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REPORT ON

**PRELIMINARY GEOTECHNICAL STUDY
YORK RAPID TRANSIT PLAN
HIGHWAY 7 CORRIDOR AND VAUGHAN NORTH-SOUTH
REGIONAL MUNICIPALITY OF YORK, ONTARIO**

Submitted to:

York Consortium 2002
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EXECUTIVE SUMMARY

Golder Associates Ltd. (“Golder”) was retained by the York Consortium 2002 (the “Consortium”), on behalf of York Region Transit (“York Transit”), to preliminarily identify geotechnical conditions along proposed transit routes being considered for development to increase transit services for The Region of York (“York Region”). The information was requested by the Consortium to assist them in selecting a preferred transit route along the Highway 7 corridor and understanding the preliminary subsurface conditions and the manner in which the subsurface conditions may influence future design and construction work.

Golder reviewed data collected through searches of the Ontario Ministry of the Environment databases and publications, York Region databases, our in-house files, publicly available information from the Ministry of Transportation Ontario, and a visual reconnaissance of the proposed Highway 7 route options.

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1.0 INTRODUCTIONS

Golder Associates Ltd. (“Golder”) was retained by the York Consortium 2002 (the “Consortium”), on behalf of York Region Transit (“York Transit”), to preliminarily identify geotechnical conditions along proposed transit routes being considered for development of transit services in The Region of York. The information was requested by the Consortium to assist them in selecting a preferred transit route along the Highway 7 corridor.

This report was prepared as part of the requirement for the preparation of the Environmental Assessment that is to be submitted for the Highway 7 transitway route options.

1.1 Transitway Route Options

The York Rapid Transit Plan has defined several potential transit corridors within York Region for alleviation of traffic congestion. The two major corridors include the Yonge Street and Highway 7 routes as illustrated on Figure 1. This report addresses conditions associated only with the Highway 7 route and its various alignment options. Several potential Highway 7 transitway route options have been identified. The main route for the new transitway follows Highway 7 from its intersection with Highway 50 in the west to Regional Road 30 (York-Durham Line) in the east. Several route alternatives that deviate from within the Highway 7 corridor have also been identified and studied as part of the overall project and these alternative routes considered for this project are described below.

- Route Alternative B1 departs from the alignment of Highway 7 just west of Jane Street. At Jane Street two parts of this route are being considered including continuation eastward on Highway 7 to near Keele Street and a route that follows Jane Street south to near Steeles Avenue connecting to the campus of York University. It is understood that future planning may include linking the Highway 7 transitway to the Toronto Transit Commissions Spadina Subway via Route Alternative B1 south along Jane Street to York University with a fully or partially underground transit route. Information regarding potential vertical or horizontal alignments of this route option had not been detailed at the time this report was prepared. General comments related to this underground option to the route alternative are, however, included in this report as appropriate for the Environmental Assessment.
- Route Alternative B2 diverts from the Highway 7 alignment at its western junction with Jane Street, follows Jane Street south to near Steeles Avenue, includes a connection to the York University campus, and then follows the existing Hydro right-of-way (ROW) to Centre Street.
- Route Alternative B3 departs from Highway 7 at Jane Street, as with Alternatives B1 and B2, and follows Jane Street south to near Steeles Avenue, turns north on Keele Street, and then turns east again onto the Highway 7 alignment at Centre Street.

- Route Alternative B4 joins all other route options at the intersection of Highway 7 and Centre Street and continues along the Highway 7 alignment to Bathurst Street.
- Route Alternative B5 continues the alignment of Route Alternative B2 along the existing Hydro ROW to Bathurst Street.
- Route Alternative B6 joins all other route alternatives near the intersection of Highway 7 and Centre Street, but follows Centre Street eastward to Bathurst Street, turns north on Bathurst Street and then west again onto the Highway 7 alignment.

The alignment then follows Highway 7 to Woodbine Avenue for all route options. At Woodbine Avenue, three different alternatives have been considered:

- Route Alternative C1 follows directly along Highway 7 to Kennedy Road, with a potential route link to the proposed Langstaff Intermodal Station along High Tech Road.
- Route Alternative C2 diverts from Highway 7 at Woodbine Avenue travels south along Woodbine Avenue to and along Yorktech Drive to Markham Centre, and then turns north along Kennedy Road to join Highway 7 again.
- Route Alternative C3 diverts from Highway 7 east of Woodbine Avenue at Town Centre Boulevard and follows this street south to Markham Centre, continues east to Kennedy Road, then north along Kennedy road to again join Highway 7.

The remaining section of the proposed route again follows Highway 7 from Kennedy Road eastward to Regional Road 30 at the York-Durham Line.

For this stage of the proposed project, the general geologic and geotechnical conditions are defined only on a preliminary basis from existing data and mapping. It is considered at this time, that all the route alternatives, as described above, should have conditions that are encompassed by the conditions along Highway 7. The available data is not considered sufficient to accurately identify differences in conditions that may occur between the main Highway 7 alignment and each of the various alternatives. Therefore, the ground conditions along only Highway 7 are presented in this report with some brief description of general geologic conditions that may result in differences along the alternative routes.

2.0 SCOPE OF WORK

2.1 Information Resources

The review of subsurface conditions for the proposed transitway route options was based on the following information:

- a visual reconnaissance of the route options;
- a review of aerial photographs obtained from York Region;
- a review of geologic maps of the area prepared by the Ontario Geological Survey;
- the Ontario Ministry of Environment (MOE) Water Well Information System (WWIS);
- geologic mapping including Quaternary Geology, Toronto and Surrounding Area, Southern Ontario, Preliminary map 2204, Ministry of Natural Resources, Ontario Geological Survey (1980);
- Logan, C., and Russell, H. A. J. (2001), Ontario Ministry of Environment and Energy (MOE) water well material coding application; Geological Survey of Canada, 1 December, 2001, http://sts.gsc.nrcan.gc.ca/orm/online_data_documentation.asp
- “Geotechnical Investigation, Highway 407, From 1.1 km West of Bathurst Street East to East Don River, Town of Vaughan, Ontario, Station 27+50 to Station 29+450,” prepared by Geo-Canada Ltd., September, 1991, Ministry of Transportation Ontario GEOCREs No. 30M14-242.
- “Report to Ewbank, Pillar & Associates Ltd. on Soil Investigation, Proposed Don Valley Parkway Underpass at Van Horne Road,” prepared by Golder Associates, January 1965.
- “Engineering Materials Office, Soil Mechanics Section, Feasibility Study of Highway 407 from East of Jane Street to East of Woodbine Avenue,” prepared by Ministry of Transportation Ontario, February, 1979, GEOCREs No. 30M14-162.
- “Soils Investigation, Proposed Construction of Highway 7N from Just West of Bathurst Street to Just East of Yonge Street, Sta. 27+440 to Sta. 30+235.777 (=10+008.773 at Yonge Street) and 10+008 to Sta. 10+250 including Connecting Road Highway 7N to Bathurst St. Sta. 5+000 to Sta. 5+481, Bathurst Street Sta. 9+170 to Sta. 10+440, Yonge Street Sta. 13+760 to Sta. 14+735,” prepared by B.P. Walker Associates Ltd., January 1992.
- “Geotechnical Investigation, Highway 407, 1 km West of Bayview Avenue East to German Mills Creek, Town of Richmond Hill and Markham, Ontario,” prepared by Geo-Canada Ltd., September, 1991, Ministry of Transportation Ontario GEOCREs No. 30M14-242.
- “Geotechnical Investigation, Highway 407, German Mills Creek to Leslie Street, Town of Markham, Ontario, Station 12+400 to Station 13+900,” prepared by Geo-Canada Ltd., September, 1991, Ministry of Transportation Ontario GEOCREs No. 30M14-242.

- “Geotechnical Investigation, Highway 407, From East Don River East to 1 km East of Yonge Street, Towns of Vaughan and Richmond Hill, Station 29+450 to Station 10+950,” prepared by Geo-Canada Ltd., September, 1991, Ministry of Transportation Ontario GEOCREs No. 30M14-242.
- Preliminary Subsurface Investigation, Proposed Multi-Storey Structure, Jane Street and Highway 7, Town of Vaughan, Ontario. Report prepared by Golder Associates, March 1981.
- York-Peel-Durham-Toronto (YPDT) Groundwater Management Strategy Study Conservation Authorities Moraine Coalition.

2.2 Evaluation Methods

The available information as listed above was examined with respect to the effects that the physical soil and groundwater conditions might have on selection of route alternatives and potential future construction. Environmental conditions as related to the potential environmental quality of subsurface materials are discussed in a separate report prepared by Golder Associates (“Environmental Assessment, York Rapid Transit Plan, Highway 7 Route Options, Regional Municipality Of York, Ontario,” dated May 2003).

The work conducted for and described within this report is intended to provide an overview of likely subsurface conditions and a preliminary summary of the possible effect that such subsurface conditions may have on the planned project with respect to design and construction of pavements, track beds, and structural foundations. It is recommended and expected that additional work will be completed to refine the understanding of the subsurface conditions and their potential effects on design and construction once the route(s) is(are) selected. Such work should consist of borehole drilling and laboratory testing at selected locations determined as the project evolves.

The water well records shown on the cross-sections are contained in a modified and updated version of the Ontario Ministry of Environment (MOE) Water Well Information System (WWIS) database, that was also compiled as part of the York-Peel-Durham-Toronto (YPD) study. The standard MOE subsurface material codes have been filtered through the Geological Survey of Canada’s rule-based geomaterials coding system which is “...designed to take unaltered MOE water well tables and convert material codes to more geologically meaningful descriptions. The code assignments are based on rules developed for sediment found in the Greater Toronto Area (GTA) as part of the Oak Ridges Moraine National Mapping Program (NATMAP) study” (Logan & Russell, 2001).

Golder personnel imported both the YPDT water well database and the geologic surfaces into ViewLog v.2.2.94, a software package that allows the user to view, manipulate and interpret

subsurface borehole data, and produce continuous geologic surfaces from interpreted stratigraphic units identified in individual boreholes. The surfaces shown in Figures 3 through 28 were created by the YPDT Study Team, by mathematically interpolating the boundaries between several thousand stratigraphic unit data points from borehole and water well records across York Region. In addition, these interpolated stratigraphic units were compared with borehole logs obtained during other conventional subsurface investigations conducted near the proposed alignments. The available data was used as a basis to further adjust the interpreted stratigraphy in areas of known subsurface geologic and groundwater conditions.

The ground surface for the simplified geologic profiles developed by the computer modelling, as described above, did not match the ground surface of the Highway 7 or alternative route alignments for two primary reasons. First, the ground surface mapping used to define the geologic database is based on borehole or well elevations and spot elevations and is not intended to accurately represent the ground surface elevation in any one particular location. In addition, the profile along the centre line of Highway 7 or the alternative routes may be different than the surrounding ground as the result of localised cutting or filling activities carried out to achieve the road or railway grades in the area. For example, near the intersection of Highway 7 and Highway 427, the ground surface profile is significantly higher than the geologic profile surface. In this area, significant filling likely occurred to construct the embankments for the Highway 7 overpass of Highway 427. This condition occurs in several other areas including the Highway 7 overpass of the tracks of CN MacMillan Yard and where route alternatives cross Highway 407.

3.0 SUBSURFACE CONDITIONS

3.1 Regional Topography

The Region of York occupies the Peel Plain and Oak Ridges Moraine geomorphic regions. Over the length of the proposed alignment, the topography is relatively flat with a maximum topographic relief of about 30 m between the high point near the CN MacMillan Yard overpass and the low point near the crossing of Pine Valley Drive. The proposed alignment is crossed by a number of watercourses including:

- Rainbow Creek
- Humber River
- Black Creek
- Plunkett's Creek
- Don Rive
- Apple Creek
- East Don River
- German Mills Creek
- Beaver Creek
- Apple Creek
- Rouge River
- Little Rouge River

In addition, a number of smaller and unnamed drainage courses and tributaries to the water courses will be crossed by the various alignments.

3.2 Regional Geology

The Quaternary-age deposits of York region consist predominantly of glacial till, glaciolacustrine sand, silt, and clay deposits, and shallow post-glacial lacustrine sediments. These deposits were laid down by glacial ice sheets and associated rivers and lakes. Recent deposits of alluvium are found in the river and stream valleys and their flood plains. Typically, bedrock is expected to be below a significant thickness of the sedimentary overburden (depths greater than 30 m).

The Quaternary soil deposits overlying the bedrock in the study area are believed to have been deposited over the course of two glaciations and one interglacial (i.e. warmer) stage. The oldest soil deposits identified in the Greater Toronto Area are the Illinoian tills that immediately overlie bedrock, where they are present. These tills are overlain by interglacial period lacustrine sands, silts, and clays that are, in turn, overlain by the most recent glacial deposits.

3.3 Local Subsurface Stratigraphy

The geologic cross-sections presented on Figures 3 through 28 illustrate the interpreted subsurface geology in the vicinity of Highway 7, between Highway 50 and Regional Road 30 in York Region. The sections were extracted from a larger compilation of subsurface geology of the entire Oak Ridges Moraine and surrounding regions, including all of York Region. This larger

regional compilation is part of the York-Peel-Durham (YPDT) Groundwater Management Strategy Study, being conducted under the direction of Steve Holysh of the Conservation Authorities Moraine Coalition. The YPDT study partners provided the subsurface geologic information as a series of digital surfaces representing the upper boundaries of the various geologic units. The surfaces were provided with the understanding that they are preliminary draft versions, and will likely be modified before being finalised. In addition, these interpolated stratigraphic units were compared with borehole logs obtained during other conventional subsurface investigations conducted near the proposed alignments and adjusted where geologic or groundwater conditions were better known.

The stratigraphic units shown on Figures 3 through 28 generally correspond with a particular type of geologic material such as sand or fine-grained till. However, these units have been constructed as part of a regional study and some heterogeneity is to be expected within each of the geologic deposit types. The stratigraphic units are described below from oldest (and deepest) to youngest (and most near the surface).

3.3.1 Paleozoic Bedrock

The Paleozoic bedrock in the area consists primarily of the Georgian Bay Formation. This sedimentary rock formation includes shale, siltstone, sandstone and interbeds of limestone. Within the area of the planned project, it is expected that the bedrock will be at depths exceeding those necessary for foundations or excavations.

3.3.2 “Lower Drift”

The “Lower Drift” includes a series of deposits, interpreted by some as interbedded glacial tills and interglacial lacustrine (lake deposited) sediments, and by others as interbedded lacustrine delta sediments that include diamict. Diamict sediments are characterized by inclusions of angular coarse sand and gravel within finer-grained soils (either silt and sand or silt and clay), producing units that, overall, can be poorly graded (a mix of different grain sizes). Glacial till, or sediments deposited at the contact between the overriding ice sheets and the underlying strata, are characteristically diamict units. Diamict can also be deposited in a near-ice lacustrine environment (with the coarse material “raining” into the sediments from the base of floating ice to the bottom of water bodies) rather than by glacial contact with the underlying sediments. This “Lower Drift” includes from oldest to youngest:

- **Don Formation:** the Don Formation, where present, consists primarily of bedded silt and sand deposits that are in direct contact with the underlying bedrock formations;
- **Scarborough Formation:** the Scarborough Formation also consists primarily of bedded silt and sand deposits overlying the Don Formation but these sediments were deposited at a later stage than the Don Formation;

- **Sunnybrook Formation:** the Sunnybrook Formation consists predominantly of fine-grained sediments that appear locally as layered diamict, massive diamict or layered fine-grained sediments more characteristic of lacustrine deposits. The composition and hard consistency of this material have resulted in this material being identified as a basal glacial till unit by some reference sources; and
- **Thorncliffe Formation:** the Thorncliffe Formation consists primarily of granular sediments including varying proportions of silt and sand.

3.3.3 Newmarket Till

The Newmarket Till is a regional glacial till sheet generally characterised by its predominantly fine-grained composition. In most areas this glacial till is relatively hard and, due to its fine-grained composition, forms a regional aquitard (deposit inhibiting flow of groundwater). The Newmarket Till also contains cobbles and boulders. In some areas, “boulder pavements” can be encountered where boulders are nested or concentrated in a layer within the till unit or near the interfaces with other geologic deposits. Experience on other construction projects in this deposit suggests that boulders may typically form about 0.1 to 0.5% of the total deposit volume, though in some areas, boulders can form up to 2% of the total deposit volume.

3.3.4 Oak Ridges Moraine Complex

The Oak Ridges Moraine Complex is a well-known and important geologic feature within the region with fine sands and silts as the dominant sediments, but with coarse sands and gravels prominent locally.

3.3.5 Halton Till

The Halton Till is generally considered a fine-grained diamicton with minor fine-grained lacustrine sediments incorporated within the body of the unit, likely from glacial reworking of underlying lacustrine sediments. The Halton Till is typically stiff to hard in consistency, though near the ground surface, weathering can result in the consistency being degraded to consistencies ranging from soft to firm. The Halton Till also contains cobbles and boulders. In some areas, “boulder pavements” can be encountered where boulders are nested or concentrated in a layer within the till unit. Experience on other construction projects in this deposit suggests that boulders may typically form about 0.1 to 0.5% of the total deposit volume, though in some areas, boulders can form up to 2% of the total deposit volume.

3.3.6 Upper Deposits

“Upper Deposits” are illustrated on interpreted simplified stratigraphy Figures 3 through 28. In addition, other areas are interpreted on these figures as “unknown materials”. Based on local experience, these deposits generally include two types of materials: more recent natural post-glacial deposits; and deposits placed for construction or disposal of unwanted materials during development of the area.

- **Fill:** Fill generally consists of reworked native soil and/or rock materials, refuse, construction and demolition debris, and other assorted random materials placed during development of the area to level the ground in preparation for building or as a disposal site for unwanted materials. Typically, older fill materials were placed with little control over the materials or how they were placed. Most of the areas illustrated on the interpreted stratigraphic profiles as “unknown” are considered to likely represent fill materials.
- **Recent Alluvial Deposits:** In the areas of watercourses, erosion and redeposition of soil materials has occurred since the last glacial period. Geologically recent deposits from watercourses are typically soft or loose in consistency. Within the boundaries of the watercourse floodplains, the subsurface conditions can be expected to vary significantly as the alignment of the watercourse has likely shifted over time. The shifting positions of watercourses produces localised and in-filled meander channels and possible organic deposits (organic silt and clay or peat from the growth, burial, and decomposition of plant materials).
- **Recent Glaciolacustrine Deposits:** During the retreat of the last glacial ice sheet from the region, low areas in the surface topography became small water bodies (locally named the “Peel Ponds”). Sediments carried by surface water runoff and watercourses were deposited in these water bodies. In many areas, the sediments are characterized by alternating layers of soft to firm silt and clay resting on the underlying dense or hard glacial till, with overlying loose silt and sand deposits near the surface.

No distinction is made on the interpreted stratigraphic profiles between areas that may be composed of Recent Alluvium and those that may consist primarily of Recent Glaciolacustrine Deposits. In addition, Recent Alluvium should be expected in all areas adjacent to existing watercourses, regardless of the interpreted native deposit type, though no distinction has been made on the interpreted stratigraphic drawings as these deposits and their extent will be highly localized. The extent of such deposits should be identified only on the basis of additional field exploration in areas that will be critical for pavement or transitway design.

3.4 Groundwater Conditions

Groundwater conditions are expected to vary considerably along the alignments. Within the region and local route alignments, several water-bearing deposits may be encountered depending on the final depth of construction. The water-bearing stratigraphic units will include those that consist predominantly of granular soils (silt, sand, and gravel). These include:

- Recent Glaciolacustrine Deposits – where these deposits include granular soils;
- Oak Ridges Moraine Complex;
- Thorncliffe Formation; and
- Scarborough Formation.

Of these deposits, the Oak Ridges Moraine Complex and Thorncliffe Formation will be the primary groundwater aquifers (major water-bearing stratigraphic unit) influencing the design and construction of the project. Although these units will be the largest continuous aquifer, the presence of layers of low-permeability materials (silt and clay) between granular soils will create areas of groundwater that are “perched” above the main aquifer. Each of the glacial till strata identified on the simplified geologic profiles will act as an aquitard and groundwater should be expected above the interfaces of any of these till units and overlying granular soils.

It is expected that groundwater will be encountered within 1 to 2 m of the ground surface in the broad watercourse valleys. Because of the generally southward declining interfaces of the sediments, and the complex sequence of aquitards (cohesive soils) and aquifers, groundwater within these Oak Ridges Moraine and Thorncliffe sediments may exhibit artesian conditions (where the groundwater will flow to the ground surface should the aquifer be punctured). The potential for artesian pressures cannot be further defined at this stage of evaluation. In all other areas, groundwater should be anticipated within 2 m of the ground surface for planning purposes. The estimated groundwater level in the uppermost aquifer is illustrated on Figures 3 through 28 based on available information. As groundwater levels will be highly controlled by the local subsurface stratigraphy, where groundwater conditions may be critical for planning, design, or construction, they should be investigated by means of observation wells or piezometers installed so as to differentiate between “perched” and aquifer groundwater levels.

The potential underground section of Route Alternative B1 is located near the valley Black Creek near where the route alternative will approach York University. General drainage of this area is probably toward Black Creek via tributary streams.

Available subsurface data in conjunction with mapping of groundwater discharge areas suggests that the Oak Ridges Moraine complex may “daylight”, or intersect the ground surface toward the valley of Black Creek. The Upper Sand/Silt Deposit may be particularly thick near the Steeles Stations. Additional subsurface exploration must be completed to reconcile apparent differences in the available subsurface database (YPDT) information, local borehole data, and the groundwater discharge mapping to confirm this interpretation. In preparation of this memorandum, database records of groundwater supply wells were reviewed to ascertain whether or not such supply wells exist in the area of the proposed construction. Based on this review, it is anticipated that any water supply wells that existed in this area have been abandoned as municipal water systems serve the area.

4.0 PRELIMINARY GEOTECHNICAL EVALUATION

It is understood that the proposed transit route construction will consist primarily of modifying or replacing existing pavements or building newly paved areas or railways/roadways adjacent to the existing Highway 7 alignment. New transitway construction may be required where the route alternatives follow the existing Hydro ROW and the existing Highway 407 corridor. A new maintenance yard may be constructed near the intersection of Highway 7 and Langstaff Avenue. An integrated transit centre may also be constructed near the intersections of Highway 407, Highway 7, and Yonge Street. In addition, transit stations or shelters may require the filling or cutting to maintain transitway grades.

It is also understood that there may be a possibility of constructing an underground transit link between the future end of the Toronto Transit Commission's Spadina Subway (near York University and Steeles Avenue) and the Highway 7 transitway, though the general vertical and horizontal alignments of this particular option were not known at the time this report was prepared.

4.1 Influence of Subsurface Conditions on Design and Construction—Overview

The Upper Deposits, as mapped on Figures 3 through 28 are likely to consist of one of three ground conditions: Recent Alluvium, Peel Ponds (Recent Glaciolacustrine) Deposits, or Fill.

Recent Alluvium may be encountered in the areas of each of the watercourses described above. In particular, the areas between Bathurst Street and Bayview Avenue, and again between Leslie Street and Highway 48 will be relatively complex and include both Recent Alluvium as well as Peel Ponds Deposits. The number of watercourses and their orientation in these areas will result in a variety of geologically recent deposits at and near the ground surface. In the area between Woodbine Avenue and Kennedy Road, the Rouge River runs approximately parallel and just to the south of Highway 7. The recent alluvium in these areas may consist of a variety of native materials ranging locally from soft silt and clay to sand and gravel. Subsurface conditions in this area should be well defined by staged investigations during the design process to determine the conditions that may govern local pavement or transitway designs. For planning purposes, the near-surface deposits (within the top two metres) of native soil will likely be soft to loose, depending upon composition. Early planning for pavement designs should be made on the basis of relatively poor subgrade conditions in this area. Foundations for structures will likely have to be designed to penetrate through these materials for desirable foundation performance.

Peel Ponds Deposits may be encountered near locations including:

- within the broad Humber River valley
- near Langstaff Road-Highway 7 intersection and the Route Alternative B2 alignment (south of Highway 7 in the Hydro ROW);

- between Bathurst Street and Bayview Avenue; and
- between Leslie Street and Highway 48.

In particular, the area between Leslie Street and Highway 48 may be characterised by extensive areas of near-surface Peel Ponds Deposits. These deposits extend over the full width of the proposed route and all route alternatives (C1, C2, and C3), including the area of the proposed Markham Centre, located to the south of Highway 7. It is anticipated that the majority of materials shown as “Upper Deposits” on Figures 3 through 27 likely represent Peel Ponds Deposits. These deposits are likely to be soft to firm silt and clay or loose to medium dense sand and silt. Based on the available subsurface information, it is anticipated that these materials are typically less than about 5 m thick where they exist. Work completed for the existing Highway 7 alignment may have included removal of some of these sediments (as suggested by Figures 17 to 21), however, extensive areas of Peel Ponds Deposits should be expected throughout this area. Early planning for pavement designs should be made on the basis of relatively poor subgrade conditions where these “Upper Deposits” are shown in this area. Foundations for structures will likely have to be designed to penetrate through these materials for desirable foundation performance. Permanent cut slopes made in these soils should be planned no steeper than about 3:1 (horizontal:vertical) and detailed evaluations of cut slopes higher than about 3 m in such materials will need to be undertaken during final design. Temporary cuts in these soils will require temporary excavation support and displacements around such excavations may be significant for typical construction unless mitigation measures are undertaken. In addition, construction near existing watercourse valley walls of these materials with slopes steeper than 3:1 should consider the stability of the native slopes. Significant thicknesses of new fill (greater than 2 m of fill) or new area loads may also result in excessive settlements depending upon the local thickness and compressibility of the “Upper Deposits.” Any new embankments will also need to be evaluated for foundation stability should they be constructed overlying these “Upper Deposits.”

Fill, placed for past urban development activities may be encountered throughout the proposed alignments. In general, the Fill should be considered to be uncontrolled in both materials and placement control and should, therefore, be considered unsuitable for foundation support. In some areas, particularly the rights-of-way for the existing Highway 7 and Highway 407 alignments, some of the fill materials may have been placed in a more controlled manner for highway construction. However, the support capabilities of these materials, outside of the main roadways, should not be relied upon until detailed reviews of construction records are completed in future design tasks. Support of pavements on existing fill materials poses presently unquantifiable risks for subsequent performance. It is also anticipated that the thickness and composition of fill materials will be random and the influence of existing Fill materials on the design and construction of the project should be examined in detail during subsequent phases of design. The presence or absence of extensive areas of Fill materials, placed during mass earthwork or demolition activities cannot be judged based on the available information at this time except for

those areas shown on Figures 3 through 27 where existing Highway 7 grades and the geologic profile surface differ significantly. Permanent cut or fill slopes made in these soils should be planned no steeper than about 3:1 (horizontal:vertical). In addition, construction near existing watercourse valley walls with slopes steeper than 3:1 in these materials should consider the stability of the existing slopes. Detailed evaluations of slopes higher than about 3 m will need to be undertaken during final design. Temporary cuts in these soils will require temporary excavation support and displacements around such excavations may be significant for typical construction unless mitigation measures are undertaken.

Other than the “Upper Deposits”, the Halton Till will likely be the primary native deposit encountered along the proposed routes, except those areas as noted above. This deposit is relatively dense or hard and should be suitable for both foundation support and pavement subgrades. Although the overall consistency and composition of the deposit should not hinder pavement construction, in most areas it is anticipated that this deposit will be composed of fine-grained soils. The fine-grained nature of the soils will make moisture control during construction and long-term subgrade/sub-base drainage critical for long-term performance of pavements or track beds. Any permanent cut or fill slopes with slopes steeper than 3:1 (horizontal:vertical) and a height or depth greater than 3 m should be further evaluated during final design.

4.2 Influence of Subsurface Conditions on Design and Construction – Route Alternative B1

If an underground transitway (for light rail, busway, or subway) is to be constructed between Highway 7 and Steeles Avenue along the Jane Street corridor, excavation will likely pass through surficial deposits of Fill, the Halton Till, Oak Ridges Moraine complex, and the Newmarket Till. Much of the excavation should be through the relatively competent Halton Till deposit.

It is anticipated that tunnel construction in this area could be accomplished using conventional cut-and-cover techniques in which a deep excavation to the proposed subgrade is made. Based on the prevailing ground conditions, temporary cuts for open-cut construction may be made with side slopes in the range of 1:1 to 1.5:1 (horizontal:vertical). It is expected, however, that in most instances, vertical excavation sides will be required and that these excavations will require some form of temporary shoring. Shoring could consist of either soldier-piles and lagging or contiguous caisson (cast-in-place secant pile) walls, depending on the requirements for groundwater control. The ground conditions along the proposed subway alignments should be favourable for tunnelling, provided groundwater is adequately controlled. For relatively long lengths of tunnel, generally greater than about 600 m, it may be both feasible and economically suitable to use a tunnel boring machine (TBM). The TBMs used for the recently constructed Sheppard Subway were designed as earth-pressure-balance (EPB) machines so as to assist in controlling ground displacements as well as groundwater levels. The TBMs designed and used for the Sheppard Subway included both rock and soil cutting tools to limit difficulties from

encountering boulders. The sequential excavation method, in which a number of short-length stages of mechanically-assisted and unsupported excavation are followed immediately by steel ribs and shot-crete lining construction, may also be a suitable technique for relatively short sections of tunnel. Where the tunnels or cut and cover structures pass directly beneath or adjacent to existing structures or highways (e.g. Highway 407), additional ground control measures may be necessary. It is generally recommended that any tunnelling that is to be carried out beneath buildings or highways be at a depth that leaves a distance of at least twice the tunnel diameter between the crown of the tunnel and the underside of any building foundations. Detailed settlement evaluations should be completed for any areas where it is contemplated that tunnelling will be completed

The Oak Ridges Moraine Complex underlies the Halton Till in this area, and groundwater pressures in this stratum may have to be controlled to facilitate construction. Groundwater lowering may require dewatering systems or cut-off wall technologies to limit the influence of groundwater on both the construction and the effects of groundwater lowering on adjacent watercourses or properties. Based on previous construction for Toronto subway projects, such dewatering may be accomplished using deep wells or eductor well systems. The influence of dewatering on settlement of the surrounding ground should be relatively minimal. The relative risks associated with potentially contaminated sites are identified in a separate report. Where the proposed construction will pass through or near such sites, the groundwater extracted during dewatering may require treatment prior to disposal. In addition, it may be necessary to seal potential vertical pathways for groundwater seepage that could develop along the boundaries between the ground, temporary shoring, and permanent structure.

Based on the available subsurface information, it appears that groundwater conditions may present an issue near Steeles Avenue and York University. In the area of the proposed route alternative, the aquifers (saturated granular deposits) typically consist primarily of fine sand and silt. The combined permeability, limited vertical thickness of the aquifers, and water pressures that may be encountered during construction may not result in the need to draw large quantities of groundwater from these aquifers (though MOE Permits to Take Water are still likely to be required). Where tunnelling may be completed by closed-face tunnel boring machines, the need for dewatering may also be minimized. The influence of construction dewatering on groundwater discharge to stream or tributary systems will be sensitive to local geology and for this reason additional subsurface information will be necessary for further evaluation of the underground section of Route Alternative B1 should this alternative be chosen.

4.3 Influence of Subsurface Conditions on Route Selection

The native subsurface conditions along the proposed route variations should be relatively similar, except in the area of the proposed Route Alternative B2 alignment where more extensive areas of Peel Ponds Deposits (Recent Deposits) may be found. Evaluating the degree to which these

conditions may affect the planned transitway construction will require further local investigations and evaluations should this alternative be selected.

Route Alternative B1 may include an underground section. It is anticipated that the choice of whether or not the section will be underground will depend on operational and long-term system planning considerations. It is generally recommended, if possible, to keep construction within the Black Creek valley area as far as practicable from the watercourse. Although crossing the Black Creek valley may be required, it is also anticipated that, pending further investigations and evaluations, limiting the influence of construction on groundwater and surface water levels (including both discharge to the watercourses and extraction of groundwater) may be controlled through selection of suitable construction technologies.

5.0 LIMITATIONS AND USE OF REPORT

This report was prepared for the exclusive use of the Consortium and York Transit. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of the third party. The report is based on data and information collected during the assessment of the Highway 7 transitway route options conducted by Golder. The report is based solely on the conditions observed at the time of limited visual reconnaissance, supplemented by a review of historical and publicly available information and data obtained by Golder as described in this report. No soil, water, liquid, gas, product or chemical sampling or analytical testing at or in the vicinity of the Site were conducted as part of this work. This report is intended to be used for planning purposes only as consistent with the feasibility and route selection activities underway at the time this report was prepared. Additional explorations of subsurface conditions will need to be carried out to better define the local geologic stratigraphy, groundwater levels, and the engineering properties of the subsurface materials for any further design activities.

6.0 CLOSURE

We trust this report provided the information required. However, should you have any questions, please do not hesitate to contact the undersigned.

Yours truly,

GOLDER ASSOCIATES LTD.

Storer J. Boone, P.Eng., Ph.D.
Associate

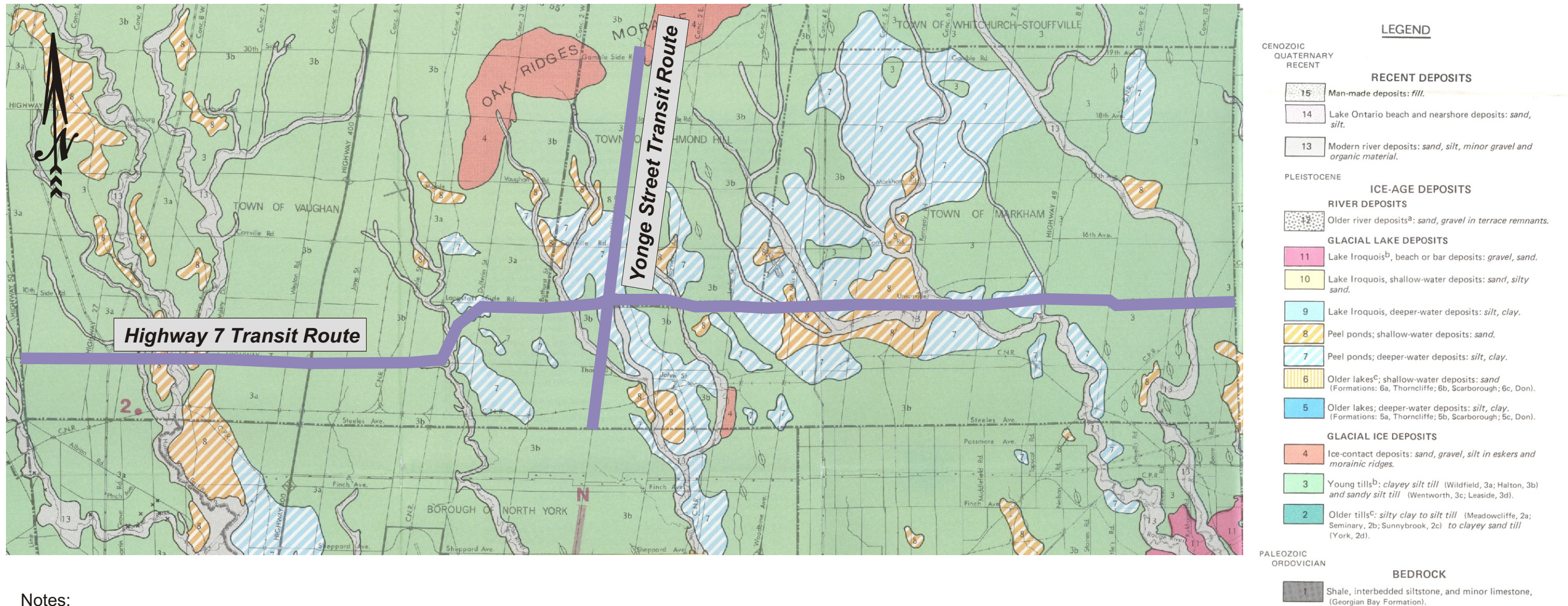
John Westland, P.Eng.
Principal

SB/JW/sm

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SITE LOCATION AND SURFICIAL GEOLOGY MAP
YORK RAPID TRANSIT PLAN

FIGURE 1



Notes:

1. Map from "Ontario Geological Survey, Preliminary Map P. 2204, Geological Series, Quaternary Geology, Toronto and Surrounding Area, Southern Ontario," Ministry of Natural Resources, 1980.
2. Map not to scale.
3. Primary routes for York Region Transit Plan shown only. Alternative routes not shown.

Figure 1 - Site Plan and Surficial Geology Map York Rapid Transit Plan

Date: May 2003

Project: 031-111001

Golder Associates


By: SJB


Chkd: JW


LEGEND TO PLAN AND SIMPLIFIED GEOLOGIC PROFILE


FIGURE 2


LEGEND:


BOREHOLE/WELL LOCATION 


STATIONS 


TRANSITWAY 


PROPOSED TRAFFIC LANES 

PROPOSED SIDEWALK 


PROPOSED LANDSCAPE 


EXISTING ROADWAYS 

EXISTING RIGHT OF WAY 

MUNICIPAL BOUNDARIES 
CITY OF VAUGHAN
TOWN OF MARKHAM


LEGEND FOR GEOLOGIC STRATIGRAPHIC UNITS:


 UNKNOWN, LIKELY FILL

 UPPER DEPOSITS OF RECENT ALLUVIUM, RECENT GLACIOLACUSTRINE DEPOSITS, AND FILL


 HALTON TILL: PREDOMINANTLY SILT AND CLAY DIAMICT

 OAK RIDGES MORaine COMPLEX: PREDOMINANTLY SAND AND SILT WITH LOCAL GRAVEL

 NEWMARKET TILL: PREDOMINANTLY SILT AND CLAY DIAMICT

 THORNCLIFF FORMATION: PREDOMINANTLY SILT AND SAND

 SUNNYBROOK FORMATION: PREDOMINANTLY SILT AND CLAY

 SCARBOROUGH FORMATION: PREDOMINANTLY SILT AND SAND

NOTES:

1. DRAWINGS INDICATE SIMPLIFIED AND INTERPRETED SUBSURFACE MATERIALS AND GEOLOGIC DEPOSIT TYPES BASED ON WIDELY SPACED BOREHOLE INFORMATION. THE SUBSURFACE CONDITIONS ARE TO BE CONSIDERED ONLY PRELIMINARY INDICATIONS OF SUBSURFACE MATERIALS AND SHOULD NOT BE USED FOR DESIGN PURPOSES WITHOUT CONFIRMATION OF ACTUAL CONDITIONS USING FIELD EXPLORATIONS.
2. THIS DRAWING MUST BE READ WITH THE ACCOMPANYING TEXT.
3. GROUND SURFACE PROFILE AND PLAN DATA PROVIDED BY DELCAN CORPORATION.

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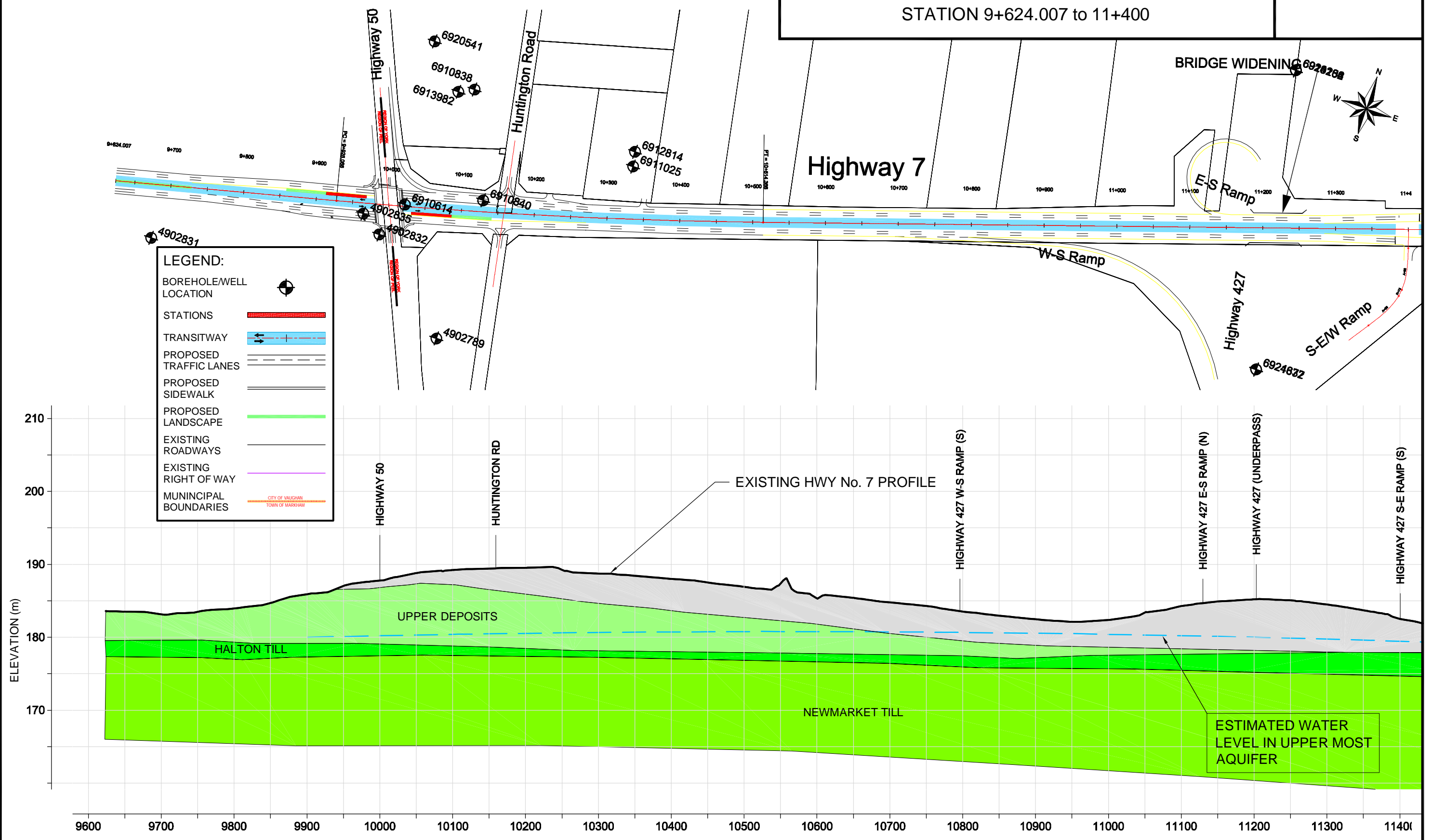
DATE: MARCH 2003
PROJECT: 03-1111-001



CAD: FC/JDR
CHK:

SITE PLAN AND SIMPLIFIED GEOLOGIC PROFILE
 HIGHWAY 7 ALIGNMENT
 STATION 9+624.007 to 11+400

FIGURE 3

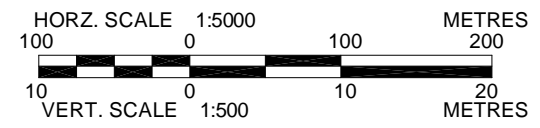


LEGEND:

- BOREHOLE/WELL LOCATION
- STATIONS
- TRANSITWAY
- PROPOSED TRAFFIC LANES
- PROPOSED SIDEWALK
- PROPOSED LANDSCAPE
- EXISTING ROADWAYS
- EXISTING RIGHT OF WAY
- MUNICIPAL BOUNDARIES

CITY OF VAUGHAN
TOWN OF MARRHAM

NOTES:
 VERTICAL EXAGGERATION IS 10 TIMES
 SEE OTHER NOTES AND LEGEND FIGURE 2



DATE: OCTOBER, 2003
 PROJECT: 03-1111-001

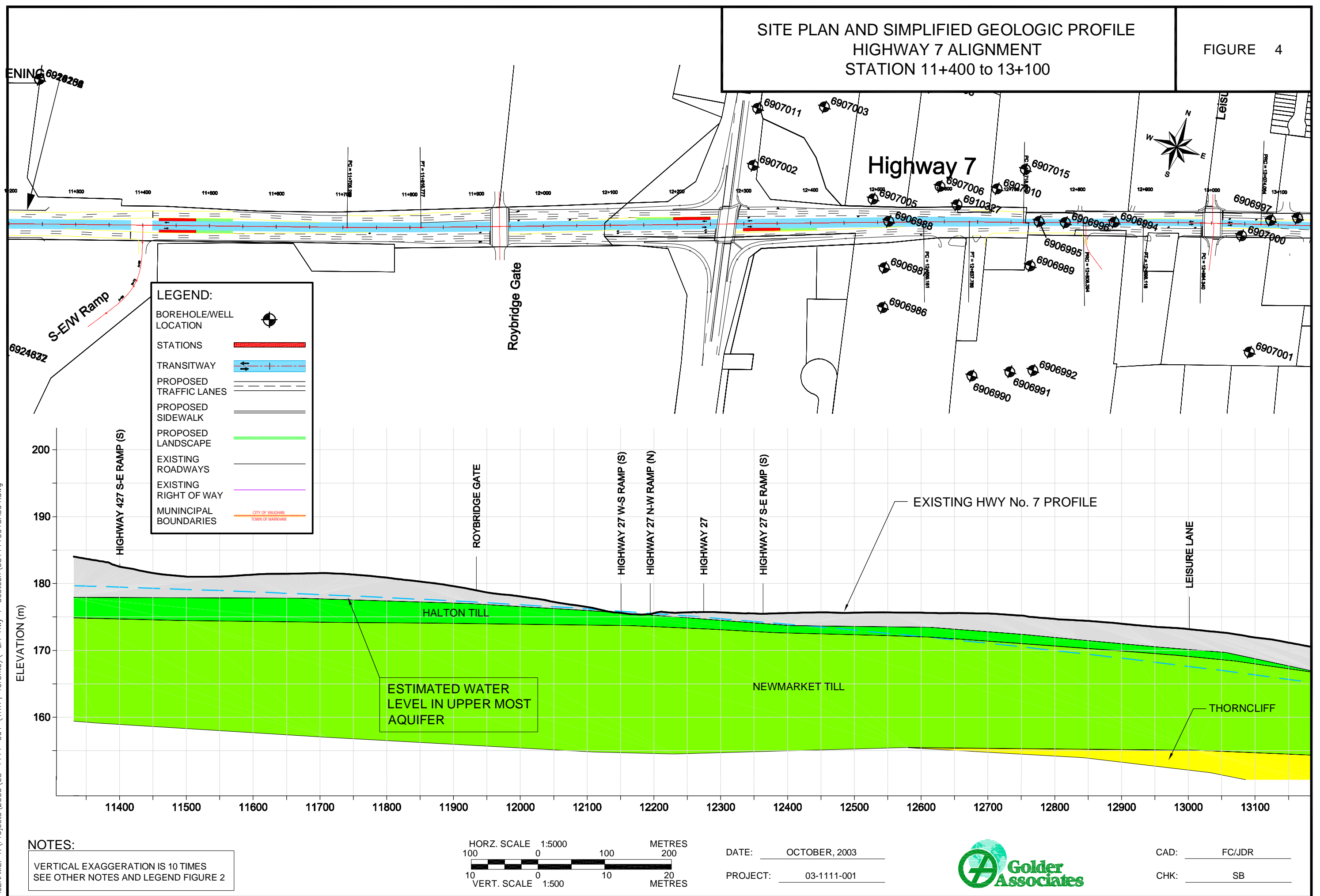


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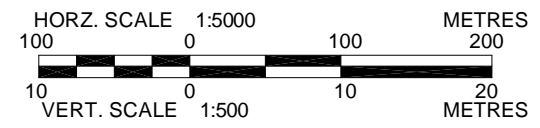
SITE PLAN AND SIMPLIFIED GEOLOGIC PROFILE
 HIGHWAY 7 ALIGNMENT
 STATION 11+400 to 13+100

FIGURE 4



PLOT DATE: March 01, 2004
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NOTES:
 VERTICAL EXAGGERATION IS 10 TIMES
 SEE OTHER NOTES AND LEGEND FIGURE 2



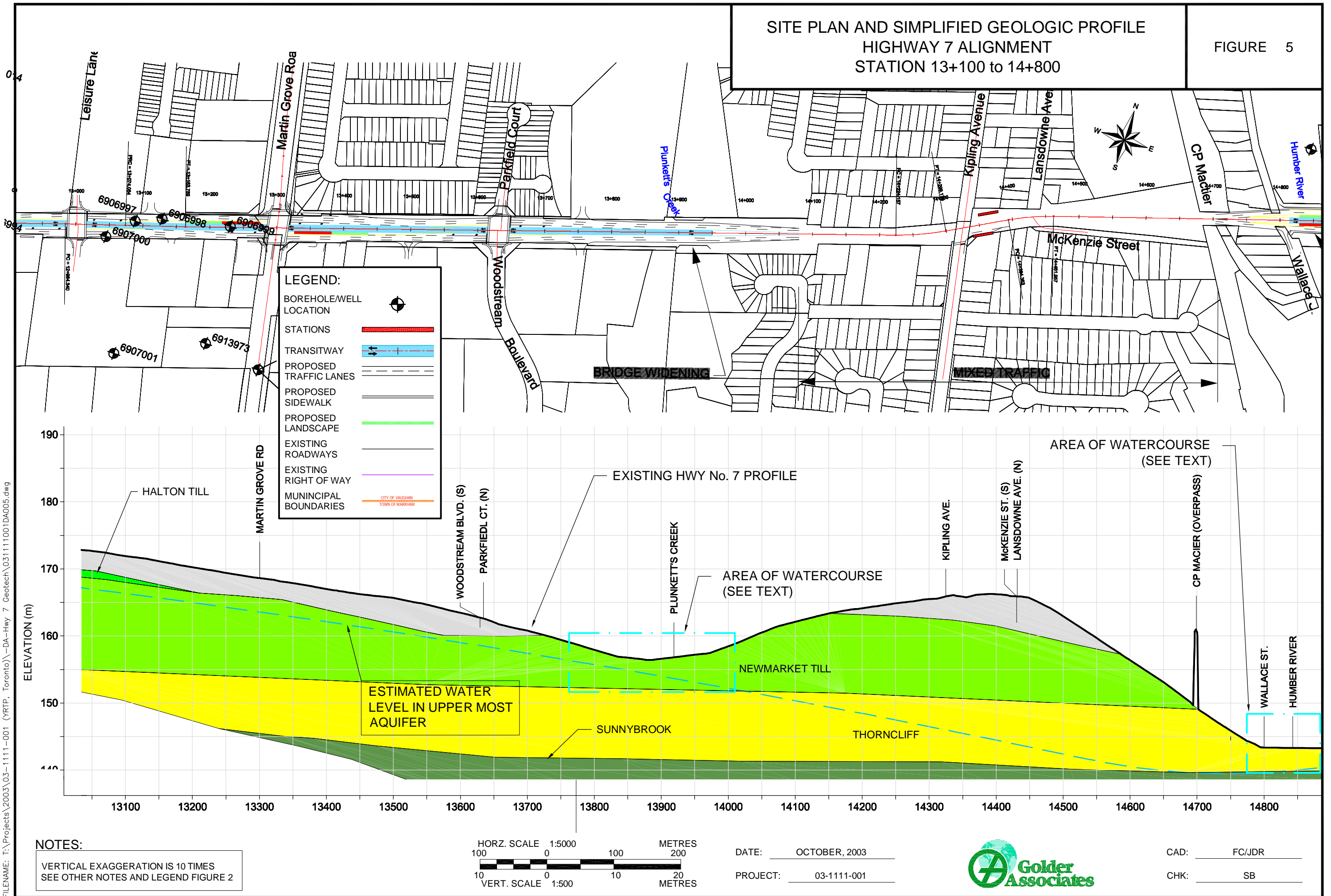
DATE: OCTOBER, 2003
 PROJECT: 03-1111-001



CAD: FC/JDR
 CHK: SB

SITE PLAN AND SIMPLIFIED GEOLOGIC PROFILE
 HIGHWAY 7 ALIGNMENT
 STATION 13+100 TO 14+800

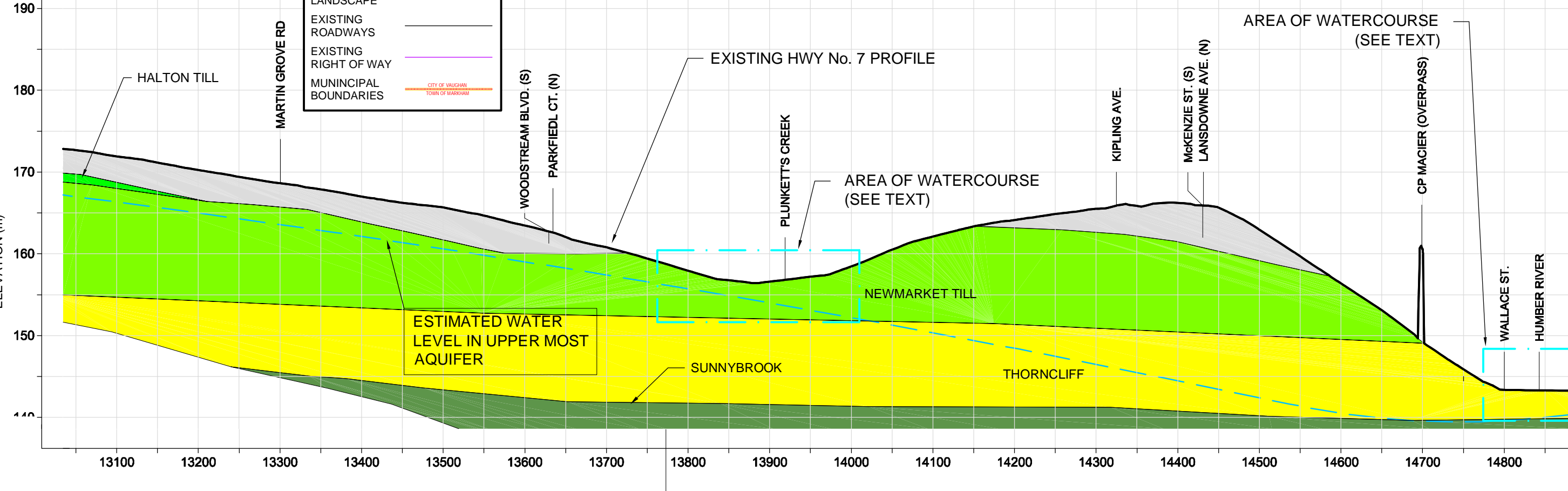
FIGURE 5



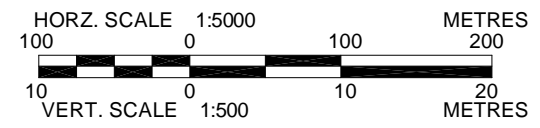
LEGEND:

- BOREHOLE/WELL LOCATION
- STATIONS
- TRANSITWAY
- PROPOSED TRAFFIC LANES
- PROPOSED SIDEWALK
- PROPOSED LANDSCAPE
- EXISTING ROADWAYS
- EXISTING RIGHT OF WAY
- MUNICIPAL BOUNDARIES

CITY OF VAUGHAN
TOWN OF MARKHAM



NOTES:
 VERTICAL EXAGGERATION IS 10 TIMES
 SEE OTHER NOTES AND LEGEND FIGURE 2



DATE: OCTOBER, 2003
 PROJECT: 03-1111-001

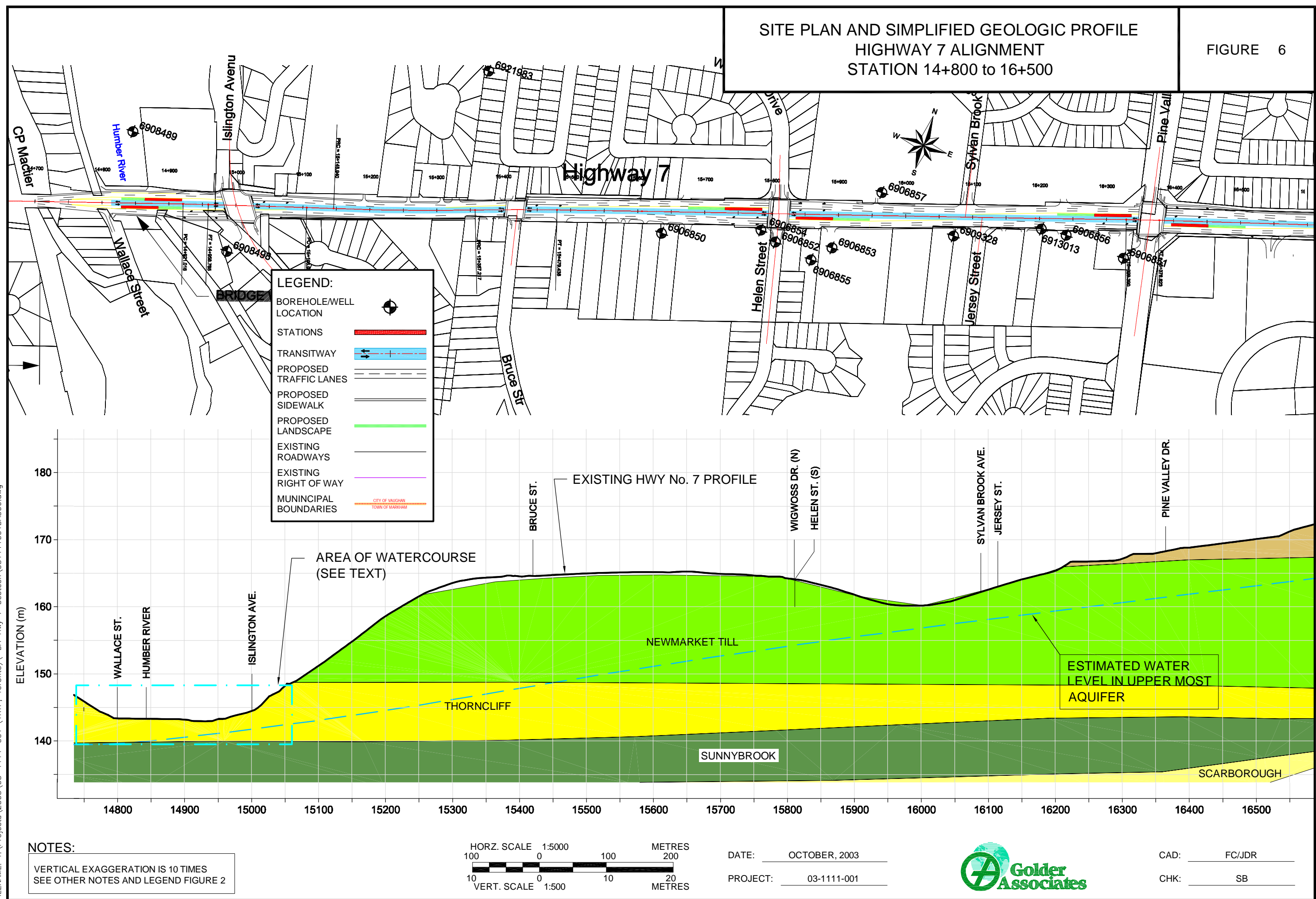


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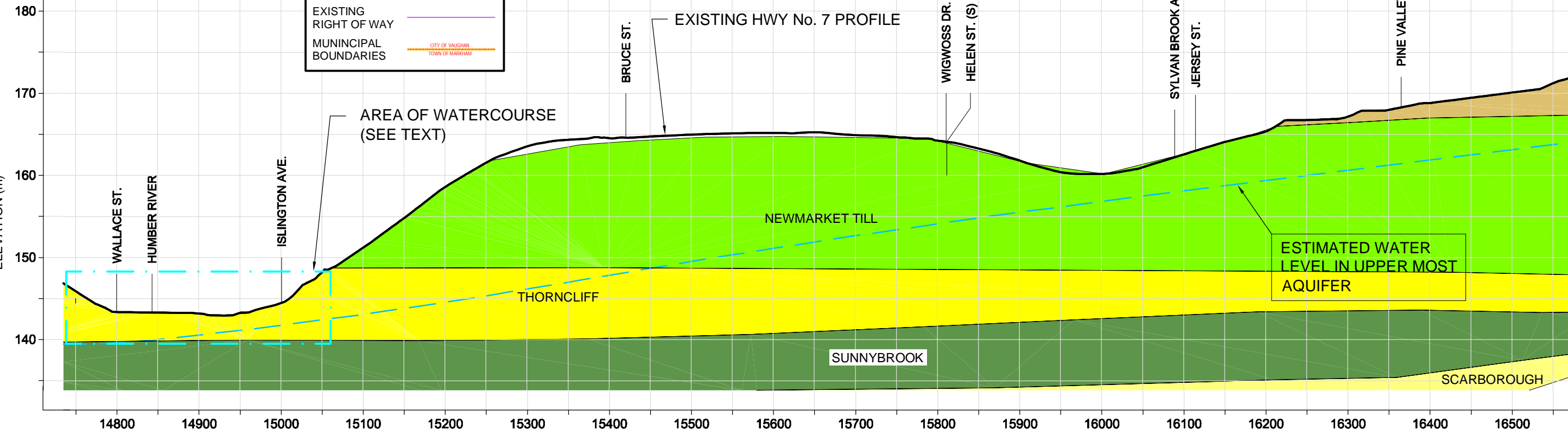
SITE PLAN AND SIMPLIFIED GEOLOGIC PROFILE
 HIGHWAY 7 ALIGNMENT
 STATION 14+800 TO 16+500

FIGURE 6

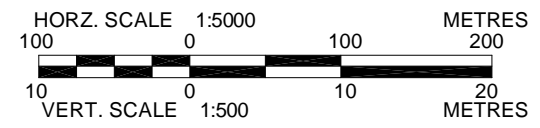


LEGEND:

- BOREHOLE/WELL LOCATION
- STATIONS
- TRANSITWAY
- PROPOSED TRAFFIC LANES
- PROPOSED SIDEWALK
- PROPOSED LANDSCAPE
- EXISTING ROADWAYS
- EXISTING RIGHT OF WAY
- MUNICIPAL BOUNDARIES



NOTES:
 VERTICAL EXAGGERATION IS 10 TIMES
 SEE OTHER NOTES AND LEGEND FIGURE 2



DATE: OCTOBER, 2003
 PROJECT: 03-1111-001

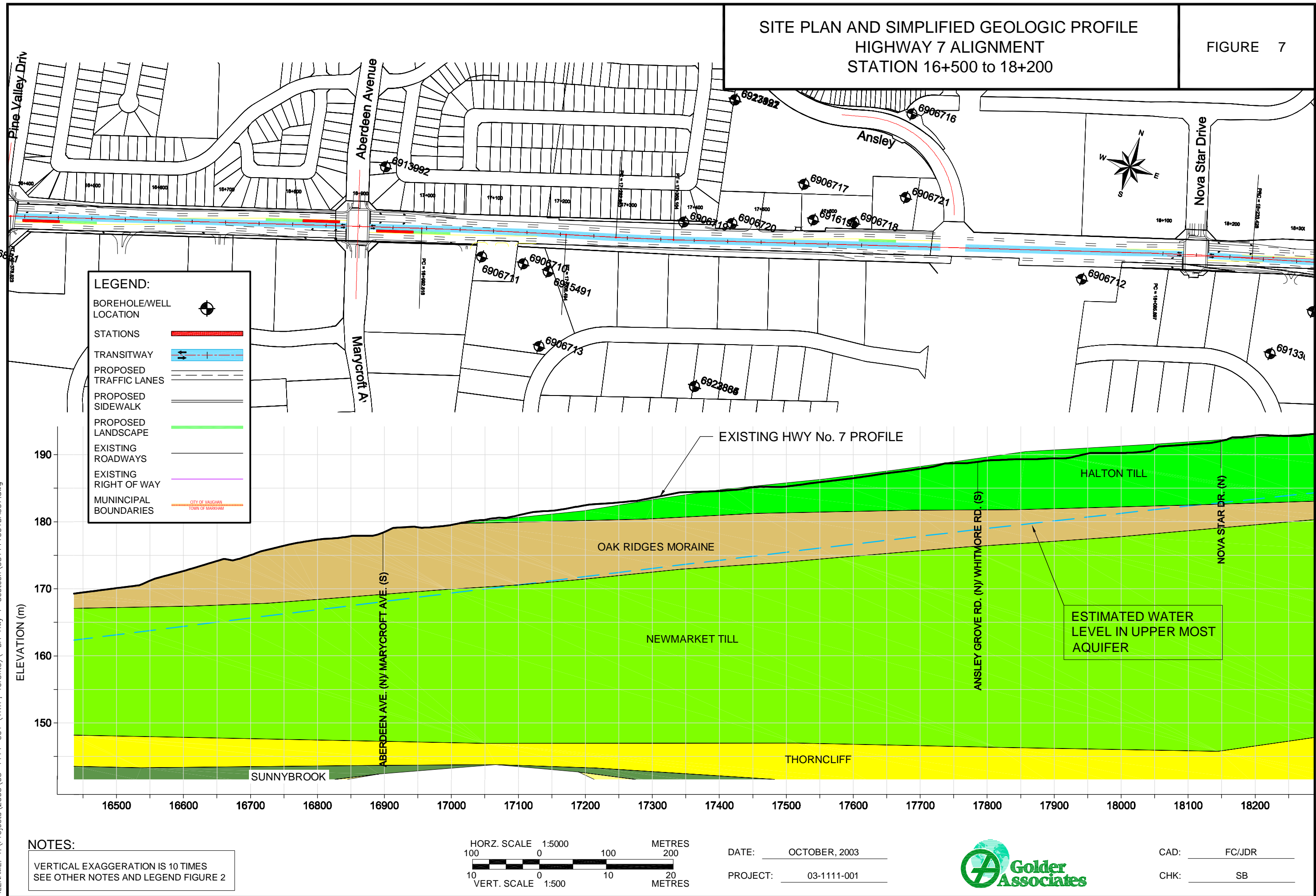


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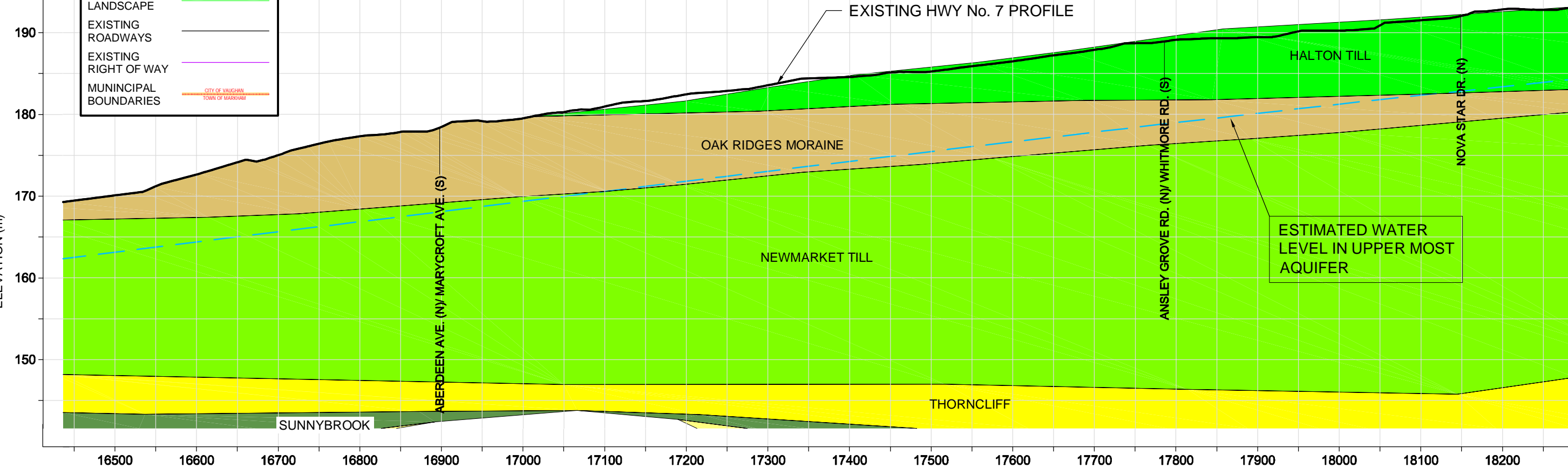
SITE PLAN AND SIMPLIFIED GEOLOGIC PROFILE
 HIGHWAY 7 ALIGNMENT
 STATION 16+500 to 18+200

FIGURE 7

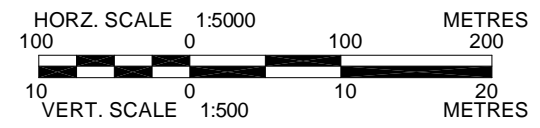


LEGEND:

- BOREHOLEWELL LOCATION
- STATIONS
- TRANSITWAY
- PROPOSED TRAFFIC LANES
- PROPOSED SIDEWALK
- PROPOSED LANDSCAPE
- EXISTING ROADWAYS
- EXISTING RIGHT OF WAY
- MUNICIPAL BOUNDARIES



NOTES:
 VERTICAL EXAGGERATION IS 10 TIMES
 SEE OTHER NOTES AND LEGEND FIGURE 2



DATE: OCTOBER, 2003
 PROJECT: 03-1111-001

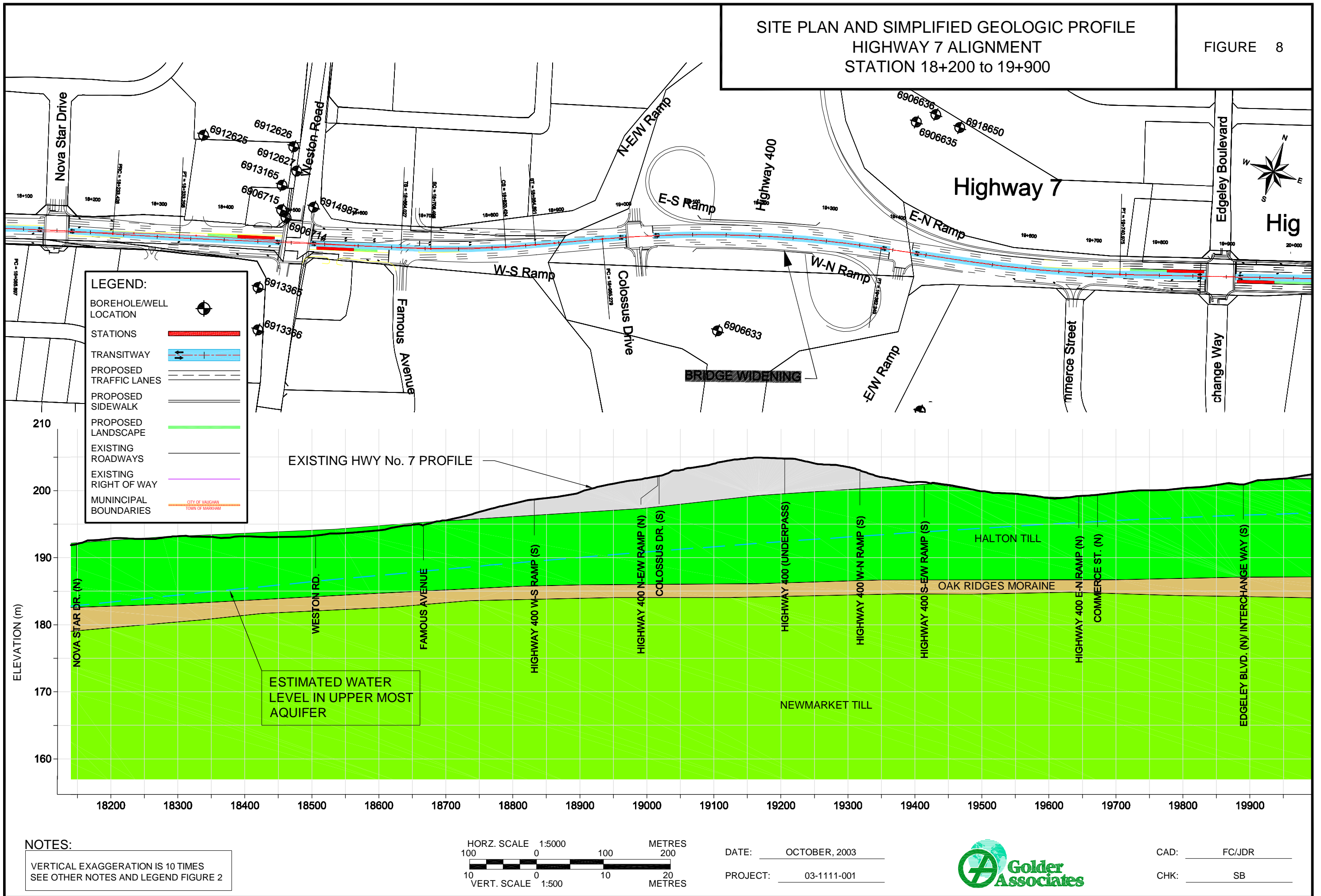


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PLOT DATE: March 01, 2004
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SITE PLAN AND SIMPLIFIED GEOLOGIC PROFILE
 HIGHWAY 7 ALIGNMENT
 STATION 18+200 TO 19+900

FIGURE 8



PLOT DATE: March 01, 2004
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NOTES:
 VERTICAL EXAGGERATION IS 10 TIMES
 SEE OTHER NOTES AND LEGEND FIGURE 2

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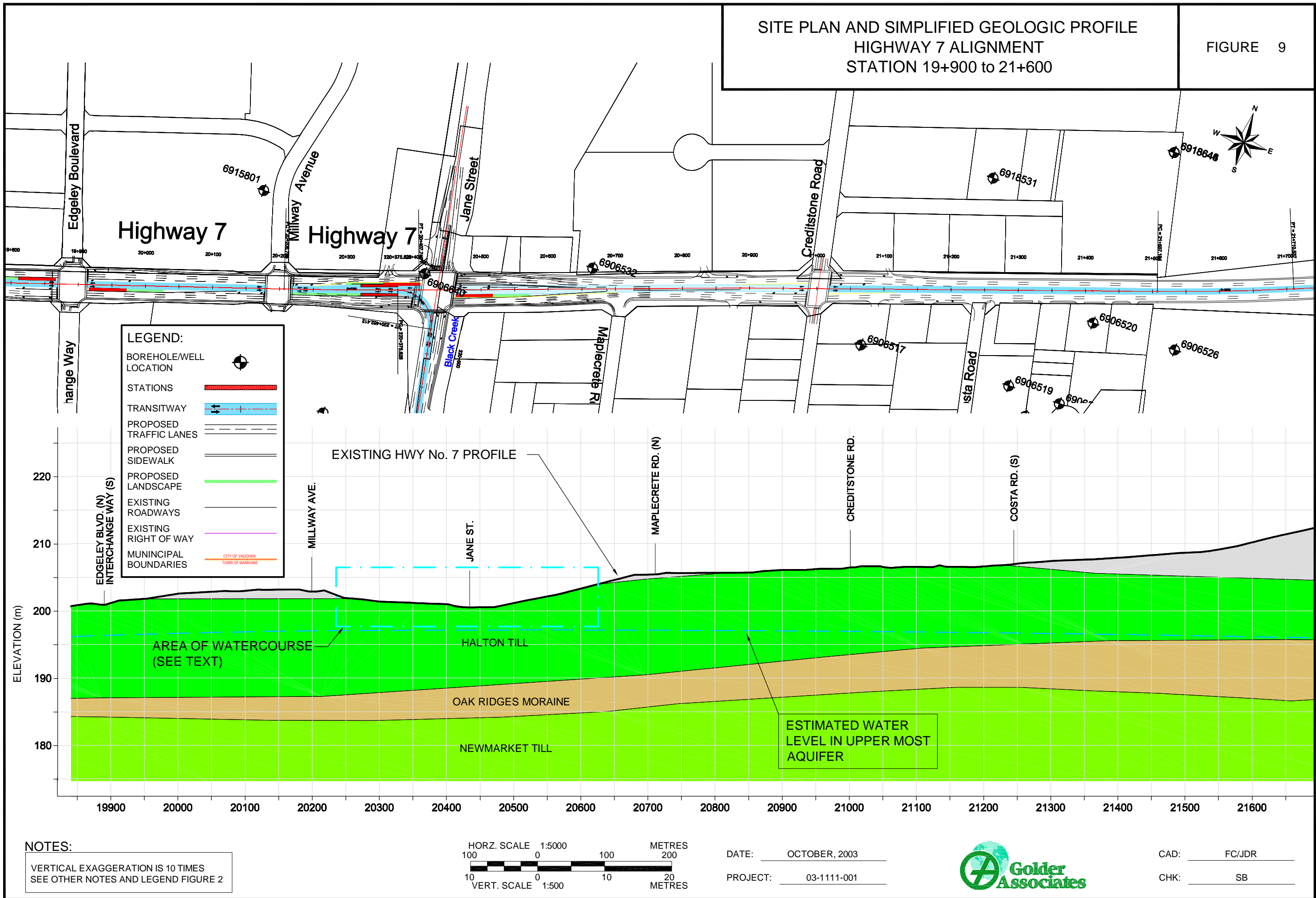
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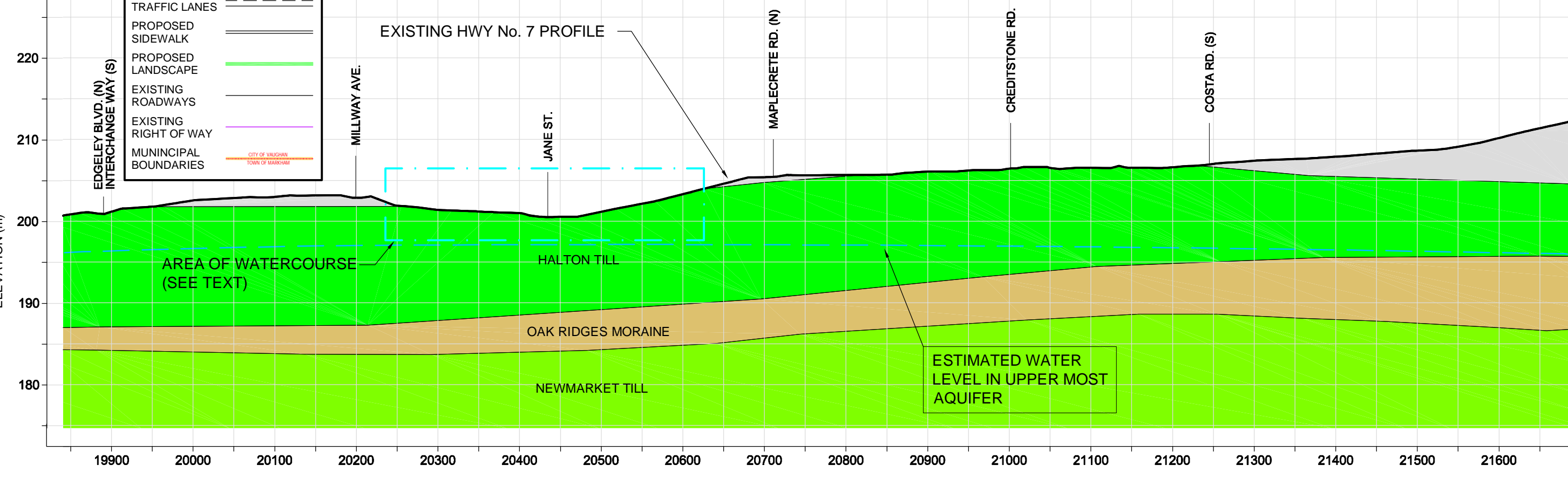
SITE PLAN AND SIMPLIFIED GEOLOGIC PROFILE
 HIGHWAY 7 ALIGNMENT
 STATION 19+900 to 21+600

FIGURE 9



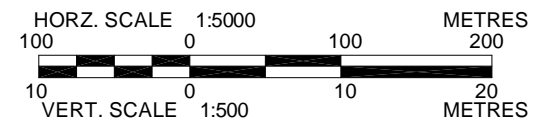
LEGEND:

- BOREHOLE/WELL LOCATION
- STATIONS
- TRANSITWAY
- PROPOSED TRAFFIC LANES
- PROPOSED SIDEWALK
- PROPOSED LANDSCAPE
- EXISTING ROADWAYS
- EXISTING RIGHT OF WAY
- MUNICIPAL BOUNDARIES



NOTES:

VERTICAL EXAGGERATION IS 10 TIMES
 SEE OTHER NOTES AND LEGEND FIGURE 2



DATE: OCTOBER, 2003

PROJECT: 03-1111-001



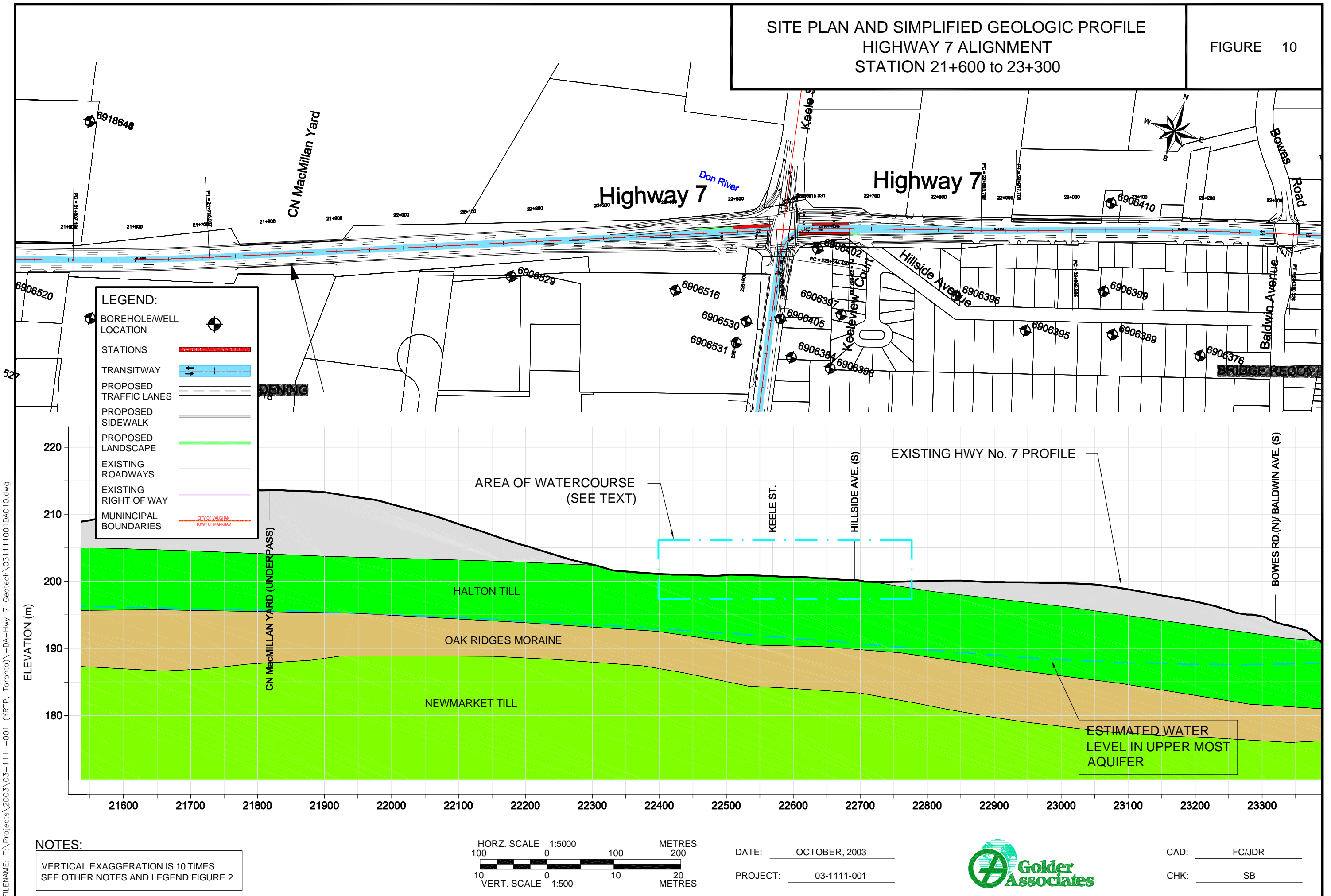
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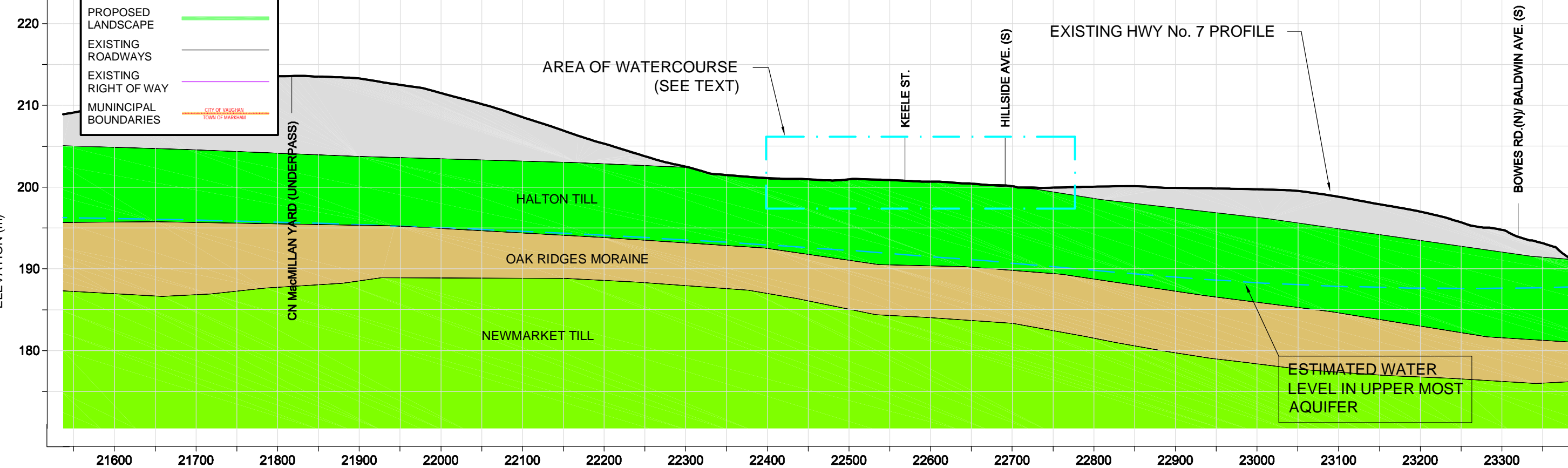
SITE PLAN AND SIMPLIFIED GEOLOGIC PROFILE
 HIGHWAY 7 ALIGNMENT
 STATION 21+600 to 23+300

FIGURE 10



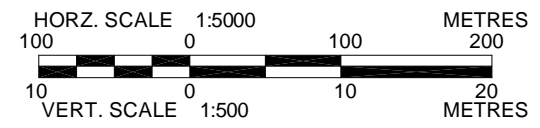
LEGEND:

- BOREHOLEWELL LOCATION
- STATIONS
- TRANSITWAY
- PROPOSED TRAFFIC LANES
- PROPOSED SIDEWALK
- PROPOSED LANDSCAPE
- EXISTING ROADWAYS
- EXISTING RIGHT OF WAY
- MUNICIPAL BOUNDARIES



NOTES:

VERTICAL EXAGGERATION IS 10 TIMES
 SEE OTHER NOTES AND LEGEND FIGURE 2



DATE: OCTOBER, 2003

PROJECT: 03-1111-001



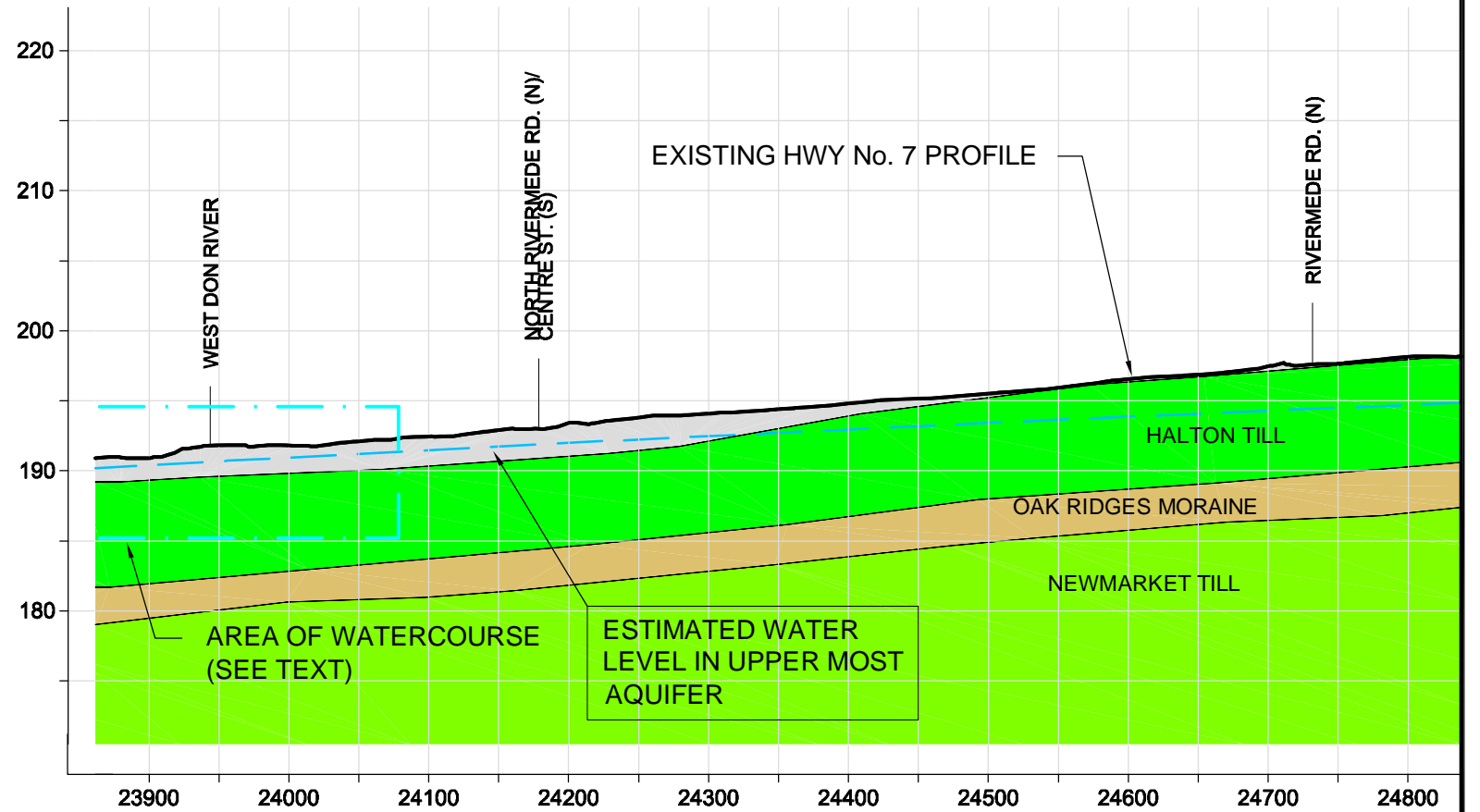
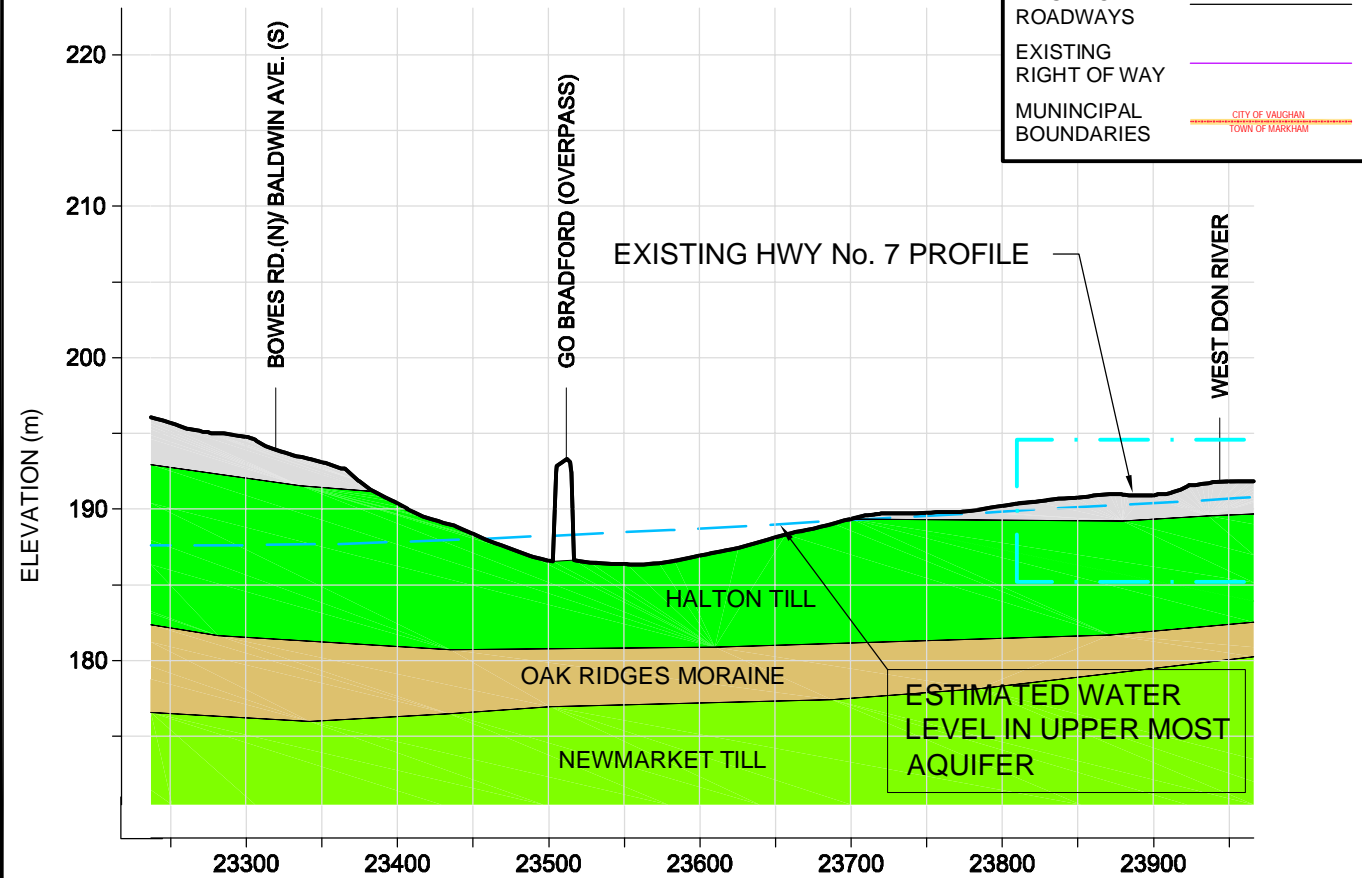
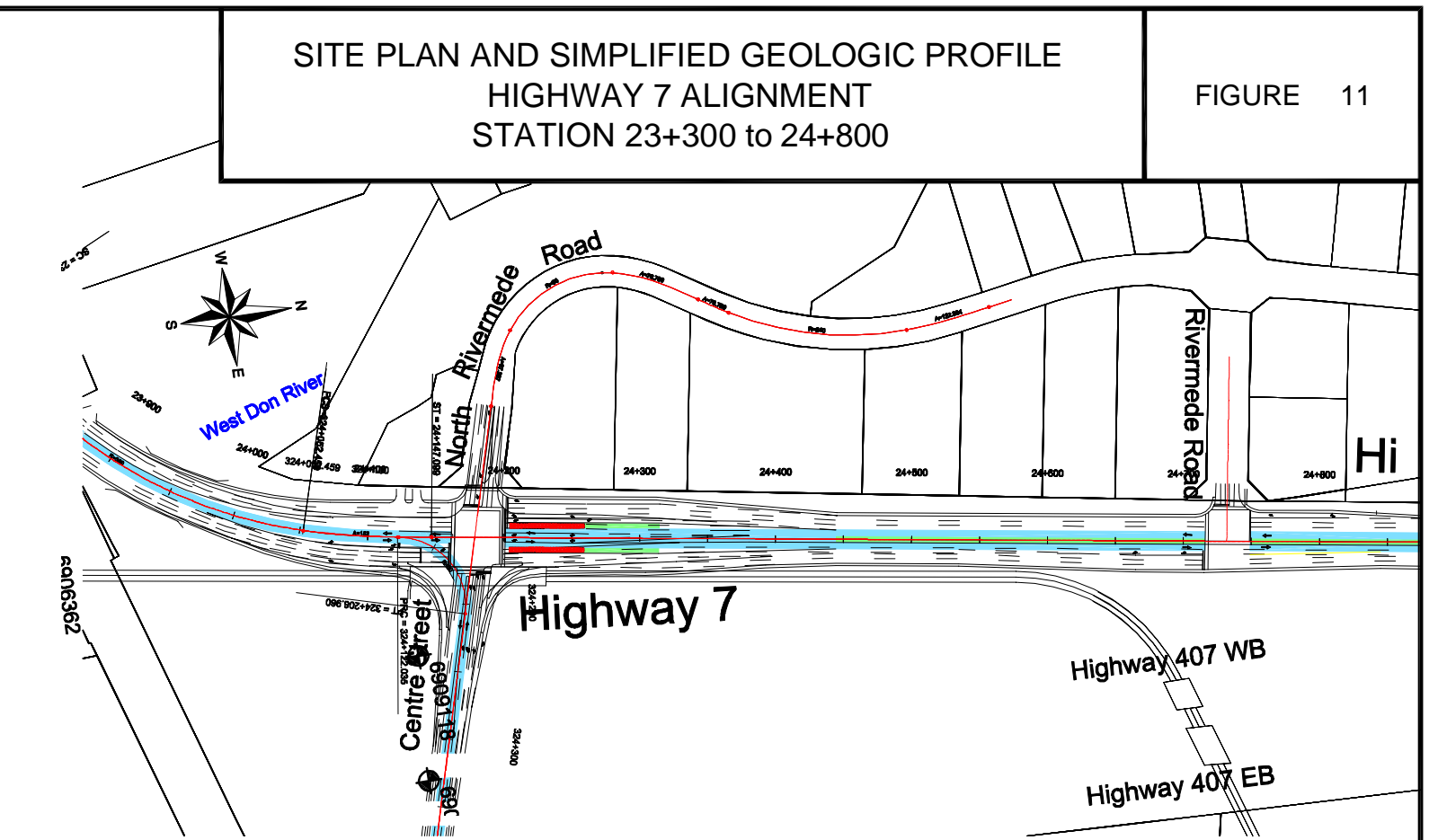
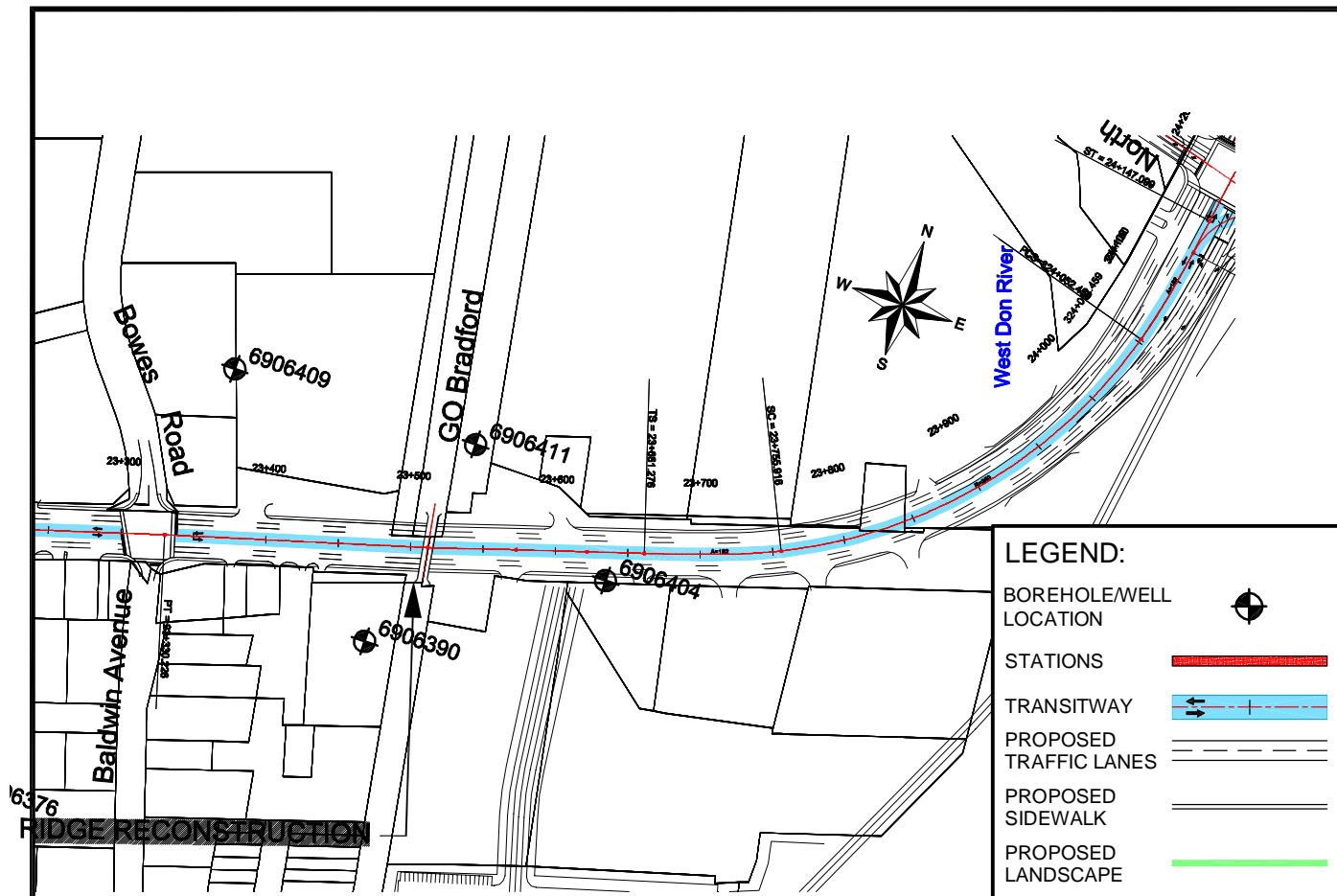
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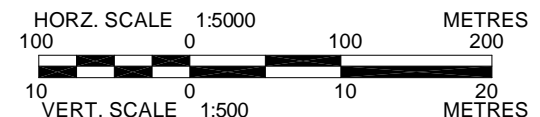
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SITE PLAN AND SIMPLIFIED GEOLOGIC PROFILE
HIGHWAY 7 ALIGNMENT
STATION 23+300 to 24+800

FIGURE 11



NOTES:
VERTICAL EXAGGERATION IS 10 TIMES
SEE OTHER NOTES AND LEGEND FIGURE 2



DATE: OCTOBER, 2003
PROJECT: 03-1111-001

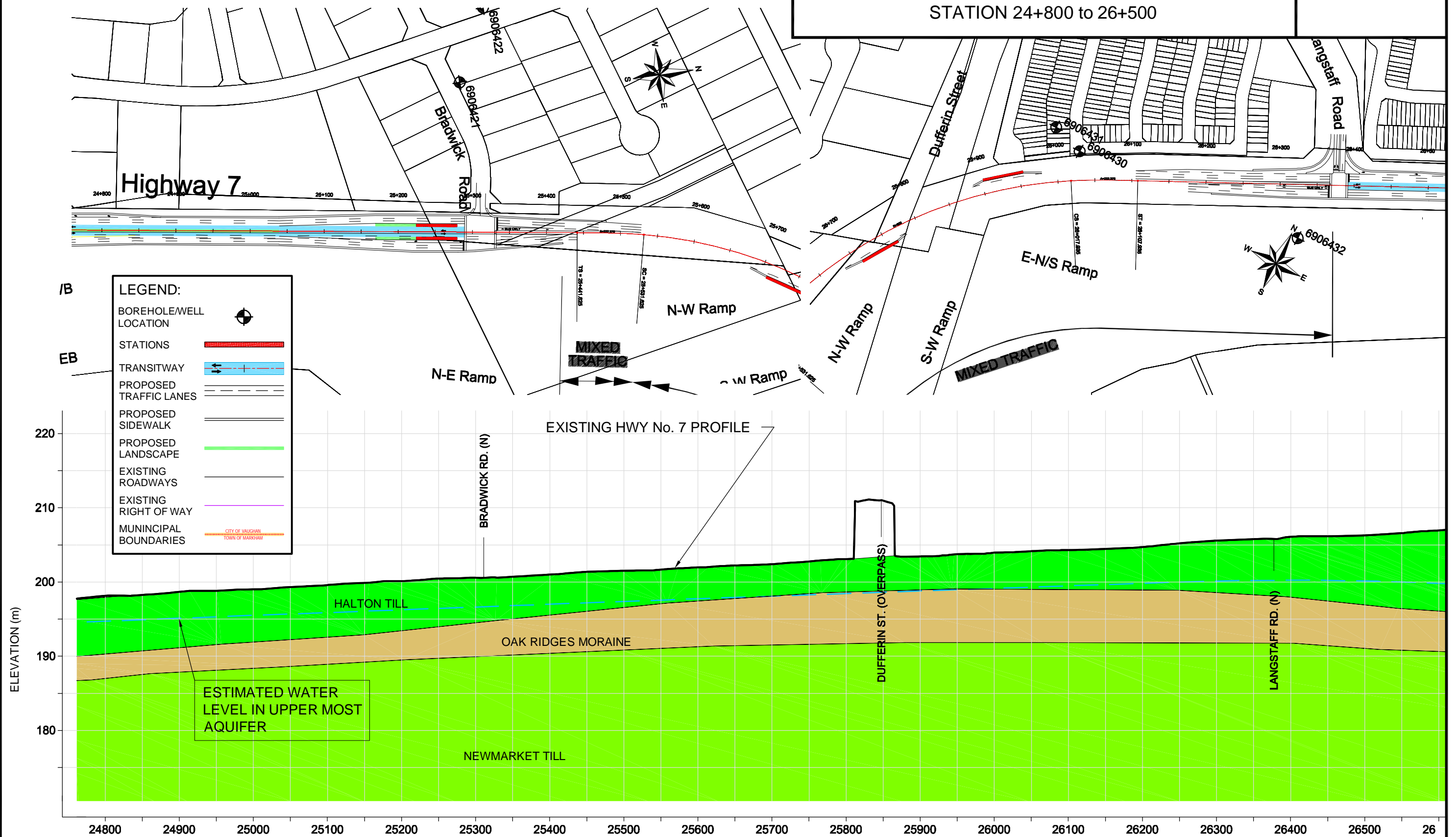


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CHK: SB

PLOT DATE: March 01, 2004
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SITE PLAN AND SIMPLIFIED GEOLOGIC PROFILE
 HIGHWAY 7 ALIGNMENT
 STATION 24+800 to 26+500

FIGURE 12



LEGEND:

- BOREHOLE/WELL LOCATION
- STATIONS
- TRANSITWAY
- PROPOSED TRAFFIC LANES
- PROPOSED SIDEWALK
- PROPOSED LANDSCAPE
- EXISTING ROADWAYS
- EXISTING RIGHT OF WAY
- MUNICIPAL BOUNDARIES

CITY OF VAUGHAN
TOWN OF MARKHAM

ELEVATION (m)

220

210

200

190

180

24800 24900 25000 25100 25200 25300 25400 25500 25600 25700 25800 25900 26000 26100 26200 26300 26400 26500 26

NOTES:

VERTICAL EXAGGERATION IS 10 TIMES
 SEE OTHER NOTES AND LEGEND FIGURE 2

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VERT. SCALE 1:500 METRES
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DATE: OCTOBER, 2003

PROJECT: 03-1111-001



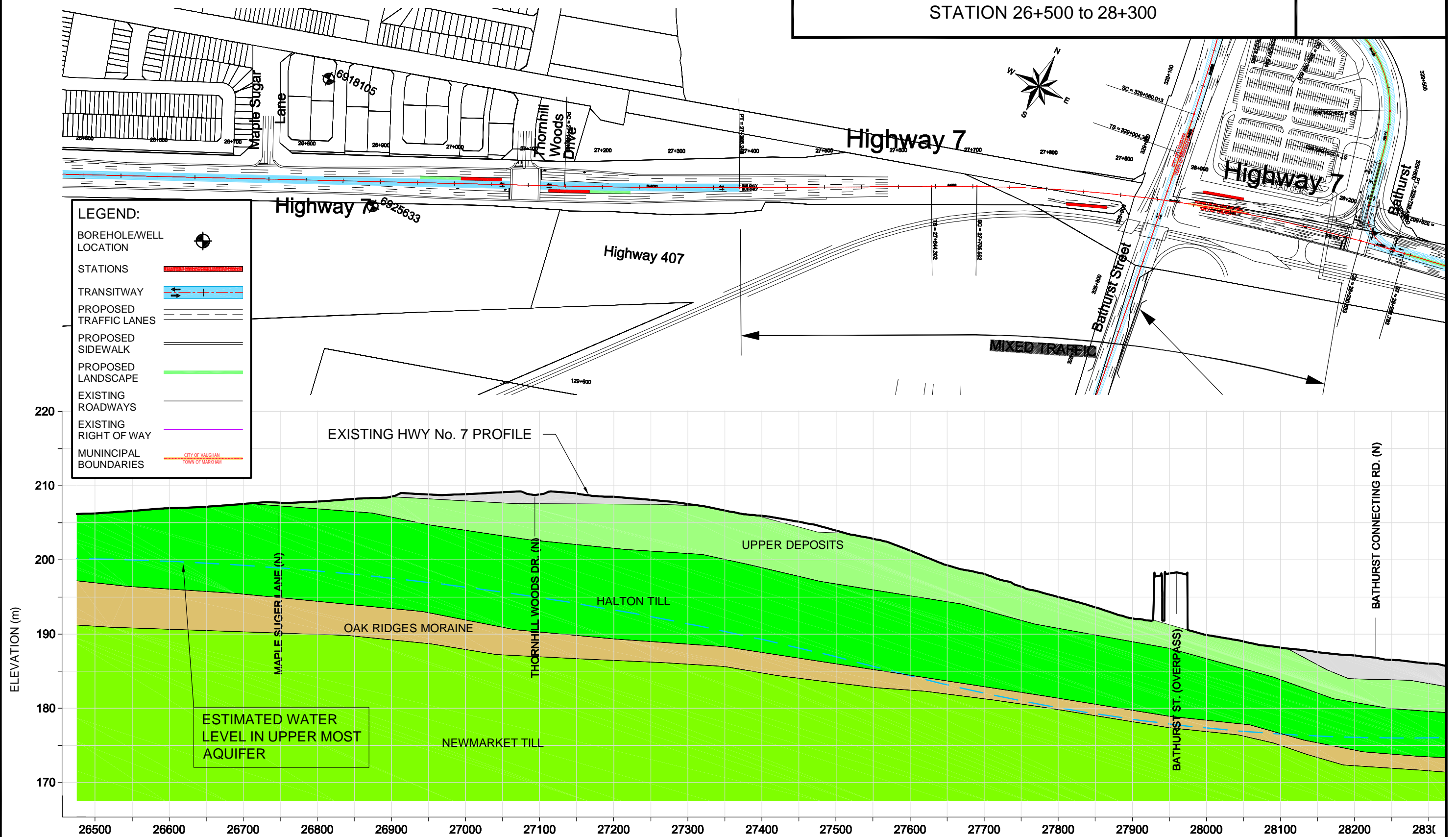
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PLOT DATE: March 01, 2004
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SITE PLAN AND SIMPLIFIED GEOLOGIC PROFILE
 HIGHWAY 7 ALIGNMENT
 STATION 26+500 TO 28+300

FIGURE 13



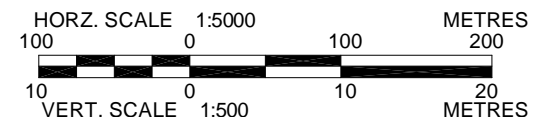
LEGEND:

- BOREHOLE/WELL LOCATION
- STATIONS
- TRANSITWAY
- PROPOSED TRAFFIC LANES
- PROPOSED SIDEWALK
- PROPOSED LANDSCAPE
- EXISTING ROADWAYS
- EXISTING RIGHT OF WAY
- MUNICIPAL BOUNDARIES

ELEVATION (m)

26500 26600 26700 26800 26900 27000 27100 27200 27300 27400 27500 27600 27700 27800 27900 28000 28100 28200 28300

NOTES:
 VERTICAL EXAGGERATION IS 10 TIMES
 SEE OTHER NOTES AND LEGEND FIGURE 2



DATE: OCTOBER, 2003
 PROJECT: 03-1111-001

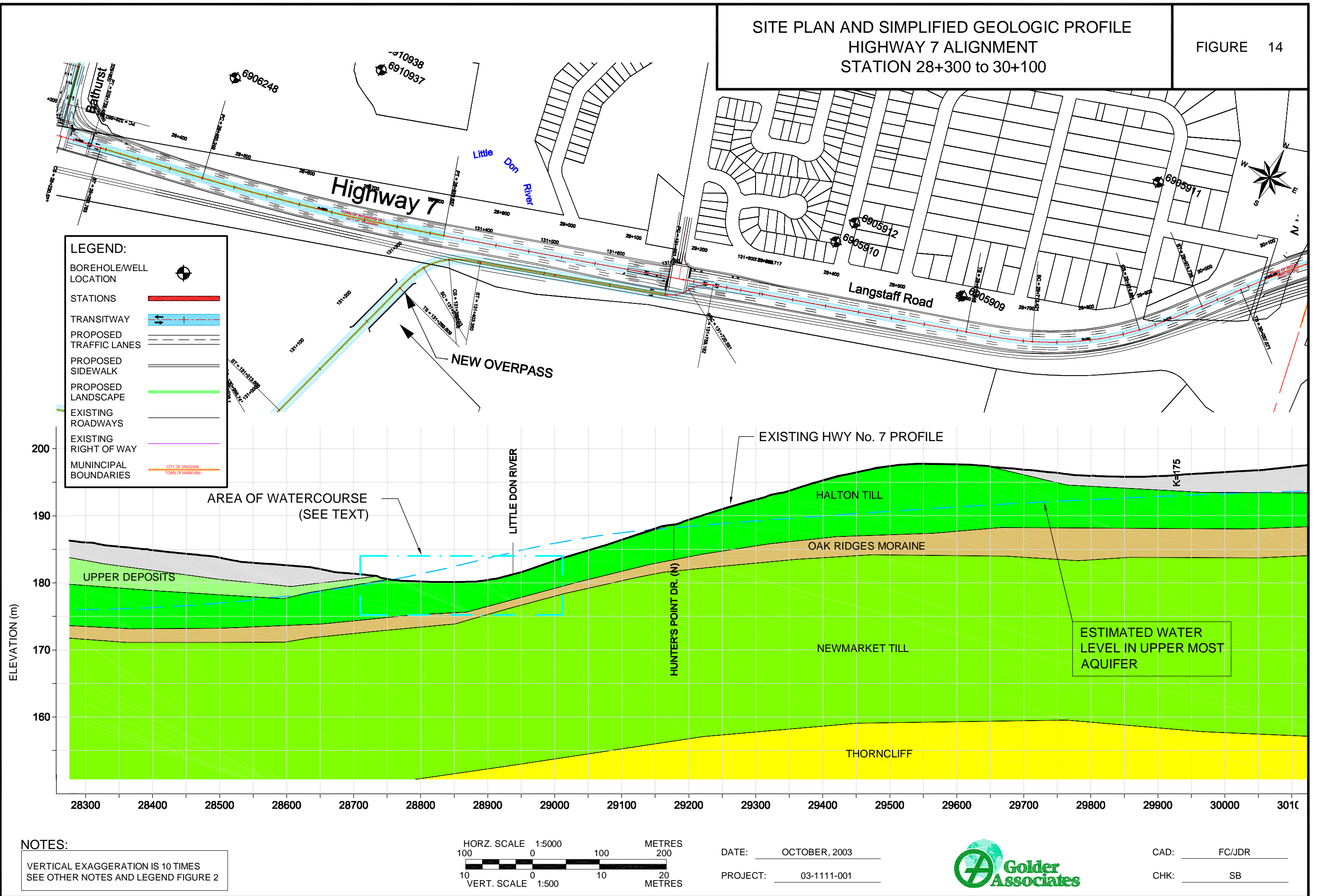


CAD: FC/JDR
 CHK: SB

PLOT DATE: March 01, 2004
 FILENAME: T:\Projects\2003\03-1111-001 (YRTP, Toronto)\-DA-Hwy 7 Geotech\031111001\DA013.dwg

SITE PLAN AND SIMPLIFIED GEOLOGIC PROFILE
 HIGHWAY 7 ALIGNMENT
 STATION 28+300 to 30+100

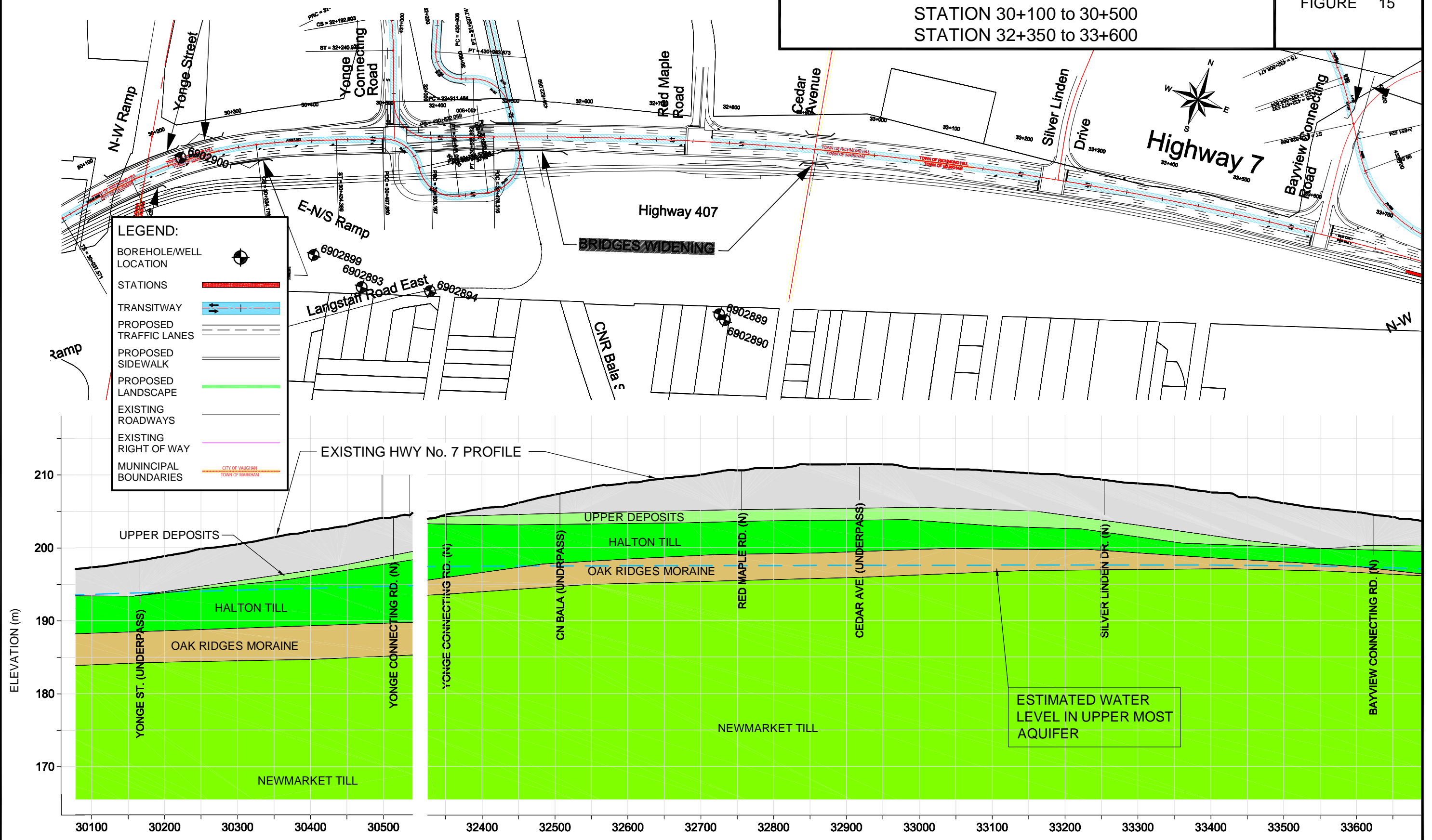
FIGURE 14



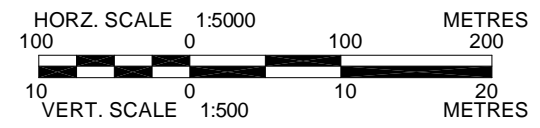
PLOT DATE: March 01, 2004
 FILENAME: T:\Projects\2003\03-1111-001 (YRTP, Toronto)\-DA-Hwy 7 Geotech\031111001\DA014.dwg

SITE PLAN AND SIMPLIFIED GEOLOGIC PROFILE
 HIGHWAY 7 ALIGNMENT
 STATION 30+100 to 30+500
 STATION 32+350 to 33+600

FIGURE 15



NOTES:
 VERTICAL EXAGGERATION IS 10 TIMES
 SEE OTHER NOTES AND LEGEND FIGURE 2



DATE: OCTOBER, 2003
 PROJECT: 03-1111-001

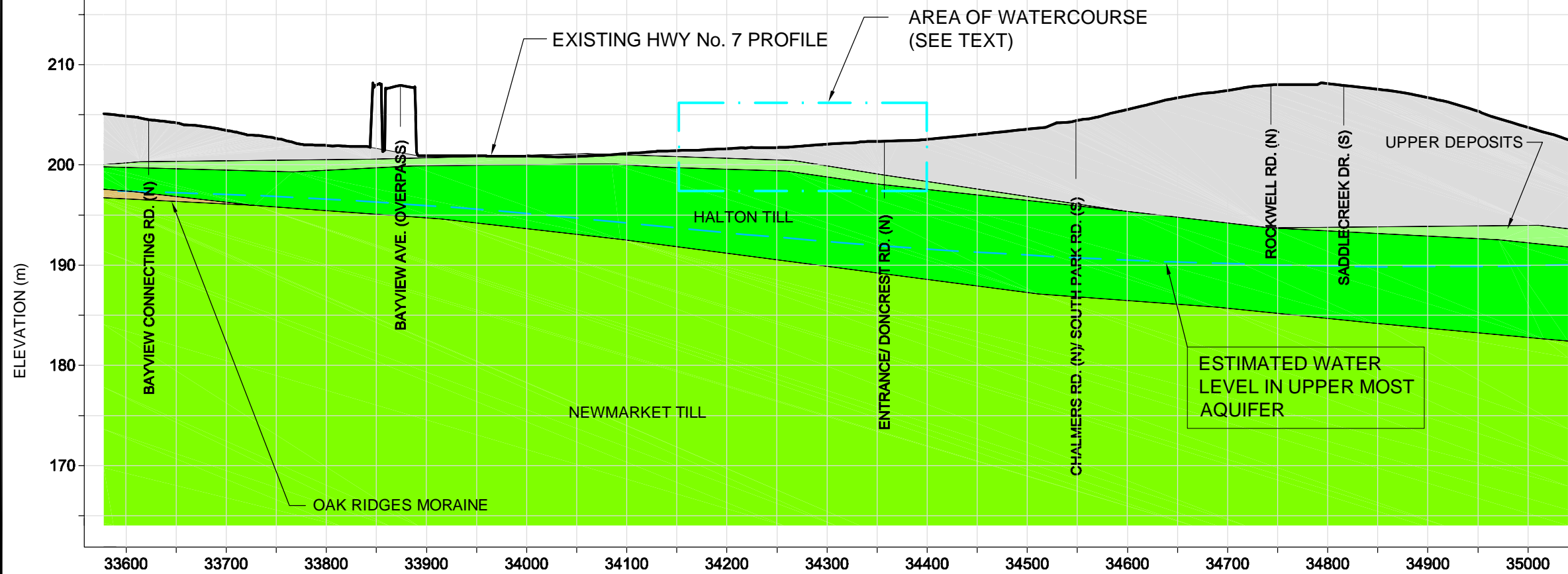
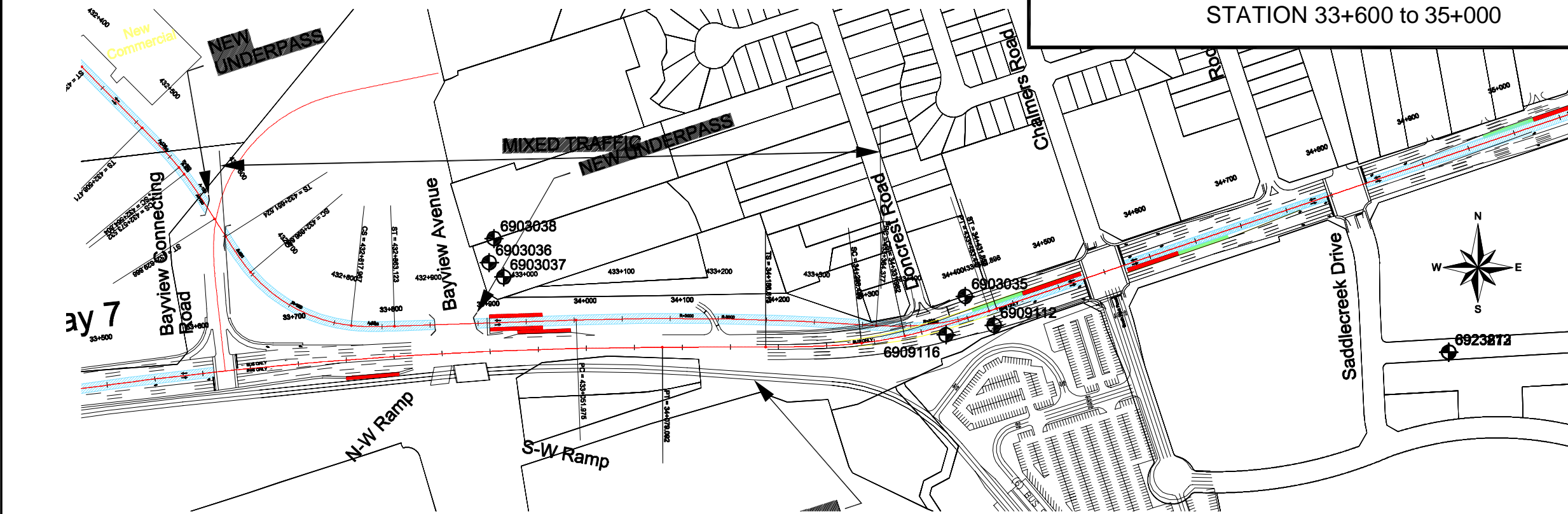


CAD: FC/JDR
 CHK: SB

PLOT DATE: March 01, 2004
 FILENAME: T:\Projects\2003\03-1111-001 (YRTP, Toronto)\-DA-Hwy 7 Geotech\031111001\DA015.dwg

SITE PLAN AND SIMPLIFIED GEOLOGIC PROFILE
 HIGHWAY 7 ALIGNMENT
 STATION 33+600 to 35+000

FIGURE 16

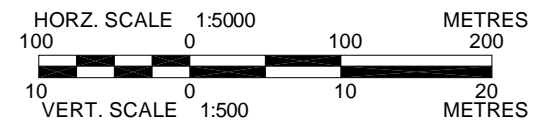


LEGEND:

- BOREHOLE/WELL LOCATION
- STATIONS
- TRANSITWAY
- PROPOSED TRAFFIC LANES
- PROPOSED SIDEWALK
- PROPOSED LANDSCAPE
- EXISTING ROADWAYS
- EXISTING RIGHT OF WAY
- MUNICIPAL BOUNDARIES

CITY OF VAUGHAN
TOWN OF MARKHAM

NOTES:
 VERTICAL EXAGGERATION IS 10 TIMES
 SEE OTHER NOTES AND LEGEND FIGURE 2



DATE: OCTOBER, 2003
 PROJECT: 03-1111-001

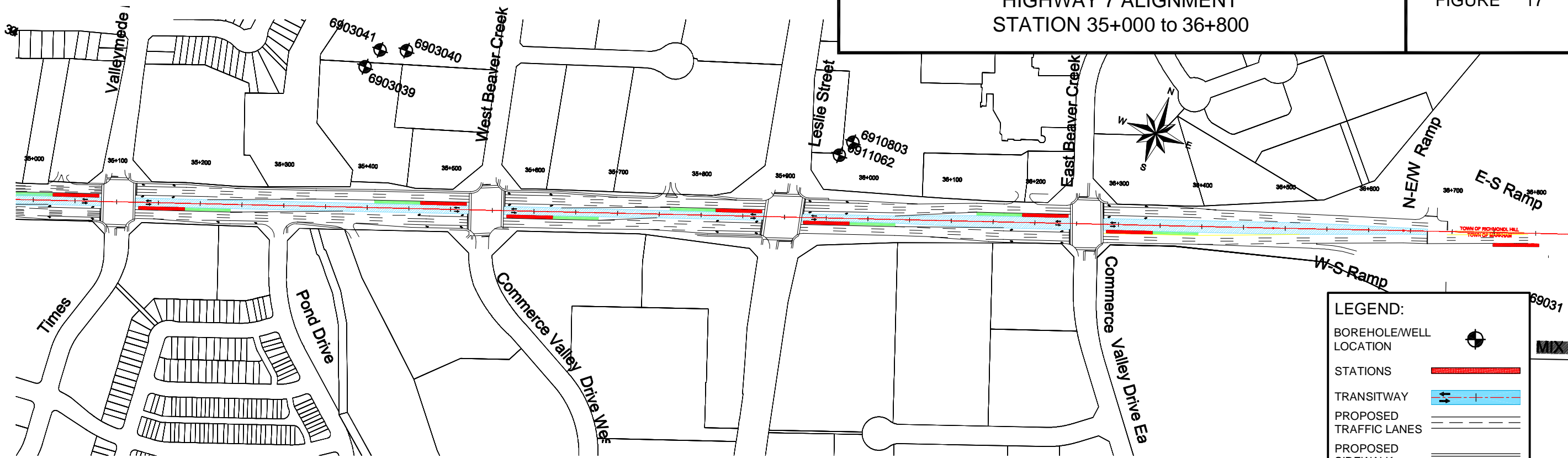


CAD: FC/JDR
 CHK: SB

PLOT DATE: March 01, 2004
 FILENAME: T:\Projects\2003\03-1111-001 (YRTP, Toronto)\-DA-Hwy 7 Geotech\031111001\DA016.dwg

SITE PLAN AND SIMPLIFIED GEOLOGIC PROFILE
 HIGHWAY 7 ALIGNMENT
 STATION 35+000 to 36+800

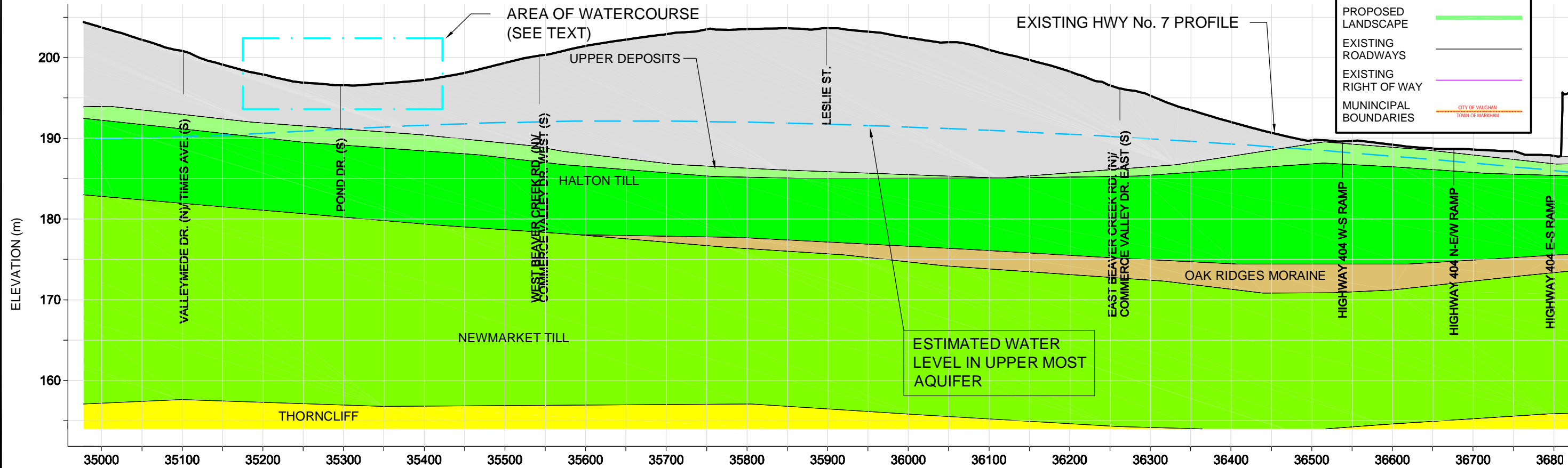
FIGURE 17



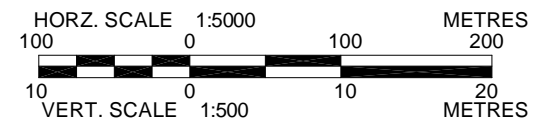
LEGEND:

- BOREHOLE/WELL LOCATION
- STATIONS
- TRANSITWAY
- PROPOSED TRAFFIC LANES
- PROPOSED SIDEWALK
- PROPOSED LANDSCAPE
- EXISTING ROADWAYS
- EXISTING RIGHT OF WAY
- MUNICIPAL BOUNDARIES

CITY OF VAUGHAN
TOWN OF MARKHAM



NOTES:
 VERTICAL EXAGGERATION IS 10 TIMES
 SEE OTHER NOTES AND LEGEND FIGURE 2



DATE: OCTOBER, 2003
 PROJECT: 03-1111-001

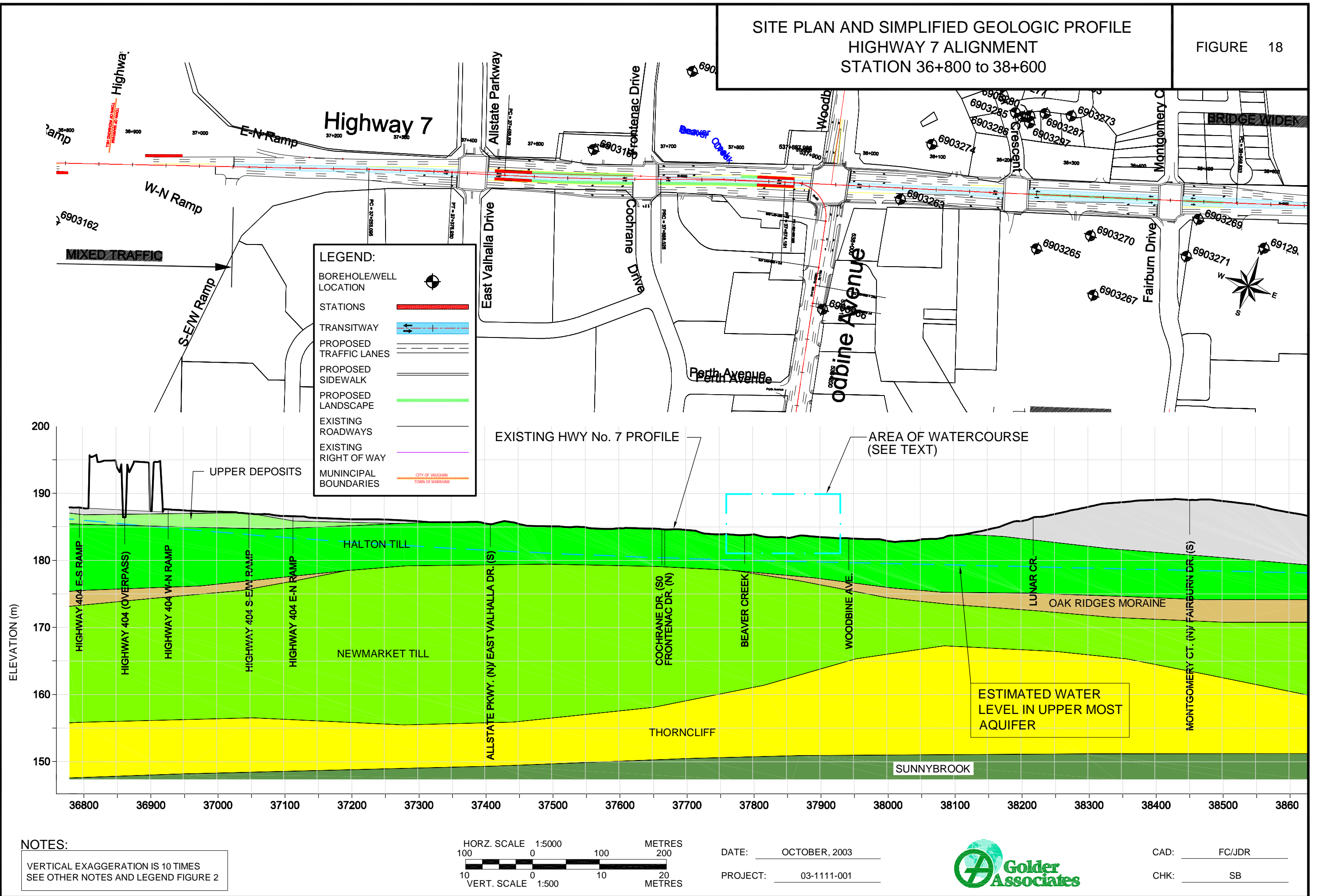


CAD: FC/JDR
 CHK: SB

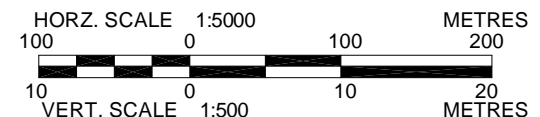
PLOT DATE: March 01, 2004
 FILENAME: T:\Projects\2003\03-1111-001 (YRTP, Toronto)\-DA-Hwy 7 Geotech\031111001\DA017.dwg

SITE PLAN AND SIMPLIFIED GEOLOGIC PROFILE
 HIGHWAY 7 ALIGNMENT
 STATION 36+800 to 38+600

FIGURE 18



NOTES:
 VERTICAL EXAGGERATION IS 10 TIMES
 SEE OTHER NOTES AND LEGEND FIGURE 2



DATE: OCTOBER, 2003
 PROJECT: 03-1111-001

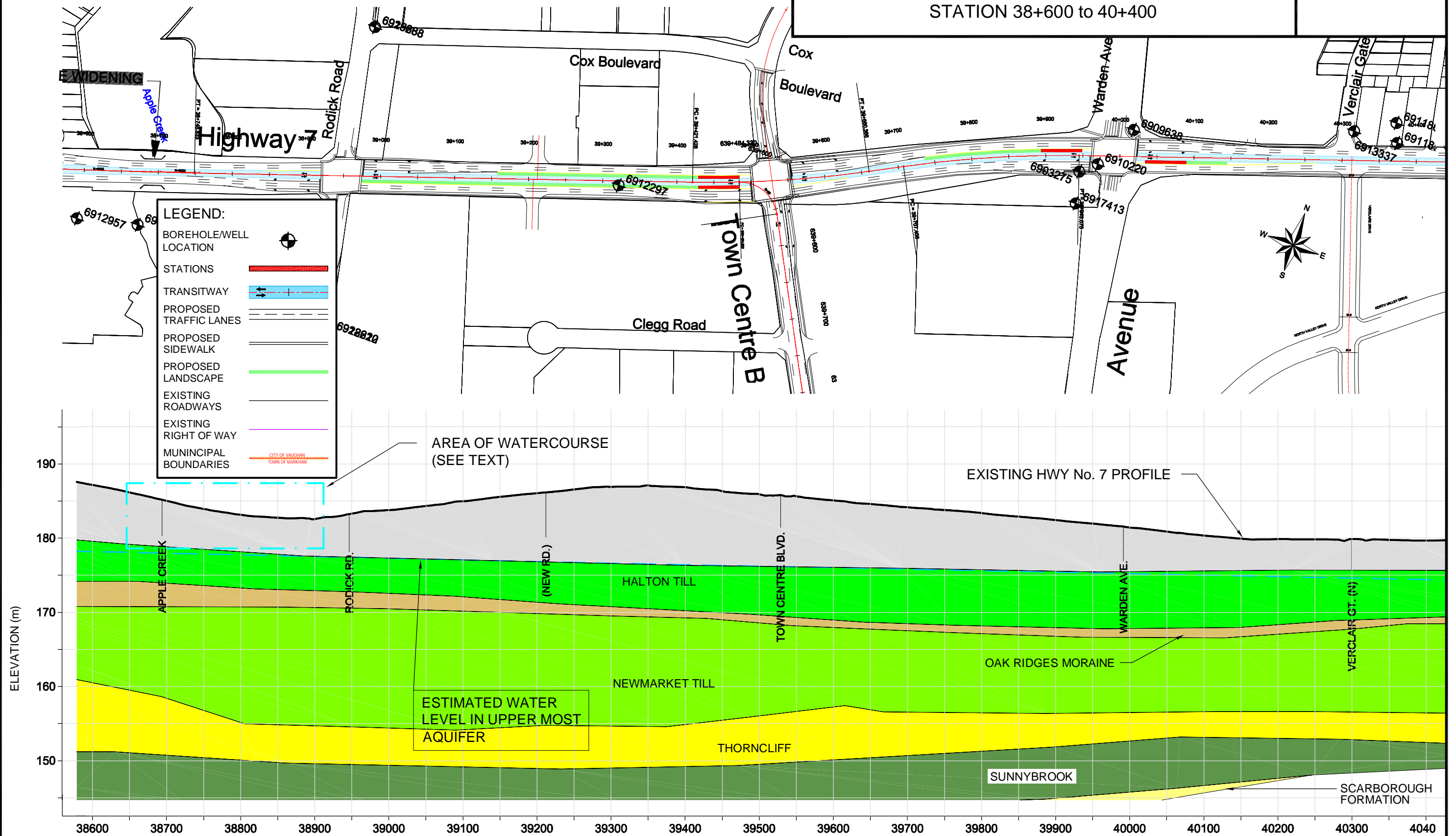


CAD: FC/JDR
 CHK: SB

PLOT DATE: March 01, 2004
 FILENAME: T:\Projects\2003\03-1111-001 (YRTP, Toronto)\-DA-Hwy 7 Geotech\031111001\DA018.dwg

SITE PLAN AND SIMPLIFIED GEOLOGIC PROFILE
 HIGHWAY 7 ALIGNMENT
 STATION 38+600 to 40+400

FIGURE 19

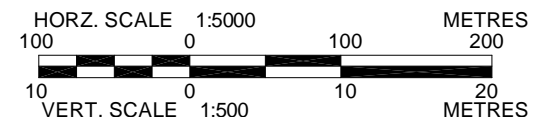


LEGEND:

- BOREHOLE/WELL LOCATION
- STATIONS
- TRANSITWAY
- PROPOSED TRAFFIC LANES
- PROPOSED SIDEWALK
- PROPOSED LANDSCAPE
- EXISTING ROADWAYS
- EXISTING RIGHT OF WAY
- MUNICIPAL BOUNDARIES

CITY OF VAUGHAN
TOWN OF MARKHAM

NOTES:
 VERTICAL EXAGGERATION IS 10 TIMES
 SEE OTHER NOTES AND LEGEND FIGURE 2



DATE: OCTOBER, 2003
 PROJECT: 03-1111-001

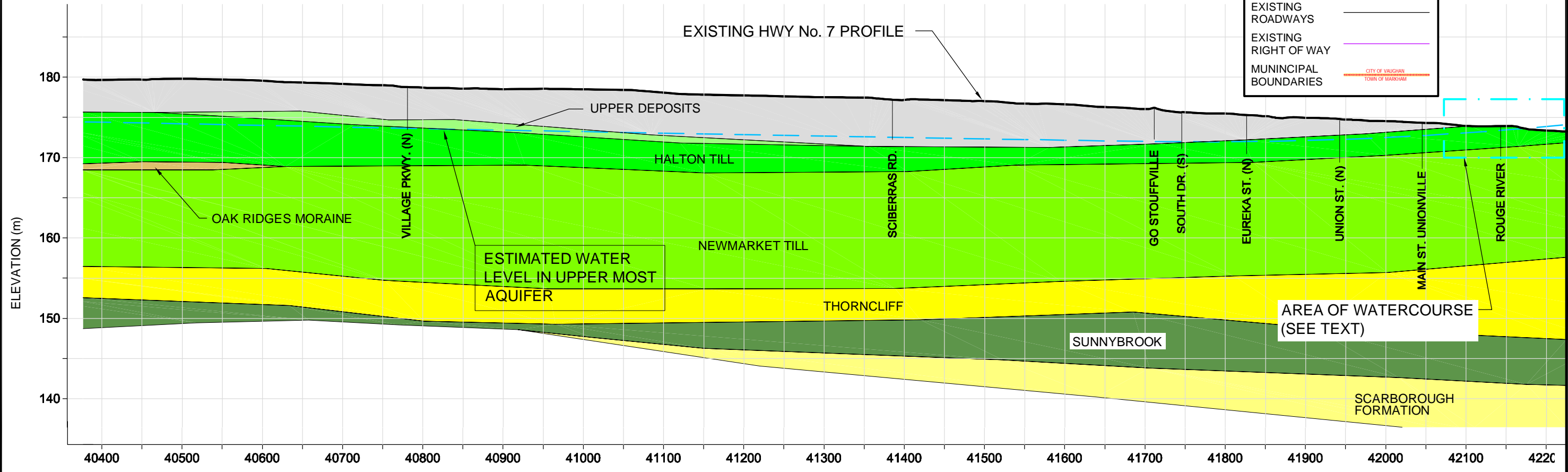


CAD: FC/JDR
 CHK: SB

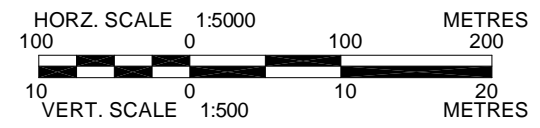
PLOT DATE: March 01, 2004
 FILENAME: T:\Projects\2003\03-1111-001 (YRTP, Toronto)\-DA-Hwy 7 Geotech\031111001\DA019.dwg

SITE PLAN AND SIMPLIFIED GEOLOGIC PROFILE
 HIGHWAY 7 ALIGNMENT
 STATION 40+400 to 42+200

FIGURE 20



NOTES:
 VERTICAL EXAGGERATION IS 10 TIMES
 SEE OTHER NOTES AND LEGEND FIGURE 2



DATE: OCTOBER, 2003
 PROJECT: 03-1111-001

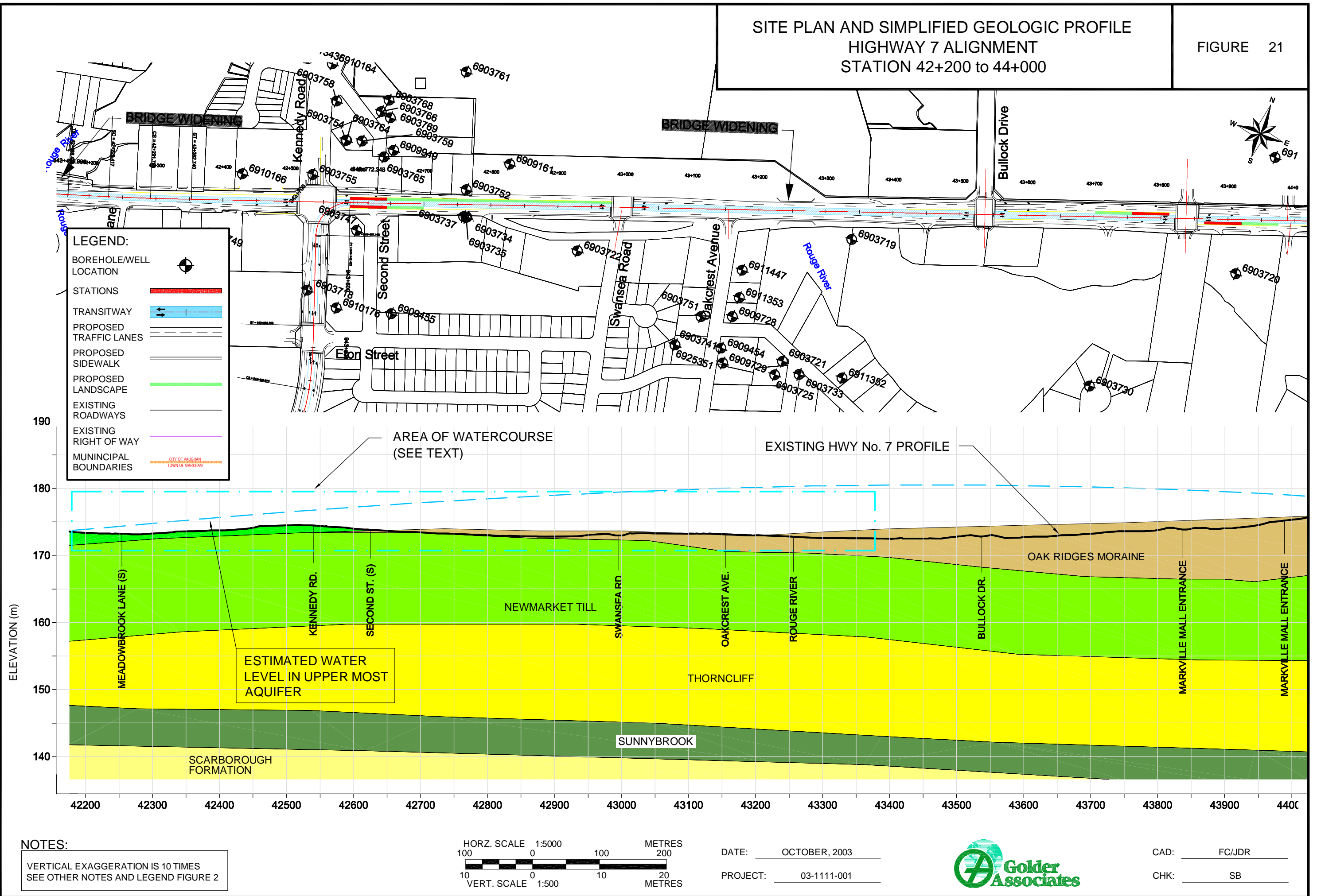


CAD: FC/JDR
 CHK: SB

PLOT DATE: March 01, 2004
 FILENAME: T:\Projects\2003\03-1111-001 (YRTP, Toronto)\-DA-Hwy 7 Geotech\031111001\DA020.dwg

SITE PLAN AND SIMPLIFIED GEOLOGIC PROFILE
 HIGHWAY 7 ALIGNMENT
 STATION 42+200 to 44+000

FIGURE 21



LEGEND:

- BOREHOLEWELL LOCATION
- STATIONS
- TRANSITWAY
- PROPOSED TRAFFIC LANES
- PROPOSED SIDEWALK
- PROPOSED LANDSCAPE
- EXISTING ROADWAYS
- EXISTING RIGHT OF WAY
- MUNICIPAL BOUNDARIES

CITY OF VAUGHAN
TOWN OF MARKHAM

ELEVATION (m)

NOTES:
 VERTICAL EXAGGERATION IS 10 TIMES
 SEE OTHER NOTES AND LEGEND FIGURE 2

HORZ. SCALE 1:5000 METRES
 100 0 100 200
 VERT. SCALE 1:500 METRES
 10 0 10 20

DATE: OCTOBER, 2003
 PROJECT: 03-1111-001

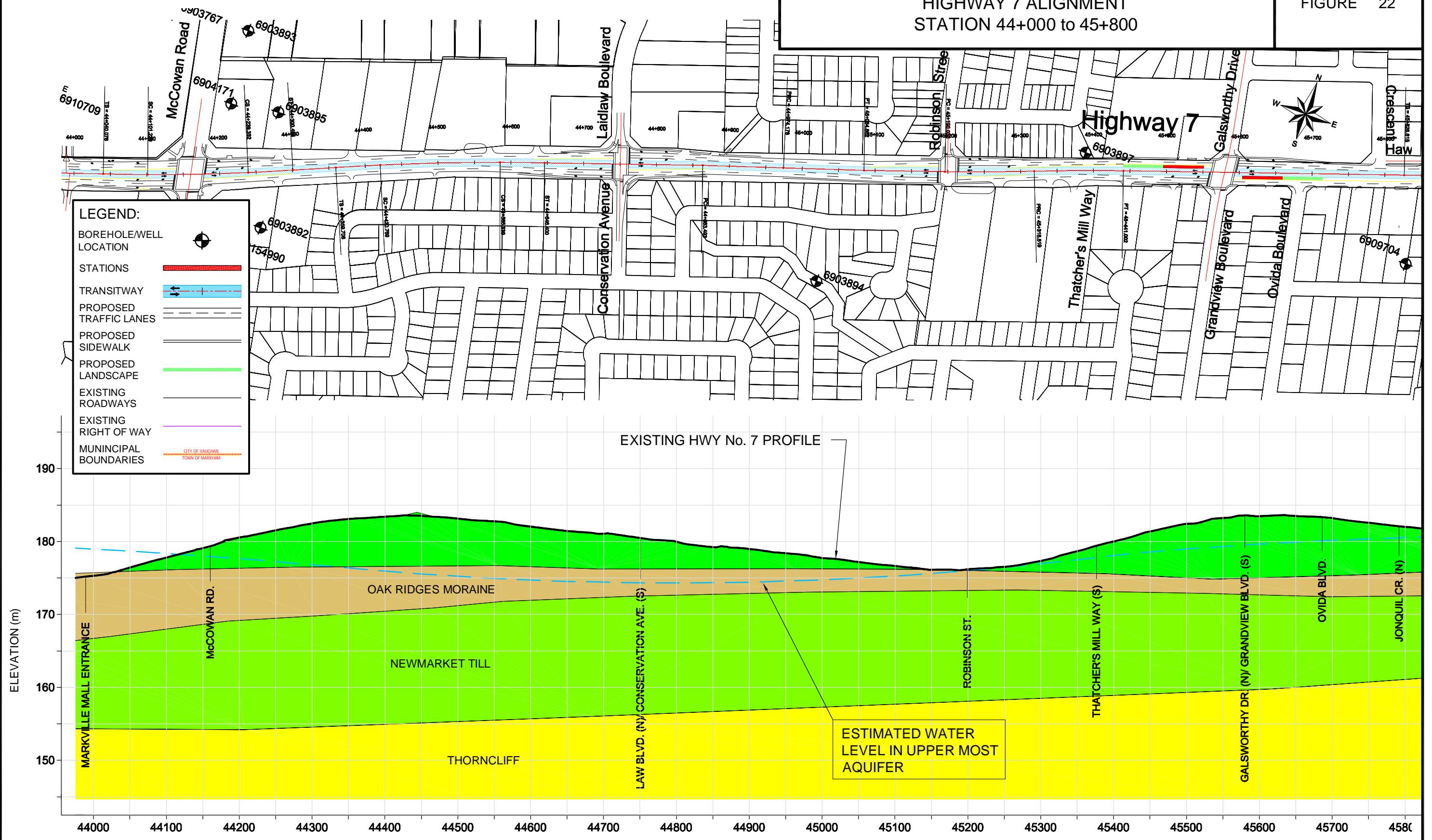


CAD: FC/JDR
 CHK: SB

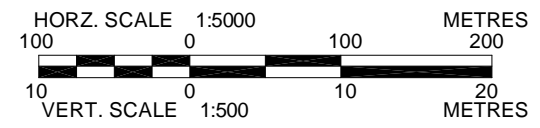
PLOT DATE: March 01, 2004
 FILENAME: T:\Projects\2003\03-1111-001 (YRTP, Toronto)\-DA-Hwy 7 Geotech\031111001\DA021.dwg

SITE PLAN AND SIMPLIFIED GEOLOGIC PROFILE
 HIGHWAY 7 ALIGNMENT
 STATION 44+000 to 45+800

FIGURE 22



NOTES:
 VERTICAL EXAGGERATION IS 10 TIMES
 SEE OTHER NOTES AND LEGEND FIGURE 2



DATE: OCTOBER, 2003
 PROJECT: 03-1111-001

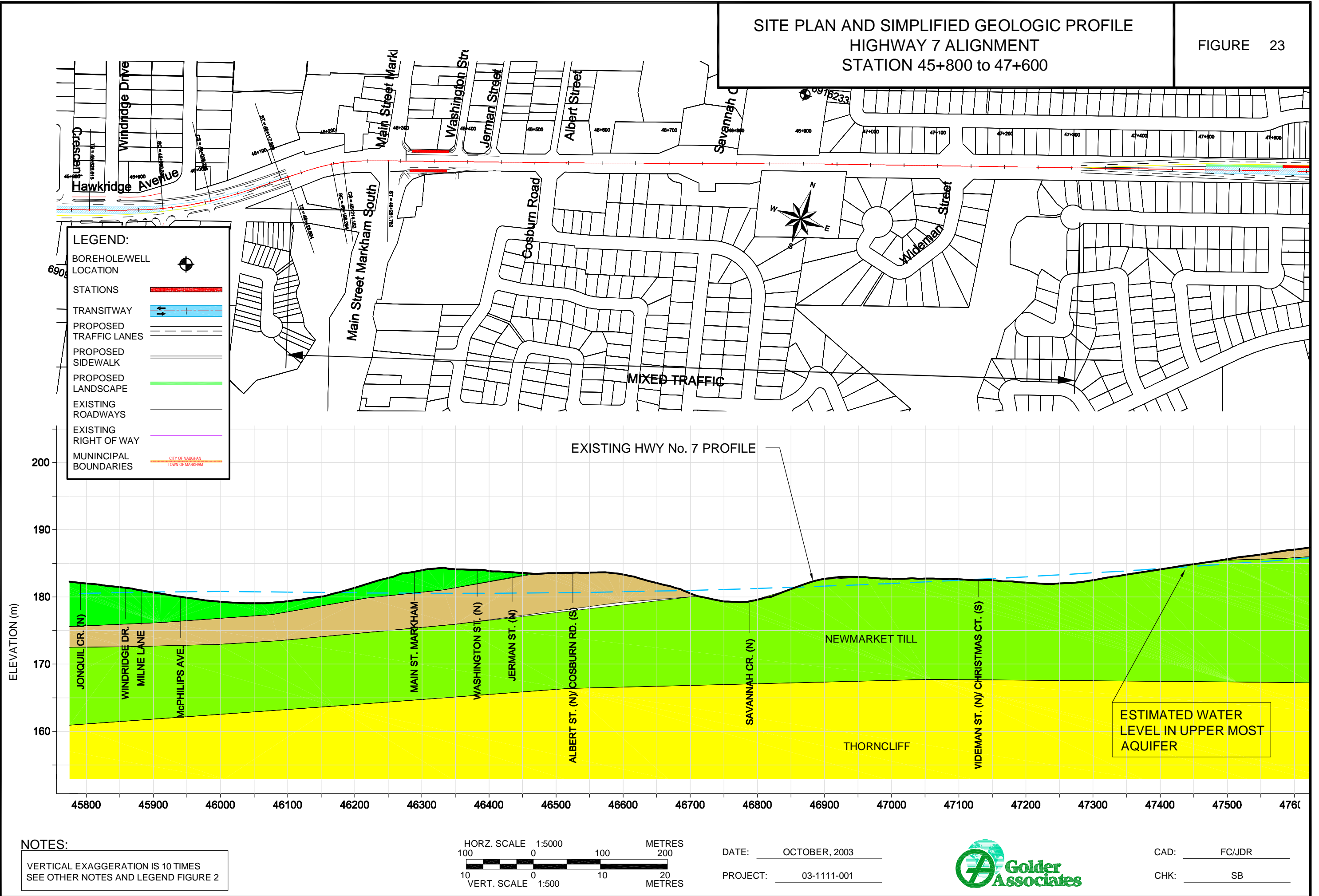


CAD: FC/JDR
 CHK: SB

PLOT DATE: March 01, 2004
 FILENAME: T:\Projects\2003\03-1111-001 (YRTP, Toronto)\-DA-Hwy 7 Geotech\031111001\DA022.dwg

SITE PLAN AND SIMPLIFIED GEOLOGIC PROFILE
 HIGHWAY 7 ALIGNMENT
 STATION 45+800 to 47+600

FIGURE 23



PLOT DATE: March 01, 2004
 FILENAME: T:\Projects\2003\03-1111-001 (YRTP, Toronto)\-DA-Hwy 7 Geotech\031111001DA023.dwg

NOTES:
 VERTICAL EXAGGERATION IS 10 TIMES
 SEE OTHER NOTES AND LEGEND FIGURE 2

HORZ. SCALE 1:5000 METRES
 100 0 100 200
 VERT. SCALE 1:500 METRES
 10 0 10 20

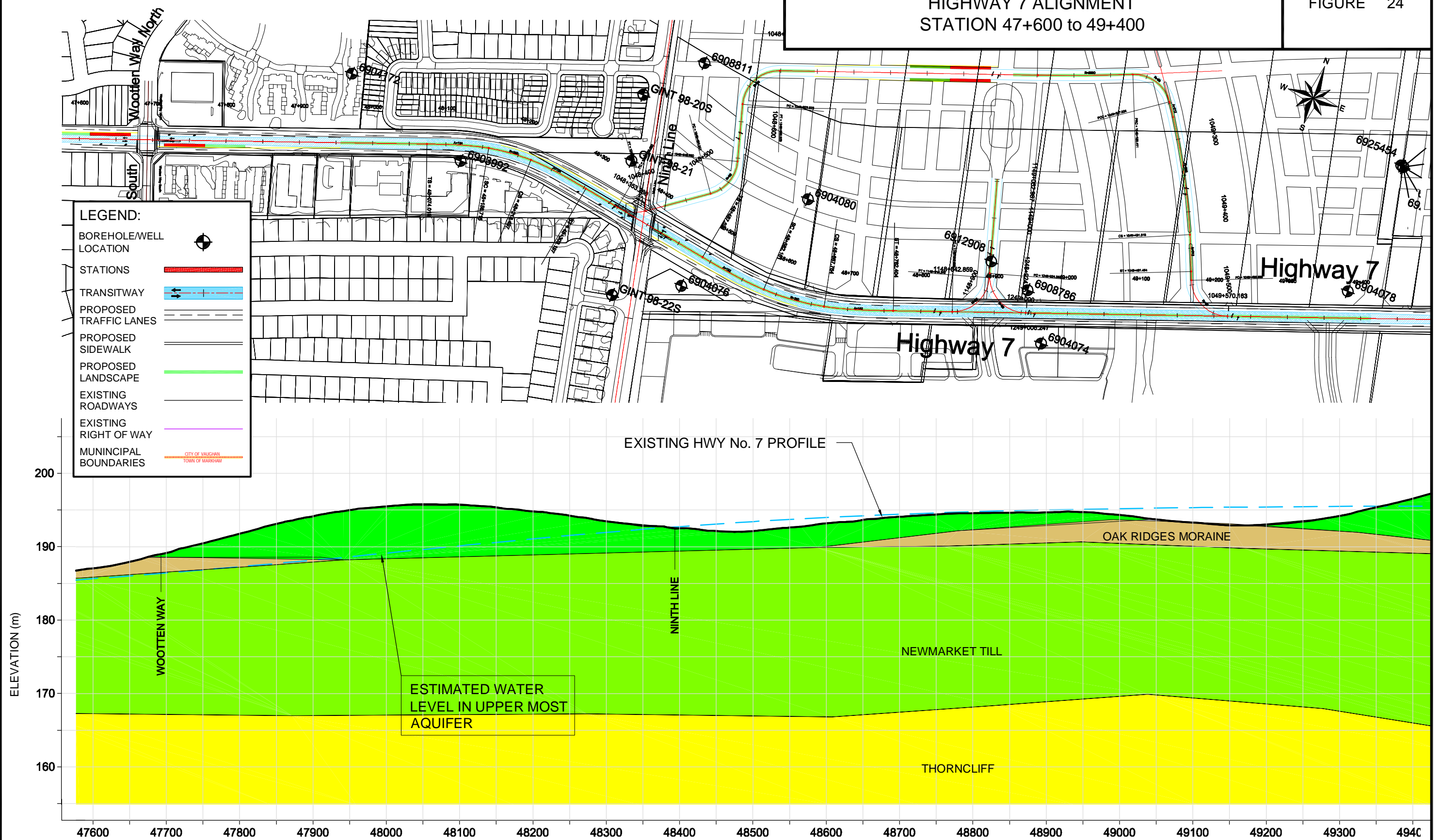
DATE: OCTOBER, 2003
 PROJECT: 03-1111-001



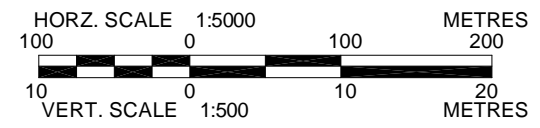
CAD: FC/JDR
 CHK: SB

SITE PLAN AND SIMPLIFIED GEOLOGIC PROFILE
 HIGHWAY 7 ALIGNMENT
 STATION 47+600 to 49+400

FIGURE 24



NOTES:
 VERTICAL EXAGGERATION IS 10 TIMES
 SEE OTHER NOTES AND LEGEND FIGURE 2



DATE: OCTOBER, 2003
 PROJECT: 03-1111-001

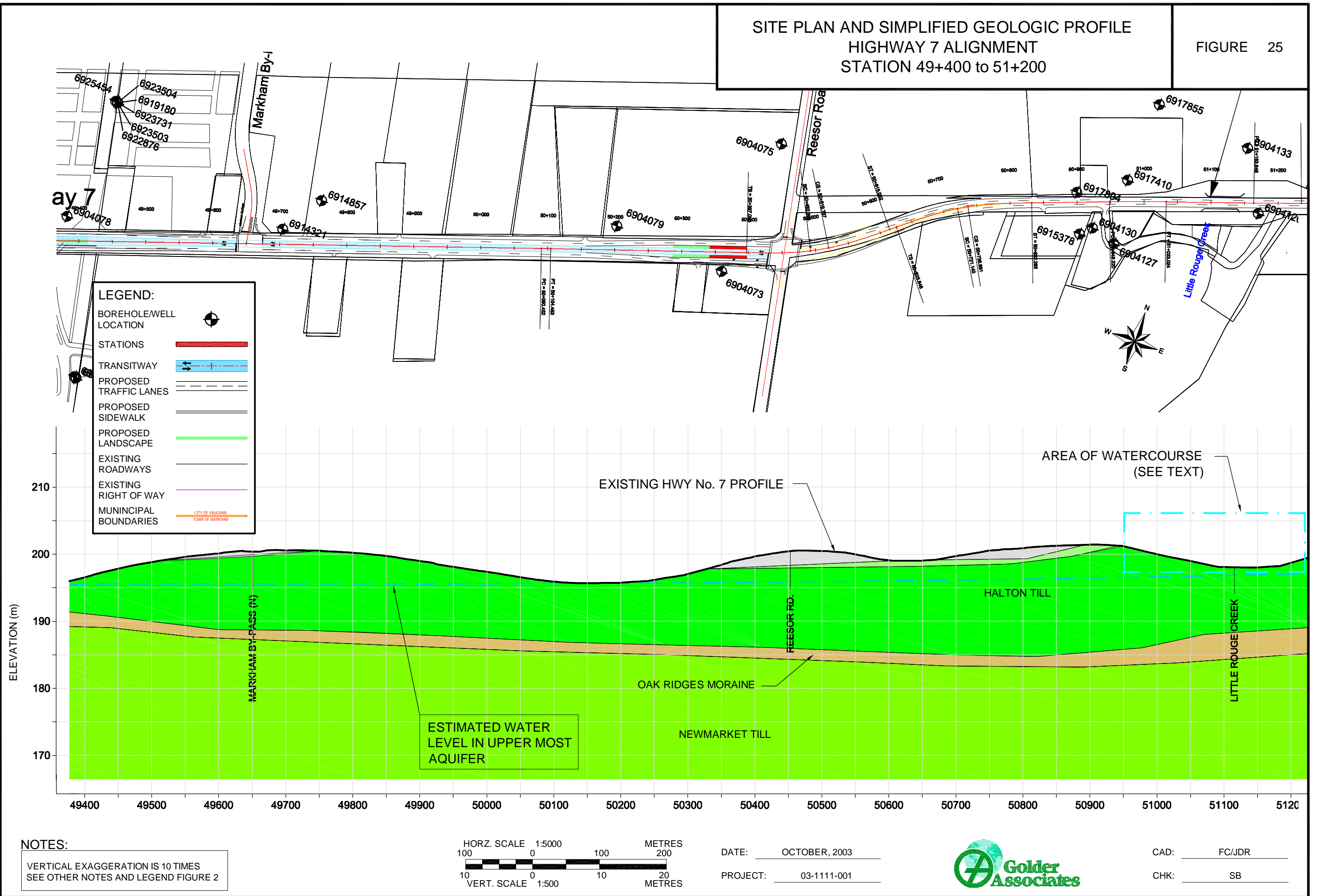


CAD: FC/JDR
 CHK: SB

PLOT DATE: March 01, 2004
 FILENAME: T:\Projects\2003\03-1111-001 (YRTP, Toronto)\-DA-Hwy 7 Geotech\031111001\DA024.dwg

SITE PLAN AND SIMPLIFIED GEOLOGIC PROFILE
 HIGHWAY 7 ALIGNMENT
 STATION 49+400 to 51+200

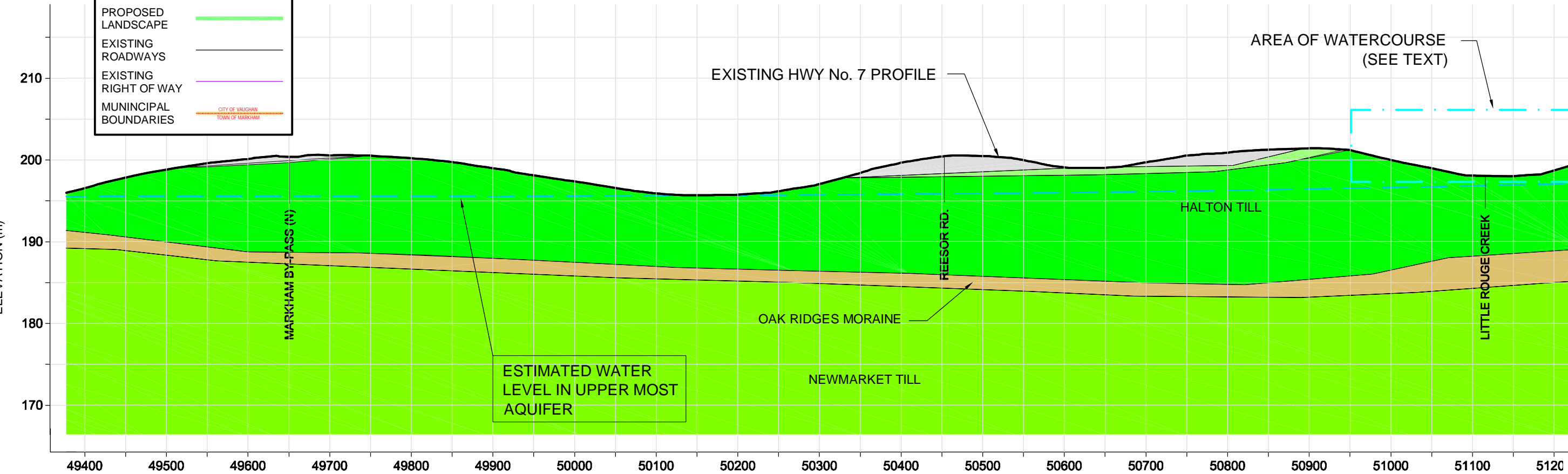
FIGURE 25



LEGEND:

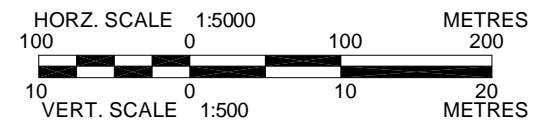
- BOREHOLE/WELL LOCATION
- STATIONS
- TRANSITWAY
- PROPOSED TRAFFIC LANES
- PROPOSED SIDEWALK
- PROPOSED LANDSCAPE
- EXISTING ROADWAYS
- EXISTING RIGHT OF WAY
- MUNICIPAL BOUNDARIES

CITY OF VAUGHAN
TOWN OF MARKHAM



NOTES:

VERTICAL EXAGGERATION IS 10 TIMES
 SEE OTHER NOTES AND LEGEND FIGURE 2



DATE: OCTOBER, 2003

PROJECT: 03-1111-001



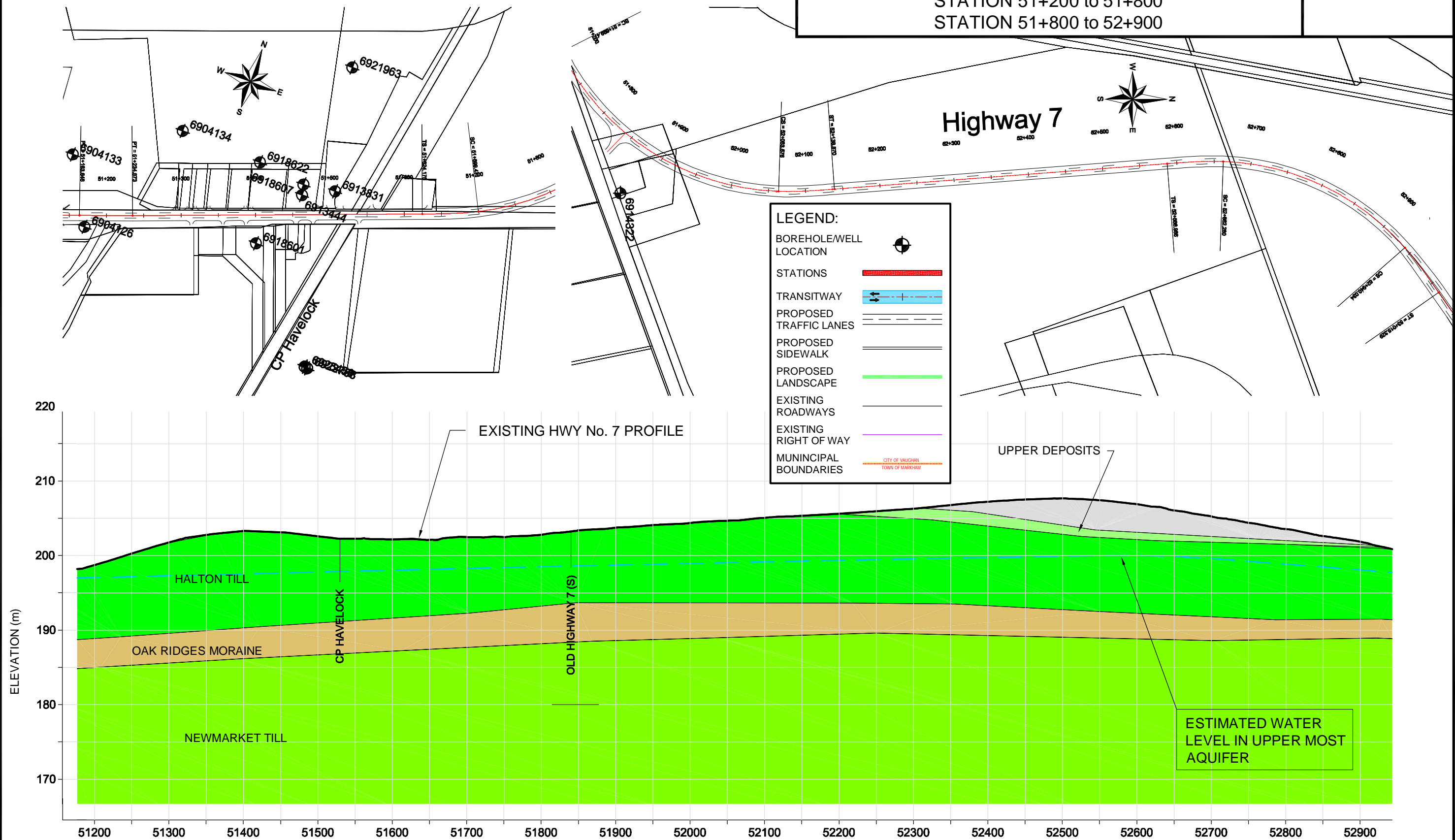
CAD: FC/JDR

CHK: SB

PLOT DATE: March 01, 2004
 FILENAME: T:\Projects\2003\03-1111-001 (YRTP, Toronto)\-DA-Hwy 7 Geotech\031111001\DA025.dwg

SITE PLAN AND SIMPLIFIED GEOLOGIC PROFILE
 HIGHWAY 7 ALIGNMENT
 STATION 51+200 to 51+800
 STATION 51+800 to 52+900

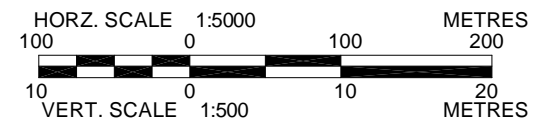
FIGURE 26



LEGEND:

- BOREHOLE/WELL LOCATION
- STATIONS
- TRANSITWAY
- PROPOSED TRAFFIC LANES
- PROPOSED SIDEWALK
- PROPOSED LANDSCAPE
- EXISTING ROADWAYS
- EXISTING RIGHT OF WAY
- MUNICIPAL BOUNDARIES

NOTES:
 VERTICAL EXAGGERATION IS 10 TIMES
 SEE OTHER NOTES AND LEGEND FIGURE 2



DATE: OCTOBER, 2003
 PROJECT: 03-1111-001

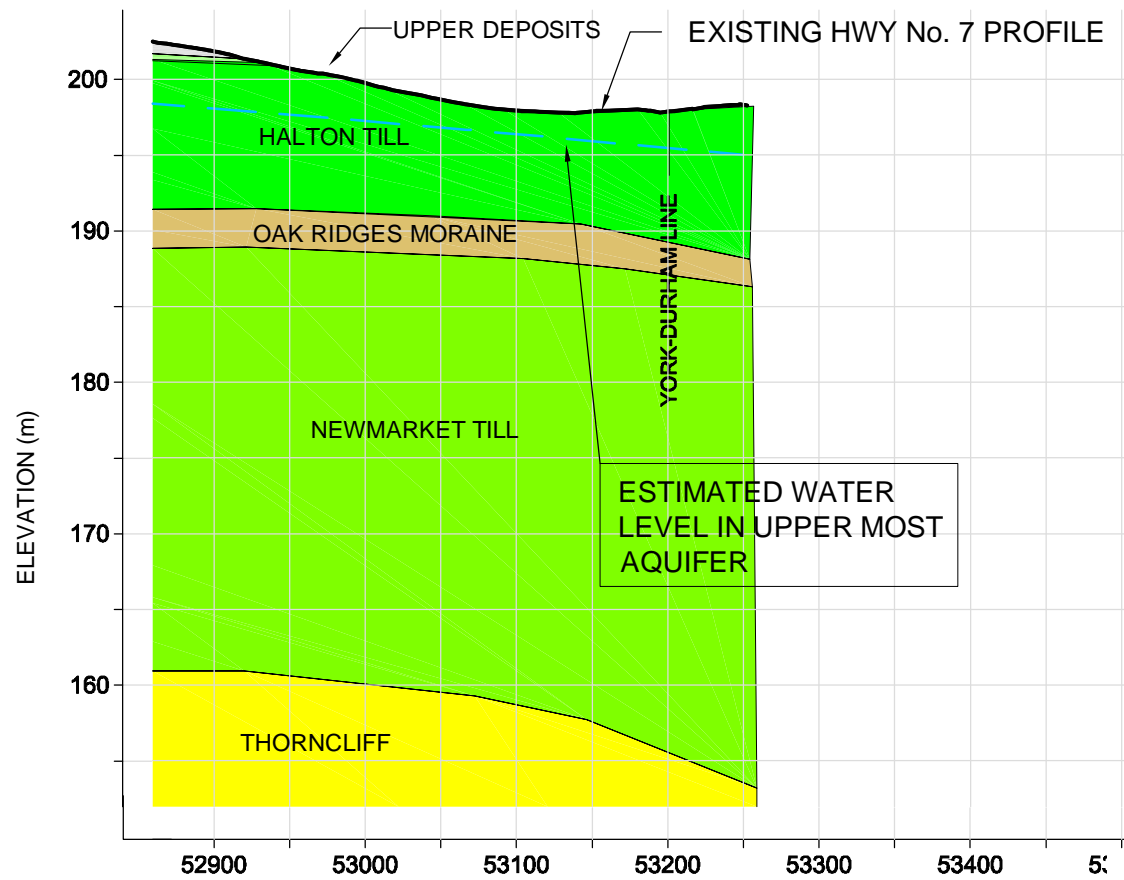
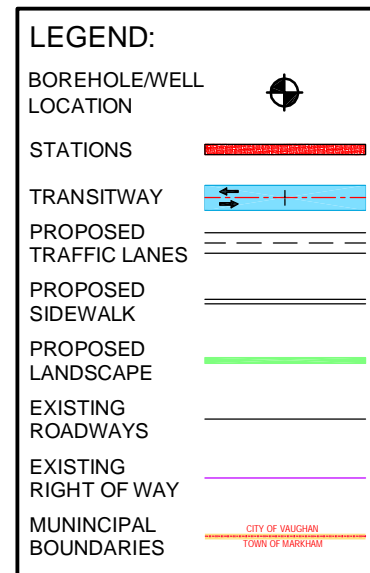
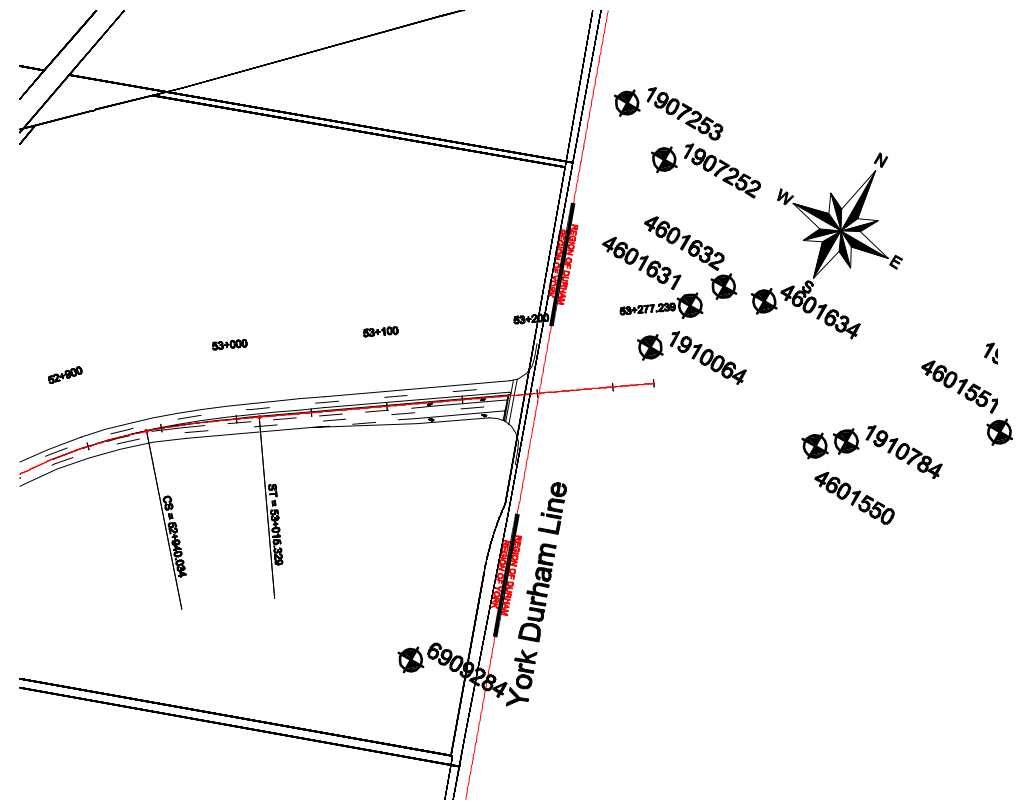


CAD: FC/JDR
 CHK: SB

PLOT DATE: March 01, 2004
 FILENAME: T:\Projects\2003\03-1111-001 (YRTP, Toronto)\-DA-Hwy 7 Geotech\031111001\DA026.dwg

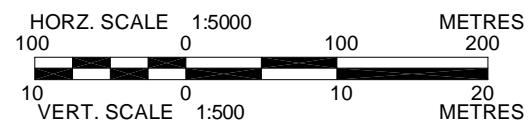
SITE PLAN AND SIMPLIFIED GEOLOGIC PROFILE
 HIGHWAY 7 ALIGNMENT
 STATION 52+900 to 53+277.239

FIGURE 27



NOTES:

VERTICAL EXAGGERATION IS 10 TIMES
 SEE OTHER NOTES AND LEGEND FIGURE 2



DATE: OCTOBER, 2003

PROJECT: 03-1111-001

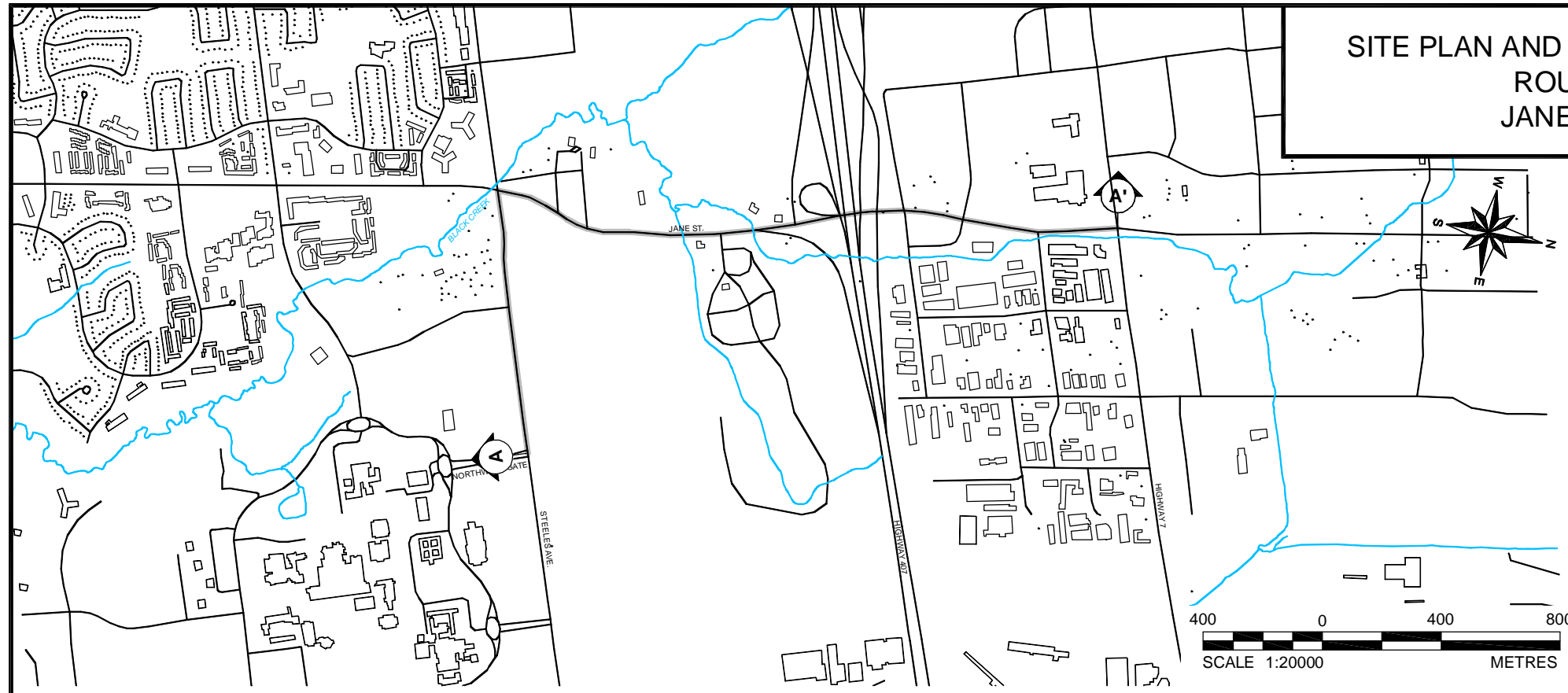


CAD: FC/JDR

CHK: SB

**SITE PLAN AND SIMPLIFIED GEOLOGIC PROFILE
ROUTE ALTERNATIVE B1
JANE STREET ALIGNMENT**

FIGURE 28



LEGEND:

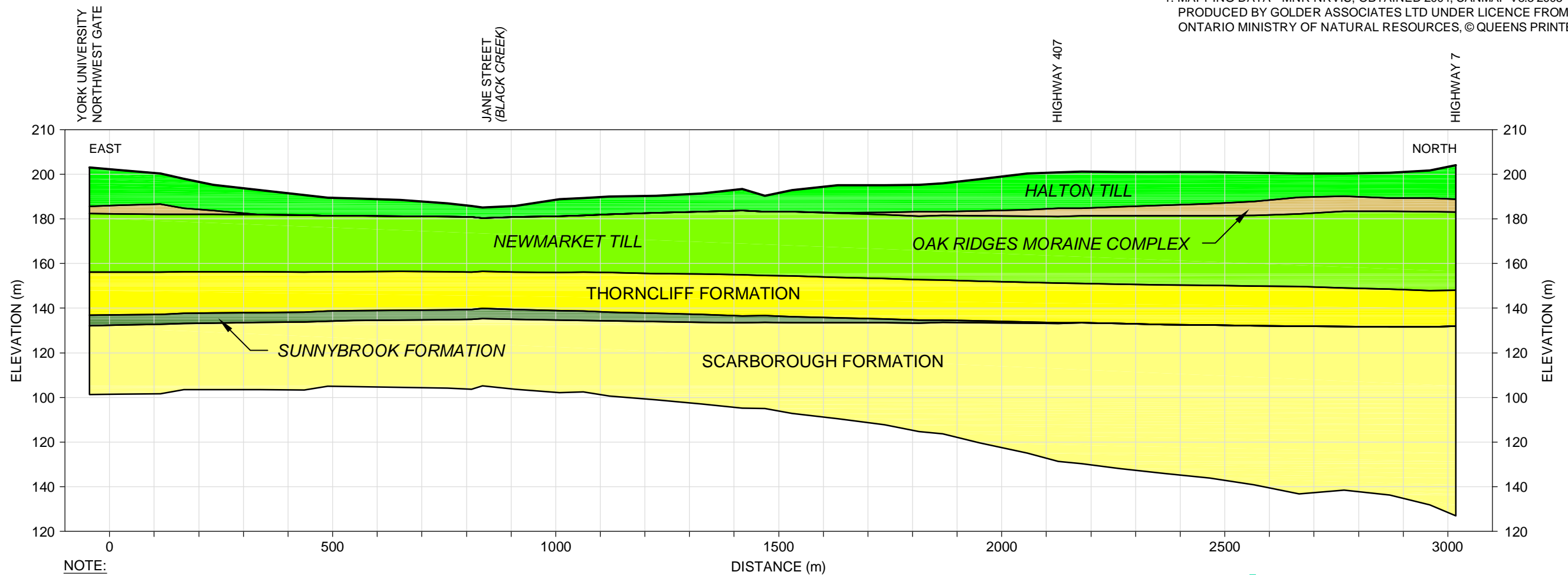
- HALTON TILL: PREDOMINANTLY SILT AND CLAY DIAMICT
- OAK RIDGES MORAINÉ COMPLEX: PREDOMINANTLY SAND AND SILT WITH LOCAL GRAVEL
- NEWMARKET TILL: PREDOMINANTLY SILT AND CLAY DIAMICT
- THORNCLIFF FORMATION: PREDOMINANTLY SILT AND SAND
- SUNNYBROOK FORMATION: PREDOMINANTLY SILT AND CLAY
- SCARBOROUGH FORMATION: PREDOMINANTLY SILT AND SAND

NOTES:

1. DRAWINGS INDICATE SIMPLIFIED AND INTERPRETED SUBSURFACE MATERIALS AND GEOLOGIC DEPOSIT TYPES BASED ON WIDELY SPACED BOREHOLE INFORMATION. THE SUBSURFACE CONDITIONS ARE TO BE CONSIDERED ONLY PRELIMINARY INDICATIONS OF SUBSURFACE MATERIALS AND SHOULD NOT BE USED FOR DESIGN PURPOSES WITHOUT CONFIRMATION OF ACTUAL CONDITIONS USING FIELD EXPLORATIONS.
2. THIS DRAWING MUST BE READ WITH THE ACCOMPANYING TEXT.

REFERENCE:

1. MAPPING DATA - MNR NRVIS, OBTAINED 2004, CANMAP V8.3 2005
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ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2005.



NOTE:
VERTICAL EXAGGERATION IS 5 TIMES.

PROFILE A-A'
HOR. SCALE 1:10,000
VER. SCALE 1:2,000

DATE: AUGUST 18, 2005
PROJECT: 03-1111-001



CAD: FC
CHK: SB