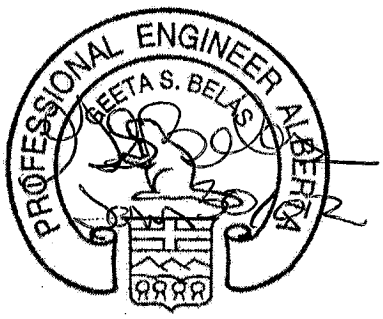
SELKIRK HOTEL RECONSTRUCTION
FORT EDMONTON PARK
GEOTECHNICAL INVESTIGATION

Report

to

Fort Edmonton Historical Society
c/o HIP Architects



Thurber Engineering Ltd.
Edmonton, Alberta

G.S. Belas, P.Eng.
Project Engineer

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Date Jan 30, 02
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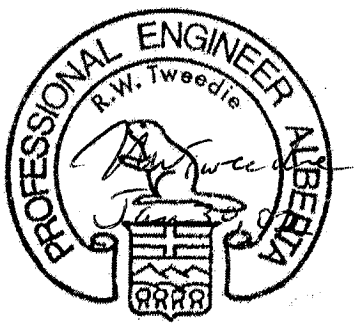

Date: January 30, 2002
File: 19-3694-0

R.W. Tweedie, P.Eng.
Review Principal

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1. INTRODUCTION

This report presents the results of a geotechnical investigation for the proposed Selkirk Hotel Reconstruction to be located west of 1920 Street in Fort Edmonton Park in Edmonton, Alberta.

The scope of the investigation was outlined in our proposal submitted on November 28, 2001. Authorization to proceed with the study was provided by Mr. Adrian Whittaker of HIP Architects on behalf of the Fort Edmonton Historical Foundation by fax on December 4, 2001.

Use of this report is subject to the Statement of General Conditions that is included at the end of the text of this report. The reader's attention is specifically drawn to these conditions as it is considered essential that they be followed for the proper use and interpretation of this report.

2. PROPOSED DEVELOPMENT

The location of the proposed building is shown on the site plan, Drawing No. 19-3694-0-1 in Appendix A. The proposed Selkirk Hotel has approximate dimensions of 60 feet X 150 feet in plan. We understand that construction will be floor slab-on-grade, without basement.

3. METHOD OF INVESTIGATION

3.1 Field Program

Three test holes (TH02-1, TH02-2, and TH02-3) were drilled on January 10, 2002, using a truck mounted auger drill rig at the approximate locations shown on Drawing No. 19-3694-0-1 in Appendix A. The test holes were drilled to depths of 8.1 m below existing ground surface.

Disturbed soil samples were obtained during drilling and Standard Penetration Tests were carried out at selected depths in the test holes. Water levels were noted during and after completion of the drilling. A standpipe piezometer was installed in TH02-1 to allow future ground water level monitoring.

3.2 Laboratory Testing

Laboratory testing included a visual classification and the determination of the natural water content of all soil samples. Atterberg Limit and a water-soluble sulphate tests were also carried out on selected soil samples.

The results of the drilling and laboratory testing are summarized on the test hole logs in Appendix A. An explanation of the symbols and terms used to describe the test hole logs, and the Modified Unified Soils Classification are also provided in Appendix A.

4. SITE DESCRIPTION

4.1 Surface Conditions

The site had about 100 mm of snow cover at the time of investigation, and slopes to the south. The ground surface at the Selkirk Hotel site is relatively flat and is currently being used as a parking lot.

4.2 Subsurface Conditions

Detailed descriptions of the subsurface conditions encountered in the test holes are provided on the individual logs in Appendix A.

The subsurface conditions generally consisted of clay fill (in test hole TH02-1) or clay followed by gravel to the completion of the test holes.

Clay Fill

Clay fill was found directly at ground surface in test hole TH02-1. The clay fill was generally dark brown, medium plastic, silty, with some organics, trace oxides and white silt pockets. Natural moisture contents in the clay fill ranged from 16% to 26%. The SPT blow count in the clay fill was 10 blows for 300 mm penetration. Undrained shear strength determined from the pocket penetrometer (Cpen) was 190 kPa, indicating a very stiff consistency.

Clay

Clay was found directly beneath the clay fill in test hole TH02-1 and at the surface in the remaining two test holes. The clay was generally brown, medium to low plastic, silty, some sand to sandy with white silt pockets and trace oxides. Natural moisture contents in the clay ranged from 11% to 31%, with the higher moisture content found just above the gravel layer. The SPT blow counts in the clay ranged from 7 to 17 blows for 300 mm penetration generally decreasing with depth.

Atterberg Limits tests were carried out a sample at a depth of 0.8 m in test hole TH02-2. The liquid limit is 36% and the plastic limit is 20%, indicating that the clay is medium plastic.

Gravel

The underlying gravel was brown, sandy, with some clay, and traces of pebbles, coal, and oxides. Natural moisture contents in the gravel ranged from 6% to 14%. The SPT blow counts in the gravel were 46 to greater than 150 blows for 300 mm penetration, indicating a dense to very dense state.

4.3 Groundwater

Water levels at the end of drilling were between 6.6 m and 6.9 m below ground surface which is just above the level of the gravel. A standpipe piezometer was installed in TH02-1 upon completion of drilling for further ground water level monitoring. This standpipe was read on January 29, 2002 when the groundwater was measured at 7.0 m below existing ground surface.

It should be noted that groundwater levels can vary in response to seasonal factors and precipitation; hence, the actual groundwater conditions at the time of construction could vary from those recorded during this investigation.

4.4 Frost Action

The expected depth of frost penetration has been estimated for the insitu materials for both the mean annual Air Freezing Index (AFI) and the 50 year return period AFI of 1400°C days and 2200°C days, respectively. The mean annual depth of

frost penetration for clay is estimated to be about 1.5 m, whereas the penetration in a 50 year return period is about 2.2 m. The mean annual depth of frost penetration could be used for short term construction cases with some risk; the 50 year return depth is usually chosen for long term design.

These depths of frost penetration are estimated assuming no insulation cover. If the area is covered with topsoil or significant snow cover, the depth of frost penetration will be less.

5. GEOTECHNICAL EVALUATION AND RECOMMENDATIONS

5.1 Site Preparation - Building Areas

All deleterious material should be stripped from the building footprint prior to site grading. In addition, any remaining organic material or soft areas should be excavated down to competent clay. Clay fill containing some organics has been noted in TH02-1 to a depth of approximately 2 m. It is recommended that the area be inspected during construction and any organic rich fill should be removed below the floor slabs. Proof rolling of the subgrade may be used to detect soft areas in the subgrade (see Appendix B). The excavated surface should be inspected by qualified geotechnical personnel to confirm that all deleterious material has been removed.

Fill should be placed and compacted to the following specifications:

(a) All site raising fill under any building floor slab area should be placed in 150 mm maximum lifts compacted thickness and compacted to at least 98% of Standard Proctor maximum dry density within ±2% of optimum moisture content.

(b) General site grading fills outside the building footprint should be placed in 150 mm lifts compacted thickness and compacted to at least 95% of Standard Proctor maximum dry density within ±2% of optimum moisture content.

(c) All fill used for landscaping purposes needs only moderate compaction (i.e. 92% of Standard Proctor maximum dry density) to ensure future settlements do not adversely affect design drainage provisions.

Uniformity of compaction is essential to minimize the potential for differential settlement. It is recommended that fill placement be inspected and tested by qualified geotechnical personnel to ensure adequate compaction.
The on-site clay is generally suitable for site grading fill, however it will require significant moisture conditioning to achieve proper compaction.

Permanent site drainage should be developed at early stages of construction in order to control surface water and reduce future frost effects in the subgrade. The final site grade should be sloped to shed water away from the building.

5.2 Foundations

5.2.1 General

Cast-in-place concrete friction and end bearing piles, as well as spread footings are considered suitable foundation types for the Selkirk Hotel Reconstruction. Recommendations for each foundation type are provided in the following sections. In addition, recommended construction procedures are presented in Appendix B.

5.2.2 Cast-In-Place Concrete Friction Piles

Straight shaft concrete friction piles may be used in the support of light to medium loaded structures.

Cast-in-place concrete friction piles may be designed based on the following allowable skin friction values.

Depth Below Grade (m)	Allowable Skin Friction (kPa)
0 – 1.5	0
1.5 - bottom	22

The upper 1.5 m of shaft should be neglected in the load capacity calculation to account for the possible surface drying and shrinkage away from the shaft.

A minimum pile length of 5 m is recommended to provide adequate uplift resistance to frost heave. Piles should not be deeper than about 6.5 m to avoid

encountering the gravel layer, since extensive seepage and sloughing may be expected in the gravel.

Recommendations regarding minimum shaft diameter, reinforcing and casing are as follows:

a) A minimum pile shaft diameter of 400 mm is recommended to prevent voids from forming during pouring of the concrete.

b) A nominal percentage of longitudinal reinforcement (0.5% of the sectional area of the shaft) is required throughout the full length of the pile to resist potential uplift forces on the pile due to frost action and seasonal moisture variations. If piles are designed as tension elements, longitudinal reinforcing steel should be designed to resist the anticipated uplift stresses.

c) Casing should be available and should be used if required to seal off water or prevent sloughing of the sides of the hole. The reinforcing steel and concrete should be on hand and placed as soon as the pile hole has been completed and approved in order to reduce the risk of groundwater seepage and sloughing soil. Although not encountered in the test holes drilled, boulders may be present in the clay and may affect pile installation.

5.2.3 Cast-in-Place Concrete End Bearing Piles

Bored cast-in-place concrete end bearing piles may be suitable for support of medium to heavily loaded structures.

The bells of the end bearing piles should be based in the firm clay at a suggested depth of 4 m below existing site grade. An allowable end bearing capacity of 140 kPa may be used for end bearing piles founded in the clay.

The following additional recommendations apply to design and installation of cast-in-place concrete end bearing piles:

a) Shaft adhesion should not be considered in determining the allowable load for end bearing piles at this site.

b) Belled or straight shaft piles may be used. For belled piles, the bell diameter

to shaft diameter ratio should not exceed 3:1, and the bell should not be sloped at more than 30° to the vertical.

c) A minimum pile depth of 2.5 times the bell diameter has been assumed in calculating the above bearing capacity. If less cover is provided, the specified bearing capacity must be reduced.

d) A minimum pile shaft diameter of 400 mm is recommended to prevent voids from forming during pouring of the concrete. If hand cleaning of the base is necessary, a minimum shaft diameter of 750 mm is required.

e) All excavations for end bearing piles should be thoroughly cleaned and visually inspected by geotechnical personnel prior to pouring of the concrete to ensure a satisfactory base has been achieved. No slough or disturbed material should be allowed to remain in the pile excavations. Water should not be left ponded on the pile base.

f) Casing should be available and should be used to seal off water or prevent sloughing of the sides of the hole. The reinforcing steel and concrete should be on hand and placed as soon as the pile hole has been completed and approved in order to reduce the risk of groundwater seepage and sloughing soil. Although not encountered in the test holes drilled, boulders may be present in the clay and may affect pile installation.

5.2.4 Spread Footings

Spread footings should be designed and constructed according to the following recommendations.

(a) Exterior spread footings should be founded at a minimum depth of 1.5 m below ground level for heated structures. Interior footings may be founded at a minimum depth of 1.0 m below site grade.

(b) All footings should be founded on the firm native clay. Footings should not be placed on fill where fill or local soft zones are encountered in the footing trenches it may be necessary to deepen the footing (eg. TH02-1) or to remove the soft material or fill and replace with lean concrete. Disturbed soil should not be allowed to remain in the footing trenches.

(c) Footings may be designed using an allowable bearing capacity of 125 kPa and 150 kPa for strip and square footings respectively.

(d) Footings should be inspected by qualified geotechnical personnel to ensure that the footings are located in the native clay.

5.3 Concrete Grade Beams

Where pile foundations are used grade beams are generally required to transfer wall loads onto the tops of the piles. Precautions should be taken to prevent heaving of the grade beams due to frost penetration, or swelling of the underlying soil. The recommended alternative construction procedures for preventing heave under the grade beam are shown in Figure 1, and consists of placing a layer of crushable non-degradable void form (e.g. Beaver Plastics Frost Cushion or equivalent) under the grade beams.

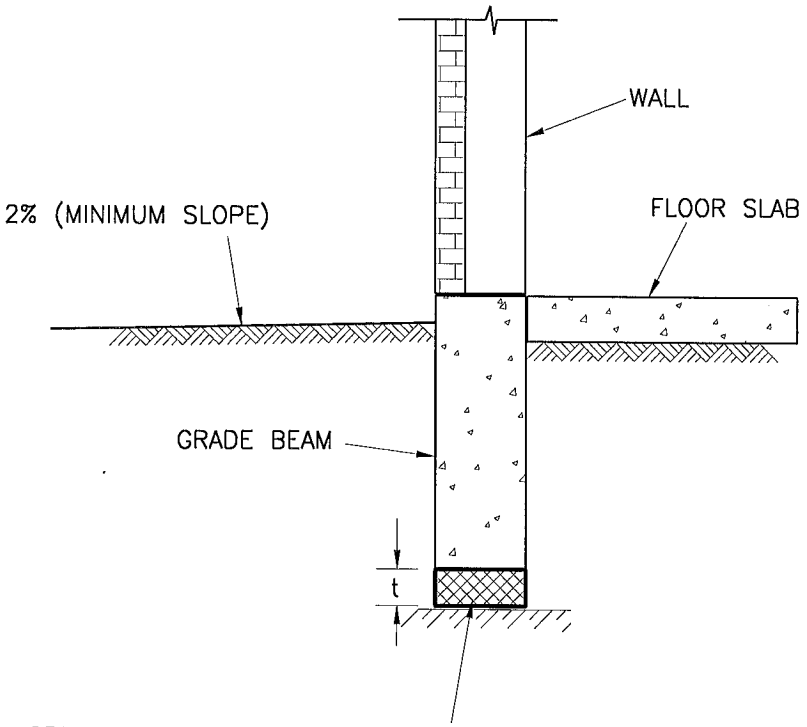
5.4 Concrete Slabs

Concrete slabs on grade subjected to light loads may be supported on the native soil or on engineered fill placed and compact as recommended in Section 5.1, providing that the following recommendations are followed:

a) All organic soil and deleterious material should be removed from under the floor slab area as indicated in Section 5.1.

b) A minimum of 150 mm of clean, well-graded sand or gravel is recommended beneath the slab on grade and along the outside of grade beams for leveling and drainage purposes. Coarse material greater than 50 mm in diameter should be avoided directly beneath the floor slab to prevent stress concentrations within the slab. The granular leveling course should be compacted to a uniform dry density of about 98% of Standard Proctor Maximum Dry Density.

A recommended typical gradation for free draining granular material for use under the floor slabs follows:



TYPICAL UNINSULATED GRADE BEAM

BASE OF GRADE BEAM ABOVE ZONE OF SEASONAL VOLUME CHANGE

THURBER

FIGURE 1

SIEVE	% PASSING
1½ (38,000 µm)	100%
⅜ (10,000 µm)	65 - 100
No. 4 (5,000 µm)	50 - 90
No. 10 (2,000 µm)	35 - 75
No. 40 (400 µm)	10 - 45
No. 100 (150 µm)	0 - 20
No. 200 (75 µm)	0 - 5

Other appropriate materials, which fall outside the above recommended gradation limits may be suitable. Alternate materials should however, be evaluated by a geotechnical engineer prior to use.

The near surface native soil is medium plastic and is moderately susceptible to swell and shrink in response to wetting and drying of the soil. Care should be taken to avoid excessive wetting and drying of the soil during construction. Any soil that has dried out or becomes very wet should be removed from below the floor slab.

Also the slabs-on-grade should be separate from the building structure and should be designed to accommodate movements due to soil moisture changes. Non-load bearing walls should have a gap of about 50 mm between the top plate and the ceiling to accommodate potential heave.

If floor movements cannot be tolerated, consideration should be given to a structural floor slab.

5.5 Cement Type

Two water soluble sulphate tests were carried out on selected soil samples from the site. The results indicate a negligible concentration of water soluble sulphate. Therefore, Type 10 normal Portland cement can be used for all concrete in contact with the soil at this site. The results of the sulphate tests are presented on the test hole logs in Appendix A.

6. CONSTRUCTION INSPECTION

The performance of the building structure(s) will depend upon the quality of workmanship during construction. This is particularly important in regard to foundation installations where variations in foundation soil conditions could occur. Therefore, it is recommended that inspection be provided by a qualified geotechnical personnel during foundation installation to confirm that the spread footings and/ or piles are installed in competent bearing material and that the stratigraphy is similar to those that have been assumed for the design. Compaction testing for backfill will also be required.

THURBER ENGINEERING LTD.

STATEMENT OF GENERAL CONDITIONS

1. STANDARD OF CARE

This study and Report have been prepared in accordance with generally accepted engineering or environmental consulting practices in this area. No other warranty, expressed or implied, is made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report which is of a summary nature and is not intended to stand alone without reference to the instructions given to us by the Client, communications between us and the Client, and to any other reports, writings, proposals or documents prepared by us for the Client relative to the specific site described herein, all of which constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. WE CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to us by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document, subject to the limitations provided herein, are only valid to the extent that this Report expressly addresses proposed development, design objectives and purposes, and then only to the extent there has been no material alteration to or variation from any of the said descriptions provided to us unless we are specifically requested by the Client to review and revise the Report in light of such alteration or variation or to consider such representations, information and instructions.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT OUR WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS WE MAY EXPRESSLY APPROVE. The contents of the Report remain our copyright property. The Client may not give, lend or, sell the Report, or otherwise make the Report, or any portion thereof, available to any person without our prior written permission. Any use which a third party makes of the Report, are the sole responsibility of such third parties. Unless expressly permitted by us, no person other than the Client is entitled to rely on this Report. We accept no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without our express written permission.

5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and this report is delivered on the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to us. We have relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by us. We are entitled to rely on such representations, information and instructions and are not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

(see over . . . .)

INTERPRETATION OF THE REPORT *(continued . . . .)*

c) Design Services: The Report may form part of the design and construction documents for information purposes even though it may have been issued prior to the final design being completed. We 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 the Report. Any differences that may exist between the report recommendations and the final design detailed in the contract documents should be reported to us immediately so that we can address potential conflicts.

d) Construction Services: During construction we must be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RISK LIMITATION

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause an accidental release of those substances. In consideration of the provision of the services by us, which are for the Client's benefit, the Client agrees to hold harmless and to indemnify and defend us and our directors, officers, servants, agents, employees, workmen and contractors (hereinafter referred to as the "Company") from and against any and all claims, losses, damages, demands, disputes, liability and legal investigative costs of defence, whether for personal injury including death, or any other loss whatsoever, regardless of any action or omission on the part of the Company, that result from an accidental release of pollutants or hazardous substances occurring as a result of carrying out this Project. This indemnification shall extend to all Claims brought or threatened against the Company under any federal or provincial statute as a result of conducting work on this Project. In addition to the above indemnification, the Client further agrees not to bring any claims against the Company in connection with any of the aforementioned causes.

7. SERVICES OF SUBCONSULTANTS AND CONTRACTORS

The conduct of engineering and environmental studies frequently requires hiring the services of individuals and companies with special expertise and/or services which we do not provide. We may arrange the hiring of these services as a convenience to our Clients. As these services are for the Client's benefit, the Client agrees to hold the Company harmless and to indemnify and defend us from and against all claims arising through such hirings to the extent that the Client would incur had he hired those services directly. This includes responsibility for payment for services rendered and pursuit of damages for errors, omissions or negligence by those parties in carrying out their work. In particular, these conditions apply to the use of drilling, excavation and laboratory testing services.

8. CONTROL OF WORK AND JOBSITE SAFETY

We are responsible only for the activities of our employees on the jobsite. The presence of our personnel on the site shall not be construed in any way to relieve the Client or any contractors on site from their responsibilities for site safety. The Client acknowledges that he, his representatives, contractors or others retain control of the site and that we never occupy a position of control of the site. The Client undertakes to inform us of all hazardous conditions, or other relevant conditions of which the Client is aware. The Client also recognizes that our activities may uncover previously unknown hazardous conditions or materials and that such a discovery may result in the necessity to undertake emergency procedures to protect our employees as well as the public at large and the environment in general. These procedures may well involve additional costs outside of any budgets previously agreed to. The Client agrees to pay us for any expenses incurred as the result of such discoveries and to compensate us through payment of additional fees and expenses for time spent by us to deal with the consequences of such discoveries. The Client also acknowledges that in some cases the discovery of hazardous conditions and materials will require that certain regulatory bodies be informed and the Client agrees that notification to such bodies by us will not be a cause of action or dispute.

9. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on our interpretation of conditions revealed through limited investigation conducted within a defined scope of services. We cannot accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

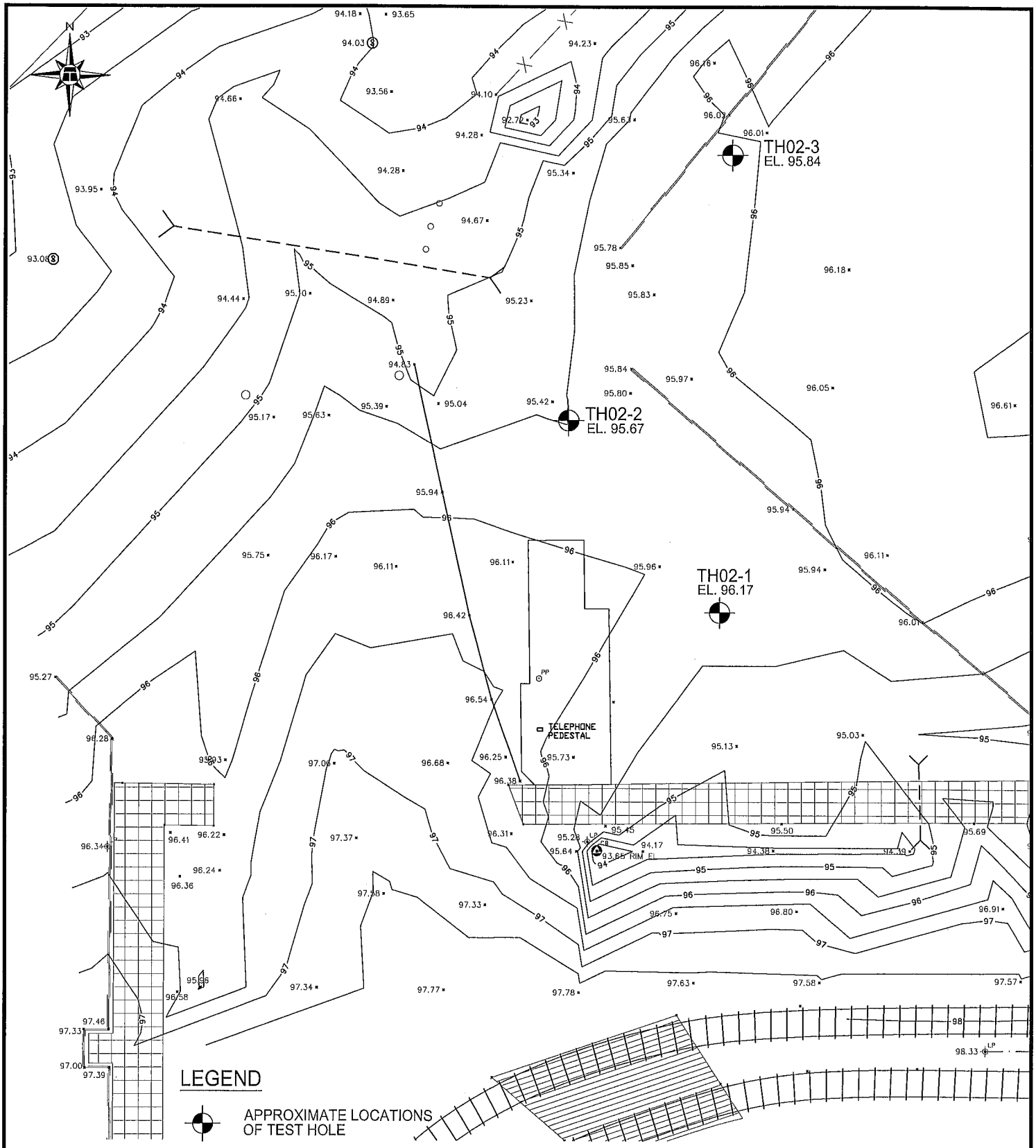
APPENDIX A

Site Plan Drawing No. 19-3694-0-1 - Site Plan Showing Test Hole Locations

Symbols and Terms Used on the Test Hole Logs

Modified Unified Soils Classification

Test Hole Logs



BASE PLAN PROVIDED BY HIP ARCHITECTS

THURBER PROJECT #19-3694-0-104

ENGINEER GSB	FORT EDMONTON HISTORICAL SOCIETY	
DRAWN MNG	SITE PLAN SHOWING TEST HOLE LOCATIONS	THURBER
DATE JAN 2002		
APPROVED		
SCALE 1"=25'-0"	SELKIRK HOTEL RECONSTRUCTION FORT EDMONTON PARK EDMONTON, AB	DRAWING No. 19 - 3694 - 0 - 1

SYMBOLS AND TERMS USED ON TEST HOLE LOGS

1. VISUAL TEXTURAL CLASSIFICATION OF MINERAL SOILS

CLASSIFICATION	APPARENT PARTICLE SIZE
Boulders	Greater than 200 mm
Cobbles	75 mm to 200 mm
Gravel	5 mm to 75 mm
Sand	Not visible to 5 mm
Silt	Non-Plastic particles, not visible to the naked eye
Clay	Plastic particles, not visible to the naked eye

2. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

DESCRIPTIVE TERM	APPROXIMATE UNDRAINED SHEAR STRENGTH	
Very Soft	Less than 10 kPa	
Soft	10 - 25 kPa	
Firm	25 - 50 kPa	
Stiff	50 - 100 kPa	
Very Stiff	100 - 200 kPa	Modified from
Hard	200 - 300 kPa	National Building
Very Hard	Greater than 300 kPa	Code

3. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

DESCRIPTIVE TERM	STANDARD PENETRATION TEST (SPT) (Number of Blows per 300 mm)	
Very Loose	0 - 4	
Loose	4 - 10	
Compact	10 - 30	Modified from
Dense	30 - 50	National Building
Very Dense	Over 50	Code

4. LEGEND FOR TEST HOLE LOGS

SYMBOL FOR SAMPLE TYPE


Shelby Tube


A-Casing


SPT


Grab


No Recovery


Core


MC - Moisture Content (% by weight) as determined by sample.

Water Level

CPen - Shear Strength determined by pocket penetrometer

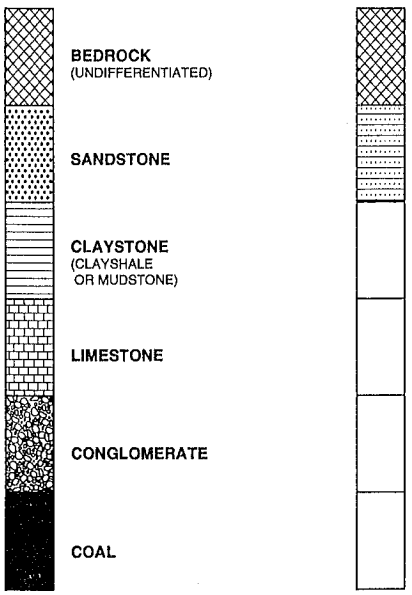
CVane - Shear Strength determined by pocket vane.

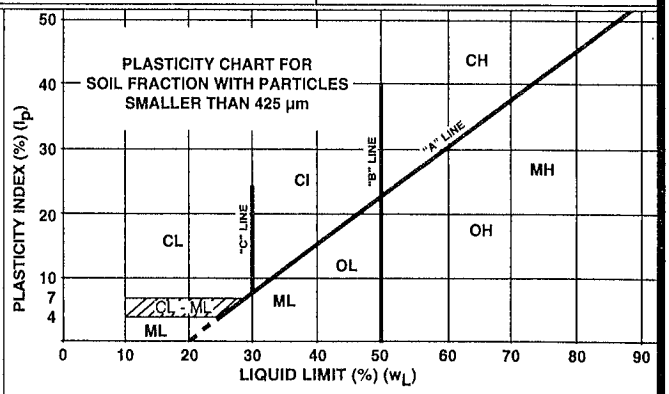
Cu - Undrained Shear Strength determined by unconfined compression test.

MODIFIED UNIFIED CLASSIFICATION SYSTEM FOR SOILS
(MODIFIED BY PFRA, 1985)

MAJOR DIVISION			GROUP SYMBOL	THURBER LOG SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA
COARSE-GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 75µm)	GRAVELS MORE THAN HALF COARSE GRAINS LARGER THAN 4.75 mm	CLEAN GRAVELS (LITTLE OR NO FINES)	GW		WELL GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES	Determine percentages of gravel and sand from grain size curve. Depending on percentages of fines (fraction smaller than 75µm) coarse grained soils are classified as follows: Less than 5% GW, GP, SW, SP; More than 12% GM, GC, SM, SC; 5% to 12% Borderline cases requiring use of dual symbols. $C_U = \frac{D_{60}}{D_{10}} > 4$; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1$ to 3
			GP		POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ALL GRADATION REQUIREMENTS FOR GW
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM		SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE I_p LESS THAN 4
			GC		CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	ATTERBERG LIMITS ABOVE "A" LINE I_p MORE THAN 7 — Above "A" line with I_p between 4 and 7 are borderline cases requiring use of dual symbols
	SANDS MORE THAN HALF COARSE GRAINS SMALLER THAN 4.75 mm	CLEAN SANDS (LITTLE OR NO FINES)	SW		WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_U = \frac{D_{60}}{D_{10}} > 6$; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1$ to 3
			SP		POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	NOT MEETING ALL GRADATION REQUIREMENTS FOR SW
		SAND WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM		SILTY SANDS, SAND-SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE I_p LESS THAN 4
			SC		CLAYEY SANDS, SAND-CLAY MIXTURES	ATTERBERG LIMITS ABOVE "A" LINE I_p MORE THAN 7 — Above "A" line with I_p between 4 and 7 are borderline cases requiring use of dual symbols
FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75µm)	SILTS BELOW "A" LINE NEGLIGIBLE ORGANIC CONTENT	$w_L < 50\%$	ML		INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	CLASSIFICATION IS BASED UPON PLASTICITY CHART (see below)
		$w_L > 50\%$	MH		INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS	
	CLAYS ABOVE "A" LINE NEGLIGIBLE ORGANIC CONTENT	$w_L < 30\%$	CL		INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAYS, LEAN CLAYS	
		$30\% < w_L < 50\%$	CI		INORGANIC CLAYS OF MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS	
		$w_L > 50\%$	CH		INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	ORGANIC SILTS & CLAYS BELOW "A" LINE	$w_L < 50\%$	OL		ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW AND MEDIUM PLASTICITY	
		$w_L > 50\%$	OH		ORGANIC CLAYS OF HIGH PLASTICITY, ORGANIC SILTS	
HIGHLY ORGANIC SOILS			Pt		PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOR OR ODOR, AND OFTEN FIBROUS TEXTURE

SPECIAL SYMBOLS





THURBER

MODIFIED UNIFIED CLASSIFICATION SYSTEM FOR SOILS
(MODIFIED BY PFRA, 1985)

CLIENT: Fort Edmonton Historical Society c/o HIP Architects	PROJECT: Selkirk Hotel Reconstruction	BOREHOLE NO: **TH02-1**
DRILLING COMPANY: SPT Drilling Ltd.	DATE DRILLED: January 10, 2002	PROJECT NO: 19-3694-0
DRILL/METHOD: B47/ Solid Stem Auger	LOCATION: See Drawing No. 19-3694-0-1	ELEVATION: 96.17 (m)

SAMPLE TYPE: GRAB SAMPLE; SPT

BACKFILL TYPE: DRILL CUTTINGS; SLOUGH

DEPTH (m)	SAMPLE TYPE	SPT (N)	REMARKS	USC	SOIL SYMBOL	SOIL DESCRIPTION	ELEVATION (m)
0			Stick-up = 0.9m	CI		CLAY (FILL) dark brown, moderate organics, trace oxides and white silt pockets	96
1				CI		- becomes silty	95
2		10		CI			
			SO4 = No reaction	CI		CLAY brown, sandy, trace organics	94
3		8		CI			93
4			- Trace seepage at 3.8 m	CI			92
5		7		CI-CL			91
6		7		CI-CL			90
7				CI-CL			89
8		50/102	>> 50 blows for 100 mm	GM		GRAVEL very dense, sandy, trace pebbles and coal	88
9						END OF TEST HOLE AT 8.1 m ON COMPLETION (Below Ground Surface): - Water to 6.9 m - Slough to 7.2 m STANDPIPE PIEZOMETER INSTALLED Water Level (Below Ground Surface): January 29, 2002 = 7.0 m	87
10							

SPT Blows/300 mm: 10 20 30 40

PLASTIC M.C. LIQUID: 10 20 30 40

BOREHOLE LOG 1936940.GPJ THRBR_AB.GDT 30/1/02

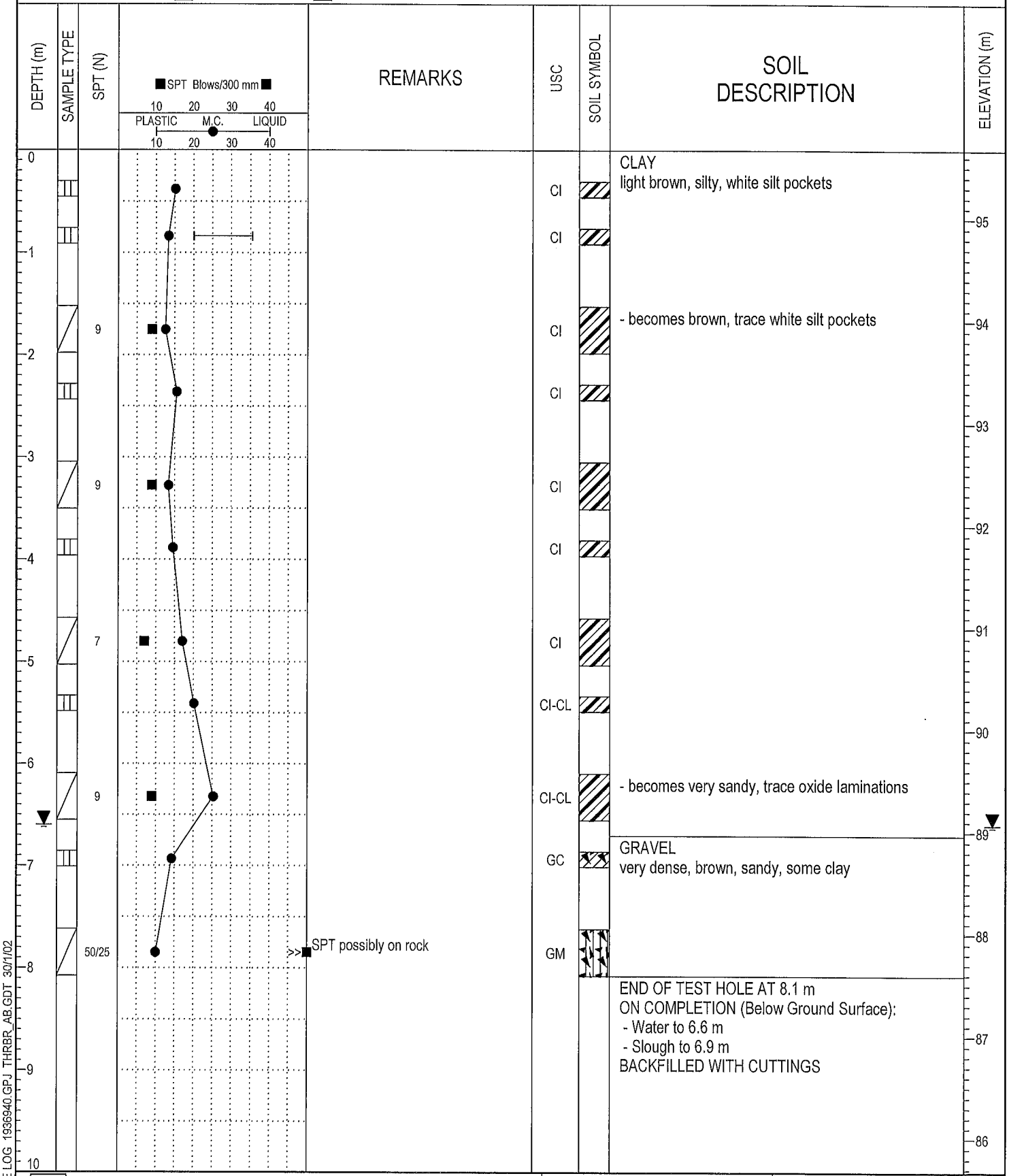
THURBER

Thurber Engineering Ltd.

LOGGED BY: GD	COMPLETION DEPTH: 8.1 m
REVIEWED BY: GSB	COMPLETION DATE: 10/1/02
	Page 1 of 1

CLIENT: Fort Edmonton Historical Society c/o HIP Architects	PROJECT: Selkirk Hotel Reconstruction	BOREHOLE NO: **TH02-2**
DRILLING COMPANY: SPT Drilling Ltd.	DATE DRILLED: January 10, 2002	PROJECT NO: 19-3694-0
DRILL/METHOD: B47/ Solid Stem Auger	LOCATION: See Drawing No. 19-3694-0-1	ELEVATION: 95.671 (m)

SAMPLE TYPE ▥ GRAB SAMPLE ▨ SPT



BOREHOLE LOG 1936940.GPJ THRBR_AB.GDT 30/1/02

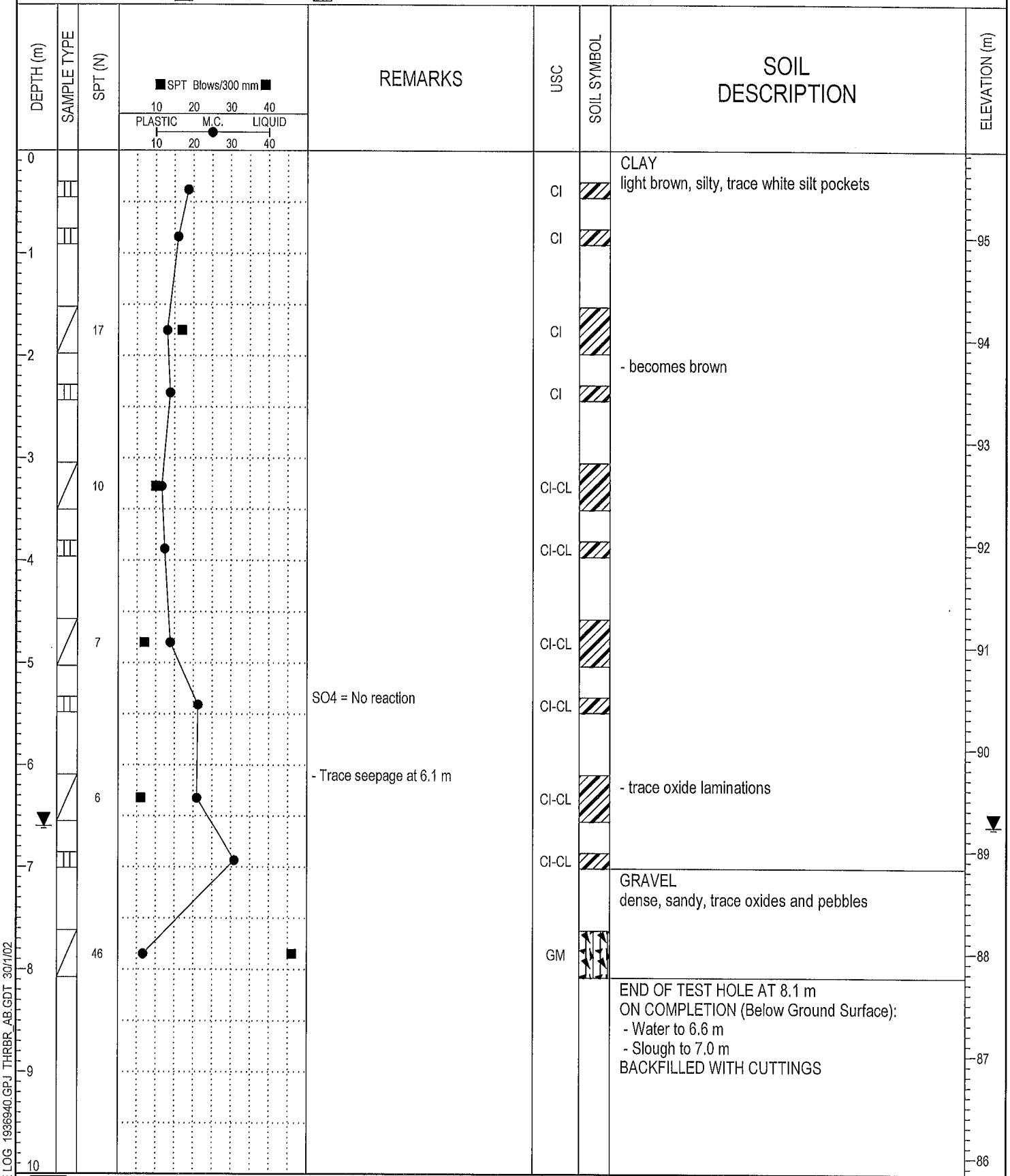
THURBER

Thurber Engineering Ltd.

LOGGED BY: GD	COMPLETION DEPTH: 8.1 m
REVIEWED BY: GSB	COMPLETION DATE: 10/1/02
	Page 1 of 1

CLIENT: Fort Edmonton Historical Society c/o HIP Architects	PROJECT: Selkirk Hotel Reconstruction	BOREHOLE NO: **TH02-3**
DRILLING COMPANY: SPT Drilling Ltd.	DATE DRILLED: January 10, 2002	PROJECT NO: 19-3694-0
DRILL/METHOD: B47/ Solid Stem Auger	LOCATION: See Drawing No. 19-3694-0-1	ELEVATION: 95.841 (m)

SAMPLE TYPE ▥ GRAB SAMPLE ▨ SPT



CLAY
light brown, silty, trace white silt pockets

- becomes brown

- trace oxide laminations

GRAVEL
dense, sandy, trace oxides and pebbles

END OF TEST HOLE AT 8.1 m
ON COMPLETION (Below Ground Surface):
- Water to 6.6 m
- Slough to 7.0 m
BACKFILLED WITH CUTTINGS

THURBER

Thurber Engineering Ltd.

LOGGED BY: GD	COMPLETION DEPTH: 8.1 m
REVIEWED BY: GSB	COMPLETION DATE: 10/1/02
	Page 1 of 1

BOREHOLE LOG 1936940.GPJ THRBR_AB.GDT 30/1/02

APPENDIX B

Recommended Construction Procedures

RECOMMENDED CONSTRUCTION PROCEDURES

The following construction procedures are considered to represent good practice and are to be read in conjunction with the text of this report.

1. EXCAVATED FOUNDATIONS

1.1 Excavation close to foundation level should be done carefully to avoid disturbance of the soil. It is essential to prevent the soil at foundation level from deterioration due to excessive drying or becoming wet from surface or seepage water. Good drainage both during and after construction is essential.

1.2 Sumps, if required, should be located well away from the foundation area. Softened or overdried soil must be removed and replaced by lean mix concrete or by extending the foundations.

1.3 The foundation must be kept from freezing both during and after construction. Foundation concrete should not be placed on or against frozen soil.

2. PROOF ROLLING

2.1 Proof rolling is a method of detecting soft areas in a subgrade for fill, pavement, floors or foundations. The intent is to detect softened areas not revealed by the test holes or visual examination of the site surface, and is used where normal scarification and compacting procedures would not be successful in detecting and eliminating soft areas. It is usually accomplished with the use of heavy 130 to 220 kN (15-25 ton) compaction equipment with high contact wheel pressures on independent axles, although heavily loaded single axle trucks will provide the equivalent result.

2.2 The procedure requires 2 complete passes with the heavy equipment in one direction and then a second series of 2 passes made at right angles to the first series.

2.3 While the passes are being made, any softened, rutted or displaced areas detected should be examined and either recompacted with additional fill or the existing material removed and replaced with better quality material.

3. BACKFILLING

3.1 Backfill around foundations should be placed in such a manner so as to prevent settlement and to be relatively impervious near the surface so that water does not pond against foundations nor be allowed to seep into the soil.

3.2 Backfill should not be placed until the structure has sufficient strength to withstand the earth pressures resulting from placement and compaction.

3.3 All backfill around grade beams, foundation walls, etc. must be carefully and uniformly compacted. The backfill should be placed in even layers and no frozen nor organic material should be incorporated into the fill. All lumps of material must be broken down or squeezed together during placing and compaction.

3.4 The final grade (allowing for some settlement of the backfill) should shed water away from the structure.

3.5 During construction, precautions should be taken to prevent water ponding in grade beam excavations thereby acting as a source of water to soften the soil under the floor slab area or providing a source of water for frost action if the building is not heated during freezing weather.

4. BORED CAST-IN-PLACE CONCRETE PILES

4.1 If there is evidence of water bearing and/or sloughing soil, casing should be used to seal off the water or prevent the sloughing of the sides of the hole. The concrete and reinforcing steel should be on hand and placed as soon as the pile hole has been completed and approved.

4.2 Pile bells, if used, should be formed entirely in self-supporting soil and it may be necessary in some cases to extend the pile bell if caving occurs at the location of the bell.

4.3 Water should not be left ponded on the pile base and should be removed, or dried by the use of dry cement when permitted by the engineer.

4.4 Concrete should be placed without segregation and carefully vibrated throughout the full length of the pile to ensure that voids do not exist in the pile shaft. The concrete slump should be between 75 and 125 mm with a minimum compressive strength at 28 days of 21 MPa (3000 psi). Higher compressive strengths may be required for structural or durability reasons, and higher slumps may be necessary for closely spaced reinforcing bars or where concrete is to be tremied under water.

4.5 Steel reinforcing should be tied into the grade beam reinforcing steel. This recommendation is important where the soil below grade beam can swell from a change in moisture content or by frost action before the building is heated.