National Research Council Canada | Conseil national de recherches Canada

Administrative Services and Property Management Branch | Direction des services administratifs et gestion de l'immobilier

NRC · CNRC

Addendum / Addenda

No./N^{o}
1

Project Description / Description de projet		
U-72 Aircraft Cabin Comfort and Environmental Research Facility - Construction Management		
Solicitation No./ No de sollicitation	Project No./N^{o} de projet	W.O. No./N^{o} d'ordre de travail
16-22023	U-72 5127	
Departmental Representative / représentant ministériel		Date
Maurice Richard		2016-06-22

Notice:	**Nota**:
This addendum shall form part of the tender documents and all conditions shall apply and be read in conjunction with the original plans and specifications.	Cet addenda fait partie intégrale des dossiers d'appel d'offres; toutes les conditions énoncées doivent être lues et appliquées en conjonction avec les plans et les devis originaux.

DESCRIPTION

This document is issued to address requests for information and/or clarifications received from the bidders.

1. Modifications:

1.1. The contract form is CM at Risk that the CM will assume obligations and will undertake construction responsibilities similar to general contractor during the Construction Phase. NRC keeps the right to enter in a Maximum Guaranteed Price (MGP) contract or not once the design are developed and finalized.

1.2. The anticipated date of Tender ready documents of all three packages is end of July 2016. The CM service for design phase is not required and excluded from the contract.

1.3. Bidders are required to obtain the RFP and addendum(s) from the buyandsell.gc.ca web site only. NRC will not be responsible for any error or omission if the information obtained from other sources.

1.4. The key contractor personnel include at a minimum: the Project Manager, Cost Estimation & Control Specialist, Superintendent, and Site Safety Officer. Although persons holding multiple-roles are allowed, full considerations will be given if these positions are filled with different individuals.

1.5. The project should be substantially completed in 40 weeks, and to be fully completed in 44 weeks. The start of the project is pending on obtaining approval from NCC (National Capital Commission) and OMCIAA (Macdonald-Cartier International Airport Authority).

1.6. The class C construction estimate including contingency is $3,810,000.

1.7. Basis of payment is explained in Appendix G. Replace “Appendix (*)- Basis of payment” with “Appendix G- Basis of payment” through the RFP.

1.8. Under SC05-SECURITY REQUIREMENT, add “Contractors who are required to perform any part of the work in the Building U61 must have secret clearance level or to be escorted by a commissioner. NRC will provide commissioner for building U61 is required.”

1.9. Under SC08- PROJECT FEATURES, item #1, Status of Design Documents, delete “Considering the schedule, work must begin before the completion of documents” and replace with “Considering the schedule, work must begin after the completion of documents for each work packages”.

1.10. Under SC08 PROJECT FEATURES, item #2. Execution of the works, add to the end of first paragraph “The contract start date is after obtaining NCC and OMCIAA approval to commence the work”

1.11. Under SRE1-GENERAL INFORMATION, Item #1.1.5-Documents to be included in second envelope, delete “b. Price table of Appendix H – Basis of Payment”

1.12. Under SRE1-GENERAL INFORMATION, Item #1.2.1-Technical Proposal, delete “Sample Project reports. Refer to SRE 2.1” and replace with “Sample of two project reports. Refer to SRE 2.1.2”

1.13. In the French version under EPEP 1 RENSEIGNEMENTS GENERAUX delete “6.1 PRESENTATIONDES PROPOSITIONS” and replace with “1.1 PRESENTATIONDES PROPOSITIONS.”

1.14. Appendix C, GC 48 Determination of Cost- Unit Price Table, item # 48.1, delete “set out in column 3 of the Unit Price Table by the price of that unit set out in column 5 of the Unit Price Table”.

1.15. Appendix F, Section 2 Description of Required Services and work, all services related to RS4 Time services, RS5 Cost services, and RS6 Risk Management will be reimbursed according to “Basis of Payment” Item 2.a- fixed fee.

1.16. RS 14 COMMISSIONING, delete the first paragraph and replace with “Hire a Commissioning Specialist who will be the Commissioning Authority for the Project, directing a commissioning process, or program of activities, for all of the work that is reasonable and practical. This specialist will assist in documenting, witnessing test results. The cost of commissioning will be reimbursed according to “Basis of Payment” Item 3-construction cost”. See Appendix G, item #3.4 . the cost of field engineer if required will be reimbursed under item-3 construction cost.

1.17. In the French Version, Appendix F, SR 5 SERVICES D’ÉTABLISSEMENT DES COÛTS, delete “à l’achèvement de l’avant-projet (documents d’appel d’offres à 66 %, 99 % et 100 %)” and replace with “à l’achèvement de l’avant-projet (documents d’appel d’offres 100 %)”

1.18. RS 18.6 FEES, PERMITS AND CERTIFICATES, add “The building permit is not required for construction. NRC is seeking design approvals from Ottawa MacDonald-Cartier International Airport Authority (OMCIAA) and

National Capital Commission (NCC). The project scope, cost and time are subject to change pending on review of NCC and OMCIAA."

1.19. Appendix G- Basis of Payment, Item 3.a, delete "GC5-Terms of reference" and replace with "Appendix B- Terms of Payments"

2. NOTES

2.1 The two site visit attendee lists are enclosed.

2.2 Revised Appendix "A" – Price Proposal Form in MS. Word and PDF formats is enclosed.

2.3 This addendum includes the 50% drawings issued for review as follows:

- Geo-tech Report
-Civil Drawings issued for 50% review by Ainely dated 15 June 2016
A100, A101, A102, A103
-Architectural Drawings issued for 50% review by KWC dated 15 June 2016
A00, A101, A102, A103, A200, A201, A300
-M&E Drawings issued for 50% review by Goodkey Weedmark Consulting Eng. dated 15 June 2016
M1, M2, M3, M4, M5, E1, E2, E3 by

3. Questions and Answers:

Q1-We just want to confirm that an addendum is being issued for the soils report as discussed at the site meeting.

A1-The geo-tech report is attached for reference.

Q2- In the RFP document, p. 30, item SER1, 5:

a. **ENVELOPE 2 – PRICE PROPOSAL:**
b. Solicitation Number; and
c. Name of Bidder.

Documents to be included in envelope 2 :
a. *Bid and acceptance form (Appendix A)*
b. *Price table of Appendix H – Basis of Payment*
c. *Bid security*

When we go the Appendix H, it is named: Instructions to obtaining mandatory security clearances. We cannot find the Price Table of Appendix H- Basis of Payment document. Could you please clarify/provide?

A2- There is an error typo. See addendum 1, item # 1.7.

Q3- Clarify SRE1 General information, 1.2.1 technical proposal, what the "sample project reports" is referred to?

A3- See addendum 1, item # 1.11.

Q4- Appendix C, items #GC46 through GC50 mentioned the "Unit price Tables". Is there any "Unit price Tables" in the RFP?

A4- The only unit price table is listed on page 2 of Appendix A for personnel.

Q5- Does RS.4 time services can be done in-house?

A5- The time, cost, and risk serves can be done in house as long as the personnel are competent in providing services that are listed under SR4,SR5, and SR6.

Q6- Is it possible to have the word document version of Appendix "A" – Price Proposal Form?

A6- See addendum 1 item 2.2.

Q7- I believe the intent is to engage a Construction Manager as an Agent of NRC, however the form of contract is unclear. There are a number of terms and references which are typically associated with stipulated sum contracts that are out of alignment with the intent. I would like to recommend the NRC use the industry standard CCDC 5A - 2010 Construction Management Contract for Services that is suitably structured for such an engagement.

A7- See Addendum 1. Item #1.1 for the form of contract. The contractor can used CCDC forms to hire the sub-contractors.

Q8- Bonding is typically not provided by the CM under an Agency engagement, as it is only their fee and any direct work (very minimal) that could be bonded. Therefore it is inappropriate to include bonding in the proposals. Major subcontractors, however, could be required to provide bonding and CM would advise NRC on how best to implement that.

A8- See Addendum 1. Item #1.1 for the form of contract.

Q9- Builders Risk Insurance can be secured by the proponents once the full scope of work is known (i.e. tender complete with a Class "A" budget") and it is considered a direct cost to the project. It is inappropriate to include this insurance as part of the proponent's fee consideration, particularly considering the limited design and cost information available in the RFP. This requirement should be removed from the CM tender and remain a requirement to price and secure as part of the budget and procurement management services.

A9- See Addendum 1. Item #1.1 for the form of contract. See Appendix G- Basis of payment, Item#5 Allowable Disbursement, bonding and insurance section for reference.

Q10- Appendix G-item #2.b- "Percent construction fee". The percent construction fee includes:

a)% profit / surcharge applicable on construction costs EXCEPT costs related site office

+

b) Construction of office expenses

+

c) All other unspecified costs elsewhere.

But this amount in the bid is represented by% applied on the amount we have to determine. Is it therefore puts a% on the $ 3,810,000 that will ensure that we cover the profits and office expenses? I do not understand the logic of putting that amount in% if we want to include the cost of site office. I think it would be easier if the site office was included in the fixed fee.

A10- The intent is to keep the cost of construction separate from the contractor operational cost. This clause remains as is.

End of Addendum No.1

NRC·CNRC

Mandatory Bidder's Conference / Conférence d'entrepreneurs obligatoire

Project Description / Description de projet				Closing Date	Closing time
U-72 Construction Management for CCER Facility				June 30th	2:00 PM
Solicitation No./N° de solicitation	Project No./No de projet			1st Showing	Showing Time
16-22023				June 9th	
Departmental Representative / représentant	Signature	Alternate/Questions deadline	Addendum Deadline	2nd Showing	1:30 PM
M. Richard	9/06/2016	June 21st	June 22nd/ 12:00	June 16th	

COMPANY/COMPAGNIE	NAME/NOM	SIGNATURE	PHONE/TELEPHONE	FAX/TELECOPIEUR	EMAIL/COURRIEL
MACOGEP	J.P. GAUDET		819-777-9750		jpmdelo1@gmail.com
RON EASTERN CONSTRUCTION	SCOTT READ		613-225-3640		SREAD@REEL.CA.
PAUL - MMC	PAUL MONDOUX		613 831-6773		PAUL@MMC.CA.
~~François Levesque~~ AMOR	François Levesque		819-968-1141		FLevesque@amor.com
POMERLEAU INC.	JANNEL LACASSE		613-244-4323	x 5535	jannel.lacasse@pomerleau.ca
DAOUST CONSTRUCTION	JEAN DAOUST		613-590-1694	613-590-1695	~~BID@D~~ JEAN@DC.CA
BMI	Peter Lowry		613 235 2126	613 235 3070	Peter@BMI-INO.COM

National Research Council Canada / Conseil national de recherches Canada

Canada

NRC·CNRC

Mandatory Bidder's Conference / Conférence d'entrepreneurs obligatoire

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COMPANY/COMPAGNIE	NAME/NOM	SIGNATURE	PHONE/TELEPHONE	FAX/TELECOPIEUR	EMAIL/COURRIEL
Marant Construction	Martin Michaud		343-540-6080	613-569-1366	martin@marant.ca
Element A					
Marant Construction	Clement Dejoie		343 540 7094	613 569 1366	clement@marant.ca
Taplen Commercial Construction	Hussein Abu Dayah		613-521-2550	613 521 8945	habudayah@taplenconstruction.com
BUTTCON EAST LIMITED	MICHAEL MERCIER		613 296 8894		MMERCIER@BUTTCONEAST.COM
BEAUDOIN	JENNIFER CLOUTIER		418 922-1022	819-595-3381	jc@beaudoincanada.com
DEMARCO CONSTRUCTION	DAVE TURNBULL		613-836-2777	613-836-0777	tom@demarcoconstruction.com

APPENDIX "A"- PRICE PROPOSAL FORM

(5 pages)

BA01 IDENTIFICATION

1. Description of the Work: Construction Management Services
   Building U72, Upland Campus
   Research Road, Ottawa, ON

2. Solicitation Number: RFP16-2203

3. Project Name: CCER-Building U72

BA02 BUSINESS NAME AND ADDRESS OF BIDDER

1. Name: _____

2. Address:_____

3. Telephone: _____ Fax:_____PBN:_____

BA03 THE OFFER

1. The Bidder offers to NRC to perform and complete the Work for the above named project in accordance with the Proposal Documents for the **TOTAL PROPOSAL AMOUNT** of

   $ _____**excluding** all applicable taxes.
   (to be expressed in numbers only)

The **TOTAL PROPOSAL AMOUNT** represents the sum of items (a) + (b) + (c) + (d) + (e) below, all excluding all applicable taxes:

(a) Project Administration and Required Services, including construction coordination services. A fixed monthly fee (Item 2. A) of Annex "G" - Basis of Payment) of
$_____ X 44 weeks = $_____

(b) A Percentage Construction Fee of (Item 2. B) of Annex "G" - Basis of Payment) of
_____% X $3,810,000.00 = $ _____

(c) Estimated Construction Cost: $3,810,000.00

(d) Bonding and Insurance (refer to Item 5) of "Annex "G" - Basis of Payment"
$ _____

(e) Firm Per Diem Rates* (inclusive of payroll costs, overhead and profit) for Additional Personnel for straight time and overtime. (Item 2. C) of Annex "G" - Basis of Payment). See tables below.

Category of Personnel Normal working hours	Quantity (days) (X)	Firm Per Diem Rate (Y)	Extended Price (X x Y)
Project Superintendent	20		
Health & Safety Officer	20		
Total Extended Prices			

Category of Personnel After hours	Quantity (days) (X)	Firm Per Diem Rate for Overtime (Y)	Extended Price (X x Y)
Project Superintendent	3		
Health & Safety Officer	3		
Total Extended Prices for Overtime			

The quantities and categories of personnel identified in (e) above are for evaluation purposes only and shall not be interpreted by the Bidder to be a commitment by NRC to request the services of any of the personnel for any quantity of days whatsoever.

2) Any errors in the addition or multiplication of the amounts in subparagraphs 1)(a), (b), (c), (d) and (e) of BA03 shall be corrected by NRC to obtain the Total Proposal Amount

3) NRC may reject the bid if any of the prices submitted do not reasonably reflect the cost of performing the part of the work to which that price applies.

4) Contractor is to hold the fixed monthly fee for any delays in any phases that would cumulatively affect the total duration of the phase by up to 3 months. The fixed monthly fee would be subject to negotiation for any phase which is delayed beyond 3 months.

BA04 CONSTRUCTION COST OF THE WORK

1. The cost of Labour and Material referred to in subparagraph 1)(b) of BA03 shall be limited to the following categories of expenditure:

(a) Payments to Subcontractors and Suppliers;

(b) Wages, salaries, bonuses of employees of the Contractor provided they are actually and properly engaged on the Work under the Contract;

(c) Assessments payable under any statutory authority relating to workers' compensation, employment insurance, pension plan or holidays with pay, provincial health or insurance plans, environmental reviews, and GST/HST collection costs;

(f) Payments for Material that is necessary for and incorporated in the Work, or that is necessary for and consumed in the performance of the Contract;

(g) Payments for preparation, delivery, handling, erection, installation, inspection, and protection of the project and material necessary for and used in the performance of the Contract;

(h) Pay all fees, levies and obtain all permits as required by authorities having jurisdiction. Provide authorities with plans, applications and information as required to obtain permits and acceptance certificates. Provide inspection and completion certificates as evidence that the work conforms to the requirements of Authority having jurisdiction. Only the actual cost of fees or levies will be reimbursed in accordance with "Basis of Payment Item 4 Allowable Disbursements". All works related in obtaining permit or certificates is to be included in the monthly fixed fee for Project Administration and Required Services.

(i) Any other payments made by the Contractor with the approval NRC that are necessary for the performance of the Contract in accordance with the Contract Documents

BA05 PROPOSAL VALIDITY PERIOD

1. The proposal shall not be withdrawn for a period of **sixty (60) days** following the date of solicitation closing.

BA06 CONTRACT DOCUMENTS

CONTRACT DOCUMENTS (CD)

1. The following are the contract documents:

a. Contract Page when signed by NRC;
b. Duly completed Bid and Acceptance Form and any Appendices attached thereto;
c. Request for Proposal, all Annexes, Appendices and Amendments thereto;
d) Terms of Reference & Basis of Payment
e) General Conditions and clauses
- General Provisions – Construction Services
- Administration of the Contract
- Execution and Control of the Work
- Protective Measures
- Terms of Payment
- Delays and Changes in the Work
- Default, Suspension or Termination of Contract
- Dispute Resolution
- Contract Security
- Insurance
- Allowable Costs for Contract Changes Under GC6.4.1
- Supplementary Conditions

e. Any amendment issued or any allowable bid revision received before the date and time set for solicitation closing;
f. Any amendment incorporated by mutual agreement between NRC and the Contractor before acceptance of the bid; and
g. Any amendment or variation of the contract documents that is made in accordance with the General Conditions.
h) The Contractor's technical proposal

2. The language of the contract documents is the language of the Bid and Acceptance Form submitted.

BA07 ACCEPTANCE AND CONTRACT

1. Upon acceptance of the Contractor's proposal by NRC, a binding Contract shall be formed between NRC and the Contractor. The documents forming the Contract shall be the contract documents referred to CONTRACT DOCUMENTS.

BA08 CONSTRUCTION TIME

1. The full scope of the work is to be completed in 44 weeks.

BA09 BID SECURITY

1. The Bidder shall enclose bid security with its proposal in accordance with GI16 BID SECURITY REQUIREMENTS.

BA11 SIGNATURE

_____

Name and title of person authorized to sign on behalf of Bidder (Type or print)

_____

Signature Date

COMPLETE LIST OF EACH INDIVIDUAL WHO ARE CURRENTLY DIRECTORS OR OWNER OF THE BIDDER

Note to bidders: Write surnames and given names in block letters.

ANNEXE A

FORMULAIRE DE LA PROPOSITION DE PRIX (5 pages)

SA01 IDENTIFICATION

1. Description : Services de gestion de la construction
Édifice U72, campus Uplands
Chemin Research, Ottawa (Ontario)

2. Numéro d'invitation : RFP16-22023

3. Nom du projet : IRCEC – Édifice U72

SA02 NOM COMMERCIAL ET ADRESSE DU SOUMISSIONNAIRE

1. Nom : _____

2. Adresse :_____

3. Téléphone : _____ Télécopieur : _____ NEA : _____

SA03 OFFRE

1. Le soumissionnaire offre au CNRC de terminer les travaux du projet susmentionné, conformément aux documents d'invitation à soumissionner pour le **MONTANT DE PROPOSITION TOTAL** de

_____ $, **excluant** toutes les taxes applicables.
(exprimé en chiffres seulement)

Le **MONTANT DE PROPOSITION TOTAL** représente la somme des éléments a), b), c), d) et e) ci-dessous (taxes applicables en sus) :

a) Administration du projet et services requis, y compris les services de coordination de la construction. Honoraires mensuels (point 2. a) de l'Annexe G - Base de paiement) de
_____ $ × 44 semaines = _____ $

b) Honoraires de construction proportionnels (point 2.b) de l'Annexe B - Base de paiement) de
_____ % × **3 810 000,00** = _____$

c) Coûts de construction estimatifs : **3 810 000,00 $**

d) Caution et assurance (se reporter au point 5) de l'Annexe G – Base de paiement) : _____$

e) Tarifs journaliers fermes * (y compris les coûts salariaux, les frais fixes et les bénéfices) pour le personnel supplémentaire requis pour effectuer les heures normales de travail et les heures supplémentaires (point 2. c) de l'Annexe G – Base de paiement). Voir le tableau ci-dessous.

Catégorie de personnel Heures normales de travail	Nombre de jours (X)	Tarif journalier ferme (Y)	Tarif journalier ferme Prix calculé (X × Y)
Directeur des travaux	20		
Agent de santé et sécurité	20		
Total des prix calculés			

Catégorie de personnel En dehors des heures normales de travail	Nombre de jours (X)	Tarif journalier ferme pour les heures supplémentaires (Y)	Tarif journalier ferme Prix calculé (X × Y)
Directeur des travaux	3		
Agent de santé et sécurité	3		
Total des prix calculés pour les heures supplémentaires			

* Les nombres de jours et les catégories de personnel présentés à l'élément e) ci-dessus sont fournies aux fins d'évaluation seulement et ne doivent pas être interprétés par le soumissionnaire comme un engagement du CNRC à faire appel aux services de quelque employé que ce soit pour quelque nombre de jours que ce soit.

2. Toute erreur d'addition ou de multiplication des montants des éléments 1. a), b), c), d) et e) du point SA03 sera corrigée par le CNRC afin d'obtenir le montant total de la proposition.

3. Le CNRC peut rejeter la soumission si les prix soumis ne reflètent pas raisonnablement les coûts associés à l'exécution de la partie des travaux associée à ce prix.

4. L'entrepreneur maintiendra les honoraires mensuels fixes malgré tout retard d'une phase qui pourrait prolonger de trois mois maximum la durée totale de la phase. Les honoraires mensuels fixes doivent faire l'objet de négociations pour tout retard d'une phase de plus de trois mois.

SA04 COÛT DE CONSTRUCTION DES TRAVAUX

1. Les frais de main-d'œuvre, d'outillage et de matériaux visés à l'élément 1. b) du point SA03 sont limités aux catégories de dépenses suivantes :

a) les paiements versés aux sous-traitants et aux fournisseurs;

b) les traitements, les salaires et les primes versés aux employés de l'entrepreneur, à la condition que ces employés soient effectivement affectés de manière appropriée aux travaux prévus au contrat;

c) les cotisations exigibles en vertu des lois se rapportant à l'indemnisation des accidents du travail, l'assurance-emploi, le régime de retraite ou les congés rémunérés, les régimes d'assurance-maladie ou d'assurance des provinces, les examens environnementaux et les frais de perception de la taxe sur les produits et services ou de la taxe de vente harmonisée;

d) les paiements relatifs aux matériaux nécessaires et intégrés aux travaux, ou nécessaires à l'exécution du contrat et utilisés à cette fin;

e) les paiements relatifs à la préparation, à la livraison, à la manutention, au montage, à l'installation, à l'inspection et à la protection du projet et des matériaux nécessaires à l'exécution du contrat et utilisés à cette fin;

f) payer les honoraires et les impositions, et obtenir tous les permis exigés par les autorités compétentes. Fournir aux autorités les plans, les demandes et les renseignements requis pour obtenir les permis et les certificats d'acceptation. Présenter des certificats d'inspection et d'achèvement comme preuve que le travail est conforme aux exigences de l'autorité compétente. Seuls les coûts réels des honoraires ou des impositions seront remboursés, conformément au point 4, Débours permis, de l'Annexe B – Base de paiement. Tous les travaux liés à l'obtention des permis ou des certificats doivent être compris dans les honoraires mensuels fixes se rapportant à l'administration du projet et aux services requis;

h) tout autre paiement fait par l'entrepreneur avec l'approbation du CNRC qui est nécessaire à l'exécution du contrat, conformément aux documents contractuels.

SA05 PÉRIODE DE VALIDITÉ DES PROPOSITIONS

1. La proposition ne peut être retirée pour une période de **soixante (60) jours** suivant la date de clôture de l'invitation.

SA06 DOCUMENTS DU CONTRAT (DC)

1. Les documents suivants constituent le contrat :

a) la page « Contrat » une fois signée par le CNRC;
b) le Formulaire de soumission et d'acceptation dûment rempli ainsi que toutes les annexes en pièce jointe;
c) la demande de propositions ainsi que tous les appendices, toutes les annexes et toutes les modifications s'y trouvant;
d) le Cadre de référence et la Base de paiement;
e) les clauses et conditions générales :
CG1 Dispositions générales – Services de construction
CG2 Administration du contrat
CG3 Exécution et contrôle des travaux
CG4 Mesures de protection
CG5 Modalités de paiement
CG6 Retards et modifications des travaux
CG7 Défaut, suspension ou résiliation du contrat
CG8 Règlement des différends
CG9 Garantie contractuelle
CG10 Assurances
Coûts admissibles pour les modifications de contrat sous CG6.4.1.
Conditions supplémentaires
f) toute modification émise ou toute révision de soumission recevable, reçue avant l'heure et la date déterminée pour la clôture de l'invitation;
g) toute modification incorporée d'un commun accord entre le CNRC et l'entrepreneur avant l'acceptation de la soumission;
h) toute modification aux documents du contrat qui est apportée conformément aux conditions générales; et
i) la proposition technique de l'entrepreneur.

2. La langue des documents du contrat est celle du Formulaire de soumission et d'acceptation présenté.

SA07 ACCEPTATION ET CONTRAT

1. À l'acceptation de la proposition de l'entrepreneur par le CNRC, un contrat exécutoire est établi entre le CNRC et l'entrepreneur. Les documents contractuels constituant le contrat correspondront aux documents décrits au DOCUMENTS CONTRACTUELS.

SA08 DURÉE DES TRAVAUX

1. L'ensemble des travaux doit être réalisé en quarante-quatre **(44**) semaines.

SA09 GARANTIE DE SOUMISSION

1. Le soumissionnaire joint à sa soumission une garantie de soumission conformément à l'IG16 EXIGENCES RELATIVES À LA GARANTIE DE SOUMISSION.

SA11 SIGNATURE

_____
Nom et titre de la personne autorisée à signer au nom du soumissionnaire (caractères d'imprimerie)

_____ _____
Signature Date

Liste complète des noms de tous les administrateurs ou propriétaires de l'entreprise qui soumissionne

Avis aux soumissionnaires : Inscrire les noms et prénoms des administrateurs en caractères d'imprimerie.

December 2015

REPORT ON

Geotechnical Investigation
Proposed Research Building
National Research Council Uplands Campus
1920 Research Road
Ottawa, Ontario

Submitted to:
Dr. Paul Lebbin
National Research Council Canada
1200 Montreal Road
Ottawa, Ontario
K1A 0R6

REPORT

Report Number: 1542724

Distribution:

2 copies - National Research Council Canada

1 copy - Golder Associates Ltd.

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Table of Contents

FIGURES

APPENDICES

APPENDIX A

APPENDIX B

1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out for a proposed research building to be located at 1920 Research Road on the National Research Council Canada (NRC) Uplands Campus in Ottawa, Ontario.

The purpose of this geotechnical investigation was to assess the general subsurface conditions in the area of the proposed building by means of four boreholes and laboratory testing. Based on an interpretation of the factual information obtained, a general description of the subsurface conditions is presented. These interpreted subsurface conditions and available project details were used to prepare engineering guidelines on the geotechnical design aspects of the project, including construction considerations which could influence design decisions.

The reader is referred to the “Important Information and Limitations of This Report” which follows the text but forms an integral part of this document.

2.0 DESCRIPTION OF PROJECT AND SITE

Plans are being prepared for the construction of a research building to be located at 1920 Research Road on the NRC Uplands Campus in Ottawa, Ontario. The approximate location of the site is shown on the attached Key Plan (Figure 1).

The following is known about the project and site:

- The proposed research building will be located at the southwest corner of the property between the existing U61 and R.C.M.P Hangar buildings on Research Road.
- The building will be 30.5 metres wide and 42.7 metres long in plan area.
- The building will be about 9 metres in height and will mostly be of slab-on-grade construction (i.e., no basement level). It is understood that two areas of the building will have below grade construction, including a 3 metre deep tunnel connection to the U61 building and a 1.2 metre deep pit to be used as a laboratory space.
- The existing site is undeveloped and vegetated with grass. The ground surface is relatively flat to gently sloping, with ground surface elevations ranging from about 113 to 114 metres.

Golder Associates has carried out several previous geotechnical investigations on the NRC Uplands Campus and the Ottawa International Airport lands. Based on the results of those previous investigations, as well as published geological mapping, the subsurface conditions at this site are expected to consist of a thick deposit of sand. The underlying bedrock is indicated to be at about 15 to 25 metres depth.

3.0 PROCEDURE

The fieldwork for this investigation was carried out on October 30, 2015. At that time, four boreholes (numbered 15-1 to 15-4, inclusive) were advanced at the locations shown on the attached Site Plan (Figure 2).

The boreholes were advanced to depths ranging from about 5.3 to 6.1 metres below the existing ground surface using a track-mounted hollow-stem auger drill rig supplied and operated by George Downing Estate Drilling of Grenville-sur-la-Rouge, Quebec.

Standard penetration tests were carried out within the boreholes at regular intervals of depth and samples of the soils encountered were recovered using split spoon sampling equipment. Upon reaching the target sampling depth in borehole 15-3 (about 6 metres), a dynamic cone penetration test (DCPT) was conducted to a final depth of about 25 metres below the existing ground surface.

A standpipe piezometer was sealed into borehole 15-4 to allow for subsequent measurement of the groundwater level. The groundwater level was measured in the standpipe on November 5, 2015.

The fieldwork was supervised by an experienced technician from our staff who located the boreholes, directed the drilling and in situ testing operations, logged the boreholes and samples, and took custody of the samples retrieved. On completion of the drilling operations, samples of the soils obtained from the boreholes were transported to our laboratory for examination by the project engineer and for laboratory grain size distribution testing.

One sample of soil from borehole 15-1 was submitted to EXOVA Laboratories for chemical analysis related to potential corrosion of buried steel elements and potential sulphate attack on buried concrete elements.

The boreholes were selected, marked in the field, and subsequently surveyed by Golder Associates personnel. The positions and ground surface elevations at the borehole locations were determined using a Trimble R8 GPS survey unit. The Geodetic reference system used for the survey is the North American datum of 1983 (NAD83). The borehole coordinates are based on the Universal Transverse Mercator (UTM Zone 18) coordinate system. The elevations are referenced to Geodetic datum (CGVD28).

4.0 SUBSURFACE CONDITIONS

The subsurface conditions encountered in the boreholes are shown on the Record of Borehole Sheets provided in Appendix A. The results of the basic chemical analysis are provided in Appendix B.

In general, the subsurface conditions consist of about 120 to 300 millimetres of topsoil overlying a thick deposit of sand that contains discontinuous interbedded silty clay layers. The sand deposit is generally layered and is composed of silty sand to sand with varying amounts of gravel, cobbles and boulders. The results of grain size distribution testing carried out two samples of silty sand are provided on Figure 3.

At boreholes 15-1 and 15-2, the sand deposit contains significant amounts of gravel, cobbles and boulders below about 3.7 metres depth. Practical refusal to augering was encountered within these two boreholes at about 6.1 and 5.3 metres depth, respectively. Based on published geological mapping and the depth of the DCPT completed at borehole 15-3, it is considered likely that these auger refusals represent boulders with the sand deposit rather than the bedrock surface.

In all of the boreholes, the sand deposit contains discontinuous clayey silt seams and silty clay layers.

Standard penetration tests carried out within the sand deposit, excluding the silty clay layers, gave 'N' values ranging from 2 to greater than 50 blows per 0.3 metres of penetration, indicating a very loose to very dense state of packing. The higher 'N' values (greater than 50 blows per 0.3 metres of penetration) may reflect the presence of cobbles or boulders within the sand deposit, rather than the state of packing of the soil matrix. Standard penetration tests carried out within the silty clay layers gave 'N' values ranging from 4 to 9 blows per 0.3 metres of penetration, indicating a stiff to very stiff consistency.

The groundwater level was measured in the standpipe sealed in borehole 15-4 on November 5, 2015. At that time, the groundwater level was measured at a depth of about 3.9 metres below the existing ground surface (i.e., about elevation 109.4 metres). Groundwater levels are expected to fluctuate seasonally. Higher groundwater levels are expected during wet periods of the year, such as spring.

One sample of soil from borehole 15-1 was submitted to EXOVA Laboratories for chemical analysis related to potential corrosion of buried steel elements and potential sulphate attack on buried concrete elements. The results of this testing are provided in Appendix B and are summarized in the table below.

Borehole/Sample Number	Sample Depth (m)	Chloride (%)	SO_4 (%)	pH	Resistivity (ohm-cm)
15-1 / Sa 3	1.5 – 2.1	0.003	<0.01	8.2	6,250

5.0 DISCUSSION

5.1 General

This section of the report provides engineering guidelines on the geotechnical design aspects of the project based on our interpretation of the available information described herein and project requirements.

Reference should be made to the "Important Information and Limitations of this Report" which follows the text of this report but forms an integral part of this document.

The foundation engineering guidelines presented in this section have been developed in a manner consistent with the procedures outlined in Part 4 of the 2010 National Building Code of Canada (NBCC) for Limit States Design.

5.2 Site Grading

In general, the subsurface conditions on this site consist of about 120 to 300 millimetres of topsoil overlying a thick deposit of sand that contains discontinuous interbedded silty clay layers. Based on the results of this investigation, there is no practical limit on the amount of grade raise fill that can be placed on this site (from the perspective of the compressibility of the underlying soil).

As a more general guideline regarding the site grading, the preparation for filling of the site should include stripping the topsoil within the footprint of the proposed structure. The topsoil should also be removed from beneath pavement areas (if planned). The topsoil should be stockpiled separately for re-use in landscaping applications only.

5.3 Excavations

No unusual problems are anticipated in excavating the overburden materials using conventional hydraulic excavating equipment, recognizing that large cobbles and boulders should be expected within the sand deposit. Boulders larger than 0.3 metres in size should be removed from the walls of the excavations for worker safety.

Provided that the groundwater level is not encountered during excavation (which is expected to be the case), the Occupational Health and Safety Act (OHSA) of Ontario indicates that side slopes in the overburden could be sloped at a minimum of 1 horizontal to 1 vertical (i.e., Type 3 soils). Steeper side slopes would require shoring to meet the requirements of the OHSA.

The groundwater level was measured in the standpipe sealed in borehole 15-4 on November 5, 2015. At that time, the groundwater level was measured at a depth of about 3.9 metres below the existing ground surface (i.e., about elevation 109.4 metres). For construction of the basement areas, it is anticipated that the excavation would be no deeper than about 3 metres depth, and therefore above the groundwater level. As such, groundwater inflow into the excavations is anticipated to be minimal. Water that accumulates in the bottom of the excavations (e.g., from perched groundwater, surface water, or precipitation) can be handled by pumping from well filtered sumps established in the floor of the excavations. Provided that excavations do not extend deeper than the groundwater level, it is not expected that the pumping volumes will be in excess of 50,000 litres per day; therefore, the requirement for a Permit-To-Take-Water (PTTW) is not anticipated. If construction occurs during or following a period of sustained rain or snowmelt (e.g., during spring), a higher groundwater level than was measured during the geotechnical investigation should be expected.

If deeper excavations are planned, groundwater inflow through the sand deposit could be significant, and has the potential to disturb the subgrade and destabilize excavation side-slopes. In that case, an active dewatering program would likely be needed in order to lower the groundwater level in advance of excavation. The volume of water to be pumped would also likely exceed 50,000 litres per day, and therefore a PTTW would be required. Further assistance with respect to excavation dewatering and preparing a PTTW can be provided, if required.

5.4 Seismic Considerations

The site is located in an area where there exists a history of earthquake activity. The potential for seismic liquefaction of the overburden therefore needs to be assessed. A seismic Site Class also needs to be assigned, to be used by the structural designer.

5.4.1 Liquefaction Assessment

Seismic liquefaction occurs when earthquake vibrations cause an increase in pore water pressures within the soil. The presence of excess pore water pressures reduces the effective stress between the soil particles, and the soil's frictional resistance to shearing. This phenomenon, which leads to a temporary reduction in the shear strength of the soil, may cause:

- Large lateral movements of even gently sloping ground, referred to as "lateral spreading";
- Reduced shear resistance (i.e., bearing capacity) of soils which support foundations, as well as reduced resistance to sliding; and,
- Reduced shaft resistance for deep foundations as well as reduced resistance to lateral loading.

In addition, 'seismic settlements' may occur once the vibrations and shear stresses have ceased. Seismic settlement is the process whereby the soils stabilize into a denser arrangement after an earthquake, causing potentially large surface settlements.

The following conditions are more prone to experiencing seismic liquefaction:

- Coarse grained soils (i.e., more probable for sands than for silts);
- Soils having a loose state of packing; and,
- Soils located below the groundwater level.

An assessment of the liquefaction potential of the sand deposit was carried out using the Seed and Idriss (1971) simplified procedure based on SPT N_{60}-values from the boreholes. The SPT N-values reported on the borehole records were corrected for overburden stress, rod length during sampling, and hammer energy efficiencies. The assessment is based on an earthquake with a magnitude of 6.0 and a peak ground acceleration of 0.37g (Ottawa area specified design values for a Site Class D site).

The results of this assessment suggest that a looser zone within the sand deposit, about 0.6 to 0.7 metres in thickness at about elevation 109 metres, is susceptible to liquefaction under the west side of the building (i.e., boreholes 15-3 and 15-4). Conversely, the sand deposit at the east side of the building (boreholes 15-1 and 15-2) would not be classified as liquefiable. The assessment assumes that the grade raise on the site would be negligible (a conservative assumption).

The anticipated total and differential settlement of the liquefiable native sand under the analyzed earthquake event could be up to about 25 and 15 millimetres, respectively. The amount of settlement is highly dependant on the earthquake event, the thickness of the deposit and its liquefaction potential, and therefore settlements could be highly variable.

The seismic settlements would be in addition to the anticipated settlements under static loading, which are discussed in Section 5.5.1.

If the foundations of the proposed building are founded above or within these materials (which will be the case if shallow foundations are used), then the structure should be designed to accept this differential settlement without experiencing collapse, which should be feasible. It should be noted that guarding against collapse (i.e., allowing for 'safe exit') is considered to be the design objective for earthquake conditions (recognizing that the 'design' earthquake has a return period of 2,475 years), although the structure may be damaged by the earthquake and rendered unserviceable.

Alternatively, the proposed building could be founded on deep foundations, or the liquefiable soils could be improved (i.e., densified) to reduce their liquefaction potential. Further discussion regarding soil improvement can be provided if the seismic settlements can not be accommodated.

5.4.2 Site Classification for Seismic Site Response

The seismic design provisions of the 2010 NBCC depend, in part, on the shear wave velocity of the upper 30 metres of soil and/or rock below founding level. The NBCC permits the Site Class to be specified based solely on the stratigraphy and in situ testing data (i.e., standard penetration test results), rather than from direct measurements of the shear wave velocity.

The NBCC requires a Site Class F designation for sites with liquefiable soils, which would require that a site-specific seismic response evaluation be carried out for the design of this building. However, the code allows the use of a "non-liquefied" Site Class for structures having a fundamental period of vibration less than or equal to 0.5 seconds. It is anticipated that this will be the case for the proposed building; however, this would need to be confirmed by the structural engineer. In that case, a non-liquefied Site Class D designation can be used for design (based on the standard penetration test 'N' values recorded in the boreholes). Due to the depth of bedrock at this site (deeper than 25 metres based on the DCPT results), it is not expected that site specific shear wave velocity testing (e.g., Multichannel Analysis of Surface Waves) would provide a more favourable Site Class and therefore is not recommended.

5.5 Foundations

The proposed building is underlain by a deposit of liquefiable sand (at depth), as discussed in Section 5.4.1. Provided that the seismic settlements can be accommodated (as anticipated), or mitigated using densification techniques (discussed in Section 5.5.2), the building can be designed using conventional shallow foundations. A discussion of this foundation type is given below. Additional discussion on alternative foundation types (e.g., deep foundations) can be provided, if requested.

5.5.1 Shallow Foundations

It is anticipated that most of the footings will bear on native silty sand or sand. In some areas, weathered silty clay may also be encountered at footing level.

The bearing resistance at Serviceability Limit States (SLS) for footings bearing on undisturbed native soil (sand or silty clay) may be taken as 150 kilopascals for footings up to 3 metres in width. The factored bearing resistance at Ultimate Limit States (ULS) may be taken as 250 kilopascals.

The post construction total and differential settlements of footings sized using the above SLS net bearing resistance value (for non-seismic loading conditions) should be less than about 25 and 15 millimetres, respectively, provided that the soil at or below founding level is not disturbed during construction. For the design earthquake event, these footings would experience seismic settlements, which are estimated to result in an additional 25 millimetres of differential settlement in the areas of boreholes 15-3 and 15-4 (west side of the building), as previously discussed in Section 5.4.1.

The factored ULS bearing resistance will potentially decrease following the design earthquake as a result of liquefaction of the underlying sand layer at depth. The magnitude of the strength decrease is dependent on the footing size and the depth to the liquefiable layer. For this site, various post-liquefaction ULS bearing resistance values (based on footing depths of 1.5 and 3.0 metres depth for the slab on grade and basement areas, respectively) are provided in the following table:

Footing Width (m)	Post-Liquefaction Factored ULS Bearing Resistance (kPa)	
	Footing Elevation = 111.5 m (1.5 m deep)	Footing Elevation = 110.0 m (3.0 m deep)
0.6	250	200
0.8	250	145
1.0	220	115
1.3	150	90
1.5	130	80
2.0	100	70

The values given above will change for different footing sizes and footing depths. Further guidance with respect to post-liquefaction bearing resistance can be provided, if requested.

5.5.2 Seismic Liquefaction Mitigation – Rapid Impact Compaction (RIC)

If the seismic settlements and/or post-liquefaction ULS bearing resistance given above cannot be accommodated, consideration can be given to carrying out a ground improvement program to mitigate the potential liquefaction. It is anticipated that the most cost-effective option for this project would be rapid impact compaction (RIC). With this method, dynamic energy is imparted to the ground by repeatedly dropping a 7.5 ton weight from a controlled height onto a patented foot. Compaction parameters are automatically controlled and monitored from the RIC's cab with an on-board data acquisition system.

If this method is employed, the RIC soil improvement should be carried out within the entire building footprint plus at least 3 metres laterally beyond the footprint. The influence depth of RIC would be typically about 5 metres to 7 metres below the ground surface based on the known site conditions. A performance

specification and verification testing program (i.e., post-RIC standard penetration testing) should be developed. For this site, it is anticipated that upon completion of the RIC program, the potential for liquefaction will be eliminated, and design can proceed assuming that seismic settlements will not occur. In addition, higher bearing resistance values could likely be provided. Further guidance with respect to RIC can be provided, if requested.

5.6 Frost Protection

Most of the soils at this site are considered to be frost susceptible. Therefore, all exterior foundation elements should be provided with a minimum of 1.5 metres of earth cover for frost protection purposes. Isolated, unheated footings adjacent to surfaces which are cleared of snow cover during winter months should be provided with a minimum of 1.8 metres of earth cover.

5.7 Floor Slabs

5.7.1 Slab on Grade

In preparation for construction of the slab on grade, the topsoil and all loose, wet, and disturbed material should be removed from within the building footprint. Provision should be made for at least 150 millimetres of Ontario Provincial Standard Specification (OPSS) Granular A to form the base for the slab on grade. Any bulk fill required to raise the grade to the underside of the Granular A should consist of OPSS Granular B Type II. The underslab fill should be placed in maximum 300 millimetre thick lifts and should be compacted to at least 95 percent of the material's standard Proctor maximum dry density using suitable vibratory compaction equipment.

If the native sands are not seismically improved during the site preparation, then the floor slab could settle, crack or heave during an earthquake event, since these native sands will liquefy and the floor slab will lose its support. However, this level of damage is considered to be consistent with the objectives of the seismic design in accordance with the National Building Code, and recognizing that the 'design' earthquake has a return period of about 2,475 years. The same applies for the basement floor slab as well.

5.7.2 Basement and Tunnel Floor Slabs

For the areas of the structure that will have a basement level, provision should be made for at least 200 millimetres of clear crushed stone to form the base of the basement floor slabs. The underslab fill should be placed in maximum 300 millimetre thick lifts and should be compacted to at least 95 percent of the material's standard Proctor maximum dry density using suitable vibratory compaction equipment.

To prevent hydrostatic pressure build up beneath the basement floor slabs, it is suggested that the granular base for the floor slabs be drained. This could be achieved by installing perforated pipes fully wrapped in a geotextile in the floor slab bedding that connects by gravity drainage to an exterior drainage system (storm sewer) or sump pit.

A geotextile should be provided between the clear stone underslab fill and the sandy subgrade soils, to avoid loss of fine soil particles from the subgrade soil into the voids in the clear stone and ultimately into the drainage system. In the extreme case, loss of fines into the clear stone could cause ground loss beneath the slab and plugging of the drainage system. Where a geotextile is required, it should consist of a Class II non-woven geotextile with a Filtration Opening Size (FOS) not exceeding about 100 microns, in accordance with OPSS 1860.

5.8 Foundation Wall Backfill and Lateral Earth Pressure

Most of the soils at this site are frost susceptible and should not be used as backfill against exterior, unheated, or well insulated foundation elements. To avoid problems with frost adhesion and heaving, foundation walls should be backfilled with non-frost susceptible sand or sand and gravel conforming to the requirements for OPSS Granular B Type I.

To avoid ground settlements around the foundations, which could affect site grading and drainage, all of the backfill materials should be placed in maximum 300 millimetre thick lifts and compacted to at least 95 percent of the material's standard Proctor maximum dry density.

Drainage of the wall backfill can be provided by means of a perforated pipe subdrain in a surround of 19 millimetre clear stone, fully wrapped in geotextile, which leads by gravity drainage to the exterior drainage system (storm sewer) or a sump pit.

Basement and tunnel walls made within open cut excavations, backfilled with granular material, and effectively drained as described above should be designed to resist lateral earth pressures calculated using a triangular distribution of the stress with a magnitude of:

$$\sigma_h(z) = K_o (\gamma z + q)$$

Where: $\sigma_h(z)$ = Lateral earth pressure on the wall at depth z, kilopascals;

K_o = At-rest earth pressure coefficient, 0.5;

γ = Unit weight of retained soil, 20 kilonewtons per cubic metre;

z = Depth below top of wall, metres; and,

q = Uniform surcharge at ground surface behind the wall to account for traffic, equipment, or stockpiled soil (use 12 kilopascals as a minimum).

The lateral earth pressure equation given above is in an unfactored format and will need to be factored for Limit States Design purposes.

These lateral earth pressures would increase under seismic loading conditions. The earthquake-induced dynamic pressure distribution, which is to be added to the static earth pressure distribution, is a linear distribution with maximum pressure at the top of the wall and minimum pressure at its toe (i.e., an inverted triangular pressure distribution). The combined pressure distribution (static plus seismic) may be determined as follows:

$$\sigma_h(z) = K_o \gamma z + (K_{AE} - K_o) \gamma (H-z)$$

Where:

K_{AE} = The seismic earth pressure coefficient, use 0.8 for a non-yielding wall, and,

H = The total depth to the bottom of the foundation wall, metres.

5.9 Site Servicing

At least 150 millimetres of OPSS Granular A should be used as pipe bedding for sewer and water pipes. Where unavoidable disturbance to the subgrade surface occurs during construction, it may be necessary to place a sub-bedding layer consisting of 300 millimetres of compacted OPSS Granular B Type II beneath the Granular A. The bedding material should in all cases extend to the spring line of the pipe and should be compacted to at least 95 percent of the material's standard Proctor maximum dry density. The use of clear crushed stone as a bedding layer should not be permitted anywhere on this project since fine particles from the sandy backfill materials and native soils could potentially migrate into the voids in the clear crushed stone and cause loss of lateral pipe support.

Cover material, from the spring line of the pipe to at least 300 millimetres above the top of pipe, should consist of OPSS Granular A or Granular B Type I with a maximum particle size of 25 millimetres. The cover material should be compacted to at least 95 percent of the material's standard Proctor maximum dry density.

It should generally be possible to re-use the excavated inorganic soils as trench backfill. Where the trench will be covered with hard surfaced areas (e.g., pavements and sidewalks), the type of material placed in the frost zone (between subgrade level and 1.8 metres depth) should match the soil exposed on the trench walls for frost heave compatibility. Trench backfill should be placed in maximum 300 millimetre thick lifts and should be compacted to at least 95 percent of the material's standard Proctor maximum dry density using suitable vibratory compaction equipment.

5.10 Pavement Design

In preparation for pavement construction (if required), all topsoil and any unsuitable fill (i.e., fill containing organic matter) should be excavated from the pavement areas for predictable pavement performance.

Areas requiring grade raising to proposed subgrade level should be filled using acceptable (compactable and inorganic) earth borrow or OPSS Select Subgrade Material. Grade raise fill should be placed in maximum 300 millimetre thick lifts and should be compacted to at least 95 percent of the material's standard Proctor maximum dry density using suitable vibratory compaction equipment.

The surface of the subgrade or fill should be crowned to promote drainage of the pavement granular structure. Perforated pipe subdrains should be provided at subgrade level extending from the catch basins for a distance of at least 3 metres in four orthogonal directions, or longitudinally where parallel to a curb. Alternatively, the subdrains could outlet into a nearby drainage swale.

The pavement structure for access roadways and truck traffic areas should consist of:

Pavement Component	Thickness (mm)
Asphaltic Concrete	90
OPSS Granular A Base	150
OPSS Granular B Type II Subbase	450

The pavement structure for car parking areas should consist of:

Pavement Component	Thickness (mm)
Asphaltic Concrete	50
OPSS Granular A Base	150
OPSS Granular B Type II Subbase	300

The granular base and subbase materials should be uniformly compacted to at least 100 percent of the material's standard Proctor maximum dry density using suitable vibratory compaction equipment. The asphaltic concrete should be compacted in accordance with OPSS 310.

The composition of the asphaltic concrete pavement in car parking areas should be as follows:

- Superpave 12.5 Surface Course – 50 millimetres

The composition of the asphaltic concrete pavement in access roadways and truck traffic areas should be as follows:

- Superpave 12.5 Surface Course – 40 millimetres
- Superpave 19.0 Binder Course – 50 millimetres

The pavement design should be based on a Traffic Category of Level B. The asphalt cement used on this project should be made with PG 58-34 asphalt cement on all lifts.

The above pavement designs are based on the assumption that the pavement subgrade has been acceptably prepared (i.e., where the trench backfill and grade raise fill have been adequately compacted to the required densities and the subgrade surface not disturbed by construction operations or precipitation). Depending on the actual conditions of the pavement subgrade at the time of construction, it could be necessary to increase the thickness of the subbase and/or to place a woven geotextile beneath the granular materials.

5.11 Corrosion and Cement Type

One sample of soil from borehole 15-1 was submitted to EXOVA Laboratories for chemical analysis related to potential corrosion of buried steel elements and potential sulphate attack on buried concrete elements. The results of this testing are provided in Appendix B.

The results indicate that concrete made with Type GU Portland cement should be acceptable for substructures. The results also indicate a potential for corrosion of exposed ferrous metal.

6.0 ADDITIONAL CONSIDERATIONS

The soils at this site are sensitive to disturbance from ponded water, construction traffic, and frost.

All footing and subgrade areas should be inspected by experienced geotechnical personnel prior to filling or concreting to ensure that soil having adequate bearing capacity has been reached and that the bearing surfaces have been properly prepared. The placing and compaction of any engineered fill should be inspected to ensure that the materials used conform to the specifications from both a grading and compaction view point.

Ontario Regulation 903 would ultimately require abandonment of the standpipe installed for this investigation. It is proposed that decommissioning of this device be made part of the construction contract.

At the time of the writing of this report, only preliminary details for the proposed building were available. Golder Associates should be retained to review the final drawings and specifications for this project prior to tendering to ensure that the guidelines in this report have been adequately interpreted.

7.0 CLOSURE

We trust that this report meets your current needs. If you have any questions, or if we may be of further assistance, please do not hesitate to contact the undersigned.

GOLDER ASSOCIATES LTD.

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IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client, National Research Council Canada. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder can not be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then the client may authorize the use of this report for such purpose by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process, provided this report is not noted to be a draft or preliminary report, and is specifically relevant to the project for which the application is being made. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client can not rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder can not be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Groundwater Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT (cont'd)

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. **The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report.** The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

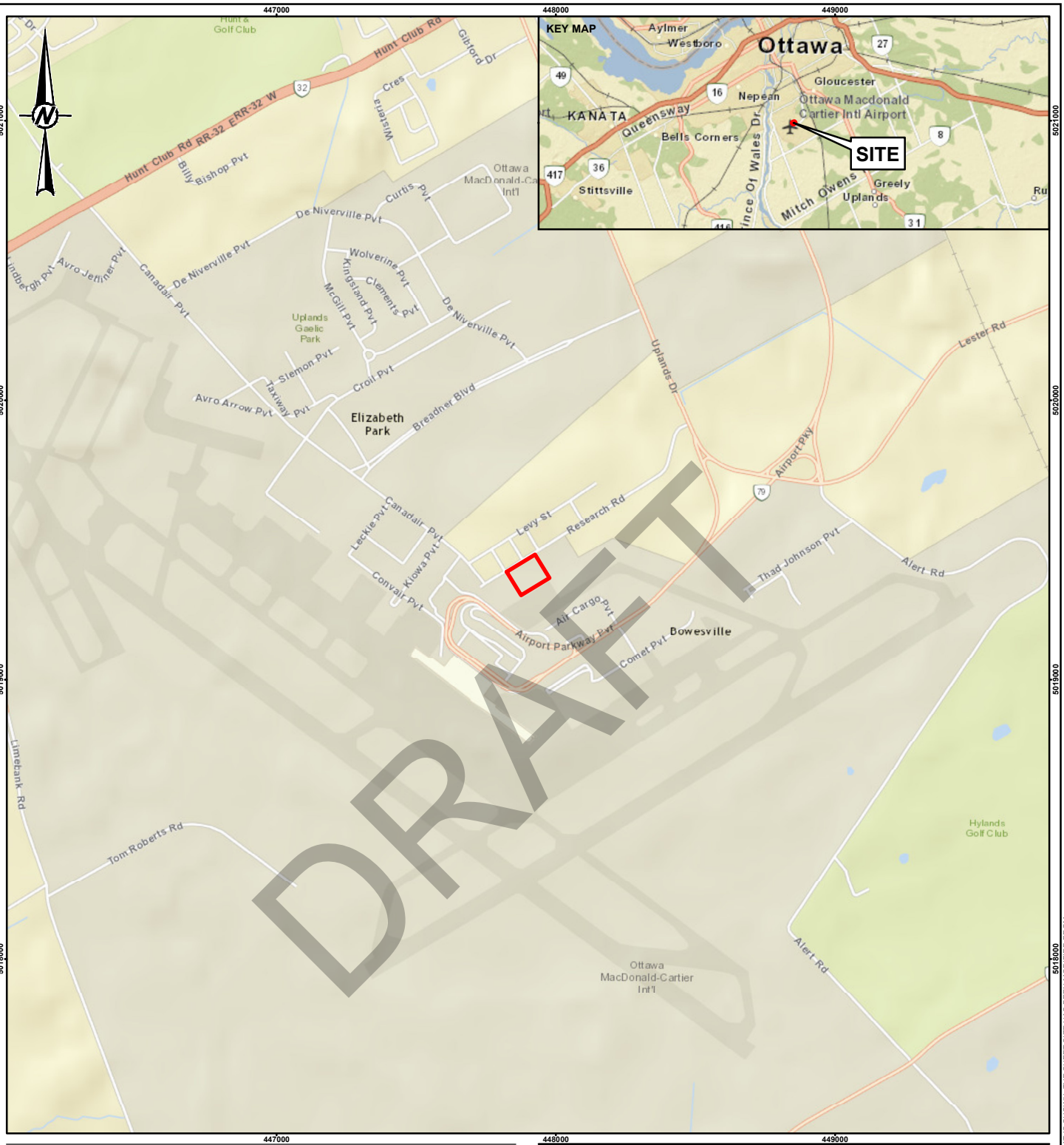
Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.



LEGEND

SITE BOUNDARY

0 200 400 800

1:20,000 METRES

NOTE(S)

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1542724

REFERENCE(S)

1. SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, DELORME, USGS, INTERMAP, INCREMENT P CORP., NRCAN, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), ESRI (THAILAND), MAPMYINDIA, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: UTM ZONE 18 VERTICAL DATUM: CGVD28

CLIENT

NATIONAL RESEARCH COUNCIL CANADA (NRC)

PROJECT

GEOTECHNICAL INVESTIGATION, PROPOSED RESEARCH BUILDING, NRC UPLANDS CAMPUS, 1920 RESEARCH ROAD, OTTAWA, ONTARIO

TITLE

KEY PLAN

CONSULTANT

Golder Associates

YYYY-MM-DD	2015-11-20
DESIGNED	----
PREPARED	BR
REVIEWED	SD
APPROVED	TMS

PROJECT NO.	PHASE	REV.	FIGURE
1542724	1000	0	1

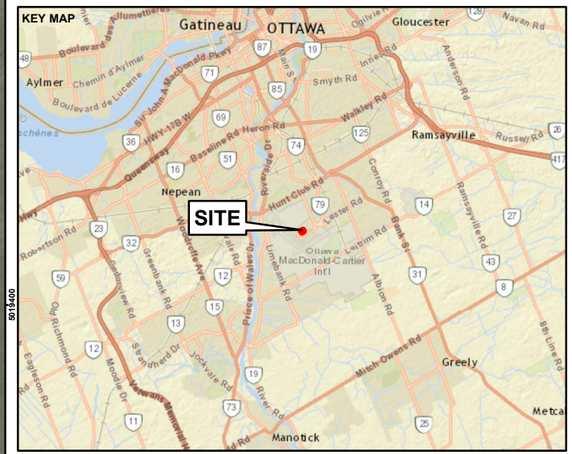
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm 0

Path: N:\Active\Spatial IM\National\ResearchCouncil\UplandsCampus\ResearchBuilding\99_PROJ\1542724_NRC_Geotech\40_PROD\Phase1000\1542724-1000-01_KeyPlan.mxd

LEGEND

- APPROXIMATE BOREHOLE LOCATION
- PROPOSED BUILDING - U72
- SITE BOUNDARY

KEY MAP



0 15 30 60

1:1,500 METRES

NOTE(S)

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1542724.

REFERENCE(S)

1. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2014
2. SERVICE LAYER CREDITS: CITY OF OTTAWA
SOURCES: ESRI, HERE, DELORME, USGS, INTERMAP, INCREMENT P CORP., NRCAN, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), ESRI (THAILAND), MAPMYINDIA, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
3. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: UTM ZONE 18 VERTICAL DATUM: CGVD28

CLIENT

NATIONAL RESEARCH COUNCIL CANADA (NRC)

PROJECT

GEOTECHNICAL INVESTIGATION, PROPOSED RESEARCH BUILDING, NRC UPLANDS CAMPUS, 1920 RESEARCH ROAD, OTTAWA, ONTARIO

TITLE

SITE PLAN

CONSULTANT

Golder Associates

YYYY-MM-DD	2015-11-20
DESIGNED	----
PREPARED	BR
REVIEWED	SD
APPROVED	TMS

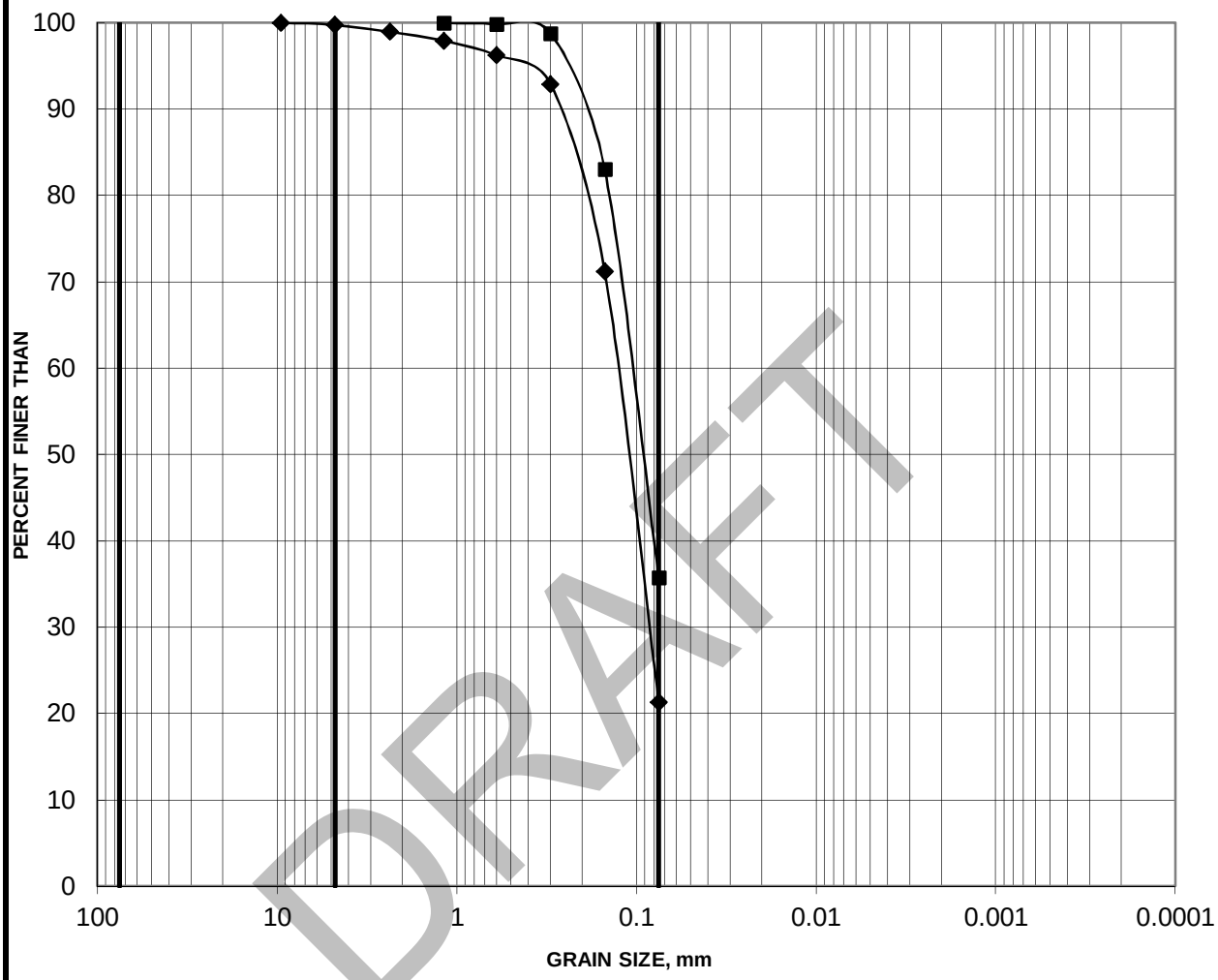
PROJECT NO.	PHASE	REV.	FIGURE
1542724	1000	0	**2**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm 0

Path: N:\Active\Spatial_IM\National\ResearchCouncilUplandsCampus\ResearchBuilding\99_PRO\1542724_NRC_Geotech\40_PROD\Phase1000\1542724-1000-02_SitePlan.mxd

GRAIN SIZE DISTRIBUTION	FIGURE 3

SILTY SAND



Cobble	coarse	fine	coarse	medium	fine	SILT AND CLAY
Size	GRAVEL SIZE		SAND SIZE			

Borehole	Sample	Depth (m)
15-3	7	4.57-5.18
15-4	8A	5.34-5.49

Project: 1542724

Golder Associates

Created by: MI
Checked by: CNM

APPENDIX A

List of Abbreviations and Symbols
Record of Borehole Sheets

LIST OF ABBREVIATIONS

The abbreviations commonly employed on Records of Boreholes, on figures, and in the text of the report are as follows:

I. SAMPLE TYPE

AS	Auger sample
BS	Block sample
CS	Chunk sample
DO or DP	Seamless open-ended, driven or pushed tube samplers
DS	Denison type sample
FS	Foil sample
RC	Rock core
SC	Soil core
SS	Split spoon sampler
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample
DT	Dual tube sample
DD	Diamond drilling

II. PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg. (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split spoon sampler for a distance of 300 mm (12 in.).

Dynamic Cone Penetration Resistance (DCPT); N_d:

The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) to drive an uncased 50 mm (2 in.) diameter, 60^0 cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH:	Sampler advanced by hydraulic pressure
PM:	Sampler advanced by manual pressure
WH:	Sampler advanced by static weight of hammer
WR:	Sampler advanced by weight of sampler and rod

Cone Penetration Test (CPT):

An electronic cone penetrometer with a 60^0 conical tip and a projected end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_t), porewater pressure (u) and friction along a sleeve are recorded electronically at 25 mm penetration intervals.

III. SOIL DESCRIPTION

(a) Cohesionless Soils

Density Index (Relative Density)	**N** Blows/300 mm Or Blows/ft.
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	over 50

(b) Cohesive Soils

C_u or S_u

Consistency	kPa	Psf
Very soft	0 to 12	0 to 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1,000
Stiff	50 to 100	1,000 to 2,000
Very stiff	100 to 200	2,000 to 4,000
Hard	Over 200	Over 4,000

IV. SOIL TESTS

w	Water content
w_p or PL	Plastic limited
w_1 or LL	Liquid limit
C	Consolidaiton (oedometer) test
CHEM	Chemical analysis (refer to text)
CID	Consolidated isotropically drained triaxial test[1]
CIU	Consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	Relative density
DS	Direct shear test
Gs	Specific gravity
M	Sieve analysis for particle size
MH	Combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	Organic content test
SO_4	Concentration of water-soluble sulphates
UC	Unconfined compression test
UU	Unconsolidated undrained triaxial test
V	Field vane test (LV-laboratory vane test)
γ	Unit weight

Note: [1] Tests which are anisotropically consolidated prior shear are shown as CAD, CAU.

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	3.1416
ln x	natural logarithm of x
$\log_{10}$ x or log x	logarithm of x to base 10
g	acceleration due to gravity
t	time
FOS	factor of safety
V	volume
W	weight

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta \sigma'$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
ν	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial vertical effective overburden stress
$\sigma_1\sigma_2\sigma_3$	principal stresses (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3) / 3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight)*
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) formerly (G_s)
e	void ratio
n	porosity
S	degree of saturation

* Density symbol is ρ. Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

(a) Index Properties (continued)

w	water content
w_1 or LL	liquid limit
w_p or PL	plastic limit
I_p or PI	plasticity Index = $(w_1 - w_p)$
w_s	shrinkage limit
I_L	liquidity index = $(w - w_p) / I_p$
I_c	consistency index = $(w_1 - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (overconsolidated range)
C_s	swelling index
C_α	coefficient of secondary consolidation
m_v	coefficient of volume change
c_v	coefficient of consolidation (vertical direction)
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation stress
OCR	overconsolidation ratio = σ'_p / σ'_{vo}

(d) Shear Strength

τ_p or τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction = tan δ
c'	effective cohesion
c_u or s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3) / 2$
p'	mean effective stress $(\sigma'_1 + \sigma'_3) / 2$
q	$(\sigma_1 - \sigma_3) / 2$ or $(\sigma'_1 - \sigma'_3) / 2$
q_u	compressive strength $(\sigma_1 - \sigma_3)$
S_t	sensitivity

Notes:
[1] $\tau = c' + \sigma' \tan \phi'$
[2] shear strength = (compressive strength) / 2

PROJECT: 1542724

RECORD OF BOREHOLE: 15-1

SHEET 1 OF 1

LOCATION: N 5019342.2 ;E 447855.1

BORING DATE: October 30, 2015

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		113.78							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00 / 113.48	1	SS	11				
		(SM) SILTY SAND, some gravel to gravelly; dark brown, with cobbles; non-cohesive, moist, compact to dense		0.30							
1					2	SS	43				
					3	SS	48				
2				111.65							
		(SP) SAND, fine, trace gravel; brown; non-cohesive, moist, compact		2.13 / 111.34							
		(SM) SILTY SAND, fine, trace gravel; red brown, with clayey silt seams; non-cohesive, moist, compact		2.44 / 110.89	4	SS	13				
3		(SP) SAND, fine, trace gravel; grey brown, with silt seams; non-cohesive; moist, compact		2.89	5	SS	22				
				110.13							
		(SW/GW) SAND and GRAVEL; grey brown, with cobbles and boulders; non-cohesive, moist, very dense		3.65	6	SS	>50				
4											
					7	SS	82				
5											
					8	SS	>50				
6				107.69							
		End of Borehole Auger Refusal on Probable Boulder		6.09							
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DG

CHECKED: SD

PROJECT: 1542724

RECORD OF BOREHOLE: 15-2

SHEET 1 OF 1

LOCATION: N 5019316.4 ;E 447871.5

BORING DATE: October 30, 2015

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		113.91							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00 / 113.71							
		(SM) SILTY SAND, some gravel to gravelly; dark brown; non-cohesive, moist, compact to very dense		0.20	1	SS	13				
1					2	SS	57				
					3	SS	21				
2				111.78							
		(SP) SAND; red brown, with clayey silt seams; non-cohesive, moist, loose		2.13	4	SS	5				
				111.02							
3		(SM) gravelly SILTY SAND; dark brown, with cobbles; non-cohesive, moist, compact		2.89	5	SS	19				
				110.26							
		(SW/GW) SAND and GRAVEL; grey brown, with cobbles and boulders; non-cohesive, moist, very dense		3.65	6	SS	83				
4											
					7	SS	>50				
5				108.58							
		End of Borehole Auger Refusal on Probable Boulder		5.33							
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DG

CHECKED: SD

PROJECT: 1542724

RECORD OF BOREHOLE: 15-3

SHEET 1 OF 3

LOCATION: N 5019364.2 ;E 447891.6

BORING DATE: October 30, 2015

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		113.02							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00							
		(SM) SILTY SAND, some gravel to gravelly; dark brown; non-cohesive, moist, compact		0.15	1	SS	12				
1					2	SS	13				
				111.65							
		(SP) SAND, fine to medium; light brown; non-cohesive, moist, compact		1.37							
				111.35							
		(SM) SILTY SAND, fine to medium, some gravel; dark brown; non-cohesive, moist, compact to loose		1.67	3	SS	27			M	
2					4	SS	7				
				110.13							
3		(CI) SILTY CLAY, trace sand; grey brown, highly fissured (WEATHERED CRUST); cohesive, w>PL, very stiff		2.89	5	SS	9				
				109.37							
		(SM) SILTY SAND, fine; grey, with clayey silt seams; non-cohesive, wet, compact to loose		3.65	6	SS	11				
4											
					7	SS	4				
5				107.84							
		(CI) SILTY CLAY; grey brown; cohesive, w>PL, stiff		5.18							
					8	SS	4				
6				106.93							
	DCPT AW Rods	Unsampled Overburden Dynamic Cone Penetration Test (DCPT)		6.09							
7											
8											
9											
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DG

CHECKED: SD

PROJECT: 1542724

RECORD OF BOREHOLE: 15-3

SHEET 2 OF 3

LOCATION: N 5019364.2 ;E 447891.6

BORING DATE: October 30, 2015

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10		*--- CONTINUED FROM PREVIOUS PAGE ---*									
	DCPT	Unsampled Overburden Dynamic Cone Penetration Test (DCPT)									
	AW Rods										
11											
12											
13											
14											
15											
16											
17											
18											
19											
20		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DG

CHECKED: SD

PROJECT: 1542724

RECORD OF BOREHOLE: 15-3

SHEET 3 OF 3

LOCATION: N 5019364.2 ;E 447891.6

BORING DATE: October 30, 2015

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
20		*--- CONTINUED FROM PREVIOUS PAGE ---*									
	DCPT AW Rods	Unsampled Overburden Dynamic Cone Penetration Test (DCPT)							105		
21											
									121		
22											
									137		
									153		
23									144		
									102		
									122		
									102		
24											
									105		
									101		
25				88.02							
		End of Borehole/DCPT		25.00					113		
26											
27											
28											
29											
30											

DEPTH SCALE

1 : 50

LOGGED: DG

CHECKED: SD

PROJECT: 1542724

RECORD OF BOREHOLE: 15-4

SHEET 1 OF 1

LOCATION: N 5019338.5 ;E 447908.2

BORING DATE: October 30, 2015

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		113.27							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00							
		(SM) SILTY SAND, some gravel to gravelly; dark brown, with cobbles; non-cohesive, moist, very loose to loose		0.12	1	SS	5				Bentonite Seal
1					2	SS	2				
					3	SS	3				Native Backfill
2					4	SS	6				
				110.38							
3		(SM) SILTY SAND, fine; brown, with clayey silt seams; non-cohesive, moist to wet, loose		2.89	5	SS	8				
4					6	SS	6				Bentonite Seal
											Silica Sand
5					7	SS	9				
				107.78							Standpipe
		(CI) SILTY CLAY; grey; cohesive, w>PL, very stiff		5.49	8	SS	6			M	
6				107.18							
		End of Borehole		6.09							WL in Standpipe at Elev. 109.36 m on Nov. 5, 2015
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: DG

CHECKED: SD

MIS-BHS 001 1542724.GPJ GAL-MIS.GDT 12/15/15 JM

APPENDIX B

Results of Chemical Analysis
EXOVA Laboratories Report No. 1522272

EXOVA ENVIRONMENTAL ONTARIO

Certificate of Analysis

Client: Golder Associates Ltd. (Ottawa)
1931 Robertson Road
Ottawa, ON
K2H 5B7
Attention: Mr. Alex Meacoe
PO#:
Invoice to: Golder Associates Ltd. (Ottawa)

Report Number:	1522272
Date Submitted:	2015-11-09
Date Reported:	2015-11-17
Project:	1542724
COC #:	803128

Dear Alex Meacoe:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: Shyla Monette 2015.11.17 15:47:27 -05'00'

Shyla Monette
Team Leader, Inorganics

All analysis is completed in Ottawa, Ontario (unless otherwise indicated).

Exova Ottawa is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on our CALA scope of accreditation. It can be found at http://www.cala.ca/scopes/2602.pdf.

Exova (Ottawa) is certified and accredited for specific parameters by OMAFRA, Ontario Ministry of Agriculture, Food and Rural Affairs (for farm soils). Licensed by Ontario MOE for specific tests in drinking water.

Exova (Mississauga) is accredited for specific parameters by SCC, Standards Council of Canada (to ISO 17025)

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline values listed on this report are provided for ease of use (informational purposes) only. Exova recommends consulting the official provincial or federal guideline as required.

Client: Golder Associates Ltd. (Ottawa)
1931 Robertson Road
Ottawa, ON
K2H 5B7
Attention: Mr. Alex Meacoe
PO#:
Invoice to: Golder Associates Ltd. (Ottawa)

Report Number: 1522272
Date Submitted: 2015-11-09
Date Reported: 2015-11-17
Project: 1542724
COC #: 803128

				Lab I.D.	1212712
				Sample Matrix	Soil
				Sample Type	
				Sampling Date	2015-10-30
				Sample I.D.	BH15-1 sa3 5-7
Group	**Analyte**	**MRL**	**Units**	**Guideline**	
Agri. - Soil	pH	2.0			8.2
General Chemistry	Cl	0.002	%		0.003
	Electrical Conductivity	0.05	mS/cm		0.16
	Resistivity	1	ohm-cm		6250
	SO4	0.01	%		<0.01

Guideline = *** = Guideline Exceedence**
All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

At Golder Associates we strive to be the most respected global group of companies specializing in ground engineering and environmental services. Employee owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organizational stability. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees now operating from offices located throughout Africa, Asia, Australasia, Europe, North America and South America.

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South America	+ 55 21 3095 9500

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Golder Associates

BUILDING U-72
FLIGHT RESEARCH LABORATORY
NRC , OTTAWA

DRAWING LIST

LEGEND

APPLICABLE TO ALL ARCHITECTURAL DRAWINGS :

- XX → DRAWING NOTE
- X / AXX → ELEVATION REFERENCE
- X / AXX → DETAIL NUMBER; SECTION DETAIL REFERENCE; DRAWING NUMBER
- X / AXX → DETAIL REFERENCE
- DXXX → DOOR TAG
- W-X → WALL TYPE
- XXX / ???? → CEILING TYPE; CEILING TAG; CEILING HEIGHT IN mm, AFF
- 00.00 → ELEVATION HEIGHT
- 100.00 → ELEVATION DATUM (IN PLAN)
- NEW 1 HR FIRE RATED WALL ASSEMBLY
- DXXX → NEW DOOR

ABBREVIATIONS

Ø	DIAMETRE
AWB	ALUMINUM WALL BASE
ACT-1	ACOUSTIC CEILING TILE
BR	BACKREST
CH	COAT HOOK
℄	CENTRE LINE
CONC	CONCRETE
CPT	CARPET
CMU	CONCRETE MASONRY UNIT
CR	CURTAIN ROD
C/W	COMPLETE WITH
DA	DOOR ACTUATOR BUTTON
DMNT	DEMOUNTABLE
DN	DOWN
DWG	DRAWING
EPF	EPOXY FLOOR FINISH
EPST	EXPOSED STRUCTURE AND ROOF DECK
EPT	EPOXY PAINT
EQ	EQUAL
EX	EXISTING
EXT.	EXTERIOR
FD	FLOOR DRAIN
FFL	FINISHED FLOOR LEVEL
FHC	RECESSED FIRE HOSE CABINET
FLR	FLOOR
FRP	FIBREGLASS REINFORCED PLASTIC
GB	GYPSUM BOARD
GL	INSULATED GLASS, SEE SPECS
GRB	GRAB BAR
HM	HOLLOW METAL
HS	HOOK STRIP
INT.	INTERIOR
LNR	METAL LINER
MR	MIRROR
ND	SANITARY NAPKIN DISPOSAL
NTS	NOT TO SCALE
OC	ON CENTER
PDO	POWER DOOR OPERATOR
PF	PRE-FINISHED
PS	PRESSED STEEL
PT	PAINT
#R	RISERS
RD	ROOF DRAIN
REV	REVERSE
RSD	ROLLING STEEL DOOR
RWB	RESILIENT WALL BASE
SD	SOAP DISPENSOR
SIM	SIMILAR
SN	STAIN FINISH
SP	SPRINKLER HEAD
TG	TEMPERED GLASS
TI	TAPERED INSULATION
T/O	TOP OF
TP	TOILET PAPER DISPENSER
TPS	THERMALLY BROKEN PRESSED STEEL
TYP	TYPICAL
U/S	UNDERSIDE
VCT	VINYL COMPOSITION TILE
VWB	VINYL WALL BASE
WC	TOILET
WD	WOOD
WT	WALL TILE
WGB	WATERPROOF GYPSUM BOARD
WHS	WALL HUNG SINK
WR	RECESSED WASTE RECEPTACLE

PARTITION WALLS:NEW CONSTRUCTION

W1 — EXTERIOR WALL
PRE-FINISHED METAL SIDING ON
175mm GALVANIZED METAL HORIZONTAL "Z" BAR FRAMING
150mm SEMI RIGID INSULATION
HORIZONTAL STRUCTURAL GIRTS.

P1 — INTERIOR WALL
16MM GYPSUM BOARD, PAINT FINISH, ON EACH SIDE OF
92MM METAL STUD AT 400 O.C. EXTEND STUD FRAMING FROM TOP OF SLAB TO UNDERSIDE OF STEEL DECK ABOVE.

R1 — ROOF ASSEMBLY
- 2-PLY MODIFIED BITUMEN ROOF MEMBRANE
- 6mm PROTECTION BOARD
- TAPERED INSULATION, THICKNESS VARIES, SEE ROOF PLAN
- 2 LAYERS OF 75mm INSULATION, SHIP-LAPPED JOINTS
- 13mm GLASS FACED GYPSUM BOARD
- ROOF DECK, SEE STRUCTURAL DRAWINGS, PAINT UNDERSIDE
- OPEN WEB STEEL JOISTS, SEE STRUCTURAL DRAWINGS, PAINT FINISH

R2 — PARAPET ASSEMBLY
2-PLY MODIFIED BITUMEN ROOF MEMBRANE
PRIMER OR ADHESIVE
19mm PRESSURE TREATED PLYWOOD
38x89mm PRESSURE TREATED WOOD STUD AT 400mm OC
89 MINERAL FIBRE INSULATION

GENERAL NOTES

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Administrative Services and Property Management Branch / Division des services administratifs et gestion de l'immobilier

NRC · CNRC

No.	Date	Revision	By: Par:
1	JUNE 15 2016	ISSUED FOR 50% REVIEW	KWC

Date Printed / Date imprimée

kwc

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B Location drawing no. / sur dessin no.
C Drawing no. / dessin no.

project / projet
U-72 FLIGHT RESEARCH FACILITY
UPLANDS CAMPUS

OTTAWA, ON

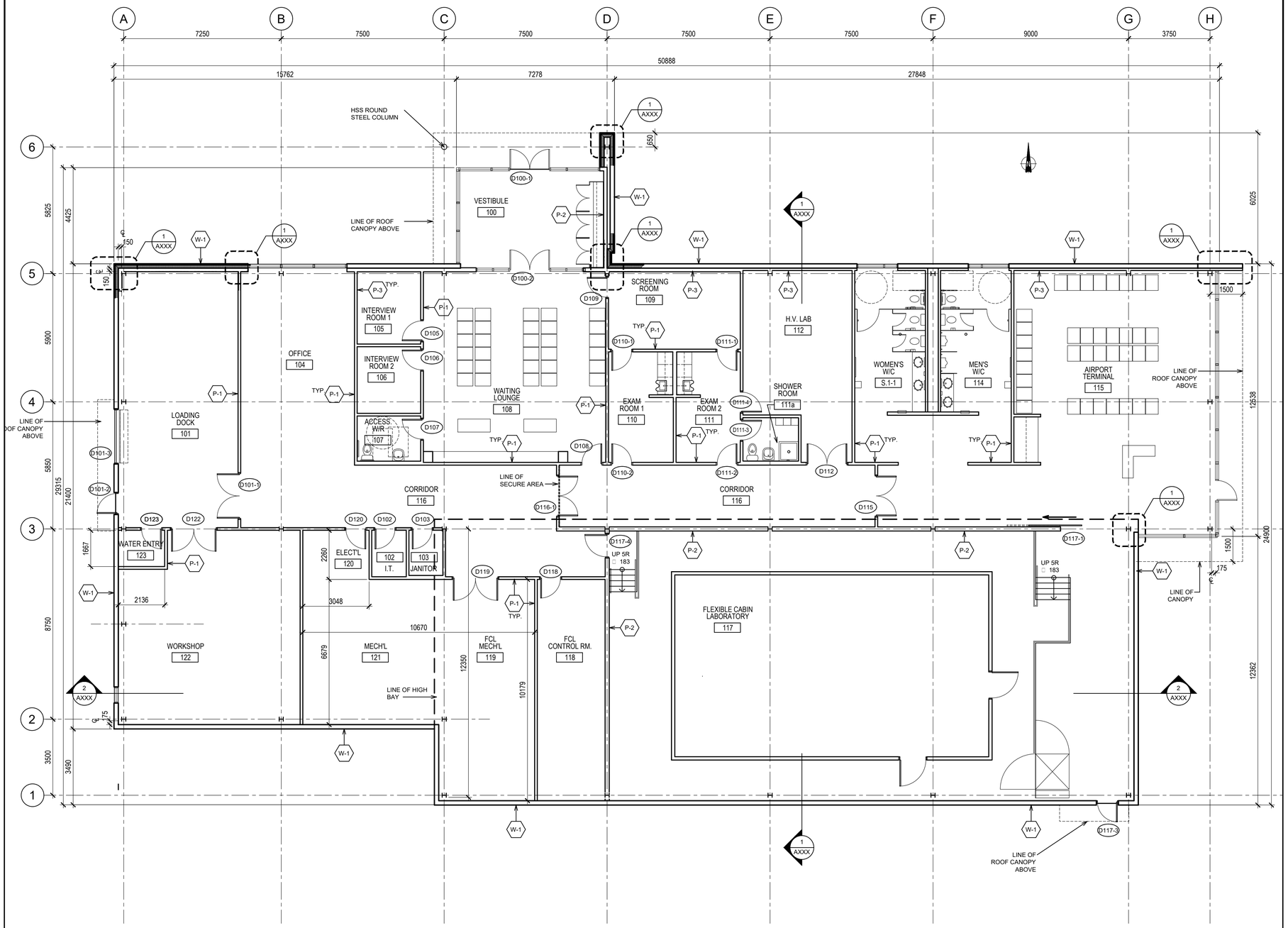
drawing / dessin
COVER SHEET

designed / conçu: CD/MM	date / date: JUNE. 2016
drawn / dessiné: CD/MM	scale / échelle: AS NOTED
checked / vérifié: MM	sheet / feuille: 1 of/de xx
approved / approuvé: MM	W.O.no. / D.T.no.: XX

dwg.no. / dessin no.: **A00**

ASPM A1 (841x594)

C
0 10 20mm 40 60 80 100 120 140 160 180 200mm



1 A100 FLOOR PLAN
SCALE 1 : 100

ASPM A1 (841x594)

GENERAL NOTES

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DRAWING NOTES - SHEET A101

THESE NOTES APPLY TO DRAWING SHEET A101 ONLY

01 XXXXXXX.

02 XXXXXXXX.

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No.	Date	Revision	By: Par:
1	JUNE 15 2016	ISSUED FOR 50% REVIEW	KWC

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NRC U72 FLIGHT RESEARCH FACILITY
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FLOOR PLAN

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CD/ MM	JUNE. 2016
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MM	----

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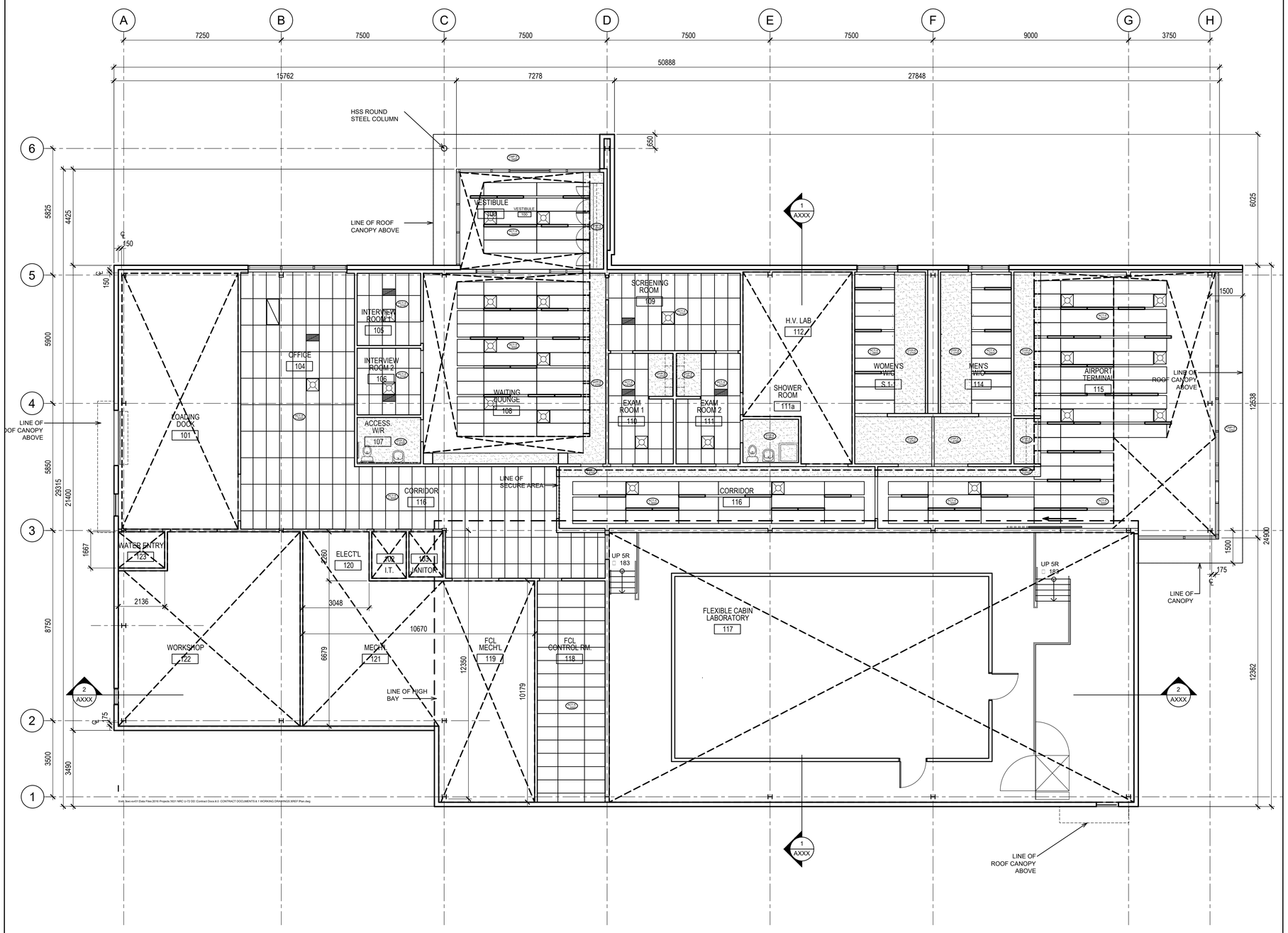
A101



1 A102 REFLECTED CEILING PLAN
SCALE 1 : 100

ASPM A1 (841x594)

0 10 20mm 40 60 80 100 120 140 160 180 200mm

GENERAL NOTES

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DRAWING NOTES - SHEET A102

THESE NOTES APPLY TO DRAWING SHEET A102 ONLY

01 XXXXXXX.

02 XXXXXXXX.

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Administrative Services and Property Management Branch
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1	JUNE 15 2016	ISSUED FOR 50% REVIEW	KWC

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project projet

NRC U72 FLIGHT RESEARCH FACILITY
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OTTAWA, ON

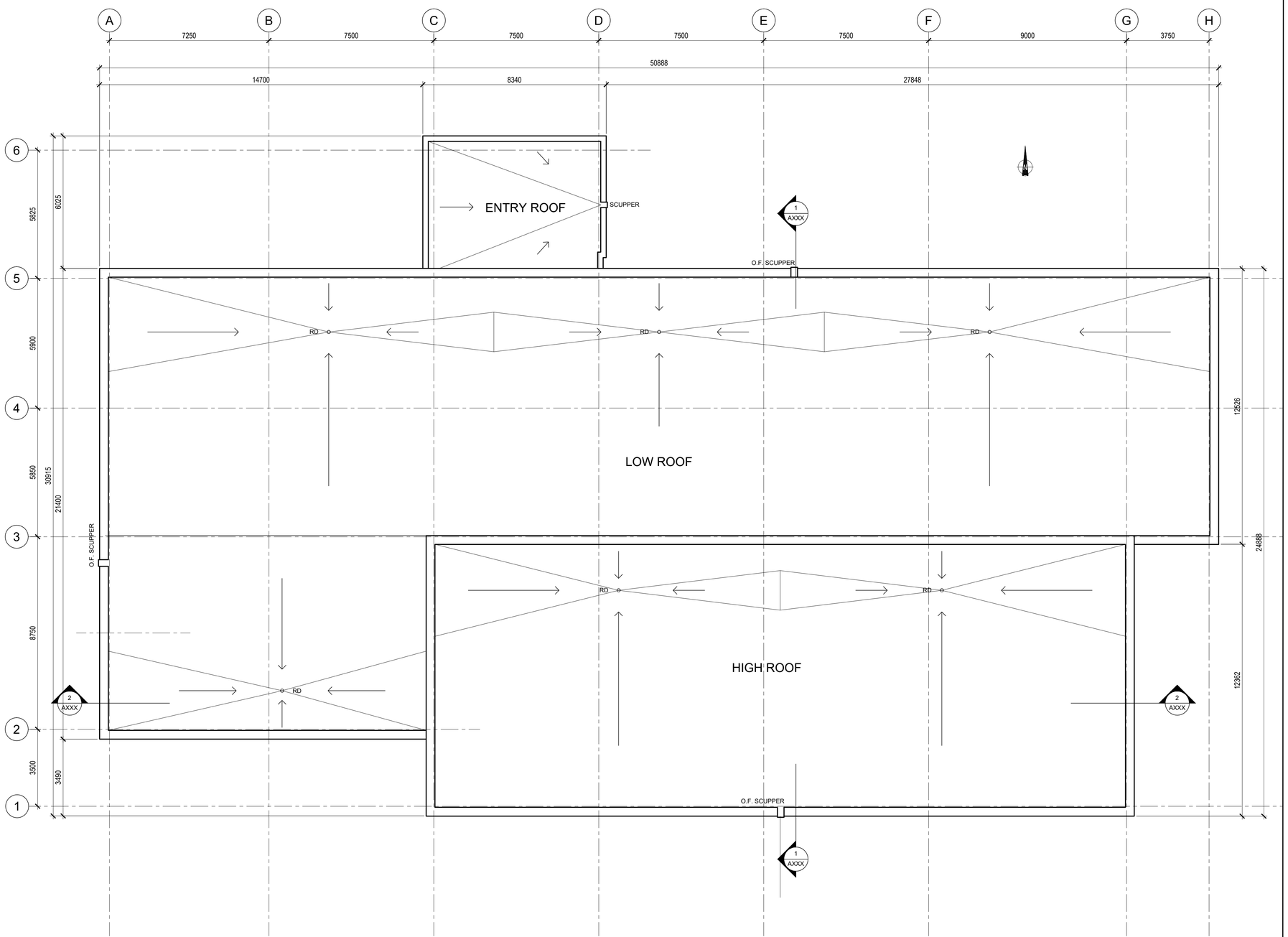
drawing dessin

REFLECTED CEILING PLAN

designed conçu	date date
MM/CD	JUN. 2016
drawn dessiné	scale échelle
CD	AS NOTED
checked vérifié	sheet feuille
MM	– of/de –
approved approuvé	W.O.no. D.T.no.
XX	----

dwg.no. dessin no.

A102



1 A103 ROOF PLAN
SCALE 1 : 100

ASPM A1 (841x594)

0 10 20mm 40 60 80 100 120 140 160 180 200mm

GENERAL NOTES

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DRAWING NOTES - SHEET A100

THESE NOTES APPLY TO DRAWING SHEET A100 ONLY

01 XXXXXXX.

02 XXXXXXXX.

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1	JUNE 15 2016	ISSUED FOR 50% REVIEW	KWC

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project / projet
NRC U72 FLIGHT RESEARCH FACILITY
UPLANDS CAMPUS

OTTAWA, ON

drawing / dessin
ROOF PLAN

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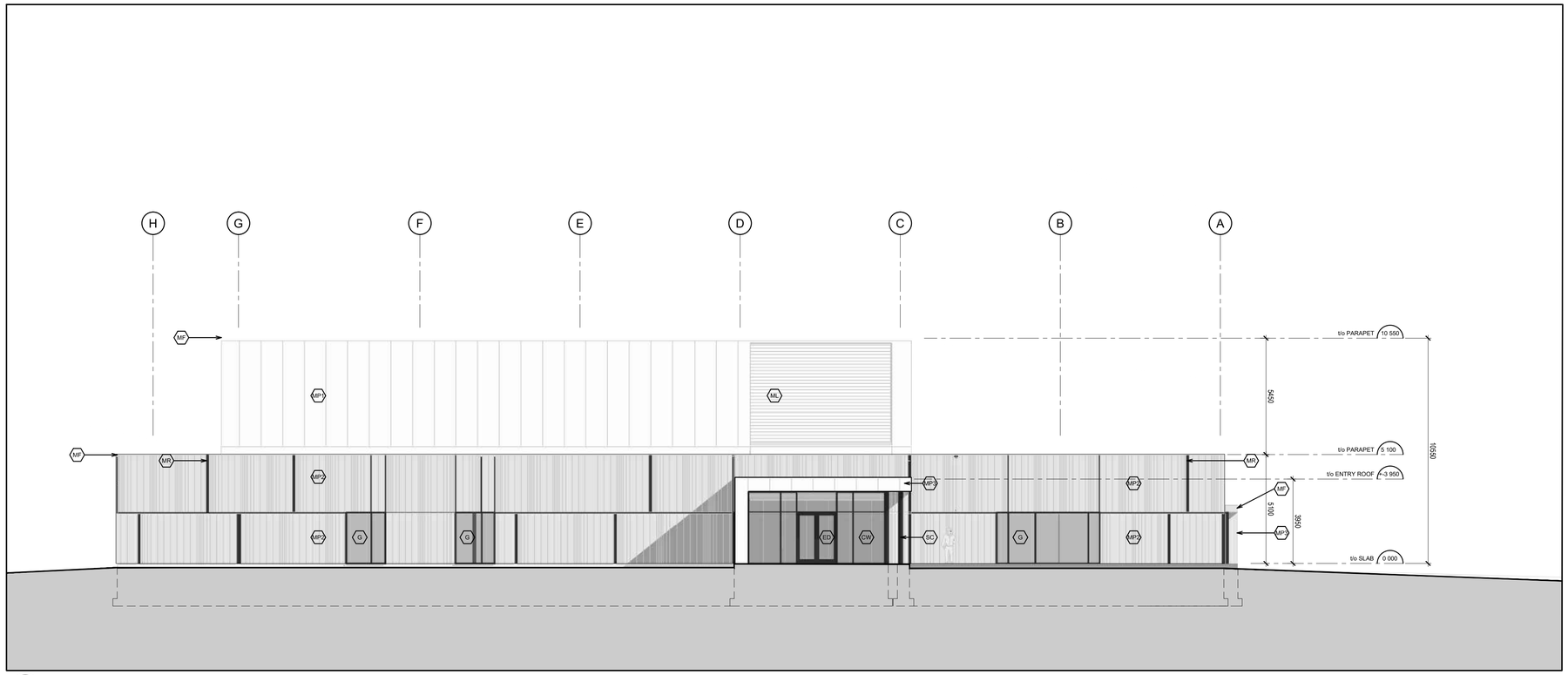
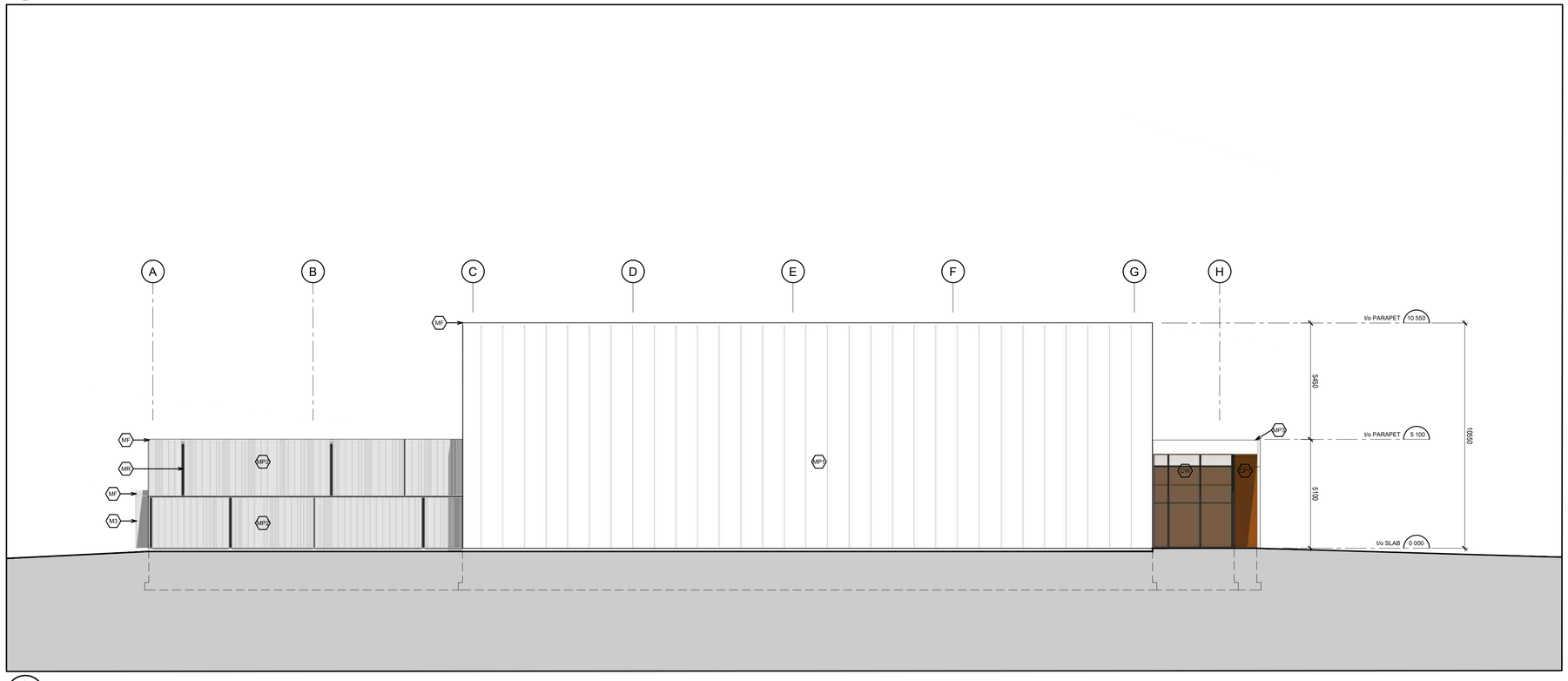
XX	----

dwg.no. / dessin no.
A103



1 A200 NORTH ELEVATION
SCALE 1 : 125



2 A200 SOUTH ELEVATION
SCALE 1 : 125

C
0 10 20mm 40 60 80 100 120 140 160 180 200mm

ASPM A1 (841x594)

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DRAWING NOTES - SHEET A200/A201

THESE NOTES APPLY TO DRAWING SHEET A201 ONLY

01 XXXXXXX.

02 XXXXXXXX.

LEGEND - SHEET A200/A201

- MP1 METAL PANEL - TYPE 1
- MP2 METAL PANEL - TYPE 2
- MP3 METAL PANEL - TYPE 3
- CP1 COMPOSITE PANEL - TYPE 4
- CW CURTAIN WALL
- G GLAZING
- CG CLERESTORY GLAZING
- MF PRE-FINISHED METAL FLASHING
- OD OVERHEAD ROLL UP DOOR
- ED ENTRANCE/EXIT DOOR
- SD SERVICE DOOR
- SC PAINTED STEEL COLUMN
- ML PREFINISHED METAL LOUVER
- MR PREFINISHED METAL REVEAL

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No.	Date	Revision	By: Par:
2			
2			
1	JUN 2016	50% CLIENT REVIEW	KWC

kwc
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NRC U72 FLIGHT RESEARCH FACILITY
UPLANDS CAMPUS
OTTAWA, ON

drawing / dessin
BUILDING ELEVATIONS
NORTH and SOUTH

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drawn / dessiné	scale / échelle
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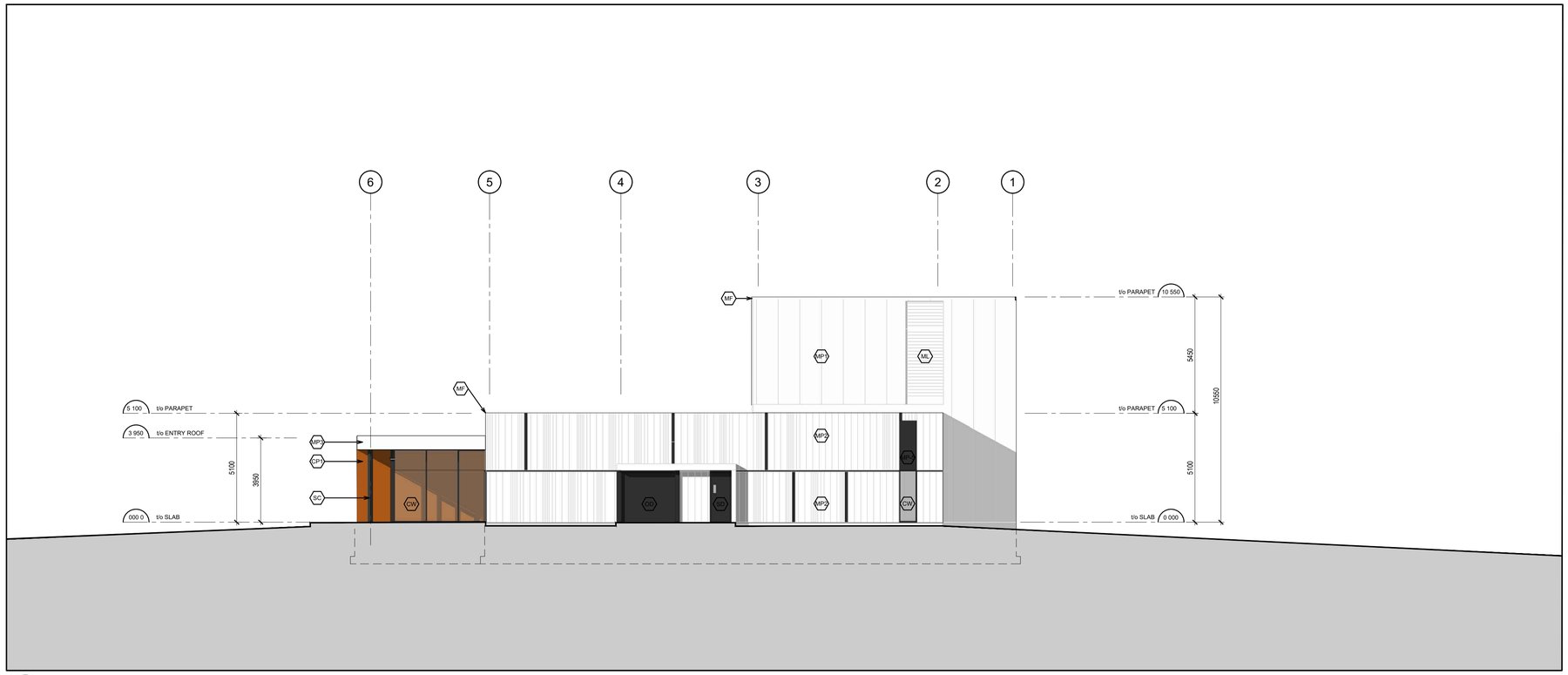
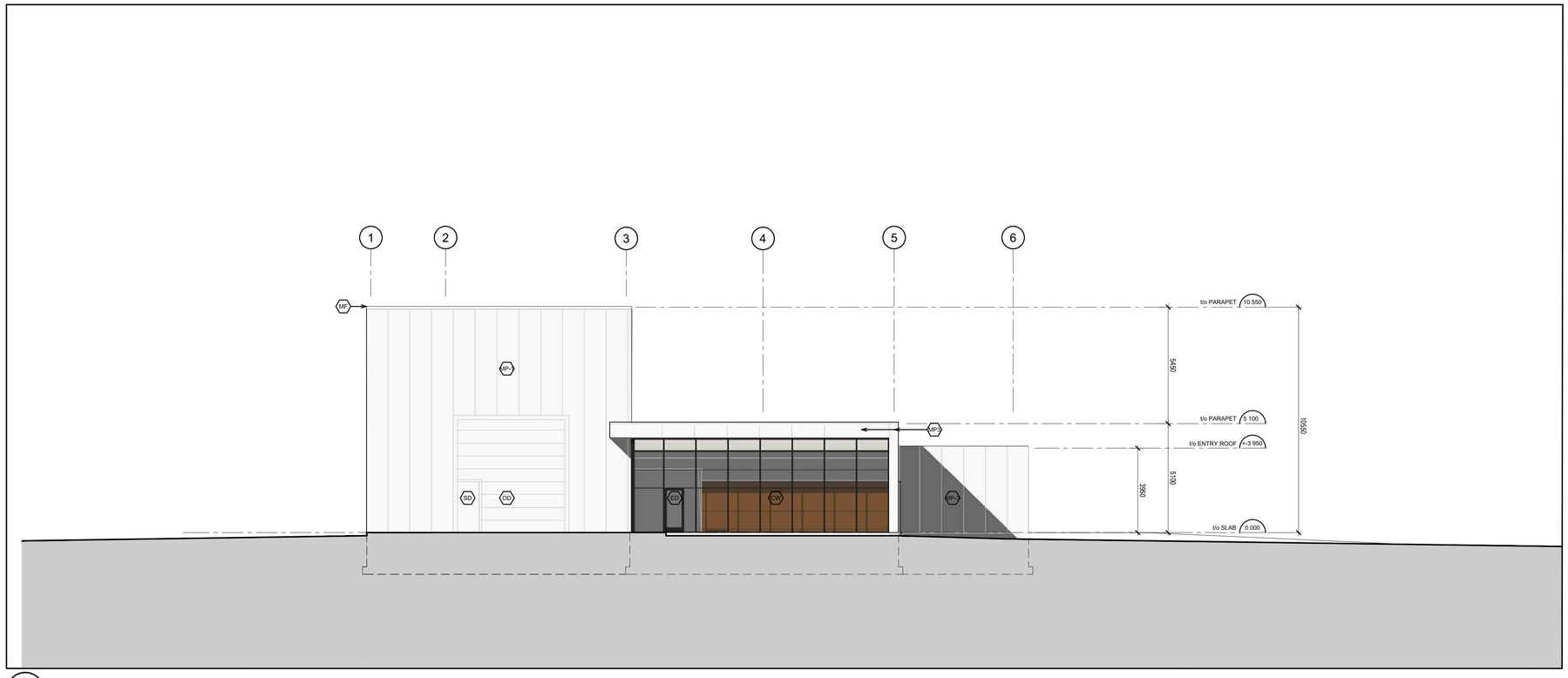
A200



1 A201 EAST ELEVATION
SCALE 1 : 125



2 A201 WEST ELEVATION
SCALE 1 : 125

C
0 10 20mm 40 60 80 100 120 140 160 180 200mm

ASPM A1 (841x594)

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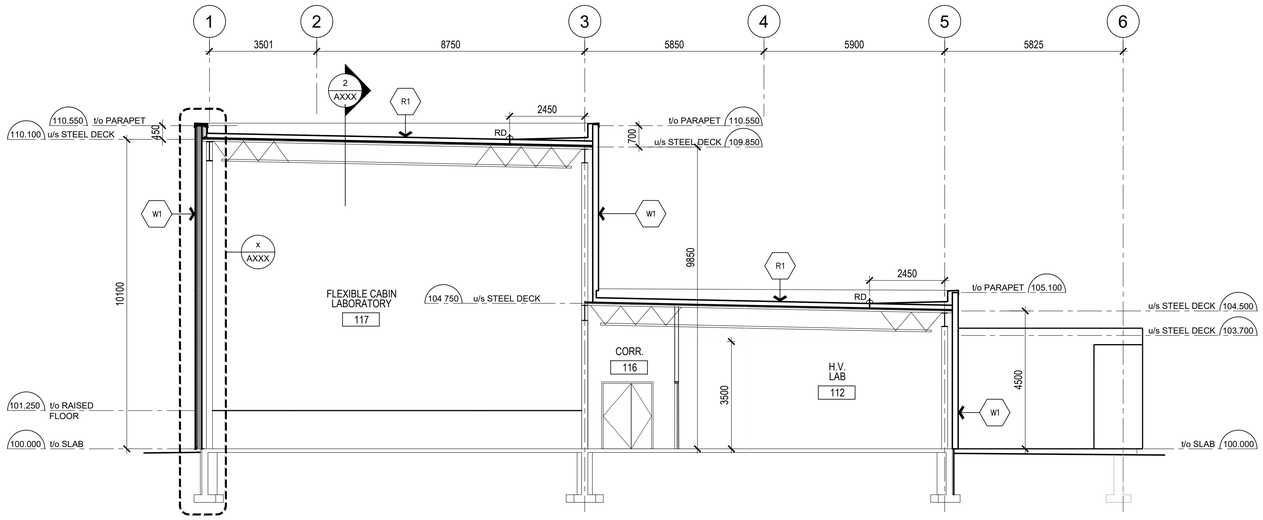
UPLANDS CAMPUS

OTTAWA, ON

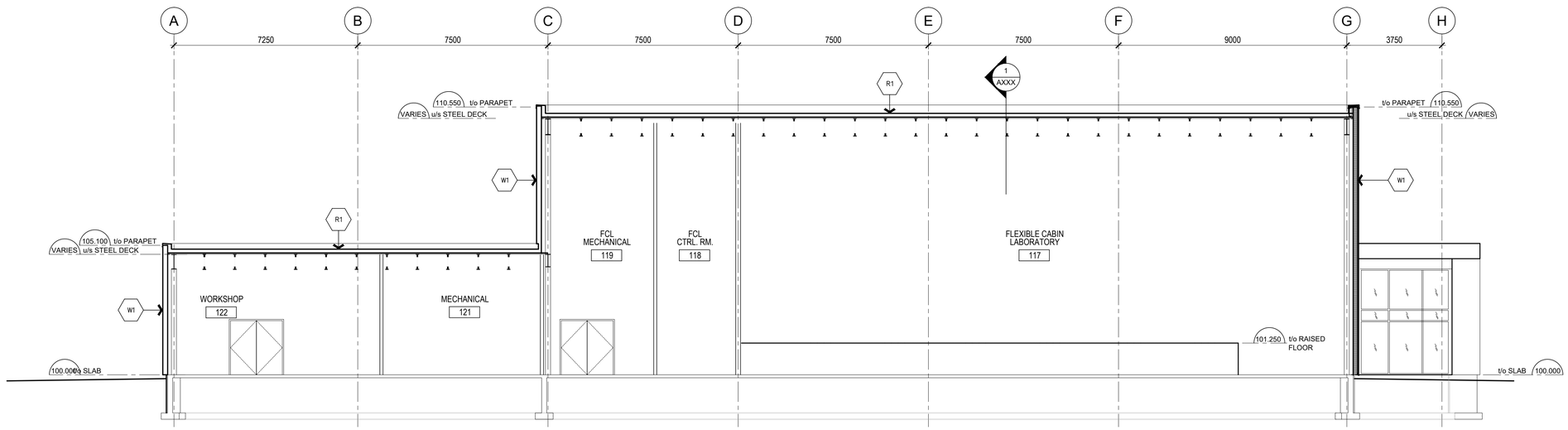
drawing / dessin
BUILDING ELEVATIONS
EAST and WEST

designed / conçu	date / date
MM/CD	JUN. 2016
drawn / dessiné	scale / échelle
CD	AS NOTED
checked / vérifié	sheet / feuille
MM	– of/de –
approved / approuvé	W.O.no. / D.T.no.
XX	----

dwg.no. / dessin no.
A201



1 A300 CROSS SECTION
SCALE 1 : 100



2 A300 LONGITUDINAL SECTION
SCALE 1 : 100

C
0 10 20mm 40 60 80 100 120 140 160 180 200mm

ASPM A1 (841x594)

GENERAL NOTES

PRIOR TO COMMENCEMENT OF WORK, NOTIFY DEPARTMENTAL REPRESENTATIVE OF ANY DISCREPANCIES NOTED IN THE CONTRACT DOCUMENTS.

A. ALL GRID TO GRID DIMENSIONS ARE PLUS/MINUS. PRIOR TO COMMENCEMENT OF WORK, REVIEW SITE CONDITIONS AND VERIFY ALL DIMENSIONS. NOTIFY DEPARTMENTAL REPRESENTATIVE OF ANY DISCREPANCIES.

B. DO NOT SCALE DRAWINGS.

C. ALL DIMENSIONS ARE INDICATED IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.

DRAWING NOTES - SHEET A300

THESE NOTES APPLY TO DRAWING SHEET A300 ONLY

01 XXXXXXX.

02 XXXXXXXX.

National Research Council Canada / Conseil national de recherches Canada
Administrative Services and Property Management Branch / Division des services administratifs et gestion de l'immobilier

NRC · CNRC

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No.	Date	Revision	By: / Par:
1	JUNE 15 2016	ISSUED FOR 50% REVIEW	KWC

Date Printed / Date imprimée

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A Detail no. / No. du détail
B Location drawing no. / sur dessin no.
C Drawing no. / dessin no.

project / projet
NRC U72 FLIGHT RESEARCH FACILITY
UPLANDS CAMPUS

OTTAWA, ON

drawing / dessin
BUILDING SECTIONS

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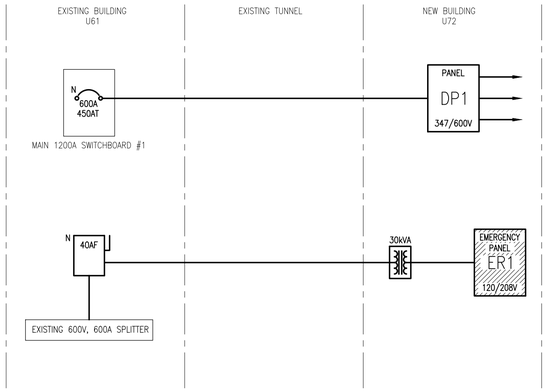
A300

NRC UPLANDS CAMPUS

BUILDING U72

ELECTRICAL



1 / E1 PARTIAL ELECTRICAL SINGLE LINE DIAGRAM

N.T.S.

DRAWING LIST

DWG No.	DESCRIPTION
E1	ELECTRICAL LEGENDS, DRAWING LIST AND PANEL SCHEDULES
E2	5TH FLOOR LIGHTING AND FIRE ALARM DEMOLITION WORK
E3	5TH FLOOR LIGHTING AND FIRE ALARM NEW WORK
E4	5TH FLOOR POWER AND SYSTEMS DEMOLITION WORK
E5	5TH FLOOR POWER AND SYSTEMS NEW WORK

LINETYPE LEGEND

SYMBOL	DESCRIPTION
———	NEW WORK
———————	EXISTING
—— – ——	ARCHITECTURAL GRID LINES
.....	CEILING GRID

ABBREVIATION LEGEND

SYMBOL	DESCRIPTION
C	CEILING MOUNTED
GFI	GROUND FAULT INTERRUPTER
OC	INSTALLED OVER COUNTER TOP
F	FLOOR MOUNTED
S	SURFACE MOUNTED
N	NEW
WP	WEATHERPROOF

ELECTRICAL LEGEND

SYMBOL	DESCRIPTION
1	LED CEILING MOUNTED LIGHT FIXTURE
1	LIGHT FIXTURE CONNECTED TO UNSWITCHED EMERGENCY CIRCUIT
E	RECESSED DOWN LIGHT FIXTURE, TYPE AS INDICATED
E	RECESSED DOWN LIGHT FIXTURE, UNSWITCHED EMERGENCY CIRCUIT
$	WALL MOUNTED LIGHT SWITCH
$D	DIMMER LIGHT SWITCH
$OS	WALL MOUNTED OCCUPANCY SENSOR SWITCH
OS	CEILING OCCUPANCY SENSOR
ELC	EMERGENCY LIGHTING CONTROL UNIT
	CEILING MOUNTED EXIT LIGHT WITH DIRECTIONAL ARROWS AS INDICATED
	WALL MOUNTED EXIT LIGHT WITH DIRECTIONAL ARROWS AS INDICATED
F	FIRE ALARM SPEAKER
F	FIRE ALARM COMBINATION SPEAKER/STROBE
	FIRE ALARM SMOKE DETECTOR
	FIRE ALARM HANDSET
ML	MAGNETIC LOCK
F	FIRE ALARM PULL STATION
	15A, 120V WALL MOUNTED DUPLEX RECEPTACLE
	15A, 120V DEDICATED DUPLEX RECEPTACLE
	15A, 120V DUPLEX RECEPTACLE – INSTALLED OVER COUNTER
	20A, 120V, RA RECEPTACLE – INSTALLED OVER COUNTER
	20A, 120V, RA RECEPTACLE
	15A, 120V HALF SWITCH RECEPTACLE
	FURNITURE POLE
S	SERVICE POLE
FM	FLOOR MONUMENT
J	JUNCTION BOX
	FLEXIBALE CONDUIT CONNECTION
	MANUAL MOTOR STARTER – CSA CERTIFIED AS A DISCONNECTING MEANS AND LOCKABLE IN THE "OFF" POSITION.
	SINGLE PHASE ELECTRIC MOTOR
SS	SPEED SWITCH
	DISCONNECT SWITCH
$P	ON/OFF SWITCH C/W PILOT LIGHT
	SURFACE MOUNTED ELECTRICAL PANEL
	RECESS MOUNTED ELECTRICAL PANEL
EPS	EMERGENCY PULL STATION
T	BASEBOARD HEATER C/W INTEGRAL THERMOSTAT
	VOICE AND/OR DATA OUTLET BOX
	CABLEVISION OUTLET
MIC	MICROPHONE OUTLET
RTE	REQUEST TO EXIT (PROVIDED BY SECURITY CONTRACTOR C/W WIRING)
CR	CARD READER (PROVIDED BY SECURITY CONTRACTOR C/W WIRING)
ES	ELECTRIC STRIKE (PROVIDED BY SECURITY CONTRACTOR C/W WIRING)
DC	DOOR CONTACT (PROVIDED BY SECURITY CONTRACTOR C/W WIRING)
MS	MOTION SENSOR (PROVIDED BY SECURITY CONTRACTOR C/W WIRING)
B	DOOR BELL CHIME
	DOOR BELL PUSHBUTTON
	BARRIER–FREE DOOR OPERATOR C/W PUSHBUTTONS

ASPM A1 (841x594)

C

0 10 20mm 40 60 80 100 120 140 160 180 200mm

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2016-05-15	ISSUED FOR 50% REVIEW	
DATE	REVISION	REF

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B Location drawing no. sur dessin no.
C Drawing no. dessin no.
A / B C

project / **projet**

U72 - FLEXIBLE CABIN LABORATORY

NRC UPLANDS CAMPUS

OTTAWA, ON

drawing / **dessin**

ELECTRICAL LEGENDS, DRAWING LIST AND PARTIAL SINGLE LINE

designed / conçu: A.G.	date / date: Jun. 2016
drawn / dessiné: A.G.	scale / échelle: AS NOTED
checked / vérifié: R.B.	sheet / feuille: – of/de –
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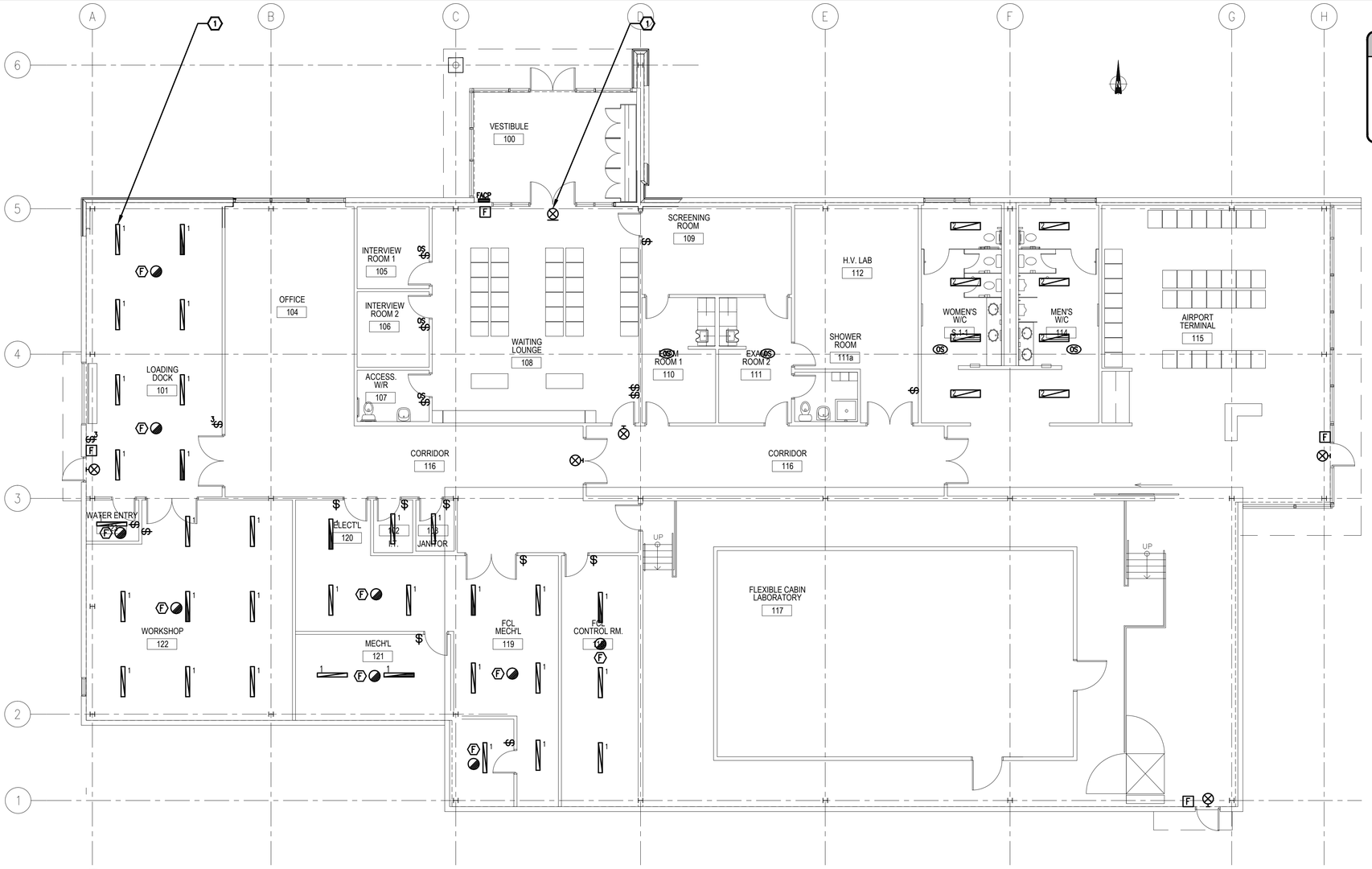
dwg.no. / dessin no.: E1



1 / E2 LIGHTING AND FIRE ALARM NEW WORK

1:100

DRAWING NOTES

1. TYPICAL:
PROVIDE NEW LIGHT FIXTURE, TYPE AS INDICATED. REFERENCE LIGHT FIXTURE SCHEDULE ON DRAWING E1.

2. TYPICAL:
PROVIDE NEW WALL/CEILING MOUNTED PICTOGRAM "RUNNING MAN" EXIT SIGN AS INDICATED. CONNECT TO INDICATED CIRCUIT.

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project / projet

U72 - FLEXIBLE CABIN LABORATORY

NRC UPLANDS CAMPUS

OTTAWA, ON

drawing / dessin

LIGHTING AND FIRE ALARM NEW WORK

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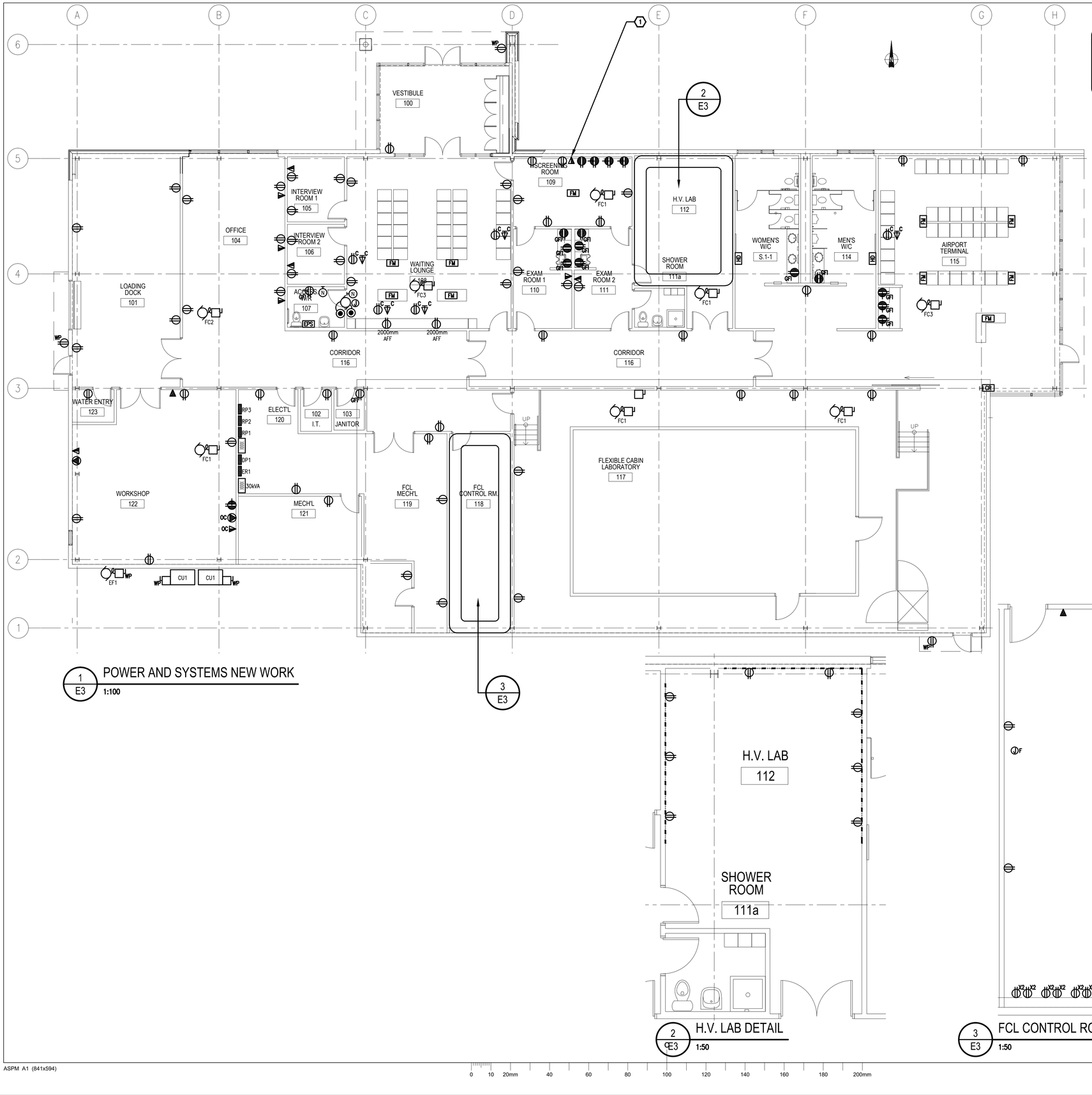
dwg.no. / dessin no.: E2

ASPM A1 (841x594)

C

0 10 20mm 40 60 80 100 120 140 160 180 200mm



1 E3 POWER AND SYSTEMS NEW WORK
1:100

2 E3 H.V. LAB DETAIL
1:50

3 E3 FCL CONTROL ROOM DETAIL
1:50

DRAWING NOTES

1. TYPICAL:
PROVIDE BACK BOX C/W 21mm CONDUIT UP TO ACCESSIBLE CEILING SPACE FOR NEW DATA OUTLETS. DATA OUTLETS TO BE SUPPLIED AND INSTALLED BY OTHERS.

ASPM A1 (841x594)

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project / projet
U72 - FLEXIBLE CABIN LABORATORY
NRC UPLANDS CAMPUS
OTTAWA, ON

drawing / dessin
POWER AND SYSTEMS NEW WORK

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dwg.no. / dessin no.
E3

U72 - FLEXIBLE CABIN LABORATORY

NRC UPLANDS CAMPUS, OTTAWA, ON

MECHANICAL

GENERAL LEGEND

SYMBOL	DESCRIPTION
	EXISTING PIPING/DUCTWORK/EQUIPMENT
	EXISTING PIPING/DUCTWORK/EQUIPMENT TO BE REMOVED/RELOCATED
	NEW/RELOCATED PIPING/DUCTWORK/EQUIPMENT
	EXISTING PIPING/DUCTWORK/EQUIPMENT BELOW SLAB
	NEW PIPING/DUCTWORK/EQUIPMENT BELOW SLAB
(E)	DENOTES EXISTING EQUIPMENT
(R)	DENOTES RELOCATED EQUIPMENT
(N)	DENOTES NEW EQUIPMENT
(X)	DENOTES EQUIPMENT TO BE REMOVED

DRAWING LIST

SYMBOL	DESCRIPTION
M1	MECHANICAL LEGENDS
M2	MECHANICAL SCHEDULES
M3	MECHANICAL DETAILS
M4	MECHANICAL PLUMBING & UTILITIES – NEW WORK
M5	MECHANICAL HVAC – NEW WORK

CONTROLS LEGEND

SYMBOL	DESCRIPTION
	LOW VOLTAGE CONTROL WIRING
	PNEUMATIC CONTROL TUBING
T	TEMPERATURE SENSOR
SC	SPEED CONTROLLER
H	HUMIDITY SENSOR

FIRE PROTECTION LEGEND

SYMBOL	DESCRIPTION
	PIPE UP
	PIPE DOWN
FE1	FIRE EXTINGUISHER C/W MOUNTING BRACKET
FE2	RECESSED FIRE EXTINGUISHER
FE3	SEMI-RECESSED FIRE EXTINGUISHER
FHC	FIRE HOSE CABINET
FDC	FIRE DEPARTMENT SIAMESE CONNECTION
TH	TEST HEADER (500 U.S. GPM) (32 L/S)

PLUMBING LEGEND

SYMBOL	DESCRIPTION
	PIPING BELOW GRADE/SLAB
DCW	DOMESTIC COLD WATER PIPING
DHW	DOMESTIC HOT WATER PIPING
DHWR	DOMESTIC HOT WATER RECIRCULATION PIPING
SAN	SANITARY PIPING
ST	STORM PIPING
V	VENT PIPING
COND	CONDENSATE DRAIN
FD1	FLOOR DRAIN (TYPE)
RD1	ROOF DRAIN (TYPE)
	PIPING OFFSET
	BRANCH PIPING DOWN
	PIPING DOWN
	PIPING UP
	REDUCER
	FLOW DIRECTION
	PIPE BREAK
	CAP
	RUNNING P-TRAP
	P-TRAP
	DRAIN ASSEMBLY
CO	CLEAN OUT
WCO	WALL CLEAN OUT
FCO	FLOOR CLEAN OUT
	ISOLATION VALVES
	PRESSURE REDUCING VALVE (PRV)
	CIRCUIT BALANCING VALVE (CBV)
	STRAINER
	CHECK VALVE
	FLEXIBLE CONNECTION
	UNION
	RELIEF VALVE
	DRAIN VALVE C/W CAP & CHAIN
BFP	BACK FLOW PREVENTER (TYPE)
NFHB	NON-FREEZE HOSE BIBB
	PUMP (P)
	CONDENSATE PUMP (CP)
FM	FLOW METER (TYPE)
	THERMOMETER
PG	PRESSURE GAUGE

HVAC LEGEND

SYMBOL	DESCRIPTION
	RECTANGULAR DUCTWORK
	ROUND DUCTWORK
	ACOUSTICALLY LINED DUCTWORK (RETURN OR SUPPLY)
	THERMALLY INSULATED DUCTWORK (RETURN OR SUPPLY)
	SILENCER (SIL)
	ROUND DUCTWORK OFFSET
	RECTANGULAR DUCTWORK OFFSET
	DUCTWORK UP
	DUCTWORK DOWN
	RECTANGULAR TO ROUND TRANSITION
	ECCENTRIC RECTANGULAR TO ROUND TRANSITION
	ECCENTRIC TRANSITION
	TAKE-OFF C/W BALANCING DAMPER
	TAKE-OFF
	SQUARE SUPPLY DIFFUSER (TYPE)
	LINEAR SUPPLY DIFFUSER (TYPE)
RG1	RETURN GRILLE (RG)
EG1	EXHAUST GRILLE (EG)
TG	TRANSFER GRILLE (TG)
WG WG	WALL GRILLE (TYPE)
L L	LOUVRE (L)
TO	TRANSFER OPENING (TO)
	ACOUSTICALLY LINED TRANSFER DUCT (TD)
FD	FIRE DAMPER (FD)
SD	SMOKE DAMPER (SD)
FD/SD	COMBINATION FIRE/SMOKE DAMPER
BD	BALANCING DAMPER (BD)
BDD	BACK DRAFT DAMPER (BDD)
	FLEXIBLE CONNECTION
	TURNING VANES
AD	ACCESS DOOR
M	MOTORIZED DAMPER
	VARIABLE AIR VOLUME BOX (VAV)
	VARIABLE AIR VOLUME BOX C/W REHEAT COIL
	FAN POWERED BOX (FPB)
	INLINE CABINET FAN (TYPE)
RH	REHEAT COIL (RH)
SD1 / 200ø/95	DIFFUSER TAG DIFFUSER TYPE AIRFLOW (L/S)(CFM) SIZE (mm)(in)

C

0 10 20mm 40 60 80 100 120 140 160 180 200mm

ASPM A1 (841x594)

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drawing / dessin

MECHANICAL
GENERAL LIST □ LEGENDS

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dwg.no. / dessin no.: M1

PUMP SCHEDULE

UNIT NO.	LOCATION	FUNCTION	TYPE	PUMP DATA		ELECTRICAL DATA				BASIS OF DESIGN	REMARKS
				DESIGN FLOW (L/s)/(GPM)	DESIGN HEAD (kPA)/(ft)	HP	WATTS	AMPS	V/PH/Hz		
HP-1	MECHANICAL ROOM	HEATING LOOP	INLINE	–	–	–	–	–	–	HK030	–

NOTES: 1. FOR DETAILS REFER TO SPECIFICATIONS.

CONDENSER UNIT SCHEDULE

UNIT NO.	LOCATION	FUNCTION	AMBIENT TEMP. (°C)	NOMINAL TONS	STAGES H.G.B.P.	ELECTRICAL DATA		BASIS OF DESIGN MAKE/MODEL	REMARKS
						V/PH/Hz	FLA/MCA/MOC		
C1	ROOF	ERV-1	–	–	–	–	–	–	–

NOTES: 1. FOR DETAILS REFER TO SPECIFICATIONS.

REFRIGERANT FAN COIL SCHEDULE

UNIT NO.	LOCATION	NOMINAL SIZE (TON)	TYPE	AIR FLOW (L/s)	TOTAL COOLING (kW)	SENSIBLE COOLING (kW)	E.A.T dB/Wb (°C)	DIMENSIONS (mmL x mmH x mmD)	ELECTRICAL DATA		BASIS OF DESIGN	REMARKS
									MOTOR HP	V/PH/Hz		
FC1	–	3	–	1200	–	–	–	–	–	–	–	–
FC2	–	2	–	800	–	–	–	–	–	–	–	–
FC3	–	1.5	–	600	–	–	–	–	–	–	–	–

NOTES: 1. FOR DETAILS REFER TO SPECIFICATIONS.

ENERGY RECOVERY VENTILATOR

UNIT NO.	LOCATION	SUPPLY FAN DATA			EXHAUST FAN DATA			ENERGY RECOVERY DATA				ELECTRICAL DATA		BASIS OF DESIGN	REMARKS
		AIR FLOW (L/s)	EXTERNAL STATIC PRESSURE (Pa)	HP	AIR FLOW (L/s)	EXTERNAL STATIC PRESSURE (Pa)	HP	EAT °Cdb/°Cwb		LAT °Cdb/°Cwb		V/PH/Hz	FLA/MCA/MOC		
								SUMMER	WINTER	SUMER	WINTER				
ERV-1	MECHANICAL ROOM	500	500	–	500	120	–	–	–	–	–	-/-/-	-/-/-	TEMPEFF-RG-1800	–

NOTES: 1. FOR DETAILS REFER TO SPECIFICATIONS.
2. MANUFACTURER NAME & MODEL NUMBER REPRESENTS ACCEPTABLE QUALITY STANDARD ONLY. ALTERNATIVE MATERIALS MAY BE APPROVED AFTER REVIEW OF TECHNICAL INFORMATION BY ENGINEER.
3. TYPICAL ENERGY RECOVERY CONDITIONS: SUMMER – E.A.T. (°C) SHALL BE 35°C/23.9°C
WINTER – E.A.T. (°C) SHALL BE -27.2°C

BOILER SCHEDULE

UNIT NO.	LOCATION	FLOW (L/s)	INPUT (kW)	OUTPUT (kW)	AFUE EFFICIENCY (%)	TYPE	V/PH/Hz	BASIS OF DESIGN MAKE/MODEL	REMARKS
B1	BOILER ROOM	0.91	47	43	92	CONDENSING BACK MOUNT	120/1/60	VIESSMANN VITODANS 200-W-B2HA-45	–
B2	BOILER ROOM	0.97	47	43	92	CONDENSING BACK MOUNT	120/1/60	VIESSMANN VITODANS 200-W-B2HA-45	–
B3	BOILER ROOM	0.97	47	43	92	CONDENSING BACK MOUNT	120/1/60	VIESSMANN VITODANS 200-W-B2HA-45	–

NOTES: 1. FOR DETAILS REFER TO SPECIFICATIONS.
2. MANUFACTURER NAME & MODEL NUMBER REPRESENT ACCEPTABLE QUALITY STANDARD ONLY.
3. ALTERNATIVE MATERIALS MAY BE APPROVED AFTER REVIEW OF TECHNICAL INFORMATION BY ENGINEER.

CHILLER SCHEDULE

UNIT NO.	LOCATION	APPLICATION	TYPE	CAPACITY (kW)	STAGES	POWER INPUT (kW)	EVAPORATOR				WATER CONDENSER				PHYSICAL DATA					ELECTRICAL DATA		BASIS OF DESIGN	REMARKS
							EWT (°F)	LWT (°F)	DESIGN FLOW (GPM)	PRESSURE DROP (Ft WC)	EWT (°F)	LWT (°F)	DESIGN FLOW (GPM)	PRESSURE DROP (Ft WC)	HEIGHT (IN)	WIDTH	LENGTH	COIL PULL (INCHES)	dBA	V/PH/HZ	FLA/MCA/MOC		
CH-1	OUTSIDE	SUB COOLING	INLINE	30		67.5	44	34	148	13.6	85	95	196	9.43					82	-/-/-	-/-/-	AERMEC	–
CH-2	OUTSIDE	SUB COOLING	INLINE	30		67.5	44	34	148	13.6	85	95	196	9.43					82	-/-/-	-/-/-	AERMEC	–

NOTES: 1. FOR DETAILS REFER TO SPECIFICATIONS.

FORCE FLOW UNIT SCHEDULE

UNIT NO.	LOCATION	ARRANGEMENT	AIR FLOW (L/s)	WATER FLOW (L/s)	NUMBER OF ROWS	CAPACITY (kW)	EWT (°C)	LWT (°C)	LAT (°C)	DIMENSIONS (mmL x mmH x mmD)	ELECTRICAL DATA			BASIS OF DESIGN	REMARKS
											MOTOR HP	V/PH/Hz	FLA		
FF1	VESTIBULE	FULLY RECESSED WALL CABINET MOUNT	405	0.17	1	10.0	65.6	51.7	47	1550x686x241	1 x 1/10 1 x 1/15	120/1/60	2.2A	STERLING RWI-1130-08	C/W LIMITED ACCESS FASTENERS, MOTOR STARTED WITH OVERLOADS, FAN RELAY FOR BAS CONTROL
FF2	VESTIBULE	FULLY RECESSED WALL CABINET MOUNT	405	0.17	1	10.0	65.6	51.7	47	1550x686x241	1 x 1/10 1 x 1/15	120/1/60	2.2A	STERLING RWI-1130-08	C/W LIMITED ACCESS FASTENERS, MOTOR STARTED WITH OVERLOADS, FAN RELAY FOR BAS CONTROL

NOTES: 1. FOR DETAILS REFER TO SPECIFICATIONS.
2. ALL INTAKE AND EXHAUST VENTING SHALL BE SIZED BY BOILER MANUFACTURER.
3. ALL BOILERS SEISMICALLY MOUNTED ON HOUSEKEEPING PAD.
4. SYSTEM SIZED FOR FUTURE EXPANSIONS. ALLOW FOR FUTURE BOILER AS INDICATED ON DRAWINGS.
5. FIELD BUILT BOILER TO MANUFACTURER'S INSTALLATION INSTRUCTIONS.

C

0 10 20mm 40 60 80 100 120 140 160 180 200mm

ASPM A1 (841x594)

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GENERAL NOTES

- CONTRACTORS TO CHECK AND VERIFY ALL DIMENSIONS ON SITE PRIOR TO DEMOLITION OR CONSTRUCTION AND REPORT ANY ERRORS OR OMISSIONS TO DEPARTMENTAL REPRESENTATIVE.
- CONTRACTORS MUST VISIT THE SITE & FULLY FAMILIARIZE THEMSELVES WITH THE SCOPE OF THE WORK.
- PREVENT THE SPREAD OF DUST & DEBRIS BEYOND THE WORK AREA AND CLEAN ALL SURFACES AT COMPLETION.
- MAKE GOOD ALL SURFACES AFFECTED BY THIS WORK.
- COORDINATE ALL SHUTDOWNS WITH THE DEPARTMENTAL REPRESENTATIVE.
- PROVIDE ALL LABOUR AND MATERIAL REQUIRED TO FORM A COMPLETE, FUNCTIONAL SYSTEM AS DESCRIBED ON DRAWINGS.

2016-05-15	ISSUED FOR 50% REVIEW	
DATE	REVISION	REF

Goodkey Weedmark *Consulting Engineers*

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KWC ARCHITECTS INC.
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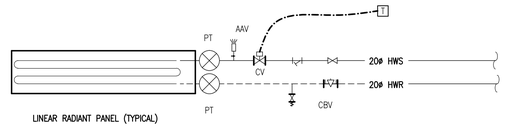
- Verify all dimensions and site conditions and be responsible for same
- Vérifier toutes les dimensions et l'etat des liéux et en assumer la responsabilité

A Detail no. No. du détail
B Location drawing no. sur dessin no.
C Drawing no. dessin no.

project / projet
U72 - FLEXIBLE CABIN LABORATORY
NRC UPLANDS CAMPUS
OTTAWA, ON

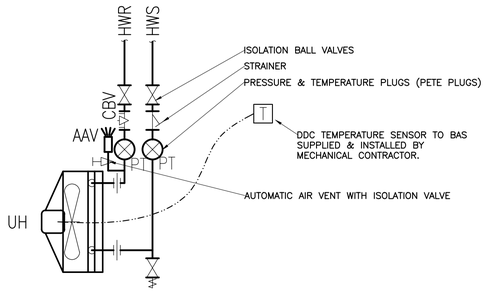
drawing / dessin
MECHANICAL SCHEDULES

designed / conçu: RL	date / date: Jun. 2016
drawn / dessiné: MP	scale / échelle: AS NOTED
checked / vérifié: RL	sheet / feuille: 2 of/de 5
approved / approuvé: RL	W.O.no. / D.T.no.
dwg.no. / dessin no.: M2	



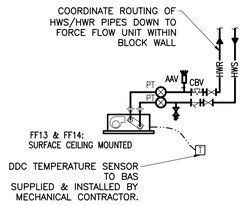
1 M3 LINEAR RADIANT PANEL CONNECTION DETAIL

NTS



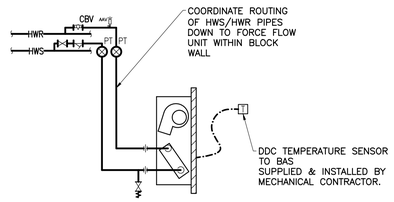
2 M3 UNIT HEATER CONNECTION DETAIL

NTS



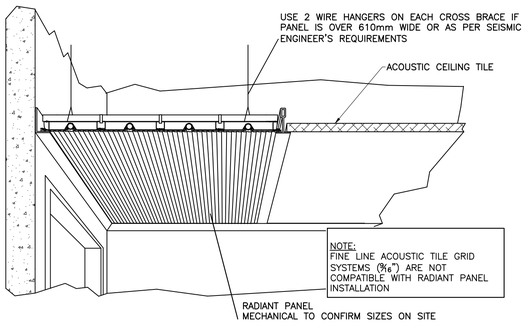
4 M3 FORCE FLOW DETAIL (CEILING)

NTS



5 M3 FORCE FLOW DETAIL (WALL)

NTS



3 M3 LINEAR RADIANT PANEL DETAIL

NTS

ASPM A1 (841x594)

C

0 10 20mm 40 60 80 100 120 140 160 180 200mm

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Administrative Services and Property Management Branch
Division des services administratifs et gestion de l'immobilier

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2016-05-15	ISSUED FOR 50% REVIEW	
DATE	REVISION	REF

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A / C — A Detail no. / No. du détail; B Location drawing no. / sur dessin no.; C Drawing no. / dessin no.

A / B C

project / **projet**

U72 - FLEXIBLE CABIN LABORATORY

NRC UPLANDS CAMPUS

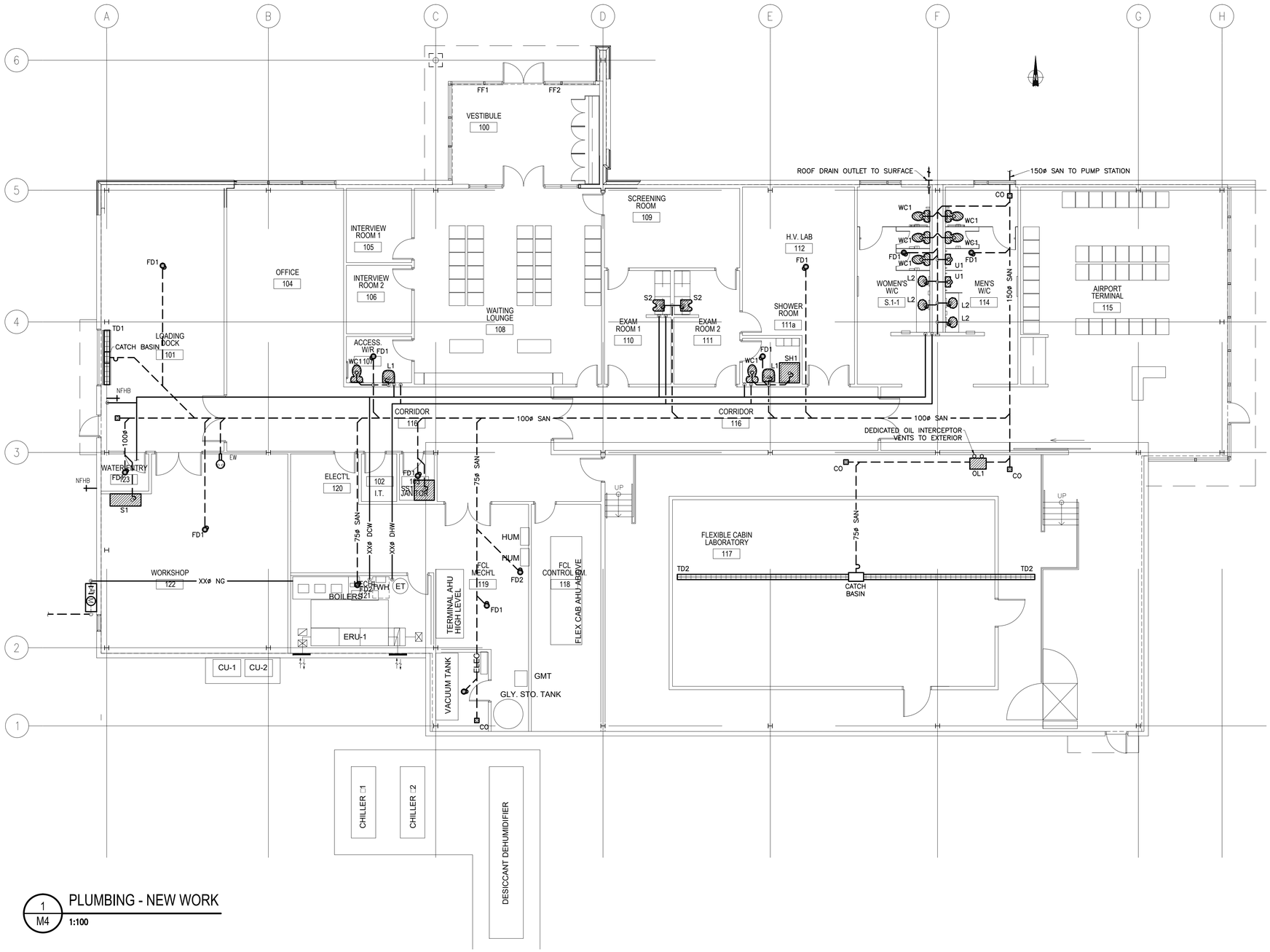
OTTAWA, ON

drawing / **dessin**

MECHANICAL
DETAILS

designed / conçu: RL	date / date: Jun. 2016
drawn / dessin6: MP	scale / 6chelle: AS NOTED
checked / vérifi6: RL	sheet / feuille: 3 of/de 5
approved / approuv6: RL	W.O.no. / D.T.no.

dwg.no. / dessin no.: M3



1 / M4 PLUMBING - NEW WORK

1:100

DESCRIPTION OF WORK: NEW WORK

① -

ASPM A1 (841x594)

C

0 10 20mm 40 60 80 100 120 140 160 180 200mm

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project / projet

U72 - FLEXIBLE CABIN LABORATORY

NRC UPLANDS CAMPUS

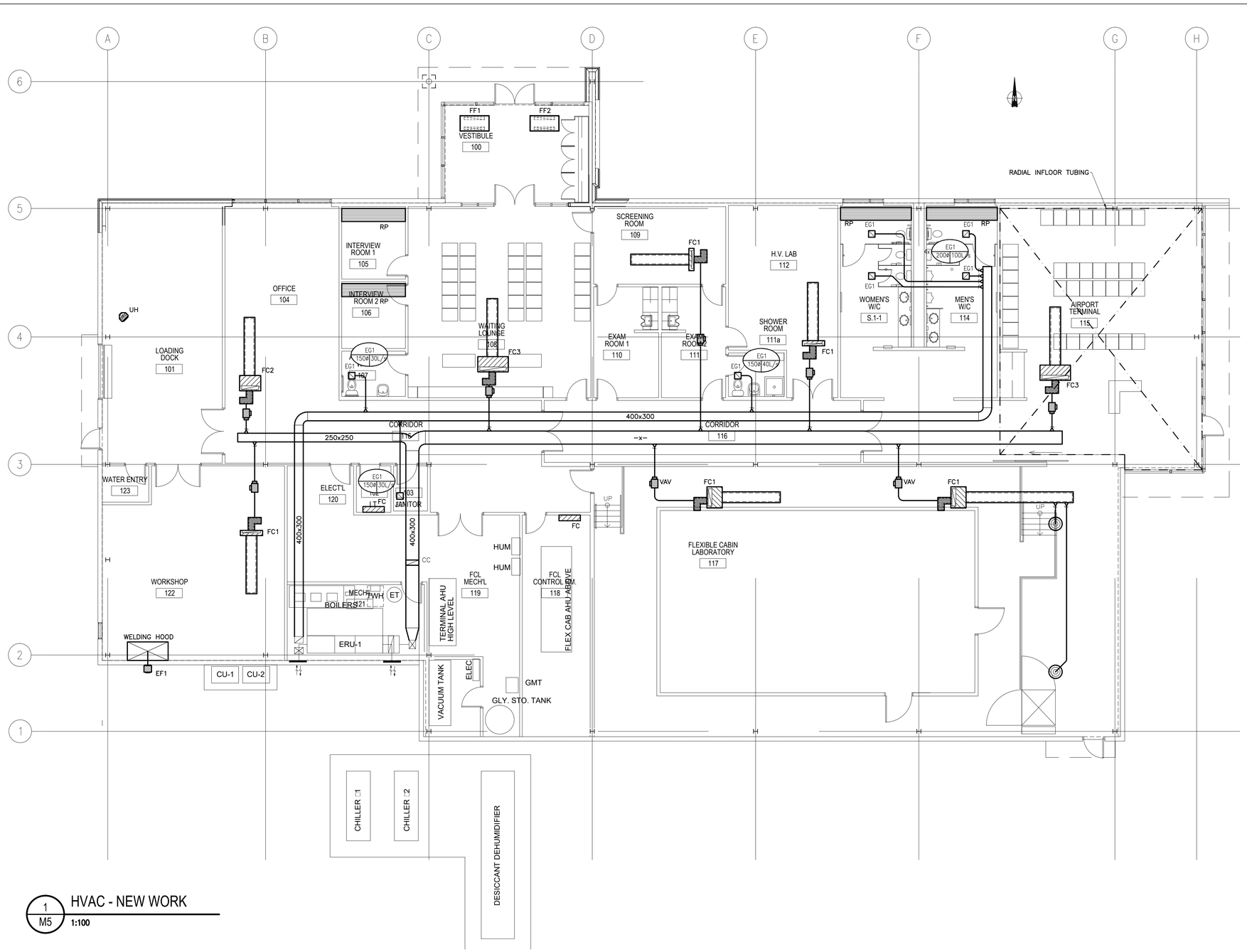
OTTAWA, ON

drawing / dessin

MECHANICAL
PLUMBING □ UTILITIES
NEW WORK

designed / conçu: RL	date / date: Jun. 2016
drawn / dessiné: MP	scale / échelle: AS NOTED
checked / vérifié: RL	sheet / feuille: 4 of/de 5
approved / approuvé: RL	W.O.no. / D.T.no.

dwg.no. / dessin no.: M4



1 / M5 HVAC - NEW WORK

1:100

DESCRIPTION OF WORK: NEW WORK
① -

ASPM A1 (841x594)

0 10 20mm 40 60 80 100 120 140 160 180 200mm

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NRC UPLANDS CAMPUS

OTTAWA, ON

drawing / dessin

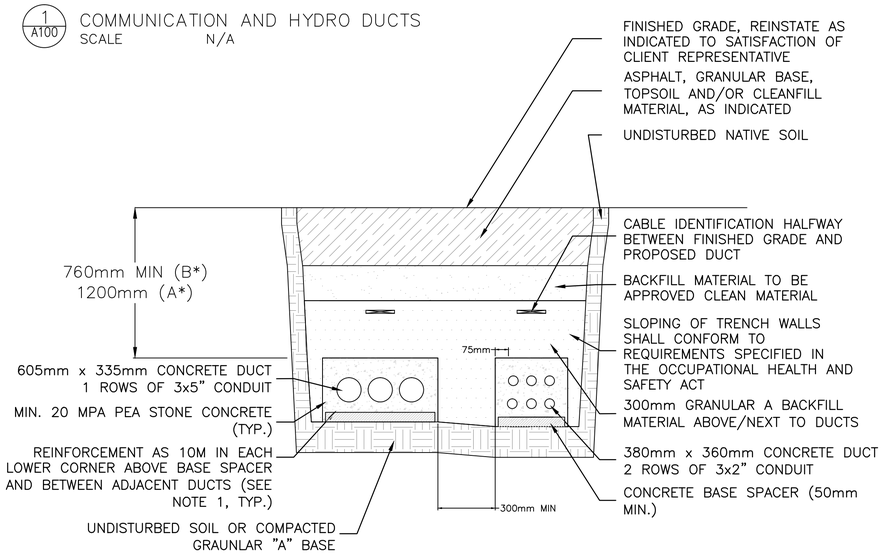
MECHANICAL
HVAC
NEW WORK

designed / conçu	date / date
RL	Jun. 2016
drawn / dessiné	scale / échelle
MP	AS NOTED
checked / vérifié	sheet / feuille
RL	5 of/de 5
approved / approuvé	W.O.no. / D.T.no.
RL	

dwg.no. / dessin no.

M5

1 / A100 COMMUNICATION AND HYDRO DUCTS
SCALE N/A

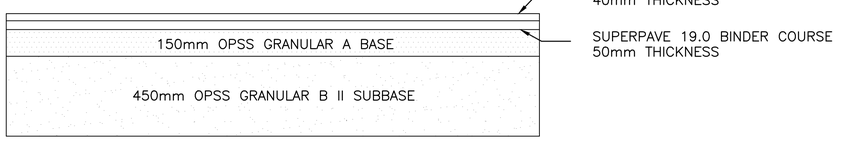


NOTES

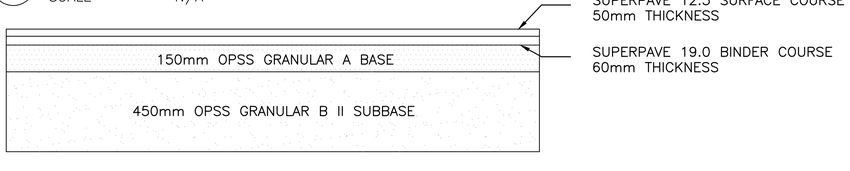
1. REINFORCING RODS FULL LENGTH OF CONCRETE ENCASED DUCTS. OVERLAP JOINTS BY 150mm ON BASE SPACERS AND TIE BOTH ENDS. DRILL AND DOWEL RODS 85mm INTO WALL OF CONCRETE STRUCTURE. A MINIMUM 25mm COVER TO REINFORCING ROD IS REQUIRED.
2. DUCT SPACERS TO BE PLACED AT A MAXIMUM OF 1500mm AND WITHIN 150mm OF COUPLING. PLASTIC DUCT SPACERS TO BE USED ONLY IF CONCRETE DUCT SPACERS ARE UNAVAILABLE.
3. FORMS REQUIRED FOR BOTH SIDES OF EACH FULL LENGTH OF CONCRETE ENCASED DUCT STRUCTURE.
4. DUCTS AND TRENCHES MUST BE INSPECTED BY CLIENT REPRESENTATIVE BEFORE ANY CONCRETE IS POURED.
5. CONTRACTOR MUST ENSURE THAT ALL DUCTS ARE CLEANED, RODDED AND THAT AN 8mm POLYPROPYLENE ROPE IS LEFT IN EACH DUCT.
6. ALL BACKFILL MATERIAL MUST BE APPROVED BY CLIENT REPRESENTATIVE.
7. ANY DEVIATION OF TEH STANDARD COVER MUST BE APPROVED BY THE CLIENT REPRESENTATIVE.
8. BELL END TERMINATORS ARE TO BE USED WHEN TERMINATING DUCTS IN STRUCTURES.
9. ALL MEASUREMENTS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.
10. THIS DETAIL IS NOT DRAWN TO SCALE.

* COVER DEPTHS CORRESPOND TO THE LOCATIONS SHOWN BY THE A – A' AND B – B' CROSS SECTION MARKERS ON DRAWING A100 – SERVICING AND GRADING.

2 / A100 ASPHALT DRIVEWAY, PATH, AND PADS
SCALE N/A



3 / A100 ASPHALT TAXIWAY
SCALE N/A



NOTES: GENERAL

1. CONTRACTOR IS RESPONSIBLE FOR ALL LAYOUT FOR CONSTRUCTION.
2. ALL ELEVATIONS / DIMENSIONS ARE IN METRIC UNITS.
3. JOB BENCH MARK – CONFIRM WITH NRC PRIOR TO UTILIZATION.
5. ALL DISTURBED AREAS SHALL BE REINSTATED TO EQUAL OR BETTER CONDITION TO THE SATISFACTION OF THE NRC REPRESENTATIVE.
6. ALL BASE AND SUB BASE GEOTECHNICAL WORK IS TO BE DONE AS PER "GEOTECHNICAL INVESTIGATION PROPOSED RESEARCH BUILDING NATIONAL RESEARCH COUNCIL UPLANDS CAMPUS 1920 RESEARCH ROAD, OTTAWA, ONTARIO", PREPARED BY GOLDER ASSOCIATES LTD. DATED DECEMBER, 2015.
7. REFER TO ARCHITECT'S SITE PLAN FOR BUILDING DIMENSIONS AND SITE LAYOUT. DIMENSIONS AND LAYOUT INFORMATION SHALL BE CONFIRMED PRIOR TO COMMENCEMENT OF CONSTRUCTION.
8. CONTRACTOR IS RESPONSIBLE FOR ALL DEWATERING, SUPPORT AND PROTECTION OF EXCAVATIONS.
9. DESIGN ELEVATIONS AS GIVEN ON THIS PLAN ARE TO BE ADHERED TO WITH NO CHANGES WITHOUT PRIOR WRITTEN APPROVAL BY THE ENGINEER.
10. U/G CONTRACTOR TO CONFIRM LOCATION(S) AND ELEVATION(S) OF EXISTING SERVICES AND STRUCTURES TO BE CONNECTED TO AND EXISTING SERVICES THAT MAY CAUSE CONFLICTS PRIOR TO CONSTRUCTION OF ANY NEW SEWER AND/OR STORM WATER WORKS. THE CLIENT REPRESENTATIVE SHALL BE INFORMED IMMEDIATELY OF ANY ERRORS, DISCREPANCIES, CONFLICTS, OMISSIONS etc THAT ARE FOUND.
12. THE CONTRACTOR SHALL VERIFY ALL SURFACE AND SUBSURFACE CONDITIONS PRIOR TO COMMENCING CONSTRUCTION BY REVIEWING THE GEOTECHNICAL INVESTIGATION REPORT "GEOTECHNICAL INVESTIGATION PROPOSED RESEARCH BUILDING NATIONAL RESEARCH COUNCIL UPLANDS CAMPUS 1920 RESEARCH ROAD, OTTAWA, ONTARIO", PREPARED BY GOLDER ASSOCIATES LTD. DATED DECEMBER, 2015.
13. THE CONTRACTOR SHALL APPRAISE HIS/HER SELF OF ALL SURFACE AND SUBSURFACE CONDITIONS TO BE ENCOUNTERED AND SHALL CARRY OUT THEIR OWN TEST PITS AS REQUIRED TO MAKE THEIR OWN INDEPENDENT ASSESSMENT OF GROUND CONDITIONS. THE CONTRACTOR SHALL NOT MAKE ANY CLAIM FOR ANY EXTRA COST DUE TO ANY SUCH GROUND CONDITIONS VARYING FROM THOSE ANTICIPATED BY THE CONTRACTOR.
14. THE CONTRACTOR SHALL COORDINATE AND PAY FOR ALL CONSTRUCTION RELATED PERMITS, FEES, INSPECTIONS AND APPROVALS REQUIRED.
15. IN PREPARATION FOR THE CONSTRUCTION OF THE NEW ASPHALTIC CONCRETE SURFACED ROADWAYS AND PARKING AREAS, ALL TOPSOIL, ORGANIC MATERIAL AND ANY LOOSE/SOFT OR WET SOIL SHOULD BE REMOVED FROM THE PROPOSED SUBGRADE SURFACE AND REPLACED WITH SUITABLE COMPACTED EARTH BORROW OR GRANULAR FILL.
16. THE CONTRACTOR IS RESPONSIBLE FOR THE INSTALLATION AND CONSTRUCTION OF ALL SEDIMENT AND EROSION CONTROL MEASURES TO ENSURE THAT SEDIMENT DOES NOT MIGRATE FROM THE CONSTRUCTION SITE. SEDIMENTS SHALL BE CONTAINED AND DISPOSED OF IN AN APPROVED MANNER. THE CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES, TO PROVIDE FOR PROTECTION OF THE AREA DRAINAGE SYSTEM AND THE RECEIVING WATERCOURSE, DURING CONSTRUCTION ACTIVITIES. THIS INCLUDES LIMITING THE AMOUNT OF EXPOSED SOIL, USING FILTER COLTH UNDER THE GRATES OF CATCHBASINS AND MANHOLES AND INSTALLING SILT FENCES (PER OPSD 219.110) AND OTHER EFFECTIVE SEDIMENT TRAPS.

NOTES: WATERMAIN

1. ALL WATERMAIN WORK AND MATERIAL SHALL BE IN ACCORDANCE WITH GEOTECHNICAL INVESTIGATION PROPOSED RESEARCH BUILDING NATIONAL RESEARCH COUNCIL UPLANDS CAMPUS 1920 RESEARCH ROAD, OTTAWA, ONTARIO", PREPARED BY GOLDER ASSOCIATES LTD. DATED DECEMBER, 2015.
2. ALL WATERMAIN SERVICES TO BE INSTALLED AT MINIMUM COVER OF 2.4m. IF COVER IS LESS THAN 2.4m, REFER TO CITY OF OTTAWA STANDARD W21 & W22 ON A103.
3. CONTRACTOR TO VERIFY THE EXACT LOCATION OF THE EXISTING WATER SERVICES AND PROVIDE EXCAVATION, BEDDING, BACKFILL AND REINSTATEMENT.

NOTES: SEWER

1. ALL SANITARY GRAVITY SEWERS ARE TO BE THE SIZES INDICATED, AND THE MATERIAL SHALL BE SDR 35.
2. THE BEDDING AND COVER MATERIAL FOR THE PROPOSED SANITARY SHOULD BE AS INDICATED IN "GEOTECHNICAL INVESTIGATION PROPOSED RESEARCH BUILDING NATIONAL RESEARCH COUNCIL UPLANDS CAMPUS 1920 RESEARCH ROAD, OTTAWA, ONTARIO", PREPARED BY GOLDER ASSOCIATES LTD. DATED DECEMBER, 2015.
3. SUPPLY AND INSTALL ALL PIPING AND APPURTENANCES AS SHOWN TO WITHIN 1.0m OF BUILDING WALLS. PROVIDE TEMPORARY CAPS.
4. THE CONTRACTOR IS RESPONSIBLE FOR ALL COSTS AND COORDINATION FOR ALL INSPECTION AND TESTING WITH RESPECT TO SEWER.
5. SEWER TO BE INSTALLED WITH A MINIMUM OF 2.0m COVER. THERMAL INSULATION TO BE INSTALLED WHERE REQUIRED.

National Research Council Canada / Conseil national de recherches Canada
Administrative Services and Property Management Branch / Division des services administratifs et gestion de l'immobilier

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GENERAL NOTES

- **SEE DRAWING A103 AND A104 FOR DETAILS AND NOTES**

ISSUED FOR 50% REVIEW 15/06/2016

Minley CONSTRUCTION
2724 Fenton Road
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Telephone: (613) 822-1052
Fax: (613) 822-1573

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A / C — A Detail no. / No. du détail; B Location drawing no. / sur dessin no.; C Drawing no. / dessin no.

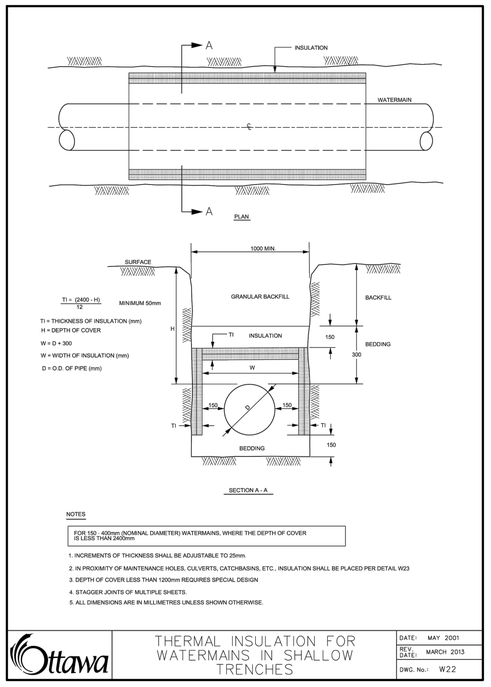
A / B C

project / projet	NRC U72 RESEARCH ROAD OTTAWA, ON
drawing / dessin	DETAILS DRAWING 1
designed / conçu	KW / LPL
date / date	JUN 2016
drawn / dessiné	LPL
scale / échelle	N/A
checked / vérifié	KW
sheet / feuille	3 of/de 4
approved / approuvé	KW
W.O.no. / D.T.no.	----
dwg.no. / dessin no.	A102

ASPM A1 (841x594)

0 10 20mm 40 60 80 100 120 140 160 180 200mm

4 A100 INSULATION DETAIL
SCALE N/A



NOTES

FOR 150 - 400mm (NOMINAL DIAMETER) WATERMAINS, WHERE THE DEPTH OF COVER IS LESS THAN 2400mm

1. INCREMENTS OF THICKNESS SHALL BE ADJUSTABLE TO 25mm.
2. IN PROXIMITY OF MAINTENANCE HOLES, CULVERTS, CATCHBASINS, ETC., INSULATION SHALL BE PLACED PER DETAIL W23
3. DEPTH OF COVER LESS THAN 1200mm REQUIRES SPECIAL DESIGN
4. STAGGER JOINTS OF MULTIPLE SHEETS.
5. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE.

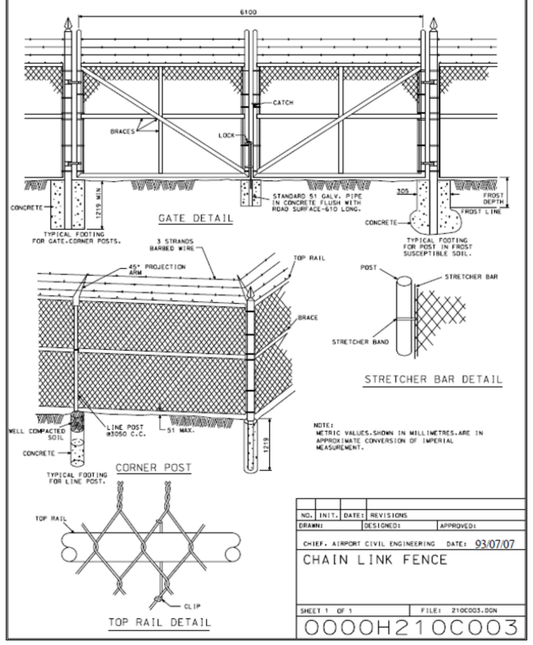
Ottawa

THERMAL INSULATION FOR WATERMAINS IN SHALLOW TRENCHES

DATE: MAY 2001
REV. DATE: MARCH 2013
DWG. No.: W22

5 A100 FENCE AND GATE DETAIL
SCALE N/A

PUBLIC WORKS CANADA | ARCHITECTURAL & ENGINEERING SERVICES | AIR TRANSPORTATION | Canada



NOTE:
METRIC VALUES SHOWN IN MILLIMETRES ARE IN APPROXIMATE CONVERSION OF IMPERIAL MEASUREMENT.

NO.	INIT.	DATE:	REVISIONS
DRAWN:		DESIGNED:	APPROVED:

CHIEF, AIRPORT CIVIL ENGINEERING DATE: 93/07/07

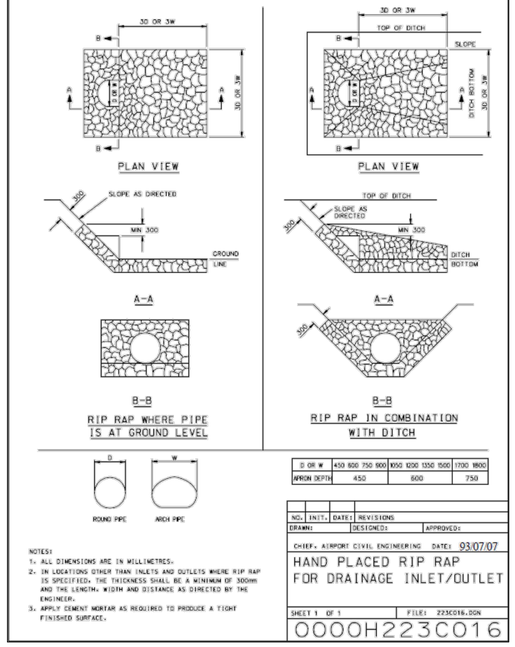
CHAIN LINK FENCE

SHEET 1 OF 1 FILE: 210C003.DGN

0000H210C003

6 A100 CULVERT RIPRAP DETAIL
SCALE N/A

PUBLIC WORKS CANADA | ARCHITECTURAL & ENGINEERING SERVICES | AIR TRANSPORTATION | Canada



D OR W	450	600	750	900	1050	1200	1350	1500	1700	1800
APRON DEPTH	450		600						750	

NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. IN LOCATIONS OTHER THAN INLETS AND OUTLETS WHERE RIP RAP IS SPECIFIED, THE THICKNESS SHALL BE A MINIMUM OF 300mm AND THE LENGTH, WIDTH AND DISTANCE AS DIRECTED BY THE ENGINEER.
3. APPLY CEMENT MORTAR AS REQUIRED TO PRODUCE A TIGHT FINISHED SURFACE.

NO.	INIT.	DATE:	REVISIONS
DRAWN:		DESIGNED:	APPROVED:

CHIEF, AIRPORT CIVIL ENGINEERING DATE: 93/07/07

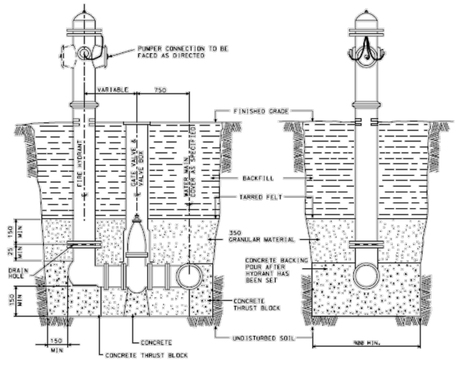
HAND PLACED RIP RAP FOR DRAINAGE INLET/OUTLET

SHEET 1 OF 1 FILE: 223C016.DGN

0000H223C016

7 A100 HYDRANT DETAIL
SCALE N/A

PUBLIC WORKS CANADA | ARCHITECTURAL & ENGINEERING SERVICES | AIR TRANSPORTATION | Canada



NOTES:
1-METRIC VALUES SHOWN IN MILLIMETRES ARE IN APPROXIMATE CONVERSION OF IMPERIAL UNITS.
2-PROVIDE CONCRETE THRUST BLOCKS AT ELBOWS AND CHANGES OF DIRECTION.

NO.	INIT.	DATE:	REVISIONS
DRAWN:		DESIGNED:	APPROVED:

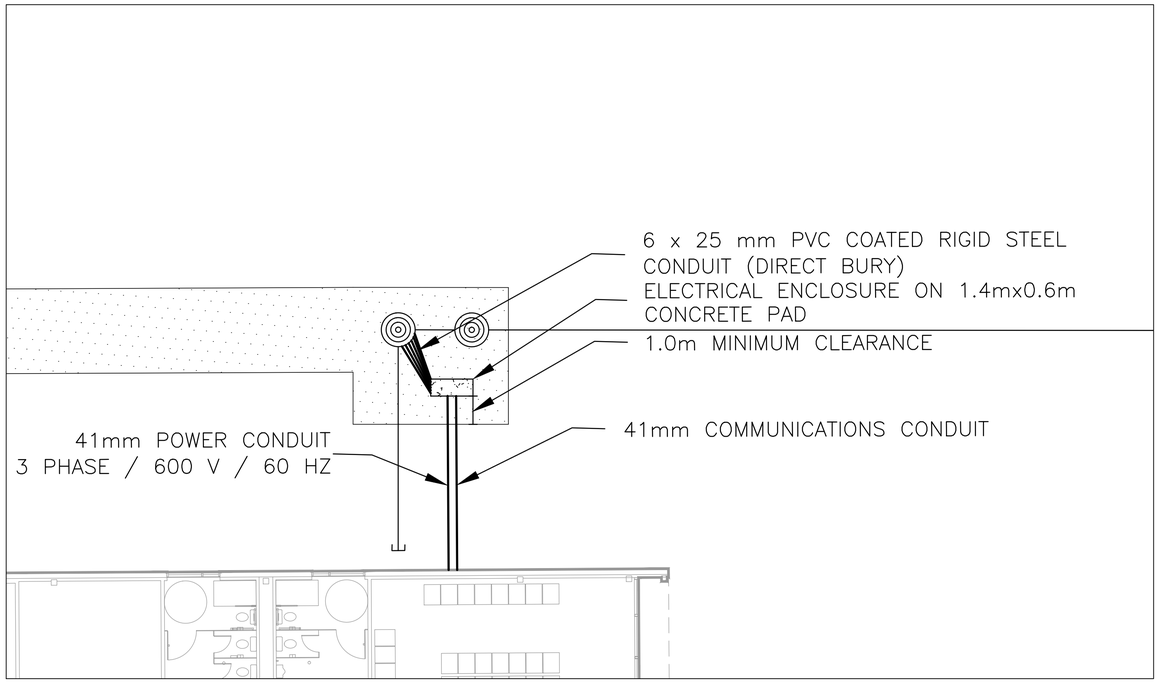
CHIEF, AIRPORT CIVIL ENGINEERING DATE: 93/07/07

HYDRANT INSTALLATION

SHEET 1 OF 1 FILE: 231C002.DGN

0000H231C002

8 A100 SANITARY PUMPING STATION ELECTRICAL DETAIL
SCALE N/A



C

0 10 20mm 40 60 80 100 120 140 160 180 200mm

ASPM A1 (841x594)

National Research Council Canada | Conseil national de recherches Canada
Administrative Services and Property Management Branch | Division des services administratifs et gestion de l'immobilier

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GENERAL NOTES

- **SEE DRAWING A103 AND A104 FOR DETAILS AND NOTES**

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2724 Fenton Road
Ottawa, Ontario
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Telephone: (613) 822-1052
Fax: (613) 822-1573

- Verify all dimensions and site conditions and be responsible for same
- Vérifier toutes les dimensions et l'etat des lieux et en assumer la responsabilité

A Detail no. No. du détail
B Location drawing no. sur dessin no.
C Drawing no. dessin no.

project / projet
NRC U72
RESEARCH ROAD
OTTAWA, ON

drawing / dessin
DETAILS DRAWING 2

designed / conçu	date / date
KW / LPL	JUN 2016
drawn / dessiné	scale / échelle
LPL	1:250
checked / vérifié	sheet / feuille
KW	4 of/de 4
approved / approuvé	W.O.no. / D.T.no.
KW	----

dwg.no. / dessin no.
A103

RESEARCH ROAD

FOURTH AVE

EX TUNNEL CONTINUES NORTH

CROSSING DATA TABLE

CROSSING DATA	PIPE CROSSING ABOVE INV	PIPE CROSSING BELOW OBV
X1	EX WM – SEE NOTE X1	110.30 (FORCEMAIN)
X2	PROPOSED DUCT – SEE NOTE X2	111.56 (WATERMAIN)

NOTE X1 – 0.5m SEPARATION IS REQUIRED ABOVE THE CROWN OF FORCEMAIN TO THE INVERT OF WATERMAIN. CONTRACTOR TO CONFIRM THE ELEVATION OF EXISTING WATERMAIN AT CROSSING PRIOR TO INSTALLATION OF FORCEMAIN. THE CLIENT REPRESENTATIVE MUST BE INFORMED IF THERE IS A CONFLICT, OR IF THE SANITARY FORCEMAIN WILL BE INSTALLED BELOW EXISTING WATERMAIN.

NOTE X2 – WATERMAIN MUST BE INSTALLED WITH VERTICAL CLEARANCE OF 0.3m FROM ALL COMMUNICATION/ELECTRICAL DUCT.

LEGEND

- PROPOSED SANITARY FORCEMAIN/SEWER
- PROPOSED WATERMAIN
- PROPOSED SWALE
- PROPOSED FENCE
- PROPOSED ASPHALT
- PROPOSED COMMUNICATION / HYDRO DUCT BANKS
- 113.45 PROPOSED GRADE
- 113.70 EXISTING GRADE
- 0.4% PROPOSED GRADER
- PROPOSED CONCRETE PAD

CONNECT PROPOSED WATERMAIN TO 200mm WATERMAIN. WATERMAIN TO BE INSTALLED AT MIN. 2.4m DEPTH. WATERMAIN INSTALLED ABOVE 2.4m MUST BE INSULATED AS PER DRAWING A103.

106.1m – 200mm WATERMAIN

106.7 m – 75mm FORCEMAIN @ 0.50%

TIE INTO EX ASPHALT (TYP.)

PROPOSED 3.0m WIDE ASPHALT LANE

PUMP STATION T/G=113.30 E INV=109.80 S INV=110.75

CHECK VALVE CHAMBER

ELECTRICAL ENCLOSURE ON 1.4mx0.6m CONCRETE PAD

7.8 m – 150mm SANITARY SEWER @ 1.0%

SANITARY STUB INV = 110.83

PROPOSED 3.0m WIDE CONCRETE SIDEWALK

6.5m WIDE ASPHALT DRIVEWAY

CONNECT PROPOSED 4.3m WATERMAIN TO EX 200mm WATERMAIN. WATERMAIN TO BE INSTALLED AT MIN 2.4m DEPTH. WATERMAIN INSTALLED ABOVE 2.4m MUST BE INSULATED AS PER DRAWING A103.

ASSUMED EX 200mm WATERMAIN

1.5m – 150mm PVC WATERMAIN

V&VB

WATER SERVICE STUB CROWN = 111.60

200x200 TEE

200x150 TEE

HYDRO AND COMMUNICATION DUCT BANKS (SEE DRAWING A102 FOR DETAILS)

TIE INTO EX ASPHALT (TYP.)

FIRE HYDRANT

6.3m – 150mm WATERMAIN

PROPOSED U-72 BUILDING
FFE = 114.00

FUTURE LABORATORY EXPANSION

3.0m x 3.0m CONCRETE PAD

5:1 SLOPE

3:1 SLOPE

112.80 MATCH EX GRADE

18.0m – 300mm CULVERT

FUTURE ASPHALT TAXIWAY

70m SWALE @ 1.0%

30m SWALE @ 0.7%

CONNECT PROPOSED WATERMAIN TO 200mm WATERMAIN. WATERMAIN TO BE INSTALLED AT MIN 2.4m DEPTH. WATERMAIN INSTALLED ABOVE 2.4m MUST BE INSULATED AS PER DRAWING A103.

TIE INTO EX FENCE

PROTECT EXISTING FENCE, TIE INTO EXISTING GRADE (TYP.)

TIE INTO EX FENCE

EX HYDRANT

EX CHAIN LINK FENCE

EX CONCRETE CURB

EX 200mm WATERMAIN

EX V&VB

EX CB 03

CB 01

MH 02

8m – 200mm STORM SEWER PVC PIPE AT 0.X%

37m – 200mm STORM SEWER PVC PIPE AT

45° BEND

INV=110.34

4.0 m – 75mm FORCEMAIN @ 36%

BOLLARDS

CONNECT 75mm FORCEMAIN TO EX SAN MH11 INV=111.80

RETAINING WALL

150mm PVC

1-STOREY STUCCO
STUCCO NOTED
U65
(RCMP. HANGER)

2-STOREY
METAL SIDING
SIDING NOTED

ASPM A1 (841x594)

0 10 20mm 40 60 80 100 120 140 160 180 200mm

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Administrative Services and Property Management Branch / Division des services administratifs et gestion de l'immobilier

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GENERAL NOTES

- SEE DRAWING A103 AND A104 FOR DETAILS AND NOTES

ISSUED FOR 50% REVIEW 15/06/2016

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Telephone: (613) 822-1052
Fax: (613) 822-1573

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A Detail no. No. du détail
B Location drawing no. sur dessin no.
C Drawing no. dessin no.

project / projet

NRC U72

RESEARCH ROAD

OTTAWA, ON

drawing / dessin

GRADING + SERVICING PLAN

designed / conçu: KW / LPL	date / date: JUN 2016
drawn / dessiné: LPL	scale / échelle: 1:250
checked / vérifié: KW	sheet / feuille: 1 of/de 4
approved / approuvé: KW	W.O.no.: ---- D.T.no.:
dwg.no.: A100	dessin no.

RESEARCH ROAD

FOURTH AVE

EX TUNNEL CONTINUES NORTH

EX HYDRANT

EX V&VB

CAP EX WATERMAIN

REMOVE EX V&VB

EXISTING WATERMAIN TO BE REMOVED OR ABANDONED AS PER CLIENT INSTRUCTIONS (TYP.)

ASSUMED 1x 200mm WATERMAIN

EX 200mm WATERMAIN

2"STEEL H.P.GAS

31.8mm EX GAS

EX CB 03

CB 01

8m - 200mm STORM SEWER PVC PIPE AT 0.X%

37m - 200mm STORM SEWER PVC PIPE AT

EX MH11

HYDRO BOX

BOLLARDS

EX CONCRETE CURB

EX CHAIN LINK FENCE

RETAINING WALL

150mm PVC

1-STOREY STUCCO
STUCCO NOTED
U65
(RCMP. HANGER)

2-STOREY
METAL SIDING
SIDING NOTED

CHAIN LINK FENCE

EX HYDRANT

REMOVE EXISTING FENCE AS INDICATED

ASPM A1 (841x594)

0 10 20mm 40 60 80 100 120 140 160 180 200mm

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Conseil national de recherches Canada

Administrative Services and Property Management Branch
Division des services administratifs et gestion de l'immobilier

NRC · CNRC

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- **SEE DRAWING A103 AND A104 FOR DETAILS AND NOTES**

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B Location drawing no. / sur dessin no.
C Drawing no. / dessin no.

project / projet

NRC U72

RESEARCH ROAD

OTTAWA, ON

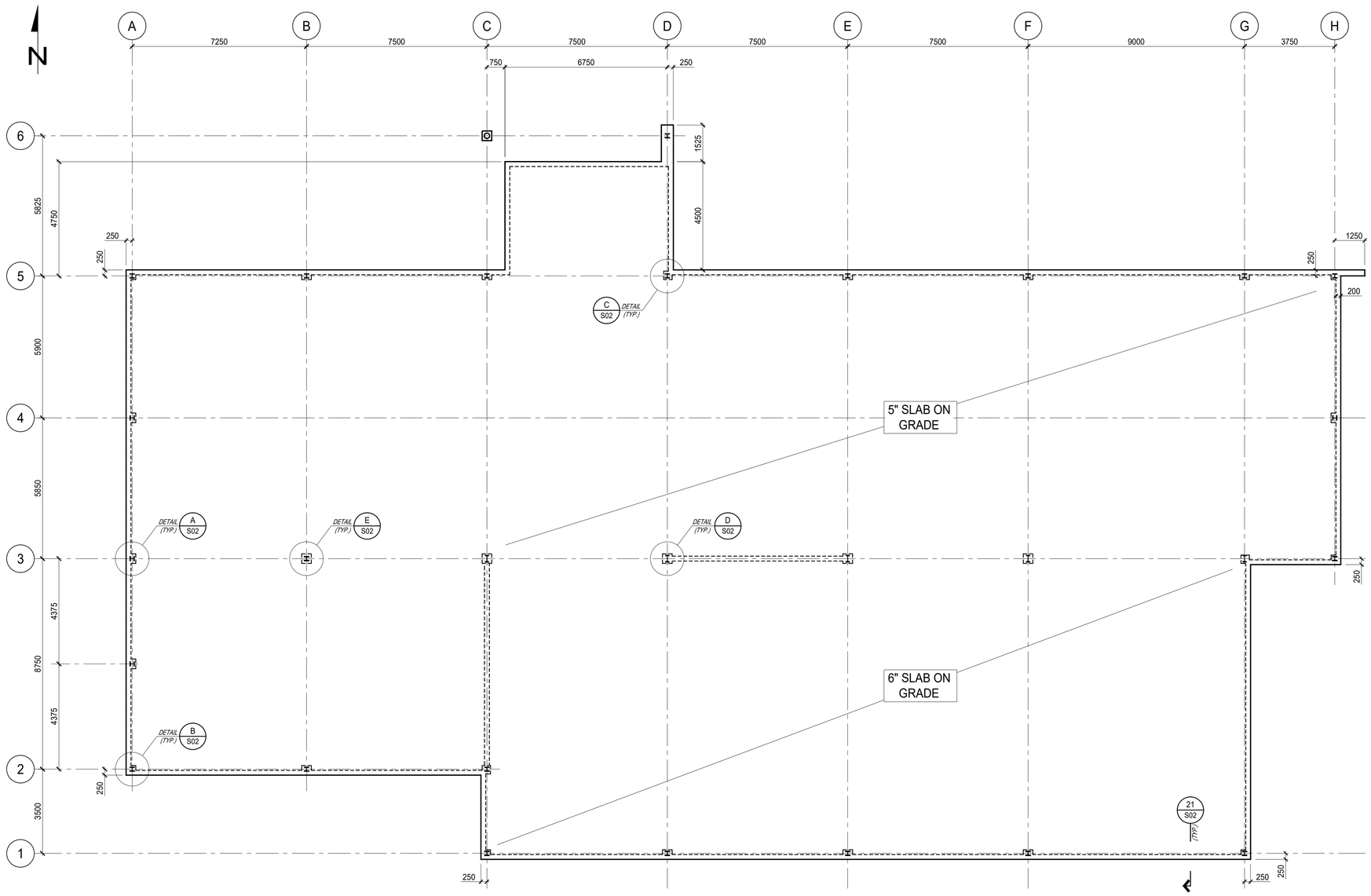
drawing / dessin

REMOVAL PLAN

designed / conçu	date / date
KW / LPL	JUN 2016
drawn / dessiné	scale / échelle
LPL	1:250
checked / vérifié	sheet / feuille
KW	2 of/de 4
approved / approuvé	W.O.no. / D.T.no.
KW	----

dwg.no. / dessin no.

A101



FOUNDATION / GROUND FLOOR PLAN

SCALE = 1:100

GENERAL NOTES:

- ALL FOOTINGS SHALL BEAR ON ORIGINAL UNDISTURBED SOIL, WITH A BEARING CAPACITY OF 100 kPa.
- BACKFILL SHALL BE GRADED CRUSHED STONE COMPACTED TO 95% MODIFIED PROCTOR DRY DENSITY.

CONCRETE:

- CONCRETE SHALL HAVE A 28-DAY COMPRESSIVE STRENGTH OF 25 MPa.
- REINFORCING STEEL SHALL CONFORM TO CSA G30.18-09, GRADE 400.
- THE CONTRACTOR SHALL TAKE THREE CONCRETE COMPRESSION TEST CYLINDERS FOR EACH CONCRETE POUR. ONE SHALL BE TESTED AT 7 DAYS AND TWO AT 28 DAYS.
- CONCRETE COVER TO REINFORCING STEEL
  - FOOTINGS 75mm
  - WALLS 50mm
- THE CONTRACTOR SHALL SUBMIT FOR REVIEW SHOP DRAWINGS AND BAR LISTS FOR THE REINFORCING STEEL.
- THE CONCRETE FLOOR SLAB SHALL RECEIVE A STEEL-TROWELED FINISH, AND SHALL BE WATER-CURED FOR A PERIOD OF 7 DAYS. THE SLAB SHALL BE SAW-CUT INTO PANELS NOT EXCEEDING 8.0 m x 8.0 m, 48 HOURS AFTER SLAB IS POURED.
- ALL CONCRETE WORK SHALL CONFORM TO CSA A23.1-04 AND CSA A23.2-04.

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22 Antares Drive, Suite 201
Ottawa, Ontario, K2E 7Z6
tel: (613) 723-7765 fax: (613) 723-0095

LICENSED PROFESSIONAL ENGINEER
R. LEIBE
26371500
PROVINCE OF ONTARIO

PRELIMINARY

No.	Date	Revision	By: Par:
1	JUN 15/16	50% COMPLETE DRAWING	R.L.
0	MAR 15/16	PRELIMINARY	R.L.

- Verify all dimensions and site conditions and be responsible for same.
- Vérifier toutes les dimensions et l'état des lieux et en assumer la responsabilité.

A Detail no. No. du détail
B Location drawing no. sur dessin no.
C Drawing no dessin no.

project / projet

BUILDING U-72

UPLANDS CAMPUS

drawing / dessin

STRUCTURAL:
FOUNDATION PLAN

designed / conçu	date / date
R.L.	FEBRUARY, 2016
drawn / dessiné	scale / échelle
D.M.D./A.A.	AS SHOWN
checked / vérifié	sheet / feuille
R.L.	S01 of/de S04
approved / approuvé	W.O.no. / D.T.no.

dwg.no. / dessin no.

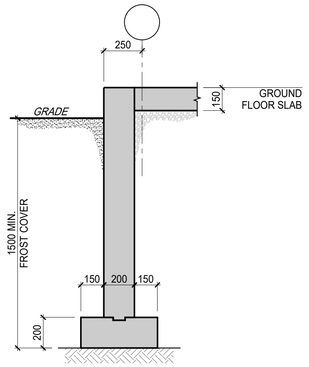
0000-S01

LEA16003

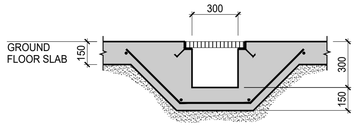
ASPM A1 (841 x 594)

C

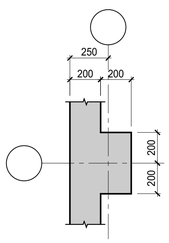
0 10 20mm 40 60 80 100 120 140 160 180 200mm



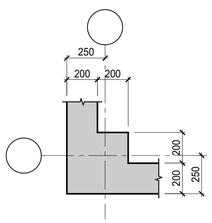
21 / S02 **SECTION** (TYPICAL UNLESS NOTED)
SCALE = 1:20



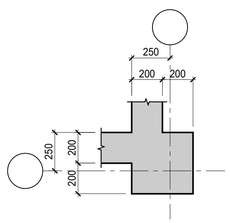
22 / S02 **SECTION** (TYPICAL TRENCH DRAIN)
SCALE = 1:20



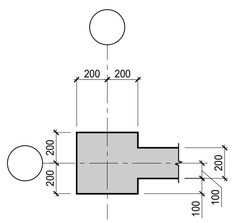
A / S02 **DETAIL**
SCALE = 1:20



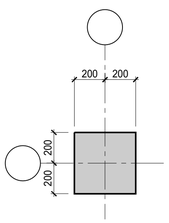
B / S02 **DETAIL**
SCALE = 1:20



C / S02 **DETAIL**
SCALE = 1:20



D / S02 **DETAIL**
SCALE = 1:20



E / S02 **DETAIL**
SCALE = 1:20

LEA16003

ASPM A1 (841 x 594)

0 10 20mm 40 60 80 100 120 140 160 180 200mm

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tel: (613) 723-7765 fax: (613) 723-0095

LICENSED PROFESSIONAL ENGINEER
R. LEIBE
26371500
PROVINCE OF ONTARIO

PRELIMINARY

No.	Date	Revision	By: Par:
0	MAR 15/16	PRELIMINARY	R.L.

- Verify all dimensions and site conditions and be responsible for same.
- Vérifier toutes les dimensions et l'état des lieux et en assumer la responsabilité.

A Detail no. / No. du détail
B Location drawing no. / sur dessin no.
C Drawing no / dessin no.

project / projet

BUILDING U-72

UPLANDS CAMPUS

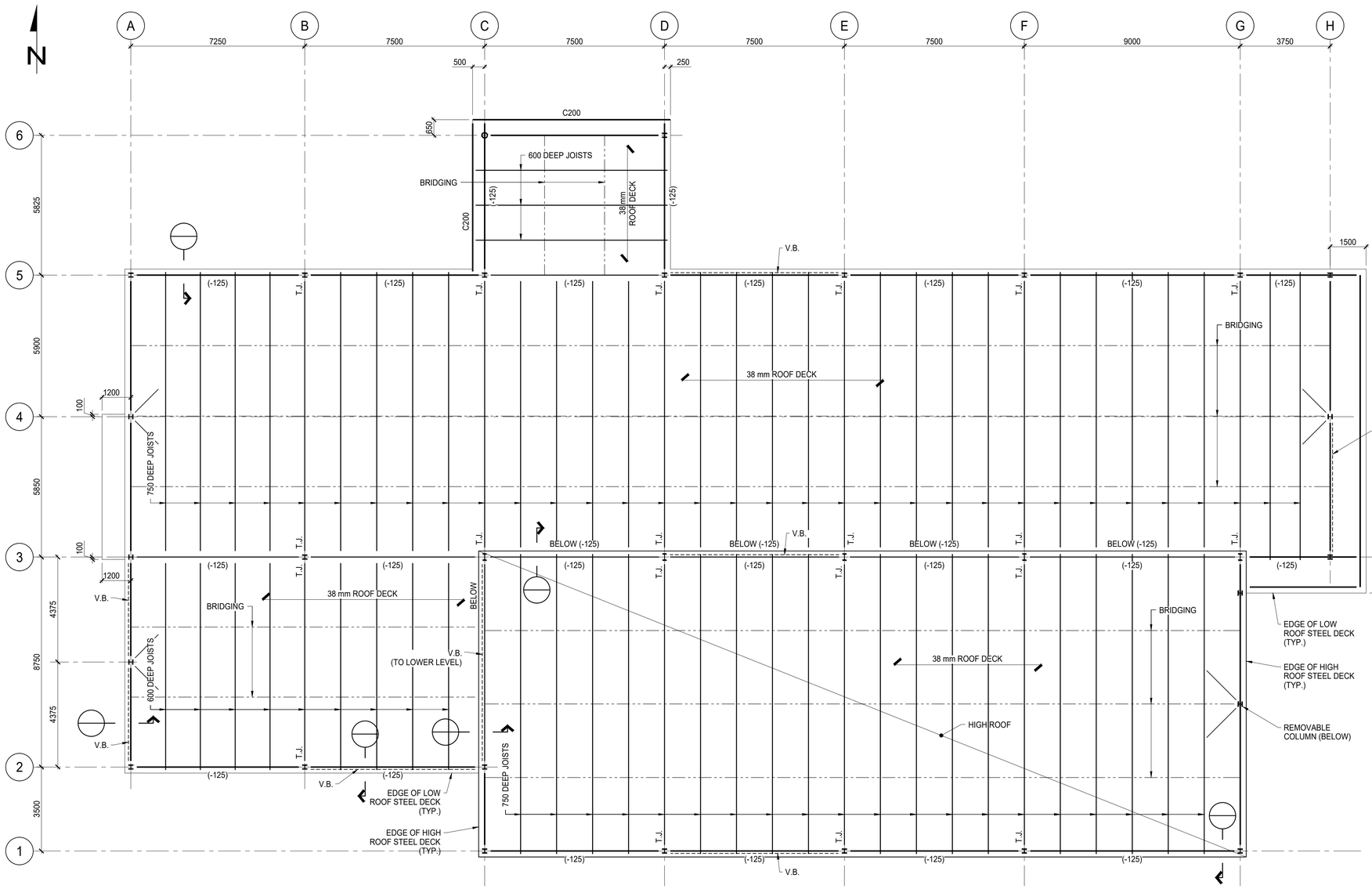
drawing / dessin

STRUCTURAL:
CONCRETE DETAILS

designed / conçu	date / date
R.L.	FEBRUARY, 2016
drawn / dessiné	scale / échelle
D.M.D.	AS SHOWN
checked / vérifié	sheet / feuille
R.L.	S02 of/de S04
approved / approuvé	W.O.no. / D.T.no.

dwg.no. / dessin no.

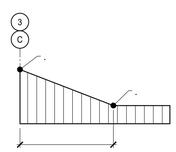
0000-S02



ROOF PLAN

SCALE = 1:100

- V.B. = VERTICAL BRACING
- DESIGN LOADS:
  - LIVE: 1.44 kPa (30 lbs/s□ft.)
  - DEAD: 2.30 kPa (48 lbs/s□ft.)



SNOW ACCUMULATION LOADS

N.T.S.

GENERAL NOTES:

STRUCTURAL STEEL:

- ALL STRUCTURAL STEEL SHALL CONFORM TO CSA G40.20-04 AND CSA G40.21-04, GRADE 350.
- ALL STRUCTURAL STEEL SHALL RECEIVE TWO SHOP COATS OF PRIMER CONFORMING TO CAN/CGSB 1-40.97, "ANTI-CORROSIVE STRUCTURAL STEEL ALKYD PRIMER."
- ALL WELDING MATERIALS SHALL CONFORM TO CSA W48.06.
- WELDING SHALL CONFORM TO CSA W59-03 (R2008) AND SHALL BE CARRIED OUT BY WELDERS □UALIFIED BY THE CANADIAN WELDING BUREAU.
- ALL BOLTS SHALL BE 20mm DIA. HIGH TENSILE BOLTS CONFORMING TO ASTM F3125, GRADE A325.
- THE CONTRACTOR SHALL SUBMIT FOR REVIEW SHOP DRAWINGS FOR REVIEW, INCLUDING ERECTION AND SHOP DETAIL DRAWINGS, BEFORE THE START OF FABRICATION.
- THE STEEL CONTRACTOR SHALL VERIFY DIMENSIONS ON SITE BEFORE THE START OF FABRICATION. NOTIFY ENGINEER OF ANY DISCREPANCIES.
- ALL STRUCTURAL STEEL WORK SHALL CONFORM TO CSA S16-14.

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PRELIMINARY

No.	Date	Revision	By: Par:
1	JUN 15/16	50% COMPLETE DRAWING	R.L.
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A Detail no. No. du détail
B Location drawing no. sur dessin no.
C Drawing no dessin no.

project / projet

BUILDING U-72

UPLANDS CAMPUS

drawing / dessin

STRUCTURAL:
ROOF PLAN

designed / conçu	date / date
R.L.	FEBRUARY, 2016
drawn / dessiné	scale / échelle
D.M.D.	AS SHOWN
checked / vérifié	sheet / feuille
R.L.	S03 of/de S04
approved / approuvé	W.O.no. / D.T.no.

dwg.no. / dessin no.

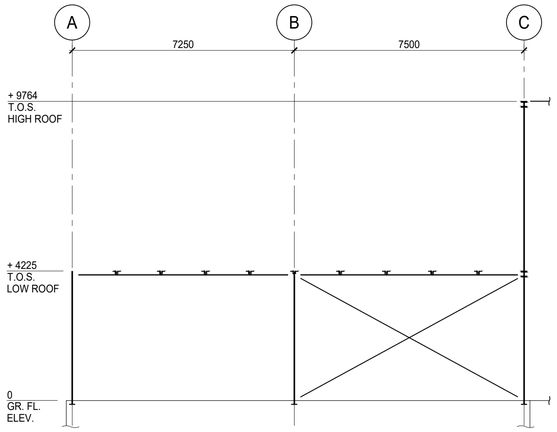
0000-S03

LEA16003

ASPM A1 (841 x 594)

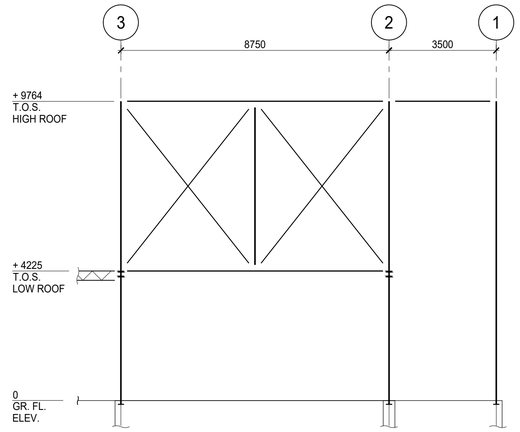
C

0 10 20mm 40 60 80 100 120 140 160 180 200mm



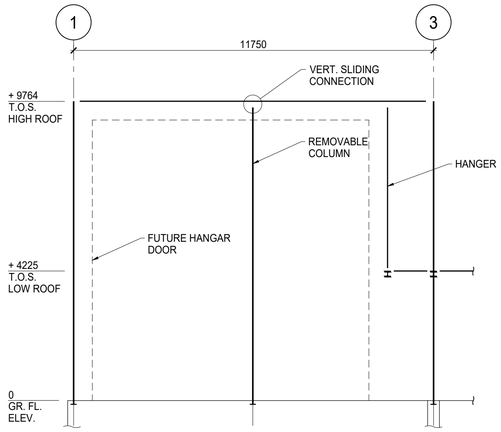
41 / S04 ELEVATION - GRID LINE 2

SCALE = 1:100



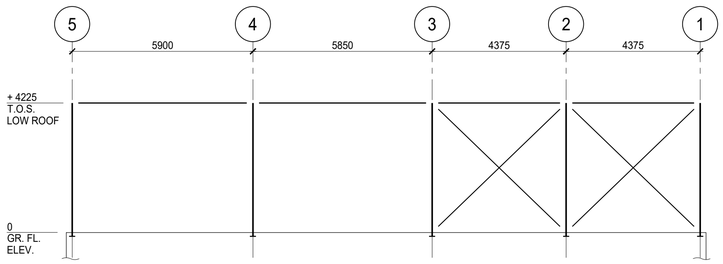
42 / S04 ELEVATION - GRID LINE C

SCALE = 1:100



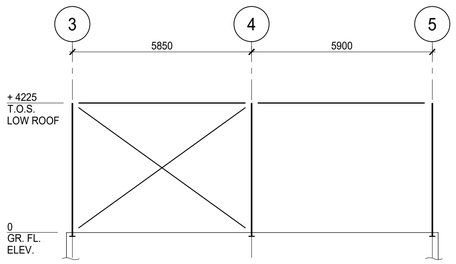
43 / S04 ELEVATION - GRID LINE G

SCALE = 1:100



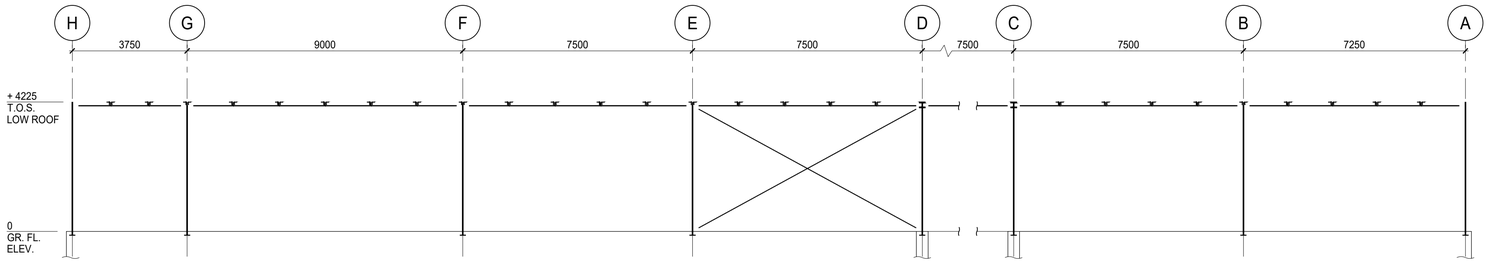
44 / S04 ELEVATION - GRID LINE A

SCALE = 1:100



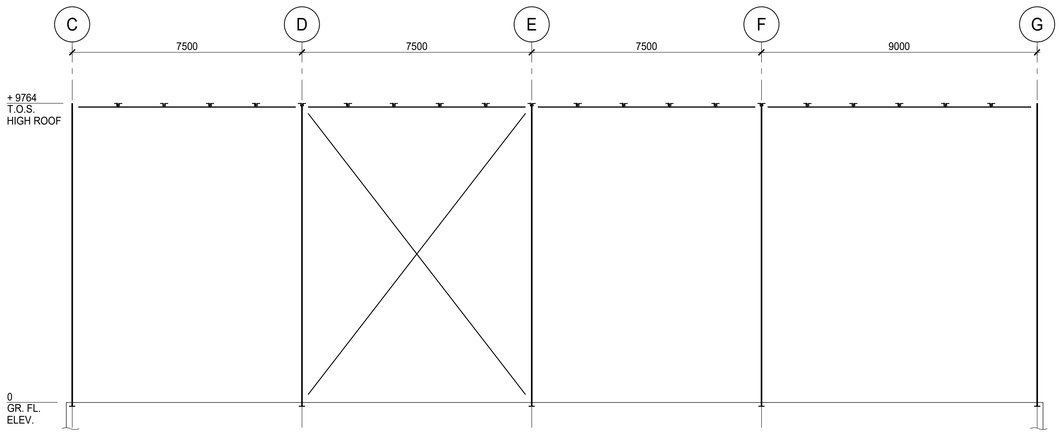
45 / S04 ELEVATION - GRID LINE H

SCALE = 1:100



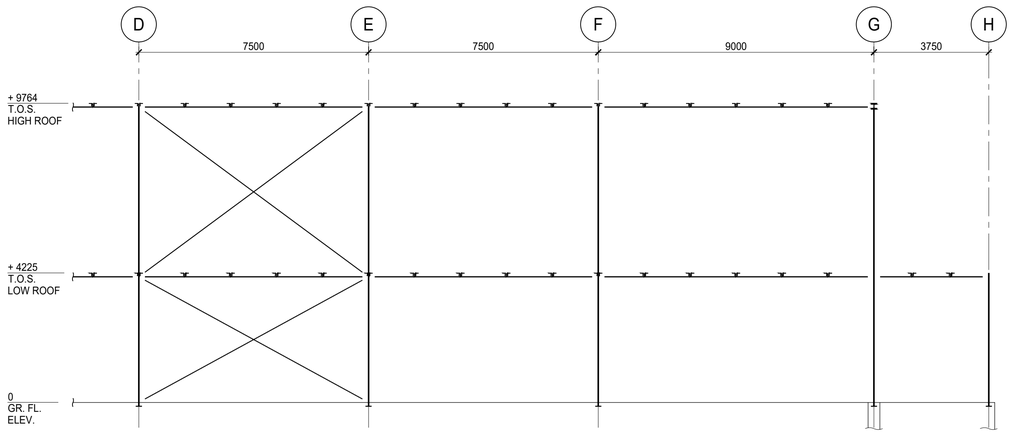
46 / S04 ELEVATION - GRID LINE 5

SCALE = 1:100



47 / S04 ELEVATION - GRID LINE 1

SCALE = 1:100



48 / S04 ELEVATION - GRID LINE 3

SCALE = 1:100

LEA16003

ASPM A1 (841 x 594)

0 10 20mm 40 60 80 100 120 140 160 180 200mm

National Research Council Canada
Conseil national de recherches Canada

Administrative Services and Property Management Branch
Division des services administratifs et gestion de l'immobilier

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LICENSED PROFESSIONAL ENGINEER
R. LEIBE
26371500
PROVINCE OF ONTARIO

No.	Date	Revision	By: Par:
1	JUN 15/16	50% COMPLETE DRAWING	R.L.
0	MAR 15/16	PRELIMINARY	R.L.

- Verify all dimensions and site conditions and be responsible for same.
- Vérifier toutes les dimensions et l'état des lieux et en assumer la responsabilité.

A Detail no. No. du détail
B Location drawing no. sur dessin no.
C Drawing no dessin no.

project / projet

BUILDING U-72

UPLANDS CAMPUS

drawing / dessin

STRUCTURAL:
WALL ELEVATIONS

designed / conçu	date / date
R.L.	FEBRUARY, 2016
drawn / dessiné	scale / échelle
A.A.	AS SHOWN
checked / vérifié	sheet / feuille
R.L.	S04 of/de S04
approved / approuvé	W.O.no. / D.T.no.

dwg.no. / dessin no.

0000-S04