICAL PLAN

SCALE: 1:100



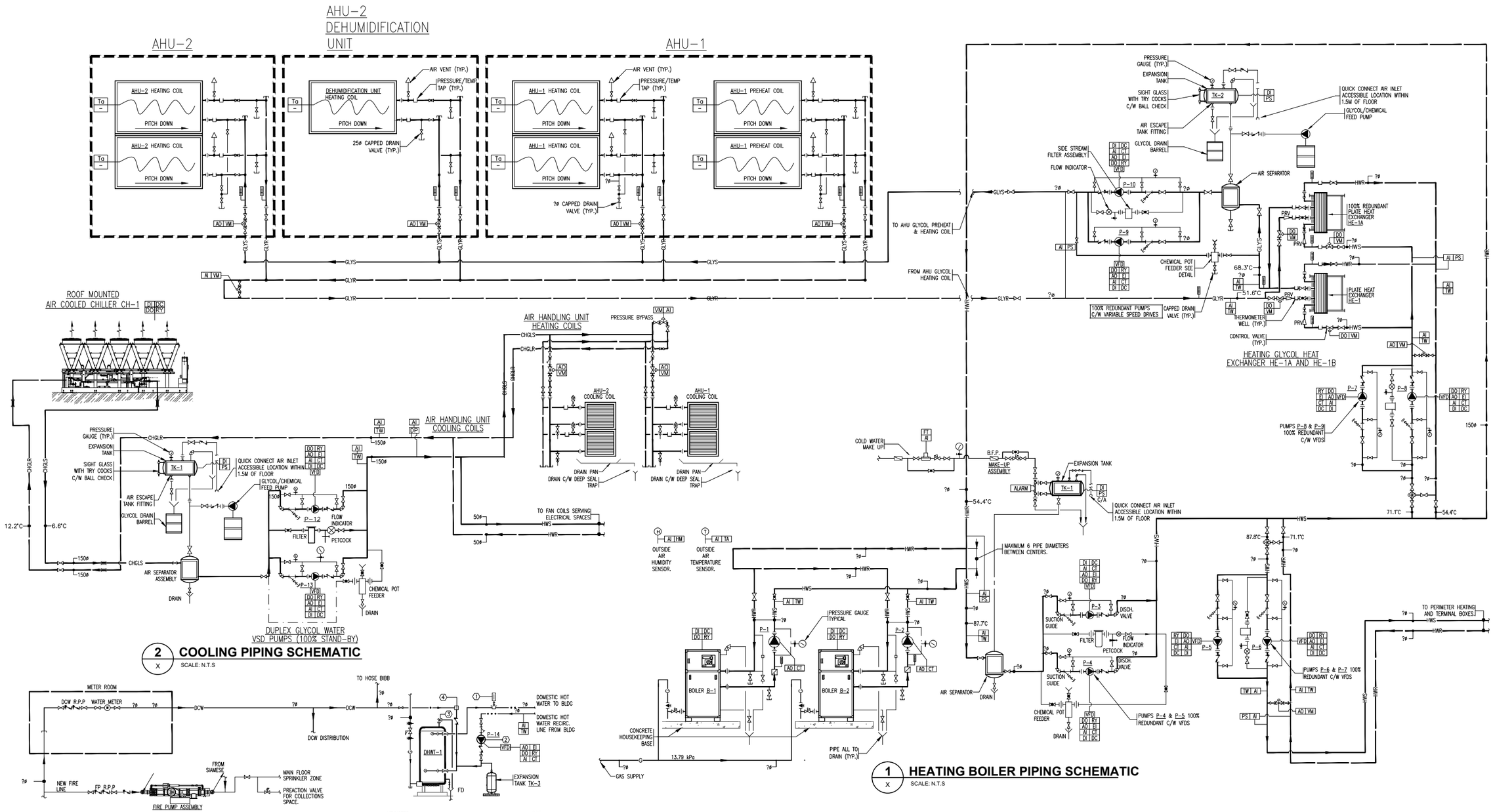
UPPER MEZZANINE LOW MECHANICAL PLAN

SCALE: 1:100



UPPER MEZZANINE HIGH MECHANICAL PLAN

SCALE: 1:100



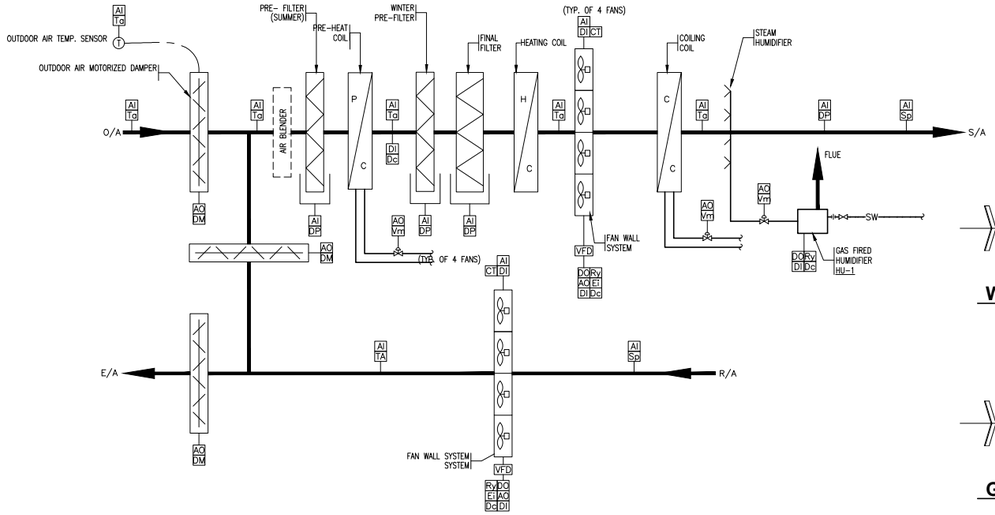
2 X **COOLING PIPING SCHEMATIC**
SCALE: N.T.S

3 X **DOMESTIC WATER SCHEMATIC**
SCALE: N.T.S

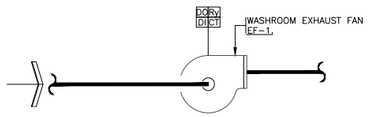
1 X **HEATING BOILER PIPING SCHEMATIC**
SCALE: N.T.S

MECHANICAL PIPING SCHEMATICS

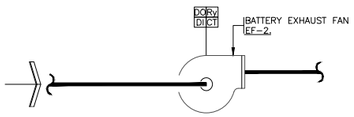
SCALE: N.T.S.



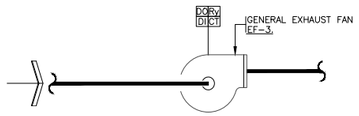
1 MX **AIR HANDLING UNIT SCHEMATIC - AHU-1**
SCALE: N.T.S



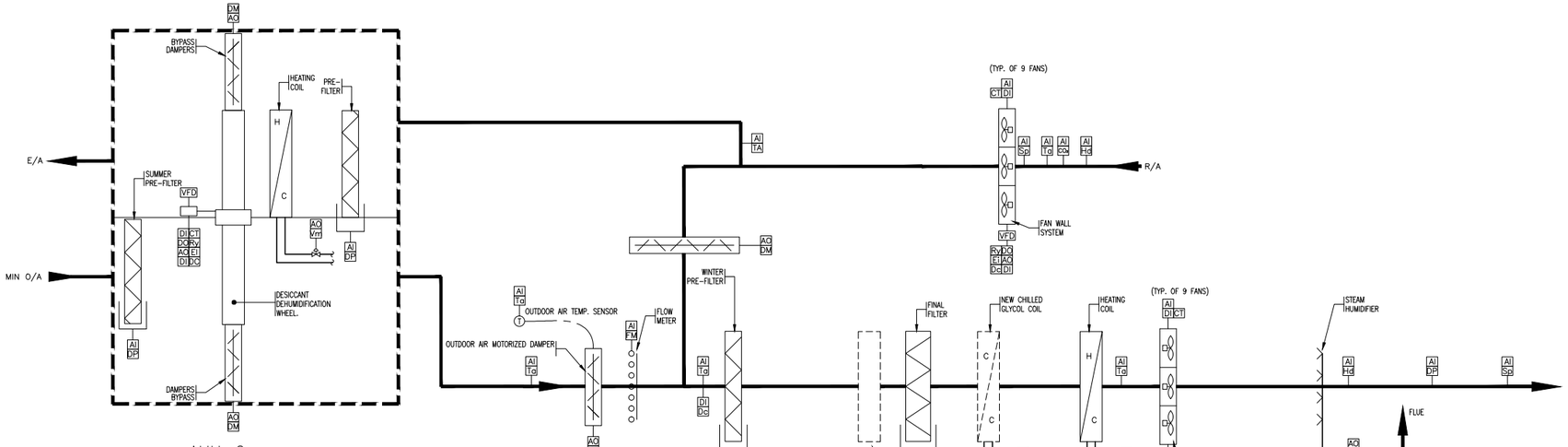
WASHROOM EXHAUST FAN EF-1



BATTERY EXHAUST FAN EF-2

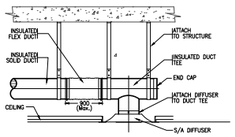


GENERAL EXHAUST FAN EF-3

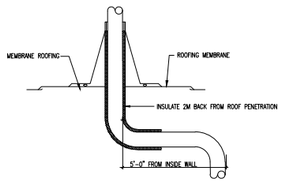


2 MX **AIR HANDLING UNIT SCHEMATIC - AHU-2**
SCALE: N.T.S

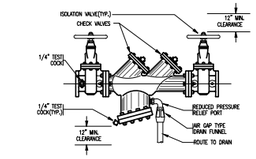
VENTILATION SCHEMATICS
SCALE: N.T.S.



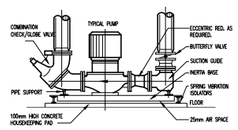
SUPPLY AIR DIFFUSER DUCT CONNECTION
SCALE: N.T.S.



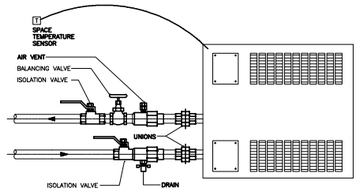
VENT THROUGH ROOF DETAIL
SCALE: N.T.S.



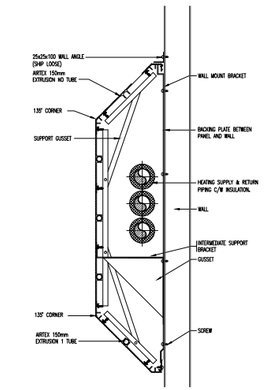
BACKFLOW PREVENTER DETAIL
SCALE: N.T.S



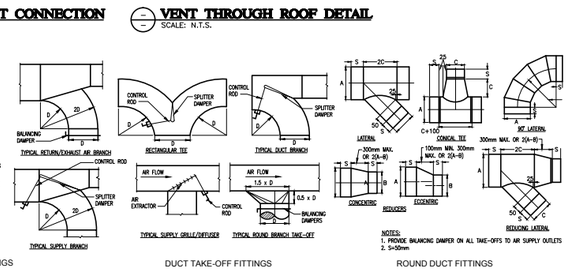
PUMP INSTALLATION DETAIL
M- SCALE: N.T.S



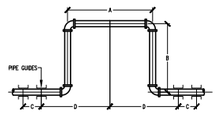
CABINET / FORCE FLOW HEATER DETAIL
M- SCALE: N.T.S



WALL MOUNTED RADIANT HEATING PANEL
M.S.



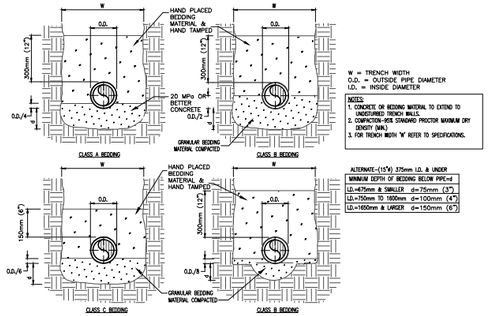
LOW VELOCITY DUCT FITTING DETAIL
SCALE: N.T.S.



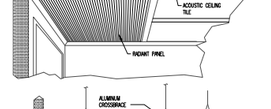
EXPANSION LOOP DETAIL

SIZE OF PIPE Inch (mm)	A Inch (mm)	B Inch (mm)	C Inch (mm)	D Inch (mm)
¾" (20)	24" (600)	40" (1000)	12" (300)	40" (1000)
1" (25)	24" (600)	40" (1000)	12" (300)	40" (1000)
1 ¼" (30)	24" (600)	60" (1500)	20" (500)	40" (1000)
1 ½" (40)	24" (600)	60" (1500)	20" (500)	40" (1000)
2" (50)	40" (1000)	60" (1500)	30" (800)	48" (1200)
2 ½" (65)	40" (1000)	60" (1500)	30" (800)	48" (1200)
3" (75)	40" (1000)	72" (1800)	44" (1100)	48" (1200)
4" (100)	48" (1200)	84" (2100)	48" (1200)	48" (1200)
6" (150)	48" (1200)	110" (2800)	72" (1800)	48" (1200)
8" (200)	48" (1200)	132" (3100)	100" (2500)	48" (1200)

EXPANSION LOOP DETAIL
SCALE: N.T.S.

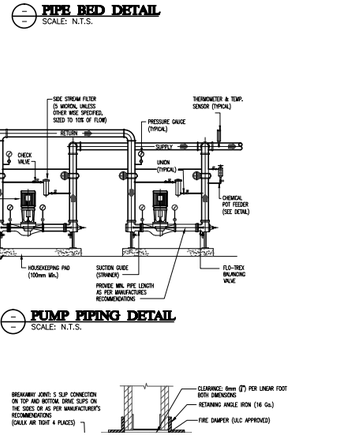


PIPE BED DETAIL
SCALE: N.T.S.

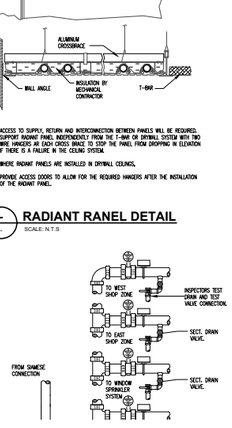


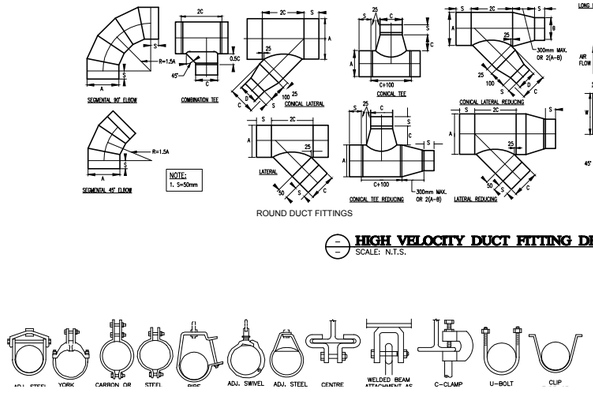
NOTE:
1. ACCESS TO SUPPLY, RETURN AND INTERCONNECTION BETWEEN PANELS WILL BE REQUIRED. SUPPORT RADIANT PANEL INDEPENDENTLY FROM THE T-BAR OR DRYWALL SYSTEM WITH TWO WIRE HANGERS AT EACH CROSS BRACE TO STOP THE PANEL FROM DROPPING IN ELEVATION IF THERE IS A FAILURE IN THE CEILING SYSTEM.
2. WHERE RADIANT PANELS ARE INSTALLED IN DRYWALL CEILINGS,
3. PROVIDE ACCESS DOORS TO ALLOW FOR THE REQUIRED HANGERS AFTER THE INSTALLATION OF THE RADIANT PANEL.

RADIANT RANEL DETAIL
SCALE: N.T.S

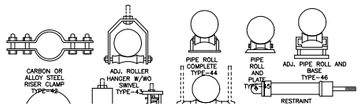


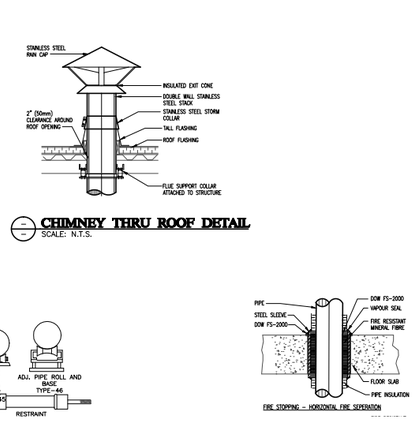
PUMP PIPING DETAIL
SCALE: N.T.S.





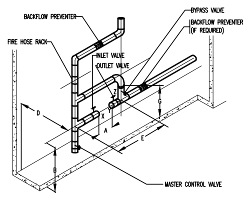
HIGH VELOCITY DUCT FITTING DETAIL
SCALE: N.T.S.





CHIMNEY THRU ROOF DETAIL
SCALE: N.T.S.

FIRE STOPPING - HORIZONTAL FIRE SEPERATION



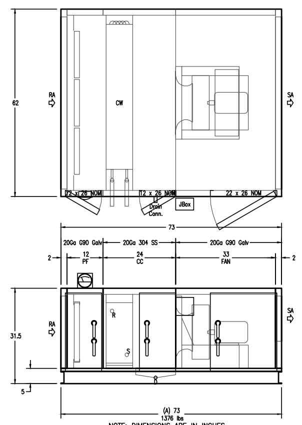
PIPE SIZE		MAXIMUM FLOOR AREA REQUIRED					
INCHES	mm	LENGTH ft.	WIDTH ft.	AREA sq. ft.	LENGTH m	WIDTH m	AREA sq. m
2	50	5	4.5	22.5	1.5	1.4	2.1
3	75	7	4.5	31.5	2.1	1.4	2.9
4	100	7	4.5	31.5	2.1	1.4	2.9
6	150	8	4.5	31.5	2.4	1.4	3.4

PIPE SIZE		A		B				C		D		E		F		G	
				min.		max.		min.		min.		min.		min.		max.	
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
2	50	36	900	15	375	18	450	36	900	18	450	48	1200	48	1200	66	1675
3	75	42	1050	15	375	18	450	36	900	18	450	54	1350	48	1200	66	1675
4	100	42	1050	15	375	18	450	36	900	18	450	60	1525	48	1200	66	1675
6	150	48	1200	18	450	18	450	36	900	18	450	66	1675	48	1200	66	1675

NOTES:

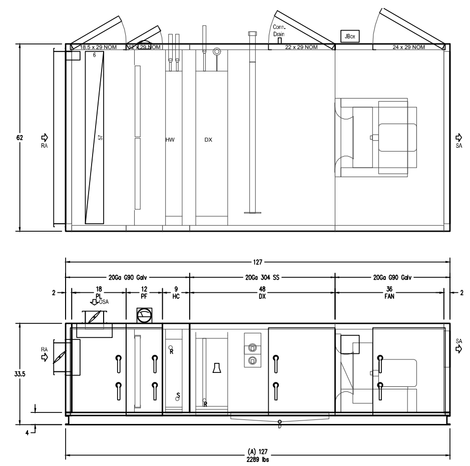
1. VALVE X AND Y MUST BE FEMALE THREADED OR FLANGED TYPE.
2. VALVE Z MAY BE LOCATED AT ANY POINT ON THE BYPASS, PROVIDED THAT IS IS ALWAYS WITHIN THE 66" (1675mm)MAXIMUM DISTANCE FROM THE FLOOR. THE MAIN PIPE ALIGNMENT MUST BE A MINIMUM 18" (450mm) FROM ANY WALL PARTITION, FIXTURE
3. OR OTHER PIPING. THE SPACE ABOVE FLOOR AREA C x E MUST BE FREE FROM OBSTRUCTIONS TO A HEIGHT OF 78" (1980mm).
4. ALL COMBINED DOMESTIC AND FIRE HOSE RACK SERVICES MUST HAVE A MASTER CONTROL VALVE BEFORE DOMESTIC TAKE-OFF. NO OTHER VALVE TO CONTROL FIRE HOSE EXCEPT BACKFLOW PREVENTER.
5. WATER SERVICE PIPING OUTSIDE BUILDING AND THROUGH BUILDING WALL TO BE INSTALLED IN ACCORDANCE WITH THE MUNICIPAL WATER DISTRIBUTION BYLAW NO.9416. FOR BACKFLOW INFORMATION AND REGULATIONS CONTACT 496-6806.
6. METER SETTINGS CONSTRUCTED USING PLASTIC PIPING SHALL HAVE ADEQUATE ANCHORING ON EACH SIDE OF THE METER CAPABLE OF KEEPING THE PIPE IN ALIGNMENT AND SUPPORTING THE WEIGHT OF THE METER, PIPE AND ALL OTHER
7. COMPONENTS.
8.

WATER METER DETAIL
SCALE: N.T.S.



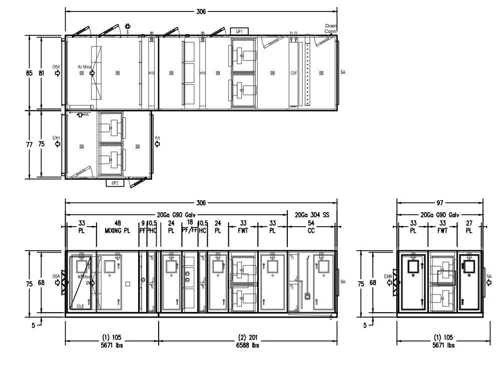
NOTE: DIMENSIONS ARE IN INCHES

FC-02 DETAIL
SCALE: N.T.S.



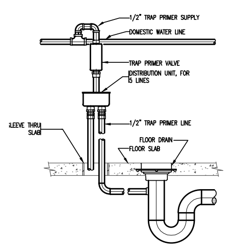
NOTE: DIMENSIONS ARE IN INCHES

FC-03 DETAIL
SCALE: N.T.S.

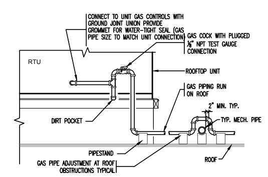


NOTE: DIMENSIONS ARE IN INCHES

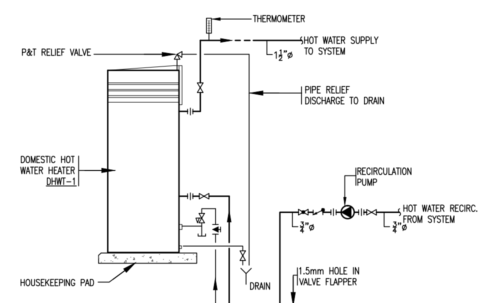
AHU-01 DETAIL
SCALE: N.T.S.



TRAP PRIMER DETAIL
SCALE: N.T.S.

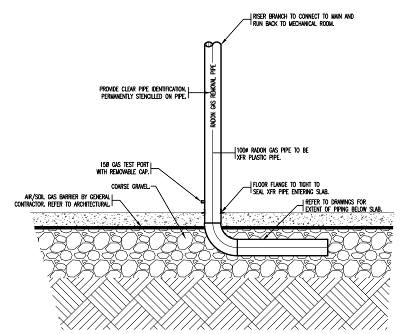


RTU GAS PIPING CONNECTION
SCALE: N.T.S.

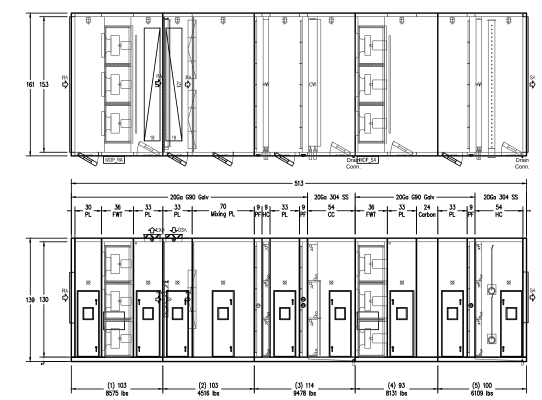


NOTE:
ALL VALVES 2" AND SMALLER SHALL BE BALL VALVE CONFIGURATION.

HOT WATER HEATER PIPING SCHEMATIC
SCALE: N.T.S.

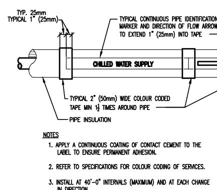


RADON DETECTION RISER DETAIL
SCALE: N.T.S.

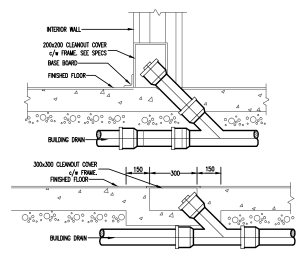


NOTE: DIMENSIONS ARE IN INCHES

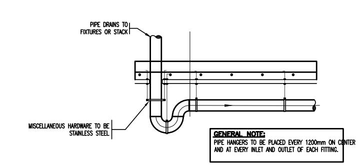
AHU-02 DETAIL
SCALE: N.T.S.



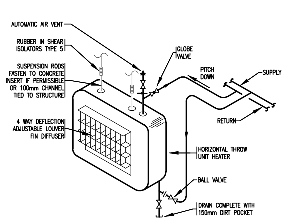
TYPICAL PIPE IDENTIFICATION DETAIL
SCALE: N.T.S.



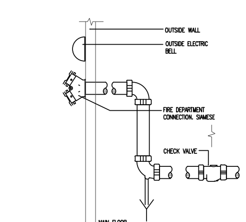
IN-FLOOR & WALL CLEANOUT DETAIL
SCALE: N.T.S.



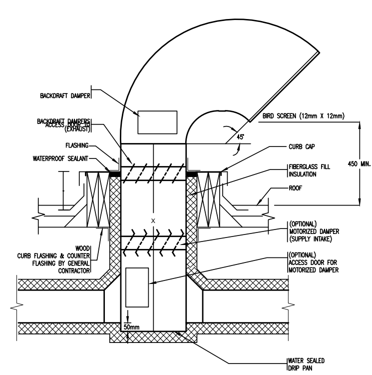
TYPICAL DETAIL FOR PIPE RISER THRU SLAB
N.T.S.



HORIZONTAL THROW UNIT HEATER
SCALE: N.T.S.

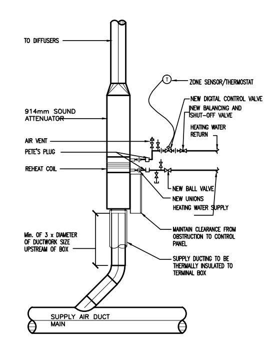


SIAMESE CONNECTION DETAIL
SCALE: N.T.S.

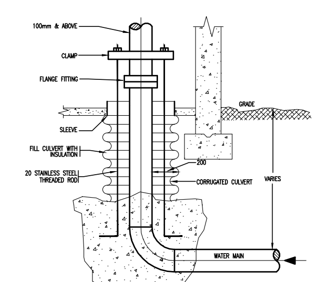


ROOFTOP INTAKE/EXHAUST GOOSNECK

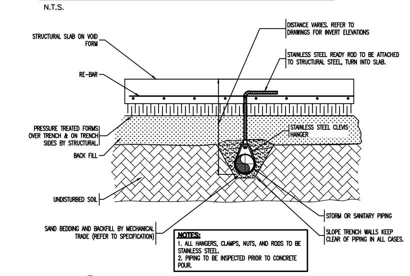
TYPICAL ROOF MOUNTED GOOSNECK DETAIL
SCALE: N.T.S.



VARIABLE VOLUME TERMINAL BOX DETAIL
SCALE: N.T.S.



UNDERGROUND WATER SERVICE ENTRY DETAIL
SCALE: N.T.S.



UNDERSLAB PIPE HANGER DETAIL
SCALE: N.T.S.

VIBRATION ISOLATION SCHEDULES

ISOLATED EQUIPMENT		BASE		ISOLATOR		Remarks
Description	Unit No.	Type	Thickness (mm)	Type	Static Deflection (mm)	
BOILERS	B-1 to B-2	–	–	8	6mm	–
PUMPS	P-1 to P-__	–	–	8	6mm	–
UNIT HEATERS	UH-1 to UH-__	–	–	6	12mm	–
VARIABLE SPEED DRIVES	VFD-1 to __	–	–	8	6mm	–
AHU-1 FANS (SF-1,2,3 & RF-1,2,3)	–	–	–	8	6mm	–
MUA-1	–	–	–	–	25mm	–
EXHAUST FANS	EF-1 to EF-_	–	–	–	25mm	–

FORCE FLOW AIR UNIT HEATER SCHEDULES

TAG	LOCATION	MANUFACTURER	MODEL	AIR FLOW (l/s)	HEATING CAPACITY (kW)	PRESSURE DROP (kPa)	HEATING MEDIA ENT./LVG. (°C)	WATER FLOW (l/s)	MOTOR (Watts)	DESCRIPTION/REMARKS
FF-1		ENGINEERED AIR					87.7/71.1		37	
FF-2		ENGINEERED AIR					87.7/71.1		37	FULLY EXPOSED WALL CABINET, ARRANGEMENT #2
UH-1		ENGINEERED AIR					87.7/71.1	1.73	373	
UH-2										
UH-3		ENGINEERED AIR					87.7/71.1			
UH-4		ENGINEERED AIR					87.7/71.1			
UH-5		ENGINEERED AIR					87.7/71.1			VERTICAL STYLE UNIT HEATER
TOTAL					##					

1. ALL FORCE FLOWS ENTRANCE HEATER TO BE COMPLETE WITH THERMOSTATS IN LOCKING COVER.
2. ALL UNIT HEATERS ARE TO BE COMPLETE WITH HANGERS AND THERMOSTATS LOCKING COVERS.

HEAT EXCHANGER SCHEDULE

					HEATING MEDIA (WATER)				HEATED MEDIA (PROPYLENE GLYCOL)				DESIGN PRESS	
UNIT TAG	LOCATION	SERVICE	MANUFACTURER	MODEL	FLOW (L/S)	ENT °C	LEAV °C	PRESS. DROP (kPa)	FLOW (L/S)	ENT °C	LEAV °C	PRESS. DROP (kPa)	(kPa)	NOTES
HE-1A	WET MECH RM.	HEATING	ARMSTRONG											BRAZED PLATE
HE-1B	WET MECH RM.	HEATING	ARMSTRONG											BRAZED PLATE

NOTE: STAINLESS STEEL 316 WITH COPPER BRAZING.

TANK SCHEDULES

TAG	SERVICES	MANUFACTURER	MODEL No.	ACCEPTED VOLUME (L)	DIAMETER	LENGTH	RATED WORKING PRESSURE	REMARKS
TK-1	HEATING WATER EXPANSION TANK	EXPANFLEX					861.9 KPA	BLADDER TYPE EXPANSION TANK
TK-2	HEATING GLYCOL EXPANSION TANK	EXPANFLEX					861.9 KPA	BLADDER TYPE EXPANSION TANK
TK-3	DOMESTIC HOT WATER HEATER EXPANSION TANK	EXPANFLEX					861.9 KPA	BLADDER TYPE EXPANSION TANK
TK-5	CHILLED GLYCOL EXPANSION TANK	EXPANFLEX					861.9 KPA	BLADDER TYPE EXPANSION TANK
TK-6	HYDRONIC SYSTEM FEEDER	AXIOM	SF-100	208	610	1245		.187 K∞ PUMP, .66 L/S @ 345 Kpa MAKE-UP CAPACITY 120V/60/1 STORAGE/MIXING TANK WITH COVER, PUMP SUCTION HOSE WITH INLET STRAINER, PRESSURE PUMP WITH THERMAL CUT OUT, INTEGRAL PRESSURE SWITCH, INTEGRAL CHECK VALVE, CORD AND PLUG, PRE-CHARGED ACCUMULATOR TANK WITH EPDM DIAPHRAGM, MANUAL DIVERTER VALVE FOR PURGING AIR AND AGITATING CONTENTS OF STORAGE TANK, PRESSURE REGULATING VALVE ADJUSTABLE (35–380 kPA) C/W PRESSURE GAUGE INTEGRAL REPLACABLE STRAINER, BUILT-IN CHECK VALVE, UNION CONNECTION, 12mmXB00mm LONG FLEXIBLE CONNECTION HOSE WITH CHECK VALVE, LOW LEVEL PUMP CUT OUT, PRESSURE PUMP CAPABLE OF RUNNING DRY WITHOUT DAMAGE.
TK-7	HYDRONIC SYSTEM FEEDER	AXIOM	SF-100	208	610	1245		.187 K∞ PUMP, .66 L/S @ 345 Kpa MAKE-UP CAPACITY 120V/60/1 STORAGE/MIXING TANK WITH COVER, PUMP SUCTION HOSE WITH INLET STRAINER, PRESSURE PUMP WITH THERMAL CUT OUT, INTEGRAL PRESSURE SWITCH, INTEGRAL CHECK VALVE, CORD AND PLUG, PRE-CHARGED ACCUMULATOR TANK WITH EPDM DIAPHRAGM, MANUAL DIVERTER VALVE FOR PURGING AIR AND AGITATING CONTENTS OF STORAGE TANK, PRESSURE REGULATING VALVE ADJUSTABLE (35–380 kPA) C/W PRESSURE GAUGE INTEGRAL REPLACABLE STRAINER, BUILT-IN CHECK VALVE, UNION CONNECTION, 12mmXB00mm LONG FLEXIBLE CONNECTION HOSE WITH CHECK VALVE, LOW LEVEL PUMP CUT OUT, PRESSURE PUMP CAPABLE OF RUNNING DRY WITHOUT DAMAGE.

AIR COOLED CHILLER SCHEDULES

TAG	SERVICES	MANUFACTURER	MODEL No.	FLUID TYPE	TOTAL COOLING	FLUID FLOW	PRESSURE DROP	ENTERING AIR TEMP. (°C)	FLUID TEMP. ENT./LVG. (°C)	ELECTRICAL	UNIT POWER	MCA/MOCP	REMARKS
CH-1	CHILLED GLYCOL	SMARDT	AC028.1BF06.F8AGDB.A006AA.G10	50% P.G.	302KW	15.3 L/S	111.4 KPA	35	12.2/6.6	575V	93.7 K/W	130/219	1.

1. INSTALLED OPTIONS – FREEZE PROTECTION, FREE COOLING OPTION, SUCTION SERVICE VALVES, NON-FUSED DISCONNECT, ENERGY MANAGEMENT MODULE, Al FIN/CU TUBE, LOW SOUND OPTION, CRN COOLER, BACnet COMMUNICATION, COIL TRIM PANELS, MINIMUM LOAD CONTROL. DUAL CIRCUITED POWER SUPPLY OPTION TO SUIT ELECTRICAL SERVICE AVAILABILITY.

RADIATION AND RADIANT PANEL SCHEDULES

TAG	MANUFACTURER	MODEL	LINEAR OUTPUT (WATTS/M)	HEATING MEDIA ENT./LVG. (°C)	DESCRIPTION	REMARKS
A	TWA PANEL	L---		90.5/73.8	600mm WIDE BARE ALUMINUM RADIANT PANEL C/W COPPER TUBE WITH ¾" ALUMINUM FINS. ALL RADIATION	3
A	TWA PANEL	L---				

1. RADIATION CABINETS TO BE COMPLETE WITH END CAPS, JOGGLE STRIPS, ACCESS DOORS, ENCLOSURES, BRACKETS, CORNERS, CAPS AND GROUND COLUMNS, HANGERS FOR PANELS WHERE THERE ARE NO CABINET TO BE SUPPLIED WALL TO WALL (OR WHERE SHOWN ON PLANS) WITH HEATING OUTPUT AS SPECIFIED.
3. RADIANT PANELS TO BE COMPLETE WITH FOIL FACE INSULATION BY MECHANICAL CONTRACTOR, CEILINGS. REFER TO DRAWINGS.

VARIABLE SPEED DRIVE SCHEDULES

TAG	DESCRIPTION	SERVICES	MANUFACTURER	MODEL	POWER	ELECTRICAL	REMARKS
VFD-1	VARIABLE SPEED DRIVE	AHU-1 SUPPLY FANS	ABB			575/3/60	
VFD-2	VARIABLE SPEED DRIVE	AHU-1 RETURN FANS	ABB			575/3/60	
VFD-1	VARIABLE SPEED DRIVE	AHU-2 SUPPLY FANS	ABB			575/3/60	NON-FUSED DISCONNECT, 5% INPUT LINE REACTOR, BACNET INTERFACE, INDIVIDUAL MOTOR OVERLOAD PROTECTION AND STARTER, PILOT LIGHT STATUS FOR EACH MOTOR, KEYPAD & LCD DISPLAY, AND 5% OUTPUT LOAD FILTER.
VFD-2	VARIABLE SPEED DRIVE	AHU-2 RETURN FANS	ABB			575/3/60	

DOMESTIC HOT WATER TANK SCHEDULES

TAG	SERVICES	MANUFACTURER	MODEL No.	INPUT (KW)	TANK CAPACITY (LITERS)	EFFICIENCY	LITERS/Hr @ 100°F RISE	POWER	DESCRIPTION/REMARKS
DHWT-1	DOMESTIC HOTT WATER	A.O. SMITH	BTH-120 (CYCLONE)	35	227	96%	523	120V/60HZ	

BOILER SCHEDULES

TAG	SERVICES	MANUFACTURER	MODEL No.	INPUT (KW)	OUTPUT (KW)	FLOW (GPM) @ 20°F	PRESSURE DROP	AMP DRAW	ELECTRICAL	DESCRIPTION/REMARKS
B-1	HEATING WATER									CONDENSING BOILER WITH 99% THERMAL EFFICIENCY, CSA, FULLY MODULATING 10:1 TURNDOWN, MODBUS COMMUNICATION. BOILER TO BE COMPLETE WITH INTEGRAL BOILER VARIABLE SPEED PUMP CONTROLLED BY LOCHINVAR SMART SYSTEM. (PUMP MODEL PUM2065) C/W ACCESSORIES TO BE C/W CONDENSATE TRAP & ACID NEUTRALIZER KIT
B-1	HEATING WATER									CONDENSING BOILER WITH 99% THERMAL EFFICIENCY, CSA, FULLY MODULATING 10:1 TURNDOWN, MODBUS COMMUNICATION. BOILER TO BE COMPLETE WITH INTEGRAL BOILER VARIABLE SPEED PUMP CONTROLLED BY LOCHINVAR SMART SYSTEM. (PUMP MODEL PUM2065) C/W ACCESSORIES TO BE C/W CONDENSATE TRAP & ACID NEUTRALIZER KIT

PUMP SCHEDULES

TAG	SERVICE	MANUFACTURER	MODEL No.	FLOW (L/s)	HEAD PRESSURE	MOTOR (KW)	MOTOR (RPM)	POWER	LIQUID TEMPERATURE	SUCTION SIZE	DISCHARGE SIZE	NOTES
P-1	BOILER CIRCULATION PUMP	ARMSTRONG										
P-2	BOILER CIRCULATION PUMP	ARMSTRONG										
P-3	SECONDARY HEATING PUMP	ARMSTRONG										
P-4	SECONDARY HEATING PUMP	ARMSTRONG										2,3
P-5	PERIMETER HEATING CIRC PUMP	ARMSTRONG										2,3
P-6	PERIMETER HEATING CIRC PUMP	ARMSTRONG										2,3
P-7	HEAT EXCHANGER CIRC PUMP	ARMSTRONG										2,3
P-8	HEAT EXCHANGER CIRC PUMP	ARMSTRONG										2,3
P-9	HEATING GLYCOL CIRC PUMP	ARMSTRONG										2,3
P-10	HEATING GLYCOL CIRC PUMP	ARMSTRONG										2,3
P-11	CHILLED GLYCOL CIRC PUMP	ARMSTRONG										2,3
P-12	CHILLED GLYCOL CIRC PUMP	ARMSTRONG										2,7
P-13	DOMESTIC HOT WATER RECIRC PUMP	ARMSTRONG										2,7
P-14	EMERGENCY FIRE PUMP	GRUNDFOS										8

1. COORDINATE PUMP FLOW AND HEAD PRESSURE WITH AWARD BOILER MANUFACTURER SPECIFICATIONS.
2. PROVIDE NIPPLE AND BALL VALVE AT TAPPED HOLE ON PUMP SUCTION AND DISCHARGE.
3. EQUIPPED WITH INTEGRAL VFD. PUMPS ARE 100% REDUNDANT
4. REFER TO SPEC SECTION 20 20 60 FOR RELATED ACCESSORIES.
5. COMPLETE WITH ALARM AND OIL LEVEL SENSORS
6. FLUID 50% PROPYLENE GLYCOL/50% WATER
7. EQUIPPED WITH INTEGRAL VFD. PUMPS ARE 60% REDUNDANT
8. C/W WALL MOUNTED VSD AND TEMPERATURE SENSOR

DIFFUSERS, GRILLES AND LOUVRE SCHEDULES

TAG	MANUFACTURER	MODEL	FINISH	CEILING TYPE	DESCRIPTION/REMARKS
S-1	PRICE	SPD	B12	T-BAR	600x600 SQUARE PLAQUE SUPPLY AIR DIFFUSER, CONFIRM CUSTOM COLOR WITH ARCHITECT
S-2	PRICE	HCD	B12	DUCT MOUNTED	HIGH CAPACITY DRUM DIFFUSER
S-3	PRICE	SERIES 520	B12	DUCT/WALL MOUNTED	STEEL DOUBLE DEFLECTION SUPPLY AIR GRILLE
R-1	PRICE	SERIES 80	B12	T-BAR/DRYWALL	EGGCRATE STYLE RETURN GRILLE
E-1	PRICE	SERIES 80	B12	DRYWALL	EGGCRATE EXHAUST GRILLE
T-1	PRICE	SERIES 80	B12	TBAR/DRYWALL	EGGCRATE TRANSFER AIR GRILLE
L-1	PRICE	JE443	COORDINATED WITH ARCHITECTURE	EXTERIOR/EXTERIOR WALL MOUNTED	43 DEGREE EXTRUDED ALUMINUM – FIXED BLADE LOUVRE
H-1	GREENHECK	FABRA HOOD	COORDINATED WITH ARCHITECTURE	ROOF RELIEF HOOD	900x900 (THROAT DIMENSION) ROOF MOUNTED RELIEF AIR HOOD.

ANTI-SCALE SYSTEM SCHEDULE

TAG	LOCATION	MANUFACTURER	MODEL	SERVICE FLOW RATE	CONNECTION SIZE (mm)	REMARKS
ASF-1	MECH. ROOM 151	WATTS				
ASF-2	MECH. ROOM 151	WATTS				
ASF-3	MECH. ROOM 151	WATTS				

TERMINAL BOX SCHEDULES

TAG	MANUFACTURER	MODEL	UNIT SIZE	AIR FLOW MIN. (L/s)	AIR FLOW MAX. (L/s)	AIR ENT./LVG. TEMP. (°C)	REHEAT COIL CAPACITY (KW)	HHD ENT./LVG. TEMP. (°C)	DESCRIPTION/REMARKS
B-1	PRICE	SDV 5000				12.7/30°		87.8/71.1°C	COMPLETE WITH REHEAT COIL AND SOUND ATTENUATOR
B-2	PRICE	SDV 5000				12.7/30°		87.8/71.1°C	COMPLETE WITH REHEAT COIL AND SOUND ATTENUATOR
B-3	PRICE	SDV 5000				12.7/30°		87.8/71.1°C	COMPLETE WITH REHEAT COIL AND SOUND ATTENUATOR
B-4	PRICE	SDV 5000				12.7/30°		87.8/71.1°C	COMPLETE WITH REHEAT COIL AND SOUND ATTENUATOR
B-5	PRICE	SDV 5000				12.7/30°		87.8/71.1°C	COMPLETE WITH REHEAT COIL AND SOUND ATTENUATOR
B-6	PRICE	SDV 5000				12.7/30°		87.8/71.1°C	COMPLETE WITH REHEAT COIL AND SOUND ATTENUATOR
B-7	PRICE	SDV 5000				12.7/30°		87.8/71.1°C	COMPLETE WITH REHEAT COIL AND SOUND ATTENUATOR
B-8	PRICE	SDV 5000				12.7/30°		87.8/71.1°C	COMPLETE WITH REHEAT COIL AND SOUND ATTENUATOR
B-9	PRICE	SDV 5000				12.7/30°		87.8/71.1°C	COMPLETE WITH REHEAT COIL AND SOUND ATTENUATOR
B-10	PRICE	SDV 5000				12.7/30°		87.8/71.1°C	COMPLETE WITH REHEAT COIL AND SOUND ATTENUATOR
B-11	PRICE	SDV 5000				12.7/30°		87.8/71.1°C	COMPLETE WITH REHEAT COIL AND SOUND ATTENUATOR
B-12	PRICE	SDV 5000				12.7/30°		87.8/71.1°C	COMPLETE WITH REHEAT COIL AND SOUND ATTENUATOR
B-13	PRICE	SDV 5000				12.7/30°		87.8/71.1°C	COMPLETE WITH REHEAT COIL AND SOUND ATTENUATOR
B-14	PRICE	SDV 5000				12.7/30°		87.8/71.1°C	COMPLETE WITH REHEAT COIL AND SOUND ATTENUATOR
TOTAL					#	12.7/30°	#		

AIR SYSTEM SCHEDULES

TAG	LOCATION	MAKE	MODEL	LINER TYPE	PRE-FILTER	FINAL FILTER	CAPACITY (L/s)	HEATING (kW)	COOLING (kW)	E.S.P. Sup/Ret (Pa)	MOTOR (kW) /POWER	DESCRIPTION
AHU-1	MECH RM.	VENTROL	(CUSTOM)	PERFORATED	FARR 30/30*	FARR RIGA-FLOW 100 MERV 13	14157	307.0	[illegible]	623/374	120/1/60 (FOR LIGHTS) REFER TO FAN SCHEDULE FOR MOTOR HP	18 GA 100mm CASING, HINGED DOORS WITH LOCKS, ROOF CURB, INLET HOOD WITH FILTER AND BIRD SCREEN, INTAKE DAMPERS, RETURN DAMPER, EXHAUST DAMPER, SUPPLY FAN (FAN WALL) (END DISCHARGE), RETURN FAN (FAN WALL) (TOP INLET), FILTER SECTIONS, CHILLED GLYCOL COOLING COIL, DISCONNECT AND CONTROLS AND PANEL (REFER TO CONTROL SECTION) REFER TO DETAIL, INCLUDE SERVICE RECEPTACLE. FAN WALL FANS, ELECTRICAL TO SUPPLY ONE CONNECTION TO VFD
AHU-2	MECH RM.	VENTROL	(CUSTOM)	PERFORATED	FARR 30/30*	FARR RIGA-FLOW 100 MERV 13	14157	307.0	[illegible]	623/374	1.3882	
DH-1	ROOF	VENTROL	(CUSTOM)	PERFORATED	FARR 30/30*	FARR RIGA-FLOW 100 MERV 13	14157	307.0	201	623/374	1.3882	

* 500 FPM FACE VELOCITY, 30% EFFICIENCY, INITIAL RESISTANCE 0.08" W.G., FINAL RESISTANCE 0.28" W.G., SUPPLIED WITH UNIT C/W 1 SPARE SET FOR MAINTENANCE
** 500 FPM FACE VELOCITY, 30% EFFICIENCY, INITIAL RESISTANCE 0.08" W.G., FINAL RESISTANCE 0.28" W.G., SUPPLIED WITH UNIT
*** 500 FPM FACE VELOCITY, 60-65% EFFICIENCY, INITIAL RESISTANCE OF [illegible]9" W.G., FINAL RESISTANCE 1.5" W.G.

COIL SCHEDULE

TAG	LOCATION	SERVICES	MANUFACTURER	AIR FLOW (L/S)	HEATING CAPACITY (kW)	UNIT SIZE	ENT./LVG. AIR TEMP (DRYBULB) (°C)	ENT./LVG. GLYCOL WATER TEMP.(°C)	REMARKS
AHU-1-PH-1	MECH RM. (AHU-1)	HEATING	VENTROL				-35.5/-11.1	68.3/51.6	PREHEAT
AHU-1-RH-1	MECH RM. (AHU-1)	HEATING	VENTROL				12.7/24.3	68.3/51.6	REHEAT
AHU-1-CC-1	MECH RM. (AHU-1)	COOLING	VENTROL				26.5/12.6	6.6/12.2	COOLING
AHU-2-PH-2	MECH RM. (AHU-2)	HEATING	VENTROL				-35.5/-11.1	68.3/51.6	PREHEAT
AHU-2-RH-2	MECH RM. (AHU-2)	HEATING	VENTROL				12.7/24.3	68.3/51.6	REHEAT
AHU-2-CC-2	MECH RM. (AHU-2)	COOLING	VENTROL				26.5/12.6	6.6/12.2	COOLING
DHU-3-PH-3	MECH RM. (AHU-3)	HEATING	VENTROL						PREHEAT

AN ALTERNATE-TUBE FEED 1 ROW COIL, WITH 5/8" O.D. TUBES. COIL TO SUPPLY HEADER. COIL IS PROOF TESTED AT A MINIMUM OF 300 psig AND A LEAK TESTED TO 200 psig. WORKING PRESSURE IS MAXIMUM 200 psig AT 250°F. COIL CASING TO BE MANUFACTURED WITH GALVANIZED STEEL. ALUMINUM PLATE FIN "PRIMA FLO E DESIGN. COIL CONNECTION IS ON ONE SIDE. COILS TO BE INSTALLED ON SITE, STAGGERED TO ALLOW FOR EASE OF REPLACEMENT.

CHIMNEY SCHEDULE

EQUIP. DESCRIPTION	HEAT RATING-(kW)	FLUE TEMP.	VENT TYPE	FUEL TYPE	REMARKS
HEATING BOILER B-1,B-2	465	204°C	TYPE "BH"	NATURAL GAS	FORCED DRAFT, ULC S636 AL29-4C
WATER HEATER DWH-1	35	60°C	TYPE "BH"	NATURAL GAS	FORCED DRAFT, ULC S636 PVC/CPVC OR AL29-4C
HUMIDIFIER HU-1 & HU-2				NATURAL GAS	

FILTER SCHEDULE

TAG	LOCATION	SERVICE	MANUFACTURER	MODEL	TOTAL AIR VOLUME (L/S)	FACE VELOCITY (MPS)	EFFICIENCY	INITIAL RESISTANCE (PA)	INITIAL RESISTANCE (IN. WG)	NOTES:
PF-1	AHU-1	PREFILTER	FARR	30/30	14158	2.54	30%	19.9	69.7	--
F-1	AHU-1	FINAL FILTER	FARR	RIGA-FLOW 100	14158	2.54	80-85%	124.55	373.6	--
MAPF-1	AHU-1	MIXED AIR PREFILTER	FARR	30/30	14158	2.54	30%	19.9	69.7	--
MAPF-2	AHU-1	MIXED AIR PREFILTER	FARR	30/30	14158	2.54	30%	19.9	69.7	--
MAPF-3	AHU-1	MIXED AIR PREFILTER	FARR	30/30	14158	2.54	30%	19.9	69.7	--
PF-2	AHU-2	PREFILTER	FARR	30/30	14158	2.54	30%	19.9	69.7	--
F-2	AHU-2	FINAL FILTER	FARR	RIGA-FLOW 100	14158	2.54	80-85%	124.55	373.6	--
PF-3	AHU-3	PREFILTER	FARR	30/30	14158	2.54	30%	19.9	69.7	--
F-3	AHU-3	FINAL FILTER	FARR	RIGA-FLOW 100	14158	2.54	80-85%	124.55	373.6	--
SF-4	MUA-1	SUMMER FILTER	DAFCO	MERV 13 GREEN PLEAT	2713	2.54	80-85%	19.9	69.7	--
WF-4	MUA-1	WINTER FILTER	DAFCO	MERV 13 GREEN PLEAT	2713	2.54	80-85%	19.9	69.7	--

HEAT WHEEL SCHEDULE

TAG	LOCATION	MANUFACTURER	DIMENSIONS (mm ø)	PERFORMANCE DATA	AIR VOLUME (L/s)	OUTDOOR AIR STREAM				EXHAUST AIR STREAM				SUPPLY AIR STREAM				RETURN AIR STREAM			REMARKS
						DRY BULB (°C)	WET BULB (°C)	ENTHALPY (kJ/kg)	PRESSURE DROP (Pa)	DRY BULB (°C)	WET BULB (°C)	ENTHALPY (kJ/kg)	PRESSURE DROP (Pa)	DRY BULB (°C)	WET BULB (°C)	ENTHALPY (kJ/kg)	PRESSURE DROP (Pa)	DRY BULB (°C)	WET BULB (°C)	ENTHALPY (kJ/kg)	
HW-1	AHU-1	SEMCO	2230	COOLING SEASON																	

FAN SCHEDULES

TAG	UNIT DESCRIPTION	LOCATION	MANUFACTURER	MODEL	CAPACITY (L/S)	E.S.P. (Pa)	FAN R.P.M.	MOTOR (KW.) /POWER	DESCRIPTION/ REMARKS	BARE FAN POWER (dB re: 10E-12 watts)										
SF-1 (AHU-1)	-- SUPPLY AIR FAN ARRAY PLENUM FANS C/W COPLANER SILENCERS & DISCHARGE BACKDRAFT DAMPERS	AHU-1 MECH ROOM AIRHANDLER	VENTROL	FAN WALL				-- KW TOTAL -- KW EA FAN		HZ	63	125	250	500	1K	2K	4K	8K	LwA	Lw
SF-2 (AHU-2)	-- SUPPLY AIR FAN ARRAY PLENUM FANS C/W COPLANER SILENCERS & DISCHARGE BACKDRAFT DAMPERS	AHU-2 MECH ROOM AIRHANDLER	VENTROL	FAN WALL				-- KW TOTAL -- KW EA FAN		INLET										
RF-1 (AHU-1)	6 - RETURN AIR FAN ARRAY PLENUM FANS C/W COPLANER SILENCERS & DISCHARGE BACKDRAFT DAMPERS	AHU-1 ROOF MOUNTED AIRHANDLER	VENTROL	FAN WALL				KW TOTAL KW EA FAN	VLIS,MG,BD,CS	HZ	63	125	250	500	1K	2K	4K	8K	LwA	Lw
RF-2 (AHU-2)	6 - RETURN AIR FAN ARRAY PLENUM FANS C/W COPLANER SILENCERS & DISCHARGE BACKDRAFT DAMPERS	AHU-2 ROOF MOUNTED AIRHANDLER	VENTROL	FAN WALL				KW TOTAL KW EA FAN		INLET										
EF-1	GENERAL EXHAUST (WASHROOM EXHAUST)	MECHANICAL ROOM	GREENHECK	[illegible]088	249.1	1291	1.1 kw	BD,WC,WH	HZ	62.5	125	250	500	1K	2K	4K	8K	LwA	dBA
										—	—	—	—	—	—	—	—	—	—
EF-2	VENTILATION EXHAUST FAN (INLINE CABINET FAN)	MECHANICAL ROOM	GREENECK		257	125	1854	.186 KW	AD	HZ	62.5	125	250	500	1K	2K	4K	8K	LwA	dBA
											—	—	—	—	—	—	—	—	—	—

Abbreviations:
AD - Access Door
AF - Air Foil
BD - Backdraft Damper
MG - Motor Guard
EP - Explosion Proof Motor
FC - Forward Curve
IS - Inlet Screen
IV - Inlet Vanes
BI - Backward Incline
DC - Drain Connection
DI - Double Inlet
DW - Double Width
EL - Extended Lube Lines
OS - Outlet Screen
SC - Speed Control Switch
SI - Single Inlet
SW - Single Width
VI - Spring Vibration Isolation
WC - Wall Collar (sidewall exhauster)
WH - Wall Housing (sidewall exhauster)
CS - Coplaner Silencers

PLUMBING FIXTURES SCHEDULES

FIXTURE DESIGNATION	MANUFACTURER/MODEL
WC-1 - BARRIER FREE - LOW FLUSH TANK WATERCLOSET	TOT ULTRAMAX II 1G ONE-PIECE TOILET. THE ONE-PIECE, ULTRA-HIGH EFFICIENCY DOUBLE CYCLONE FLUSHING SYSTEM TOILET SHALL BE 1.0GPF/3.8LPF. TOILET SHALL HAVE SANAGLOSS CERAMIC GLAZE AND BE AT UNIVERSAL HEIGHT. TOILET SHALL HAVE HIGH-PROFILE TANK, ELONGATED FRONT BOWL WITH SOFTCLOSE SEAT AND CHROME TRIP LEVER. TOILET SHALL BE TOTO MODEL MS604114CUFG.
LAV-1 - BARRIER FREE - COUNTER MOUNTED SELF-RIMMING/DROP-IN BASIN ELECTRONIC 'NO TOUCH' SOLAR POWERED FAUCET	AMERICAN STANDARD CADET UNIVERSAL ACCESS #9495.001 BASIN, CENTER HOLE ONLY, 533 MM X 445 MM X 175 MM (21" X 17-1/2" X 6-7/8") HIGH, OVAL, VITREOUS CHINA, SELF-RIMMING / DROP-IN, SIDE REAR OVERFLOW, FAUCET LEDGE. PROVIDE BASIN RIM SEALANT. SLOAN SOLIS #EAF-275/EAF-51 ELECTRONIC 'NO TOUCH' SOLAR POWERED FAUCET, CHROME PLATED, CENTER HOLE ONLY, CAST BODY, 148 MM (5-13/16") PROJECTION REACH, WITH, 1.3 L (0.35 US GAL) FLOW PER MINUTE MULTI-STREAM LAMINAR SPRAY HEAD, DUAL INFRARED SENSOR WITH AUTOMATIC SETTING FEATURE AND AUTOMATIC SELF-ADAPTING TECHNOLOGY, CONCEALED ABOVE DECK MAGNETIC SOLENOID VALVE, MICROPROCESSOR BASED LOGIC, 6 VDC LITHIUM BATTERY, SOLAR CELL THAT WILL HARNESS POWER FROM ARTIFICIAL INDOOR LIGHT, 6 VDC SOLAR ENERGY MODULE CONCEALED ABOVE DECK. LAWLER #TMM-1070, BELOW DECK MECHANICAL WATER MIXING VALVE, BRONZE BODY, TEMPERATURE ADJUSTING DIAL, 10 MM (3/8") INLETS AND OUTLET COMPRESSION FITTINGS, HIGH TEMPERATURE THERMOSTATIC LIMIT STOP, SHUT-OFF WITH AUTOMATIC RESET WHEN TEMPERATURE EXCEEDS 120 °F (48.8 °C), INTEGRAL CHECKS, OFFER TEMPERATURE RANGE FROM FULL COLD THROUGH 46 °C (114.8 °F). PROVIDE TEE, ADAPTORS AND FLEX. COPPER TUBING TO SUIT INSTALLATION. MCGUIRE #LFH170BV, FAUCET SUPPLIES, CHROME PLATED POLISHED BRASS, COMMERCIAL DUTY 1/4 TURN BALL VALVE ANGLE STOPS, 13 MM (1/2") I.D. INLET X 127 MM (5") HORIZONTAL EXTENSION TUBES, COMBINATION V.P. LOOSE KEY HANDLES, ESCUTCHEON AND FLEXIBLE COPPER RISERS. MCGUIRE #8872C P-TRAP, HEAVY CAST BRASS ADJUSTABLE BODY, WITH SLIP NUT, 32 MM (1-1/4") SIZE, SHALLOW WALL FLANGE AND SEAMLESS TUBULAR WALL BEND. MCGUIRE PROWRAP #PW2000MC SANITARY COVERING VANDAL-RESISTANT, FLEXIBLE SEAMLESS MOULDED CLOSED-CELL PVC RESIN, FORMULATED WITH ANTI-MICROBIAL ADDITIVE TO LIMIT THE GROWTH OF FUNGUS AND BACTERIA, TO EXPOSED PIPING (TO PROTECT AGAINST HEAT/CONTUSIONS) AS PER LOCAL CODES.
SK-1 - COUNTERTOP MOUNT SINK - SINGLE HANDLE FAUCET BELOW DECK MECHANICAL WATER MIXING VALVE	FRANKE COMMERCIAL #LBS6808-1/1 SINGLE BOWL COUNTERTOP MOUNT SINK, 1 HOLE, 508 MM (20") WIDE X 521 MM (20-1/2") X 203 MM (8") HIGH DEEP, COUNTER MOUNTED, BACKLEDGE, GRADE 18-10 20 GA. (0.9 MM) TYPE 302 STAINLESS STEEL, SELF-RIMMING, SATIN FINISH RIM AND BOWLS, MOUNTING KIT PROVIDED, FULLY UNDERCOATED TO REDUCE CONDENSATION AND RESONANCE, FACTORY APPLIED RIM SEAL, 3-1/2" (89 MM) CRUMB CUP WASTE ASSEMBLY WITH 1-1/2" (38 MM) TAILPIECE. DXV ISLE #D35409300 SINGLE HANDLE FAUCET, POLISHED CHROME, CENTER HOLE ONLY, CERAMIC DISC VALVE CARTRIDGE, 5.7 LPM (1.5 GPM) AERATOR OUTLET, SWIVEL GOOSENECK PULL-OUT SPOUT, LEVER HANDLE. LAWLER #TMM-1070, BELOW DECK MECHANICAL WATER MIXING VALVE, BRONZE BODY, TEMPERATURE ADJUSTING DIAL, 10 MM (3/8") INLETS AND OUTLET COMPRESSION FITTINGS, HIGH TEMPERATURE THERMOSTATIC LIMIT STOP, SHUT-OFF WITH AUTOMATIC RESET WHEN TEMPERATURE EXCEEDS 120 °F (48.8 °C), INTEGRAL CHECKS, OFFER TEMPERATURE RANGE FROM FULL COLD THROUGH 46 °C (114.8 °F). PROVIDE TEE, ADAPTORS AND FLEX. COPPER TUBING TO SUIT INSTALLATION. PROVIDE TEMPERED WATER TO HOT SIDE OF FAUCET. MCGUIRE #LFH170BV, FAUCET SUPPLIES, CHROME PLATED POLISHED BRASS, COMMERCIAL DUTY 1/4 TURN BALL VALVE ANGLE STOPS, 13 MM (1/2") I.D. INLET X 127 MM (5") HORIZONTAL EXTENSION TUBES, COMBINATION V.P. LOOSE KEY HANDLES, ESCUTCHEON AND FLEXIBLE COPPER RISERS. MCGUIRE #8912CB P-TRAP, HEAVY CAST BRASS ADJUSTABLE BODY, WITH SLIP NUT, 38 MM (1-1/2") SIZE, BOX FLANGE AND SEAMLESS TUBULAR WALL BEND.
SK-2 - COUNTERTOP MOUNT SINK - SINGLE HANDLE FAUCET BELOW DECK MECHANICAL WATER MIXING VALVE	FRANKE COMMERCIAL #LBS1306-1/1 SINGLE BOWL COUNTERTOP MOUNT SINK, 1 HOLE, 384 MM (15-1/8") WIDE X 392 MM (15-7/16") X 152 MM (6") HIGH DEEP, COUNTER MOUNTED, BACKLEDGE, GRADE 18-10 20 GA. (0.9 MM) TYPE 302 STAINLESS STEEL, SELF-RIMMING, SATIN FINISH RIM AND BOWLS, MOUNTING KIT PROVIDED, FULLY UNDERCOATED TO REDUCE CONDENSATION AND RESONANCE, FACTORY APPLIED RIM SEAL, 3-1/2" (89 MM) CRUMB CUP WASTE ASSEMBLY WITH 1-1/2" (38 MM) TAILPIECE. DXV ISLE #D35409300 SINGLE HANDLE FAUCET, POLISHED CHROME, CENTER HOLE ONLY, CERAMIC DISC VALVE CARTRIDGE, 5.7 LPM (1.5 GPM) AERATOR OUTLET, SWIVEL GOOSENECK PULL-OUT SPOUT, LEVER HANDLE. LAWLER #TMM-1070, BELOW DECK MECHANICAL WATER MIXING VALVE, BRONZE BODY, TEMPERATURE ADJUSTING DIAL, 10 MM (3/8") INLETS AND OUTLET COMPRESSION FITTINGS, HIGH TEMPERATURE THERMOSTATIC LIMIT STOP, SHUT-OFF WITH AUTOMATIC RESET WHEN TEMPERATURE EXCEEDS 120 °F (48.8 °C), INTEGRAL CHECKS, OFFER TEMPERATURE RANGE FROM FULL COLD THROUGH 46 °C (114.8 °F). PROVIDE TEE, ADAPTORS AND FLEX. COPPER TUBING TO SUIT INSTALLATION. PROVIDE TEMPERED WATER TO HOT SIDE OF FAUCET. MCGUIRE #LFH170BV, FAUCET SUPPLIES, CHROME PLATED POLISHED BRASS, COMMERCIAL DUTY 1/4 TURN BALL VALVE ANGLE STOPS, 13 MM (1/2") I.D. INLET X 127 MM (5") HORIZONTAL EXTENSION TUBES, COMBINATION V.P. LOOSE KEY HANDLES, ESCUTCHEON AND FLEXIBLE COPPER RISERS. MCGUIRE #8912CB P-TRAP, HEAVY CAST BRASS ADJUSTABLE BODY, WITH SLIP NUT, 38 MM (1-1/2") SIZE, BOX FLANGE AND SEAMLESS TUBULAR WALL BEND.
MR-1 - SERVICE / MOP SINK - TWO (2) HANDLE FAUCET	STERN WILLIAMS #SB-900 SQUARE SERVICE / MOP SINK, 610 MM (24") WIDE X 610 MM (24") X 305 MM (12") HIGH DEEP, FLOOR MOUNTED, TERRAZZO COMPOSED OF PEARL GRAY MARBLE CHIPS AND PORTLAND CEMENT GROUND SMOOTH, SEALED TO RESIST STAIN, ONE PIECE STAINLESS STEEL CAST INTEGRAL ON ALL SIDES, WITHOUT TILING FLANGE, CAST BRASS DRAIN WITH STAINLESS STEEL STRAINER, 3"(75 MM) OUTLET. CHICAGO FAUCETS #897-XK-CP WALL MOUNTED TWO (2) HANDLE FAUCET, CHROME PLATED, 8" (203 MM) CENTERSET, SOLID BRASS EXPOSED BODY, 1/4 TURN CERAMIC DISC VALVE CARTRIDGES, UNRESTRICTED HOSE END OUTLET, 203 MM (8") PROJECTION SPOUT WITH ATMOSPHERIC VACUUM BREAKER AND BUCKET HOOK, 60 MM (2-3/8") METAL VANDAL PROOF LEVER HANDLES WITH BLUE AND RED INDEX BUTTONS. STERN WILLIAMS T-35 HOSE AND WALL HOOK 36" (914 MM) LONG HOSE WITH 3/4" (19 MM) CHROME COUPLING, STAINLESS STEEL WALL BRACKET. STERN WILLIAMS T-40 MOP HANGER STAINLESS STEEL #4 FINISH, 24" (610 MM) LONG WITH 3 RUBBER SPRING LOADED CLIPS. STERN WILLIAMS BP BACK SPLASH PANEL 20 GA. (0.9 MM) TYPE 304 STAINLESS STEEL. PROVIDE P-TRAP, SAME MATERIAL AS THE CONNECTING PIPE DRAIN.
HB-1 - NON-FREEZE WALL HYDRANT WITH NB BOX, INTEGRAL VACUUM BREAKER	WATTS #HY-725-88-K HYDRANT NON-FREEZE HYDRANT, ALL BRONZE HEAD, SEAT CASTING AND INTERNAL WORKING PARTS, WALL MOUNT HYDRANT, CONCEALED, BRONZE WALL CASING, CHROME PLATED FACE, INTEGRAL VACUUM BREAKER, NICKEL BRONZE BOX AND DOOR, LOOSE KEY, CYLINDER LOCK, WALL CLAMP, 3/4" (19 MM) DIAMETER HOSE CONNECTION, 3/4" (19 MM) FEMALE X 1" (25 MM) MALE PIPE CONNECTION.
HB-2 - CAST BRASS HOSE BIBB	WATTS #SC8-3 HYDRANT - CAST BRASS, WALL MOUNT, WATTS MODEL 8B TAMPER-PROOF VACUUM BREAKER WITH BREAK-AWAY SCREW, ADJUSTABLE PACKING NUT CARTRIDGE, LAWN FAUCET, 1/2" (13 MM) OR 3/4" (19 MM) REGULAR PATTERN, DUAL SWEAT CONNECTION WITH CAST IRON HAND WHEEL.
FD-1 - FINISHED AREA	WATTS #FD-100-C-7-A5-1 FLOOR DRAIN - EPOXY COATED, CAST IRON BODY, REVERSIBLE FLASHING CLAMP WITH PRIMARY AND SECONDARY WEEPHOLES, TRAP PRIMER CONNECTION WITH PLUG, NO HUB OUTLET. WATTS -A5-1 5" (127 MM) DIAMETER, NICKEL BRONZE, ADJUSTABLE ROUND STRAINER.
FD-2 - FLOOR DRAIN WITH HEAVY DUTY GRATE	WATTS #FD-320-7-4 FLOOR DRAIN - EPOXY COATED, CAST IRON BODY, BODY COLLAR WITH WEEPHOLES AND MEMBRANE CLAMP, TRAP PRIMER CONNECTION WITH PLUG, ANCHOR FLANGE, NO HUB OUTLET. WATTS -4 7-7/8" (200 MM) DIAMETER EPOXY COATED DUCTILE IRON, HEEL-PROOF ROUND GRATE.

5.0 ELECTRICAL DESIGN

Introduction

The following electrical design and services report is for the proposed Research and Collection Resource Facility (RCRF). It is based upon an anticipated gross building area of approximately 40,000 ft^2.

The design documents for the RCRF will be completed in accordance with University of Alberta, governing local standards and codes, incorporating current energy efficient design practices.

This electrical design includes, but is not limited to, power distribution, branch circuitry, lighting, controls, and low tension systems.

Lighting throughout the facility will meet the owner's requirements, enhance the architectural features and provide a warm and inviting atmosphere to its occupants. Light sources throughout will be primarily fluorescent T5/8 and T5HO with LED lighting in the Reading, Collaboration Rooms and for exterior lighting. Lighting systems will be co-ordinated with the BMS and 'relay based' low voltage lighting control systems. System day lighting and occupancy sensors will be introduced to reduce unnecessary energy consumption where possible.

A combination of 347/600V and 120/208V, 3 phase 4 wire power sources will be distributed throughout the facility. 347/600V will be to feed larger mechanical loads; 120/208V 'the branch distribution' will be for general use, lighting, and user/base building equipment. A free standing exterior diesel-powered emergency generator will to be installed to service life safety systems and the fire pump.

A communication room will be centrally located so as to limit cabling distances to end devices. A fibre service for the building IT infrastructure, in addition to a wireless system will also be provided throughout the facility.

A card access security and CCTV system will monitor the major access points, main entrance, interior process area and loading dock.
Mass notification and general paging will be deployed through the fire alarm speaker system.
Audio/visual systems will be designed within the collaboration room along with a sound masking system.

Design Criteria

The electrical design will be based on the following applicable University of Alberta and other applicable standards including:

- University of Alberta, Facilities Management Commissioning Manual.
- University of Alberta, Electrical Design Guidelines.
- University of Alberta, Guidelines for Design and Installation of Street, Sidewalk and Area Lighting – Revised October 2000.
- University of Alberta, Fire Alarm Design Standards, draft copy issued January 2005.
- University of Alberta, Electric Utility Standards, draft issued December 2004.
- ANSI, IEEE, EEMAC Standard for High and Low Voltage Switchgear.
- Canadian Electrical Code – Part I Latest Edition
- Regulations of the Alberta Electrical Protection Branch – Safety Codes Act.
- Current Alberta Building Code.
- Current Alberta Fire Code.
- CSA Standard C282-05 Emergency Electrical Power Supply for Buildings.
- CSA Standard B651-95 Barrier Free Design.
- CSA Fire Alarm Standards and ULC Standards Latest Edition.
- Illuminating Engineering Society of North America (IESNA) Standards.
- IST Telecommunications Design Guidelines, University of Alberta Cabling Standards (version to be confirmed by U of A).
- University of Alberta, Lighting Design Guidelines and Standards (January 2009, Revision 0.2).

Each system outlined in this report will be discussed in further in-depth with the University of Alberta Facility Management group and the user groups.

Sustainable Design Considerations

The RCRF design is based upon achieving a 'Green Globes' certification. Engaging sustainable design creates a facility that will contribute to reduced future demands on the earth resources. There are three major areas that are impacted by engaging Green Globe practices into electrical systems:

- Energy conservation and lighting control systems
- Light pollution reduction
- Low mercury content within lamps

Sustainability design for the RCRF will be considered based on Facilities and Operations ability to support them within their operating and maintenance budgets.

<u>Other sustainable design options include:</u>

Energy Conservation:
The electrical energy percentage varies when viewed with the overall energy consumption of a facility. When expressed in actual utility costs, the electrical system consumes approximately 20 – 40% of the total building's energy budget. The following initiatives will be adopted in the design to reduce the building's energy consumption:

- Illumination sources will include LED lighting, T8 and T5HO fluorescent lamps. High efficiency luminaires provided wherever justified by application.
- The Minimum Energy Performance prerequisite in Green Globes complies with the minimum level of energy efficiency as specified in ASHRAE / JESNA 90.1. The basic requirement to improve energy performance is to include efficient control technologies. Lighting will be controlled via occupancy sensors in the warehouse and direct control through local switching in the office and public spaces.
- Occupancy, daylight harvesting sensors, photocells and local controls interconnected with the relay based lighting system will be supplied. In addition to the former an interface to the University's building automation system will optimize the use of lighting and ventilation systems when a space is occupied reduced when not occupied.
- Engineered lighting systems to provide appropriate lighting levels are safe and effective. The lighting will comply with prescribed guidelines rather than using light levels that are on the high end of the IESNA (Illuminating Engineering Society of North America) standard. Reduced ambient lighting levels are provided in offices and public spaces.
- Photovoltaic will not to be pursued at this point.

The following non-Green Globes energy efficient design parameters will be considered:

- Use of soft start or VFDs for larger motor loads to help reduce peak power demand.
- Power distribution centres will be located as close as possible to their connected loads, minimizing the length of branch circuit wiring which in turn will improve the voltage regulation and reduced capital costs.
- Designated equipment will have "manual-off-automatic" controls so as to be operated manually or automatically through the building management system.
- Copper versus aluminum-wound transformers will be installed. Copper windings are more efficient than aluminum-wound transformers and consume less energy.
- The design will favor the use of environmentally friendly LED and fluorescent lamps with low mercury content.

Power Distribution

Service:
University of Alberta will provide a primary service and pad-mounted 13.8 kV /600 V transformer.

Power Distribution System Design:
Based on a building size of approximately 40,000 $ft^{2.}$ the connected load for RCRF is estimated at approximately 450 kW. A 600A, 347/600V 3 phase 4 wire service is anticipated. The former will be further reviewed with U of A Electrical Utilities. The design provides for a minimum of 25% reserve capacity. Allowance for future expansion to the building has not been incorporated.

The Main Electrical Room will be located on the main floor with direct access to the exterior. It will house the 347/600V 3 phase and 120/208V, 3 phase 4 wire distributions and the automatic transfer switch for the emergency generator.

Electrical Distribution Equipment:
Mechanical Penthouse – A 600V distribution centre as well as 120/208V distribution panels will be provided.

The RCRF service entrance switchgear will be metal-enclosed indoor rated 600V, with withdrawable type power-air circuit breakers and programmable protective relays.

The general operating, distribution and utilization voltages for RCRF will be 600V, 3 phase 3 wire and 120/208V, 3 phase 4 wire. Step-down transformers, large mechanical motor loads, and with high amperage electrical loads will be supplied at 600V.

General electrical loads will be supplied from 120/208V, 3 phase 4 wire electrical distribution systems. 120/208 V panelboards will be located throughout the facility to meet user requirements. The panelboards will have a minimum of 25% spare for future use.

Emergency Power Distribution:
A 250kW emergency generator will be provided for the fire pump and life safety systems. The self-contained exterior diesel generator will be complete with a 24 hour sub-base fuel tank and sound attenuated enclosure.

Mechanical Systems:
All motors 0.25 kW and smaller will be single-phase 120V and all motors at 0.37 kW (1/2 hp) and larger will be 208V or 600V, 3 phase. The supply and installation of all motor protection switches, starters and disconnect switches will be provided by the electrical contractor. VFDs or soft starts will be provided for all motors 18.65 kW (25 hp) and larger. Disconnect switches will be provided for each motor. Motor control centres of the grouped design will be utilized where large quantities of mechanical equipment are located. Locations include mechanical rooms, penthouses, etc. Motor Control Centres will reduce capital costs of equipment and allow more effective use of mechanical room space. VFD controlled motor loads will be fed from Distribution Centres (CDP) rather than Motor Control Centres. Energy consumption of all HVAC loads will be measured for the Green Globes measurement and verification credit.

Grounding and Bonding:
The grounding system will be designed to provide a low impedance path for ground fault currents. The final design will be completed upon a further review of the soils conditions, completed during the next phase of design.

The main electrical rooms will have a grounding bus connected the ground grid. All non-current-carrying metal parts of equipment in the electrical rooms will be bonded as per Canadian Electrical Code. This will include all metal raceways, equipment enclosures, metal structures, low tension systems and miscellaneous metal systems. A bonding conductor will be provided in each conduit.

General Wiring:
All wiring will be copper installed in conduit. Feeders/ conductors 150A and larger may be aluminum. Conduits will not be installed in the concrete slabs providing greater flexibility for future renovations and additions.

Cable tray systems and other organized methods will be incorporated to aid future expansion and modifications to base building systems.

Life safety systems cabling including emergency lighting and fire alarm systems will be minimum one-hour fire rated. Inverter grade cables will be installed from VFD's to the motors when separated by more than 10 meters.

Lighting

The lighting systems will be designed to in accordance with the functional requirements of the user. Established standards and parameters for an educational facility will form the criteria. These in include the Illuminating Engineering Society of North America (IESNA) standards and the University of Alberta lighting design guide.

Achieving Green Globes certification may result in variances to the guidelines. Energy consumption and lighting levels will be weighed against the certification benefits.

RCRF lighting systems will be designed in concert with the users for the various tasks in both the storage facility and in the office. All systems will be cognizant of the possibility of reducing potential degradation to the collection materials.

The U of A and User Group prefer fluorescent lighting in the storage space. The abbreviated hours of operation for these fixtures would result in lower life cycle costs. The additional capital cost for LED lighting would not justify its installation.

The general lighting source within the facility will be fluorescent T-8 and T-5 lamps. LED lighting will be provided for the Reading, Meeting Rooms and for exterior lighting.

Lighting levels within the building will target the following values:

- General Office areas – 300 lux
- Work spaces – 450 lux
- Storage area – 250 lux

Additional lighting concepts being considered are:

- Wall washing luminaires on the north, south and west exterior elevations.
- Soffit lighting will be provided for the east canopy via the reading room lighting, main entrance and loading bay canopy.
- Vertical entry plinth lighting feature will be complete w LED lighting.
- Supplementing exterior site poles with luminaires to illuminate the landscaping.
- Bollard style landscape lighting in front of building

Lighting Control System:
Building lighting systems will be controlled to decrease energy use, allow flexibility, meeting the requirements of the University of Alberta, Green Globes program and to increase user comfort and ease of maintenance while reducing overall energy consumption.
The lighting control system will be interfaced with the Building Automation System.

Controls will include:

- Daylight sensors for perimeter spaces, including dimming control for luminaires.
- Occupancy sensors in the offices, loading dock and warehouse storage space.
- Manual switches (digital) will be provided in all rooms for local control and override.
- Exterior lighting will be provided with an atomic clock control.

Designated luminaires in public spaces and paths of egress will be connected to the emergency power system to comply with governing life safety codes.

Fire Alarm System

The fire alarm system will be a single-stage, annunciated, Class A wired and electrically supervised system. Zoning of the fire alarm system will be based on smoke zone subdivision. System devices will be addressable and will consist of manual pull station, products-of-combustion detectors, thermal detectors and sprinkler flow valves.

The possibility installation of a two-stage system will be considered during the next phase of design.

Fire alarm sounding devices and visual (strobes) will be in compliance with the latest Alberta Barrier-Free Code requirements. The building will be equipped with fire fighters telephone handsets.

Beam detection devices will be utilized for the warehouse area, allowing for ease of maintenance.

The fire alarm system will be interconnected into the campus wide FM Net system and Mass Notification System.

Low Tension Systems

Various low tension and security systems are envisioned for the RCRF.

Access Control System:
Discussions with the University of Alberta facility management staff and RCMS to define the door access requirements is still underway and will be finalized at the next stage of design.

Further review will be required in conjunction with a CPTED review. The project will allow for the installation of a conduit and cabling system complete with all necessary power supplies, end devices and architectural electrified door hardware.
Access control has been provided for the following locations:

- Loading dock
- Main entrance
- Interior process space from the main entrance.
- Archives Office & Processing
- Manager Office (Processing)

Security Television System:
Security television will be provided in the following areas:

- Process area
- Reading room
- Collaboration Meeting Room
- Archives Office & Processing Area
- Loading dock
- Cameras at main entrance either mounted on light pole or in main entrance soffit.

Emergency Blue Phone System:
There is no provision for a blue phone system. CPTED will confirm future requirements.

Sound Masking System:
Sound masking system rough in will be provided within the Reading and Collaboration rooms for future noise attenuating measures.

Mass Notification System:
A Mass Notification system will be deployed throughout the facility, fully integrated with the Campus wide system. The former will be interfaced with the fire alarm system. The system will incorporate text to speech functions through the fire alarm system speakers. Marque messaging boards and Alertus panels will be provided allowing further coordination with the University.

Communication Infrastructure:
Main Communication Room – Service Entrance:
Main Communication room will be located on the main floor adjacent the main electrical room and will house telephone/ data, demark point, fire alarm and security head end systems.

The RCRF User IT group will work with the design team and IST to determine facility requirements. The main server will be housed within this facility. Further investigation is required to finalize the design.

Three sets of four inch conduits will be provided from the new communication room to a new fiber vault located at the northeast end of the site. The existing conduits will be abandoned. New conduits will be installed from the communication room to the west property line via the north ROW for future development. UofA will confirm the final raceway routing and scope.

Structured Cabling Pathways:
Communications cabling will be installed in conduits, stubbed up to the nearest basket style cable tray and terminated at the designated Communications Room.

Cable trays will be 105mm by 300mm. All conduits for communication systems shall be EMT (electrical metallic tubing). Flex conduit will not installed. Minimum conduit size for voice/data outlets will be 27 mm. Maximum fill ratio is 40% per the Telecommunication Industry Association standards. Office areas will have additional sets of two (2) conduits complete with pull strings located on an opposite wall for future growth and/or support office rearrangements. Design will provide for one power receptacle (two per duplex outlet) per data port.

Routing of horizontal structured cabling will be accomplished by utilizing the main cable trays within the corridors. Conduits will be stubbed into the ceiling space from voice/data outlets. FT6 rated cabling will be provided.

Data and Voice Cabling – Structured Cabling:
A duplex outlet will be installed in close proximity to all voice and data drop outlets including future locations.

- Data Network Architecture: using standard Ethernet design concepts and protocols, this system will be built on a logical bus and centralized physical star topology using vertical and horizontal cabling and localized switching. The horizontal segments will be built using structured cabling solutions with home runs from the outlet jack back to rack mounted patch panels inside the closest Communications Room. Vertical segments will provide connections between the Communications Rooms and a centralized location such as the Main Communication room. Fiber connections will be made to the campus wide area network(s).

Data Outlets:
Copper: Certified Category 6 (CAT 6) unshielded twisted pair structured FT6 rated cable will be utilized for horizontal distribution. The maximum cable run distance will be 90 m between termination and end devices (additional 10 m allowance for interconnecting patch cabling).

Voice:
Voice communication will consist of Voice over Internet Protocol (VoIP) for standard voice and data communication.

VoIP Network Architecture: This will consist of a certified CAT.6 UTP FT6 rated cable between each outlet jack to a rack inside the Communication Rooms.

The cabling will be translated into a fiber connection at the rack then back to the Main Communication Room where it will connect to a VoIP Call Manager.

Telephone handsets and the telephone switch will be supplied, installed and programmed by the University of Alberta.

Wireless Local Area Network:
With the exception of areas sensitive to radio frequency interference (RFI), this facility will contain a complete 802.11abg enterprise designed wireless infrastructure. The former will consist of access points, network switches, servers, wireless local area network (WLAN) controllers and the necessary cabling infrastructure as required throughout all general and service areas.

The University of Alberta has conducted a review of existing WLAN technologies for capable enterprise wide wireless wide area network (WWAN) solutions and has determined a Cisco system provider. The RCRF wireless solution will be an extension of the campus wireless system. Wireless hot-spots will be offered for the general public.

The density of access points will be generally spaced at 10 to 20m based on the level of usage required. Further comments will be provided by IST group.

Commissioning and Testing

The commissioning and testing of major electrical equipment and systems will be undertaken by a commissioning and testing agency. part of the electrical contractor's scope of work
The work will include;

- Verification, start-up procedures and safety procedures
- Operation and Maintenance manuals incorporating copies of shop drawings, complete schematic diagrams, recommended maintenance schedules, logs, system operation write-ups, and test results

LEGEND OF SYMBOLS

LIGHTING

	RECESSED LUMINAIRE
	WALL MOUNTED LUMINAIRE
	RECESSED LUMINAIRE ON EMERGENCY POWER
	WALL MOUNTED LUMINAIRE ON EMERGENCY POWER
	RECESSED LUMINAIRE
	SURFACE MOUNTED LUMINAIRE
	STRIP LUMINAIRE
	WALL MOUNTED LUMINAIRE
	RECESSED LUMINAIRE ON EMERGENCY POWER
	STRIP LUMINAIRE ON EMERGENCY POWER
	SURFACE MOUNTED LUMINAIRE ON EMERGENCY POWER
	WALL MOUNTED LUMINAIRE ON EMERGENCY POWER
	POLE MOUNTED LUMINAIRE
	LIGHTING BOLLARD
	LIGHTING LUMINAIRE TYPE TAG
	EXIT LIGHT - CEILING (C/W ARROWS AS INDICATED)
	EXIT LIGHT - WALL (C/W ARROWS AS INDICATED)
	SWITCH - LOW VOLTAGE
D	SWITCH - DIMMER SWITCH
OS	OCCUPANCY SENSOR - CEILING MOUNTED
DS	DAYLIGHT HARVESTER - CEILING MOUNTED
	SWITCH - MOTION SENSOR SWITCH

SYSTEMS

	DATA OUTLET
	COMBINATION VOICE/DATA OUTLET
	TELEVISION OUTLET
	FLOOR MOUNTED COMBINATION VOICE/DATA OUTLET
	CHIME / BUZZER
	PUSHBUTTON

SECURITY

CR	CARD READER
KP	KEYPAD
ES	ELECTRIC STRIKE
DC	DOOR CONTACT
MS	MOTION SENSOR - CEILING MOUNTED
	CCTV CAMERA

POWER

	DUPLEX RECEPTACLE
	WEATHERPROOF RECEPTACLE
	T-SLOT DUPLEX RECEPTACLE (5-20R)
	T-SLOT GROUND FAULT RECEPTACLE (5-20R)
	FLOOR MOUNTED RECEPTACLE
	FLOOR MOUNTED FOURPLEX RECEPTACLE
J	CEILING MOUNTED JUNCTION/SLAB BOX
	WALL MOUNTED JUNCTION BOX
J	FLOOR MOUNTED JUNCTION/SLAB BOX
	ELECTRICAL PANELBOARD - SURFACE MOUNTED
TC	TIMECLOCK

MECHANICAL

	MOTOR
M	SWITCH - MANUAL STARTER
	MOTOR C/W DISCONNECT SWITCH
	UNFUSED DISCONNECT SWITCH
T	THERMOSTAT
MECH	MOTOR IDENTIFICATION TAG

FIRE ALARM

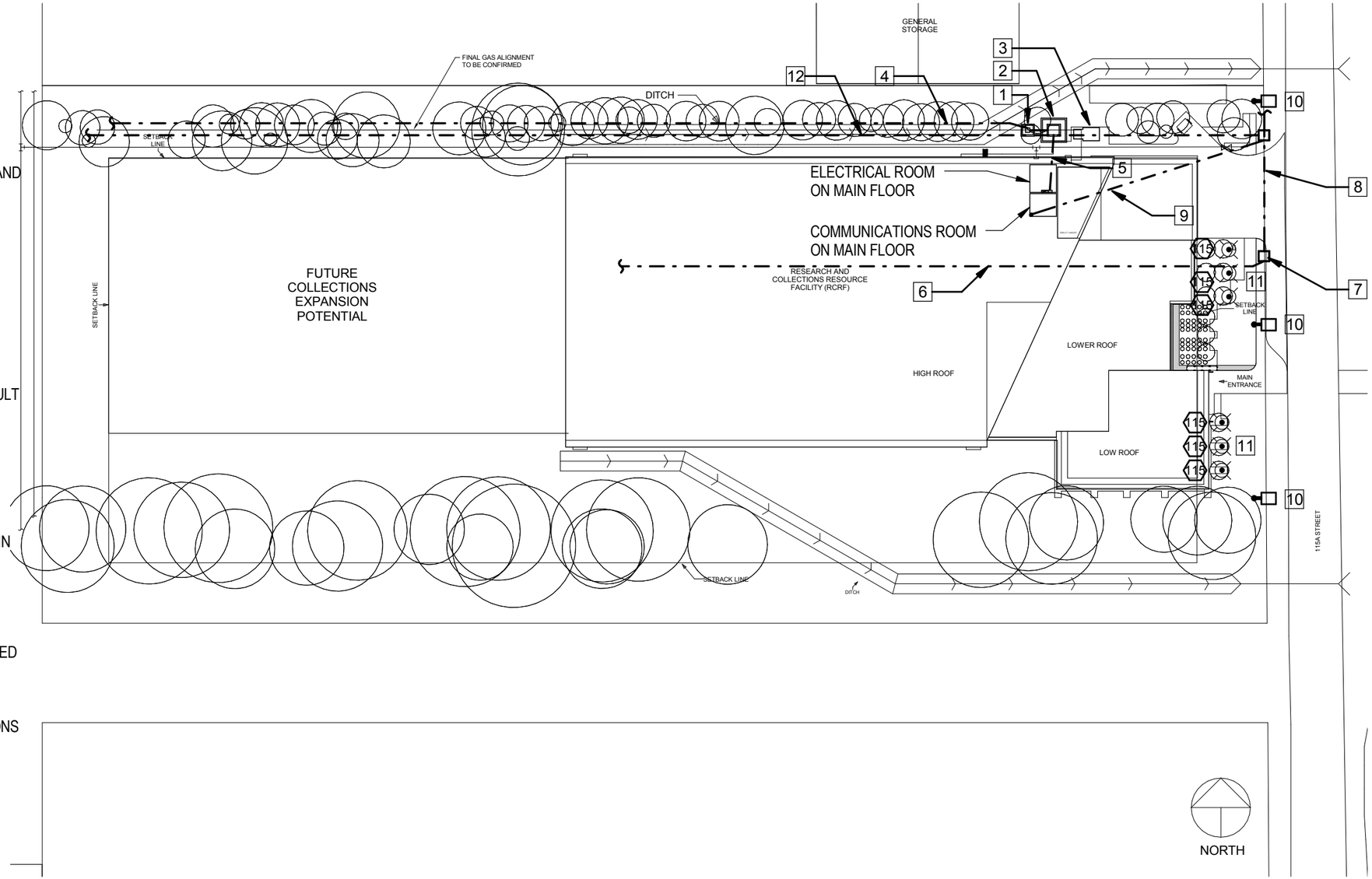
	SMOKE DETECTOR
	RATE OF RISE HEAT DETECTOR
SA	DUCT SMOKE DETECTOR - 'SA' DENOTES SUPPLY AIR, 'RA' DENOTES RETURN AIR
FS	SPRINKLER FLOW SWITCH
TS	SPRINKLER TAMPER SWITCH
PS	PRESSURE SWITCH
	FIRE ALARM STROBE - WALL MOUNTED
F	FIRE ALARM COMBINATION SPEAKER/STROBE - CEILING MOUNTED
F	FIRE ALARM SPEAKER - WALL MOUNTED
F	FIRE ALARM COMBINATION SPEAKER/STROBE - WALL MOUNTED
ANN	FIRE ALARM ANNUNCIATOR
FACP	FIRE ALARM CONTROL PANEL

GENERAL

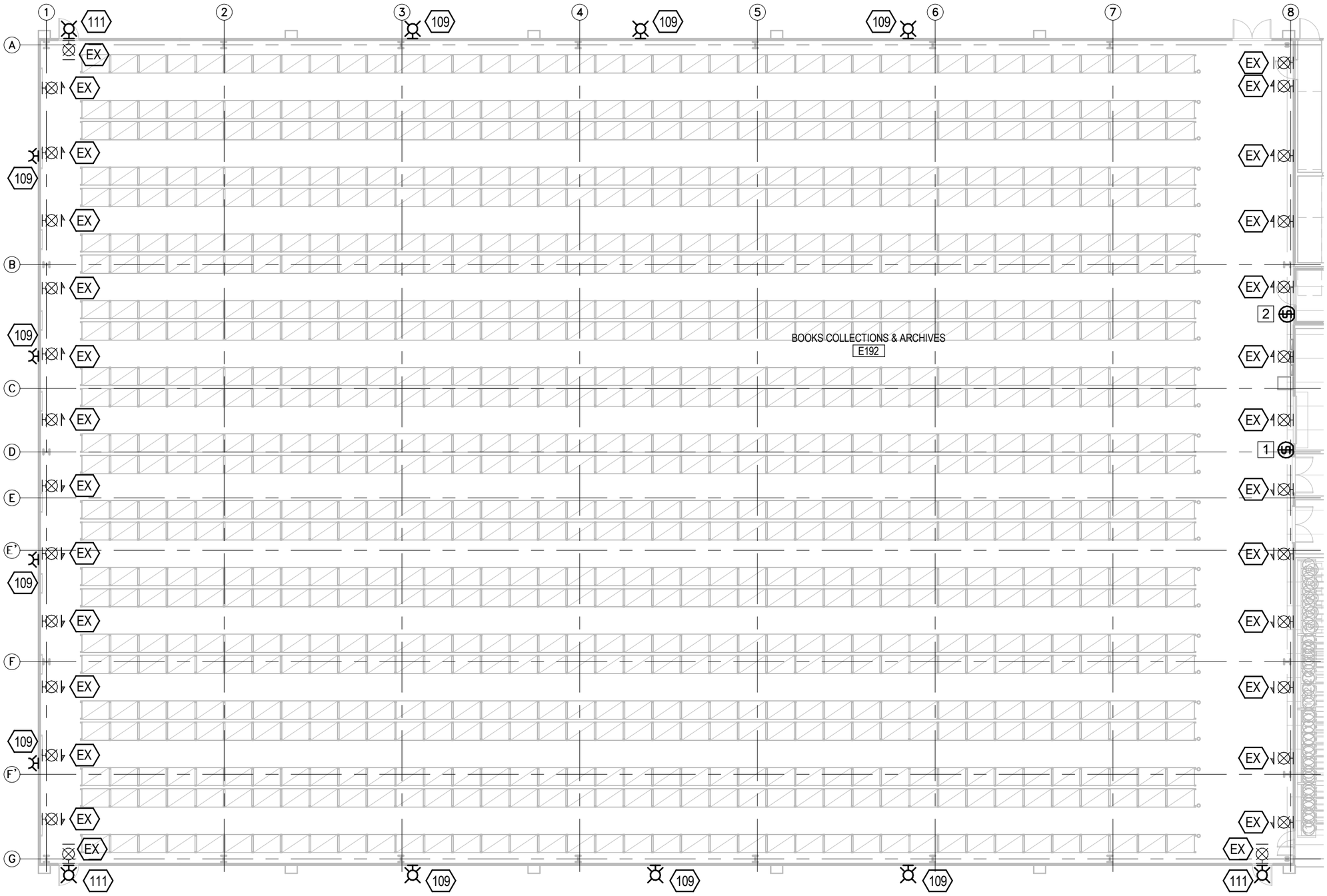
	CONDUIT CONCEALED IN WALL OR CEILING
	CONDUIT CONCEALED IN WALL/CEILING - EMERGENCY OR UPS POWER
	CONDUIT CONCEALED IN SLAB
	CONDUIT BURIED BELOW GRADE
	CONDUIT - UP
	CONDUIT - DOWN
WP	DENOTES WEATHERPROOF DEVICE

ELECTRICAL SITE PLAN KEY NOTES:

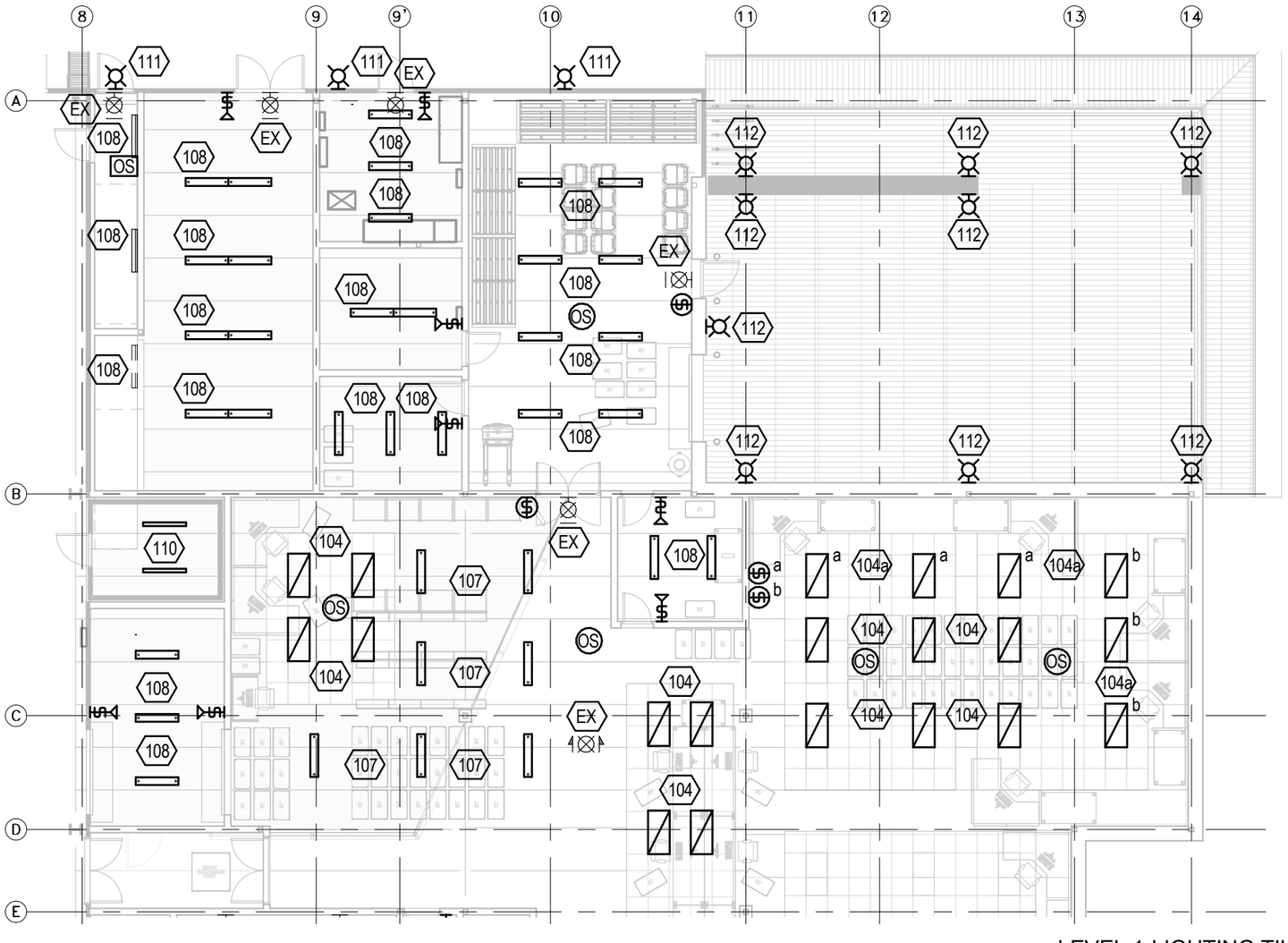
1. NEW PADMOUNT METERING CUBICLE BY U of A. MAINTAIN A MINIMUM OF 1m CLEARANCE BETWEEN METERING CUBICLE GROUND GRID AND CIVIL DITCH.
2. NEW 500kVA, 347/600V PADMOUNT TRANSFORMER BY U of A.
3. NEW 250kW GENERATOR c/w 24-HOUR SUB BASE FUEL TANK AND SOUND ATTENUATED ENCLOSURE.
4. INCOMING PRIMARY CONDUIT BY U of A FROM UTILITY CORRIDOR/ROW.
5. SECONDARY CONDUIT FROM TRANSFORMER TO ELECTRICAL ROOM. REFER TO SINGLE LINE DIAGRAM FOR SIZING.
6. EXISTING 3-103mm FIBRE CONDUITS TO BE ABANDONED.
7. EXISTING FIBRE PEDESTAL TO BE REMOVED AND REPLACED WITH NEW COMMUNICATION VAULT. EXACT LOCATION OF VAULT TO BE COORDINATED ON SITE WITH U of A AND GENERAL CONTRACTOR.
8. EXISTING 3-103mm FIBRE CONDUITS ROUTED TO FIBRE HUB ROOM TO BE INTERCEPTED WITH NEW VAULT.
9. PROPOSED 3-103mm CONDUITS FOR FIBRE FROM NEW COMMUNICATION VAULT TO COMMUNICATIONS ROOM ON MAIN FLOOR.
10. EXISTING RELOCATED SITE LUMINAIRE. CONFIRM ORIGINAL LOCATION AND RELOCATION METHOD PRIOR TO SITE WORK.
11. EXACT LOCATION OF TYPE 115 LUMINAIRE TO BE COORDINATED WITH LANDSCAPE ARCHITECT AND U of A PRIOR TO INSTALLATION. TYPICAL OF SIX (6) LUMINAIRES.
12. TWO (2) 127mm CONDUITS BY U OF A TO NEW COMMUNICATIONS VAULT. COORDINATE EXACT ROUTING AND LOCATION WITH OTHER UTILITIES.



ELECTRICAL SITE PLAN
1:700



LEVEL 1-LIGHTING TILE 1
1:200



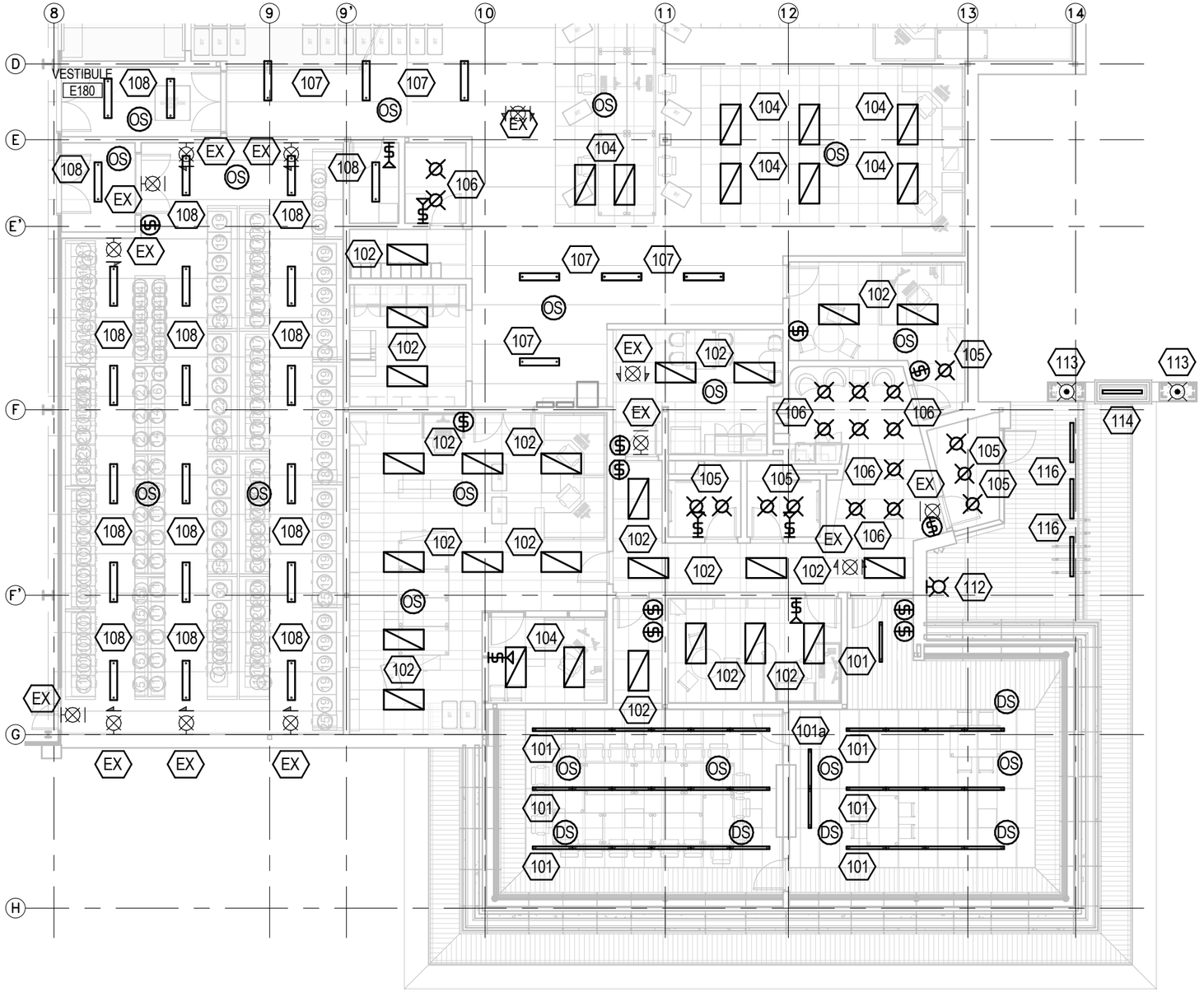
LEVEL 1-LIGHTING TILE 2
1:150

LIGHTING KEY NOTES:

1. MASTER SWITCH TO CONTROL TYPE 100 LUMINAIRES IN WAREHOUSE. REFER TO LIGHTING CONTROL DRAWING FOR CONTROLS DETAILS.
2. SWITCH TO CONTROL FREEZER LIGHTING. COORDINATE EXACT LOCATION AND REQUIREMENTS PRIOR TO INSTALLATION.
3. DAYLIGHT HARVESTER TO BE CONNECTED TO MOTORIZED BLINDS.
4. HIGH BAY OCCUPANCY SENSOR TO CONTROL TYPE 100 LUMINAIRES AS INDICATED. COORDINATE EXACT LOCATION PRIOR TO ROUGH-IN.

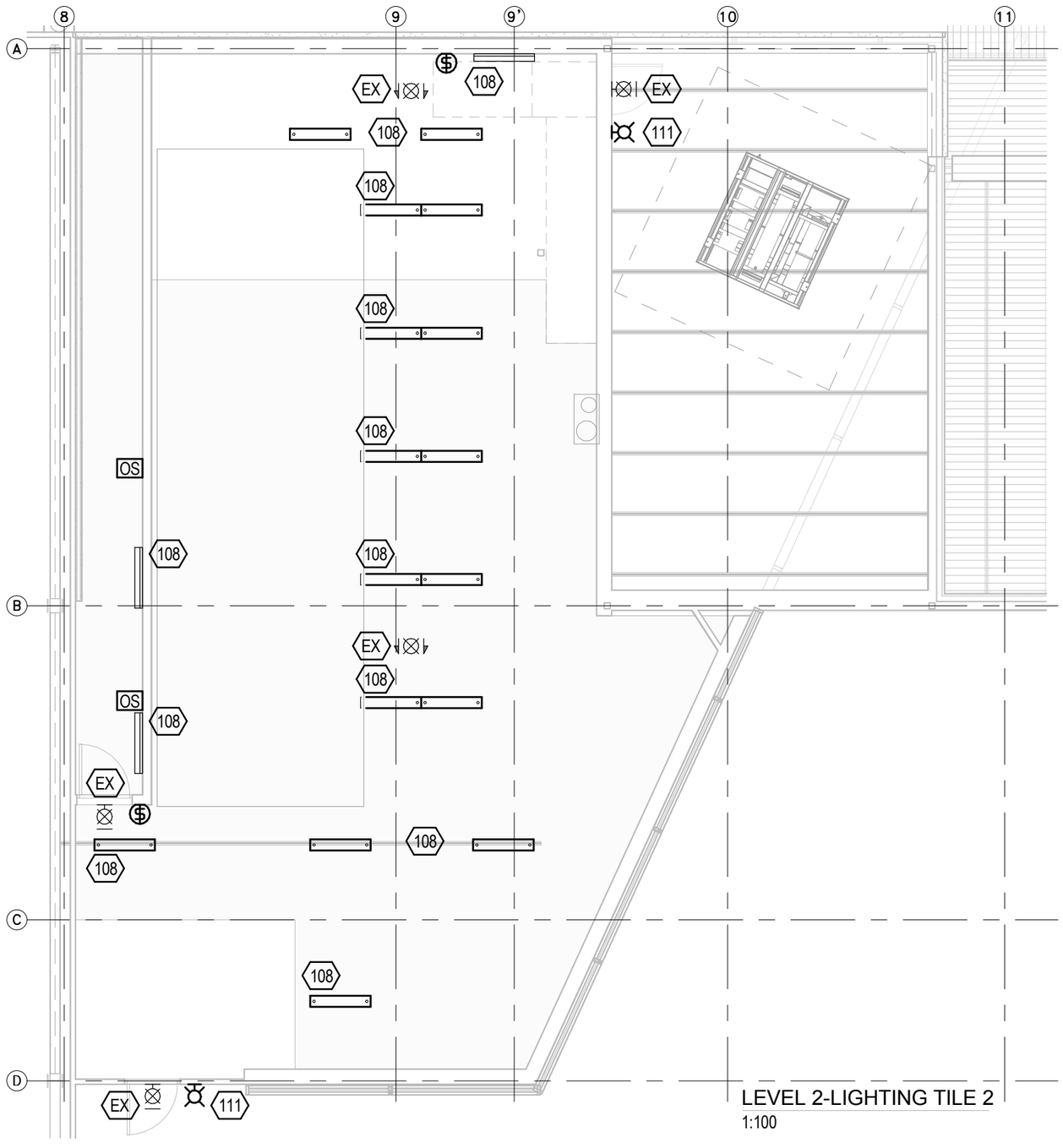
LUMINAIF

TYPE	DESCRIPTION	LAMPS	MTG
100	305mm X 1220mm FLUORESCENT HIGH BAY LUMINAIRE	4- 54W T5HO	SUSPENDE
101	1220mm DIRECT/INDIRECT LUMINAIRE, 3500 LUMEN/FT	28.6W LED	SUSPENDE
101a	1220mm DIRECT/INDIRECT LUMINAIRE, 3500 LUMEN/FT	28.6W LED	SUSPENDE
102	1220mm X 610mm RECESSED DIRECT/INDIRECT LUMINAIRE	2- 32W T8	RECESS
103	1220mm X 610mm RECESSED DIRECT/INDIRECT LUMINAIRE	2-32W T8	RECESS
104	1220mm X 610mm RECESSED DIRECT/INDIRECT LUMINAIRE	2-32W T8	RECESS
104a	1220mm X 610mm RECESSED DIRECT/INDIRECT LUMINAIRE	3-32W T8	RECESS
105	103mm DIAMETER RECESSED DOWNLIGHT, 1000 LUMENS	11.3W LED	RECESS
		16.8W	

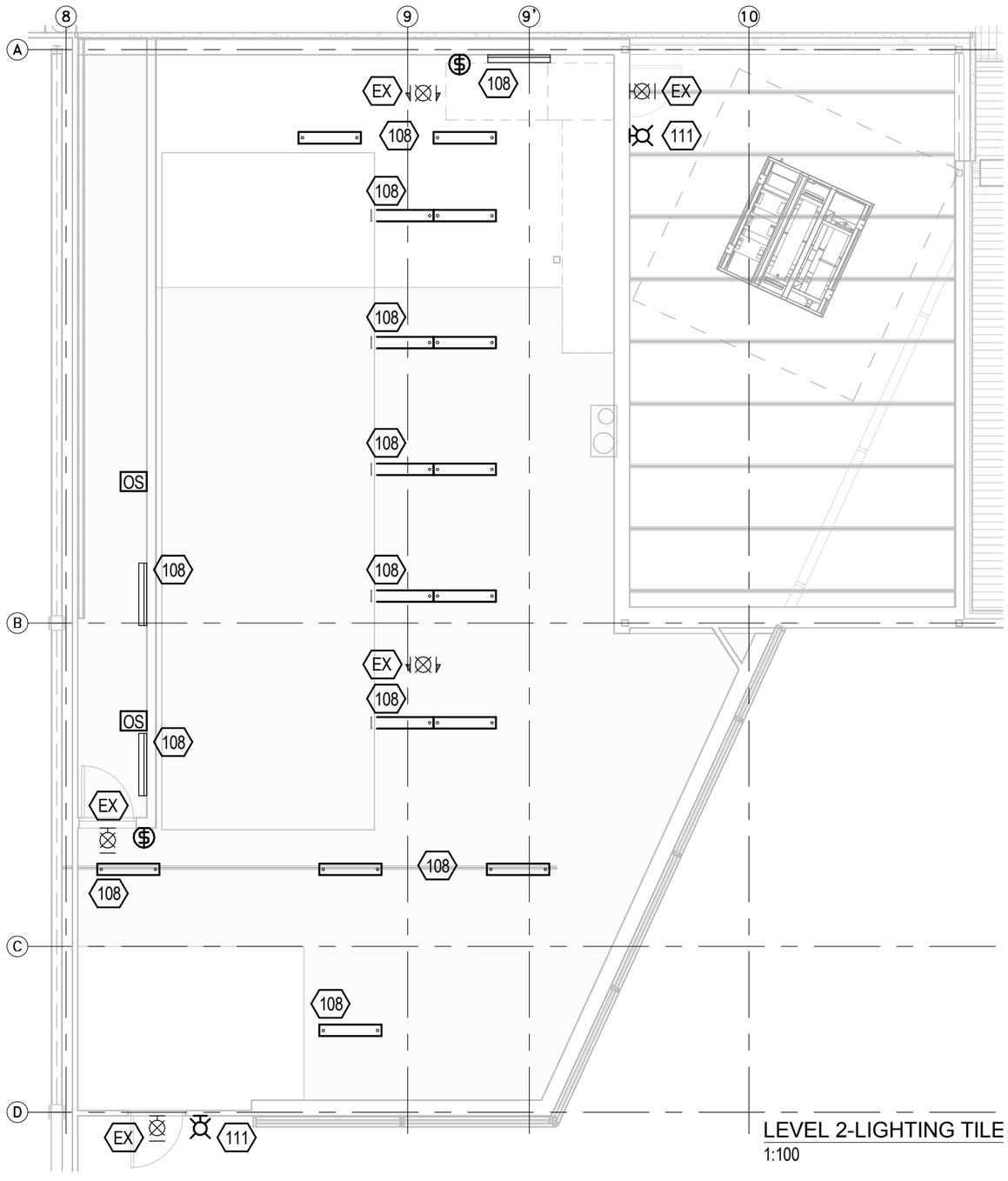


LEVEL 1-LIGHTING TILE 3
1:150

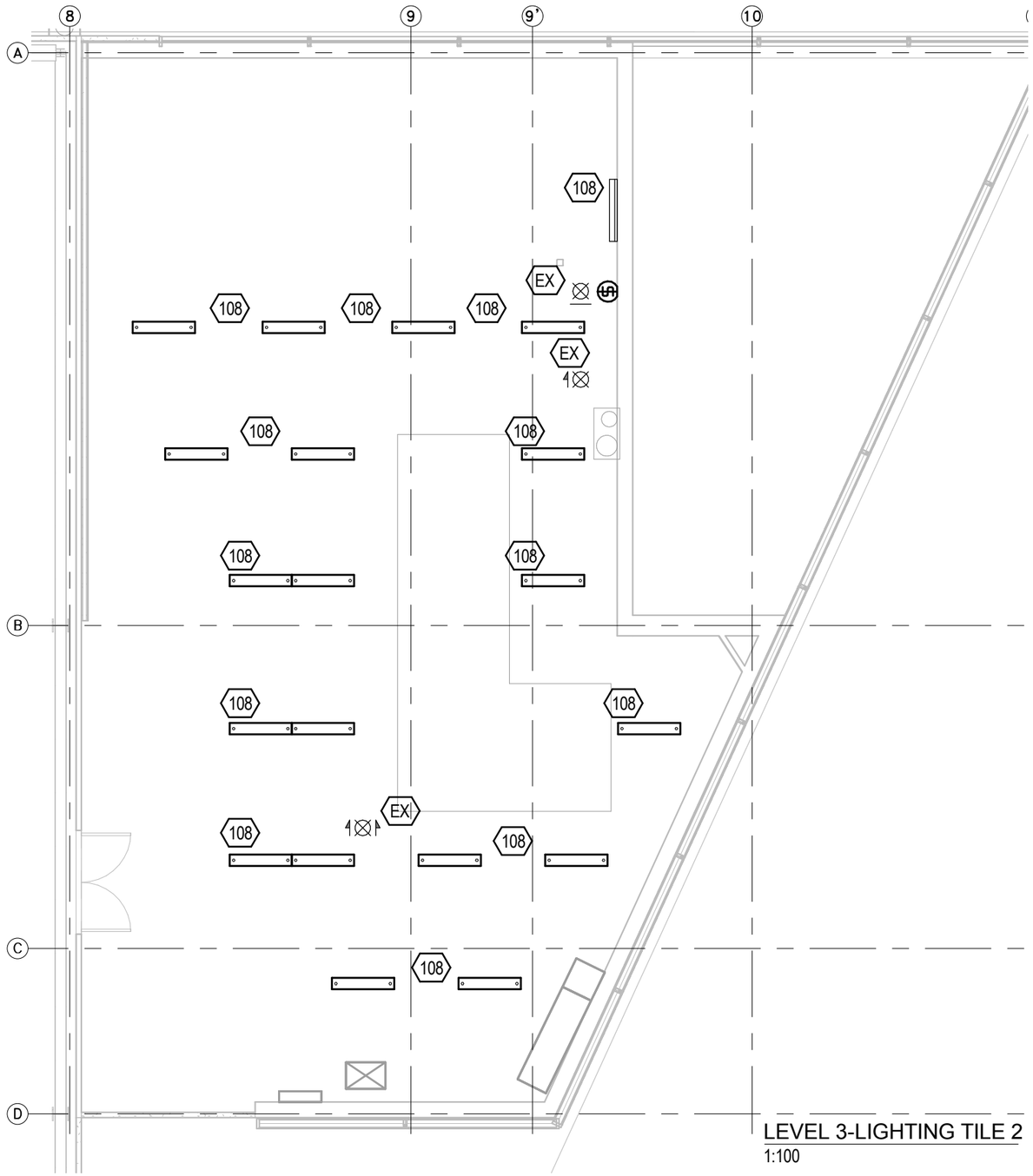
LEVEL 3-LIGHTING TILE 1
1:200



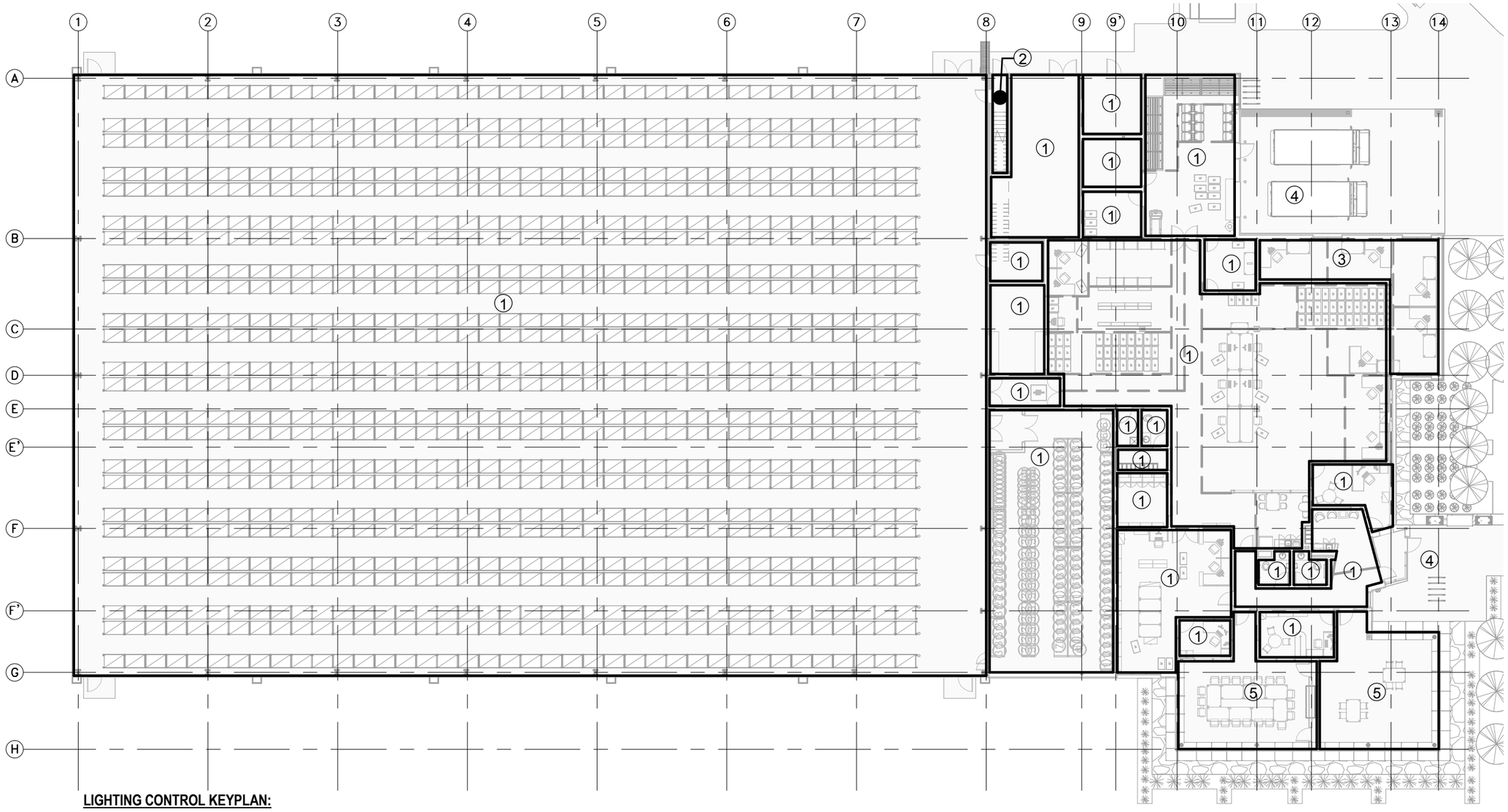
LEVEL 2-LIGHTING TILE 2
1:100



LEVEL 2-LIGHTING TILE
1:100



LEVEL 3-LIGHTING TILE 2
1:100



LIGHTING CONTROL KEYPLAN:

① ON/OFF SWITCH, OCCUPANCY SENSOR, BMS

② OCCUPANCY SENSOR, BMS

③ ON/OFF SWITCH, MULTI-LEVEL SWITCHING, OCCUPANCY SENSOR, BMS

④ ATOMIC TIMECLOCK, BMS

⑤ ON/OFF SWITCH, DAYLIGHT HARVESTER, OCCUPANCY SENSOR, DIMMER, BMS

MAIN FLOOR LIGHTING CONTROL PLAN
1:300

MOTOR CONTROL SCHEDULE

MOTOR NUMBER	DESCRIPTION	LOCATION	HORSEPOWER	FULL LOAD AMPS	KILOWATTS kW	VOLTAGE	PHASE	OVERCURRENT PROTECTION	FEEDER	REMARKS
AHU-1 (SF-1)	SUPPLY AIR SYSTEM FOR AHU-1	MECH ROOM	30	-	-	600	3	70A-3P	1"C-3#4	CONTROLLED BY VSD
AHU-1 (RF-1)	RETURN AIR SYSTEM FOR AHU-1	MECH ROOM	12	-	-	600	3	30A-3P	3/4"C-3#10	CONTROLLED BY VSD
AHU-2 (SF-2)	SUPPLY AIR SYSTEM FOR AHU-2	MECH ROOM	120	-	-	600	3	250A-3P	2 1/2"C-3#250	CONTROLLED BY VSD
AHU-1 (RF-2)	RETURN AIR SYSTEM FOR AHU-2	MECH ROOM	36	-	-	600	3	80A-3P	1"C-3#4	CONTROLLED BY VSD
RCR-AS2-DW	DEHUMIDIFIER	MECH ROOM	0.013	-	-	-	-	-A--P	-	CONTROLLED BY VSD
CH-1	AIR COOLED CHILLER	ROOF	-	96	-	600	3	200A-3P	2"C-3#3/0	MCA 116A, MOCP 193A
EF-1	EXHAUST FAN- WASHROOM	MECH ROOM	0.3	-	-	120	1	15A-1P	1/2"C-2#12	-
EF-2	EXHAUST FAN- BATTERY VENT.	MECH ROOM	0.3	-	-	120	1	15A-1P	1/2"C-2#12	- -
EF-3	EXHAUST FAN- QUARANTINE	MECH ROOM	0.5	-	-	120	1	15A-1P	1/2"C-2#12	- -
P-1	BOILER CIRCULATION PUMP	MECH ROOM	-	-	-	-	-	-	-	CONTROLLED BY BOILER -
P-2	BOILER CIRCULATION PUMP	MECH ROOM	-	-	-	-	-	-	-	CONTROLLED BY BOILER -
P-3	SECONDARY HEATING CIR PUMP	MECH ROOM	-	-	-	600	3	-	-	CONTROLLED BY VSD
P-4	SECONDARY HEATING CIR PUMP	MECH ROOM	-	-	-	600	3	-	-	CONTROLLED BY VSD
P-5	PERIMETER HEATING CIR PUMP	MECH ROOM	-	-	-	600	3	-	-	CONTROLLED BY VSD
P-6	PERIMETER HEATING CIR PUMP	MECH ROOM	-	-	-	600	3	-	-	CONTROLLED BY VSD
P-7	HEATING WATER HEAT EXCHANGER PUMP	MECH ROOM	-	-	-	600	3	-	-	CONTROLLED BY VSD
P-8	HEATING WATER HEAT EXCHANGER PUMP	MECH ROOM	-	-	-	600	3	-	-	CONTROLLED BY VSD
P-9	HEATING GLYCOL CIRC PUMP	MECH ROOM	-	-	-	600	3	-	-	CONTROLLED BY VSD
P-10	HEATING GLYCOL CIRC PUMP	MECH ROOM	-	-	-	600	3	-	-	CONTROLLED BY VSD
P-11	CHILLED GLYCOL CIR PUMP	MECH ROOM	-	-	-	600	3	-	-	CONTROLLED BY VSD

MOTOR CONTROL SCHEDULE CONTINUED

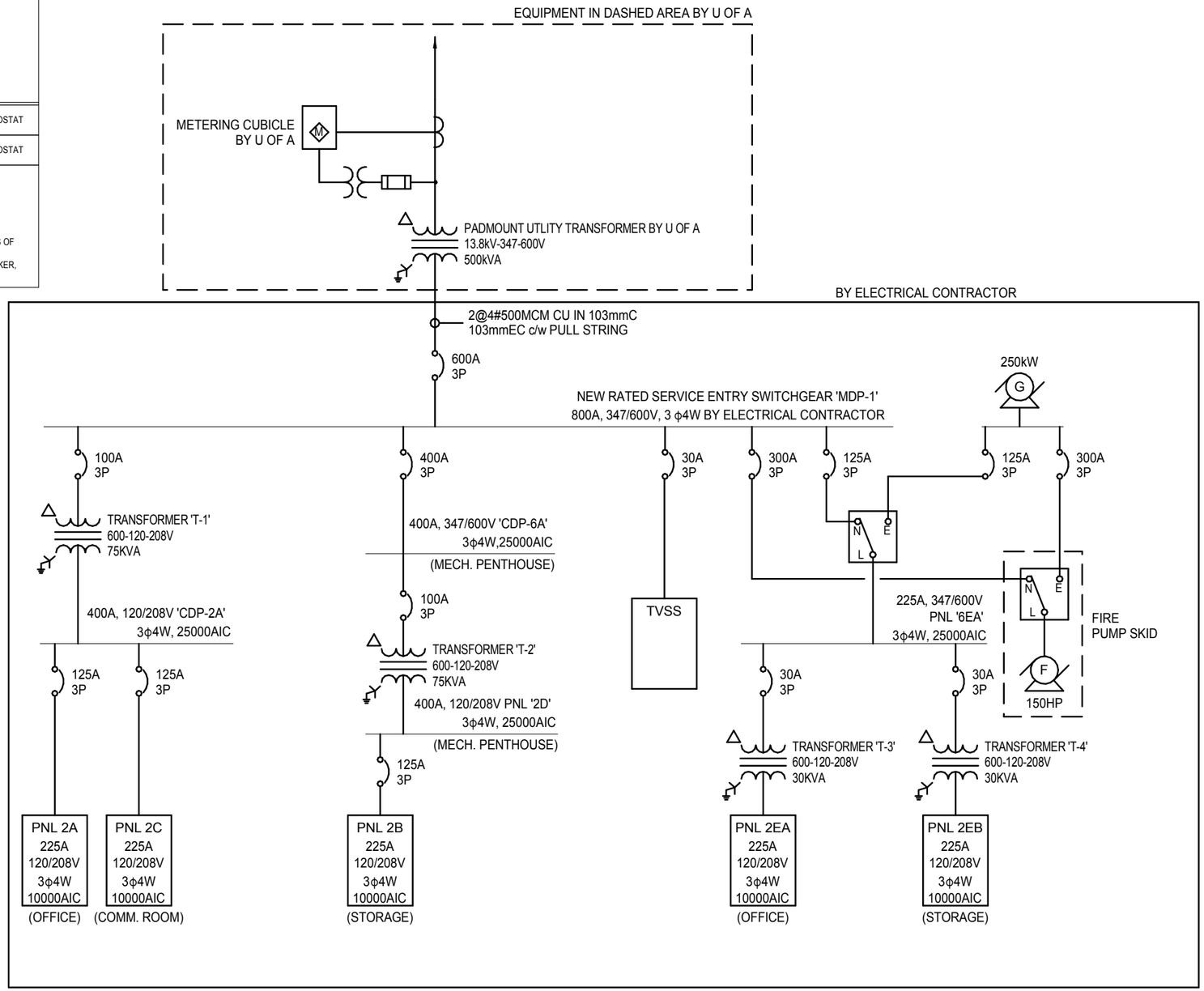
MOTOR NUMBER	DESCRIPTION	LOCATION	HORSEPOWER	FULL LOAD AMPS	KILOWATTS kW	VOLTAGE	PHASE	OVERCURRENT PROTECTION	FEEDER	REMARKS
P-12	CHILLED GLYCOL CIR PUMP	MECH ROOM	-	-	-	600	3	-	-	CONTROLLED BY VSD
P-13	DOMESTIC HOT WATER RECIRC PUMP	MECH ROOM	0.33	-	-	600	3	15A-3P	3/4"C-3#12	- -
FP-1	FIRE PUMP	MECH ROOM	150	-	-	600	3	300A-3P	3"C-3#350	-
B-1	HEATING BOILER	-	-	-	-	120	1	-	-	- -
B-2	HEATING BOILER	-	-	-	-	120	1	-	-	- -
DHWT-1	DOMESTIC HOT WATER HEATER	MECH ROOM	-	15	-	120	1	15A-1P	3/4"C-2#12	- -
HU-1	GAS FIRED HUMIDIFIER	MECH ROOM	-	-	-	120	1	-	-	- -
HU-2	GAS FIRED HUMIDIFIER	MECH ROOM	-	-	-	120	1	-	-	- -
VAC-1	CENTRAL VACUUM	LOADING AREA	-	-	-	120	1	-	-	- -
GF-1	GLYCOL SYSTEM FEEDER - HEATING GLYCOL FEEDER	MECH ROOM	0.25	-	-	120	1	15A-1P	3/4"C-2#12	- -
GF-2	GLYCOL SYSTEM FEEDER - COOLING GLYCOL FEEDER	MECH ROOM	0.25	-	-	120	1	15A-1P	3/4"C-2#12	- -
UH-1	UNIT HEATER	MECH ROOM	0.50		-	120	1	20A-1P	3/4"C-2#12	LINE VOLTAGE THERMOSTAT
UH-2	UNIT HEATER	MECH ROOM	-	-	-	120	1	-	-	LINE VOLTAGE THERMOSTAT
UH-3	UNIT HEATER	LOADING DOCK	0.05	-	-	120	1	15A-1P	3/4"C-2#12	LINE VOLTAGE THERMOSTAT
UH-4	UNIT HEATER	LOADING DOCK	0.50	-	-	120	1	15A-1P	3/4"C-2#12	LINE VOLTAGE THERMOSTAT
UH-5	UNIT HEATER	ELECTRICAL ROOM	0.05	-	-	120	1	15A-1P	3/4"C-2#12	LINE VOLTAGE THERMOSTAT
UH-6	UNIT HEATER	FIRE PUMP ROOM	0.05	-	-	120	1	15A-1P	3/4"C-2#12	LINE VOLTAGE THERMOSTAT
FF-1	FORCE FLOW UNIT - HOT WATER	FRONT VESTIBULE	0.05	-	-	120	1	15A-1P	3/4"C-2#12	LINE VOLTAGE THERMOSTAT
FF-2	FORCE FLOW UNIT - HOT WATER	STAIRWELL TO MECH RM.	0.05	-	-	120	1	15A-1P	3/4"C-2#12	LINE VOLTAGE THERMOSTAT
FC-1	FAN COIL - CHILLED WATER	MECH ROOM	-	-	-	208	1	--A-2P	-	LINE VOLTAGE THERMOSTAT

MOTOR CONTROL SCHEDULE CONTINUED

MOTOR NUMBER	DESCRIPTION	LOCATION	HORSEPOWER	FULL LOAD AMPS	KILOWATTS kW	VOLTAGE	PHASE	OVERCURRENT PROTECTION	FEEDER	REMARKS
FC-2	FAN COIL - CHILLED WATER	LOADING AREA	-	-	-	208	1	--A-2P	-	LINE VOLTAGE THERMOSTAT
FC-3	FAN COIL - CHILLED WATER	LOADING AREA	-	-	-	208	1	--A-2P	-	LINE VOLTAGE THERMOSTAT

NOTES:

1. IN MOST CASES THE FLA'S AND ASSOCIATED BRANCH CIRCUITS ARE BASED ON THE VALUES SHOWN IN THE CANADIAN ELECTRICAL CODE. CONFIRM THE ACTUAL FLA'S OF MOTORS WITH THE MECHANICAL CONTRACTOR PRIOR TO ORDERING EQUIPMENT (BREAKERS, OVERLOADS, ETC.), AND INSTALLATION OF BRANCH CIRCUITS. APPROVAL OF MCC SHOP DRAWINGS ARE BASED ON THE ASSUMPTION THAT FLA'S OF MOTORS HAVE BEEN CONFIRMED. NO ADDITIONAL COSTS WILL BE CONSIDERED FOR FAILURE TO CONFIRM THE FLA'S OF MOTORS PRIOR TO SUBMISSION OF MCC SHOP DRAWINGS.
2. ALL THREE PHASE MOTORS ARE TO BE PROVIDED WITH LOSS OF PHASE PROTECTION. THIS MAY BE ACCOMPLISHED WITH A COMBINATION OVERLOAD/LOSS OF PHASE RELAY.
3. ALL VSD/VFDs SUPPLIED BY MECHANICAL CONTRACTOR. ELECTRICAL CONTRACTOR TO INSTALL AS REQUIRED AND PROVIDE CONNECTION BETWEEN BREAKER, VSD/VFD AND MOTOR.



SINGLE LINE DIAGRAM
NTS

POWER AND SYSTEMS KEY NOTES:

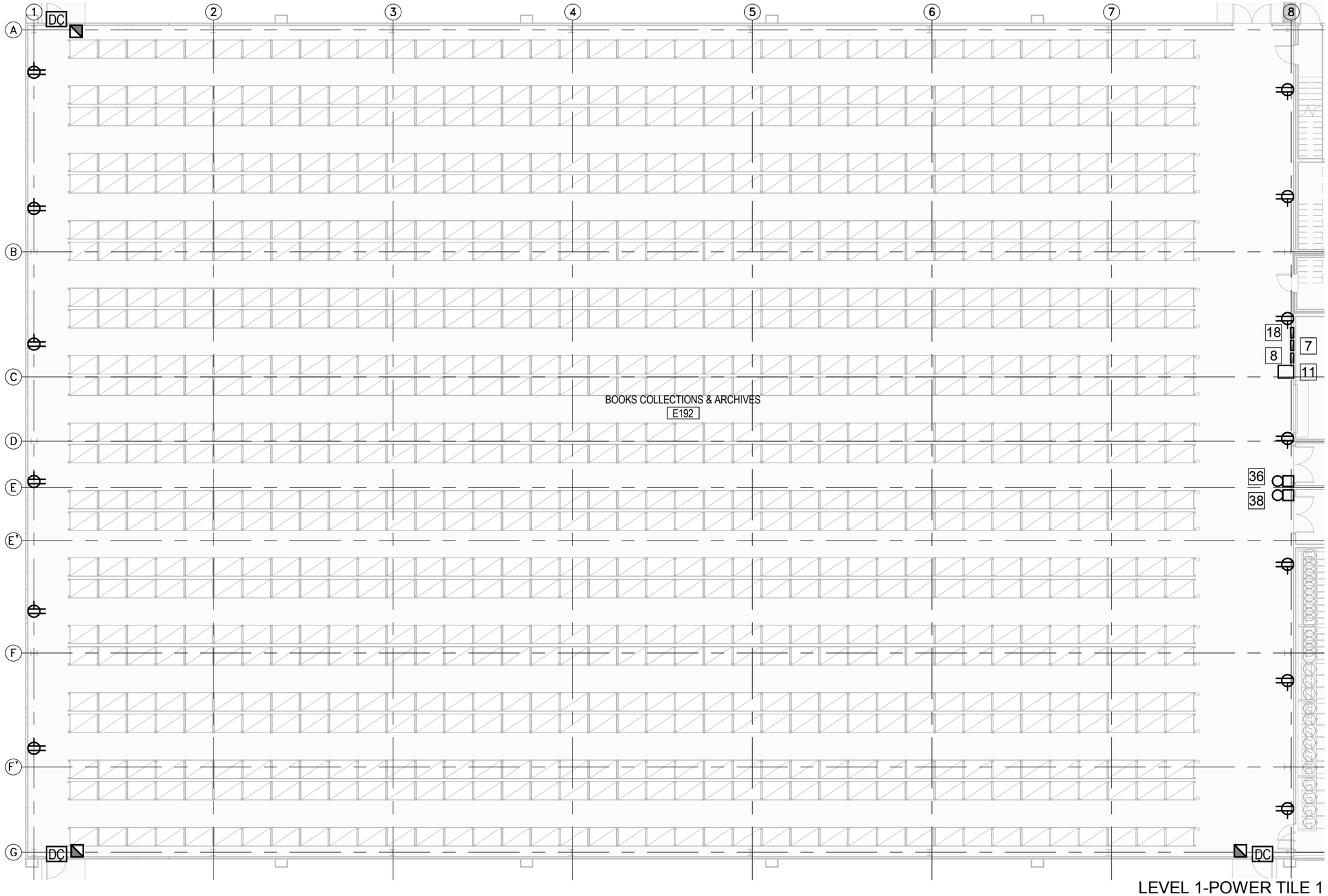
1. BYPASS ISOLATION AUTOMATIC TRANSFER SWITCH.
2. 225A, 347/600V EMERGENCY PANEL '6EA'.
3. GROUND BUS. COORDINATE EXACT LOCATION PRIOR TO ROUGH-IN.
4. 800A, 347/600V NEW RATED SERVICE ENTRY SWITCHGEAR 'MDP-1'.
5. 75kVA, 600-120/208V FLOOR MOUNTED TRANSFORMER 'T-1'.
6. 400A, 120/208V CENTRAL DISTRIBUTION PANEL 'CDP-2A'.
7. 225A, 120/208V PANEL '2B'.
8. 225A, 120/208V PANEL '2EB'.
9. 225A, 120/208V PANEL '2A'.
10. 225A, 120/208V PANEL '2EA'.
11. 30kVA, 600-120/208V WALL MOUNTED TRANSFORMER 'T-4'.
12. 30kVA, 600-120/208V WALL MOUNTED TRANSFORMER 'T-3'.
13. 225A, 120/208V PANEL '2C'.
14. FIRE ALARM CONTROL PANEL.
15. BASKET STYLE CABLE TRAY.
16. MAIN TELEPHONE BACKBOARD.
17. 4 POST DATA RACK c/w FMNET SWITCH.
18. LOW VOLTAGE RELAY CABINET.
19. COMMUNICATION GROUND BUS. COORDINATE EXACT LOCATION PRIOR TO ROUGH-IN.
20. ALTERUS BEACON.
21. TTS FIRE PANEL INTERFACE.
22. SECURITY POWER SUPPLIES.
23. SECURITY PANEL.
24. 3-103mm COMMUNICATIONS RISERS.
25. 208V RECEPTACLE.
26. SOUND MASKING PANEL.

POWER AND SYSTEMS KEY NOTES:

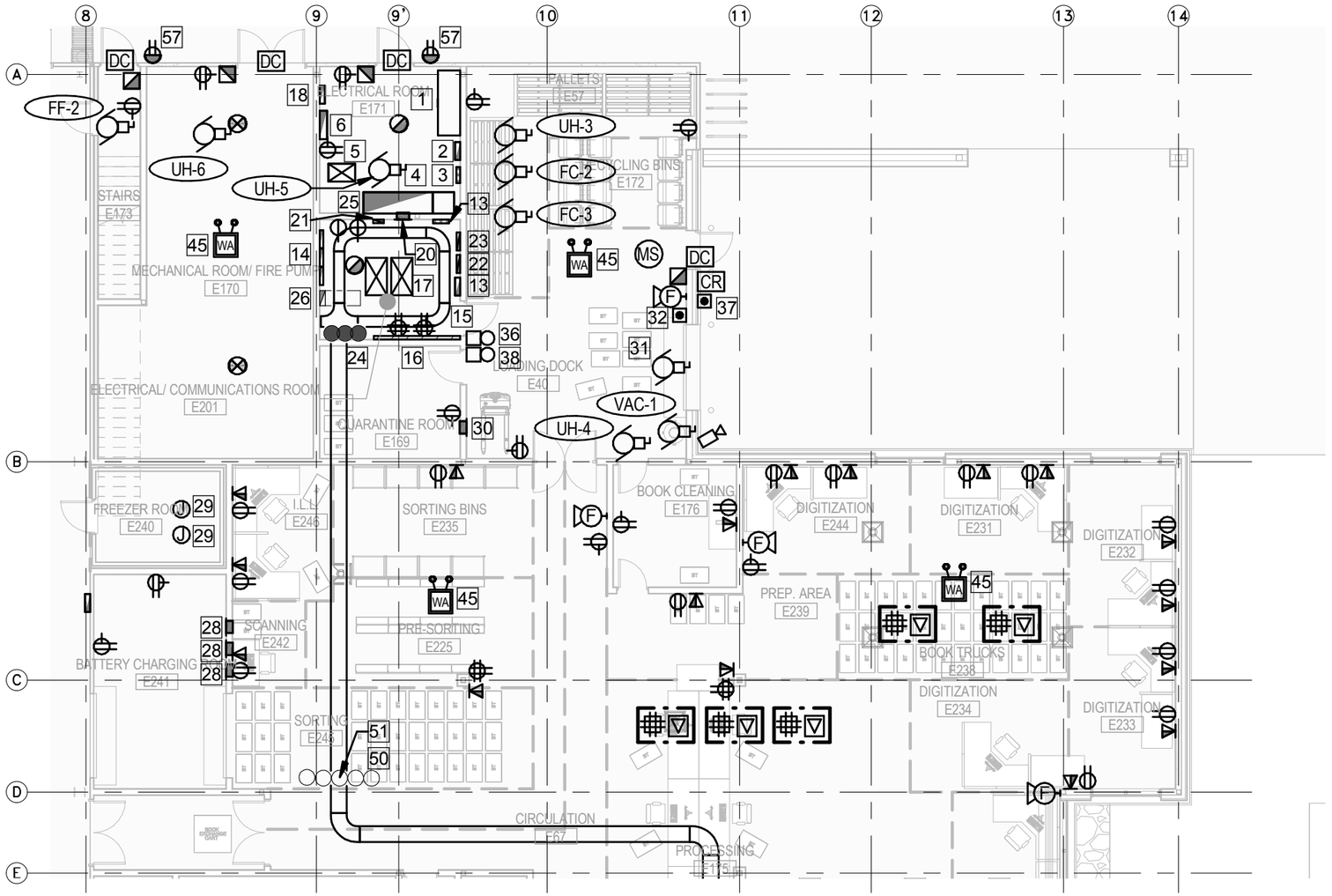
27. JUNCTION BOX MOUNTED IN ACCESSIBLE CEILING SPACE FOR FIREPLACE. COORDINATE EXACT LOCATION AND POWER REQUIREMENTS PRIOR TO ROUGH-IN.
28. JUNCTION BOX FOR BATTERY CHARGER. COORDINATE EXACT LOCATION PRIOR TO ROUGH-IN.
29. JUNCTION BOX FOR FREEZER. COORDINATE EXACT LOCATION AND POWER REQUIREMENTS PRIOR TO ROUGH-IN.
30. JUNCTION BOX FOR FORKLIFT CHARGER. COORDINATE EXACT POWER REQUIREMENTS AND LOCATION PRIOR TO ROUGH-IN.
31. MOTOR CONNECTION FOR OVERHEAD DOOR. COORDINATE EXACT LOCATION AND POWER REQUIREMENTS PRIOR TO ROUGH-IN.
32. PUSHBUTTON FOR AUTOMATIC DOOR OPERATOR. COORDINATE EXACT LOCATION PRIOR TO ROUGH-IN.
33. JUNCTION BOX IN ACCESSIBLE CEILING SPACE FOR AUTOMATIC DOOR OPERATOR. COORDINATE EXACT LOCATION PRIOR TO ROUGH-IN.
34. 5-20R RECEPTACLE ON A DEDICATED CIRCUIT AND DATA OUTLET FOR PRINTER. COORDINATE EXACT LOCATION PRIOR TO ROUGH-IN.
35. MAIN ENTRANCE DOORBELL. COORDINATE EXACT LOCATION PRIOR TO ROUGH-IN.
36. CHIME FOR MAIN ENTRANCE DOORBELL. COORDINATE EXACT LOCATION PRIOR TO ROUGH-IN.
37. LOADING DOCK DOORBELL. COORDINATE EXACT LOCATION PRIOR TO ROUGH-IN.
38. CHIME FOR LOADING DOCK DOORBELL. COORDINATE EXACT LOCATION PRIOR TO ROUGH-IN.
39. 5-20R HOUSEKEEPING RECEPTACLE. PROVIDE LAMACOID LABLE INDICATING 'HOUSEKEEPING'.
40. OUTLETS FOR WALL MOUNTED LCD SCREEN. COORDINATE EXACT LOCATION PRIOR TO ROUGH-IN. REFER TO SPIDER BOX DETAIL ON DRAWING...
41. JUNCTION BOX IN CEILING SPACE FOR FUTURE PROJECTOR. COODINATE EXACT LOCATION PRIOR TO ROUGH-IN.
42. JUNCTION BOX IN CEILING SPACE FOR FUTURE SOUND MASKING SPEAKER. RUN ONE (1) 21mmC BACK TO COMMUNICATIONS ROOM E201.

POWER AND SYSTEMS KEY NOTES:

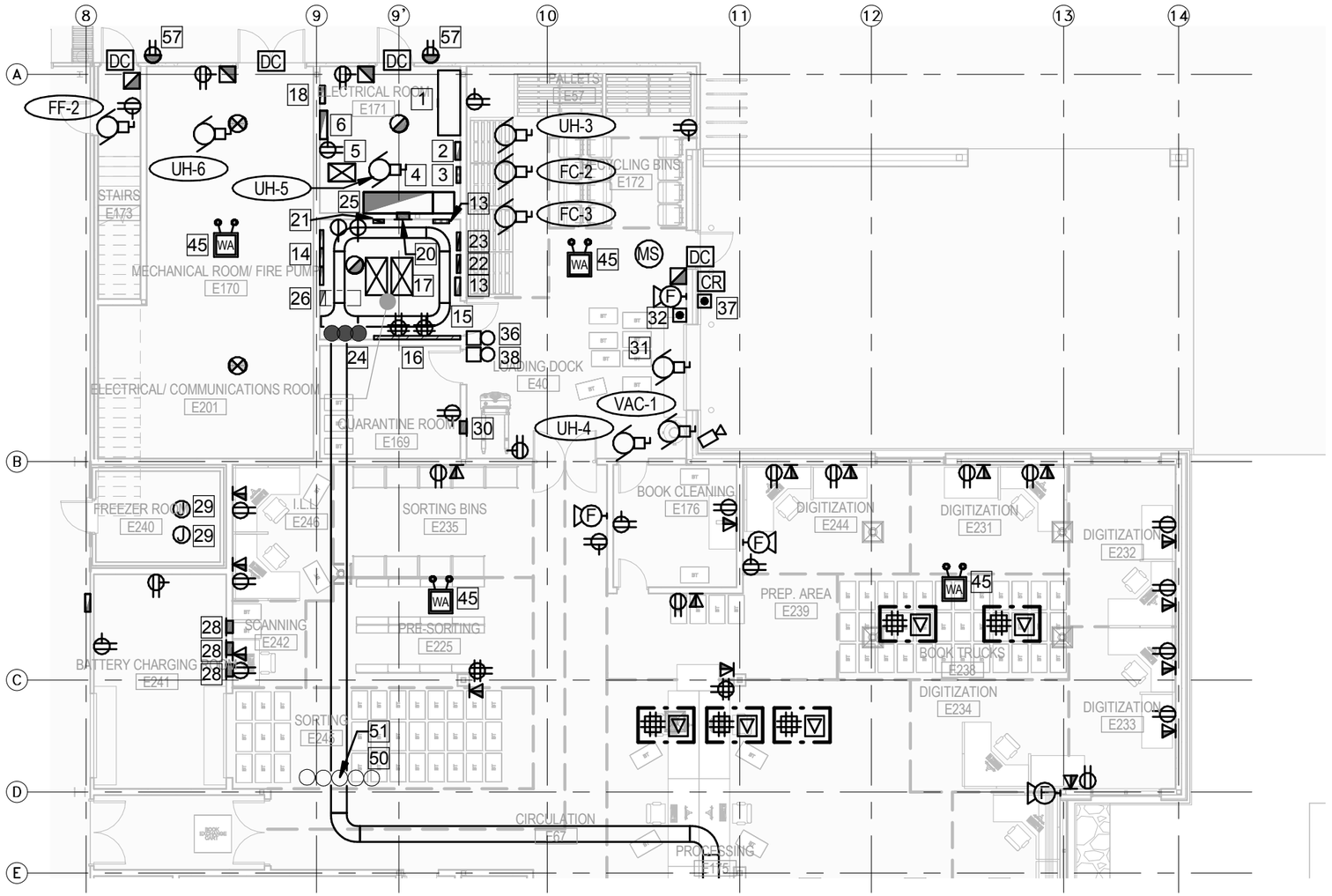
43. FIRE ALARM BEAM DETECTION SYSTEM. MOUNT DEVICE AT +9754mm AFF. COORDINATE EXACT LOCATION PRIOR TO ROUGH-IN.
44. JUNCTION BOX LOCATED IN CEILING SPACE FOR MOTORIZED BLINDS. COORDINATE EXACT POWER REQUIREMENTS AND LOCATION PRIOR TO ROUGH-IN.
45. RUN 21mm CONDUIT FROM WIRELESS ACCESS POINT BACK TO CABLE TRAY.
46. RUN VFD RATED CABLE FROM MECHANICAL VFD TO UNIT PANEL. COORDINATE EXACT REQUIREMENTS WITH MECHANICAL PRIOR TO ROUGH-IN.
47. JUNCTION BOX AND DISCONNECT FOR 120V POWER FOR MECHANICAL EQUIPMENT. COORDINATE EXACT LOCATION WITH MECHANICAL PRIOR TO ROUGH-IN.
48. 5-20R WEATHERPROOF RECEPTACLE c/w WHILE-IN-USE COVER MOUNTED ON OR NEAR MECHANICAL EQUIPMENT. COORDINATE EXACT LOCATION WITH MECHANICAL PRIOR TO ROUGH-IN.
49. JUNCTION BOX FOR BMS SYSTEM CONNECTION. COORDINATE EXACT POWER REQUIREMENTS AND LOCATION PRIOR TO INSTALLTION.
50. TWO (2) 53mm POWER AND THREE (3) 53mmC COMMUNICATION CONDUIT RISE AND CORE LOCATION. COODINATE EXACT LOCATION PRIOR TO CORING.
51. BASKET STYLE CABLE TRAY TO EXTEND TO/FROM CORE LOCATION. COORDINATE EXACT LOCATION AND ROUTING PRIOR TO INSTALLATION.
52. WEATHERPROOF FIRE ALARM STROBE MOUNTED AT +2440mm AFF. COORDINATE EXACT LOCATION PRIOR TO ROUGH-IN.
53. WEATHERPROOF FIRE ALARM SPEAKER MOUNTED AT +2440mm AFF. COORDINATE EXACT LOCATION PRIOR TO ROUGH-IN.
54. 400A, 347/600V CENTRAL DISTRIBUTION PANEL 'CDP-6A'.
55. 75kVA, 600-120/208V TRANSFORMER 'T-2'.
56. 400A, 120/208V PANEL '2D'.
57. 5-20R WEATHERPROOF RECEPTACLE c/w WHILE-IN-USE COVER. COORDINATE EXACT LOCATION PRIOR TO ROUGH-IN.
58. FIRE ALARM COMMAND CENTRE. COORDINATE EXACT LOCATION PRIOR TO ROUGH-IN.



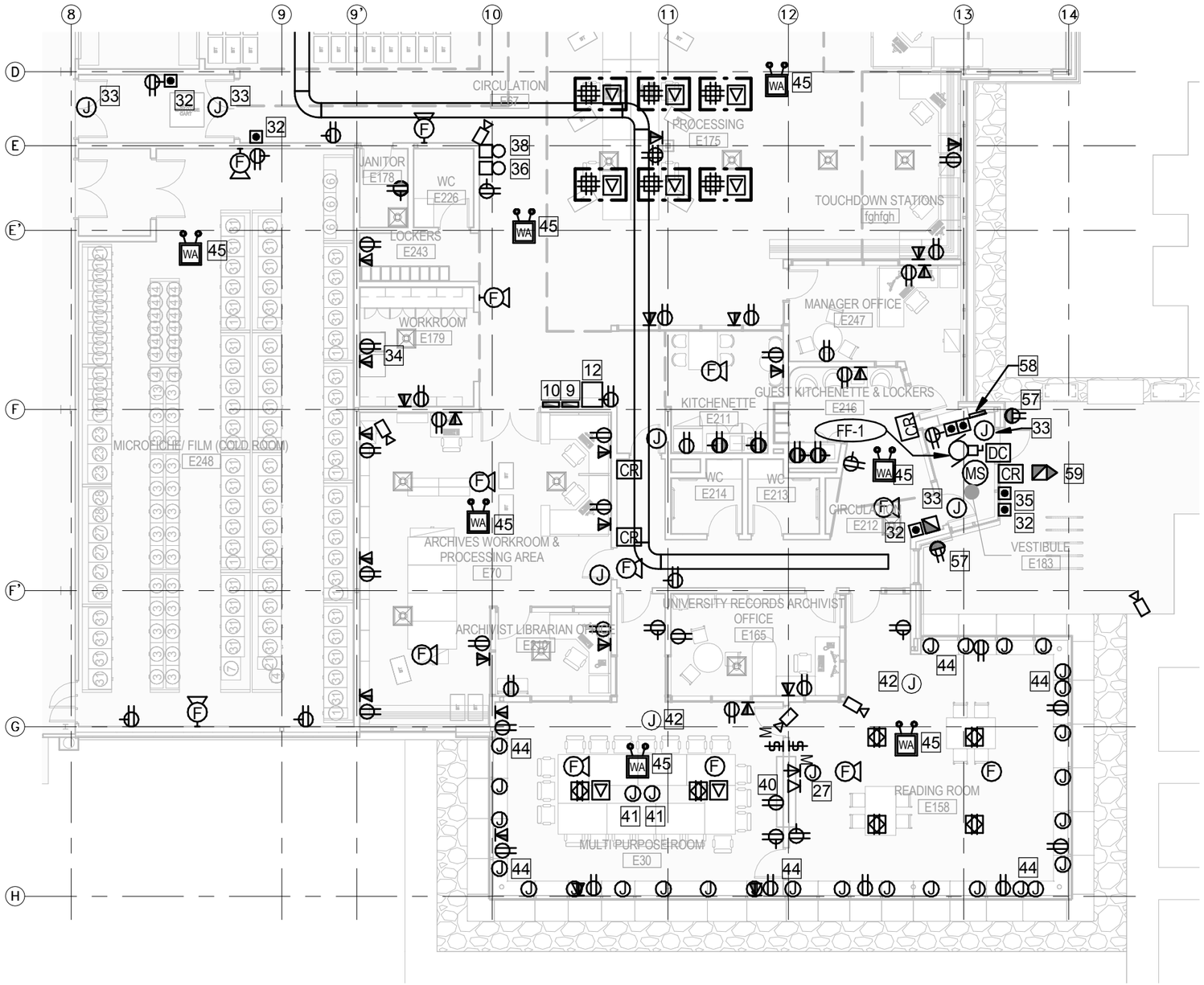
LEVEL 1-POWER TILE 1
1:200



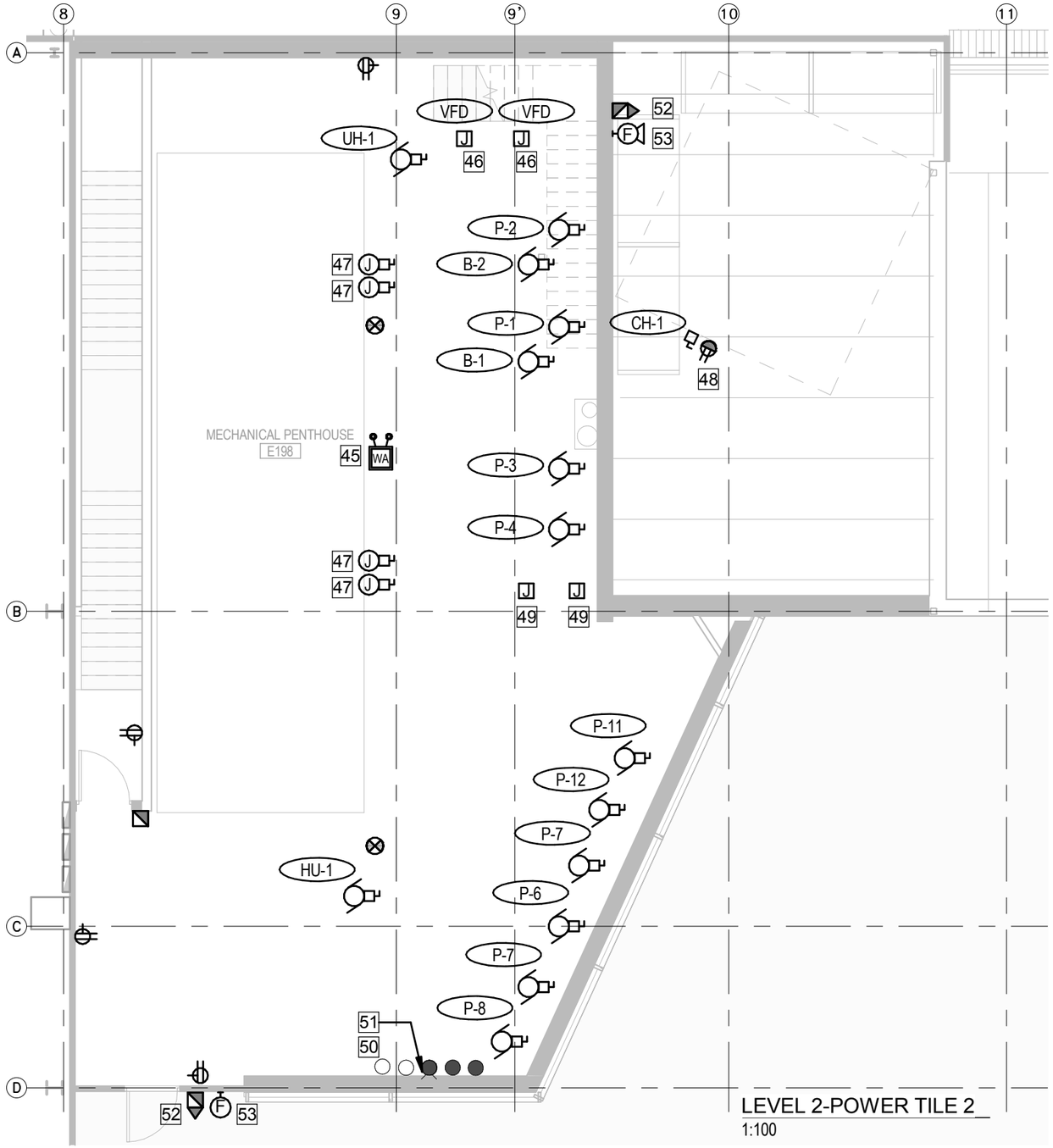
LEVEL 1-POWER TILE 2_
1:150

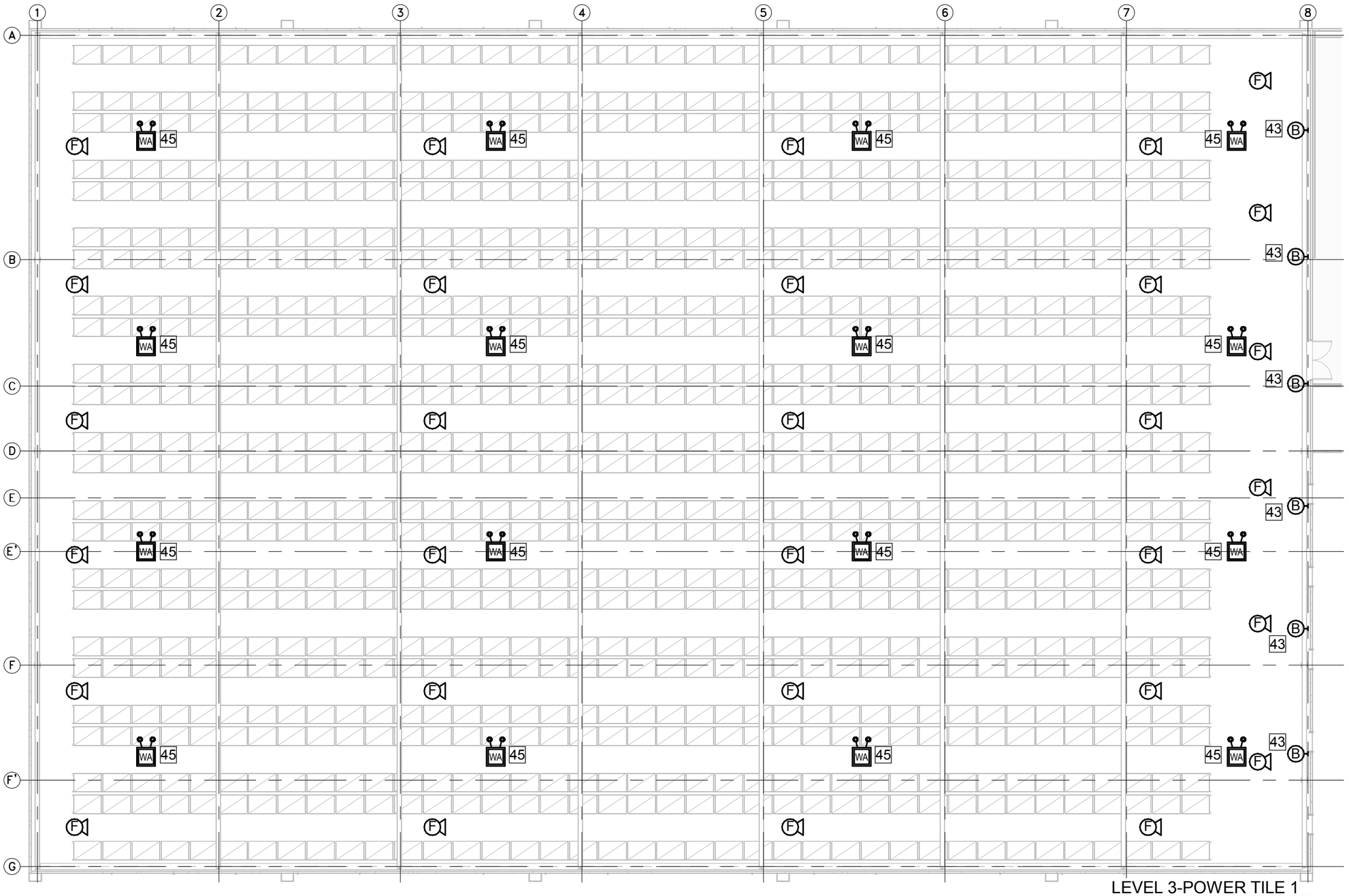


LEVEL 1-POWER TILE 2_
1:150

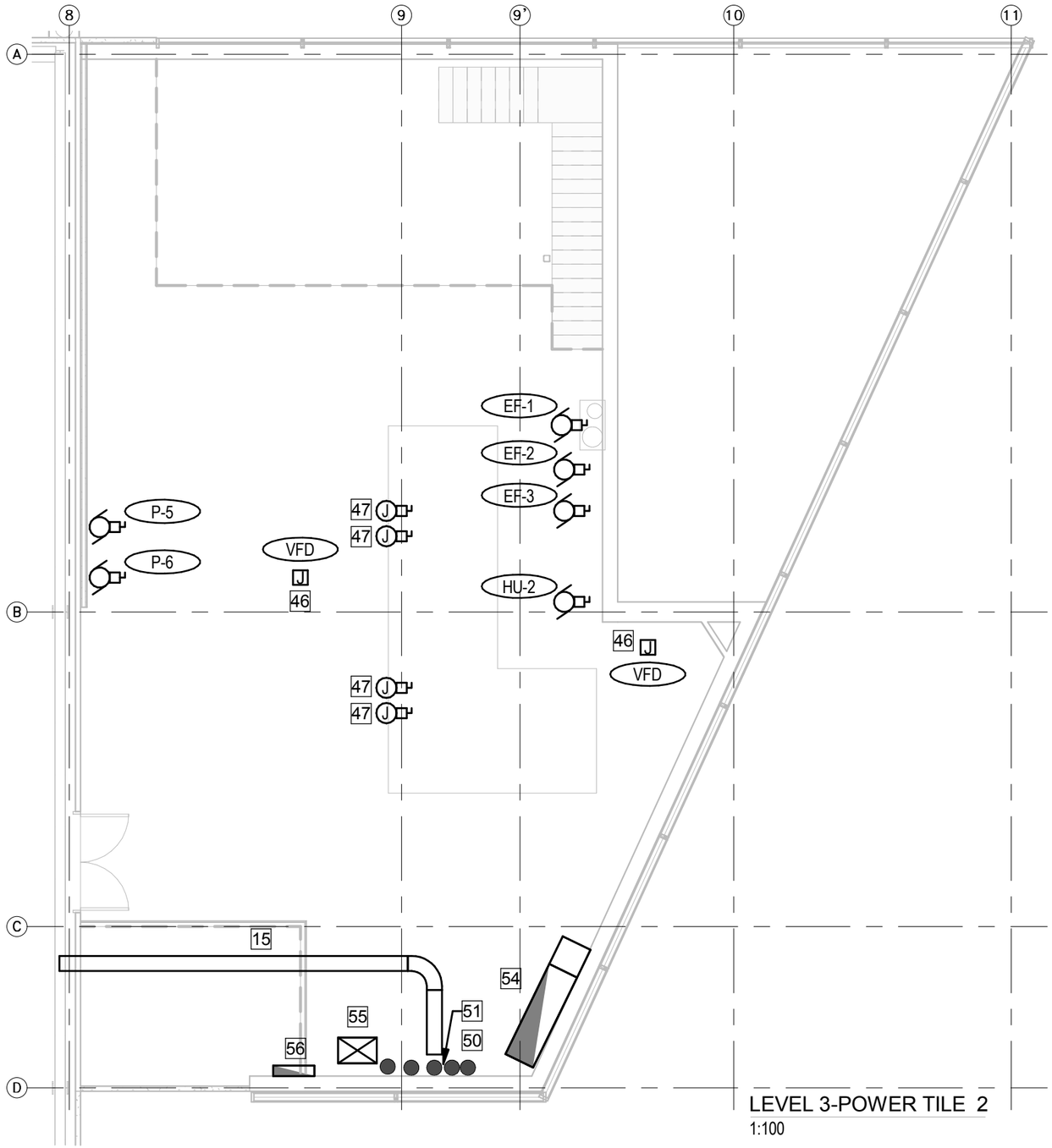


LEVEL 1-POWER TILE 3
1:150


8
9
9'
10
11
A
B
C
D
VFD
VFD
UH-1
J
46
J
46
52
F
53
P-2
47
J
B-2
47
J
P-1
CH-1
B-1
48
MECHANICAL PENTHOUSE
E198
45
WA
P-3
P-4
47
J
47
J
J
49
J
49
P-11
P-12
P-7
HU-1
P-6
P-7
P-8
51
50
52
F
53
LEVEL 2-POWER TILE 2_
1:100



LEVEL 3-POWER TILE 1
1:200



LEVEL 3-POWER TILE 2
1:100

PAGE INTENTIONALLY LEFT BLANK

6.0 LANDSCAPE DESIGN

Introduction

The proposed landscape plan is based on the preservation of the majority of the existing shelterbelt planting which forms the north and south boundaries of the development site and new planting along the building's east frontage. This new planting provides visual interest, both from views to the building from the outside and from the inside of the building looking out. The final selection of landscape materials is based on colour, form, texture and sustainability, during all the seasons of the year.

Site Context

The history of the site as an agricultural plot on the University Farms is clearly defined by the hedgerow of mature trees on the North boundary of the site and a paralleling row just north of the South boundary. The hedgerows of trees reinforce that agricultural heritage of the area, something that early on in the design process was recognized as being an important element to be retained. In addition, the mature trees help to screen the large building faces and tend to bring down the scale of the building mass. Recognizing that necessary construction operations such as site excavation for the building foundation can have damaging effects on the trees root systems, much consideration has been given to positioning the building and its supporting infrastructure so as to minimize the impact, and allowing approximately 90% of the existing trees to be retained.

Landscape Planting

The focus of the new plantings on site will be mainly along the east side of the building, the public face that presents itself to passing traffic both vehicular and pedestrian, as well as LRT. The Southeast corner of the building is the public sector, landscaped to present a welcoming image, defining the public entrance and complimenting the building form. The Northeast corner of the building is the service sector with the landscape focussing on screening of activities and surface utilities located along the North side of the building. Generally, planting is expressed in several layers consisting of trees, shrubs, grasses and groundcover, in rectilinear patterns drawn from images of agricultural plots while at the same time expressing some of the building forms on the ground plane. The intent is to provide visual interest both from outside the building and from the inside the building looking out.

Any deep swales in the landscape developed for the purpose of channeling rainwater, will be treated with native grasses, ground covers and granular materials so as to naturalize their image and eliminate their need for ongoing maintenance such as mowing. The South and West edges of the site have minimal landscape treatment, as it is envisioned that their development will be influenced strongly by the development along the adjacent future service corridors, details which have not yet been defined. The rear of the building will also be developed with a simple sculpting of the landform and turf grass landscape treatment, so as not to encumber the area designated for future expansion.

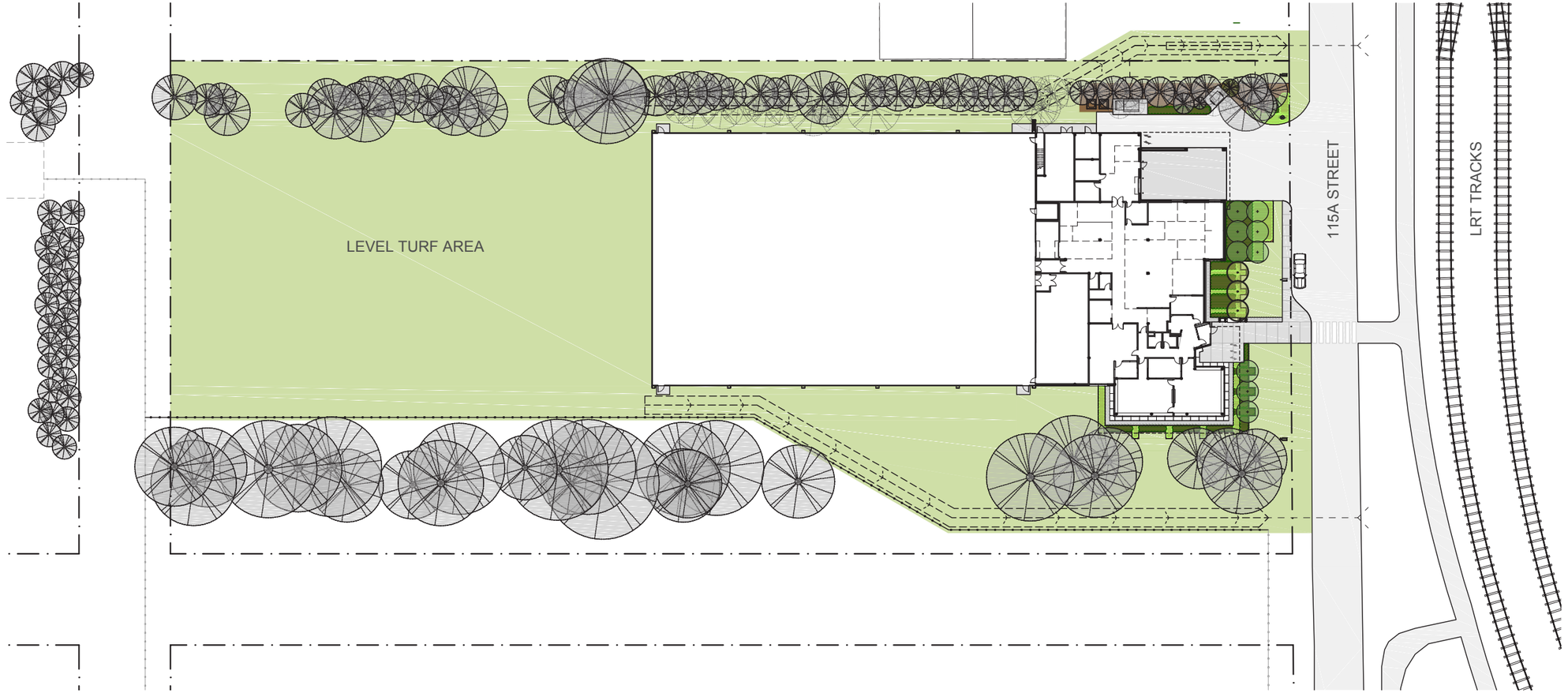
All woody ornamental and perennial planting will conform to the standards of the Canadian Nursery Landscape Association (CNLA), sod to the Canadian Nursery Sod Growers of Landscape Alberta (CNSGLA) and turf grass seed to the Canadian Seed Trade Association (CSTA). In addition, the APO/Manager, Research Stations for ALES was contacted in order to confirm that the proposed woody ornamental and ornamental grass planting proposed is acceptable.

Site Furniture and Fencing

Recognizing the need of both visitors and staff, bicycle racks are located at the main building entrance and adjacent the loading dock access at the north east corner of the building. An exterior bench is also provided at the main entry.

A new 1.8 M height chain link fence will be installed to define the south boundary of the site.

LANDSCAPE CONCEPT



LEGEND

- PROPERTY LINE
- EXISTING FENCE LINE
- PROPOSED CHAIN LINK FENCE
- ALUMINUM PLANT BED EDGER
- DRAINAGE SWALE
- ASPHALTH SURFACE
- CONCRETE SURFACE
- EXISTING TREE
- EXISTING TREE TO BE REMOVED
- PROPOSED ORNAMENTAL TREE 1
- PROPOSED ORNAMENTAL TREE 2
- PROPOSED CONIFEROUS TREE
- PROPOSED SHRUB PLANTING
- PROPOSED GROUNDCOVER/GRASSES
- TURF AREA
- PROPOSED MULCH BED
- PROPOSED GRANULAR MULCH
- PROPOSED BIKE RACK
- PROPOSED WASTE RECEPTACLE
- PROPOSED TRANSFORMER
- PROPOSED LIGHT STANDARD LOCATION
- PROPOSED FIRE HYDRANT LOCATION
- PROPOSED CULVERT
- SITE AND LANDSCAPE PLANS TO HAVE CPTED REVIEW PERFORMED

LEGEND

- PROPERTY LINE
- EXISTING FENCE LINE
- PROPOSED CHAIN LINK FENCE
- ALUMINUM PLANT BED EDGER
- DRAINAGE SWALE
- ASPHALTH SURFACE
- CONCRETE SURFACE
- EXISTING TREE TO REMAIN
- EXISTING TREE TO BE REMOVED
- PROPOSED ORNAMENTAL TREE 1
- PROPOSED ORNAMENTAL TREE 2
- PROPOSED CONIFEROUS TREE
- PROPOSED SHRUB PLANTING
- PROPOSED GROUNDCOVER/GRASSES TURF AREA
- TURF AREA
- PROPOSED MULCH BED
- PROPOSED GRANULAR MULCH
- PROPOSED BIKE RACK
- PROPOSED WASTE RECEPTACLE
- PROPOSED TRANSFORMER
- PROPOSED LIGHT STANDARD LOCATION
- PROPOSED FIRE HYDRANT LOCATION
- PROPOSED CULVERT

SITE AND LANDSCAPE PLANS TO HAVE CPTED REVIEW PERFORMED

NORTH

PLANT LIST

SYMBOL	QTY	SIZE	COMMON NAME	LATIN
TREES				
	9	50MM CAL.	SPRINGSNOW HAWTHORN	CRATAEGUS X MORDENSIS 'SNOWBIRD'
	3	50MM CAL.	TOBA HAWTHORN	CRATAEGUS X MORDENSIS 'TOBA'
	1	3.0M HT	SCOTS PINE PINE	PINUS SYLVESTRIS
SHRUBS				
	10	450MM HT	DIABLO NINEBARK	PHYSOCARPUS OPULIFOLIUS 'DIABLO'
	25	450MM HT	PYGMY CARAGANA	CARAGANA PYGMAEA
	15	400MM HT	BLUE FOX WILLOW	SALIX BRACHYCARPA 'BLUE FOX'
	58	450MM HT	GOLDFINGER POTENTILLA	POTENTILLA FRUTICOSA 'GOLDFINGER'
	26	400MM HT	GOLDFLAME SPIREA	SPIRAEA X 'GOLDFLAME'
PROPOSED GRASSES/GROUNDCOVER				
	16	500MM SPR	SKANDIA JUNIPER	JUNIPERUS SABINA 'SKANDIA
	43	#1 CONTAINER	KARL FOERSTER REED GRASS	CALAMAGROSTIS X ACUTIFLORA 'KARL FOERSTER'
	96	#1 CONTAINER	ELIJAH BLUE FESCUE	FESTUCA OVINA 'ELIJAH BLUE'
GROUND COVER				
	7785 M²	TURF AREA		
	345 M²	MULCH BED - SHREDDED BARK MULCH		
	45 M²	GRANULAR MULCH - 25 - 50MM DIA. CRUSHED ANGULAR GREY RUNDLE STONE		

REPRESENTATIVE IMAGES - LANDSCAPE FEATURES

PROPOSED TREES


SNOWBIRD HAWTHORN


TOBA HAWTHORN


SCOTS PINE

PROPOSED SHRUBS


BLUE FOX WILLOW


DIABLO NINEBARK


GOLDFINGER POTENTILLA


PYGMY CARAGANA


GOLDFLAME SPIREA

PROPOSED GROUNDCOVER/GRASSES

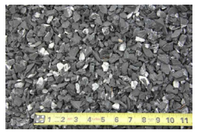

HUGHES JUNIPER


KARL FOERSTER


ELIJAH BLUE FESCUE

LANDSCAPE MATERIAL


ALUMINUM EDGER


GRANULAR MULCH

SITE FURNITURE


BIKE RACK


BENCH

PAGE INTENTIONALLY LEFT BLANK

7.0 CIVIL DESIGN

Existing Site

The RCRF site is a low-lying vegetated site south of the existing Saville Sports Centre on U of A South Campus. The site is bordered by 115A Street to the east. Topographic information shows the lot is non-draining and varies little in elevation from north to south and east to west. The site is currently un-serviced, scheduled to change in 2016 with plans to extend infrastructure to the site. Geotechnical information shows the lot currently has 300mm of topsoil on site as well as poor soils for economical foundation designs.

Site Servicing

Site servicing for the building will be brought from a location west of the site to entry point locations on or around the building. A new fire hydrant will be placed in the northeast corner of the site to aid in fire protection for the RCRF project, the hydrant will have no more than 45m of travel distance to the fire department connection located on the building. Storm sewer services will not be brought to site as the area will utilize surface drainage to convey storm water. 1m wide ditch bottoms will convey roof drainage to the east and convey the storm flows underneath 115A Avenue through the use of a 600mm culvert. Due to the nature of the fire response system in the building, flushing strategies to convey 3000GPM of water for the fire pump testing strategy have been considered as it relates to conveying flows without major erosion in the surface drainage systems. Currently there are the following deep utilities designed for the building:

- 200mm water service
- 150mm sanitary service

Site Grading

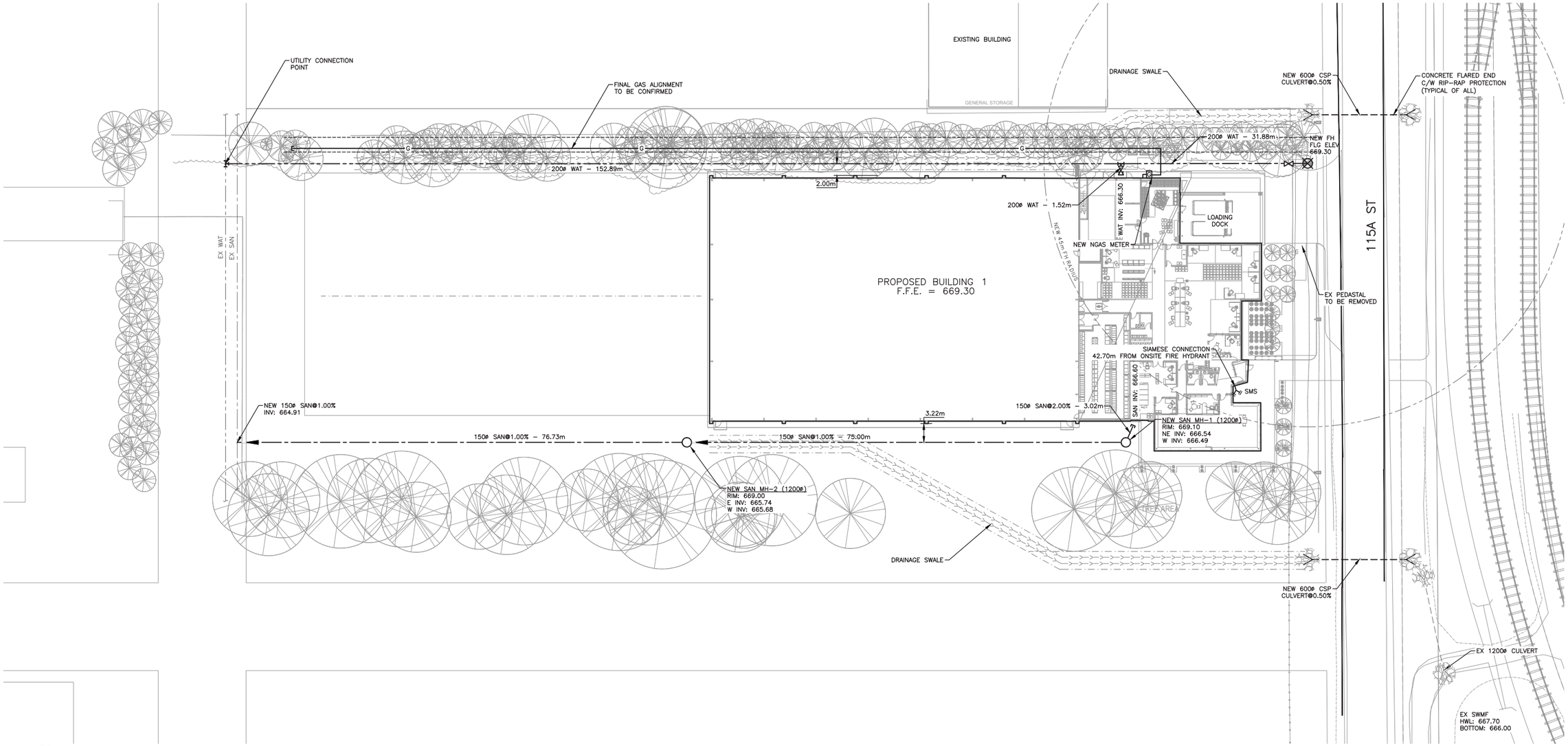
Minimum slopes of 1% and maximum slopes of 4% will be utilized where vehicle and pedestrian traffic is expected. Storm water will be conveyed from the roof area, loading dock area and pedestrian areas through the use of surface drainage and will ultimately enter a ditch system that is to be established on the north and south sides of the building. Drainage ditches will convey the storm water to culvert crossings (under 115A Street) to a major drainage ditch that ultimately makes its way to a dry pond located southeast of the RCRF project. A cross section of a typical drainage ditch is shown on the grading plans as part of this report.

The finished floor elevation (669.30m) is currently set at 200mm above the centreline of the adjacent roadway, where the north culvert crossing is currently proposed (major overland flow path for storm event @ 669.10m). The finished floor of the building is well above the high water level (HWL) of the downstream dry pond. Minor storm events will be conveyed by the ditches and culverts to the adjacent storm pond. In a major storm event the ditches will hold back storm water, once full capacity is reached in the ditches water will spill over the adjacent roadway at an elevation of 669.10m. As the project continues to construction documents there will be a further discussion to raise the finished floor of the building to ensure the longevity of the sites ability to combat major storm events.
Erosion and Sediment Control (ESC)

At a minimum the project shall adhere to the current City of Edmonton ESC guidelines. A silt fence shall be installed around the limits of construction for the RCRF project.

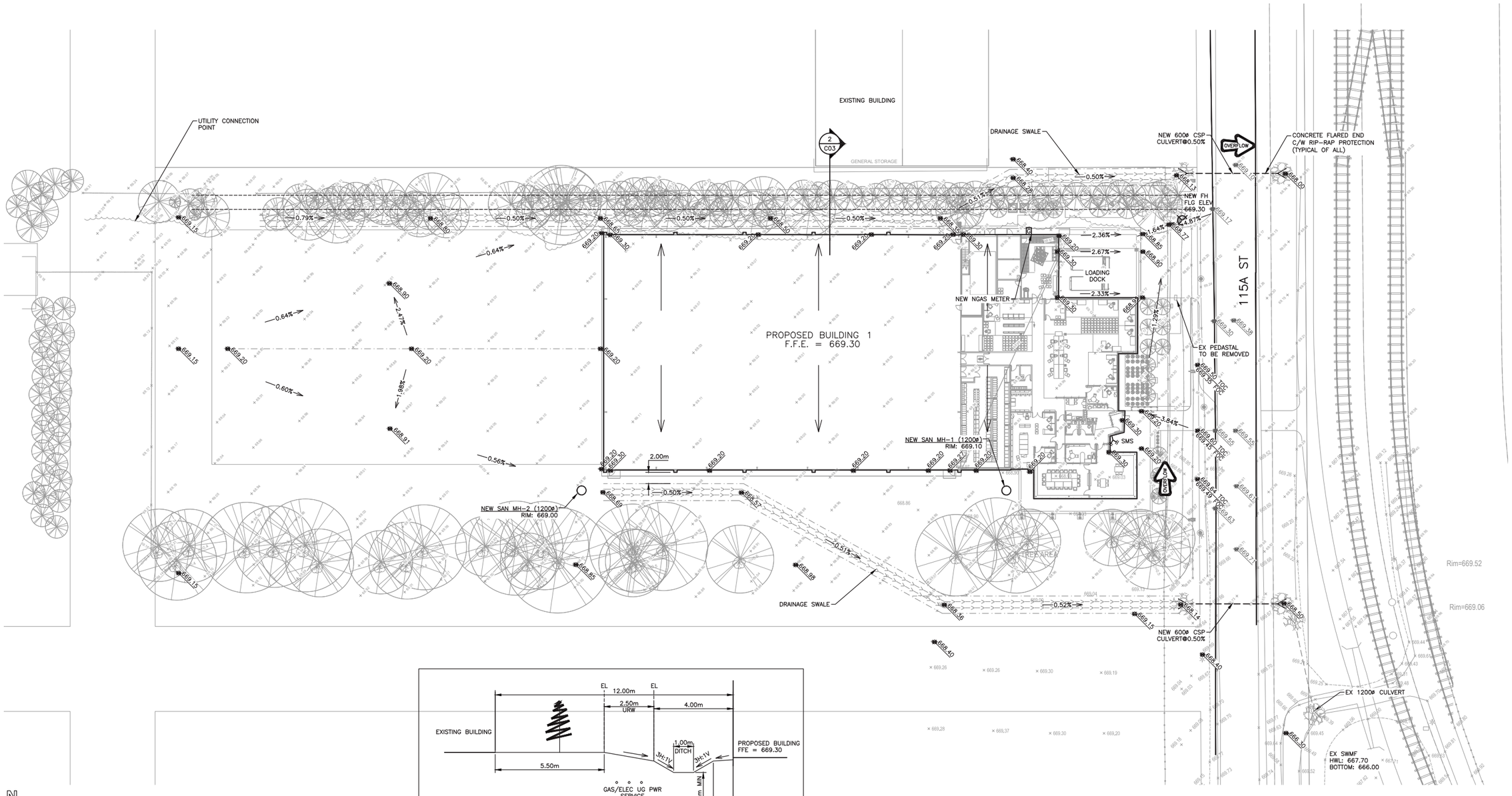
Future Considerations

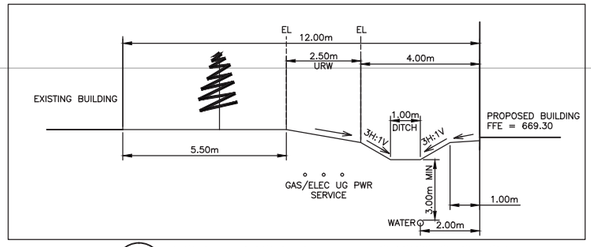
Infrastructure as described above and installed as part of the RCRF project may be adequate to service the expansion of the building or other projects planned for this parcel of land, depending on magnitude. Currently we can conclude that the drainage ditch will be able to convey future rain water from a building expansion as depicted on the Architectural plans. We can also conclude that the sanitary and water infrastructure are sized adequately to deal with domestic water and waste water needs for a future building expansion.



N

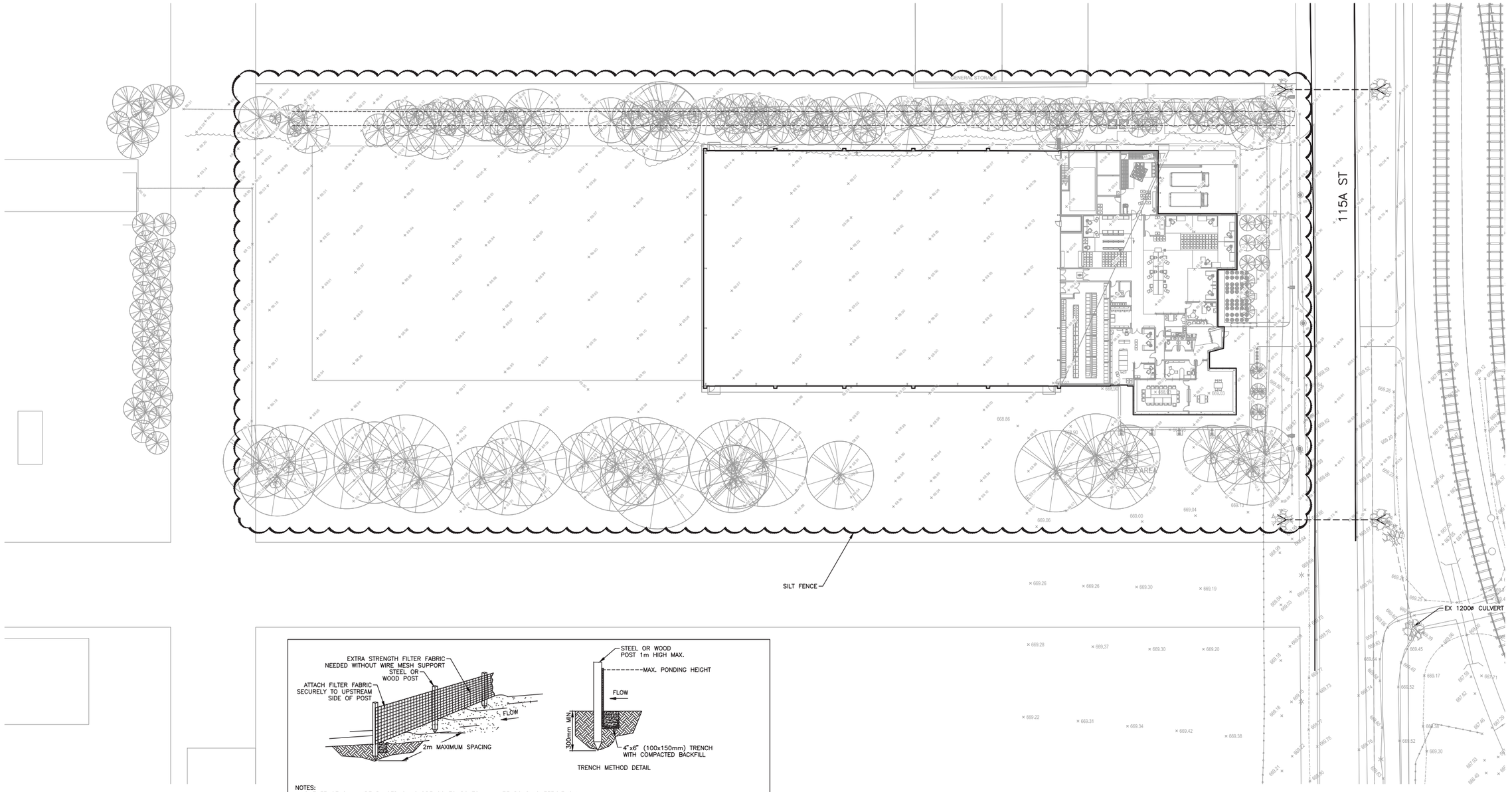
1 / C01 **SITE SERVICING PLAN**
SCALE: 22x34 1:350
11x17 1:700

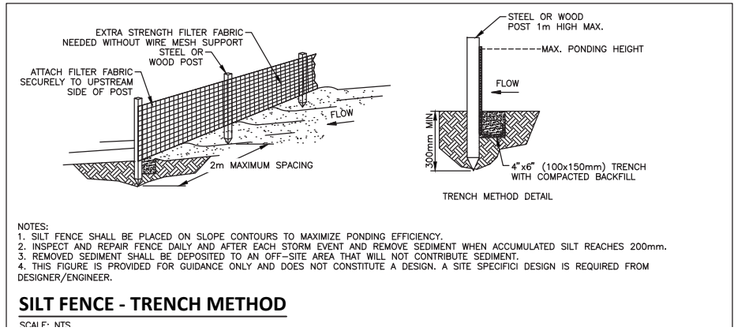




1 / C02 SITE GRADING PLAN
SCALE: 22x34 1:350
11x17 1:700

2 / C02 NORTH PROPERTY LINE CROSS SECTION
SCALE: N.T.S.





TRENCH METHOD DETAIL

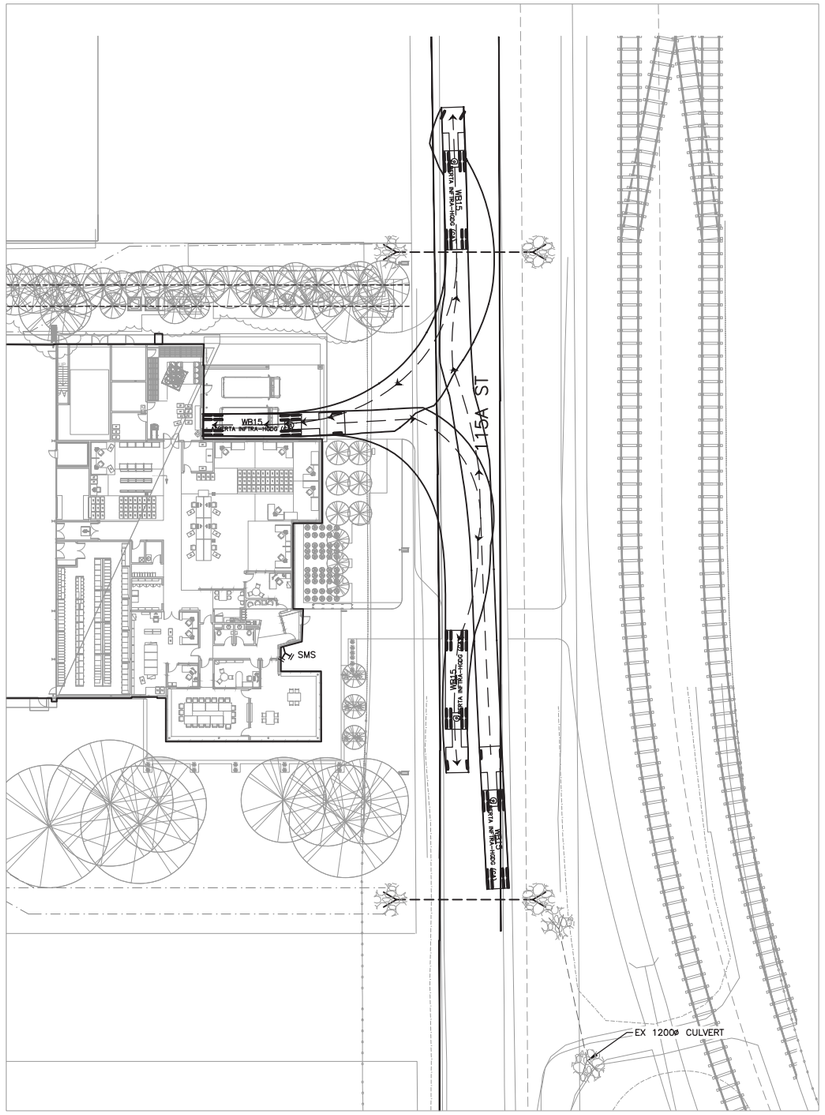
NOTES:
1. SILT FENCE SHALL BE PLACED ON SLOPE CONTOURS TO MAXIMIZE PONDING EFFICIENCY.
2. INSPECT AND REPAIR FENCE DAILY AND AFTER EACH STORM EVENT AND REMOVE SEDIMENT WHEN ACCUMULATED SILT REACHES 200mm.
3. REMOVED SEDIMENT SHALL BE DEPOSITED TO AN OFF-SITE AREA THAT WILL NOT CONTRIBUTE SEDIMENT.
4. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFICI DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

SILT FENCE - TRENCH METHOD

SCALE: NTS

N

1 / C03 **ESC PLAN**
SCALE: 22x34 1:350
11x17 1:700

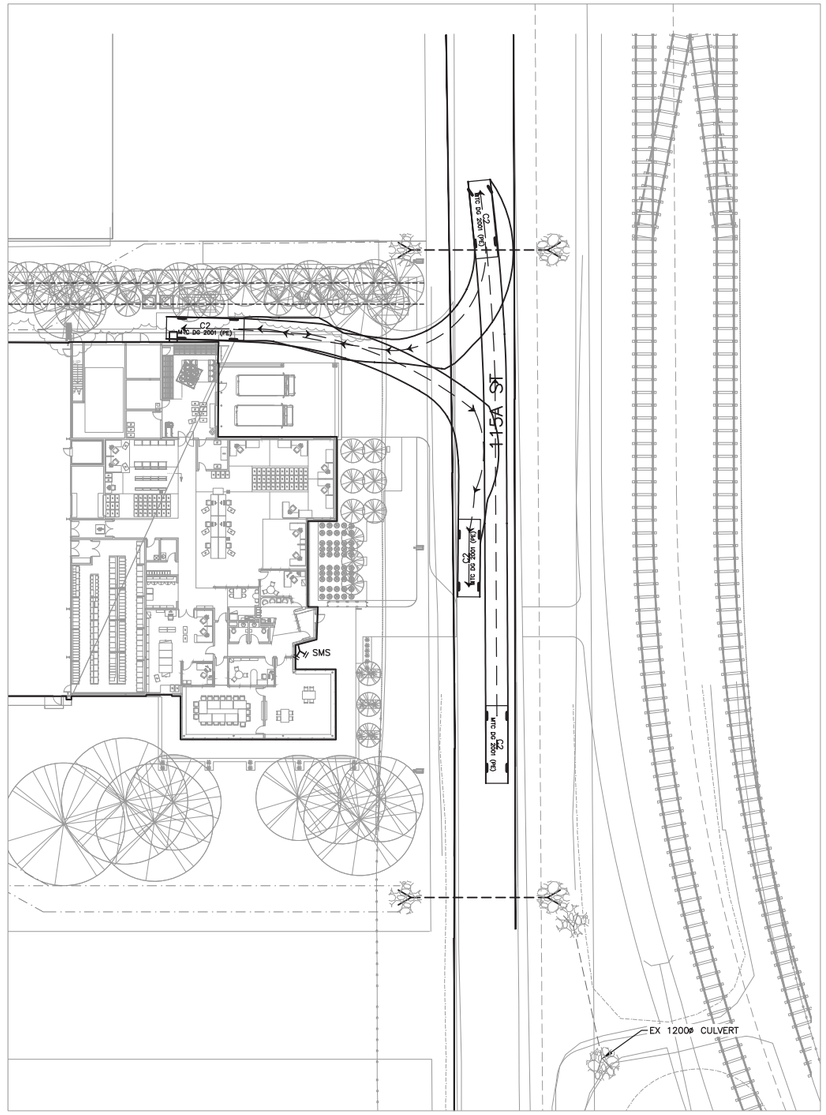


N

1 / C03

TURNING RADII
SEMI TRUCK/FIRE TRUCK

SCALE: 22x34 1:350
11x17 1:700

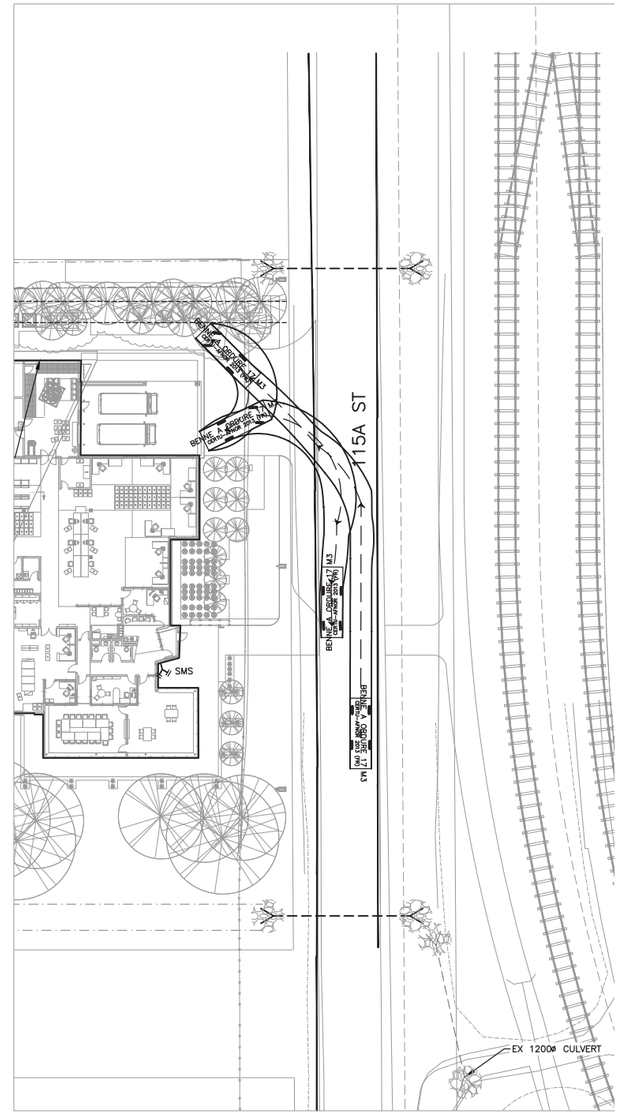


N

1 / C03

TURNING RADII
FLATBED TRUCK

SCALE: 22x34 1:350
11x17 1:700



N

1 / C03

TURNING RADII
GARBAGE TRUCK

SCALE: 22x34 1:350
11x17 1:700

8.0 OUTLINE SPECIFICATIONS

Design Development Outline Specifications

The Outline Specifications at the Design Development phase provide a basic description of materials and systems proposed for utilization in the project, divided into:

- *Architectural*
- *Structural*
- *Mechanical*
- *Electrical*
- *Civil*
- *Landscaping*

The following descriptive information will be further enhanced and expanded during the working documents phase (Drawings and Specifications) for construction.

Proposed Specification Divisions and Sections

This is a global outline listing of all Divisions and Sections proposed for the project. In coordination with the drawing set to be issued, the final working specifications proper will be issued as a separate bound set of documents inclusive of all tendering, legal, and materials requirements for the project.

The "Source" indicated below denotes the authorship of each individual Division as follows:

HFKS	HFKS Architects Inc.(HFKS)
Structural	Chernenko Engineering Ltd. (CHK)
Mechanical	KFR Engineering Ltd (KFR)
Electrical	SMP Engineering (SMP)
Civil	Arrow Engineering (ARR)
Landscaping	EDA Collaborative Inc. (EDA)
Construction Manager	Stuart Olson Construction Ltd. (SO)

OUTLINE SPECIFICATIONS: INDEX

SECTION #	TITLE	SOURCE
ARCHITECTURAL SPECIFICATIONS		
DIVISION 00:	BIDDING REQUIREMENTS	
	Cover	
	List of Project Entities	HFKS
00 01 10	Table of Contents	HFKS
00 01 15	List of Drawings	HFKS
00 11 00	Invitation to Bid	SO
00 21 00	Instructions to Bidders	SO
00 25 13	Pre-Bid Meeting	HFKS
00 31 00	Information Available to Bidders	SO
00 41 00	Bid Submission Documents	SO
00 41 15	(Separate Prices)	HFKS
00 52 00	Subcontract Agreement	SO
DIVISION 01	GENERAL REQUIREMENTS	
01 11 00	Summary of Work	SO
01 12 00	Fire Separation Basic Requirements (Cash Allowances)	HFKS
01 21 13		HFKS
01 26 00	Trade Scope Definitions & Notwithstanding Clauses	HFKS
01 29 00	Delegated Engineering Submittals	HFKS
01 31 13	Mechanical and Electrical Coordination	HFKS
01 31 19	Project Meetings	HFKS
01 35 00	Mock-Ups	HFKS
01 35 20	Environmental Procedures	HFKS
01 35 29	Work Site Safety	HFKS
01 35 53	Security Screening of CM's Personnel	HFKS
01 41 00	Regulatory Requirements	HFKS
01 50 00	Temporary Facilities & Controls	SO
01 62 00	Product Options & Substitutions	HFKS
01 71 00	Final Cleaning – Interior	HFKS
01 72 00	Exterior Clean-up	HFKS
01 73 29	Cutting & Patching	HFKS
01 74 19	Waste Management & Disposal	HFKS
01 77 20	Contract Acceptance Procedures	HFKS
01 78 23	Operation and Maintenance Data and Manuals	HFKS
01 78 39	Project Record Documents	HFKS
01 78 43	Spare Parts and Maintenance Materials	HFKS
01 79 00	Equipment and Systems Demonstration and Instruction	HFKS
01 91 01	Facility Start-Up Procedures	HFKS
01 91 05	Starting of Equipment and Systems	HFKS
01 91 10	Testing, Adjusting and Balancing	HFKS
DIVISION 02 – EXISTING CONDITIONS/SITE WORK – N/A		
DIVISION 03 – CONCRETE		
30 10 00	Concrete Forms & Accessories	HFKS
30 20 00	Concrete Reinforcement	HFKS
03 30 00	Cast-in-Place Concrete	HFKS
03 35 00	Concrete Finishing	HFKS
03 35 53	Polished Concrete Topping	HFKS
DIVISION 04 – MASONRY		
04 22 00	Concrete Unit Masonry	HFKS
DIVISION 05 – METALS		
05 12 23	Structural Steel Framing for Buildings	HFKS
05 21 00	Steel Joist Framing	HFKS
05 31 00	Steel Decking	HFKS
05 51 29	Metal Stairs and Ladders	HFKS
DIVISION 06 – WOOD, PLASTICS & COMPOSITES		
06 10 00	Rough Carpentry	HFKS
06 20 00	Finish Carpentry	HFKS
06 40 00	Architectural Woodwork	HFKS
06 65 00	Solid Polymer Fabrications	HFKS
DIVISION 07 – THERMAL & MOISTURE PROTECTION		
07 11 00	Thermographic Survey	HFKS
07 13 52	Sheet Membrane Waterproofing	HFKS
07 21 13	Semi-Rigid & Rigid Board Insulation	HFKS
07 21 16	Non-Rigid Fibrous Insulation	HFKS
07 26 00	Sheet Membrane Air & Vapour Seal	HFKS
07 26 10	Under-Slab Moisture Barrier	HFKS
07 42 13	Prefinished Insulated Steel Cladding	HFKS
07 50 10	Modified Bituminous Membrane Roofing	HFKS
07 60 00	Sheet Metal Flashings & Trim	HFKS
07 61 10	Eaves Troughs & Downspouts	HFKS
07 62 00	Metal Flashings for Roofing	HFKS
07 81 16	Cementitious Fireproofing	HFKS
07 84 00	Firestopping & Smokeseals	HFKS
07 92 00	Joint Sealants	HFKS
DIVISION 08 – OPENINGS		
08 11 16	Aluminum Doors and Frames	HFKS
08 12 13	Hollow Steel Doors & Frames	HFKS
08 21 10	Plastic Laminated Faced Wood Doors	HFKS
08 25 00	Overhead Doors	HFKS
08 70 00	Door Hardware	HFKS
08 81 00	Glass & Glazing General Requirements	HFKS
08 83 13	Mirror Glass	HFKS
08 99 10	Door, Frame, & Hardware Schedule	HFKS
DIVISION 09 – FINISHES		
09 29 00	Gypsum Board Assemblies	HFKS
09 30 13	Ceramic Wall Tile	HFKS
09 31 00	Porcelain Floor Tile	HFKS
09 51 13	Acoustic Unit Ceilings	HFKS
09 68 00	Carpet Tile	HFKS
09 91 05	Painting & Finishing General Requirements	HFKS
09 91 23	Interior Painting & Finishing Schedule	HFKS
09 91 30	Painting of Mechanical & Electrical Work	HFKS
DIVISION 10 – SPECIALTIES		
10 11 13	Whiteboards, Tackboards	HFKS
10 28 10	Washroom & Janitorial Accessories	HFKS
10 95 00	Miscellaneous Specialties	HFKS

DIVISION 11 – EQUIPMENT

11 60 00`	Walk-in Freezer	HFKS
11 62 00	(Owner Supplied Equipment)	HFKS

DIVISION 12 – FURNISHINGS

12 49 00	Roller Shades	HFKS

DIVISION 13 – SPECIAL CONSTRUCTION

13 xx xx	Pallet Racking System	HFKS
13 xx xx	Light Boxes	HFKS

DIVISION 14 – CONVEYING EQUIPMENT (N/A)

STRUCTURAL SPECIFICATIONS
STRUCT (CHK)

DIVISION 03 – CONCRETE

03 10 00	Concrete Forms and Accessories
03 20 00	Concrete Reinforcing
03 30 00	Cast-in-Place Concrete

DIVISION 05 – METALS

05 12 00	Structural Steel Framing
05 21 19	Open Web Steel Joists
05 30 00	Metal Decking

MECHANICAL SPECIFICATIONS MECH
(KFR)

DIVISION 20 – GENERAL MECHANICAL

20 00 13	General Mechanical Provisions
20 03 20	Mechanical Systems Balancing
20 00 23	Mechanical Spare Parts & Maintenance Materials
20 01 06	Documentation
20 02 10	Motors
20 03 10	Testing
20 03 20	Mechanical Systems Balancing
20 04 10	Chemical Treatment Equipment & Procedures
20 05 23	Valves
20 05 25	Pressure Gauges and Thermometers
20 05 29	Pipe and Equipment Supports
20 05 30	Pipe and Duct Penetrations and Fire Stops
20 05 31	Access Doors in Walls/Ceilings
20 05 43	Mechanical Identification
20 05 48	Mechanical Vibration Control
20 15 00	Tanks
20 20 10	Pipe and Pipe Fittings
20 20 30	Piping and Equipment Insulation
20 20 40	Expansion Compensation
20 20 60	Pumps
20 30 10	Variable Speed Drive Systems

DIVISION 21 – FIRE SUPPRESSION

21 12 10	Standpipe and Hose Systems
21 13 13	Wet Pipe Sprinkler System
21 13 16	Dry Pipe Sprinkler System
21 21 16	Hand Held Fire Extinguishers

DIVISION 22 – PLUMBING

22 05 10	Plumbing Systems and Specialties
22 34 10	Domestic Water Heaters
22 42 10	Plumbing Fixtures and Trim

DIVISION 23 – HEATING, VENTILATION AND AIR CONDITIONING

23 07 13	Ductwork and Breeching Insulation
23 09 00	BMCS General Requirements
23 21 10	Hydronic Systems Specialties
23 21 11	Glycol System
23 31 13	Ductwork
23 31 20	Ductwork Cleaning
23 33 10	Duct Accessories
23 34 16	Fans
23 36 11	Electronic Single Duct Air Terminal Units
23 37 10	Air Outlets and Inlets
23 41 10	Air Filters
23 51 10	Breeching and Chimneys
23 52 34	Hot Water Packaged Water Tube Boiler
23 57 12	Plate Heat Exchangers
23 64 17	Air Cooled Packaged Chillers
23 73 10	Custom Fabricated Indoor Air Handling Unit
23 82 10	Hydronic Terminal Heat Transfer Units
23 82 16	Coils
23 82 19	Fan Coil Units
23 84 13	Gas Fired Steam Humidifier

ELECTRICAL SPECIFICATIONS ELECT
(SMP)

DIVISION 26 – ELECTRICAL GENERAL REQUIREMENTS

26 05 00	General Electrical Provisions
26 05 08	Existing Facilities and Services
26 05 19	General Wiring Methods
26 05 26	Grounding and Bonding
26 05 33	Conduit and Raceways
26 05 36	Wire Mesh Cable Trays
26 05 81	Mechanical Systems
26 24 13	Service and Power Distribution
26 50 10	Lighting
26 09 23	Lighting control System

DIVISION 27 – COMMUNICATIONS

27 10 05	Structured Cabling

DIVISION 28 – ELECTRONIC SAFETY & SECURITY

28 13 00	Access Control System and Security
28 31 00	Fire Alarm System

DIVISION 31 – EARTHWORKS (ARR)

LANDSCAPE SPECIFICATIONS LAND
(EDA)

DIVISION 32 – EXTERIOR IMPROVEMENTS (EDA)

32 01 91	Tree Protection
32 31 13	Chain Link Fence
32 37 00	Exterior Site Furnishings
32 93 10	Tree, Shrub and Ground Cover Planting
32 91 21	Topsoil Placement and Grading
32 92 20	Seeding
32 92 23	Sodding

OUTLINE SPECIFICATIONS

The following Divisions & Sections identify the major architectural, structural, mechanical, electrical, civil and landscape components of the project.

ARCHITECTURAL SECTIONS

03 34 00 – FLOOR LEVELING/PATCHING

1.1 INTENT
.1 The supply and installation of initial floor patching, leveling and filling compounds to provide finished, true-to-plane substrates over the base concrete structural slab as required for the installation of finishing floor materials or the ground concrete finishing process.
.2 The provision of a floor slab profile survey of the existing floor slab surface in order to determine the extent of supplementary floor leveling that will be required to provide a floor slab surface that is suitable for the purpose intended. It is anticipated that the equipment used to establish the existing floor profile will be automated "Dipstick Levelling Equipment" or similar technology.

1.2 DELIVERY/STORAGE/HANDING
.1 Store materials in a dry protected area and away from sources of water or dampness. Damaged or broken containers are to be removed from the site.

1.3 ENVIRONMENTAL CONDITIONS
.1 Maintain surface and ambient temperatures as recommended by the manufacturer.
.2 Post and enforce "do not enter" signs until floor leveling material has cured. Provide physical barriers as required to prevent traffic on newly installed installations. Prevent fumes and odours from travelling to remainder of the building.

1.4 MATERIALS/METHODS
.1 Polymer-modified, cement-based compound for patching and leveling, for applications varying from feather edge to approximately 25 mm thickness. **No gypsum products.**
.2 Primers as recommended by the leveling compound manufacturer for the particular substrate.
.3 Sealers for the finished installation as recommended by the leveling compound manufacturer.

1.5 PREPARATION
.1 Abraiding of the existing surfaces as necessary to achieve maximum bond of leveling materials to substrate.
.2 All other substrate preparation methods as required by the leveling compound manufacturers.

1.6 APPLICATION
.1 Install the materials in strict accordance with the manufacturers recommendations, perfectly true to plane and ready to receive the finished flooring materials specified in other Sections. Trueness of plane shall be not less than 6 mm total variance in 3 M, in any direction.

03 35 53 – POLISHED CONCRETE TOPPING

1.1 INTENT
.1 This section includes products and procedures for the installation of a Polished Concrete system using a multi-step dry mechanical process and accessories specified to achieve a **medium** gloss finish (41-55 gloss reading to ASTM E.430).
.1 Polished concrete topping materials.
.2 Substrate Preparation Epoxy.
.3 Mechanical Diamond Grinding and Polishing Equipment.
.4 Concrete Topping Treatment Chemicals.

1.2 REFERENCES
.1 IPCI: International Polished Concrete Institute.
.2 ASTM C 109M, Compressive Strength Air-Cure Only.
.3 ASTM C348, Flexural Strength of Hydraulic-Cement Mortar.
.4 ASTM F2170, relative Humidity in Concrete Floor Slabs Using in situ Probes.
.5 ASTM F1869, Moisture Vapour Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
.6 ASTM E430, Standard Test Method for Measurement of Gloss of High-Gloss Surfaces by Abridged Goniophotometry.
.7 ASTM E 1155 – Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers.

1.3 SUBMITTALS
.1 Qualification Data: Provide written documentation from the manufacturer confirming that the installer meets the qualifications as specified and is eligible for manufacturer's warranty.
.2 Maintenance Data: Provide complete instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under intended use. These instructions shall contain precautions against cleaning products and methods that may be detrimental to finishes and performance. For inclusion in the Operation and Maintenance Data Manuals.

1.4 QUALITY ASSURANCE
.1 Installer Qualifications: Products for the Polished Concrete System must be installed by an installer approved by the system manufacturer, qualified to provide a warranty as specified.
.2 Mock=Up: Before performing the work in this section, an on-site mock-up (in an area as designated by the Consultant) of the specified system representative of specified process, surface, finish, colour and joint design/treatments, must be installed for review and approval. The mock-up shall be installed using the same installation personnel who will perform the work. Approved mock-up may become part of completed work, if undisturbed at time of Substantial Performance.

05 50 00, 05 56 00 CUSTOM STEEL & STAINLESS STEEL FABRICATIONS

1.1 INTENT
.1 For the supply and installation of miscellaneous (generally concealed) custom steel elements: above-ceiling equipment supports, in-wall structural bracing, etc., and custom (generally exposed to view) finished stainless steel elements: corner guards, work counters, wall cladding, etc.

06 10 00 – ROUGH CARPENTRY

1.1 INTENT
.1 For the supply and installation of all rough carpentry as generally required.

1.2 REGULATORY REQUIREMENTS
.1 Comply with applicable requirements of CAN/CSA 086.

1.3 SOURCE QUALITY CONTROL
.1 Supply lumber graded by an agency certified by Canadian Lumber Standards Administrative Board. Supply lumber and panel components marked with a recognized, visible grade stamp.

1.4 LUMBER PRODUCTS
.1 Dimension Board Lumber: to CAN/CSA 0141-91 and graded in accordance with current National Lumber Grades Authority (NLGA) Standard Grading Rules for Canadian Lumber.
.1 Moisture Content: maximum 19% at time of installation.
.2 Surface Finish: S2S or S4S for members not receiving finishes.

1.5 PANEL PRODUCTS
.1 Canadian Softwood Plywood: to CSA 0151-M1978.
.2 Douglas Fir Plywood: to CSA 0121-M1978.
.3 Poplar Plywood: to CSA 0151-M1980.

06 20 00 – FINISH CARPENTRY

1.1 INTENT
.1 The supply and installation of all finishing carpentry, and the installation of all cabinetry specified in Section 06 40 00, Architectural Woodwork.

1.2 REFERENCES
.1 Architectural Woodwork Manufacturers Association of Canada (AWMAC) Architectural Woodwork Quality Standards Illustrated, latest edition. Custom Grade.
.2 Canadian General Standards Board (CGSB), CAN/CGSB-11.3-M87.
.3 Canadian Plywood Association (CanPly), The Plywood Handbook 2005.
.4 Canadian Standards Association (CSA International)

1.3 QUALITY ASSURANCE
.1 Provide lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board. Plywood and wood based composite panels in accordance with CSA and ANSI standards.

1.4 MATERIALS
.1 Softwood Lumber: average moisture content of 6% and maximum of 9% for interior work, an average of 12% and maximum of 15% for exterior work: to AWMAC custom grade.
.2 Canadian Softwood Plywood: to CSA 0151-M1978.
.3 Hardboard: to CAN/CGSB-11.3-M87 Type 2, tempered.
.4 Adhesives: as recommended by AWMAC.

06 40 00 – ARCHITECTURAL WOODWORK

1.1 INTENT
.1 The supply and installation of all new cabinetry assemblies.

1.2 REFERENCES/FINISH
.1 Millwork shall conform to the Millwork Standards of the Architectural Woodwork Manufacturers Association of Canada, Quality Standards for Architectural Woodwork, Latest Edition: Custom Grade.

1.3 SHEET & SOLID MATERIALS
.1 Plywood Substrate: for all cases, adjustable shelves, drawer fronts and gable ends, floor cabinet bases: softwood plywood, veneer core, 19 mm thick for shelves, 12.7 mm thick for cleats and bases. No fir plywood. Doors are to be to AWMAC requirements for material.
.2 Standard Plastic Laminate: GP Grade: to CAN3-A172-M79, minimum thickness 1.2 mm: Horizontal surfaces.
.3 Vertical grade P.lam for cabinet interiors and exposed vertical surfaces.
.4 Post-forming Plastic Laminate: minimum thickness: 1 mm.
.5 Panel Edging: 3 mm thick flexible PVC, hot-glue applied. Colour as chosen by the Prime Consultant.
.6 Other Accessories: to AWMAC Manual.
.7 Plastic Laminate Backer Sheet: standard brown colour: to CAN3-A172-M79. All panels with plastic

laminate face finishes.

1.4 HARDWARE
.1 All shelving standards are to be flush mounted metal.
.2 Pulls and hinges as specified by the Consultant.
.3 Locks if required.

06 65 00 – SOLID POLYMER FABRICATIONS

1.1 INTENT
.1 The supply and installation of solid polymer (eg: similar to Corian brand) countertops, wall panels, sills, and other similar locations requiring a seamless, homogeneous, and watertight material.

07 13 52 – SHEET MEMBRANE WATERPROOFING

1.1 INTENT
.1 The supply and installation of below-grade perimeter sheet membrane waterproofing.

1.2 REFERENCES
.1 The manufacturer of the specified elastomeric bitumen products shall provide proof of current ISO 9001 and ISO 14001 certifications.

1.3 MATERIALS/FINISHES
.1 Waterproofing Membrane: torch-applied; Membrane composed of non-woven polyester reinforcement and SBS modified bitumen. Thermofusible plastic film both faces. Colour: black. Thickness (total): 3.0 mm.
.2 Mastic: purpose-made for sealing joints and edges of membrane: in gun grade.

07 21 13 – RIGID & SEMI-RIGID BOARD INSULATION

1.1 INTENT
.1 The supply and installation of rigid & semi-rigid board wall insulation.

1.2 REFERENCES/CERTIFICATION
.1 Polystyrene Rigid Insulation: to CGSB 51.20-M87, Type 4.
.2 Mineral Wool Semi-Rigid Insulation: to CAN/ULC S114-M80. CAN/ULC 5102 & AASTM standards C356, C553, E96-95, C209-92.
.3 Glass Fibre Semi-Rigid Wall Insulation: to CGSB 51-11-92, CAN4-5102-M83, & CAN4-5114-M80.

1.3 MATERIALS
.1 Mineral Wool: to CAN/CGSB 51.10-92, Type 2, Class 4.
Board dimensions: 400 x 1220 mm "Roxul Cavity Rock", or approved alternative.
.2 Glass Fibre: to CGSB 51.11.92.
Board dimensions: 610 x 1220 mm "Fibreglas Wall Insulation AF 180" or approved alternative.

1.4 FASTENERS
.1 Fasteners shall be specifically designed to anchor standard semi-rigid board insulation by frictional resistance to structurally adequate substrates.

07 21 16 – NON-RIGID FIBROUS INSULATION

1.1 INTENT
.1 The supply and installation of all non-rigid above grade interior wall insulation.

1.2 MATERIALS
.1 Fibrous Glass Batts or Mineral Wood Batts: preformed insulation without a membrane, sized for friction fit between framing, thermal resistance (RSI) as indicated in insulation schedule, ULC labeled for rated partitions. Sized for steel stud wall construction.

07 26 00 – SHEET MEMBRANE AIR & VAPOUR SEAL

1.1 INTENT
.1 Provide torched-on flexible sheet membrane assembly:

.1 Continuously adhered to all wall substrates, bridging joints and gaps. Continuously sealed to the roofing assembly membrane. Installed to provide a complete seal at window frames, door frames, and other components fitted into openings in building envelope, and sealed tightly around all pipes, ducts, conduits, insulation connectors and other items penetrating the building envelope.
.2 The intent is to provide a continuous barrier to air movement and to water vapour transmission through the building envelope.

1.2 MATERIALS/STANDARDS
.1 The membrane comprises glass grid reinforcement and SBS modified bitumen. Both faces are covered with a thermofusible plastic film.
.2 Components:
.1 Reinforcement: Glass Fleece.
.2 Elastomeric bitumen: Mix of selected bitumen and SBS polymer.
.3 Thickness: 2.7 mm.
.4 Prefabricated Membrane: complies with CAN/CGSB-037.56-M, 9th Draft.
.5 Primer: a blend of elastomeric bitumen, volatile solvents and adhesive enhancing additives used to prime concrete or metal substrates to enhance the adhesion of torch-applied waterproofing membranes.

07 46 13 – PREFORMED METAL SIDING & SOFFITS

1.1 INTENT
.1 Provision of a prefinished insulated sheet panel system c/w structural support, sealants, fasteners, and all other materials required for a complete, finished, and air-tight installation.

1.2 REFERENCES
.1 Design Architectural Wall Panel system in accordance with:
.1 national Building Code of Canada, current edition.
.2 CSA S136 "Cold Formed Steel Structural Members".
.3 Voluntary Specification for High Performance Coatings on Architectural Panels and Extrusions.

1.3 MATERIAL - PANELS
.1 Composition: prefinished, pre-formed, profiled, rolled steel sheet, 100 mm thick x 1015 mm wide, x length as required similar to Vicwest Striated (ST40) series. 1 colour.

1.4 MATERIAL - SOFFITS
.1 Composition: prefinished extruded aluminum profiles finished with AMMA 2604 powder coat. Wood grain pattern and colour to be determined by the Consultant.
.2 Source: "Longboard Premium Soffit & Siding".

1.5 MATERIALS: PANEL & WALL ACCESSORIES
.1 Complete installation: provide proprietary and steel framed support system, manufacturer's standard profiles, vertical and horizontal joint closures and perimeter trim as required for a complete installation.
.2 Fasteners: as recommended by the panel manufacturer, concealed and non-corrosive.
.3 Clips for attaching panels to the sub-structure: purpose made steel.

07 52 00 – MODIFIED BITUMINOUS MEMBRANE ROOFING (FLAT ROOFS)

1.1 INTENT
.1 This Section specifies requirements common to bituminous membrane roofing work. Read in conjunction with the following related Sections:
.1 Modified Bituminous Membrane Roofing: Section 07 52 00
.2 Metal Flashings for Bituminous Membrane Roofing: Section 07 60 00

1.2 REFERENCE DOCUMENTS
.1 Alberta Roofing Contractor's Association: Roofing Applications Standards Manual latest edition. Except where specified otherwise, meet or exceed the Alberta Roofing Contractors Association Ltd. (ARCA) requirements for the Five Year Certificate of Assurance. These requirements are published in the ARCA "Manual on Good Roofing Practice and Accepted Roofing Systems", current edition.
.2 ASTM C1396/C1396M-06a, Standard Specification for Gypsum Board.
.3 ASTM D2822-05, Standard Specification for Asphalt Roof Cement.
.4 CAN/ULC S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.4 MATERIALS/SYSTEMS
.1 Primary Membrane and Membrane Flashing
- Provide two-ply SBS modified bitumen membrane, including SBS modified bitumen flashings, to manufacturer's recommendations conforming with ARCA accepted specifications, and as specified in this Section.

.2 Roofing Assembly (Proposed):
.1 Flat, 16 mm glass fiber faced gypsum board, fire-rated.
- Vapour barrier-torched.
- Adhesive.
- Insulation Type 4 extruded polystyrene, sloped.
- Adhesive.
- Fiber board/integral base sheet.
- Cap Sheet – torched.
- Granular finish.

07 60 00 – SHEET METAL FLASHINGS & TRIM

1.1 INTENT
.1 All miscellaneous galvanized and prefinished steel components where and as required to complete the Work, that are not related to roofing, masonry, or other trades by definition.

1.2 REFERENCE STANDARDS
.1 CGSB 19-gp-13m – "Sealing Compound, One Component, Polysulphide Base, Chemical Curing".
.2 CGSB 37-GP-5M – "Cement, Plastic, Cutback Asphalt".
.3 CGSB 37-GP-29 – "Sealing Compound, Rubber Asphalt".

1.3 MATERIALS
.1 Galvanized steel, prefinished, with baked-on enamel: 0.75 mm (22 ga.) thick, minimum, prefinished.
.2 Galvanized Steel: 0.75 mm. (22 ga.) thick, minimum (where noted specifically as being 'galvanized' with no further finishing).
.3 Fasteners: concealed hook strip or clip type: of same material as flashings; sized to suit application.
.4 Sealant: one component, conforming to requirements of CGSB 19-GP-13M; non-staining; non-bleeding; non-sagging.

07 84 00 – FIRESTOPPING

1.1 INTENT
.1 The supply and installation of firestopping for all wall penetrations to meet or exceed requirements of the Alberta Building & Fire Codes (latest editions) and the rating of the assembly being penetrated: to specific areas as noted in the specifications, where indicated on the drawings, and wherever rated partitions and floor assemblies are penetrated by mechanical and electrical components.

1.2 REFERENCE DOCUMENTS
.1 Alberta Building Code, current edition.
.2 Alberta Fire Code, latest edition.
.3 Underwriter's Laboratories of Canada ULC S115-95 – Standard Method of Fire Tests of Firestop Systems.
.4 Underwriter's Laboratories of Canada (ULC), "List of Equipment and Materials Volume II", current edition.
.5 Warnock Hersey (WH) Certification Listings, current edition.

1.3 SYSTEMS AND MATERIALS
.1 Firestopping Systems: as listed under ULC Guide 40 U19 – "Firestop Systems" or as listed in WH Listings under "Through-Penetration Firestopping Systems".
.2 Firestopping materials, whether used in a tested system or not, shall be:
.1 Listed under ULC Guide No. 40 or under WH Listings, (UL ratings only are not acceptable).
.2 Labeled with applicable ULC or WH label, and
.3 Compatible with applicable substrates and openings.
.3 Primer: as recommended by firestopping manufacturer for applicable substrate.

07 92 00 – JOINT SEALANTS

1.1 INTENT
.1 The supply and installation of various types of low VOC joint sealants according to the usage of the areas being sealed: where shown on the drawings and as specified.

1.2 MATERIALS
.1 Joint Cleaner: Non-corrosive solvent recommended by sealant manufacturer for applicable substrate material.
.2 Primer: Non staining type recommended by sealant manufacturer.
.3 Joint Back-Up: Round closed cell foam, extruded polyethylene or urethane. Shore A hardness of 20, tensile strength 140 to 200 kPa, outside 30-50%, compatible with sealant and primer, non-adhering to sealant.
.4 Bond Breaker: Pressure sensitive polyethylene tape, not bondable to sealant. Note the specific requirements for installation.
.5 Sealant Types:
.1 General Interior Sealant: Mould and mildew resistant, conforming to CAN/CGSB-19.22-M; CGE 1700, Dow Corning 786, Tremco Trimflex 834. No transparent materials.
.2 Other sealant types impervious to oil, standing water and chemicals, extreme temperature variations, level traffic surfaces, etc.

08 13 00 – HOLLOW STEEL DOORS & FRAMES

1.1 INTENT
.1 The supply and installation of standard non-rated and rated steel doors and frames in various configurations and locations.

1.2 REFERENCE STANDARDS
.1 American Society for Testing and Materials International, (ASTM).
.2 Canadian Standards Association (CSA International).
.3 Canadian Steel Door Manufacturers' Association (CSDMA).
.4 National Fire Protection Association (NFPA).
.5 Underwriters' Laboratories of Canada (ULC).
.6 CAN4-S105-M85, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104.
.7 Except as otherwise specified, comply with requirements of Canadian Manufacturing Standards for Steel Doors and Frames published by the Canadian Steel Door and Frame Manufacturers' Association.

1.3 FIRE RATED DOORS & FRAMES
.1 Provide doors and frames produced under a label service program of a testing agency acceptable to the authorities having jurisdiction.

1.4 MATERIALS
.1 Sheet Steel: to ASTM A653M-96 commercial quality steel, cold rolled, zinc coated to ZF075 coating designation. 1.6 mm skins minimum. 1.6 mm frames minimum.
.2 Honeycomb core material: rigid pre-expanded resin impregnated kraft paper having maximum 25 mm hexagonal shaped cells.
.3 Core: Fiberglass: to CAN/ULC S702, semi rigid type.
.4 Core: Temperature Rise Rated (TRR).

08 21 10 – PLASTIC LAMINATE FACED WOOD DOORS

1.1 INTENT
.1 The supply and installation of solid wood core plastic laminate faced wood doors.

1.1 QUALITY ASSURANCE
.1 Fabricate plastic faced doors to CAN/CSA-0132.2 Series-90 and to quality standards for architectural millwork, AWMAC/AWI manual, latest edition. To Institutional Grade.

1.2 SHOP DRAWINGS
.1 Submit electronic shop drawings in accordance with Division 1.
.2 Clearly indicate door construction and cut-outs for lites.
.3 Reference door types to door schedule, indicate door and frame numbers as applicable.

1.3 MATERIALS
.1 Door core: solid wood particle core with 3-ply 2 mm thick cross laminated plywood face in accordance with CAN/CSA-0132.2 Series-90 and 19 mm solid hardwood strips on both vertical and top and bottom edges.
.2 Plastic laminate: Vertical grade laminate to CAN3-A172-M79 Type VG, suede finish: standard colours and patterns to be confirmed by the Prime Consultant.

.3 Adhesive: low or no VOC: as recommended by plastic laminate manufacturer.
.4 Glazing stops: hardwood with mitred corners, clear finish.

1.4 FABRICATION
.1 Apply plastic laminate to both faces of door cores in accordance with adhesive and plastic laminate manufacturer's instructions.
.2 Make provisions for glass. Cut openings with radiused inside corners. No cut-outs permitted within 125 mm of sides and top of door or 200 mm from bottom of door.
.3 Prepare doors to receive hardware using templates provided.
.4 Bevel edges of single acting doors 3 mm in 50 mm on lock side and 1.5 mm in 50 mm on hinge side.
.5 Seal all exposed wood core surfaces at cut-outs, hardware mortises and top and bottom rails prior to attaching hardware with INT.6.4, clear finish.

1.5 INSTALLATION
.1 Install doors and hardware in accordance with manufacturer's instructions.
.2 Adjust hardware for correct function.
.3 Install glazing and stops.
.4 Seal top and bottom edges of doors after fitting. Seal edges of glass openings prior to installing stops.
.5 Maximum permissible warp of 3 mm measured diagonally across the door.

08 40 00 – ALUMINUM DOORS AND FRAMES

1.1 INTENT
.1 Glazed single and paired aluminum doors, and glazing framing in various configurations and operational modes, integrated into the aluminum curtain wall assembly Some electronically card access assemblies.

1.2 PERFORAMNCE REQUIREMENTS
.1 Install assemblies to withstand, within acceptable deflection limitations, their own weight, weight of glass and design loads, with maximum deflection of L/200 of span.

1.3 STORAGE AND HANDLING
.1 Protect finished aluminum surfaces with wrapping or strippable coating.
.2 Store components off ground, braced or blocked to prevent racking, twisting, bending or sagging.

1.4 FINISHES
.1 Generally clear anodized for serviceability.

1.5 FABRICATION
.1 Accurately machine and rigidly fit together all joints and corners. Match components carefully ensuring continuity of line and design. Ensure all joints and connections are flush, butt tight and hairline, with joints and connections of exterior assemblies weather tight, and with provisions to accommodation thermal movement.

1.6 INSTALLATION
.1 Install assemblies plumb, level and free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
.2 Glaze assemblies, with glazing gaskets only, installed tightly in place. Install in a manner to prevent stretching of gaskets.
.3 Use sufficient corrosion resistant anchorage devices to securely and rigidly fasten assemblies in place, without causing detrimental effects to shape or performance.

1.7 ERECTION TOLERANCES
.1 Maximum variation from plane or location shown on drawings: 2 mm/m of length, non-accumulative.
.2 Maximum offset from true plane between 2 adjacent members butting end to end, in line: 1 mm.

1.8 CLEANING
.1 Remove protective material from aluminum surfaces.
.2 Wash down surfaces with a mild domestic detergent in warm water, applied with soft clean wiping cloths after complete installation.

1.9 OPERATION
.1 Doors must operate with as little manual pressure as possible, and must seal tightly at the perimeter when closed.

08 50 00 – ALUMINUM WINDOWS

1.1 INTENT
.1 Exterior Window Framing: double or triple outside structurally silicone glazed curtain wall assembly: based on Kawneer 1600 Wall system.
.2 Sheet block fabrication, concealed fastener joinery, steel reinforcing. Clear anodized finish.
.3 Section 08 80 50 defines the glazing components.

08 70 00 – DOOR HARDWARE

1.1 INTENT
.1 The supply and installation of all door hardware: medium duty, to University standards.

1.2 QUALITY ASSURANCE
.1 Door Hardware Supplier shall have a fully certified and qualified Architectural Hardware Consultant (AHC) on permanent staff who shall prepare the hardware schedule, and shall also provide manufacturers' wiring diagrams, mode of operation, and other electrical data for electrically activated hardware to the Electrical Division hardware Specialist for coordination purposes. Provide door elevations of each door location to receive electronic security and electrical operational devices.

1.3 DOOR HARDWARE
.1 Hardware for each individual doors will be scheduled in (this) Section 08 70 00. Section 08 99 10 (Door, Frame, & Hardware Schedule) will assign individual Hardware Groups for each door in the facility. Hardware Groups are specified in the Door Hardware Groups listing that will be appended to the end of this Section. Types and quantities of hardware for each Door Hardware Group are identified in the listing.
.2 Hardware specified in the Door Hardware Groups listing establishes quality standards, finishes, manufacturers and functions required for the Project.
.3 All fastening devices shall be of same finish and material as the hardware it is fastening.
.4 Door Schedule will follow. (Section 08 99 10, Door, Frame, & Hardware Schedule).

08 80 50 – GLASS AND GLAZING GENERAL REQUIREMENTS

1.1 INTENT
.1 General requirements common to all site installed glass and glazing work.
.2 Glass and glazing products.

1.2 REFERENCE DOCUMENTS
.1 CAN/CGSB-12.1-M90 Tempered or Laminated Safety Glass.
.2 CAN/CGSB-12.3-M91 Flat, Clear Float Glass.
.3 CAN/CGSB-12.8-M90 Insulating Glass Units
.4 CSA A440.298, Energy Performance Evaluation of Windows and Sliding Glass Doors.
.5 CSA Certification Program for Windows and Doors, latest issue.

1.3 CERTIFICATIONS (IF APPLICABLE)
.1 Insulating glass units shall be certified by the Insulated Glass Manufacturers Alliance (IGMA). Provide written certification for the O & M manuals.

1.4 MATERIALS
.1 Clear Float Glass: to CAN/CGSB-12.3-M91, glazing quality.
.2 Clear Laminated Safety Glass: Product: to CAN/CGSB-12.1-M90 and as follows: Type 1- laminated. Class: B – float glass, annealed. Minimum thickness of laminating film: vertical glazing applications: 0.75 mm.
.3 Clear Tempered Safety Glass: Product: CAN/CGSB-12.1-M90 and as follows. Type 2 – tempered. Class: B – float glass. Category: II – 540 J impact resistance.
.4 Translucent glazing film where required for privacy.
.5 Sealed Glazing Units: double or triple-glazed units (to be determined) capable of being installed as a component of the structurally silicone glazed curtain wall system specified in Section 08 80 00, Aluminum windows.
- Potential double-glazed unit configuration: exterior lite: 6 mm tinted glass with low-e coating on #2 surface, argon gas in the air

space, 6 mm clear/clear glass for the interior lite.
- Potential triple-glazed unit configuration: exterior lite 6 mm tinted glass, argon gas in adjacent cavity, middle lite of 6 mm tinted glass, argon gas in next cavity, 6 mm clear/ clear glass for the interior lite.

.6 Frit glass: "Vitrum" brand: pattern TBD.
.7 Glass Panel Support Spiders:

08 83 13 – MIRROR GLASS

1.1 INTENT
.1 This section includes requirements for supply and installation of wall mounted, unframed, fully silvered glass mirror units. Framed mirrors are specified in Section 10 28 10, Washroom & Specialties.

1.2 REFERENCE DOCUMENTS
.1 Canadian General Standards Board (CGSB), CAN/ CGSB 12.3 M91, Flat, Clear float Glass.
.2 Canadian General Standards Board (CGSB), CAN/ CGSB 12.5 M86, Mirrors, Silvered.

1.3 MATERIALS
.1 Mirrors, Silvered: to CAN/CGSB-12.5-M986 and as follows:
.1 Type 1A – Float glass, for normal use.
.2 Edges: Flat polished edge. Seal edges to prevent chemical or atmospheric penetration of backing.

08 99 10 - DOOR, FRAME, AND HARDWARE SCHEDULE

1.1 INTENT
.1 This Schedule specifically co-ordinates the location and required rating of each opening: the size and material for each door, the door and frame material and finish, all glazing frames, the hardware group for each door or pair of doors, and the door type.
.2 The Hardware Groups are detailed in Section 08 70 00, Hardware.
.3 The door and frame types (elevations) will be attached to this Section.

09 29 00 – GYPSUM BOARD ASSEMBLIES

1.1 INTENT
.1 This Section includes requirements for supply and installation of:
.1 All gypsum board walls, ceilings, and bulkheads: finished, ready for painting.

1.2 REFERENCE DOCUMENTS
.1 Materials and workmanship shall meet or exceed the following:
.1 Association of Wall and Ceiling Contractors of Alberta (AWCC): Specification Standards Manual, latest edition.

1.3 LEVEL OF FINISH
.1 Level 4, in accordance with AWCC manual standards, for all areas: ready to receive finishes. Level 5 for some specific areas.

1.4 GYPSUM BOARD
.1 Type "X" Gypsum Board: board with Type 'X' core, to ASTM C36-95b, labeled in accordance with ULC, Warnock-Hersey, or other accredited Canadian certification program. 16 mm thick.
.2 Standard Gypsum Board: to ASTM C36, 12.7 mm and 16 mm thick.

1.5 FRAMING MEMBERS
.1 Standard Steel Furring and Framing Sections: to CAN/CGSB-7.1 M86, galvanized sheet steel to ASTM A653M-96, Z180 zinc coating: 18, 20, and 25 ga., various widths as indicated on the drawings.

1.6 ACCESSORIES
.1 Screws: to ASTM C1002-96a, and modified as required for fastening to 25 ga. or thicker steel studs.
.2 Corner Beads: to ASTM C1047-95, galvanized sheet steel, beaded angle, knurled and perforated, 32 mm wide flanges, for joint compound filling.
.3 Edge Beads: to ASTM C1047-95, galvanized sheet steel to ASTM A653M-96, Z180 zinc coating, beaded edge, knurled and perforated flange 32 mm wide: for joint compound filing.
.4 Joint treatment material, joint tape and topping compound: to ASTM C475-95.
.5 In-wall "blocking": 18 ga. Galvanized steel sheet or 18 ga. stud sections: for the support of wall-mounted components.

09 30 13 – CERAMIC WALL TILE

1.1 INTENT
.1 Supply and installation of ceramic tile for walls.

1.2 REFERENCES
.1 American National Standards Institute (ANSI)/ Ceramic Tile Institute (CTI).
.1 ANSI A108.1-99, Specification for the Installation of Ceramic Tile (includes ANSI A108.1A-C, 108.4-.13, A118.1-.10, ANSI A136.1).
.2 Canadian General Standards Board (CGSB)
.1 CGSB 71-GP-22M-78(AMEND.), Adhesive, Organic, for installation of Ceramic Wall Tile
.2 CAN/CGSB-75.1-M88, Tile, Ceramic.
.3 Terrazzo Tile and Marble Association of Canada (TTMAC)
.1 Tile Specification Guide 09 30 00, latest edition, Tile Installation Manual (TTMAC).
.2 Tile Maintenance Guide, latest edition.

1.3 AMBIENT CONDITIONS
.1 Maintain air temperature and structural base temperature at ceramic tile installation area above 12 degrees C for 48 hours before, during, and 48 hours after, installation.

1.4 MAINTENANCE
.1 Extra materials: Provide minimum 2% of each type and colour of tile required for project for maintenance use. Box and store where directed.

1.5 WALL TILE
.1 Ceramic tile: (to be determined). Standard Colour(s) as selected by Consultant.

1.6 GROUT
.1 Commercial Cement Grout: to CTI A118.6.
.2 Latex Cement Grout: to ANSI A108.1, fast curing, high early strength, polymer-modified, stain resistant, unsanded mix for walls

1.7 WORKMANSHIP
.1 Do tile work in accordance with TTMAC Tile Installation Manual latest edition: "Ceramic Tile", except where specified otherwise. Apply tile or backing coats to clean and sound surfaces.
.2 Make joints between tile uniform and approximately 1.5 mm wide, plumb, straight, true, even and flush with adjacent tile. Align patterns.
.3 Use round edged tiles at termination of wall tile panels, except where panel abuts projecting surface or differing plane. If RE shapes are unavailable, finish all exposed edges of tile planes with purpose-made stainless steel "J" edge strips (Schlüter).

09 31 00 – PORCELAIN FLOOR TILE

1.1 INTENT
.1 Supply and installation of porcelain floor tile c/w wall base.

1.2 QUALITY STANDARD/REFERENCES
.1 Do tile work in accordance with the latest edition and relevant details of the Installation Manual 200, "Ceramic Tile", produced by Terrazzo Tile and Marble Association of Canada (TTMAC), except where specified otherwise.
.1 Manufacturer's Instructions: manufacturer's installation instructions.

1.3 EXTRA MATERIALS
.1 Ceramic Tile: 12 pieces of each colour and type specified, including tile base size. Boxed/labelled.
.2 Three only lengths of the metal tile edging: min 1 M in length.'
.3 All materials shall be securely boxed and labeled with contents and areas of installation.

1.4 MATERIALS
.1 Porcelain Floor tile: to be determined: Standard Colour(s) as selected by the Consultant.
.2 Grout: to CAN/CSA-A5-93: Mapei: sanded.
.3 Dry-Set Mortar: to ANSI A118.1-1992.
.4 Organic Adhesive: to CGSB 17-GP-22M type 1.
.5 Edging Accessories: Schlüter, stainless steel.

1.5 WORKMANSHIP
.1 Fit tile units around corners, fitments, and other built-in objects to maintain uniform joint appearance. Make cut edges smooth, even and free from chipping. Edges resulting from splitting not acceptable.

.2 Make joints between tiles uniform and approximately 1.5 mm, plumb, straight, true, even and with adjacent tile flush. Ensure sheet layout not visible after installation.
.3 Layout and align patterns as shown on the drawings.
,4 Top of wall base tiles and all wall outside corners shall be finished with the Schlüter metal trim in lengths as long as possible.
.5 Apply sealant to the top edge of the metal trim against the abutting vertical surfaces.
.6 Seal all tile grout joints with manufacturer approved sealer.

09 51 13 – ACOUSTIC UNIT CEILINGS

1.1 INTENT
.1 Provision of new 610 x 610 and 610 x 1220 mm t-bar grid and lay-in panels, c/w edge angles as required. Pattern: "once scored". Texture: TBD.
.2 Provision of natural wood or "wood-look" metal ceiling panels in some areas.
.3 Provision of proprietary suspended "clouds" comprising t-bar ceiling components in an extruded perimeter edge border, ± 150 mm high.

1.2 MATERIALS
.1 Acoustical Units: mineral fibre panels conforming to ASTM E. 1264.
Pattern: to be determined.
Flame Spread Classification: A
NRC: 0.65
CAC: 35
LR: 0.85
Colour: White
Source: to be determined.

.2 Acoustic Unit Suspension System: 13.5 mm face width, non-fire rated, exposed steel tee bar grid, including standard right angle wall molding.

09 68 00 – CARPET TILE

1.1 INTENT
.1 The supply and installation of carpet tiles in standard colours.

1.2 SAMPLES
.1 Comply with requirements of Division 1.
.2 Submit four full tiles of the specified carpet tile.

1.3 PRODUCT DATA
.1 Comply with requirements of Division 1.
.2 Provide technical data regarding tile construction and the adhesive system.

1.4 PRODUCT OFF-GASSING, HANDLING, DELIVERY AND STORAGE
.1 Deliver carpet and other accessories clearly marked as to size, type, dye lot and quality. Store under cover and away from moisture. Keep dry at all times.
.2 Prior to delivery to site, off-gas carpet tiles in warehouse heated to minimum 23°C. Unwrap and spread tiles to allow air circulation and leave in place for 72 hours.

1.5 SEQUENCING AND SCHEDULING
.1 Install carpet prior to installation of coved resilient base.

1.6 CARPET TILE
.1 Product: Interface Flor Carpet Tile: colour (1): to be determined.
.2

Specifications	SL930 138790AK00 (tentative)
Yarn System	100% Recycled Content
Type 6 Nylon	
Colour System	100% Solution Dyed
Construction	Tufted Textured Loop
Soil/Stain Protection	Protekt®
Pile thickness	4.6 mm
Electrostatic	Less than 3.0 KV
Flammability	Doc-FFI-70

1.7 ACCESSORIES
.1 Carpet Securement: Non-adhesive, no VOC, dry installation method.
.2 Cementitious Underlayment: self-levelling and trowel grade, pre-mixed, polymer-modified, containing no gypsum, not softened by water after final set.
.3 Carpet Tile Edge Guard: carpet to other flooring materials: as recommended by the carpet tile manufacturer: extruded aluminum, clear anodized finish.

1.8 CONDITION OF SUBSTRATE
.1 Inspect substrate and verify substrate surfaces are sufficiently dry and properly cured before beginning work of this Section.

1.9 CARPET TILE INSTALLATION - GENERAL
.1 Install carpet tile and accessories in accordance with manufacturer's recommendations and as specified. Dry lay carpet tile to check colour and pattern matching and amount of cutting required. Re-arrange to obtain best results and matching. Trim and straighten edges as required.

1.10 CLEANING & PROTECTION
.1 Follow carpet manufacturer's recommendations for all cleaning procedures. Vacuum clean carpet tile installation and wipe all accessories clean after installation as soon as traffic is allowed and during final cleaning of building. Protect carpet tile installation from damage and soiling until acceptance by the Prime Consultant.

09 91 05 – PAINTING AND FINISHING GENERAL REQUIREMENTS

1.1 INTENT
.1 This Section specifies general requirements for all painting and finishing work to be performed on site.

1.2 REFERENCES
.1 The painting and finishing specifications for new, not previously painted or finished, substrates are based on and make reference to the "Master Painters Institute (MPI) Architectural Painting Specification Manual", latest edition.
.2 The painting and finishing specifications for previously finished substrates are based on and make reference to the "Master Painters Institute (MPI) Maintenance Repainting Manual", latest edition.

1.3 MATERIALS
.1 Paint: Use only "top line quality" products. Refer to specification Sections for product descriptions and product numbers. All materials to be low odor/low or no VOC.

1.4 INSPECTION
.1 All painting materials and workmanship shall be subject to mandatory inspection at the site by an inspector approved by APCA. The cost for such inspection shall be included in the painting subcontract.
.2 Painting materials and workmanship that do not meet MPI/APCA Quality Standards shall be refinished by the painting subcontractor, to the satisfaction of the Consultant and APCA inspector, at no additional cost to the Contract.

1.5 EXTENDED WARRANTY
.1 Provide a warranty, in the form of a written MPI/APCA Certificate of Guarantee, for a term of 2 years following the date of Substantial Performance, to the full value of the painting subcontract, certifying that all materials and work have been installed in accordance with the standards incorporated in the MPI Painting & Repainting Specification Manuals.

09 91 23 – INTERIOR PAINTING AND FINISHING SCHEDULE

1.1 INTENT
.1 Read this Section in conjunction with Section 09 91 05 – Painting and Finishing General Requirements.

1.2 INTERIOR PAINTING AND FINISHING SCHEDULE
.1 Code numbers, finishing system descriptions, gloss levels, coats and product descriptions are derived from the MIP Architectural Painting Specification Manual and the MPI Approved Products List, for all surfaces.

09 91 30 – PAINTING OF MECHANICAL & ELECTRICAL WORK

1.1 INTENT
.1 This Section specifies requirements for site painting and colour coding of mechanical and electrical work.
.2 Read this Section in conjunction with Section 09 91 05 – Painting and Finishing General Requirements.

1.2 REFERENCE DOCUMENTS
.1 Comply with requirements of latest edition of the University of Alberta "Colour Coding Requirements for Mechanical and Electrical Systems". Review same with the Facility Representative prior to application.

1.3 MATERIALS
.1 Use only MPI approved products from the MPI Approved Product Lists (latest edition) corresponding to the specified finishing systems, for the following surfaces:
Iron and Steel Piping and Equipment
Galvanized Metal Piping, Ductwork, Conduit, and Equipment
Aluminum Jacketed Piping, Conduit, and Equipment (Exposed Aluminum)
Copper Piping
Canvas and Cotton Insulated Piping, Ductwork, and Equipment
Iron and Steel Piping and Equipment
Copper Piping
Plastic Piping

10 11 13 – WHITEBOARDS, TACKBOARDS

1.1 INTENT
.1 The supply and installation of Proprietary whiteboards and tackboards of various sizes where indicated in the drawings.

1.2 MATERIALS
.1 Whiteboards: fired vitreous porcelain enamel on 28 ga. Steel (magnetic) on 12.7 mm fibreboard core: White.
.2 Tackboards: fibreboard backed colour cork: standard colours as chosen by the Consultant.
.3 Perimeter Trim: Extruded clear anodized aluminum, tight mitred corners, concealed back fastening trim: c/w full length marker tray.

10 28 10 – WASHROOM & CUSTODIAL ACCESSORIES

1.1 INTENT
.1 The supply and installation of various patient and public washrooms, and custodial accessories.

1.2 MATERIALS & COMPONENTS
.1 Soap Dispenser: manual operation. (Facility standard).
.2 Paper Towel Dispenser: manual operation. (Facility standard).
.3 Toilet Tissue Dispenser: double roll: (Facility standard).
.4 Coat Hooks: stainless steel.
.5 Grab Bars: constructed of 1.2 mm, type 304 satin-finish stainless steel tubing: 38 mm diameter.
.6 Mop Rail/Shelf Assembly: Janitor's room: stainless steel.
.7 Framed Washroom Mirrors: 6 mm glass, stainless steel frames.

10 95 00 – MISCELLANEOUS SPECIALTIES

1.1 INTENT
.1 Miscellaneous proprietary items are listed herein: supply and installation, except as noted: to be determined.

1.2 Wall-mounted Shelving: proprietary chrome plated wire shelving in various configurations.

1.3 Lockers: proprietary lockable metal lockers (full size, half size: TBD).

1.4 Miscellaneous wall bumpers and handrails and wall protection sheets.

1.5 Potential electric fireplace.

1.6 Other miscellaneous items to be determined.

11 60 00 – WALK-IN FREEZER

1.1 INTENT
.1 A prefabricated temperature controlled room of insulated metal panel construction furnished and installed as a complete self-contained unit and system with self-contained chilled water-type refrigeration equipment, plenums, controls, and all other equipment necessary to achieve the environmental conditions specified herein.
.2 Manufacturer/Installer Qualifications: Provide prefabricated temperature controlled rooms system produced by a manufacturer with not less than 10 years successful experience in the fabrication of assemblies of the type and quality required. Manufacturer shall assume responsibility for fabricating, finishing and installing the prefabricated temperature controlled rooms system.

1.2 SYSTEM PERFORMANCE REQUIREMENTS
.1 General Engineer, design, fabricate and erect the prefabricated temperature controlled rooms room system to maintain the specified operating conditions.
.1 The temperature controlled room shall maintain set point temperature without resulting in deposition of condensate on the exterior of the temperature controlled room panels, within the ceiling space above the temperature controlled room, and on the underside of the floor slab below the floor of the temperature controlled room system.
.2 Insulated Metal Panel Construction
.1 All fabrication shall comply with ULC standards and be labeled for insulated wall construction.
.2 Foamed-in-place polyurethane insulation sandwiched between interior and exterior skins with tongue-in-groove panel edges.
.1 Panel Thickness: 100 mm.
.2 Panel Width: 305mm min. width; 1220 mm. max. width.
.3 Interior and Exterior Wall Skins:
.1 Wall panels: 24 gauge smooth galvanized steel; white polyester baked-on finish.
.2 Ceiling Panels: 24 gauge smooth galvanized steel white polyester baked-on finish.
.3 Insulation: C.F.C. Free foamed-in-place polyurethane insulation complying with the following requirements:
.1 R Value: 33.3.
.2 Coefficient of Heat Transfer (U-factor): 0.030.
.3 In-place Density: 2.2 pcf.
.4 Flame Spread: 25 or less in accordance with ASTM E 84.
.5 Smoke Developed: 450 or less in accordance with ASTM E 84.
.4 Hinged Entrance Door Panels:
.1 Provide in-fitting flush-design door similar in construction to wall panels. Door location and direction of swing are indicated on Drawings.
.1 Door thickness: 100 mm.
.2 Door Size: 864 mm x 2134 mm mounted in 1220 mm wide panel.

11 62 00 – OWNER SUPPLIED EQUIPMENT

1.1 INTENT
.1 (TBD)

12 49 00 – ROLLER SHADES (TBD)

1.1 INTENT
.1 Supply and installation of manually chain operated roller shades (including all track and related hardware required for a complete installation.
.2 Install in window framing openings. Actual window shade component sizes shall be confirmed by this sub-contractor on site.

1.2 QUALITY ASSURANCE
.1 Perform all work of this Section using one Subcontractor who has his own forces, specializing in the fabrication and installation of shading for a minimum of five (5) years, to supply and install all work of this Section.
.2 Conform to the Alberta Building Code and local authority having jurisdiction.

.3 Provide and install one (1) solar shade (as specified) complete at a location on the site as chosen by the Construction Manager, with attachments and accessories, for review by the Consultant. Do not proceed with the remainder of the installation until the Consultant has accepted the sample installation. Adjust the sample installation as requested. The accepted sample shall become part of the final installation.

1.3 SAMPLES
.1 Submit duplicate 300 x 300 mm samples of solar shade (blackout) fabrics for review in accordance with Section 01 30 00.

1.4 WARRANTY
.1 Shade Hardware & Shade Cloth: 10 years.
.2 Chain: 10 years.
.3 Installation Warranty: 1 year.

1.5 MATERIALS
.1 For the provision of manually chain-operated roller shades (single) c/w clear anodized aluminum case and related hardware: mounted between window mullions.
.2 Fabric Weight: 491.63 gms/sq.meter; thickness: 0.51 mm; openness (% to be determined); Composition: 100% polyester/acrylic finish, pvc free; UV blockage: 95-96%, fire classification: NFPA 701-2004 TM#1. Standard colour.

1.6 ACCESSORIES
.1 Back/Regular roll fascia:
.1 Extruded aluminum ally 6063-T5, prefinished, 105 mm x 45 mm x 1.6 mm wall thickness, custom designed profile to fit onto remoulded end mounting brackets without exposed fasteners. Colour prefinished to match adjacent window framing or as selected by the Consultant.

13 xx xx – PALLET RACKING SYSTEM

1.1 INTENT
.1 For the supply and installation of a proprietary purpose-made heavy duty steel framed storage rack system c/w with vertically adjustable beams/ shelves, with slotted or bolted connections. Actual configurations and loadings to be determined. All components pre-finished in standard colours.

END OF ARCHITECTURAL SECTIONS

STRUCTURAL SPECIFICATIONS

Section 03 11 00 - CONCRETE FORMS AND ACCESSORIES

1. General
1.1 RELATED SECTIONS
.1 Concrete reinforcement: Section 03 20 00
.2 Cast in place concrete: Section 03 30 00
.3 Joint Sealers: Section 07 92 00

1.2 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION
.1 Install following materials specified to be supplied under other Sections of these project specifications:
.1 Fabricated components, anchor bolts, bearing plates, sleeves and other inserts to be built into concrete.

1.3 REFERENCE DOCUMENTS
.1 CSA A23.1 00 - Concrete Materials and Methods of Concrete Construction
.2 CAN/CSA-O86.1-94 – Engineering Design in Wood (Limit States Design)
.3 CAN/CSA-O86.1S1-98 - Supplement No. 1 to O86.1-94, Engineering Design in Wood (Limit States Design)
.4 CSA-O121-M1978 - Douglas Fir Plywood
.5 CSA-O151-M1978 - Canadian Softwood Plywood
.6 CSA-O153-M1980 - Poplar Plywood
.7 CSA-S269.1-1975 (R1998) - Falsework for Construction Purposes
.8 CAN/CSA- S269.3-M92 - Concrete Formwork
.9 ACI 347 – Recommended Practice for Concrete Formwork

1.4 SHOP DRAWINGS
.1 Submit shop drawings for formwork and falsework in accordance with Division 01.
.2 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners and locations of temporary embedded parts.
.3 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.

1.5 SAMPLE PANEL – NOT APPLICABLE

1.6 QUALITY ASSURANCE

.1 Design, construct and erect formwork in accordance with CSA A23.1-00, CSA S269.1, ACI 347, and all applicable construction safety regulations for the place of the work.

2. Products
2.1 MATERIALS
.1 Formwork materials:
.1 Concrete without special architectural features: use plywood and wood formwork materials to CAN/ CSA-O86.1S1. Square-edged, smooth surfaced panels true in plane, free of holes, surface markings or defects.
.2 Pan forms: as indicated, free of bends, dents and residual concrete, well matched, tight fitting and adequately stiffened to support concrete weight without deflection detrimental to appearance of finished concrete surfaces.
.3 Tubular column forms: round, spirally wound laminated fiber forms, internally treated with release material.
.4 Form ties:
.1 Concrete without special architectural features: use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.
.2 Concrete with special architectural features: use snap ties complete with plastic cones and light gray concrete plugs.
.5 Form liner: Not Applicable
.6 Void Forms: moisture resistant treated paper faces; biodegradable; structurally sufficient to support weight of wet concrete mix until initial set; 150 mm thick.
.7 Falsework materials: to CSA-S269.1.

2.2 ACCESSORIES
.1 Form release agents: Ecologo certified under the Environmental Choice Program (ECP) or, if not Ecologo certified, Contractor shall:
.1 provide a product that conforms to the requirements for concrete release agents in accordance with ECP Certification Criteria Document (CCD) 143 governing Asphalt and Concrete Release Agents, excluding the provisions under Conditions for Ecologo Use and,
.2 if requested, provide the Engineer with the same rights as the ECP under CCD 143 with regard to verification for product compliance.
.2 Corner or Chamfer Fillets: As indicated on Structural and Architectural drawings

3. Execution
3.1 FORMWORK PREPARATION
.1 Apply form release agent in accordance with manufacturer's recommendations, prior to placing reinforcing steel, anchoring devices and embedded parts.
.2 Do not apply form release agent where concrete surfaces are to receive special finishes or applied coverings which are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces moist prior to placing concrete.

3.2 TOLERANCES
.1 Construct formwork to produce concrete with dimensions, lines and levels within tolerances specified in ACI 347.
.1 Deviation in Cross Sectional Dimensions of Columns and Beams, and in Thickness of Slabs and Walls: plus or minus 6 mm.

3.3 FABRICATION AND ERECTION
.1 Verify lines, levels and centers before proceeding with formwork/falsework and ensure dimensions agree with drawings.
.2 Obtain Engineers' approval for use of earth forms framing openings not indicated on drawings.
.3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
.4 Fabricate and erect falsework in accordance with CSA-S269.1.
.5 Refer to architectural drawings for concrete and concrete members requiring architectural exposed finishes.
.6 Do not place shores and mud sills on frozen ground.

.7 Provide site drainage to prevent washout of soil supporting shores and mud sills.
.8 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/CSA-A23.1.
.9 Align form joints and make watertight. Keep form joints to a minimum.
.10 Locate horizontal form joints for exposed columns 2400 mm above finished floor elevation.
.11 Use 25 mm chamfer strips on external corners and 25mm fillets at interior corners of concrete members, unless specified otherwise.
.12 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
.13 Construct forms for architectural concrete, and place ties as indicated and as directed. Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
.14 Build in anchors, sleeves, and other inserts required to accommodate work specified in other sections. Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including paint.
.15 Do not stagger joints of form lining materials. Align joints to obtain uniform pattern.
.16 Clean formwork in accordance with CAN/CSA-A23.1, prior to placing concrete.
.17 Re-use of formwork and falsework subject to requirements of CAN/CSA-A23.1.

3.4 INSERTS, EMBEDDED ITEMS, AND OPENINGS
.1 Provide formed openings where required for pipes, conduits, sleeves or other work to be embedded in and passing through concrete members. Obtain Engineers' approval before framing openings in slabs, beams and columns, not shown on drawings.
.2 Accurately locate and set in place items which are to be cast directly into concrete.
.3 Coordinate forming of openings, slots, recesses, chases, and setting of sleeves, bolts, anchors and other inserts with work of other Sections as required.
.4 Coordinate installation of concrete accessories.
.5 Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings in bottom of forms to allow flushing water to drain.
.6 Close temporary ports or openings with tight fitting panels, flush with inside face of forms, neatly fitted so no leakage occurs and to provide uniform surface on exposed concrete.

3.5 CLEANING
.1 Clean forms as erection proceeds, to remove foreign matter. Remove cuttings, shavings and debris from within forms. Clean with compressed air to remove foreign matter. Ensure that water and debris drain to the exterior through clean-out ports.
.2 During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out completed forms, unless formwork and concrete construction proceed within a heated enclosure. Use compressed air or other means to remove foreign matter.

3.6 FORM REMOVAL
.1 Do not remove forms and falsework until concrete has gained sufficient strength to carry its own weight, plus construction loads and other design loads that are liable to be imposed. Verify strength of concrete by compression tests to the satisfaction of the Engineer.
.2 Remove falsework progressively, in accordance with CSA 269.1 and ensure that no shock loads or unbalanced loads are imposed on the structure.
.3 Loosen forms carefully. Do not wedge pry bars, hammers or tools against finish concrete surfaces scheduled for exposure to view.
.4 Leave forms loosely in place for protection until curing requirements are complete.
.5 Store removed forms for exposed architectural concrete in a manner that surfaces to be in contact with fresh concrete will not be damaged. Marked or scored forms will be rejected.

3.7 RESHORING
.1 Prepare a schedule of reshoring and submit to engineer for review.
.2 Reshore structural members where required due to design requirements or construction conditions. Remove load supporting forms only when concrete has attained 75 percent of required 28 day strength and reshore.
.3 Install reshoring as required to permit progressive construction.

3.8 FIELD QUALITY CONTROL
.1 Inspect and check complete formwork, falsework, shoring and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties and parts are secure.

Section 03 20 00 - CONCRETE REINFORCING

1. General
1.1 RELATED SECTIONS
.1 Concrete formwork and accessories: Section 03 11 00.
.2 Cast in place concrete: Section 03 30 00.

1.2 REFERENCE DOCUMENTS
.1 ACI 315-94 – ACI Detailing Manual
.2 A775/A775M-00 Standard Specification for Epoxy-Coated Reinforcing Steel Bars
.3 CSA A23.1 00 - Concrete Materials and Methods of Concrete Construction
.4 CSA A23.3-94 - Design of Concrete Structures
.5 CAN/CSA-G30.3-M1983 R1998 - Cold-Drawn Steel Wire for Concrete Reinforcement
.6 CAN/CSA-G30.5-M1983 R1998 - Welded Steel Wire Fabric for Concrete Reinforcement
.7 CAN/CSA-G30.18-M92 R1998 - Billet-Steel Bars for Concrete Reinforcement
.8 CAN/CSA-G30.14-M1983 R1998 - Deformed Steel Wire for Concrete Reinforcement
.9 CAN/CSA-G30.15-M1983 R1998 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement
.10 CAN/CSA-G40.21-98 - Structural Quality Steel
.11 CAN/CSA-G164-M92 R1998 - Hot Dip Galvanizing of Irregularly Shaped Articles
.12 CAN/CSA-W186-M1990 R1998 - Welding of Reinforcing Bars in Reinforced Concrete Construction
.13 Reinforcing Steel Institute of Canada - Reinforcing Steel Manual of Standard Practice

1.3 SHOP DRAWINGS
.1 Submit shop drawings including placing of reinforcement in accordance with Division 01.
.2 Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacings, locations of reinforcement and mechanical splices if approved by Engineer, with identifying code marks to permit correct placement without reference to structural drawings. Prepare reinforcement drawings in accordance with Reinforcing Steel Manual of Standard Practice – by Reinforcing Steel Institute of Canada.
.3 Detail lap lengths and bar development lengths to CSA A23.3, unless otherwise indicated. Provide type B tension lap splices unless otherwise indicated.

1.4 QUALITY ASSURANCE
.1 Provide Engineer, upon request, with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, prior to commencing reinforcing work.
.2 Inform Engineer, upon request, of proposed source of material to be supplied.

1.5 DELIVERY, STORAGE AND HANDLING
.1 Deliver, store and handle reinforcing steel, welded wire fabric and accessories in manner that prevents contamination which reduces bond, and damage to fabricated forms.
.2 Protect reinforcement from rust, dirt, grease, form oil and other bond-breaking substances.

2. Products
2.1 REINFORCEMENT MATERIALS
.1 Reinforcing Steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise; Plain finish.
.2 Weldable Reinforcing Steel – where indicated: weldable low alloy steel deformed bars to CAN/CSA-G30.18.
.3 Plain Round Bars: to CAN/CSA-G40.21.
.4 Deformed Steel Wire for Concrete Reinforcement: to CSA-G30.14.
.5 Welded Steel Wire Fabric: to CSA-G30.5.
.6 Welded Deformed Steel Wire Fabric: to CSA-G30.15.
.7 Epoxy Coating of Non-Prestressed Reinforcement: to A775/A775M.
.8 Galvanizing of Non-Prestressed Reinforcement: to CAN/CSA-G164.
.9 Cold-Drawn Annealed Steel Wire Ties: to CSA-G30.3.
.10 Chairs, Bolsters, Bar Supports and Spacers: to CSA A23.1.
.11 Mechanical Splices: subject to Engineer's approval.

2.2 FABRICATION
.1 Fabricate reinforcing steel in accordance with CSA A23.1, ACI 315, and Reinforcing Steel Manual of Standard Practice – by Reinforcing Steel Institute of Canada.

.2 Obtain Engineer's approval for locations of reinforcement splices other than those shown on placing drawings.
.3 Upon approval of Engineer, weld reinforcement in accordance with CAN/CSA-W186.
.4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.
.5 Bundle and transport epoxy coated reinforcement in accordance with ASTM A775/A775M.
.6 Fabricate within the following tolerances:
.1 Sheared Length: +/- 25mm
.2 Stirrups, Ties and Spirals: +/- 10 mm
.3 Other Bends: +/- 25 mm
.7 Locate reinforcing splices not shown on drawings at points of minimum stress.

3. Execution
3.1 FIELD BENDING
.1 Do not field bend or field weld reinforcement except where indicated or authorized by Engineer.
.2 When field bending is authorized, bend without heat, applying slow and steady pressure.
.3 Replace bars which develop cracks or splits.

3.2 PLACEMENT DETAILING
.1 Conform to CSA-A23.1 and CSA-A23.3 for hooks, bends laps and similar details not specifically shown.
.2 Reinforce slab and wall openings, unless otherwise shown, as follows:
.1 Openings with greatest dimension of 600 mm or less: four 15M diagonal bars, 900 mm longer than greatest opening dimension.
.2 Openings with greatest dimension larger than 600 mm: two 15M bars on each side, top and bottom, 1500 mm longer than greatest opening dimension.
.3 Reinforce circular openings as square.
.3 Secure chairs for reinforcing in place located at 1200 mm o.c. maximum.
.4 Provide horizontal "L" shaped corner bars of same cross section and spacing as horizontal bars or welded wire fabric around wall and grade beam corners.
.5 Cover electrical conduit, ductwork or piping buried in slabs with 600 mm wide strip of 102 x 102 x MW13.3 x MW13.3 welded wire fabric. If principal slab reinforcement is placed above conduit then place 600 mm strip under conduit. Position of reinforcing steel takes precedence over conduit, ductwork or piping.

3.3 PLACEMENT
.1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CSA A23.1. Chair slab reinforcing not further apart than 1.2 m in either direction.
.2 Place, support and secure reinforcement against displacement. Do not deviate from required position.
.3 Do not displace or damage vapour barrier. Repair and reposition vapour barrier as required.
.4 Use plain round bars as slip dowels in concrete. Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint. When paint is dry, apply a thick even film of mineral lubricating grease.
.5 Prior to placing concrete, obtain Engineer's approval of reinforcing material and placement.
.6 Ensure reinforcement location is maintained to provide required concrete cover to reinforcement during placement of concrete.
.7 Place reinforcing steel to provide concrete cover as noted on drawings.

3.4 FIELD TOUCH-UP
.1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.

3.5 CLEANING
.1 Ensure concrete reinforcing is clean and free from oil and deleterious matter.
.2 Remove all loose scale, loose rust and other deleterious matter from surfaces of reinforcing.

3.6 SCHEDULE – NOT APPLICABLE

Section 03 30 00 - CAST IN PLACE CONCRETE

1. General
1.1 RELATED SECTIONS
.1 Cast in place concrete piles: Section 31 62 13
.2 Concrete forms and accessories: Section 03 11 00
.3 Concrete Reinforcement: Section 03 20 00
.4 Concrete floor finishes: Section 03 35 10

1.2 REFERENCE DOCUMENTS
.1 ASTM C109/C109M-99, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens).
.2 ASTM C295-98, Standard Guide for Petrographic Examination of Aggregates for Concrete.
.3 ASTM C309-98a, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
.4 ASTM C827-95a (1997), Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.
.5 ASTM C939-97, Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).
.6 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
.7 CAN/CSA-A23.1 00, Concrete Materials and Methods of Concrete Construction.
.8 CAN/CSA-A23.2 00, Methods of Test for Concrete.
.9 CAN/CSA-A23.3-94, Design of Concrete Structures.
.10 CAN/CSA-A3000-98, Cementitious Materials Compendium (Consists of A5-98, A8-98, A23.5-98, A362-98, A363-98, A456.1-98, A456.2-98, A456.3-98).

1.3 QUALITY ASSURANCE
.1 Cast-in-place concrete to conform to CSA-A23.1
.2 Testing shall conform to CSA-A23.2

1.4 INSPECTION AND TESTING
.1 Concrete work may be tested by a testing firm retained by the Contractor.
.2 Submit the following to testing firm:
.1 Results of petrographic examination of aggregates to ASTM C295, representative of aggregates to be supplied for project.
.2 Samples of fine and coarse aggregate.
.3 Proposed concrete mix design.
.3 Provide casual labour to the testing firm's field personnel for the purpose of obtaining and handling sample materials.
.4 Advise testing firm in advance of concrete placement.
.5 Provide and maintain facilities at the site for storage of concrete test cylinders for the first 24 hours.
.6 Provide copies of mill test reports of cement as required.
.7 Secure sufficient three and seven day cylinders for testing by concrete supplier to ensure concrete quality control.
.8 Provide at least one cube test, to ASTM C109/C109M, on grout used under base plates and machinery.
.9 Conduct core tests when required.
.10 Testing firm will do the following:
.1 Take three test cylinders from each 60 m3 of concrete, or fraction thereof, of each type of concrete placed in any one day.
.2 Take samples of concrete mix close to the point of final deposit in the form. Contractor shall provide suitable access to the Work for obtaining samples.
.3 Moist cure and test one cylinder in 7 days and moist cure and test the remaining two cylinders in 28 days.
.4 Take one additional test cylinder when the temperature is likely to fall below 0°C within 48 hours after placing and no provisions have been made to heat the concrete to greater than 10°C. Test cylinder to be cured on job site under same conditions as concrete it represents and tested in 7 days.
.5 Make at least one slump test and one entrained air test for each set of test cylinders taken.
.11 Results of field tests will be reported immediately to the Contractor by the field representative of the testing firm. These results do not imply approval or disapproval of the work, but are for the Contractor's information. Acceptability of the work will be determined by the Engineer.
.12 Results of concrete tests will be forwarded to the Engineer and to the Contractor. Included with the results will be the following information: Name of Project, Date of Sampling, Name of Supplier, Delivery Truck Number, Identification of Sampling and Testing Technician and exact location in the structure of the concrete sampled.
.13 Testing firm personnel are not authorized to revoke, relax, enlarge or release any requirements of the specification, nor to accept or reject any portion of the work.
.14 Contractor may arrange and pay for additional tests for use as evidence to expedite construction.

1.5 ACCEPTABILITY

.1 Failure to comply with the requirements that control strength and durability will result in the structure being considered potentially deficient.

.2 A structure will be considered potentially deficient when:

.1 Concrete used is not as specified in Concrete Mix Schedule in this Section.

.2 Improper curing methods or materials are used.

.3 There has been inadequate protection of concrete from extremes of temperature during early stages of curing and strength development.

.4 There has been mechanical injury from fire, construction overload or premature removal of forms.

.5 Poor workmanship is determined.

.6 Concrete differs from the required dimensions.

.3 Strength evaluation tests and analysis.

.1 The Engineer may order an independent testing firm to obtain cores, x rays, or similar non-destructive tests.

.2 The Engineer may order a load test and/ or analysis as defined by CSA A23.3, Section 18, if the non-destructive tests are impractical or inconclusive.

.3 Reinforce by additional construction or replace as directed by the Engineer, concrete judged inadequate by structural analysis or by results of load tests.

.4 The Contractor will pay the cost of testing and/or analysis which is required to demonstrate the adequacy of the structure which does not meet the requirements for strength or which has been placed before formwork and reinforcing have been inspected and approved by the Engineer.

.5 The Engineer may order additional testing at any time even though the required tests indicate that the strength requirements have been met. In this instance the Engineer will pay for those tests that meet the specified requirements and the Contractor shall pay for those that do not.

.4 Concrete not conforming to the lines, detail, strength and grade specified herein or as shown on drawings shall be modified or replaced at the Contractor's expense, to the satisfaction of the Engineer.

1.6 SAMPLE PANEL – NOT APPLICABLE

2. Products

2.1 CONCRETE MATERIALS

.1 Portland Cement , Supplementary Cementing Materials: to CAN/CSA A3000.

.2 Aggregates: to CSA A23.1 and as follows.

.1 Coarse aggregate to be normal density.

.2 Ensure that no aggregates are used which may undergo volume change due to alkali reactivity, moisture retention or other causes. Confirm suitability of aggregate with a petrographic analysis if deemed necessary by the Engineer.

.3 Water: potable, to CSA A23.1.

.3 Admixtures: to CAN/CSA-A23.1. Engineer to approve accelerating or set retarding admixtures during cold and hot weather placing.

.1 Air Entrainment: conforming to CAN 3-A266.1-M78.

.2 Chemical: conforming to CAN 3-A266.2-M78

2.2 CONCRETE ACCESSORIES – NOT APPLICABLE

2.3 MIX

.1 Supply concrete mix proportioned to produce concrete specified in Concrete Mix Schedule.

.2 Requirements not specified in Schedule shall conform to CSA A23.1.

.3 Use of admixtures, other than air entraining admixtures, are not permitted without prior approval of the Engineer.

.4 Fly ash up to a maximum of 30% of the total cement content may be used for concrete placed at the following locations:

.1 Piles/Footings

.2 Walls/Columns

.5 Superplasticizers shall be used in strict accordance with the recommendations of the manufacturer. Concrete slump after superplasticizing shall not exceed 200 mm.

.6 All admixtures are subject to Engineer's approval. List all proposed admixtures in mix design submission. Do not change or add admixtures to approved design mixes without Engineer's approval.

3. Execution

3.1 PREPARATION

.1 Obtain Engineer's approval before placing concrete. Provide Engineer and testing agency 48 hours of notice prior to placing concrete.

.2 Coordinate placement of inserts and joint devices with erection of concrete formwork and formwork accessories.

.3 Pumping of concrete is permitted only after approval of equipment and mix.

.4 Ensure reinforcement and inserts are not disturbed during concrete placement.

.5 Prior to placing concrete obtain Engineer's approval of method for protection of concrete during placing and curing in adverse weather.

.6 Maintain accurate records of poured concrete items to indicate date, location of pour, quality of concrete, ambient air temperature and test samples taken.

.7 Clean previously placed concrete with steel brush. Use acid if necessary. Mix and brush on bonding agent in accordance with manufacturer's instructions.

.8 Do no place load upon new concrete until authorized by the Engineer.

3.2 SLEEVES AND INSERTS

.1 No sleeves, ducts, pipes or other openings shall pass through joists, beams, column capitals or columns, except where indicated or approved by the Engineer.

.2 Where approved by the Engineer, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 x 100 mm not indicated, must be approved by the Engineer.

.3 Do not cut, bend, eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from the Engineer before placing of concrete.

.4 Check locations and sizes of sleeves and openings shown on drawings.

.5 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

.6 Conduit and pipe embedded in concrete shall:

.1 Not displace more than 4% of the cross sectional area of a column, including the area of concrete displaced by the bending of the conduit, or the exit path of the conduit out of the column.

.2 Not exceed one-third of the solid portion of the slab thickness.

.3 Not be spaced closer than three diameters on centre.

.4 Have a minimum concrete cover of 25 mm.

3.3 ANCHOR BOLTS AND BASE PLATES

.1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.

.2 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.

.3 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.

3.4 DOVETAIL ANCHOR SLOTS – NOT APPLICABLE

3.5 WATER STOPS – NOT APPLICABLE

3.6 DAMP-PROOF MEMBRANE

.1 Install damp-proof membrane on prepared sub-grade under concrete slabs-on-grade inside building.

.2 Lap damp-proof membrane minimum 150 mm at joints and seal as recommended by manufacturer.

.3 Seal punctures in damp-proof membrane before placing concrete. Use patching material at least 150 mm larger than puncture and seal.

3.7 JOINT FILLERS – NOT APPLICABLE

3.8 PLACING CONCRETE

.1 Perform cast-in-place concrete work in accordance with CAN/CSA-A23.1.

.2 Revise, re seat and correct improperly positioned reinforcing, immediately before placing concrete.

.3 Place concrete as a continuous operation stopping only at construction joints indicated on the drawings or as follows: At center of span of suspended slabs, beams and joists; in walls and columns immediately above or below floor construction; at center of steel beam that supports concrete slab.

.4 Construction joints at center of span of suspended slabs beams and joists shall be adequately doweled and keyed.

.5 Place floor slabs on grade as one continuous pour between construction joints indicated on drawings. Control joints for each pour shall be formed by sawing a continuous 1/4 slab depth slot at 6 m centers each way unless otherwise indicated on drawings. Sawing shall be done as soon as the concrete has sufficiently hardened to prevent raveling of the edges but in no case later than 18 hours after the concrete slab has been placed.

.6 Use winter concreting methods in accordance with CAN/CSA A23.1 when the mean daily temperature falls below 5°C.

.7 Use procedures noted in CAN/CSA-A23.1 to remove excess bleed water. Ensure surfaces are not damaged.

.8 Vibrate concrete using the appropriate size equipment as placing proceeds in strict accordance with Clause 19.5 of CSA-A23.1. Check frequency and amplitude of vibrations prior to use. Provide additional standby vibrators in the event of equipment failure.

.9 Do not place concrete if carbon monoxide producing equipment has been in operation in the building during the 12 hours preceding the pour. This equipment shall not be used during placing, or for 24 hours after placing. During placing and curing concrete, surfaces shall be protected by formwork or by an impermeable membrane from direct exposure to carbon dioxide, combustion gases or drying from heaters.

.10 Honeycomb or embedded debris in concrete is not acceptable.

.11 Remove and replace defective concrete.

3.9 CURING

.1 Cure concrete in accordance with CAN/CSA-A23.1 and as follows.

.2 All concrete shall receive moist curing for a period of seven days. One of the following methods shall be used as soon as the concrete has hardened sufficiently to prevent marring:

.1 Surface covered with canvas, burlap or other satisfactory material and kept thoroughly wet.

.2 Surface sealed with polyethylene sheeting and the concrete kept thoroughly wet.

.3 Subject to the approval of the Engineer, a liquid membrane curing compound used in accordance with the manufacturer's recommendations, may be used. Membrane to remain intact during the curing period.

.3 Surfaces of concrete that are protected by formwork which is left in place for seven days shall not require any additional curing except as specified for hot weather. If the formwork is removed in less than seven days, the concrete shall receive moist curing until seven days have elapsed since the concrete was placed.

.4 Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration that compounds used are compatible.

.5 Curing compounds shall not be used on concrete surfaces to receive topping or other type of bonded finish unless approved by the Engineer.

.6 Protect freshly placed and consolidated concrete against damage or defacement from adverse weather conditions.

.7 Coat exposed concrete walking surfaces not to receive an integral hardener with curing compound of type that provides permanent seal.

.8 Do not use curing compound in locations where chemical hardener is to be used.

3.10 FINISHING AND TREATMENT OF SLAB OR FLOOR SURFACES

.1 Provide swirl-troweled finish unless otherwise indicated.

.2 Slab and floor finish tolerance, unless specified otherwise, in accordance with CAN/CSA-A23.1, straight edge method as noted on Structural Drawings.

.3 Provide floor level at walls with uniform minimum slope of 1% to floor drain, where applicable.

.4 Sprinkling of dry cement or a mixture of dry cement and sand over concrete surface is not acceptable.

3.11 BULL FLOATING – NOT APPLICABLE

3.12 MECHANICAL FLOATING – NOT APPLICABLE

3.13 TROWELLING

.1 Trowel floor surfaces with mechanical trowelling machines fitted with steel blades.

.2 Commence trowelling when surface is sufficiently hard to prevent working excess fine material to the surface.

.3 Perform additional trowelling at intervals so final trowelling is done just before concrete becomes so hard that further trowelling is ineffective.

.4 Finished trowelled surfaces to be hard, dense, and free from blemishes or other imperfections.

.5 Hand trowel in restricted areas, corners, etc.

3.14 TEXTURED SURFACES

.1 Final trowelling to be spin trowel or hand swirl finish.

.2 Immediately after final trowelling, brush or fine broom surfaces with a hair broom.

.3 Immediately after mechanical floating, broom surfaces with a stiff bristled broom.

.4 Protect textured floors from damage during construction.

3.15 TOPPINGS – NOT APPLICABLE

3.16 FINISHING FORMED SURFACES

.1 Upon removal of forms, treat imperfections in formed surfaces in accordance with CSA A23.1 and to Engineer's approval.

.2 Modify or replace concrete not conforming to the quality, lines, details and elevations specified herein or as shown on drawings.

.3 Finish all exposed formed concrete surfaces with smooth rubbed finish according to CSA A23.1.

.4 Rough Finish Concrete Surfaces not exposed to View: Place concrete against forms true and plane. Cut off form ties a minimum of 10 mm below concrete surface. Patch tie holes and defects. Remove fins exceeding 5 mm.

.5 Smooth Finish Overhead Surfaces Exposed to View: Place concrete against plywood, steel or tempered hardboard. Patch tie holes and defects. Remove fins.

3.17 GROUT

.1 Mix non-shrink grout to consistency specified in part 2 of this Section as required for use intended and apply in accordance with manufacturer's instructions. Install under columns, beams and equipment bases as shown on drawings, in accordance with the manufacturer's recommendations.

3.18 EQUIPMENT PADS

.1 Provide concrete pads for equipment where indicated on drawings. Adjust dimensions of pads to reviewed shop drawings.

.2 Insert bolts and sleeves and pack with non-shrink grout, in accordance with setting details and templates.

.3 Steel trowel surfaces smooth. Chamfer exposed edges.

3.19 SLABS ON FILL

.1 Seal punctures and damaged edges of vapour barrier before placing concrete. Use vapour barrier material, lapped over punctures and damaged areas 150 mm in all directions. Seal with tape.

.2 Place adjustable screeds at suitable locations. Do not pierce vapour barrier.

.3 Place concrete to required elevations shown on drawings.

.4 Separate slabs-on-fill from vertical surfaces with a suitable smooth faced bond breaker.

3.20 COLD AND HOT WEATHER CONCRETING

.1 Conform to the requirements of CSA A23.1.

.2 Protect slabs being finished during drying conditions above 25° C, and/or during high winds with moisture retention film.

3.21 CONCRETE MIX SCHEDULE – AS NOTED ON STRUCTURAL DRAWINGS

Section 05 12 00 - STRUCTURAL STEEL FRAMING

1. General

1.1 REFERENCE DOCUMENTS

.1 American Society for Testing and Materials (ASTM):

.1 ASTM A108-07 Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished

.2 ASTM F1554-07 Standard Specification for Anchor Bolts, Steel, 36, 55 and 105 ksi Yield Strength

.3 ASTM A325-10 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

.4 ASTM A490-11 Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength

.2 Canadian Institute of Steel Construction (CISC)/ Canadian Paint Manufacturer's Association (CPMA):

.1 CISC/CPMA 1-73a A Quick Drying One-Coat Paint for use on Structural Steel

.2 CISC/CPMA 2-75 A Quick Drying Primer for use on Structural Steel

.3 Canadian Standards Association (CSA):

.1 CAN/CSA-G40.20/G40.21-04 General

Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steels
.2 CAN/CSA-G164-M92 (R2003) Hot Dip Galvanizing of Irregularly Shaped Articles
.3 CAN/CSA-S16-09 Design of Steel Structures
.4 CSA S136-07 Design of Cold-Formed Steel Structural Members
.5 CSA W47.1-09 Certification of Companies for Fusion Welding of Steel Structures
.6 CSA W59-03 (R2008) Welded Steel Construction (Metal Arc Welding)
.4 Master Painters Institute:
.1 Master Painters Institute Green Performance Standard GPS-1-08
.5 The Society for Protective Coatings (SSPC):
.1 SSPC SP 3-2004 Power Tool Cleaning
.2 SSPC SP-6-2007 Commercial Blast Cleaning

1.2 DESIGN CRITERIA
.1 Design connections and other work not detailed on drawings, but necessary for completion of the Work, in accordance with requirements of Alberta Building Code, CAN/CSA S16 and CSA S136.

1.3 ADMINISTRATIVE REQUIREMENTS
.1 Coordination:
.1 Where structural steel is scheduled to be finish painted, ensure that shop paint primer is compatible with painting coats specified in Division 09, Painting and Finishing Schedules.

1.4 SUBMITTALS
.1 Product Data:
.1 Submit manufacturer's printed product literature, specifications, and data sheet in accordance with Section 01 33 00 Submittal Procedures.
.2 Shop Drawings:
.1 Submit shop drawings and product data prior to commencement of fabrication.
.2 Shop Drawings shall include shop details and erection diagrams and shall indicate framing and grid lines, bearing and anchorage details, framed openings, accessories, schedule of materials, camber and loadings, fasteners, method of torquing bolts, and welds using American Welding Society basic weld symbols.
.3 Shop drawings for work designed by fabricator shall bear the stamp and signature of a specialty structural engineer registered in the Province of Alberta.
.3 Manufacturer Reports:
.1 Submit three copies of certified mill test reports for the materials used.

1.5 QUALITY ASSURANCE
.1 Comply with applicable requirements of CAN/CSA S16 and CAN/CSA S136.
.2 Do welding in accordance with CSA W59.
.3 Welding shall be undertaken only by a company approved by the Canadian Welding Bureau to the requirements of CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.

1.6 DELIVERY, STORAGE, AND HANDLING
.1 Waste Management and Disposal:
.1 Separate waste materials for recycling in accordance with Section 01 74 19 – Waste Management and Disposal.

1.7 QUALIFICATIONS
.1 Structural steel fabricator shall have minimum five (5) years experience in the fabrication of structural steel.
.2 Structural steel erector shall have minimum five (5) years experience in the erection of structural steel.
.3 Steel fabricators and erectors must be certified under requirements of CSA W47.1 as required by CSA S16.
.4 Welding procedures, welders, and welding operations shall be qualified in accordance with Canadian Welding Bureau Standards.

1.8 EXAMINATIONS
.1 Examine and verify all measurements and dimensions critical to the work of this contract.

1.9 TESTING AND FIELD REVIEW
.1 See Section 05 00 50 - Testing of Structural Steel, Steel Joist Framing and Steel Decking.
.2 The Specialty Structural Engineer responsible for shop drawings, or their representative, shall visit the site to review in place the connections and components designed by that Specialty Structural Engineer. The Specialty Structural Engineer shall be satisfied or take steps to ensure that these connections and components substantially comply with the Specialty Structural Engineer's design. The Specialty Structural Engineer shall then provide a sealed and signed letter to the Engineer to this effect.
.3 Prior to the commencement of work, provide a schedule of shop fabrication to the Testing Agency.
.4 The Contractor shall advise the Testing Agency of the scheduling of all shop and field work pertaining to this Project. The Contractor shall permit the testing agency full access to the fabrication shop and the site, for the purpose of carrying out his work and he shall provide assistance required to aid in the performance of the inspection and testing.

2. Products
2.1 MATERIALS
.1 Steel: Structural quality, to CAN/CSA G40.20.
.2 Rolled Structural Steel Sections: to CAN/CSA G40.21, Type W, grade 350 shop primed and finish painted.
.3 Hollow Structural Steel Sections: to CAN/CSA G40.21, Type W, grade 350, Class C shop primed and finish painted.
.4 Cold Rolled Sections: Conforming to CAN/CSA S136 with yield strength of 380 Mpa.
.5 Bolts: to ASTM A325 and as required to A490.
.6 Anchor Bolts: Conforming to ASTM F1554, yield strength 36 ksi.
.7 Welding Materials: Conforming to CSA W59.
.8 Shear Stud Connectors: to ASTM A108.
.9 Shop Paint Primer: to CISC/CPMA 2-75 and as specified in Division 09, Painting and Finishing Schedules.
.10 Zinc rich paint and touch-up primer for interior surfaces: meeting requirements of Green Seal Standard GS-11, Paints and Coatings, for VOC content to be less than 250 g/l.

2.2 DESIGN
.1 Unless otherwise noted, connections and trusses shall be designed by the Specialty Structural Engineer to the reference Standards.
.2 Connections of the type and detail shown on the drawings shall be used. Modifications to the specified connection types and details will not be permitted without prior approval from the Engineer.
.3 The following connections, and any connections so noted on the structural drawings, shall be designed as slip critical and shall be pre-tensioned:
.1 Trusses.
.2 Elements resisting crane loads.
.3 Connections for supports of running machines or other live loads that produce impact or cyclic loads.
.4 Connections where bolts are subject to repeated tensile loads.
.5 Connections using slotted holes in the direction of the load or oversize holes unless specifically designed to accommodate movement.
.4 Connections for wind or seismic lateral load-resisting elements, such as bracing and drag struts, and others so noted on the structural drawings may be designed as bearing connections, but shall be pre-tensioned.
.5 Other bolted connections may be snug tight.
.6 Use standard connection types where connections are not detailed on the structural drawings.
.7 Design shall be for the forces and loads shown on the drawings and shall allow for the effects of beam deflections. Provide a minimum of two (2) 19 mm (3/4") diameter A325 bolts or an equivalent weld for all beam to girder and beam to column connections. If forces or loads are not given, the connection shall be designed for the maximum uniform distributed load that the member can carry for the span shown.
.8 Structural steel members spliced for ease of fabrication or transportation shall have splices designed to develop the full strength and stiffness of the member. Splices shall be subject to non-destructive testing as directed by the Engineer. The cost for such testing shall be borne by the Contractor.
.9 Provide stiffeners in beam webs at all locations where beams pass over supports. Unless noted otherwise in the structural drawings, web stiffeners shall be 10 mm minimum.
.10 Provide separators for all double members in accordance with CSA S16.

2.3 FABRICATION
.1 Fabricate structural steel in accordance with CAN/CSA S16 and CSA S136.
.2 Camber steel members as indicated on drawings.
.3 Shop weld shear stud connectors with automatic stud welding equipment. Thoroughly clean surface to which studs are to be welded. Ensure stud stem is perpendicular to surface to which it is attached.

2.4 SURFACE PREPARATION AND SHOP PRIMING
.1 Where structural steel is scheduled to be finish painted, prepare surfaces in accordance with Steel Structures Painting Council, SP-6 - Commercial Blast Cleaning
.2 Apply shop paint primer in accordance with manufacturer's instructions to a dry film thickness of 50 to 75 micrometers.

3. Execution

3.1 ERECTION
.1 Erect structural steel in accordance with CAN/CSA S16, CSA W59, and CSA S136.
.2 Structural steel erector is fully responsible for erection methods, equipment, workmanship, and safety precautions.
.3 Obtain Engineer's approval prior to field cutting or altering of members.
.4 Field touch up shop paint primer at bolts, welds and burned or scratched surfaces. Use same primer as applied in shop.

Section 05 21 19 - OPEN WEB STEEL JOISTS

1. General
1.1 REFERENCE DOCUMENTS
.1 American Society for Testing and Materials (ASTM):
.1 ASTM A108-07 Standard Specifications for Steel Bars, Carbon, Cold-Finished, Standard Quality
.2 Canadian Institute of Steel Construction (CISC)/ Canadian Paint Manufacturers' Association (CPMA) CISC/ CPMA 2-75A quick Drying Primer for use on Structural Steel.
.3 Canadian Standards Association (CSA):
.1 CAN/CSA-G40.20/G40.21-04 General Requirements for Rolled or Welded Structural Quality Steels
.2 CAN/CSA-S16-09 Design of Steel Structures
.3 CSA S136-07 Design of Cold-Formed Steel Structural Members
.4 CSA W47.1-09 Certification of Companies for Fusion Welding of Steel Structures
.5 CSA W59-03 (R2008) Welded Steel Construction (Metal Arc Welding)
.4 Master Painters Institute:
.1 Master Painters Institute Green Performance Standard GPS-1-08
.5 The Society for Protective Coatings (SSPC):
.1 SSPC SP -3-2004 Power Tool Cleaning
.2 SSPC SP-6 Commercial Blast Cleaning

1.2 DESIGN CRITERIA
.1 Design members, connections and other work not detailed on drawings, but necessary for completion of the Work, in accordance with dimensions and loadings indicated on drawings, and requirements of Alberta Building Code, CAN/CSA S16 and CSA S136, the Canadian Institute of Steel Construction (CISC) "Code of Standard Practice for Buildings" and "Steel Joist Facts".
.2 The deflection due to live load shall not exceed 1/360 of the span unless noted otherwise on the drawings.

1.3 ADMINISTRATIVE REQUIREMENTS
.1 Coordination:
.1 Where structural steel is scheduled to be finish painted, ensure that shop paint primer is compatible with painting coats specified in Division 09, Painting and Finishing Schedules.

1.4 SUBMITTALS
.1 Product Data:
.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.
.2 Shop Drawings:
.1 Submit shop drawings and product data prior to commencement of fabrication.
.2 Shop Drawings shall include shop details and erection diagrams and shall indicate framing and grid lines, bearing and anchorage details, framed openings, accessories, schedule of materials, camber and loadings, fasteners, method of torquing bolts, and welds using American Welding Society basic weld symbols.
.3 Shop drawings for work designed by fabricator shall bear the stamp and signature of a professional engineer registered in the Province of Alberta.
.3 Test and Evaluation Reports
.1 Owner may appoint and pay for services of testing agency to perform testing and inspection of work of this Section.
.2 Notify Engineer prior to commencement of fabrication work so that testing and inspection may be properly scheduled.
.3 When defects are revealed, Engineer may request additional testing and inspection at Contractor's expense.
.4 Manufacturer Reports:
.1 Submit three copies of certified mill test reports for the materials used.

1.5 QUALITY ASSURANCE
.1 Welding shall be undertaken only by a company approved by the Canadian Welding Bureau to the requirements of CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.

1.6 DELIVERY, STORAGE, AND HANDLING
.1 Waste Management and Disposal:
.1 Separate waste materials for recycling in accordance with Section 01 74 19 - Management and Disposal.

1.7 QUALIFICATIONS
.1 Open web steel joist fabricator shall have minimum five (5) years experience in the fabrication of open web steel joists.
.2 Steel Joist erector shall have minimum five (5) years experience in the erection of open web steel joists.
.3 Steel fabricators and erectors must be certified under requirements of CSA W47.1 as required by CSA S16.
.4 Welding procedures, welders and welding operations shall be qualified in accordance with Canadian Welding Bureau Standards.

1.8 EXAMINATIONS
.1 Examine and verify all measurements critical to the work of this contract.

1.9 SUBMITTALS
.1 The Contractor shall submit, before starting work, written evidence of qualification of the steel fabricators and erectors for welding under Canadian Welding Bureau requirements.
.2 The Contractor shall submit, before starting work], written evidence of ability to weld reinforcing steel to structural steel in accordance with CSA W186.
.3 When requested, submit copies of mill test reports properly correlated to the materials used on the project.
.4 Provide a schedule of fabrication to the Engineer and Testing Agency prior to the commencement of the fabrication.

1.10 SHOP DRAWINGS
.1 Submit shop drawings and product data prior to commencement of fabrication.
.2 Shop Drawings shall include shop details and erection diagrams and shall indicate framing and grid lines, bearing and anchorage details, framed openings, accessories, schedule of materials, camber and loadings, fasteners, method of torquing bolts, and welds using American Welding Society basic weld symbols.
.3 Shop drawings for work designed by fabricator shall bear the stamp and signature of a specialty structural engineer registered in the Province of Alberta.

1.11 TESTING AND FIELD REVIEW
.1 See Section 05 00 50 - Testing of Structural Steel, Steel Joist Framing and Steel Decking.
.2 Prior to the commencement of work provide a schedule of shop fabrication to the Testing Agency.

2. Products
2.1 MATERIALS
.1 Steel: structural quality to CAN/CSA G40.20 and CAN/CSA G40.21.
.2 Welding Materials: to CSA W59.
.3 Shop Paint Primer: as specified in Division 09, Painting and Finishing Schedules.
.4 Zinc rich paint and touch-up primer for interior surfaces: meeting requirements of Green Seal Standard GS-11, for VOC content to be less than 250 g/l.

2.2 DESIGN
.1 Unless otherwise noted open web steel joists shall be designed by the Specialty Structural Engineer to the reference Standards.
.2 Design joists of the depth and spacing shown on the drawings to carry the loads shown on the drawings in accordance with CSA S16.

.3 Design of bridging for steel joists shall conform to the requirements of CSA S16, unless otherwise indicated on the drawings. Refer to the drawings for areas of non-typical joist bridging and bracing.
.4 Joists shall have a live load deflection of less than 1/360 of the span unless noted otherwise.
.5 Line up openings and webs in adjacent joists to allow for passage of pipe, ducts, conduits, etc. Make allowance in joist design for support of pipes, ducts, conduits, etc.
.6 Where joists frame into both sides of a support, extend the top chord of the joists to the center of the support, unless shown otherwise.
.7 Where joists frame into one side of a support, extend the top chord of the joists to the far side of the support, unless shown otherwise.

2.3 FABRICATION
.1 Fabricate steel joists and accessories in accordance with CAN/CSA S16 and CSA S136.
.2 Camber joists to dead load deflection indicated on drawings.
.3 Drill holes in chords where necessary for attachment of wood nailers. Make allowance for the reduction in cross sectional area of tension flanges.
.4 Fabricate top and bottom chord extensions where indicated.

2.4 SURFACE PREPARATION AND SHOP PRIMING
.1 Where steel joists are scheduled to be finish painted, prepare surfaces in accordance with Steel Structures Painting Council, SP-6 Commercial Blast Cleaning.
.2 Apply shop paint primer in accordance with CAN/CSA S16 and manufacturer's instructions to a dry film thickness of 50 to 75 micrometers.

3. Execution
3.1 ERECTION
.1 The steel joist erector is fully responsible for erection methods, equipment, workmanship and safety precautions.
.2 Steel joists shall bear on beams as per section 2.2, but in no case shall be less than 65 mm on supporting steel members. Connect to supporting steel with a 5 mm x 30 mm long fillet weld at each side. Secure to bearing plates on masonry walls in the same manner, bearing 100 mm minimum.
.3 Erect steel joists and bridging in accordance with CAN/CSA S16, CSA W59 and CSA S136.
.4 Obtain Engineer's approval prior to field cutting or altering of joists or bridging.
.5 Field touch up shop paint primer at bolts, welds and burned or scratched surfaces. Use same primer as applied in shop.

Section 05 30 00 - METAL DECKING

1. General
1.1 RELATED SECTIONS
.1 Waste Management and Disposal Section 01 74 19.
.2 Structural Steel Framing Section 05 12 00.
.3 Open Web Steel Joists Section 05 12 19.

1.2 REFERENCE DOCUMENTS
.1 American Society for Testing and Materials (ASTM):
.1 ASTM A653/A653M 09 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
.2 Canadian Standards Association (CSA):
.1 CAN/CSA-S16-01 Consolidation (R2007) Limit States Design of Steel Structures (Includes Update No. 3, August 2006), and Supplement No. 1 (2005)
.2 CSA W47.1-03 (R2008) Certification of Companies for Fusion Welding of Steel Structures
.3 CSA W59-M1989 (R2008) Welded Steel Construction (Metal Arc Welding)

1.3 REQUIREMENTS
.1 Comply with applicable requirements of CSA S136.
.2 Except where otherwise specified, comply with applicable requirements of Canadian Sheet Steel Building Institute standards.
.3 Do welding in accordance with CSA W59.

1.4 DESIGN CRITERIA
.1 Design of metal decking shall be in accordance with CSA S136.
.2 Design deck to safely support loads shown on drawings.
.3 Deck units shall be continuous over three or more spans where possible.
.4 Live load deflection shall not exceed 1/240 of span for roofs and 1/360 of span for floors.

1.5 SUBMITTALS
.1 Product Data:
.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 Submittal Procedures.
.2 Shop drawings:
.1 Indicate decking plan, joints, anchorages, supports, projections, opening and reinforcement, details and accessories.

1.6 DELIVERY, STORAGE, AND HANDLING
.1 Waste Management and Disposal:
.1 Separate waste materials for recycling in accordance with Section 01 74 19 - Management and Disposal.

2. Products
2.1 MATERIALS
.1 Sheet Steel: to ASTM A653M, zinc coated to Z275 coating designation.
.2 Acoustic Insulation: fibrous type, profiled to suit deck flutes.
.3 Acoustic Closures: 25 mm tick, closed cell foam rubber, profiled to deck corrugations.

2.2 DECK AND RELATED ACCESSORIES
.1 Roof Deck: 0.91 mm thickness base sheet steel Z275 zinc coating, 76 mm deep profile.
.2 Floor Deck: 0.76 mm thickness base sheet steel, Z275 zinc coating, 38 mm deep profile, ribbed vertical webs.
.3 Closure Strips, Flashing, Cover Plates: 0.76 mm minimum thickness base sheet steel, Z275 zinc coating, or required profiles and sizes.

3. Execution
3.1 FABRICATION
.1 Fabricate deck sections to CSA S136, Canadian Sheet Steel Building Institute (CSSBI) and to dimensions indicated on drawings.
.2 Provide a male and female lip for each section of steel deck.

3.2 INSTALLATION - GENERAL
.1 Reinforce steel deck openings shown on the drawings unless otherwise noted.
.2 Reinforce openings up to 450 mm in any dimension with 50 x 50 x 6 mm steel angles. Place angles at right angles to ribs and weld to a minimum of two flutes each side of opening.
.3 Install decking according to design sheet widths and depths. Correct sheet spread during installations.
.4 Locate all end joints over support. Lap all end joints on non-cellular deck 50 mm minimum.
.5 Minimum end bearing on steel supports shall be equal to the depth of the deck.
.6 Wire brush, clean and touch-up welds and scarred areas on top surface or metal decking with touch-up primer.

3.3 ROOF DECK INSTALLATION
.1 Fasten roof deck with #14 x 20 mm cadmium plated stainless steel self-tapping screws, complete with neoprene washers and located at 100 mm on centre.
.2 Mechanically fasten side laps at 300 mm on centre with mechanical fasteners as noted on structural drawings.
.3 Install 150 mm minimum width continuous cover plates where deck changes direction. Screw in place at 300 mm on centre maximum.
.4 Install angle or channel closures full length on all deck edges at perimeter, walls and openings.
.5 Install acoustical closures over walls and partitions.

3.4 FLOOR AND DECK INSTALLATION
.1 Lap end joints on non-cellular deck 50 mm minimum. Butt ends of cellular deck. Install steel cover plates over open joints greater than 3 mm.
.2 Fasten to all supports with mechanical fasteners 450 mm on centre maximum.
.3 Mechanically fasten sidelaps at 610 mm on centre with mechanical fasteners.

.4 Install angles, closure strips and flashing, extended to top concrete slab to contain wet concrete, at all deck edges around perimeter, at openings, at columns, etc. Use adequate metal thickness to maintain wet concrete in place without distortion.
.5 Install acoustical closures over all walls and partitions.

END OF STRUCTURAL SECTIONS

MECHANICAL SECTIONS

23 00 13 – GENERAL MECHANICAL PROVISIONS

1.1 INTENT
.1 Mechanical general requirements including general testing, fire stopping, equipment supports, housekeeping pads, access doors, spare parts, special tools, demonstration and operating instructions, and Mechanical requirements for O&M Manuals and Record Drawings.

20 00 23 – MECHANICAL SPARE PARTS & MAINTENANCE MATERIALS

1.1 INTENT
.1 For the supply and installation of mechanical spare parts and maintenance materials including: sprinkler heads, pump seals, air filters, glycol, valve washers and seats, and fire damper fusible links.

20 01 06 – DOCUMENTATION

1.1 INTENT
.1 Outlines the requirements for operations and maintenance manuals and record drawings.

20 02 10 – MOTORS

1.1 INTENT
.1 Outlines the standards for acceptable motor quality including insulation requirements for variable speed driven motors and efficiency.

20 03 10 – TESTING

1.1 INTENT
.1 Outlines the requirements for all mechanicals systems testing

1.2 PRESSURE TESTING
.1 Heating water piping
.2 Cooling water piping
.3 Domestic water
.4 Drainage
.5 Gas
.6 Sprinkler piping
.7 Ductwork

1.3 PERFORMANCE TESTING
.1 Conduct performance tests to demonstrate equipment and systems meet specified requirements after mechanical installations are completed and pressure tested. Conduct tests as soon as conditions permit. Make changes, repairs and adjustments required as tests may indicate prior to operating tests.

20 03 20 – MECHANICAL SYSTEMS BALANCING

1.1 INTENT
.1 Balance air and water system terminals to provide flow rates within +10% of those specified when equipment is operating at design conditions.
1.2 STANDARDS
.1 AABC, NEBB

20 04 10 – CHEMICAL TREATMENT & PROCEDURES

1.1 INTENT
.1 This section specifies equipment, chemicals and procedures to be used in chemical treatment and cleaning of piping and equipment.
1.2 STANDARDS
.1 ASME Sec VIII

1.3 EQUIPMENT
.1 Chemical pot feeder assembly
.2 Test kits for closed systems

1.4 CHEMICAL CLEANERS
.1 Closed loop hydronic systems

1.5 INHIBITORS
.1 Closed loop hydronic systems
.2 Glycol systems: Heating systems 50% Propylene Glycol, Cooling systems 50% Ethylene Glycol.

20 05 23 – VALVES

1.1 INTENT
.1 This section outlines the standard of quality for valves used in all systems and the locations in which each valve type is acceptable.

20 05 25 – PRESSURE GAUGES AND THERMOMETERS

1.1 INTENT
.1 This section outlines the standard of quality for pressure gauges and thermometers used in all systems and the locations in which each type is required.
1.2 STANDARDS
.1 Pressure gauges to: CGSB 91
.2 Thermometers to: CGSB 14

20 05 29 – PIPE AND EQUIPMENT SUPPORTS

1.1 INTENT
.1 This section outlines the installation requirements pipe and duct supports.

1.2 STANDARDS
.1 ANSI B31.1, MSS SP-58

1.3 HOUSEKEEPING PADS
.1 For major equipment, provide reinforced concrete housekeeping pads poured directly on floor slab, 100 mm thick minimum, extended 100 mm minimum beyond machinery bedplates. Provide templates, anchor bolts and accessories required for mounting and anchoring equipment.

20 05 30 – PIPE AND DUCT PENETRATIONS AND FIRE STOPS

1.1 INTENT
.1 This section outlines the installation requirements and fire stopping for pipes and duct that penetrate various types of assemblies. These include fire rated walls and floors, poured concrete, masonry and roof penetrations.
1.2 STANDARDS
.1 ASTM E 814, UL 1479, ASTM E 119, UL 723, ASTM E 84, UL 263 and CAN4 5115

20 05 31 – ACCESS DOORS IN WALLS/CEILINGS

1.1 INTENT
.1 This section outlines the standard of quality for access doors for all serviceable mechanical components and the locations in which each type is required.

20 05 43 – MECHANICAL IDENTIFICATION

1.1 INTENT
.1 Piping and duct identification systems. Mechanical equipment identification and valve and controller tagging. Equipment location identifiers. Specified system will include the adhesive style of labels and arrows. All valve tagging and equipment identification to be by lamacoid labels and discs.
1.2 STANDARDS
.1 CAN/CGSB-24.3, ANSI/NFPA 13

20 05 48 – MECHANICAL VIBRATION CONTROL

1.1 INTENT
.1 All vibration isolation equipment including acoustic barriers, Elastomeric pads, floor and hanging spring isolators and spring isolated hanging systems are identified.

20 15 00 – TANKS

1.1 INTENT
.1 All requirements for tanks are outlined; specifically expansion tanks.
1.2 STANDARDS
.1 ASME

1.3 EXPANSION TANKS - DIAPHRAGM TYPE

.1 Body Construction: steel pressure vessel outer tank.
.2 support: steel skirt for vertical floor support.
.3 Air Chamber: heavy duty butyl diaphragm bonded with polypropylene liner to steel shell, separating air chamber from water. Chamber precharged to 80 kPa.
.4 Ratings: maximum working pressure 520 kPa; maximum operating temperature at 115°C.
.5 Fittings: air side charge connection; water side inlet connection.

20 20 10 – PIPE AND PIPE FITTINGS

1.1 INTENT
.1 All requirements for piping are outlined including types of pipe for each system and acceptable locations for each type of piping.

1.2 STANDARDS
.1 Fabricate piping systems in accordance with Alberta Regulation 49/2006, Safety Codes Act, Pressure Equipment Safety Regulation
.2 Natural gas and propane to CSA B149.1
.3 Refrigerant systems to ANSI/ASME B31.5

1.3 PLUMBING
.1 Hard drawn copper DW piping and PEX DW tubing and fittings. DW fittings and connection methods and installation instructions.

1.4 DRAINAGE
.1 DWV copper tube and fittings and DWV mechanical joint cast iron piping and fittings. Fire retardant PVC piping and fittings and directions on acceptability for use within the building.

1.5 HYDRONIC PIPING
.1 Schedule 40 steel and copper piping, fittings and joints for hydronic heating and cooling systems.

1.6 NATURAL GAS PIPING
.1 Schedule 40 steel piping, fittings and joints for all natural gas-fired equipment and piping.

1.7 FIRE PROTECTION
.1 To NFPA 13 requirements.

20 20 30 – PIPE AND EQUIPMENT INSULATION

1.1 INTENT
.1 All requirements for piping are outlined including types of pipe for each system and acceptable locations for each type of piping. Insulation thicknesses will meet MNECB requirements.

1.2 STANDARDS
.1 CAN/CGSB 51.9, ANSI/NFPA 90A, CAN/CGSB-51.2, CSA HA M1980

20 20 40 – EXPANSION COMPENSATION

1.1 INTENT
.1 All requirements for expansion compensation are outlined including braided stainless steel flexible connections equipment; guides and anchors for HW systems; and inline expansion joints for HW systems.
1.2 STANDARDS
.1 ASTM A 53-90B, ASTM A 105/A 105M-02

1.3 FLEXIBLE PIPE CONNECTORS
.1 Stainless Steel Braided Spools: 316 or 321 and stainless steel inner corrugated hose and outer braid with integral stainless steel flanged pipe connections, rated for operating temperatures to 450°C and pressures to 900 kPa.

20 20 60 – PUMPS

1.1 INTENT
.1 All requirements for pumps are outlined including vertical in-line pumps for heating and cooling as well as fire pumps.

1.2 VERTICAL IN-LINE PUMPS
.1 Type: centrifugal, single stage, close coupled in-line, back pullout design suitable for vertical operation.
.2 Casing: cast iron, rated for greater of 1035 kPa or 1.5 times actual discharge working pressure, suction and discharge gauge ports, air vent, wear rings, seal flushing connection, drain plug.
.3 Impeller: bronze, fully enclosed, keyed to shaft, dynamically balanced.
.4 Shaft: stainless steel.
.5 Bearings: oil lubricated ball or roller and thrust bearings with oil reservoir, oil seals with integral dirt and water seals at each end of reservoir; rated for minimum life of 10,000 h.
.6 Seals: spring loaded carbon rotating washer complete with rubber bellow held against a stationary floating satellite seat and seat ring.
.7 Provide split-coupled type Vertical In-Line HVAC pumping units, with rigid spacer type couplings and supplied with NEMA Premium efficiency motors and Armstrong NEMA/UL type-12 enclosure integrated controls. NEMA/UL type 1 enclosure is not acceptable for integrated controls. Refer to pump schedule for pump flows and heads and motor speed, enclosure and power requirements and other system conditions.
.8 Controls shall be of the VVC-PWM type providing near unity displacement power factor at all loads and speeds without the need for external power factor correction capacitors. The controls shall incorporate DC link chokes for the reduction of mains borne harmonic currents to reduce the DC link ripple current thereby increasing the DC link capacitors lifetime. This shall be at least equivalent to a 5% input filter. The controls shall be UL and C-UL Listed & CE Marked showing compliance with both the EMC Directive 89/336/EEC and the Low Voltage Directive 72/23/EEC. RFI filters shall be incorporated within the controls to ensure it meets the emission and immunity requirements of EN61800-3 to the 1st Environment Class C1 (EN55011 unrestricted sales class B) and supports IEEE 519-1992 requirements. The controls and motor protection shall include: motor phase to phase fault, motor phase to ground fault, loss of supply phase, over voltage, under voltage, motor over temperature, inverter overload, over current. Over current is not allowed ensuring 4300IVS units will not overload the motor at any point in the operating range of the unit.
.9 The controls shall incorporate an integrated graphical user interface that shall provide running and diagnostic information and identify faults and status in clear English language. Faults shall be logged / recorded for interrogation at a later date. It shall be possible to upload parameters from one control hardware into the non-volatile memory of a computer and download the parameters into other control requiring the same settings. The keypad shall incorporate Hand-Off-Auto pushbuttons to enable switching between BAS/BMS and manual control. The controls shall incorporate a USB port for direct connection to a PC and an RS485 connection with Modbus RTU protocol. Include BACnet MS/TP.

1.3 VERTICAL IN-LINE FIRE PUMPS
.1 General: The pumps furnished for fire protection service shall be supplied with the specified drivers, controls and pump accessory items by the pump manufacturer. The pump, driver and control shall be Underwriters' Laboratories Canada (ULC) listed for the fire protection service. The pumping equipment shall be installed as recommended in the National Fire Protection Association (NFPA) 20, Standard for the Installation of Centrifugal Fire Pumps. The fire pump shall be capable of delivering not less than 150% of rated flow at not less than 65% rated head. Pump manufacturer shall have unit responsibility for the proper operation of the complete unit assembly as indicated by field acceptance tests.

20 30 10 – VARIABLE SPEED DRIVE SYSTEMS

1.1 INTENT
.1 All requirements for stand-alone variable speed drives are outlined.

1.2 STANDARDS
.1 CSA Quality Standard Z299.3

1.3 VARIABLE SPEED DRIVES
.1 All variable speed drives to be as per the University of Alberta Master Specification.

21 12 10 – STANDPIPE AND HOSE SYSTEMS

1.1 INTENT
.1 All requirements for hose systems are outlined.

1.2 STANDARDS
.1 NFPA 14

21 13 13 – WET PIPE SPRINKLER SYSTEM

1.1 INTENT
.1 All requirements for the wet pipe sprinklers throughout the facility are outlined.

1.2 STANDARDS
.1 NFPA 13

1.3 HYDRAULICALLY DESIGNED SYSTEMS
.1 Consultant will accept a Contractor designed and hydraulically calculated sprinkler system provided the following requirements are met:
.1 System design to NFPA 13 ordinary hazard occupancy.
.2 System design to incorporate Owner's Insurer's requirements.
.3 Base design on current water supply data from the appropriate municipality.
.4 Make allowance for pressure losses through the backflow preventer assembly installed on the water supply to the sprinkler system.
.5 Sprinkler heads exceeding the minimum code requirements but necessary to coordinate ceiling patterns are provided.

1.4 INSTALLATION
.1 Sprinklers within the collections space are to be Early Suppression Fast Response (ESFR) heads designed to "high bay records storage" as defined by NFPA 13.
.2 Piping within the Collections space is to be welded.
.3 System within the office space is to be designed to light hazard occupancy.

21 13 16 – DRY PIPE SPRINKLER SYSTEM

1.1 INTENT
.1 All requirements for dry pipe sprinklers serving the loading dock overhang are outlined.

1.2 STANDARDS
.1 NFPA 13

1.3 DRY PIPE VALVE ASSEMBLY
.1 Main Valve: Cast iron housing complete with double clapper, upper and lower chamber, drain outlet, air connections, handhole cover and all necessary fittings.
.2 Accessories: Drain valves, check valves, 2-pole flow detector, alarm connection, water and air gauges indicating type valve for controlling water flow and alarm shut-off.

1.4 AIR COMPRESSOR
.1 Compressor: Electric driven air compressor capable of restoring normal air pressure in the system in not more than 30 minutes. For low differential air pressure system, the time may be 60 minutes. Where low differential dry pipe valves are used, the air supply shall be maintained automatically.
.2 Connections: The connecting pipe from compressor to system shall not be less than 15 mm. Install check valve and shut-off valve on the supply side of the check valve.

21 21 16 – HAND HELD FIRE EXTINGUISHERS

1.1 INTENT
.1 All requirements for hand held fire extinguishers and cabinets are outlined.

1.2 STANDARDS
.1 NFPA 10

1.3 PRESSURIZED DRY CHEMICAL:
.1 Description: Multi-purpose Ammonium Phosphate, powder type, heavy duty steel cylinder, baked enamel finish, squeeze grip handle with positive on/ off valve, hose and nozzle, ULC labelled.
.2 Capacity: 2.7 kg.
.3 Capacity Rating: 2A, 2 to 10 BC.
.4 Classification: A, B and C fires.

1.4 FIRE EXTINGUISHER CABINET:
.1 Fire Extinguisher Cabinet: Cabinet tub formed of 1.52 mm steel. Door and adjustable frame are fabricated of 2.66 mm steel corrosion resistant treated, stainless steel front.
.2 Semi-recessed with canopy door type with approved latching device, prime coated.

22 05 10 – PLUMBING SYSTEMS AND SPECIALTIES

1.1 INTENT
.1 All requirements for plumbing accessories and specialty items including: floor drains, cleanouts, water hammer arrestors, hose bibs, strainers, vent flashing, DW valves, DW manifolds, backflow preventers, , trap seal primers, vent flashings and mixing valves are outlined.

1.2 STANDARDS
.1 ASTM A 126, CSA B79, ASNI/AWWA C700, CSA B64, ANSI Z359.1

1.3 FLOOR DRAINS
.1 Floor Drain Type I (General Service): lacquered, cast iron body with double drainage flange, weep holes, combination two-piece body, reversible clamping device and adjustable nickel-bronze strainer. Unit to be c/w trap primer.
.2 Floor Drain Type II (Washrooms): drain body as Type I drain, with a removable perforated sediment bucket and solid screwed down nickel bronze strainer. Unit to be c/w trap primer.
.3 Floor Drain Type III (Equipment Rooms): drain body as Type I drain with a polished bronze funnel type strainer. Unit to be c/w trap primer.
.4 Floor Drain Type IV (Loading Areas): lacquered, extra heavy duty type drain body with ductile iron grate and sediment bucket. Unit to be c/w trap primer.

1.4 BACKFLOW PREVENTER
.1 Reduced Pressure Type: assembly to CAN3 B64.4-M86 consisting of the following components:
.1 Two replaceable type check valves, positive seating with stainless steel seat and pressure differential relief valve between check valves.
.2 One test cock before and after each check valve.
.3 Two shut-off valves to isolate complete assembly.
.4 One strainer on units 50 mm and smaller on inlet to assembly.
.2 Dual Check Valve Type: assembly to CAN3 B64.5-M86 consisting of the following components:
.1 Two replaceable type check valves, positive seating with stainless steel seats.
.2 One test cock before and after each check valve.
.3 Two shut-off valves to isolate complete assembly.
.4 One strainer on units 50 mm and smaller
.3 Fire Service: Approved backflow preventer assemblies on water supplies to fire protection systems to utilize OS&Y shut-off valves, monitored, UL [FM] approved.
.4 Vacuum Breaker: to CAN3 B64.7-M86.

22 34 10 – DOMESTIC WATER HEATERS

1.1 INTENT
.1 All requirements for the gas fired domestic water heater are outlined.

1.2 STANDARDS
.1 CSA B149

1.3 DOMESTIC WATER HEATERS

.1 Gas Fired 96% Thermal Efficiency Direct Vent:
.2 Quality Control: CUL listed, UL listed, ANSI Z21.10.3-CSA 4.3 standards. Heaters to meet or exceed the thermal efficiency and standby loss requirements of ASHRAE 90.1.
.3 Helical Internal Heat Exchanger.
.4 Power direct-vent design.

22 42 10 – PLUMBING FIXTURES AND TRIM

1.1 INTENT
.1 All requirements for the plumbing fixtures and trim are outlined modular lavatories, stainless steel sinks, terrazzo mop sinks, low flush WC. Faucets will be with infrared control, all trim will be institutional cast brass.

1.2 STANDARDS
.1 CAN/CSA-B45, CSA B125

23 07 13 – DUCTWORK AND BREECHING INSULATION

1.1 INTENT
.1 All requirements for the insulation of ductwork and breeching are outlined. Insulation thicknesses will meet MNECB requirements.

1.2 STANDARDS
.1 SMACNA, ASTM C423, CAN/CGSB-51.10, CAN/CGSB-51.11, ANSI/NFPA 90A, ANSI/NFPA 90B-1993

1.3 INSULATION MATERIALS
.1 Mineral Fibre Insulation for Hot and Cold Ducts:
.1 Material: flexible mineral fibre blanket insulation to CAN/CGSB-51.11 and CGSB 51-GP-52.
.2 "k" Value: maximum 0.038 W/m. °C at 24°C.
.3 Service Temperature: - 40°C to 65°C
.4 Jacket: factory applied reinforced aluminum foil vapour barrier to CGSB 51-GP-52M.

1.4 RECOVERY MATERIALS
.1 Canvas: 220 g/m² plain weave cotton fabric with dilute fire retardant lagging adhesive, ULC listed.

23 09 00 – BCS GENERAL REQUIREMENTS

1.1 INTENT
.1 All requirements for the building management control system to meet U of A standards.

1.2 DESCRIPTION OF WORK
.1 Provide a complete, operating BCS. The system shall be capable of being operated from the Niagara Supervisor user interface provided at a future time by the Integrator under Section 17000.
.2 The BCS shall monitor and/or control the room terminal devices for this project, including, but shall not be limited to the following functions (where applicable based on the Point Schedule and/or Sequence of Operation):
.1 The monitoring and control of the variable volume terminal units along with their associated reheat coils, and induction unit(s) with face-and-bypass damper(s) as required. Provide built-in point capacity in each Terminal Controller for future control of perimeter heat/cool valves, as indicated in the project drawings.
.3 The BCS shall be a turnkey installation that shall comprise, at minimum, of the following components:
.1 Management Level Panel(s).
.2 Terminal Controllers.
.3 Graphics associated with this work, added to the existing University server for BCS systems. BCS graphics required are for individual VAV box/reheat coil combinations only, not floor plans.
.4 Wiring and routers/network switches, etc. as required for the BCS Ethernet/IP LAN and the expansion of the TC-level BACnet MS/TP Networks. Additional routers and network switches are not anticipated as a requirement.
.5 Field instrumentation including associated enclosures, wiring and conduit.
.6 Supply of two-way control valves for reheat coils, complete with electric actuators.
.7 Factory standard and/or custom control sequences of operation, point database, start/stop scheduling, data logging, alarm/event initiations, and all other functions necessary to provide a fully functional operating BCS.
.8 System set-up to coordinate communications with the University's Niagara Supervisor.
.9 All power supplies, equipment enclosures and other components, materials and services required to complete the project.
.4 Acceptable BCS system architecture:
.1 An all BACnet system where the terminal controllers are BACnet/MSTP and the management level panels are BACnet/IP. All panels/controllers are BTL-listed and shall be capable of communicating with the JACE management level panel(s) using BACnet/IP. The JACE management level panel(s) in turn communicate to the Niagara Supervisor using proprietary Niagara Network communications.

23 21 10 – HYDRONIC SYSTEMS SPECIALTIES

1.1 INTENT
.1 All requirements for miscellaneous hydronic specialties including manual and automatic air vents, air separators, relief valves and pump fittings are outlined.

1.2 COMBINATION CHECK AND SHUT-OFF VALVE
.1 Provide angle or straight type with flanged or grooved cast iron body and bronze disc and seat.

1.3 COMBINATION PUMP INLET AND STRAINER FITTINGS
.1 Provide angle type suction guide fitting with flanged or grooved cast iron body, stainless steel guide vanes and removable stainless steel strainer, equal to Victaulic, Armstrong, ITT or Mueller.

23 21 11 – GLYCOL SYSTEM

1.1 INTENT
.1 All requirements for glycol and associated make-up package are outlined.

1.2 GLYCOL MAKE-UP PACKAGE
.1 Supply and install pre-assembled glycol fill assembly to CSA Standard C22.2 No. 68, with the following components:
.1 180 litre storage/mixing tank with cover
.2 Pump suction hose with inlet strainer
.3 Pressure pump with thermal cut out
.4 Integral pressure switch
.5 Integral check valve
.6 Cord and plug
.7 Pre-charged accumulator tank with EPDM diaphragm
.8 Manual diverter valve for purging air and agitating contents of storage tank
.9 Pressure regulating valve adjustable (35-380 kPa) complete with pressure gauge
.10 Integral replaceable strainer
.11 Built-in check valve
.12 Union connection
.13 12 mm x 800 mm long flexible connection hose with check valve
.14 Low level pump cut out
.15 Pressure pump capable of running dry without damage
.16 Power supply 115/60/1 0.7A.
.2 Glycol for heating coils to be 50% Propylene Glycol. Glycol for cooling system to be 50% Ethylene Glycol.

23 31 13 – DUCTWORK

1.1 INTENT
.1 All requirements for ductwork quality and installation standards are outlined.

1.2 STANDARDS
.1 SMACNA, ASHRAE

1.3 MATERIALS
.1 Galvanized Steel Ducts: Galvanized steel, lock forming quality, with galvanized coating to ASTM A525 G90 designations on both sides.

23 31 20 – DUCTWORK CLEANING

1.1 INTENT
.1 Ductwork cleaning of all ductwork to a level 2 clean is outlined.
.2 Level 2 Clean: No visible particulates or deposition after vacuum techniques have been completed.

23 33 10 – DUCT ACCESSORIES

1.1 INTENT
.1 Ventilation accessories including neoprene flexible connections, duct access doors, turning vanes and instrument test ports. Single bladed and multi-bladed dampers balancing dampers. Aluminum insulated /thermally broken dampers for outdoor air and exhaust air dampers. Fire damper fabrication and installation instructions.

1.2 STANDARDS
.1 SMACNA, ASHRAE

23 34 16 – FANS

1.1 INTENT
.1 General fans including cabinet and inline exhaust air fans, transfer fans and cooling fans. All inline centrifugal fans are included with acoustic lined housings. Performance schedules for all fans including LwA or Sones sound criteria are included.

1.2 STANDARDS
.1 CSA C22.2, CAN/CGSB 1.181, ANSI/ASHRAE 5, AMCA

1.3 CENTRIFUGAL FANS
.1 Fabricate with multi-blade wheels with die formed airfoil blades welded to side and back plate in heavy gauge steel housing reinforced for service encountered. Provide access door and drain connection to scroll.
.2 Provide V-belt drives with fan and motor mounted on reinforced, rigid steel base with adjustable motor mount.
.3 Provide heavy duty, self-aligning, anti-friction bearings with external lubrication.

23 36 11 – ELECTRONIC SINGLE DUCT AIR TERMINAL UNITS

1.1 INTENT
.1 All requirements for electronic single duct air terminal units quality and installation standards are outlined.

1.2 STANDARDS
.1 SMACNA, ASHRAE

1.3 OPERATING CHARACTERISTICS
.1 Type: independent of inlet air pressure, controlled by electronic package, suitable for DDC interface.
.2 Inlet Air Pressure Range: maximum 1500 Pa; minimum 5 Pa.
.3 Maximum 45 Pa at an inlet velocity of 610 m/s.

23 37 10 – AIR OUTLETS AND INLETS

1.1 INTENT
.1 All requirements for steel ceiling diffusers, steel wall and ceiling grilles, aluminum ceiling grilles and factory fabricated extruded stationary aluminum louvres are outlined.

1.2 STANDARDS
.1 SMACNA, ASHRAE

23 41 10 – AIR FILTERS

1.1 INTENT
.1 All requirements for air filters quality and installation standards are outlined.

1.2 STANDARDS
.1 SMACNA, ASHRAE, AMCA

1.3 PANEL FILTERS – PRE-FILTERS
.1 Media: 50 mm thick fibrous glass blanket, factory sprayed with flameproof, non-drip, non-volatile adhesive.
.2 Holding Frames: 1.2 mm minimum galvanized frame with expanded metal grid on leaving air side and steel rod grid on air entering side, hinged with pull and retaining handles.
.3 Minimum MERV-7 Rating.

1.4 PANEL FILTERS – FINAL FILTERS
1 Media: 300 mm thick fibrous glass blanket, factory sprayed with flameproof, non-drip, non-volatile adhesive.
2 .2 Holding Frames: 1.2 mm minimum galvanized frame with expanded metal grid on leaving air side and steel rod grid on air entering side, hinged with pull and retaining handles.
3 .3 Minimum MERV-13 rating.

23 51 10 – BREECHING AND CHIMNEYS

1.1 INTENT
.1 All requirements for breeching and chimneys for all gas fired appliances quality and installation standards are outlined.

1.2 STANDARDS
.1 CSA B149, CAN/ULC-S636

1.3 VENTS1 Type BH Vent: to CAN/ULC-S636.
.1 Application: Category II and IV Appliance.
.2 Stainless steel type AL-29-4C.
.3 PVC schedule 40 or CPVC schedule 40.
.4 Polypropylene
.5 Service Temperature: maximum flue gas temperature of 248°C.

23 52 39 – PACKAGED BOILERS

1.1 INTENT
.1 All requirements for boiler quality and installation standards are outlined.

1.2 STANDARDS
.1 CSA B149

1.3 GENERAL DESIGN
.1 Boiler modules shall be natural gas fired, condensing fire tube design with a modulating forced draft power burner and positive pressure vent discharge.

1.4 MODULATING AIR/FUEL VALVE AND BURNER
.1 The boiler burner shall be capable of a 15 to 1 turndown ratio of the firing rate without loss of combustion efficiency or staging of gas valves
.2 The burner shall produce <30ppm of NOx corrected to 3% excess oxygen. The burner shall be metal fiber mesh covering a stainless steel body, with spark ignition and flame rectification.
.3 All burner material exposed to the combustion zone shall be of stainless steel construction.
.4 There shall be no moving parts within the burner itself. A modulating air/fuel valve shall meter the air and natural gas input. The modulating motor must be linked to both the gas valve body and air valve body with a single linkage. The linkage shall not require any field adjustment.
.5 A variable frequency drive (VFD) controlled cast aluminum pre-mix blower with a nylon impeller shall be utilized to ensure the optimum mixing of air & fuel between the air/fuel valve and the burner

23 57 12 – PLATE HEAT EXCHANGERS

1.1 INTENT
.1 All requirements for plate and frame heat exchangers quality and installation standards are outlined.

1.2 STANDARDS
.1 Alberta Regulation 49/2006 Safety Codes Act

1.3 PLATE AND FRAME EXCHANGERS
.1 Units shall be plate type with 304 stainless steel plates and nitrile rubber gaskets
.2 Frame shall be carbon steel with one stationary cover and one moveable cover. Upper carrying bar and lower guiding bar shall be attached to the stationary frame and to a support column.
.3 Heat transfer plates and moveable cover shall be suspended from carrying bar and guided by guiding bar. Tightening bolts shall hold moveable plates and cover to stationary plates.
.4 Design shall permit ready access to the plate pack for inspection and cleaning and easy removable of individual plates.
.5 Frames shall be prime coated.
.6 Maximum operating temperature: 160°C.
Maximum working pressure: 2500 kPa.

23 64 17 – AIR COOLED PACKAGED CHILLERS

1.1 INTENT
.1 All requirements for the air cooled packaged chiller quality and installation standards are outlined.

1.2 STANDARDS
.1 ARI

1.3 DESCRIPTION

.1 Each unit shall include one or more Turbocor, magnetic bearing, and variable-speed centrifugal compressors. Integrated variable frequency drive shall operate with inlet guide vanes. Chillers shall operate with HCF-134a refrigerant not subject to phase-out by the Montreal Protocol and the U.S. EPA Phase-out schedule.

.2 The evaporator, condenser, and expansion valve shall be configured to operate as a single refrigerant circuit unless otherwise specified. The chiller unit compressors shall be designed for mechanical and electrical isolation to facilitate service and removal.

3 Air cooled controls shall be capable of reliable operation between -40°F and 105° ambient air temperature. Condenser shall be sized for both extremes.

23 73 10 – CUSTOM FABRICATED INDOOR AIR HANDLING UNIT

1.1 INTENT

.1 All requirements for the air handling unit quality including casing, filter frames, coils, fans and dehumidification desiccant wheels are outlined.

1.2 STANDARDS

.1 ASHRAE, SMACNA

1.3 DESCRIPTION

.1 Air handling units shall be designed for indoor application as indicated in the project design documents and design drawings. AHU units shall be individually complete and self-supporting. Manufacturing standards that are not project specific and do not address the actual unit configurations and design for this project will not be approved as meeting this requirement.

1.4 FANS

.1 The supply fan arrays, shall be minimum of AMCA Class III construction, as required, to meet the application specific performance requirements. All fans shall be selected to deliver design airflow at the specified operating TSP at the specified motor speed and as scheduled. The Array shall be selected to operate at a fan array Total Static Pressure that does not exceed 90% of the specified peak static pressure producing capability at the specified fan speed and with the specified wheel width.

.2 Each fan/motor assembly, fan cell or/or cube shall consist of an 11 gauge A60 Galvanized steel intake wall, 14 gauge spun steel inlet funnel, and an 11 gauge A60 Galvanized steel motor support plate and structure.

.3 The fan cell intake wall, inlet funnel, and motor support structure shall be powder coated.

1.5 DAMPERS

.1 Motorized dampers for outside air and exhaust air. Construct dampers of extruded aluminum blades. Provide blades with extruded vinyl or rubber edge seals. Damper end seal shall be positive and shall provide for overall leakage rates that meet or exceed AMCA standards for low leakage construction. Construct the external frame of heavy gauge welded steel with 6.35mm plate bearing bars with a bronze or turcite insert bearing. Arrange linkage externally for opposed-blade action. Jack shafting as required.

.2 Damper Actuators shall be provided by the Controls Contractor and mounted by the air handling unit manufacturer at the factory.

1.6 FILTERS

.1 Filter rack assemblies to be blanked off on the sides, roof and floor and properly sealed to prevent filter bypass. Filter holding frames shall be designed to accommodate standard sized 610mm x 610mm and/or 610mm x 305mm) filters.

.2 Each filter bank to be provided with a Dwyer Series 2000 Magnehelic Air Filter Gauge with adjustable signal flag. Gauges to be flush mounted.

23 82 10 – HYDRONIC TERMINAL HEAT TRANSFER UNITS

1.1 INTENT

.1 All requirements for radiant panels, unit heaters, force flows and radiation are outlined.

1.2 PERFORMANCE

.1 Radiation, forced air cabinet heaters, unit heater and fan-coil capacities are based on 18.3°C entering air temperature, 82°C average water temperature.

.2 Radiant panel sizes are based on 21°C room air temperature, 82.2°C average water temperature. Refer to drawings for exact configuration and sizes. Provide panels to width specified.

23 82 16 – COILS

1.1 INTENT

.1 All requirements for radiant panels, unit heaters, force flows and radiation are outlined.

1.2 STANDARDS

.1 ARI

1.3 CONSTRUCTION

.1 Construct extended surface coils with tubes of copper or brass expanded into headers for permanent, leak tight joint.

2 Construct fins of plate type aluminum or copper with fin collars mechanically bonded to tube, accurately spaced.

.3 Mount coil section in 1.6 mm thick galvanized steel casing designed for bolting to other sections of ductwork. Provide 2 mm thick galvanized steel center support on coils with header heights greater than 915 mm and on coils longer than 1070 mm.

.4 Construct headers of grey cast iron or round, seamless copper.

.5 Coils are to be suitable for maximum 1380 kPa working pressure, at 104°C fluid temperature.

.6 Construct coils with maximum length of 3 m per section.

.7 Construct coils with foam sealing strip between casing and fins.

23 82 19 – FAN COIL UNITS

1.1 INTENT

.1 All requirements for fan coil units including casing, fans, filters and coils are outlined.

1.2 STANDARDS

.1 ARI

1.3 GENERAL

1 Furnish and install Horizontal Concealed Direct Drive Fan Coil Units where indicated on the plans and in the specifications. Units shall be completely factory assembled, tested and shipped as one piece. All units shall be capable of meeting or exceeding the scheduled capacities for cooling, heating and air delivery. All unit dimensions for each model and size shall be considered maximums. Units shall be ETL listed in compliance with UL/ANSI Standard 1995, and be certified as complying with the latest edition of ARI Standard 440.

23 84 13 – GAS FIRED STEAM HUMIDIFIER

1.1 INTENT

.1 All requirements for gas fired steam humidifiers including casing, controls and distribution are outlined.

1.2 STANDARDS

.1 CSA B149, CGA4.9

1.3 GENERAL DESIGN REQUIREMENTS

.1 Self-contained, electrically controlled gas fired steam humidifier for distribution of humidity (steam vapour) into air handling system or directly into space.

.2 Generate steam by boiling off tap water inside a steam generator.

END OF MECHANICAL SECTIONS

ELECTRICAL SECTIONS

26 05 00 - GENERAL ELECTRICAL PROVISIONS

1.1 APPLICABLE STANDARDS:
.1 University of Alberta, Facilities Management Commissioning Manual.
.2 University of Alberta, Electrical Design Guidelines.
.3 University of Alberta, Fire Alarm Design Standards, draft copy issued January 2005.
.4 Latest adopted Canadian Electrical Code – Part I.
.5 Regulations of the Alberta Electrical Protection Branch – Safety Codes Act.
.6 Latest Alberta Building Code.
.7 Latest Alberta Fire Code.
.8 Latest CSA Fire Alarm Standards and ULC Standards.
.9 Latest Illuminating Engineering Society of North America (IESNA) Standards.
.1 AICT Telecommunications Design Guidelines, University of Alberta Cabling Standards (Version 2.2, May 23, 2008).
.2 University of Alberta, Lighting Design Guidelines and Standards (January 2009, Revision 0.2).
.10 Provide O&M manuals complete with CAD record drawings.
.11 Provide colour coding of panels and raceways as per applicable UofA standards.
.12 Labeling and identification of panels and circuits numbers shall follow applicable UofA standards.

26 05 08 - EXISTING FACILITIES AND SERVICES

.1 Where the work of the Contract requires shutdown or will otherwise affect an existing electrical system, contractor is to obtain shut down permission/ confirmation University personnel.
.2 Shutdowns for tie into existing systems may be required after normal working hour to maintain facility operation. Shutdown of existing systems under direction of University of Alberta Maintenance personnel.
.3 All costs related to non-coordinated nuisance alarms or the fire alarm system caused by this contractor will be borne by this contractor (i.e. false alarm charges by Fire Department).

1.1 DEMOLITION
.1 Disconnect and remove all existing lighting poles and existing fiber pedestal. Existing lighting circuitry to remain in operation.
.2 In order to ensure continuity of existing electrical systems, all electric demolition is to be carried out by Electrical Contractor with coordination as required with the University of Alberta

26 05 19 - GENERAL WIRING METHODS

.1 All wiring will be installed in conduit. Copper wiring shall be used in the facility. Aluminum wiring to be used for feeders greater that 150A excluding the secondary service into the building which will be copper.
.2 Minimum size #12AWG R90/XLPE
.3 Colour coding to UofA Technical Standards.
.4 Provide inverter grade cables from VFD's to the motors when they are separated by more than 10 m of cable length from the VFD's.

26 05 26 - GROUNDING AND BONDING

.1 Provide ground bus in the new electrical room and communication room connected back to main ground grid.
.2 Provide bonding conductors in each conduit.
.3 Provide ground bushings on all conduits stubbed on to cable tray and bond to tray.
.4 Ground cable tray and data racks to ground bus in communication room with insulated #6 AWG ground conductors.

26 05 33 - CONDUIT AND RACEWAYS

.1 Minimum size conduit to be 21 mm.
.2 All wiring to be installed in conduit or raceways.
.3 Underground wiring to be installed in rigid PVC.
.4 Liquid tight flexible steel conduit to be used for motor locations and damp locations.
.5 Flexible steel conduit to be used for luminaire connections, transformer connections.
.6 The use of ENT is strictly prohibited.

26 05 36 – WIRE MESH CABLE TRAYS

.1 Cable trays to be basket style with electroplated zinc galvanized finish, with 100 mm grid pattern.
.2 Provide #6 insulated ground throughout tray, bonded to each tray section.
.3 Install Tray to manufactures recommendations.
.4 Tray to be Cablofil or approved alternate.

26 05 81 – MECHANICAL SYSTEMS

.1 All motors 0.25 kW and smaller will be single-phase 120 V and all motors at 0.37 kW and larger should be 600 V, 3-phase. The supply and installation of all motor protection switches, starters, and disconnect switches for mechanical equipment will be provided by the electrical contractor.
.2 A dedicated HVAC panel will be provided in the Penthouse for connection of cooling units. Provide appropriately sized breakers and connect units to panel, complete with disconnect switches located at each unit.

26 24 13 - SERVICE AND POWER DISTRIBUTION

1.1 POWER DISTRIBUTION SYSTEM DESIGN
.1 Provide 600 A, 347/600 V, 3P, 4W main distribution centre.
.2 Branch panels to be as manufactured by Cutler Hammer Eaton/Schneider or approved equal.
.3 All lighting, utilization and plug loads will be connected at 120/208 volts.
.4 Panels to be 66 circuit minimum complete with breakers for all noted loads and 8 x 15 amp spares.
1.2 WIRING DEVICES:
.1 Standard receptacles – 15A, 125V, duplex, grounding type, specification grade.
.2 Convenience receptacles – 20A, 125V, duplex, c/w USB-ports, specification grade.
1.3 PANELBOARDS:
.1 Bolt on moulded case circuit breakers.
.2 Copper bus.
.3 10,000A IC minimum rating for 120/208V panels.
1.4 DISTRIBUTION SWITCHBOARDS:
.1 Bolt on circuit breakers and fused switches.
.2 Copper bus bars.
.3 EEMAC 1 enclosure.
.4 Components braced for and rated for available short circuit current.
1.5 DRY TYPE TRANSFORMERS:
.1 600 – 208/120V 3-phase, 4 wire, delta-wye.
.2 Dry type, class H insulation.
.3 Secondary wye connection grounded.

1.1 EMERGENCY POWER DISTRIBUTION
.1 New 250 kW diesel generator to be complete w 24 hour sub base fuel tank and sound attenuated enclosure and all connection to auxiliary systems including fire alarm and controls.

26 50 10 LIGHTING

.1 Illumination levels and power density to meet IES (Illuminating Engineering Standards) and UofA design Guidelines.
.2 Recessed fixtures shall be single and two lamp 1x4 fixtures with reflectors, instant start electronic ballasts.
.3 Recessed Down lights to be specification grade LED lamps. No compact fluorescent or incandescent lighting will be used.
.4 Exit signs shall be brushed Aluminum, with LED illumination. Provide RED lettered signs, subject to revision and acceptance of new building code.

.5 All lamps to be low mercury.

26 09 23 LIGHTING CONTROL SYSTEM

.1 The lighting control systems will be stand alone systems. Controls include:
- .1 Combination Daylight/occupancy sensors for perimeter spaces.
- .2 Occupancy sensors wall switches with override provided in private offices, washrooms and similar spaces.
- .3 Meeting rooms shall be provided with occupancy sensor control with on/off switches in series to provide local over ride as well as dimming control.

.2 The general lighting source to be used in the facility shall be fluorescent lighting with LED lighting for pot lights, exterior or where dimming is required.

.3 Fluorescent luminaires shall utilize high efficient program start electronic ballasts, suitable for occupancy sensor control.

.4 Emergency lighting for egress paths will also operate as the 24/7 night lighting for the space.

.5 Controls shall be relay based.
- .1 Corridor sensors shall be auto on,
- .2 Office switches shall be dual technology, manual on.
- .3 Corridor lighting shall be controlled off when natural daylight is greater than 16fc

27 10 05 STRUCTURED CABLING

1.1 MAIN COMMUNICATION ROOM – SERVICE ENTRANCE

.1 Main Communication room – is located on the main floor and houses the tel/data racking and associated low tension systems including fire alarm control panel and access control.

.2 Owner will supply and install all the switches for data/voice and wireless infrastructure.

1.2 STRUCTURED CABLING PATHWAYS

.1 Communications cabling shall be installed in conduits, stubbed up to the closest cable tray and run to the designated Communications closet. Cable trays will be 105 mm by 200 or 300 mm basket tray.

.2 All conduits for communication systems shall be EMT (electrical metallic tubing). Flex conduit is not permitted. Minimum conduit size for voice/data outlets will be 27 mm.

.3 Maximum fill ratio is 40% per the Telecommunication Industry Association standards.

.4 Routing of horizontal structured cabling to be accomplished by utilizing the main cable trays, and providing conduit stubs into the ceiling space from voice/data outlets. # 6 insulated ground to be installed in all trays, and to be connected to ground bushing on all conduit stubs.

28 13 00 ACCESS CONTROL SYSTEM AND SECURITY

.1 All electrified doors to be complete with conduit, cabling and outlet boxes for a complete and operational system. Card readers to be provided by the UofA.

.2 CCTV cameras to be complete with CAT 6 cabling and conduit routed back to communication room.

28 31 00 FIRE ALARM SYSTEM

.1 New fire alarm to match existing UofA buildings and network (Simplex).

.2 Provide connection of monitoring for sprinkler flow and tamper switches.

.3 Install to meet University of Alberta Requirements.

.4 Provide manufacture and independent agent verification and testing.

DATA AND VOICE CABLING – STRUCTURED CABLING

1.1 DESKTOP

.1 **Copper:** Certified Category 6 FT6 rated, unshielded twisted pair structured data/voice cable for horizontal distribution.
- .1 The maximum cable run distance is 90 m between terminating devices (additional 10 m allowance for interconnecting patch cabling).
- .2 Cabling to be GenSpeed 6, yellow, by General Cable or approved equal.
- .3 Outlets, jacks and connectors to be Hubbell Premise Wiring

1.2 WIRELESS SYSTEM

.1 Provide Cat 6 data cabling to access point locations for equipment supplied and installed by the University of Alberta IST group. Locations are to be confirmed, but the density of access points in most areas will be spaced a maximum of 10 to 20m based on the level of usage required. Further review will be required.

END OF ELECTRICAL SECTIONS

OUTLINE SPECIFICATIONS

LANDSCAPE DEVELOPMENT SECTIONS

32 01 91 – TREE PROTECTION

1.1 INTENT

.1 To ensure the long term health of existing trees and in close proximity to construction activity.

1.2 TREE PROTECTION

.1 All trees on site to be protected from damage as a result of construction activity.

.2 Trees within 3 to 5 meters of construction: a standard "safety orange" snow fence must be placed at the farthest distance from the trees.

.3 Trees within 1 to 3 meters of construction: "plywood 1 cm or ½" 1.25m or 48" in height enclosing trees from the project site at the farthest distance away from the trees.

.4 Trees within 1 meter: 4" x 4" wooden posts at 12" intervals secured vertically around the tree trunk with strapping or an equivalent.

32-31-13 – CHAIN LINK FENCE

1.1 INTENT

.1 Supply and installation of chain link fence conforming to CGSB CAN2-138.1M

1.2 CHAIN LINK FABRIC

.1 Type I steel fabric, medium style; class A zinc-coated, grade 1 at minimum 490 g/m².

.2 Nominal wire diameter: 3.5 mm (9-gauge).

.3 Mesh size: 50 mm.

.4 Fabric height: 1.8m with selvage (twisted top and knuckled bottom).

1.3 FENCE FRAMEWORK

.1 Posts and Rails: Hot-dip galvanized welded steel pipe, standard weight (schedule 40, ASTM A120), zinc-coated at minimum 550 g/m² and with the following minimum dimensions:

Line Post Outside Diameter: 60.3mmx 2.9m

Terminal Post Outside Diameter (end, gate corner, straining): 88.9mmx 2.9m

Rail and Brace Outside Diameter 42.2mm

.2 Bottom Tension Wire: 5 mm diameter (6-gauge) steel wire, zinc-coated at minimum 490 g/m².

1.4 GATE:

.1 Gate Frame: As in Clause 1.3 with minimum 42.2 mm outside diameter; to be electrically welded at all joints and hot-dip galvanized after welding. If braces are required, use truss rod and turnbuckle adequate for gate size.

32 37 00 – EXTERIOR SITE FURNISHINGS

1.1 INTENT

.1 The supply and installation of benches and bike racks.

1.2 DELIVERY/STORAGE/HANDING

.1 Landscape Architect to inspect all landscape furniture prior to installation. Broken, scarred, or damaged furniture elements will not be accepted.

1.3 MATERIALS

.1 Bench: Manufactured by Landscape Forms, model #35 Stay backless, powdercoat finish, colour Metalic Bronze.

.2 Bike Rack: Manufactured by Landscape Forms, model #35 Loop, powdercoat finish, colour Metalic Bronze.

.3 Installation, surface mount to concrete surfaces with manufacturer supplied anchors and in accordance with manufacturers installation instructions.

32 93 10 – TREE, SHRUBS AND GROUND COVER PLANTING

1.1 INTENT

.1 The supply and installation of trees, shrubs and groundcovers.

1.2 DELIVERY/STORAGE/HANDING

.1 Handle plant material with care and skill to prevent injuries to trunk, branches, roots, rootballs and containers.

.2 Protect plants during shipment with suitable covering and carefully tie in all branches before transporting.

.3 All plants should be unloaded and checked immediately upon arrival and should be watered as required to keep moist until planted.

1.3 SUBSTITUTION

.1 All requests for substitutions shall be vetted through the Landscape Architect.

1.4 MATERIALS

.1 All plant materials shall meet the horticultural standards of and comply with, all sections of the latest edition of Canadian Nursery Landscape Association (C.N.L.A.) planting specifications. The use of "collected" plants will not be permitted.

.2 Mulch in landscape planting beds and tree wells: Coniferous bark chip mulch: chipped trees, mulch containing bark, wood. Maximum chipped sizes 50 mm to 100 mm.

.3 Mulch in transition strips against building edge: Granular mulch shall be 25 – 50mm crushed angular grey rundle stone free of organic and inorganic debris.

.4 Landscape fabric shall be installed as a base for all Granular Mulch. No landscape fabric to be installed in landscape beds of Bark Chip Mulch.

.5 Landscape edging to be Permaloc ProSlide aluminum edging, Mill finish, 1.40mm thick x 140mm high, located where shrub beds abut granular transition strip, or where shrub beds abut turfgrass.

1.5 PREPARATION

.1 Planting shrub beds shall be prepared in accordance with "issued for construction" landscape drawings.

.2 Staked locations of all trees to be approved by Landscape Architect prior to installation.

1.6 APPLICATION

.1 Trees shall be set in firmly packed soil mix so that the plant retains its vertical position with the top 1/3 of wire baskets to be folded back or removed and the top 1/3 of the burlap to be cut back and removed from root ball hole.

.2 Shrubs shall be set in firmly packed soil mix so that the plant retains its vertical position and all nonporous or non-biodegradable containers shall be completely removed.

.3 Trees shall be braced upright in position with a minimum of 2 stakes and guy wires.

32 91 21 – TOPSOIL PLACEMENT AND GRADING

1.1 INTENT

.1 The supply and installation of imported or approved on site topsoil, amended as required.

1.2 MATERIALS

.1 Topsoil Mix: 4 parts topsoil, 1 part compost.

.2 Compost: Compost should be stable, mature and derived from organic waste materials

.3 Topsoil: Composition of topsoil shall be 35% sand (±5%), 35% silt (±10%), 30% clay (±10%) with a pH of 5.5 to 7.3. Topsoil shall be free of weeds or foreign materials.

. 4 Do not screen or over mix to maintain soil peds. Soil peds or clumps up to 75 mm in diameter are acceptable in the soil mix.

1.3 PLACING TOPSOIL MIX

.1 Landscape Architect shall approve the subgrade prior to placing topsoil and approve finished topsoil grade prior to work proceeding.

32 92 20 – SEEDING

1.1 INTENT

.1 The supply and installation of turf grass seed.

1.2 DELIVERY/STORAGE/HANDING

.1 Deliver grass seed in the original containers, tagged with identification as to the analysis of seed mixture, percentages of seed, year of seed production, net weight and date.

1.3 SEED MIX

.1 Certified Canada No. 1 mixture that meets the standards of the Canadian Seed Trade Association and is free of disease, weed seeds or foreign matter, minimum germination of 75%, minimum purity of 97% and conforming to the following mix:

35% Fairway Crested Wheatgrass
10% Norlac Red Clover
20% Nakiska Sheeps Fescue
10% Birdsfoot Trefoil
20% Durar Hard Fescue
5% Perennial Rye Grass

1.4 PREPARATION

.1 Remove weeds and debris from topsoil already in place and verify that the topsoil has been placed to specified grades. .

.2 Apply fertilizer according to manufacturer's instructions.

.3 Float and level out the finished topsoil surface.

1.5 APPLICATION

.1 When weather conditions are favorable, apply seed by mechanical dry spread (Brillion or Cyclone type) at a rate of 24 kg/1,000 m2 . Apply in two passes, each pass at a rate of 12 kg/1,000 m2 at 90 degrees to each other. Lightly roll seeded area.

.2 If seed fails to germinate, re-cultivate and re-seed until germination takes place.

32 92 23 – SODDING

1.1 INTENT

.1 The supply and installation of sod.

1.2 DELIVERY/STORAGE/HANDING

.1 Protect sod from sun scald or drying out during transportation.

.2 Sod to be installed on the day of arrival at site. If delays in installation occur due to weather, protect sod on site from sun, keep sod moist and store in a cool place until installation.

1.3 SOD

.1 Certified No. 1 cultivated turf sod that meets the standards of the Canadian Nursery Landscape Association, and of the following mix or approved equal:

70-90% Kentucky Bluegrass
5-10% Creeping Red Fescue
10-30% Perennial Ryegrass

1.4 PREPARATION

.1 Remove weeds and debris from topsoil already in place and roll the soil bed before sodding.

.2 Apply fertilizer according to manufacturer's instructions and mix thoroughly into the upper portions of topsoil.

.3 Float and level out the finished topsoil surface.

1.5 APPLICATION

.1 Lay sod evenly in staggered row, with edges and ends butted tightly and set flush with finished hard surfaces.

.2 Top-dress seams as required with topsoil mix. Water the sod and upper 100 mm of topsoil mix with water spray.

.3 Roll sod with a roller to ensure good bond between sod and soil and immediately after rolling, saturate sod and upper 100 mm of soil with fine spray and continue adequate watering until roots are well established.

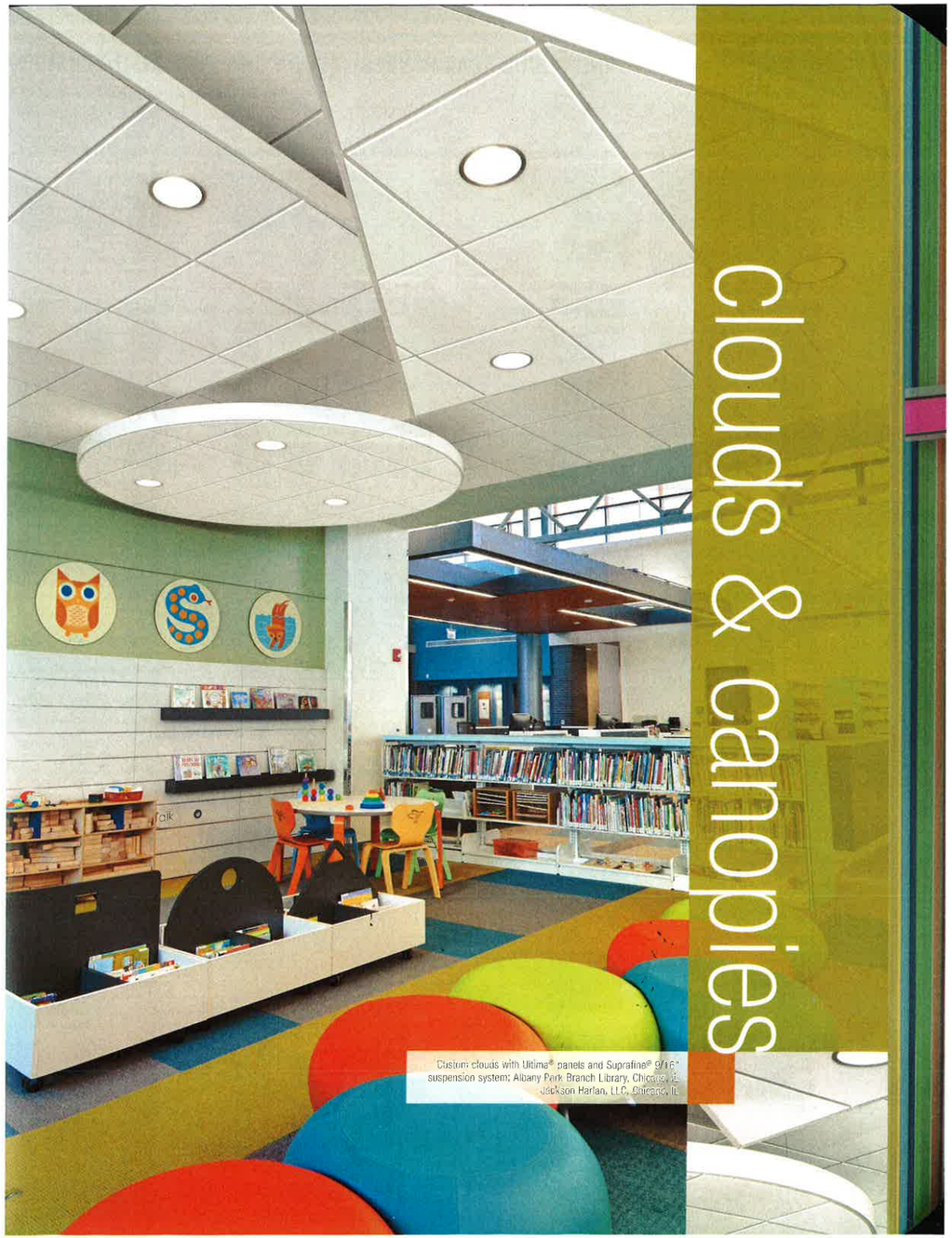
.4 Following initial cutting apply organic supplementary fertilizer 27-14-0, at a rate determined by topsoil analysis.

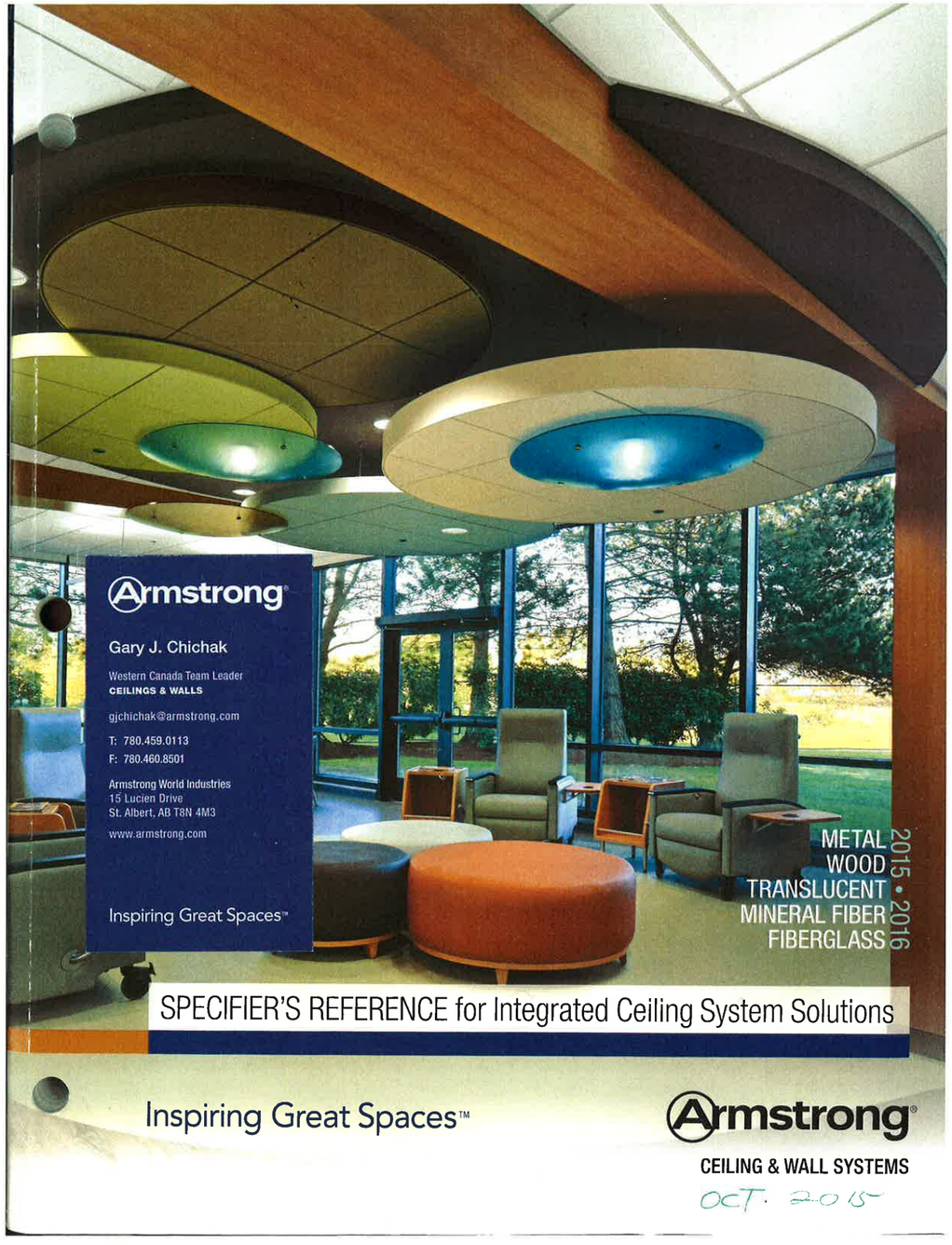
.5 Areas showing deterioration, bare spots or thin areas shall be re-sodded.

END OF LANDSCAPE SECTIONS

APPENDIX A: Cut Sheets: Architectural

Pa


clouds &
canopies
Custom clouds with Ultima® panels and Suprafine® 9/16"
suspension system; Albany Park Branch Library, Chicago, IL;
Jackson Harlan, LLC, Chicago, IL



GEORGIAN™ & GEORGIAN™ HIGH WASHABILITY

Square Lay-in & Tegular
medium texture

Georgian™ Beveled Tegular panels with Prelude® 15/16" suspension system (Pgs. 279-280)

This medium-textured panel offers good acoustics and high washability options to meet USDA/FSIS guidelines.

KEY SELECTION ATTRIBUTES

- Unique spatter-painted visual
- Total Acoustics™ options (Items 795, 796)
- High Washability items available
  - Meets USDA/FSIS guidelines for use in food processing establishments
- Durable –
  Washable
  Scrubbable
  Impact-resistant
  Scratch-resistant
- 30-Year Limited System Warranty against visible sag (excludes item 791 and other sizes), mold, and mildew

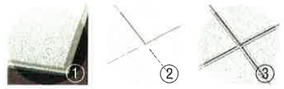
TYPICAL APPLICATIONS

- Schools/classrooms (Items 795, 796)
- Corridors/conference rooms
- Kitchen/food preparation areas (Items 793, 794)

COLOR

White

DETAILS (Other Suspension Systems compatible. Refer to listing on page 192.)



1. Georgian Beveled Tegular
2. Georgian Beveled Tegular with Prelude 15/16" suspension system
3. Georgian Beveled Tegular with Silhouette® 9/16" suspension system 1/4" Reveal

CART SPECIFICATIONS

Toter®
Tel: 800.424.0422 | toter@toter.com
www.toter.com

96 GALLON EVR® II UNIVERSAL / NESTABLE

Part Number:
79296

Description
96 GALLON EVR® II CART

Size (l x w x h)
35.25" X 29.75" X 43.25"

Load Rating
335 LBS/151.9 KG

Wheel Diameter
10"

STANDARD COLORS

UPSCALE GRANITE COLORS AVAILABLE

64 GALLON EVR® II UNIVERSAL / NESTABLE

Part Number:
79264

Description
64 GALLON EVR® II CART

Size (l x w x h)
31.75" X 24.25" X 41.75"

Load Rating
224 LBS/101.6 KG

Wheel Diameter
10"

32 GALLON EVR® UNIVERSAL

Part Number:
76532*

Description
32 GALLON EVR® CART

Size (l x w x h)
24.25" X 19.25" X 38.50"

Load Rating
112 LBS/50.8 KG

Wheel Diameter
10"

* 32 gallon is original EVR design and does not nest fully assembled.

48 GALLON EVR® II UNIVERSAL / NESTABLE

Part Number:
79248

Description
48 GALLON EVR® II CART

Size (l x w x h)
28.75" X 23.50" X 37.50"

Load Rating
168 LBS/76.3 KG

Wheel Diameter
10"

24 GALLON EVR® II UNIVERSAL

Part Number:
79224*

Description
24 GALLON EVR® II CART

Size (l x w x h)
24.00" X 19.75" X 34.50"

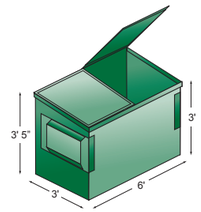
Load Rating
84.0 LBS/38.1 KG

Wheel Diameter
10"

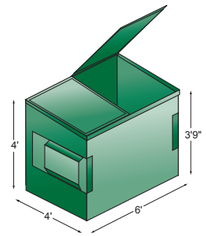
* 24 gallon does not nest fully assembled.

CONTAINERS & TRUCKS

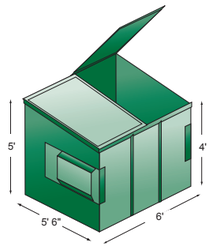
COMMERCIAL CONTAINERS



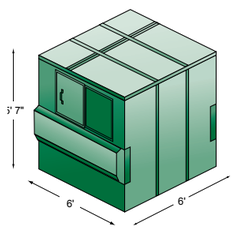
2-Yard Bin



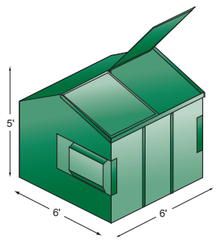
3-Yard Bin



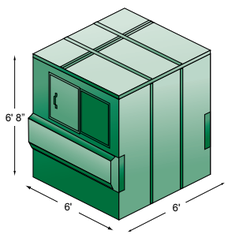
4-Yard Bin



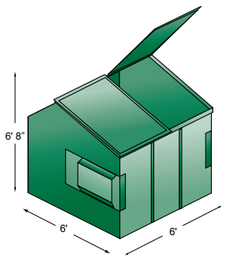
6-Yard Bin



6-Yard Slant Bin

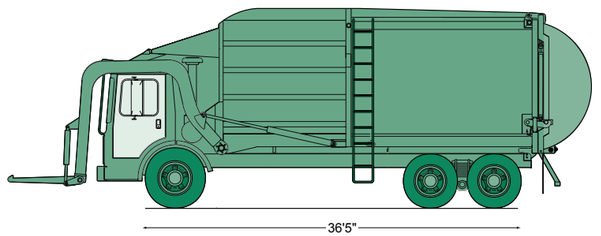


8-Yard Bin



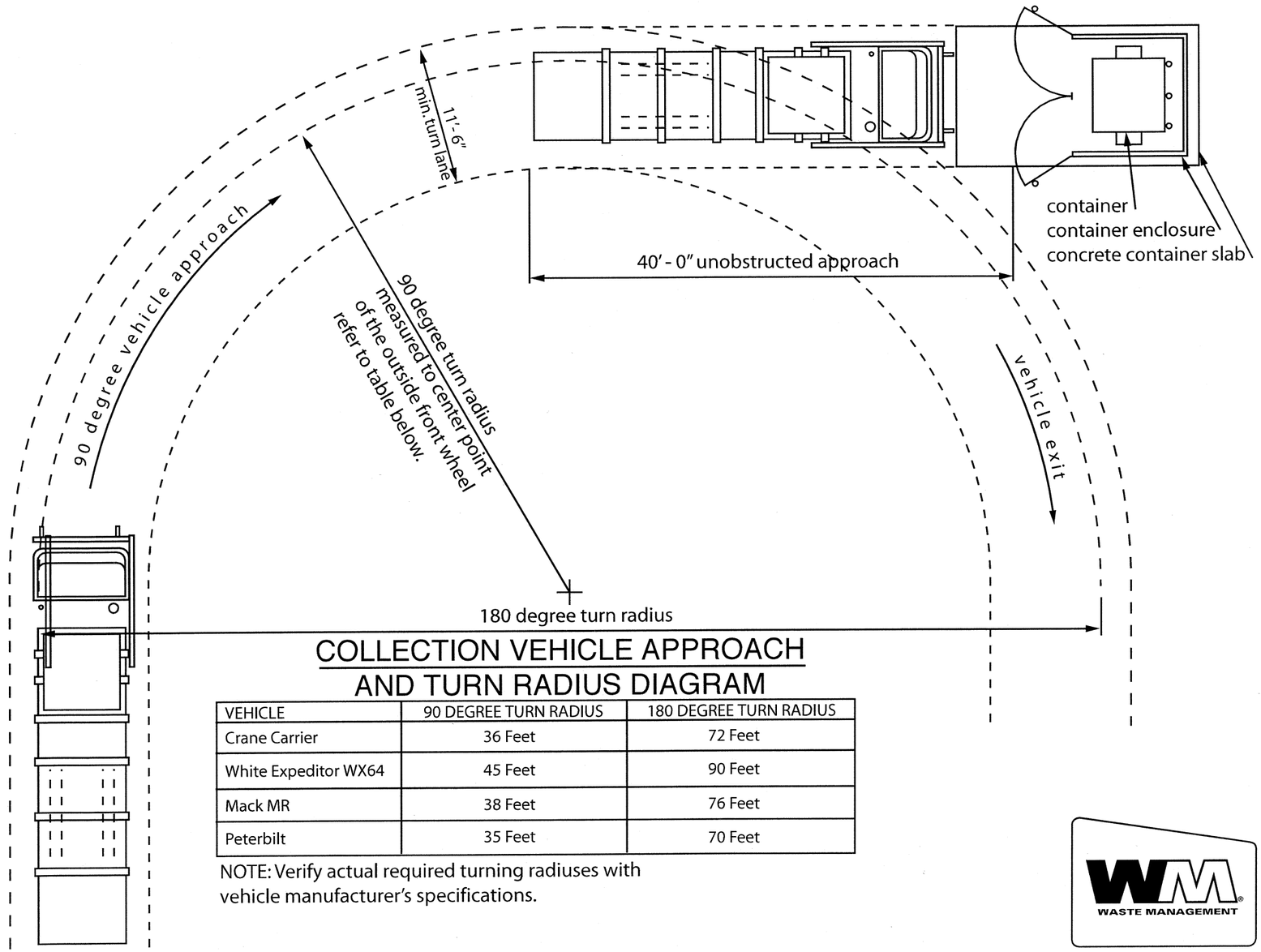
8-Yard Slant Bin

COMMERCIAL TRUCKS



WASTE MANAGEMENT

From everyday collection to environmental protection, Think Green.® Think Waste Management.



COLLECTION VEHICLE APPROACH AND TURN RADIUS DIAGRAM

VEHICLE	90 DEGREE TURN RADIUS	180 DEGREE TURN RADIUS
Crane Carrier	36 Feet	72 Feet
White Expeditor WX64	45 Feet	90 Feet
Mack MR	38 Feet	76 Feet
Peterbilt	35 Feet	70 Feet

NOTE: Verify actual required turning radiuses with vehicle manufacturer's specifications.

WASTE MANAGEMENT

50% RECYCLED CONTENT
armstrong.com/greengenie

AXIOM® – Classic Trim

KEY SELECTION ATTRIBUTES

Axiom is an extruded aluminum perimeter trim solution for use as an exposed custom decorative trim with suspended lay-in panels or as drywall trim for unique detailing and transition flexibility, available for straight and curved applications

- Extruded aluminum trim provides crisp edge detailing and excellent corrosion resistance compared to steel systems
- Eight profile heights
- Compatible with Armstrong suspension systems and Drywall Grid Systems
- Finely articulated drywall trim with beaded edge integrates with all trim profiles for pre-engineered drywall transitions (see pg. 290)
- Colors coordinate with Armstrong ceiling and suspension systems, custom colors available
- Design flexibility for straight and curved applications
- 10-year limited warranty, 30-year system warranty

TYPICAL APPLICATIONS

- Entry accents
- "Floating" clouds
- Open corridors
- Stepped soffits

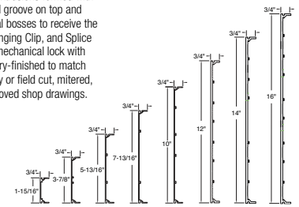
colorations™

Refer to BPCS-3996 Axiom Color Chart for new Colorations finishes, available on coordinating Calla™ ceiling panels, Suprafine® 9/16" suspension system, and select Axiom trim.

VISUAL SELECTION

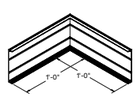
Item No.*	Description	Dimensions
Axiom Classic Trim (Available Straight or Curved)		
☐ **AX16STR*_ _ _**	16" Straight Only	120 x 3/4 x 16"
☐ **AX14STR*_ _ _**	14" Straight Only	120 x 3/4 x 14"
☐ **AX12STR_ _ _**	12" Straight	120 x 3/4 x 12"
☐ **AX12CUR*_ _ _**	12" Curved	120 x 3/4 x 12"
☐ **AX10STR_ _ _**	10" Straight	120 x 3/4 x 10"
☐ **AX10CUR*_ _ _**	10" Curved	120 x 3/4 x 10"
☐ **AX8STR_ _ _**	8" Straight	120 x 3/4 x 8"
☐ **AX8CUR*_ _ _**	8" Curved	120 x 3/4 x 8"
☐ **AX6STR_ _ _**	6" Straight	120 x 3/4 x 6"
☐ **AX6CUR*_ _ _**	6" Curved	120 x 3/4 x 6"
☐ **AX4STR_ _ _**	4" Straight	120 x 3/4 x 4"
☐ **AX4CUR*_ _ _**	4" Curved	120 x 3/4 x 4"
☐ **AX2STR_ _ _**	2" Straight	120 x 3/4 x 2"
☐ **AX2CUR*_ _ _**	2" Curved	120 x 3/4 x 2"

Trim Channel: Aluminum extrusions formed with distinct architectural detail groove on top and bottom flanges and special bosses to receive the T-Bar Connection Clip, Hanging Clip, and Splice Plate, to provide positive mechanical lock with no visible fasteners. Factory-finished to match approved samples. Factory or field cut, mitered, and curved to match approved shop drawings.

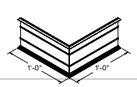


AXIOM – Classic Pre-mitered QuickShip™ Corners		
☐ **AX16QSOS*_ _ _**	16" Outside Corner	12 x 3/4 x 16"
☐ **AX16QSIS*_ _ _**	16" Inside Corner	12 x 3/4 x 16"
☐ **AX14QSOS*_ _ _**	14" Outside Corner	12 x 3/4 x 14"
☐ **AX14QSIS*_ _ _**	14" Inside Corner	12 x 3/4 x 14"
☐ **AX12QSOS_ _ _**	12" Outside Corner	12 x 3/4 x 12"
☐ **AX12QSIS_ _ _**	12" Inside Corner	12 x 3/4 x 12"
☐ **AX10QSOS_ _ _**	10" Outside Corner	12 x 3/4 x 10"
☐ **AX10QSIS_ _ _**	10" Inside Corner	12 x 3/4 x 10"
☐ **AX8QSOS_ _ _**	8" Outside Corner	12 x 3/4 x 8"
☐ **AX8QSIS_ _ _**	8" Inside Corner	12 x 3/4 x 8"
☐ **AX6QSOS_ _ _**	6" Outside Corner	12 x 3/4 x 6"
☐ **AX6QSIS_ _ _**	6" Inside Corner	12 x 3/4 x 6"
☐ **AX4QSOS_ _ _**	4" Outside Corner	12 x 3/4 x 4"
☐ **AX4QSIS_ _ _**	4" Inside Corner	12 x 3/4 x 4"
☐ **AX2QSOS_ _ _**	2" Outside Corner	12 x 3/4 x 2"
☐ **AX2QSIS_ _ _**	2" Inside Corner	12 x 3/4 x 2"

Axiom factory-mitered inside and outside corner pieces are created to match your Axiom Trim channel order. These corners come as 2 – 12" long pieces that are assembled in the field for a clean mitered corner intersection.



Outside Corner



Inside Corner

MINIMUM BEND RADIUS FOR AXIOM-CLASSIC
2", 4", 6", 8" – 24" Minimum
10" – 36" Minimum
12" – 60" Minimum

AXIOM FACTORY MITER LIMIT
2", 4", 6", 8" – Minimum 30º acute angle (15º per cut)
10", 12", 14", 16" – Minimum 60º acute angle (30º per cut)

* Not available in architectural film finishes

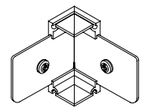
◆ Add the 2- or 3-digit color suffix to the item number when specifying or ordering (Example: AX2STR H A), add an extra digit "3" before the color suffix if paint is required inside and outside of trim (Example: AX2STR 3 H A).

AXIOM® – Classic Trim

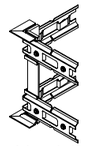
VISUAL SELECTION

Item No.*	Description	Dimensions
AXIOM – Classic – Corner Posts*†		
☐ **AX12OSCP_ _**	12" Outside Corner Post	7/8 x 7/8 x 12"
☐ **AX12ISCP_ _**	12" Inside Corner Post	3/4 x 3/4 x 12"
☐ **AX10OSCP_ _**	10" Outside Corner Post	7/8 x 7/8 x 10"
☐ **AX10ISCP_ _**	10" Inside Corner Post	3/4 x 3/4 x 10"
☐ **AX8OSCP_ _**	8" Outside Corner Post	7/8 x 7/8 x 8"
☐ **AX8ISCP_ _**	8" Inside Corner Post	3/4 x 3/4 x 8"
☐ **AX6OSCP_ _**	6" Outside Corner Post	7/8 x 7/8 x 6"
☐ **AX6ISCP_ _**	6" Inside Corner Post	3/4 x 3/4 x 6"
☐ **AX4OSCP_ _**	4" Outside Corner Post	7/8 x 7/8 x 4"
☐ **AX4ISCP_ _**	4" Inside Corner Post	3/4 x 3/4 x 4"
☐ **AX2OSCP_ _**	2" Outside Corner Post	7/8 x 7/8 x 2"
☐ **AX2ISCP_ _**	2" Inside Corner Post	3/4 x 3/4 x 2"

Axiom corner posts eliminate miter cuts at corners for a fast and easy installation.

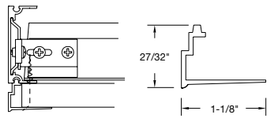


Axiom – Outside Corner Post



Axiom – Inside Corner Post

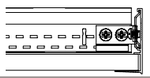
Item No.	Description
Axiom Classic Drywall Bottom Trim	
☐ **AXBTSTR**	Straight Bottom Trim
☐ **AXBTCUR**	Curved Bottom Trim



2" Axiom Classic with Drywall Bottom Trim attached to Armstrong Drywall Grid using AXTBC.

Bottom Drywall Trim used with Axiom Classic (for 5/8" drywall): Aluminum extrusion formed to match the profile of the Axiom Trim Channel, key into the channel's architectural groove detail, and provide a taping flange for 5/8" drywall finishing. Factory or field cut, mitered, and curved to match approved shop drawings.

Axiom One-Piece Drywall Trim	
☐ **AX1PC6STR**	6" Straight Drywall Trim
☐ **AX1PC6CUR**	6" Curved Drywall Trim
☐ **AX1PC4STR**	4" Straight Drywall Trim
☐ **AX1PC4CUR**	4" Curved Drywall Trim
☐ **AX1PC2STR**	2.5" Straight Drywall Trim
☐ **AX1PC2CUR**	2.5" Curved Drywall Trim



2.5" One-Piece Drywall Trim attached to Armstrong Drywall Grid using AXTBC.

One-Piece Drywall Trim: Integrated and pre-punched taping flange for drywall attachment. Available in White, standard colors, and unfinished for field painting.

Item No.	Description
Accessories	
☐ **AXAC**	Alignment Clip

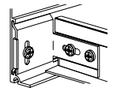
Alignment Clip: Sheet aluminum formed to fit into special trim channel bosses and provide positive mechanical lock, screw-fastened connection to suspension members which intersect below the trim channel.

☐ **AX2HGC**	Hanging Clip

Hanging Clip: Sheet aluminum formed to fit into special trim channel bosses and provide positive mechanical lock, screw-fastened connection to suspension members which intersect below the trim channel.

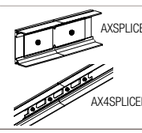
☐ **AXTBC**	T-Bar Connection Clip

T-Bar Connection Clip: Galvanized sheet steel formed to fit into special trim channel bosses and provide positive mechanical lock with factory-installed screw, screw-fastened connection to suspension members which intersect the trim channel.



☐ **AXSPLICE**	Axiom Splice Plate
☐ **AX4SPLICEB**	Axiom Splice Plate

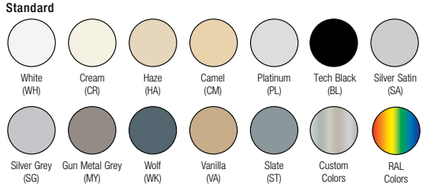
Splice Plate: Galvanized sheet steel formed to fit into the trim channel bosses and provide positive lock between abutting channels with factory-installed setscrews.



COLOR SELECTION

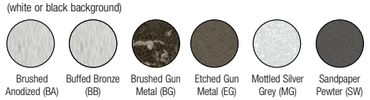
Due to printing limitations, shade may vary from actual product.

Standard



ARCHITECTURAL FILM FINISHES

(white or black background)



◆ Add the 2- or 3-digit color suffix to the item number when specifying or ordering (Example: AX2STR H A), add an extra digit "3" before the color suffix if paint is required inside and outside of trim (Example: AX2STR 3 H A).

NOTE: 360º paint finishes and custom colors available as special order

NOTE: White is standard color for all AXIOM products.

NEW BLIZZARD WHITE FINISH

Blizzard White†† (ZW)

†† Blizzard White finish available on select Axiom Classic, Knife Edge, and Vector trim profiles

PHYSICAL DATA

Material
Commercial quality extruded aluminum alloy 6063

Surface Finish
Factory-applied baked polyester paint finish

Warranty
10-year limited warranty; 30-year system warranty

Profile
2", 4", 6", 8", 10", 12", 14", 16" wide face with 3/4" horizontal flange

Cross Tee/Main Beam Interface
Flush Fit

End Detail
Splice with screws

ICC Reports
For areas under ICC jurisdiction, see evaluation report numbers ESR-1289 and ESR-1308 for allowable values and/or conditions of use concerning the suspension system components listed on this page. The reports are subject to reexamination, revisions, and possible cancellation.

TechLine℠ / 1 877 ARMSTRONG
1 877 276 7876

armstrong.com/axiom
BPCS-3080-914

Electrical Cut Sheets

DIESEL GENERATOR SET
MTU 6R1600 DS250

250 kWe / 60 Hz / Standby
208 - 600V

Reference MTU 6R1600 DS250 (230 kWe) for Prime Rating Technical Data

SYSTEM RATINGS

Standby

Voltage (L-L)	208V*	240V*	380V	440V	480V*	600V*
Phase	3	3	3	3	3	3
PF	0.8	0.8	0.8	0.8	0.8	0.8
Hz	60	60	60	60	60	60
kW	250	250	250	250	250	250
kVA	312	312	312	312	312	312
Amps	867	752	475	410	376	301
skVA@30%						
Voltage Dip	608	608	430	580	809	720
Generator Model	432CSL6210	432CSL6210	432CSL6210	432CSL6210	432CSL6210	432PSL6246
Temp Rise	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C
Connection	12 LEAD WYE	12 LEAD DELTA	12 LEAD WYE	12 LEAD WYE	12 LEAD WYE	4 LEAD WYE

* UL 2200 Offered

CERTIFICATIONS AND STANDARDS

// **Emissions –** EPA Tier 3 Certified

// **Generator set is designed and manufactured in facilities certified to standards ISO 9001:2008 and ISO 14001:2004**

// **Seismic Certification – Optional**
- IBC Certification
- OSHPD Pre-Approval

// **UL 2200 / CSA – Optional**
- UL 2200 Listed
- CSA Certified

// **Performance Assurance Certification (PAC)**
- Generator Set Tested to ISO 8528-5 for Transient Response
- Verified product design, quality and performance integrity
- All engine systems are prototype and factory tested

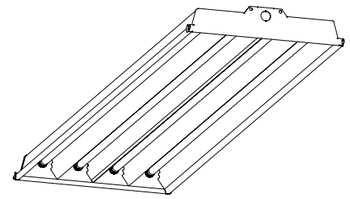
// **Power Rating**
- Accepts Rated Load in One Step Per NFPA 110
- Permissible average power output during 24 hours of operation is approved up to 85%.

PHILIPS
Day-Brite
CFI

Industrial

FBF high bay

T8 or T5HO



Project:
Location:
Cat.No:
Type:
Lamps: Qty:
Notes:

The FBF fluorescent high bay is a flexible luminaire designed to meet the needs of today's industrial environment. This luminaire is available with T5HO or T8 lamps. The 95% reflective specular aluminum reflectors and solid body design result in a sturdy and efficient luminaire. A variety of mounting methods and accessories allow the luminaire to be used in many different types of applications.

Ordering guide **Example: FBD654HO-UNV-1/42-EB**

Family	Lamp Quantity	Lamp Type/ Wattage	Voltage	Ballast	Options
FBF Single Unit **TFBF** Tandem (3 & 4 lamp only)	**3** **4** **6**	**32** 32WT8 (48") **54HO** 54WT5HO (46")	**UNV** (108-305V) **120** **277** **347** **480**	**1/3-EB** One 3 lamp electronic ballast (FBF only) **1/3-EBH** One 3 lamp electronic ballast, high ballast factor (32W T8 only) **1/4-EB** One 4 lamp electronic ballast (FBF only) **1/4-EB-2LS** One 4 lamp electronic ballast with 2 level switching (54W T5HO FBF only) **1/4-EBH** One 4 lamp electronic ballast, high ballast factor (32W T8 FBF only) **2/2-EB** Two 2 lamp electronic ballasts **2/2-EBH** Two 2 lamp electronic ballasts, high ballast factor (32W T8 FBF only) **2/3-EBH** Two 3 lamp electronic ballasts, high ballast factor (32W T8 only) **3/2-EBH** Three 2 lamp electronic ballasts, high ballast factor (32W T8 only) **1/42-EBH** One 4 lamp and one 2 Lamp electronic ballast, high ballast factor (32W T8 only) **1/42-EB** One 4 lamp and one 2 lamp electronic ballast **2/4-EB** Two 4 lamp electronic ballasts **2/4-EBH** Two 4 lamp electronic ballasts, high ballast factor (32W T8 TFBF only) **4/2-EBH** Four 2 lamp electronic ballasts, high ballast factor (32W T8 TFBF only)	**GLR** Fusing, fast blow **WC3** Wired 3'Cord **WP3** Wired 3' Cord and Plug Assembly (specify voltage) **U** Uplight (Uplight is not field adjustable on 3 lamp TFBF) **PAF** Painted After Fabrication **WT** Optional White Reflector **HS** Hang Straight (req'd when using FBF-PENHGR and a hook) **E7LP** LP550 emerg. ballast T5/T5HO/T8, 430-700 lumens, 120/277V **E6LP** LP600 emerg. ballast U.S. or Canada market, T5/T5HO/T8, 750-1325 lumens, 120/277V **E5LP** B50LP emerg. ballast T8, 1375-1400 lumens, 120/277V **MD360** Installed motion detector

Accessories (order separately)

- **FBF/FBE CHAIN KIT** 54" chains & V brackets
- **FBF/FBE-GRIP5** 5' cables & V brackets
- **WG-FBF4** 4 Lamp Wire Guard (2 required for TFBF)
- **WG-FBF6** 6 Lamp Wire Guard
- **MD180** Motion Detector with linear coverage (e.g. aisles) 120/277V
- **MD360** Motion Detector with circular cover (e.g. open areas) 120V/277V
- **MD360-480** Motion Detector (480V)
- **FBF-4E-1W** Single gasketed door with clear acrylic lens – 4 lamp unit (4ft. unit only)
- **FBF-4E-1W-DB21** Single gasketed door with prismatic lens – 4 lamp unit (4ft. unit only)
- **FBF-4E-2W** Double gasketed door with clear acrylic lens – 4 lamp unit (4ft. unit only)
- **FBF-6E-1W** Single gasketed door with clear acrylic lens – 6 lamp unit (4ft. unit only)
- **FBF-6E-1W-DB21** Single gasketed door with prismatic lens – 6 lamp unit (4ft. unit only)
- **FBF-6E-2W** Double gasketed door with clear acrylic lens – 6 lamp unit (4ft. unit only)
- **FBF-PENHGR** Pendant Hanger (4ft. unit only)
- **FBF-JB** Junction Box (used with FBF-PENHGR to conceal wiring)

General Notes

- All options factory installed.
- All accessories are field installed.

c UL us

FBF_high_bay 09/15 page 1 of 3

Fearless innovation in architectural LED lighting

BOLDPLAY
SUSPENDED LED

DIRECT/INDIRECT, MESOOPTICS LENS
CRI >80 4000K, 3400 lm/4ft

Project:	
Spec Type:	
Catalog No:	7806LAEQN
Qty	
Line Notes:	

Ordering guide

Product Type	Source	Color Temp *	Lumens *	Lower Optics	Upper Optics	Run Length	Wiring †	Voltage	Driver	Finish
7806	L	A	E	Q	N					
BoldPlay Direct/ Indirect	L LED	A 4000K B 3500K C 3000K	C 4800 lm/4ft E 3400 lm/4ft	Q MesoOptics Lens	N None G 80% Down Kit J 100% Down Kit	04 4' 08 8' XX Total run length (4' increments)	1 1 cct 3 1 cct w/ EM cct 7 1 cct w/ Dimming 8 1 cct w/ TW B 2 cct A/B	1 120V 2 277V	E Standard	WStandard White T Titanium Silver B Black X Custom

* Nominal values within a range. Consult ies file for exact color temp and lumens † Consult website for complete list of standard wiring options

Mounting Hardware

[ ] Mount Type
Consult separate mounting spec sheet for mount type options

[ ] Suspension Length
Distance from ceiling to top of luminaire in inches

Endcaps - [.]

Sculpted

Gloss white flat

Gloss black flat

Solid flat

Integrated Controls Please indicate with check mark.

[ ] Response Daylight Single Zone (DS)

PHILIPS
Day-Brite
CFI

Recessed

Arioso acrylic 2x2

T5, TT5, or T8

Project:	
Location:	
Cat.No:	
Type:	
Lamps:	Qty:
Notes:	

The Philips Day-Brite / Philips CFI Arioso recessed acrylic features a white opal acrylic diffuser and contoured seamless reflectors. Arioso acrylic strips Arioso down to its purest form, where only light and shape are displayed. With these clean crisp lines and soft illumination, this luminaire emulates the qualities of natural lighting.

Ordering guide

Example: 2AVG217-ACR-UNV-1/2-EBHE-LPT835HL

Width	Family	Ceiling Type	No. of Lamps (not included)	Lamp Type	Shielding	Voltage	Options
2	AV	G		–	ACR –	–	
2 2'	**AV** Arioso recessed	**G** Grid	**1** (CF only) **2** **3**	**14** 14WT5 (22") **17** 17WT8 (24") **CF40** 40WTT5 (24")	**ACR** White opal acrylic diffuser	**120** **277** **347** **UNV** Universal Voltage 120-277V	

1/1	One 1-lamp ballast
1/2	One 2-lamp ballast
1/3	One 3-lamp ballast
1/21	2-lamp & 1-lamp ballast
EB	Electronic ballast, <10% THD, std. ballast factor
EB10I	CF40 electronic ballast, instant start, <10% THD
EB10R	T8 electronic ballast, program rapid start, <10% THD
EBHE	T8 electronic ballast, high efficiency, std. ballast factor
EBLHE	T8 electronic ballast, high efficiency, low ballast factor
EBHHE	T8 electronic ballast, high efficiency, high ballast factor
EBSD	T8 electronic step dimming ballast, .88 ballast factor
EBD7	Advance Mark 7 dimming ballast, 0-10V (low voltage) control
EBDX	Advance Mark 10 dimming ballast, phase control
EBD	Electronic dimming ballast, customer specified
E1	B100 emerg. ballast, T8, 350-450 lumens, 120/277V
E1CAN	B100-CAN emerg. ballast, Canada market, T8, 350-450 lumens, 120/347V
E7	B60 emerg. ballast, T8, 600-700 lumens, 120/277V
E5	B50 emerg. ballast, U.S. or Canada market, T8 or CF, 1100-1400 lumens, UNV
E5CAN	B50-CAN emerg. ballast, Canada market, T8, 1100-1400 lumens, 120/347V
E5ST	B50ST emerg. ballast w/self test, T8, 1100-1400 lumens, UNV
E7LP	LP550 emerg. ballast T5/T5HO, 430-700 lumens, 120/277V
E6LP	LP600 emerg. ballast U.S. or Canada market, T5/T5HO, 750-1325 lumens, 120/277V
F1	3/8" flex 3 wire, 18 gauge 6'
F2	3/8" flex 4 wire, 18 gauge 6'
F2/5W	3/8" flex, 5 wire 18 gauge 6'
GLR	Fusing, fast blow
LPT830	Installed T8/T5/T5HO lamps, 80+ CRI, 3000K
LPT835	Installed T8/T5/T5HO lamps, 80+ CRI, 3500K
LPT841	Installed T8/T5/T5HO lamps, 80+ CRI, 4100K
LPT830HL	Installed T8 high lumen lamps, 80+ CRI, 3000K
LPT835HL	Installed T8 high lumen lamps, 80+ CRI, 3500K
LPT841HL	Installed T8 high lumen lamps, 80+ CRI, 4100K
CHIC	Chicago plenum rated

Accessories (order separately)

- **AVHD** Hold down clips
- **AV-DC2** Debris cover 2'x2'
- **AV-GC2** Germ cover 2'x2'
- **FMA22** 2'x2' "F" mounting frame for NEMA "F" mounting

PHILIPS

Day-Brite

CFI

Recessed

Arioso acrylic 2x2

T5, TT5, or T8

Project:
Location:
Cat.No:
Type:
Lamps: Qty:
Notes:

The Philips Day-Brite / Philips CFI Arioso recessed acrylic features a white opal acrylic diffuser and contoured seamless reflectors. Arioso acrylic strips Arioso down to its purest form, where only light and shape are displayed. With these clean crisp lines and soft illumination, this luminaire emulates the qualities of natural lighting.

Ordering guide **Example: 2AVG217-ACR-UNV-1/2-EBHE-LPT835HL**

Width	Family	Ceiling Type	No. of Lamps (not included)	Lamp Type		Shielding		Voltage		Options
2	AV	G			–	ACR	–		–	

2	2'	**AV**	Arioso recessed	**G**	Grid
1	(CF only)	**14**	14WT5 (22")	**ACR**	White opal acrylic diffuser
2		**17**	17WT8 (24")		
3		**CF40**	40WTT5 (24")		

120			
277			
347			
UNV	Universal Voltage 120-277V		

1/1	One 1-lamp ballast
1/2	One 2-lamp ballast
1/3	One 3-lamp ballast
1/21	2-lamp & 1-lamp ballast
EB	Electronic ballast, <10% THD, std. ballast factor
EB10I	CF40 electronic ballast, instant start, <10% THD
EB10R	T8 electronic ballast, program rapid start, <10% THD
EBHE	T8 electronic ballast, high efficiency, std. ballast factor
EBLHE	T8 electronic ballast, high efficiency, low ballast factor
EBHHE	T8 electronic ballast, high efficiency, high ballast factor
EBSD	T8 electronic step dimming ballast, .88 ballast factor
EBD7	Advance Mark 7 dimming ballast, 0-10V (low voltage) control
EBDX	Advance Mark 10 dimming ballast, phase control
EBD	Electronic dimming ballast, customer specified
E1	B100 emerg. ballast, T8, 350-450 lumens, 120/277V
E1CAN	B100-CAN emerg. ballast, Canada market, T8, 350-450 lumens, 120/347V
E7	B60 emerg. ballast, T8, 600-700 lumens, 120/277V
E5	B50 emerg. ballast, U.S. or Canada market, T8 or CF, 1100-1400 lumens, UNV
E5CAN	B50-CAN emerg. ballast, Canada market, T8, 1100-1400 lumens, 120/347V
E5ST	B50ST emerg. ballast w/self test, T8, 1100-1400 lumens, UNV
E7LP	LP550 emerg. ballast T5/T5HO, 430-700 lumens, 120/277V
E6LP	LP600 emerg. ballast U.S. or Canada market, T5/T5HO, 750-1325 lumens, 120/277V
F1	3/8" flex 3 wire, 18 gauge 6'
F2	3/8" flex 4 wire, 18 gauge 6'
F2/5W	3/8" flex, 5 wire 18 gauge 6'
GLR	Fusing, fast blow
LPT830	Installed T8/T5/T5HO lamps, 80+ CRI, 3000K
LPT835	Installed T8/T5/T5HO lamps, 80+ CRI, 3500K
LPT841	Installed T8/T5/T5HO lamps, 80+ CRI, 4100K
LPT830HL	Installed T8 high lumen lamps, 80+ CRI, 3000K
LPT835HL	Installed T8 high lumen lamps, 80+ CRI, 3500K
LPT841HL	Installed T8 high lumen lamps, 80+ CRI, 4100K
CHIC	Chicago plenum rated

Accessories (order separately)

- **AVHD** Hold down clips
- **AV-DC2** Debris cover 2'x2'
- **AV-GC2** Germ cover 2'x2'
- **FMA22** 2'x2' "F" mounting frame for NEMA "F" mounting

PHILIPS
Day-Brite
CFI
Recessed
Arioso acrylic 2x2
T5, TT5, or T8

Project:
Location:
Cat.No:
Type:
Lamps: Qty:
Notes:

The Philips Day-Brite / Philips CFI Arioso recessed acrylic features a white opal acrylic diffuser and contoured seamless reflectors. Arioso acrylic strips Arioso down to its purest form, where only light and shape are displayed. With these clean crisp lines and soft illumination, this luminaire emulates the qualities of natural lighting.

Ordering guide Example: 2AVG217-ACR-UNV-1/2-EBHE-LPT835HL

Width	Family	Ceiling Type	No. of Lamps (not included)	Lamp Type		Shielding		Voltage		Options
2	AV	G			–	ACR	–		–	

2	2'	**AV**	Arioso recessed	**G**	Grid
1	(CF only)	**14**	14WT5 (22")	**ACR**	White opal acrylic diffuser
2		**17**	17WT8 (24")		
3		**CF40**	40WTT5 (24")		

120			
277			
347			
UNV	Universal Voltage 120-277V		

1/1	One 1-lamp ballast
1/2	One 2-lamp ballast
1/3	One 3-lamp ballast
1/21	2-lamp & 1-lamp ballast
EB	Electronic ballast, <10% THD, std. ballast factor
EB10I	CF40 electronic ballast, instant start, <10% THD
EB10R	T8 electronic ballast, program rapid start, <10% THD
EBHE	T8 electronic ballast, high efficiency, std. ballast factor
EBLHE	T8 electronic ballast, high efficiency, low ballast factor
EBHHE	T8 electronic ballast, high efficiency, high ballast factor
EBSD	T8 electronic step dimming ballast, .88 ballast factor
EBD7	Advance Mark 7 dimming ballast, 0-10V (low voltage) control
EBDX	Advance Mark 10 dimming ballast, phase control
EBD	Electronic dimming ballast, customer specified
E1	B100 emerg. ballast, T8, 350-450 lumens, 120/277V
E1CAN	B100-CAN emerg. ballast, Canada market, T8, 350-450 lumens, 120/347V
E7	B60 emerg. ballast, T8, 600-700 lumens, 120/277V
E5	B50 emerg. ballast, U.S. or Canada market, T8 or CF, 1100-1400 lumens, UNV
E5CAN	B50-CAN emerg. ballast, Canada market, T8, 1100-1400 lumens, 120/347V
E5ST	B50ST emerg. ballast w/self test, T8, 1100-1400 lumens, UNV
E7LP	LP550 emerg. ballast T5/T5HO, 430-700 lumens, 120/277V
E6LP	LP600 emerg. ballast U.S. or Canada market, T5/T5HO, 750-1325 lumens, 120/277V
F1	3/8" flex 3 wire, 18 gauge 6'
F2	3/8" flex 4 wire, 18 gauge 6'
F2/5W	3/8" flex, 5 wire 18 gauge 6'
GLR	Fusing, fast blow
LPT830	Installed T8/T5/T5HO lamps, 80+ CRI, 3000K
LPT835	Installed T8/T5/T5HO lamps, 80+ CRI, 3500K
LPT841	Installed T8/T5/T5HO lamps, 80+ CRI, 4100K
LPT830HL	Installed T8 high lumen lamps, 80+ CRI, 3000K
LPT835HL	Installed T8 high lumen lamps, 80+ CRI, 3500K
LPT841HL	Installed T8 high lumen lamps, 80+ CRI, 4100K
CHIC	Chicago plenum rated

Accessories (order separately)

- **AVHD** Hold down clips
- **AV-DC2** Debris cover 2'x2'
- **AV-GC2** Germ cover 2'x2'
- **FMA22** 2'x2' "F" mounting frame for NEMA "F" mounting

Arioso_2x2_acrylic 08/15 page 1 of 3

PHILIPS LIGHTOLIER

Downlighting

LyteProfile

4" Round downlight
and Lensed wall wash

Project:
Location:
Cat.No:
Type:
Lamps: Qty:
Notes:

LyteProfile LED Downlights are designed for new construction and include downlight and wall wash distributions. They are highly energy efficient with up to 95lm/W, provide a full 60° cutoff, and feature an impressively, shallow 4.5" depth.

Complete Product = Frame-in kit + Light engine + Reflector Order each separately

Ordering guide: Frame-in kit[1]

Example: P4RD15NZ10UVBEM

Series	Style	Lumens	Installation	Dimming	Input voltage	Version	Options
P4R	**D**		**N**			**VB**	
P4R LyteProfile 4" Round	**D** Downlight	**10** 1,000 lm **15** 1,500 lm	**N** Non-IC New construction	**Z10** 0-10V Dimming **L** Lutron	**U** Universal (120/277v) **3** 347V[2]	**VB** Version B	**EM** Emergency[2]
		20 2,000 lm	**N** Non-IC New construction	**Z10** 0-10V Dimming **L** Lutron	**1** 120V **2** 277V **3** 347V[2]		

Ordering guide: Light engine

Example: P4RD835VB

Series	Style	CRI	CCT	Version
P4R	**D**	**8**		**VB**
P4R LyteProfile 4" Round	**D** Downlight	**8** 80 CRI	**27** 2700K **30** 3000K **35** 3500K **40** 4000K	**VB** Version B

For 90 CRI, contact factory.

Ordering guide: Reflector

Example: P4RDCCP

Series	Style	Reflector	Flange
P4R			
P4R LyteProfile 4" Round	**D** Downlight **LW** Lensed wall wash	**CL** Clear **CC** Comfort clear **D** Clear diffuse (applied)	**Blank** White (painted) **P** Polished (matches aperture)
		W White (painted)	**Blank** White (painted)

1. Mounting Bars need to be ordered separately, see Options and Accessories on page 2 for Mounting Bar options.
2. 347V configurations are not available with the emergency option.
Note: Refer to page 2 for Energy Star certification details.

PHILIPS LIGHTOLIER

Downlighting

SlimSurface LED

4" and 6" square aperture
surface mount downlight

SlimSurface LED is a 5/8" thick surface mounted luminaire with the appearance of a recessed downlight. Easy to install into most standard j-boxes, the SlimSurface LED square apertures are available in a 4" 650lm and 6" 1000lm fixture.

Project:
Location:
Cat.No:
Type:
Lamps: Qty:
Notes:

Ordering information

example: S4S830K7AL

Series	Size	Shape	CRI	CCT	Lumens	Finish	UL listing
S		**S**					
S SlimSurface	**4** 4"	**S** Square	**8** 80 **9** 90[1]	**27K** 2700K **30K** 3000K **35K** 3500K **40K** 4000K	**7** 650lm	**blank** White **AL** Aluminum **BK** Black	**blank** Wet location
	4 4"	**S** Square	**8** 80	**30K** 3000K	**7** 650lm	**blank** White	**-D** Damp location
	6 6"	**S** Square	**8** 80 **9** 90[1]	**27K** 2700K **30K** 3000K **35K** 3500K **40K** 4000K	**10** 1000lm	**blank** White **AL** Aluminum **BK** Black	**blank** Wet location
	6 6"	**S** Square	**8** 80	**30K** 3000K	**10** 1000lm	**blank** White	**-D** Damp location

White


Black


Aluminum

1. 90 CRI is only available with 2700K

Note: Lumen output is calculated based on 80 CRI and 3000K CCT. Please consult adjustment factors table on page 3 for other lumen outputs.

Features

1. **Flange:** One piece plastic flange. Injection molded white, applied aluminum or black.
2. **Lens:** High transmittance lens allowing for smooth, comfortable light pattern.
3. **Power supply:** Integral class 2 driver. Factory wired electronic LED driver (see Electrical section for specifications)
4. **LED Strip:** Utilizes Philips LEDs.
5. **Lifetime:** Expected lifetime 50,000 hours and backed by a 5-year warranty (see Philips.com/warranties for details).
6. **Compliance:** Non-conductive fixture for shower light application. This product complies with the requirements of the California Energy Commission regulated under Title 24, and has been listed in the Title 20 database.

.

Electrical

Electronic power supply: RoHS compliant. Class 2 power unit. Unit tolerates sustained open circuit and short circuit output conditions without damage.

Dimming: All luminaires are intended for use with incandescent standard type dimmers (TRIAC). 10%-100% dimming range.

Lumen Output	Max. Input Current	Max. Input Power
630lm	0.08A	9.5W
980lm	0.13A	14.2W

Input Voltage 120V
Input Frequency 50/60Hz
Power Factor > 0.9
Max. THD <15%
Minimum Operating Temperature -20°C

Labels

cULus listed for damp locations (wall mount applications and wet locations (covered ceilings). ENERGY STAR® certified.

Compatibility

Installs into standard J-box applications:


3 1/2" round (plastic)


4" square (plastic)
Not compatible with S4S


4" octagonal (metal)


4" square (metal)
Not compatible with S4S

Note: 2 1/8" deep octagon junction box recommended for through circuit wiring applications.

PHILIPS
Day-Brite
CFI

Linear

SV strip

2', 3', 4', or 8'
T5 or T5HO


SV T5 Strip


SV T5 Strip with lens accessory


SV T5 Strip with symmetric reflector accessory


SV T5 Strip with louver accessory

Project:
Location:
Cat.No:
Type:
Lamps: Qty:
Notes:

The Philips Day-Brite / Philips CFI SV strip utilizes compact, efficient T5 or T5HO lamps and is available in 2', 3', 4' and 8' nominal lengths. Lens and louver accessories are available for 4' or 8' models, and reflector accessories are available for all models.

Ordering guide

Example: SV4S228UNV-1/2-EB

Family	Nominal length	Ceiling type	Lamp quantity/ cross section	Lamp Type (by others)	Voltage	Options
SV		S			–	
SV Strip T5	**2** nominal 22" **3** nominal 34" **4** nominal 46" **8** nominal 92" (tandem lamps)	**S** Surface	**1** **2**	**14** 14WT5 (22") **24** 24WT5HO (22") **21** 21WT5 (34") **39** 39WT5HO (34") **28** 28WT5 (46") **54** 54WT5HO (46")	**UNV** Universal voltage 120-277V **120** 120V **277** 277V **347** 347V	**1/1** One 1-lamp ballast **1/2** One 2-lamp ballast **1/4** One 4-lamp ballast **2/2** Two 2-lamp ballasts **EB** Electronic ballast, <10% THD **E7LP*** LP550 emerg. ballast, 430-700 lumens, 120/277V **E6LP*** LP600 emerg. ballast, US or Canada market, 750-1325 lumens, 120/277V **GLR** Fusing, fast blow Power-Connect modular wiring – see sheet 1604-OA. *"46" or 92" models only

Reflector only (order separately, 2', 3', or 4' – order two 4' reflectors for 8' tandem unit)

Example: SV5R1W4SSLD

Reflector type	Reflector style	Finish	Reflector length	Light distribution	Reflector type
SV5R	1				
SV5R Reflector for SV Strip T5	**1**	**W** White **S** Specular	**2** 22" **3** 34" **4** 46" (order two 4' reflectors for tandem models)	**S** Symmetric **A** Asymmetric	**SLD** Solid **SLT** Slotted (white only) **PER** Microperforated (white only)

Lens or louver with reflector (order separately, 4' only – order two for 8' tandem unit)

Example: SV5CLW4SSLD

Family	Lens/Louver style	Finish	Reflector length	Reflector design	Reflector style
SV5		W	4	S	
SV5 Lens or louver accessory for SV Strip T5	**CL** Clear linear lens **FL** Frosted linear lens **LV** Perforated white blade louver **LW** Solid white blade louver **LG** Solid grey blade louver **LH** Perforated grey blade louver **XX** No optic, reflector only	**W** White	**4** 46" (order two 4' units for tandem models)	**S** Symmetric	**SLD** Solid **SLT** Slotted **PER** Perforated

STANDARD STRIP

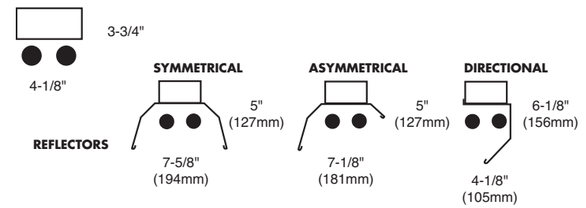
The Standard Strip is a basic strip luminaire, available in many lamp types.

STANDARD STRIP—PRODUCT AVAILABILITY

Nominal Length (Ft.)	Family	Lamps/ X Section	Lamps/ Fixture	Lamp Type	Length	Inches (mm) Width	Depth	Ballast Power Factor*
2	TL	1, 2	1, 2	20	24" (610)	4-1/8" (105)	3-3/4" (95)	L
2	T	1, 2	1, 2	17, 20	24" (610)	4-1/8" (105)	3-3/4" (95)	H
2	TB	1, 2	1, 2	CF40, CF50, CF55	24" (610)	4-1/8" (105)	3-3/8" (86)	H
3	T	1, 2	1, 2	25, 30	36" (914)	4-1/8" (105)	3-3/4" (95)	H
4	T	1, 2	1, 2	32, 40, 48	48" (1219)	4-1/8" (105)	3-3/4" (95)	H
4	TTB	1, 2	2, 4	CF40, CF50, CF55	48" (1219)	4-1/8" (105)	3-3/8" (86)	H
6	TT	1, 2	2, 4	25, 30	72" (1829)	4-1/8" (105)	3-3/4" (95)	H
6	T	1, 2	1, 2	72	72" (1829)	4-1/8" (105)	3-3/4" (95)	H
8	TT	1, 2	2, 4	32, 40	96" (2438)	4-1/8" (105)	3-3/4" (95)	H
8	T	1, 2	1, 2	59, 96	96" (2438)	4-1/8" (105)	3-3/4" (95)	H
16	TT	1, 2	2, 4	59, 96	192" (4876)	4-1/8" (105)	3-3/4" (95)	H

*Ballast power factor: L=Low (only available in 120V), H=High

DIMENSIONS



REFLECTOR—PRODUCT AVAILABILITY**

Length (Feet)	Symmetrical Steel	Symmetrical Silverado	Asymmetrical Steel	Asymmetrical Silverado	Directional Steel	Directional Silverado
2'	TSR-2	TSS-2	TAR-2	TAS-2	TDR-2	TDS-2
3'	TSR-3	TSS-3	TAR-3	TAS-3	TDR-3	TDS-3
4'	TSR-4	TSS-4	TAR-4	TAS-4	TDR-4	TDS-4

**Order two 3' reflectors for 6' fixtures and two 4' reflectors for 8' fixtures. Silverado reflectors are specular, providing more precise light control. Above reflectors not for use with "TB" or "TTB" strips.

SAMPLE CATALOG NUMBER: T232-UNV-1/2-EB

– –

NO. OF LAMPS/ CROSS SECTION (not included)
1
2

VOLTAGE
120
277
347
UNV – Universal Voltage, 120-277 volt (with32wT8/25wT8/17wT8 electronic ballast only)

FAMILY
T – Standard Strip (Rapid Start and Slimline)
TL – Standard Strip (Trigger Start, Normal Power Factor)
TB – Twin Tube (Biax)
TT – Tandem "T" Series
TTB – Tandem "TB" Series

LAMP TYPE/WATTAGE
17 – 17wT8 (24")
20 – 20wT12 (24")
25 – 25wT8 (36")
30 – 30wT12 (36")
32 – 32wT8 (48")
40 – 40wT12 (48")
CF40 – 40wT5 (24")
CF50 – 50wT5 (24")
CF55 – 55wT5 (24")
48 – 38wT12 Slimline (48")
59 – 59wT8 (96")
72 – 55wT12 Slimline (72")
96 – 75wT12 Slimline (96")

OPTIONS
1/2 – One 2-lamp ballast (electronic or non-standard)
1/4 – One 4-lamp ballast (electronic or non-standard)
2/2 – Two 2-lamp ballasts (electronic or non-standard)
EB – Electronic ballast, <20% THD
EBH – High ballast factor electronic ballast (F17T8, F25T8, F32T8 only)
EB10I – Electronic ballast, instant start, <10% THD
EB10R – Electronic ballast, program rapid start, <10% THD
E1 – DEB-1 emerg. ballast, 350-450 lumens, UL dry loc.
E7 – DEB-7 emerg. ballast, 600-700 lumens, UL dry loc.
E5 – DEB-5 emerg. ballast, 1100-1400 lumens, UL dry loc.
E5ST – DEB-5ST emerg. ballast w/self test, 1100-1400 lumens, UL dry loc.
GLR# – Fusing, fast blow (# = number of ballasts)
LT – Low temperature (0°F) start ballast (standard on F17T8, F25T8, F32T8)
Power-Connect modular wiring – see page 187

See pages 182-183 for mounting information and 187-192 for option info.
See pages 202-203 for ballast and lamp info.

Features
- 17, 20, 25, 30, 32, and 40 watt T12 or T8 and Slimline models are UL listed for direct mounting on low density ceilings (except low power factor models).
- Combination end plate/couplers included.
- Suitable for unit or row mounting.
- Housing is multi-stage phosphate treated for maximum corrosion resistance and finish coat is high reflectance baked white enamel.
- Wireway cover retained by quarter turn fastener, providing easy ballast access without tools.
- UL listed for damp locations. Units incorporating emergency ballasts UL listed for dry locations.

** ***Important:*** *Reflectors must be ordered separately.*

Accessories
- **reflectors** – see above
- **5988W/5977W** – Hydee hangers
- **CG-2/3/4** – 2'/3'/4' wire guards for strip w/out reflector
- **C-173** – 4' wire guard for strip w/symmetrical reflector
- **CS-400** – Rigid stem canopy
- **CS-500** – Swivel stem canopy
- **CS series stems**
- **CTBH-1/2/3** – T-bar sliding hangers
- **FKR-126** – Chain hanger set
- **TH-1/2/4** – Sliding hangers
- **TC-1** – Heavy duty coupler

See pages 182-183 for details.

For T5/T5HO applications, see the T5 Micro Strip on pages 160-161.
For HO/VHO applications, see the TH strip on page 168.
For retrofit applications, see page 167.

For more information concerning the Standard Strip consult specification sheets 1103-S to 1105-S in your Day-Brite Fluorescent Binder or go to www.daybritelighting.com. See page 208 for warranty & lamp disposal info. Data subject to change w/out notice.

PHILIPS
KEENE

Wall mount

LytePro LED Sconce

LPW32

Project:
Location:
Cat.No:
Type:
Quantity:
Notes:

The Philips Keene LytePro LED Wall Sconce LPW32 features outstanding value in a compact, architectural design. This wall sconce features state-of-the-art, long-life and maintenance savings, in a combined discreet LED package with high precision over-optic design. This powerful and precise combination offers outstanding energy savings with excellent photometric performance. LPW32 is ideal for building perimeters and corridors in addition to wall lighting applications requiring strong lateral spacing and forward pattern projection.

Stocked luminaires – Ordering guide

Catalog Number	Description	Master Pack, Qty	UPC Code
LPW32-78DGY	LPW32,71W,700mA,120-277V, Dark grey textured paint	3	786034960564
LPW32-78WH	LPW32,71W,700mA,120-277V, White textured paint	3	786034960571
LPW32-78BZ	LPW32,71W,700mA,120-277V, Bronze textured paint	3	786034960588
LPW32-79DGY	LPW32,71W,700mA,347-480V, Dark grey textured paint	3	624563299352
LPW32-79WH	LPW32,71W,700mA,347-480V, White textured paint	3	624563299369
LPW32-79BZ	LPW32,71W,700mA,347-480V, Bronze textured paint	3	624563299345

Stocked accessories - Ordering guide (Must be ordered separately)

Catalog Number	Description	Master Pack, Qty	UPC Code
LPWCVRPLT-BZ	LPW Universal wall cover mounting plate, Bronze textured paint	(none)	786034960618

Description of catalog codes

Family	Drive current	Voltage	Finish
LPW32 = LytePro 32 LED Wall Sconce	7 = 700mA drive current	8 = 120-277V 9 = 347-480V	BZ = Bronze textured paint DGY = Dark gray textured paint WH = White textured paint

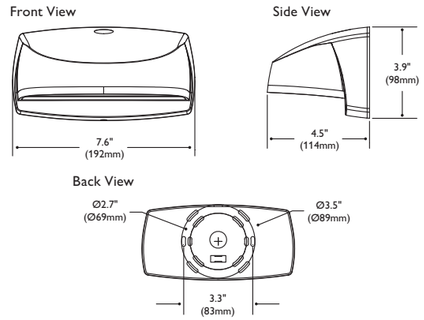
LytePro7
Architectural LED Wall Sconce

Features

- 555 lumen system providing advantageous replacement of 35W HPS, 28W CFL or 100W incandescent with only 13W energy consumption.
- Provides safety and security in residential and light commercial applications in locations such as entrances, over garages, illuminate house numbers, wall signs, and located along perimeters and pathways.
- Seven high-output LEDs having an average rated life of 60,000 hours (L_{70})
- Patented Philips LED Optical System individually controls the placement of light in the target area minimizing glare.
- 4000K neutral colour temperature delivers light with minimal waste
- Type III distribution with shielded optics and minimal uplight.
- Individual precision collimating optics collects and redirects light to optimize performance.
- Functions in environments with temperatures that range from -30°C to 40°C.
- Housing constructed of heavy die cast aluminum and fully gasketed.
- Corrosion resistant Duraplex II polyester powder coated finish available in white, bronze and titanium.
- Fully enclosed bottom and protected with clear acrylic lens.
- Electronic Class II LED driver accepts 120-220V, 50/60Hz input (constant current).
- Universal mounting plate with hook and lock mounting, including built-in bubble level for accuracy, and complete with integral splice chamber.
- Optional field installed button-type photocontrol for automatic all night light. Order catalogue number P105A.
- cETLus tested suitable for wet location
- 5 year Standard Limited Warranty

Provides 555 lumens
cETLus tested for wet locations

Dimensions



Ordering information

Explanation of catalog number: Example: LP7T

LP7	
Series:	**Colour:**
LP7: LytePro7 Architectural LED wall Sconce Series	**T** = Titanium **W** = White **P** = Bronze

Job Information	Type:
Job Name:	
Cat. No.:	
Lamp(s):	
Notes:	

SD0958 06/13

PHILIPS
KEENE

Simplex

4100ES Fire Control Panels

UL, ULC, CSFM Listed; FM Approved;
*MEA (NYC) Acceptance**

Cabinet Reference; Boxes, Doors,
Dress Panels, Rack Mounting, and Accessories

Features

Simplex® 4100ES Box and door options:

- Boxes are available sized for one, two, or three equipment bays, each with a battery bay located at the bottom
- Colors include platinum or red
- Doors are glass front with modular dress panels, or solid
- Models are available with box and door combined for single package shipping, or packaged separately
- Enclosures are NEMA 1 rated; wall mount enclosures are also IP30 rated
- Refer to individual 4100ES data sheets for product application listings (see list on page 2)

Door and dress panel selection is coordinated with cabinet function:

- Glass doors with modular dress panels provide visibility of annunciation and interface modules for Control Panels, Network Display Units (NDU), and Remote Annunciators
- Solid doors are for MINIPLEX Transponders and utility function cabinets where module visibility is not required

4100ES Enclosure details:

- Latching dress panels easily lift off for internal access
- Smooth box surfaces are provided for locally cutting conduit entrance holes exactly where required
- Alignment markers are provided at the top and bottom of each box side for 6” (152 mm) or 4” (102 mm) wall studs
- Knockout screw/nail holes are supplied for semi-flush mounting

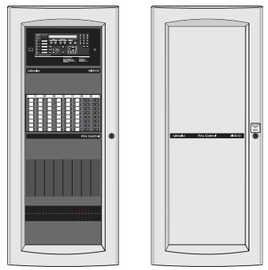
Upright cabinet rack packaging reference:

- For use with Bud Industries Inc. special cabinet rack model number 45964
- Refer to page 2 for cabinet rack listing

* For 4100ES one, two, and three bay cabinets with associated equipment: Products are listed by the California State Fire Marshal (CSFM) pursuant to Section 13144.1 of the California Health and Safety Code. See CSFM Listing 7165-0026:251 for allowable values and/or conditions concerning material presented in this document. Accepted for use – City of New York Department of Buildings – MEA35-93E. Additional listings may be applicable, contact your local Simplex product supplier for the latest status. Listings and approvals under Simplex Time Recorder Co. are the property of Tyco Fire Protection Products.

4100ES One Bay Cabinets

4100ES Two Bay Cabinets



4100ES Three Bay Cabinets

Cabinet Rack Enclosure (shown with door open)

S4100-0037-14 12/2014

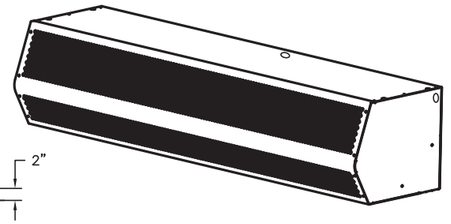
Mechanical Cut Sheets

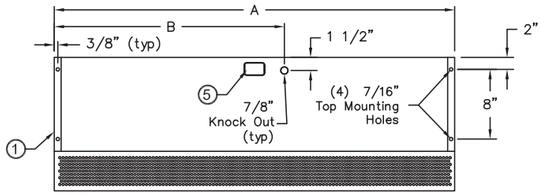
mars
atmosphere is everything
14716 S. Broadway · Gardena, CA 90248 · USA
TEL:(310) 532-1555 · (800) 421-1266 · FAX:(310) 324-3030
Web Site: www.marsair.com · E-mail:info@marsair.com

PROJECT			OPTIONS/ITEMS
TITLE			
COMMENTS		DATE 3/30/15	PAGE
		REV. NO	
MODEL NO. HV2 Series	DRAWING NO HV2U–F	DRAWN BY FRC	CHECKED BY	FILE NAME

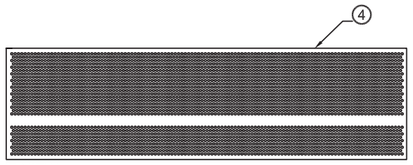
Unheated Drawing

HV2
(High Velocity 2) Series

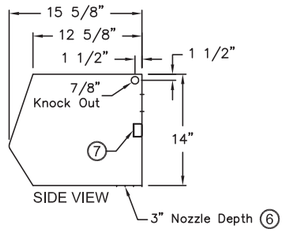




TOP VIEW



FRONT VIEW

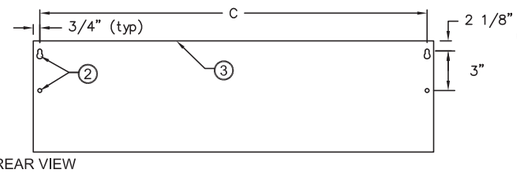


SIDE VIEW

amca CERTIFIED RATINGS — AIR PERFORMANCE — AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL INC.

Note: Models HV260-1, HV296-3, HV2108-2 & HV2120-2 are not AMCA Certified.

C ETL LISTED US — Intertek

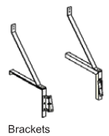


REAR VIEW

8 Recommended Accessories

Control Panels

Door Limit Switches



Brackets

*- Use corresponding letters in "Electrical Data" columns to complete the model numbers.

MODEL NUMBER	OVERALL LENGTH A (in)	KNOCKOUT LOCATION B (in)	REAR MOUNTING CENTER C (in)
HV236-1U*-TS	36	25 1/2	34 1/2
HV242-1U*-TS	42	28 1/2	40 1/2
HV248-1U*-TS	48	31 1/2	46 1/2
HV260-1U*-TS	60	37 1/2	58 1/2
HV272-2U*-TS	72	40	70 1/2
HV284-2U*-TS	84	46	82 1/2
HV296-2U*-TS	96	52	94 1/2
HV296-3U*-TS	96	52	94 1/2
HV2108-2U*-TS	108	58	106 1/2
HV2108-3U*-TS	108	58	106 1/2
HV2120-2U*-TS	120	64	118 1/2
HV2120-3U*-TS	120	64	118 1/2
HV2144-3U*-TS	144	76	142 1/2
HV2144-4U*-TS	144	76	142 1/2

Notes:

1. This product is designed to meet the National Electric Code (NEC), ETL Listed (UL 507 and CSA 22.2) and AMCA 211 Certified.
2. (2) 1/2" key hole slots and (2) 7/16" mounting holes provided on for wall mounting and (4) 7/16" mounting holes for overhead mounting provided, (2) on each end.
3. All units have a self contained one piece cabinet, fire retardant and corrosion proof paint lock metal double protected with baked on Titanium Silver color, rust preventative electrostatic polyurethane powder coating.
4. Cabinet has sufficient strength for fastening to wall on both ends without intermediate support.
5. Internal J-Box(es) for electrical wiring: one motor-(1) 2"x 4"; two motors-(1) 4"x 4"; three motors-(2) 4"x 4".
6. Unit is to be installed such that air flow is unobstructed. Air discharge nozzle containing adjustable air directional vanes with 40° sweep front to back.
7. Circuit protection as per NEC by others.
8. Optional motor control panel, door limit switch and mounting brackets are field installed and/or wired by others. The door limit switch is to be mounted such that the air curtain turns on as door begins to open. To prevent unit damage, the mounting brackets must be installed such that the bottom of the air curtain is not below the door header.

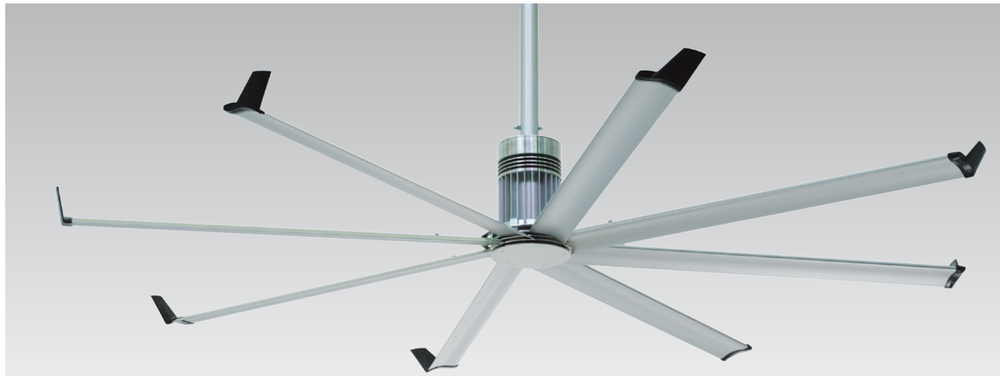
AERCO®

Business/Residential/Hotels

BENCHMARK SERIES High-Efficiency Boilers

Education

Government



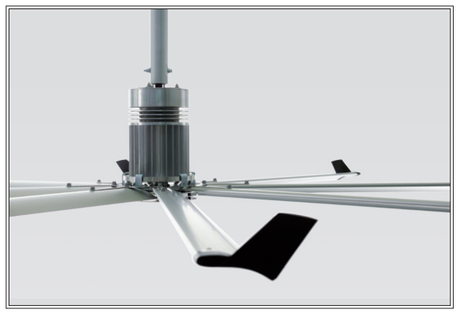
Isis®

Sleek. Effective.

Isis® by Big Ass Fans® is engineered to circulate large volumes of air in commercial and institutional spaces. Its sweeping airfoil blades – shaped like aircraft wings – revolve slowly and quietly to produce gentle but powerful currents of air that deliver consistent, energy efficient comfort year round. Isis incorporates the same sturdy components and aerodynamic principles as industrial Big Ass Fans, but in a lighter, smaller and more stylish package. Isis is perfect for ceilings as low as 12 feet (3.7 m) in restaurants, bars, health clubs and offices. And hidden inside the sleek exterior is the brain of Isis—a proprietary gearless direct drive motor that allows the fan to operate silently. Isis is the total package.

Features

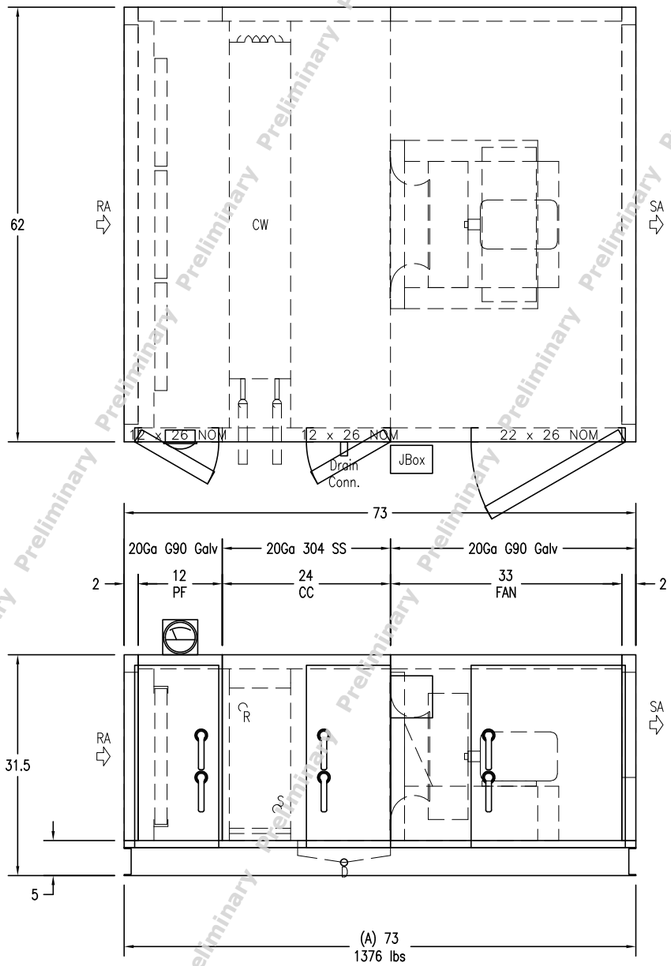
- Lightweight commercial fan for flat or sloped ceilings as low as 12 feet (3.7 m)
- Silent operation for sound sensitive spaces
- Industrial-grade components
- Available in 8- (2.4) and 10-ft (3 m) diameters
- Backed by a 10-year, non-prorated commercial warranty
- Models rated for outdoor use available



(877) 244-3267 | BIGASSFANS.COM

BIG ASS FANS®

Preliminary



Printed (dd/mm/yyyy): 21/12/2015

All dimensions shown in inches, Operating weights shown in pounds. Overall unit dimensions do not include lifting lugs, electrical panels, pipe connections, door handles, etc.
QX Construction 3,000 ACFM

Temtrol
a Nortek Air Solutions Brand
106 N Industrial Blvd.
Okarche, OK 73762
(405) 263-7286
www.temtrol.com

UofA – RCRF

Unit Tag: FC-02					Unit Type: Indoor	Dsg Qty: 1
Rep Firm: Aqua Air Systems Ltd.: Edmonton Edmonton, AB, Canada					Weight: 1,376	Box Qty: 1
Rep Contact: Taylor Maron, (780) 465-8011				Model No		
NASDA Ver: 6.2.0	Factory SAE	Quote No	Job No	Date m/d/y: 12/21/2015	Rev	

Guardian

WideArea™

Eye/face wash

Wall Mounted bowl is lowered and extended to permit access by wheelchair user

To be specified

☒ **Eyewash/Facewash fixture should be installed 4 to 10 feet from the mixing valve.**

P-Trap

☒ **Provide P-Trap,** acid resistant, 38 mm (1-1/2") size.

Watts

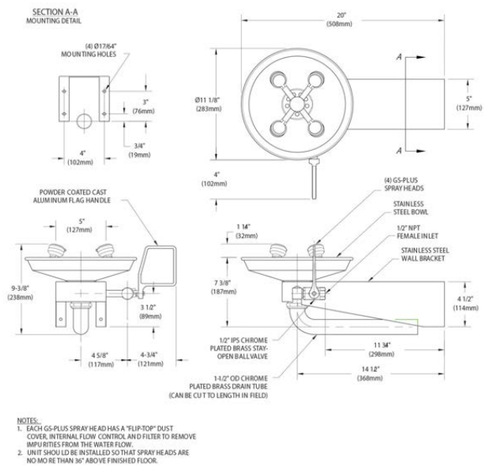
☒ **FD-100-C-A Floor Drain,** epoxy coated cast iron, anchor flange, 5" (127 mm) adjustable round nickel bronze strainer, reversible clamping collar with primary & secondary weepholes.

☒ **Provide p-trap for drain.**

☒ For Thermostatic Mixing Valve, Lawler model # 911E/F

☒ **GBF1724**

Wall Mounted - bowl is lowered and extended to permit access by wheelchair user - eye/face wash - 11-1/2" (292 mm) diameter - stainless steel bowl - four GS-Plus spray heads with fliptop dust cover and filter - 1/2" (13 mm) NPT female inlet - powder coated cast aluminum flag handle activation - 1/2" (13 mm) IPS chrome plated brass stay-open ball valve with Teflon seal - welded stainless steel bracket - 1-1/2" (38mm) OD chrome plated brass tailpiece - Unit is third party certified by IAPMO to meet ANSI Z358.1-2014, the Uniform Plumbing Code cUPC and the National Plumbing Code of Canada.



Note :	Drawing No. : **(349637) EE34841 PT14017 BSDR24390 CM23576**	Estimated Total:

LAWLER

EW-1 911E/F

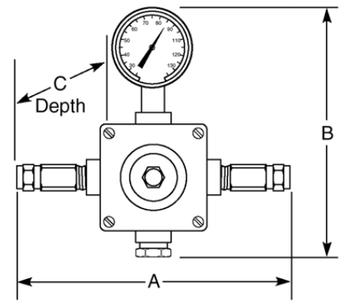
Emergency tempered water mixer

Emergency tempered water mixer

lead-free brass and stainless steel design

☒ **911E/F**

Emergency Thermostatic Mixing Valve for Eyewash or Eye/Face Wash , lead-free brass and stainless steel design, vandal-resistant temperature adjustment, stainless steel sliding piston control device allow cold flow through both the fixed and variable bypass, 13 mm (1/2") N.P.T. Inlets, 13 mm (1/2") N.P.T. Outlet, positive hot water shut-off, liquid-filled thermostatic motor control mechanism, 29 °C (84.2 °F) factory set temperature, standard 69.8 °F (21 °C) - 89.6 °F (32 °C) temperature range, maximum operating pressure of (861.25 kPa), 26 LPM (6.9 GPM) flow capacity at 30 psi (207 kPa) pressure drop across the valve, 7.57 LPM (2.0 GPM) min. Flow rate, 18 LPM (4.8 GPM) bypass flowrate at 30 psid. (See 911E/F)



Valve Number	A	B	C
911E/F	9″	8″	5″

Note :	Drawing No. : **(349073) EE34789 PT13977 CM23576**	Estimated Total:

Certified Drawing for CU-1

Project: University of Alberta - RCRF
Prepared By: Wesley Bruce

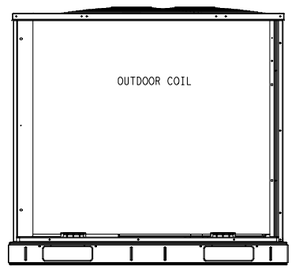
12/21/2015
01:08PM

UNITED TECHNOLOGIES CARRIER P.O. BOX 4808 SYRACUSE, NY 13221

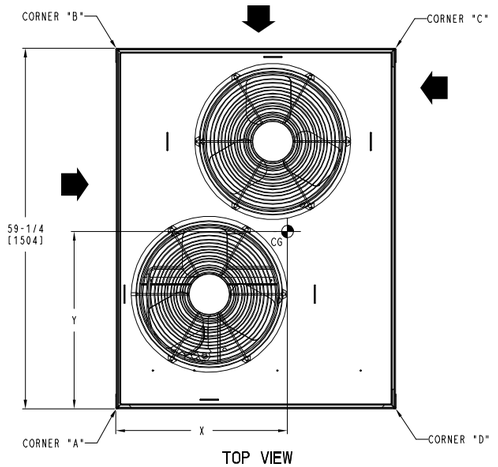
CG CENTER OF GRAVITY

DIRECTION OF AIR FLOW

DIMENSIONS IN [ ] ARE IN MM

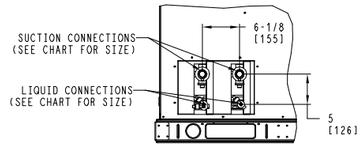


REAR VIEW

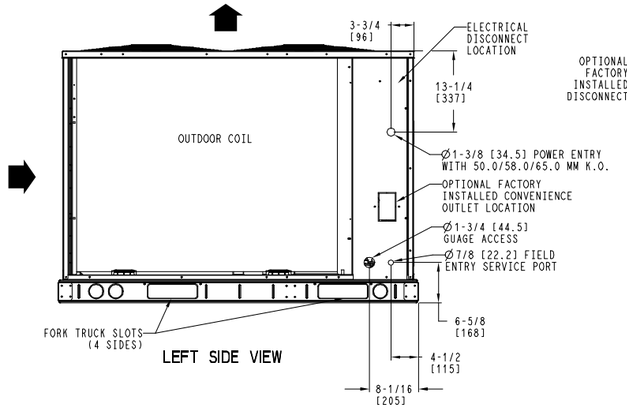


TOP VIEW

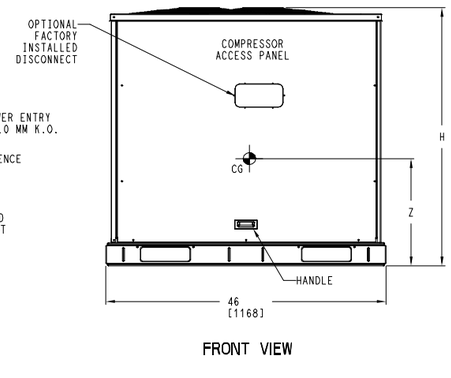
SERVICE VALVE CONNECTIONS			QTY
UNIT	SUCTION	LIQUID	
38AUZ07	1-1/8 [28.6]	3/8 [9.5]	1
38AUZ08	1-1/8 [28.6]	1/2 [12.7]	1
38AUZ12	1-3/8 [34.9]	1/2 [12.7]	1
38AUZ14	1-3/8 [34.9]	5/8 [15.9]	1
38AUD12	1-1/8 [28.6]	3/8 [9.5]	2
38AUD14	1-3/8 [34.9]	1/2 [12.7]	2
38AUQ07	1-1/8 [28.6]	3/8 [9.5]	1
38AUQ08	1-1/8 [28.6]	1/2 [12.7]	1
38AUQ12	1-3/8 [34.9]	1/2 [12.7]	1



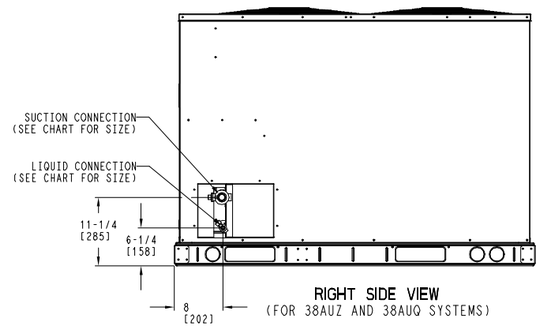
RIGHT SIDE VIEW
(FOR 38AUD SYSTEMS)



LEFT SIDE VIEW



FRONT VIEW



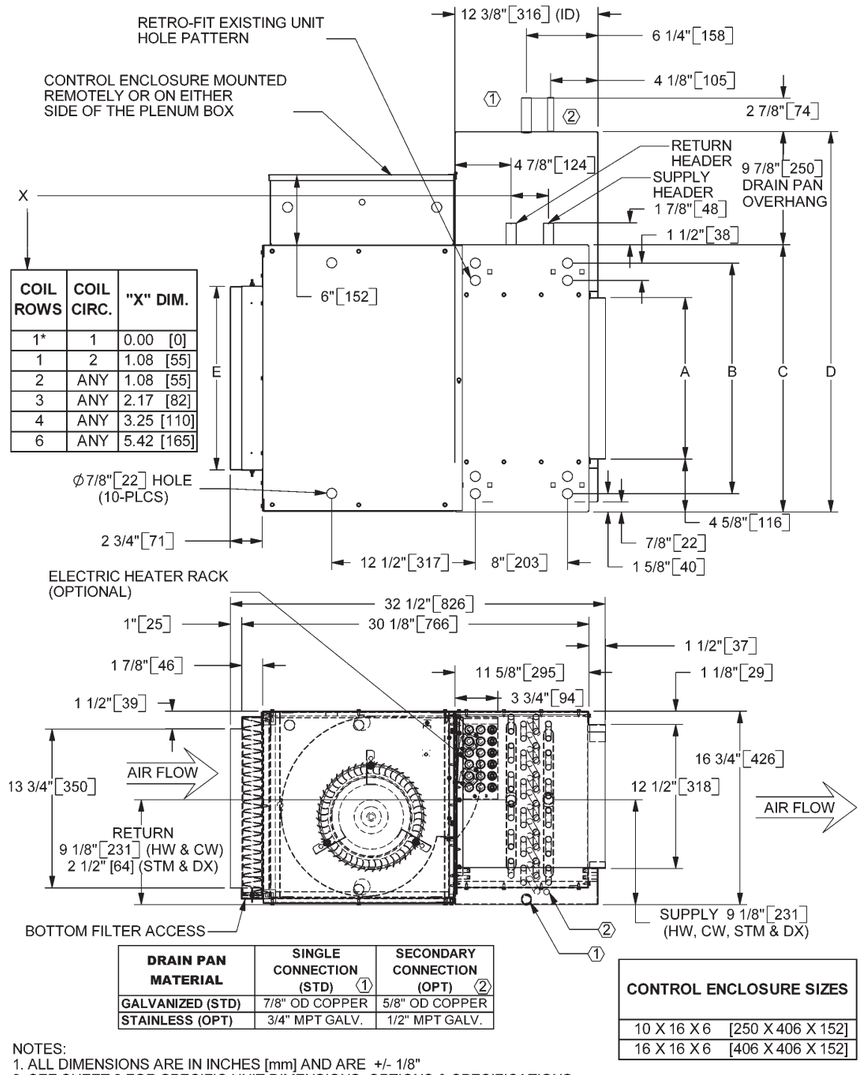
RIGHT SIDE VIEW
(FOR 38AUZ AND 38AUQ SYSTEMS)

DATE	SUPERCEDES			REV
11/10/14	10/20/11	CONDENSING UNIT 38AUZ / 38AUD / 38AUQ - 07/08/12/14	38AU500349	H

DIMENSIONAL DATA

THHP PLENUM UNITS

Drawings are not to scale and are not for inst allation purposes.



COIL ROWS	COIL CIRC.	"X" DIM.
1*	1	0.00 [0]
1	2	1.08 [55]
2	ANY	1.08 [55]
3	ANY	2.17 [82]
4	ANY	3.25 [110]
6	ANY	5.42 [165]

DRAIN PAN MATERIAL	SINGLE CONNECTION (STD) ①	SECONDARY CONNECTION (OPT) ②
GALVANIZED (STD)	7/8" OD COPPER	5/8" OD COPPER
STAINLESS (OPT)	3/4" MPT GALV.	1/2" MPT GALV.

CONTROL ENCLOSURE SIZES
10 X 16 X 6 [250 X 406 X 152]
16 X 16 X 6 [406 X 406 X 152]

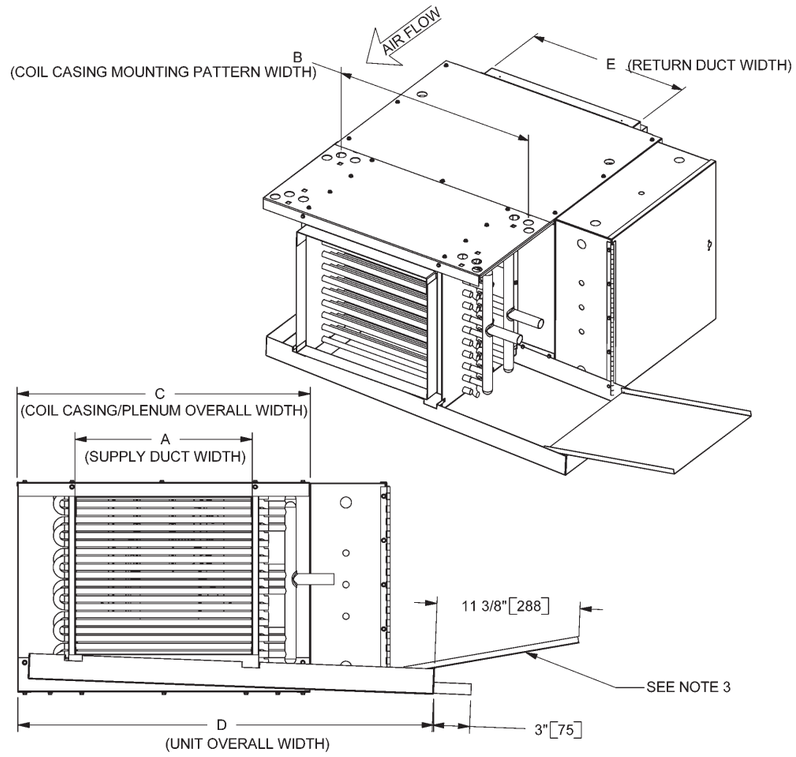
NOTES:
1. ALL DIMENSIONS ARE IN INCHES [mm] AND ARE +/- 1/8"
2. SEE SHEET 2 FOR SPECIFIC UNIT DIMENSIONS, OPTIONS & SPECIFICATIONS
3. * 1 ROW SINGLE CIRCUIT COILS ARE ON THE SAME AXIS, BUT ARE 13 3/4" APART IN HEIGHT
4. CONTROL ENCLOSURE SIZE IS DETERMINED BY ELECTRICAL COMPONENTS SELECTED

High-Performance, Horizontal Fan-Coil Units

DIMENSIONAL DATA

THHP PLENUM UNITS

Drawings are not to scale and are not for inst allation purposes.



UNIT SIZE	FAN QTY	A	B	C	D	E
06	1	14 [356]	20 [508]	23 1/8 [587]	34 [864]	16 [406]
08	1	19 [483]	25 [635]	28 1/8 [714]	39 [991]	19 7/8 [505]
10	1	23 [584]	29 [737]	32 1/8 [816]	43 [1092]	25 7/8 [657]
12	2	28 [711]	34 [864]	37 1/8 [943]	48 [1219]	32 [813]
14	2	33 [838]	39 [991]	42 1/8 [1070]	53 [1346]	35 7/8 [911]
16	2	38 [965]	44 [1118]	47 1/8 [1197]	58 [1473]	39 7/8 [1013]
18	2	43 [1092]	49 [1245]	52 1/8 [1324]	63 [1600]	44 7/8 [1140]
20	2	47 [1194]	53 [1346]	56 1/8 [1426]	67 [1702]	49 7/8 [1267]

NOTES:
1. ALL DIMENSIONS ARE IN INCHES [mm] AND ARE +/- 1/8"
2. DRAIN PAN IS FIELD REVERSIBLE 180° AND EXTERNALLY INSULATED
3. OPTIONAL AUXILIARY DRIP PAN AVAILABLE FOR PIPING PACKAGE CONDENSATE
4. COIL HAND IS FIELD REVERSIBLE (LEFT HAND UNIT SHOWN)
5. PLENUM BOX IS FIELD REVERSIBLE FOR REAR OR BOTTOM RETURN AIR
6. FILTER RACK CAN ACCOMMODATE STANDARD 1" TAW AND 1" & 2" PLEATED FILTERS

WATTS

FD-1 - Finished areas

FD-100-C Series

Floor Drain
Finished Floor
Finished Area

To be specified

Body Finish
☒- epoxy coated
☐-13 - all galvanized
☐-113M - special epoxy from 3M range

Body Material
☒- cast iron body
☐-60 - PVC body
☐-61 - ABS body

Outlet Connection
☒NH - no hub outlet
☐P - push on outlet
☐T - threaded outlet
☐X - inside caulk outlet

Outlet Size
☒- unspecified
☐2 - 2"Ø (51 mm)
☐3 - 3"Ø (76 mm)
☐4 - 4"Ø (102 mm)
☐6 - 6"Ø (152 mm)

Options
☐-5 - sediment bucket
☐-6 - vandal proof
☒-7 - trap primer connection with plug
☐-8 - backwater valve
☐-12 - galvanized top
☐-15 - strainer extension
☐-SO - side outlet
☐-Z - elastomeric flange

Watts

Funnel Option
☒- none
☐-F4-50 - 4"Ø (102 mm) cast iron funnel
☐-F4-1 - 4"Ø (102 mm) nickel bronze funnel
☐-F6-1 - 6"Ø (152 mm) nickel bronze funnel
☐-G-50 - 4" x 9" (102 mm x 229 mm) oval cast iron funnel
☐-G-1 - 4" x 9" (102 mm x 229 mm) oval nickel bronze funnel

Strainer Option
☒-A5-1 - 5" (127 mm) diameter, nickel bronze
☐-A6-1 - 6" (152 mm) diameter nickel bronze
☐-A7-1 - 7" (178 mm) diameter, nickel bronze
☐-A8-1 - 8" (203 mm) diameter, nickel bronze

☒ FD-100-C-7-A5-1

Epoxy coated, cast iron body, reversible flashing clamp with primary and secondary weepholes, trap primer connection with plug, no hub outlet.

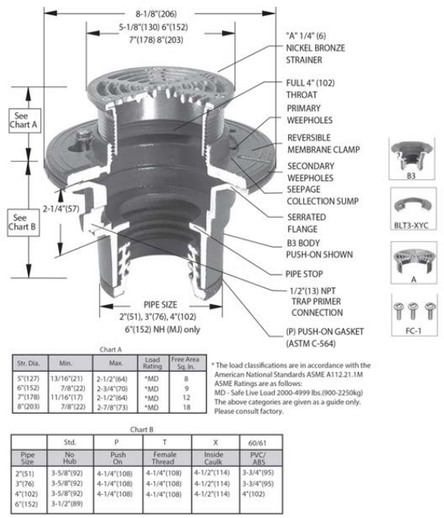


Chart A

Str. Dia.	Min.	Max.	Load Rating	Free Area Sq. In.
5"(127)	13/16"(21)	2-1/2"(64)	*MD	8
6"(152)	7/8"(22)	2-3/4"(70)	*MD	9
7"(178)	11/16"(17)	2-1/2"(64)	*MD	12
8"(203)	7/8"(22)	2-7/8"(73)	*MD	18

* The load classifications are in accordance with the American National Standards ASME A112.21.1M ASME Ratings are as follows:
MD - Safe Live Load 2000-4999 lbs.(900-2250kg)
The above categories are given as a guide only. Please consult factory.

Chart B

	Std.	P	T	X	60/61
Pipe Size	No Hub	Push On	Female Thread	Inside Caulk	PVC/ ABS
2"(51)	3-5/8"(92)	4-1/4"(108)	4-1/4"(108)	4-1/2"(114)	3-3/4"(95)
3"(76)	3-5/8"(92)	4-1/4"(108)	4-1/4"(108)	4-1/2"(114)	3-3/4"(95)
4"(102)	3-5/8"(92)	4-1/4"(108)	4-1/4"(108)	4-1/2"(114)	4"(102)
6"(152)	3-1/2"(89)				

Note :

Drawing No. : **(347654) DS26674 DSS26717 - p:17939**

Estimated Total:

WATTS

FD-2 - Mechanical/loading

FD-320 Series

Floor Drain
Area Drain
Floor Drain with Heavy Duty Grate

To be specified

Body Finish
☒- epoxy coated
☐-13 - all galvanized
☐-113M - special epoxy from 3M range

Body Material
☒- cast iron body
☐-60 - PVC body
☐-61 - ABS body

Outlet Connection
☒NH - no hub outlet
☐P - push on outlet
☐T - threaded outlet
☐X - inside caulk outlet

Outlet Size
☒- unspecified
☐2 - 2"Ø (51 mm)
☐3 - 3"Ø (76 mm)
☐4 - 4"Ø (102 mm)
☐6 - 6"Ø (152 mm)

Options
☐-5 - sediment bucket
☐-6 - vandal proof
☒-7 - trap primer connection with plug
☐-8 - backwater valve
☐-10 - secured top c/w philips screw
☐-12 - galvanized top
☐-15 - adjustable extension (2" (51 mm) to 2-3/4" (70 mm))
☐-SO - side outlet
☐-Z - elastomeric flange

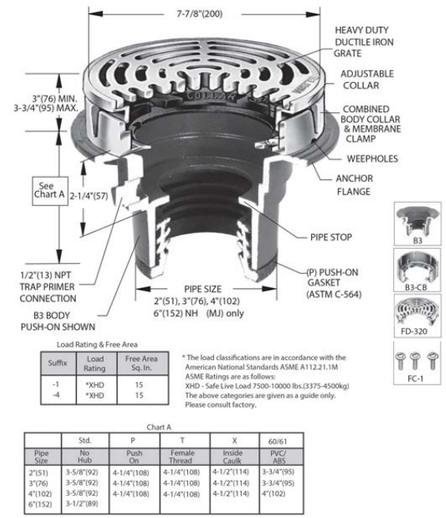
Watts

Funnel Option
☒- none
☐-F4-50 - 4"Ø (102 mm) cast iron funnel
☐-F4-1 - 4"Ø (102 mm) nickel bronze funnel
☐-F6-1 - 6"Ø (152 mm) nickel bronze funnel
☐-G-50 - 4" x 9" (102 mm x 229 mm) oval cast iron funnel
☐-G-1 - 4" x 9" (102 mm x 229 mm) oval nickel bronze funnel

Grate Option
☒-4 - 7-7/8" (200 mm) diameter epoxy coated ductile iron

☒ FD-320-7-4

Epoxy coated, cast iron body, body collar with weepholes and membrane clamp, trap primer connection with plug, anchor flange, no hub outlet.



Load Rating & Free Area

Suffix	Load Rating	Free Area Sq. In.
-1	*XHD	15
-4	*XHD	15

* The load classifications are in accordance with the American National Standards ASME A112.21.1M ASME Ratings are as follows:
XHD - Safe Live Load 7500-10000 lbs.(3375-4500kg)
The above categories are given as a guide only. Please consult factory.

Chart A

	Std.	P	T	X	60/61
Pipe Size	No Hub	Push On	Female Thread	Inside Caulk	PVC/ ABS
2"(51)	3-5/8"(92)	4-1/4"(108)	4-1/4"(108)	4-1/2"(114)	3-3/4"(95)
3"(76)	3-5/8"(92)	4-1/4"(108)	4-1/4"(108)	4-1/2"(114)	3-3/4"(95)
4"(102)	3-5/8"(92)	4-1/4"(108)	4-1/4"(108)	4-1/2"(114)	4"(102)
6"(152)	3-1/2"(89)				

Note :

Drawing No. : **(347655) DS26683 DSS27145 - p:7638**

Estimated Total:

Ceiling Diffusers
Application Guidelines

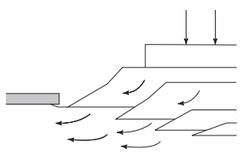
price

Overview

This section presents a full range of ceiling air diffusers. The performance objective of a ceiling air diffuser is to deliver conditioned air into an occupied space in a quiet draft-free manner. The performance efficiency of a particular diffuser design is usually judged by the diffuser's ability to rapidly dissipate the air velocities and temperature differential of the supply air before it enters the occupied space. Many models have been developed in response to specific air distribution requirements. Others have been developed or modified to meet architectural requirements of appearance, module size or other aesthetic considerations.

Square Cone Diffusers

The most popular, and one of the most efficient in the market today, is the family of square multiple cone ceiling diffusers. The cones are one-piece die-formed with smooth aerodynamically designed surfaces and no corner joints. With a round inlet, they combine the performance of a round diffuser with a square modular appearance. The square cone diffuser provides a true 360° radial horizontal air flow pattern, ideal for VAV applications. The 360° radial horizontal air flow promotes rapid mixing, temperature equalization and velocity reduction. A consistent, stable air pattern is maintained as the air volume is reduced. For ceiling applications, neck velocities as low as 75 fpm on reduced air volumes result in stable, horizontal air distribution without dumping. On exposed duct VAV applications, stable horizontal air distribution is maintained without dumping down to 20% of the maximum air volume.



360° Radial Horizontal Air Flow Pattern

Ceiling smudging has long been a concern, and it has been recognized that airborne dirt deposited on ceilings adjacent to air outlets comes from one or both of two sources.

1. The primary air stream may carry dirt through the duct system and deposit it adjacent to the outlets.
2. The secondary or entrained room air can carry dirt from the occupied space and deposit it adjacent to the outlets.

Model SPD

Model SCD - 3 Cone

Model SCD - 4 Cone

For use in T-Bar Ceilings

Since the square cone diffusers have been designed to discharge the primary supply air in a 360° radial horizontal air flow pattern, voids and low pressure areas adjacent to the diffuser are either nonexistent or minimized. This provides an effective barrier between the ceiling surface and the secondary air movement that may carry entrained room dirt, the prime cause of smudging and streaking.

Field experience has confirmed that square cone diffusers produce less smudging and streaking than most other similar types of diffusers.

The Price SCD family of square diffusers offers a wide range of options to suit most applications. 3 cone and 4 cone models are available to coordinate with most modular ceilings. A wide range of inlet sizes, border styles and modular panel sizes are available. The model SCDA includes adjustable pattern controllers to provide either a horizontal or vertical air pattern.

Square Plaque Diffusers

The SPD square plaque diffuser is based on the same aerodynamic outer cone of the SCD, however instead of multiple cones, the SPD features a flat face panel. This plaque design delivers both architectural appeal and engineering performance criteria. The simple, clean and unobtrusive face design is intended to blend with most ceiling systems. The face panel appears flush with the ceiling and has smooth edges and rounded corners to blend with the back cone. The SPD exhibits the same 360° radial horizontal air pattern as the SCD, resulting in all the performance benefits. Rapid mixing, ideal VAV operation and reduced smudging are all achieved with the SPD.

All Metric dimensions ( ) are soft conversion.
Imperial dimensions are converted to metric and rounded to the nearest millimeter.

Round Plaque Diffusers
RPD Series

price

Product Information

Models

Horizontal / Vertical Air Pattern
Three Position Adjustable (Steel) **RPD**

Price RPD Series round plaque diffuser satisfies engineering performance criteria, both in architectural ceilings and facilities with exposed ductwork. The smooth faced plaque is adjustable in three positions for horizontal or vertical air flow.

Features

- Heavy gauge spun steel construction.
- Outer cone is one-piece with smooth, aerodynamically designed surfaces to help prevent ceiling smudging.
- The outer cone shape combined with the face plaque delivers a tight 360° radial horizontal air pattern.
- Face plaque is easily installed and removed without special tools.
- Three field adjustable plaque positions:
  - Vertical air flow;
  - Horizontal air flow, with ceiling;
  - Horizontal air flow, exposed ductwork;
- Excellent performance for VAV applications.
- Excellent performance for heating / cooling applications.
- Complete range of available accessory dampers, equalizing grids, etc.

Options

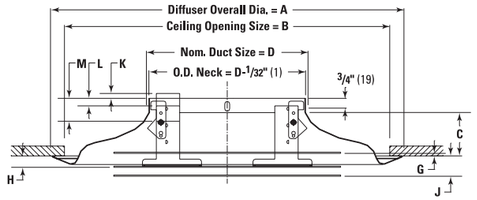
Retaining cable to attach inner plaque assembly to outer cone when a plaque removed for maintenance, etc.

Finish

White Powder Coat **B12**

For optional and special finishes see color matrix.

For Installations with exposed duct and open structure



Dimensional Data — Imperial (in.) / Metric [mm]

Nom. Size	A	B	C	D	E	F	Plaque Position refer. to Ceiling Line: Vert. Pattern G	Horiz.1 Pattern H	Horiz.2 Pattern J	Plaque Web Height refer. top of inlet: Vert. Pattern K	Horiz.1 Pattern L	Horiz.2 Pattern M
8	18 [457]	16 [406]	2 1/8 [54]	8 [203]	2 9/16 [56]	1 3/16 [30]	-1/8 [-3]	9/16 [14]	1 1/16 [27]	1/4 [6]	-7/16 [-11]	-15/16 [-24]
10	22 1/2 [572]	20 [508]	2 5/8 [67]	10 [254]	2 11/16 [68]	1 7/16 [37]	7/16 [11]	1 3/16 [30]	1 1/2 [38]	7/16 [11]	-1/4 [-6]	-9/16 [-14]
12	27 [686]	24 [610]	3 1/4 [83]	12 [305]	3 1/8 [79]	1 5/8 [41]	0 [0]	1 [25]	1 3/8 [35]	3/8 [10]	-5/8 [-16]	-15/16 [-24]
14	31 1/2 [800]	28 [711]	3 3/4 [95]	14 [356]	3 15/16 [100]	1 15/16 [49]	1/2 [13]	1 1/8 [29]	1 7/8 [48]	9/16 [14]	3/8 [10]	3/8 [10]

✓ Product Selection Checklist

1] Select Unit Size based on specified inlet diameter.
2] Select Outlet Type by model number.
3] Select Finish.

Example: 14 in. / RPD / B12

All Metric dimensions ( ) are soft conversion.
Imperial dimensions are converted to metric and rounded to the nearest millimeter.

WATTS

Non-Freeze Hose Bibb

HY-725 Series

Hydrant
Wall
Non-Freeze Wall Hydrant with NB Box, Integral Vacuum Breaker

To be specified

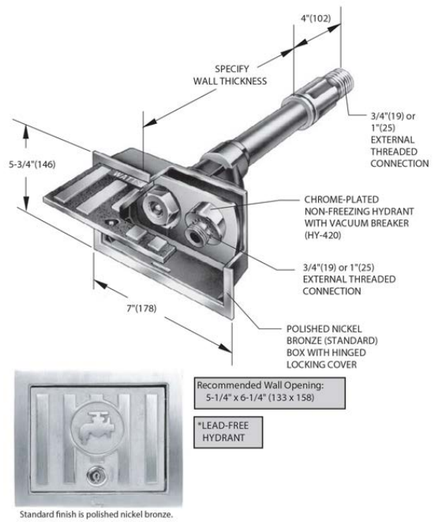
Wall Thickness
☒- unspecified
☐-6 - 6" (152 mm) thick
☐-8 - 8" (203 mm) thick
☐-10 - 10" (254 mm) thick
☐-12 - 12" (305 mm) thick
☐-14 - 14" (356 mm) thick
☐-16 - 16" (406 mm) thick
☐-18 - 18" (457 mm) thick
☐-20 - 20" (508 mm) thick
☐-22 - 22" (559 mm) thick
☐-24 - 24" (610 mm) thick

Body Variation
☒-88 - wall clamp
☒-K - cylinder lock
☐-R - round stainless steel box

Box Material
☒- nickel bronze box and door
☐-3 - stainless steel box

☒ **HY-725-88-K**

Non-freeze hydrant, all bronze head, seat casting and internal working parts, wall mount hydrant, concealed, bronze wall casing, chrome plated face, integral vacuum breaker, nickel bronze box and door, loose key, cylinder lock, wall clamp, 3/4" (19 mm) diameter hose connection, 3/4" (19 mm) female x 1" (25 mm) male pipe connection.



Note :

Drawing No. : **(347944) DS75082**

Estimated Total:

WATTS

Hose Bibb

SC8 Series

Hydrant
Hose Bibb/Sill Cock
Cast Brass Hose Bibb

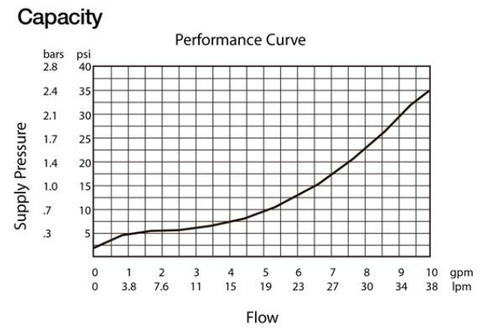
To be specified

Options
☐-1 - no kink faucet, 1/2" (13 mm) male NPT of copper sweat connection with tee handle
☐-2 - no kink faucet, 3/4" (19 mm) male NPT of copper sweat connection with tee handle
☒-3 - lawn faucet, 1/2" (13 mm) or 3/4" (19 mm) regular pattern, dual sweat connection with cast iron hand wheel
☐-4 - lawn faucet, 3/4" (19 mm) female NPT regular pattern with cast iron hand wheel
☐-5 - hex shoulder, 1/2" (13 mm) male NPT with tee handle
☐-6 - hex shoulder, 3/4" (19 mm) male NPT with tee handle

☒ **SC8-3**

Cast brass, wall mount, Watts Model 8B tamper-proof vacuum breaker with break-away screw, adjustable packing nut cartridge, lawn faucet, 1/2" (13 mm) or 3/4" (19 mm) regular pattern, dual sweat connection with cast iron hand wheel.

Capacity



Dimension drawing on the next page

Note :

Drawing No. : **(347948) DS47090**

Estimated Total:

ARMSTRONG

A.O. Smith | Commercial Gas Water Heaters

CYCLONE® Xi

UP TO 96% THERMAL EFFICIENCY, DIRECT VENT

FEATURES

The A. O. Smith Cyclone Xi family of products represents the industry's most technologically advanced commercial water heaters. The innovative Cyclone Xi design takes performance to its highest level with efficiencies of 95% and 96%. Models are available from 120,000 BTUs up to 500,000 BTUs. In addition, the Cyclone Xi features an Intelligent Control system making it the smartest water heater in the industry. All models are ENERGY STAR® Qualified.

Cyclone Xi provides outstanding hot water output, with dramatic savings on operating costs compared to units with standard 80% efficiency. A. O. Smith's leading-edge engineering delivers conventional power-vent or power direct-vent versatility, low NOx emissions and excellent space-saving characteristics. Powered anodes, standard on all Cyclone Xi models, provide superior tank protection for years of trouble free operation.

INTELLIGENT CONTROL SYSTEM WITH LCD DISPLAY

- Exclusive A. O. Smith designed control system
- Provides detailed water heater status information
- Precise temperature control
- Built-in diagnostics
- Run history information
- Cyclone water heaters are iCOMM™ compatible and can be monitored from remote locations. Call 1.888.WATER02 for more information.

This model is iCOMM COMPATIBLE. iCOMM For info call: 1-888-WATER02

SUBMERGED COMBUSTION CHAMBER, WITH HELICAL HEAT EXCHANGER COIL

- Positioned in center of tank, surrounded by water to virtually eliminate radiant heat loss from chamber
- Spiral heat exchanger keeps hot burner gases swirling, uses centrifugal force to maximize efficiency of heat transfer to water in tank
- Spiral shaped heat exchanger reduces the accumulation of lime scale; maintains higher efficiency performance over time.

POWERED ANODES STANDARD ON ALL MODELS

- Provides long-lasting tank protection in varying water conditions
- Anodes are of a permanent design and do not require replacement unless damaged

PERMAGLAS® ULTRA COAT™ GLASSLINING

- Exclusive process provides superior protection against corrosion
- Both sides of heat exchanger coil are lined for protection against flue gas condensate inside coil

MECHANICAL VENTING VERSATILITY

- Conventional power-venting or power-direct venting
- Vents vertically or through sidewall
- Direct-vent intake and exhaust pipe can terminate separately outside building, or through single opening, using concentric vent assembly
- Uses inexpensive PVC, CPVC or ABS pipe for intake and exhaust. Canadian installations require ULC S636 listed PVC or CPVC pipe for intake and exhaust.

HIGH EFFICIENCY PRE-MIX POWERED BURNER

- Down-fired pre-mix burner provides optimum efficiency and quiet operation
- Top-mounted radial burner design ensures optimum combustion efficiency

Revised June 2013

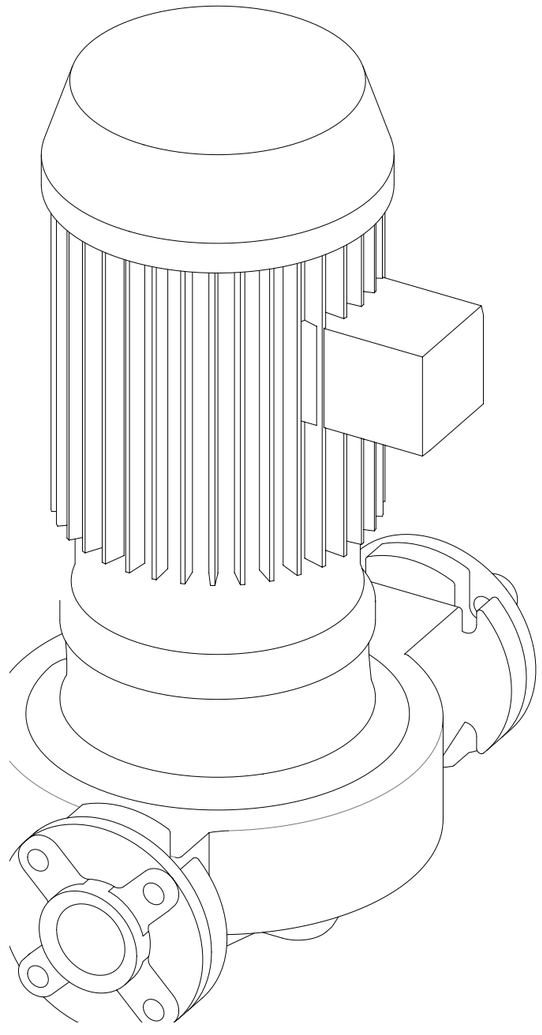
BTH-120 through BTH-500

BTH-120-250

ASME (OPTIONAL) HLW

ENERGY STAR

Page 1 of 6
AOSCG10200



Commercial pumps Series 4300, 4360 and 4380

Vertical In-Line pumps

Installation and operating instructions

File No: 43.80
Date: SEPTEMBER 14, 2012
Supersedes: 43.80
Date: SEPTEMBER 15, 2010

APPENDIX A

American Standard

LAV-2 - Barrier free

Cadet® Universal Access

Self-rimming / Drop-in Basin
Vitreous china
Electronic No touch power-harvesting Faucet

To be specified

☒ **Provide basin rim sealant.**

Sloan

☒ **EAF-275/EAF-51 Solis Electronic 'No Touch' Solar powered Faucet**, chrome plated, center hole only, cast body, 148 mm (5-13/16") projection, with, 1.3 L (0.35 US Gal) flow per minute multi-stream laminar spray head, dual infrared sensor with automatic setting feature and automatic self-adapting technology, magnetic solenoid valve concealed above deck, microprocessor based logic, 6 VDC lithium battery, 6 VDC solar energy module concealed above deck, solar cell that will harvest power from artificial indoor light.

Lawler

☒ **TMM-1070 Below Deck Mechanical Water Mixing Valve**, bronze body, temperature adjusting dial, 10 mm (3/8") inlets and outlet compression fittings, high temperature thermostatic limit stop, shut-off with automatic reset when temperature exceeds 120 ºF (48.8 ºC), integral checks, offer temperature range from full cold through 46 °C (114.8 °F).

☒ **Provide tee, adaptors and flex. copper tubing to suit installation.**

McGuire

☒ **155WC Offset Open Grid Drain**, cast brass one piece top, 17 GA. (1.5 mm) mm tubular 32 mm (1-1/4") tailpiece.

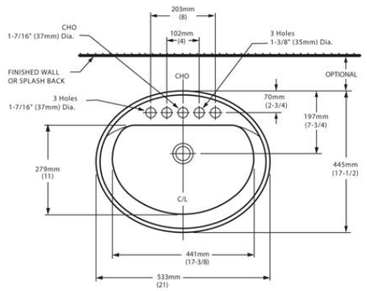
☒ **LFH170BV Faucet Supplies**, chrome plated polished brass, commercial duty 1/4 turn ball valve angle stops, 13 mm (1/2") I.D. Inlet x 127 mm (5") horizontal extension tubes, combination V.P. Loose key handles, escutcheon and flexible copper risers.

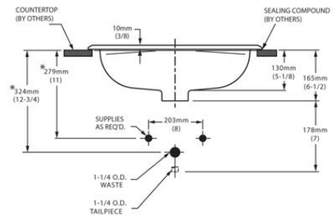
☒ **8872C P-Trap,** chrome plated, heavy cast brass adjustable body, with slip nut, 32 mm (1-1/4") size, with cleanout, shallow wall flange and seamless tubular wall bend.

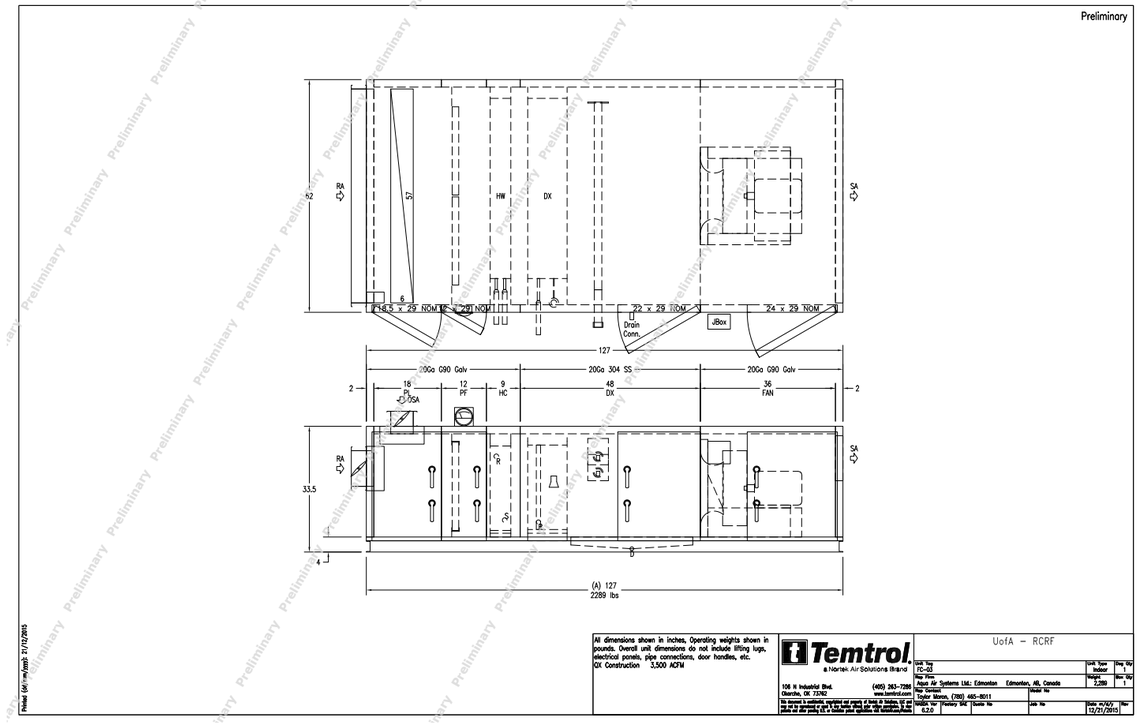
☒ **PW2000WC PROWRAP Sanitary Covering** vandal-resistant, flexible seamless moulded closed-cell PVC resin, formulated with anti-microbial additive to limit the growth of fungus and bacteria, to exposed piping (to protect against heat/contusions) as per local codes.

☒ **9495.001** - center hole only

Self-rimming / Drop-in Basin - vitreous china - side rear overflow - faucet ledge - 32 mm (1-1/4") waste assembly (not included) .
Nominal Dimensions: 533 mm (21") wide x 445 mm (17-1/2") front to back x 175 mm (6-7/8") high.
Bowl Dimensions: 441 mm x 279 mm x 133 mm (17-3/8" x 11" x 5-1/4")
Shipping Weight:

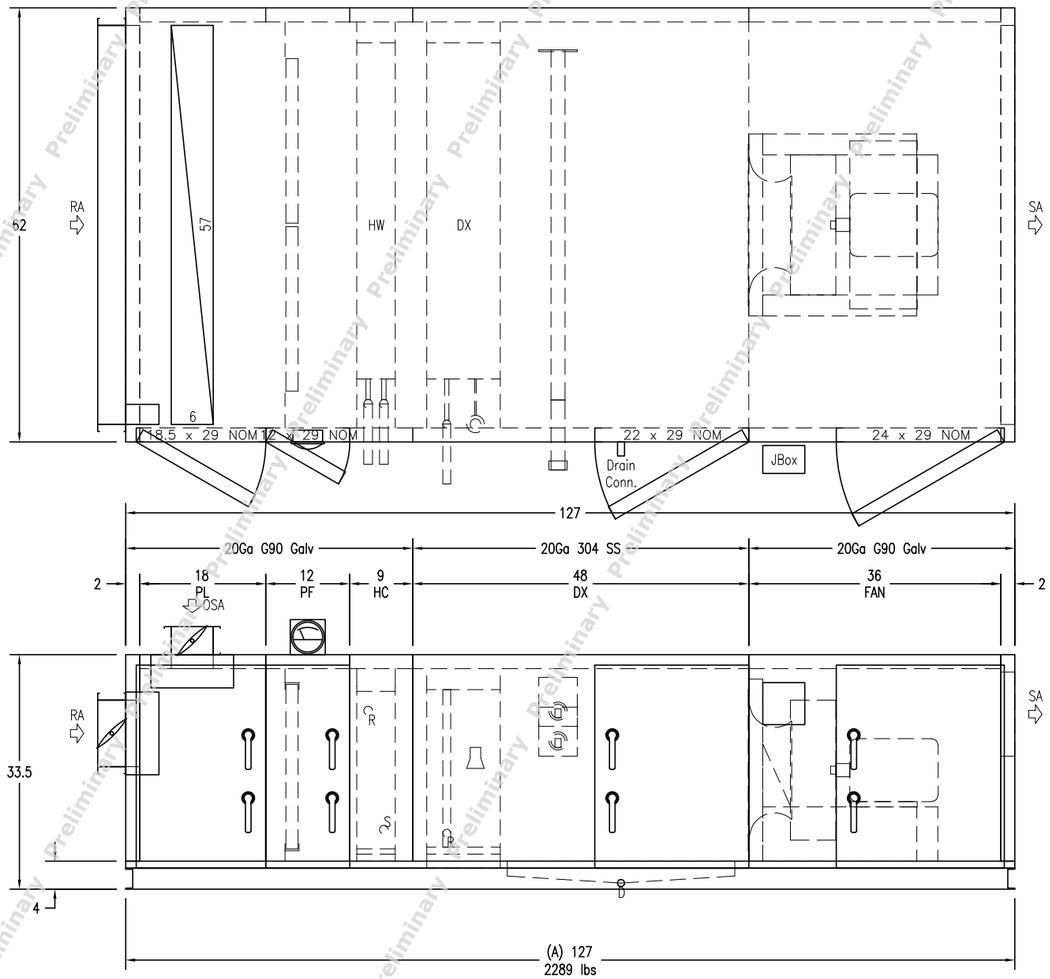






Note :	Drawing No. : **(347637) B14200 FAU15106 MPU13969 DR14801 SU6117 PT13977 CO14723**	Estimated Total:

Preliminary



Printed (dd/mm/yyyy): 21/12/2015

All dimensions shown in inches, Operating weights shown in pounds. Overall unit dimensions do not include lifting lugs, electrical panels, pipe connections, door handles, etc.
QX Construction 3,500 ACFM

Temtrol
a Nortek Air Solutions Brand
106 N Industrial Blvd.
Okarche, OK 73762
(405) 263-7286
www.temtrol.com

UofA – RCRF

Unit Tag		Unit Type	Dsg Qty
FC-03		Indoor	1
Rep Firm: Aqua Air Systems Ltd.: Edmonton Edmonton, AB, Canada		Weight 2,289	Box Qty 1
Rep Contact: Taylor Maron, (780) 465-8011	Model No		
NASDA Ver 6.2.0 / Factory SAE / Quote No	Job No	Date m/d/y 12/21/2015	Rev

STERN-WILLIAMS

Mop Sink

SB-900

Service / Mop Sink
terrazzo
Manual two (2) Handle Faucet

To be specified

Chicago Faucets

☒ **897-XK-CP Wall Mounted two (2) Handle utility / mop Faucet**, chrome plated, 8" (203 mm) centerset, solid brass exposed body, rigid copper connections, 1/4 turn ceramic disc valve cartridges, unrestricted hose end outlet, 203 mm (8") projection spout with atmospheric vacuum breaker and bucket hook, 60 mm (2-3/8") metal vandal proof lever handles with blue and red index buttons.

Stern Williams

☒ **T-35 Hose and Wall Hook** 36" (914 mm) long hose with 3/4" (19 mm) chrome coupling, stainless steel wall bracket.

☒ **T-40 Mop Hanger** stainless steel #4 finish, 24" (610 mm) long with 3 rubber spring loaded clips.

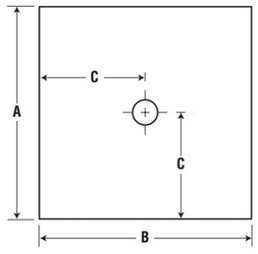
☒ **BP Back Splash Panel** 20 GA. (0.9 mm) type 304 stainless steel.

P-Trap

☒ **Provide P-Trap,** same material as the connecting pipe drain.

☒ **SB-900**

Service / Mop Sink square - floor mounted - terrazzo composed of pearl gray marble chips and Portland cement ground smooth sealed to resist stain - one piece stainless steel cast integral on all sides - without tiling flange - cast brass drain with stainless steel strainer, 3"(75 mm) outlet .
Nominal Dimensions: 610 mm (24") wide x 610 mm (24") x 305 mm (12") high
Shipping Weight:



Height all models 12", 305 MM

SERIES	A		B		C	
	INCHES	MM	INCHES	MM	INCHES	MM
900	24	610	24	610	12	305
800	24	610	24	610	12	305
700	32	813	32	813	16	406
600	32	813	32	813	16	406
500	36	914	36	914	18	457
400	36	914	36	914	18	457

Note :

Drawing No. : **(347946) S16141 FAU25553 HWH21329 MH21330 BSP21331 PT14019**

Estimated Total:

FRANKE COMMERCIAL SYSTEMS

SK-1-kitchenette

LBS6808-1/1

Single Bowl Countertop Mount Sink
stainless steel
Manual Single handle Faucet

To be specified

DXV

☒ **D35409300 Isle Single handle Faucet**, polished chrome, center hole only, ceramic disc valve cartridge, 5.7 LPM (1.5 GPM) aerator outlet, swivel gooseneck pull-out spout, lever handle, 9.5 mm (3/8") N.P.T. Inlets.

Lawler

☒ **TMM-1070 Below Deck Mechanical Water Mixing Valve**, bronze body, temperature adjusting dial, 10 mm (3/8") inlets and outlet compression fittings, high temperature thermostatic limit stop, shut-off with automatic reset when temperature exceeds 120 °F (48.8 °C), integral checks, offer temperature range from full cold through 46 °C (114.8 °F).

☒ **Provide tee, adaptors and flex. copper tubing to suit installation.**

☒ **Provide tempered water to hot side of faucet.**

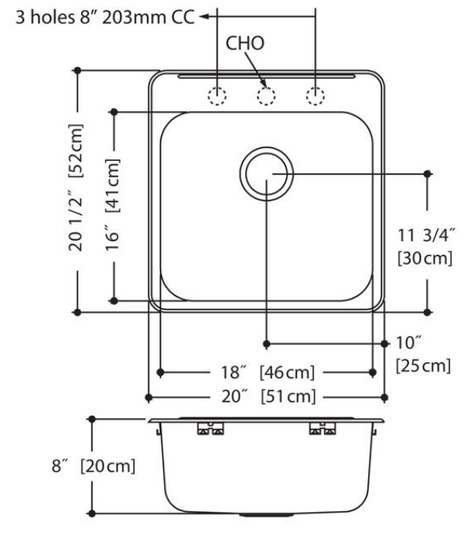
McGuire

☒ **LFH170BV Faucet Supplies**, chrome plated polished brass, commercial duty 1/4 turn ball valve angle stops, 13 mm (1/2") I.D. Inlet x 127 mm (5") horizontal extension tubes, combination V.P. Loose key handles, escutcheon and flexible copper risers.

☒ **8912CB P-Trap,** chrome plated, heavy cast brass adjustable body, with slip nut, 38 mm (1-1/2") size, with cleanout, box flange and seamless tubular wall bend.

☒ **LBS6808-1/1** - center hole only

Single Bowl Countertop Mount Sink - grade 18-10 20 GA. (0.9 mm) type 302 stainless steel - self-rimming - backledge - satin finish rim and bowls - mounting kit provided - fully undercoated to reduce condensation and resonance - factory applied rim seal - 3-1/2" (89 mm) crumb cup waste assembly with 1-1/2" (38 mm) tailpiece.
Nominal Dimensions: 508 mm (20") wide x 521 mm (20-1/2") x 203 mm (8") high
Shipping Weight:



Note :

Drawing No. : **(347650) S2410 FAU25562 MPU13969 SU6117 PT16027**

Estimated Total:

FRANKE COMMERCIAL SYSTEMS

SK-2-coffee

LBS1306-1/1

Single Bowl Countertop Mount Sink
stainless steel
Manual Single handle Faucet

To be specified

DXV

☒ **D35409300 Isle Single handle Faucet**, polished chrome, center hole only, ceramic disc valve cartridge, 5.7 LPM (1.5 GPM) aerator outlet, swivel gooseneck pull-out spout, lever handle, 9.5 mm (3/8") N.P.T. Inlets.

Lawler

☒ **TMM-1070 Below Deck Mechanical Water Mixing Valve**, bronze body, temperature adjusting dial, 10 mm (3/8") inlets and outlet compression fittings, high temperature thermostatic limit stop, shut-off with automatic reset when temperature exceeds 120 ºF (48.8 ºC), integral checks, offer temperature range from full cold through 46 °C (114.8 °F).

☒ **Provide tee, adaptors and flex. copper tubing to suit installation.**

☒ **Provide tempered water to hot side of faucet.**

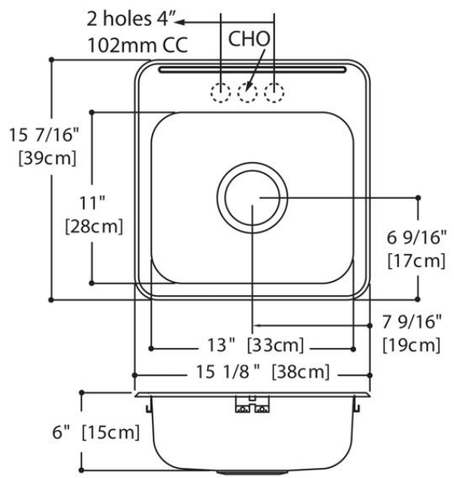
McGuire

☒ **LFH170BV Faucet Supplies**, chrome plated polished brass, commercial duty 1/4 turn ball valve angle stops, 13 mm (1/2") I.D. Inlet x 127 mm (5") horizontal extension tubes, combination V.P. Loose key handles, escutcheon and flexible copper risers.

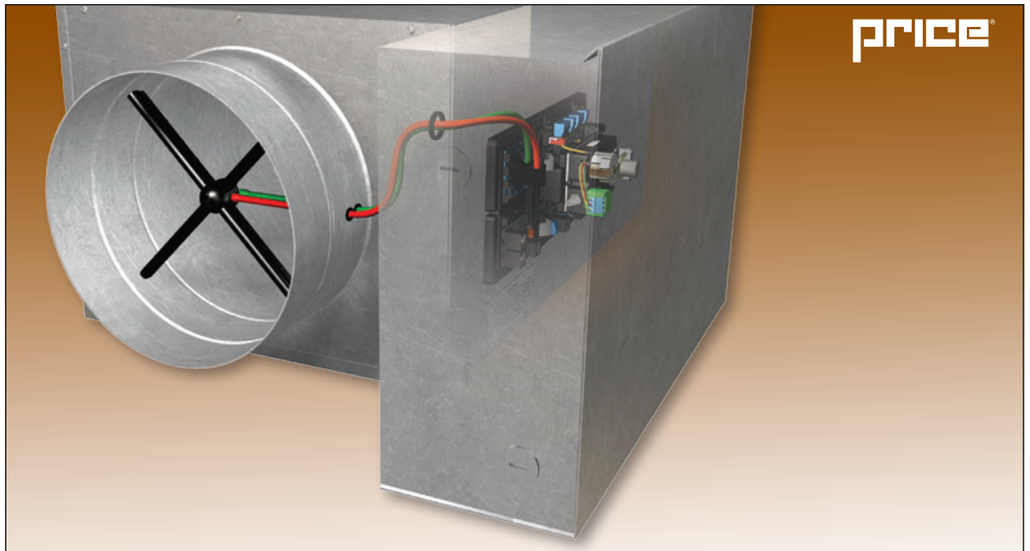
☒ **8912CB P-Trap,** chrome plated, heavy cast brass adjustable body, with slip nut, 38 mm (1-1/2") size, with cleanout, box flange and seamless tubular wall bend.

☒ **LBS1306-1/1** - center hole only

Single Bowl Countertop Mount Sink - grade 18-10 20 GA. (0.9 mm) type 302 stainless steel - self-rimming - backledge - satin finish rim and bowls - mounting kit provided - fully undercoated to reduce condensation and resonance - factory applied rim seal - 3-1/2" (89 mm) crumb cup waste assembly with 1-1/2" (38 mm) tailpiece.
Nominal Dimensions: 384 mm (15-1/8") wide x 392 mm (15-7/16") x 152 mm (6") high
Shipping Weight: 1.4 kg



Note :	Drawing No. : **(347653) S2308 FAU25562 MPU13969 SU6117 PT16027**	Estimated Total:



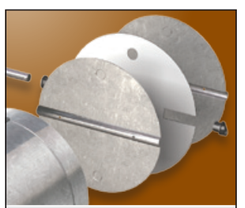
price

SPV/SDV Series

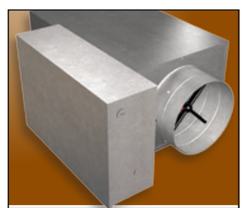
SINGLE DUCT TERMINAL UNITS

Price single duct terminal units are designed to control the airflow rate of conditioned air into an occupied space with minimal pressure drop and low noise levels. An extensive selection of liners is available where indoor air quality is critical. Control options can be chosen to suit almost any application with pneumatic, analog and DDC.

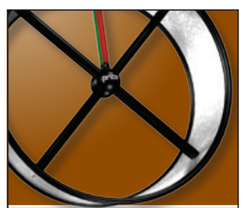
Clean and efficient design produces minimal pressure drop and low noise.



Robust damper design is proven to operate to over 1.5M cycles



Compact configuration makes it easier to use in crowded mechanical spaces



SP300 multipoint sensor for accurate duct air velocity pressure measurement

Selection of liners available for hospital applications

AHRI CERTIFIED™ www.ahridirectory.org
VAV Terminals
AHRI Standard 880

www.priceindustries.com for additional product information, including product videos and brochures.

WC-1-BARRIER FREE

TOTO®

MS604114CUFG

UltraMax® II 1G One-Piece Toilet, 1.0 GPF

FEATURES

- Double Cyclone® flushing system, ultra-high efficiency (1.0GPF/3.8LPF)
- SanaGloss glaze minimizes debris, mold and bacteria from sticking to porous, ceramic surfaces
- Universal Height
- Decorative one-piece design with high-profile tank
- Elongated front bowl with SoftClose® seat (SS114)
- 12" rough-in
- Chrome trip lever

MODELS

- MS604114CUFG
  With SanaGloss ceramic glaze, SS114 SoftClose seat included (#01)

COLORS/FINISHES

- #01 Cotton

PRODUCT SPECIFICATION

The one-piece, ultra-high efficiency Double Cyclone flushing system toilet shall be 1.0GPF/3.8LPF. Toilet shall have SanaGloss ceramic glaze and be at Universal Height. Toilet shall have high-profile tank, elongated front bowl with SoftClose seat and Chrome trip lever. Toilet shall be **TOTO Model MS604114CUFG__.**

SanaGloss

CYCLONE® FLUSHING SYSTEM BY TOTO

CODES/STANDARDS

- Meets and exceeds [ASME A112.19.2] CSA B45.1
- Certifications: IAPMO(cUPC), EPA Watersense, State of Massachusetts , City of Los Angeles, and others
- Code compliance: UPC, IPC, NSPC, NPC Canada, and others
- Legislative Compliance: California AB715, California Green Building Code, City of Los Angeles Water Efficiency Ordinance
- ADA compliant (when installed with trip lever located on the approach side)

MS604114CUFG

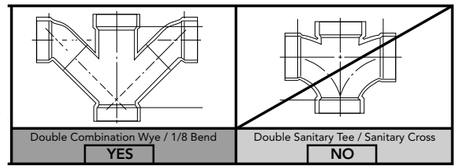
UltraMax® II 1G One-Piece Toilet, 1.0 GPF

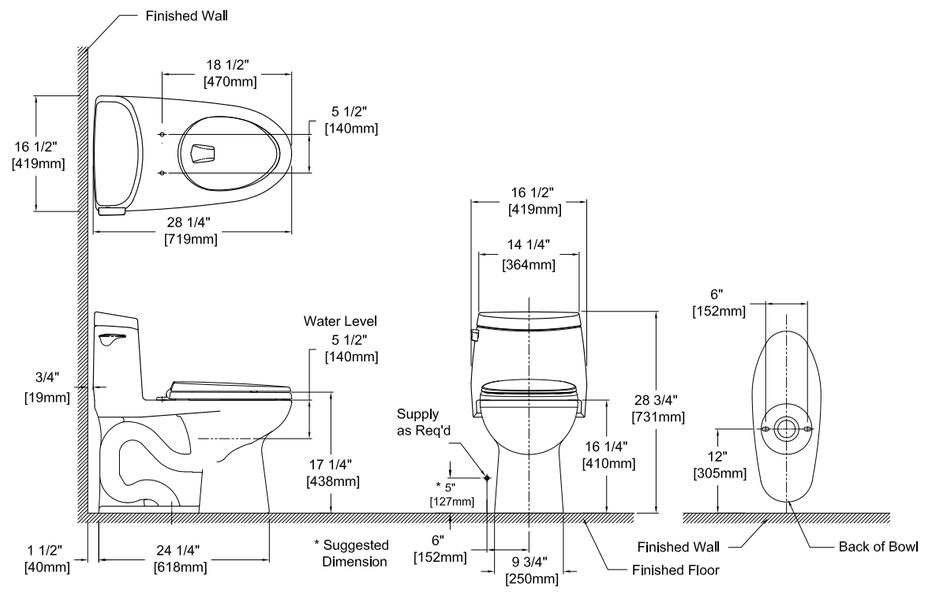
SPECIFICATIONS

Water Use	1.0 GPF/3.8LPF
Flush System	Double Cyclone®
Min. Water Pressure	8 psi (static)
Water Surface	7-1/8" x 9-1/8"
Trap Diameter	2-1/8"
Rough-in	12"
Trap Seal	2-1/8"
Warranty	One Year Limited Warranty
Material	Vitreous china
Shipping Weight	99 lbs.
Shipping Dimensions	32"L x 20"W x 17-3/4" H[1] x 28-3/4" H[2]

INSTALLATION NOTES

Back-to-Back Toilet Installations:
TOTO recommends the use of a nationally listed, double sanitary tee-wye only, in vertical waste stacks, in accordance with the stipulations noted in the majority of nationally recognized plumbing codes.





TOTO®

These dimensions and specifications are subject to change without notice

Ph: (888) 295-8134 | Fax: (800) 699-4889 | www.totousa.com

#SS-00971 v.01

WATTS DRAINAGE

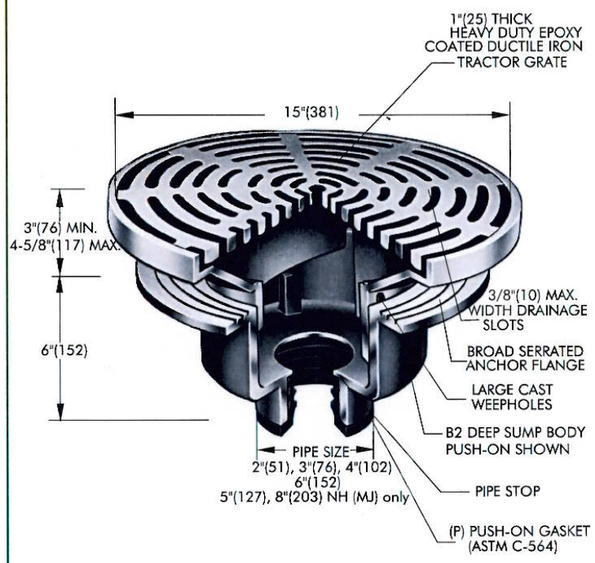
FD-360

Tag: _____

Area Drain with 15" Round Adjustable Top

Components:

SPECIFICATION: Watts Drainage Products FD-360 epoxy coated cast iron area drain with anchor flange, weepholes, 15"(381) diameter adjustable top with ductile iron (standard) tractor grate, no hub (MJ) (standard) outlet.



Load Rating & Free Area

Suffix	Load Rating	Free Area Sq. In.
-1	*XHD	61
-4	*XHD	61

* The load classifications are in accordance with the American National Standards ASME A112.21.1M
ASME Ratings are as follows:
XHD - Safe Live Load 7500-10000 lbs.(3375-4500kg)
The above categories are given as a guide only.
Please consult factory.

Order Code: FD-36☐☐-☐-☐

Ex. FD-362P-1

Pipe Sizing (Select One)

Suffix	Description	
2	2"(51) Pipe Size	☐
3	3"(76) Pipe Size	☐
4	4"(102) Pipe Size	☐
5	5"(127) Pipe Size	☐
6	6"(152) Pipe Size	☐
8	8"(203) Pipe Size	☐

Outlet Type (Select One)

Suffix	Description	
NH	No Hub (MJ)	☐
P	Push On	☐
T	Threaded Outlet	☐
X	Inside Caulk	☐

Grade (Select One)

Suffix	Description	
-1	15"(381) Nickel Bronze	☐
-4	15"(381) Ductile Iron	☐

Options (Select One or More)

Suffix	Description	
-5	Sediment Bucket	☐
-6	Vandal Proof	☐
-8	Backwater Valve (3" / 4" Only)	☐
-10	Secured Top c/w Phillips screws	☐
-12	Galvanized Top	☐
-13	All Galvanized	☐
-15	Adj. Extension (4"- 5-5/8")	☐
-113M	Special Epoxy from 3M Range	☐
-F4-50	4" Round Cast Iron Funnel	☐
-F4-1	4" Round Nickel Bronze Funnel	☐
-F6-1	6" Round Nickel Bronze Funnel	☐
-G-50	4x9" Oval Cast Iron Funnel	☐
-G-1	4x9" Oval Nickel Bronze Funnel	☐
-Z	Elastomeric Flange	☐

Job Name _____ Contractor _____

Job Location _____ Contractor's P.O. No. _____

Engineer _____ Representative _____

WATTS DRAINAGE
CANADA: 5435 North Service Road, Burlington, ON, L7L 5H7 TEL: 905-332-6718 TOLL-FREE: 1-888-208-8927 Website: www.wattsdrainage.ca
CANADA

ES-WD-FD-360 CANADA 0403

(Dimension) Denotes Millimeters

48

PAGE INTENTIONALLY LEFT BLANK

APPENDIX B: Energy Modelling Report

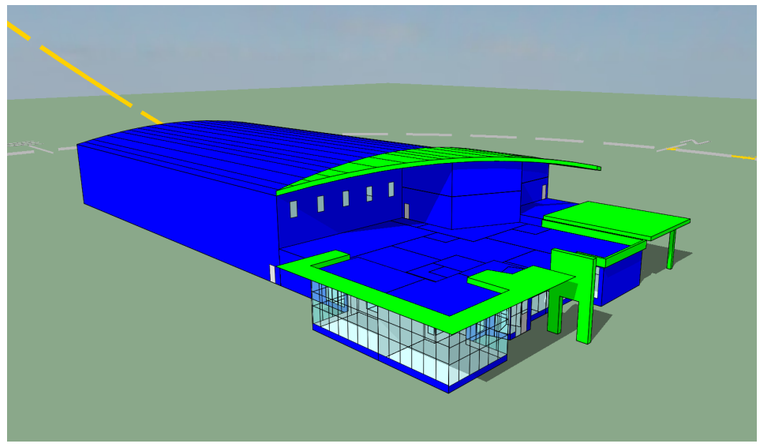
Energy Model - Introduction

The Green Globes rating system requires Energy Modelling as an integral part of the certification system. Typically, one energy model is performed for the proposed building and the predicted energy use intensity (kWh/m^2/year) is compared to a target value which is derived from comparable buildings found in a BOMA energy consumption database. However, because this database contains mostly "mainstream" building types, there is no category that can be applied to this building. Essentially, there is no data to compare this building to. For this reason, the design team has been instructed (by Gord Shymko – Green Globes verifier) to compare the building to the ASHRAE 90.1-07 Appendix G baseline building. Points will be awarded based on an energy reduction relative to the baseline, according to the following scale:

Energy Savings	Points
>5%	15
>10%	30
>15%	45
>20%	60
>25%	75
>30%	90
>35%	105
>40%	120
>45%	135
>50%	150

Energy Modelling Methodology

The preliminary energy model for the UofA RCRF building has been performed using the latest version of the IES Virtual Environment (IES VE 2015). A snapshot of the building model can be seen below:



Proposed Model

The preliminary energy model is based on design development drawings and all building information available at the time. The floor plans have been frozen before the commencement of modelling so the model should reflect the final building layout. Other data is based on preliminary drawings and information which includes:

- Preliminary envelope constructions (R20 Walls, R30 Roof – effective R-values)
- Dual pane low-e glazing (U=1.36 W/m^{2}K (center glass) and U=1.79 W/m^{2}K with frame)
- Preliminary lighting density estimates for each space (W/m^2)
  Note: 10% power adjustment has been taken to take credit for occupancy sensors (as per Table G3.2 of Appendix G).
- Equipment power density (plug loads) for office areas based on Ashrae estimates.
- Occupant density based on client feedback (12-15 people)
- Building schedules as per client feedback (7am-4:30pm Mon-Fri)
- Temperature setpoints as per mechanical development report.
- HVAC systems and equipment as per preliminary Mechanical drawings.
  Note: Since equipment sizing was not yet available, the proposed systems were autosized based on calculated demand for each space.
- Zoning as per mechanical drawings.
- Ventilation as per mechanical drawings.
- Pumping power was estimated using the same pump power values as the baseline building (301 W/L/s).

Baseline Model

The preliminary baseline model is based on the exact same building geometry and zoning as the proposed model but will follow the prescriptive requirements of ASHRAE 90.1-07 Appendix G. As per the requirements of Appendix G, the following information must be the same in the baseline building as the proposed building:

- Equipment power density (plug loads)
- Occupancy density
- Building operation schedule
- Infiltration
- Ventilation requirements
- Temperature setpoints

The following are Appendix G specific requirements that differ from the proposed building:

- Shading (overhangs etc..) from proposed model has been removed from baseline model.
- Envelope requirements (including wall construction, roof construction, floor construction, door construction and glazing) are set as per Table 5.5-7 of Ashrae 90.1-07.
- Lighting power densities as per Table 9.6.1 using the space-by-space method.
- Baseline HVAC system as per Table G3.1.1A – System

5 – Packaged VAV with Reheat (this includes a hot-water fossil fuel boiler for heating and direction expansion for cooling)
- Baseline HVAC system for the Communications Room and warehouse storage areas (Book Storage and Film Storage) will be set to System 3 – Packaged Single Zone as per exceptions in section G3.1.1.
- Cooling and heating coils oversized by 15 and 25%, respectively.
- Based on requirements of G3.1.2.10, baseline systems will *not* include exhaust air energy recovery.
- Based on requirements of G3.1.2.6, outside air economizers will be included in baseline systems.

Energy Model Results

The following represent the results of the preliminary energy modelling, broken down for each category. For more detailed modelling results, please see the attached Energy Modelling Report. Please note that based on the preliminary nature of the building design, not all building equipment was fully modelled. In some cases, estimates and approximations were used; however, as much as possible, estimates were used that were equal to the requirements of the baseline building (for example, pump power requirements).

Optional Energy Saving Measures (Envelope)

Two optional scenarios for the building envelope have been run to determine what possible improvements could be made to the building envelope and to increase the percent savings over the baseline building. Only two are presented here but other energy saving measures can be analyzed as needed to optimize the building design and energy savings.

Option 1 – Install Triple Pane Windows with U=0.68 (center of glass) and SHGC=0.23.

By specifying triple pane windows for all glazing, the percent energy savings can be improved to 18.1% over the baseline building (from the current 16.5%). Because the glass only accounts for 10% of the building wall area, the effect is not significant. Furthermore, as the energy savings does not increase above 20%, no additional points would be awarded towards Green Globes certification.

Option 2 – Install Triple Pane Windows as above and improve wall and roof R-values to R-30/R-40 respectively.

By specifying triple pane windows *and* improving the effective wall and roof R-values to R-30 and R-40 respectively, the percent energy savings can be increased to 20.3%. This would increase the points awarded from 45 to 60.

End Use	Proposed (kWh)	Baseline (kWh)	Percent Savings (%)
Lighting	36,930	52,103	29.1
Heating	253,032	410,465	38.4
Cooling	166,007	119,419	-39.0
Pumps	22,344	1,473	-1,417
Heat Rejection	10,596	7,623	-39.0
Fans	441,004	529,074	16.6
Plug Loads	30,456	30,456	0
Total Annual Energy Use (kWh/year)	**960,369**	**1,150,613**	**16.5**
Energy Use Intensity (kWh/m²/year)	**229.6**	**273.9**	**16.5**

Based on the above energy savings, the building is expected to receive **45** points towards Green Globes certification.

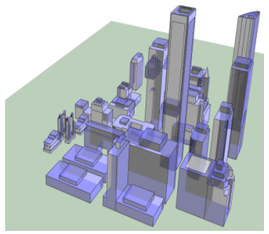
15094 - UofA RCRF.mit

General info *Space summary* *Advisory messages* *Proposed vs baseline* *Energy type summary* *On site renewables*
Exceptional calc measure *Report*

INTEGRATED ENVIRONMENTAL SOLUTIONS LTD IES

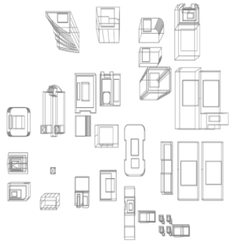
1.1 General information

Building City,Zip,Country



Building Form

Building Plan



Responsible individual: Name
Company name: IES

Simulation program:
Integrated Environmental Solutions
Virtual Environment version 2015

Energy Code:
ASHRAE 90.1 - 2007 Appendix G

Model data:

Project file	15094 - UofARCRF.mit
Model floor area[1]	4201.62 m2
Building floor area[2]	4190.06 m2
Building volume[3]	40073.25 m3
Number of conditioned rooms	29
No of floors	3

Heating calculation data:

Principal heating source	Electricity
Results file	Loads.htg
Calculated	29/Dec/2015 13:56

Cooling calculation data:

Principal cooling source	Electricity
Results file	Loads.clg
Calculated	29/Dec/2015 13:56

Design weather:

Source	ASHRAE design weather database
Weather location	Edmonton Intl Airport , Alberta
Weather file	Edmonton_AB_CWEC

Climate zone:

ASHRAE 90.1	7
Koeppen-Geiger	Dfb

Construction:

New construction %	100
Existing construction %	0

This report produces output in accordance with the LEE NC 2009 Submittal Template, 2007 - option 1: Performance Rating Method

The Virtual Environment software has all the capabilitie described in G2 Simulation General Requirements in Appendix G of ASHRAE 90.1 - 2007

The baseline building and proposed building in this project's energy simulation runs use the assumptions an modelling methodology described in Appendix G of ASHRAE 90.1 - 2007

The report outputs that sequence with the following 90. sections:

1.1 - General info
1.2 - Space Summary
1.3 - Advisory messages
1.4 - Comparison of proposed design versus baseline design energy model inputs
1.5 - Energy type summary
1.6 - On site renewable energy (if applicable)
1.7 - Exceptional calculation measure summary (if applicable)
1.8 - Performance rating method compliance report

1. 'Model floor area' is the total floor area of all rooms i the building regardless of whether they are conditioned

2. 'Building floor area' is the total area of all rooms for which 'Include in building floor area' is ticked in 'Room Data' (used for loads metrics in this report)

3. 'Building volume' is the total volume of all rooms for which 'Include in building floor area' is ticked in 'Room Data'

1.2 - Space Summary

Table 1.2 Space Summary

Building Use (Occupancy type)	Conditioned Area m^2	Un-conditioned Area m^2	Total Area m^2
A-Z	Hi/Lo	Hi/Lo	Hi/Lo
SPACE: Active storage	14	0	14
SPACE: Conference/ Meeting/ Multipurpose	66	0	66
SPACE: Corridor/ Transition	34	0	34
SPACE: Dining area	21	0	21
SPACE: Electrical/ Mechanical	522	0	522
SPACE: Inactive storage	24	0	24
SPACE: Lobby	26	0	26
SPACE: Office - Enclosed	63	0	63
SPACE: Office - Open plan	608	0	608
SPACE: Restrooms	22	0	22
SPACE: Stairs - Active	21	0	21
SPACE: Void/Plenum	0	332	332
SPACE: Warehouse - Fine material storage	2,768	0	2768
Totals	4,190.1	332.2	4,522.3

1.3 - Advisory Messages

Table 1.3 - Advisory messages

Advisory Messages	Proposed Building	Baseline Building	Difference
Number of hours heating loads not met:	349.0	64.3	-284.7
Number of hours cooling loads not met:	187.0	0.5	-186.5
Number of warning messages:	0	0	0.0
Number of error messages:	0	0	0.0
Number of defaults overridden			

1.4 - Comparison of Proposed versus Baseline Design

Table 1.4 - Proposed vs Baseline Const.

Model Input parameter Construction	Proposed		Baseline	
	Description	Input U value / % (area weighted)	Description	Input U value / % (area weighted)
Exterior wall construction	Steel Framing at 24 in. OC (R-11 Ins. + R-11.0 Cont. Ins.)	0.29	CZ7 Ext Wall (Non-Res) - Steel Framed; R-13.0 + 7.5 (2.3 + 1.3); U=0.064 (0.365)	0.36
Roof construction	2013 Roof	0.18	CZ7 Roof (Non-Res) - Ins Above Deck; R-20 (3.5); U=0.048 (0.273)	0.27
Roof construction	Roofs with Insulation Entirely Above Deck Insulation Entirely Above Deck (R-30 Ins.)	0.18		
Floor/slab construction	2013 Exposed Floor	0.22	Ground contact floor: U=F(0.899982)*Floor perim. (311.43m)/Floor area(3774.46m^2)	0.07
Floor/slab construction	Ground contact floor: U=F(0.899982)*Floor perim. (311.43m)/Floor area(3774.46m^2)	0.07	CZ7 Floor (Non-Res) - Steel Joist; R-30.0 (5.3); U=0.038 (0.214)	0.21
Window to gross wall ratio	Overall	10%	Overall	10%
Window to gross wall ratio	North / South / East / West	4 / 12 / 19 / 9%	North / South / East / West	4 / 12 / 19 / 9%
Fenestration U-Value (North)	UofA - RCRF - Dual Pane	1.79	CZ7 Window (Non-Res) - Metal framing (all other) U=0.45(2.56); SHGC=0.45	2.56
Fenestration U-Value (North)	2013 Internal Window	4.18		
Fenestration U-Value (non - North)	UofA - RCRF - Dual Pane	1.79	CZ7 Window (Non-Res) - Metal framing (all other) U=0.45(2.56); SHGC=0.45	2.56
Fenestration U-Value (non - North)	2013 Internal Window	4.18		
Fenestration SHGC - North	UofA - RCRF - Dual Pane	0.32	CZ7 Window (Non-Res) - Metal framing (all other) U=0.45(2.56); SHGC=0.45	0.47
Fenestration SHGC - North	2013 Internal Window	0.87		
Fenestration SHGC - non - North	UofA - RCRF - Dual Pane	0.32	CZ7 Window (Non-Res) - Metal framing (all other) U=0.45(2.56); SHGC=0.45	0.47
Fenestration SHGC - non - North	2013 Internal Window	0.87		
Fenestration visual light transmittance (N)	UofA - RCRF - Dual Pane	0.71	CZ7 Window (Non-Res) - Metal framing (all other) U=0.45(2.56); SHGC=0.45	0.76
Fenestration visual light transmittance (N)	2013 Internal Window	0.41		
Fenestration visual light transmittance	UofA - RCRF - Dual Pane	0.71	CZ7 Window (Non-Res) - Metal framing (all other) U=0.45(2.56); SHGC=0.45	0.76
Fenestration visual light transmittance	2013 Internal Window	0.41		
Shading devices				

Table 1.4 - Proposed vs Baseline MEP

Model Input parameter MEP	Proposed		Baseline	
	Description	Input (area weighted)	Description	Input (area weighted)
Other Lighting Controls				
Interior lighting power density	Total power density (W/m^2)	9.51	Total power density (W/m^2)	13.32
Day lighting controls	Radiance simulation	No	Radiance simulation	No
Exterior lighting power	Total power consumption (kW)	0.00	Total power consumption (kW)	0.00
Process lighting	Total power density (W/m^2)	0.00	Total power density (W/m^2)	0.00
Receptacle equipment	Total power density (W/m^2)	2.14	Total power density (W/m^2)	2.14
Elevators/escalators	Total power density (W/m^2)	0.00	Total power density (W/m^2)	0.00
Refridgeration equipment	Total power density (W/m^2)	0.00	Total power density (W/m^2)	0.00
Cooking equipment	Total power density (W/m^2)	0.00	Total power density (W/m^2)	0.00
Data processing/centre equipment	Total power density (W/m^2)	0.00	Total power density (W/m^2)	0.00

Table 1.4 - Proposed vs Baseline HVAC

Model Input parameter HVAC	Proposed		Baseline	
	Description	Performance SCop / SSEER Cfm / SFP / kW	Description	Performance SCop / SSEER Cfm / SFP / kW
Primary HVAC system				
Other HVAC system				
Fan supply power				
Fan power				
Economiser control				
Demand control ventilation				
Unitary equip cooling efficiency				
Unitary equip heating efficiency				
Chiller				
Chilled water loop and pump				
Boiler				
Hot water loop and pump				
Cooling tower				
Condenser water loop and pump				

1.5 - Energy Type Summary

Table 1.5 - Energy type summary

Energy Type Proposed / baseline design	Utility rate description	Units of Energy	Units of demand
Electricity	Commercial Unrestricted Tariff (£ GBP)	kWh	kW
Gas	Commercial Standard Tariff A (£ GBP)	kWh	kW
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-

1.6 - On Site Renewable Energy

Table 1.6 - On site Renewables

Renewable Source	Back up Energy Type	Annual Energy Generated (kWh)	Rated Capacity (kW)	Renewable Energy Cost (GBP)
Photovoltaic Panels	Electricity	0.00	0.00	0.00
Wind Power	Electricity	0.00	0.00	0.00
Combined Heat and Power (electricity)	Electricity	0.00	0.00	0.00
Solar Water Heating	Electricity	0.00	0.00	0.00

1.7 - Exceptional Calculation Measures

The Energy Analysis does not include exceptional calculation method (s)

1.8.1 Baseline Performance

Table 1.8.1 - Baseline Performance - PRM

End Use	Process	Baseline Design Energy Type	Units of Annual Energy & peak demand	Baseline 0 rotation	Baseline 90 rotation	Baseline 180 rotation	Baseline 270 rotation	Baseline Solution
Internal Lighting	No	Electricity	Energy use kWh	52,103.32	52,103.32	52,103.32	52,103.32	52,103.32
Internal LightingDemand	No	Electricity	Demand kW	22.35	22.35	22.35	22.35	22.35
Exterior Lighting	No	Electricity	Energy use kWh	0.00	0.00	0.00	0.00	0.00
Exterior LightingDemand	No	Electricity	Demand kW	0.00	0.00	0.00	0.00	0.00
Space Heating (Fossil Fuel)	No	Gas	Energy use kWh	405,742.03	409,049.84	414,845.31	412,221.41	410,464.65
Space Heating (Fossil Fuel)Demand	No	Gas	Demand kW	305.59	353.65	305.68	305.86	317.70
Space Heating	No	Electricity	Energy use kWh	0.00	0.00	0.00	0.00	0.00
Space HeatingDemand	No	Electricity	Demand kW	0.00	0.00	0.00	0.00	0.00
Space Cooling	No	Electricity	Energy use kWh	121,562.93	118,146.35	116,963.50	121,003.65	119,419.11
Space CoolingDemand	No	Electricity	Demand kW	63.14	63.44	61.31	61.33	62.30
Pumps	No	Electricity	Energy use kWh	1,465.24	1,447.20	1,484.96	1,495.70	1,473.28
PumpsDemand	No	Electricity	Demand kW	0.38	0.38	0.38	0.38	0.38
Heat Rejection	No	Electricity	Energy use kWh	7,759.34	7,541.26	7,465.75	7,723.64	7,622.50
Heat RejectionDemand	No	Electricity	Demand kW	4.03	4.05	3.91	3.91	3.98
Fans Interior	No	Electricity	Energy use kWh	532,171.39	516,679.02	526,696.35	540,749.94	529,074.17
Fans InteriorDemand	No	Electricity	Demand kW	66.63	64.88	66.27	67.64	66.35
Fans Parking Garage	No	Electricity	Energy use kWh	0.00	0.00	0.00	0.00	0.00
Fans Parking GarageDemand	No	Electricity	Demand kW	0.00	0.00	0.00	0.00	0.00
Service Water Heating (Fossil Fuel)	No	Gas	Energy use kWh	0.00	0.00	0.00	0.00	0.00
Service Water Heating (Fossil Fuel)Demand	No	Gas	Demand kW	0.00	0.00	0.00	0.00	0.00
Service Water Heating	No	Electricity	Energy use kWh	0.00	0.00	0.00	0.00	0.00
Service Water HeatingDemand	No	Electricity	Demand kW	0.00	0.00	0.00	0.00	0.00
Combined Heat and Power (heat)	No	Gas	Energy use kWh	0.00	0.00	0.00	0.00	0.00
Combined Heat and Power (heat)Demand	No	Gas	Demand kW	0.00	0.00	0.00	0.00	0.00
Receptacle Equipment	Yes	Electricity	Energy use kWh	30,455.73	30,455.73	30,455.73	30,455.73	30,455.73
Receptacle EquipmentDemand	Yes	Electricity	Demand kW	8.20	8.20	8.20	8.20	8.20
Interior Lighting Process	Yes	Electricity	Energy use kWh	0.00	0.00	0.00	0.00	0.00
Interior Lighting ProcessDemand	Yes	Electricity	Demand kW	0.00	0.00	0.00	0.00	0.00
Refrigeration	Yes	Electricity	Energy use kWh	0.00	0.00	0.00	0.00	0.00
RefrigerationDemand	Yes	Electricity	Demand kW	0.00	0.00	0.00	0.00	0.00
Data Centre Equipment	Yes	Electricity	Energy use kWh	0.00	0.00	0.00	0.00	0.00
Data Centre EquipmentDemand	Yes	Electricity	Demand kW	0.00	0.00	0.00	0.00	0.00
Cooking (Fossil Fuel)	Yes	Gas	Energy use kWh	0.00	0.00	0.00	0.00	0.00
Cooking (Fossil Fuel)Demand	Yes	Gas	Demand kW	0.00	0.00	0.00	0.00	0.00
Cooking	Yes	Electricity	Energy use kWh	0.00	0.00	0.00	0.00	0.00
CookingDemand	Yes	Electricity	Demand kW	0.00	0.00	0.00	0.00	0.00
Elevators Escalators	Yes	Electricity	Energy use kWh	0.00	0.00	0.00	0.00	0.00
Elevators EscalatorsDemand	Yes	Electricity	Demand kW	0.00	0.00	0.00	0.00	0.00
Other Processes	Yes	Electricity	Energy use kWh	0.00	0.00	0.00	0.00	0.00
Other ProcessesDemand	Yes	Electricity	Demand kW	0.00	0.00	0.00	0.00	0.00
Total Annual Energy Use kWh/year				1,151,259.99	1,135,422.72	1,150,014.92	1,165,753.38	**1,150,612.75**
Total Process Energy kWh/year								**30,455.73**

1.8.2 Performance Rating Table - PRM Compliance

Table 1.8.2 - Performance Rating

End Use	Process	Proposed Design Energy Type	Proposed Design Units	Proposed Building Results	Baseline Design Units	Baseline Building Results	Percent Savings %
Internal Lighting	No	Electricity	Energy use kWh	36,930.20	Energy use kWh	52,103.32	29.1
Internal Lighting	No	Electricity	Demand kW	15.63	Demand kW	22.35	30.1
Exterior Lighting	No	Electricity	Energy use kWh	0.00	Energy use kWh	0.00	0.0
Exterior Lighting	No	Electricity	Demand kW	0.00	Demand kW	0.00	0.0
Space Heating (Fossil Fuel)	No	Gas	Energy use kWh	253,031.89	Energy use kWh	410,464.65	38.4
Space Heating (Fossil Fuel)	No	Gas	Demand kW	263.19	Demand kW	317.70	17.2
Space Heating	No	Electricity	Energy use kWh	0.00	Energy use kWh	0.00	0.0
Space Heating	No	Electricity	Demand kW	0.00	Demand kW	0.00	0.0
Space Cooling	No	Electricity	Energy use kWh	166,006.91	Energy use kWh	119,419.11	-39.0
Space Cooling	No	Electricity	Demand kW	59.28	Demand kW	62.30	4.9
Pumps	No	Electricity	Energy use kWh	22,344.43	Energy use kWh	1,473.28	-1,416.6
Pumps	No	Electricity	Demand kW	9.86	Demand kW	0.38	-2,520.0
Heat Rejection	No	Electricity	Energy use kWh	10,596.19	Energy use kWh	7,622.50	-39.0
Heat Rejection	No	Electricity	Demand kW	3.78	Demand kW	3.98	4.9
Fans Interior	No	Electricity	Energy use kWh	441,004.06	Energy use kWh	529,074.17	16.6
Fans Interior	No	Electricity	Demand kW	53.48	Demand kW	66.35	19.4
Fans Parking Garage	No	Electricity	Energy use kWh	0.00	Energy use kWh	0.00	0.0
Fans Parking Garage	No	Electricity	Demand kW	0.00	Demand kW	0.00	0.0
Service Water Heating (Fossil Fuel)	No	Gas	Energy use kWh	0.00	Energy use kWh	0.00	0.0
Service Water Heating (Fossil Fuel)	No	Gas	Demand kW	0.00	Demand kW	0.00	0.0
Service Water Heating	No	Electricity	Energy use kWh	0.00	Energy use kWh	0.00	0.0
Service Water Heating	No	Electricity	Demand kW	0.00	Demand kW	0.00	0.0
Combined Heat and Power (heat)	No	Gas	Energy use kWh	0.00	Energy use kWh	0.00	0.0
Combined Heat and Power (heat)	No	Gas	Demand kW	0.00	Demand kW	0.00	0.0
Receptacle Equipment	Yes	Electricity	Energy use kWh	30,455.73	Energy use kWh	30,455.73	0.0
Receptacle Equipment	Yes	Electricity	Demand kW	8.20	Demand kW	8.20	0.0
Interior Lighting Process	Yes	Electricity	Energy use kWh	0.00	Energy use kWh	0.00	0.0
Interior Lighting Process	Yes	Electricity	Demand kW	0.00	Demand kW	0.00	0.0
Refrigeration	Yes	Electricity	Energy use kWh	0.00	Energy use kWh	0.00	0.0
Refrigeration	Yes	Electricity	Demand kW	0.00	Demand kW	0.00	0.0
Data Centre Equipment	Yes	Electricity	Energy use kWh	0.00	Energy use kWh	0.00	0.0
Data Centre Equipment	Yes	Electricity	Demand kW	0.00	Demand kW	0.00	0.0
Cooking (Fossil Fuel)	Yes	Gas	Energy use kWh	0.00	Energy use kWh	0.00	0.0
Cooking (Fossil Fuel)	Yes	Gas	Demand kW	0.00	Demand kW	0.00	0.0
Cooking	Yes	Electricity	Energy use kWh	0.00	Energy use kWh	0.00	0.0
Cooking	Yes	Electricity	Demand kW	0.00	Demand kW	0.00	0.0
Elevators Escalators	Yes	Electricity	Energy use kWh	0.00	Energy use kWh	0.00	0.0
Elevators Escalators	Yes	Electricity	Demand kW	0.00	Demand kW	0.00	0.0
Other Processes	Yes	Electricity	Energy use kWh	0.00	Energy use kWh	0.00	0.0
Other Processes	Yes	Electricity	Demand kW	0.00	Demand kW	0.00	0.0
Total Annual Energy Use kWh/year				960,369.42		1,150,612.75	**16.5**
Total Process Energy kWh/year				30,455.73		30,455.73	**0.0**

1.8.1 (b) Baseline Energy Costs

Table 1.8.1 (b) - Baseline Energy Costs

Energy Type	Baseline 0 rotation (GBP)	Baseline 90 rotation (GBP)	Baseline 180 rotation (GBP)	Baseline 270 rotation (GBP)	Baseline Building Performance (GBP)
Electricity	70,240.52	68,437.07	69,265.72	70,995.44	69,734.69
Gas	12,060.39	12,158.63	12,330.78	12,252.82	12,200.65
Coal	0.00	0.00	0.00	0.00	0.00
Oil	0.00	0.00	0.00	0.00	0.00
-	0.00	0.00	0.00	0.00	0.00
-	0.00	0.00	0.00	0.00	0.00
-	0.00	0.00	0.00	0.00	0.00
-	0.00	0.00	0.00	0.00	0.00
-	0.00	0.00	0.00	0.00	0.00
-	0.00	0.00	0.00	0.00	0.00
-	0.00	0.00	0.00	0.00	0.00
-	0.00	0.00	0.00	0.00	0.00
-	0.00	0.00	0.00	0.00	0.00
-	0.00	0.00	0.00	0.00	0.00
Total Baseline Costs:	82,300.91	80,595.70	81,596.50	83,248.26	**81,935.34**

1.8.2 (b) Energy Cost & Consumption by energy Type - PRM Compliance

Table 1.8.2 (b) - Energy Cost

Energy Type	Units	Proposed Design		Baseline Design		Percent Savings	
		Energy Use	Cost (GBP)	Energy Use	Cost (GBP)	Energy Use	Cost
Electricity	kWh	707,337.53	66,643.94	740,148.11	69,734.69	4.43	4.43
Gas	kWh	253,031.89	7,524.92	410,464.65	12,200.65	38.35	38.32
Subtotal (Model Outputs):		960,369.42	74,168.86	1,150,612.75	81,935.34	16.53	9.48

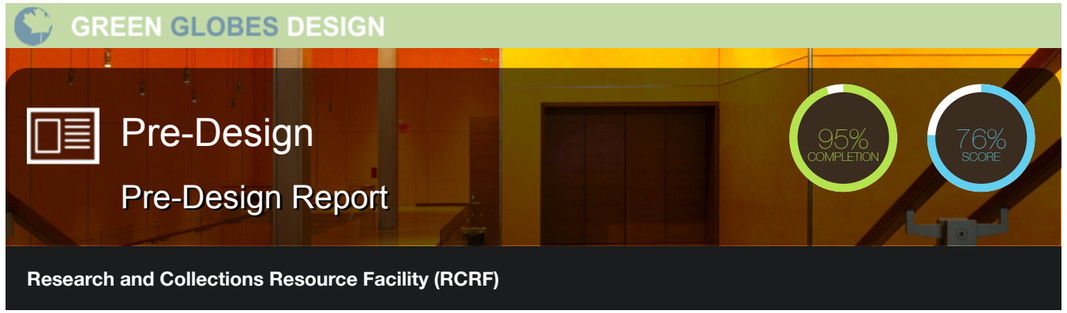
On site Renewable Energy	Energy Generated (kWh)	Renewable Energy Cost (GBP)	Narrative
Photovoltaic Panels	0.00	0.00	Generated from source
Wind Power	0.00	0.00	Generated from source
Combined Heat and Power (electricity)	0.00	0.00	Generated from source
Solar Water Heating	0.00	0.00	Generated from source

Exceptional Calculations	Energy Savings	Cost Savings	Narrative

Summary	Units	Proposed Design		Baseline Design		Percent Savings	
		Energy use	Cost (GBP)	Energy use	Cost (GBP)	Energy use	Cost
Total	kWh	960,369.42	74,168.86	1,150,612.75	81,935.34	16.53	9.48

Percent Savings	
Energy use	Cost
16.53	9.48

APPENDIX C: Green Globes



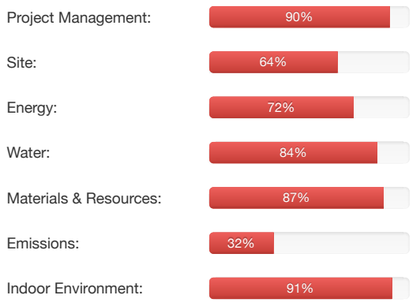
Predesign Environmental Intent Report

Introduction

Research and Collections Resource Facility (RCRF), Edmonton, Alberta is a storey, m², Warehouse (Unrefrigerated) building project. There will be no underground parking. The building will be located in climate zone 7.

The client is University of Alberta. The architect is HFKS Architects. Based on the answers given as of this report, Research and Collections Resource Facility (RCRF) is likely to achieve an overall rating of 76%.

The percentage of points that are likely to be achieved by Research and Collections Resource Facility (RCRF) for each module:



PROJECT MANAGEMENT

INTEGRATED DESIGN PROCESS (IDP)

Pre-Design Meetings

1.1.1.1.1 Hold integrated design meetings that will include a **minimum of five** of the key design disciplines involved in the project: (check as many as apply)

1.1.1.1.1.1 • Owner's representative

1.1.1.1.1.2 • Architect

1.1.1.1.1.3 • Sustainable Design Coordinator

1.1.1.1.1.4 • Civil Engineer

1.1.1.1.1.5 • Electrical Engineer

1.1.1.1.1.6 • Mechanical Engineer - HVAC

1.1.1.1.1.7 • Structural Engineer

1.1.1.1.2 Also include in the IDP workshop any one of the following:

1.1.1.1.2.1 • Facilities Manager and/or User Group Representative and/or Interior Designer

1.1.1.1.2.2 • Community Representative(s)

1.1.1.1.2.3 • Supporting experts

IDP Performance Goals

1.1.1.2.1 Establish (qualitative) green design goals at the pre-design phase for the following:

1.1.1.2.1.1 • Site Design

1.1.1.2.1.2 • Envelope

1.1.1.2.1.3 • Material efficiency

1.1.1.2.1.4 • Indoor environment

1.1.1.2.2 Establish performance goals (quantitative metrics) at the pre-design phase for the following:

1.1.1.2.2.1 • Energy efficiency

1.1.1.2.2.2 • Renewable energy (percentage of total energy)

1.1.1.2.2.3 • Greenhouse gas emissions

1.1.1.2.2.4 • Water conservation, efficiency, and reuse

1.1.1.2.2.5 • Life cycle impact

1.1.1.2.2.6 • Construction waste diversion

IDP Progress Meetings for Design

1.1.1.3.1 Hold progress meetings prior to the completion of the following project phases that include Green Design and Delivery Coordination (GDDC):

1.1.1.3.1.1 • At the Concept Design Phase

1.1.1.3.1.2 • At the Design Development Phase

1.1.1.3.1.3 • At the Construction Documents Phase

1.1.1.3.2 Require that the Green Design and Delivery Coordination (GDDC) team holds progress meetings prior to the completion of the following project milestones:

1.1.1.3.2.1 • Pre-Construction

1.1.1.3.2.2 • 25% Completion of budget or schedule

1.1.1.3.2.3 • 50% Completion of budget or schedule

1.1.1.3.2.4 • Substantial Completion

ENVIRONMENTAL MANAGEMENT DURING CONSTRUCTION

Environmental Management Systems (EMS)

1.1.2.1.1 Require that the Contractor or Builder has in place an Environmental Management System (EMS) that includes the following:

1.1.2.1.1.1 • General Contractor's Environmental Policy

1.1.2.1.1.2 • Regulatory Compliance and Training

1.1.2.1.1.3 • Environmental Risk Assessment that shows sensitive environmental areas and ranks potential risks that may arise from the construction

1.1.2.1.1.4 • Environmental Risk Management Strategies

1.1.2.1.1.5 • Environmental Management Roles, Responsibilities and Reporting Structure for the construction phase

1.1.2.1.1.6 • Site and Work Instructions for site personnel outlining environmental procedures during construction

1.1.2.1.1.7 • Environmental Inspection Checklists

1.1.2.1.1.8 • Records of Compliance

Clean Diesel Practices

1.1.2.2.1 Require that the General Contractor or Builder supplement mandatory regulatory requirements by implementing one or more of the following "clean diesel" strategies:

1.1.2.2.1.4 • Engine maintenance records

Mold Mitigation during Construction

1.1.2.3.1 Prevent mold in the building envelope during construction with the following best-practices:

1.1.2.3.1.1 • Building materials made of organic material or those that could absorb moisture are to be protected in transit and at the construction site from contact with moisture and from collecting organic matter such as leaves, soil or insects

1.1.2.3.1.2 • The building envelope will be weather-tight and permitted to dry before installation of interior walls, wood floors, ceilings or HVAC systems

IAQ during Construction

1.1.2.4.1 Prior to occupancy assure good indoor air quality by the following best-practices:

1.1.2.4.1.2 • Baseline Indoor Air Quality testing is to be undertaken, and should give positive results as per EPA “Testing for Indoor Air Quality”, section 01 81 09, December 2007.

1.1.2.4.2 Where parts of the building will be **occupied during construction**, implement one or more of the following five basic strategies specified per SMACNA‘S “IAQ Guidelines for Occupied Buildings Under Construction” to control dust, odors or irritants:

COMMISSIONING

Pre-Commissioning

1.1.3.1.1 Document the Owner’s Project Requirements for building systems in accordance with ASHRAE Guideline 0-05: Annexes I and J "Owner’s Project Requirements".

1.1.3.1.2 Document the Basis of Design for building systems in accordance with ASHRAE Guideline 0-05: Annex K "Basis of Design".

1.1.3.1.3 Assign an independent Commissioning Authority with technical credentials as per ASHRAE Guideline 0-2005, who will report directly to the owner, lead the commissioning team and coordinate the commissioning process.

Whole Building Commissioning

1.1.3.2.1 Produce a Commissioning Plan in accordance with ASHRAE/NIBS Guideline 0-05 “The Commissioning Process: Article 5, 6 and 7” for the following:

1.1.3.2.1.1 • HVAC&R systems and their controls

1.1.3.2.1.2 • Building envelope

1.1.3.2.1.3 • Fire protection system

1.1.3.2.1.4 • Plumbing system

1.1.3.2.1.5 • Electrical systems

1.1.3.2.1.6 • Lighting system and their controls

1.1.3.2.1.7 • Building automation systems

1.1.3.2.1.8 • Elevating and conveying systems

1.1.3.2.1.9 • Communication systems

1.1.3.2.2 Conduct the building system commissioning in accordance with CSA Z320, ASHRAE Guideline 0-05: Annex L and/or NRCan "Commissioning Guide for New Buildings".

Training

1.1.3.3.1 Provide training for building operators on the systems listed above in accordance with ASHRAE Guideline 0-2005: Article 7.2.14.

Operations and Maintenance Manual

1.1.3.4.1 Provide an Operations and Maintenance (O&M) Manual and/or CMMS that contains descriptions and information on the continuous tasks related to the systems and to each piece of equipment, which are necessary to operate the building efficiently.

SITE

DEVELOPMENT AREA

Urban Infill and Urban Sprawl

1.2.1.1.1 Identify the building’s walkability index.

1.2.1.1.2 Locate the project within 0.8 km (0.5 mile) of a commercial zone.

Greenfields, Brownfields and Floodplains

1.2.1.2.3 Elevate the lowest level of any habitable space above the 100-year flood plain.

ECOLOGICAL IMPACTS

Site Disturbance and Erosion

Green Globes provides two paths for assessing site disturbance and erosion:

- **Path A: Erosion and Sedimentation Control Plan**
- **Path B: Erosion and Sedimentation Control Specifications**

Points cannot be combined between paths. Please review and select one of the two pathways below.

Path B: Erosion and Sedimentation Control Specifications

1.2.2.1.2.1 In the absence of an Erosion and Sedimentation Control Plan by a Professional Engineer, require that the General Contractor will implement the following best practices for erosion and sediment control during construction:

1.2.2.1.2.1.1 • Silt fences to be installed or fiber socks filled with compost/wood chips around the construction site and maintained throughout construction.

1.2.2.1.2.1.2 • Gravel pads to be placed at all site entries and cleaned throughout construction.

1.2.2.1.2.1.3 • Riprap to be placed around all storm sewer outlets and silt and debris removed after each 24-hour rainfall of 5.08 mm (0.2 in) or more.

1.2.2.1.2.1.4 • Disturbed soils to be corrected using erosion control mats, or mulched and seeded within 90 days of being disturbed.

1.2.2.1.2.1.5 • During dry days, dust to be controlled by wetting the soil each day for 15 to 30 minutes before construction activities began, and again after construction activities were done for the day.

Consider the following criteria regardless of the Path chosen above.

1.2.2.1.3 Locate construction activities in such a way to limit disturbance to the site.

Tree Integration

1.2.2.2.1 Integrate the following existing vegetation into the landscape plan:
(check as many as apply)

1.2.2.2.1.1 • Large trees

1.2.2.2.1.2 • Clusters of trees

Tree Preservation

Green Globes provides two paths for assessing tree preservation:

- **Path A: Tree Preservation Plan**
- **Path B: Tree Protection Specifications**

Points cannot be combined between paths. Please review and select one of the two pathways below.

Path B: Tree Protection Specifications

1.2.2.3.2.1 In the absence of Tree Preservation Plan by a certified Arborist, implement the following best practices for tree protection during construction:

1.2.2.3.2.1.1 • Tree protection barriers that enclose a minimum Tree Protection Zone (TPZ) around the trees and shrubs that are to be retained on the site

1.2.2.3.2.1.2 • Root protection installed to protect tree roots from compaction during construction

1.2.2.3.2.1.3 • Sediment control barriers will be provided where some fill or excavate will be temporarily located near a TPZ

Heat Island Effect

1.2.2.4.2 Install paved surfaces that have a high SRI.

1.2.2.4.3 Plant trees capable of providing shade on paved surfaces outside of the building footprint within 15 years.

1.2.2.4.4 Provide 75% of opaque wall surfaces (by area) with an SRI of 29 or greater on the east and west facades.

Bird Collisions

1.2.2.5.1 Provide the following measures to address bird collisions and contamination from roostings:

1.2.2.5.1.1 • Visual markers

1.2.2.5.1.2 • Avoidance of reflections

STORMWATER MANAGEMENT

1.2.3.1 Provide a Stormwater Management Report by a Civil Engineer that shows that:

1.2.3.1.1 • The project meets municipal and/or local watershed flood and erosion control targets (i.e. post to pre control).

1.2.3.2 The site boundary is farther than 30.5 m (100 ft.) from a natural body of water.

LANDSCAPING

1.2.4.1 Provide a Landscape and Irrigation Plan developed by a Landscape Architect or certified horticulturalist or certified irrigation professional.

1.2.4.2 Address the following considerations in the Landscape and Irrigation Plan:

1.2.4.2.1 • Soil type, drainage, and light conditions

1.2.4.2.2 • Structural limitations (e.g. shading, utilities, overhangs, lights) that would impact the location and growth of plants

1.2.4.3 Include the following considerations in the plant palette:

1.2.4.3.1 • A minimum of 50% of the vegetated area covered with plants that are drought-tolerant.

1.2.4.3.2 •A minimum of 50% of vegetated area covered with plants (new or salvaged plantings) that are native and non-invasive

1.2.4.4 Install landscaped areas with following characteristics:

1.2.4.4.1 • At least 15.2 cm (6 in.) of soil; aerated, tilled and/or broken up

1.2.4.4.2 • Organic mulch as per best practices

1.2.4.5 Locate plants on the site as follows:

1.2.4.5.1 • Plants with similar water requirements grouped together

1.2.4.5.2 • Plants spaced to allow for maturation at a 5-year growth rate

EXTERIOR LIGHT POLLUTION

Green Globes provides two paths for assessing exterior light pollution:
Path A - Lighting Design Performance
Path B - Prescriptive Lighting Requirements
Please review and select one of the two pathways below.

Path A: Lighting Design Performance

1.2.5.1.1 Develop and implement a lighting design by an Engineer or Lighting Professional that meets all the performance requirements of the IES Model Lighting Ordinance.

1.2.5.2.2 Provide exterior lighting with trespass not exceeding the prescribed BUG ratings as per IDA - IES Model Lighting Ordinance (MLO) Table C for the following:

SITE INNOVATION

1.2.6.1 Set aside an equal amount of land off-site for every square foot of development for habitat exchange.

1.2.6.2 Create/integrate opportunities for urban agriculture.

ENERGY

ENERGY PERFORMANCE

1.3.1.1 Establish a target for electrical energy intensity (kWh/m^2/yr) (Use Excel as per Green Globes™ Performance Benchmarking Example) .
145 kWh/m^2/yr

1.3.1.2 Establish a target for heating fuel intensity (converted to kWh/m^2/yr) (Use Excel as per Green Globes™ Performance Benchmarking Example).
172 kWh/m^2/yr

1.3.1.3 Establish a target for on-site generated renewable energy intensity (kWh/m^2/yr)
0 kWh/m^2/yr

ENERGY DEMAND

Power Demand Reduction

METERING, MEASUREMENT AND VERIFICATION

Metering

1.3.3.1.1 Provide metering (at the building level) for the following:

1.3.3.1.1.1 • Electricity

1.3.3.1.2 Provide sub-metering for the following systems:

1.3.3.1.2.1 • Lighting and lighting controls by floor or by zones with floor areas no greater than 1,860 m^2 (20,000 ft^2)

1.3.3.1.2.2 • Plug loads by floor or by zones no greater than 1,860 m^2 (20,000 ft^2)

Measurement and Verification

1.3.3.2.1 Provide an Energy Metering Reporting Plan that includes the following monitoring protocols: (e.g. daily, monthly, seasonal, by floor etc.)

BUILDING OPAQUE ENVELOPE

Thermal Resistance and Transmittance

1.3.4.1.1 Meet a target equal to or better than requirements of the Model National Energy Code for Buildings (MNECB) for the thermal resistance and effective thermal transmittance of the roof as per the *Green Globes New Construction Technical Manual Table 3.3.4.1.1 (Insulation Minimum RSI/ R values)*.

1.3.4.1.2 Meet a target equal to or better than the requirements of the Model National Energy Code for Buildings (MNECB) for the effective thermal resistance and effective thermal transmittance of the walls above grade as per the *Green Globes New Construction Technical Manual Table 3.3.4.1.3 (Insulation Minimum RSI/ R values)*.

1.3.4.1.3 Meet a target equal to or better than the requirements of the Model National Energy Code for Buildings (MNECB) for the thermal resistance and effective thermal transmittance of the walls below grade as per the *Green Globes New Construction Technical Manual Table 3.3.4.1.5 (Insulation Minimum RSI/ R values)*.

1.3.4.1.4 Meet a target equal to or better than the requirements of the Model National Energy Code for Buildings (MNECB) for the effective thermal resistance and effective thermal transmittance of the floors as per the Green *Globes New Construction Technical Manual Table 3.3.4.1.7 (Insulation Minimum RSI/ R values for Floors)*.

1.3.4.1.5 Meet a target equal to or better than the requirements of the Model National Energy Code for Buildings (MNECB) for the effective thermal resistance and effective thermal transmittance of slab on grade as per the *Green Globes New Construction Technical Manual Table 3.3.4.1.9 (Insulation Minimum RSI/ R values for Slab on Grade)*.

1.3.4.1.11 Meet a target equal to or better than the requirements of the Model National Energy Code for Buildings (MNECB) for the U values of opaque doors as per the Green *Globes New Construction Technical Manual Table 3.3.4.1.11 (Building Envelope Requirements: Opaque Doors U values)*.

Orientation

1.3.4.2.1 Provide a ratio of the north/south fenestration area to the east/west fenestration area between 1.25 and 2.00.

Fenestration Systems

1.3.4.3.1 Meet a target equal to or better than the requirements of the Model National Energy Code for Buildings (MNECB) for the thermal transmittance (U-factor) of the building's fenestration system as per the *Green Globes New Construction Technical Manual Table 3.3.4.3 (Fenestration)*.

1.3.4.3.2 Meet a target equal to or better than the requirements of the Model National Energy Code for Buildings (MNECB) for the Solar Heat Gain Coefficient (SHGC) of the building's fenestration system as per the *Green Globes New Construction Technical Manual Table 3.3.4.3 (Fenestration)*.

LIGHTING

Lighting Power Density

1.3.5.1.1 Meet a target for total lighting power density (LPD) that is at or below the recommended lighting power density of ASHRAE Standard 90.1-2007.

Interior Automatic Light Shut-off Controls

1.3.5.2.1 Provide time-scheduling devices for lights ***and/or*** individual occupant-sensing devices.

Light Reduction Controls

1.3.5.3.1 Provide one or more of the following lighting controls in all interior, non-daylighted areas:

- Dual switching of alternate rows or luminaries
- Switching of individual lamps independently of adjacent lamps within a luminaire
- Switching of each lamp or luminaire
- Occupancy sensors within the space

Daylighting

Controls for Daylighted Zones

1.3.5.5.1 Provide small daylit areas with manual or automatic photocell lighting controls.

1.3.5.5.2 Provide all large daylit areas with automatic photocell lighting controls.

Exterior Luminaires and Controls

1.3.5.6.1 Provide exterior luminaires that have lamps with an initial system efficacy of at least 60 lumens per watt

1.3.5.6.2 Provide LED lamps for all exterior lighting.

1.3.5.6.3 Provide lamps that have low or no mercury content

1.3.5.6.4 Provide one or more of the following exterior lighting controls:
- Lighting designated for dusk-to-dawn controlled by a photo sensor or astronomical time switch with 10-hour backup
- Lighting not designated for dusk-to-dawn controlled by a time switch with 10-hour backup

HVAC SYSTEMS AND CONTROLS (PART 1)

Building Automation System

1.3.6.1.1 Provide a central Building Automation System (BAS) that encompasses all systems that affect building energy performance, lighting, and thermal comfort.

Cooling Equipment

Cooling Towers

Heat Pumps

Heating Equipment

1.3.6.5.1 Provide heating equipment that exceeds ASHRAE 90.1-2007 for one of the following:
- Annual fuel utilization efficiency (AFUE)
- Thermal efficiency (E_t)
- Combustion Efficiency (E_c)

Condensate Recovery

Steam Traps

Domestic Hot Water Heaters

1.3.6.8.1 Require that all domestic hot water heaters meet the efficiency requirements of ASHRAE 90.1-2007.

1.3.6.8.2 Require that all domestic hot water heaters be equipped with intermittent electrical igniters and low NO_X burners.

Variable Speed Control of Pumps

1.3.6.9.1 For pumps greater than 3hp, provide variable speed controls for 15% or more of connected hydronic pumping power.

HVAC SYSTEMS AND CONTROLS (PART 2)

Minimizing Re-heat and Re-cool

1.3.7.1.1 Provide an HVAC design that minimizes or eliminates re-heat and re-cool.

Air Economizers

1.3.7.2.1 Provide air economizers with a mode that uses outdoor air for cooling in place of mechanical cooling.

1.3.7.2.2 Provide controls to shut off outdoor and exhaust air dampers during periods when the system is not operating.

1.3.7.2.3 Provide 'low leakage' dampers in the air handling system.

Fans and Ductwork

1.3.7.3.1 Provide the duct distribution system with the following:

1.3.7.3.1.1 • Diffusers and registers sized with a full flow pressure drop no greater than 0.01 in (0.03 cm) of water column

1.3.7.3.1.2 • Noise criteria (NC) of 35 or less

1.3.7.3.2 Require flexible ductwork that is:

1.3.7.3.2.1 • No longer than 1.5 m (5 ft.) when fully stretched

1.3.7.3.2.2 • Limited to only connections between duct branches and diffusers, and connections between duct branches and va volume terminal units

1.3.7.3.2.3 • Supported by a durable elbow support when flexible ductwork is used as an elbow

1.3.7.3.3 Seal duct joints to achieve an overall leak rate that does not exceed 5% (based on leak testing of the seams).

1.3.7.3.4 Require that motors for fans of one horsepower or more meet NEMA's Premium® "Energy Efficiency Motor Program".

1.3.7.3.5 Require that variable speed fans are controlled by a duct pressure set-point or an energy management control system.

Demand Controlled Ventilation

1.3.7.4.3 Include the following in the ventilation heat recovery systems:

OTHER ENERGY EFFICIENT EQUIPMENT AND MEASURES

Elevators and Escalators

Other Energy Efficient Equipment

RENEWABLE ENERGY

On-site Renewable Energy

1.3.9.1.1 Install on-site renewable energy technology and/or conduct a study to determine the technical feasibility and life-cycle cost effectiveness of on-site renewable energy.

Off-site Renewable Energy

ENERGY EFFICIENT TRANSPORTATION

1.3.10.1 Locate the site within 400 m (0.25 mi) of a public transportation facility such as a public bus stop or train-stop.

1.3.10.2 Provide designated preferred parking for car/van pooling, and shelter from weather for persons waiting for a lift.

1.3.10.4 Locate the site within 400 m (0.25 mi) of a public bicycle path or multi-user path or on a road with an existing dedicated bicycle lane.

1.3.10.5 Provide sheltered bicycle parking for:
• At least 5% of the maximum number of office building occupants
or
• At least 50% of units in a multi-family residential building

ENERGY INNOVATION

1.3.11.1 Produce one hundred percent or more of the project's energy needs by renewable energy.

WATER

WATER CONSUMPTION

1.4.1.1 Meet or surpass the requirements of the Green Globes™ benchmarks by a minimum of 25%, as determined using the Green Globes™ Water Consumption Calculator to calculate the baseline water use, projected water use and percentage reduction in water use.

1.4.1.3 Provide the following plumbing fixtures and fittings that comply with the prescribed efficiencies:

1.4.1.3.1 • Toilets with a maximum effective flush volume 4.8 L (1.28 gal) or less

1.4.1.3.2 • Urinals with a consumption of 1.9 L/flush (0.5 gal)

1.4.1.3.6 • Non-residential lavatory faucets with a maximum flow rate 1.9 L/min. (0.5 gal per min.)

1.4.1.4. Comply with the prescribed water use factors per full cycle for the following:

COOLING TOWERS

1.4.2.1 Provide cooling towers that minimize the amount of make-up water needed as follows:

1.4.2.2 Provide wet-cooling towers that have the following features to monitor and control make-up water:

BOILERS AND WATER HEATERS

1.4.3.1 Install boilers and/or water heaters with the following features:

1.4.3.1.1 • Boilers and water heating systems of 37 kW (50 bhp) and above that have a boiler feed makeup meter

WATER INTENSIVE APPLICATIONS

Commercial Food Service Equipment

1.4.4.1.1 Avoid the following water intensive equipment:

1.4.4.1.2 Provide appliances that meet the following prescribed limits for water usage:

Laboratory and Medical Equipment

1.4.4.2.1 Equip steam sterilizers with the following:

1.4.4.2.5 Provide fume hoods with the following:

Laundry Equipment

Special water features

1.4.4.4.1 Install the following water-efficiency measures for special water features (e.g. swimming pools, spas, ornamental fountains, water playscapes):

WATER TREATMENT (FOR LAUNDRIES, LABORATORIES, PHARMACIES, AND CAR WASHES)

ALTERNATE SOURCES OF WATER

METERING

1.4.7.3 Link all water meters and sub-meters to a Meter Data Management System to store and report water consumption data.

1.4.7.4 Equip chilled or hot water loops with makeup meters.

IRRIGATION

1.4.8.1 Provide vegetated landscaping that is naturalized and non-irrigated.

1.4.8.2 Equip the irrigation system with any of the following features:

1.4.8.2.1 • Gutter downspouts directed into planted areas or other landscape features *and/or* onsite cistern and/or rainwater harvesting system, *and/or* reclaimed water system

WATER INNOVATION

1.4.9.1 Produce 100% or more of the project's water needs by capturing precipitation, other natural closed loop water systems, or by recycling used water.

1.4.9.2 Utilize 100% of captured stormwater and/or used water (greywater) onsite or on an adjacent site (e.g. for irrigation).

MATERIALS & RESOURCES

BUILDING ASSEMBLY (CORE AND SHELL INCLUDING ENVELOPE)

1.5.1.1 Use the Athena Impact Estimator for Buildings (Version 4.2 or later) to evaluate a minimum of two building assemblies (core and shell, including envelope) in the conceptual design phase which will result in a selection that provides the least environmental impact based upon the comparable application.

INTERIOR FIT-OUT (INCLUDING FINISHES AND FURNISHINGS)

1.5.2.1 Select at least 40% (based on cost) of interior fit-out products that have:

1.5.2.1.1
- Environmental Product Declarations (EPDs) that utilize recognized Product Category Rules, conform to ISO standards, and minimally includes cradle-to-gate scope:
- Industry Wide (Generic) EPD: Products specified for the interior fit-out shall include third-party certified Type III Environmental Product Declaration (EPD), including external verification where the manufacturer is explicitly recognized as a participant by the program operator
  and/or
- Product Specific Declaration: Products specified for the interior fit-out shall be products with a publicly available product-specific third-party certified Type III Environmental Product Declaration (EPD), including external verification
  and/or
- Third-party certifications that are based upon a multiple attribute standard(s) developed by a consensus based process from an approved standard development organization. Examples include NSF sustainability assessment standards, UL Environment sustainability standards, sustainable forestry certifications, and other consensus-based assessment standards that are multiple attribute and life cycle based.
  and/or
- Third-party certified life cycle product assessment based upon ISO 14040 and 14044, and minimally covers cradle-to-gate scope

RE-USE OF EXISTING STRUCTURES

Façades

Structural Systems

Non-structural Elements

1.5.3.3.3 Incorporate reused and off-site salvaged materials.

WASTE

Construction Waste

1.5.4.1.1 Divert at least 50% of demolition and construction waste from the landfill.

Operational Waste

1.5.4.2.1 Address operations-related recycling programs through one or more of the following:

1.5.4.2.1.1 • Operational flow for waste handling and storage facilities for recycling

1.5.4.2.1.2 • Storage areas for recyclable waste at points of service

1.5.4.2.1.3 • Storage areas for recyclable waste at pick-up areas

1.5.4.2.1.4 • Operational flow for handling and storage facilities for composting

1.5.4.2.2 Indicate the predicted total storage area (in m^2) for recyclable waste at points of service and pick-up areas.
12 m^2

BUILDING SERVICE LIFE PLAN

1.5.5.1.1 Prepare a preliminary Building Service Life Plan that includes the expected service life estimates for the following:

1.5.5.1.1.1 • The building

1.5.5.1.1.2 • The structural systems, building envelope, and hardscape materials that will need to be replaced during the life of the building

1.5.5.1.1.3 • The mechanical, electrical, plumbing, and energy generation systems that will require inspection and/or replacement during the service life of the building

1.5.5.1.2 Provide a schedule for maintenance, repair, and replacement for each building element including the building fit-out (as applicable) for the duration of the building design life.

RESOURCE CONSERVATION

Minimized Use of Raw Materials

1.5.6.1.1 Use prefabricated, preassembled, and/or modular products in the design.

1.5.6.1.2 Design the building to use materials efficiently and/or minimize the use of raw materials as compared with typical construction practices in the building design.

Multi-Functional Assemblies

1.5.6.2.1 Incorporate into the design assemblies that will perform multiple functions.

Deconstruction and Disassembly

1.5.6.3 Ensure the building design facilitates future deconstruction, demounting and disassembly; and re-configuration.

ENVELOPE – ROOFING / OPENINGS

Roofing Membrane Assemblies and Systems

1.5.7.1 Roofing membrane assemblies and systems are to be:

1.5.7.1.1 • Installed as per manufacturers' instructions and recommendations

1.5.7.1.2 • Field-inspected by a roofing system manufacturer's technical personnel or RCI-certified third-party roofing inspector as per the prescribed industry protocol. (Manual of Roof Inspection, Maintenance and Emergency Repair for Existing Single-Ply Roofing Systems"; and "NRCA Roofing and Waterproofing Manual)

Flashings

1.5.7.2 Require that newly installed building envelope flashings and sheet metal assemblies are to be:

1.5.7.2.1 • Installed as per prescribed industry best practice. (SMACNA's "Architectural Sheet Metal Manual)

1.5.7.2.2 • Inspected as per prescribed industry protocol. (NIBS Guideline 3-06: Annex M.1 Construction & Industry Checklist M.1-4 for Flashing and Sheet Metal)

Roof and Wall Openings

1.5.7.3 Require that all products for roof and wall openings (doors, windows, skylights etc.) are to:

1.5.7.3.1 • Comprise moisture management design that meets industry prescribed performance requirements. (AAMA/WDMA/CSA 101/I.S.2/A440-08)

1.5.7.3.2 • Be installed as per prescribed industry best practice. (ASTM E2112–07 or CMHC Flashings: Best Practice Guide)

1.5.7.3.3 • Be inspected as per the prescribed industry protocol, including field testing with respect to water penetration. (NIBS Guideline 3-06: Annex M.1 Construction & Industry Checklists M.1-7 for Windows and M.1-8 Skylights)

ENVELOPE – FOUNDATION, WATERPROOFING

Foundation Systems

1.5.8.1.1 Require that newly installed foundation systems for conditioned spaces are to:

1.5.8.1.1.1 • Be constructed with slab-on-ground vapor retarders conforming to prescribed industry best practices. (ASTM E1745 – 11, and/or CMHC Best Practice Guide, and/or Building Science.com - Best Practices; and American concrete Institute 302.2R-06: "Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials)

1.5.8.1.1.2 • Be constructed such that all slabs on grade will be positioned directly over vapor retarders and capillary-break base courses

1.5.8.1.2 Require the following damp-proofing measures to be applied to all newly installed foundation walls in contact with grade:

1.5.8.1.2.1 • 5% slope grade away indicated from the building for at least 3.05 m (10 ft.)

1.5.8.1.2.2 • Roof drainage to be directed at least 0.9 m (3 ft.) beyond the edge of the foundation wall

1.5.8.1.2.3 • Comprise a foundation drainage system

Below Grade Wall Slabs and Above Grade Horizontal Assemblies

1.5.8.2.1 Newly installed waterproofing membrane assemblies are to be:

ENVELOPE – CLADDING

Exterior Wall Cladding Systems

1.5.9.1.1 Install cladding systems as per the following industry best practices as applicable:
- Exterior Insulation Finishing Systems (EIFS) installed as water-managed systems in accordance with the manufacturer's requirements
- Aluminum framed glazing systems installed in accordance with the manufacturer's requirements and warranted by the manufacturer for the intended purpose
- Masonry veneer cladding installed in accordance with industry technical notes and bulletins
- Architectural precast concrete cladding systems that incorporate pressure equalized two stage joints between precast concrete panels and adjacent cladding assemblies

1.5.9.1.2 Inspect cladding installation as per the appropriate prescribed industry protocols as applicable:
- EIS cladding systems (NIBS Guideline 3-06: Annex M.1 Construction & Industry Checklist M.1-2 for EIFS.)
- Aluminum framed glazing systems (NIBS Guideline 3-06: Annex M.1 Construction & Industry Checklist M.1-6 for Entrances and Storefronts and M 1-10 for Glazed Curtain Walls.)
- Masonry veneer cladding (NIBS Guideline 3-06: Annex M.2 Example Construction Checklist for Building Envelope System for Brick)

1.5.9.1.3 Install joints sealers as per prescribed industry best practice, and be field inspected as per prescribed industry protocol. (NIBS Guideline 3-06: Annex M.1 Construction & Industry Checklist M.1-5 for Joint Sealers; Annex M.2 Example Construction Checklist for Building Envelope System Joint Sealants).

Rainscreen Wall Cladding

1.5.9.2.1 Provide exterior rainscreen wall cladding systems over framed walls that include the following:

1.5.9.2.1.1 • A primary and secondary line of defense

1.5.9.2.1.2 • An air barrier

1.5.9.2.1.3 • A means for incidental bulk water intrusion to escape the cladding system assembly

1.5.9.2.2 Require rainscreen cladding assemblies to pass requirements of AAMA 508-07 laboratory-testing

ENVELOPE – BARRIERS

Air Barriers

1.5.10.1.1 Install the continuous air barrier according to the following practices:

1.5.10.1.1.1 • The air barrier material of each assembly detail shows an airtight and flexible joint between the air barrier material and adjacent assemblies

1.5.10.1.1.2 • The air barrier is designed to withstand positive and negative combined design wind, fan, and stack pressures on the air barrier without damage or displacement

1.5.10.1.1.3 • The air barrier is designed to withstand movement in the structure and not displace materials under full load

1.5.10.1.1.4 • Provide proper air barrier detailing in areas connecting: foundation and walls; walls and windows or doors; different wall systems; wall and roof; wall and roof over conditioned space or wall and ceiling under unconditioned space; walls, floors and roof across construction, control, and expansion joints; walls, floors, and roof to utility, pipe, and duct penetrations

1.5.10.1.2 Use the following strategies for a continuous air barrier for the opaque building envelope:

- **Materials:** tested in accordance with ASTM E2178-03 and determined that the air permeability of individual materials does not exceed 0.02 L/s·m^2 @ 75 Pa (0.004 cfm/ft.^{2} @ of 0.3 in. w.g. (1.6 psf)). When all joints are sealed, materials meet this requirement.
  or
- **Assemblies:** tested in accordance with ASTM E2357-05 or ASTM E1677-05, and showing that the average air leakage does not exceed 0.2 L/s·m^2 @ 75 Pa (0.04 cfm/ft.^{2} @ 0.3 in. w.g. (1.6 psf)). Concrete masonry walls that are sealed and painted do not have to be tested. When all joints are sealed, assemblies meet this requirement.
  or
- **Building:** tested with ASTM-E779-03 or an equivalent approved method and showing that the air leakage rate of the building envelope does not exceed 2.0 L/s·m^2 @ 75 Pa (0.4 cfm/ft.^{2} @ 0.3 in. w.g. (1.6 psf)).

Vapor Retarders

1.5.10.2.1 Install Class I or II vapor retarder that is in accordance with the International Energy Conservation Code 2012, International Energy Conservation Code 2007 Supplement, or 2009 International Building Code Section 1405.3 on the interior side of framed walls in Climate Zones 5, 6, 7, 8 and Marine 4.

1.5.10.2.2 Install on the walls of unvented crawl spaces, insulation that is permanently fastened to the wall and extends downward from the floor to the finished grade level, and then vertically and/or horizontally for at least an additional 24 inches (60.9 cm).

1.5.10.2.3 Cover the exposed earth in unvented crawl space foundations with a continuous Class I vapor retarder, installed such that:
- All joints of the vapor retarder are overlapped by15 cm (6 in.) and are sealed or taped
  and
- The edges of the vapor retarder extend at least 15 cm (6 in.) up the stem wall and are attached to the stem wall

RESOURCE INNOVATION

EMISSIONS

HEATING

Green Globes provides two paths for assessing heating:

- **Path A: District Heating**
- **Path B: Low Emission Boilers and Furnaces**

Please select one of the two paths below.

Path B: Low Emission Boilers and Furnaces

COOLING

Ozone-depleting Potential

1.6.2.2 Use refrigerants that have zero or “near-zero” ozone depletion potential (ODP) for cooling equipment. (not including equipment with less than 0.5 kg (1 lb.) of refrigerant – for example, refrigerators, temporary cooling equipment.)
or
Avoid refrigerants.

Global Warming Potential

Leak Detection

1.6.2.4.1 Require that equipment installer(s) test remote commercial systems (e.g. supermarket refrigeration) as per *GreenChill Best Practices Guideline Ensuring Leak-Tight Installations of Commercial Refrigeration Equipment*.

JANITORIAL EQUIPMENT

1.6.3.1 Provide designated storage areas with full height, floor-to-floor walls and mechanical ventilation for hazardous materials/janitorial supplies.

INDOOR ENVIRONMENT

VENTILATION

Ventilation Air Quantity

1.7.1.1 Provide a quantity of ventilation air compliant with ASHRAE Standard 62.1-2007, except where local codes or standards require a greater quantity of ventilation air.

Air Exchange

Green Globes provides three paths for assessing air exchange:
- **Path A: Mechanical Ventilation Only**
- **Path B: Natural Ventilation Only**
- **Path C: Combination of Mechanical & Natural Ventilation**

Please review and select one of the three pathways below, as appropriate to your project.

Path A: Mechanical Ventilation Only

1.7.1.2.1.1 For mechanically ventilated, provide a zone air distribution effectiveness E_z value greater than or equal to 0.9 in all regularly occupied spaces, excluding the circulation and transitional spaces.

1.7.1.2.2.1 Meet the following conditions as per ASHRAE 62.1-2010: Section 5.1:

1.7.1.2.3.2 Where natural ventilation is employed, meet the following conditions as per ASHRAE 62.1-2010 Section 5.1:

Ventilation Intakes and Exhausts

1.7.1.3.1 Provide ventilation systems with the following features:

1.7.1.3.1.1 • Exhaust outlets and plumbing vent stacks are located at least 6.1 m (20 ft.) away from outdoor air intakes.

1.7.1.3.1.2 • Outdoor air intakes are located at least 9.1 m (30 ft.) away from sources of pollution.

1.7.1.3.1.3 • Outdoor air intakes are protected with 6.4 mm (0.3 in) or smaller mesh screens.

1.7.1.3.1.4 • For each air handling system in single or multiple arrangements, filters are compliant with ASHRAE 62.1-2010.

1.7.1.3.1.5 • Outdoor air inlets and outlets, including louvers and rain hoods, are sized appropriately as per ASHRAE 62.1-2010.

1.7.1.3.1.6 • Except in transfer air ducts, all outdoor air, return air, and supply air ductwork avoids interior liner that could harbour microbial growth and/or erode in the air stream.

1.7.1.3.1.7 • Roof drainage slopes away from outdoor air intakes.

CO_2 Sensing and Ventilation Control Equipment

Air Handling Equipment

1.7.1.5.1 Provide air handling equipment that has filters with a Minimum Efficiency Reporting Value (MERV) of 13 (or equivalent) or higher.

SOURCE CONTROL AND MEASUREMENT OF INDOOR POLLUTANTS

Volatile Organic Compounds

1.7.2.1.1 Require that adhesives and sealants (not including carpet adhesives) comply with prescribed limits of VOCs as per the South Coast Air Quality Management District Rule 1168 for volatile organic compounds *and/or* have third-party certifications showing compliance to predetermined indoor air quality standards. *Green Globes for New Construction Technical Reference Manual, Table 3.7.2.1.1: Adhesives and Sealants VOC Limits*.

1.7.2.1.2 Require that carpet and under-carpet adhesives comply with the Carpet and Rug Institute's (CRI) Green Label Plus program.

1.7.2.1.3 Require that paints comply with prescribed limits of VOCs as per the ASTM D6886-03 "Standard Test Method for Speciation of the VOCs in Low VOC Content Waterborne Air-Dry Coatings by Gas Chromatography" ***and/or*** have third-party certifications showing compliance to predetermined indoor air quality standards. *Green Globes for New Construction Technical Reference Manual, Table 3.7.2.1.3: Paint VOC Limits*.

1.7.2.1.4 Require that all floors, floor coverings, and other interior products comply with prescribed limits of VOCs as per the Reference Exposure Levels (REL) developed by the California Office of Environmental Health and Hazard Assessment (OEHHA) for volatile organic compounds ***and/or*** have third-party certifications showing compliance to predetermined indoor air quality standards. *Green Globes for New Construction Technical Reference Manual, Table 3.7.2.1.4: Floor and Floor Coverings VOC Limits*.

Leakage, Condensation and Humidity

1.7.2.2.1 Implement the following measures to avoid mould:

1.7.2.2.1.1 • The HVAC is capable of monitoring and controlling the dew point.

1.7.2.2.1.2 • Materials and finishes are resistant to mold growth in spaces that generate high humidity (e.g. kitchens, toilet rooms, pools, laundry facilities, shower areas).

1.7.2.2.1.3 • There are floor drains where equipment failures may cause plumbing leaks, spills or overflows.

Access for HVAC Maintenance

1.7.2.3.1 Provide the following measures to facilitate the maintenance of any HVAC equipment that requires routine and periodic maintenance:

1.7.2.3.1.1 • Access to equipment complies with ICC 2009 International Mechanical Code, IAPMO 2009 Uniform Mechanical Code, and manufacturer published and/or suggested recommendations.

1.7.2.3.1.2 • Distribution systems are installed in accordance with ASHRAE 62.1-2010: section 5.13, and SMACNA's "HVAC Duct Construction Standards: Metal and Flexible 3rd Edition 2005".

1.7.2.3.1.4 • Access doors to HVAC are removable or have full degree swing.

Carbon Monoxide Monitoring

1.7.2.4.1 Provide carbon monoxide monitoring devices and alarms in enclosed areas where there are sources of combustion.

Wet Cooling Towers

Domestic Hot Water Systems

1.7.2.6.1 Design the domestic hot water system to maintain hot water storage at or above 55°C (131°F); ***or*** install a tankless system.

Humidification and Dehumidification Systems

1.7.2.7.1 Provide drain pans for dehumidifying cooling coils that properly capture and drain the condensate in the air handler by including the following measures:

- Drain pans have a 10 mm slope per meter (1/8 inch slope per foot) in two directions toward the drain outlet.
- The drain opening is located at the lowest point of the drain pan.
- The drain pan is sufficiently wide to span the cooling coils and is sized to prevent overflow under peak dew point conditions.
- A P-trap or other seal prevents ingestion of air while allowing complete drainage.

Pest and Contamination Control

1.7.2.8.1 Use the following integrated pest management strategies:

1.7.2.8.1.1 • Outdoor air inlets have insect screens of 18x14 mesh for plenum systems feeding multiple air handlers.

1.7.2.8.1.2 • Structural and mechanical openings are fitted with permanent protection (e.g. screens, sealants, etc.).

1.7.2.8.1.3 • Advertising signs and other assemblies are affixed to the building façade in a way that reduces bird habitation; and any penetrations in the façade are sealed to prevent entry.

1.7.2.8.1.4 • Mullions and ledges are less than 2.5 cm (1 in.) deep to discourage bird roosting.

1.7.2.8.2 Provide a sealed storage area for food/kitchen solid waste and recycling.

Other Indoor Pollutants (Tobacco, Radon)

1.7.2.9.1 Provide a construction management policy that prohibits smoking in the building and within 7.5 m (25 feet) of the building.

1.7.2.9.2 Post “No Smoking” signage in the building and near all building entrances.

Ventilation and Physical Isolation for Specialized Activities

LIGHTING DESIGN AND SYSTEMS

Daylighting

1.7.3.1.1 Design floor area occupied for critical visual tasks to achieve a minimum daylight factor (DF) of 2 (excluding all direct sunlight penetration).

1.7.3.1.2 Configure the space so that primary occupied spaces have views to the exterior or atria within 7.6 m (25 ft.) from a window.

1.7.3.1.3 Install shading devices on southern, western and eastern exposures to control direct sunlight to task areas.

1.7.3.1.4 Specify photo-sensors in daylit areas to maintain consistent lighting levels throughout the day using both daylighting and artificial lighting.

Lighting Design

1.7.3.2.1 Provide primary occupied spaces with prescribed lighting levels for the types of tasks anticipated in the various building spaces as per the most recent IESNA Lighting Handbook.

1.7.3.2.2 Provide luminance ratios for the following tasks that do not exceed the following as per IESNA (as confirmed by a Lighting Engineer):

- 3:1 between the task and adjacent surroundings
- 10:1 between the task and remote (non-adjacent) surfaces
- 20:1 between the brightest and darkest surface in the field of view
- 8:1 between rows of luminaires where there is indirect lighting and where ceiling luminance exceeds 425 cd/m^2 (124.1 fL).

1.7.3.2.3 Where there is *direct* lighting, provide average luminance that does not exceed the following values for given luminaire angles (as confirmed by a Lighting Engineer):

- 850 cd/m^2 (248.1 fL) at 65° from the vertical
- 350 cd/m^2 (102.2 fL) at 75° from the vertical
- 175 cd/m^2 (51.1 fL) at 85° from the vertical

1.7.3.2.4 Where there is *direct* lighting, provide ceiling uniformity that is lower than 8:1 (Max: Min) between the rows of luminaires (as confirmed by a Lighting Engineer).

THERMAL COMFORT

Thermal Comfort Strategies

1.7.4.1.3 For open circulation areas such as open offices and healthcare general patient areas, provide thermal control zones that are 93 m^2 (1,000 ft^2) or less.

1.7.4.1.4 For smaller functional areas such as offices, meeting rooms and hospital/hotel rooms, provide thermal control zones that are 111 m^2 (1,200 ft^2) or less.

1.7.4.1.5 Does the design conform to ANSI/ASHRAE 55-2010 or ANSI/ASHRAE 55-2004?

ACOUSTIC COMFORT

Acoustic Comfort Design

1.7.5.1.1 Implement the following acoustic design strategies for specific interior sound control performance:

1.7.5.1.1.1 • Toilets are located remotely from acoustically separated areas.

1.7.5.1.1.2 • Acoustically separated areas are located away from noise producing areas such as dance studios, music rooms, cafeterias, indoor swimming pools, mechanical rooms, and gymnasia.

1.7.5.1.1.6 • Walls separating quiet areas from other areas have all joints and penetrations sealed with acoustical sealant.

1.7.5.1.2 Comply with the following minimum Sound Transmission Class (STC) ratings for floor/ceiling assemblies, walls and doors between acoustically separated areas (learning spaces), and adjacent spaces as applicable:

1.7.5.1.4 Do not exceed the following Reverberation Time (RT) in quiet areas and all areas where speech intelligibility is important:
- 0.6 seconds in spaces less than 10,000 cu. ft. in volume
- 0.7 seconds in spaces 10,000 - 20,000 cu. ft.
- Compliance with Annex C of ANSI S12.60-2010/Part 1 in spaces larger than 20,000 cu.

Mechanical, Plumbing, and Electrical

1.7.5.2.1 Provide a design signed off by a Acoustical Engineer that complies with minimum background sound levels associated with mechanical systems as follows:

1.7.5.2.1.1 • Airborne sound power levels from HVAC units do not exceed Room Criteria as per ASHRAE Systems Application Handbook 2007, Chapter 47, Table 42 for listed spaces.

1.7.5.2.1.2 • Spaces are designed such that room background noise using Room Criteria (RC) ratings complies with ASHRAE Systems Application Handbook 2007 Chapter 47, Table 42.

1.7.5.2.2 Implement the following measures to minimize air-borne noise from the HVAC system:

1.7.5.2.2.1 • Duct transitions are spread out and graduated to minimize generation of turbulence and air flow separations.

1.7.5.2.2.2 • Secondary attenuators are located immediately downstream of duct fittings that would otherwise generate noise.

1.7.5.2.2.4 • Where significant cross talk paths exist between two habitable spaces, there are sound attenuators and/or silencers, or ducts are designed in a “Z” configuration.

1.7.5.2.2.5 • HVAC grilles and diffusers comply with ANSI S12.60-2010/Part 1.

1.7.5.2.3 Provide the following measures to minimize structure-borne noise from the HVAC system:

1.7.5.2.3.1 • Fans and other powered HVAC equipment are acoustically separated from the structure using vibration isolators.

1.7.5.2.3.2 • Ducts are supported on resilient mounts to isolate them from the structural system, and ducts are isolated using resilient material where they pass through walls.

1.7.5.2.4 Implement the following measures to mitigate noise from the plumbing system:

1.7.5.2.4.1 • Piping does not run above quiet areas and learning spaces with the exception of sprinklers and radiant heating systems.

1.7.5.2.4.2 • Waste water piping noise is mitigated using cast iron pipe, or with acoustic insulation above quiet areas and learning spaces; and a water hammer arrester is used.

1.7.5.2.5 Provide the following measures to minimize noise from the electrical system:

PAGE INTENTIONALLY LEFT BLANK

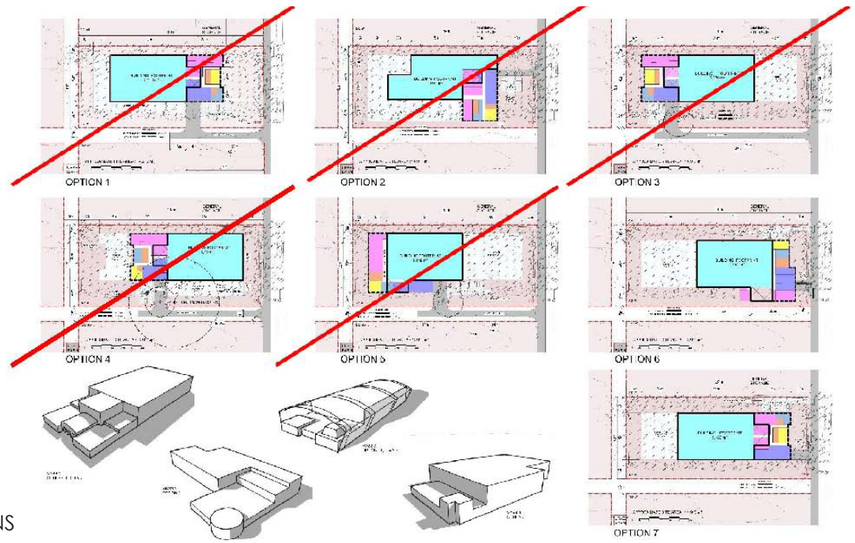
APPENDIX D: Design Development

Summary of Options

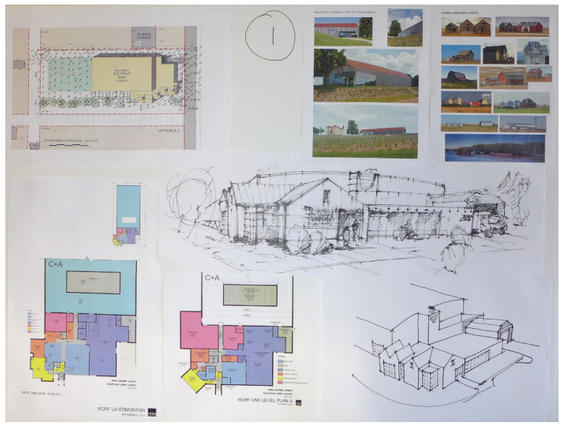
The Schematic Design and validation phase involved exploration of various site and building development options to balance LDRP and Sector 12 long range planning criteria with functional and operational requirements of RCRF. Over the course of few weeks a total of seven siting options were developed and assessed identifying Pros and Cons, anticipated relative cost impacts, opportunities created and potential limitations brought about each of the planning approaches. The resulting analysis allowed more detailed determination of the RCRF placement, which was to:

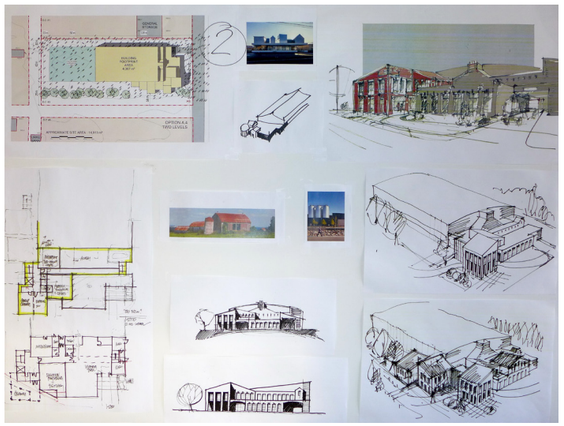
- occupy the northeast area of the D-2 #3 site;
- provide for separate access points for visiting researchers and students and away from the vehicular deliveries traffic;
- eliminate of the on-site staff parking;
- create opportunities for public real engagement;
- preserve, where possible, the existing natural site features (trees);
- consider impact of the prevailing winds and the sun path on design;
- take advantage of the LRT Station and public multi-use path proximity;
- provide for future expansions largely available to the west;
- mitigate the massing impact of the high density storage volume.

WORKSHOP DESIGN SESSION SEP 17, 2015



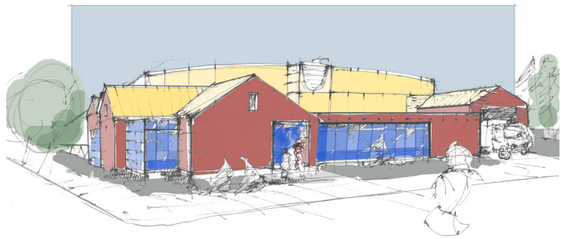
SITING OPTIONS



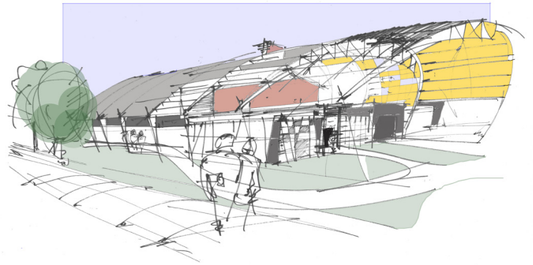


CONCEPT OPTIONS

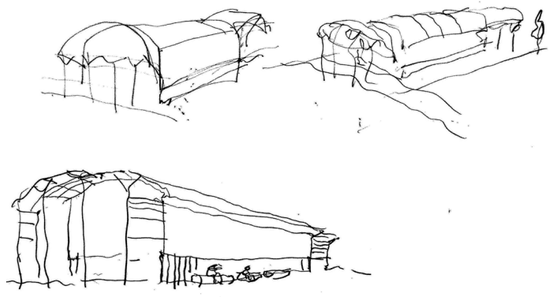
OPTION A PRELIMINARY SKETCH



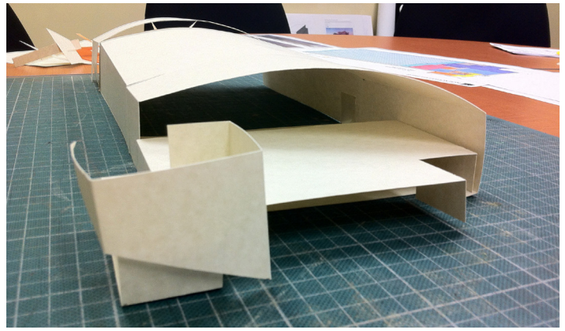
OPTION B PRELIMINARY SKETCH

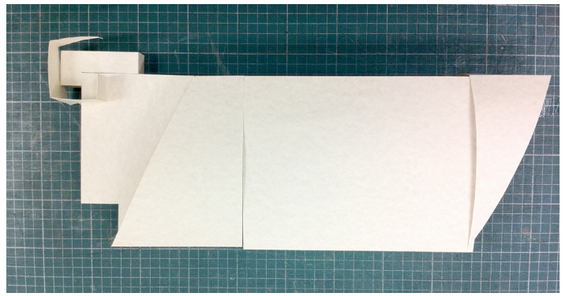


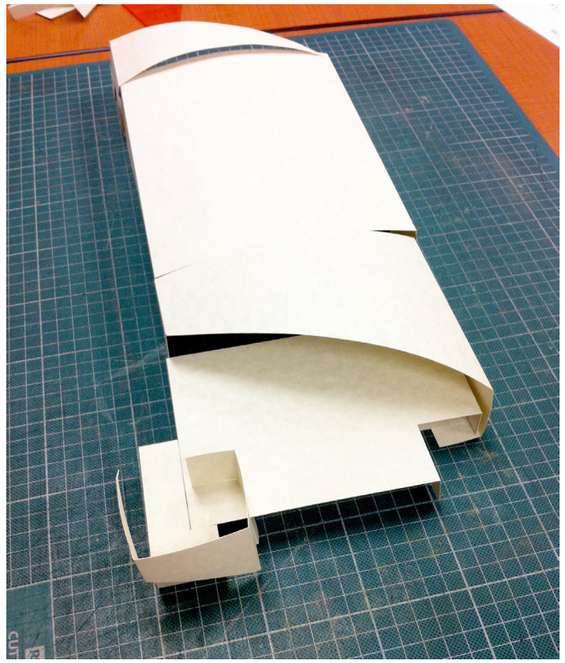
OPTION C PRELIMINARY SKETCH



MASSING STUDIES

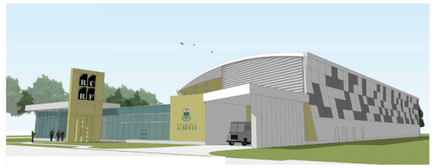


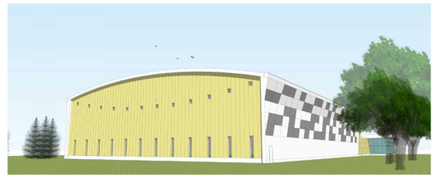


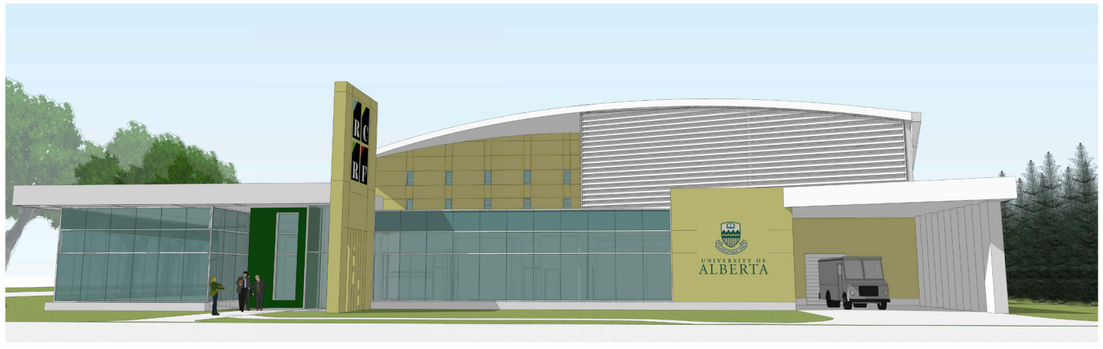


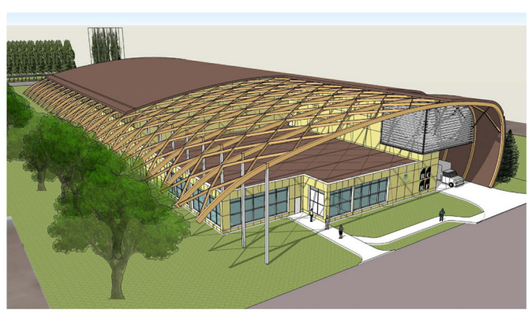
WORKING MODEL VIEWS

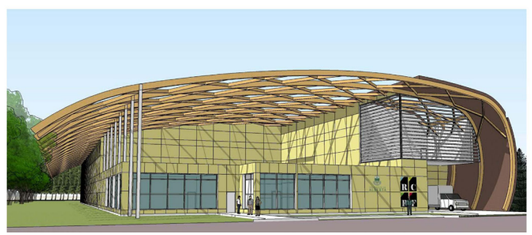
OPTION A DEVELOPMENT











OPTION C DEVELOPMENT

With the facility placement determination, more advanced designs were developed to meet LRDP criteria following the input offered at the Community Open House #1, which occurred at the end of July 2015 and the on-going IPD process with participation of the University of Alberta teams. Three design options were further developed and presented, all of which based on approved design direction to face front of house operations towards the 115A Street and taking advantage of the service access placement close to the site north boundary. The following options were discussed, assessed and cost estimated:

- OPTION A – single storey front of house with separate high density storage roof enclosure;
- OPTION B – two-level front of house with separate high density storage roof enclosure;
- OPTION C – single level front of house with continuous roof enclosure for the entire facility.

It has been determined that while the two-storey approach results in a reduced footprint of the front of house component, an introduction of two functional levels had not produces sufficient advantages both operationally, and from the construction cost points of view. This eliminated further exploration of Option B. Another round of more detailed costing has been conducted by Stuart Olson cost estimating department for Options A and C, which concluded correspondingly that while both approaches projected higher than anticipated construction costs, the Option C become less likely to stay within budgetary parameters established by university for the RCRF project. The direction provided to the DB Team was to pursue the approach and to advance schematic design of Option A to the Design Development phase.

Schematic Design Report

The SDR was submitted 9th November 2015. The design of Option A was developed further and explored by the use of a 3D model. This was presented at the Open House. A sketchup model was used to finalize materiality and form.

UNIVERSITY OF ALBERTA

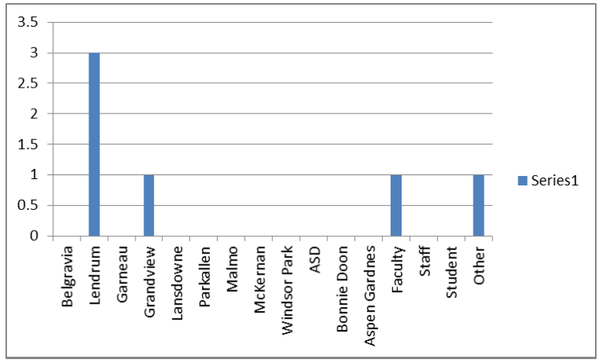
Public Information Open House
Research & Collections Resource Facility (RCRF)
Monday, July 27, 2015

Foote Field, Multipurpose Room
5 – 8 p.m.

Evaluation Summary

6 evaluations received

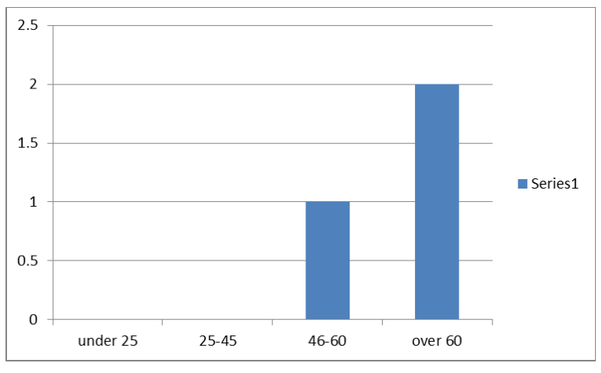
1. Please circle the description below that best portrays you:



2. If you chose “Other” above, please let us know about yourself

   City of Edmonton

3. Please check the age category that you are in.



UNIVERSITY OF ALBERTA

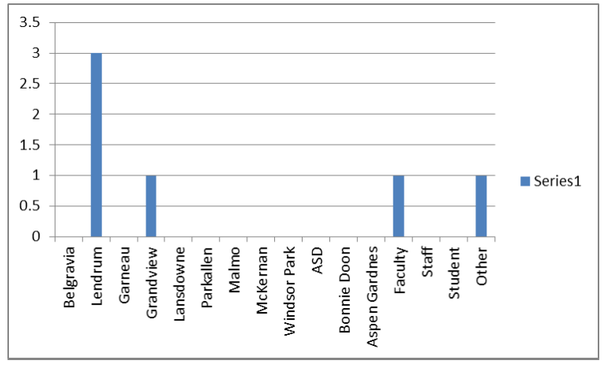
Public Information Open House
Research & Collections Resource Facility (RCRF)
Monday, July 27, 2015

Foote Field, Multipurpose Room
5 – 8 p.m.

Evaluation Summary

6 evaluations received

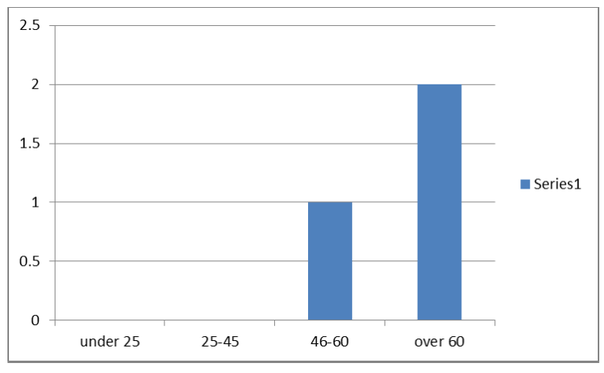
1. Please circle the description below that best portrays you:



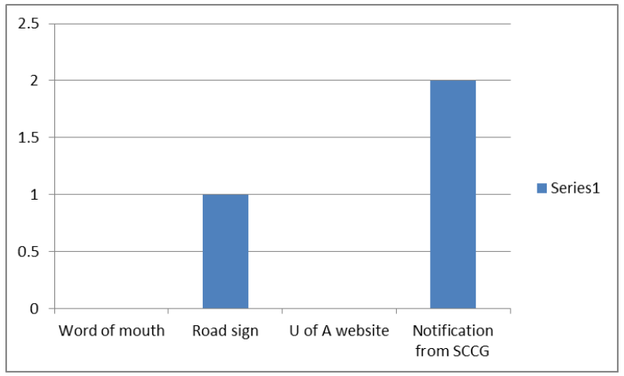
2. If you chose “Other” above, please let us know about yourself

   City of Edmonton

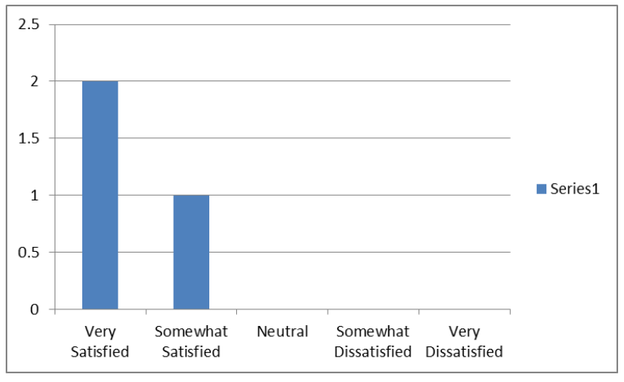
3. Please check the age category that you are in.



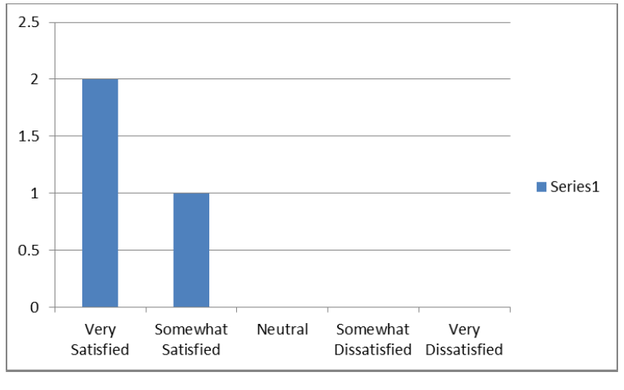
4. How did you hear about this open house?



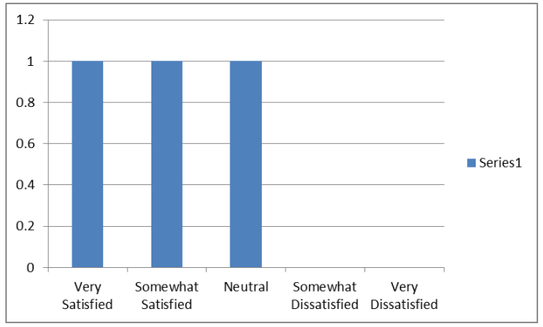
5. Did the material that was presented help you understand the University of Alberta RCRF project?



6. Did the material that was presented help you understand how the RCRF fits into the Long Range Development Plan (LRDP)?



7. Did the material that was presented help you understand the site options (Board # 5) for the RCRF?



8. Please comment on your impressions regarding the proposed site plan options for the RCRF (Board #6)? Please let us know if there are potential impacts that the U of A should consider i.e. traffic, noise, and parking.

Plan 1:

No comments

Plan 2:

Next best after Plan 4

Plan 3:

No comments

Plan 4:

I prefer this plan as it leaves room for much greater future expansion and the parking lot is hidden from view (from Lendrum). Otherwise Plan 2 is next best.

9. Please comment on your impressions regarding the concept plan development for the RCRF (Board #7)?

- Whatever you go with, make it an interesting structure to look at. DON'T make it a big square boring box like the Go Center!
- Seems reasonable and is driven by end of lease of present BARD site.
- The options are good.

10. Please provide any further comments about the RCRF.

- "Hi University Relations, I hope the university keeps Lendrum inform of the progress of the RCRF's construction development. I hope that construction workers are provided parking on site and are told not to park in Lendrum. I hope workers parking on the farm do not displace people that currently park on the farm. I hope that traffic associated with the transport of construction material and

books is managed so as to not be disruptive to Lendrum. An aesthetically pleasing building would be an asset to the community. Stephen Dobson, Lendrum Civics"

- I think it will be important for the archives to have a budget for proper archiving of the various collections. Not just a budget of the building.

- Snow removal and incorporate art on the building for aesthetics.

- City of Edmonton comments are as follows:

  30 July 2015
  TO: Emily Ball University Relations
  FROM: Mo Bot, Principal Planner Planning + Design Section, Nodes+Corridors Planning Unit
  SUBJECT: Research and Collection Resource Facility – July 27 Open House Comments

  The Nodes+Corridors Planning Unit within the Urban Planning and Environment Branch is supportive of this proposal to move the sensitive University of Alberta resource collection from BARD, accommodate a great number of research materials, and free up space at North Campus facilities for other needed uses. The proposed location on South Campus provides excellent access via LRT, in a lower risk location away from industrial land uses, while also providing an opportunity to maximize North Campus facility assets.

  The following comments are provided for your consideration as the concept design is evolved.

  General Site Plan Comments Each of the four site plan proposals indicate future phases. The various site plans present different orientations that will have impacts on pedestrian connectivity and access as well as general integration of the site with other future facilities on the campus. What are the plans for this future phase? Is this expansion something that is expected in the relatively near term (2-5 years) or is the future phase a placeholder for development to come in a much longer time frame?

  For Plan 3 and Plan 4 the future phases are indicated to be internal to the campus away from the eastern edge. This makes sense in the short term, but if this future development is a long way off, there is a risk of these building orientations sanitizing the lands in the internal campus and creating unused space that negatively impacts the pedestrian-oriented design that is envisioned for South Campus. Plan 1 and Plan 2 situate the future phases on the eastern edge of the campus and away from the pedestrian throughways in the sector plan. This ensures that when the pedestrian pathways are developed there are active edges already in existence to help frame the spaces and public realm.

  If the future phase development is envisioned for the 2-5 year time frame after completion of the new RCRF this negative impact is potentially lessened as much of South Campus remains to be developed and pedestrian activity in the near future is likely to be limited.

  Each of the four plans shows limited parking spaces. We are supportive of minimizing parking requirements at South Campus due to proximity to the LRT.

  Site Specific Comments Plan 1
  • Supportive of operational access off existing east service road as this directs vehicular service traffic away from pedestrian throughways and plaza entranceways.
  • Would the pedestrian pathways connecting to the LRT that are outlined in the Long Range Development Plan be implemented as part of this development? If not, then users would likely make use of the east service road which would negate the safety benefit of separating pedestrians and vehicles and would result in an awkward access to the front of the building. Even if the pedestrian throughways are implemented with this project, it could be worth including secondary entrances on other sides of the building to support a more porous campus precinct and facilitates ease of movement between different facilities.

  Nodes+Corridors SUPPORTS Plan 1 due to the above mentioned comments

  Plan 2
  • The same comments for Plan 1 about pedestrian access and orientation apply here.

  Nodes+Corridors SUPPORTS Plan 2 due to the above mentioned comments.

  Plan 3
  • By orienting the main entrance of the facility to the existing service road the potential for conflict between pedestrians and vehicles is increased. While this orientation allows for more direct access from the LRT station it results in the library turning its back on the main campus area that will be developed. It is recommended that if this orientation is advanced that a second major entrance be considered facing into the campus and pedestrian areas to improve visibility and access from the west.
  • Reinforcing the path to the LRT is a positive outcome, however this could be achieved in other ways such as development of the proposed pedestrian network in the Long Range Development Plan.

• This plan has the weakest pedestrian access design and is less supportive of the design guidelines that speak to creating a vibrant public realm.

Nodes+Corridors DOES NOT SUPPORT Plan 3 due to the above mentioned comments.

Plan 4
• This plan is a departure from the sector plan layout. A low rise library is a relatively low intensity land use. While the improved direct access to the LRT is desirable, the lands immediately adjacent to the LRT could be better utilized for higher intensity mixed uses as envisioned in the Long Range Development Plan. This could be achieved with a different building design that includes the library in the base podium of a stacked mixed use building with other institutional uses sharing the same site vertically. The proposed FAR of 1.0 would need to be increased to achieve this type of development.
• By creating direct access to the LRT the potential for pedestrian and service vehicle conflicts on the east access road are reduced.
• Land use intensity and an active mix of activities on LRT-adjacent properties can have a significant impact on the sustainable operations of the transit service as well as the passenger experience. This option presents an incompatible land use mix and intensity for a major transit node on the LRT network.

Nodes+Corridors DOES NOT SUPPORT Plan 4 due to the above mentioned comments.

Design Guidelines Comments

The approach to the concept plan development states that the project aims to
• enhance the public realm;
• create engaging and transparent edges in relation to pedestrian plazas, pathways, and circulation corridors;
• support cohesive and barrier-free connectivity; and
• adhere to sustainable design guidelines that maximize sun potential and reduce wind effects.

It is suggested that the designers reference the City of Edmonton Winter Design Guidelines (draft available here http://www.edmonton.ca/city_government/initiatives_innovation/winter-designguidelines.aspx) when considering ways to improve micro-climate effects around the new building.

The campus wide land use and design guidelines reference a pedestrian campus vision and also speak to complementary internal and external space design. By employing transparent building materials on the ground floor a porous feeling is created where the line between internal and external space blur, which also creates a different pedestrian experience of connectivity to the activities within the building. The City of Edmonton Transit-Oriented Development Guidelines (http://www.edmonton.ca/city_government/documents/PDF/TOD_Guidelines_-_February_2012.pdf) suggest a 70% transparency target for ground-level, non-residential uses, which could be applied in this case.

To support access of the site by alternative and sustainable transportation modes it is suggested that bicycle parking be provided at the facility. There is no mention of bicycle parking on the four site plans.

The district specific design guidelines speak of potential future pedway connections between buildings. Will this design take that goal into consideration and build in knock out panels that would facilitate ease of connecting in to future developments when they are under construction?

These comments are aligned with the provisions in the TOD Guidelines. If there are any questions about these comments or if there is any interest in speaking with planning staff about this project or the future of South Campus more generally, we are available to discuss at your convenience.

Thank you,
Mo Bot

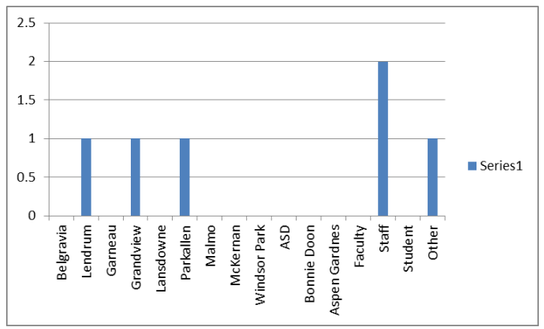
UNIVERSITY OF ALBERTA

Public Information Open House
Research & Collections Resource Facility (RCRF)
Tuesday, November 24, 2015

Evaluation Summary

4 evaluations received

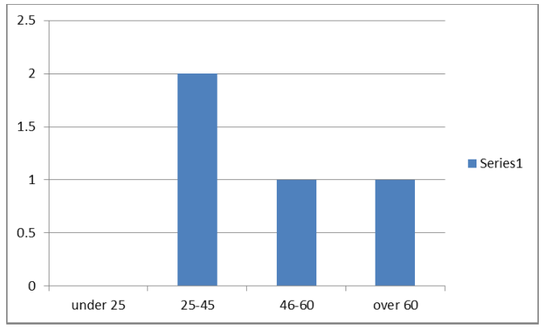
1. Please circle the descriptions below that best portray you:



2. If you chose “Other” above, please let us know about yourself

   No responses

3. Please check the age category that you are in.



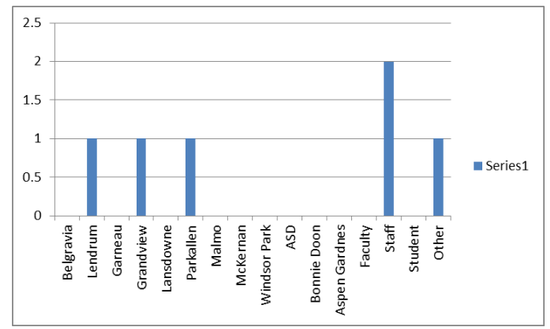
UNIVERSITY OF ALBERTA

Public Information Open House
Research & Collections Resource Facility (RCRF)
Tuesday, November 24, 2015

Evaluation Summary

4 evaluations received

1. Please circle the descriptions below that best portray you:



2. If you chose “Other” above, please let us know about yourself

   No responses

3. Please check the age category that you are in.