Champagne District Area Structure Plan

Bylaw 9/2006

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IMPORTANT NOTICE

MGA Section 63(2)

This document is consolidated into a single publication for the convenience of users. The official Bylaw and all amendments thereto are available from the Legislative Officer and should be consulted in interpreting and applying this Bylaw.

In case of any dispute, the original Land Use Bylaw must be consulted. Where legal land description, spelling, punctuation or type face was updated or corrected, the change was not noted in this document.

For easy reference, the amending Bylaw Numbers are adjoining the Sections that were amended to identify that a change has occurred in a Section, Subsection or Clause, subsequent to the adoption of the original Land Use Bylaw.

Following is a list of Bylaws adopted by Council subsequent to adoption of this Bylaw that amended the Land Use Bylaw:

BYLAW NO.	ADOPTION DATE	CONTEXT
19/2012	12/11/2012	Amending Figure 6 - Development Concept, by redesignating Plan 112 5502, Block 37, Lot 83 in the northwest section of the plan area from Medium Density Residential to Low Density Residential.
3/2014	02/25/2014	Replacing Figure 6 - Development Concept and addressing the inconsistencies between the road layout and the lots within the plan area. New Figure 6 shall apply to figures 7 through 11. In addition, the figure reflects the following: - Changing Medium Residential to Low Residential to reflect amendment Bylaw 19/2012; - Designating a new school/park area located in the northeast section of the plan; - Changing the text of "JH School Site" with the general Municipal Reserve School/Park text; - Adjusting the areas of Low Density Residential in the north section of the plan to Municipal Reserve lots; and - Changing Low Density Residential to Medium Density Residential to reflect actual registered land uses.
		Replacing Table 2 - Area Breakdown, and Table 4 - Number of Units and Population, and replacing them with updated areas, and number of units and population. The updated tables shall supersede any text or map inconsistencies within the plan.
1/2017	02/28/2017	Replacing Figure 6 - Development Concept, to facilitate duplex-side-by-side rear detached garages fronting 107 Ave from Lots 50 to 61 in Block 3, and Lots 4 to 10 in Block 5 as an alternative housing product.
		Replacing Table 2 – Units and Population, to reflect the changes from Figure 6 by decreasing the housing units by two, increasing persons by one, and decrease school generation by one student.
11/2023	04/25/2023	Changes to tables 2 and 4, and figure 6 were required due to the reclassify of specific land uses.

CHAMPAGNE DISTRICT

Area Structure Plan

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March 2006

Champagne District
Area Structure Plan

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1. Introduction

1.1 Purpose

This Area Structure Plan has been prepared to provide a framework for the subdivision and development of part of the S ½ of 3-56-25-W4M that is located in the northeast quadrant of the Town of Morinville. The Plan area comprises approximately 71 hectares, and will be developed as a low to medium density residential neighbourhood. Landrex Developers Inc. controls a considerable portion of the land within the Plan area under a purchase agreement with the Town of Morinville.

The Plan area is contained within the 1991 Northeast Morinville Area Structure Plan. Significant amendments to the 1991 Area Structure Plan have occurred, including the relocation of the proposed school site. As such, a new Area Structure Plan is required that considers these amendments, as well as shifting market and industry dynamics, current lifestyle requirements, and new design and development objectives. The Northeast Morinville Area Structure Plan will cease to have effect once the Champagne District Area Structure Plan is adopted.

The Champagne District Area Structure Plan meets the requirements of Section 633 of the Municipal Government Act, and the Generic Terms of Reference for the Preparation of an Area Structure Plan in the Town of Morinville. As such, it describes future land uses, potential population levels, transportation and infrastructure requirements, and the sequence of development.

1.2 Location Context

The Champagne District Plan area is located in the northeast quadrant of Morinville, and is defined by:

- Champlain/100th Street to the west;
- Parcel A Plan 782 2335 and the ¼ section property line to the north;
- Grandin Drive to the east; and,
- Laval/101st Avenue and existing legal lot lines to the south.

Figure 1 shows the boundaries of the Plan area, and its location within the Town.

1.3 Policy Context

Town of Morinville Municipal Development Plan Bylaw No. 19/98

The Champagne District Area Structure Plan complies with the Town of Morinville's Municipal Development Plan Bylaw No. 19/98 (see Figure 2) in terms of generalized future land use. The Champagne District Plan area is referred to as the East Central Neighbourhood (Residential Area) by the Municipal Development Plan, and although a portion of the lands located just west of Grandin Drive are shown as Developed Townsite, only a portion of these lands have recently been developed by Landrex for single detached housing purposes.

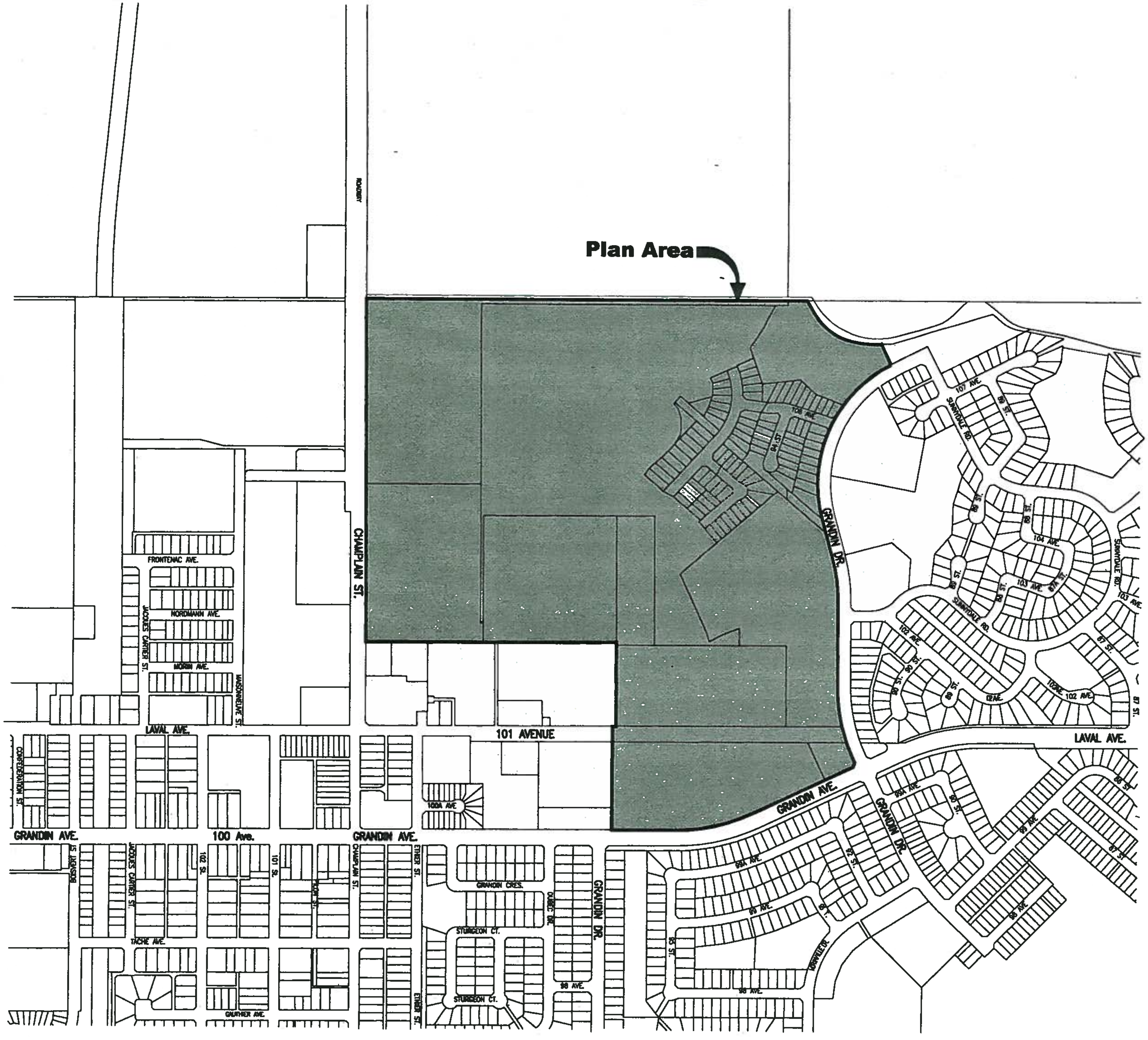

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Figure 1

Locational Context

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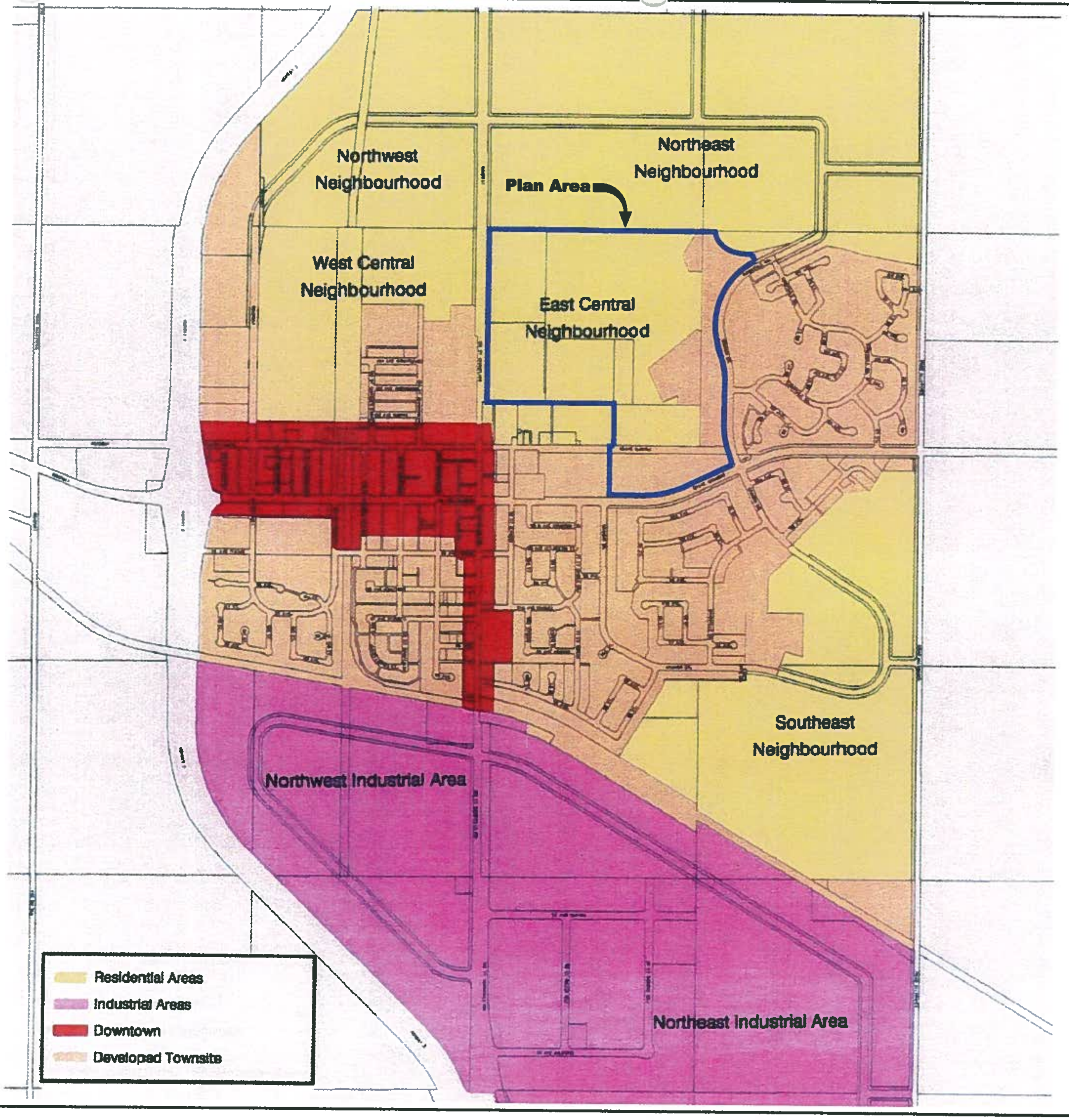

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Figure 2

Municipal Development Plan Context

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Significant Municipal Development Plan policies that have a bearing on this Plan are listed under Policy 12: Neighbourhood Design and include:

(a) *Curvilinear roadways based on a grid street system, to create a more interesting streetscape and privacy*;

(b) *Provision of various focal points (neighbourhood parks, playgrounds, community centres, and churches) within the neighbourhood to encourage cohesion and interaction*;

(c) *Development of pedestrian circulation routes linking residential areas to schools, parks, recreation facilities, the trail system, and local commercial centres*;

(d) *Creation of distinct units, which discourage through traffic and are oriented inward, away from major thoroughfares*;

(e) *Limitation of smaller park and playground areas (i.e. tot lots) in favour of larger centralized park areas.*

Town of Morinville Land Use Bylaw No. 4/2003

Most of the Plan area is zoned Urban Reserve (UR) by the Town's Land Use Bylaw No. 4/2003. The purpose of this District is *to protect significant tracts of vacant land for future urban development, and to allow for a limited range of low intensity uses which are consistent with that intent.*

Lot 5 Plan 972 0345 that is owned by Qualico is zoned Direct Control (DC) 3-4. The purpose of this District *is to provide residential development in the form of smaller lot single detached housing.* The minimum lot depth in this DC District is 34.0 metres and minimum lot width is 11.0 metres for lots fronting onto a collector roadway and corner lots, and 9.75 metres for all other lots. A block *shadow* plan was prepared for this DC site by the Town, and this plan is generally recognized by this Plan.

The east central portion of the Landrex holdings has been rezoned to Single Detached Compact Residential (R-2) District and this area has been subdivided to create 95 lots (Stages 1 – 3B). The purpose of this District is to provide for residential development in the form of single detached housing on compact lot sizes, allowing for a slightly higher density than in the R-1 (Single Detached Residential) District.

Although the minimum lot depth in the R-2 District is less than in the DC 3-4 District, at 30.5 metres as compared to 34 metres, minimum lot width is greater at 13.75 metres for corner lots and 12.2 metres for all other lots, as compared to 11.0 metre and 9.75 metres respectively. The DC 3-4 lot dimensions provide an opportunity for the compatible integration of clusters of similar smaller lots in the Champagne District Plan.

A pipeline right-of-way and two parcels abutting the right-of-way have been rezoned from Urban Reserve Semi-Public (SP) as part of the R-2 rezoning.

The Land Use Bylaw will need to be amended at the time of subdivision pursuant to the uses approved under this Plan.

1.4 Land Ownership

Land ownership within the Champagne District Plan area is shown on Figure 3 and is summarized by Table 1 below. Land areas shown for parcels controlled and/or owned by Landrex are based on a recent survey of the parcels and, therefore, are accurate. Areas as shown on the registered plans for Stages 1-3B are also assumed to be accurate. The areas of the remaining parcels are based on current Certificates of Title and will be confirmed at the time of survey.

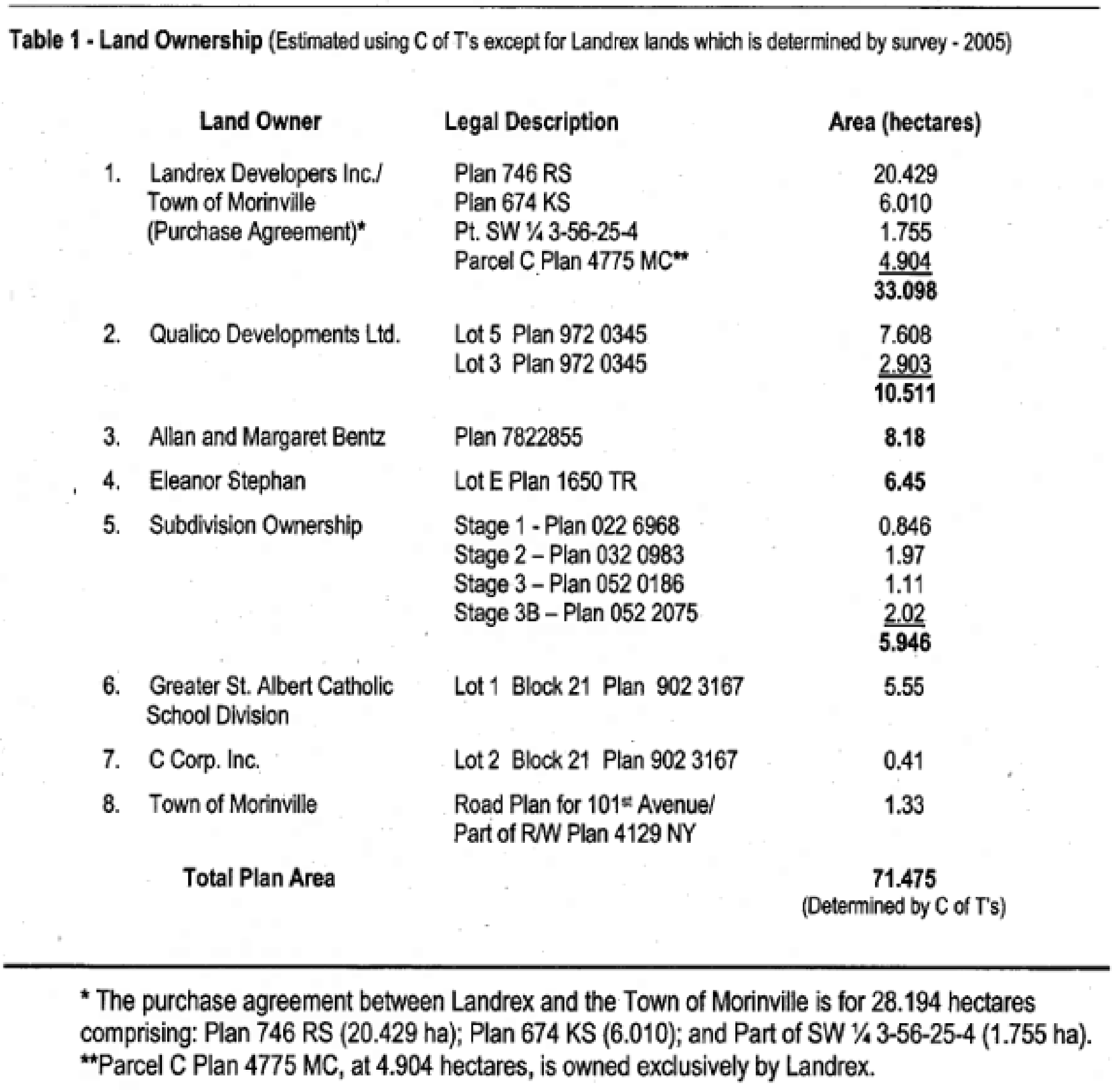

Table 1 - Land Ownership (Estimated using C of T's except for Landrex lands which is determined by survey - 2005)

	Land Owner	Legal Description	Area (hectares)
1.	Landrex Developers Inc./ Town of Morinville (Purchase Agreement)*	Plan 746 RS	20.429
		Plan 674 KS	6.010
		Pt. SW ¼ 3-56-25-4	1.755
		Parcel C Plan 4775 MC**	4.904
			33.098
2.	Qualico Developments Ltd.	Lot 5 Plan 972 0345	7.608
		Lot 3 Plan 972 0345	2.903
			10.511
3.	Allan and Margaret Bentz	Plan 7822855	**8.18**
4.	Eleanor Stephan	Lot E Plan 1650 TR	**6.45**
5.	Subdivision Ownership	Stage 1 - Plan 022 6968	0.846
		Stage 2 – Plan 032 0983	1.97
		Stage 3 – Plan 052 0186	1.11
		Stage 3B – Plan 052 2075	2.02
			5.946
6.	Greater St. Albert Catholic School Division	Lot 1 Block 21 Plan 902 3167	5.55
7.	C Corp. Inc.	Lot 2 Block 21 Plan 902 3167	0.41
8.	Town of Morinville	Road Plan for 101st Avenue/ Part of R/W Plan 4129 NY	1.33
	Total Plan Area		**71.475** (Determined by C of T's)

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* The purchase agreement between Landrex and the Town of Morinville is for 28.194 hectares comprising: Plan 746 RS (20.429 ha); Plan 674 KS (6.010); and Part of SW ¼ 3-56-25-4 (1.755 ha).

**Parcel C Plan 4775 MC, at 4.904 hectares, is owned exclusively by Landrex.

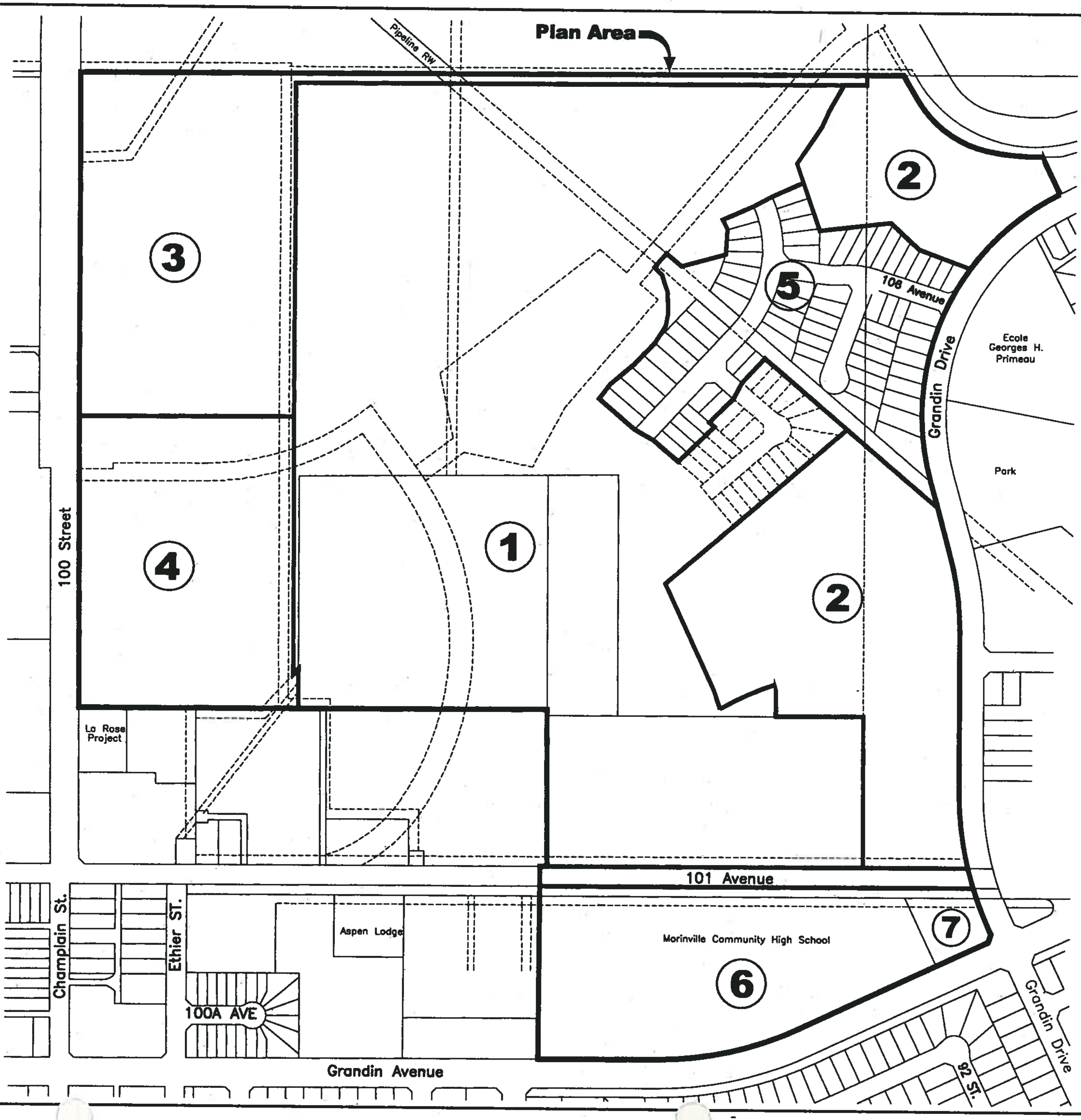

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Figure 3

Land Ownership

①	Landrex Developers Inc.
②	Qualico Developments Ltd.
③	A&M Bentz
④	E Stephan
⑤	Subdivided Ownership
⑥	GSAC School Division
⑦	C Corp. Inc.

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2. Existing Conditions

2.1 Surrounding Land Uses

Existing uses surrounding the Plan area are shown on Figure 3 and are described as follows:

- To the north, the lands are in agricultural crop production although these lands are contained within the Town boundaries and are zoned Urban Reserve. The Town boundary extends ½ mile north of the Plan area.
- To the east, the developed residential neighbourhood of Sunshine Lake Estates. A park and Ecole Georges H. Primeau School (Grades 6, 7 and 8) are located directly to the east, across Grandin Drive.
- To the south, the Morinville Community High School and some five vacant and/or underdeveloped lots, most of which are proposed to be developed for medium density residential purposes. The recently constructed La Rose Townhouse project is located directly south of the southwest corner of the Plan area. Aspen Lodge for seniors and an adult housing project are located adjacent the west side of the high school. The existing and proposed residential projects will result in a significant cluster of medium density housing adjacent to the Plan area.
- To the west, Champlain/100th Street. A school, the cemetery and a park site are located west across 100th Street.

The Champagne District Plan puts forward a neighbourhood that will be compatible with the surrounding land use pattern.

2.2 Existing Land Use

Excepting the above noted 95 single family lots, the Plan area comprises cultivated farmland. Single detached houses exist, or are being constructed on, 53 of the 95 R-2 lots. No other uses exist within the Plan area excepting a prominent, centrally located storm water feature.

2.3 Natural Features

The Plan area comprises a gently undulating lacustrine plain with a natural relief of about 1.0 metre. Several shallow drainage ditches traverse the area. A soil stockpile is located at the southwest corner of the area, likely as a result of excavation for the storm water pond. The Manawan Canal is located just northeast of the Plan Area.

A poplar tree stand is located north of the Community High School. The stand is sparse and contains few mature trees. Other vegetation is limited to a *windrow* and some willows that surround low areas located in the southeast and northeast corners. The low areas are mostly located on the Qualico lands (see Figures 4 and 5). Neither low area contains water permanently.

J.R. Paine & Associates has undertaken a Geotechnical Investigation of much of the Landrex controlled portion of the Plan area (see Appendix A). The investigation concludes that no major problems are anticipated for the construction of residential housing units, and that the subsurface soil conditions are satisfactory for dwellings using standard concrete footing foundations.

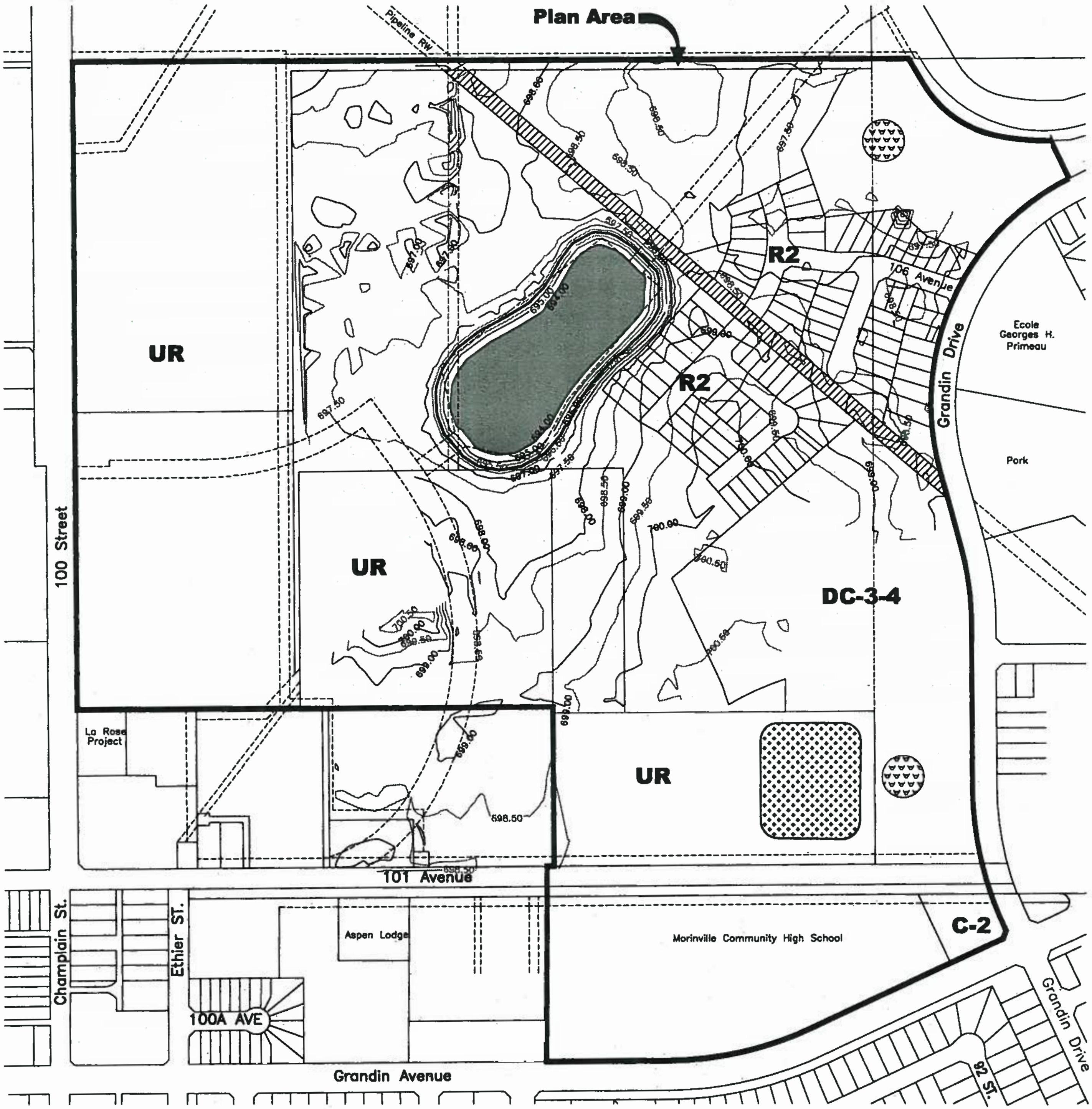

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Figure 4

Existing Conditions

▨ Storm Water Pond
▨ Pembina Pipeline
▨ Tree Stand
● Low Area

Available Contours at 0.5m Interval

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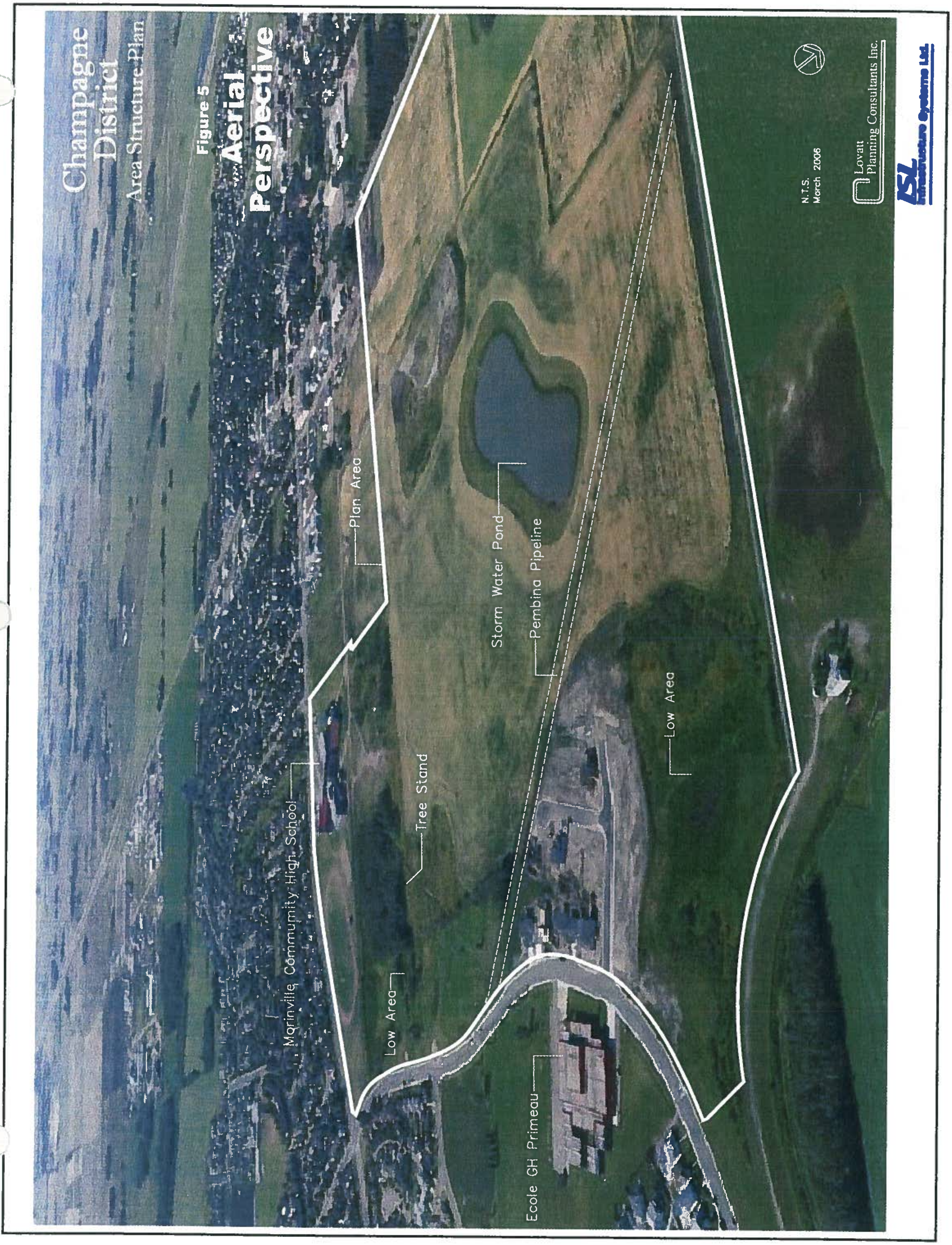

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Figure 5
Aerial Perspective

EBA Engineering has completed both a Phase 1 and a Phase 2 Environmental Site Assessment (ESA) for the lands controlled by Landrex (see Appendix B). Both assessments were prepared for the Town. The Phase 1 Assessment determined that seven sewage lagoons were located in the southwest portion of the Landrex site and were in operation between 1949 and 1976. The lagoons were decommissioned in the 1980's. The assessment also recommends that the sediment at the bottom of the storm water pond be further assessed to determine if contaminants exist.

No other features that may pose environmental concerns were identified, although a Pembina pipeline that extends through the northeast corner of the Plan Area was identified as a potential concern that may need to be addressed by Pembina.

The Phase 1 ESA recommends that a Phase 2 ESA be undertaken to determine if any contamination is present in the areas of the decommissioned lagoons, as well as at the bottom of the storm water pond. The Phase 2 Assessment concluded that, although a minor detectable impact on soil and ground water is evident, the impact is minor and does not warrant remediation or long term monitoring. This means that the Landrex controlled lands are suitable for residential development.

2.4 Pipelines and Utility Rights-of-Way

The above noted storm water management pond located near the centre of the Plan area, and the connecting storm sewers, are significant features that have been considered in designing the Champagne District Plan. These features are registered on title as Utility Right of Way Plan 812 0409, and are integrated into the storm water management plan indicated herein.

The Pembina crude oil pipeline that extends through the northeast segment of the Plan has been recognized as a Public Utility Lot in the recently approved subdivisions registered by Landrex. A segment of the pipeline right-of-way has been zoned Semi Public (SP). The entire length of the pipeline will be retained as a Public Utility Lot. This lot is proposed to contain a future trail linkage to Morinville's integrated community wide trail system. A segment of the Town's trail system has been constructed along the north boundary of the Plan.

No other pipeline or utility easements are registered on the titles controlled by Landrex. However, such easements, including a segment of the above noted storm sewer easement, are registered on the titles of the two westerly parcels. Most of these easements are located along the east property lines of the said parcels.

2.5 Historical and Archaeological Features

At the time the Northeast Morinville Area Structure Plan was prepared in 1991, Alberta Community Development determined that a Historical Impact Assessment of the Plan Area is not required. For the purposes of this Plan, the 1991 decision is assumed.

2.6 Implications for Future Development

The existing conditions result in the following implications for future development.

1. The Municipal Development Plan Neighbourhood Design considerations listed in Section 1.3 provide guidelines for design purposes.
2. The existing DC District that applies to the Qualico lands in the southeast corner of the Plan Area provides an opportunity for similar residential lots to be developed in other portions of this Plan.
3. The significant amount of existing and proposed medium density residential housing located adjacent the southwest portion of the Plan area should be considered by the future land use concept and housing mix proposed in this Plan.
4. The 1991 Northeast Morinville Area Structure Plan requires that a school site, likely for a junior high school, be located within this Plan. This requirement remains valid. The location of the Morinville Community High School provides an opportunity for locating the required school site adjacent the high school, thereby creating a campus facility that will result in efficiencies in the joint use of school sites. This Plan also provides an opportunity to close the unused segment of 101st Avenue and to consolidate it with adjacent existing and proposed school lands.
5. The centrally located storm water management pond provides an opportunity to create an amenity and accessible focal feature, thereby promoting community identity.
6. The vegetation stands are not environmentally significant and have little amenity value for future planning purposes.
7. The Geotechnical Investigation and two ESA's completed for the lands controlled by Landrex conclude that these lands are suitable for residential development.
8. The Pembina pipeline right-of-way provides an opportunity to link to the Town's integrated trail system, a segment of which has been extended along the north boundary of the Plan area. The right-of-way is strategically located at the northeast end of the storm pond such that a future trail can be extended along the storm pond.

The foregoing implications are recognized by the Development Concept that is shown on Figure 6.

3. The Development Concept

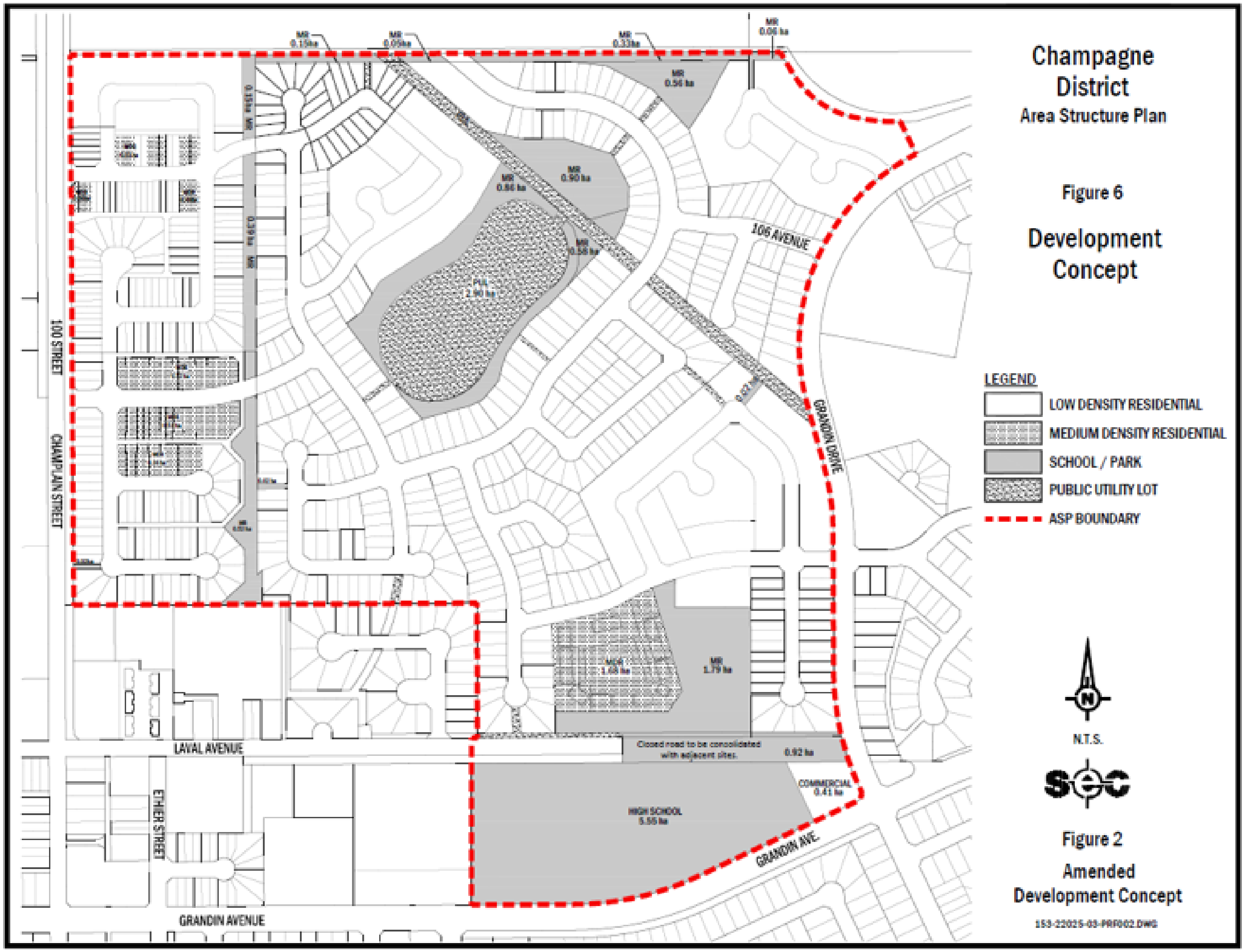
3.1 Development Objectives

The primary development objective of the Champagne District Area Structure Plan is to create a viable, comprehensively designed residential neighbourhood that focuses on the centrally located storm water pond. This storm pond will be developed as an amenity feature and will provide future residents with a tangible community identity. The storm pond and the existing and proposed school sites are connected through an internal and external pedestrian trail system comprising designated trails and sidewalks. Three neighbourhood park sites are also linked to this system. The development concept that is shown on Figure 6 reflects the following objectives:

1. To create opportunities for a *sustainable* residential neighbourhood that displays an individual identity, but that is linked to the balance of the Town to allow for community interaction.
2. To provide a *meaningful* choice of innovative and conventional housing options that cater to a range of income, age and social groups.
3. To provide for a high standard of amenities and community services, which include provision for a new school site, a centrally located lake amenity feature, and strategically located neighbourhood park sites that are linked by a trail system that, in turn, is linked to the Town's comprehensive trail system.
4. To provide for a functional and safe internal circulation system based on a hierarchy of collector and local residential roads.
5. To provide for safe and efficient linkages to the Town's arterial road system.

The foregoing policy objectives compliment and support the relevant policies of the Town's Municipal Development Plan and its Sustainable Development Policy. This policy requires that new developments promote community sustainability by applying land use planning practices that create and maintain efficient infrastructure, ensure close-knit neighbourhoods and sense of community, and preserve natural systems.

Bylaw:
11/2023



3.2 Land Area Breakdown

Table 2 provides a summary of the land use breakdown by area proposed by the Development Concept.

Bylaw: 11/2023

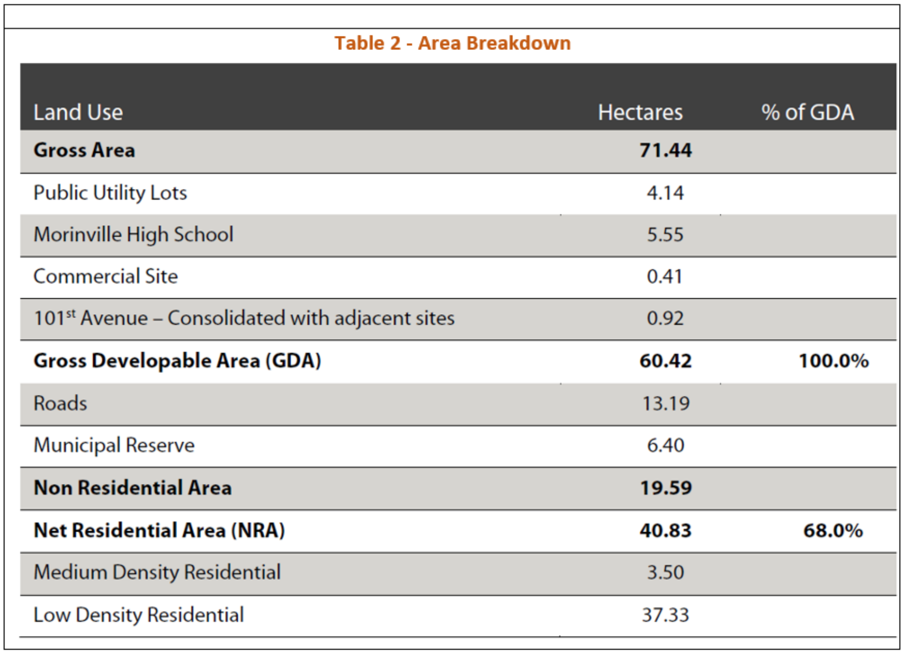


Table 2 - Area Breakdown

Land Use	Hectares	% of GDA
Gross Area	**71.44**	
Public Utility Lots	4.14	
Morinville High School	5.55	
Commercial Site	0.41	
101st Avenue – Consolidated with adjacent sites	0.92	
Gross Developable Area (GDA)	**60.42**	**100.0%**
Roads	13.19	
Municipal Reserve	6.40	
Non Residential Area	**19.59**	
Net Residential Area (NRA)	**40.83**	**68.0%**
Medium Density Residential	3.50	
Low Density Residential	37.33	

Municipal Reserve is owing and is being provided in the amount of 10 percent of the Gross Area of the Plan (as indicated in Table 2) which amounts to 6.40 hectares (i.e. 10 percent of 60.2 hectares). Each land holding is being required to dedicate exactly 10 percent of what they owe in accordance with the Municipal Government Act, as shown in Table 3.

Table 3 – Municipal Reserve Dedication

Land Owner	**Area Owned**	**MR Dedicated**	**% of Area Owned**
Landrex Developers Inc.	33.098 ha		
Stages 1-3B	5.946 ha		
Total Landrex and Stages 1-3B	39.044 ha	3.9 ha	10.0
Qualico Developments Ltd.	10.48 ha	1.05 ha	10.0
Allan and Margaret Bentz	8.18 ha	0.82 ha	10.0
Eleanor Stephan	6.45 ha	0.65 ha	10.0
Total Municipal Reserve Dedication		**6.42 ha**	

3.3 Design Elements

The Development Concept shown on Figure 6 incorporates the design considerations listed in the Municipal Development Plan and, therefore, provides for:

- Curvilinear roadways based on a grid system, to create a more interesting streetscape and encourage privacy;
- Provision of various focal points within the neighbourhood to encourage cohesion and interaction;
- Development of direct pedestrian circulation routes linking residential areas to schools, parks, recreation facilities, the trail system, and local commercial centres;
- Creation of distinct neighbourhood units, which discourage through traffic and are oriented inward, away from major traffic thoroughfares.

The storm pond and surrounding open space and trail system result in a very effective, impressive amenity feature and community focal point. All parks are linked by trails and sidewalks to the major focal points, including the storm pond and the joint campus facility, as well as the Town's Trail System that will be enhanced by the Pembina pipeline Public Utility Lot.

Two smaller parks are provided on the west side of the Plan but are large enough so that playing fields and/or playgrounds can be developed in each park. These parks provide Municipal Reserve for each of the segments of the Plan that are under separate ownership.

At 9.59 hectares in size, the joint campus is also a significant focal point and functions as a major public open space/playing field feature. Relatively large parks exist directly west and east of the Plan. As is noted in Section 2.6, this Plan also provides an opportunity to close the unused segment of 101st Avenue and to consolidate it with adjacent existing and proposed school lands.

Two medium density residential.sites are proposed by the Development Concept.

3.4 Population and School Generation

Population and number of unit estimates for this Plan area are summarized in Table 4. For the purposes of this Plan, the following factors are assumed:

Table 4 – Number of Units and Population

	Low Density		**Medium/High Density**	**Total**
	Single Detached Dwelling	*Duplex*		
Area (hectares)	34.39	2.94	3.50	40.83
Units/ha	21	24	54	
Units	722	70	189	981
Population/Unit	3.46	3.1	2.6	
Population	2,498	217	491	3206
School Generation (units x 1.2)	866	84	226	1,176

* Please note, unit counts are approximate only and may vary at the time of subdivision.
** Hectares designated for low density may vary between housing product types at the subdivision stage.

4. Municipal Services

4.1 Sanitary Sewer Concept

The sanitary sewer catchment area concept is shown on Figure 7. Existing development and the NE sector of the Plan is served by a 450mm sub-trunk from Grandin Drive along 106th Avenue. This sewer is also sized to accommodate lands to the north which lie outside the boundary of this Plan. Those lands will be liable for oversize payments to developers within The Lakes, and shall be in accordance with the Town of Morinville's Shared Cost Study.

The west central and south areas of the Plan will be serviced by a new sanitary sub-trunk connecting to the existing trunk along 101st Avenue. Cost sharing will be required for any capacity in this sub-trunk that is required to service the parcel located directly west of the Plan. The sub-trunk will be designed to accommodate lands to the northwest of the Plan, and as with the NE sub-trunk, those lands will also be liable to pay oversize costs to the developers within the Plan in accordance with the Town of Morinville Shared Cost Study.

Two small catchment areas along Grandin Drive may be served independently of the sub-trunk systems, and will tie directly into existing sanitary sewers at 102nd and 107th Avenues.

It should be noted that with existing sanitary sewers, changes to land use or design criteria may impact the ability of those sewers to accommodate the catchments shown on Figure 7.

4.2 Storm Drainage Concept.

With the exception of two small catchment areas adjacent to Grandin Drive, storm drainage from this Plan will discharge to a central wet pond (see Figure 8). This pond currently has inlets in the southwest and southeast, with the 900mm outlet to the northeast. This outlet flows to a lift station which pumps the stormwater into the Manawan Canal. A future inlet to the pond may be required in the northwest, depending on future major overland flow grading considerations.

The southwest inlet to the pond accepts flows from existing 1950mm and 1350mm pipes from the south and west respectively, and these pipes have been oversized to accommodate lands beyond the boundaries of this Plan.

Minimum grade, at house, shall be 698.5m. Also, a berm is required at the Manawan Canal to an elevation of 698.5m.

The existing pond has been licensed by Alberta Environment and is based on the land use concept shown on Figure 6.

4.3 Water Distribution Concept

Water service to this Plan will be provided by a looped system sized to provide acceptable domestic flows, with fire flows that achieve recognized standards for residential development (see Figure 9). Water supply is currently provided from a connection to Grandin Drive at 106th Avenue. As development approaches 80 lots, looping will be required by a connection to the existing 250mm main on 101st Avenue. Cost sharing will be required for any capacity in loop system that is required to service the parcel located directly west of the Plan.

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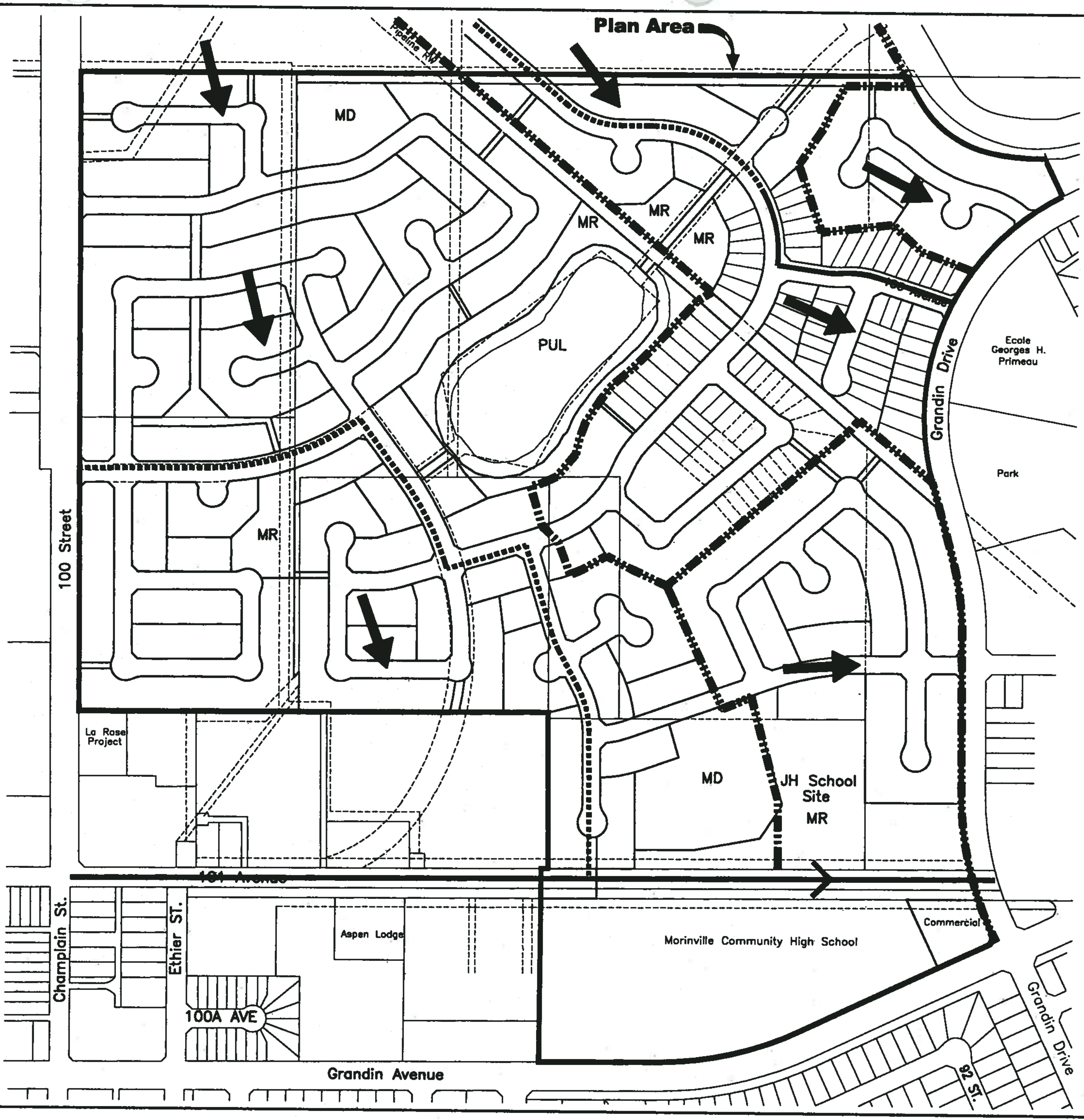
Figure 7

Sanitary Sewer Concept



▬ ▪ ▬ Catchment Area

▬▬ Existing Sanitary Sub Trunk

▪▪▪▪▪ Future Sanitary Sub Trunk

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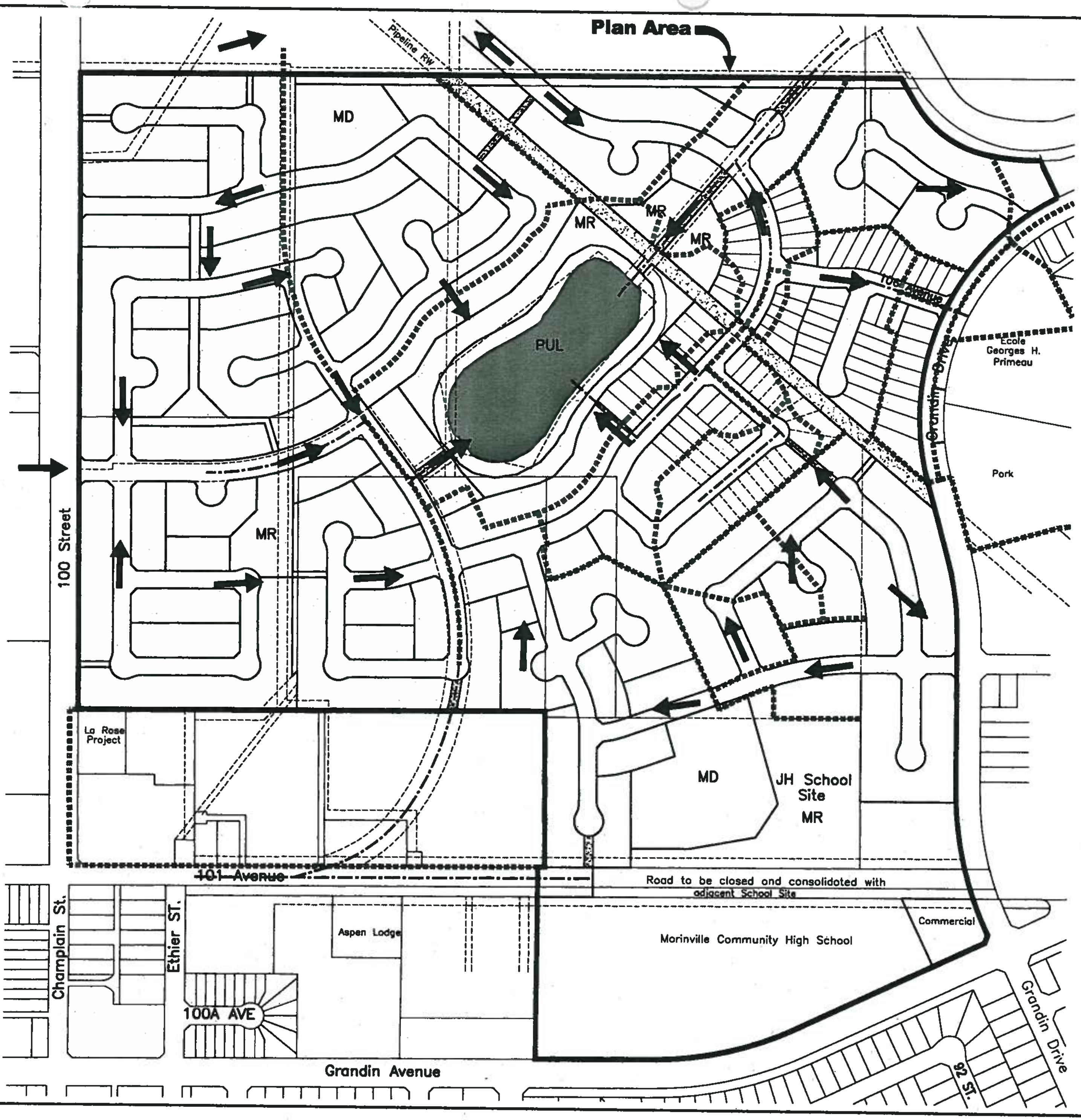

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Figure 8

Storm Drainage Concept

→ Major Overland Flow Routes

–·– Existing Storm Sewer

▪▪▪▪ Catchment Areas

▨ Existing SWMF

NOTE
For complete Catchment Area see Plan 3 of the Stormwater Implementation Study for the Town of Morinville

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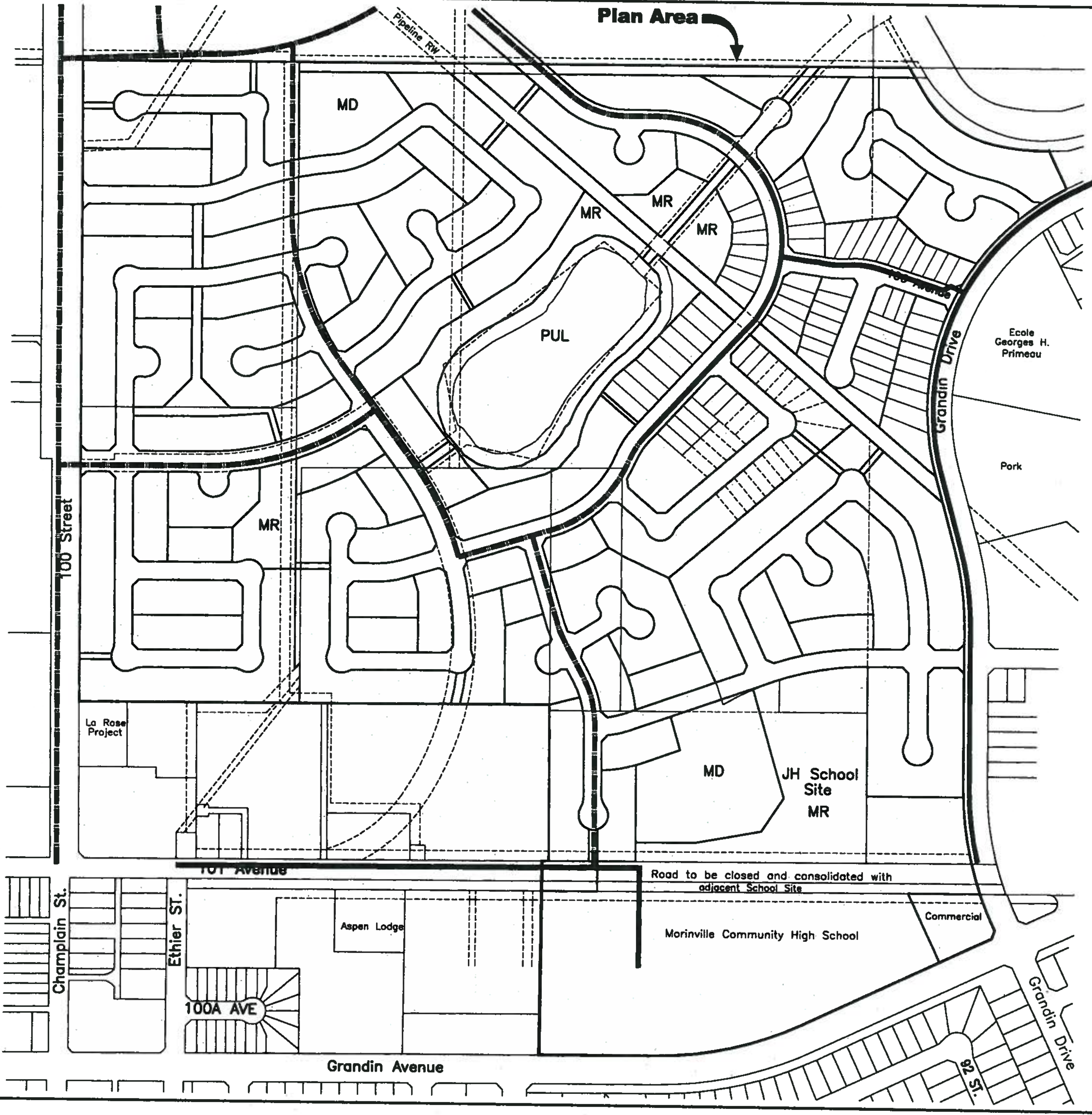
Figure 9

Water Distribution Concept



Existing Water 250ø or Greater

Future Water 250ø or Greater

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4.4 Franchise Utilities

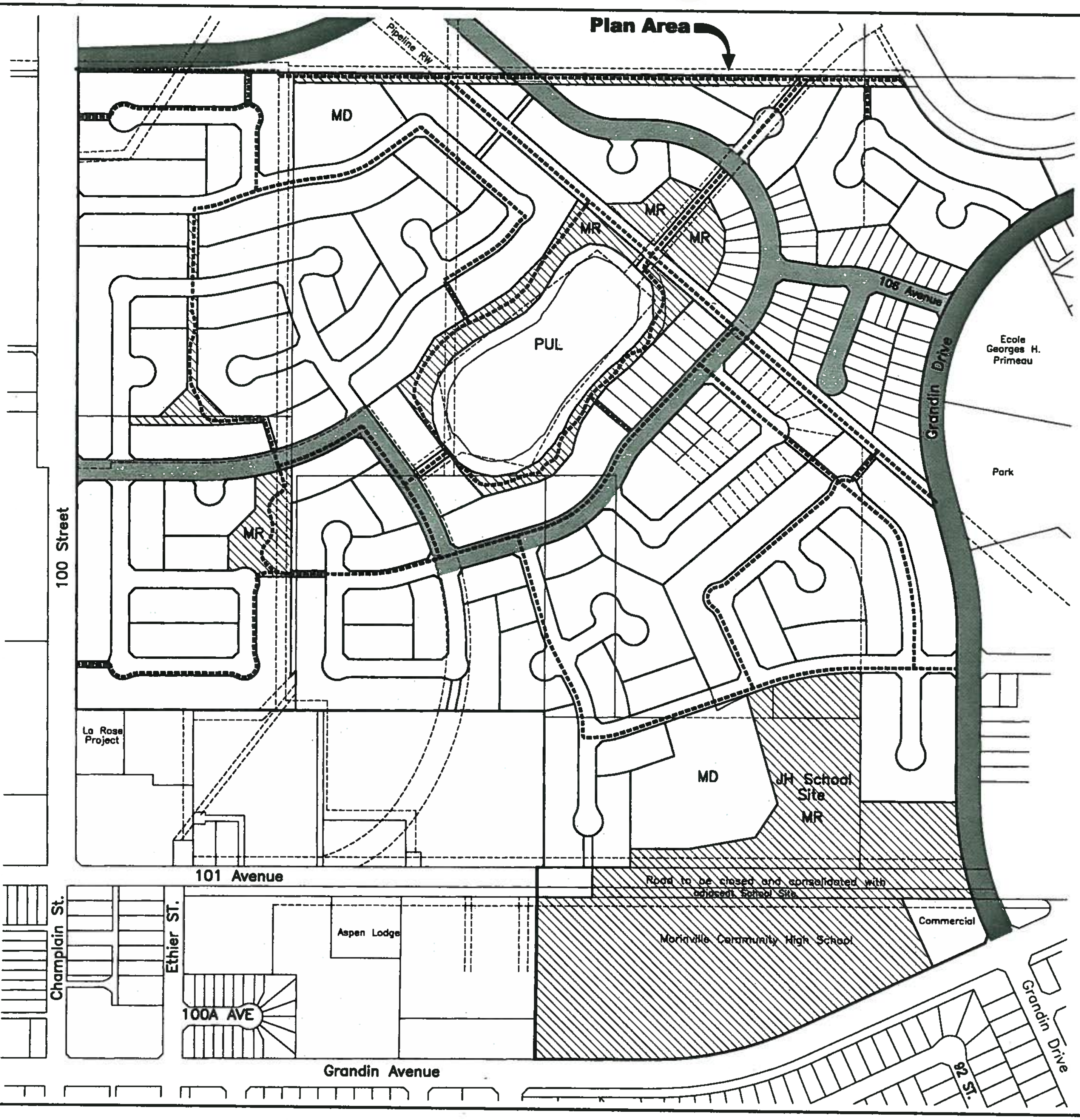
Power telephone cable TV and gas will be provided to the area by the extension of existing facilities.

4.5 Circulation

The hierarchy of roads is illustrated on Figure 10, with a north/south major collector being identified in the central portion of the Plan, supplementing Grandin Drive on the east boundary and a possible future collector along 110th street to the west. In accordance with accepted practice, the major collectors will be connected by a series of minor collectors, onto which the residential streets feed. The cost of constructing that segment of roadway connecting to 101st Avenue that straddles the Plan area boundary will be shared.

As with the requirement for watermain looping, when development approaches 80 lots, a temporary emergency access will be required from 101st Avenue to link through to Stage 3.

A pedestrian trail system will follow the Pembina pipeline right of way in the northeast quadrant of the area. Construction of this trail system will be dependant on the necessary permits from the oil company for construction within their right of way. This trail will link with a series of roads and public utility lots to form a comprehensive pedestrian network (see Figure 10).



Champagne District
Area Structure Plan

Figure 10

Circulation Plan

▆	Major Collector
▒	Minor Collector
-------	Pedestrian

N.T.S.
March 2006

Lovatt Planning Consultants Inc.

ISL Infrastructure Systems Ltd.

5. Staging and Implementation

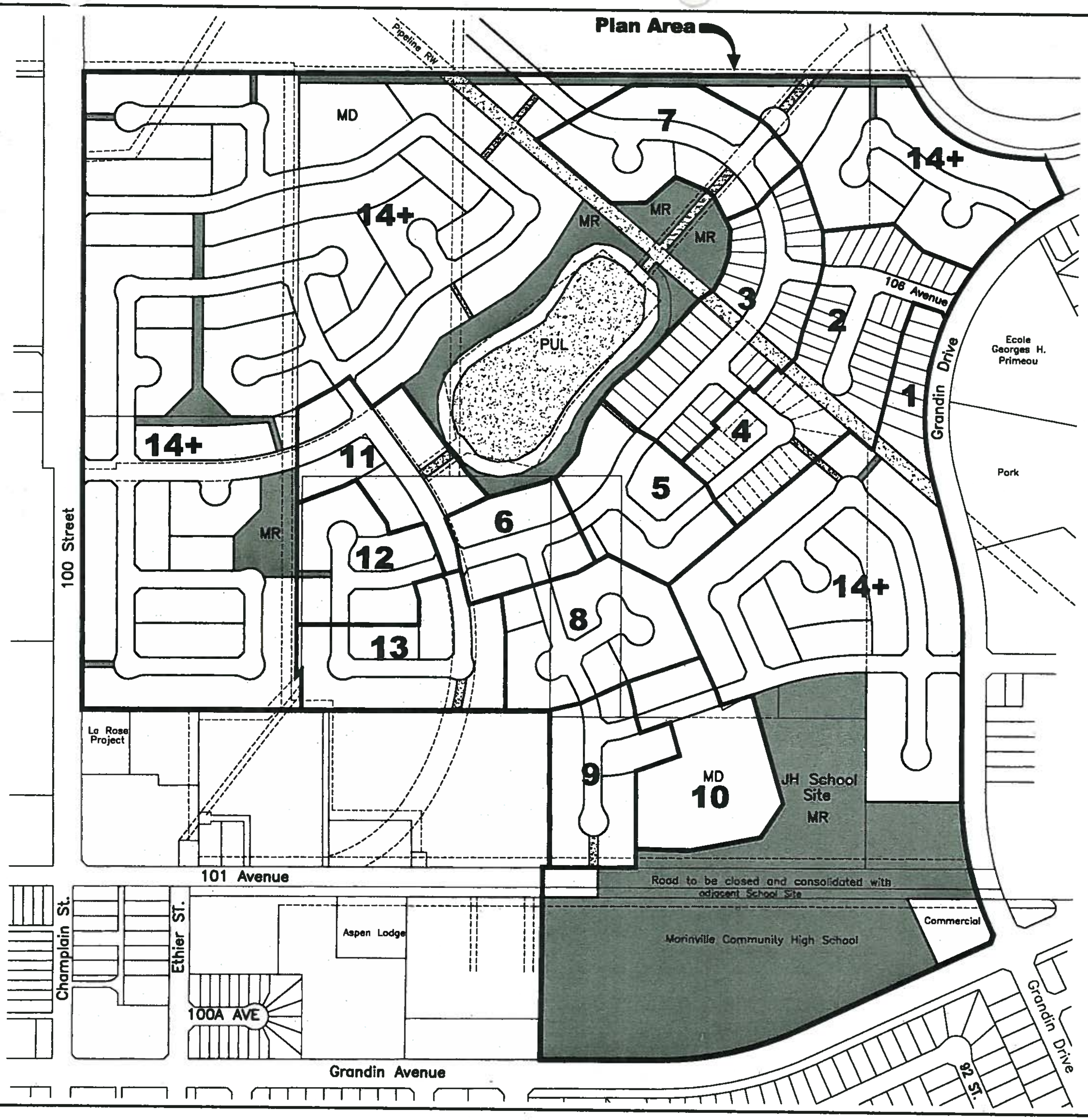
A Potential Staging Plan is shown on Figure 11. The first three phases are developed as Stages 1 to 3B. Stages 4 and 5 are imminent, and future stages are dependant on approval of this Area Structure Plan. Watermain looping and a temporary road will be required to allow the development of Stages 4 and 5.

Upon adoption of the Plan, the 1991 Morinville Northeast Area Structure Plan will be simultaneously rescinded and will no longer have any effect.

As is noted in Section 1.3, the Land Use Bylaw will need to be amended at the time of subdivision and development. As is also noted in Section 1.3, Stages 1-3 are zoned R-2, and it is anticipated that Stages 4 to 8 may also will be zoned R-2. However, Stage 9 may be zoned R-4 (Two Family Residential District) to allow for semi-detached housing depending on market demand at the time of rezoning and subdivision. The medium density sites will likely be zoned R-5 (Medium Density District).

Clusters of the small lot low density residential product that reflect the DC District that applies to the Qualico site, and that have been successfully integrated into neighbourhoods in Edmonton, Fort Saskatchewan, Sherwood Park, Leduc and other in municipalities, may be considered in future stages.

It must be noted that the immediately foregoing discussion regarding future zoning in no way binds the Town of Morinville to grant the zoning specifically contemplated. Furthermore, in deciding upon future zoning assigned to the lands within this Plan, the Town will need to remain mindful of and monitor the capacities of the off-site services and adjust lot densities/sizes (and therefore zoning) within the Plan accordingly.



Champagne District
Area Structure Plan

Figure 11

Potential Staging Plan

(Conceptual Only Subject to Change)

N.T.S.
March 2006

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ISL Infrastructure Systems Ltd.

6. Force and Effect

The Champagne District Area Structure Plan (Plan) is intended to refine existing general policy direction and land use designations assigned to these lands within the Town of Morinville Municipal Development Plan, guide the subsequent assignment of land use districts to the lands within the Town of Morinville Land Use Bylaw as well as establish a sound framework for future decisions on land use, subdivision, servicing and development permits. The following policies are for the purposes of implementing this Plan and to ensure that its provisions are followed in decisions rendered pursuant to this Plan.

1. The Town shall ensure that all future land use, subdivision, development, amendment and servicing decisions made regarding lands within the Champagne District Area Structure Plan (Plan) comply with the provisions (including Tables and Figures) contained in this Plan. Should such a decision require or amount to a major deviation from or relaxation/variation of the provisions of this Plan, an amendment to this Plan shall be required. Decisions that would result in or amount to a minor deviation from or relaxation/variation of the provisions of this Plan may be considered without an amendment to this Plan where the owner/developer can demonstrate to the satisfaction of the Town that the deviation, relaxation or variation does not substantively alter the intent, force or effect of the provisions of this Plan.

2. It is intended that this Plan, its concepts and provisions are used in tandem with the relevant provisions of the Municipal Development Plan and Land Use Bylaw, particularly in guiding the exercise of discretion in rendering decisions on subdivision and development permit applications. This Plan will be used to guide any required amendments to the provisions or land use designations or districts in the Municipal Development Plan or Land Use Bylaw.

3. The Town shall pursue whatever actions are deemed appropriate or necessary to secure compliance with the provisions of this Plan.

4. Should an owner/developer make repeated applications to amend this Plan once it is in effect, the Town may undertake or require that the owner/developer undertake an overall review of this Plan instead of continuing to entertain individual, isolated amendment applications so that the implications of the revisions to this Plan can be considered and evaluated, at a minimum, in the context of the entire Plan area and, if warranted, beyond this Plan area.

APPENDIX A
J.R. Paine & Associates, Geotechnical Investigations

J.R. Paine & Associates Ltd.
CONSULTING AND TESTING ENGINEERS
EDMONTON — GRANDE PRAIRIE — PEACE RIVER — WHITEHORSE

17505 - 106 Avenue
Edmonton, Alberta
T5S 1E7

September 23, 2002
File No. 2461-170

LANDREX DEVELOPMENTS INC.
c/o INFRASTRUCTURE SYSTEMS LTD.
300, 5141 Calgary Trail South
Edmonton, Alberta
T6H 5G8

ATTENTION: **Mr. Laurence London, P. Eng.**

Dear Sir:

Re: Geotechnical Investigation
Proposed Morinville Mews Subdivision
North of 101st Avenue, West of Grandin Drive
Morinville, Alberta

Please find enclosed our report with respect to the above noted investigation. In brief, this report presents the general soil conditions and geotechnical recommendations for the subdivision construction.

Thank you for the privilege of providing this service to your organization. We will be pleased to meet with you to review the contents of this report at your convenience.

Yours truly,
J.R. PAINE & ASSOCIATES LTD.

Bob Rau

Robert Rau, P. Eng.

H:\DATA 2002\2461 Infrastructure Systems Ltd\2461-170 Proposed Morinville Subdivision\r1169isl.doc

EDMONTON 489-0700
GRANDE PRAIRIE 532-1515
PEACE RIVER 624-4966
WHITEHORSE 668-4648

REPORT NO: 2461-170

GEOTECHNICAL INVESTIGATION
PROPOSED MORINVILLE MEWS SUBDIVISION
NORTH OF 101ST AVENUE, WEST OF GRANDIN DRIVE
MORINVILLE, ALBERTA

September, 2002

J.R. PAINE & ASSOCIATES LTD.
17505 - 106 Avenue
Edmonton, Alberta
T5S 1E7

PHONE: 489-0700
FAX: 489-0800

REPORT NO: 2461-170

GEOTECHNICAL INVESTIGATION
PROPOSED MORINVILLE MEWS SUBDIVISION
NORTH OF 101ST AVENUE, WEST OF GRANDIN DRIVE
MORINVILLE, ALBERTA

TABLE OF CONTENTS

GEOTECHNICAL INVESTIGATION

PROJECT: Proposed Morinville Mews Subdivision

LOCATION: North of 101st Avenue, West of Grandin Drive
Morinville, Alberta

CLIENT: Landrex Developments Inc.
c/o Infrastructure Systems Ltd.
300, 5141 Calgary Trail South
Edmonton, Alberta
T6H 5G8

ATTENTION: Mr. Laurence London, P. Eng.

1.0 INTRODUCTION

This report presents the results of the subsurface investigation made on the site of the proposed residential subdivision in Morinville, Alberta. The objective of the investigation was to determine the subsoil data for use in the hydro-geotechnical planning and design aspects of the residential development project. Authorization to proceed was received from Laurence London of Infrastructure Systems Ltd. in May, 2002. Field work for the project was completed on May 21 and 22, 2002.

2.0 SITE DESCRIPTION

The proposed residential development is located north of the existing 101st Avenue, northwest of the intersection of Grandin Drive and Sunnydale Road, in Morinville, Alberta. The area is bordered to the north and west by farm land, and to the south by several acreages and an abandoned auction mart located on the north side of 101 Avenue. Bordering the site to the east is Grandin Drive, and a vacant lot. A lift station was also noted northeast of the study site.

The study site is mostly undeveloped farm land, with the exception of the existing storm pond located in the central portion of the site. Several shallow drainage ditches were noted traversing the site. A treed area was noted along the northeast edge of the site, extending south into the study site. A slough area was also noted past the trees along the northeast portion of the site. It appears that a portion of this slough area is within the proposed development area. At the time of drilling, the area was accessible for truck mounted vehicles. Access to the site was obtained off the lift station access road, in the northeast corner of the site.

It is understood that the area near and south of the existing storm pond was once the site of a sewage lagoon. This report will make geotechnical recommendations on aspects of residential subdivision construction in this area. However, any environmental concerns are beyond the scope of this report. No information is available on the removal of the lagoon at this time. It is understood that the Town of Morinville is currently preparing a Phase I Environmental Site Assessment for this project.

3.0 FIELD INVESTIGATION

The soils investigation for this project was undertaken on May 21 and 22, 2002 utilizing a truck mounted drill rig owned and operated by Canadian Geological Drilling Ltd. A total of 15 testholes and 5 probeholes were drilled at locations shown on the attached site plan. The testholes were advanced to depths of 7.3 metres below ground surface, and the shallow probeholes were advanced to a depth of 3.8 metres below ground surface. The testhole layout was selected by J. R. Paine & Associates Ltd. and was located by Infrastructure Systems Ltd. in the field prior to drilling.

The testholes were advanced with 150 millimetre diameter solid stem augers in 1.5 metre increments. A continuous visual description, which included the soil types, depths, moisture, transitions, and other pertinent observations, was recorded on site. Disturbed samples were removed from the auger cuttings at 750 millimetre intervals for laboratory testing. Standard Penetration Tests c/w split spoon sampling and Shelby Tubes were also taken at regular 1.5 metre intervals in the deep testholes.

Following the drilling operation, slotted piezometric standpipes were inserted into all testholes for watertable level determination. The testholes were backfilled with cuttings, with bentonitic seals placed at the surface. Watertable readings were obtained once drilling had been completed, and again 8 and 13 days later.

4.0 LABORATORY TESTING

All disturbed bag samples returned to the laboratory were tested for moisture content. In addition, the plastic and liquid Atterberg Limits and soluble soil sulphate concentrations were determined on selected samples. Grain size analyses were conducted on selected coarse grained samples. The Shelby Tube samples were tested for unconfined compressive strength and dry density. Lab results are included on the attached testhole logs located in the Appendix.

5.0 SOIL CONDITIONS

A detailed description of the soils encountered is found on the attached testhole logs in the Appendix. In general, the soil conditions at this site consisted of surficial topsoil and occasional clay fill material, underlain by a native silty clay materials. A deposit of clay till featuring various silt and sand layers was the final soil encountered in the testholes.

In all of the testholes, a surficial topsoil was the first soil encountered. This material was moist, black in colour, and typically extended to between 200 millimetres and 350 millimetres in undisturbed areas. In the testholes where underlying fill was noted, less topsoil was present, typically 100 millimetres or less. The topsoil depth is known only at the testhole locations, and may vary between testholes.

Below the surficial topsoil in seven of the testholes (Testholes 02-3, 02-13, 02-14, 02-16, 02-17, 02-18, and 02-19), a silty clay fill material was encountered. This material had a stiff, moist consistency, and was medium or high plastic. The material was brown and black in colour, and normally had a moderate organic content, except for Testholes 02-3 and 02-16, where the fill had a moderate to high or high organic content. The fill was noted to depths ranging from 0.5 to 1.8 metres below ground surface.

Below the fill in the above mentioned testholes, and directly below the surficial topsoil in the rest of the testholes, a lacustrine silty clay was encountered. This material typically had a moist, stiff consistency, with some very moist areas noted. The plasticity of the material was variable, ranging from medium to high, with the higher plastic material encountered in five testholes (Testholes 02-1, 02-4, 02-11, 02-13, and 02-19). The moisture content of the medium plastic portions of this material was typically between 15 and 18 percent, increasing to between 20 and 22 percent in the very moist portions of the material. Atterberg Limit tests on samples of the less plastic material revealed a plastic limit of approximately 13 to 15 percent, and liquid limits of approximately 40 to 48 percent. In the higher plastic portions of this material, typical moisture contents of approximately 20 to 25 percent were noted, increasing to as much as 30 percent in the moister portions. Atterberg Limit tests on one of these samples revealed a plastic limit of approximately 18 percent and a liquid limit of approximately 59 percent. Pocket penetrometer readings of approximately 100 to 300 kilopascals were noted throughout this deposit. This material was encountered to depths of between 0.5 and 2.0 metres below ground surface in the testholes.

Below the upper silty clay deposits, a glacial clay till was encountered. The clay till was typically silty and sandy, with a medium plasticity. Its consistency in the testholes ranged from damp to moist and very stiff to firm and very moist, but usually it had a stiff, moist consistency. Moisture contents ranged from approximately 15 to 20 percent. Atterberg Limit tests on this soil revealed plastic limits of approximately 12 to 14 percent, and a liquid limits of approximately 35 to 42 percent. The till contained traces of coal, oxides, pebbles, and gravel, and was brown in colour near the top of the deposit, becoming grey at depth. Pocket penetrometer readings of approximately 150 to 300 kilopascals were noted in this deposit, with Standard Penetration Test "N" values of between 14 and 48 blows per 300 millimetres. The till was still being encountered at termination depth of 3.8 or 7.3 metres below ground surface in the testholes.

Located within the clay till material in seven of the testholes (Testholes 02-2, 02-3, 02-9, 02-12, 02-15, 02-17, and 02-20), were various silt and sand layers. The silts were typically clayey with a low to medium plasticity, and the sand was mostly a silty, fine grained material. These materials had a medium dense to dense consistency, but were disturbed on the auger, especially where these materials were noted below the watertable, as was the case with five of the seven testholes. Below the watertable, very moist consistencies were noted, while above the watertable, the materials were generally less moist. Some slough material and ingressing groundwater were associated with these materials below the watertable. Moisture contents for the silt ranged from approximately 18 to 25 percent, while the sand featured moisture contents of 5 to 20 percent. Standard Penetration Test "N" values of between 16 and 42 blows per 300 millimetres. The layers ranged in thickness from 500 millimetres to greater than 4.0 metres. In Testholes 02-12, 02-15, 02-17, and 02-20, the silt and sand layers were still being encountered at termination depth of the testholes. In Testholes 02-2, 02-3, and 02-9, clay till was again being encountered at termination depth.

At the completion of drilling, some accumulations of free water and slough material were noted in the testholes which featured silt or sand below the watertable. The rest of the testholes were dry.

6.0 GROUNDWATER CONDITIONS

The groundwater table within the study area was variable, mostly ranging from low to moderate, with several high and one very high area. The watertable was observed in the lacustrine clay or clay till material, between approximately 0.8 and greater than 6.9 metres below the ground surface. Several sets of watertable readings were taken, with the results as follows:

Groundwater Table Readings
Proposed Morinville Mews Subdivision
(Metres Below Ground Surface)

Testhole		**Watertable Readings**			**Watertable Elevation**
Number	**Elevation**	**Same Day**	**8 or 9 Day 30-May-02**	**13 or 14 Day 4-Jun-02**	**4-Jun-02**
02-1	697.31	dry @ 3.80 (4.5 hr)	0.77	0.82	696.49
02-2	697.75	3.33 (8.5 hr)	2.28	2.18	695.57
02-3	698.32	2.96 (3.5 hr)	2.63	2.57	695.75
02-4	698.06	dry @ 6.90 (8.0 hr)	dry @ 6.90	dry @ 6.90	<691.16
02-5	698.23	1.83 (2.5 hr)	1.57	1.50	696.73
02-6	698.32	dry @ 6.90 (3.0 hr)	6.37	5.78	692.54
02-7	697.39	dry @ 6.90 (1.5 hr)	dry @ 6.90	6.50	690.89
02-8	698.76	dry @ 6.90 (1.0 hr)	dry @ 6.90	dry @ 6.90	<691.86
02-9	698.45	dry @ 6.90 (1.5 hr)	dry @ 6.90	dry @ 6.90	<691.55
02-10	697.60	6.10 (2.5 hr)	4.93	4.66	692.94
02-11	697.66	dry @ 6.90 (4.5 hr)	dry @ 6.90	destroyed	<690.76
02-12	697.86	6.54 (0.5 hr)	5.74	5.77	692.09
02-13	697.37	dry @ 6.90 (3.0 hr)	dry @ 6.90	dry @ 6.90	<690.47
02-14	697.58	dry @ 6.90 (5.5 hr)	dry @ 6.90	dry @ 6.90	<690.68
02-15	700.08	6.24 (7.5 hr)	6.23	6.22	693.86
02-16	699.20	dry @ 6.90 (6.5 hr)	dry @ 6.90	dry @ 6.90	<692.30
02-17	700.36	4.41 (6.0 hr)	4.30	destroyed	696.06
02-18	697.41	dry @ 3.80 (4.0 hr)	dry @ 3.80	dry @ 3.80	<693.61
02-19	697.19	dry @ 3.80 (3.5 hr)	dry @ 3.80	dry @ 3.80	<693.39
02-20	698.97	dry @ 3.80 (5.0 hr)	dry @ 3.80	dry @ 3.80	<695.17

It should be noted that water table levels may fluctuate on a seasonal or yearly basis with the highest readings obtained in the spring or after periods of heavy rainfall. The above readings would be near the annual low levels.

7.0 RECOMMENDATIONS

7.1 Residential Housing Units

1. No major problems are anticipated with construction of residential units on the non-organic native soils encountered throughout this site. The subsurface soil conditions encountered throughout this site are considered satisfactory for supporting single family dwellings utilizing standard concrete footing foundations. Some portions of the silty clay and clay till materials encountered in the testholes were soft to firm and very moist, therefore the bearing capacity of these materials may fall below the minimum 75 kilopascals required for applying the Alberta Building Code Section 9. In such cases, a wider strip footing will be required. The surficial topsoil encountered in the testholes is not considered suitable for footing or slab-on-grade support.

   Fill and occasional underlying organic materials were encountered in seven of the testholes. These materials are considered unsuitable for footing support. Slab-on-grade support would have to evaluated at the time of construction on a lot by lot basis, although support by the fill for this purpose is likely adequate. The exception was in Testhole 02-16, where slab-on-grade support would not be recommended due to the highly organic nature of the fill.

2. Proper lot grading away from the houses must be provided to minimize the ingress of surface water into the subsoil. All houses will require at least 1.2 metres of earthen cover to prevent potential frost heave problems, and to minimize movements associated with seasonal variations in moisture content. The amount of cover should be increased to 2.0 metres for exterior isolated footings or for footings of non-continuously heated structures.

3. Final lot grading is unknown at this time. However, it is expected that final lot grades will largely correspond to existing conditions. If general lot grading will produce areas of fill extending to depths below that of footing elevations, it is strongly recommended that house excavations be inspected by qualified geotechnical personnel prior to foundation construction. Generally, it is not recommended that footings be constructed on non engineered fill. In such cases, the following alternatives are commonly recommended:

i) Removal of the fill down to native soil and replacement with a compacted coarse clean granular material, or concrete. A normal footing foundation may then be utilized.

or

ii) Utilize a pile foundation.

4. In the case of pile foundations, some installation problems may be encountered. Some accumulations of free water were present at the completion of drilling in several of the testholes around the site. While it is not likely that casing of the piles would be required, slowly ingressing groundwater may be encountered. Therefore, at the very least, pile concrete should be on-site during the pile drilling to allow for quick concrete placement.

5. Engineered fill may be considered in areas where low elevations necessitate deep fill zones. This option should be reviewed prior to implementation by a geotechnical consultant to evaluate site conditions and borrow material sources. Basically, engineered fill is fill which is placed in a controlled manner under the full-time inspection of a qualified soils technician. The fill is placed and compacted to a minimum 98 percent of its Standard Proctor Density near its optimum moisture content, in maximum 150 millimetre lifts. All topsoil and non-engineered fill must first be stripped from the engineered fill area. This includes the fill encountered in the seven testholes mentioned previously. It should be noted that engineered fill requires fill depth differentials across the building footprint of less than 1.5 metres.

Engineered fill construction requires full-time monitoring and extensive testing by the geotechnical consultant during construction. However, proper placement of engineered fill will negate the need for pile foundations in deep lot fill areas, and possibly reduce the foundation costs to the builders and developer.

It should be noted that engineered fill construction is not possible in all situations. One of these situations occurs when soft, very moist, underlying soils are exposed once stripping has been completed. Compacting the first lift of fill material over these soft underlying soils to the engineered fill standard may be impossible. Where a minimum fill depth condition is met, construction of a clay pad approximately of 300 to 500 millimetres in thickness will be required to obtain an adequate working platform to start from. This pad should be compacted to a minimum of 95 percent of Standard Proctor

Density where possible. The normal engineered fill lift thickness and compaction criteria mentioned above should be applied to successive lifts. To employ this method, a minimum of 1.0 metre of engineered fill must be placed on top of the clay pad. If this condition is not met, the fill would not be considered to have met engineered fill standards. In addition, engineered fill requires fill depth differentials across the building footprint of less than 1.0 metre. In some cases, removal of native material may allow for the minimum fill depth or the maximum fill differential conditions to be met. However, this may not be the most economical solution.

6. No loose, disturbed, remoulded or slough material should be allowed to remain in the open footing excavations. Hand cleaning is advised if an acceptable surface cannot be prepared by mechanical equipment. In order to reduce the disturbance to the bearing surface, all basement excavations should be advanced by a backhoe operating remote from the bearing surface.
7. Footing excavations should be protected from drying, rain, snow, freezing and the ingress of surface or groundwater. Care should be taken to ensure that all exposed soils are protected from excessive drying or wetting. The soils encountered immediately below the topsoil in some of the testholes were high plastic, and have a high swelling potential. The rest of the testholes featured medium plastic soils, which would have a moderate swelling potential.
8. A 150 millimetre layer of free draining sand or sand-gravel mixture should be placed immediately below all floor slabs. This material should be uniformly compacted to 100 percent of the corresponding Standard Proctor Density at optimum moisture content.
9. A non-deteriorating vapour barrier should be placed immediately below the floor slab to prevent desiccation of the subgrade material.
10. Temporary dewatering may be required for basement excavations advanced below the watertable.
11. At a minimum, peripheral weeping tile lines will be required for all houses. All lines should be placed at or slightly below footing elevation and connected to ensure positive drainage to an approved system. The weeping tile lines will require a suitable clean tile rock drainage filter, with a minimum of 150 millimetres of filter around the line. Basements located below the water table may require interior drains and clean tile rock beneath the floor in addition to

perimeter drains. The recommended configuration for houses with footing elevations located below the watertable is illustrated in the Appendix.

12. The time span between the start of excavation to installation of basement footings, walls, peripheral weeping tile and backfilling operations should be minimized in order to prevent any problems developing within the excavation due to ingressing of ground or surface waters or desiccation of the subsoil.
13. It is recommended that floor joists be placed prior to backfilling the excavation in order to minimize any detrimental effects on the foundation walls caused by backfilling operations.
14. During winter construction, it is essential that all interior fill and load bearing materials remain frost free. Recommended winter construction practices, with respect to hoarding and heating of the forms and the fresh concrete, should be followed. In order to minimize the potential frost heave problems, the interior of the building must be heated as soon as the walls have been poured. The period in which the excavation is left open due to freezing conditions should be as short as possible. If doubts remain as to the suitability of the foundation during construction, the builder should consult a qualified geotechnical engineer.

7.2 Underground Utilities

1. The subsurface soil conditions encountered in the testholes are considered generally poor to fair for the installation of underground utilities. The silty clay and clay till soils encountered in the testholes would be considered fair, while the saturated sand and silt materials encountered within the clay till soils in five of the testholes would be considered poor. Both the upper silty clay and the clay till soils were near to several percent above optimum moisture content, while the saturated sand and silt materials were well in excess of optimum moisture content.

Topsoil and other organic materials are not considered suitable for backfill material. Clay fill was encountered at the surface of seven of the testholes. Generally, the fill was a silty clay material featuring a moderate organic content, and can be re-used as trench backfill material. However, the fill in Testhole 02-3 had a moderate to high organic content, and the fill in Testhole 02-16 had a high organic content. These materials, as well as any other significant organic layers encountered while trenching, should be separated from the non-organic soils, and should not be re-used as trench backfill.

2. The watertable was variable around the site, ranging from 0.8 to greater than 6.9 metres below ground surface in the testholes, indicating that saturated conditions will likely be encountered in some of the trenches, depending on the design elevations and nature of the subsoil. Free water was encountered during drilling in several of the testholes, and low to moderate amounts of ingressing water in the trenches can be expected. Temporary dewatering will likely be required. Opening relatively long portions of utility trench is not recommended for this site.
3. Some drying or mixing of the soils may be required in areas where moister silty clay and clay till soils are encountered during trenching. The saturated silt and sand materials encountered in some of the testholes will require more significant drying or mixing with drier clay to be used as trench backfill. Another option would be to utilize these materials as general lot fill elsewhere on the site.
4. Standard trenching cutback angles of approximately 30 degrees from the vertical are anticipated for most areas of the site, although some portions of the moister clays and saturated silt and sand layers may require increased cutback angles of 45 degrees or more in order to remain stable, due to their low strength and elevated moisture contents. Actual cutback angles should be determined in the field during construction. Exact stable slope values cannot be pinpointed without detailed and extensive analysis. For this reason, this information should be used as a guideline only and that the optimum cutback angles for utility trenches be determined in the field during construction. The Occupational Health and Safety Act, General Safety Regulation Item 173 and 174 should be strictly followed, except were superseded by this report.
5. To minimize pipe loading, trench widths should be minimal but compatible with safe construction operations. The trench width must be wide enough to accommodate pipe bedding and compaction equipment.
6. Temporary surcharge loads, such as spill piles, should not be allowed to within 2.0 metres of an unsupported excavation face, while mobile vehicles should be kept back at least 1.0 metre. All excavations should be checked regularly for signs of sloughing or failures, especially after rainfall periods.

7. Pipe bedding and trench backfill procedures should adhere to the Town of Morinville specifications as outlined in the Municipal Engineering Standards. The backfill material beneath and above the pipe should be an approved bedding sand material where conditions allow. This material should be hand placed and hand tamped, with care taken to fill the underside of the pipe. To overcome the possible poor utility support where ingressing groundwater and/or poor bearing conditions in the saturated silt and sand materials are encountered, it is recommended that a washed rock and geotextile separator be utilized for pipe bedding in these areas. The washed rock and geotextile configuration should be determined in the field during construction. The need for this configuration should be limited to moderate at this site.
8. Trench compaction requirements of the Town of Morinville are 98 percent of the corresponding Standard Proctor Density above a depth of 1.5 metres, and 95 percent of the corresponding Proctor Density below this level. The maximum lift thickness is 200 millimetres (un-compacted thickness). This degree of compaction should be achievable with a some to a considerable amount of drying or mixing of the trench backfill in portions of the trench. This higher degree of compaction in the top of the trenches will require more extensive mixing or drying of the trench backfill in portions of the site.
9. It should be noted that the ultimate performance of the trench backfill is directly related to the consistency and uniformity of the backfill compaction, as well as the underground contractors construction procedures. In order to achieve this uniformity, the lift thickness and compaction criteria should be strictly enforced.

7.3 Surface Utilities

1. The subsurface soil conditions encountered throughout this site are considered generally fair for the construction of roads, curbs, and sidewalks in undisturbed areas. Difficulty will likely be encountered in utility areas due to mixing of materials during trench backfilling. The existing topsoil and other deleterious materials should be removed prior to construction of roads, sidewalks and other surface utilities. The higher organic clay fill encountered in Testholes 02-3 and 02-16 should also be removed. The slightly organic clay fill encountered in Testholes 02-13, 02-14, 02-17, 02-18, and 02-19 may be left in place.
2. One main concern for surface utility construction at this site is the elevated moisture content of the saturated sands and silt materials encountered at depth in several of the testholes, and

to a lesser extent, some areas of the upper silty clay and clay till materials. The near surface silty clay and clay till materials were usually slightly above its optimum moisture content, with some moister areas noted. However, mixing and disturbance during underground utility installation will degrade the soil conditions, especially where the saturated silt and sand soils are encountered during trenching. Extra subgrade work beyond standard scarification and re-compaction will be required in order to construct an adequate working platform for the pavement structure placement and long term support. It is noted that the degree of trench backfill drying during underground utility installation affects the soil conditions for road and sidewalk construction, with increased drying improving the soil conditions. The use of boulevard servicing improves the soil conditions for surface utilities, and should be considered for this project.

Another main concern for surface utility construction is the high watertable which was noted in isolated areas. A secondary concerns would also be the high plasticity of some of the surficial soils, which would be susceptible to shrinkage and swelling.

3. The standard subgrade preparation method in most areas at this site should consist of scarifying 150 millimetres of material, and recompacting to 100 percent of Standard Proctor Density near optimum moisture content. High plastic clays, which are susceptible to swelling, were also encountered in some areas of this site. Cement stabilization is the recommended subgrade preparation method where high plastic clays are encountered. Past experience has shown that cement stabilization is effective in reducing the swelling potential of high plastic clays. Application rates would best be determined in the field during construction. The addition of 10 kilograms of cement per square metre of subgrade mixed to a depth of 150 millimetres is estimated for this swelling control purpose. The subgrade should be proof rolled after final compaction and any areas showing visible deflections should be inspected and repaired. Care must be taken not to allow any excess moisture into these soils. Early curb backfill should be considered.

4. At the time of drilling, the moisture content was mostly near or slightly above optimum in the near surface clays. Some very moist portions of the silty clay and clay till soils were noted at various depths. In areas where final subgrade elevation will be near these very moist materials, as well as in some underground utility installation areas, some extra subgrade work will likely be required beyond the above mentioned subgrade preparation.

Depending on the final grade, deeper cement stabilization (25 to 30 kilograms per square metre of subgrade mixed to a depth of 300 millimetres) or extensive drying could be considered.

Where very moist soils are encountered at or near final grade, and in underground utility areas where saturated silt and sand materials were mixed in the trench backfill, other alternative measures may have to be considered. These alternatives may include replacing the very moist materials with a drier clay material to obtain a more stable and stronger subgrade. An estimated 1.0 to 1.5 metres of material would be required to bridge the in-situ soft clay soils. The imported fill should be placed in maximum 150 millimetre lifts and be compacted to a minimum of 98 percent of Standard Proctor Density. If the upper high plastic clays are to be used for this purpose, they should be compacted over optimum, to avoid future swelling concerns. Any imported clay should be approved by our firm.

Another option would be the use of a pit-run gravel subbase. The estimated thickness of subbase to support the roadway is 450 to 600 millimetres. A medium duty woven geotextile should initially be placed below the gravel for separation and reinforcement. The placement of a minimum 75 millimetre PVC weeping tile within the granular is recommended. The weeping tile should be wrapped in filter cloth, and should extend laterally across the roadway and be tied into catch basins. The need for a pit-run subbase should be limited at this site.

5. Where fill is to be placed, the fill material below the upper 150 millimetres should be compacted to 98 percent of Standard Proctor Density. All fill should be placed in maximum thickness lifts of 150 millimetres.

6. Where road construction is to take place in slough areas, it is strongly recommended that the grade be set as high as possible. Cuts should be avoided. The recommended construction method for slough areas is to totally remove the organic materials. After total removal of the organic material, drying and /or bridging may be required as the clay soils immediately below the organics are generally very moist. A high watertable would also become a concern. Difficulty achieving compaction once the organics are removed can be expected. Where fill is to be placed on yielding ground, it may not be possible to place the initial lift in a 150 millimetre compacted lift. The first lift may be constructed to

a depth sufficient to support the construction equipment, to a maximum thickness of 600 millimetres. Successive lifts above this support should be constructed in 150 millimetre depths and compacted to meet the specified density requirements as stated previously.

7. The near surface site clays are of low to moderate frost susceptibility, with the susceptibility becoming higher in the silt and sand soils encountered at depth. A high watertable within approximately 3.0 metres of the road surface is required for significant frost heaving to occur. The closer the watertable is to the surface, the higher is the frost heave potential. The standpipes for most of this project have stabilized below this level, and as such, no frost heave concerns are foreseen, provided significant cuts are not made. A limited number of the standpipes at this project have stabilized above this level, and the potential for frost heave will be moderate. Therefore, the design grade should be set as high as possible in these limited areas, and no cuts are recommended.

   An isolated very high watertable area was noted at Testhole 02-1, at the existing slough area. It is recommended that the grade be raised by a minimum of 1.0 metre in this area. Additionally, an attempt should be made to lower the watertable. This may be accomplished by using sub-drains, usually consisting of perforated pipe and manhole inlets, to collect groundwater below the road area. Other options which may be utilized are hydraulically connecting the bedding materials to the manholes, or leaving the rings off of the storm sewers during construction, allowing groundwater to seep into the sewer. When employing this method, it is important to wrap the joints in filter cloth to prevent silting. The exact configuration and need for the sub-drains should be determined during construction.

8. It is recommended that the subgrade be inspected by qualified personnel during construction to determine the recommended subgrade treatment.

9. It is recommended that all areas beyond the back of curb/sidewalk be landscaped as soon as possible to avoid water permeating into the subgrade from free standing puddles. The near surface soils encountered in some of the testholes throughout this area exhibit a high swelling potential. It is important that subgrade soils not be allowed to dry excessively when exposed, and moisture contents are kept slightly over optimum.

10. Surface water will often collect within the granular base, causing subgrade softening and pavement damage. Therefore, it is recommended that wic drains to be installed in the gravel

road base at the curb bottom locations. The wic drains must be properly attached to the catch basins.

11. The following 2 year staged pavement design may be applied to the proposed residential roadways. An estimated California Bearing Ratio of 3.0 percent is used in the design, as well as a design life of 20 years. The traffic volumes for the different road classes are taken from City of Edmonton guidelines.

Recommended Staged Roadway Structures
Proposed Morinville Mews Subdivision

STAGE 1

Structure Options	Local Residential (3.5x10^4 ESALs)	Minor Collector (1.0x10^5 ESALs)	Major Collector (4.7x10^5 ESALs)
Option 1:			
Granular Base			
Asphaltic Concrete	65 mm ACR	75 mm ACR	75 mm ACO
Crushed Gravel (20 mm)	200 mm	225 mm	320 mm or 225 mm
Gravel Sub-Base (63 mm)			150 mm

Soil Cement and Full-Depth Asphalt Options Can Also Be Provided If Required

STAGE 2

All Options:
40 mm of Asphaltic Concrete Overlay

Notes: A thinner overlay (35 mm) can be utlilized if it is demonstrated that the contractor can adequately compact such a lift to the Town of Morinville Standard of 98 percent.
All gravel and soil cement should be compacted to 100 percent of SPD, in maximum 150 mm lifts.
ACR = City of Edmonton Designation Asphaltic Concrete Residential or equivalent
ACO = City of Edmonton Designation Asphaltic Concrete Overlayor equivalent

7.4 Cement

Tests on selected soil samples indicated negligible or low concentrations of water soluble soil sulphates in the near surface clay deposits. The following alternatives are advised:

1. Underground Concrete Pipe

   Concrete used for all underground pipes must be constructed of C.S.A. Type 50, sulphate resistant Portland cement.

2. Curbs and Sidewalks

   All concrete for surface improvements such as sidewalks and curbs may be constructed using CSA Type 10, normal Portland cement.

3. Foundation Construction

   All concrete used for residential construction and coming into direct contact with the soil may be constructed with CSA Type 10, normal Portland cement. A minimum 28 day compressive strength of 20 megapascals is recommended for house foundation construction due to the sulphate content. In addition, all concrete subject to freeze thaw must be air entrained with 5 to 7 percent air. Individual locations may show lower concentrations of soluble soil sulphates, and thus additional soil testing on particular sites may prove valuable.

7.5 Hydrogeotechnical Concerns

1. The groundwater readings in the proposed subdivision were variable and generally low to moderate with isolated higher areas, and are of some concern in design and construction of underground utilities and house construction.
2. The groundwater seepage rates into utility trenches from the native clay formations should be relatively low. Saturated sand and silt layers or laminations, such as the ones encountered in the clay till material in Testholes 02-2, 02-3, 02-12, and 02-15, may produce moderate ingressing water until drained. It is expected that some trench dewatering may be necessary, and construction delays can be expected. Opening relatively long portions of trench should be avoided.
3. A very high watertable was noted in Testhole 02-1, near the existing slough area, and to a lesser extent in Testholes 02-2, 02-3, and 02-5, near the slough. In high watertable areas, subgrade softening below surface utilities is a concern. In these areas, it is recommended that the grade be set as high as possible, as was mentioned previously. Attempts should also be made to lower the watertable. This may be accomplished by using sub-drains, usually consisting of perforated pipe and manhole inlets, to collect groundwater below the road area. Other options which may be utilized are hydraulically connecting the bedding materials to the manholes, or leaving the rings off of the storm sewers during construction, allowing

groundwater to seep into the sewer. When employing this method, it is important to wrap the joints in filter cloth to prevent silting. The exact configuration and need for the sub-drains should be determined during construction.

4. House footing elevation designs should consider the groundwater level. The watertable readings at this site were mostly low to moderate with occasional isolated high watertable areas. Therefore the discharge method will have to be determined on a lot specific basis. Depending on the foundation design, the footing elevations may intercept the watertable, and the weeping tile flow may need to be directed to a storm service. The need for storm services will depend on the flow characteristics desired from basement sump pumps. Preventing only winter flows in order to reduce sidewalk icing and pump outlet maintenance will require a different standard than preventing excessive flows throughout the year. Our experience shows a watertable rise of approximately one metre from low winter readings to high spring and summer readings in this area. Actual site levels may vary. The highest seasonal watertable levels would be an estimated 1.0 metre higher than the measured levels.

   The design footing elevations should be compared to the watertable elevations to assess the need for storm services. A storm service would be recommended where the highest seasonal watertable elevation is above the footing elevation. A margin of safety (usually 300 millimetres) may also be taken into account. Once final lot grades are available, our firm could assist in choosing which lots would benefit from having storm service connections. A rough estimate would be that the area nearest the slough would require storm services, and the rest of the site would not.

5. At a minimum, peripheral weeping tile lines will be required for all houses. All lines should be placed at or slightly below footing elevation and connected to ensure positive drainage to an approved system. The weeping tile lines will require a suitable clean tile rock drainage filter, with a minimum of 150 millimetres of filter around the line. Basements located below the water table may require interior drains and clean tile rock beneath the floor in addition to perimeter drains. The recommended configuration for houses with footing elevations located below the watertable is illustrated in the Appendix.

6. House basement excavations situated below the groundwater table may experience water ingress. If this the case, our firm should be contacted to provide recommendations for

handling the groundwater. A temporary dewatering system may be required until the permanent weeping tile system is operational.

7. Water dispersed on the property from the roof leaders must not be allowed to accumulate against the foundation walls. To ensure positive drainage, the soil surface of all lots should be made sloping away from all buildings. This will require a positive lot grading of at least five percent away from the foundation walls toward the sidewalk for a minimum of 1.5 metres. In cases where the lot drainage runs from the back of the lot to the front, runoff should be kept 1.2 metres away from the house.
8. At least the top 1.0 metre of backfill around the basement walls must be a suitable impermeable clay material. The near surface clay materials found at this site will be suitable for this purpose. This serves to reduce water penetration into the backfill, and subsequently into the weeping tile system.
9. In order to ensure no flow paths for water from the roof leaders occur adjacent to the foundation walls, the following two alternatives are proposed:
   i) A concrete splash pad, placed beneath the downspouts, a minimum of 1.2 metres long and firmly anchored to the house foundation can be used.

   or

   ii) A permanent downspout extension could be used to carry water away from the foundation wall.

8.0 CLOSURE

This report has been prepared for the exclusive and confidential use of Landrex Developments Inc. and Infrastructure Systems Ltd. Use of this report is limited to the subject proposed residential subdivision only. The recommendations given are based on the subsurface soil conditions encountered during test boring, current construction techniques and generally accepted engineering practices. No other warranty, expressed or implied, is made. Due to geological randomness of many soils formations, no interpolation of soil conditions between or away from the testholes has been made or implied. Soil conditions are known only at the test boring location. Should other soils be encountered during construction or other information pertinent become available, the undersigned should be contacted as the recommendations may be altered or modified.

We trust this information is satisfactory. If you should have any further questions, please contact our office.

APPROVED BY:

PERMIT TO PRACTICE
JR PAINE & ASSOCIATES LTD.
Signature R. Evans
Date Sept. 27/02
PERMIT NUMBER: P 0401
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

Rick Evans, P. Eng.

Yours truly,
J.R. PAINE & ASSOCIATES LTD.

ROBERT L RAU

Robert Rau, P. Eng.

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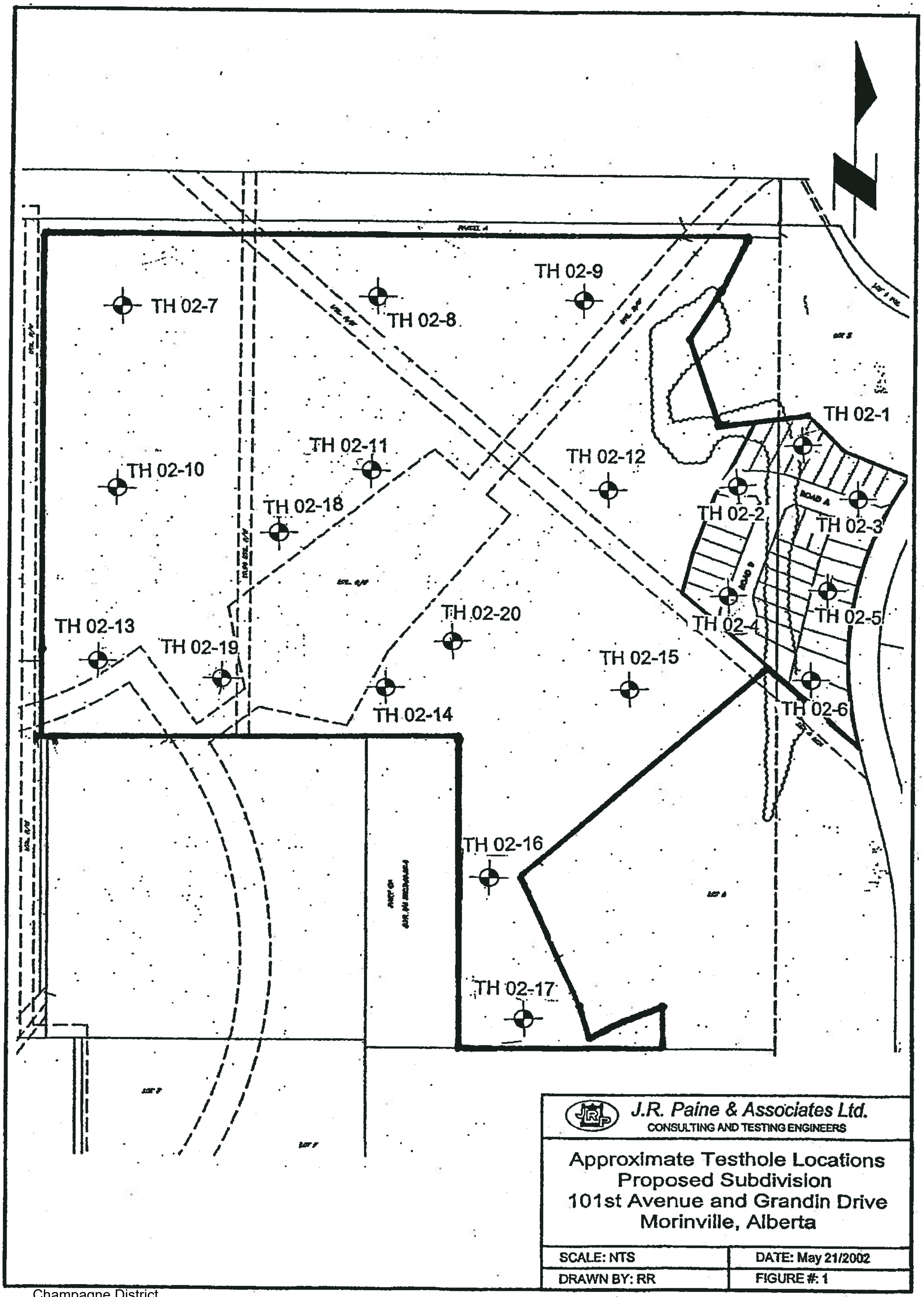
APPENDIX



J.R. Paine & Associates Ltd.
CONSULTING AND TESTING ENGINEERS

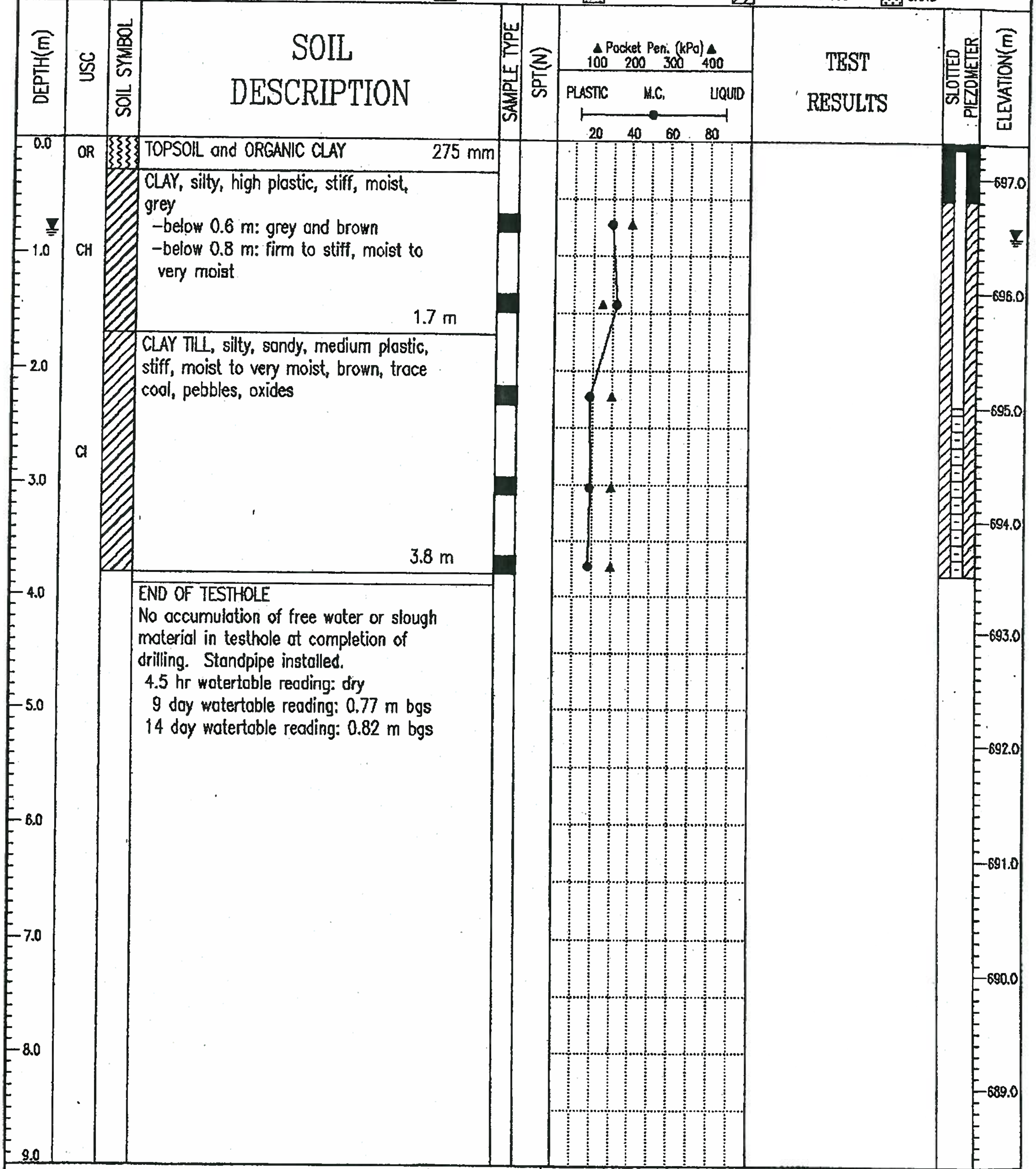
Approximate Testhole Locations
Proposed Subdivision
101st Avenue and Grandin Drive
Morinville, Alberta

SCALE: NTS	DATE: May 21/2002
DRAWN BY: RR	FIGURE #: 1

PROJECT: Proposed Subdivision	CLIENT: Landrex Developments c/o ISL	TEST HOLE NO: 02-1
LOCATION: NW of 101 Ave. and Grandin Dr.	DRILL METHOD: Solid Stem Auger	PROJECT NO: 2461-170
Morinville, Alberta	PROJECT ENGINEER: RR	ELEVATION: 697.31 (m)

SAMPLE TYPE ■ Disturbed ▨ Shelby Tube ☒ SPT ☰ Bulk

BACKFILL TYPE ■ BENTONITE ⁚ PEA GRAVEL ▥ SLOUGH ▣ GROUT ▨ DRILL CUTTINGS ▩ SAND



TOPSOIL and ORGANIC CLAY 275 mm

CLAY, silty, high plastic, stiff, moist, grey
- below 0.6 m: grey and brown
- below 0.8 m: firm to stiff, moist to very moist

1.7 m

CLAY TILL, silty, sandy, medium plastic, stiff, moist to very moist, brown, trace coal, pebbles, oxides

3.8 m

END OF TESTHOLE
No accumulation of free water or slough material in testhole at completion of drilling. Standpipe installed.
4.5 hr watertable reading: dry
9 day watertable reading: 0.77 m bgs
14 day watertable reading: 0.82 m bgs

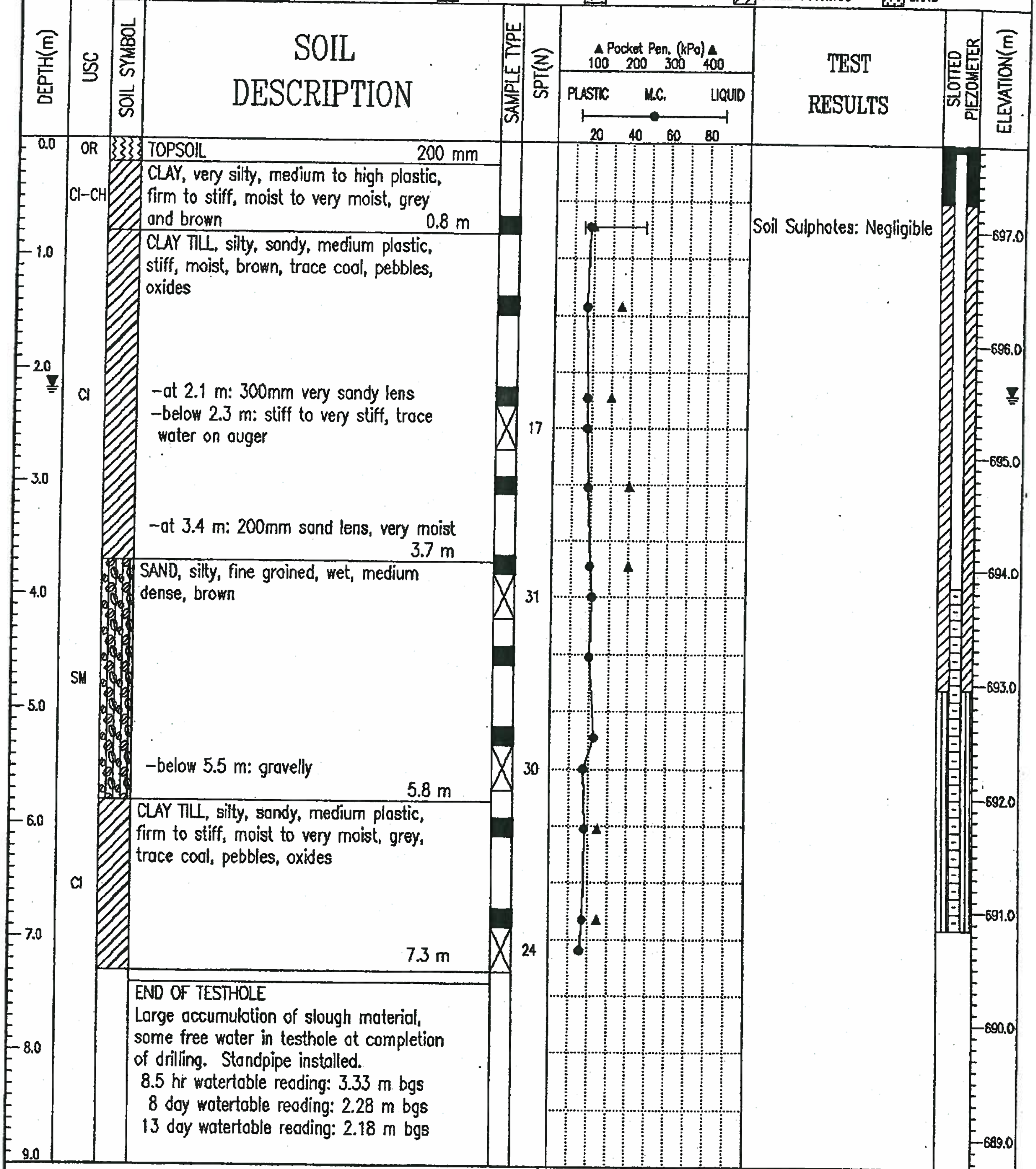
J.R. Paine & Associates	LOGGED BY: RR	COMPLETION DEPTH: 3.8 m
Edmonton, Alberta	REVIEWED BY: RE	COMPLETE: 02/05/21
	Fig. No: 2	Page 1 of 1

02/06/27 10:32AM (ELEV09HP)

PROJECT: Proposed Subdivision	CLIENT: Landrex Developments c/o ISL	TEST HOLE NO: 02-2
LOCATION: NW of 101 Ave. and Grandin Dr.	DRILL METHOD: Solid Stem Auger	PROJECT NO: 2461-170
Morinville, Alberta	PROJECT ENGINEER: RR	ELEVATION: 697.75 (m)

SAMPLE TYPE ■ Disturbed ▨ Shelby Tube ☒ SPT ☰ Bulk

BACKFILL TYPE ■ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ▨ GROUT ▨ DRILL CUTTINGS ▩ SAND



USC	SOIL DESCRIPTION	SPT(N)	TEST RESULTS
OR	TOPSOIL 200 mm		
CI-CH	CLAY, very silty, medium to high plastic, firm to stiff, moist to very moist, grey and brown 0.8 m		Soil Sulphotes: Negligible
CI	CLAY TILL, silty, sandy, medium plastic, stiff, moist, brown, trace coal, pebbles, oxides -at 2.1 m: 300mm very sandy lens -below 2.3 m: stiff to very stiff, trace water on auger -at 3.4 m: 200mm sand lens, very moist 3.7 m	17	
SM	SAND, silty, fine grained, wet, medium dense, brown -below 5.5 m: gravelly 5.8 m	31 30	
CI	CLAY TILL, silty, sandy, medium plastic, firm to stiff, moist to very moist, grey, trace coal, pebbles, oxides 7.3 m	24	

END OF TESTHOLE

Large accumulation of slough material, some free water in testhole at completion of drilling. Standpipe installed.

8.5 hr watertable reading: 3.33 m bgs

8 day watertable reading: 2.28 m bgs

13 day watertable reading: 2.18 m bgs

J.R. Paine & Associates Edmonton, Alberta	LOGGED BY: RR	COMPLETION DEPTH: 7.3 m
	REVIEWED BY: RE	COMPLETE: 02/05/22
	Fig. No: 3	Page 1 of 1

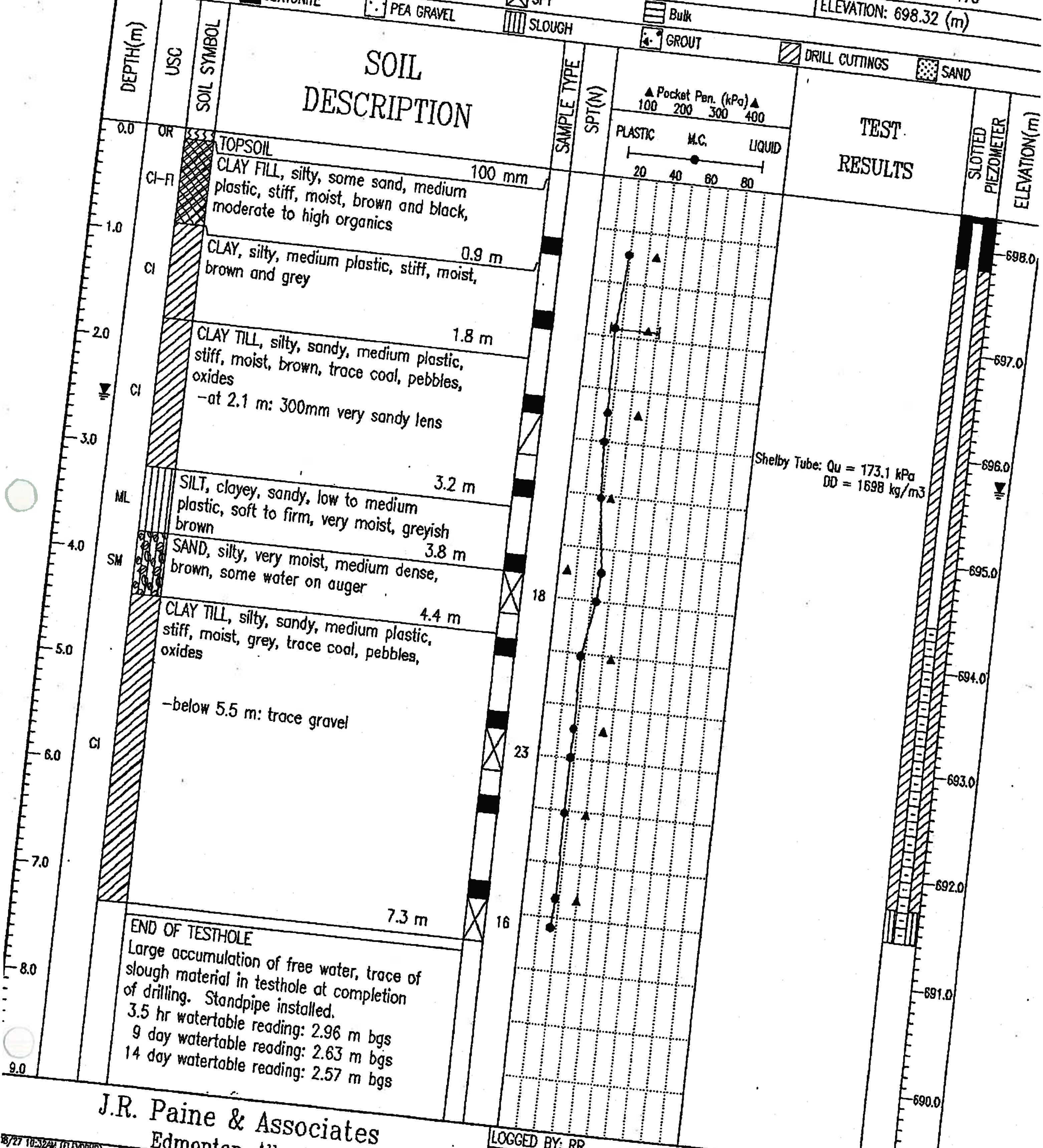
02/06/27 10:32AM (ELEV09HP)

PROJECT: Proposed Subdivision
LOCATION: NW of 101 Ave. and Grandin Dr.
Morinville, Alberta

CLIENT: Landrex Developments c/o ISL
DRILL METHOD: Solid Stem Auger
PROJECT ENGINEER: RR

TEST HOLE NO: 02-3
PROJECT NO: 2461-170
ELEVATION: 698.32 (m)

SAMPLE TYPE ■ Disturbed ▨ Shelby Tube ☒ SPT ☰ Bulk
BACKFILL TYPE ■ BENTONITE ⁚ PEA GRAVEL ||| SLOUGH ▫ GROUT ▨ DRILL CUTTINGS ░ SAND



TOPSOIL 100 mm

CLAY FILL, silty, some sand, medium plastic, stiff, moist, brown and black, moderate to high organics 0.9 m

CLAY, silty, medium plastic, stiff, moist, brown and grey 1.8 m

CLAY TILL, silty, sandy, medium plastic, stiff, moist, brown, trace coal, pebbles, oxides
-at 2.1 m: 300mm very sandy lens 3.2 m

SILT, clayey, sandy, low to medium plastic, soft to firm, very moist, greyish brown 3.8 m

SAND, silty, very moist, medium dense, brown, some water on auger 4.4 m

CLAY TILL, silty, sandy, medium plastic, stiff, moist, grey, trace coal, pebbles, oxides

-below 5.5 m: trace gravel 7.3 m

END OF TESTHOLE
Large accumulation of free water, trace of slough material in testhole at completion of drilling. Standpipe installed.
3.5 hr watertable reading: 2.96 m bgs
9 day watertable reading: 2.63 m bgs
14 day watertable reading: 2.57 m bgs

Shelby Tube: Qu = 173.1 kPa
DD = 1698 kg/m3

J.R. Paine & Associates
Edmonton, Alberta

LOGGED BY: RR
REVIEWED BY: RE
COMPLETION DEPTH: 7.3

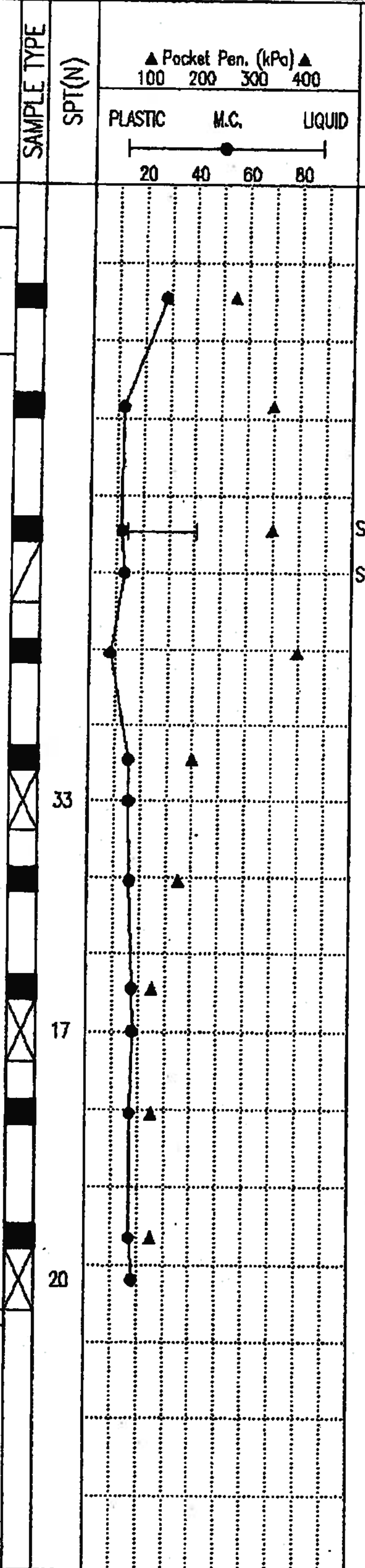
18/27 10:32AM (ELEVDSHP)

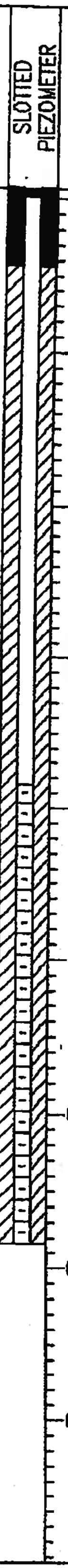
PROJECT: Proposed Subdivision	CLIENT: Landrex Developments c/o ISL	TEST HOLE NO: 02-4
LOCATION: NW of 101 Ave. and Grandin Dr.	DRILL METHOD: Solid Stem Auger	PROJECT NO: 2461-170
Morinville, Alberta	PROJECT ENGINEER: RR	ELEVATION: 698.06 (m)

SAMPLE TYPE ■ Disturbed ▨ Shelby Tube ☒ SPT ☰ Bulk

BACKFILL TYPE ■ BENTONITE ⁚ PEA GRAVEL ▥ SLOUGH ▦ GROUT ▨ DRILL CUTTINGS ▩ SAND

DEPTH(m)	USC	SOIL DESCRIPTION	SPT(N)	TEST RESULTS
0.0	OR	TOPSOIL 275 mm		
	CH	CLAY, silty, high plastic, stiff, moist, greyish brown with white streaks 1.1 m		
1.0		CLAY TILL, silty, sandy, medium plastic, very stiff, moist, brown, trace coal, pebbles, oxides		
2.0		-below 2.3 m: trace gravel, occasional small sand lenses		Soil Sulphates: Low Shelby Tube: Qu = 663.5 kPa DD = 1961 kg/m3
3.0		-at 3.4 m: 150mm sand lens, damp to moist -below 3.5 m: stiff, grey		
4.0	CI		33	
5.0		-below 4.9 m: moist to very moist	17	
7.0		7.3 m	20	
8.0		END OF TESTHOLE No accumulations of free water or slough material in testhole at completion of drilling. Standpipe installed. 8.0 hr watertable reading: dry 8 day watertable reading: dry 13 day watertable reading: dry		
9.0				





J.R. Paine & Associates Edmonton, Alberta	LOGGED BY: RR	COMPLETION DEPTH: 7.3 m
	REVIEWED BY: RE	COMPLETE: 02/05/22
	Fig. No: 5	Page 1 of 1

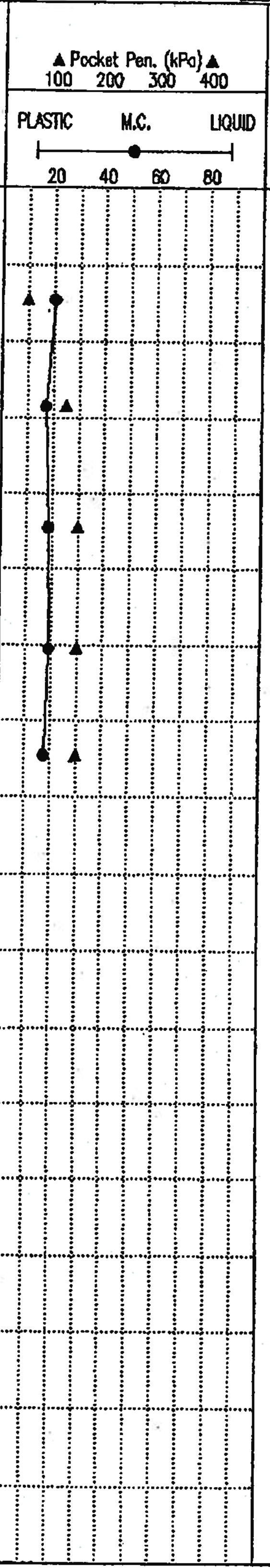
02/06/27 10:32AM (ELEV09HP)

PROJECT: Proposed Subdivision	CLIENT: Landrex Developments c/o ISL	TEST HOLE NO: 02-5
LOCATION: NW of 101 Ave. and Grandin Dr.	DRILL METHOD: Solid Stem Auger	PROJECT NO: 2461-170
Morinville, Alberta	PROJECT ENGINEER: RR	ELEVATION: 698.23 (m)

SAMPLE TYPE ■ Disturbed ▨ Shelby Tube ☒ SPT ☰ Bulk

BACKFILL TYPE ■ BENTONITE ⁙ PEA GRAVEL ▥ SLOUGH ▩ GROUT ▨ DRILL CUTTINGS ⁙ SAND

DEPTH(m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SPT(N)	TEST RESULTS	SLOTTED PIEZOMETER	ELEVATION(m)
0.0	OR		TOPSOIL 250 mm				■	
	CI	▨	CLAY, silty, medium plastic, firm, very moist, brown 0.9 m	■			■	698.0
1.0	CI	▨	CLAY TILL, silty, sandy, medium plastic, stiff, moist, brown, trace coal, pebbles, oxides -at 1.2 m: 150mm sand lens, moist -below 2.7 m: brownish grey -below 3.4 m: grey 3.8 m	■ ■ ■ ■			▨	697.0 696.0 695.0
4.0			END OF TESTHOLE No accumulation of free water or slough material in testhole at completion of drilling. Standpipe installed. 2.5 hr watertable reading: 1.83 m bgs 9 day watertable reading: 1.57 m bgs 14 day watertable reading: 1.50 m bgs					694.0
5.0								693.0
6.0								692.0
7.0								691.0
8.0								690.0
9.0								



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Edmonton, Alberta

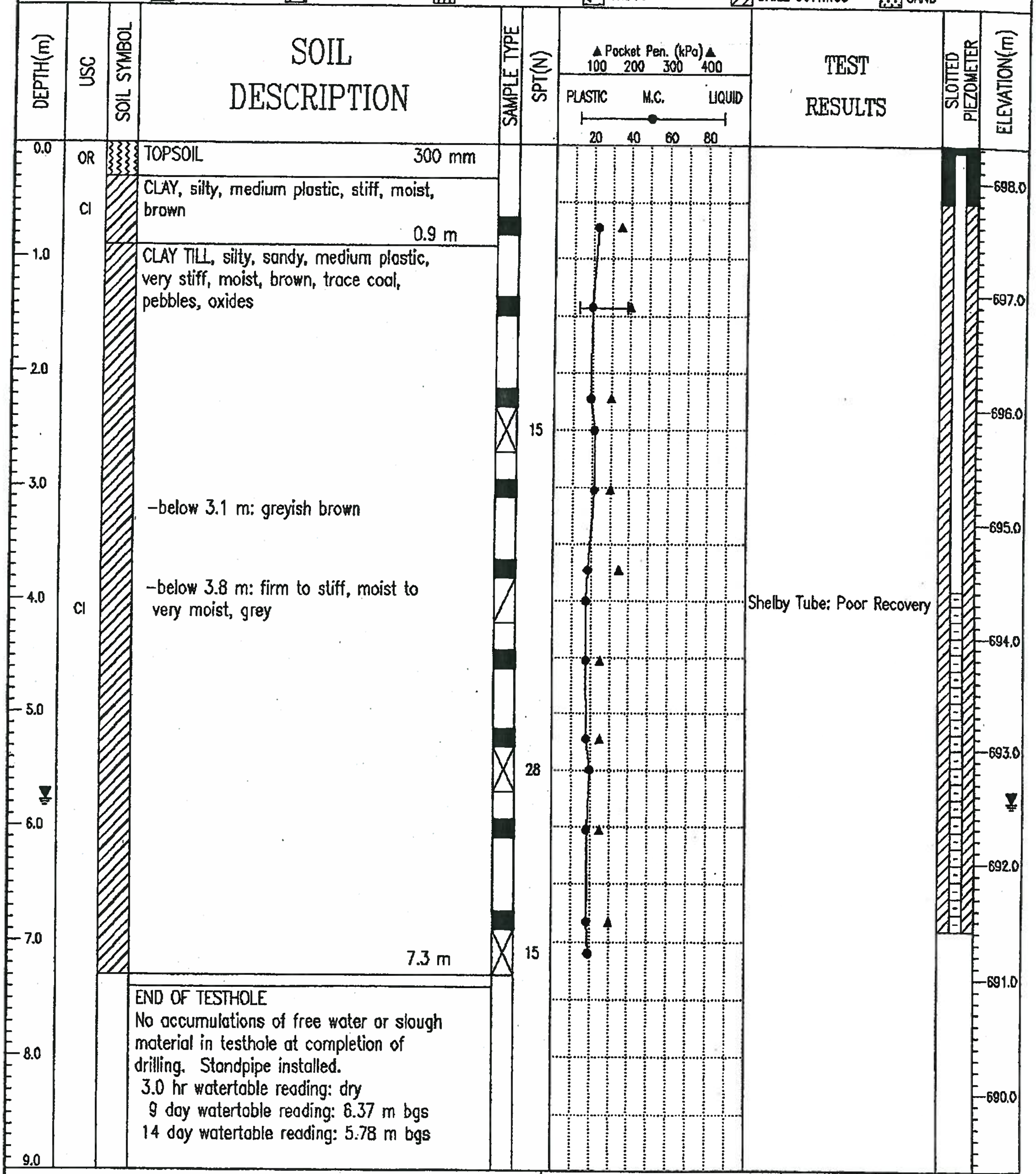
LOGGED BY: RR	COMPLETION DEPTH: 3.8 m
REVIEWED BY: RE	COMPLETE: 02/05/21
Fig. No: 6	Page 1 of 1

02/08/27 10:33AM (ELEV09HP)

PROJECT: Proposed Subdivision	CLIENT: Landrex Developments c/o ISL	TEST HOLE NO: 02-6
LOCATION: NW of 101 Ave. and Grandin Dr.	DRILL METHOD: Solid Stem Auger	PROJECT NO: 2461-170
Morinville, Alberta	PROJECT ENGINEER: RR	ELEVATION: 698.32 (m)

SAMPLE TYPE: ■ Disturbed ▨ Shelby Tube ☒ SPT ☰ Bulk

BACKFILL TYPE: ■ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ⁛ GROUT ▨ DRILL CUTTINGS ▩ SAND



TOPSOIL 300 mm

CLAY, silty, medium plastic, stiff, moist, brown 0.9 m

CLAY TILL, silty, sandy, medium plastic, very stiff, moist, brown, trace coal, pebbles, oxides

-below 3.1 m: greyish brown

-below 3.8 m: firm to stiff, moist to very moist, grey

7.3 m

Shelby Tube: Poor Recovery

END OF TESTHOLE

No accumulations of free water or slough material in testhole at completion of drilling. Standpipe installed.

3.0 hr watertable reading: dry

9 day watertable reading: 6.37 m bgs

14 day watertable reading: 5.78 m bgs

J.R. Paine & Associates Edmonton, Alberta	LOGGED BY: RR	COMPLETION DEPTH: 7.3 m
	REVIEWED BY: RE	COMPLETE: 02/05/21
	Fig. No: 7	Page 1 of 1

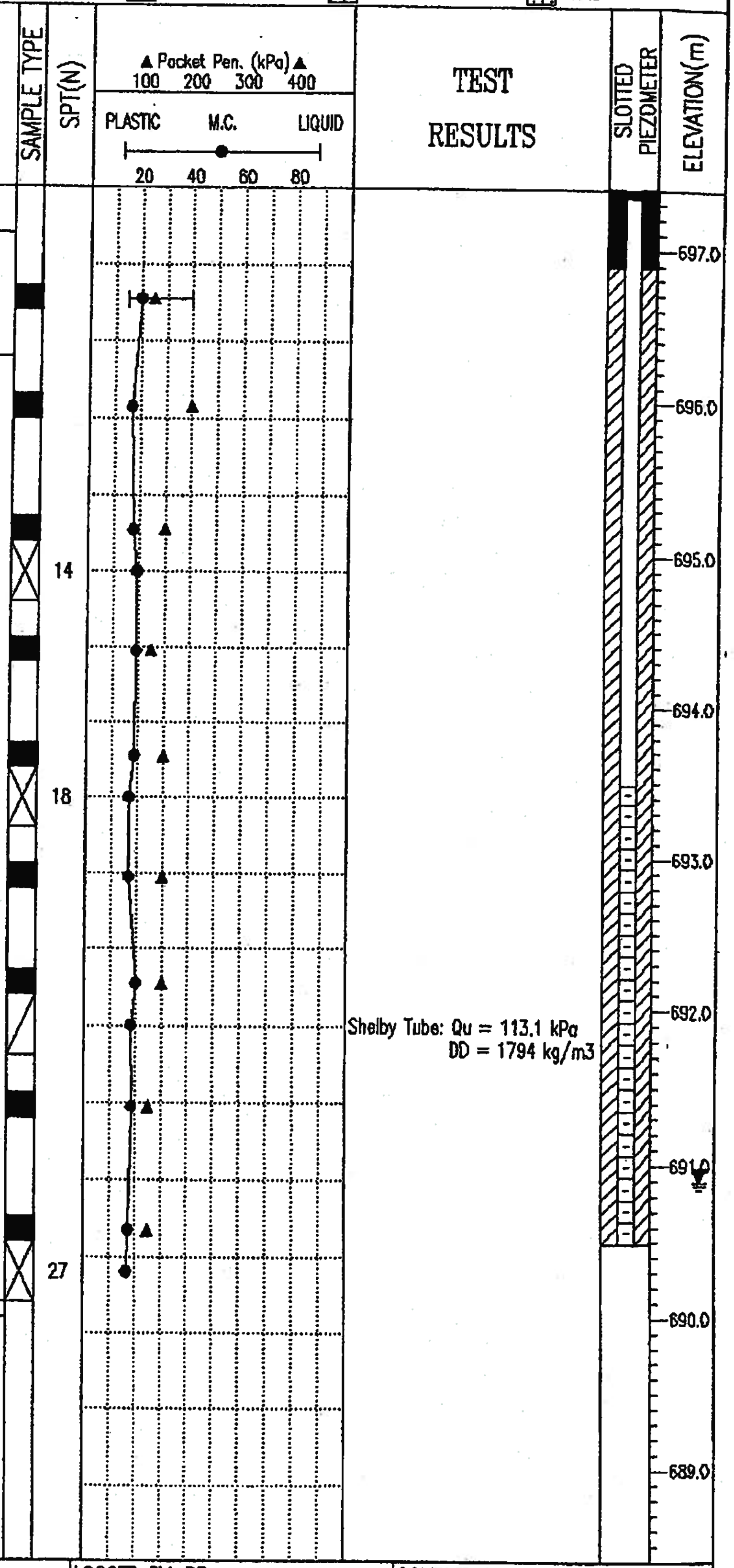
02/08/27 10:33AM (ELEV09HP)

PROJECT: Proposed Subdivision	CLIENT: Landrex Developments c/o ISL	TEST HOLE NO: 02-7
LOCATION: NW of 101 Ave. and Grandin Dr.	DRILL METHOD: Solid Stem Auger	PROJECT NO: 2461-170
Morinville, Alberta	PROJECT ENGINEER: RR	ELEVATION: 697.39 (m)

SAMPLE TYPE ■ Disturbed ▨ Shelby Tube ☒ SPT ☰ Bulk

BACKFILL TYPE ■ BENTONITE ⁙ PEA GRAVEL ▥ SLOUGH ▦ GROUT ▨ DRILL CUTTINGS ▦ SAND

DEPTH(m)	USC	SOIL DESCRIPTION
0.0	OR	TOPSOIL 300 mm
	CI	CLAY, silty, medium plastic, stiff, moist, brown 1.1 m
1.1	CI	CLAY TILL, silty, sandy, medium plastic, stiff, moist, brown, trace coal, pebbles, oxides –below 2.3 m: slightly more moist, greyish brown –at 2.3 m: 50mm coal lens –below 3.5 m: grey 7.3 m
7.3		END OF TESTHOLE No accumulations of free water or slough material in testhole at completion of drilling. Standpipe installed. 1.5 hr watertable reading: dry 8 day watertable reading: dry 13 day watertable reading: 6.50 m bgs



TEST RESULTS

Shelby Tube: Qu = 113.1 kPa
DD = 1794 kg/m3

J.R. Paine & Associates Edmonton, Alberta	LOGGED BY: RR	COMPLETION DEPTH: 7.3 m
	REVIEWED BY: RE	COMPLETE: 02/05/22
	Fig. No: 8	Page 1 of 1

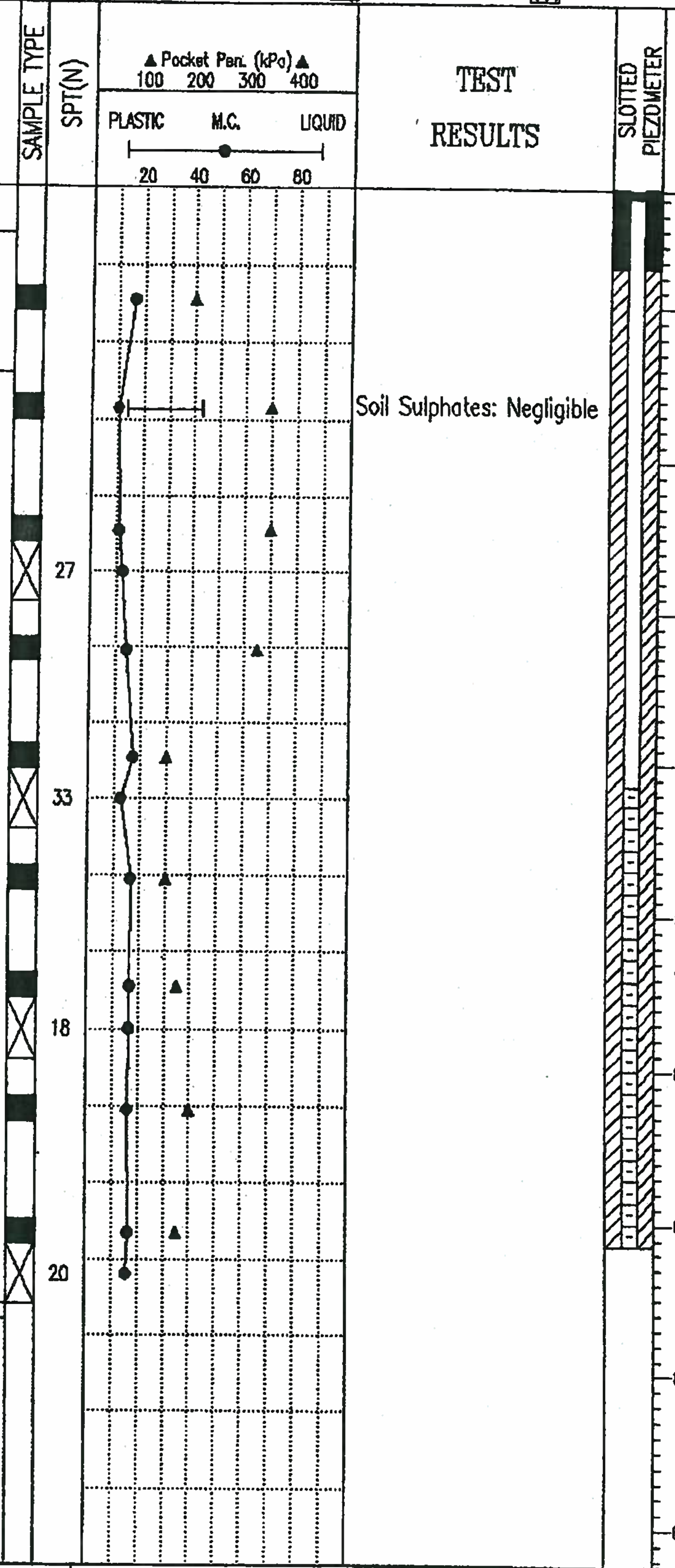
02/06/27 10:33AM (ELEV09HP)

PROJECT: Proposed Subdivision	CLIENT: Landrex Developments c/o ISL	TEST HOLE NO: 02-8
LOCATION: NW of 101 Ave. and Grandin Dr.	DRILL METHOD: Solid Stem Auger	PROJECT NO: 2461-170
Morinville, Alberta	PROJECT ENGINEER: RR	ELEVATION: 698.76 (m)

SAMPLE TYPE: ■ Disturbed ▨ Shelby Tube ☒ SPT ☰ Bulk

BACKFILL TYPE: ■ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ⁖ GROUT ▨ DRILL CUTTINGS ▩ SAND

DEPTH (m)	USC	SOIL DESCRIPTION	TEST RESULTS
0.0	OR	TOPSOIL 300 mm	
	CI	CLAY, silty, medium plastic, stiff, moist, brown 1.2 m	
1.2	CI	CLAY TILL, silty, sandy, medium plastic, very stiff, moist, brown, trace coal, pebbles, oxides -below 3.5 m: stiff, greyish brown -at 3.5 m: 100mm sand lens, moist -below 4.6 m: grey 7.3 m	Soil Sulphates: Negligible



END OF TESTHOLE
No accumulations of free water or slough material in testhole at completion of drilling. Standpipe installed.
1.0 hr watertable reading: dry
8 day watertable reading: dry
13 day watertable reading: dry

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Edmonton, Alberta

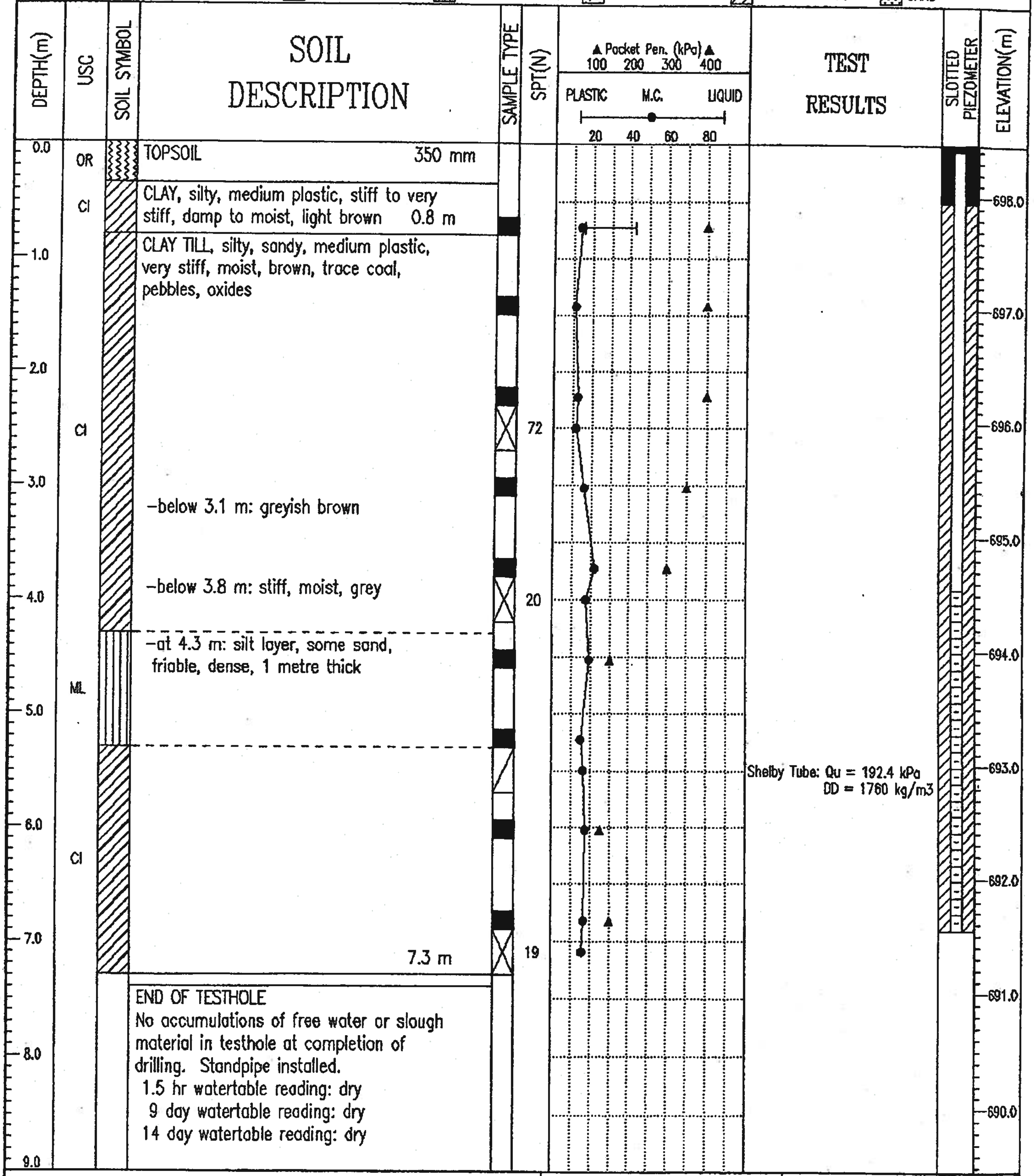
LOGGED BY: RR
REVIEWED BY: RE
Fig. No: 9

COMPLETION DEPTH: 7.3 m
COMPLETE: 02/05/22
Page 1 of 1

02/08/27 11:53AM (ELEV08HP)

PROJECT: Proposed Subdivision
CLIENT: Landrex Developments c/o ISL
TEST HOLE NO: 02-9
LOCATION: NW of 101 Ave. and Grandin Dr.
Morinville, Alberta
DRILL METHOD: Solid Stem Auger
PROJECT NO: 2461-170
PROJECT ENGINEER: RR
ELEVATION: 698.45 (m)

SAMPLE TYPE ■ Disturbed ▨ Shelby Tube ☒ SPT ☰ Bulk
BACKFILL TYPE ■ BENTONITE ⁛ PEA GRAVEL ▥ SLOUGH ▨ GROUT ▨ DRILL CUTTINGS ⁛ SAND



TOPSOIL 350 mm

CLAY, silty, medium plastic, stiff to very stiff, damp to moist, light brown 0.8 m

CLAY TILL, silty, sandy, medium plastic, very stiff, moist, brown, trace coal, pebbles, oxides

-below 3.1 m: greyish brown

-below 3.8 m: stiff, moist, grey

-at 4.3 m: silt layer, some sand, friable, dense, 1 metre thick

7.3 m

Shelby Tube: Qu = 192.4 kPa
DD = 1760 kg/m3

END OF TESTHOLE
No accumulations of free water or slough material in testhole at completion of drilling. Standpipe installed.
1.5 hr watertable reading: dry
9 day watertable reading: dry
14 day watertable reading: dry

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Edmonton, Alberta

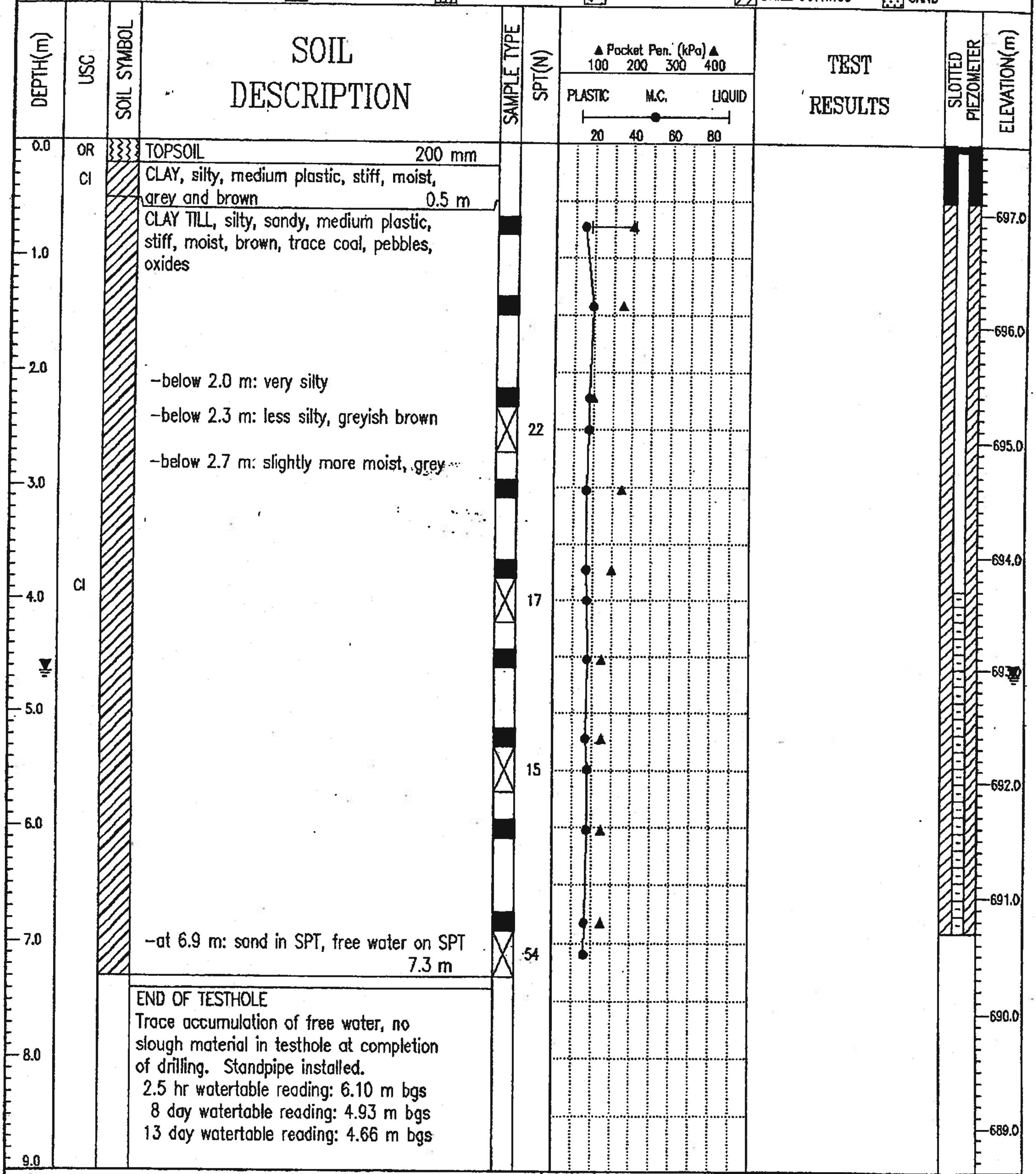
LOGGED BY: RR
REVIEWED BY: RE
Fig. No: 10
COMPLETION DEPTH: 7.3 m
COMPLETE: 02/05/21
Page 1 of 1

02/06/27 10:33AM (ELEVGRHP)

PROJECT: Proposed Subdivision	CLIENT: Landrex Developments c/o ISL	TEST HOLE NO: 02-10
LOCATION: NW of 101 Ave. and Grandin Dr.	DRILL METHOD: Solid Stem Auger	PROJECT NO: 2461-170
Morinville, Alberta	PROJECT ENGINEER: RR	ELEVATION: 697.6 (m)

SAMPLE TYPE ■ Disturbed ▨ Shelby Tube ☒ SPT ☰ Bulk

BACKFILL TYPE ■ BENTONITE ⁙ PEA GRAVEL ▥ SLOUGH ▣ GROUT ▨ DRILL CUTTINGS ▦ SAND



TOPSOIL 200 mm

CLAY, silty, medium plastic, stiff, moist, grey and brown 0.5 m

CLAY TILL, silty, sandy, medium plastic, stiff, moist, brown, trace coal, pebbles, oxides

-below 2.0 m: very silty

-below 2.3 m: less silty, greyish brown

-below 2.7 m: slightly more moist, grey

-at 6.9 m: sand in SPT, free water on SPT 7.3 m

END OF TESTHOLE

Trace accumulation of free water, no slough material in testhole at completion of drilling. Standpipe installed.

2.5 hr watertable reading: 6.10 m bgs

8 day watertable reading: 4.93 m bgs

13 day watertable reading: 4.66 m bgs

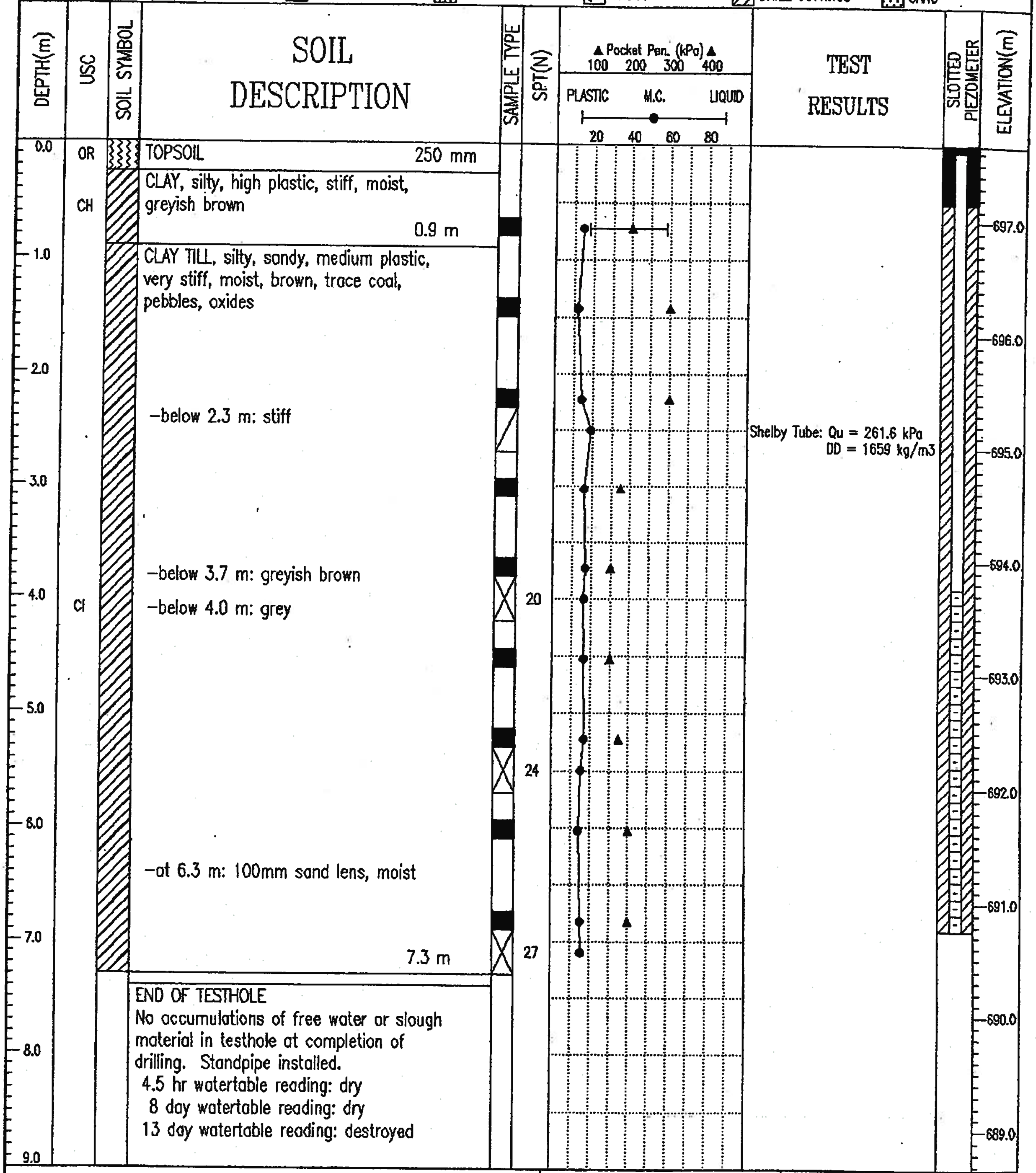
J.R. Paine & Associates Edmonton, Alberta	LOGGED BY: RR	COMPLETION DEPTH: 7.3 m
	REVIEWED BY: RE	COMPLETE: 02/05/22
	Fig. No: 11	Page 1 of 1

02/08/27 10:33AM (ELEV05HP)

PROJECT: Proposed Subdivision	CLIENT: Landrex Developments c/o ISL	TEST HOLE NO: 02-11
LOCATION: NW of 101 Ave. and Grandin Dr.	DRILL METHOD: Solid Stem Auger	PROJECT NO: 2461-170
Morinville, Alberta	PROJECT ENGINEER: RR	ELEVATION: 697.66 (m)

SAMPLE TYPE: ■ Disturbed ▨ Shelby Tube ☒ SPT ☰ Bulk

BACKFILL TYPE: ■ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ⁘ GROUT ▨ DRILL CUTTINGS ▩ SAND



SOIL DESCRIPTION

TOPSOIL 250 mm

CLAY, silty, high plastic, stiff, moist, greyish brown 0.9 m

CLAY TILL, silty, sandy, medium plastic, very stiff, moist, brown, trace coal, pebbles, oxides

-below 2.3 m: stiff

-below 3.7 m: greyish brown

-below 4.0 m: grey

-at 6.3 m: 100mm sand lens, moist

7.3 m

END OF TESTHOLE
No accumulations of free water or slough material in testhole at completion of drilling. Standpipe installed.
4.5 hr watertable reading: dry
8 day watertable reading: dry
13 day watertable reading: destroyed

TEST RESULTS

Shelby Tube: Qu = 261.6 kPa
DD = 1659 kg/m3

J.R. Paine & Associates Edmonton, Alberta	LOGGED BY: RR	COMPLETION DEPTH: 7.3 m
	REVIEWED BY: RE	COMPLETE: 02/05/22
	Fig. No: 12	Page 1 of 1

02/08/27 10:33AM (ELEV09HP)

PROJECT: Proposed Subdivision
LOCATION: NW of 101 Ave. and Grandin Dr.
Morinville, Alberta

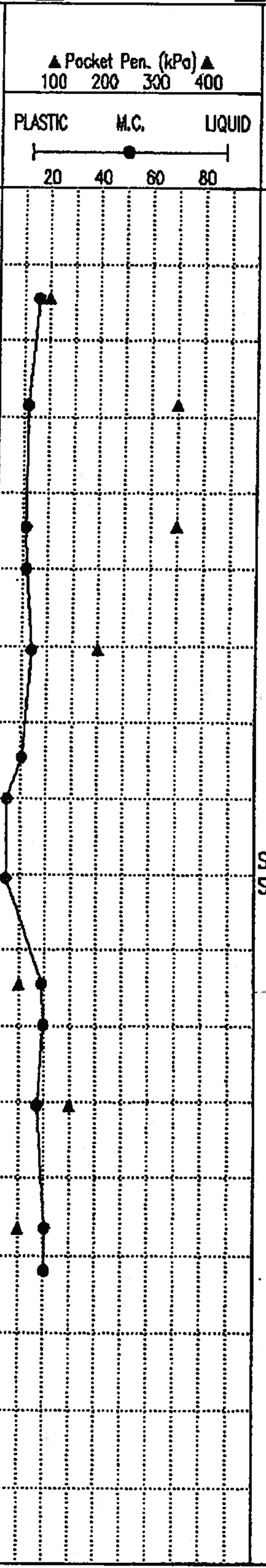
CLIENT: Landrex Developments c/o ISL
DRILL METHOD: Solid Stem Auger
PROJECT ENGINEER: RR

TEST HOLE NO: 02-12
PROJECT NO: 2461-170
ELEVATION: 697.86 (m)

SAMPLE TYPE: ■ Disturbed ◪ Shelby Tube ☒ SPT ☰ Bulk

BACKFILL TYPE: ■ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ▨ GROUT ▨ DRILL CUTTINGS ▩ SAND

DEPTH(m)	USC	SOIL DESCRIPTION	SPT(N)	TEST RESULTS
0.0	OR	TOPSOIL 350 mm		
	CI	CLAY, silty, medium plastic, firm to stiff, moist to very moist, brown with orange and white streaks 1.1 m		
1.0	CI	CLAY TILL, silty, sandy, medium plastic, very stiff, moist, brown, trace coal, pebbles, oxides -at 2.4 m: 150mm sandy silt lens, damp 3.5 m	40	
	SM	SAND, silty, damp, medium dense, fine to medium grained, light brown 4.7 m	28	Soil Sulphates: Negligible Sieve: 86.6 % Sand 13.4 % Silt and Clay
5.0	ML	SILT, clayey, some sand, low to medium plastic, firm, very moist, olive brown and grey 5.8 m	27	
6.0	CI	CLAY TILL, silty, sandy, medium plastic, stiff, moist, grey, trace coal, pebbles, oxides 6.6 m		
7.0	ML	SILT, clayey, low to medium plastic, firm, very moist, grey/brown 7.3 m	23	
8.0		END OF TESTHOLE No accumulations of free water or slough material in testhole at completion of drilling. Standpipe installed. 0.5 hr watertable reading: 6.54 m bgs 9 day watertable reading: 5.74 m bgs 14 day watertable reading: 5.77 m bgs		
9.0				



SLOTTED PIEZOMETER

ELEVATION(m): 697.0, 696.0, 695.0, 694.0, 693.0, 692.0, 691.0, 690.0, 689.0

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Edmonton, Alberta

LOGGED BY: RR
REVIEWED BY: RE
Fig. No: 13

COMPLETION DEPTH: 7.3 m
COMPLETE: 02/05/21
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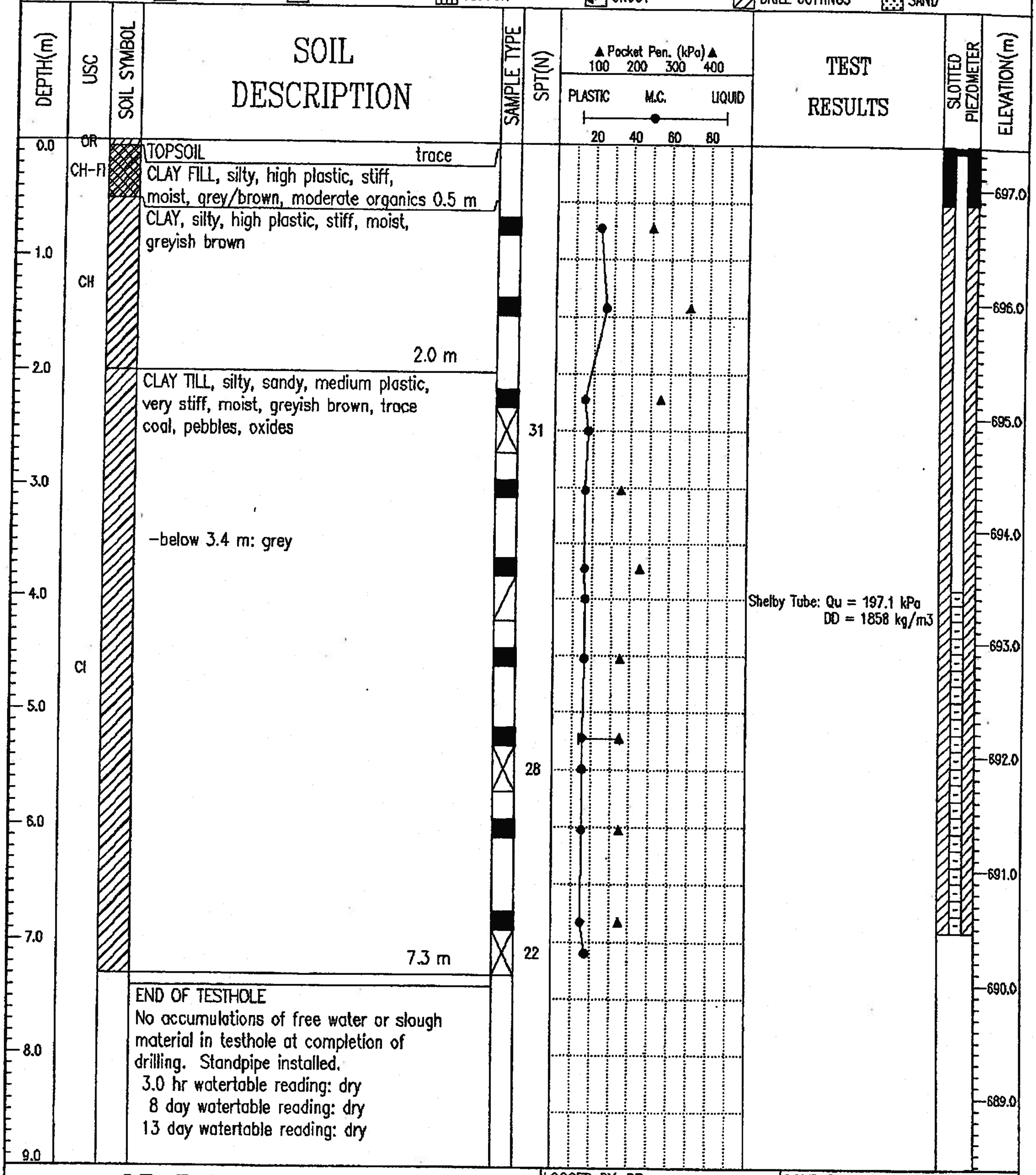
02/08/27 10:33AM (ELEV09HP)

PROJECT: Proposed Subdivision	CLIENT: Landrex Developments c/o ISL	TEST HOLE NO: 02-13
LOCATION: NW of 101 Ave. and Grandin Dr.	DRILL METHOD: Solid Stem Auger	PROJECT NO: 2461-170
Morinville, Alberta	PROJECT ENGINEER: RR	ELEVATION: 697.37 (m)

SAMPLE TYPE ■ Disturbed ◪ Shelby Tube ☒ SPT ☰ Bulk

BACKFILL TYPE ■ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ▣ GROUT ▨ DRILL CUTTINGS ░ SAND



TOPSOIL trace

CLAY FILL, silty, high plastic, stiff, moist, grey/brown, moderate organics 0.5 m

CLAY, silty, high plastic, stiff, moist, greyish brown 2.0 m

CLAY TILL, silty, sandy, medium plastic, very stiff, moist, greyish brown, trace coal, pebbles, oxides

-below 3.4 m: grey

7.3 m

END OF TESTHOLE
No accumulations of free water or slough material in testhole at completion of drilling. Standpipe installed.
3.0 hr watertable reading: dry
8 day watertable reading: dry
13 day watertable reading: dry

Shelby Tube: Qu = 197.1 kPa
DD = 1858 kg/m3

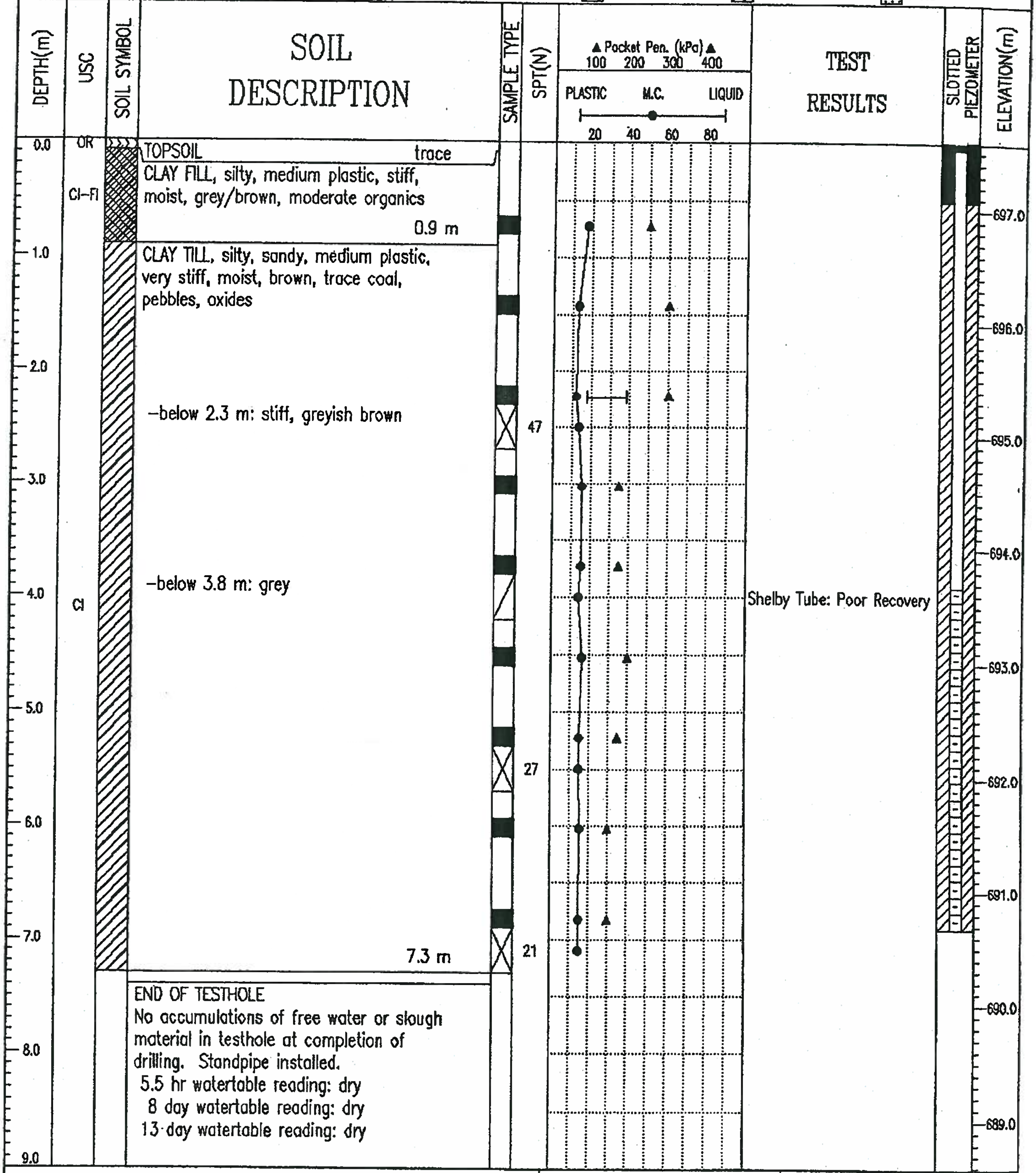
J.R. Paine & Associates Edmonton, Alberta	LOGGED BY: RR	COMPLETION DEPTH: 7.3 m
	REVIEWED BY: RE	COMPLETE: 02/05/22
	Fig. No: 14	Page 1 of 1

02/08/27 10:33AM (ELEV09HP)

PROJECT: Proposed Subdivision	CLIENT: Landrex Developments c/o ISL	TEST HOLE NO: 02-14
LOCATION: NW of 101 Ave. and Grandin Dr.	DRILL METHOD: Solid Stem Auger	PROJECT NO: 2461-170
Morinville, Alberta	PROJECT ENGINEER: RR	ELEVATION: 697.58 (m)

SAMPLE TYPE ■ Disturbed ◪ Shelby Tube ☒ SPT ▤ Bulk

BACKFILL TYPE ■ BENTONITE ⁙ PEA GRAVEL ▥ SLOUGH ▩ GROUT ▨ DRILL CUTTINGS ▦ SAND



SOIL DESCRIPTION

TOPSOIL trace

CLAY FILL, silty, medium plastic, stiff, moist, grey/brown, moderate organics

0.9 m

CLAY TILL, silty, sandy, medium plastic, very stiff, moist, brown, trace coal, pebbles, oxides

-below 2.3 m: stiff, greyish brown

-below 3.8 m: grey

7.3 m

END OF TESTHOLE
No accumulations of free water or slough material in testhole at completion of drilling. Standpipe installed.
5.5 hr watertable reading: dry
8 day watertable reading: dry
13 day watertable reading: dry

TEST RESULTS

Shelby Tube: Poor Recovery

J.R. Paine & Associates Edmonton, Alberta	LOGGED BY: RR REVIEWED BY: RE Fig. No: 15
	COMPLETION DEPTH: 7.3 m COMPLETE: 02/05/22 Page 1 of 1

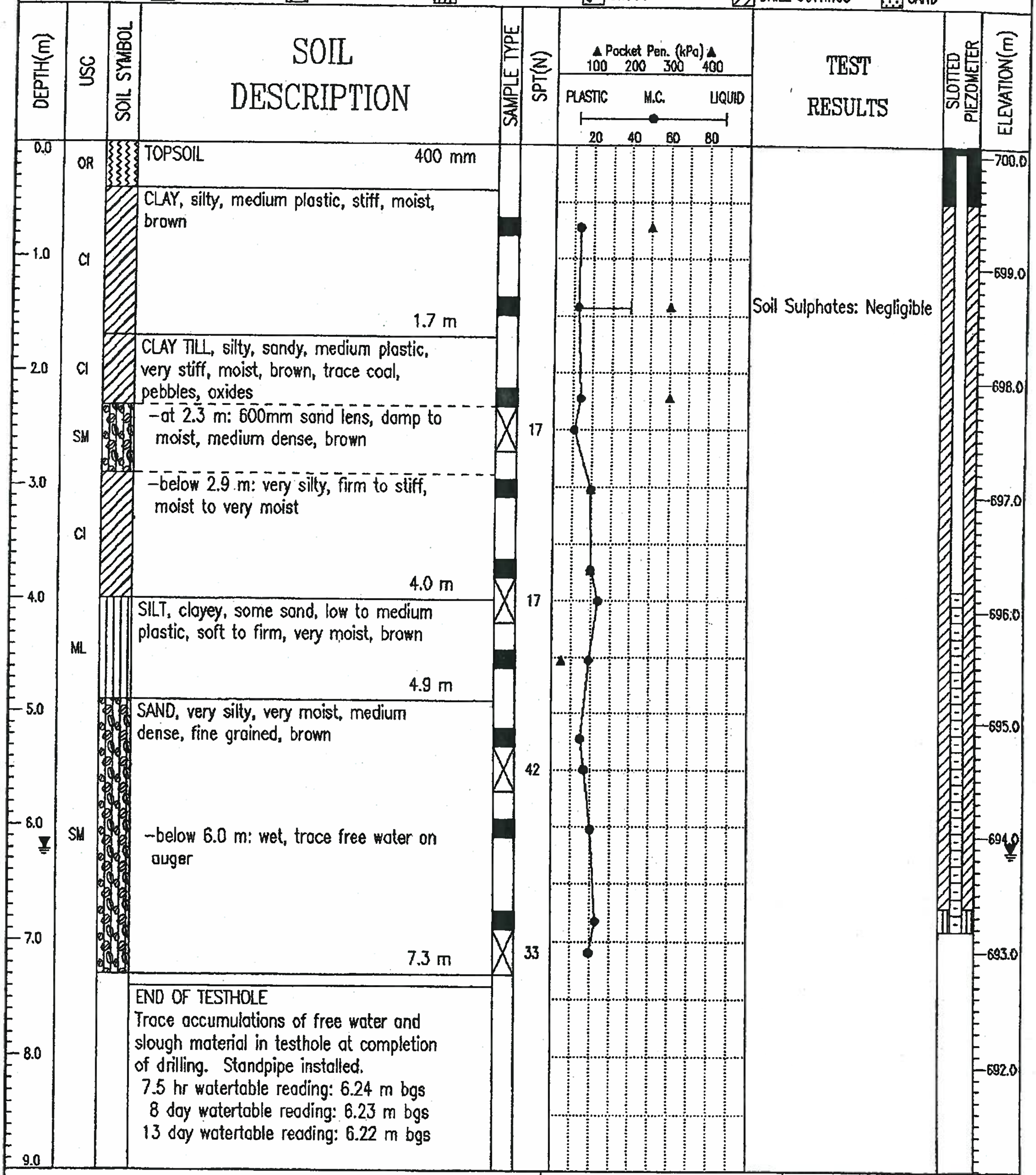
02/06/27 10:34AM (ELEV09HP)

PROJECT: Proposed Subdivision
LOCATION: NW of 101 Ave. and Grandin Dr.
Morinville, Alberta

CLIENT: Landrex Developments c/o ISL
DRILL METHOD: Solid Stem Auger
PROJECT ENGINEER: RR

TEST HOLE NO: 02-15
PROJECT NO: 2461-170
ELEVATION: 700.08 (m)

SAMPLE TYPE ■ Disturbed ▨ Shelby Tube ☒ SPT ☰ Bulk
BACKFILL TYPE ■ BENTONITE ⁚ PEA GRAVEL ▥ SLOUGH ⁘ GROUT ▨ DRILL CUTTINGS ▩ SAND



TOPSOIL 400 mm

CLAY, silty, medium plastic, stiff, moist, brown 1.7 m

CLAY TILL, silty, sandy, medium plastic, very stiff, moist, brown, trace coal, pebbles, oxides

-at 2.3 m: 600mm sand lens, damp to moist, medium dense, brown

-below 2.9 m: very silty, firm to stiff, moist to very moist 4.0 m

SILT, clayey, some sand, low to medium plastic, soft to firm, very moist, brown 4.9 m

SAND, very silty, very moist, medium dense, fine grained, brown

-below 6.0 m: wet, trace free water on auger 7.3 m

END OF TESTHOLE
Trace accumulations of free water and slough material in testhole at completion of drilling. Standpipe installed.
7.5 hr watertable reading: 6.24 m bgs
8 day watertable reading: 6.23 m bgs
13 day watertable reading: 6.22 m bgs

Soil Sulphates: Negligible

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Edmonton, Alberta

LOGGED BY: RR
REVIEWED BY: RE
Fig. No: 16

COMPLETION DEPTH: 7.3 m
COMPLETE: 02/05/22
Page 1 of 1

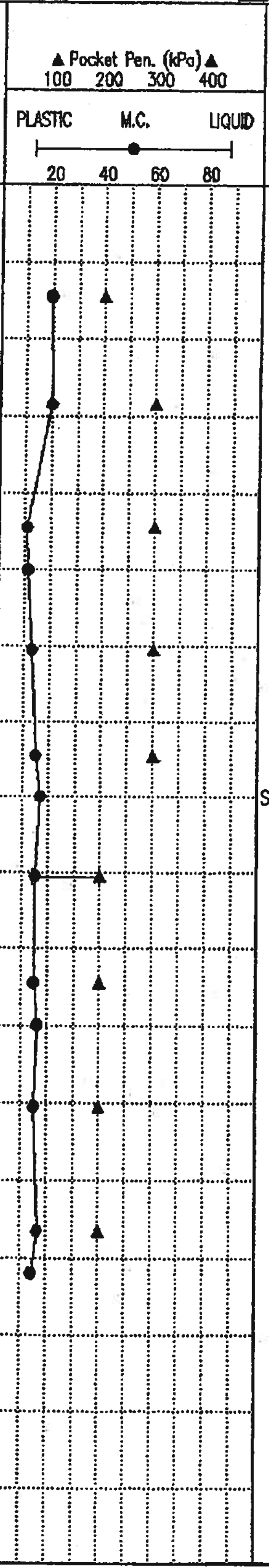
02/08/27 1E:34AM (ELEV09HP)

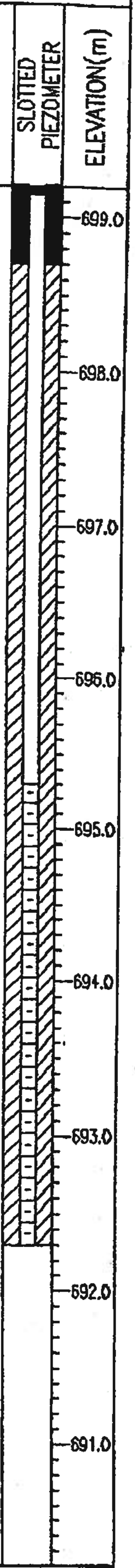
PROJECT: Proposed Subdivision	CLIENT: Landrex Developments c/o ISL	TEST HOLE NO: 02-16
LOCATION: NW of 101 Ave. and Grandin Dr.	DRILL METHOD: Solid Stem Auger	PROJECT NO: 2461-170
Morinville, Alberta	PROJECT ENGINEER: RR	ELEVATION: 699.2 (m)

SAMPLE TYPE ■ Disturbed ▨ Shelby Tube ☒ SPT ☰ Bulk

BACKFILL TYPE ■ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ⁘ GROUT ▨ DRILL CUTTINGS ⁘ SAND

DEPTH(m)	USC	SOIL DESCRIPTION	SPT(N)	TEST RESULTS
0.0	OR	TOPSOIL 100 mm		
	CI-FI	CLAY FILL, silty, medium plastic, stiff, moist, brown/black, moderate-high organics -below 0.5 m: high organics 1.1 m		
1.0	CI	CLAY TILL, silty, sandy, medium plastic, very stiff, moist, brown, trace coal, pebbles, oxides		
2.0			48	
4.0				Shelby Tube: Qu = 163.9 kPa DD = 1855 kg/m3
		-below 4.6 m: stiff to very stiff, greyish brown		
5.0			26	
7.0		7.3 m	27	
		END OF TESTHOLE No accumulations of free water or slough material in testhole at completion of drilling. Standpipe installed. 6.5 hr watertable reading: dry 8 day watertable reading: dry 13 day watertable reading: dry		
9.0				





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Edmonton, Alberta

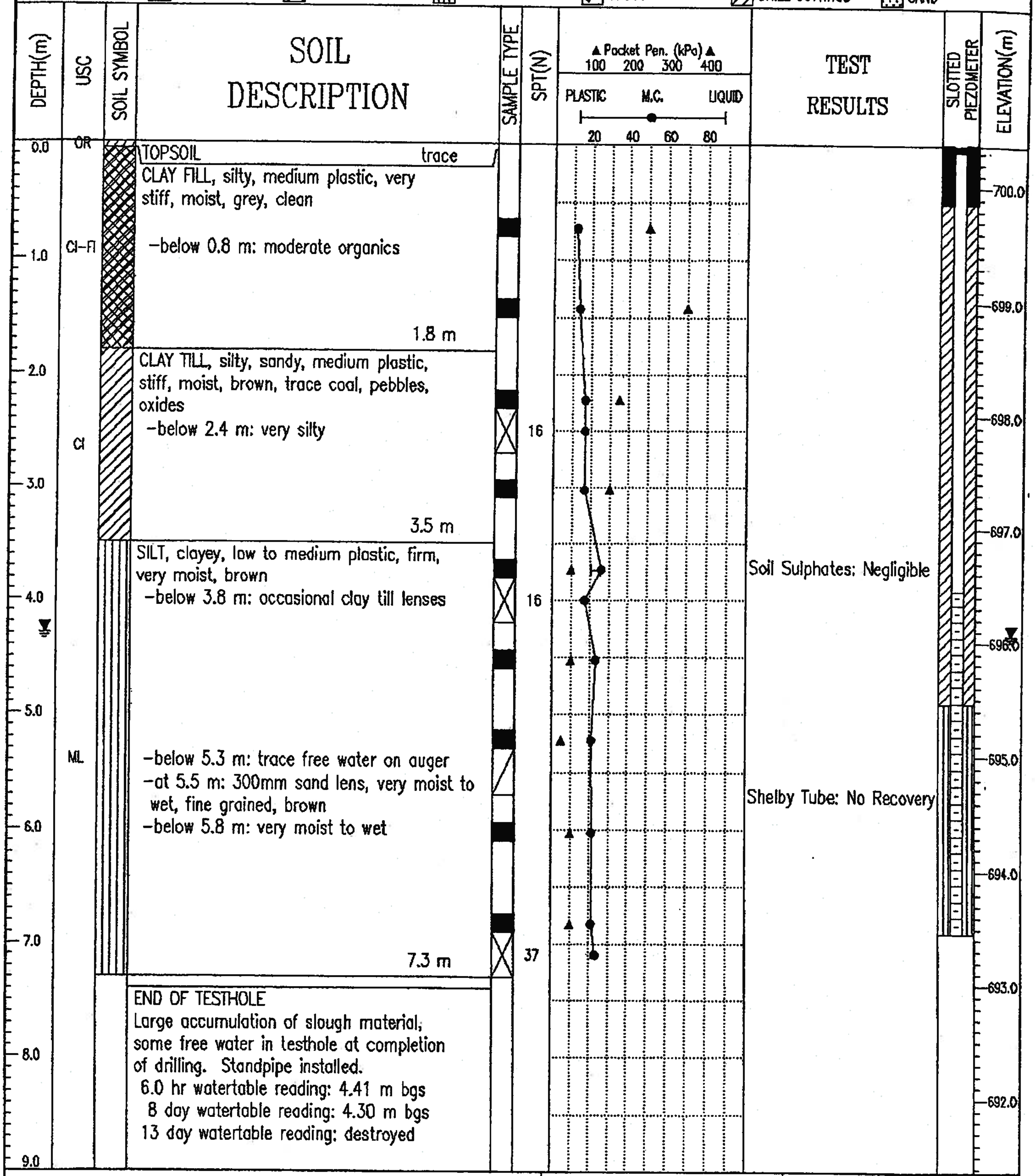
LOGGED BY: RR	COMPLETION DEPTH: 7.3 m
REVIEWED BY: RE	COMPLETE: 02/05/22
Fig. No: 17	Page 1 of 1

02/08/27 11:34AM (ELEV09HP)

PROJECT: Proposed Subdivision	CLIENT: Landrex Developments c/o ISL	TEST HOLE NO: 02-17
LOCATION: NW of 101 Ave. and Grandin Dr.	DRILL METHOD: Solid Stem Auger	PROJECT NO: 2461-170
Morinville, Alberta	PROJECT ENGINEER: RR	ELEVATION: 700.36 (m)

SAMPLE TYPE ■ Disturbed ▨ Shelby Tube ☒ SPT ☰ Bulk

BACKFILL TYPE ■ BENTONITE ⁙ PEA GRAVEL ▥ SLOUGH ▦ GROUT ▨ DRILL CUTTINGS ▩ SAND



TOPSOIL trace

CLAY FILL, silty, medium plastic, very stiff, moist, grey, clean

-below 0.8 m: moderate organics

1.8 m

CLAY TILL, silty, sandy, medium plastic, stiff, moist, brown, trace coal, pebbles, oxides

-below 2.4 m: very silty

3.5 m

SILT, clayey, low to medium plastic, firm, very moist, brown

-below 3.8 m: occasional clay till lenses

-below 5.3 m: trace free water on auger

-at 5.5 m: 300mm sand lens, very moist to wet, fine grained, brown

-below 5.8 m: very moist to wet

7.3 m

END OF TESTHOLE

Large accumulation of slough material, some free water in testhole at completion of drilling. Standpipe installed.

6.0 hr watertable reading: 4.41 m bgs

8 day watertable reading: 4.30 m bgs

13 day watertable reading: destroyed

Soil Sulphates: Negligible

Shelby Tube: No Recovery

J.R. Paine & Associates Edmonton, Alberta	LOGGED BY: RR	COMPLETION DEPTH: 7.3 m
	REVIEWED BY: RE	COMPLETE: 02/05/22
	Fig. No: 18	Page 1 of 1

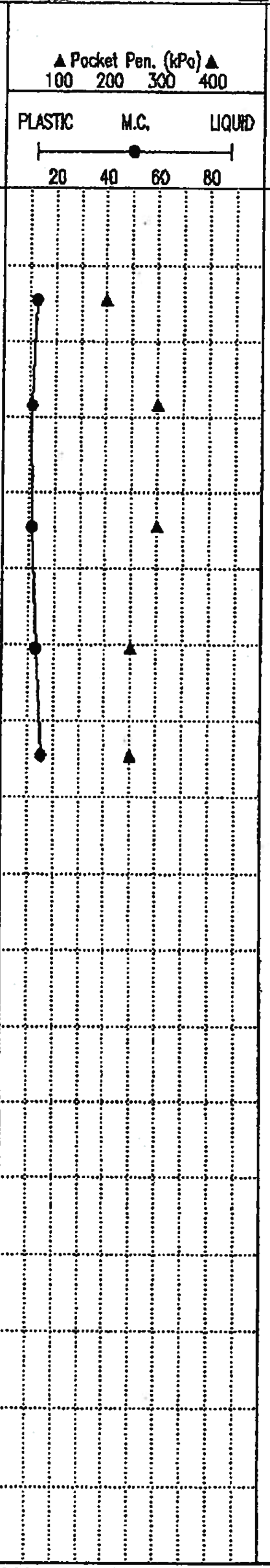
02/08/27 10:34AM (ELEVGWP)

PROJECT: Proposed Subdivision	CLIENT: Landrex Developments c/o ISL	TEST HOLE NO: 02-18
LOCATION: NW of 101 Ave. and Grandin Dr.	DRILL METHOD: Solid Stem Auger	PROJECT NO: 2461-170
Morinville, Alberta	PROJECT ENGINEER: RR	ELEVATION: 697.41 (m)

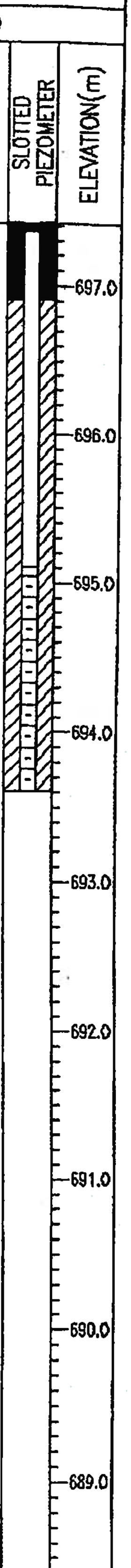
SAMPLE TYPE ■ Disturbed ▨ Shelby Tube ☒ SPT ☰ Bulk

BACKFILL TYPE ■ BENTONITE ⁙ PEA GRAVEL ▥ SLOUGH ▨ GROUT ▨ DRILL CUTTINGS ▩ SAND

DEPTH(m)	USC	SOIL DESCRIPTION
0.0	OR	TOPSOIL 100 mm
	CI-FI	CLAY FILL, silty, medium plastic, stiff, moist, brown, moderate organics 0.5 m
	CI	CLAY TILL, silty, sandy, medium plastic, very stiff, moist, brown, trace coal, pebbles, oxides -below 2.4 m: greyish brown -below 3.5 m: grey 3.8 m
4.0		END OF TESTHOLE No accumulation of free water or slough material in testhole at completion of drilling. Standpipe installed. 4.0 hr watertable reading: dry 8 day watertable reading: dry 13 day watertable reading: dry



TEST RESULTS



DEPTH(m): 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0

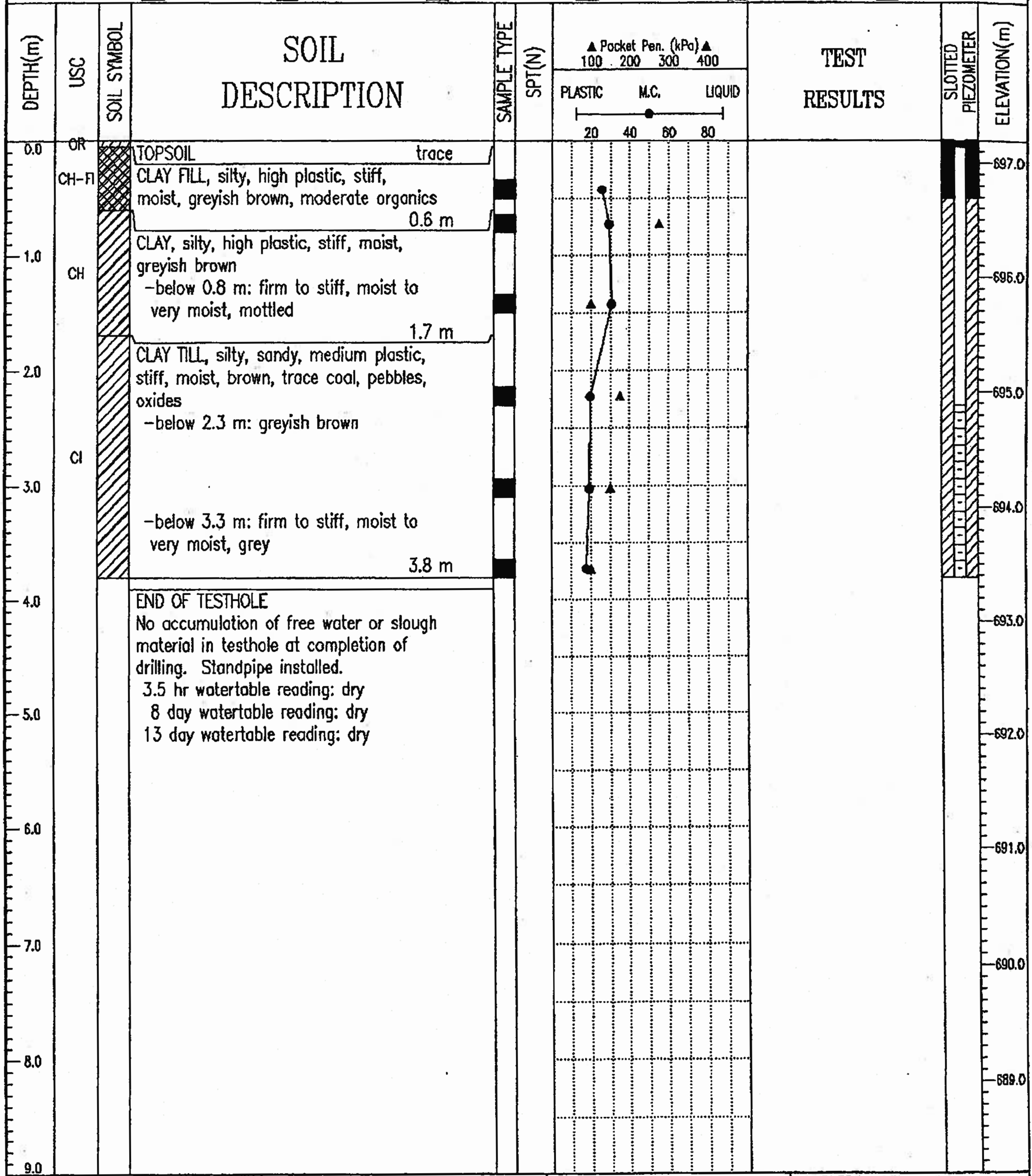
J.R. Paine & Associates Edmonton, Alberta	LOGGED BY: RR	COMPLETION DEPTH: 3.8 m
	REVIEWED BY: RE	COMPLETE: 02/05/22
	Fig. No: 19	Page 1 of 1

02/08/27 10:34AM (ELEV05HP)

PROJECT: Proposed Subdivision	CLIENT: Landrex Developments c/o ISL	TEST HOLE NO: 02-19
LOCATION: NW of 101 Ave. and Grandin Dr.	DRILL METHOD: Solid Stem Auger	PROJECT NO: 2461-170
Morinville, Alberta	PROJECT ENGINEER: RR	ELEVATION: 697.19 (m)

SAMPLE TYPE ■ Disturbed ▨ Shelby Tube ☒ SPT ☰ Bulk

BACKFILL TYPE ■ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ▦ GROUT ▨ DRILL CUTTINGS ▩ SAND



TOPSOIL trace

CLAY FILL, silty, high plastic, stiff, moist, greyish brown, moderate organics 0.6 m

CLAY, silty, high plastic, stiff, moist, greyish brown
- below 0.8 m: firm to stiff, moist to very moist, mottled

1.7 m

CLAY TILL, silty, sandy, medium plastic, stiff, moist, brown, trace coal, pebbles, oxides
- below 2.3 m: greyish brown
- below 3.3 m: firm to stiff, moist to very moist, grey

3.8 m

END OF TESTHOLE
No accumulation of free water or slough material in testhole at completion of drilling. Standpipe installed.
3.5 hr watertable reading: dry
8 day watertable reading: dry
13 day watertable reading: dry

J.R. Paine & Associates Edmonton, Alberta	LOGGED BY: RR	COMPLETION DEPTH: 3.8 m
	REVIEWED BY: RE	COMPLETE: 02/05/22
	Fig. No: 20	Page 1 of 1

02/08/27 10:34AM (ELEVOPHP)

PROJECT: Proposed Subdivision
LOCATION: NW of 101 Ave. and Grandin Dr.
Morinville, Alberta

CLIENT: Landrex Developments c/o ISL
DRILL METHOD: Solid Stem Auger
PROJECT ENGINEER: RR

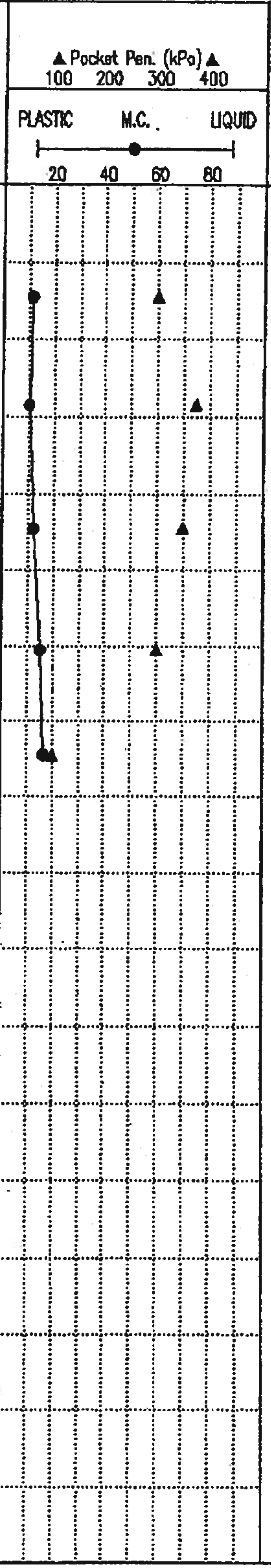
TEST HOLE NO: 02-20
PROJECT NO: 2461-170
ELEVATION: 698.97 (m)

SAMPLE TYPE ■ Disturbed ▨ Shelby Tube ☒ SPT ☰ Bulk
BACKFILL TYPE ■ BENTONITE ⁙ PEA GRAVEL ▥ SLOUGH ⁘ GROUT ▨ DRILL CUTTINGS ⁙ SAND

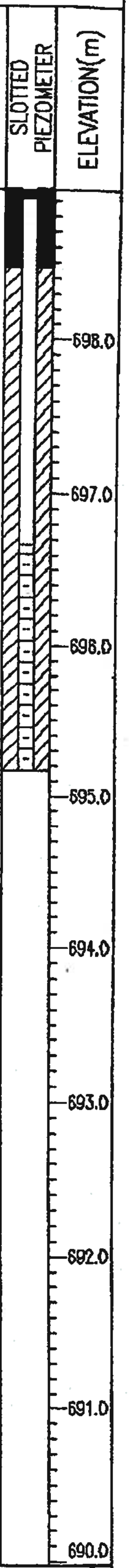
DEPTH(m)	USC	SOIL DESCRIPTION
0.0	OR	TOPSOIL 175 mm
	CI	CLAY, silty, medium plastic, stiff, moist, brown 0.5 m
	CI	CLAY TILL, silty, sandy, medium plastic, very stiff, moist, brown, trace coal, pebbles, oxides 3.2 m
	ML	SILT, clayey, low to medium plastic, firm to stiff, damp to moist, brown 3.8 m
		END OF TESTHOLE No accumulation of free water or slough material in testhole at completion of drilling. Standpipe installed. 5.0 hr watertable reading: dry 8 day watertable reading: dry 13 day watertable reading: dry

DEPTH(m): 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0

SAMPLE TYPE SPT(N)



TEST RESULTS



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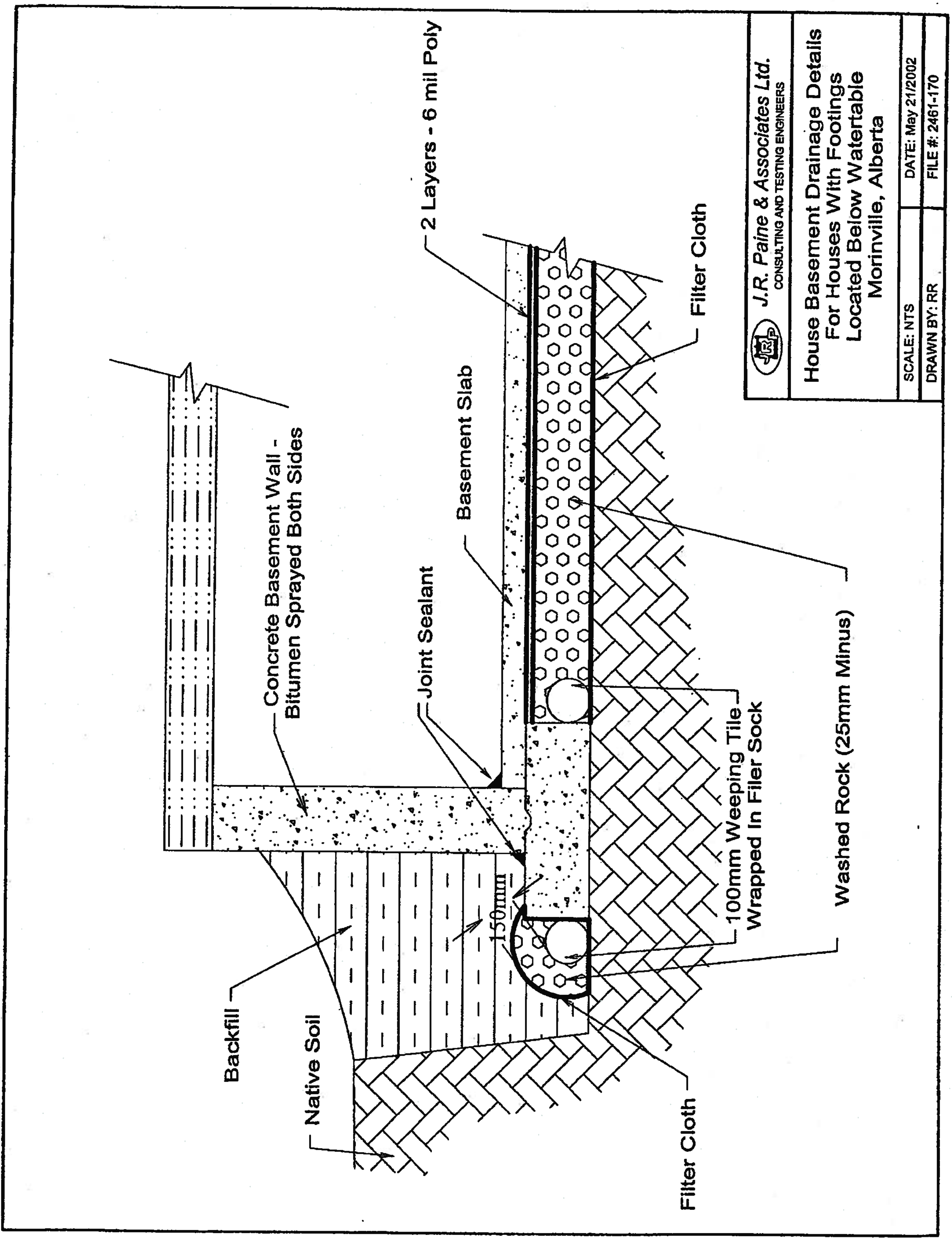
Edmonton, Alberta

LOGGED BY: RR
REVIEWED BY: RE
Fig. No: 21

COMPLETION DEPTH: 3.8 m
COMPLETE: 02/05/22
Page 1 of 1

02/08/27 11:34AM (ELEV09HP)


J.R. Paine & Associates Ltd.
CONSULTING AND TESTING ENGINEERS
House Basement Drainage Details
For Houses With Footings
Located Below Watertable
Morinville, Alberta
SCALE: NTS
DATE: May 21/2002
DRAWN BY: RR
FILE #: 2461-170
2 Layers - 6 mil Poly
Filter Cloth
Basement Slab
Concrete Basement Wall - Bitumen Sprayed Both Sides
Joint Sealant
Washed Rock (25mm Minus)
100mm Weeping Tile Wrapped In Filer Sock
150mm
Backfill
Native Soil
Filter Cloth

J.R. Paine & Associates Ltd.
CONSULTING AND TESTING ENGINEERS
EDMONTON — GRANDE PRAIRIE — PEACE RIVER — WHITEHORSE

17505 106 Avenue
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February 8, 2005
File No: 2461-258

LANDREX INVESTMENT COPORATION
c/o INFRASTRUCTURE SYSTEMS LTD.
100, 7909 – 51 Avenue
Edmonton, Alberta
T6E 5L9

ATTENTION: Mr. James Hickle, C.E.T.

Dear Sir:

Re: Geotechnical Investigation
Proposed Residential Subdivision
101 Avenue & 100 Street
Morinville Lakes Subdivision
Morinville, Alberta

Please find enclosed our report with respect to the above noted investigation. In brief, this report presents the general soil conditions and geotechnical recommendations for the proposed subdivision development.

Thank you for the privilege of providing this service to your organization. We will be pleased to meet with you to review the contents of this report at your convenience.

Yours truly,
J.R. PAINE & ASSOCIATES LTD.

Patrick Winski, E.I.T.

H:\DATA 2005\2461 Infrastructure Systems Limited\2461-258 Morinville Lakes Subdivision\r1477isl.doc

J.R. Paine & Associates Ltd.

REPORT NO: 2461-258

GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL SUBDIVISION
101 AVENUE & 100 STREET
MORINVILLE LAKES SUBDIVISION
MORINVILLE, ALBERTA

January, 2005

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J.R. Paine & Associates Ltd.

REPORT NO. 2461-258

GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL SUBDIVISION
101 AVENUE & 100 STREET
MORINVILLE LAKES SUBDIVISION
MORINVILLE, ALBERTA

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GEOTECHNICAL INVESTIGATION

PROJECT: Proposed Residential Subdivision

LOCATION:
101 Avenue & 100 Street
Morinville Lakes
Morinville, Alberta

CLIENT:
LANDREX INVESTMENT CORPORATION
c/o INFRASTRUCTURES SYSTEMS LTD.
100, 7909 – 51 Avenue
Edmonton, Alberta
T6E 5L9

ATTENTION: Mr. James Hickle

1.0 INTRODUCTION

This report presents the results of the subsurface investigation made on the site of the proposed residential subdivision in Morinville, Alberta. The objective of the investigation was to determine the subsoil data for use in the geotechnical planning, design, and construction aspects of the residential development project. Authorization to proceed was received from James Hickle in December, 2004. Field work for the project was completed on December 17, 2004.

2.0 PROJECT AND SITE DESCRIPTION

The proposed residential subdivision development is located north of 101 Avenue and east of 100 Street in Morinville, Alberta. The site is bordered on all sides by farm field. To the Northwest of the site was a proposed stormwater pond. In the Northwest corner of the site a number of small stockpiles were noted. At the time of the fieldwork the site was an empty field with some low vegetation, near the stockpiles. The site profile consisted of gradual rolling terrain with no discernable drainage. It is understood that a portion of the testing area was once the site of a sewage lagoon. This report will make geotechnical recommendations on aspects of residential subdivision construction in this area. However, any environmental concerns area beyond the scope of this report. Travel around the site was possible for a truck mounted vehicles. Access was obtained off 101 Avenue.

3.0 FIELD INVESTIGATION

The soils investigation for this project was undertaken on December 17, 2004 utilizing a truck mounted drill rig owned and operated by Canadian Geological Drilling Ltd.. A total of five testholes were drilled at this site, three testholes to 7.3 metres below ground surface and two to 2.3 metres, at locations shown on the attached site plan. The testhole layout was selected by J. R. Paine & Associates Ltd. prior to drilling.

The testholes were advanced with 150 millimetre diameter solid stem augers in 1.5 metre increments. A continuous visual description was recorded on site which included the soil types, depths, moisture, transitions, and other pertinent observations. Disturbed samples were removed from the auger cuttings at 750 millimetre intervals for laboratory testing. Standard Penetration Tests c/w split spoon sampling and Shelby tubes were also taken at regular 1.5 metre intervals.

Following the drilling operation, slotted piezometric standpipes were inserted into the three deep testholes for watertable level determination. The testholes were backfilled with cuttings, with a bentonite seal placed at the surface.

4.0 LABORATORY TESTING

All bag samples returned to the laboratory were tested for moisture content. Representative samples were further tested to determine the liquid and plastic limits of the Atterberg limit series. Selected samples were also tested to determine the concentration of soluble soil sulphates. Selected Shelby Tube samples were tested for unconfined compressive strength and dry density. The results of all laboratory and field testing are provided on the attached testhole logs.

5.0 SOIL CONDITIONS

A detailed description of the soils encountered is found on the attached testhole logs in the Appendix. In general, the soil conditions at this site consisted of surficial topsoil, underlain by a clay fill, and silty clay, overlying a glacial clay till material.

In three of the five of the testholes, a black, moist, surficial topsoil was the first soil encountered at this site. This material typically extended to between 150 and 200 millimetres. The topsoil depth is known only at the testhole locations, and may vary between testholes.

Below the topsoil and at the surface in Testholes 04-1 and 04-4 a silty clay fill was encountered. The clay fill was moist, with a medium plasticity and stiff consistency, and featured traces to some organics. Moisture contents were typically between 20 and 30 percent. This material featured pocket penetrometer values of approximately 100 kilopascals with some softer areas noted. Standard Penetration Test "N" values of 9 to 14 blows per 300 millimetres were noted for this deposit. The clay fill layer varied in depths, typically extending to depths between 0.9 to 2.9 metres below ground surface in the testholes.

A deposit of lacustrine clay was encountered below the fill material in all five testholes. The clay was typically silty, moist to very moist, and brown in color. It had a medium to high plasticity and a stiff consistency, and featured traces of coal, pebbles and oxides. Moisture contents of the clay were typically between 30 and 41 percent, with some low values noted. Atterberg Limit tests on this soil revealed plastic limits between approximately 15 to 23 percent, and liquid limits from approximately 41 to 53 percent. This material featured pocket penetrometer values of 100 to 150 kilopascals with some softer areas noted in Testhole 04-1. Standard Penetration Test "N" values of 6 to 11 blows per 300 millimetres were noted for this deposit. The clay layer extended to depths of between 3.2 to 5.1 metres and to termination in both of the shallow testholes.

Below the clay in the testholes, a glacial clay till was encountered. The clay till was typically silty and sandy, grey in color, with a medium plasticity. Various small sand lenses and laminations, as well as traces of coal, oxides and pebbles were located within the clay matrix. It generally had a stiff, moist consistency. Moisture contents ranged from approximately 17 to 20 percent, with a plastic limit of approximately 14 percent, and a liquid limit of 40 percent. This material featured pocket penetrometer values of 150 to 200 kilopascals. Standard Penetration Test "N" values of 18 to 30 blows per 300 millimetres were observed. The clay till was still being encountered to termination in all three deep testholes.

In Testhole 04-3, a deposit of ice rafted clay shale was encountered within the clay till layer. The clay shale was moist, grey in color with a high plasticity and very stiff consistency. Some oxides were noted throughout the deposit as well as some till lumps. The shale was approximately 1.0 metre in thickness.

6.0 GROUNDWATER CONDITIONS

The groundwater table within the study area varied from low to high. The observed water levels were generally between 1.6 and 3.3 metres below the ground surface with Testhole 04-3 remaining dry to 10.4 metres. Two sets of watertable readings were taken, with the results as follows:

Groundwater Table Readings
Morinville Lakes, Morinville, AB
(Metres Below Ground Surface)

Testhole	Conditions At Testhole Completion	6 Day 23-Dec-04	19 Day 5-Jan-05
04-1	No water or slough	3.32	3.43
04-2	No water or slough	2.30	1.62
04-3	No water or slough	Dry	Dry

It should be noted that water table levels may fluctuate on a seasonal or yearly basis with the highest readings obtained in the spring or after periods of heavy rainfall. The winter readings should be near seasonal lows.

7.0 RECOMMENDATIONS

7.1 House Foundations

1. No major problems are anticipated with construction of residential units on the non-organic native soils encountered throughout most of this site. The native subsurface soil conditions encountered throughout this site are considered satisfactory for supporting single family dwellings utilizing standard concrete footing foundations applying the Alberta Building Code Section 9. Fill and occasional underlying organic materials were encountered in many of the testholes. These materials are considered unsuitable for footing support. Slab-on-grade support would have to evaluated at the time of construction on a lot by lot basis, although support by the fill for this purpose is likely adequate.
2. Proper lot grading away from the houses must be provided to minimize the ingress of surface water into the subsoil. All houses will require at least 1.2 metres of earthen cover

to prevent potential frost heave problems, and to minimize movements associated with seasonal variations in moisture content. The amount of cover should be increased to 2.0 metres for exterior isolated footings or for footings of non-continuously heated structures.

3. Lot grading plans are not known at this time. If general lot grading will produce areas of fill extending in depth below that of the footing elevation, it is strongly recommended that qualified geotechnical personnel inspect the house excavations. Generally, it is not recommended that footings be constructed on non-engineered fill. In such cases, the following alternatives are commonly recommended:

   i) Removal of the fill down to native soil and replacement with a compacted granular material. A normal footing foundation may then be utilized.

   Or

   ii) Utilize a pile foundation.

4. In the case of pile foundations, some installation problems may be encountered. Very moist conditions and water seepage were encountered in Testholes 04-1 and 04-2 at various depths. Also difficulties may be encountered in the very sandy layers or sand lenses that were noted in the clay till material. While it is not likely that casing of the piles would be required, slowly ingressing groundwater may be encountered. Therefore, at the very least, pile concrete should be on-site during the pile drilling to allow for quick concrete placement.

5. Engineered fill may be considered in areas where low elevations necessitate deep fill zones. This option should be reviewed prior to implementation by a geotechnical consultant to evaluate site conditions and borrow material sources. Basically, engineered fill is fill which is placed in a controlled manner under the full-time inspection of a qualified soils technician. The fill is placed and compacted to a minimum 98 percent of its Standard Proctor Density near its optimum moisture content, in maximum 150 millimetre lifts. This includes all the fill in the testholes. All topsoil and non-engineered fill must first be stripped from the engineered fill area. It should be noted that engineered fill requires fill depth differentials across the building footprint of less than 1.5 metres.

   Engineered fill construction requires full-time monitoring and extensive testing by the geotechnical consultant during construction. However, proper placement of engineered fill will negate the need for pile foundations in deep lot fill areas, and possibly reduce the foundation costs to the builders and developer.

It should be noted that engineered fill construction is not possible in all situations. One of these situations occurs when soft, very moist, underlying soils are exposed once stripping has been completed. Compacting the first lift of fill material over these soft underlying soils to the engineered fill standard may be impossible. Where a minimum fill depth condition is met, construction of a clay pad approximately of 300 to 500 millimetres in thickness will be required to obtain an adequate working platform to start from. This pad should be compacted to a minimum of 95 percent of Standard Proctor Density where possible. The normal engineered fill lift thickness and compaction criteria mentioned above should be applied to successive lifts. To employ this method, a minimum of 1.0 metre of engineered fill must be placed on top of the clay pad. If this condition is not met, the fill would not be considered to have met engineered fill standards. In some cases, removal of native material may allow for the minimum fill depth or the maximum fill differential conditions to be met. However, this may not be the most economical solution.

6. No loose, disturbed, remoulded or slough material should be allowed to remain in the open footing excavations. Hand cleaning is advised if an acceptable surface cannot be prepared by mechanical equipment. In order to reduce the disturbance to the bearing surface, all basement excavations should be advanced by a backhoe operating remote from the bearing surface.
7. Footing excavations should be protected from drying, rain, snow, freezing and the ingress of surface or groundwater. Care should be taken to ensure that all exposed soils are protected from excessive drying or wetting. The soils encountered below the topsoil in the testholes were mostly medium plastic, and have a low to moderate swelling potential.
8. A 150 millimetre layer of free draining sand or sand-gravel mixture should be placed immediately below all floor slabs. This material should be uniformly compacted to 98 percent of the corresponding Standard Proctor Density at optimum moisture content.
9. A non-deteriorating vapour barrier should be placed immediately below the floor slab to prevent desiccation of the subgrade material.
10. Temporary dewatering may be required for basement excavations advanced below the

watertable. At a minimum, peripheral weeping tile lines will be required for all houses. All lines should be placed at or slightly below footing elevation and connected to ensure positive drainage to an approved system. The weeping tile lines will require a suitable clean tile rock drainage filter, with a minimum of 150 millimetres of filter around the line. Basements located below the water table may require interior drains and clean tile rock beneath the floor in addition to perimeter drains. The recommended configuration for houses with footing elevations located near the watertable is illustrated in the Appendix.

11. The time span between the start of excavation to installation of basement footings, walls, peripheral weeping tile and backfilling operations should be minimized in order to prevent any problems developing within the excavation due to ingressing of ground or surface waters or desiccation of the subsoil.
12. It is recommended that floor joists be placed prior to backfilling the excavation in order to minimize any detrimental effects on the foundation walls caused by backfilling operations.
13. During winter construction, it is essential that all interior fill and load bearing materials remain frost free. Recommended winter construction practices, with respect to hoarding and heating of the forms and the fresh concrete, should be followed. In order to minimize the potential frost heave problems, the interior of the building must be heated as soon as the walls have been poured. The period in which the excavation is left open due to freezing conditions should be as short as possible. If doubts remain as to the suitability of the foundation during construction, the builder should consult a qualified geotechnical engineer.

7.2 Underground Utilities

1. The subsurface soil conditions in the testholes were generally fair to good for the installation of underground utilities, with some difficulties anticipated in the wet silty clay encountered in Testholes 04-1, 04-2, and 04-3. The clay soils were mostly slightly above optimum moisture contents. Topsoil and other organic materials are not considered suitable for backfill material.
2. The watertable was between approximately 1.6 metres and 3.2 metres depth below ground surface in the testholes. Saturated soil conditions and ingressing groundwater may be

encountered in the trenches at this site, depending on the design elevations and location within the site. Temporary dewatering measures may be required during utility installation, pumping from the trenches during installation should be sufficient to maintain trench working conditions. Delays in construction may occur.

3. Standard trenching cutback angles of approximately 30 degrees from the vertical are anticipated for most areas of the site, although some portions of the moister clays and saturated sand seams may require increased cutback angles of 45 degrees or more in order to remain stable, due to their low strength and elevated moisture contents. Actual cutback angles should be determined in the field during construction. Exact stable slope values cannot be pinpointed without detailed and extensive analysis. For this reason, this information should be used as a guideline only and that the optimum cutback angles for utility trenches be determined in the field during construction. The Occupational Health and Safety Act, General Safety Regulation Item 173 and 174 should be strictly followed, except were superseded by this report.
4. To minimize pipe loading, trench widths should be minimal but compatible with safe construction operations. The trench width must be wide enough to accommodate pipe bedding and compaction equipment.
5. Temporary surcharge loads, such as spill piles, should not be allowed to within 2.0 metres of an unsupported excavation face, while mobile vehicles should be kept back at least 1.0 metre. All excavations should be checked regularly for signs of sloughing or failures, especially after rainfall periods.
6. Pipe bedding and trench backfill procedures should adhere to the Town of Morinville specifications as outlined in Municipal Engineering Standards. The backfill material beneath and above the pipe should be an approved bedding sand material where conditions allow. This material should be hand placed and hand tamped, with care taken to fill the underside of the pipe. However, ingressing groundwater was encountered in many of the testholes around the site. To overcome the installation difficulties which may be encountered where ingressing groundwater and/or poor bearing conditions may be a problem, it is recommended that a washed rock and geotextile separator be utilized for pipe bedding in these areas. The washed rock and geotextile configuration should be determined in the field during construction.

7. The moisture content of the clay soils in the testholes was generally slightly to considerably above optimum. The very moist clay soils encountered in Testholes 04-1, 04-2, and 04-3 will require considerable drying to attain adequate compaction. The clay till soils had moisture contents generally slightly above the plastic limit and should be readily compactable as trench backfill.

   Trench compaction requirements of the Town of Morinville are 98 percent of the Standard Proctor Density compacted in maximum 200 millimetre lifts, above 1.5 metres, and 95 percent of the Standard Proctor Density compacted in maximum 300 millimetre lifts below this level. This degree of compaction should be achievable with a moderate to high amount of drying or mixing of the trench backfill in portions of the trench.

   In the very moist or wet clay encountered in Testholes 04-1, 04-2, and 04-3 at this site, compaction to a Standard Proctor Density standard will be difficult. In this case, the compaction specification may be switched to a One-Point Proctor. However, it must be noted that placing very moist or wet backfill in the trenches will jeopardize the road subgrade and may cause extra, more costly subgrade treatment methods to be required. Field decisions will be required as to when a One-Point Proctor criteria should be utilized, our firm should be contacted if this is desired. Also, the Town of Morinville should be contacted and approve any compaction specification changes.

10. It should be noted that the ultimate performance of the trench backfill is directly related to the consistency and uniformity of the backfill compaction, as well as the underground contractors construction procedures. In order to achieve this uniformity, the lift thickness and compaction criteria should be strictly enforced. The amount of drying performed during trench backfill compaction will directly affect the subgrade performance during roadway construction.

7.3 Surface Utilities

1. The subsurface soil conditions encountered throughout this site are considered generally fair for the construction of roads, curbs, and sidewalks in undisturbed areas. Difficulty will likely be encountered in utility areas due to mixing of materials during trench backfilling. The existing topsoil and other deleterious materials should be removed prior to construction of roads, sidewalks and other surface utilities. Fill depths are known only at testhole

locations and will likely vary throughout the site. Also, a stockpile was noted in the vicinity of Testhole 04-1, fill depths are likely to be deeper near this testhole.

2. The near surface inorganic clays encountered below the fill in most of the testholes were generally high or medium to high plastic in nature, and are susceptible to swelling. Cement stabilization is the recommended subgrade preparation method where high plastic clays are encountered. Past experience has shown that cement stabilization is effective in reducing the swelling potential of high plastic clays. Application rates would best be determined in the field during construction. The addition of 10 kilograms of cement per square metre of subgrade mixed to a depth of 150 millimetres is reccomended for this swelling control purpose. The subgrade should be proof rolled after final compaction and any areas showing visible deflections should be inspected and repaired. Care must be taken not to allow any excess moisture into these soils. Early curb backfill should be considered.

3. At the time of drilling, the moisture content of the near surface clays was generally slightly above optimum and somewhat variable. Some very moist portions of the upper clay soils were noted in Testholes 04-1, 04-2, and 04-3. In areas where final subgrade elevation will be near these very moist materials, some extra subgrade work will likely be required beyond the above mentioned subgrade preparation. Depending on the final grade, cement stabilization of 25 to 30 kilograms per square metre of subgrade mixed to a depth of 300 millimetres or extensive drying could be considered. Mixing and disturbance during underground utility installation will degrade the soil conditions. It is noted that the degree of trench backfill drying during underground utility installation affects the soil conditions for road and sidewalk construction, with increased drying improving the soil conditions

   Where very moist soils are encountered at or near final grade, and in some underground utility areas, other alternative measures may have to be considered. These alternatives may include replacing the very moist materials with a drier clay material to obtain a more stable and stronger subgrade. An estimated 1.0 to 1.5 metres of material would be required to bridge the in-situ soft clay soils. The imported fill should be placed in maximum 150 millimetre lifts and be compacted to a minimum of 98 percent of Standard Proctor Density. Any imported clay should be approved by our firm. Uniform backfill techniques are suggested to help dry the native clay soils and prepare an adequate subgrade.

   Another option would be the use of a pit-run gravel subbase. The estimated thickness of subbase to support the roadway is 300 to 450 millimetres. A medium duty woven geotextile should initially be placed below the gravel for separation and reinforcement. The placement of wic drains within the subbase is recommended. The drains should extend longitudinally along the roadway and be tied into catch basins. The need for a pit-run subbase should be low to moderateat this site.

4. In cases of fill areas, road fill material should be compacted to 98 percent of Standard Proctor Density. Any fill areas should be placed in lifts of 150 millimetres maximum thickness.

5. It is recommended that in all cases qualified personnel inspect the subgrade during construction to determine the recommended subgrade treatment. Observations during underground construction would also help determine the subgrade treatment required. The subgrade should be proof rolled after final compaction and any areas showing visible deflections should be inspected and repaired. Care must be taken not to allow any excess moisture into these soils.

6. Surface water will often collect within the granular subgrade, causing subgrade softening and pavement damage. Therefore, it is recommended that wic drains to be installed in the gravel road base at the curb bottom locations. The wic drains must be properly installed to ensure positive drainage into the catch basins or manholes.

7. The observed watertable depths are generally low to high at this site, between approximately 1.6 and 3.3 metres depth. The clays are of low to moderate frost susceptibility. A high watertable within approximately 3.0 metres of the road surface is required for significant frost heaving to occur. The closer the watertable is to the surface, the higher is the frost heave potential. One of the standpipes has stabilized above this level, therefore the potential for frost heave will be low to moderate. The design grade should be set as high as possible, in the high watertable areas and no cuts are recommended in those areas.

   In addition, an attempt can be made to lower the watertable. This may be accomplished by using sub-drains, usually consisting of perforated pipe and manhole inlets, to collect groundwater below the road area. Other options which may be utilized are hydraulically connecting the bedding materials to the manholes, or leaving the rings off of the storm sewers during construction, allowing groundwater to seep into the sewer. When employing this method, it is important to wrap the joints in filter cloth to prevent silting.

The exact configuration and need for the sub-drains should be determined during construction.

8. It is recommended that all areas beyond the back of curb/sidewalk be landscaped as soon as possible to avoid water permeating into the subgrade from free standing puddles. The near surface soils encountered throughout this area exhibit a moderate swelling potential. It is important that subgrade soils not be allowed to dry excessively when exposed, and moisture contents are kept slightly over optimum.

9. The following pavement design may be applied to the proposed residential roadways. An estimated California Bearing Ratio of 3.0 percent is used in the design, as well as a design life of 20 years. The previous items have discussed the possible difficulty and recommended options for attaining this estimated CBR at this site, and need to be referenced. The stated Equivalent Single Axel Load (ESAL) values for different roadway designations were obtained from City of Edmonton guidelines.

Recommended Staged Roadway Structures
Proposed Morinville Lakes Subdivision

STAGE 1

Structure Options	**Local Residential ($3.7x10^4$ ESALs)**	**Minor Collector ($1.1x10^5$ ESALs)**	**Major Collector ($4.7x10^5$ ESALs)**
Granular Base			
Asphaltic Concrete	65 mm ACR	75 mm ACR	85 mm ACO
Crushed Gravel (20 mm)	275 mm	325 mm	375 mm

STAGE 2

35 mm of Asphaltic Concrete Overlay (ACO)

ACO = City of Edmonton Designation Asphaltic Concrete Overlay
ACR = City of Edmonton Designation Asphaltic Concrete Residential
All gravel must be compacted to 100 % of Standard Proctor Density
in maximum 150 millimetre thick lifts.

7.4 Cement

Tests on selected soil samples from the testholes indicated generally considerable to severe concentrations of water soluble soil sulphates in the site subsoils. Based on observed sulphate levels, the following alternatives are therefore advised:

1. Underground Concrete Pipe

   Concrete used for all underground pipes must be constructed of C.S.A. Type 50, sulphate resistant Portland cement.

2. Curbs and Sidewalks

   All concrete for surface improvements such as sidewalks and curbs may be constructed using CSA Type 10, normal Portland cement.

3. Foundation Construction

   All concrete used for residential construction and coming into direct contact with the soil should be made with CSA Type 50, sulphate resistant Portland cement. A minimum 56 day compressive strength of 32 megapascals is recommended due to the sulphate content. In addition, all concrete subject to freeze thaw conditions must be air entrained with 5 to 7 percent air. Individual locations may show higher or lower concentrations of soluble soil sulphates, as illustrated above, and thus additional soil testing on particular sites may prove valuable. All concrete should conform to CSA Standards A23.1-04.

7.5 Hydrogeological Issues

1. The watertable readings at this site were generally high, with the water levels ranging from 1.6 to 3.3 meters below ground surface, although Testhole 04-3 was noted to be dry to 10.4 metres. Saturated soil conditions and ingressing groundwater may be encountered in the trenches at this site, depending on the design elevations and location within the site. Temporary dewatering measures may be required during utility installation, pumping from the trenches during installation should be sufficient to maintain trench working conditions. Delays in construction may occur.
2. In high watertable areas, subgrade softening below surface utilities is a concern. In these areas, attempts should be made to lower the watertable. This may be accomplished by using

sub-drains, usually consisting of perforated pipe and manhole inlets, to collect groundwater below the road area. Other options which may be utilized are hydraulically connecting the bedding materials to the manholes, or leaving the rings off of the storm sewers during construction, allowing groundwater to seep into the sewer. When employing this method, it is important to wrap the joints in filter cloth to prevent silting. The exact configuration and need for the sub-drains should be determined during construction.

For these high watertable areas, increased pavement structures may be required or cement stabilization. See section 7.4 for further details.

3. House footing elevation designs should consider the groundwater level. The watertable readings at this site were high, therefore the discharge method will have to be determined on a lot specific basis. Depending on the foundation design, the footing elevations may intercept the watertable, and the weeping tile flow may need to be directed to a foundation drain service. The need for foundation drains will depend on the flow characteristics desired from basement sump pumps. Preventing only winter flows in order to reduce sidewalk icing and pump outlet maintenance will require a different standard than preventing excessive flows throughout the year. Our experience shows a watertable rise of approximately one metre from low winter readings to high spring and summer readings in the Edmonton area. Actual site levels may vary.

   The design footing elevations should be compared to the watertable elevations to assess the need for foundation drains. A foundation drain service would be recommended where the highest seasonal watertable elevation is above the footing elevation. A margin of safety (usually 1.0 metre) may also be taken into account. Once final lot grades are available, our firm could assist in choosing which lots would benefit from having foundation drain connections.

4. At a minimum, peripheral weeping tile lines will be required for all houses. All lines should be placed at or slightly below footing elevation and connected to ensure positive drainage to an approved system. The weeping tile lines will require a suitable clean tile rock drainage filter, with a minimum of 150 millimetres of filter around the line. Basements located near the water table may require interior drains, clean tile rock beneath the floor and other measures in addition to perimeter drains. A drawing is located in the Appendix showing the recommended upgraded drainage measures.

5. House basement excavations situated below the groundwater table may experience water ingress. If this is the case, our firm should be contacted to provide recommendations for handling the groundwater. A temporary dewatering system may be required until the permanent weeping tile system is operational.
6. Water dispersed on the property from the roof leaders should not be allowed to accumulate against the foundation walls. To ensure positive drainage, the soil surface of all lots should be made sloping away from all buildings. This will require a positive lot grading of at least five percent away from the foundation walls for a minimum of 1.5 metres. In cases where the lot drainage runs from the back of the lot to the front, runoff should be kept 1.2 metres away from the house.
7. At least the top 1.0 metre of backfill around the basement walls must be a suitable low permeablility clay material. The near surface clay materials found at this site will be suitable for this purpose. This serves to reduce water penetration into the backfill, and subsequently into the weeping tile system.
8. In order to ensure no flow paths for water from the roof leaders occur adjacent to the foundation walls, the following two alternatives are proposed:
    i) A concrete splash pad, placed beneath the downspouts, a minimum of 1.2 metres long and firmly anchored to the house foundation can be used.

    or

    ii) A permanent downspout extension could be used to carry water away from the foundation wall.

8.0 CLOSURE

This report has been prepared for the exclusive and confidential use of Landrex Investment Corporation, Infrastructures Systems Ltd. and their respective authorized agents. Use of this report is limited to the subject proposed Residential Subdivision only. The recommendations given are based on the subsurface soil conditions encountered during test boring, current construction techniques and generally accepted engineering practices. No other warranty, expressed or implied, is made. Due to geological randomness of many soils formations, no interpolation of soil conditions between or away from the testholes has been made or implied. Soil conditions are known only at the test boring location. Should other soils be encountered during construction or other information pertinent becomes available, the undersigned should be contacted as the recommendations may be altered or modified.

We trust this information is satisfactory. If you should have any questions, please contact our office.

Respectfully Submitted:
J.R. Paine & Associates Ltd.

Patrick Winski, E.I.T.

Reviewed by:

RICHARD A. EVANS
Feb. 7/05

PERMIT TO PRACTICE
JR PAINE & ASSOCIATES LTD.
Signature R. Stefaniw
Date Feb 8/05
PERMIT NUMBER: P 0401
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

Rick Evans, P. Eng

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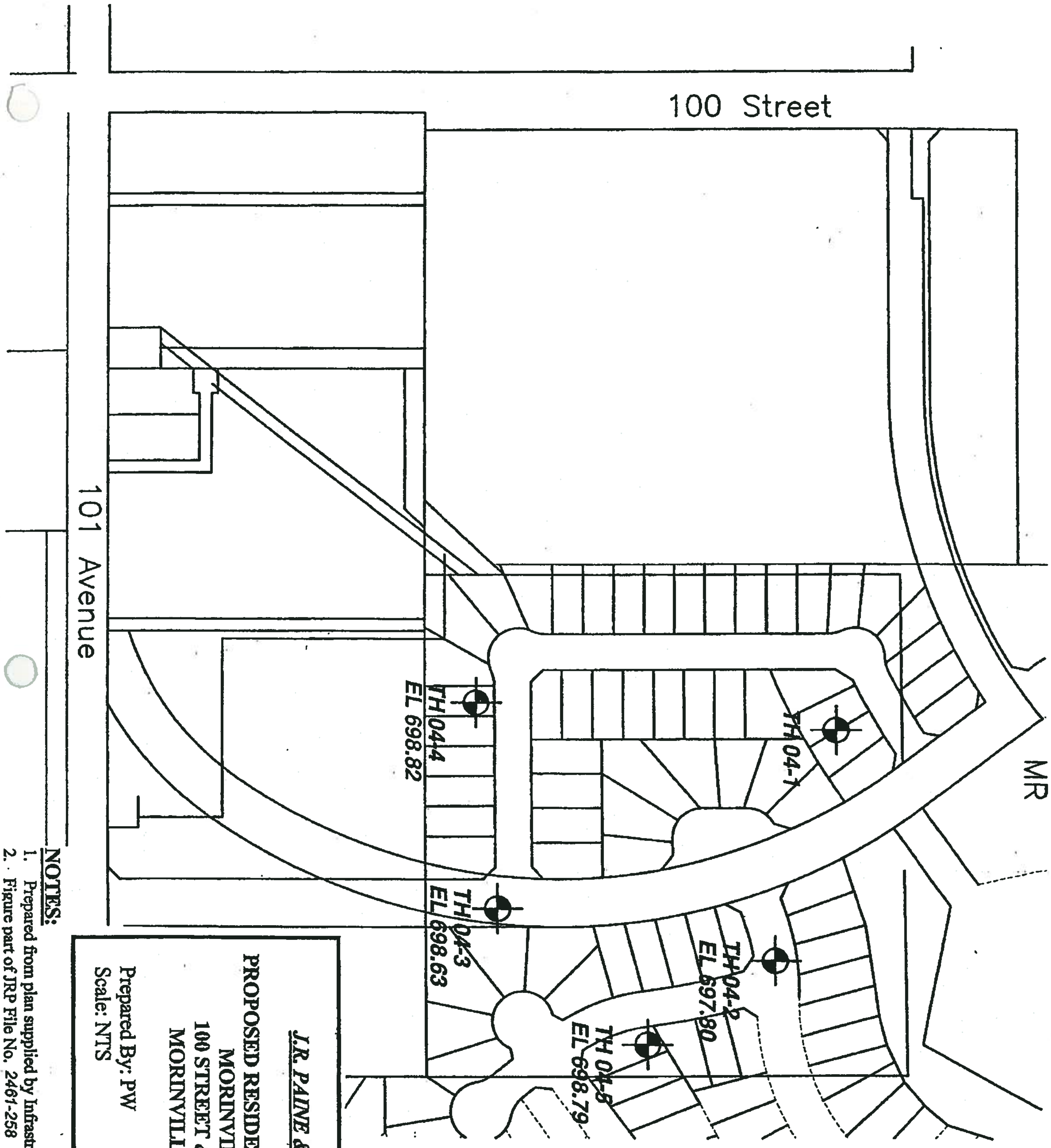
APPENDIX



J.R. PAINE & ASSOC. LTD.

PROPOSED RESIDENTIAL SUBDIVISION
MORINVILLE LAKES
100 STREET & 101 AVENUE
MORINVILLE, ALBERTA.

Prepared By: PW Date: Jan 13/05
Scale: NTS Figure: 1

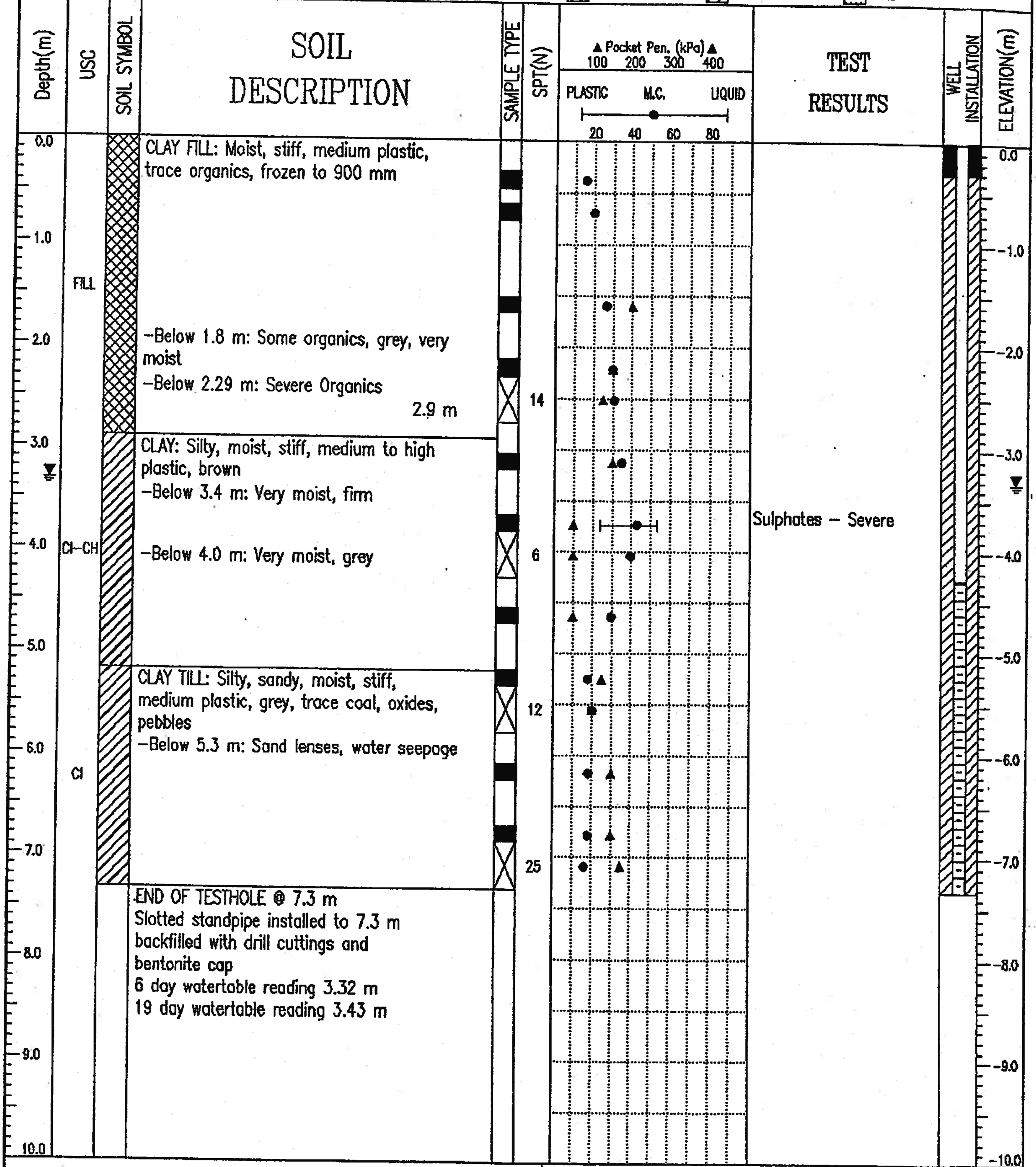
NOTES:

1. Prepared from plan supplied by Infrastructures Sy[illegible]s Ltd.
2. Figure part of JRP File No. 2461-258

PROJECT: MORINVILLE LAKES	CLIENT: LANDREX c/o ISL	TEST HOLE NO: 04–1
LOCATION: North of 101 Ave and East of 100 Street, Morinville, Alberta	DRILL METHOD: Solid Stem Auger	PROJECT NO: 2461–258
	PROJECT ENGINEER: PW	ELEVATION:

SAMPLE TYPE ■ DISTURBED ▨ TUBE ☒ SPT

BACKFILL TYPE ■ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ∴ GROUT ▨ DRILL CUTTINGS ⁙ SAND



CLAY FILL: Moist, stiff, medium plastic, trace organics, frozen to 900 mm

–Below 1.8 m: Some organics, grey, very moist

–Below 2.29 m: Severe Organics

2.9 m

CLAY: Silty, moist, stiff, medium to high plastic, brown

–Below 3.4 m: Very moist, firm

–Below 4.0 m: Very moist, grey

CLAY TILL: Silty, sandy, moist, stiff, medium plastic, grey, trace coal, oxides, pebbles

–Below 5.3 m: Sand lenses, water seepage

END OF TESTHOLE @ 7.3 m
Slotted standpipe installed to 7.3 m backfilled with drill cuttings and bentonite cap
6 day watertable reading 3.32 m
19 day watertable reading 3.43 m

Sulphates – Severe

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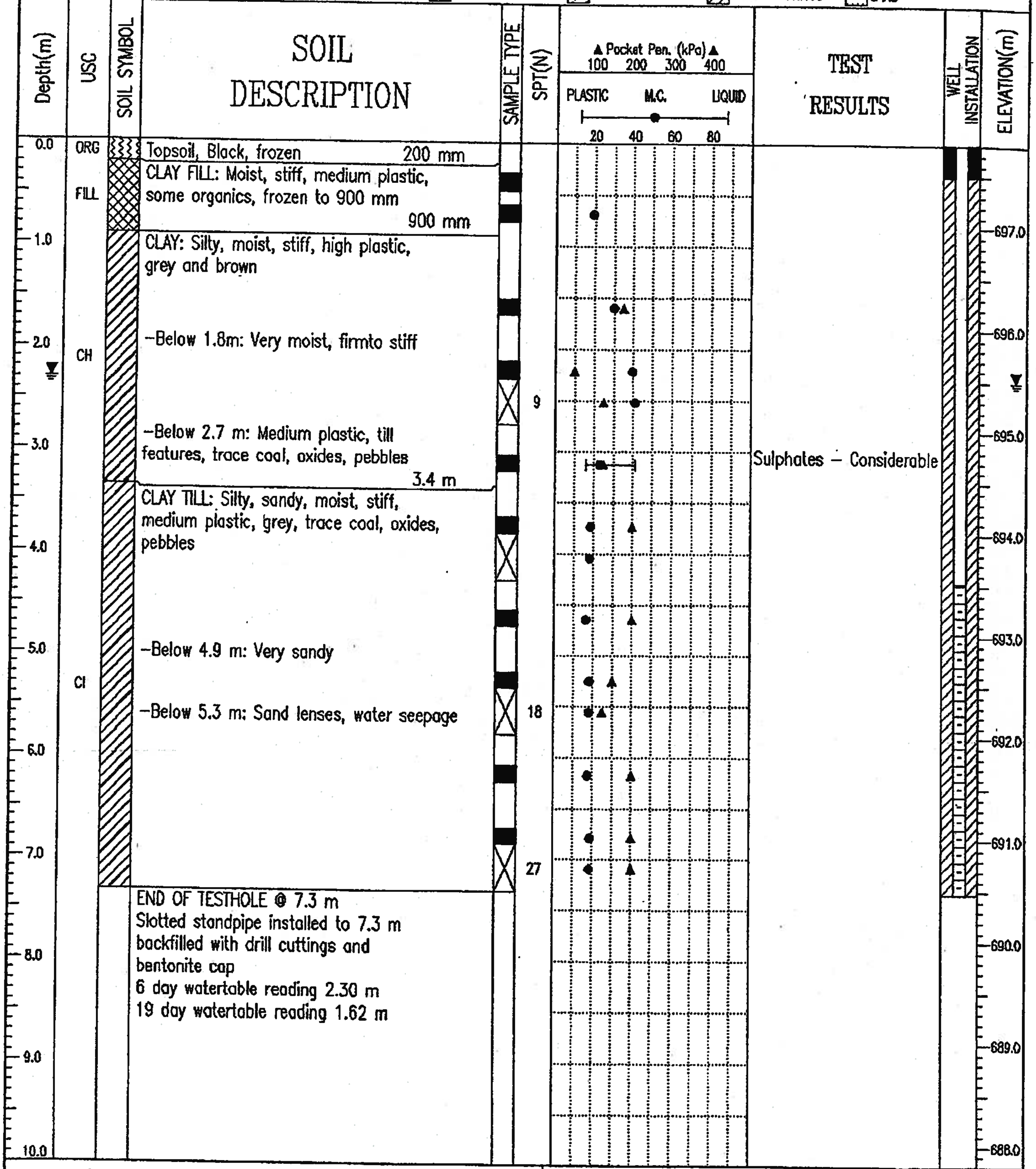
Edmonton, Alberta

LOGGED BY: PW	COMPLETION DEPTH: 7.32 m
REVIEWED BY: RE	COMPLETE: 17/12/04
Fig. No: 2	Page 1 of 1

05/01/14 02:50PM (101ST100)

PROJECT: MORINVILLE LAKES
LOCATION: North of 101 Ave and East of 100 Street, Morinville, Alberta
CLIENT: LANDREX c/o ISL
DRILL METHOD: Solid Stem Auger
PROJECT ENGINEER: PW
TEST HOLE NO: 04-2
PROJECT NO: 2461-258
ELEVATION: 697.8 m

SAMPLE TYPE ■ DISTURBED ▨ TUBE ☒ SPT
BACKFILL TYPE ■ BENTONITE ⁘ PEA GRAVEL ||| SLOUGH ⁘ GROUT ▨ DRILL CUTTINGS ⁘ SAND



Topsoil, Black, frozen 200 mm

CLAY FILL: Moist, stiff, medium plastic, some organics, frozen to 900 mm 900 mm

CLAY: Silty, moist, stiff, high plastic, grey and brown

–Below 1.8m: Very moist, firmto stiff

–Below 2.7 m: Medium plastic, till features, trace coal, oxides, pebbles 3.4 m

CLAY TILL: Silty, sandy, moist, stiff, medium plastic, grey, trace coal, oxides, pebbles

–Below 4.9 m: Very sandy

–Below 5.3 m: Sand lenses, water seepage

END OF TESTHOLE @ 7.3 m
Slotted standpipe installed to 7.3 m backfilled with drill cuttings and bentonite cap
6 day watertable reading 2.30 m
19 day watertable reading 1.62 m

Sulphates – Considerable

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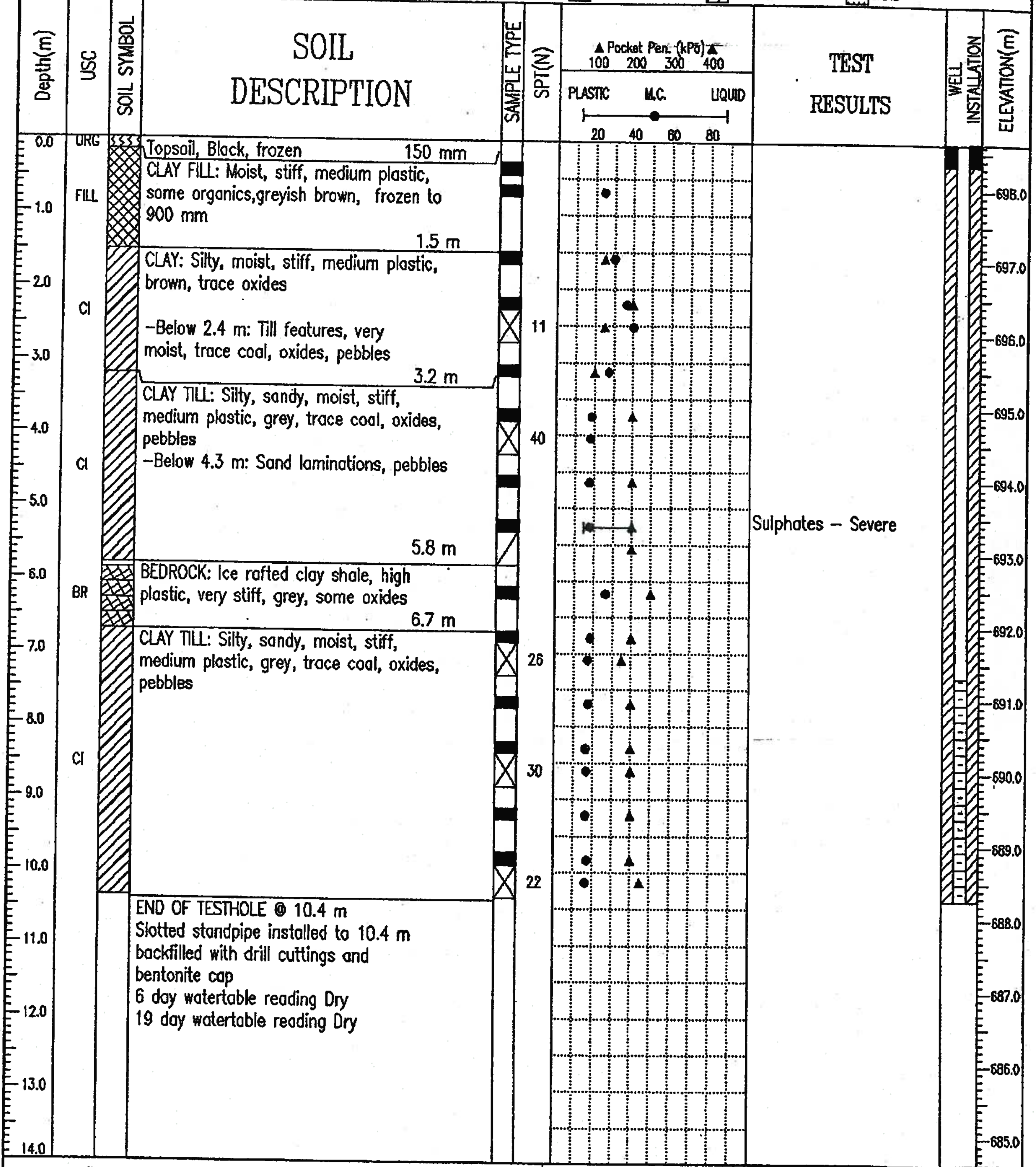
05/01/14 02:53PM (10TST180)

LOGGED BY: PW
REVIEWED BY: RE
Fig. No: 4
COMPLETION DEPTH: 10.36 m
COMPLETE: 17/12/04
Page 1 of 2

PROJECT: MORINVILLE LAKES
LOCATION: North of 101 Ave and East of 100 Street, Morinville, Alberta
CLIENT: LANDREX c/o ISL
DRILL METHOD: Solid Stem Auger
PROJECT ENGINEER: PW
TEST HOLE NO: 04-3
PROJECT NO: 2461-258
ELEVATION: 698.63 m

SAMPLE TYPE ■ DISTURBED ▧ TUBE ☒ SPT
BACKFILL TYPE ■ BENTONITE ⁘ PEA GRAVEL ▥ SLOUGH ⁘ GROUT ▨ DRILL CUTTINGS ⁘ SAND



Topsoil, Black, frozen 150 mm

CLAY FILL: Moist, stiff, medium plastic, some organics, greyish brown, frozen to 900 mm 1.5 m

CLAY: Silty, moist, stiff, medium plastic, brown, trace oxides

-Below 2.4 m: Till features, very moist, trace coal, oxides, pebbles 3.2 m

CLAY TILL: Silty, sandy, moist, stiff, medium plastic, grey, trace coal, oxides, pebbles

-Below 4.3 m: Sand laminations, pebbles 5.8 m

BEDROCK: Ice rafted clay shale, high plastic, very stiff, grey, some oxides 6.7 m

CLAY TILL: Silty, sandy, moist, stiff, medium plastic, grey, trace coal, oxides, pebbles

END OF TESTHOLE @ 10.4 m
Slotted standpipe installed to 10.4 m backfilled with drill cuttings and bentonite cap
6 day watertable reading Dry
19 day watertable reading Dry

Sulphates – Severe

J. R. Paine & Associates Ltd.
Edmonton, Alberta

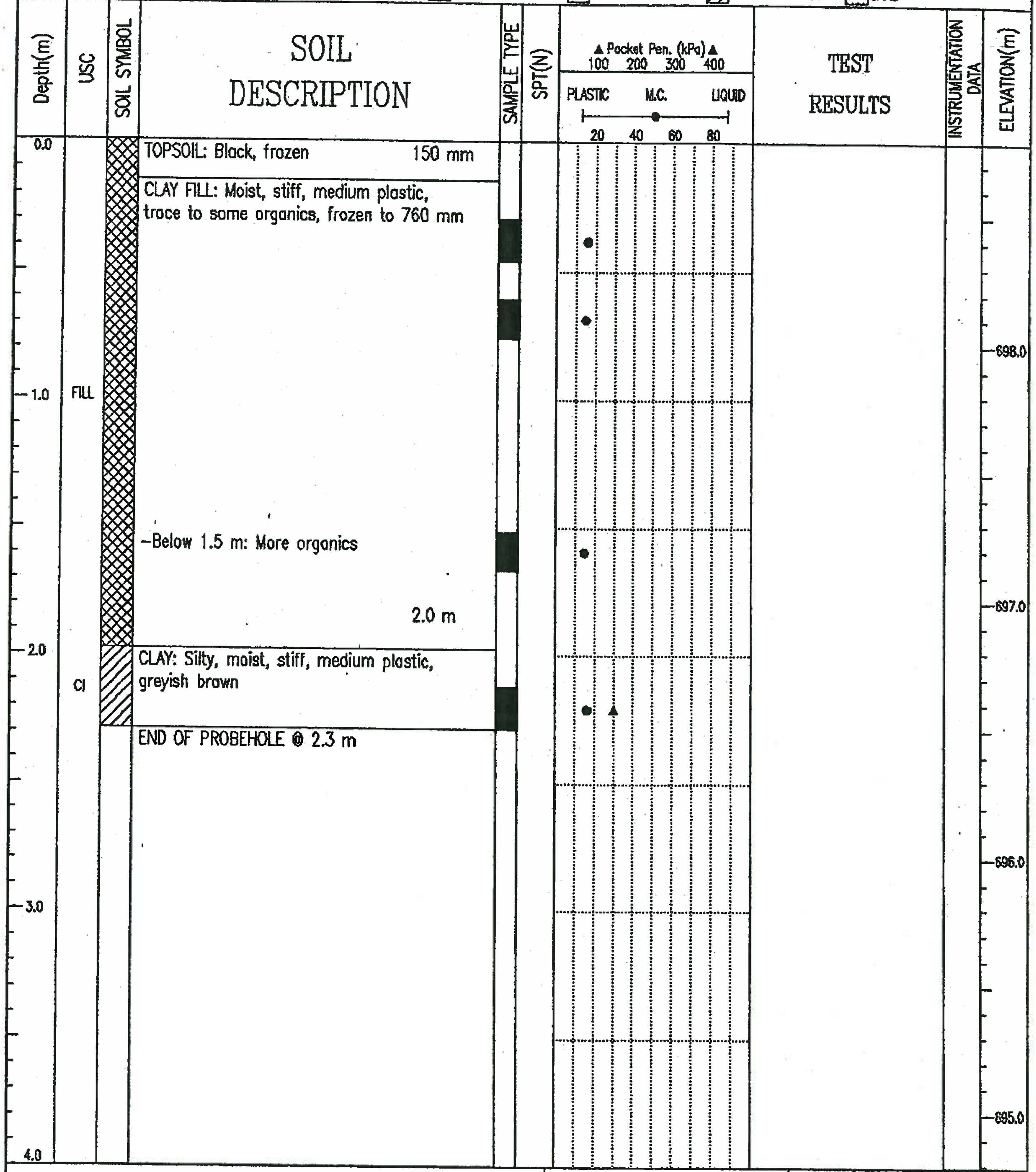
LOGGED BY: PW
REVIEWED BY: RE
Fig. No: 4
COMPLETION DEPTH: 10.36 m
COMPLETE: 17/12/04
Page 1 of 1

05/01/14 02:51PM (14TST180)

PROJECT: MORINVILLE LAKES	CLIENT: LANDREX c/o ISL	TEST HOLE NO: 04-5
LOCATION: North of 101 Ave and East of	DRILL METHOD: Solid Stem Auger	PROJECT NO: 2461-258
100 Street, Morinville, Alberta	PROJECT ENGINEER: PW	ELEVATION: 698.79 m

SAMPLE TYPE ■ DISTURBED ▨ TUBE ☒ SPT

BACKFILL TYPE ■ BENTONITE ⁚ PEA GRAVEL ▥ SLOUGH ⁖ GROUT ▨ DRILL CUTTINGS ⁙ SAND



TOPSOIL: Black, frozen 150 mm

CLAY FILL: Moist, stiff, medium plastic, trace to some organics, frozen to 760 mm

–Below 1.5 m: More organics

2.0 m

CLAY: Silty, moist, stiff, medium plastic, greyish brown

END OF PROBEHOLE @ 2.3 m

J. R. Paine & Associates Ltd. Edmonton, Alberta	LOGGED BY: PW	COMPLETION DEPTH: 2.29 m
	REVIEWED BY: RE	COMPLETE: 17/12/04
	Fig. No: 6	Page 1 of 1

05/01/14 02:51PM (415T100)

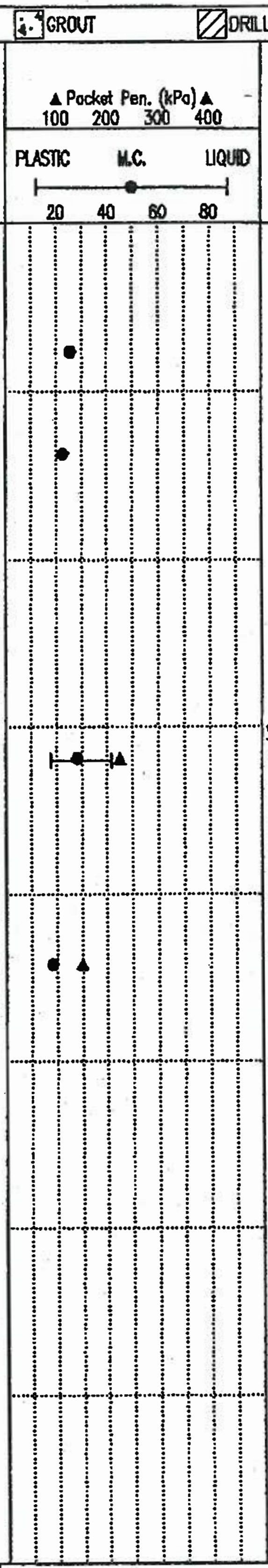
PROJECT: MORINVILLE LAKES	CLIENT: LANDREX c/o ISL	TEST HOLE NO: 04-4
LOCATION: North of 101 Ave and East of 100 Street, Morinville, Alberta	DRILL METHOD: Solid Stem Auger	PROJECT NO: 2461-258
	PROJECT ENGINEER: PW	ELEVATION: 698.82 m

SAMPLE TYPE ■ DISTURBED ▨ TUBE ☒ SPT

BACKFILL TYPE ■ BENTONITE ⁚ PEA GRAVEL ▥ SLOUGH ▦ GROUT ▨ DRILL CUTTINGS ⁚ SAND

Depth(m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SPT(N)	TEST RESULTS	INSTRUMENTATION DATA	ELEVATION(m)
0.0	FILL	▩	CLAY FILL: Moist, stiff, medium plastic, Some organics, frozen to 900 mm 1.5 m	■ ■				698.0
1.5	CI	▨	CLAY: Silty, very moist, stiff, medium plastic, brown and grey	■ ■		Suplphates – Severe		697.0
2.3			END OF PROBEHOLE @ 2.3 m					696.0 695.0

Depth(m): 0.0, 1.0, 2.0, 3.0, 4.0



J. R. Paine & Associates Ltd. Edmonton, Alberta	LOGGED BY: PW	COMPLETION DEPTH: 2.29 m
	REVIEWED BY: RE	COMPLETE: 17/12/04
	Fig. No: 5	Page 1 of 1

05/01/14 02:51PM (4157100)

APPENDIX B
Phase 1 and Phase 2 Environmental Site Assessments