



A TETRA TECH COMPANY

August 29, 2012

ISSUED FOR USE
EBA FILE: W14103028-01

Lansing Point Condo Association
111-134 Seine Square
Whitehorse, YT Y1A 3C3

Attention: Mr. Geoff Wooding, President

Subject: Geotechnical Observations – Building B Foundation Recommendations
134 Seine Square, Whitehorse, YT

1.0 INTRODUCTION

EBA Engineering Consultants Ltd., operating as EBA, A Tetra Tech Company (EBA), was retained by Lansing Point Condo Association (LPCA) to provide observation services during the execution of EBA's foundation recommendations for the Phase II west building ("Building B" shown on the attached Figure 1) at 134 Seine Square in Whitehorse, Yukon.

EBA scope of services for this project included:

- Upon start of construction EBA is to complete daily site visits (as required) during the work week to discuss progress with the contractor (Castle Rock Enterprises) and LPCA.
- Upon completion of the project EBA will generate a summary construction report for LPCA.

This work was requested by Mr. Geoff Wooding, president of LPCA and was authorized through an e-mail dated July 9, 2012.

This letter report fulfills EBA's scope of service for this project.

2.0 BACKGROUND

In October 2006, J.R. Paine & Associates Ltd. (J.R. Paine) of Whitehorse, YT completed a foundation investigation report titled "Re: Foundation Investigation, Proposed 20-Unit Condominium Complex, Seine Crescent, Takhini Subdivision – Whitehorse, Yukon Territory". The report copy received by EBA was incomplete, did not have a signature page and was possibly missing appendices info (Testpit Logs, Laboratory Testing Results, Site Plan, etc.). Mr. Bud Kofoed, P.Eng. from the J.R. Paine Edmonton office was contacted and asked if there was any additional info available regarding the foundation investigation report or associated with the subject site. He confirmed that all the info that was made available to EBA was all that could be found in the file.

Between September 2006 and June 2007 Issue for Construction drawings for architectural, structural mechanical and electrical services were completed and provided to the building contractor. The architectural design services were provided by Zeko Design Build, the structural design services provided

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Stoeven Lerer Engineering Ltd., the mechanical design services provided by For Hire Plumbing and the electrical design services provided by FSC / Hyland Electric.

In early August 2011, EBA was contacted by Mr. Bill Marsh, P.Eng. of W.A. Marsh Engineering Ltd. (Marsh Engineering) to assist with a site visit to observe the present foundation conditions of Building B and to provide geotechnical engineering input on the condition of the concrete foundation and what might be the likely cause of Building B's structural damage (significant cracking of the interior drywall, cracking of the interior garage concrete slabs and bulging of the perimeter parking lot asphalt). On August 16 and 17, 2011, EBA's representative completed a site visit with Mr. Marsh to observe the perimeter ground surface and subsurface soil conditions surrounding Building B. EBA's site observations and foundation restoration recommendations were detailed in an EBA report titled "Geotechnical Evaluation – Frost Heave Potential, 134 Seine Square, Whitehorse, YT" dated November 4, 2011, completed for Marsh Engineering.

The observations and recommendations are summarized below. The northwest and northeast sides and a portion of the southeast side were surfaced with asphalt. The west side was landscaped with drain rock overlying a layer of geotextile underlain by granular fill. There were noticeable areas of frost heave along the edge of the building where the asphalt had bulged and cracked. There was also evidence of frost heave at the southwest entrance doors where the bottom of the doors was binding with the surface of the concrete side walk. The subsurface soil conditions near the perimeter strip footing along the southwest portion of Building B consisted of 0.9m of wet to saturated granular fill overlying wet and soft silt. The moisture contents and particle size distribution results indicated that the silt was frost susceptible and if seasonal frost were to penetrate to a depth of 2.4m, frost related movement would most likely occur causing structural damage to the building and the foundation.

To reduce the potential for frost heave, one of the following three conditions must be removed, frost susceptible (fine grained) soils, excess moisture, or freezing temperatures. Based on site conditions encountered during the site visit EBA recommended that the frost susceptible soil be protected (insulated) from seasonal frost penetration. Details for protecting the frost susceptible soil with insulation were as follows:

- Remove asphalt, concrete and landscaping materials from the perimeter of Building B to an offset distance of at least 2.4 m to allow for the placement of the protective perimeter rigid board insulation.
- Within the area of the exposed subgrade excavate to a depth of 200 mm beneath the bottom of the perimeter foundation footing to allow for the placement of 75 mm of compacted bedding sand beneath the rigid board insulation.
- The recommended dimensions for the insulation placement are 100 mm thick and 1.8 m wide. . The insulation is to overlap the base of the perimeter wall and top outer edge of the perimeter footing. The bedding sand should also be placed on top of the rigid board insulation for protection before final grading with asphalt, concrete and landscaping materials.
- At the entrance and garage doorways the soil beneath the perimeter footing will have to be removed to create a void that is about 100 mm deep, 300 mm wide and extends 300 mm beyond the width of the entrance way. This void is to be filled with high density spray foam insulation and tie-in with the horizontal perimeter rigid board insulation.

- Air temperatures within the garages will have to remain above 0°C to reduce the frost heave potential beneath the garage interior concrete slabs.
- The drain line from the parking lot catch basins should be rerouted in a northeast direction and then onto the landscaped (grassed) area along the northeast perimeter of the site (northeast side of Building A). This recommendation was completed in the Fall 2012.

3.0 GEOTECHNICAL OBSERVATIONS

3.1 General Foundation Construction

On July 9, 2012 EBA took part in a site meeting with the Mr. Larry Bragg (representative for LPCA) and Castle Rock Enterprises (contractor hired by LPCA) to review the construction schedule and EBA's foundation recommendations. Construction started immediately on July 10, 2012 and the majority of the work was completed by mid-August 2012. The foundation work started in the western corner of Building B and proceeded in a south easterly direction (counter clockwise) along the building's perimeter to the southern corner; then to the eastern corner; on to the northern corner and finally back to the western corner.

The following is a summary (including photos) of the work that was completed according to the recommendations identified in the EBA November 2011 geotechnical evaluation report.

The perimeter area along Building B was excavated approximately 2.4 m from the exterior edge of the building and exterior deck columns, down a minimum depth of 200mm from the bottom of the concrete perimeter footings to allow for the placement of 75 mm of bedding sand (Photos 1 and 2). 100 mm of rigid board insulation was then placed sloping away from the exterior edge of the concrete footing out 1.8 m on the prepared bedding sand surface and covered with 75 mm layer of bedding sand. An additional 100 mm of insulation was placed at the corners of the building 1.8 m in each direction from the corner (shown on Figure 1). The 100 mm of insulation was also placed vertically along the exterior side of the concrete footings up to the bottom of the exterior siding in the landscaped areas (Photo 3) and to the underside of the asphalt in the paved areas.

At the entrance and garage doorways the soil beneath the perimeter footing was removed to create a void that was about 150 mm deep, 300 mm wide and extended 300 mm beyond the width of the entrance way (Photo 4). This void was filled with high density spray foam insulation and tied-in with the horizontal perimeter rigid board insulation.



Photo 1

Excavation of perimeter soils to allow for placement of the bedding sand and insulation. (July 12, 2012)



Photo 2

Additional excavation around the deck column to allow for placement of the bedding sand and insulation. (July 13, 2012)



Photo 3

Vertical rigid board insulation placement along the perimeter of the concrete footings. (July 13, 2012)



Photo 4

Excavation under the garage door openings to allow for the placement of spray foam insulation. (July 12, 2012)

3.2 Additional Foundation Construction Requirements

During the excavation of the soils surrounding the deck column foundations along the south eastern side of Building B (Photo 5), it was determined that the concrete foundations consisted of unsupported 300 mm (12") concrete sono-tubes to an approximate depth of 600 mm (24"). After reviewing the 2006 design drawings EBA determined that the column foundations were not constructed to the design requirements which were to be 200 mm (8") concrete sono-tubes to a depth of 1.5 m (5') supported by a 600 mm x 600mm (24" x 24") by 200 mm (8") thick concrete spread footing. Based on these finding EBA contacted Mr. Marsh of Marsh Engineering to review the existing dimensions of these foundation columns and determine if they met the structural requirements to support the deck columns. Mr. Marsh concluded that the existing concrete sono-tube foundations were under designed and would require additional spread footing support. Mr. Marsh completed a review of the column design loads and determined that each concrete sono-tube would require a concrete spread footing 900 mm x 900 mm (36" x 36") by 300 mm (12") thick dowelled into the concrete sono-tube. Marsh completed detailed drawings and specifications (attached in Appendix A) for the construction of the spread footings.



Photo 5

Concrete sono-tube supporting deck columns. (July 12, 2012)

The spread footings were constructed on top of the rigid board insulation to the required dimensions specified in the Marsh Engineering drawings (Photos 6 and 7).



Photo 6

Dowel and rebar placement for the concrete spread footings. (July 26, 2012)



Photo 7

Concrete spread footings for deck columns along the north eastern side of Building B. (July 26, 2012)

Further investigation of the deck column foundations along the north western side of Building B (Photo 8), where there had been evidence of over 100 mm of settlement, determined that there were concrete spread footings 900 mm x 900 mm (36" x 36") by 200 mm (8") thick at an approximate depth of 600 mm (24") (Photo 9). It was determined that the additional spread footing requirements would not be required for these columns but instead they would require continued monitoring for settlement and appropriate adjustments made to correct any future settlement.



Photo 8

Concrete sono-tubes located along the north western side of Building B. (July 24, 2012)



Photo 9

Existing concrete spread footings beneath the concrete sono-tubes along the north western side of Building B. (July 24, 2012)

4.0 SUMMARY

Observations noted by EBA's representative, Mr. Chad Cowan, P.Eng., throughout the period of construction confirmed that the foundation improvements recommended by EBA have been completed. Therefore, frost heave potential has been minimized, which should result in little to no future seasonal frost related foundation movements causing structural damage to Building B. The following Photos 10 through 15 show the completed work along the perimeter of Building B.



Photo 10

The front entrance to Building B located along the south western side. (August 22, 2012)



Photo 11

Looking northwest at the south western side of Building B. (August 22, 2012)

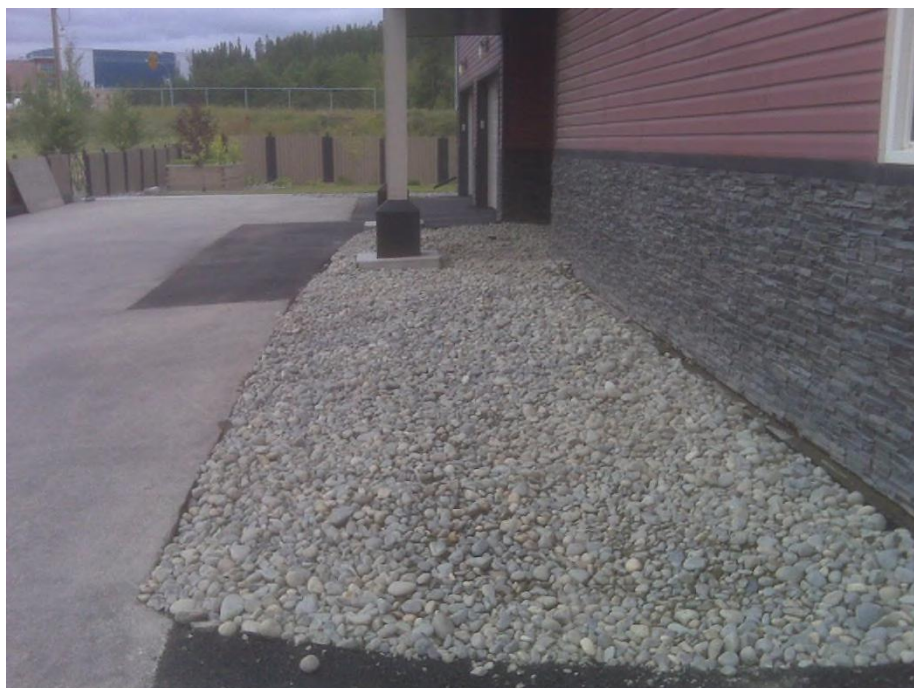


Photo 12

Looking southwest at the south eastern side of Building B. (August 22, 2012)



Photo 13

Looking southwest at the north eastern side of Building B. (August 22, 2012)



Photo 14

Looking northeast at the north western side of Building B. (August 22, 2012)

5.0 LIMITATIONS

This report and its contents are intended for the sole use of Lansing Point Condo Association and their agents. EBA Engineering Consultants Ltd., operating as EBA, A Tetra Tech Company, does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Lansing Point Condo Association, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in EBA's Services Agreement and in EBA's General Conditions that are attached in Appendix B.

6.0 CLOSURE

We trust this letter meets your present requirements. Should you have any questions or comments, please contact the undersigned.

Sincerely,
EBA Engineering Consultants Ltd.

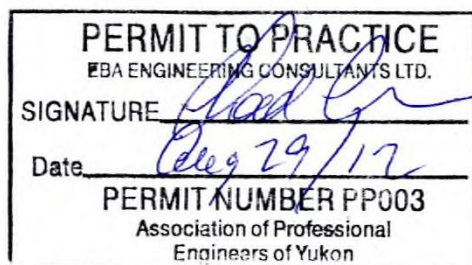
Reviewed:



A handwritten signature in blue ink, appearing to read "Jon Dixon".

Chad Cowan, P.Eng.
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ccowan@eba.ca

Jonathon Dixon, P.Eng.
Geotechnical Engineer, Arctic Region
Direct Line: 867.668.2071 x246
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FIGURES

- Figure 1 Site Plan Showing Location of Building B
Figure 2 Site Plan Showing Placement of Perimeter Foundation Insulation

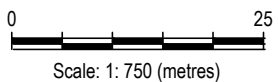


LEGEND:

⊕ - TESTPIT LOCATION

— - DRAINAGE LINE

- - - BURIED DRAINAGE LINE



CLIENT

LANSING POINT CONDO ASSOCIATION



GEOTECHNICAL OBSERVATIONS
BUILDING B FOUNDATION RECOMMENDATIONS
134 SEINE SQUARE - WHITEHORSE, YUKON

**SITE PLAN SHOWING TESTPIT LOCATIONS
AND OTHER PERTINENT INFORMATION**

PROJECT NO.
W14103028-01

DWN
CB

CKD
CPC

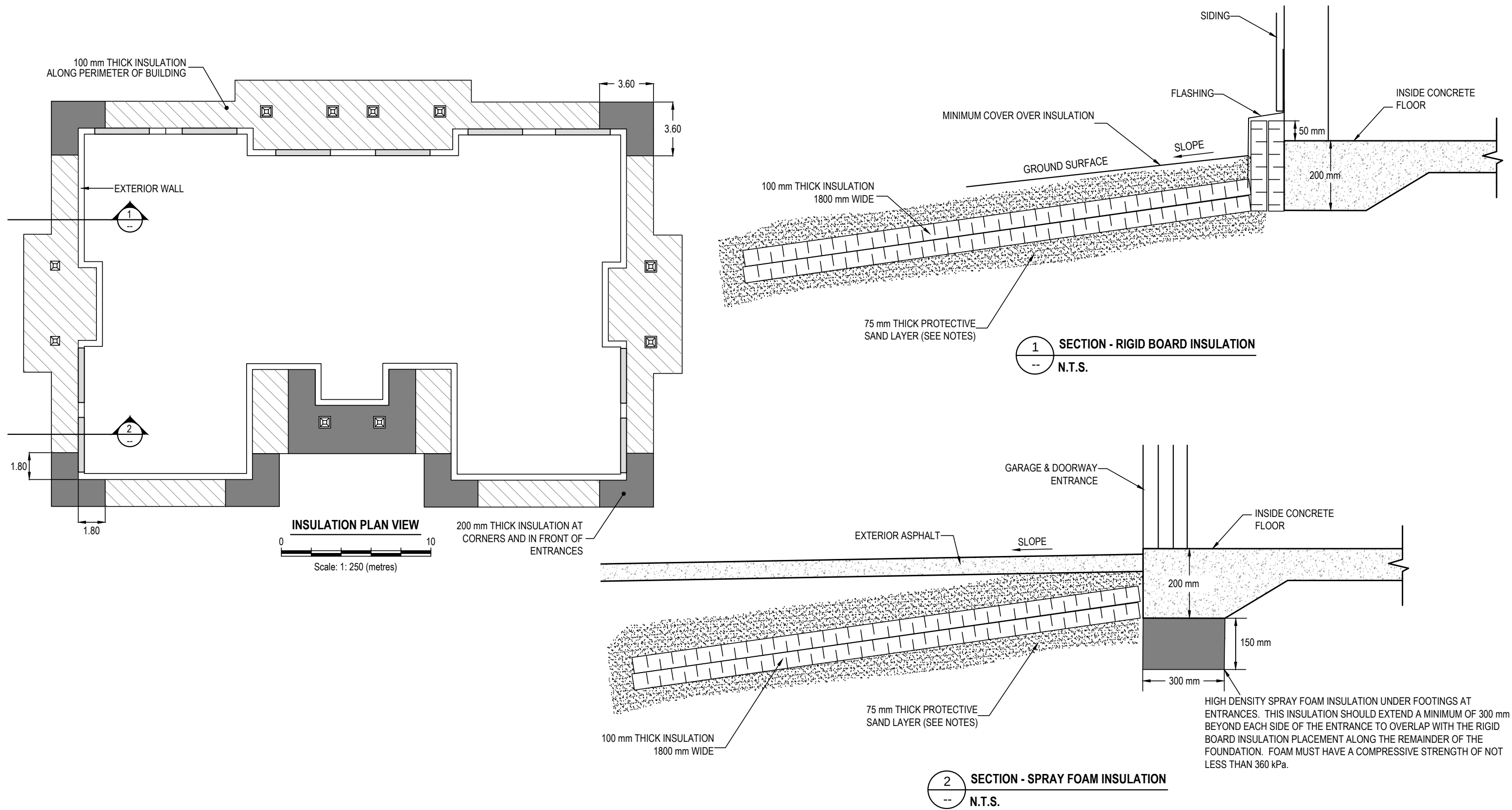
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OFFICE
EBA-WHSE

DATE
August 29, 2012

Figure 1

Q:\Whitehorse\Data\0201 drawings\Whitehorse\W14\103028-01 Building B Foundation Recommendations\W14\103028-01 Fig.2 RD.dwg [FIGURE 2] June 13, 2014 - 3:59:10 pm (BY: BUCHAN, CAMERON)



LEGEND:

- INDICATES 100 mm LAYER OF INSULATION
- INDICATES 200 mm LAYER OF INSULATION
- GARAGE DOOR LOCATION

- NOTES:
- THE INSULATION (DOW CHEMICAL HI SERIES STYROFOAM OR POLYURETHANE OR APPROVED EQUIVALENT) SHOULD BE MOISTURE RESISTANT AND SUITABLE FOR BURIAL UNDER VEHICULAR TRAFFIC AREAS.
 - A MINIMUM BEDDING THICKNESS OF 75 mm OF FINE TO MEDIUM GRAINED SAND SHOULD BE PLACED ABOVE AND BELOW THE INSULATION FOR PROTECTION.

CLIENT		GEOTECHNICAL OBSERVATIONS BUILDING B FOUNDATION RECOMMENDATIONS 134 SEINE SQUARE - WHITEHORSE, YUKON				
LANSING POINT CONDO ASSOCIATION		PERIMETER INSULATION DETAILS				
	PROJECT NO. W14103028-01	DWN CB	CKD CPC	REV 0	Figure 2	
	OFFICE EBA-WHSE	DATE August 29, 2012				

APPENDIX A

W.A. MARSH ENGINEERING LTD. CONCRETE SPREAD FOOTING FOUNDATION DESIGN DRAWINGS AND SPECIFICATIONS

4 November 2011

THE ECONOMICAL INSURANCE GROUP
C/o Claimspro, an SCM Company
17 – 1114 First Avenue
WHITEHORSE, YT
Y1A 1A3

Attention: Lawrence Bredy

RE: **DAMAGED CONDOMINIUM EVALUATION** Our Job No. 11-012
Takhini Condominiums 134 Seine Square, Whitehorse, YT
Client File Name: The Owners, Condominium Corporation #124
TEIG Policy No.: 4996038
TEIG Claim No.: 758286

REFERENCE MATERIALS:

- **Alcan Adjusters Report** dated June 10, 2011 with 13 pages of Photographs and two Plans
- **Archive Information from City of Whitehorse:**
 - Fax Transmittal by N.A. Jacobsen, P. Eng. with Notes and hand sketches of **foundations** (included in Addendum A) dated September 10, 2006.
 - **Soils Report** by J.R. Paine & Associates Ltd. dated October 3, 2006 (2 page report plus 4 sheets of sample analyses of native and imported materials, 2 pages of testing/density tests, and 2 pages of field density testing).
 - **Structural Completion Letter** by Steven Lerer, Bogdonov Lerer Engineering Ltd. dated June 27, 2008 for Buildings A&B
 - **Foundation Structural Letter of Assurance** by N.A. Jacobsen, P. Eng. dated July 7, 2008
 - **Structural Drawings** S1.1, S2.1, S2.2, S2.3, S2.4, S4.1, S4.2 by Steven Lerer Engineering Ltd. dated January 12, 2007 (complete set)
 - **Architectural Drawings** A101, A102, A201, A202, A203, A501, A502, A601, A701, A801 by Zeko Design Building dated 18 July 2006 (complete set)
 - **Electrical Drawings** E1, E2, E3, E4 by FSC Architects and Engineers dated September 25, 2006

PRELIMINARY EVALUATION REPORT

INTRODUCTION:

As requested, the writer attended the subject damaged building site 16 & 17 August 2011 to examine the subject buildings at 134 Seine Square, Whitehorse, YT. There are two identical buildings on the site (mirror reverse) with foundations likely constructed late 2006, the Phase I east building ("Building A") likely constructed 2007, and the Phase II west building ("Building B") completed in 2008 per the above Letters of Assurance (See the attached Site Plan and Letters in Addendum A). Occupants of Building B noticed significant cracking throughout the building in the fall of 2010. W.A. Marsh Engineering Ltd. has been retained to determine the cause(s) of the reported cracking. The purpose of this report is to confirm our findings and make general recommendations regarding likely future repairs.

11-014.PRE.REP continued Page 2

W.A. MARSH ENGINEERING LTD.

STRUCTURAL CONSULTANTS

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North Vancouver, B.C.
V7N 1N1

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marsh@marsheng.com

I examined the perimeter of the buildings from grade on all exposures and the interior of Building B. Ground Floor Units 201, 202, 203, 205, 208, 209, 210, Second Floor Unit 205 with an owner's mark up of damage to Unit 201; Third Floor Units 207, 208, 210 and the lobby and common areas on all levels (See Drawings SE-4, 5&6 Addendum B). This report is based on our notes and photographs from our site visit and original construction drawings obtained from the City of Whitehorse. Copies of the above noted Reference Materials are available upon request.

At the time of our site review, a contractor and soils engineer were on stand-by to assist me in my investigation. I initially walked around the perimeter of Building B and the west side of Building A. The top surface of the entry apron slab of Building B had been ground down where it interfered with the door swing but at the time of my inspection there was adequate clearance. This suggested that heaving of the slab had occurred at some prior time requiring the observed grinding, and the slab had settled back into place. We immediately requested the soils engineer, Chad Cowan, P Eng. of EBA, a Tetra Company, attend the site and with the assistance of a contractor, Adam Greetham of Groundtrax Environmental Services Inc., we undertook a more in-depth investigation of the foundations and sub-grade conditions around the perimeter of the Buildings. Test pits were excavated at the north and southwest corners of Building B and the southeast corner of Building A. (See the attached report regarding observed soils and site conditions by EBA in Addendum C.)

DESCRIPTION:

i) Building Site:

The above noted two three storey residential buildings are separated by a paved north/south drive aisle with at grade parking and a drive aisle along the north end of the buildings to the north property line, and a drive aisle along the south end of the buildings. Based on the Site Plan in Addendum A, for the purposes of this report, assume Project North is parallel with the centre drive aisle separating the two buildings. Cobble landscaping, concrete sidewalk, and lawn extend from the east side of Building A to the east property line and the west side of Building B to the west property line. A drainage ditch with standing water in it extends along the west side of the property. Based on the location of adjacent existing grade along the north side of the property, finished grade at the building site has been built-up above original grade with paved areas and building grades approximately level. The northwest corner has been built up about 1.5 feet above natural grade, 3 feet above natural grade midway along the north exposure, and 4.5 feet above natural grade at the northeast corner, with existing grade at the southeast corner of the property about 1.5 feet above grade at the northwest corner of the site. The asphalt paved parking and drive aisles along the north side have drainage slopes down to a trench with two manholes located in the centre of the centre drive aisle. The drive aisles along the south side of the buildings slope down to the landscaping along the south edge of the property. Landscaped grade slopes down approximately 3 feet from the southeast corner of Building A to the southeast corner of the property. (For grades and detailed site observations see the EBA Report in Addendum C.)

According to the owners, the area around the north manhole would flood regularly, so in the Spring 2009 a contractor installed a sump pump in the manhole with discharge into the drainage ditch along the west side of the property. This factor is addressed by EBA in their report in Addendum C.

11-014.PRE.REP continued Page 3

ii) Buildings:

The subject buildings are wood framed founded on a "monolithic slab-on-grade/footing foundation system" ("raft slab") per Section 3 Drawing A701 and N.A. Jacobsen sketches in Addendum A. The buildings are "H" shaped in plan with gable plated wood roof trusses spanning perpendicular to the exterior walls in the middle section and oriented north/south over the north and south suites. Floor framing is oriented perpendicular to the garage level party walls (See Addendum B Drawing SE-4). Upper floor wall layouts do not match the garage wall layouts. As a result, the upper floor framing layouts consist of pre-engineered wood I-joists spanning onto interior posts and beams with posts located over built up studs in garage party walls. The framing engineer (Lerer) added upstand concrete curbs onto the Jacobsen designed slab thickenings to distribute the load concentrations more uniformly into the raft slab foundations.

Exterior finishes consist mainly of vinyl siding on 2x6 wood framed walls. There are decorative cultured stone bands extending three and a half feet above grade on most exposures. The vinyl siding is on 1x4 vertical strips creating a "rain screen" and the cultured stone is mortared directly to the plywood wall sheathing. Interior finishes consist largely of painted gypsum wallboard on walls and ceilings.

OBSERVATIONS:

There is no foundation plan in the Reference Drawings. According the N.A. Jacobsen letter of assurance, concrete foundations have been constructed from the sketches prepared by Mr. Jacobsen in Addendum A and the architectural drawings Building Sections and detail Wall Sections. For a sample see the portion of Section 3 Drawing A701 in Addendum A. In order to confirm the existing foundation configuration, we measured the thickness of the exterior concrete slab thickening at the test pit at the northwest corner of Building A and verified the concrete slab thickness by drilling a hole into the slab in the garage of Suite 201. We also verified the slab thickening under the party wall of the Suite 201 garage (See the reference marks on Drawing SE-4). We also confirmed the existence of the concrete upstand in the party wall of the Suite 201 garage. The configuration of the specified foundations is shown on Sections 1&2 Drawing SE-1, and Section 1 Drawing SE-2. Based on this limited investigation, the as-found concrete foundation construction appears to generally conform with the intent of the design by N.A. Jacobsen, P. Eng.

Location of grade and the extent of the exterior plywood sheathing shown on Section 1 Drawing SE-1 Addendum B are as-found and vary from the requirements shown Section 3 Drawing A701 in Addendum A. The architectural section specifies the concrete foundations to be located 6 inches above grade as required by the Code (see below). Also note that the architect specifies the perimeter of the exposed concrete be insulated, with the insulation extending two feet below the concrete foundation. The soils report requires silty soil be removed to a depth of 1.2 meters below the soffit of the concrete foundation extending 1.5 meters beyond the perimeter of the building. (See the EBA report in Addendum C for their findings and recommendations.) In addition, the as-found configuration of the thickening at the garage doors is as shown on Section 1 Drawing SE-2 Addendum B. Asphalt paving is cracked where shown at all garage door openings. We observed structurally insignificant hairline cracking in all of the garage slabs examined.

11-014 PRE REP continued Page 4

At the time of our site investigation evidence of ground movement consisted of gaps between base of the cultured stone veneer and the asphalt apron all around Building B and on the west side of Building A. The asphalt paving was locally distressed against the walls and the movements had delaminated the stone base course from the wall at the northwest corner and at the south entry column of Building B. Observed gaps were up to two inches along the north side and less than one inch along the south side of Building B. There was a localized two inch gap at the northwest corner of Building A but gaps of less than an inch elsewhere along the west exposure of Building A. The dressed finishes applied to the balcony support posts at the north end of Building B were perched more than an inch above the asphalt and the west post had a similar gap at the underside of the Third Floor deck. Observed gaps appeared to decrease the further the location from the northwest corner of Building B and were most prevalent in along the north wall of Building B.

Similarly, as shown on Drawings SE-4, SE-5, and SE-6 in Addendum B, my observations of the interior of upper storey suites confirms more damage at the north end of Building B. The Third Floor suites appear to have suffered the most dramatic damage resulting from the fact that the heaving of the exterior walls lifted the trussed roof as a whole, causing gaps between the ceiling and the top and sometimes the bottom of interior walls as well. At the time of our investigation the cracks were hairline, but attached photographs from some of the owners included in Addendum B show the much larger size of some of the gaps occurring during the winter months of 2010-2011.

Distortions of the building caused cracking of the drywall finishes along taped joints between successive sheets of gypsum wallboard. The cracks were chiefly vertical where the long axes of sheets were oriented vertically and horizontal where the long axes of the sheets were oriented horizontally. There were numerous cracks emanating diagonally from the corners of windows and doors. These cracks result from differential movements across the window and door openings (See the markup of a building section Drawing SE-3 Addendum B).

Others have installed survey pins in the centre of the garage doors of Building B presumably to monitor vertical movements. We are not privy to the results of this survey.

COMMENTS & ISSUES:

i) Foundations – Frost Heaving:

According to Zeko Design Build Drawing A101, the building was required to be designed in conformance with Part 3 Fire Protection, Occupant Safety and Accessibility and Part 4 Structural Design of the 2005 National Building Code of Canada ("the Code"). These Sections require designs by registered professionals per Code Subsection 2.2.7 Division C. For the purposes of reviewing design details in this report, we are applying Part 9 of the Code which is prescriptive for three storey wood framed buildings with residential occupancy but a limiting footprint of 600 square meters which is exceeded by the subject buildings. In my opinion, the Part 9 prescriptive requirements noted below apply to the subject buildings and have been referenced for simplicity to show the Code expectations for construction.

11-014.PRE.REP continued Page 5

Three conditions must exist to induce frost heaving in soils: silt size content greater than 3% of the total volume of soil, water, and exposure to freezing temperatures (See the report by EBA in Addendum C). In the test pits at the west corners of Building B the subgrade was found to be saturated. The excavation at the southeast corner of Building A was much drier and the silty insitu soil was found at greater depth than the Building B excavations. Water is being directed into the soil from the drainage ditch along the natural uphill west side of the property and from the roof drainage at some locations. EBA shows that the conditions in the subgrade under Building B are suitable for frost heave (See their report in Addendum C).

The Code requires perimeter insulation of concrete slabs on grade per Articles 9.25.2.1(1), 9.25.2.3.(5) and Table 9.25.2.1 (See the excerpt in Addendum B). Had appropriate insulation been installed similar to that shown Section 3 Drawing A 701 in Addendum A, it is likely that no heaving would have occurred (see the recommended repairs in the EBA report Addendum C). Similarly Subsection 9.12.2 specifies the depth of footings depending on site and construction conditions. As shown in Table 9.12.2.2 where no perimeter insulation is installed then for coarse grained soils with poor soil drainage, the foundation should extend below the depth of frost penetration which is greater than the 1.2 meters specified in the J.R. Paine & Associates ("Paine") report in Addendum A. As shown in the Table where the soil is silty then the foundation should extend below the depth of frost penetration regardless of the drainage conditions. If the foundation is insulated then there is no restriction on the depth of the foundations. The foundations should have had perimeter insulation installed. Paine did not specify the requirement for perimeter insulation in their report.

Observed cracking in the asphalt where support conditions transition from the reduced foundation thickening to exterior grade will continue and be an ongoing maintenance issue (See Section 1 Drawing SE-2 Addendum B). It may be advisable to remove the asphalt from the garage door to the edge of the concrete, fill the top of the reduced section with concrete and integrate the repair into the recommended repairs by EBA in their report Addendum C.

II) Foundations - Configuration:

The Code requires foundations extend 150mm (6 inches) above grade per Article 9.15.4.6 (See the excerpt in Addendum B). This is to reduce the possibility of moisture ingress into the building and damage to wood components from moisture around the building. Additionally, the as-built extension of plywood sheathing to the bottom of the exterior slab thickening presents a condition leading to moisture and mold deterioration over time contravening the intent of the Code per Subsection 9.23.2.3 and Articles 9.27.1.1(1) and 9.27.2.2(1) included in Addendum B.

It would be expensive to install a 6 inch high concrete curb under the exterior walls at this time. The repair proposed in Section 2 Drawing SE-2 Addendum B would address this issue in a reasonably cost-effective way provided it meets with the acceptance of the local Building Inspector. Additionally, this repair could be integrated into the foundation repair recommended by EBA in their report in Addendum C.

iii) Foundation Disclaimer:

We have reviewed the foundation loads in several sampled areas and find the allowable bearing stress of 2000 pounds per square foot (psf) specified by N A Jacobsen and the higher allowable bearing stress of 130 kPa (2700 psf) specified by Paine are exceeded if we assume the foundation thickenings 18 inches wide support all of the building loads and the slab-on-grade is simply cast integrally with the footings but performs as a standard slab-on-grade. In reality, the induced bearing pressures extend beyond the thickenings and into the adjacent slabs. Accordingly, in our experience, and considering concrete design Standards, the slab is too thin, and lacks sufficient stiffness to support the loads without deflecting excessively. Similarly, the slab thickenings may not possess adequate stiffness to distribute reactions from concentrated loads uniformly to the soil. Concentrated loads emanate from upper storey beams supported by built-up studs in walls. It is possible or even likely that differential settlements may occur in the existing raft slab structure due to inequitable distribution of stresses into the soil resulting from the lack of stiffness in the raft slab foundations.

The adequacy of the long term performance of the existing raft slab remains with the original consultants

CONCLUSIONS:

Damage to Building B reported by the owners results from frost heaving. Damage is most severe adjacent the north end of the building. Although evidence of movements around the perimeter of Building A is less pronounced and appears to be largely restricted to the west side, it is possible that heaving leading to damage of the superstructure similar to Building B and as described above, could occur in the future. The buildings are missing perimeter insulation, the concrete foundations do not extend minimum 6 inches above finished grade, and the concrete foundations may not be thick enough to support the required loads without undergoing long-term settlements or excessive distortions of the concrete.

I trust you will find this brief report as discussed and suitable for your current purposes. Please do not hesitate to contact me with any queries.

Respectfully,

W.A. MARSH ENGINEERING LTD.



W.A. Marsh, P.Eng.



Cc EBA, a Tetra Company Attention: Chad Cowan, P.Eng.
File 11-014.REP

W.A. MARSH ENGINEERING LTD.

STRUCTURAL CONSULTANTS

APPENDIX B

EBA'S GENERAL CONDITIONS

GENERAL CONDITIONS

GEOTECHNICAL REPORT

This report incorporates and is subject to these "General Conditions".

1.0 USE OF REPORT AND OWNERSHIP

This geotechnical report pertains to a specific site, a specific development and a specific scope of work. It is not applicable to any other sites nor should it be relied upon for types of development other than that to which it refers. Any variation from the site or development would necessitate a supplementary geotechnical assessment.

This report and the recommendations contained in it are intended for the sole use of EBA's Client. EBA does not accept any responsibility for the accuracy of any of the data, the analyses or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than EBA's Client unless otherwise authorized in writing by EBA. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of EBA. Additional copies of the report, if required, may be obtained upon request.

2.0 ALTERNATE REPORT FORMAT

Where EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed EBA's instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by EBA shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of EBA's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except EBA. EBA's instruments of professional service will be used only and exactly as submitted by EBA.

Electronic files submitted by EBA have been prepared and submitted using specific software and hardware systems. EBA makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

3.0 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, EBA has not been retained to investigate, address or consider and has not investigated, addressed or considered any environmental or regulatory issues associated with development on the subject site.

4.0 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. EBA does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

5.0 LOGS OF TEST HOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

6.0 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historic environment. EBA does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional investigation and review may be necessary.

7.0 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

8.0 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

9.0 INFLUENCE OF CONSTRUCTION ACTIVITY

There is a direct correlation between construction activity and structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques are known.

10.0 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, as well as the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

11.0 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

12.0 BEARING CAPACITY

Design bearing capacities, loads and allowable stresses quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions assumed in this report in fact exist at the site.

13.0 SAMPLES

EBA will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

14.0 INFORMATION PROVIDED TO EBA BY OTHERS

During the performance of the work and the preparation of the report, EBA may rely on information provided by persons other than the Client. While EBA endeavours to verify the accuracy of such information when instructed to do so by the Client, EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.