Volume Three
Appendices N - V

Mississauga Transitway Environmental Assessment Report

City of Mississauga
January 1992



MISSISSAUGA
Transportation and Works

Ministry of Transportation
Ontario

LET'S MOVE

MISSISSAUGA TRANSITWAY PLANNING STUDY
ENVIRONMENTAL ASSESSMENT REPORT
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NOISE ANALYSIS

MISSISSASUGA TRANSITWAY PLANNING STUDY EA REPORT

APPENDIX N - NOISE ANALYSIS

A detailed noise analysis of the potential effect of the proposed Mississauga Transitway was carried out as part of the current study. Due to the level of detail involved in the complete documentation and its subsequent size, only the relevant portion of the text is reproduced here. Requests to review the complete documentation may be addressed to the Director of Transportation and Engineering Planning, Transportation and Works Department, City of Mississauga, 11th Floor, Mississauga Civic Centre, 300 City Centre Drive, Mississauga, Ontario L5B 3C1.

It should be noted that several minor changes in the Transitway alignment and station configuration have occurred since the noise report was completed.

S.S. WILSON AND ASSOCIATES
DIV. OF M.H.G. ENGINEERING INC.
Consulting Engineers

REPORT NO. W90-72

ENVIRONMENTAL NOISE STUDY
PROPOSED MISSISSAUGA BUSWAY SYSTEM
MISSISSAUGA, ONTARIO

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1.0 INTRODUCTION

1.1 The services of S.S. Wilson and Associates were retained by the Consulting Engineering firms M.M. Dillon, McCormick Rankin Ltd., and The IBI Group on behalf of the City of Mississauga to prepare an environmental noise impact study for the proposed Mississauga Busway System located in the City of Mississauga, Ontario.

1.2 The Proposed Busway System is composed of an exclusive 2-lane busway stretching from Ridgeway Drive eastward parallel to Highway 403 and Highway 403 Arterial Road, to Fieldgate Blvd., then heading north from Fieldgate Drive to Eglinton Avenue and then parallel to Eglinton Avenue to Renforth Drive.

To serve the busway traffic as well as local bus traffic on the existing arterial crossings, a total of 17 stations are being proposed for the Busway system at the following locations:

1. Highway 403 at Ridgeway Blvd.
2. Highway 403 Interchange with Winston Churchill Blvd.
3. Highway 403 at Glen Erin Blvd.
4. Highway 403 Interchange with Erin Mills Parkway.
5. Highway 403 at Creditview Road.
6. Highway 403 at Mississauga Road.
7. Highway 403 Interchange with Mavis Road.
8. Highway 403 at City Centre.
9. Highway 403 at Central Parkway.
10. Highway 403 Arterial at Cawthra Road.
11. Highway 403 Arterial at Tomken Blvd.
12. Highway 403 Arterial at Dixie Road.
13. Fieldgate Blvd.
14. Eglinton Avenue at Spectrum Drive.
15. Eglinton Avenue at Satellite Drive.
16. Eglinton Avenue at Orbitor drive.
17. Eglinton Avenue at Renforth drive.

The general location of the study area is shown in Figure 1 and the overall layout of the proposed Busway is illustrated in Figures 2 to 23.

Figures 4 to 6 show the section of the proposed Busway alignment where two different alignments are proposed. For that section of the Busway, the impact of both alignments will be addressed.

1.3 The scope of this study is to establish through measurements and prediction models the existing ambient/background sound

levels and the project sound levels at selected receptor locations along the proposed Busway or in the vicinity of the proposed stations as well as to recommend noise control measures where warranted.

2.0 CONCLUSIONS AND RECOMMENDATIONS

2.1 CONCLUSIONS

1. A study has been carried out to research all aspects related to the potential noise impact of the proposed Busway on the noise-sensitive developments adjacent to the proposed Busway alignments which also include the proposed stations. The study dealt with documentation of the existing ambient conditions, the applicable criteria, the effectiveness of the proposed noise control measures and the future sound environment.

2. Traffic on the existing Highway 403, Highway 403 Arterial, Eglinton Avenue, and all roads overpassing and intersecting the Busway are considered as the major sources of environmental ambient noise within the entire study area as vehicular traffic noise is the most dominant source. The predicted sound levels at most of the potential receivers prior to undertaking of the proposed Busway system do exceed the Provincial objective of Leq 55 dBA due to the close proximity of many dwellings and buildings to the existing network of roads and highways.

3. The predicted future sound levels at the building facades or yards of the nearest dwelling units along the area in question in case of a "Do-Nothing Option" will be in the range of Leq (day) 42 to 67 dBA. The established excess sound levels dur to the Busway at the year 2021 over the future Do-Nothing option sound levels will be up to a maximum of 5 dB at some locations; i.e. within the government maximum allowable excess of 5 dB.

4. The Busway alignment has been selected in areas that are dominated by the noise from well established arterial roads and Highway 403; i.e. the proposed alignment is acoustically compatible with the existing land uses.

5. Most of the Busway lanes will be located within a cut or at relatively lower elevations which will result in lower sound levels compared to at-grade situations. The proposed cuts are considered effective sound barriers that are capable of providing noticeable to significant sound level reductions depending on the depth of cut and the location with respect to the receptor locations.

6. There are marginal differences in the sound levels generated by the various proposed alternative alignments.. Therefore the noise concern may not be considered as one of the dominant

factors in selecting either of the alternatives.

2.2 RECOMMENDATIONS

1. The noise impact due to ultimate bus traffic on the proposed Busway system is considered minor with respect to all locations along the proposed alignment since the increase in sound levels due to bus traffic on the proposed Busway would be a maximum of 5 dBA. This increase is within the MOE/MTO acceptable Protocol criteria for new and expanded roadway projects. Accordingly additional noise control measures are NOT required.

2. In the case of the receptors located in the vicinity of the proposed stations, the overall combined noise impact is also considered minor with respect to all proposed stations, and additional noise control measures are also NOT warranted.

3. To meet the MOE requirements for stationary noise sources during the construction phase of the proposed undertaking, construction equipment used on the site should meet the sound emission level standards set by the MOE.

   The MOE assesses noise impact during the construction period against the sound level standards set out in Publications NPC-115 and NPC-118 (see Appendix D). These standards limit the allowable levels from the equipment at source rather than at the receiver. In order to meet the above requirements, the equipment will have to be certified by the manufacturer. If such certification is not available or if the equipment is not new, it will be required that the proponent certify that the actual equipment used based on "on-site" measurements, under typical operating conditions comply with the MOE requirements.

   Other relevant standards include the Federal Government Standards regulating the noise emissions from heavy and medium trucks.

4. To improve the acoustical performance of the proposed Busway cuts we recommend that the wall construction materials have reasonable sound absorptive qualities and/or by constructing the cuts sidewalls using an outward slope or slant. These measures will improve both the noise perceived at the near-by receptors, the transit system riders and the by-standers.

3.0 ANALYSIS

3.1 DESCRIPTION OF THE SOURCES OF NOISE

The proposal calls for the establishment of a Busway System composed of an exclusive 2-lane busway stretching from Ridgeway Drive eastward parallel to Highway 403 and Highway 403 Arterial Road, to Fieldgate Blvd., then heading north from Fieldgate Drive to Eglinton Avenue and then parallel to Eglinton Avenue to Renforth Drive.

To serve the busway traffic as well as local bus traffic on the existing arterial crossings, a total of 17 stations were proposed for the Busway system.

The primary source of noise associated with the proposed system is bus noise operating on the transit route and within the stations. Other sources of noise of lesser magnitude include automobile traffic using the designated parking areas associated with some stations and possibly mechanical equipment associated with one of the stations. The noise emitted by buses is due to bus exhaust, engine and tire/ground interaction depending on the bus speed and the type of pavement.

Since noise prediction methodologies for buses moving on a roadway or within a station are different, the description of the specific bus activities and associated sound levels will be dealt with separately.

1. In-Between Stations Bus Movements

Buses are expected to operate between stations using a posted speed limit of 80 km/hr depending on the segment of the Busway except near the proposed stations where buses will be accelerating and decelerating as discussed below. Although individual buses are considered as point sources, the combined movements of such point sources on a linear path would qualify the entire system of point sources moving steadily as a line source.

The traffic noise prediction model used for the assessment of bus movements between the stations is "ORNAMENT" which was developed by the Ontario Ministry of the Environment. The technical details of the model could be found in the MOE Technical Document ORNAMENT, October 1989. The computerized version of the Model used for this project is STAMSON 3.0. It is important to note

that City buses are classified under the "Medium Trucks" category as outlined in the model. Appendix A contains summary of the procedures and adjustments used.

Since the majority of the proposed transitway will be carrying buses only, the percentage of Medium Trucks used in the prediction of such sections was set at 100% relative to the entire vehicular traffic movements on the exclusive busway.

According to the prediction model, the 2-way movements of; for example 50 buses per hour (i.e. 25 buses in either direction) are capable of producing an energy equivalent sound level (Leq) of 64 dBA at a typical receptor 15 metres away from the centreline of the Busway. It is important to realize that the peak sound levels due to bus pass-bys will still remain at 75 to 80 dBA due to each individual bus pass-by at 15m since the Leq represents the average energy exposure due to multiple bus movements over the period of interest (1 hour in this case). The following table provides a quick reference for illustration purposes only of the resulting Leq sound levels due to various bus movements:

One Way Bus Movements/Hr.	Total 2-Way/Hr.	Leq, dBA
25	50	64
50	100	67
75	150	69
100	200	70

(Based on 80 km/hr., 15m from busway centre line to receptor and normal ground conditions without any physical barriers).

For this analysis, no other sources of noise were considered along the Busway corridor since City buses are the predominant part of traffic allowed on the major part of this proposed corridor.

2. Bus Movements Within the Stations

The term station as used in this study refers to both bus stations and conventional road-side bus stops. Figure 29 illustrates typical details of a bus station and a bus stop.

The primary sources of noise within a bus station are mostly due to the variety of bus activities and movements within the designated areas of the station where buses accelerate, decelerate, idle or move at constant speeds. Such activities generate different peak sound levels and

the time or duration of each event may be different. Since the ORNAMENT model cannot deal with such complex evaluations, a different approach was followed whereby the sound emission levels of buses operating under different conditions were actually measured and the results were then used to recompose overall noise exposure levels at the specific points of reception.

Appendix B contains the details of the recent bus sound level measurements taken within the City of Mississauga Transit Yards in connection with this project. The results contained in Appendix B were used in the subsequent calculations of the bus station sound levels.

Sound levels due to bus activities within the bus stations and along the bus stops were calculated using computer programs developed by **S.S. Wilson and Associates** for multiple receptors or at grid points (contours) and for multiple noise sources. These programs take into account the following factors:

- Reference sound levels (emission levels from Appendix B) and reference distances for the various bus movements or activities; examples include idling, acceleration, deceleration, stop and go, movements near bus stop, stop signs, ... etc.

- Reference sound levels for vehicular traffic activities within the parking area based on data measured by **S.S. Wilson and Associates** in connection with other similar projects.

- Speeds of buses within the various segments of the stations or alternatively, the time spent by each bus in each identified time segment.

- Volume of buses (2 way movements).

- Divergence (distance) attenuation.

- Sound barrier attenuation where applicable.

- Ground and Atmospheric attenuation (as modified by source/receiver elevations and the intervening sound barrier).

- Source and receptor elevations.

Figure 29 illustrates the details of a selected station along with a description of the various noise activity areas or segments within or near the station. For example, the data received from the project traffic

consultants indicate that the buses are likely to spend 3 minutes each idling at each respective bay within the station as shown. The Figure also shows the various noise zones such as a stop sign noise zone, acceleration at low speeds, movements at a constant low speed, ... etc.

Since no detailed plans are available at this time to show the design of the specific station where a station building will be constructed, the noise from any potential mechanical equipment such as ventilation fans and air conditioning equipment was not considered at this point. It is worth noting that the noise from mechanical equipment are expected to be lower than the noise generated by the bus movements and also due to the high ambient/background sound levels. Shielding effects provided by station buildings were also not considered.

3.2 AMBIENT/BACKGROUND NOISE

In Section 2.0 it was indicated that noise assessment of the proposed undertaking also includes comparative evaluation of the source sound levels (due to bus activities) against the existing or established ambient/background sound levels due to vehicular traffic in the area. There are several sources of transportation noise in the area including Highway 403, the intersecting arterial roads and the associated ramps to Hwy. 403. The following is a list of the transportation sources of noise considered in this study:

- Highway 401 & Highway 427
- Highway 403
- Highway 403 Arterial Road extension.
- Eglinton Avenue
- Ridgeway Blvd.
- Winston Churchill Blvd.
- Glen Erin Blvd.
- Erin Mills Parkway.
- Mississauga Road.
- Creditview Road.
- Mavis Road.
- Hurontario Street (Highway 10)
- Central Parkway.
- Cawthra Road.
- Tomken Blvd.
- Dixie Road.
- Fieldgate Blvd.
- Spectrum Drive.
- Satellite Drive.
- Orbitor Drive.
- Explorer Drive.

- Renforth Drive.

It should be noted that there are other major sources of transportation noise affecting the area of concern which were not included in the estimation of the ambient noise. The sources include aircraft and railway noise which were specifically excluded from the analysis in order to comply with the MOE recommendation for the exclusion of sources of noise that are fairly intermittent in nature.

Traffic noise due to vehicular traffic movements on the above-noted roadways were calculated using the ORNAMENT model based on the roadway and traffic data supplied by the traffic consultants.

Since the proposed Busway system is planned to be fully operational by the year 2021 the ambient sound levels were calculated using the future ambient traffic data; i.e. the "Do-Nothing" alternative.

Appendix F contains the road and traffic data used for the ambient calculations.

It should be noted that for receptor locations in the vicinity of Central Parkway station, the current horizontal and vertical configurations of the traffic lanes of highway 403 were used in calculating the ambient sound levels due to vehicular traffic on the highway as it will be the worst case as opposed to future proposed configurations.

3.3 POINTS OF RECEPTION

Points of reception are considered any point on the premises of a person where sound originating from other than the premises are received.

If we examine the existing land uses near the proposed transit system it could be concluded that the predominant land use is residential followed by commercial and industrial. There are several vacant properties north of Highway 403, most of which are designated for residential land use and the remaining are residential subdivision already under construction.

For the purposes of this study, several representative locations were selected to represent the closest points of reception to both the Busway and the stations. Moveover, many of the selected receptors are located further away from the arterial roads in order to provide a more conservative approach in calculating the ambient sound levels, but still keeping the distance as close as possible to the proposed transit system. As an added measure of safety, the receptor

elevation was considered as a typical second storey level in a dwelling unit when calculating the stations sound levels since less ground attenuation would be included in the calculation of the sound propagation factors. A sound barrier in the form of an acoustical wall with an unspecified height is proposed by the consulting engineering firms McCormick Rankin Ltd., and The IBI Group. This wall was not taken into consideration during sound level calculations of both the ambient, station activities and Busway traffic.

Figures 2 to 23 illustrate the selected receptors along the various sections and alternatives of the proposed transit system.

The receptors shown in these figures represent a combination of residential dwellings and noise-sensitive commercial (office) buildings.

3.4 BRIEF DESCRIPTION OF THE TRANSIT CORRIDOR

Figures 2 to 23 also illustrate the proposed alignments of the transit system including the Busway lanes, crossings, stations and connections to the existing arterial network. The ultimate service extends from Ridgeway Drive to Renforth Drive primarily in the proximity of the Kings Highway 403 corridor and the Hydro transmission corridor in the City of Mississauga.

There are two basic alternatives for the Busway alignment designated as the "north" and "south" alignments as shown in the figures. The primary difference is the location of the Busway lanes and the resulting crossings of other roadways. Figures 4, 4.a , 5, 5.a , 6 and 6.a show, where applicable, the differences between the proposed alignments.

There are 17 station locations, of which 15 stations were considered in this study due to their potential noise impacts. The stations studies are:

1. Ridgeway Station
2. Winston Churchill Station
3. Glen Erin Station
4. Erin Mills Station
5. Mississauga Road Station
6. Creditview Station
7. Mavis Station
8. Central Parkway Station
9. Cawthra Station
10. Tomken Station
11. Dixie Station
12. Fieldgate Station
13. Spectrum/Satellite Station
14. Orbitor/Explorer Station
15. Renforth Station

The proposed stations at City Centre and Hurontario will not be addressed in this report as the layout and design of the stations as well as the surrounding land development are not complete at the time of the undertaking of this study.

The proposed speed limit on the transitway is 80 km/hr. with two primary lanes (one in each direction). Traffic data was obtained from the project traffic and engineering consultants; M.M. Dillon Ltd., McCormick Rankin Ltd., and The IBI Group.

Appendix F contains a summary of the traffic data used. It should be noted that the actual number of bus movements used for sound level calculations is assumed to be twice the number of bus movements in any one direction.

It is important to note that a significant proportion of the proposed Busway corridor is planned in a cut; i.e. below the existing grades as shown in Figures 2 to 23

The depressed Busway grade elevations are considered to be acoustically beneficial as the Busway edge closest to the receiver may act as an effective sound barrier depending on the Busway final grade elevations and the elevations at the points of reception. The acoustical benefits to be derived from the Busway depression/cut were included in the analysis of the noise impact.

Figure 28 illustrates a typical cross-section through the Busway showing the proposed cut.

3.5 GENERAL APPROACH

Ideally, stationary noise source assessment procedures recommended by the MOE call for hourly examination of the source sound levels against the ambient sound levels thereby establishing more-or-less 24 sets of hourly excess sound levels; if any at each receptor.

Although this procedure is considered favourable for sources of noise that are not directly related to the ambient in terms of their operation, hourly variations and daily pattern, the results of this study are based on examination of the average hourly bus movements during the daytime against the average ambient due to traffic represented by the 16 hour descriptor (Leq_{16}) and the 8 hour night-time descriptor (Leq_{8}).

This approach was selected for this project due to the following reasons:

(i) The daily variations and traffic patterns of the Busway are likely to be similar to that of the ambient traffic in that the bus A.M. and P.M. peak movements are likely to be higher than the average daily, but still follow to a large extent the traffic patterns on the roadways under consideration.

(ii) At this early stage of the planning process it is difficult to predict with a reasonable degree of accuracy the hourly variations in bus movements.

3.6 RESULTS

Sound levels were calculated at the selected receptors due to three different noise sources:

1. Bus traffic along the proposed Busway.
2. Activities within the proposed stations. This includes

local and Busway buses entering into, exiting from, manoeuvring and idling within the station boundaries as well as cars entering into, exiting from and idling within the Kiss & Ride and Park & Ride Facilities (where applicable).

3. Vehicular traffic on the existing Highway 403, Highway 403 Arterial and local roads. The sources constitute the sources of ambient sound levels.

Sample calculations are included in Appendix C and the full calculation sheets may be obtained separately by contacting S.S. Wilson & Associates.

The results are presented in the form of sound levels due to each of the above mentioned items as well as the combinations of all three. The excess over the ambient sound levels are calculated for the individual cases of bus traffic, station activities, and the overall combined sources. It has to be noted that a correction factor of up to 3 dBA was added to the sound levels due to bus traffic on the Busway to compensate for the effect of reflection as a result of the predominantly cut section of the Busway. The STAMSON 3.0 noise prediction model used in sound levels predictions does not have the capability to correctly simulate sound waves behaviour in this geometrical configuration. It can be further concluded that the cut section configuration of the proposed Busway proved to be favourable from an acoustical point of view, as it provided a minimum net reduction of sound levels of approximately 6 dBA.

Tables 3 to 19 summarize the results of the analysis. Figures shown are predicted sound levels in terms of Leq_{16} dBA.

A graphical presentation of the summary of the results is given in Figures 24 to 27.

The results at the worst case receptors in the vicinity of the proposed Busway stations are given in Tables 1 and 1.a.

From these tables it can be concluded that ambient sound levels at most of the selected receptors are considerably higher than the MOE Day-time Leq 55 dBA criteria.

In the case of the Busway traffic, the maximum calculated excess sound level over the ambient, as shown in Table 2, was 5 dBA, i.e. within the MOE/MTO maximum excess criteria.

In the case of the station activities, the maximum calculated excess sound level over the ambient, as shown in Tables 1 and 1.a, was less than 5 dBA, i.e. within the proposed criteria.

4.0 CRITERIA

4.1 SOUND LEVEL CRITERIA FOR BUS MOVEMENTS

At the present time, there are no provincial regulations or policies for the control of individual or cumulative bus sound levels operating on provincial or municipal roadways. For example, if a transit authority decides to increase the frequency of bus movements on an existing bus route or to add a new road-site bus stop no specific approval is required by any provincial jurisdiction.

The only applicable provincial legislation is the Highway Traffic Act which requires all vehicles to be equipped with exhaust muffling devices. On the other hand, the Federal Government has published noise emission standards for new buses not to exceed 83 dBA at 15m when tested at the manufacturers facilities.

It is worth noting that the Ontario Ministry of the Environment has previously endorsed environmental noise guidelines prepared by the Ontario Ministry of Transportation for the "GO-ALRT" system which included the establishment of new rail transit lines, stations and maintenance facilities in southern Ontario.

Other major busway transit systems established in Ontario included the Ottawa-Carleton Transportation (OC TRANSPO) system developed by the Regional Municipality of Ottawa-Carleton (RMOC). The RMOC-OC TRANSPO system included the assessment of environmental noise based on informal guidelines used by the RMOC and the project consultants in consultation only with the MOE.

In the absence of specific provincial policies and guidelines on the development of exclusive bus transit systems noise impact, a written submission was made to the MOE based on the discussions with MOE staff. Appendix E contains a copy of the letter prepared by this firm to the MOE which contains a brief description of the suggested methodology and the sound level criteria specific to this project.

The following summarizes the tentative criteria verbally endorsed by the MOE for the proposed Mississauga Busway:

(a) Bus Movements Between Stations

The Busway impact should be characterized by developing the 2 descriptors Leq 16 hour (daytime) and the Leq 8

hours (night-time), i.e. 07:00-23:00 and 23:00-07:00 Leq values. This approach seems reasonable since the AM and PM peak bus activities will occur at the same time as that due to the ambient/background vehicular traffic on other roads. Similarly low ambient on Sundays will correspond with low Sunday bus service anyway, therefore, no additional calculations will be needed for the weekend case.

The calculated Busway Leq 16 and Leq 8 should then be compared against the MOE general objective of; the higher of both: Leq 55 dBA or the ambient/background due to vehicular traffic elsewhere; i.e. use the same principles included in the MOE/MTO Protocol for Highway Noise Assessments. A maximum excess of 5 dB to be applied (to be consistent with the MOE/MTO Protocol) for this transit system which may be equated to a new roadway.

(b) Station Noise

All sources within a station (with the exception of a simple road side bus stop) should be treated as a Stationary Source that is subject to the MOE's Publications NPC-105 and NPC-106 (i.e. the higher of either the ambient or the NPC-106-2 Table).

The following exceptions or variations are recommended for this specific project:

(i) The assessment to be performed in terms of the Leq 16 and Leq 8 in order to be consistent with the busway impact between stations. The general activities in a bus station are expected to follow the ambient activities, therefore 16 hour and 8 hour averages may be used.

(ii) The excess that may be allowed by the MOE for the busway may also be allowed for the stations as well as for the combined effect of stations plus the busway. Therefore, if the 5 dB MOE/MTO Protocol excess or any other excess is allowed, the proposed stations and the combined effect of stations and busway may also be allowed the same excess.

4.2 SOUND LEVEL CRITERIA FOR CONSTRUCTION EQUIPMENT

Sound levels generated by construction equipment are assessed against the Ontario Ministry of the Environment Publication NPC-115 "Construction Equipment" and Publication NPC-118, "Motorized Conveyances". These publications do not set overall or combined sound level limits due construction sites but set limits for noise generated by the individual pieces of

equipment used on construction sites. M.O.E. approval will be based on whether or not the equipment used on site meets their requirements. (Copies of M.O.E. publications NPC-115 and NPC-118 are included as Appendix D.

For example, the M.O.E. specifies that the maximum sound emission level from excavation equipment loaders and dozers not exceed 85 dBA at 7m for equipment having 75 kw and larger power rating if manufactured after January 1, 1981.

With respect to truck noise, the governing criteria are contained in the Federal Government safety test standards for manufacturing of new trucks included in their publication titled "SECTION 1106-Noise Emission Tests For Motor Vehicles, and the relevant Consolidated Regulations of Canada, 1978 amended by SOP-179-115, September 1, 1979: Section 1106". Typical trucks maximum sound emission level is 83 dBA for a vehicle gross weight of over 4500 kg.

TABLE 1
PREDICTED SOUND LEVELS AT THE BUSWAY STATIONS[1]
WORST CASE RECEPTORS

Location/Station	Predicted Sound Levels (dBA)				Excess Over future Ambient Sound Levels (dB)	Mitigation[5]
	Future Ambient[2] (Do-Nothing)	Station Activities[3]	Busway Traffic	Total Combined Sound Levels[4]		
<u>West of City Centre</u>						
Ridgeway	59	51	43	60	+1	Not Required
Winston Churchill	60	54	53	62	+2	Not Required
Glen Erin*	62	57	52	64	+2	Not Required
Erin Mills*	61	58	58	64	+3	Not Required
Mississauga Road	57	47	48	58	+1	Not Required
Erindale/Creditview	65	60	51	66	+1	Not Required
Mavis	62	53	53	63	+1	Not Required
<u>East of City Centre</u>						
Central Parkway	63	56	60	65	+2	Not Required
Cawthra	53	45	45	54	+1	Not Required
Tomken	56	51	51	58	+2	Not Required
Dixie	56	52	49	58	+2	Not Required
Fieldgate**	45	46	46	50	+5	Not Required
Spectrum/Satellite	64	61	53	66	+2	Not Required
Orbitor/Explorer	64	61	53	66	+2	Not Required
Renforth	63	54	N/A	64	+1	Not Required

(1) Sound levels predicted at Receptor Locations in the vicinity of the stations.
(2) Future ambient sound levels are due to vehicular traffic on Highway no. 403 and local roads.
(3) Station activities include :
    (a) Local and Busway buses entering into, exiting from, manoeuvring and idling within the station boundaries as well as Cars entering into, exiting from and idling within the Kiss & Ride and Park & Ride Facilities (where applicable).
(4) Total Combined Sound Levels refers to future ambient sound levels combined with both station activities sound levels and Busway traffic sound levels.
(5) Pending MOE Approval of 5 dBA excess.

*North-bound

TABLE 1.a
PREDICTED SOUND LEVELS AT KEY STATIONS[1]
SOUTH ALIGNMENT

Location/Station	Predicted Sound Levels (dBA)				Excess Over future Ambient Sound Levels (dBA)	Mitigation[5]
	Future Ambient[2] (Do-Nothing)	Station Activities[3]	Busway Traffic	Total Combined Sound Levels[4]		
Glen Erin	62	57	47	63	+1	Not Required
Erin Mills Parkway	61	52	55	62	+1	Not Required

Notes :

(1) Sound levels predicted at Receptor Locations in the vicinity of the stations that are likely to have the highest impact.

(2) Future ambient sound levels are due to vehicular traffic on Highway no. 403 and local roads.

(3) Station activities include :
   (a) Local and Busway buses entering into, existing from, manoeuvring and idling within the station boundaries.
   (b) Cars entering into, exiting from and idling within the Kiss & Ride and Park & Ride Facilities (where applicable).

(4) Total Combined Sound Levels refer to future ambient sound levels combined with both station activities sound levels and Busway traffic sound levels.

(5) Pending MOE Approval of 5 dBA excess.

TABLE 2
PREDICTED SOUND LEVELS DUE TO BUSWAY TRAFFIC[1]
WORST CASE RECEPTORS

Link From To	Receptor	Predicted Sound Levels (dBA)			Excess Over future Ambient Sound Levels (dB)	Mitigation
		Future Ambient[2] (Do-Nothing)	Busway Traffic	Total Combined Sound Levels[3]		
Ridgeway Winston Churchill	A2	60	62	64	+4	Not Required
Winston Churchill Glen Erin	A5	62	54	63	+1	Not Required
Glen Erin Erin Mills	A11	57	54	59	+2	Not Required
Erin Mills Mississauga Road	A15	57	61	62	+5	Not Required
Erin Mills Mississauga Road (South Alignment)	A17	61	56	62	+1	Not Required
Mississauga Road Erindale/Creditview	A24	63	52	63	0	Not Required
Erindale/Creditview Mavis	A30	67	64	69	+2	Not Required
Mavis** Confedration	B3	62	55	63	+1	Not Required
Hurontario Central Parkway	B6	67	62	68	+1	Not Required

Link From To	Receptor	Predicted Sound Levels (dBA)			Excess Over future Ambient Sound Levels (dB)	Mitigation
		Future Ambient[2] (Do-Nothing)	Busway Traffic	Total Combined Sound Levels[3]		
Central Parkway Cawthra	B11	62	56	63	+1	Not Required
Cawthra Tomken	B14	58	45	58	0	Not Required
Tomken Dixie	C3	48	52	53	+5	Not Required
Dixie Fieldgate	C7	49	49	52	+3	Not Required
Fieldgate Spectrum/Satellite++	Typical Receptor	61	53	62	+1	Not Required
Spectrum/Satellite Orbitor/Renforth++	Typical Receptor	61	53	62	+1	Not Required

(1) Sound levels predicted at receivers Locations in the vicinity of the proposed busway with no impact from stations activities.
(2) Future ambient sound levels are due to vehicular traffic on Highway no. 403 or its arterial.
(3) Total Combined Sound Levels refers to future ambient sound levels combined with and Busway traffic sound levels.

** East of City Centre.
++ Along Eglinton Avenue.

GLOSSARY

Some of the terms used in this report may require an explanation.

AADT: is the abbreviation for Annual Average Daily Traffic and refers to the average daily volume of vehicles (cars and trucks) on a roadway for a calendar yard.

Ambient Sound Level: in the context of this report ambient sound level is the level existing in an area of at a receptor without the addition of any noise which may be generated by the operations under consideration.

dBA: The decibel (dB) is a dimensionless measure of sound pressure level. "A weighting" is the frequency weighting characteristic intended to approximate the relative sensitivity of the normal human ear to different frequencies (pitches) of sound.

Heavy Trucks (H.T.): Cargo vehicles having 3 or more axles. Generally, the vehicle gross weight is more than 12,000 Kg. inter-city buses are also classified as heavy vehicles.

Leq: The equivalent energy sound level (Leq) is the value of the constant sound level which would result in exposure to the same total A-weighted energy as would the specified time-varying sound, if the constant sound level persisted over an equal time interval. It is measured in dBA.

Medium Trucks (M.T.): Cargo vehicles having 2 axles and 6 wheels. Generally, the vehicle gross weight is within the range 4,500 to 12,000 Kg. Urban transit buses are classified as medium trucks.

Pascal: is a unit for measurement of pressure expressed in the International System (SI) of Units.

Sound Level: is the weighted sound pressure level.

Sound Pressure Level (SPL): in decibels, at a point is 20 times the logarithm (to the base 10) of the ratio of the effective pressure of a sound (at the point) to a reference pressure of 20 micro pascals.

Decibel: The "decibel" is a dimensionless measure of sound level or sound pressure level; see sound pressure level.

Frequency: The "frequency" of a periodic quantity is the number of times that the quantity repeats itself in a unit interval of time. The unit of measurement is hertz (Hz) which is the same as cycles per second.

Percentile Sound Level: The "x percentile sound level", designated L_x, is the statistical sound level exceeded x percent of a specified time period. It is measured in dBA most commonly used descriptors are L_{10}, L_{50} and L_{90}.

Sound: "Sound" is an oscillation in pressure, stress, particle displacement or particle velocity, in a medium with internal forces (e.g. elastic, viscous), or the superposition of such propagated oscillations, which may cause an auditory sensation.

Noise: "Noise" is defined as any unwanted sound.

APPENDIX 'N-A'

GENERAL PROCEDURES AND ADJUSTMENTS

APPENDIX A

GENERAL PROCEDURES AND ADJUSTMENTS

1.1 MOE ROAD TRAFFIC NOISE PREDICTION TECHNIQUE

The road traffic noise assessment method is based on a model originally developed by the U.S. Federal Highway Administration in 1978 as modified by the Ontario Ministry of the Environment to suit the provincial requirements.

The analytical model predicts hourly Leq due to road traffic. It is modular in structure and thereby lends itself to applications requiring detailed analysis.

The variables required for the road traffic assessment include the following: road traffic volume per hour, percentages of automobiles, medium trucks and heavy trucks, average speed of traffic flow, roadway gradient, source to receiver distance(s), type of ground cover, road element size and shielding applicable.

The details of the model could be found in the publication "Ontario Road Noise Analysis Method for Environment and Transportation (ORNAMENT)[1]", Ministry of the Environment, November 1988.

The applicable procedures are summarized in the following paragraphs. Sample calculations are included in this report for a typical receiver location.

1.1.1. Predicted sound level data are generally based on two daily periods or the full 24 hour period as requested by the MOE for specific sources:

07:00 to 23:00 hours
23:00 to 07:00 hours

1.1.2. Roadway traffic volumes (AADT) split:

Regional Roads	Provincial Highways
07:00 to 23:00 hours = 91%	07:00 to 23:00 hours = 85%
23:00 to 07:00 hours = 9%	23:00 to 07:00 hours = 15%

1.1.3. Reference Hour Sound Level:

$$Leq_{ref} = 10 \log \sum_{i=1}^{3} \{K_g P_i 10^{\frac{(L_0)_i}{10}}\} - 10 \log S + 2.76$$

[1] The computerized versions of this model are 'STAMSCN 3.0 and STAMSCN 4.1'.

$(L_0)_{AUTOMOBIL}$ - 38.1 log(S) - 2.4

$(L_0)_{MEDIUM\ TRUCK}$ - 33.9 log(S) + 16.4

$(L_0)_{HEAVY\ TRUCK}$ - 24.6 log(S) + 38.5

where Leq_{ref} is the reference hourly sound level;
K_g the road gradient adjustment factor for heavy trucks;
P_i the percentage of ith vehicle class, expressed as fraction of the total volume;
$(L_0)_i$ the reference energy mean emission level of ith vehicle class;
S the posted speed limit in km/h.

1.1.4. Adjustments to Reference Level (dB)

o Traffic Volume:

Adjustment = 10 log (V/V_{ref}) = 10 log (V/40)

where V is the total traffic volume.

o Distance:

Adjustment = 10 log $(D_{ref}/D)^{1+\alpha}$

where D_{ref} is reference distance of 15 m.

α = 0 for reflective surfaces (hard ground)

α = 0.66 for absorptive surfaces (soft ground) where $h_{eff} \leq 3$ m

$\alpha = 0.75(1-(h_{eff}/25))$ for absorptive surfaces where $3 < h_{eff} \leq 25$ m

α = 0 for absorptive surfaces where $h_{eff} > 25$ m

h_{eff}= s + p + t + r

where h_{eff} is the total effective height.

α is ground absorbtion coefficient.

o Road Segment

Non-Reflective Surface :

$$Adjustment - 10 \log \left(\frac{1}{\pi}\int_{\Phi_1}^{\Phi_2} \cos^{\alpha}\Phi \, d\Phi\right)$$

Reflective Surface :

$$Adjustment = 10 \log \{\frac{\Phi_2 - \Phi_1}{\pi}\}$$

where ϕ_1 is the negative angle of view;
ϕ_2 is the positive angle of view.

1.1.5. Typical Receiver and Source Heights:

Outdoor Living Areas (OLA) = 1.5 m

Second Storey Bedroom = 4.5 m

Source Height = 0.5 m where $P_{HT} < 0.01$

Source Height = $\sqrt[4]{100\ P_{HT}}$ where $0.01 \leq P_{HT} \leq 0.30$

Source Height = 2.4 m where $P_{HT} > 0.30$

where P_{HT} is the percentage of heavy trucks, unadjusted by the gradient factor, expressed as a fraction of the total volume.

1.2 BARRIER CALCULATION MODEL

1.2.1. Barrier attenuation is calculated using optical diffraction theory.

1.2.2. Attenuation for road traffic noise is calculated at 500 Hz for an incoherent infinite line source.

1.2.3. The barrier prediction model has been developed by the National Research Council which is somewhat more conservative than the Kurze and Anderson original model.

$$Barrier\ Atenuation = 0\ dB, \quad for\ (N_0)_i \cos\phi \leq -0.1916$$

$$Barrier\ Attenuation = 10 \log\{\frac{1}{\Phi_2 - \Phi_1} \int_{\Phi_1}^{\Phi_2} \frac{\tan^2 \sqrt{2\pi\ |N_0|_i \cos\phi}}{\sqrt{10}\ 2\pi\ |N_0|_i \cos\phi}\ d\Phi\},$$

$$for\ -0.1916 \leq (N_0)_i \cos\phi \leq 0$$

$$Barrier\ Attenuation = 10 \log\{\frac{1}{\Phi_2 - \Phi_1} \int_{\Phi_1}^{\Phi_2} \frac{\tanh^2 \sqrt{2\pi\ (N_0)_i \cos\phi}}{\sqrt{10}\ 2\pi\ (N_0)_i \cos\phi}\ d\Phi\},$$

$$for\ 0 \leq (N_0)_i \cos\phi \leq 5.03$$

$$Barrier\ Attenuation = 20\ dBA \quad for\ (N_0)_i \cos\phi \geq 5.03$$

where N_0 is Fresnel Number, $N_0 = 2.915 \times (P.L.D.)$

S.S. WILSON AND ASSOCIATES
DIV. OF M.M.G. ENGINEERING INC.
Consulting Engineers

September 17, 1990

Mr. Leslie G. Kende, P. Eng.
Supervisor, Noise Assessment and
Systems Support Unit
Ministry of the Environment
250 Davisville Avenue, 3rd Floor
Toronto, Ontario
M4S 1H2

BY MAIL/FAX: 440-6973

Dear Les:

Re: Proposed Noise Criteria for the City of Mississauga Busway System

The services of S.S. Wilson and Associates have been retained by M.M. Dillon Ltd., the IBI Group and McCormick Rankin and Assoc. Ltd. on behalf of the City of Mississauga to study the noise impact potential due to the proposed Busway transit system in the City of Mississauga.

The proposal is subject to a one-stage individual Environmental Assessment under the authority of the EAA. My client will be preparing the necessary documentation to contain environmental noise as one of the issues to be addressed.

The proposal calls for the construction of a dedicated bus transit corridor (Busway) as well as different levels of bus station designs from west of Winston Churchill Blvd. to east of Commerce Blvd. in the proximity of the existing Highway 403 Corridor, the proposed Highway 403 Arterial Road and Eglinton Ave. The attached Exhibit 1 illustrates the integrated operating strategy for the entire system. The attached Figure 1 also shows copies of some of the proposed station locations and preliminary layouts.

I have been advised by the Study Team that the ultimate capacity will be approximately 200 x 2 = 400 bus movements per hour on the busiest part of the Busway Corridor itself with lower bus movements within each station.

I have been asked by members of the Study Team to confirm with the MOE two main issues related to environmental noise:

1. PREDICTION MODELS

Bus Movements Between Stations

Use the Stamson 3 or 4 programs to calculate the ambient due to vehicular traffic on the existing road network in the area. Also use the Stamson 3 or 4 programs to calculate the busway noise impact assuming that each bus is represented by a "Medium Truck".

Bus/Vehicle Movements Within the Stations

Calculate the overall Leq sound levels due to all bus movements within the Station in a manner similar to stationary source calculations. This will include bus movements, acceleration, idling, ventilation equipment; if any, etc. Enclosed, please find sample results for a hypothetical station showing the various Leq sound level contours for a 40 buses per hour station using the computer program developed by this firm.

The existing ambient sound levels due to vehicular traffic on the near-by roadways will be based on the Stamson 3 or 4 models.

2. APPLICABLE CRITERIA

In the following paragraphs (a) and (b) I will summarize the results of our discussions on August 27, 1990 and our proposal to deal with this issue:

(a) Bus Movements Between Stations

The Busway impact should be characterized by developing the 2 descriptors Leq 16 hour (daytime) and the Leq 8 hours (night-time), i.e. 07:00-23:00 and 23:00-07:00 Leq values. This approach seems reasonable since the AM and PM peak bus activities will occur at the same time as that due to the ambient/background vehicular traffic on other roads. Similarly low ambient on Sundays will correspond with low Sunday bus service anyway, therefore, no additional calculations will be needed for the weekend case.

The calculated Busway Leq 16 and Leq 8 will then be compared against the MOE general objective of; the higher of both: Leq 55 dBA or the ambient/background due to vehicular traffic elsewhere; i.e. use the same principles included in the MOE/MTO Protocol for Highway Noise Assessments. At this point I also need confirmation as to whether the MOE will accept a maximum excess of 5 dB (to be consistent with the MOE/MTO Protocol) for this transit system which may be equated to a new roadway?. As you very well know, if we design the busway so that its level will be equal to that of the applicable ambient then we end up with a +3 dB increase which is considered acoustically marginal. It is the opinion of the Study Team members that if 0 (zero) dB excess is desired it will not be possible to construct this transit service to serve the general public as its overall level will have to be approximately 10 dB lower than the ambient, which is very difficult to achieve from the technical view point.

(b) Station Noise

If you examine the variety of Station designs for this project you will find that the stations may be as simple as an ordinary road side "bus stop" just like TTC bus stops along City streets up to a full station involving bus turning movements, Kiss & Ride, public parking, a structure and platforms.

As discussed, all sources within a station (with the exception of a simple road side bus stop) should be treated as a Stationary Source that is subject to the MOE's Publications NPC-105 and NPC-106 (i.e. the higher of either the ambient or the NPC-106-2 Table).

The following exceptions or variations are offered for your approval for this specific project:

(i) The assessment to be performed in terms of the Leq 16 and Leq 8 in order to be consistent with the busway impact between stations. It is also important to note that hourly bus volume projections at this stage are extremely difficult and may result in reducing the desired accuracy at the first place (At the present time it is still challenging for the Study Team to come up with average daily (16 hr.) and night (8 hr.) bus volumes for each station). As also mentioned earlier the general activities in a bus station is expected to follow the ambient activities, therefore 16 hour and 8 hour averages appear to be reasonable and plausible.

(ii) The excess that may be allowed by the MOE for the busway should also be allowed for the stations as well as for the combined effect of stations plus the busway. Therefore, if the 5 dB MOE/MTO Protocol excess or any other excess is allowed, the proposed stations and the combined effect of stations and busway should also be allowed the same excess.

I am looking forward to hear from you at the earliest opportunity as the City of Mississauga is anxious to proceed with the study. If a meeting is necessary I will be happy to meet with you. Thank you.

Yours truly

Hazem Gidamy

Hazem Gidamy, P. Eng.
Principal

GC:7 "Busway-1"

c.c.:	Bob Sasaki,	City of Mississauga	(By Fax (416) 896-5220)
	Chris Bishop,	M.M. Dillon	(By Fax 229-4692)
	Lee Sims,	IBI Group	(By Fax 596-0644)
	Steve Schijns,	McCormick Rankin	(By Fax (416) 823-8503)

Received by Mail by S.S. Wilson & Assoc. Friday Feb. 22/91

Ministry of the Environment / Ministère de l'Environnement
Ontario

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250, avenue Davisville
Toronto (Ontario)
M4S 1H2

APPROVALS BRANCH
3rd Floor
Tel.: (416)440-3588
Fax.: (416)440-6973

Copy Feb. 15, 1991
~~November 29~~, 1990

Mr. Hazem Gidamy, P.Eng.
S.S. Wilson and Associates
305 Renfrew Drive
Suite 101
Markham, Ontario L3R 9S7

Dear Hazem:

Re: MINISTRY NOISE CRITERIA FOR THE CITY OF MISSISSAUGA BUSWAY SYSTEM

Your letters dated September 17, 1990 and November 28, 1990 described an approach to the assessment of the acceptability of the noise impact by a new bus route in Mississauga. This approach is in agreement by and large with the concepts of our previous approaches to similar transportation activities and also in agreement with the procedures that we discussed over the telephone recently. The subject has also been discussed within our group and a general understanding of the criteria was reached as follows:

1. BUS MOVEMENT BETWEEN STATIONS

The recommendations that the noise should be assessed on an 16/8 hour basis, 07:00 - 23:00 and 23:00 - 07:00 is acceptable. However, the criteria should be 55 dBA, day-time, and 50 dBA, night-time, or the ambient in either period, whichever is higher. The MOE/MTO Protocol is applicable, i.e. control measures need be applied only if the excess is more than 5 dB.

2. BUS STOPS

Simple bus stops, such as the TTC bus stops, do not have to be separated from the general noise produced by the moving buses.

3. BUS STATIONS

The assessment procedure for the main bus stations is well established. Bus stations, except the simple bus stops addressed above, are stationary sources and should be assessed in accordance with NPC-105. This implies assessment using 1 hour L_{eq} and the limit being defined by the pre-existing ambient noise level.

4. GENERAL

The above criteria are mostly following the general practices of our noise guidelines. Where they differ from our guidelines, they are to be considered

as interim approach, yet to be verified by practice and used as draft guidelines until approved and published by the Ministry.

Yours truly,

L.G. Kende, P. Eng.
Supervisor
Noise Assessment and Systems Support

VS/vs

APPENDIX '0'

MISSISSAUGA CITY CENTRE BUSWAY / GATEWAY PLANNING STUDY TECHNICAL STATUS REPORT

(MAY 1990)

MISSISSAUGA TRANSITWAY PLANNING STUDY EA REPORT

APPENDIX 0 - MISSISSAUGA CITY CENTRE BUSWAY / GATEWAY PLANNING STUDY TECHNICAL STATUS REPORT

The revision of the Secondary Plan for the Mississauga City Centre in 1987 - 90 was accompanied by a review of the rapid transit requirements within the Secondary Plan area. Due to uncertainty at that time regarding the timing of the Mississauga Transitway Planning Study and the need to provide some input to the Secondary Plan review, it was decided to carry out an investigation of the functional and property requirements of the Transitway within the City Centre as a standalone study. When, in late 1989, the overall Transitway study in fact got underway, the City Centre portion (which was well advanced by that point) was documented in a Technical Status Report (this Appendix) and further work in the area was absorbed into the scope of work of the overall study.

The Technical Status Report was reviewed by City Centre property owners as part of the Official Plan review process, and the recommendations contained therein were incorporated into the revised Draft Secondary Plan; this was endorsed by City Council in November, 1990 and is now being considered by the provincial Ministry of Municipal Affairs for approval.

It should be noted that all references to "Busway" in the Technical Status Report should be superseded by "Transitway".

MISSISSAUGA CITY CENTRE BUSWAY / GATEWAY PLANNING STUDY

TECHNICAL STATUS REPORT

McCormick Rankin

May, 1990

MISSISSAUGA CITY CENTRE BUSWAY / GATEWAY PLANNING STUDY

SUMMARY REPORT

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MISSISSAUGA CITY CENTRE
BUSWAY PLANNING STUDY
EXECUTIVE SUMMARY

The City Centre Busway Planning Study was carried out in 1989 to identify property protection requirements and transit terminal / Gateway needs in the Mississauga City Centre. The study was expected to be a stand-alone exercise but was overtaken by the early initiation of the overall Mississauga Busway Functional Planning Study at the start of 1990. It was therefore decided to document the City Centre Busway findings to date in this brief Status Report, while carrying on the planning work into the overall study. The final report for the overall study (expected in 1991) will incorporate all the details of the entire Busway planning process in the City Centre.

The Busway within the City Centre is being planned in conjunction with the ongoing review and revision of the City Centre Secondary Plan, and is compatible with the goals and criteria outlined in the Secondary Plan. The Busway plays a key role in the City Centre, both as a natural focus of activity and development, and as an essential transportation facility without which the City Centre is incapable of developing to its proposed ultimate condition. In the long term, there is projected to be close to 20,000 passengers (two way) on the Mississauga Busway in the peak hour at the City Centre, of which approximately 8,000 are anticipated to be destined to the City Centre. In addition, in the order of 12,000 transit trips are projected to be destined to the City Centre in the ultimate morning peak hour by surface (non-Busway) transit, while the remainder of external trips will be by car.

A Busway concept has been identified that accommodates these demands, while supporting the planning goals of the City Centre, maintaining the operational feasibility and function of the Busway and optimizing the cost-effectiveness of the facilities.

An alignment in the Rathburn Road corridor best balances the demand for service to the City Centre, Busway function, and cost compared to alternatives in the Highway 403 or City Centre Drive corridors. A below-grade bus-only roadway, with protection for the potential for ultimate conversion to fixed rail is recommended.

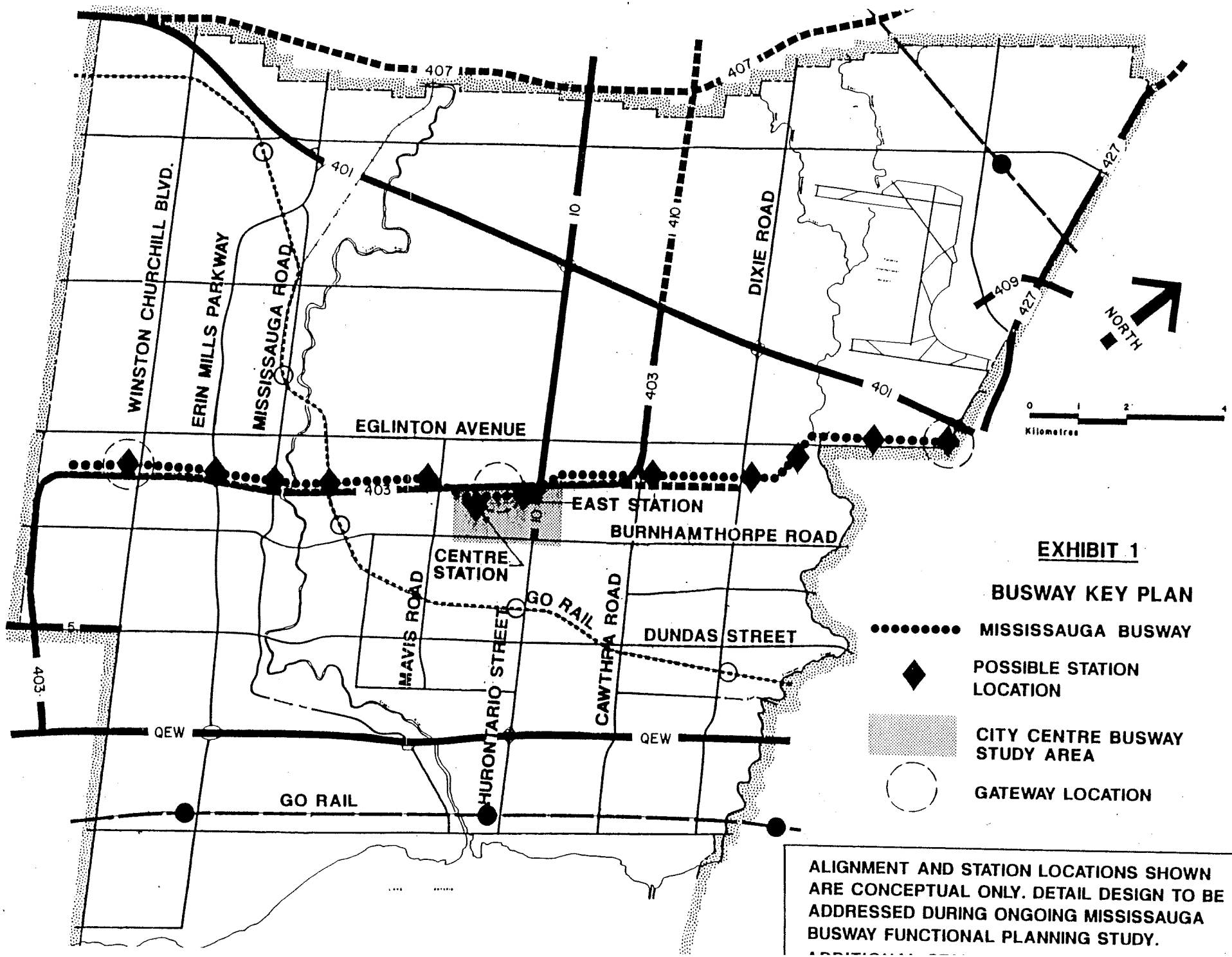
The analysis to date indicates a technical preference for a two-station system within the City Centre, one just west of Hurontario Street and a Centre Station on the south side of Rathburn Road east of Duke of York Boulevard. A third station in the vicinity of Confederation Parkway was considered seriously but the physical and development impact on the area is significant relative to the potential service benefits. Further analysis of this key issue will be carried out in the overall Busway study now underway. It may be noted that a two-station approach puts greater weight on each of the stations, possibly advancing the timing of the East Station, in comparison to a three-station arrangement. The East Station provides the interchange between key transit corridors (Hurontario and Highway 403 / Rathburn) while directly serving the eastern part of the City Centre, while the Centre Station will be the focal point for bus and passenger interface as well as Gateway functions within the City Centre. Together these stations fulfil key Gateway roles as transportation nodes and hold the potential to be developed in a fully integrated manner with future high density commercial space.

A Busway alignment in the Rathburn Road right-of-way within the City Centre ties these stations together, while not deviating significantly from the City-wide Busway alignment in the Highway 403 corridor. To minimize the potential disruption to the urban fabric of the proposed high density Rathburn Road corridor, while avoiding the high costs associated with a completely enclosed tunnel option, a partially-covered Busway depressed within a widened Rathburn Road median is under consideration.

A detailed comparison of options and further development of functional plans for the Busway within the Rathburn Road corridor will be part of the overall Busway study now underway.

Exact Station layouts have not been defined as part of this study, but concepts have been advanced for the East and Centre Stations that illustrate the ability of the sites to accommodate the Busway, passenger, and Gateway demands placed on them. In particular, provision of facilities for express and local bus stops, a high level of surface shuttle service, and efficient passenger movement both within the stations and between the site and adjacent development are key station elements. Refinement of station layouts awaits development of an ultimate transit operating strategy, to be done as part of the overall Busway study.

In terms of property protection for the Busway within the City Centre, development plans for properties potentially physically impacted by the Busway (see Exhibit 13) should proceed in a manner that does not preclude the provision of the Busway and its stations, pending the outcome of the overall Busway Functional Planning Study. Liaison with all City Centre property owners and the general public will continue throughout the Mississauga Busway Planning Study, and a detailed property protection plan will be prepared as part of the ongoing work.


407
407
401
10
410
DIXIE ROAD
427
409
427
NORTH
401
WINSTON CHURCHILL BLVD.
ERIN MILLS PARKWAY
MISSISSAUGA ROAD
EGLINTON AVENUE
403
403
EAST STATION
BURNHAMTHORPE ROAD
CENTRE STATION
10
MAVIS ROAD
GO RAIL
CAWTHRA ROAD
DUNDAS STREET
HURONTARIO STREET
5
403
QEW
QEW
GO RAIL
0 1 2 4
Kilometres
EXHIBIT 1
BUSWAY KEY PLAN
MISSISSAUGA BUSWAY
POSSIBLE STATION LOCATION
CITY CENTRE BUSWAY STUDY AREA
GATEWAY LOCATION
ALIGNMENT AND STATION LOCATIONS SHOWN ARE CONCEPTUAL ONLY. DETAIL DESIGN TO BE ADDRESSED DURING ONGOING MISSISSAUGA BUSWAY FUNCTIONAL PLANNING STUDY.

1. INTRODUCTION

The City of Mississauga initiated the City Centre Busway / Gateway Planning Study in September 1988 to identify the busway / transit terminal / gateway needs within the City Centre and to develop functional plans and property plans to enable implementation of the City Centre Secondary Plan and future development of the area.

Several planning studies have been carried out in the City since the mid-1970's to address transportation and planning issues in the area. Previous work has established the planning goals, transportation needs, and general infrastructure layout. The following documents, summarized in Appendix A, served as background to the current study:

- Mississauga Urban Development and Transportation Plan (1975)
- City of Mississauga Official Plan (1980)
- City Centre Secondary Plan (1981)
- Mississauga Transportation Study (1985)
- City Centre Transportation Plan (1985)
- GO-ALRT City Centre Transit Interface Feasibility Study (1985)
- Municipal Rapid Transit Service Study (1985)
- Greater Toronto Area Planning Forum (1986)
- Highway 403 / Mississauga City Centre Feasibility Study (1987)
- Revised City Centre Secondary Plan (1987 - Present)
- Transportation Directions for the Greater Toronto Area (1988)
- Provincial Gateways Initiative (1988)

The City Centre Busway / Gateway Study was funded jointly by the City of Mississauga and the Ministry of Transportation, and was carried out simultaneously and in coordination with the Highway 403 South Service Road Planning Study. A joint Technical Steering Committee guided both studies. Committee members included:

City of Mississauga		
Public Works Department	-	Mr. K. Schipper
Public Works Department	-	Mr. B. Sasaki
Public Works Department	-	Mr. M. Powell
Planning & Building Department	-	Mr. J. Calvert
Transit Department	-	Mr. N. Dodd
Ministry of Transportation		
Toronto Area Coordinating Office	-	Mr. B. Ogden
Transit Office	-	Mr. A. Thompson
Planning & Design Section	-	Mr. L. Dutchak
GO Transit	-	Mr. S. Bruno
Hammerson Inc. (property owner)	-	Mr. M. Smith
duToit, Allsopp Hillier		
(Hammerson Consultant)	-	Mr. R. duToit
McCormick Rankin (City Consultant)	-	Mr. J. Sutherns
McCormick Rankin	-	Mr. S. Schijns

Information regarding the City Centre Busway / Gateway Study was presented to the public on June 7, 1989 in conjunction with a South Service Road Public Information Centre in City Hall. Publicity was through newspaper advertisements in Mississauga and direct notices to adjacent residents. The Busway was specifically outlined in the material. Approximately 100 residents in the area south of Highway 403 from west of Mavis Road to Confederation Parkway attended the Information Centre. The potential location of the Busway between the Service Road and adjacent homes was a concern of the affected residents, but the Busway generated little other comment.

Several meetings with individual City Centre property owners were held over the course of the study. On February 1, 1990, property owners in the City Centre were met with as a group to explain the Busway plans and obtain their input. Their involvement both individually and as a group, will continue as part of the overall busway planning process.

The ongoing review and updating of the City Centre Secondary Plan provided another forum for all property owners in the City Centre to comment on the Busway. The Busway is identified and conceptually located in the Rathburn corridor in the Secondary Plan, and highlighted as a key component in the City Centre transportation system. The Secondary Plan review process, coordinated through the City Planning department, has involved several meetings and written submissions concerning all the aspects of the City Centre plan. Planning department staff, through their presence on the Busway Technical Steering Committee, have ensured planning coordination and awareness of issues related to the Busway for all concerned parties.

The basis for carrying out the City Centre Busway / Gateway Planning Study was the need to address property protection requirements in the City Centre prior to further development in the potential Busway corridor. It had been expected that the overall Mississauga Busway Planning Study would not be undertaken in an early enough timeframe for this purpose, but in December 1989 the overall Busway Planning Study from Ninth Line to Highway 427 was initiated by the City.

With the City Centre-related work subsumed into the overall study, it was decided to document the findings to date of the City Centre Busway / Gateway Planning Study in a Technical Status Report, while carrying on with further planning work into the overall Busway study. The overall study's product will be a Functional Planning Report which will document the entire Busway planning process in the City Centre, incorporate all the technical data and analysis, and have final technical recommendations as to the Busway's functional plan. This material is accordingly not included in the Technical Status Report.

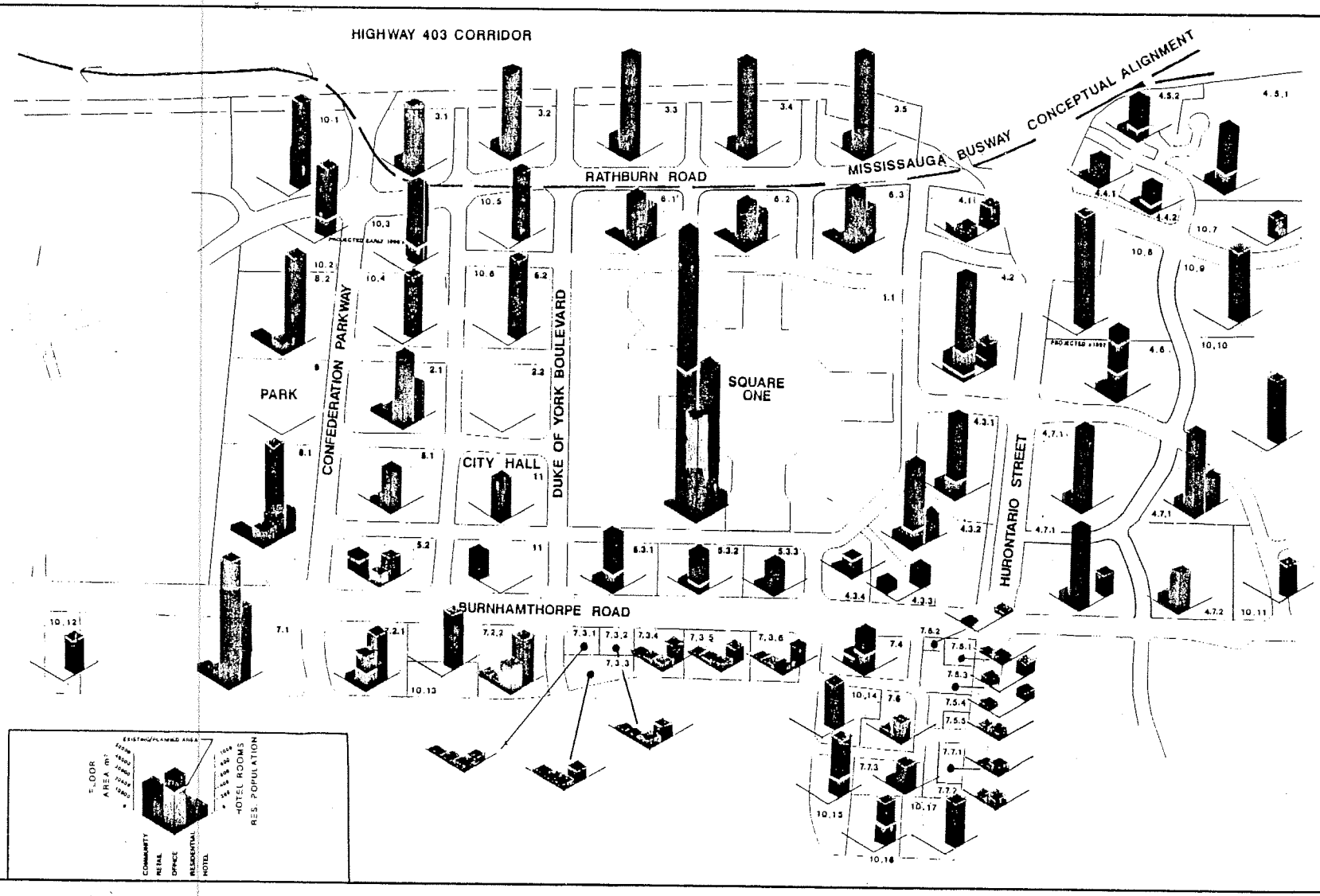
2. CITY CENTRE SECONDARY PLAN

Development within the City Centre area is governed by the principles outlined in the City Centre Secondary Plan. Although a Secondary Plan has been in place since 1981, a revised Secondary Plan, anticipated to be in place in 1990, would provide for an ultimate development level of approximately 110,000 jobs and 25,000 residents. Existing City Centre employment is in the order of 14,000.

Extensive review of the proposed revisions, including the transportation components, property owners, residents, and employees has occurred. The results of the current Busway Study are compatible with the draft revised Secondary Plan.

Exhibit 2 illustrates the distribution of development within the City Centre at its ultimate planning stage: Square One remains the commercial core, while high density office development is focused on the major arterials / corridors and the Highway 403 face; high density residential development buffers the edges of the City Centre and fills the northwest segment; and a band of more mixed-use and civic land uses stretches across the southwest portion of the City Centre.

It may be noted that, without a high modal split to transit (50 percent of peak hour trips) and completion of the full road network serving the City Centre, the transportation system will not be able to support the ultimate development level proposed for the City Centre.



MISSISSAUGA CITY CENTRE

BUSWAY PLANNING STUDY

ULTIMATE LAND USE

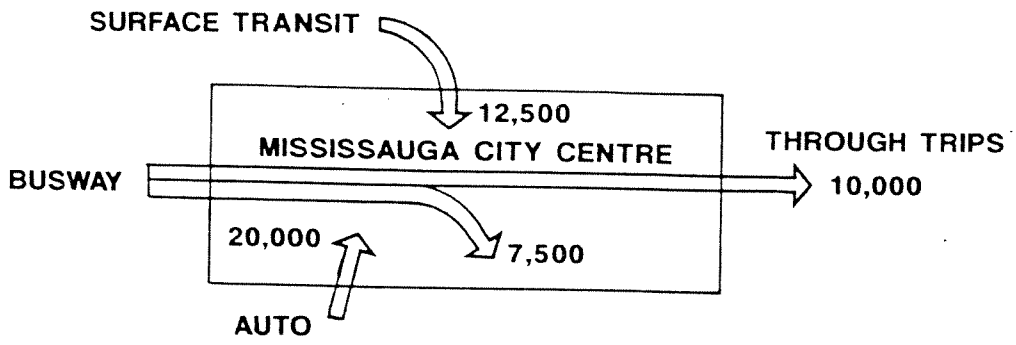
(DRAFT SECONDARY PLAN, SEPTEMBER 1989)

EXHIBIT

2

3. TRAVEL DEMAND

The Mississauga Transportation Study established the need for an east-west Busway in the Highway 403 corridor to serve the City Centre and accommodate the ultimate travel demands of the entire City. Under the revised City Centre Secondary Plan, at the 110,000 job level approximately 40,000 external trips will be destined to the City Centre in the morning peak hour, distributed as shown below. The afternoon peak is the reverse of, and slightly less than, the morning peak figures.



TOTAL TRIPS TO CITY CENTRE: 40,000
TOTAL TRIPS ON BUSWAY AT CITY CENTRE: 17,500

A sensitivity analysis comparing the transportation demands for a variety of development and demand scenarios was carried out. This was based on the travel model developed for the Mississauga Transportation Study, with the addition of several scenarios reflecting the changes in land use and increase in City Centre jobs proposed since that time. A definitive refined travel demand model for the City Centre was not developed as part of the Busway Study.

Table 1 summarizes the demand assignments generated for the various scenarios considered. Scenario 5, based on Institute of Transportation Engineers (I.T.E.) trip generation data, Secondary Plan land uses, modified Mississauga Transportation Study external trip distribution, approximately 20 percent internal trips, and a 50 percent transit modal split, was used for the ultimate travel demand scenario for the City Centre.

The demand and sensitivity analysis showed that the combination of high through volumes, heavy demand on all surface routes, and high volumes of Busway passengers stopping at the City Centre will require high-capacity, well-integrated stations and bus facilities in the City Centre.

TABLE 1: AM PEAK HOUR INBOUND TRIPS AT MISSISSAUGA CITY CENTRE

Scenario	Existing		1		2		3		4		5	
Total Employment	12,000		64,300		110,600		110,600		110,600		110,600	
Modal Split Auto/Bus	87/13		66/34		50/50		50/50		48/52		50/50	
Distribution	Existing (no Busway)		Miss. Transp. Study		Miss. Transp. Study		Skew add. Trips N & W		Refined		I.T.E. Trip Generation	
Approach	Auto Veh.	Transit Pass.	Auto Veh.	Transit Pass.	Auto Veh.	Transit Pass.	Auto Veh.	Transit Pass.	Auto Veh.	Transit Pass.	Auto Veh.	Transit Pass.
403 W. / Busway	870	25	2800	1900	3600	4800	3800	5100	3000	6900	2400	5000
Rathburn W.	60	30	1000	200	1300	500	1500	1800	1000	200	800	200
Burnhamthorpe W.	230	60	1500	1200	2000	3000	2000	2800	2200	3000	1800	2200
Mavis S.	50	0	400	600	500	1500	600	1200	600	1200	500	900
Confederation S.	120	0	1400	300	1800	800	1600	900	1600	900	1300	600
Hurontario S.	530	300	1500	1000	2000	2500	1700	1700	1700	1700	1400	1200
Burnhamthorpe E.	230	110	600	500	800	1200	800	1200	800	1200	600	900
Rathburn E.	70	60	900	200	1200	500	1100	800	1100	800	900	600
403 E. / Busway	690	25	2500	1700	3200	4200	3000	3300	3000	3300	2400	2400
Hurontario N.	240	40	900	2000	1200	5000	1400	3600	1400	5400	1100	3900
Confederation N.	0	0	1500	500	2000	1200	2000	2100	2000	1300	1600	900
Mavis N.	110	0	1500	600	2000	1500	2000	2200	2300	1800	1900	1300
Total Trips	3200	650	16500	10700	21500	26700	21500	26700	20700	27700	16700	20100
Total Person Trips	4400		31200		53400		53400		53400		40200	

4. GATEWAYS

In May 1988 the Ministry of Transportation announced its support for the development of a series of "Gateways" across the Greater Metropolitan Toronto Area. Implementation of the transportation gateways concept is a key component of the regional transit strategy. Gateways will be focal points in the transportation network which will substantially increase the use of transit in the areas of greatest traffic congestion around Metro Toronto.

Gateways will provide interchange points where people can move from cars to transit or from buses to high-speed transit. They will also attract services which cater to the needs of commuters, such as banking, shopping and day care centres. In addition, gateways will serve intercity buses and car pools and provide a transfer location for the special transit services used by disabled travellers. These sites will become urban nodes of appropriate residential, commercial and recreational development throughout the G.T.A. (Greater Toronto Area).

In addition, "Gateways" will promote / support the continued development of major city centres and sub-centres. The announcement included the identification of a possible gateway at the Mississauga City Centre. The planning of Busway Stations at the City Centre therefore requires consideration of the ability to provide as strong a Gateway function as possible.

Typical components for possible consideration within a Gateway site are listed below. It should be emphasized that not all components have to be included.

- High Density Walk-in Locations (Existing or Potential)
- Municipal Rapid Transit Interface
- Shuttle Bus Connections
- Parking
- Day Care Facilities
- Kiss'N Ride Facilities
- Intercity Buss Connections
- Restaurant Facilities

- Go Bus Connections
- Transfer for the Disabled
- Taxi
- Airport Service Connection
- Special Events
- Car Rentals
- Vanpools
- Goods Movement

The Busway stations considered for the Mississauga City Centre were therefore developed, where appropriate and feasible, with the Gateway principles in mind.

5. ANALYSIS OF ALTERNATIVE BUSWAY CORRIDORS

Although the analysis of alternative Busway corridors through the Mississauga City Centre had been carried out previously in the Transit Interface Feasibility Study (1985), it was appropriate to revisit the analysis in the context of the draft revised Secondary Plan and a more current understanding of the appropriate technology, demands, and constraints on the alternatives. The previous work had pointed to the Rathburn Road corridor as being the most appropriate transit focus.

Between two relatively fixed end points (Highway 403 west of Confederation Parkway and Highway 403 east of Hurontario Street, many alternative alignments are available to the Busway. Three distinct concepts were compared, through the development of eight representative schemes (see Exhibit 3).

The three approaches were:

A) locate the Busway in the Highway 403 corridor (considered a "base case") (Alternatives 1 and 2)

B) utilize the Rathburn Road corridor (Alternatives 3, 4 and 8)

C) provide a "loop" around the City Centre area to reach the Confederation Parkway, Burnhamthorpe Road and Hurontario Street corridors (Alternatives 5, 6 and 7)

The analysis of alternatives was based on a multi-faceted comparison of factors in two general areas: the construction and operation of the Busway itself (Transit Service, System Design, Staging and Cost factors); and the relationship of the Busway to the City Centre, particularly at the ultimate stage of development (Land Use and Development, and Environment factors).

Under the first group, the weighing of the needs of the through Busway passengers against the potential service improvements to City Centre employees was a key issue. To that end, indicators such as overall travel time to all transit users and the proximity of the stations to City Centre employees were used. In the second area, that of development impact, the potential of the Busway to support City Centre growth and the desire to minimize its intrusion into the urban fabric of the area were recognized.

A preliminary screening of alternatives led to the setting aside of three of the alignment concepts, in order to focus on realistic alternatives. Alignment 8 was disruptive to several property blocks yet provided service little different from Alternatives 3 or 4 and was not pursued. Alternatives 6 and 7 were set aside chiefly for two reasons: the significant diversion of through Busway trips from the Parkway Belt corridor; and the duplication of what will ultimately be a very high level of transit service in the Confederation Parkway, Burnhamthorpe Road, and/or Hurontario Street corridors. The latter two in particular were foreseen to have frequent bus service on dedicated lanes and possible higher-order transit service in the ultimate scenario. Further drawbacks in the areas of cost, geometric alignment, and number of stations required were noted. Alternative 5 was retained as an alignment representative of the "loop" approach, and as a route that, at less cost and duplication of service, served the City Centre as well as or better than the other "loop" alternatives.

Table 2, which follows the exhibits of the route alternatives, provides a brief overview of the analysis of alternatives.

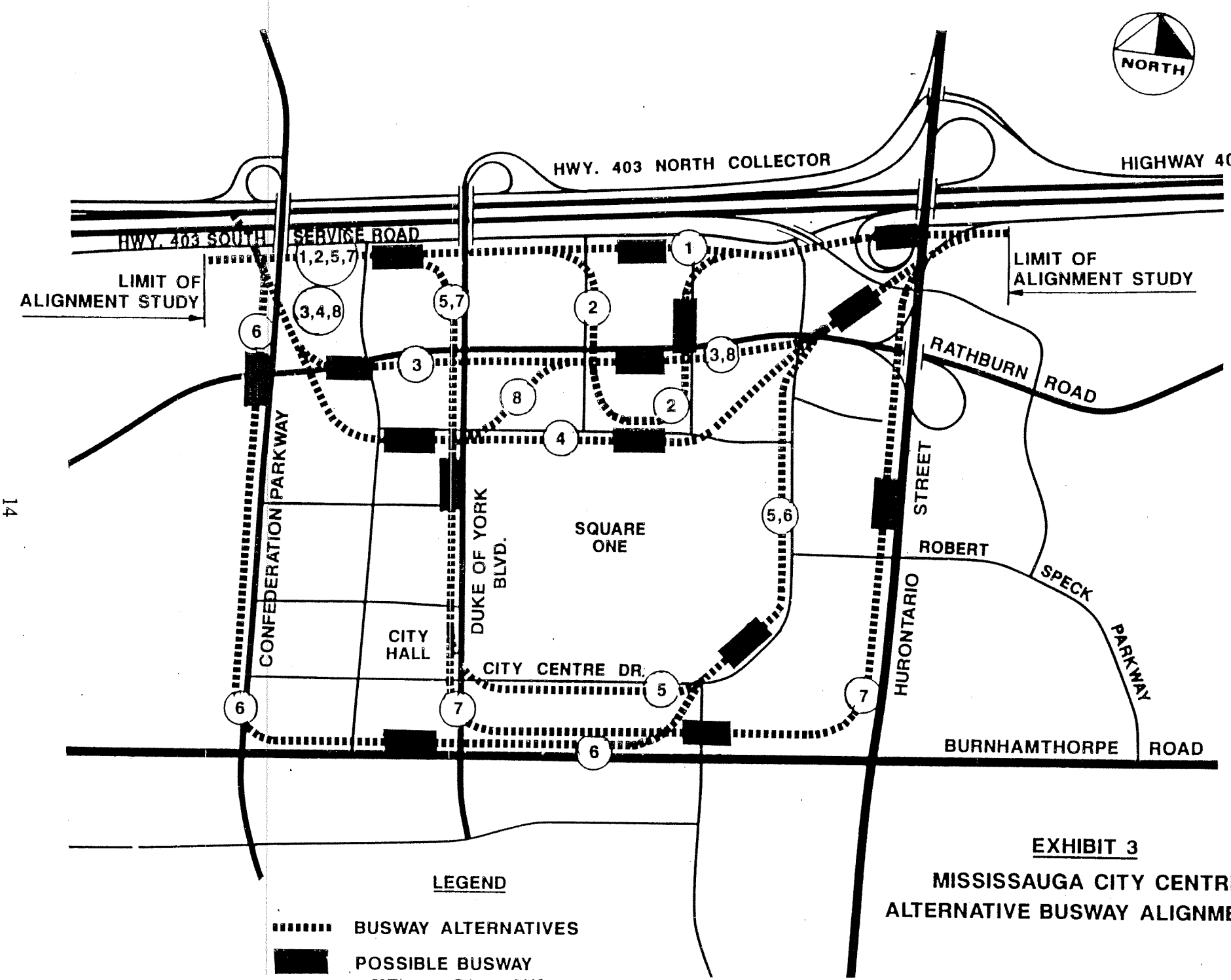
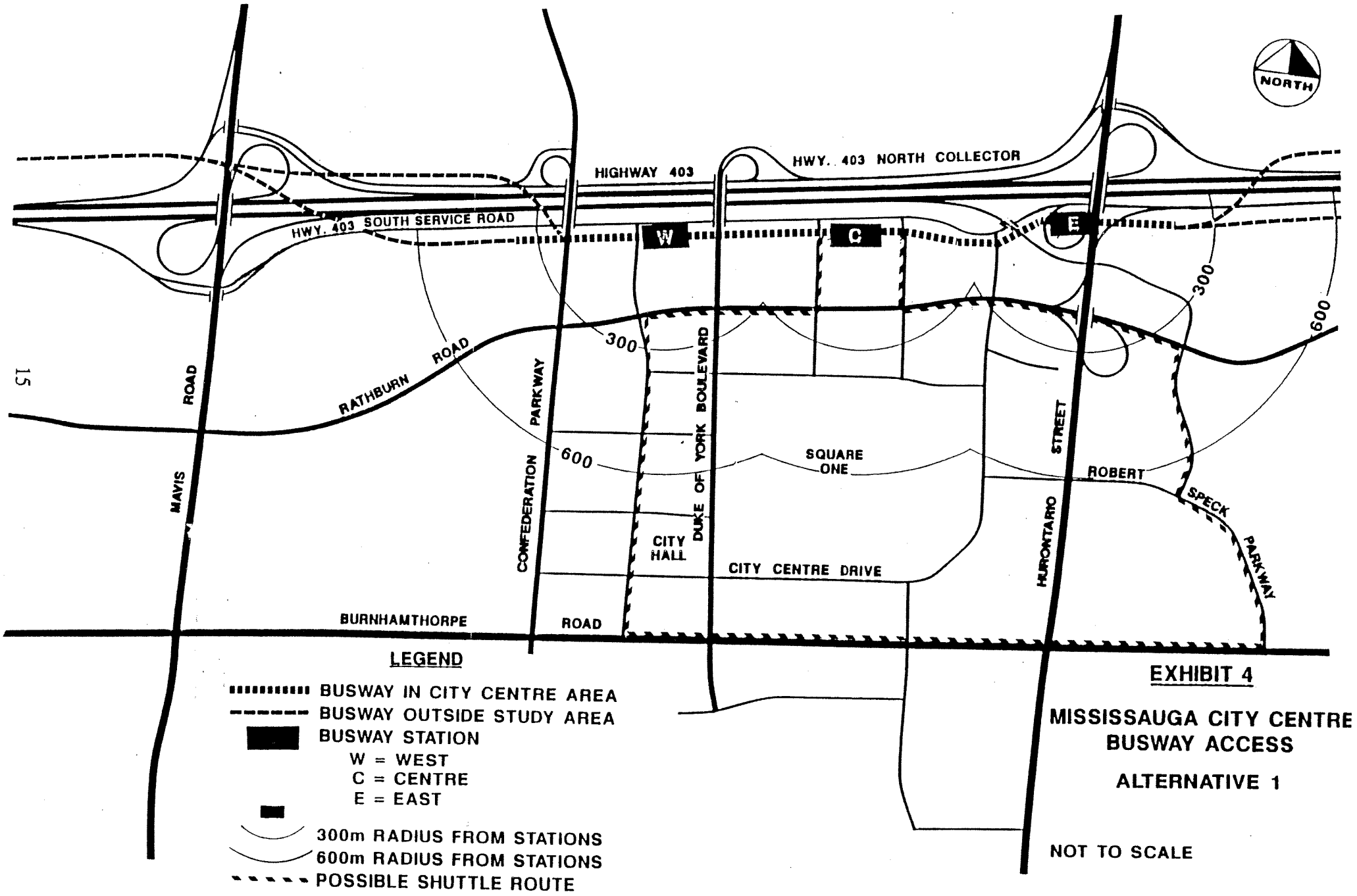
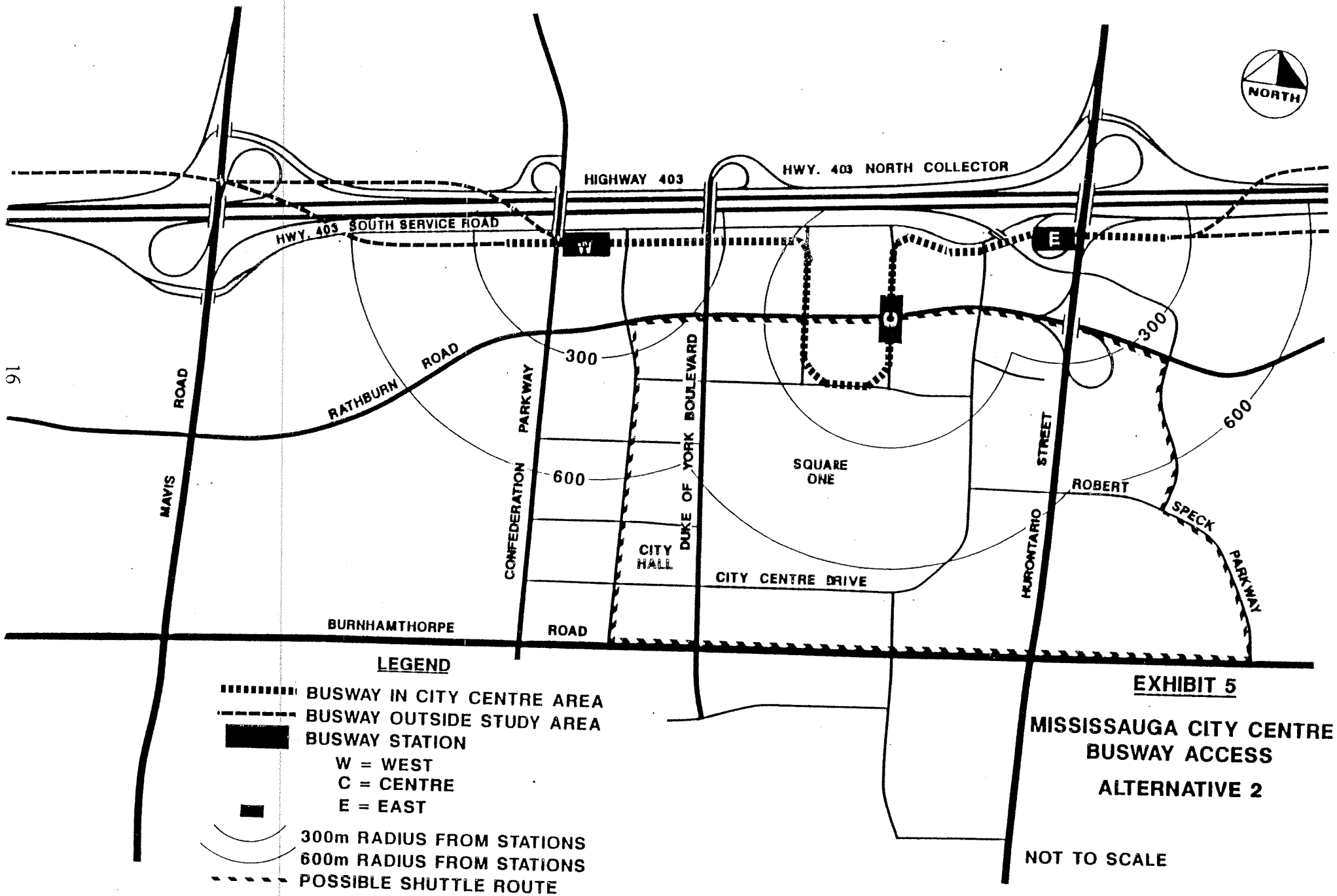


EXHIBIT 3

MISSISSAUGA CITY CENTRE
ALTERNATIVE BUSWAY ALIGNMENTS


NORTH
HIGHWAY 403
HWY. 403 NORTH COLLECTOR
HWY. 403 SOUTH SERVICE ROAD
W
C
E
300
600
RATHBURN ROAD
MAVIS ROAD
CONFEDERATION PARKWAY
DUKE OF YORK BOULEVARD
CITY HALL
SQUARE ONE
ROBERT SPECK PARKWAY
HURONTARIO STREET
CITY CENTRE DRIVE
BURNHAMTHORPE ROAD
LEGEND
BUSWAY IN CITY CENTRE AREA
BUSWAY OUTSIDE STUDY AREA
BUSWAY STATION
W = WEST
C = CENTRE
E = EAST
300m RADIUS FROM STATIONS
600m RADIUS FROM STATIONS
POSSIBLE SHUTTLE ROUTE
EXHIBIT 4
MISSISSAUGA CITY CENTRE BUSWAY ACCESS
ALTERNATIVE 1
NOT TO SCALE


NORTH
HIGHWAY 403
HWY. 403 NORTH COLLECTOR
HWY. 403 SOUTH SERVICE ROAD
W
C
E
300
600
MAVIS ROAD
RATHBURN ROAD
CONFEDERATION PARKWAY
DUKE OF YORK BOULEVARD
SQUARE ONE
CITY HALL
CITY CENTRE DRIVE
ROBERT SPECK PARKWAY
HURONTARIO STREET
BURNHAMTHORPE ROAD
LEGEND
BUSWAY IN CITY CENTRE AREA
BUSWAY OUTSIDE STUDY AREA
BUSWAY STATION
W = WEST
C = CENTRE
E = EAST
300m RADIUS FROM STATIONS
600m RADIUS FROM STATIONS
POSSIBLE SHUTTLE ROUTE
EXHIBIT 5
MISSISSAUGA CITY CENTRE
BUSWAY ACCESS
ALTERNATIVE 2
NOT TO SCALE

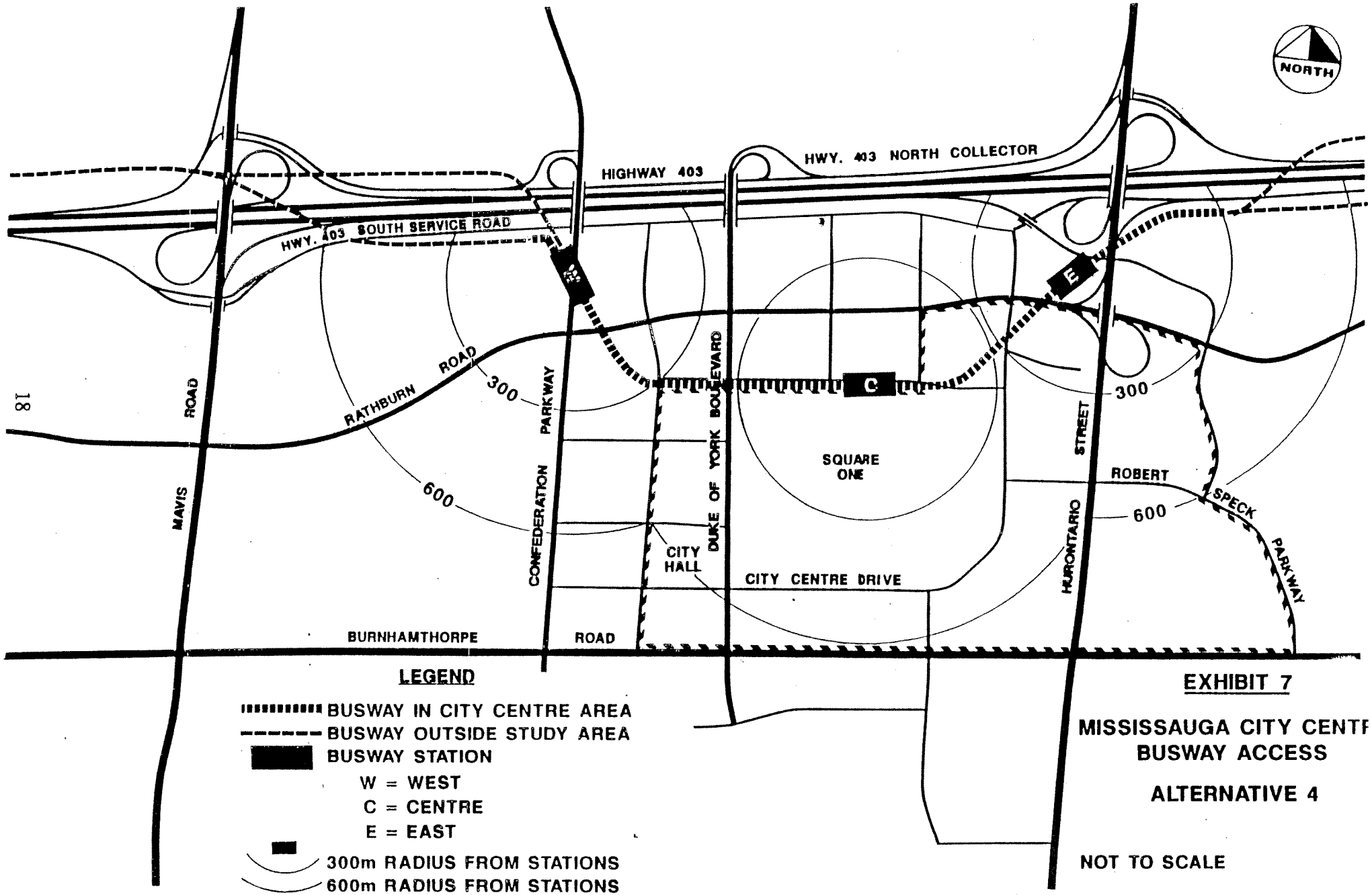


EXHIBIT 7

MISSISSAUGA CITY CENTR
BUSWAY ACCESS

ALTERNATIVE 4

NOT TO SCALE

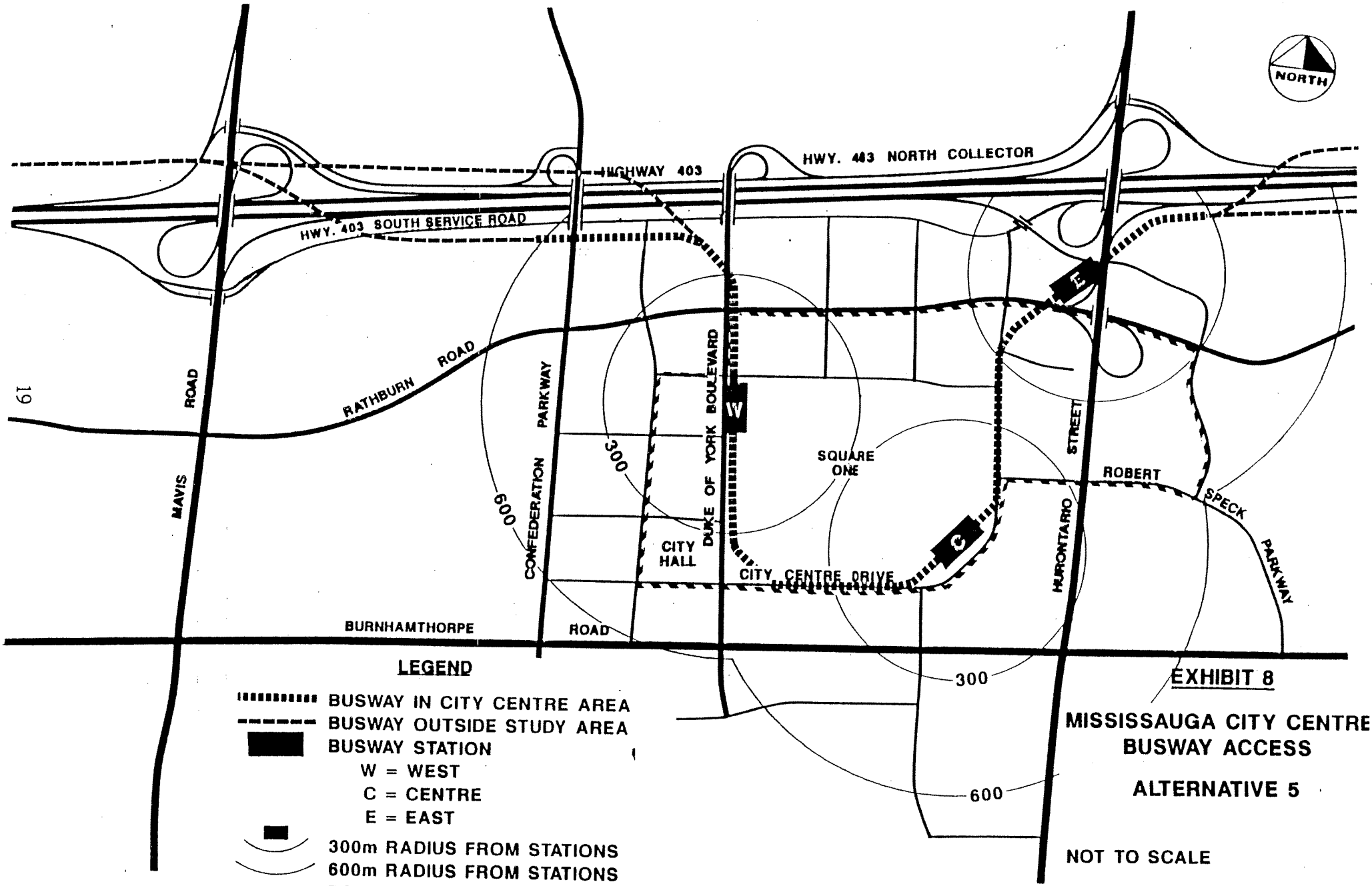

NORTH
HIGHWAY 403
HWY. 403 NORTH COLLECTOR
HWY. 403 SOUTH SERVICE ROAD
RATHBURN ROAD
MAVIS ROAD
CONFEDERATION PARKWAY
DUKE OF YORK BOULEVARD
STREET
SQUARE ONE
ROBERT SPECK PARKWAY
HURONTARIO
CITY HALL
CITY CENTRE DRIVE
BURNHAMTHORPE ROAD
W
C
E
300
600
300
600
LEGEND
BUSWAY IN CITY CENTRE AREA
BUSWAY OUTSIDE STUDY AREA
BUSWAY STATION
W = WEST
C = CENTRE
E = EAST
300m RADIUS FROM STATIONS
600m RADIUS FROM STATIONS
POSSIBLE SHUTTLE ROUTE
EXHIBIT 8
MISSISSAUGA CITY CENTRE
BUSWAY ACCESS
ALTERNATIVE 5
NOT TO SCALE

EXHIBIT 9

TRANSIT TRAVEL TIME AT MISSISSAUGA CITY CENTRE
(TOTAL PERSON HOURS SPENT BY TRANSIT USERS IN ULTIMATE A.M. PEAK HOUR)

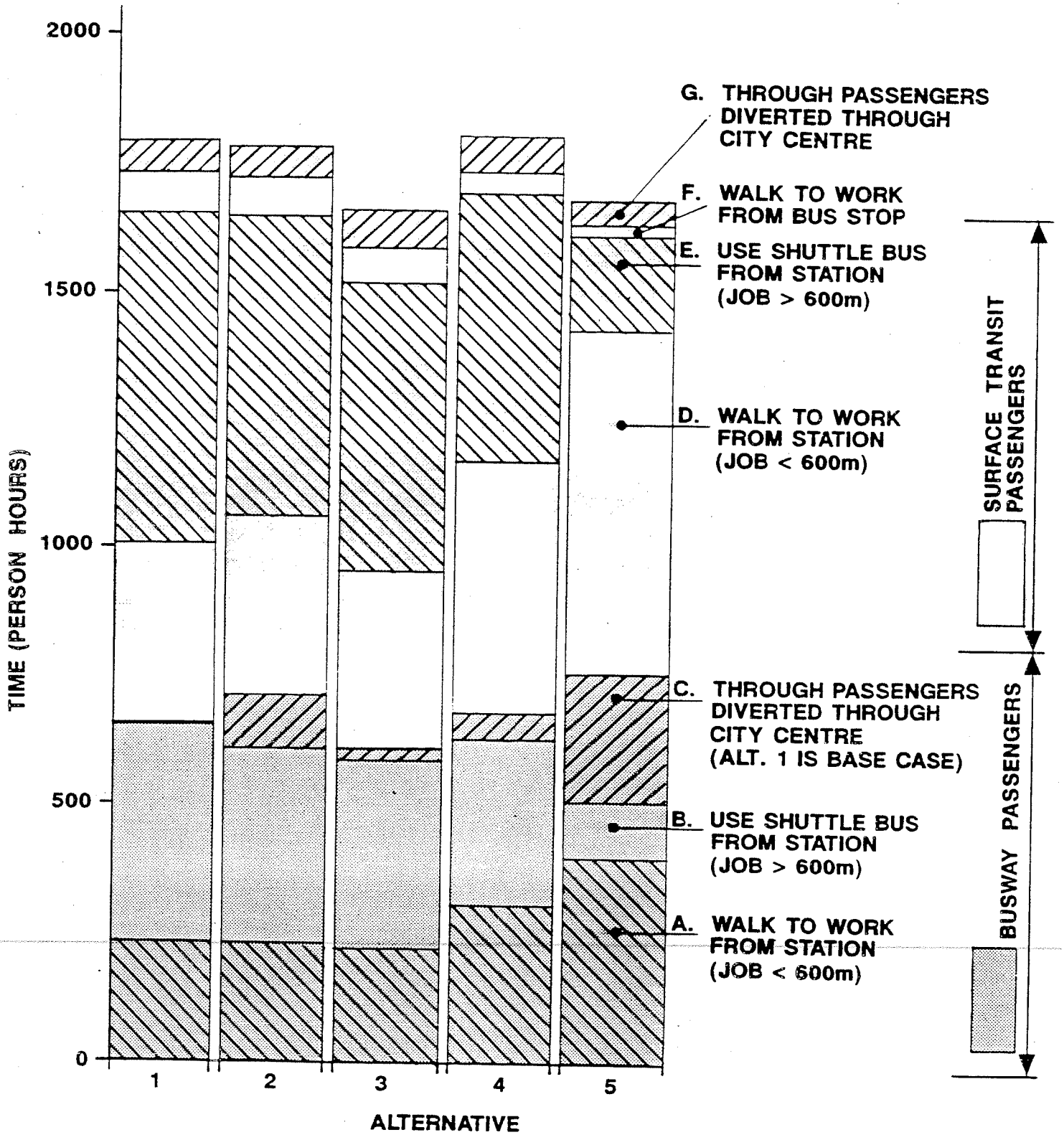


TABLE 2
MISSISSAUGA CITY CENTRE

SUMMARY OF ANALYSIS OF BUSWAY ALIGNMENT ALTERNATIVES

FACTOR	RATIONALE ALTERNATIVES 1	2	3	4	5
TRANSIT SERVICE * * JOB FIGURES BASED ON APRIL 1990 DRAFT CITY CENTRE SECONDARY PLAN INFORMATION	- 25% of jobs within 300m - 50% of jobs within 600m - high shuttle use	- 27% of jobs within 300m - 53% of jobs within 600m	- 31% of jobs within 300m - best balance between Busway and City Centre demand - 56% of jobs within 600m	- 32% of jobs within 300m - 63% of jobs within 600m - favours City Centre at expense of Busway through movement	- 30% of jobs within 300m - greatest transit service to City Centre - 86% of jobs within 600m - greatest diversion of through Busway trips
LAND USE AND DEVELOPMENT	- minimum disruption - minimum positive impact - on fringe of area	- compromise between Alts. 1 & 3	- few constraints - significant development/ gateway opportunities	- significant development/ gateway opportunities - property severances are a drawback	- fewer opportunities to integrate stations with new development
ENVIRONMENT	- greatest visibility and noise effect - minor impact overall	- some visibility and noise effect - some construction impact	- route covered and in undeveloped area	- route covered and in undeveloped area	- major construction effect
SYSTEM DESIGN	- good for Busway - poor for surface transit	- restrictive Busway geometry	- flexible alignment at west - fair Busway geometry	- similar to Alt. 3 but has no advantages over it	- role of City-wide Busway compromised - constrained alignment - duplicates Hurontario transit corridor
STAGING	- readily staged	- some staging opportunities	- some staging opportunities	- some staging opportunities	- limited staging opportunities
COST* * ORDER-OF-MAGNITUDE COST FOR COMPARATIVE PURPOSES ONLY	- $20 M construction cost - highest cost for surface transit	- $50 M construction cost	- $65 M construction cost	- $75 M construction cost	- $100 M construction cost
OVERALL	- low cost, but unacceptably low transit service to City Centre	- minor service improvement over Alt. 1 has higher cost and poorer alignment	- most balanced alternative, with good development/gateway opportunities	- good service, but high cost and property impact	- most extensive City Centre service; compromises all other goals

In analysing the Busway alternatives, it is recognized that the Busway is but one component in the overall City Centre transportation plan, and is not anticipated to carry more than approximately 40 percent of the total work period transit trips (twenty percent of all trips) to the City Centre. Fifty percent of City Centre visitors are still anticipated to arrive by car, even in the ultimate state of development, while the remaining thirty percent will arrive by non-Busway transit. With transit service driven by demand, this translates into a high level of transit service via surface streets to all parts of the City Centre, with bus-only lanes and preferential treatment of transit and passengers in key corridors.

Recognizing the inability of any Busway alignment alternative to serve every building in the City Centre directly, a high-capacity shuttle transit system is anticipated to play a key role in distributing Busway passengers to the extremities of the City Centre. The shuttle will continue to be important for internal circulation within this large multi-use downtown. Whether, in the long term, the appropriate technology for such a shuttle service is an elevated fixed-guideway light rail system, cannot be determined at this point. However, station development will take into account the protection measures required to accommodate a higher order people-mover system. Such a system would operate on a loop basis, and costs from analogous systems (Vancouver, Scarborough) indicate a basic cost for a City Centre loop in the $50 - 65 million range. For the purposes of the analysis of alternative alignments, a high level of shuttle service, ultimately utilizing dedicated lanes, is taken to be flexible enough and of adequate capacity to accommodate the ultimate demands placed on it. Nevertheless, it is preferable for the Busway to serve as much of the City Centre directly as possible without unduly compromising its overall function as Mississauga's city wide transit spine.

In addressing the Transit Service factor, it is apparent from Table 2 that Alternatives 1 and 2, being on the periphery of the City Centre in the Highway 403 corridor, are relatively weak in comparison with the other alignments, and that Alternatives 3 and 5 serve the greatest number of employees directly. Although Alternative 5 has a significant edge in terms of jobs within 600 m of its stations, the additional jobs are all more than 300 m from the stations and in corridors (Burnhamthorpe, Hurontario)

already extremely well served by surface transit. Exhibit 9 is a comparison of the alternatives by overall travel time for all transit users in the City Centre, illustrating the balance achieved between direct Busway service, arterial transit routes, shuttle service and diversion of through Busway passengers. Overall, Alternatives 3 and 5 once again illustrate their superiority in balancing these sometimes conflicting demands. Alternatives 3, 4 and 5 are also capable of linking with Square One to extend their catchment areas for walk-in passengers.

In supporting the development and land use plans of the City Centre, Alternative 1 is constrained by its location at the periphery of the area in an undevelopable zone surrounded by roads. Alternatives 2, 3 and 4 are located largely in areas slated for high density development but as of yet undisturbed. The potential, particularly for Alternative 3, to have stations integrated into development is significant. The other two alignments are more difficult to construct without significant property impact or block severances. Alternative 5 also has significant station-related development potential, but is also constrained to a greater degree than the others by the presence of existing structures along the southern and eastern part of the route.

The Environment factor reflects the visibility, urban design fit, and disruption to existing conditions resulting from Busway implantation, and by those measures Alternatives 3 and 4 are ranked ahead of the others. However, it is considered that each alternative is capable of being implemented with an acceptable environmental impact.

The System Design factor, referring as it does to the City Centre portion of the busway being a small component of the citywide Busway, clearly favours the more direct alignments of Alternatives 1 and 3 over the others. This is reflected in indicators such as geometric design constraints, ability to convert to LRT or subway operation, and system travel time. As an example, the following approximate Busway travel times, including station stops, from the west of Confederation Parkway to east of Hurontario Street would apply:

Alternative 1	3'54"
Alternative 2	4'31"
Alternative 3	4'03"
Alternative 4	4'12"
Alternative 5	5'20"

Further, the loop Alternative 5 duplicates the transit service provided in the Burnhamthorpe Road and Hurontario corridors while diverting and delaying the 60 percent or more of peak hour Busway trips that are not destined to the City Centre.

The loop Alternative 5 entails a significantly greater capital construction cost than the shorter, more direct alignments in the Rathburn Road corridor. Due to road congestion, the Busway under Alternative 5 would need to be advanced in its timing. A key consideration is that, rather than having to sink the entire City Centre transit investment into the fixed busway route at the same time as the initial busway is constructed (i.e. a number of years before the ultimate development of the City Centre is achieved), Alternatives 3 and 4 allow the initial Busway cost to be minimized and the shuttle service to be expanded (in both extent and level of sophistication) in proportion to the growth of the City Centre demand for it. The lower capital cost for Alternatives 1 and 2 does not produce a Busway capable of serving a high proportion of the City Centre directly, thereby advancing the need for a people mover which would be a disruptive standalone system with a very high cost attached, negating any initial benefits of low Busway cost.

In summary, Alternatives 1 and 2 do not serve the City Centre to an adequate degree without a great emphasis on shuttle or people-mover use. A busway alignment in the Rathburn Road corridor such as Alternative 3 or 4 results in benefits for both busway users and the City Centre in general, while having the opportunity to delay expenditures until necessitated by demand growth. Alternatives 3 or 4 are therefore recommended over the City Centre Drive Alternative 5, which has higher front-end costs and similar or lesser benefits.

The additional costs, alignment constraints, and property severances entailed by Alternative 4 make it less attractive when compared to Alternative 3, and the latter is therefore preferred. The preferred alternative is conceptually similar to recommended plans identified in previous studies. The analysis is summarized in Table 3.

TABLE 3
MISSISSAUGA CITY CENTRE
SUMMARY OF EVALUATION OF BUSWAY ALIGNMENT ALTERNATIVES

FACTOR	RATING ALTERNATIVES 1	2	3	4	5
TRANSIT SERVICE	○	○	◒	◒	●
LAND USE AND DEVELOPMENT	◒	◒	●	◒	◒
ENVIRONMENT	○	◒	●	●	◒
SYSTEM DESIGN	◒	○	●	◒	○
STAGING	●	◒	◒	◒	○
COST	●	◒	◒	◒	○
OVERALL	◒	○	●	◒	○

MOST PREFERRED ⟶ LEAST PREFERRED

● ◒ ○

6. ANALYSIS OF ALTERNATIVE BUSWAY CONCEPTS WITHIN RECOMMENDED CORRIDOR

Within the preferred Rathburn Road corridor, there are a great number of options as to the initial and ultimate layout and operation of the Busways, its stations, and Rathburn Road itself. There are also a great number of constraints and a number of factors with unquantifiable effects. A summary listing follows:

Options

- busway alignment
- busway profile
- tunnel vs. open cut
- number of stations
- station locations
- station layouts
- technology

Constraints

- available property
- geometric standards
- cost
- environment
- bus operation
- demand
- staging
- utilities / services
- traffic operation

Factors

- development integration
- development staging
- urban design
- transit system operation
- flexibility
- Gateway elements
- shuttle service
- land use patterns
- facility users

Given the complexity of the issues and the initiation of the overall Mississauga Busway Functional Planning Study, the focus of the City Centre Busway / Gateway Planning Study has been limited to the identification of property protection needs within the City Centre, rather than on the preparation of a detailed functional plan. Several plans were, however, formulated to assist in the analysis process and will provide a basis for continued design work in the overall Busway Planning Study.

The following summarizes the analysis in key areas:

Technology

It is the position of the City of Mississauga that buses will be the operating transit technology for the foreseeable future. In the long term, however, it is possible that a rail-based vehicle could be appropriate to meet the demands of the day. It is therefore recommended that the design criteria for the busway itself permit the conversion if necessary to Light Rail and Subway modes. A minimum platform

length of 160 m, a minimum horizontal curve radius of 160 m, and a minimum vertical clearance of 4.7 m will allow use of the Busway by current Light and Heavy Rail vehicles, and are recommended.

Busway Profile

An efficient, high-volume Busway operation is incompatible with mixed traffic operation and conflicts on city streets. Grade separation is required, and since an elevated option is costly, complex, and unacceptable in terms of urban design impact on the City Centre, a below grade Busway is recommended within the City Centre.

Number of Stations

A key issue in the City Centre portion of the Busway is whether two or three stations are appropriate. Originally conceived of as a major Centre Station with supplementary east (Hurontario) and west (Confederation) "satellite" stations, the evolution of the Busway planning process has resulted in a reassessment of the station concept. With increasing demands on the Hurontario corridor and the availability (and necessity) of a major north-south / east-west transit interface near Hurontario Street, the role of the east station has been strengthened. The Centre Station maintains its vitality as the focal point of City Centre-related passenger activity, and with the proposed increase in density and employment in the City Centre, the importance of the Centre Station is magnified. Meanwhile, the west (Confederation) Station has been found to be constrained by development activity in the area, the geometric and physical requirements of the Busway, and the shift in land use emphasis in the Station area from office and mixed use to residential uses. In the absence of a West station, a two-station arrangement would place greater emphasis on early development of the East station. The role of the East station as half of a binary Gateway consisting of both the Centre and East stations is seen to be more significant than as a secondary or satellite station, which it would more closely resemble in a three-station arrangement.

The difficulties in providing a physically feasible station that would have a satisfactory interface with Confederation Parkway buses while not impacting adjacent development, combined with a desire from a development interface viewpoint to shift the Centre Station westward one block to Duke of York Boulevard, call into question the appropriateness of a third station in the west part of the City Centre.

A Confederation Station would have significant cost and development impact, would result in delays to most Busway passengers (either on through trips or destined elsewhere in the City Centre), and would be inappropriate for use by an LRT or subway if ultimately converted, while benefitting only about ten percent of City Centre Busway users.

Since two Busway stations are capable of accommodating the ultimate passenger movement demand, a two-station approach appears to be preferable at this stage in the analysis process. Provision of a third limited-use on-line station in the west part of the City Centre is not precluded, however, pending the outcome of the overall Busway Planning Study. It may be noted that the preference for limiting the number of stations to two emerged subsequent to much of the corridor analysis, which was carried out using three stations, and that further analysis of the question will be undertaken in the overall Busway Planning Study.

Station Locations

Station locations are a function of available property, operational needs, number of stations, adjacent development, and busway alignment needs.

Since the property bounded by Hurontario Street, Rathburn Road and City Centre Drive is largely publicly owned, at the intersection of two key transit corridors (east-west Busway and Hurontario Street), has limited development potential otherwise, and is physically capable of accommodating a variety of Busway station functions, it is recommended as a major City Centre station site. Access, drainage, and area constraints are recognized but there is no suitable alternative to serve the eastern half of the City Centre as well as to provide the key interface between major transit corridors. The site is capable of accommodating not only the

Mississauga Busway but, as may be needed in the long term to cope with demand in the corridor, a higher-order busway system along Hurontario Street and its associated interface facility needs.

The City Centre station is intended to act as the focal point of both the Busway system and of the high-capacity surface bus network feeding and operating within the City Centre. A Central facility will optimize access to all parts of the City Centre for bus passengers and just as importantly allow efficient transfer of passengers between routes and between surface and busway systems. In a three-station scheme, a third Busway station is located in the west part of the City Centre near Prince of Wales Drive, and the central station is located directly north of Square One. However, in the two-station scheme, the westerly station is eliminated and the central station is shifted one block west, to the block in the southeast quadrant of the Rathburn Road / Duke of York Boulevard intersection.

Both the Centre and Hurontario Stations are capable of incorporating a number of "Gateway" elements. Apart from being major nodes for several local and interregional transit services, the sites can have kiss and ride areas, access for taxis, special transit services, shuttle bus routes, and particularly at the Centre Station, convenience services within the station. The ability to provide direct passenger links with adjacent office, retail and high density residential developments is a feature of all stations.

Busway Alignment

The alignment of the Busway within the corridor is the one aspect subject to the most constraints, and is most interrelated with other option decisions. An alignment that enters the City Centre from the west side of the Confederation Parkway alignment south of Highway 403, then curves to the east at a 160 m radius into the Rathburn Road right-of-way, then angles back up to the Highway 403 corridor under the Hurontario Street / Sherwoodtowne Boulevard / Highway 403 interchange is most appropriate.

In the vicinity of Confederation Parkway, various options are possible, but a basic criterion is to minimize the impact on developable property. This results in the alignment being contained within existing road allowances to the greatest extent possible, and the desirability of developing adjacent property in complete integration with the Busway. A series of discussions have occurred with affected property owners and discussions will continue as part of the overall Busway study. Property owners have noted acceptance of the busway concepts, with the detailed alignment to be finalized in conjunction with ongoing development planning. It is recommended that property in the area continue to be protected for potential busway use and that any development proposals in the meantime be examined in that light (see Exhibit 13).

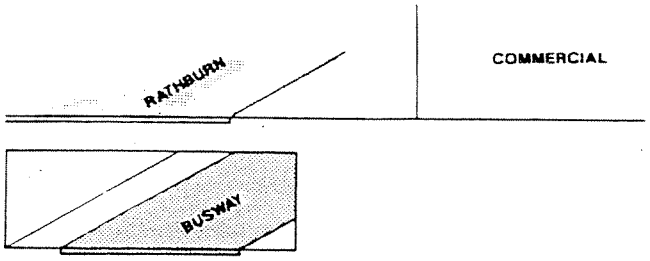
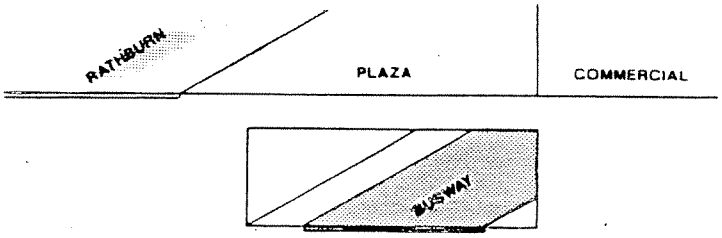
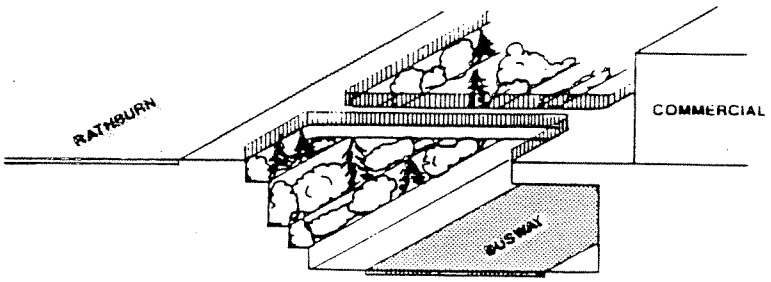
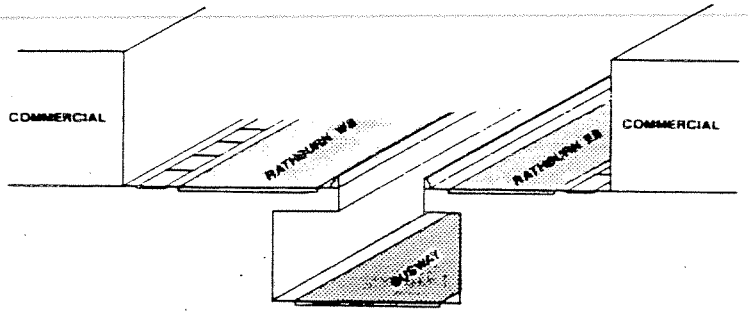
Within the Rathburn Road corridor itself, the urban design, cost and development integration issues are key aspects. Alternative cross-section concepts are illustrated in Exhibit 10. Although, for cost reasons it would be desirable to have the Busway run either north or south of Rathburn Road in open cut, underpassing the surface streets, such an option is incompatible with the City Centre Secondary Plan's goals for Rathburn Road as the major high density office and commercial artery in the City Centre. An open Busway would create a "moat" effect and would prevent the effective development of one side of Rathburn Road. The impact on developable property would be significant, and the plans for the property on the south side of Rathburn Road west of Duke of York Boulevard are already so advanced as to eliminate the potential routing of the Busway through those blocks.

Within the Rathburn Road right-of-way, then, the Busway may be in cut and cover tunnel, or partially open in a widened roadway median. The high cost and operational / ventilation concerns with the tunnel alternative are significant, and given that a feasible alternative is possible using the opened median approach, the latter is preferred at this stage in the analysis. This would entail a wider Rathburn right-of-way but the approach would be capable of preserving the function and urban design values of the corridor at street level while allowing the Busway to share the right-of-way.

The overall Busway Functional Planning Study will address the key concerns of design, ventilation, structural approach, lighting and construction in greater detail.

EXHIBIT 10: CITY CENTRE BUSWAY PLANNING STUDY

ALTERNATIVE BUSWAY CROSS SECTIONS CONCEPTS IN RATHBURN ROAD CORRIDOR

ALTERNATIVE	COMMENT
1. TUNNEL UNDER RATHBURN 	● HIGH COST ● VENTILATION/LIGHTING PROBLEMS ● SIGNIFICANT DISRUPTION DURING CONSTRUCTION ● NO IMPACT ON SURFACE/URBAN DESIGN ● NO ADDITIONAL R.O.W. REQUIRED
2. TUNNEL SOUTH OF RATHBURN 	● HIGH COST ● VENTILATION/LIGHTING PROBLEMS ● INTRODUCES OPEN PLAZA SPACE ● REQUIRES ADDITIONAL R.O.W. ● LESS DISRUPTIVE TO RATHBURN AND UTILITIES
3. OPEN CUT SOUTH OF RATHBURN 	● LOWEST COST ● ALTERS URBAN DESIGN OF RATHBURN CORRIDOR ● REDUCED VENTILATION/LIGHTING CONCERNS ● REQUIRES ADDITIONAL R.O.W. ● LESS DISRUPTIVE TO RATHBURN AND UTILITIES
4. TUNNEL - OPEN RATHBURN MEDIAN 	● HIGH COST ● REDUCED VENTILATION/LIGHTING CONCERNS ● WIDENS ROADWAY CORRIDOR - INTRODUCES MEDIAN ● SIGNIFICANT DISRUPTION DURING CONSTRUCTION ● MINOR INCREASE IN R.O.W. WIDTH REQUIRED

Station Layouts

Each station has a different function and has site-specific constraints, so it is therefore inappropriate to use the same station layout for all sites in the City Centre.

A possible layout for the East (Hurontario) Station is shown in Exhibit 11, developed to illustrate the feasibility of the available property to accommodate all the Busway and Gateway needs. The layout as developed provides facilities for Busway traffic, local and regional bus access and turnaround, bus layover, direct pedestrian links to nearby development, and flexibility for an ultimate north-south busway and link ramp. The latter is a significant consideration in that high transit demands in the Hurontario Corridor may lead to a Busway-like facility in the north-south direction and its ultimate interface with the east-west Busway would be a major focus of transit and passenger activity. Since most bus facilities must be at the Busway level, the potential exists at the site for street-level development of parking, kiss & ride, and air rights commercial opportunities. The refinement of the station layout is part of the work to be carried out in the overall Busway Planning Study.

The Centre Station is the key element in the City Centre Busway system, and is proposed to be the focus of transit and passenger activity in Central Mississauga. A station layout reflecting this role as well as the station's Gateway functions requires Busway platforms for express buses, surface platforms for arterial and shuttle routes, direct grade-separated pedestrian linkages between the platforms, a ramp allowing bus movement between the surface and the Busway, a high standard of passenger amenities and Gateway convenience facilities, and direct pedestrian links to adjacent development, Square One, and the street. The overall Mississauga Busway Planning Study will address in much greater detail the potential layout and design of all Stations, and in particular the Centre Station.

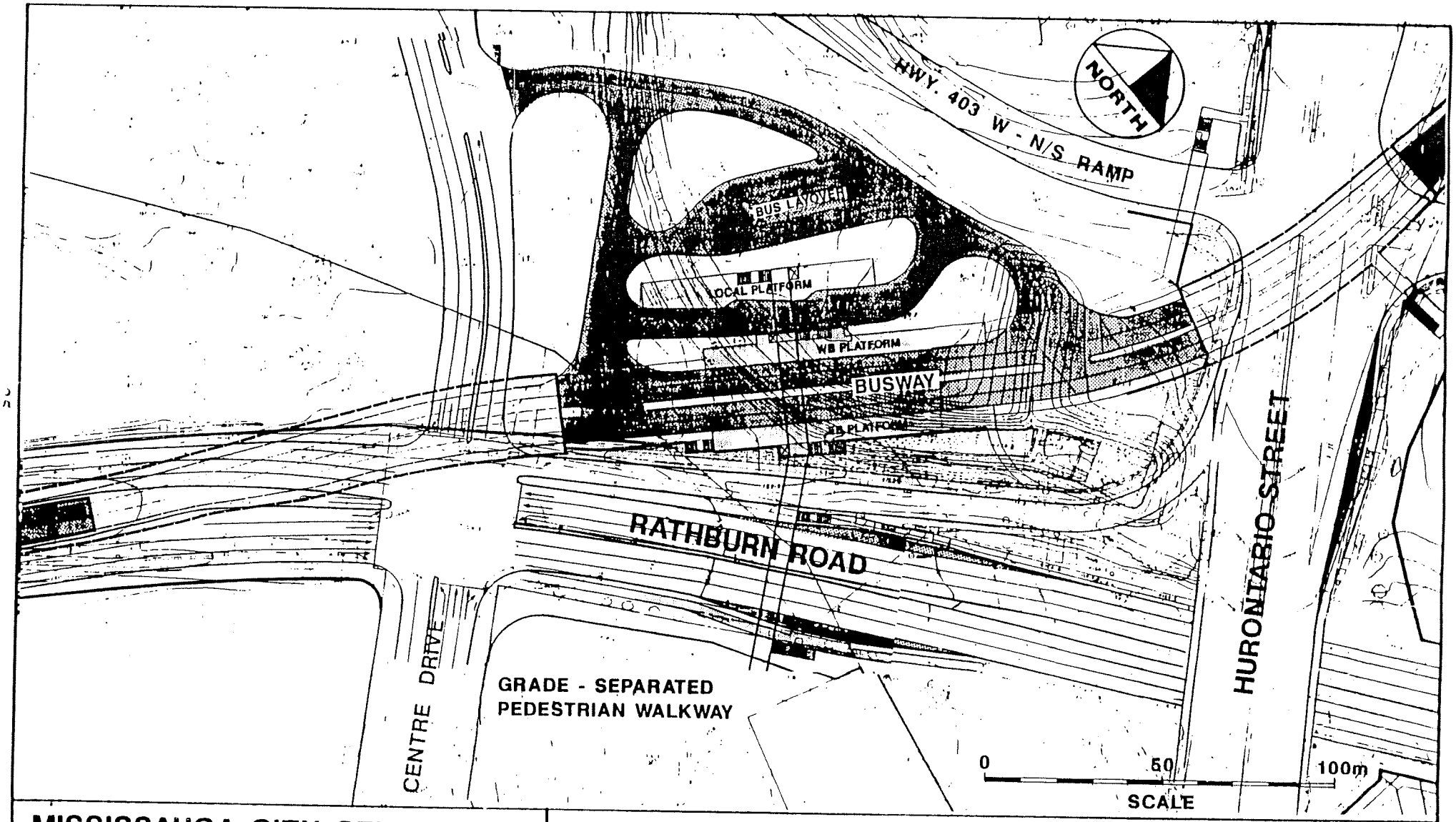
Given the position of the station in the heart of the ultimately high density Rathburn Road corridor, minimizing its surface area, closely integrating its development with nearby development, maintaining a high standard of design, and maximizing the efficiency of its operation while not compromising its functional needs requires

careful study and sensitive development plans. A number of potential layouts have been developed over the course of this study, but since the surface bus functional needs depend on the operational strategy employed by the station's main user, Mississauga Transit, it is appropriate to await the definition of the operating strategy (to be done as part of the overall Busway Study) before recommending a specific layout. In view of the great, and possibly unforeseeable changes likely to occur at the City Centre and in Mississauga Transit's operations over the coming decades, it is necessary to build in as much flexibility to the station layout as possible.

One layout is shown in Exhibit 12, not as a definitive plan but as an illustration of one potential approach to the station layout.

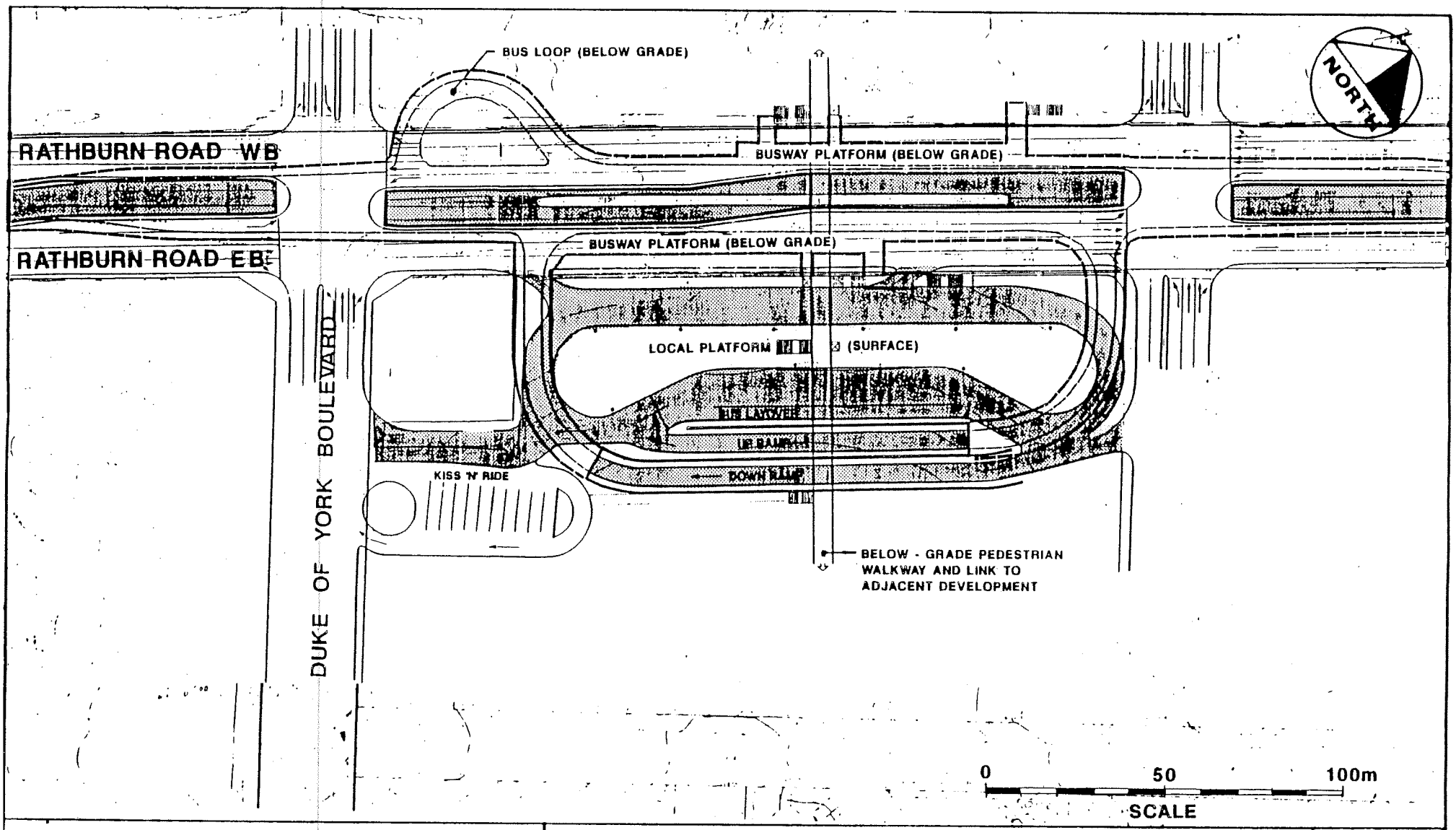
The basic layout and function of the Centre Station is not dependent on whether there are two or three Busway Station in the City Centre. However, a two-station layout would see the Centre Station preferably located in the block south of Rathburn Road immediately east of Duke of York Boulevard, while a three-station layout, with additional service provided to the western part of the City Centre by the third site, would see the Centre Station shift one block to the east. Pending the outcome of the further detailed analysis to be done as part of the overall Mississauga Busway Planning Study, the continued reservation of the north half of the two Hammerson-owned blocks on the south side of Rathburn Road east of Duke of York Boulevard is recommended to protect an envelope capable of accommodating a functional Centre Station layout under either the two-station or three-station scenarios (see Exhibit 13).

If a West (Confederation) Station were to be built as part of a three-station scheme, it would be limited to on-line Busway platforms, passenger access to adjacent development and street level, and one or two surface bus bays on Rathburn Road or on Confederation Parkway. These limitations reflect its role as a distributor of busway passengers to destinations within the western part of the City Centre and as a potential interceptor of bus trips entering the City Centre from Confederation Parkway and Rathburn Road West.



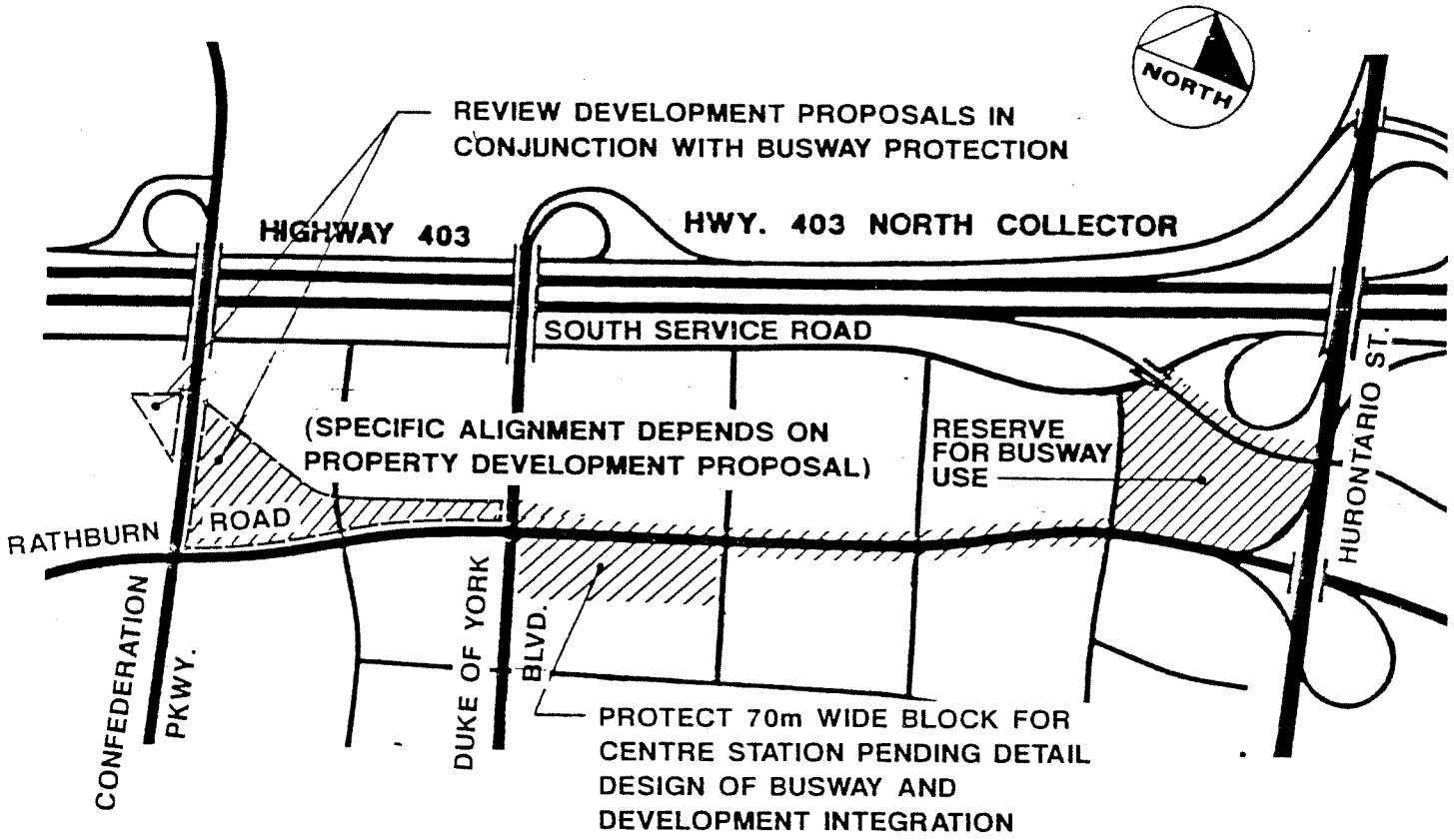
MISSISSAUGA CITY CENTRE
BUSWAY PLANNING STUDY

EXHIBIT 11
EAST (HURONTARIO) STATION POTENTIAL LAYOUT CONCEPT
(PRELIMINARY PLAN ONLY - TO BE FINALIZED DURING MISSISSAUGA BUSWAY FUNCTIONAL PLANNING STUDY)

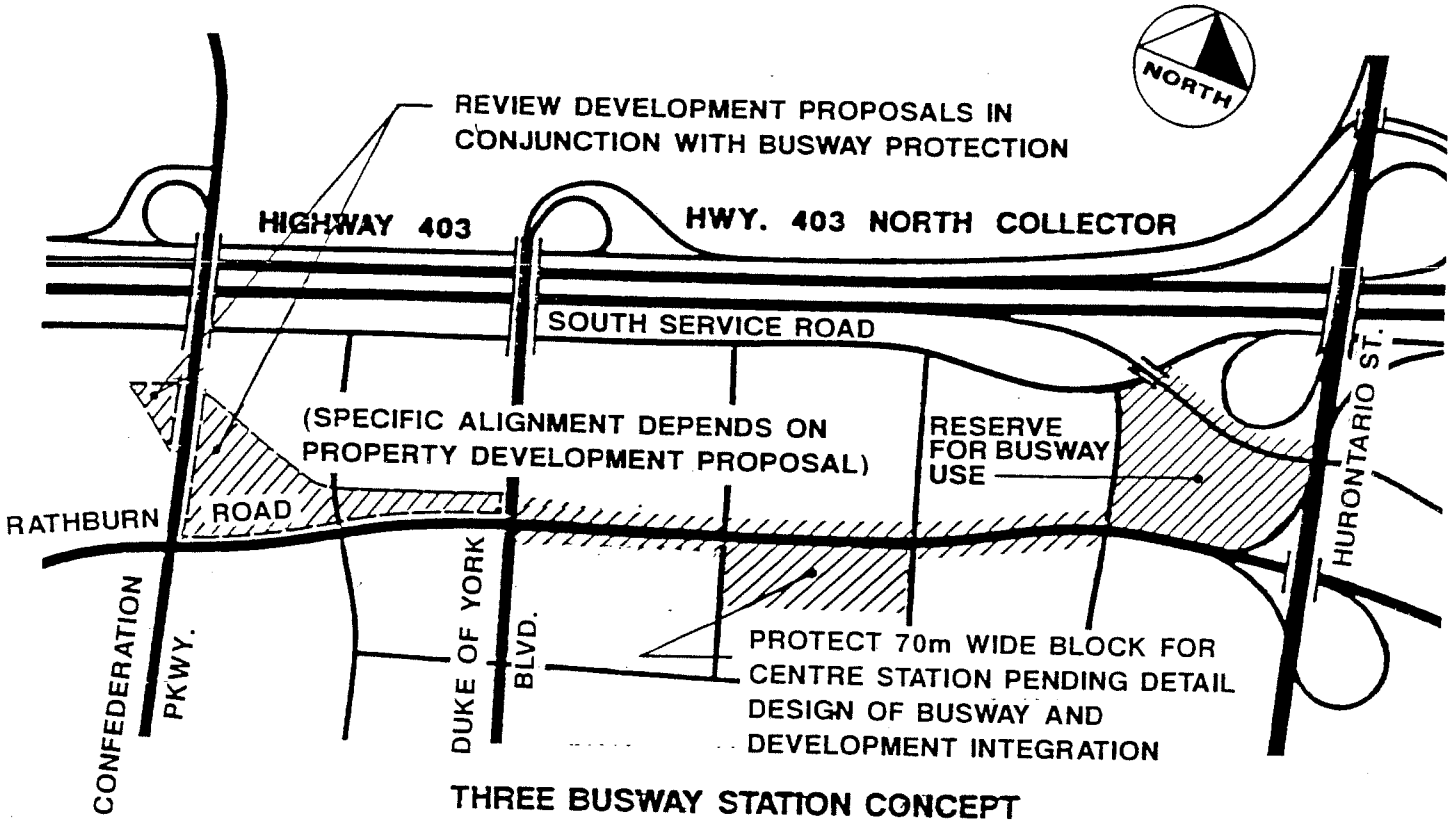


MISSISSAUGA CITY CENTRE
BUSWAY PLANNING STUDY

EXHIBIT 12
CENTRE STATION POTENTIAL LAYOUT CONCEPT
(PRELIMINARY PLAN ONLY - TO BE FINALIZED DURING MISSISSAUGA BUSWAY FUNCTIONAL PLANNING STUDY)



TWO BUSWAY STATION CONCEPT



THREE BUSWAY STATION CONCEPT

EXHIBIT 13
CITY CENTRE BUSWAY
AREAS OF POTENTIAL PROPERTY IMPAC

7. SUMMARY OF ANALYSIS

Corridor:

The Rathburn Road corridor provides the best balance of cost, City Centre service, and Busway function.

Technology:

Bus technology with protection for fixed rail is preferred.

Profile:

A below grade Busway profile is required within the City Centre.

Number of Stations:

Although three stations may be desirable, a two station scheme appears to be preferable at this point due to its reduced development impact, operational constraints and cost, while not seriously affecting the level of transit service provided at the City Centre. Further analysis work regarding this issue will be carried out in the overall Busway Planning Study, and both scenarios should be protected for.

Station Locations:

An East Station at Hurontario Street compatible with the ultimate requirements of a Hurontario Busway-type facility, combined with a Centre Station east of Duke of York Boulevard on the south side of Rathburn Road are recommended in a two station layout. A third station, if determined to be appropriate, would be in the Rathburn Road / Confederation Parkway vicinity.

Busway Alignment:

Numerous options exist, but a busway alignment within the Rathburn Road right-of-way where possible, utilizing a minimum 160 m radius curve in the shift from the Highway 403 corridor to Rathburn Road at Confederation Parkway is the basic preference.

Busway Cross-section:

Given the choice between a fully enclosed (tunnel) cross-section which can be aligned anywhere within the right-of-way, and a partially open-roofed busway utilizing a median in the centre of Rathburn Road, the latter appears preferable due to reduced cost, ventilation and structural impact. A detailed study of Busway cross-sections will be undertaken as part of the overall Busway Functional Planning Study, now underway.

Station Layout:

A number of feasible Station layouts have been identified, but definition of final plans should await development of an ultimate operating strategy for Mississauga Transit.

Property Protection

Development plans for properties potentially physically impacted by the Busway as shown in Exhibit 13, should proceed in a manner that does not preclude provision of the Busway and its stations, pending further discussions with the owners and the outcome of the overall Mississauga Busway Functional Planning Study.

APPENDIX 'P'

TRANSIT OPERATING STRATEGY

MISSISSAUGA TRANSITWAY PLANNING STUDY EA REPORT

APPENDIX P - TRANSIT OPERATING STRATEGY

This brief working paper was prepared at an early stage of the Transitway Planning Study in order to assist in the understanding of operation-related station requirements, as an input to the planning and design process. The report is not a definitive Mississauga Transit long term operating plan, and does not address other potential Transitway users; however it is a useful component of the Environmental Assessment Report and helps address the question, "how will the Transitway operate?" This Appendix is not an essential part of the EA submission, but is included so that the report may serve as a complete and comprehensive basis for future planning and design work on the project.

It should be noted that, at the time of preparing the Operating Plan, stations at both Glen Erin Drive and Mississauga Road were under consideration. Subsequent developments resulted in neither station being included in the final recommended plan for the Transitway; consequently any reference in this Appendix to either site should be disregarded.

CITY OF MISSISSAUGA

TRANSITWAY OPERATING PLAN

IBI GROUP

DECEMBER, 1990

IBI
GROUP

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Mississauga Transitway Operating Plan

1. INTRODUCTION

The Mississauga Transitway Functional Planning Study has developed a functional design for a proposed busway in the Highway 403/Parkway Belt Corridor through Mississauga. The busway will be a grade-separated roadway for the exclusive use of buses and will consist of a major terminal at the City Centre and stations at strategic locations along the corridor between Ridgeway Drive in the west and Renforth Drive in the east. It is proposed to construct the busway in stages over a ten year period with the section between Erin Mills Parkway and Cawthra Road planned for completion by 1996.

This report reviews the possible impact of the busway on transit services and operations in Mississauga, and sets out a plan for the operation of the busway over the short and long term. The purpose of this analysis was to examine how the busway would be used in order to provide input to the preliminary design of the busway.

A second purpose of this analysis was to develop preliminary ideas on how the busway facility might be staged.

2. THE TEN-YEAR TRANSIT SERVICE STRATEGY

In 1989, the City adopted a Ten-Year Transit Service Strategy. The Service Strategy set out the priorities for improving the basic elements of the City's public transportation system: the bus route network, the rapid transit systems, and the road infrastructure for the transit systems.

Grid System of Bus Routes

The Service Strategy recognized that there would have to be significantly higher market shares for transit over the next ten years if the City is to provide relief to growing road congestion for both internal and external travel. It concluded that, to achieve these higher market shares, the cornerstone of the City's future transit policies would have to be the development and implementation of a basic grid bus route network with substantially higher levels of service than the present network. The rationale for this basic service strategy is the diffuse nature of travel demand in Mississauga and the emergence of four rapid transit corridors within the City: the corridors defined by the three existing GO Transit commuter rail lines, and the corridor defined by the planned Transitway for future bus or light rail transit operations. The Grid System makes it easier to travel from any origin to any destination, usually with a maximum of one transfer.

Role of the Transitway

The Transitway is a key element of the Ten-Year Transit Service Strategy in that it is the only rapid transit facility serving the Mississauga City Centre and non-downtown Toronto destinations. It is also the only facility that can be used by buses thereby permitting components of the basic grid bus route network to be operated more efficiently and effectively. The Transitway, then, has two fundamental roles in the City's Transit Service Strategy as follows:

- **East-West Rapid Transit Spine** - a rapid transit spine crossing the City providing direct east-west service to the City Centre and Eglinton/Renforth "gateway", and to the Eglinton corridor in Metropolitan Toronto when the Eglinton West rapid transit line is built;

- **High Speed Facility For Buses** - an exclusive bus roadway than can be incorporated into the basic grid bus route network so that passengers can be offered travel times that are more competitive with the automobile, particularly during congested peak periods;

The Mississauga Transitway is different from rapid transit facilities in other cities. While it is anchored on the City Centre as are facilities in other cities, the catchment areas are removed from the busway corridor; therefore, it will require the strong support of the bus route network to bring passengers into the corridor. The City Centre

will not be the only focal point for the bus route network as in most other cities as the network needs to satisfy travel patterns which are very decentralized and which are significantly different north and south of the busway corridor and east and west of the City Centre.

Service South of the Transitway Corridor

In the densely populated, more established areas south of the busway corridor, travel patterns are strongly oriented to southern Mississauga, Etobicoke, and downtown Toronto destinations with the result that there is a heavy concentration of Mississauga-based trips in the Lakeshore corridor (served by the Lakeshore GO line), and in the Hurontario and Dundas/Bloor corridors (served by Mississauga Transit connecting to the TTC subway and the Milton GO line). Here Mississauga Transit has a relatively high market penetration because of the high levels of service provided within the corridors to the TTC Subway.

In the future, if Mississauga Transit is to maintain or improve its market share in the southern section of the City, it will need to reinforce the service it provides in the main travel corridors servicing this section through such measures as feeder bus services to the GO stations and reserved bus lanes on congested road sections particularly in the Hurontario and Dundas corridors.

The busway will aid this process by enabling Mississauga Transit to provide faster access to the Erindale GO station and the City Centre from the southwest part of the City.

Service West and North of the Transitway Corridor

In the developing areas west and north of the busway corridor, travel patterns are more dispersed because of the nature of the growth and development. West and northwest of the City Centre, the area is mainly low density residential development with travel patterns strongly oriented to downtown Toronto (served by the Milton GO line) and to the businesses within the City Centre and north of the Eglinton corridor.

The busway will provide a high speed transit link to the City Centre, to the Mississauga industrial areas, and to Metro for residents living in the developing west and northwest areas of the City.

Service North and East of the Transitway

North and northeast of the City Centre, the area is mainly low density industrial development drawing workers from both Mississauga and Metropolitan Toronto via the main east-west and north-south arterial roadways serving the area, particularly the roadways within the Highway 403/Highway 401, Hurontario and Dixie corridors. While the nature of the development in the northern section of the City requires a grid system of bus routes for substantial market penetration, Mississauga Transit has been unable to provide such a

system because the demand levels and road networks have not yet been developed to the point where high frequency through services on arterial roads can be provided cost effectively. In the future, if Mississauga Transit is to significantly increase its market share in the northern section of the City, it will need to provide such a grid system of routes supplemented by express services on the main roads serving the section and supported by service coordination and fare integration with the TTC in the main cross-boundary travel corridors.

The busway will be important to the development of transit services in the central and northern sections of the City where an a east-west rapid transit spine and high speed facility for buses will significantly improve the level of service for residents travelling to the businesses and industries in the area.

3. Transitway OPERATING STRATEGY

The main role of the busway is to act as an east-west rapid transit spine for fast access to the City Centre in Mississauga and the Eglinton West corridor in Metropolitan Toronto. The extent to which the facility can be incorporated into the basic grid bus route network will depend on the operating strategy that is adopted by the carriers using the facility.

Mississauga Transit

As the main carrier using the busway, Mississauga Transit would be expected to adopt one of the following strategies to the operation of the busway:

- **Coordinated Operations** - in this strategy, a dedicated bus route restricted to the busway would provide a base service between all of the stations along the busway. During the peak periods, the base service would be supplemented by express services between the major stations. The regular bus routes on the roads crossing the busway would be coordinated with the base service so that transfer connections can be made at the stations;

- **Integrated Operations** - in this strategy, branches of the regular bus routes would access the busway at key stations and would be integrated so as to provide a base service between all stations and express service between the major stations. The bus routes on the roads crossing the busway would be coordinated with the base service so that transfer connections can be made at the stations. When the demand warrants, the base service would be provided by a dedicated bus route which would be overlaid by the branched routes operating primarily on an express basis.

Both operating strategies can be incorporated into the basic grid bus route network being developed by Mississauga Transit although the integrated operations strategy would provide the greatest flexibility to match route structures and headways to the demand, and to coordinate MT and TTC services in the corridor when there is service coordination and fare integration between the two operators. The integrated operations strategy would also minimize the number of transfers and provide the least inconvenience to passengers travelling to the City Centre area and the Eglinton West corridor in Metro.

For these reasons, the Integrated Operations strategy is recommended for the operation of the busway by Mississauga Transit.

Other Carriers

There are several other public transit carriers in the Mississauga area which may want to use the busway. As a general policy, those carriers that offer services not provided by Mississauga Transit or that connect with the Mississauga Transit or other public transit services should be permitted to use the busway. These include:

- **TTC Bus Services** - in the near future, it is expected that there will be a number of service coordination and fare integration measures implemented between the TTC and Mississauga Transit. When fully implemented, duplicated MT/TTC bus services will be eliminated in the common corridors in Metro, TTC and MT bus services will be extended into each others territory on an open door basis, and through bus services will be offered in the main cross-boundary corridors in Mississauga and Metropolitan Toronto.

  A priority is to improve the bus services in the Eglinton corridor between the City Centre in Mississauga and the Spadina subway line in Metropolitan Toronto. It is likely that the TTC's Eglinton West bus route will be extended to the City Centre via the busway when it is built or along any facilities that might be constructed as precursors to the busway. The route would be a part of Mississauga Transit's integrated operations strategy for the busway, and would provide access to the TTC bus routes at the Renforth Gateway station for service to Etobicoke destinations.

  The environmental assessment report for the Eglinton West Rapid Transit (EWRT) is now being prepared. It is hoped that a compatible technology will be recommended for both the EWRT and the Mississauga Transitway. If so, it is expected that many TTC and Mississauga Transit services will run directly between the Transitway and the EWRT through the Renforth connection.

- **GO Transit Bus Services** - there are two existing GO bus routes serving Mississauga which provide inter-regional transit services; the Oakville - Mississauga - York Mills route which presently uses Highway 403 and serves the Credit Valley Hospital and City Centre areas, and the Milton - Meadowvale - York Mills route which currently serves the Meadowvale Town Centre and uses Highway 401 between Mississauga Road and Yorkdale.

  These two routes should be encouraged to use the busway through Mississauga with possible stops at the Erin Mills

Parkway, City Centre, Dixie, and Renforth Gateway stations. Other future GO bus routes could also use the busway. When the Eglinton West Rapid Transit line is constructed and if it uses busway technology, these GO routes could continue along the EWRT rather than using Highway 401.

- **Oakville Transit Services** - Oakville Transit now connects with the Mississauga Transit services at the Clarkson GO station. Currently there is a low transit demand from Oakville to North and Central Mississauga; the GO Oakville - Mississauga - York Mills bus service operates at a half hour headway during the peak period. As employment growth occurs in Mississauga, however, there will be increases in demand.

  The orientation of the present inter-regional GO bus service is to the Oakville GO station and Trafalgar Road and thus it serves mainly the southern part of Oakville. Use of this service may be expected to increase considerably in the future with the growth of employment in Mississauga.

  As Oakville grows further north and as the Mississauga City Centre increases in importance as an employment centre, there will be increased demand for services from other parts of Oakville into Mississauga. The Region of Halton has taken the position that the design of Highway 403, west of the Mississauga boundary, should take into account a future busway in this corridor. The Region is undertaking a study of transit opportunities within Halton which will examine the busway and other transit opportunities. Before the busway is extended into Halton, it is very possible that Oakville Transit services may enter the busway via Highway 407 south (currently called Highway 403) and via the extension of Highway 403 to the west;

- **Milton Transit** - at present there is no local transit service within the Town of Milton. The area is served by the GO Milton - Meadowvale - York Mills bus service. In the future, however, as growth in the Milton area intensifies a municipal bus service (or a Halton regional bus service) may be developed to serve Milton trips. It is quite possible that such a transit agency may wish to use sections of the Mississauga Transitway to access the high employment areas of Mississauga.

- **Brampton Transit Services** - Brampton Transit currently connects with Mississauga Transit services on Hurontario Street, at the intersection of Dixie and Derry Roads and in

the Malton area. It is unlikely in the short term that it would want to extend its services into the busway corridor. In the longer term, however, particularly if some bus facilities are constructed in the Highway 403/410 north-south corridor, it is possible that Brampton Transit may use central parts of the busway to access the Mississauga City Centre.

- **Peel Region Transit Services** - The Region's Transhelp service and the School Boards' school bus services are important elements of public transit services in Mississauga. They may not want to use the busway extensively because of the door-to-door nature of the service provided but both should be permitted to use the facility provided drivers are qualified to use the facility.

- **Intercity Bus Services** - at present there are no intercity bus services oriented to the Highway 403 corridor through Mississauga. However, in future, if changes are made to the location of intercity bus terminals in Toronto, it is possible that such services may be introduced. These services should be permitted to use the Mississauga Transitway.

4. OPERATIONAL REQUIREMENTS

The busway needs to meet certain requirements before it can become an integral part of Mississauga Transit's service and operating strategies. These requirements are reviewed in this section.

Service Standards

The stations need to be designed to enable Mississauga Transit to meet its service standards. These standards are based on the financial targets established by Mississauga Council and the Province. The relevant service standards are as follows:

- **Loading Standards** - Maximum passenger loads on any bus are not to exceed 150% of seated capacity during peak periods and 100% of seated capacity during off peak periods. This means that at the major busway stations there will need to be provision for inserting extra buses when loadings exceed this standard;

- **On-Time Standard** - No bus is to leave early from any time point and no bus is to leave later than three minutes from the time point, 95% of the time. This means that provisions must be made at the major busway stations to hold or turn buses so as to maintain the schedules;

- **Service Utilization Standards** - Each transit route needs to achieve a minimum ridership performance of 40 passengers per revenue hour during the daytime Monday through Saturday. This means that the busway and its stations will need to be designed so as to minimize delay time and stop time for both the busway routes and the connecting local routes of Mississauga Transit; ideally, delay time and stop time should not exceed 10% of the terminal to terminal time of bus routes using or connecting with the busway;

These service standards are intended to achieve a minimum cost recovery for each MT transit route of 40% of operating costs from passenger revenues, or not less than two-thirds of the average for the system as a whole.

Transitway Route Structure

The structure of the MT routes using the busway or connecting with the busway will depend on the demand and the application of the above service standards. Based on the current understanding of the existing and ten-year demand, it would seem likely that the busway will need to accommodate one or a combination of the following types of routes:

- **A spine route** operating the full length of the busway in Mississauga and travelling along Eglinton West in

Metropolitan Toronto when there is MT/TTC service coordination;

- **Branches of local routes** blended with the spine route. Most of these routes would branch into the busway from the northwest, southwest, and northeast quadrants of the city to serve the City Centre and Airport area in Mississauga and the Bloor subway in Metropolitan Toronto. This means that ramps to and from the busway would need to be provided at the intersections of the busway with most arterial roads;

- **Express or limited stop operation** of the routes operating on the busway depending on demand. This means that the busway stations would need to have provision for bypass lanes to accommodate express buses.

A possible structure of Mississauga Transit routes in the busway corridor is shown in Exhibit 4.1. This route structure is based on the estimated 2021 bus loads and frequencies as shown in Exhibit 4.2. The total demand projected by the demand study has been manually assigned to a number of routes using the busway based upon the origin and destination of trips. In addition to demand that has been assigned to busway routes, some passenger usage has been assigned to local routes which may not use the busway but rather parallel streets for part or all of their routes.

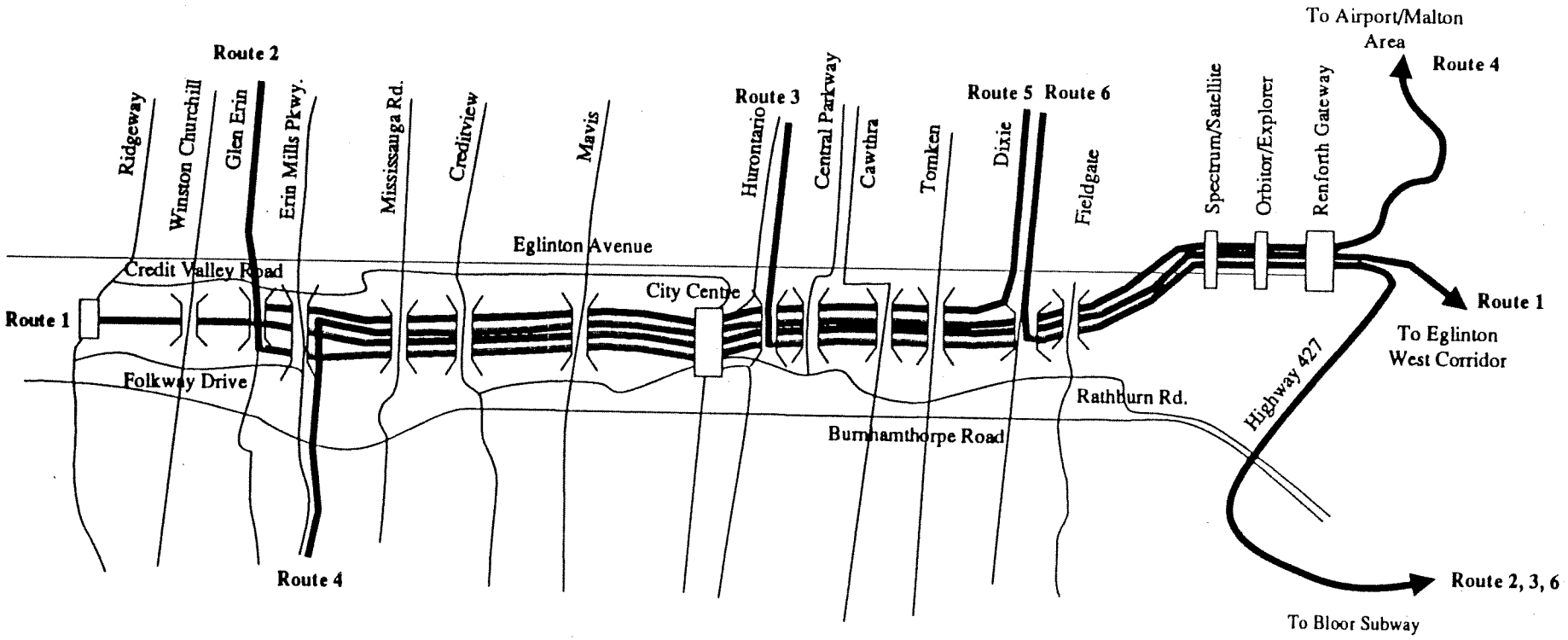
By 2021, it is expected that the spine route (Route 1) would have a peak frequency of 20 buses/hour (3 minute headway) supplemented by additional buses west of the City Centre as the demand warrants. Two routes would branch onto the busway at various locations to serve the subway: Route 2 from Meadowvale with a 3 minute headway and Route 3 from Hurontario North with a 4 minute headway. One route (Route 4) would serve the Airport area operating from Erin Mills South with a 4 minute headway. Two routes would use the busway to serve the North Dixie area: Route 5 from Glen Erin Station in the west with a 6 minute headway and Route 6 from the subway in the east with a 5 minute headway.

This route structure will be influenced by the extent to which there is MT/TTC service coordination in the future. Because there is a major demand between Mississauga and Etobicoke, a major grid route operating "through" Mississauga and Etobicoke in the Transitway/Eglinton West corridor will likely generate the highest ridership and therefore trigger the highest frequency of buses when compared to other route structures. Because of MT financial targets and service standards, this can only be justified if there is MT/TTC

EXHIBIT 4.1

EXPECTED ULTIMATE ROUTE STRUCTURE IN MISSISSAUGA BUSWAY CORRIDOR

(AFTER YEAR 2001)



Legend:

- Busway Routes
- Local Routes

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EXHIBIT 4.2

A.M. PEAK HOUR BUS LOADS AND FREQUENCIES AT MAXIMUM LOAD POINTS IN BUSWAY CORRIDOR (1) 2021

Busway Routes	West of City Centre		West of Dixie		West of Renforth	
	EB Load	Buses Per Hr	EB Load	Buses Per Hr	EB Load	Buses Per Hr
1 Spine Route - Eglinton	5,420	60	1,590	20	1,710	20
2 Meadowvale - Subway	1,770	20	1,770	20	1,770	20
3 Hurontario N. - Subway			1,030	15	1,030	15
4 Erin Mills S. - Airport	1,200	15	1,280	15	1,130	15
5 Glen Erin Sta. - N. Dixie	910	10	910	10		
6 North Dixie - Subway					360	5 (2)
Sub Total	9,300	105	6,580	80	6,000	75
LOCAL ROUTES	2,010	30	740	12	740	12
Total	11,310	135	7,320	92	6,740	87

Notes: (1) These estimates have been based on the "high land use" demand characteristics outlined in the report entitled "Mississauga Busway Ridership Forecasts" dated November 1990. The estimates assume that the Ten Year Transit Service Strategy will have been implemented by 2001, and that short distance trips will use the grid local routes in the corridor.

(2) The a.m. peak maximum load for this busway route will likely be westbound from the subway. The westbound load is expected to be about 1,100 passengers which will require a frequency of about 12 buses per hour.

service coordination in the corridor. In consideration that such coordination will likely be accomplished over the next few years, it is essential that the busway be designed to accommodate integrated MT/TTC routes throughout its length, and the coordination of MT and TTC routes at the Renforth Gateway station. Because of the loads expected under such a route structure, all busway stations should be designed to accommodate articulated buses operating on a single or double head basis.

Station Requirements

The Transitway will eventually require stations at all crossings with the Mississauga road system although in the early stages some stations may not be required as the catchment area may not be developed to the point where connecting bus routes can be justified.

Ultimately west of the City Centre, stations will probably be required at Ridgeway Drive, Winston Churchill Boulevard, Glen Erin Drive, Erin Mills Parkway, Mississauga Road, Creditview Road, and Mavis Road; Glen Erin and Erin Mills Parkway will likely be the major stations in terms of passenger demand and bus operations. The Creditview Station will provide an interchange with the Milton GO Transit commuter rail service.

East of the City Centre, stations will ultimately be required at Hurontario Street, Central Parkway, Cawthra Road, Tomken Road, Dixie Road, Fieldgate Drive, Spectrum/Satellite, Orbitor/Explorer, and Renforth; Hurontario, Dixie and Renforth will be the major stations in terms of passenger demand and bus operations.

The busway route structure and operating strategy will require busway stations that can accommodate passengers arriving and leaving the stations by automobile, connecting bus, or busway bus. While the design of the busway stations is influenced by environmental, physical and economic considerations, from the service and operations perspectives, the design should try to adhere to the following principles:

- **Service**
  - kiss and ride provisions at all stations where possible
  - park and ride provisions at the major gateway stations
  - sheltered waiting areas with easy access
  - passenger information facilities (display boards, electronic signage)
- **Operations**
  - efficient bus access to and from station

- minimum conflicts with traffic and pedestrians
- provision for turning and holding buses
- access to/from busway for buses where possible
- dedicated stopping areas for each connecting route.

The expected service and operating characteristics of the busway stations are shown in Exhibit 4.3. The desirable features that should be incorporated in the design of each station are indicated on Exhibit 4.4.

EXHIBIT 4.3

MISSISSAUGA BUSWAY
EXPECTED SERVICE AND OPERATING CHARACTERISTICS OF BUSWAY STATIONS

October 22, 1990

Busway Station	Likely Passenger Demand Characteristics at Busway Station[1]				Expected Characteristics of Connecting Routes[2]			Platform/Bus Stop Requirements by Direction [3]				Desirable Station Type[4]
								Mississauga Transit		Other Carriers		
	Through Demand Across Busway	Transfer Demand between Connecting Routes	Demand To/From Busway Corridor	Potential Walk-in Demand	Operate Across Busway	Turnaround at Busway	Operate onto Busway	Connecting Routes	Busway Routes	Connecting Routes	Busway Routes	
Ridgeway	Low	Low	Medium	Medium	Possibly	Yes	Possibly	1	1			On street
Winston Churchill	Low	Low	Medium	Medium	Yes	Yes	Yes	2	2	2	1	Off street
Glen Erin	Low-Med.	Medium	Medium	Low	Possibly	Yes	Yes	2	2			Off street
Erin Mills Parkway	Medium	Low	High	Low	Yes	Yes	Yes	2	3			Off street
Mississauga Road	Low	Low	Medium	Low	Yes	Yes	Yes	1	3			On street
Erindale/Creditview	Low	High	Medium	Medium	Unlikely	Yes	Yes	3	5			On street
Mavis	Low	Low	Low-Med	Low	Yes	Yes	Possibly	1	3			Off street
City Centre	n.a.	High	High	High	No	Yes	Yes	20	10	2	1	Off street
Hurontario	High	High	High	High	Yes	No	Yes	2	3	1		Off street
Central Parkway	Low	Low	Low	Low	Yes	No	No	1	3		1	On street
Cawthra	Low	Low	Medium	Low	Yes	Yes	Yes	1	3	2	1	Off street
Tomken	Low	Low	Medium	Low	Yes	Yes	Yes	1	3			On street
Dixie	Medium	Medium	Medium	Medium	Yes	Yes	Yes	2	3	1	1	On street
Fieldgate	Low	Low	Low	Medium	Yes	No	Yes	1	3			On street
Spectrum/Satellite	n.a.	n.a.	Medium	High	No	No	No	1	3			On street
Orbitor/Explorer	n.a.	n.a.	Medium	High	No	No	No	1	3			On street
Renforth	Low	High	High	High	Yes	Yes	Yes	1	7	2	2	On or off street

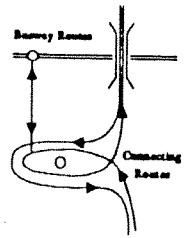
(1) Passenger demand characteristics are the estimated passenger volumes during the AM peak hour for the year 2021 expressed as:

- Low under 500 passengers/hour on the buses, under 100 walk-ins/hour
- Medium 500-2,000 passengers/hour on the buses, 100-200 walk-ins/hour
- High over 2,000 passengers/hour on the buses, over 200 walk-ins/hour

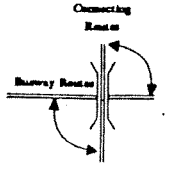
(2) The buses on the connecting routes at the busway station would stop at the station. Depending on the demand, some buses would proceed across the busway to other destinations, some buses would turnaround at the station, and some buses would operate onto the busway.

(3) The platform or bus stop requirements are the facilities for accommodating passengers boarding and alighting the buses on the connecting routes (either passing through or terminating at the station) and on the busway routes (either passing through or branching on to the busway at the station).

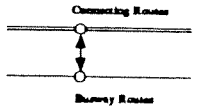
(4) Desireable station types include:



Off Street Station



On Street Station (Crossing Routes)



On Street Station (Parallel Routes)

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EXHIBIT 4.4

MISSISSAUGA BUSWAY
DESIRABLE STATION FEATURES

	Kiss & Ride Area	Parking Area	Busbays on Local Street	Off street Bus Turnaround and Layover Area	Ramp to and from Busway
Ridgeway	Yes[1]	Yes[1]	Yes	Yes	Yes
Winston Churchill	Yes[1]	Yes[1]	No	Yes	Yes
Glen Erin	Yes	No	No	Yes	Yes
Erin Mills Pkwy.	No	No	No	Yes	Yes
Mississauga Rd.	Yes	No	Yes	Yes	Yes
Creditview	Yes	Yes	Yes	Yes	Yes
Mavis	Yes	No	No	Yes	Yes
City Centre	No	No	No	Yes	Yes
Hurontario	No	No	No[2]	Yes	Yes
Central Parkway	No	No	Yes	No	No
Cawthra	Yes	Yes	No	Yes	Yes
Tomken	Yes	No	Yes	Yes	Yes
Dixie	Yes	Yes	Yes	Yes	Yes
Fieldgate	Yes	Yes[2]	Yes	Yes	Yes
Spectrum/Satellite	No	No	Yes	No	No
Orbitor/Explorer	No	No	Yes	No	No
Renforth	No	Yes	Probably	Yes	Yes

Notes

(1) Because of the proximity of the Ridgeway and Winston Churchill Stations, only one parking facility would be required for both stations.

5. POSSIBLE STAGING

An insight into the possible operating characteristics of the busway during the early stages is shown in Exhibit 5.1 for the year 2001. The information presented in this exhibit was developed on the basis of the demand forecasts which are documented in a separate report (Mississauga Transitway Ridership Forecasts). The total demand estimated in that report has been assigned to individual routes including some local routes which may not operate on the busway itself but on parallel roads.

The demand projected for 2001 suggests that two routes would branch onto the busway to serve the subway: Route 2 from Meadowvale with a 4 minute headway and Route 3 from Hurontario North with a 6 minute headway. Two routes would branch onto the busway to serve the North Dixie area: Route 5 from the City Centre with a 10 minute headway and Route 6 from the subway with a 6 minute headway. The spine route (Route 1) would be required only if the Eglinton West rapid transit line is built but, if not in operation, the demand within Mississauga would have to be handled by other routes.

Mississauga Transit must be able to take advantage of sections of the busway as they are built over the ten year construction period. There are several staging options for the west and east sections of the busway which can be considered from the operations perspective.

West Section

For the section of the busway west of the City Centre two types of options have been investigated:

- W1 Options which would use sections of Highway 403 for bus services;
- the W2 Option which anticipates building strategic sections of the busway and utilizing them until the remainder of the busway and the busway stations can be constructed.

With the W1 Options, parts of the west section of Highway 403 could be used to carry buses before the busway is built. Because of traffic congestion on the freeway, one of the following staging options might be applied to ease bus movement:

- **Option A** - constructing queue jumping lanes at the major intersections to enable buses to enter and leave the freeway without delay; as a minimum, these would be required at the Erin Mills Parkway and Mavis Road interchanges.

EXHIBIT 5.1

A.M. PEAK HOUR BUS LOADS AND FREQUENCIES AT MAXIMUM LOAD POINTS IN BUSWAY CORRIDOR (1) 2001

Busway Routes	West of City Centre EB Load	West of City Centre Buses Per Hr	West of Dixie EB Load	West of Dixie Buses Per Hr	West of Renforth EB Load	West of Renforth Buses Per Hr
1 Spine Route - Eglinton	1,650	20	1,620	20	1,820	20 (2)
2 Meadowvale - Subway	1,220	15	1,220	15	1,210	15
3 Hurontario N. - Subway			760	10	760	10
5 City Centre - N. Dixie			540	6		
6 North Dixie - Subway (3)					330	4
Sub Total	2,870	35	4,140	51	4,120	49
LOCAL ROUTES	750	12	660	10	660	10
Total	3,620	46	4,800	61	4,780	59

Notes: (1) These estimates have been based on the "low land use" demand characteristics outlined in the report entitled "Mississauga Busway Ridership Forecasts" dated November 1990. The estimates assume that the Ten Year Transit Service Strategy will have been implemented by 2001, and that short distance trips will use the grid local routes in the corridor.

(2) These estimates assume that there will be a rapid transit line along Eglinton Avenue West in Metropolitan Toronto. If the line is not built by 2001, the spine busway route (Route 1) would not be needed east of the City Centre.

(3) The a.m. peak maximum load for this busway route will likely be westbound from the subway. The westbound load is expected to be about 740 passengers which will require a frequency of about 10 buses per hour.

- **Option B** - Paving the shoulders of the freeway for bus only operation between Erin Mills Parkway and Mavis Road (although possibly not across the Credit River) to enable buses to avoid traffic congestion.

- **Option C** - constructing high occupancy vehicle (HOV) lanes in the centre strip of the freeway for buses and for vehicles with three or more passengers. This would represent an acceleration of MTO plans to widen the highway into the median.

- **Option D** - constructing the road portion of the busway and access ramps at Glen Erin Drive or Erin Mills Parkway, Creditview Road, and Mavis Road. Transitway stations would not be required in this option.

It is unlikely that these options can create the demand conditions to justify a major restructuring of MT routes in the west section. As shown in Exhibit 5.2, it is likely that only one route (from the northwest) would be justified in the early stages, primarily because of the lack of transit stations en-route and the relatively short freeway distances involved in the trip to and from the City Centre.

A better early stage alternative, in terms of potential ridership increases, might be to construct the busway between Glen Erin Drive or Erin Mills Parkway and the City Centre and to build full stations at Erin Mills Parkway Creditview Road (connection with GO rail Milton service) and possibly Mavis Road. We have termed this option W2. This would likely create the demand conditions to justify busway routes from the northwest and west parts of the city, and local connecting routes on the arterials served by each station.

East Section

Similarly, to the east of the City Centre, there are two options that might be utilized, Option E1 in which buses would use Highway 403 and the 403 arterial road before the busway is constructed and Option E2 under which the busway and selected stations will be constructed. In the early stages, the Highway 403 Arterial Road (currently under construction to Dixie Road) could be used by Mississauga Transit to serve passengers destined for the City Centre, the Dixie North industrial areas, the Airport and Metropolitan Toronto. Because the arterial has at grade intersections, sheltered transfer stops could be established by Mississauga Transit at the intersections so that its routes using the section can connect with its local routes serving the Cawthra, Tomken and Dixie corridors.

An alternative to this strategy in the early stages would be to construct the busway between the City Centre and the Renforth

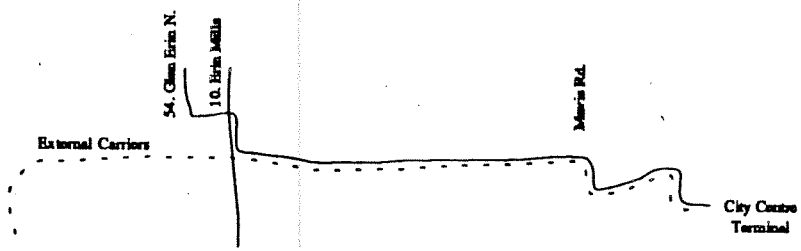
EXHIBIT 5.2

MISSISSAUGA BUSWAY
STAGING OPTIONS

STAGING OPTION W1
HWY. 403 WEST SECTION

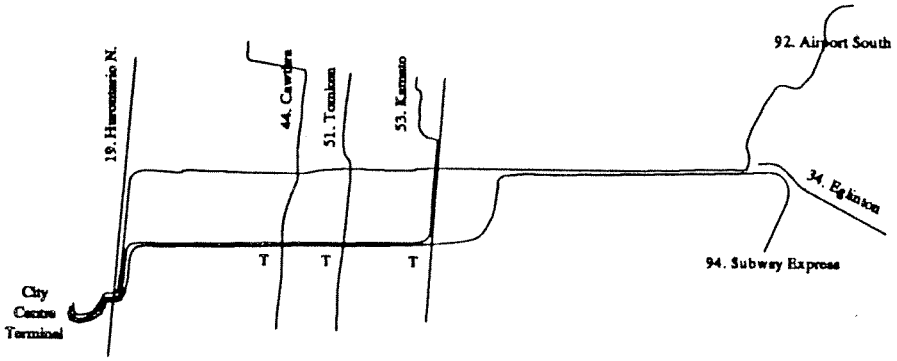
A with Queue Jumping Lanes for Buses
B with Paved Shoulders for Buses
C with new HOV Centre lanes
D with Busway and no stations

Max. load west of City Centre = 1200 AM peak hour BB (15 buses/hr)



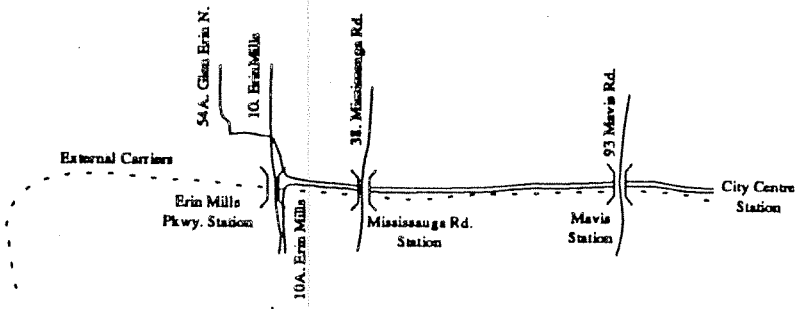
STAGING OPTION E1
HWY. 403 ARTERIAL

Max. load west of Dixie = 1800 am peak hour BB (20 buses/hr)



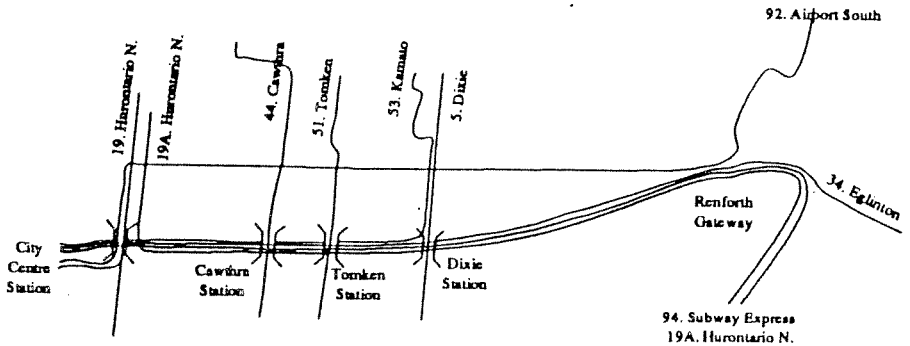
STAGING OPTION W2
BUSWAY WEST SECTION

Max. load west of City Centre = 2,500 AM peak hour BB (30 buses/hr)



STAGING OPTION E2
BUSWAY EAST SECTION

Max. load west of Dixie = 2,500 AM peak hour BB (30 buses/hr) without Eglinton West R.T.
Max. load west of Dixie = 4,000 AM peak hour BB (50 buses/hr) with Eglinton West R.T.



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Gateway, and to build full stations at Cawthra, Tomken, and Dixie Road as a minimum. As shown on Exhibit 5.2, the demand conditions and route structure will likely be similar for either the Highway 403 arterial or the early stage busway alternative. A higher busway demand on the busway will likely not occur until the busway can be connected to a rapid transit facility in the Eglinton West corridor in Metropolitan Toronto.

Staging Strategy

Exhibit 5.3 provides a broad evaluation of the various options for the early stages of the busway. The evaluation addresses five criteria and qualitatively ranks each option with respect to the criteria. The criteria are:

- travel time saved for passengers and for bus operations;
- passenger minutes saved per dollar spent on construction;
- potential for a ridership increase;
- new passengers per dollar spent; and
- ease of obtaining the necessary approvals and the implementation of system.

Based on this evaluation, a busway with three stations in the west section, and either a busway with three stations or the use of the Highway 403 arterial in the east would seem to be the best early stage option from the operations perspective.

The recommended staging strategy is to use the Highway 403 Arterial Road as soon as it is completed, construct the busway between Erin Mills Parkway and the City Centre with three stations and extend the Highway 403 arterial service into the west section, and then construct the busway between the City Centre and the Renforth Gateway with three stations initially. A likely route structure for this strategy is shown in Exhibit 5.4.

Bus Requirements

The recommended staging strategy would require the purchase of additional buses by 2001 as follows:

- **Before Eglinton West Rapid Transit** - an estimated 40 buses would likely be required to operate four busway routes at the frequencies shown in Exhibit 5.4. The 40 bus requirement includes spares;
- **After Eglinton West Rapid Transit** - an estimated 60 buses would likely be required to operate five busway routes at

EXHIBIT 5.3

MISSISSAUGA BUSWAY
EVALUATION OF EARLY STAGE OPTIONS

OPTIONS	SAVED TRAVEL TIME	PASSENGER MINUTES SAVED PER DOLLAR SPENT	POTENTIAL FOR RIDERSHIP INCREASE	NEW PASSENGERS PER DOLLAR SPENT	EASE OF APPROVAL/ IMPLEMEN-TATION	TOTAL RATING
WEST SECTION						
Option W1: Use of Hwy. 403						
A with Queue Jumping	1	2	1	1	2	7
B with Paved Shoulders	2	3	1	1	2	9
C with HOV Centre Lane	3	2	1	1	1	8
D with Busway No Stations	3	1	1	1	1	7
Option W2: Busway with 3 Stations	3	2	2	1	2	10
EAST SECTION						
Option E1: Hwy. 403 Arterial	2	3	2	2	3	12
Option E2: Busway with 3 Stations	3	1	2	1	2	10

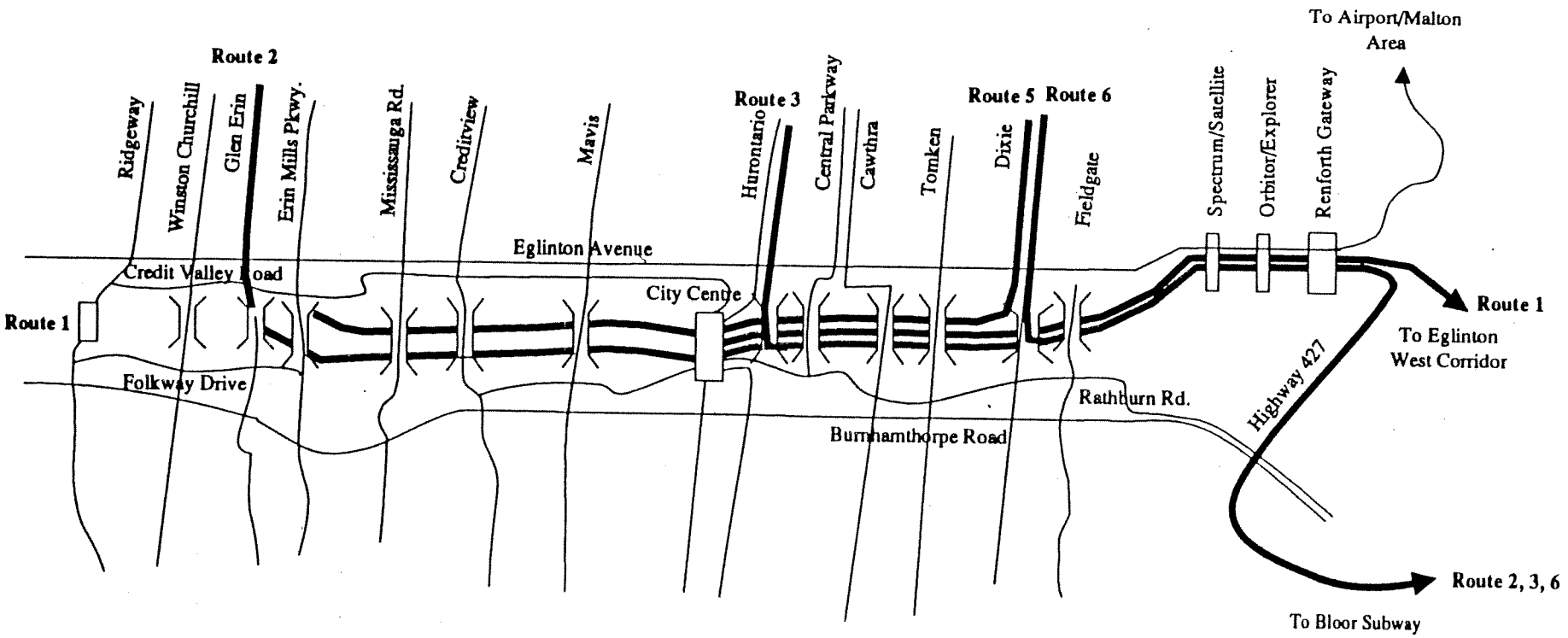
LEGEND: 1 (low), 2 (medium), 3 (high) degree of adherence to the evaluation criteria.

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EXHIBIT 5.4

LIKELY ROUTE STRUCTURE OF RECOMMENDED STAGING STRATEGY FOR MISSISSAUGA BUSWAY

(BY YEAR 2001)



Legend:

- Busway Routes
- Local Routes

Peak Bus Frequencies (Buses/Hr)		
Route	With Eglinton West Rapid Transit	Without Eglinton West Rapid Transit
Route 1	20	-
Route 2	15	15
Route 3	10	10
Route 5	6	6
Route 6	10	10

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the frequencies shown in Exhibit 5.4. The 60 bus requirement includes spares.

APPENDIX 'Q'

TRANSITWAY STATION CONCEPTS, PLANNING PRINCIPLES, AND DESIGN CRITERIA

MISSISSAUGA TRANSITWAY PLANNING STUDY EA REPORT

APPENDIX Q - TRANSITWAY STATION CONCEPTS, PLANNING PRINCIPLES, AND DESIGN CRITERIA

This Appendix provides some background regarding the planning and design approach used for the Transitway. Since the technical report in this Appendix was prepared prior to the development of 1:1000 scale functional plans, some aspects may have been modified in actual application to a given site. Also some stations originally contemplated have been deleted and "Transitway" has superseded "Busway" as the project name.

It is recognized that this material is not required to be included in the Environmental Assessment submission for the Transitway, but has been appended to allow the EA Report to act concurrently as a Functional Planning Report. In compiling all relevant Transitway material in a single comprehensive document, it is intended this report act as a sound foundation for all future work on the project.

MISSISSAUGA BUSWAY FUNCTIONAL PLANNING STUDY

TECHNICAL REPORT

BUSWAY STATION CONCEPTS

McCormick Rankin

May 2, 1990

MISSISSAUGA BUSWAY PLANNING STUDY

BUSWAY STATION CONCEPTS

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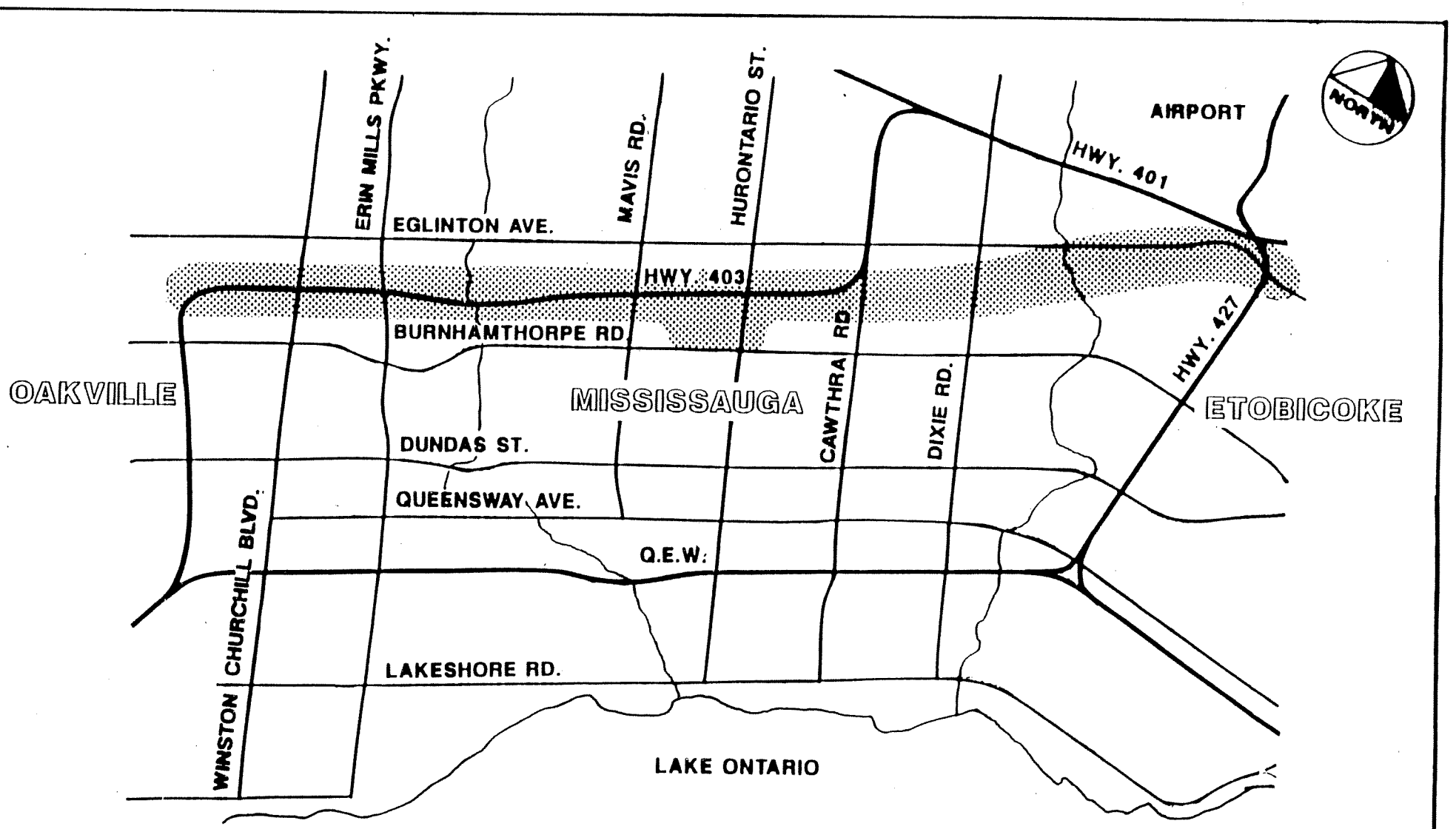
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MISSISSAUGA BUSWAY FUNCTIONAL PLANNING STUDY

EXHIBIT 1 : **KEY MAP**

0 SCALE 5000m

FUNCTIONAL PLAN STUDY AREA

1. SYSTEM OPERATION

Busway planning is based on the ultimate (mature) bus-only network. It is assumed that, if ultimate conversion to another mode occurs, it would occur for reasons of area-wide system compatibility or unforeseen technological advances. It has been shown that a bus-only network will be capable of accommodating the ultimate Mississauga travel demand for transit trips.

Intermediate stages of bus-only operation may require larger stations at some locations for an interim period prior to Busway completion.

There are three basic bus route types projected for the ultimate scenario (with the Busway in place):

- Line Haul Busway route: frequent service to all Busway Stations; does not leave the Busway
- Arterial routes: frequent peak period service on north-south arterials crossing Busway; terminates, crosses, or enters the Busway. If using Busway for part of trip, travels express to nearest Gateway(s) and may continue to external destinations.
- Intermediate routes: buses that do not enter the Busway; passengers transfer to Busway routes.

In addition, "external" carriers/services may use the Busway or parts of it:

- Intercity transit (GO; United Trails, Gray Coach, etc.)
- Airport Shuttle
- T.T.C. (Toronto Transit Commission)
- Oakville Transit
- Brampton Transit
- Transhelp (Peel handicapped service)
- City Centre Shuttle

Emergency vehicles may need to use the Busway on occasion and will be permitted. School buses and private vehicles will not be permitted on the Busway.

Line Haul Route Operation

While on the Busway, the Line Haul route would stop at each Busway station. A "Super Express" line haul route is a possibility to link key stations only, while skipping intermediate stops. Intercity carriers would be expected to use the Busway in a "Super Express" manner. At key stations, the line haul routes have a potential need to short turn (loop) or terminate (see Exhibit 2).

Arterial Route Operation

Those bus routes that cross or use the Busway, but have either an origin or destination off the Busway are designed to serve catchment areas focused on the north-south arterial grid. These routes have numerous options, depending on the demand characteristics of their specific corridor (see Exhibit 3). In general, a continuous shuttle up and down the arterial, with stops at all major crossing roadways (including the Busway) would characterize arterial service. In peak periods, however, bus operational efficiency and a high proportion of home to work/ work to home trips will likely generate routes that begin/end on arterials, enter the Busway at its crossing, and travel express to/from major Busway stations serving employment nodes. Passengers wishing to reach intermediate stations would transfer to the frequent Line Haul route at the point of entering the Busway. The Busway stations at which these arterial-based trips would terminate are the City Centre and possibly the Renforth Gateway. Direct Links to/from the T.T.C. subway system could occur from the latter.

Given the trip-interceptor function of the Busway, it may be assumed that some arterial-based buses (if not routes) could terminate at the crossing Busway station. For example, a Mavis Route could be split into Mavis North and Mavis South routes, linked at the Busway node.

Intermediate Route Operation

Those routes using intermediate roads may be assumed to not need to enter the Busway, although property protection for an access may be appropriate for future operational flexibility or construction staging purposes. Busway-oriented passengers would need to transfer to a Line Haul route on the Busway (see Exhibit 4). On intermediate roads that cross the Busway, routes are likely to continue on after stopping to discharge/collect passengers. Other intermediate routes may be designed to feed the Busway or to terminate at the City Centre station after a "radial" path through the area. These routes would terminate at the Busway station but have no need to enter the Busway itself.

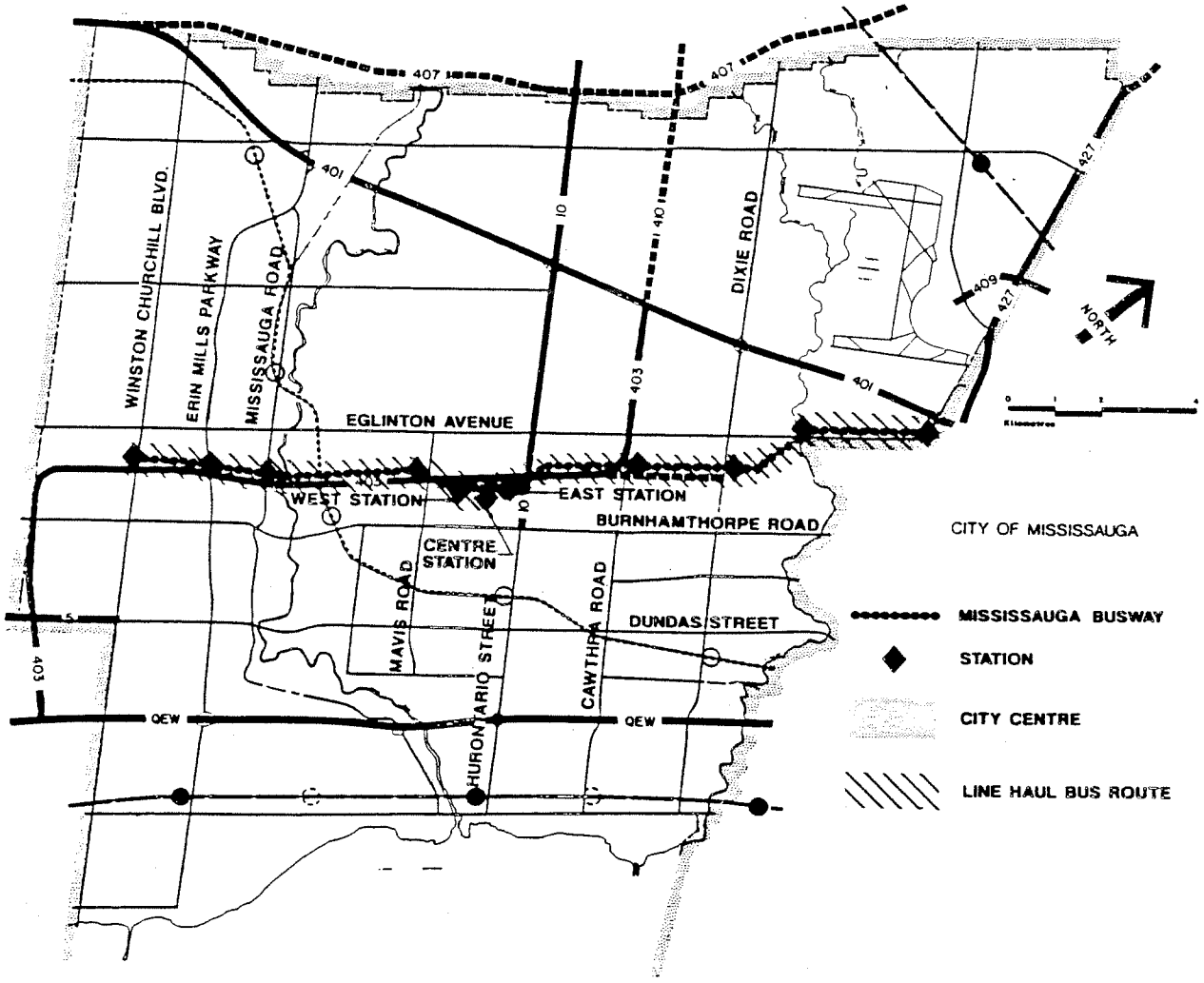


EXHIBIT 2 : LINE HAUL BUS ROUTE

- o provide continuous service along entire length of busway
- o all day service
- o peak headway - continuous
- o off peak headway - frequent
- o stop at all busway stations

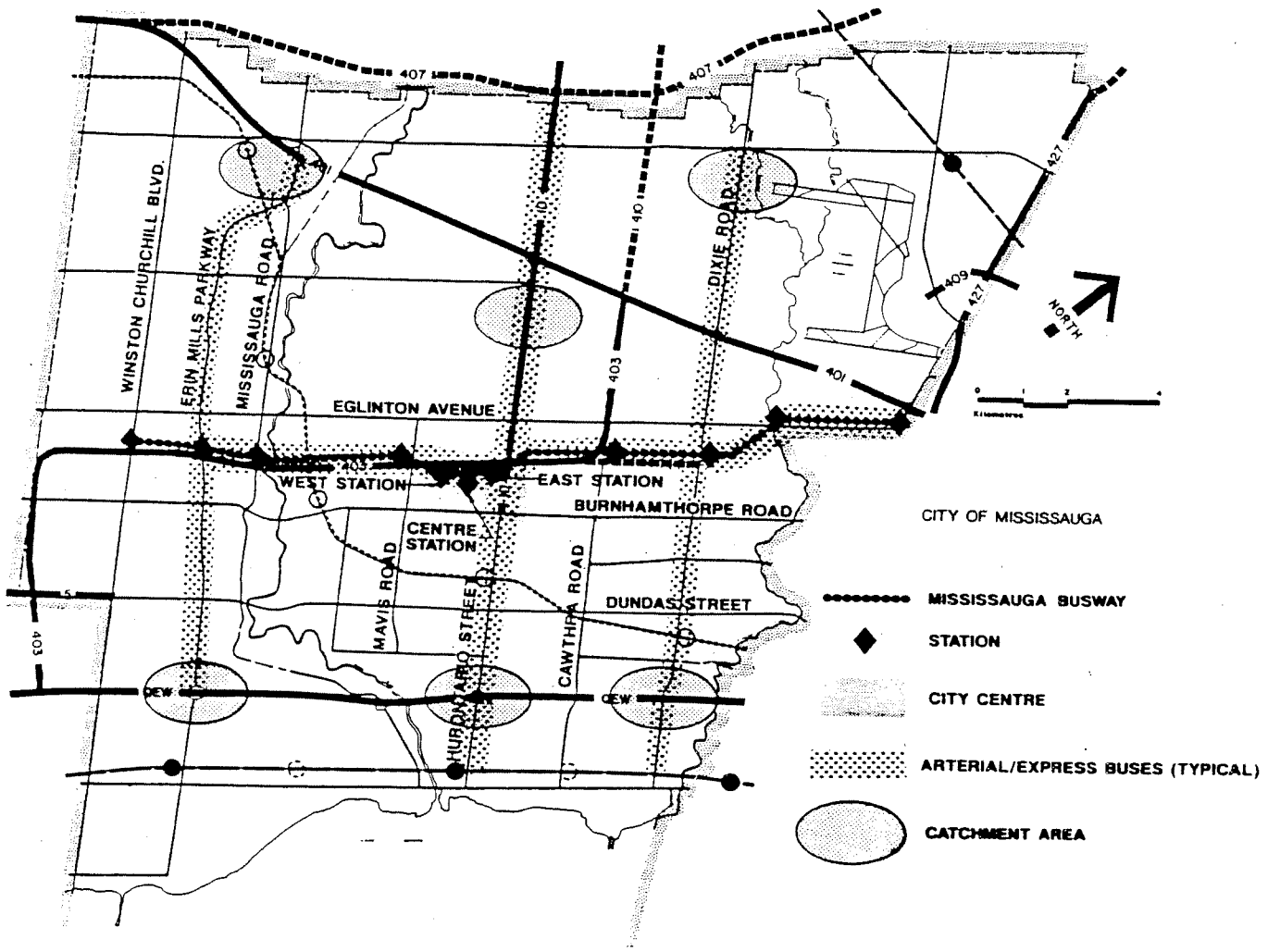


EXHIBIT 3 : ARTERIAL BUS ROUTES

- o provide predominately peak service
- o headway - frequent
- o stops at all local stops in catchment area, express service to City Centre via busway OR RENFORTH GATEWAYS
- o potential lay-over requirement at City Centre AND RENFORTH STATIONS

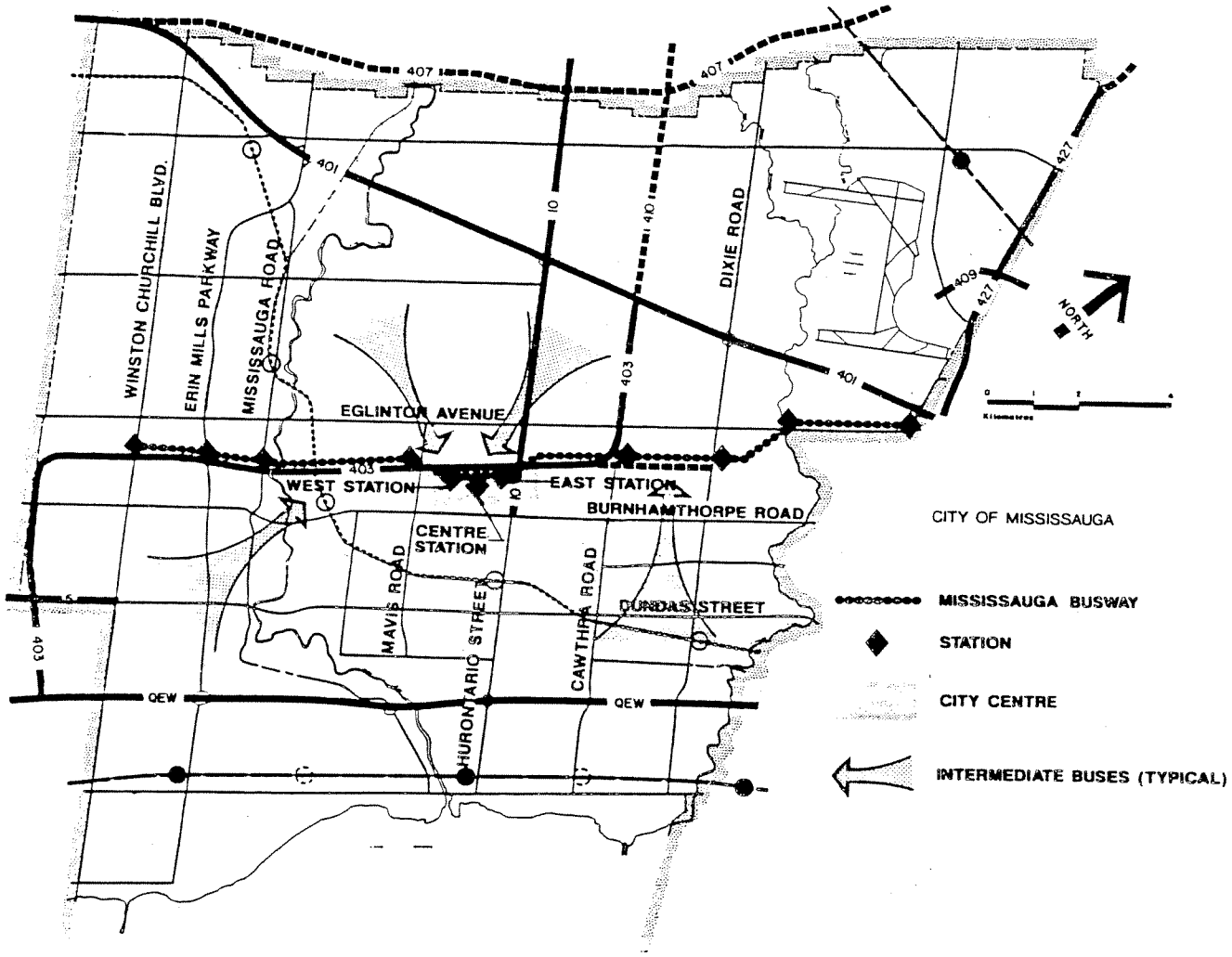


EXHIBIT 4 : INTERMEDIATE BUS ROUTES

- o provide service to local neighbourhood, connecting to Busway Station
- o all day service
- o peak headway - frequent
- o off peak headway - basic
- o stops at all stops along route
- o potential lay-over requirements at Busway Station

2. STATION FUNCTION

There are essentially three types of Busway stations in the Mississauga system: those that function as "Gateways" or major focal points; major stations at arterial/Busway interfaces; and on-line Busway stations at intermediate points or minor crossing roads. Table 1 summarizes the key operational aspects of each Busway station type.

Bus operational requirements will vary depending on the type of station, and although general principles may be defined, each station may have unique operating features, opportunities, or site characteristics.

Protection for ultimate introduction of high-order transit service on intersecting arterial corridors is required, as "Gateway" stations will each be key nodes for high-demand facilities.

"Gateway" Type Stations

The "Gateway" type stations may be assumed to have all routes, be they on the Busway or on crossing roadways, stop at the station to allow either passenger or route transfer between major corridors. The possibility that routes would terminate at the "Gateway" sites must be considered in developing a flexible station layout.

"Arterial" Type Stations

"Arterial" type stations would function differently from "Gateway" stations in that some Busway routes would skip various arterial stations while travelling express to the "Gateways", and no Busway routes would be expected to terminate at an "Arterial" station. The frequent Line Haul Busway service would, however, stop at each "Arterial" station. Access between the Busway and the arterial crossing road would be necessary to allow arterial routes to travel express to and from "Gateway" stations via the Busway. Meanwhile, all arterial routes would stop at the Busway, then either continue on the arterial, turn around, or enter the Busway system.

"Intermediate" Type Stations

The "Intermediate" type stations would see the Line Haul route on the Busway stop at the station, then continue on after collecting passengers from buses using the crossing roadway. It is possible that the local route would terminate at the Busway station, although more often it would carry on across the Busway on the crossing roadway. No routes would enter or leave the Busway at an intermediate station.

MISSISSAUGA BUSWAY PLANNING STUDY

TABLE 1: BUS OPERATIONS AT BUSWAY STATIONS

BUS ROUTE OPERATION	STATION TYPE		
ENTER STATION FROM BUSWAY	GATEWAY	ARTERIAL	INTERMEDIATE
STOP	√	√	√
SKIP	-	√	√
TERMINATE/LOOP	√	-	-
EXIT BUSWAY	√	√	-
ENTER STATION FROM ARTERIAL			
STOP	√	√	√
SKIP	-	-	-
TERMINATE/LOOP	√	√	possible
ENTER BUSWAY	√	√	-
Potential Station Sites	Winston Churchill City Centre Hurontario Cawthra Eglinton/Renforth	Erin Mills Glen Erin Mississauga Road Creditview/GO Mavis Tomken Dixie	Confederation Central Parkway Fieldgate Etobicoke Creek Centennial Park Orbitor

Other Functional Demands

The preceding paragraphs have dealt with bus operational impacts on station function, but there are several other factors guiding the Busway station functional needs.

Development Integration

A key distinguishing feature of most of the "Gateway" type stations is the potential for physical and functional integration into surrounding development. A particularly good example is the City Centre Station, where planned high density office and retail development may completely encompass the station site. It is clear that a Busway station must be located at least partly outside the limits of the Parkway Belt West for development integration to be a significant consideration.

For those stations, mostly of the "Arterial" or "Intermediate" types, located entirely within the Parkway Belt, some walk-in user potential exists, although this would be of significance only in those areas not bordered by low-density residential land uses. The walk-in potential in areas with low-density development within 400 metres of the station is limited to that of a normal suburban bus stop.

Park and Ride

Not to be ignored is the third mode of Busway access - automobile. It is a guiding principle of Busway development and city-wide Bus system operation that as many transit trips as possible be taken door-to-door on bus. Given the ultimate service network of Mississauga Transit throughout the entire fully-developed city, it is not desirable to encourage any use of cars for intra-city travel. However, trips originating external to Mississauga should be encouraged to use Mississauga Transit once inside City Boundaries. This would relieve local roads of external traffic, enhance the viability of the Busway and transit system, and reduce parking demand at major destination nodes such as the City Centre.

Accordingly, two strategies are desirable. Firstly, a push towards operational linkages with external transit systems (i.e. fare integration, route structures, joint route operation, etc.) is desired to reduce as much as possible externally based auto trips. For Busway planning purposes, this may be assumed to have been largely accomplished in the long term, resulting in an apparently borderless transit system to the user. Secondly, those remaining Mississauga-destined trips entering the City by car should be intercepted by park and ride lots, with direct, convenient express transit service via the Busway to the entire city. In terms of Busway station functional requirements, this would imply the need for park and ride lots at the three points where the freeway and Busway alignments interact: Winston Churchill, Cawthra, and Eglinton/Renforth. It may also be appropriate to have park and ride lots and shuttle bus service at other key interception points in Mississauga such as QEW/Winston Churchill or 401/Winston Churchill but these would have little impact on Busway station functional requirements.

Kiss and Ride

The final mode of access to be considered is the drop off/pick up of passengers by cars. Given the fragmentation of the origin-destination matrix in the Greater Toronto Area, the number of two-worker households, and the continuing importance of the auto mode for work-based trips, it is conceivable that the "kiss and ride" component of Busway demand will be significant, and would occur at all Busway stations. It should be noted that the "pick up" move requires parking space, while dropping off passengers occurs faster and more readily. It may be assumed that kiss and ride activity would be greatest at those stations close to freeway interchanges: Winston Churchill, Erin Mills, Mavis, Confederation, Hurontario, Cawthra, Dixie, and Eglinton/Renforth. Given the density of development, the concentration of transit service, walk-in potential, and traffic levels in the City Centre station vicinity, demand for kiss and ride facilities at the station site may be downplayed or focused on a more easily accessible spot elsewhere in the City Centre, (perhaps associated with Square One).

Kiss and ride facilities should therefore, be considered at all stations, but with emphasis shifting depending on transit service, area characteristics, property availability, and the ability to provide a functional kiss and ride facility.

Table 2 summarizes the functional requirements to be considered in the development of each of the three station types.

TABLE 2 : BUSWAY STATION FUNCTIONAL REQUIREMENTS

ELEMENT	STATION TYPE		
	GATEWAY	ARTERIAL	INTERMEDIATE
BUSWAY STOPS	YES	YES	YES
BUSWAY EXPRESS (BYPASS) LANE	YES	YES	YES
BUS MOVE BETWEEN BUSWAY AND LOCAL PLATFORM	YES	YES	NO
TURNAROUND ON BUSWAY	YES	NO	NO
TURNAROUND AT LOCAL PLATFORM	YES	YES	NO
BUS LAYOVER (INCL. DRIVER FACILITIES)	YES	YES	NO
EXTERNAL BUS OPERATORS	YES	NO	NO
PARK AND RIDE	YES (EXCEPT CITY CENTRE STATIONS)	NO	NO
KISS AND RIDE	YES	YES	YES

3. PLANNING PRINCIPLES OF STATION LAYOUT

With the functional needs of all those using the Busway stations determined (see Table 2), the key issue is the manner in which the various station components are organized to achieve the City's goals. The guiding principles of Busway station layout as applicable to the Mississauga Busway are as follows:

- efficient bus operation
- "user-friendly" for bus passengers
- adequate capacity for ultimate demands
- flexibility (bus routing, Operation, and non-bus technology)
- compatibility with surroundings (aesthetics; traffic operation; adjacent development; environmental impact)
- economical (station and property cost; ability to stage)

In terms of Busway station layout, the above principles focus on three aspects: the relationship of the station to the adjacent or crossing arterial; the relationship of the station to the surrounding area; and the internal facilities, features, and layout that most efficiently accomplishes the basic station function, that of providing a location for passengers to transfer from one vehicle to another.

Relationship Between Busway and Arterial

The Busway will be built physically separated from all crossing roadways and railways. There is, however, a functional requirement that the two transportation systems be closely linked wherever they intersect. It is logical that Busway stations therefore be located in close proximity to intersecting roads, but neither system should be interfered with by the operation of the other. In other words, the integrity and operation of the road system should not be compromised by the operation of the busway, just as the busway is designed to provide a transit facility free from interference by mixed traffic. It is possible that some interference between the systems could be tolerated in an interim period when neither is at capacity, but at the ultimate level of development in Mississauga, all the City's transportation networks will be at or near capacity and their continued ability to operate efficiently will depend on the elimination as much as possible of any interference points.

With this background, Tables 3 and 4 summarize the arguments to be made for and against Busway station facilities being located physically on the crossing arterials compared to being situated off the arterial. This analysis applies only to Busway stations where there is vehicular interaction between the Busway and roadway networks. This includes "Gateway" and "Arterial" type stations and excludes "Intermediate" stations.

TABLE 3: MISSISSAUGA BUSWAY STATION INTERFACE CONCEPT ANALYSIS

Analysis Factor	Local Buses Remain on Arterial	Local Buses use off-line platform
Bus Operation Efficiency	• minimum stopped time • delay due to additional movement in mixed-flow, say 0.5 min. • buses cannot turn around on arterial • limited platform space available at major arterials; difficult to use arterial bay as a time point or to provide driver facilities	• diversion of through route: 700 m± plus up to two left turns to/from arterial, 30 sec. + 90 sec. + 80 sec. = 3 mins. • route termination, time points, driver facilities readily accommodated
Bus Operation Flexibility	• restricted platform space on most arterial crossings - little expansion potential • some routes terminating at Busway will need to have a turning loop on arterial or leave arterial to turn on Busway • greater potential of conflict with future arterial modifications (widening, reconstruction, etc.)	• ample platform space available • potential to expand • allows all routes access to and from busway in any direction
Safety	• increases pedestrian movement across and beside major arterials and highway ramps • greater potential for bus/car conflict at turnout bays	• isolates pedestrian movement from vehicles as much as possible • segregates buses from cars; any conflict points are controlled by signals or traffic signs
Traffic Operation	• significant potential for disruption to arterial traffic - introduces additional turbulence (weaving, stopping, turning) in a busy interchange area • bus platforms on arterial do not eliminate the need for bus access to/from Busway • probable use of platforms for kiss & ride	• additional entrance and turning moves at arterial • limited number of buses - traffic disruption minimal • can remove kiss & ride from arterial to off-line facility • kiss & ride/park & ride/busway access can be focused on a single new entrance on arterial
Property Impact/Geometric Design	• Busway or park & ride access ramp required independent of arterial bus stops • can generally be contained within publicly owned property • ability to provide an optimum Busway platform constrained in proximity to arterial and highway ramps	• local bus platform can be generally contained within access ramp/Busway publicly owned envelope • greater potential for highway ramps realignment need • optimum Busway platform may be provided free of geometric constraints due to interchange ramps
Passenger Service	• local and Busway platforms physically separated • minimum delay to through trips • less attractive to walk-in passengers due to traffic conflicts	• greater ability to link Busway and local platforms on one level • greater control over design and aesthetics of surroundings • through passengers on arterials delayed up to 2.5 minutes.

TABLE 4 : MISSISSAUGA BUSWAY STATION INTERFACE CONCEPT ANALYSIS
SUMMARY OF ANALYSIS

ANALYSIS FACTOR	LOCAL BUSES REMAIN ON ARTERIAL	LOCAL BUSES USE OFF - LINE PLATFORM
BUS OPERATION EFFICIENCY		
BUS OPERATION FLEXIBILITY		
SAFETY		
TRAFFIC OPERATION		
PROPERTY IMPACT/ GEOMETRIC DESIGN		
PASSENGER SERVICE		

GOOD 
FAIR 
POOR 

It is apparent from the analysis that, wherever physically feasible, as much of the Busway's station and ancillary facilities as possible should be located off the crossing arterial, even though a time penalty could result for those passengers on north-south arterial routes not using the Busway system.

Relationship Between Busway Station and Surrounding Area

Although the Busway roadway itself is to be physically separated as much as possible from all other facilities, the Busway stations will become very much a part of their surroundings. This is in part due to a functional need to reach out to adjacent development and serve it directly by Busway transit, but the "fitting in" of the station to either an already-developed or emerging area without disruption of the community or its urban design also plays a role.

With this in mind, several issues can be addressed. The station should be as close as possible to major trip generators, and attractive pedestrian links (grade-separated where appropriate) should be in place between the nodes. A grade separation approach that minimizes the number of level changes for the greatest number of people should be pursued.

As noted previously, those stations located in whole or in part outside the Parkway Belt have the potential to be physically integrated in the future development. Although in most cases it may be impossible to define the actual shape or use of the development, consideration of possible future station development needs is appropriate. This could include elements such as pier locations for air rights construction, integration of entrances to parking garages, pedestrian passages to below-, at-, or above-grade office or retail structures, and drainage/utility treatment.

One of the main drawbacks of transit use that may be addressed through station planning and design is the exposure of passengers to the elements. Passengers within the station, being dropped off or picked up, or walking to the site should be protected to as great an extent as possible from inclement weather such as snow, rain, wind, cold and heat. This implies the need for covered or enclosed pedestrian passages and waiting areas wherever feasible.

Internal Station Layout

The physical layout and property needs of each Busway station are likely to be unique, but there are basic layout principles applicable to each of the three major station types: Gateway, Arterial, and Intermediate. Property availability, adjacent development, roadway layout, and bus operation patterns vary at each site, but the station's internal layout will be driven by the need to be flexible, functional, cost-effective, while being capable of accommodating the ultimate demands that may be put on it.

Flexibility refers to both bus operation and to the potential in the long term to convert Busway operation to Light Rail or Subway technology, or even some other technology currently unforeseen. It should be a guiding principle of station layout for Arterial and Gateway-type stations that all bus routes entering the station have the ability to leave the station by any bus route. In a transit system such as Mississauga's that will evolve and possibly change considerably over the decades ahead to protect for any less than full routing flexibility is inappropriate. Bus layover areas and turnaround loops are other features that build operational flexibility into the system.

Conversion to another mode, although not considered likely in the foreseeable future, should be protected for where appropriate in the station layout as well as in the mainline geometrics of the Busway. Any new mode would essentially take over the Line Haul and Express functions of the Busway and place a greater reliance on passenger transfer and feeder bus routes looping against the Busway station. While local platforms would continue in use, it would be likely that the new mode would not be compatible with bus use of its guideway and all of the local-to-Busway ramps would be closed. The Busway-level platforms would likely need to be reconstructed and possibly extended the full length of the 150 metre desirable tangent platform. It is also possible that use of some intermediate stations would be eliminated or reduced with a rail-type system, due to the proximity of stations, changes in street bus routing, or physical incompatibility. For example, an intermediate station located on a curved part of the busway could be served by buses but be unable to serve as a stop for a subway train due to the curved platform.

In general, if a 150 m long tangent, a 4 lane cross section and 4.7 m vertical clearance is maintained at each Busway station, the conversion of the Busway itself to another mode would not appear to have major implications on Busway station functional layout.

While in the station, passengers should be well-informed, feel safe, and feel proud of pleasant, clean surroundings. Architectural treatment of building materials, openness of plan, light penetration, landscaping, and minimizing of hidden or dark corners or passages are typical means of addressing these passenger needs, but consideration should be kept in mind throughout the station planning process of the user's needs. For example, short direct walking routes and minimizing use of pedestrian tunnels could be considered. The introduction of commercial or retail services in the Gateway stations (i.e. bank machines, day care centres, etc.) is a further possibility to be considered.

"Gateway" Type Station Planning Notes

- due to the number of entering routes, local platform should be an island
- due to the number of different operators, at least a portion of the bays should be straight, while bays dedicated to Mississauga Transit may be sawtooth. This preserves flexibility to accommodate various bus types.
- station is a focus for passenger transfers; to minimize transfer time and walking distance, local platform should be directly over or under the Busway platforms where possible. This also reduces the impact of the station "footprint" on surrounding property
- ramps and turnabouts allowing all bus moves are required
- Busway turning loops should be located downstream of platforms to allow "short turning" of routes
- pedestrian links to adjacent/overhead development to be provided
- bus layover, driver facilities, kiss and ride, park and ride, (some Gateway stations only), and central ticket/waiting/concessions area are additional elements
- location of bus ramp from Busway to surface depends on peak travel pattern; desirable for a.m. express buses entering Busway downstream of Busway platform and to have p.m. express buses leave Busway upstream of platform. This minimizes transfers and bus movement at Busway platforms
- a single two-way bus ramp is less costly, takes less property, places fewer constraints on a mezzanine-level pedestrian link, and can be arranged to meet peak demand patterns more readily than a pair of up-and-down ramps.
- pedestrian links to adjacent/overhead development to be provided
- where feasible, preferred location of pedestrian link is central to the platform at the mezzanine level (i.e. between the Busway and local platform levels). In cases where the additional grade change requires unacceptable long ramps or excessive Busway excavation/structure, a different location may be considered

- if a shuttle bus (frequent local circulation) uses the Gateway Station, it is desirable to provide a route to bring it off the arterial and in to the local platform with as little diversion as possible. Since its main function is the local distribution of Busway-based passengers, it is important to have the shuttle stop at the local platform, thereby minimizing the transfer movement of passengers. Shuttle use of dedicated bays on the adjacent arterial may be considered, if direct station access by pedestrian link is possible. For a local station on the north side of an arterial, a shuttle route that travels westbound on the arterial as part of a one-way loop is most readily diverted into the station. For a south side local station, an eastbound shuttle route is more suitable.

- due to the need for elevator access to both Busway platforms, an opening must be reserved at the surface for the head mechanism or a costlier piston-type elevator considered. It is preferable for the elevators to rise directly to the pedestrian link and local platform. The local platform would therefore need to be wider at that point than the Busway and its two platforms, or located at a skew over the Busway. Alternatively, one Busway elevator could be located outside the local bus circulation area and the second directly below the local platform.

- apart from elevator links between the Busway and local platforms, access within and around stations will be by stair. Escalators should be protected for at Gateways stations pending an assessment of ultimate passenger demand and movement patterns during detail design. Additional stairs or escalators between the Busway and local platforms should be considered at key stations.

- the local platform amy be located parallel to, perpendicular to, or skewed relative to the Busway without compromising any of the principles outlined above. Orientation will be a function of property availability, cost, road access, and site characteristics

- Exhibits 5, 6 and 7 illustrate typical "Gateway" type stations with the planning components as described above in a schematic arrangement that will vary according to the particular station site.

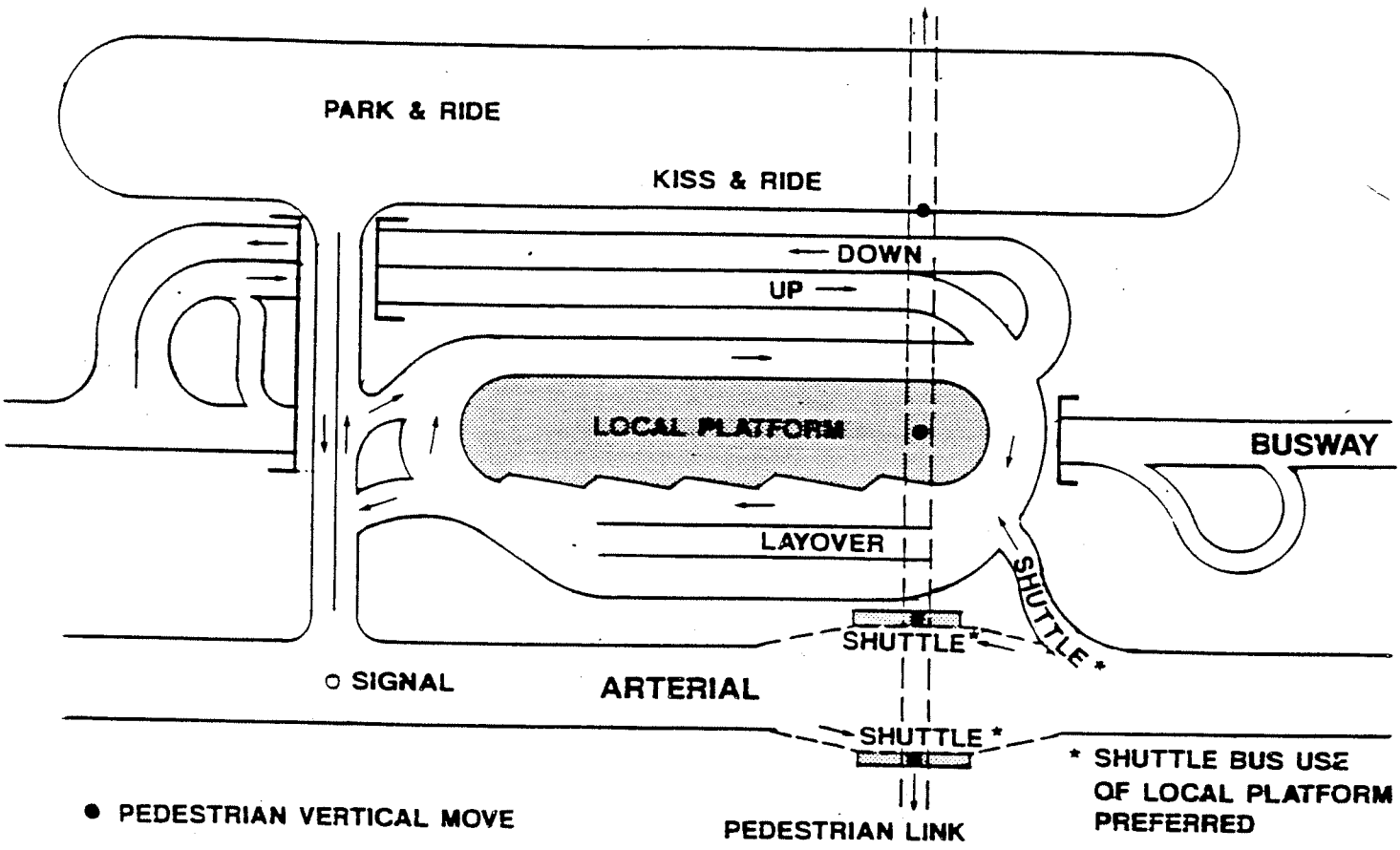
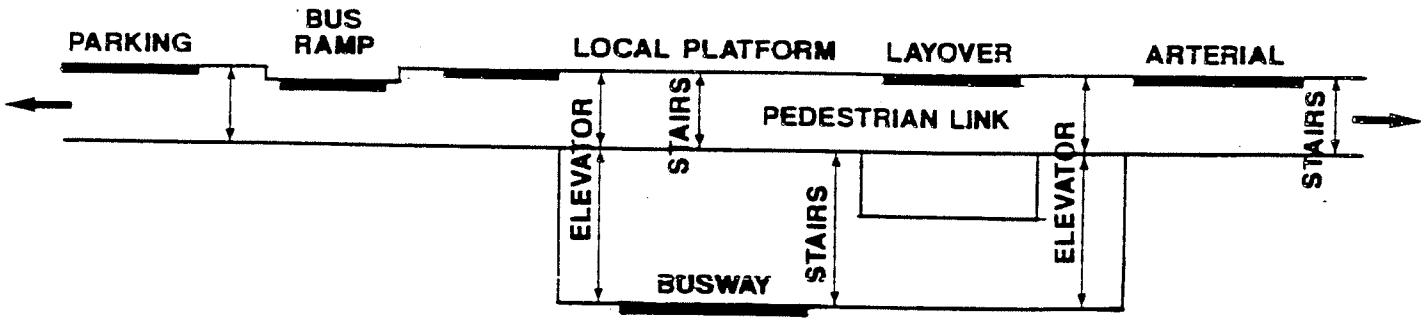


EXHIBIT 5 : ARTERIAL - LINKED GATEWAY TYPE STATION WITH TWO WAY BUS RAMP (PREFERRED)

SCHEMATIC ARRANGEMENT



CROSS SECTION AT PEDESTRIAN LINK

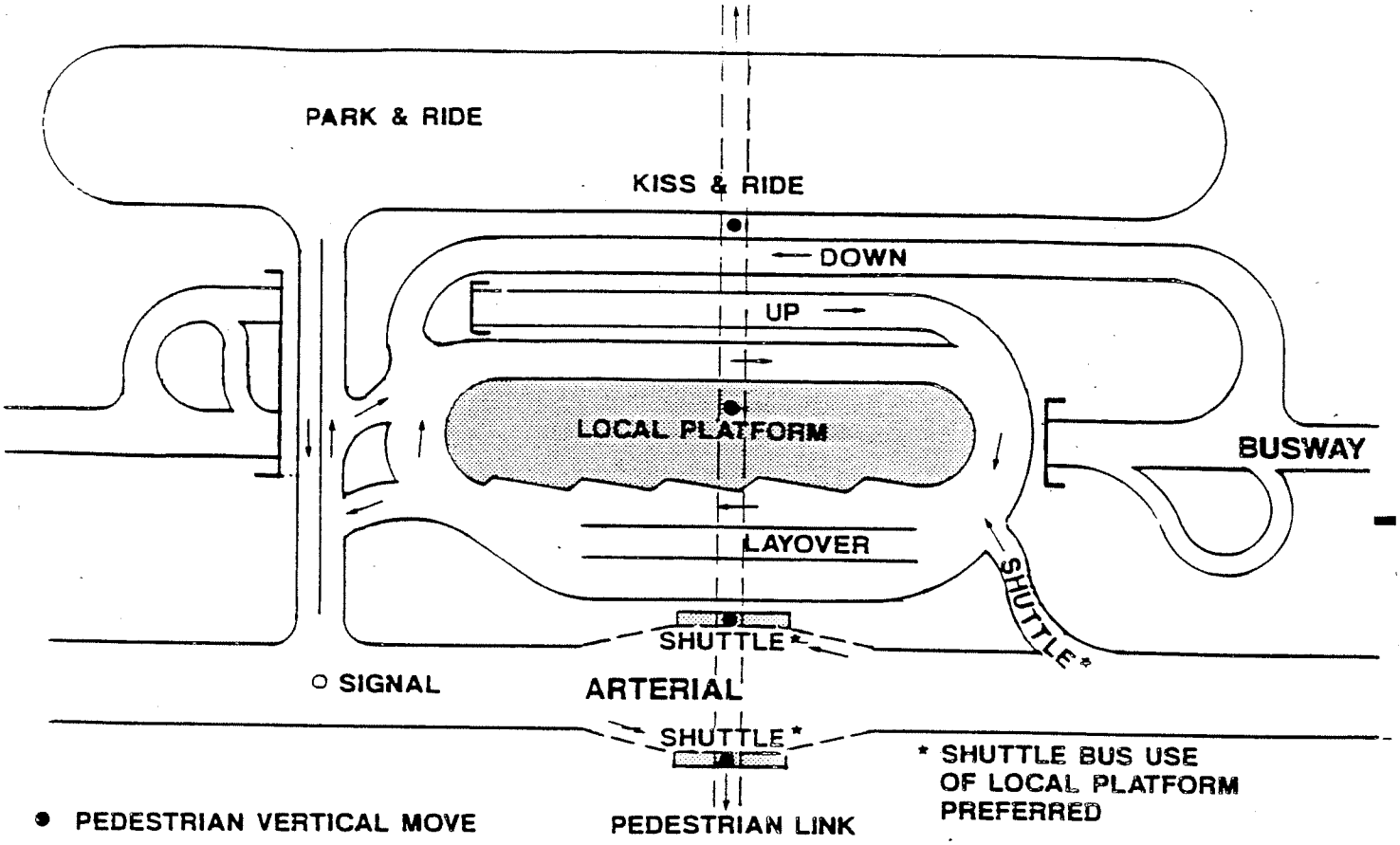
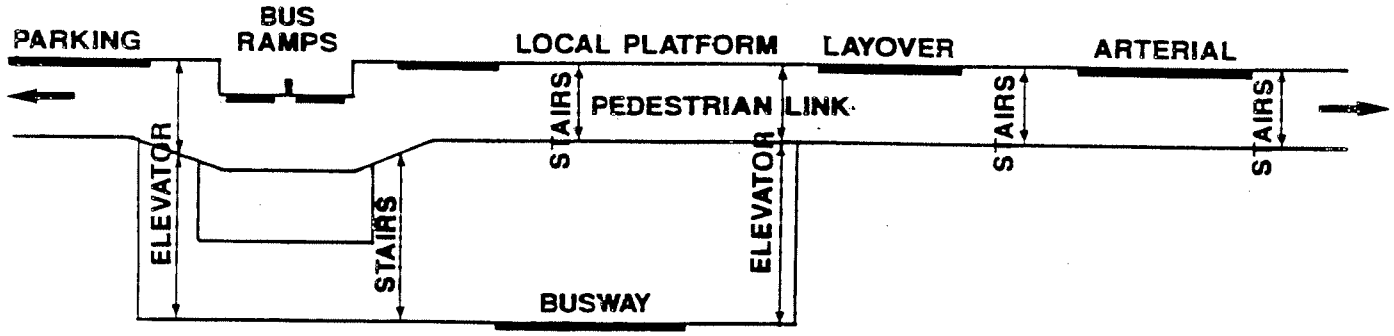
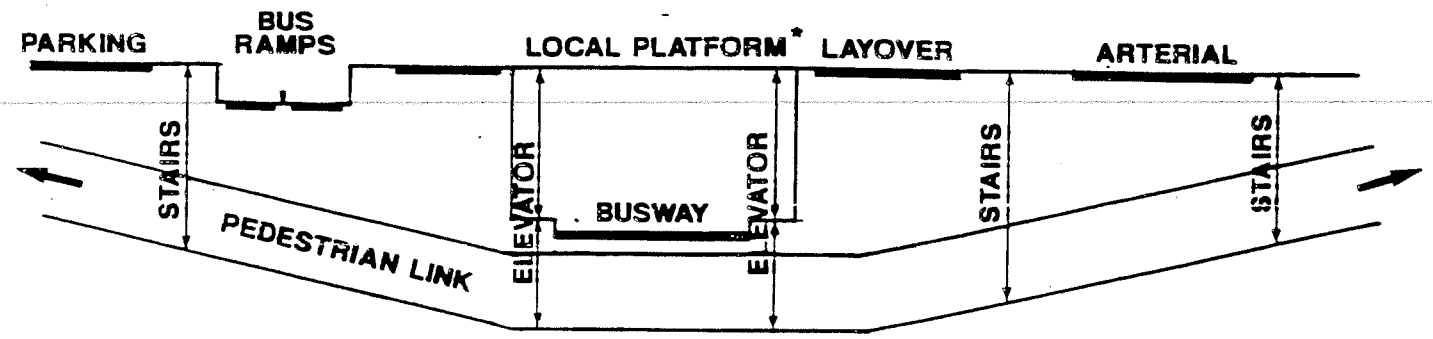


EXHIBIT 6 : ARTERIAL - LINKED GATEWAY TYPE STATION WITH ONE WAY BUS RAMPS (NOT PREFERRED) SCHEMATIC ARRANGEMENT



CROSS SECTION AT PEDESTRIAN LINK - MEZZANINE ALTERNATIVE



CROSS SECTION AT PEDESTRIAN LINK - TUNNEL ALTERNATIVE

* LOCAL PLATFORM MUST BE WIDE ENOUGH TO BE DIRECTLY ABOVE BOTH BUSWAY PLATFORMS TO ALLOW ELEVATOR ACCESS

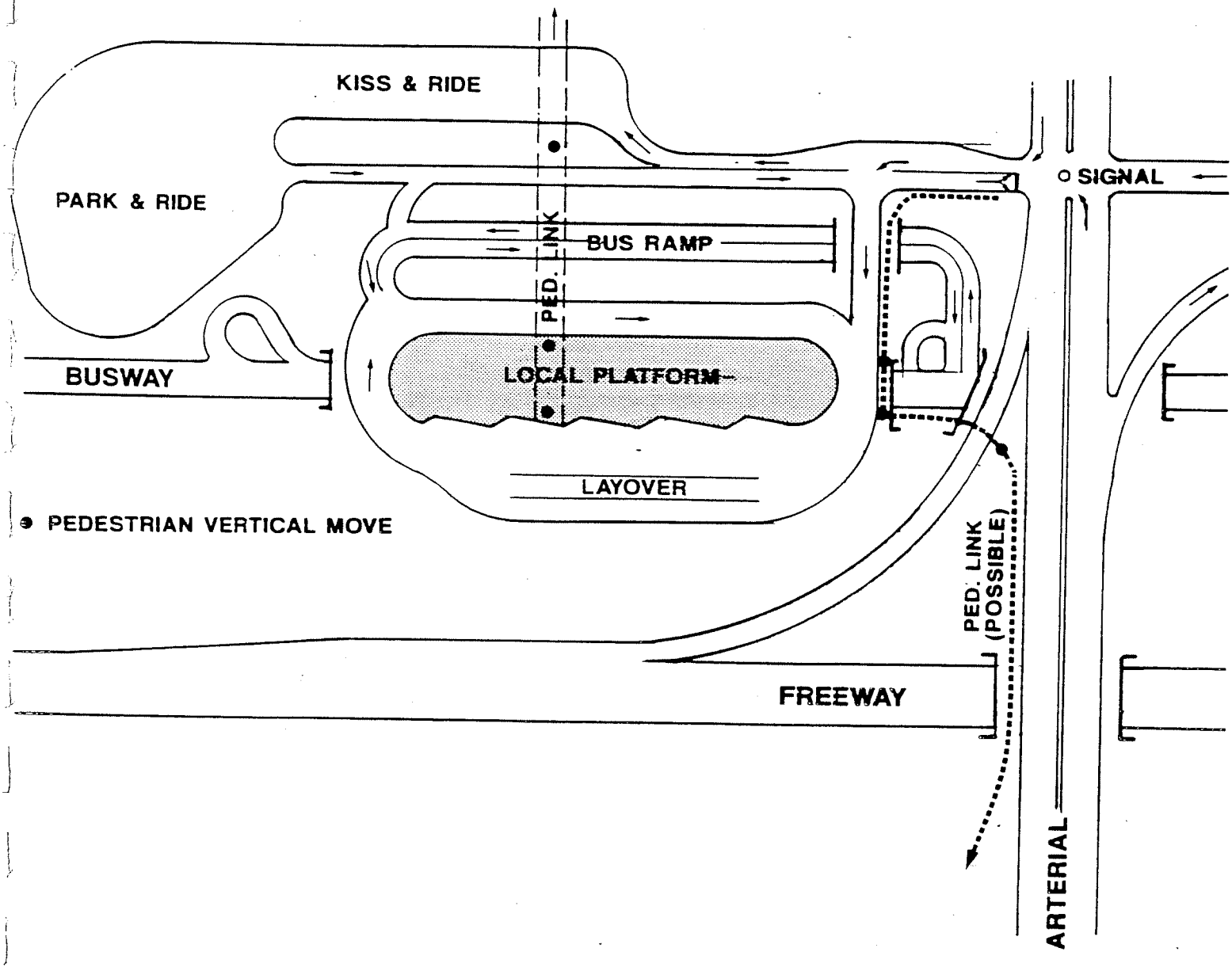


EXHIBIT 7 : GATEWAY TYPE STATION AT FREEWAY INTERCHANGE

SCHEMATIC ARRANGEMENT

"Arterial" Type Station Planning Notes

- local platform located adjacent to and parallel to Busway
- local platform to be a sawtooth side platform capable of accommodating at least two, and preferably four, bays. If more than four routes use the local platform, consideration should be given to the use of an island platform
- local platform desirably located either at the Busway level or one grade level different (up or down) to minimize pedestrian vertical movement
- local platform should be located so as to minimize additional trip length for diverted arterial buses. Therefore, a local platform at the arterial grade rather than the Busway grade is preferred.
- bus access ramps between local platform and busway, kiss and ride facilities, bus layover, and driver facilities are required. Park and ride lots are not necessary.
- bus turning loop is not required at the Busway level, but provision for arterial buses looping against the local station should be provided
- bus ramp should be located to allow peak a.m. express buses to enter Busway downstream of Busway platforms and to return in the p.m. peak
- it may be assumed that no shuttle bus type service is present, and if ultimately needed, it could use the local platform area.
- consideration can be made of the provision of bus bays on the crossing arterial, with direct pedestrian links to the station, to allow arterial buses to cross the Busway without diverting from the arterial. This could apply in the off-peak period but is not desirable in the peak period due to the high volume of passengers either transferring between arterial and Busway routes or entering or leaving the Busway by express bus at the station. Arterial bus bay provision would be subject to property availability, road layout, and traffic conditions at the site.
- the grade-separated pedestrian link should be over the Busway unless the Busway is elevated. For Busway platforms 55 m long, the pedestrian link should be one-third of the platform length, or approximately 18 m from the head of the platform, reflecting the fact that the first two bus bays will likely be the most heavily used.
- Exhibits 8 and 9 illustrate typical Arterial type stations with all necessary components in a schematic arrangement applicable to a station site perpendicular to a crossing arterial. Exhibit 10 illustrates the same components on a site laid out parallel to the arterial road.

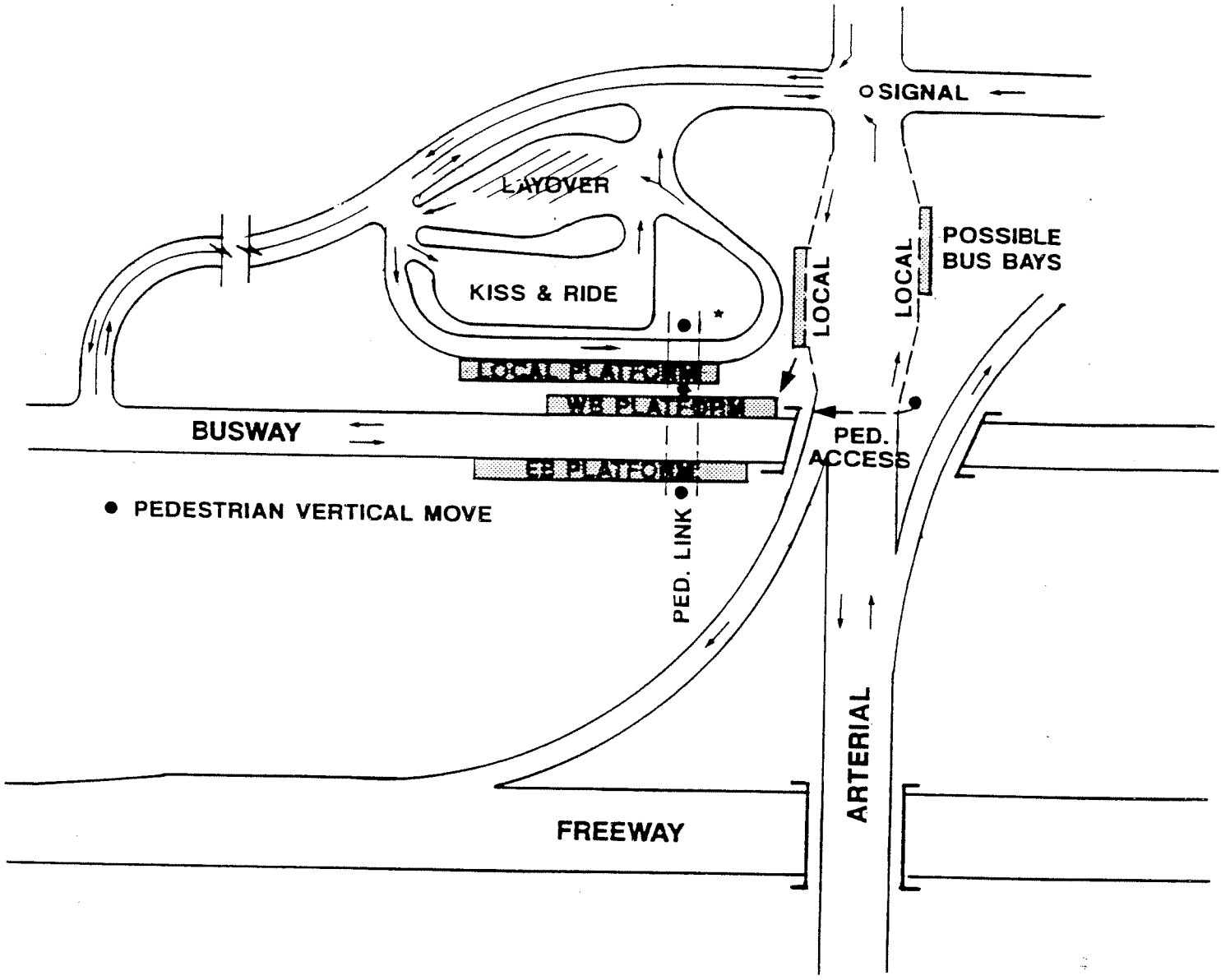
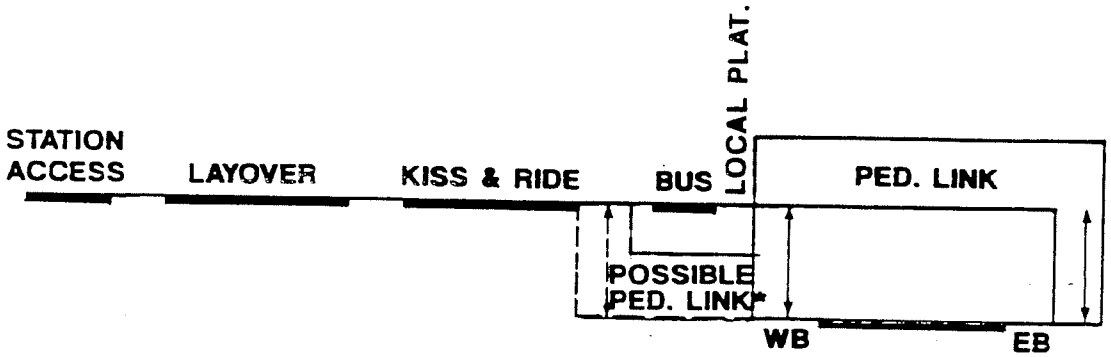


EXHIBIT 8 : "ARTERIAL" TYPE BUSWAY STATION AT CROSSING ROADWAY WITH ROADWAY LEVEL LOCAL STATION (PREFERRED)

SCHEMATIC ARRANGEMENT



* KISS & RIDE ACCESS MAY BE AT GRADE (ACROSS LOCAL BUS LANE) OR BY TUNNEL

CROSS SECTION AT PEDESTRIAN LINK

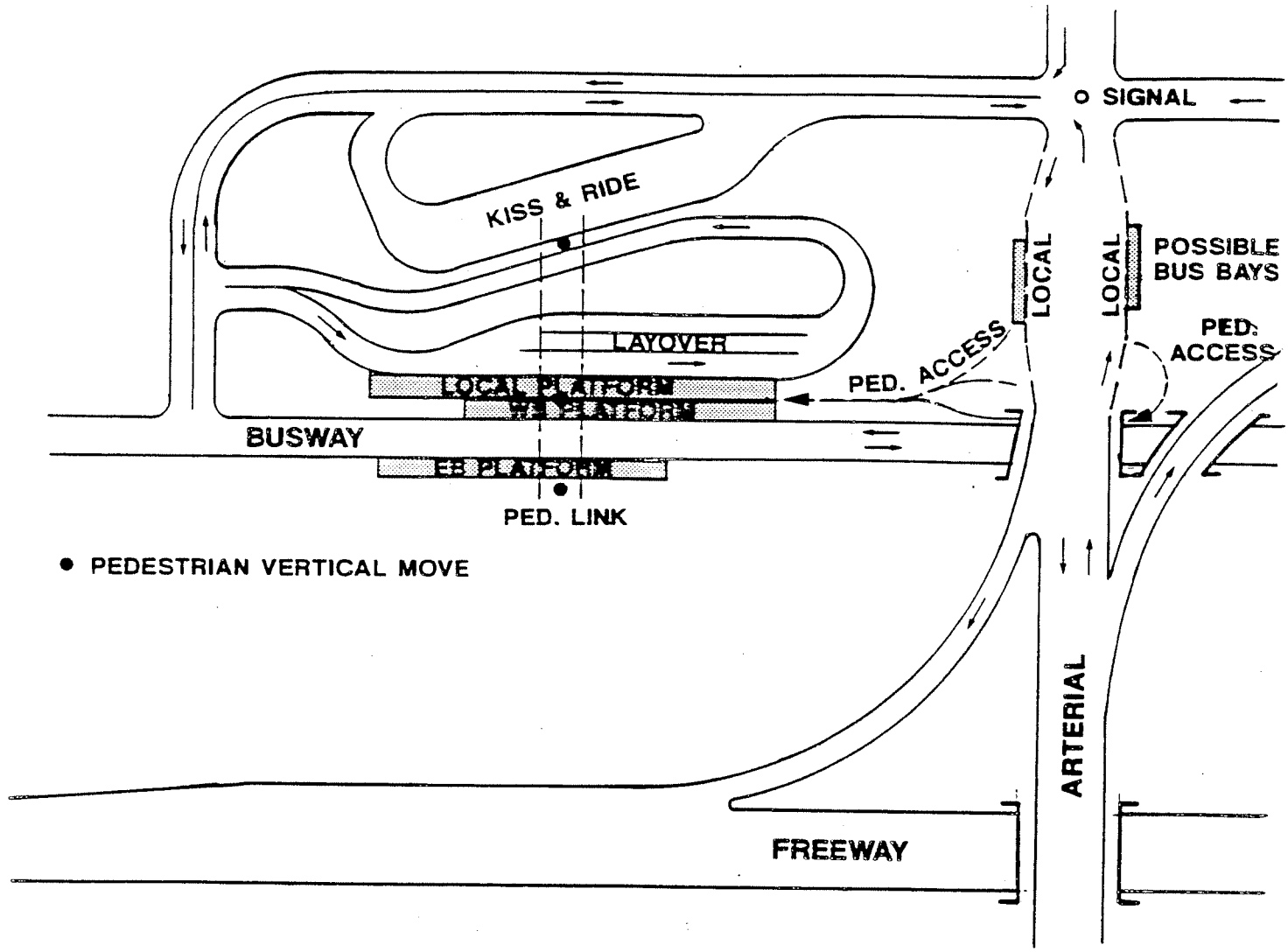
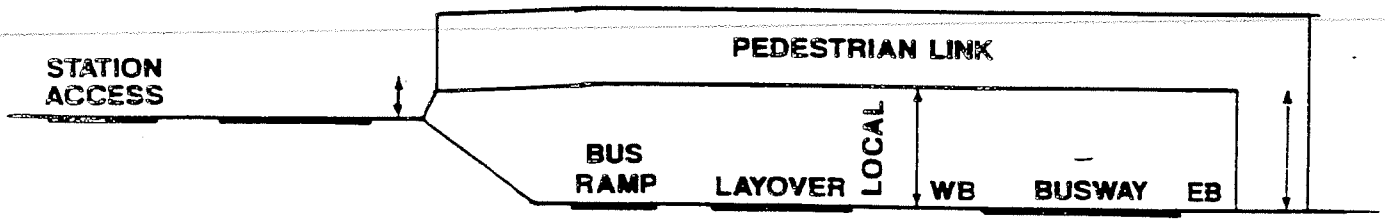
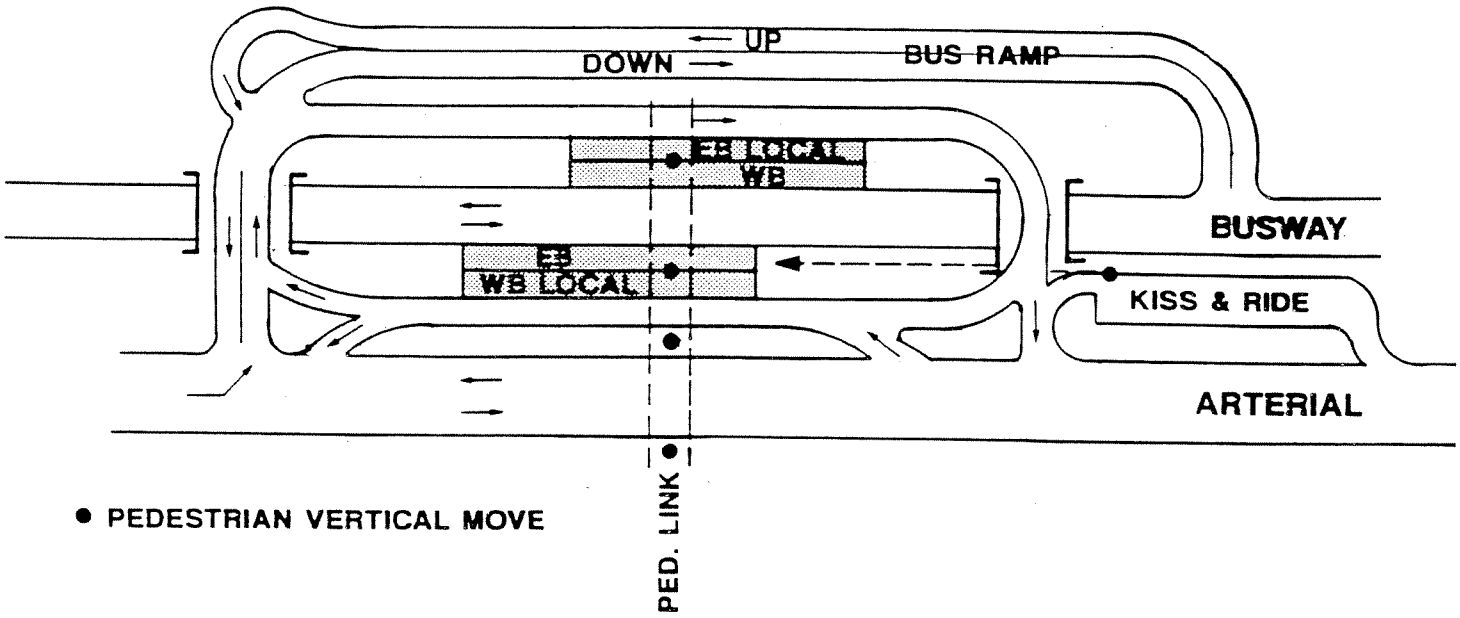


EXHIBIT 9 : "ARTERIAL" TYPE BUSWAY STATION AT CROSSING ROADWAY WITH BUSWAY LEVEL LOCAL STATION (NOT PREFERRED)

SCHEMATIC ARRANGEMENT



CROSS SECTION AT PEDESTRIAN LINK



● PEDESTRIAN VERTICAL MOVE

NOTE: WB LOCAL PLATFORM MAY BE ELIMINATED IF NECESSARY,
AND ALL LOCAL BUSES LOOP THROUGH EB LOCAL PLATFORM

EXHIBIT 10 : "ARTERIAL" TYPE BUSWAY STATION AT PARALLEL ROADWAY

"Intermediate" Type Station Planning Notes

- emphasis is on walk-in passengers and passenger transfers
- no bus ramps are required
- only two platforms are needed on the local street
- provision for a small kiss and ride area is needed; no other ancillary features are required
- Busway platforms should be located as close as possible to the street crossing point to minimize walking distance and transfer time
- Pedestrian links should connect with Busway platforms at the downstream end, since not all Busway routes will stop at Intermediate stations and those buses that do not stop, will tend to halt at the end of the platform to drop off/pick up passengers.
- Exhibits 11 and 12 illustrate schematic layouts for two types of Intermediate stations.

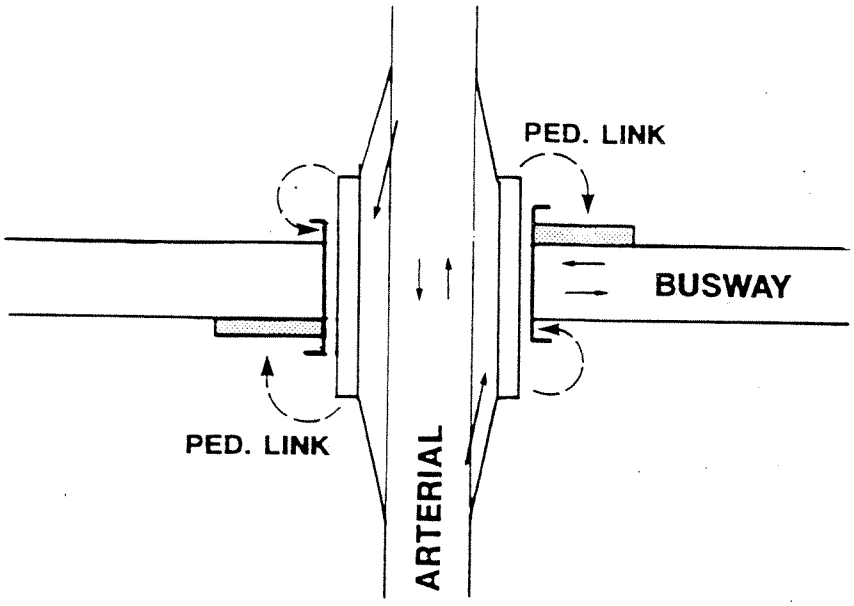


EXHIBIT 11 : "INTERMEDIATE" TYPE BUSWAY STATION AT CROSSING ROADWAY

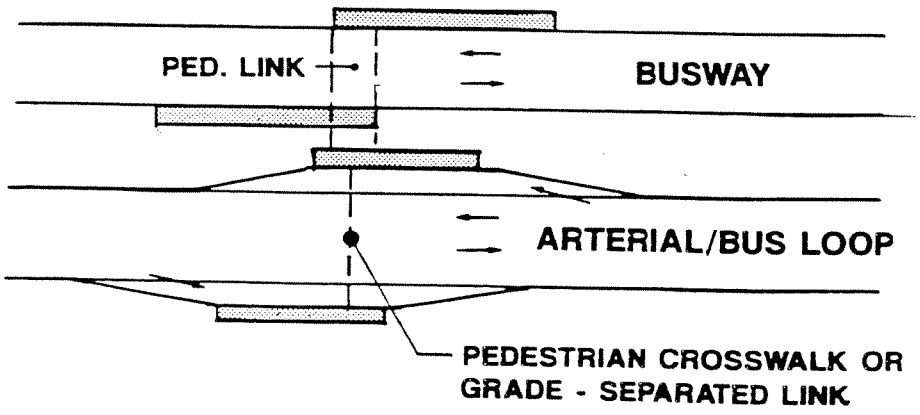


EXHIBIT 12 : "INTERMEDIATE" TYPE BUSWAY STATION AT PARALLEL ROADWAY

4. DESIGN CRITERIA OF STATION FEATURES

The basic design criteria for the Mississauga Busway and its stations are adapted from the January 1990 draft of the Transitway Design Manual prepared by the Regional Municipality of Ottawa-Carleton. Table 5 outlines the key design criteria appropriate to Mississauga, as well as those used in several other jurisdictions for comparative purposes. Busway plan and profile are governed by the desire to protect for the ultimate possible conversion to Light Rail or Subway modes, while all local bus station elements are designed for use by buses only. A B12/16.8 m turning template is the desirable guide for local platform and roadway layout at the Arterial and Intermediate type stations. Since external carriers and intercity services such as GO Transit are anticipated to use the Gateway stations, it is appropriate to use the intercity bus standard turning template B12R/15 m (stopped condition) or B12R/20 m (in motion) for the layout of local platforms and roadways at Gateway-type stations.

Basic Busway platform length will be 55 m, with consideration of a longer platform (78 m) at the Centre Station. Protection for subway conversion requires a 150 m long tangent section at the Busway platform and a minimum 160 m radius Busway curvature. Busway station profile grade is to be between 0.5% and 1.0%, and connecting bus ramps have a maximum gradient of 6% (although 5% is the desirable maximum). Vertical clearance from the Busway to any overhead structure should be at least 4.7 m to protect for an overhead catenary-powered mode to be used if appropriate in the long term. All other off-line structures should follow the Ontario Highway Bridge Design Code for minimum clearances.

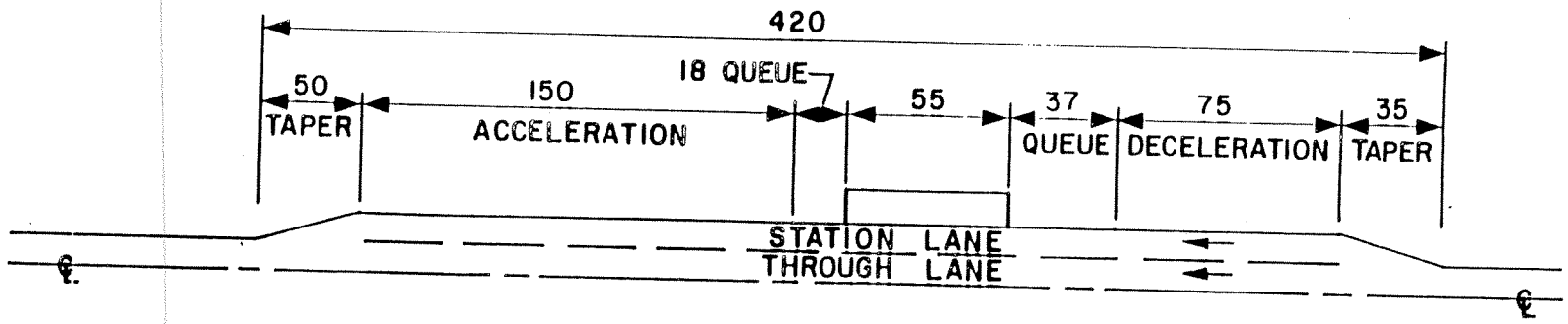
A fixed barrier shall be located on the centre line of the Busway at each station to prevent pedestrian crossings. It should extend 15 m past the end of each platform. Busway platforms should be straight, and in order to preserve flexibility for a variety of possible transit vehicles and to ensure platform safety, all platforms should be 0.15 m high. If sawtooth bays are used at local platforms, they should accommodate the 18 m articulated buses now in use.

Park and Ride and Kiss and Ride facilities should be laid out where possible to GO Transit standards. All Park and Ride facilities should be designed to accommodate paid parking operation.

A variety of relevant design guidelines from Ottawa-Carleton and GO Transit follow for reference. Use of the original respective design manuals for points of clarification or station features not shown here is recommended.

TABLE 5: SUMMARY OF KEY TRANSIT SYSTEM DESIGN CRITERIA

SYSTEM / DESIGN CRITERIA	BUSWAY		RAIL TRANSIT				HIGHWAY	
	OTTAWA TRANSITWAY	PITTSBURGH TRANSITWAY	CALGARY LRT	TORONTO SUBWAY	TORONTO LRT	SCARBOROUGH ICTS	MTO HIGHWAY/ UAU80	MISSISSAUGA BUSWAY
GEOMETRIC DESIGN								
DESIGN SPEED - MAINLINE	80 km/h	80 km/h	80 km/h	80 km/h	80 km/h	80/km/h	80 km/h	80 km/h ←
- STATIONS	50 km/h	-	-	-	-	-	-	50 km/h ←
MINIMUM RADIUS (STANDARD)	250 m	as avail.	300 m	305 m	-	35 m	250 m	250 km/h
MINIMUM RADIUS (PRACTICE)	90 m (Stns.)	as avail.	75 m (Street)	150 m ±	-	20 m (Yard)	-	160 m Busway
MAXIMUM GRADIENT - ONLINE	3.5%	4%	6.0%	3.5%	6.0%	6.0%	5.0%	3.5% Busway
- OFFLINE	6%	6%	6.0%	-	-	-	-	6% Ramps (5% Desirable)
- IN STATION	0.35%	-	0.30% (1.5% max)	-	-	1.0%	-	0.5% Min.; 1% Max.
GRADE SEPARATION	Initial			Initial	At Grade	Initial	N/A	Initial
TURNING TEMPLATE (BUS) - LOCAL PLATFORMS INTERSECTIONS, ETC.	B12/16.8>15km/h B12/12.2<15/km/h	-	-	B12/18.3 Des. B12/16.8 Min.	Same	Same	B12R/20 (moving)(GO) B12R/15 (Stop)	B12R-Gateway Stns. B12/16.8 Elsewhere
CROSS-SECTION								
VERTICAL CLEARANCE - SLAB	5.0 m (4.5 m)	5.0 Des. 4.4 m Min.	4.6 m	3.965 m	4.7 m	3.6 m	4.65 m	4.7 m
- GIRDER	5.0 m		-	3.965 m	4.7 m	3.6 m	5.0 m	-
- PED.	5.3 m		-	3.965 m	4.7 m	3.6 m	5.3 m	-
LANE WIDTH	3.5 m	3.65 m	-	-	-	-	3.75 m	
RAMP WIDTH	5.0 m	3.65 m	-	-	-	-	4.75 m	
SECTION WIDTH (E/Sh - E/Sh)	13.0 m	12.2 m		12.8 m				As Per Ottawa Standards
MINIMUM SECTION WIDTH	13.0 m	7.3 m	8.46 m		8.23 m	8.72 m	12.5 m	
SECTION WIDTH AT STATION (BACK OF PLATFORM TO BACK OF PLATFORM)	29.0 m	-	- (Side)	14.730 m	11.520 m	11.3 m (Grade)	-	
		(Centre)	14.56 m (Centre)	17.130 m		12.13 m (Elev.)		17.0 m + Platforms
FLEXIBILITY								
CONVERSION TO OTHER MODE	Vert: LRT Horiz: HRT Struct: HRT	Struct - LRV	-	No	No	No	-	Vert: LRT Horiz: HRT Struct: HRT
STATIONS								
PLATFORM LENGTH - ONLINE	55 m (<100 Bus/h) 78 m (>100 Bus/h)		130 m ULT	150 m	50 m	84 m		55m Typ/78m if Req'd
PLATFORM WIDTH - SIDE	6.0 m		3.63 m	3.5 m	2.6 m	3.0 m		4.35 m Std. /
- CENTRE	-		7.28 m	9.0 m		6.0 m		6 m - Gateway
FARE COLLECTION	On Bus			Station		Station		On-Bus (Possibly Off-bus at Gateways)
VEH/PED. GRADE SEPARATION	Yes		No-On Street Yes-In Row	Yes	No	Yes		Busway - Yes Local Platform - Goal
LOCAL BUS PLATFORM								
TANGENT LENGTH AT STATION	110 m		160 m	150 m				150 m
VEHICLE CAPACITY (DESIGN)	90		780	1457	260 (2 Cars)	600		90
OTHER								
DESIGN CRITERIA NOT LISTED ABOVE								Use Ottawa Transitway Design Manual (Jan.1990 Draft Version)



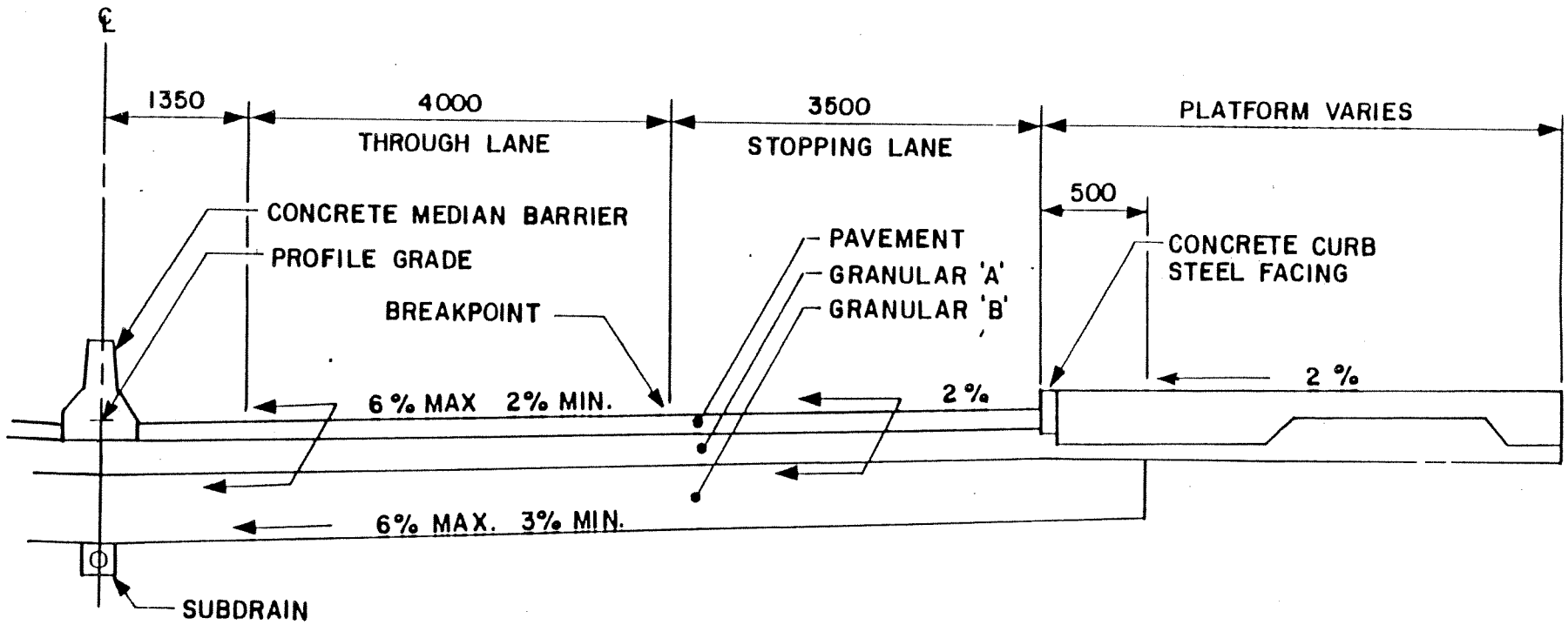
SOURCE: OTTAWA-CARLETON

CITY OF MISSISSAUGA

BUSWAY DESIGN CRITERIA

EXHIBIT 13

STATION AREA LANE ARRANGEMENT



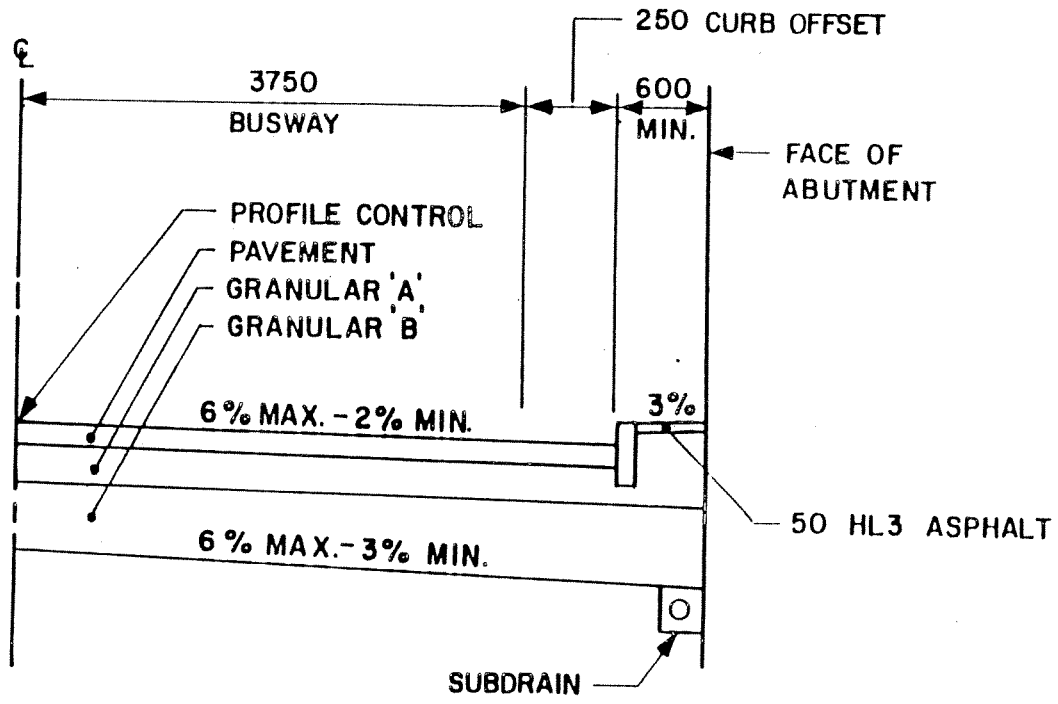
SOURCE: OTTAWA-CARLETON

CITY OF MISSISSAUGA

BUSWAY DESIGN CRITERIA

EXHIBIT 14

SECTION AT STATION PLATFORM



SOURCE: OTTAWA-CARLETON

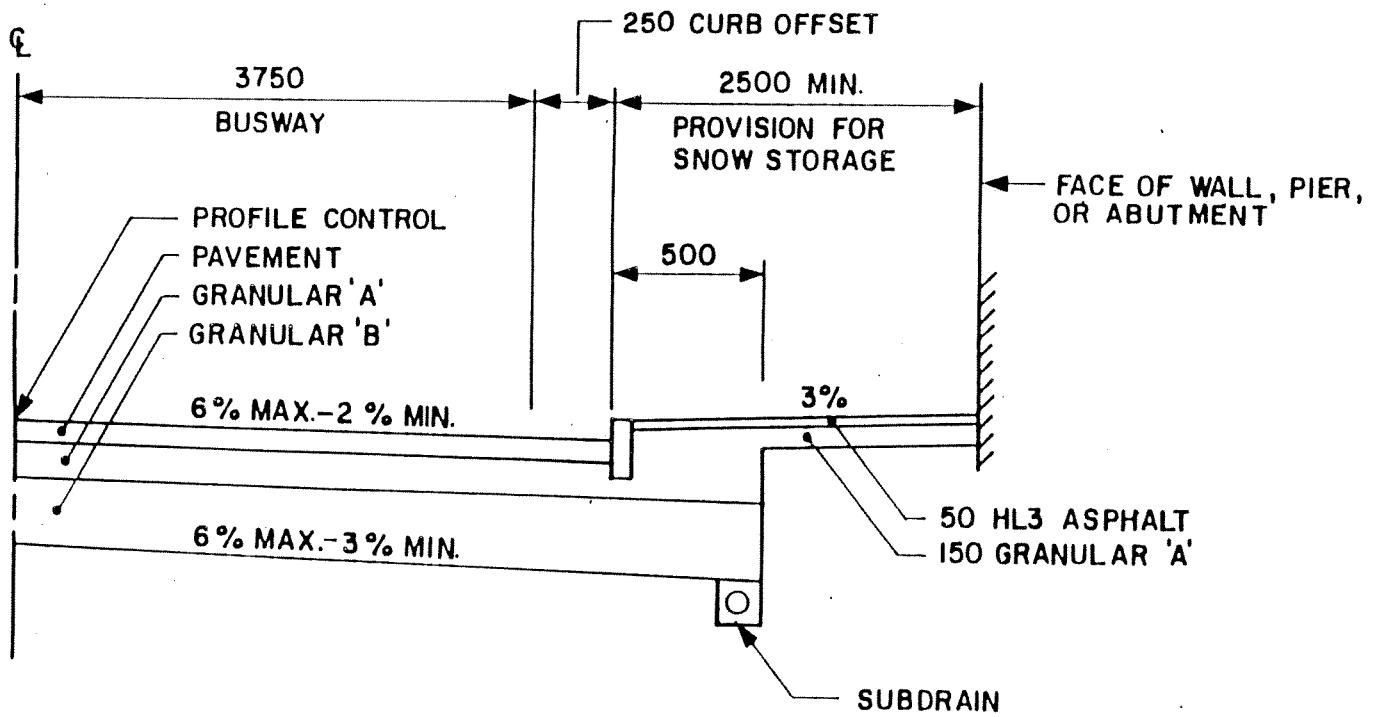
CITY OF MISSISSAUGA

BUSWAY DESIGN CRITERIA

EXHIBIT 15

URBAN CUT OR FILL SECTION

CLOSED DRAINAGE AT CLOSED STRUCTURE



SOURCE:OTTAWA-CARLETON

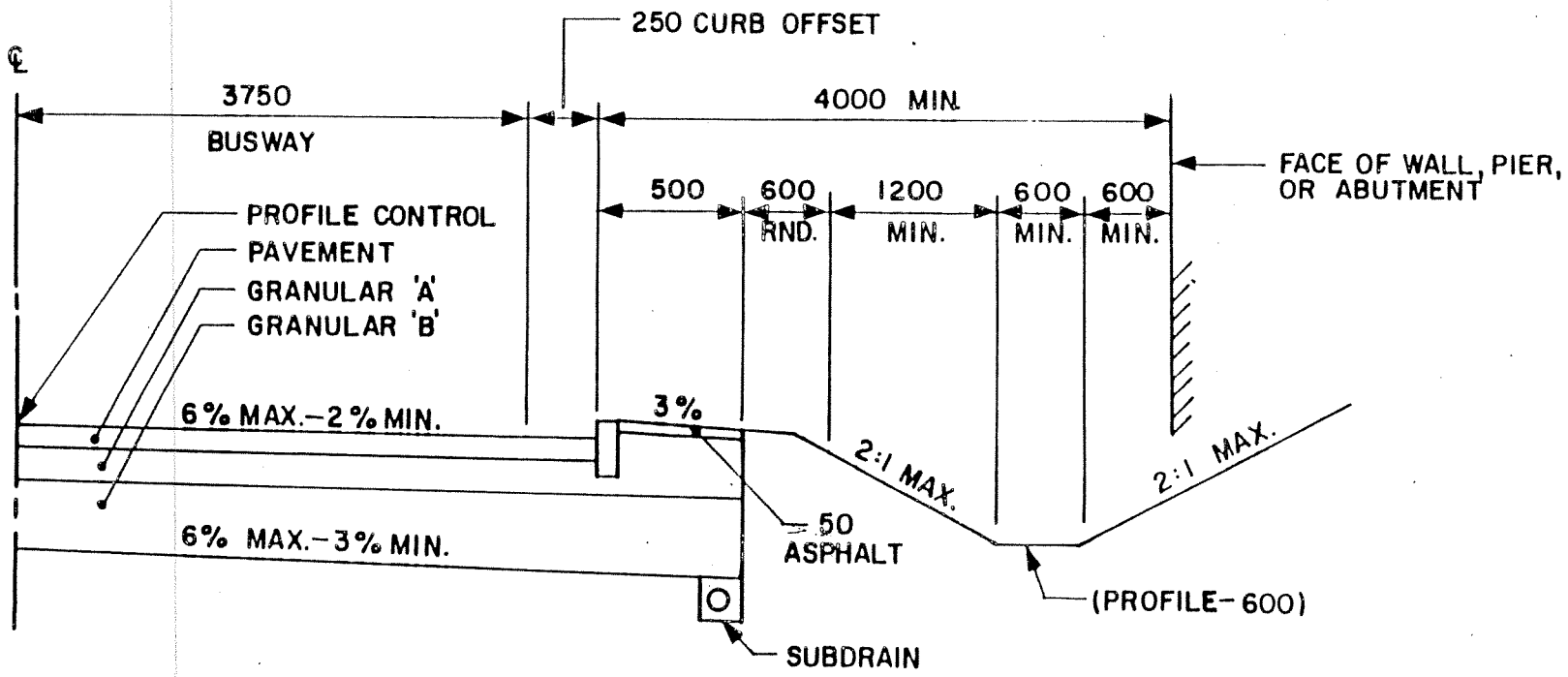
CITY OF MISSISSAUGA

BUSWAY DESIGN CRITERIA

EXHIBIT 16

URBAN CUT OR FILL SECTION

CLOSED DRAINAGE RESTRICTED R.O.W.



SOURCE: OTTAWA-CARLETON

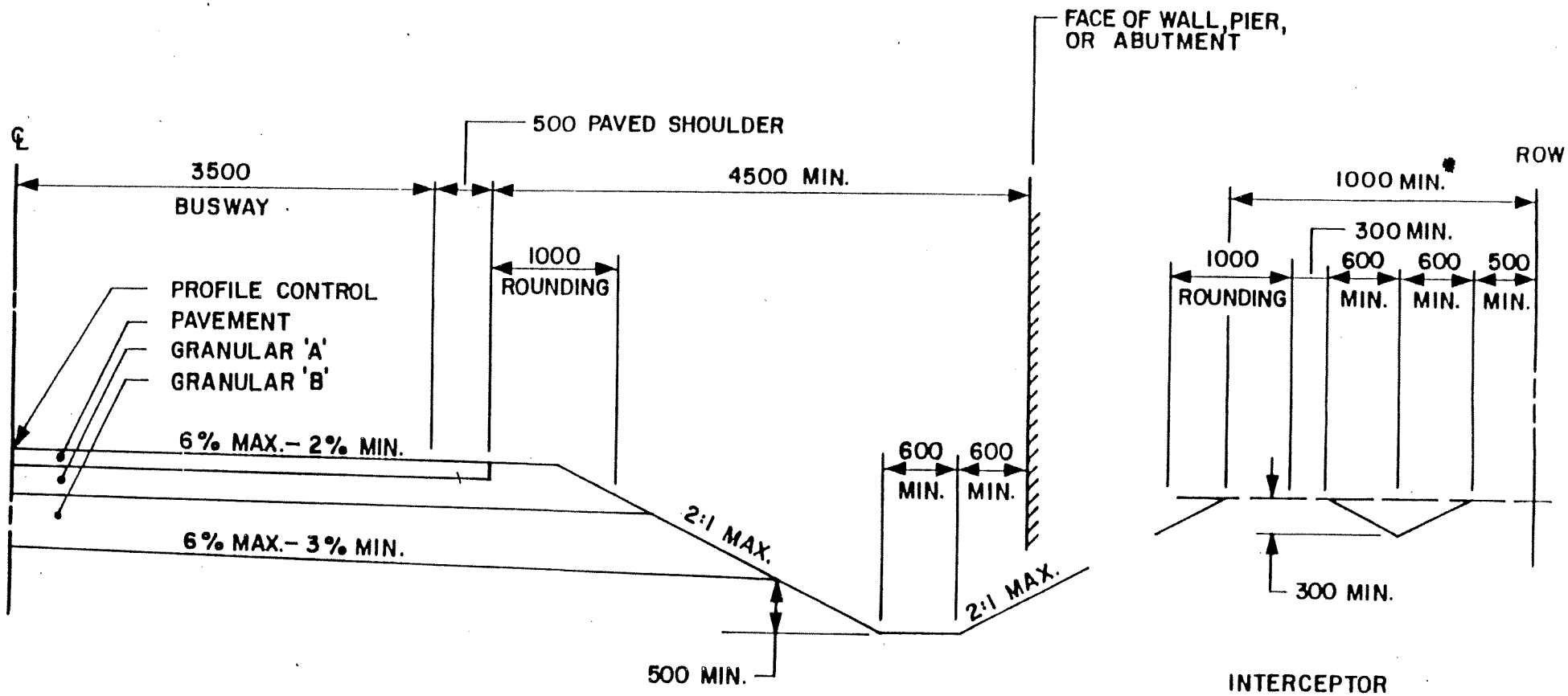
CITY OF MISSISSAUGA

BUSWAY DESIGN CRITERIA

EXHIBIT 17

URBAN CUT SECTION

CLOSED DRAINAGE



INTERCEPTOR
DITCH DETAIL
(AS REQUIRED)

* WHERE NO DITCH REQUIRED

SOURCE: OTTAWA-CARLETON

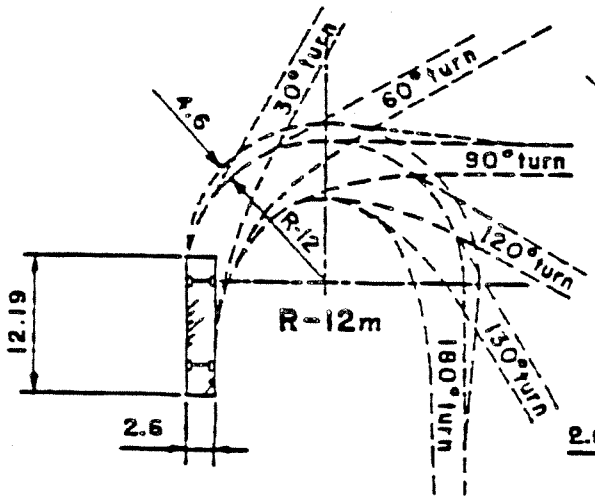
CITY OF MISSISSAUGA

BUSWAY DESIGN CRITERIA

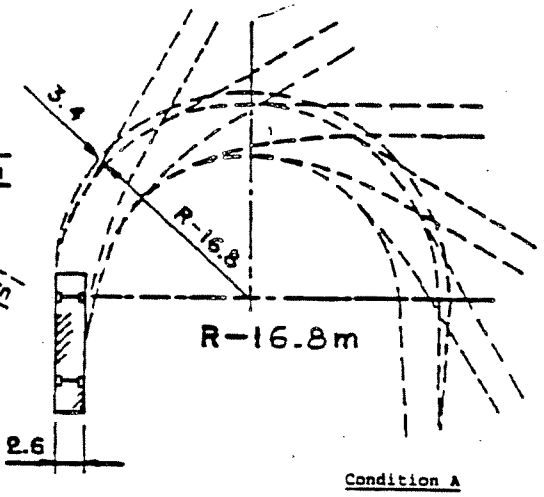
EXHIBIT 18

RURAL CUT SECTION
OPEN DRAINAGE

condition 'a'



condition 'b'



Condition A

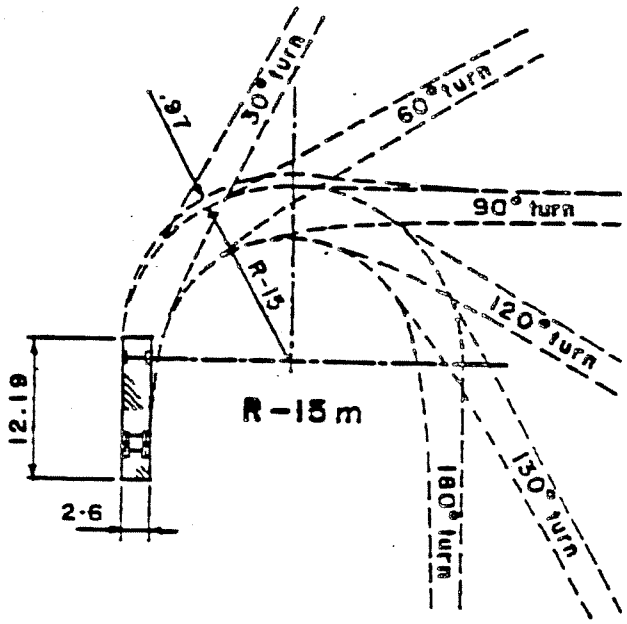
The vehicle commences a turn from a stationary position (e.g. from a stop sign on to an access road).

Condition B

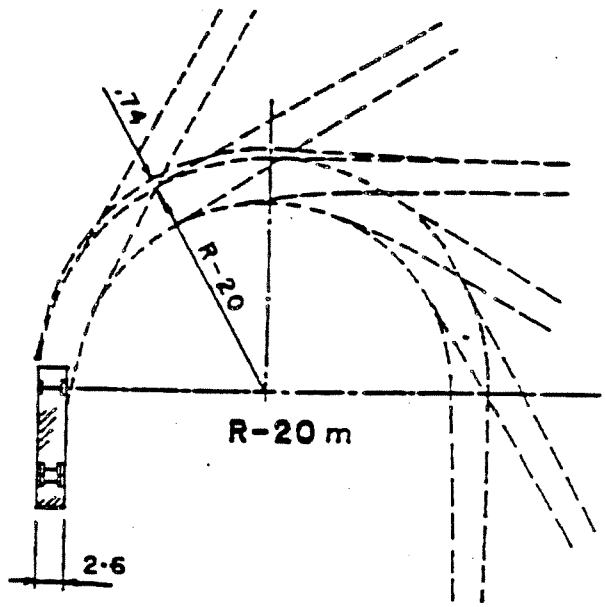
The vehicle commences a turn at speeds between 15 and 25 kph (e.g. from left or right side of an access road into a bus loop).

B-12 DESIGN VEHICLE TURNING RADIUS

condition 'a'



condition 'b'



B-12R DESIGN VEHICLE TURNING RADIUS

SOURCE : GO TRANSIT

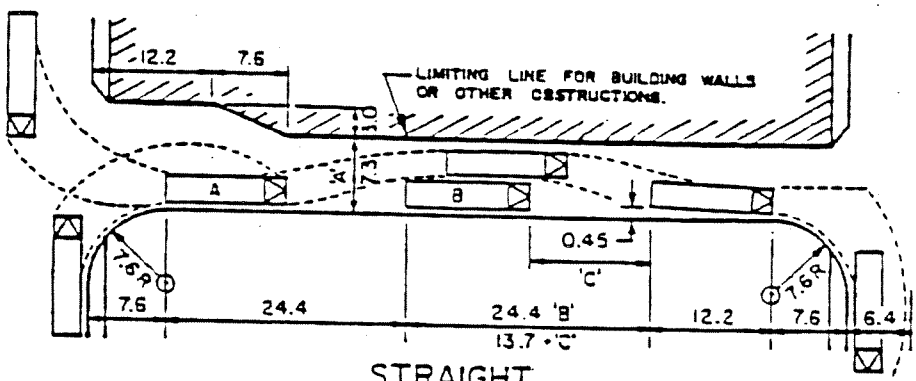
CITY OF MISSISSAUGA

BUSWAY DESIGN CRITERIA

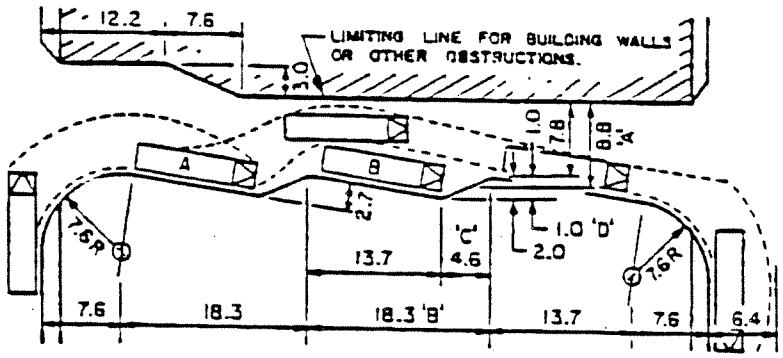
EXHIBIT 19

DESIGN VEHICLE TEMPLATES

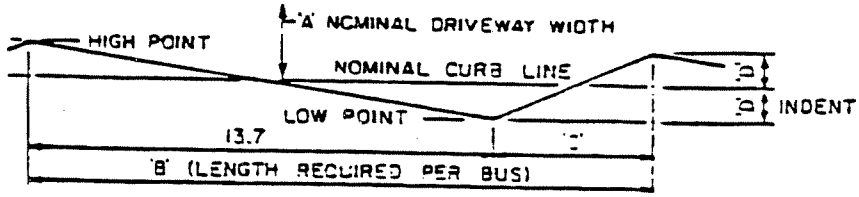
NOTE:
- ALL DIMENSIONS ARE METRES



STRAIGHT



SAWTOOTH (MAXIMUM INDENT)



PREFERRED

'A'	7.3	7.6	7.9	8.2	8.5	8.8
'B'	24.4	23.2	21.9	20.7	19.5	18.3
'C'	10.7	9.5	8.2	7.0	5.8	4.6
'D'	0.0	0.2	0.4	0.6	0.8	1.0

DIMENSIONS FOR VARIOUS INDENTS

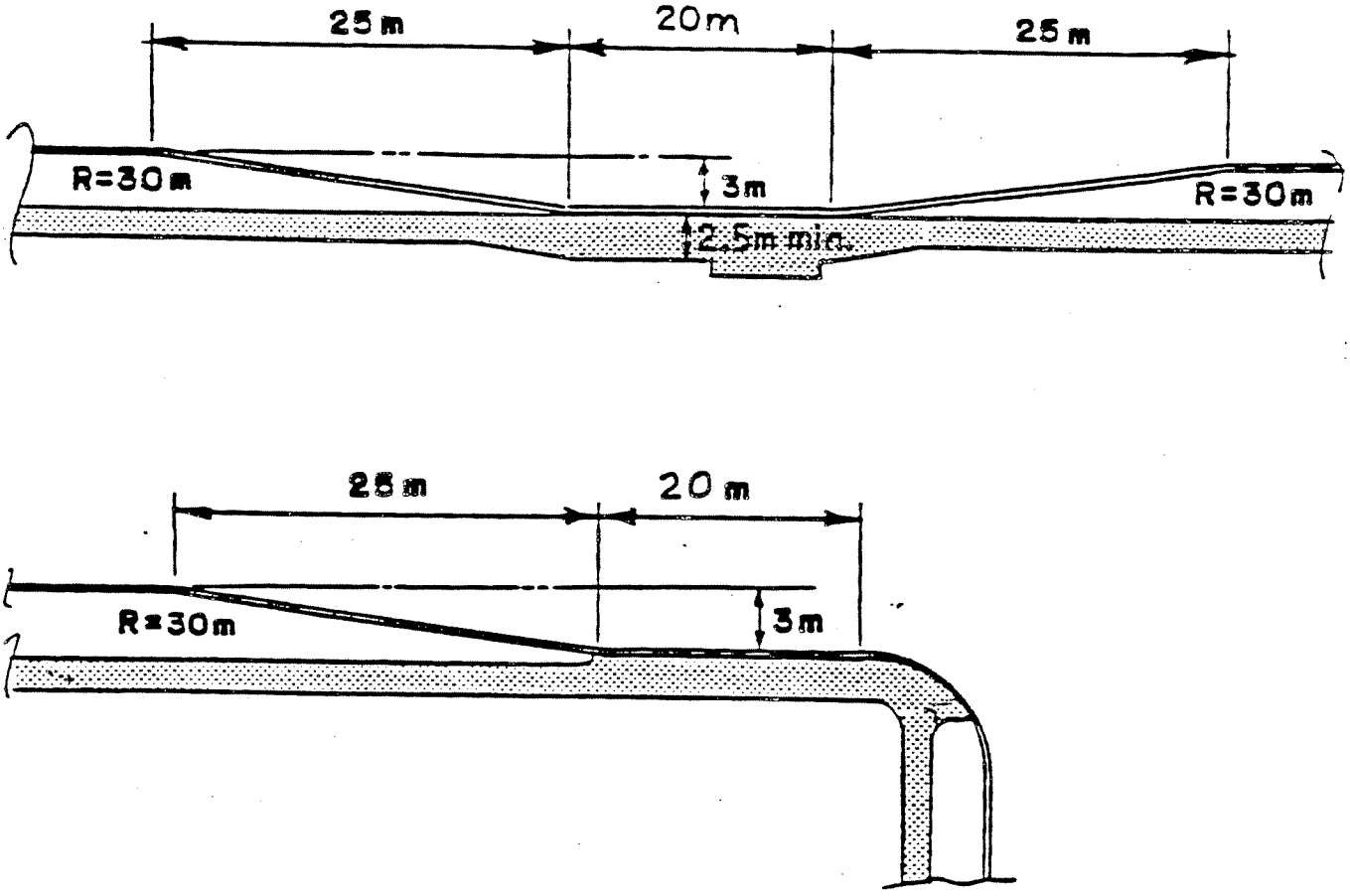
SOURCE: GO TRANSIT

CITY OF MISSISSAUGA

BUSWAY DESIGN CRITERIA

EXHIBIT 20

TYPICAL SPACE REQUIREMENTS FOR LOCAL BUS PLATFORMS



SOURCE: GO TRANSIT

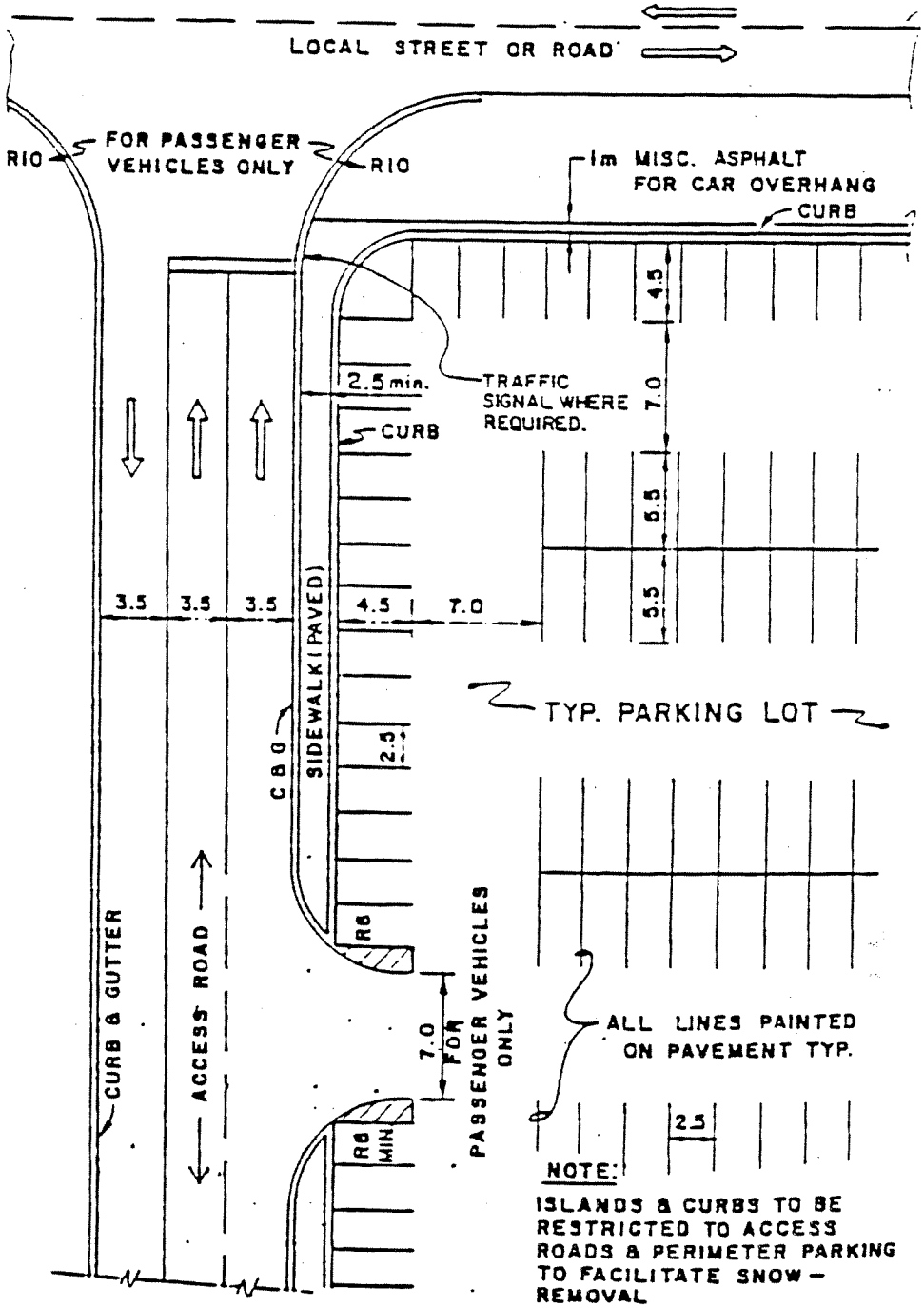
CITY OF MISSISSAUGA

BUSWAY DESIGN CRITERIA

EXHIBIT 21

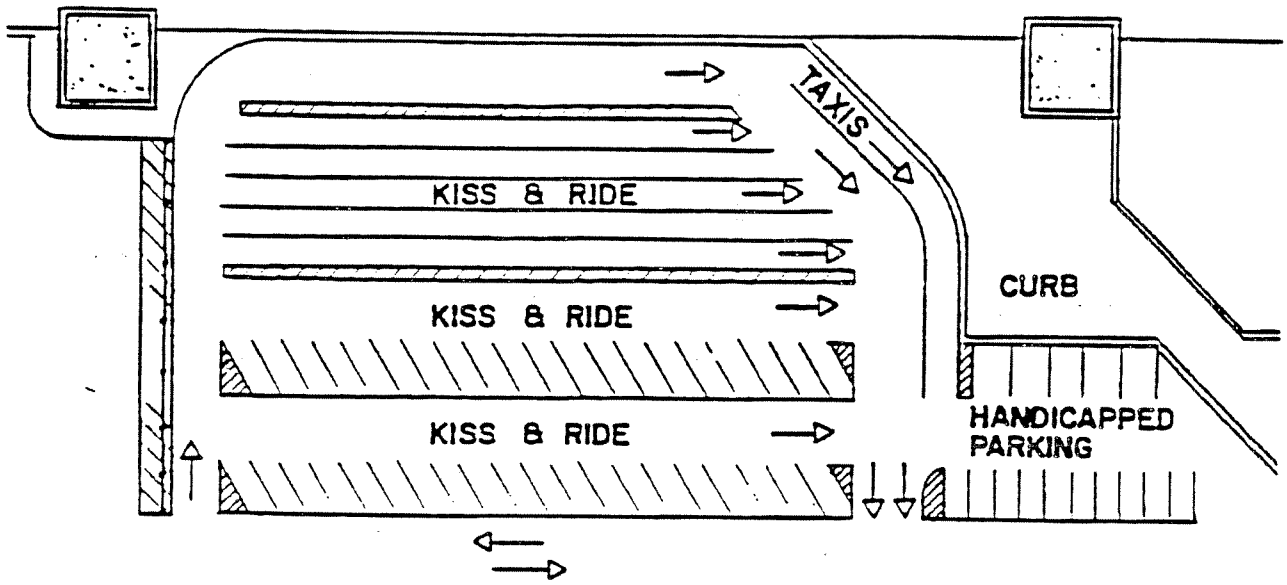
DESIGN CHARACTERISTICS

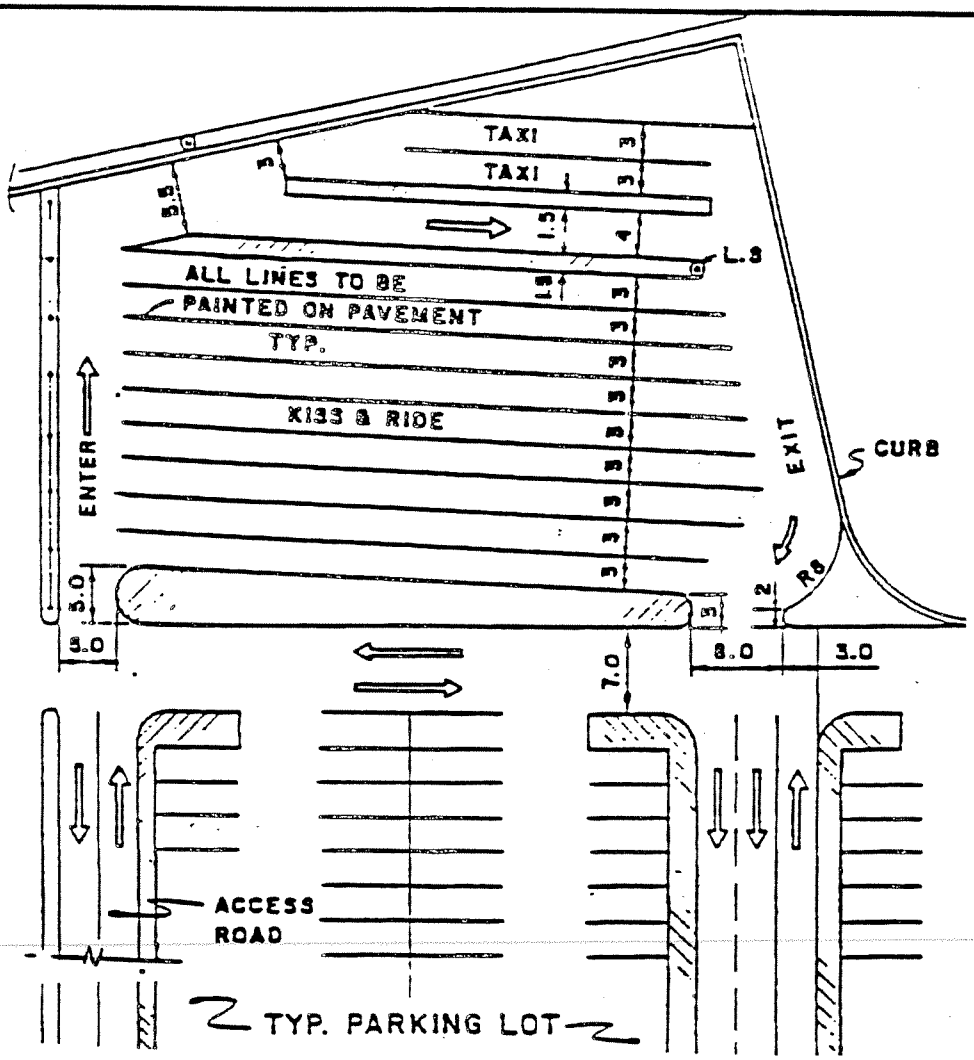
OF ON-STREET BUS BAY



SOURCE: GO TRANSIT

CITY OF MISSISSAUGA **BUSWAY DESIGN CRITERIA**	**EXHIBIT 22** **GEOMETRIC DESIGN DATA** **PARKING LOT**





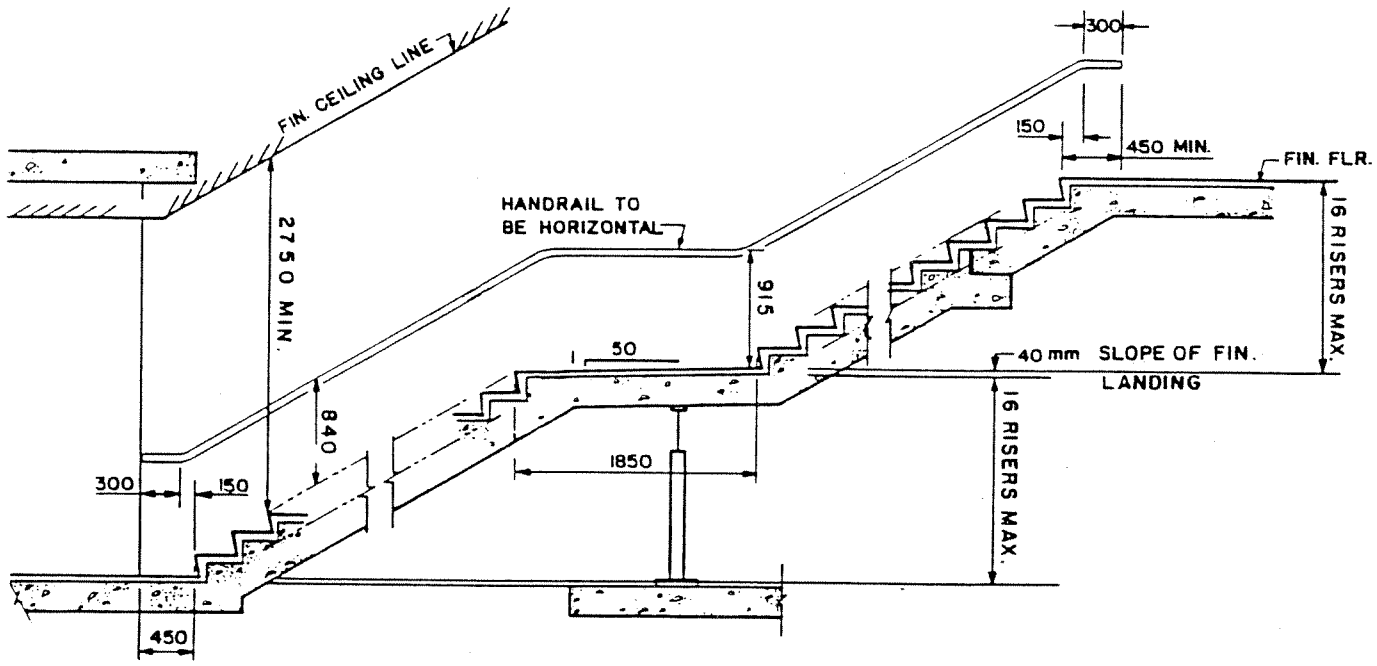
SOURCE: GO TRANSIT

CITY OF MISSISSAUGA

BUSWAY DESIGN CRITERIA

EXHIBIT 23

GEOMETRIC DESIGN DATA
KISS AND RIDE LOT



NOTES:

1. STAIR — RISERS TO BE 165 TO 170
   — TREADS TO BE 280 TO 285
2. LANDING LENGTHS — ONE LANDING 1850 (AS SHOWN)
   — TWO LANDING 1200

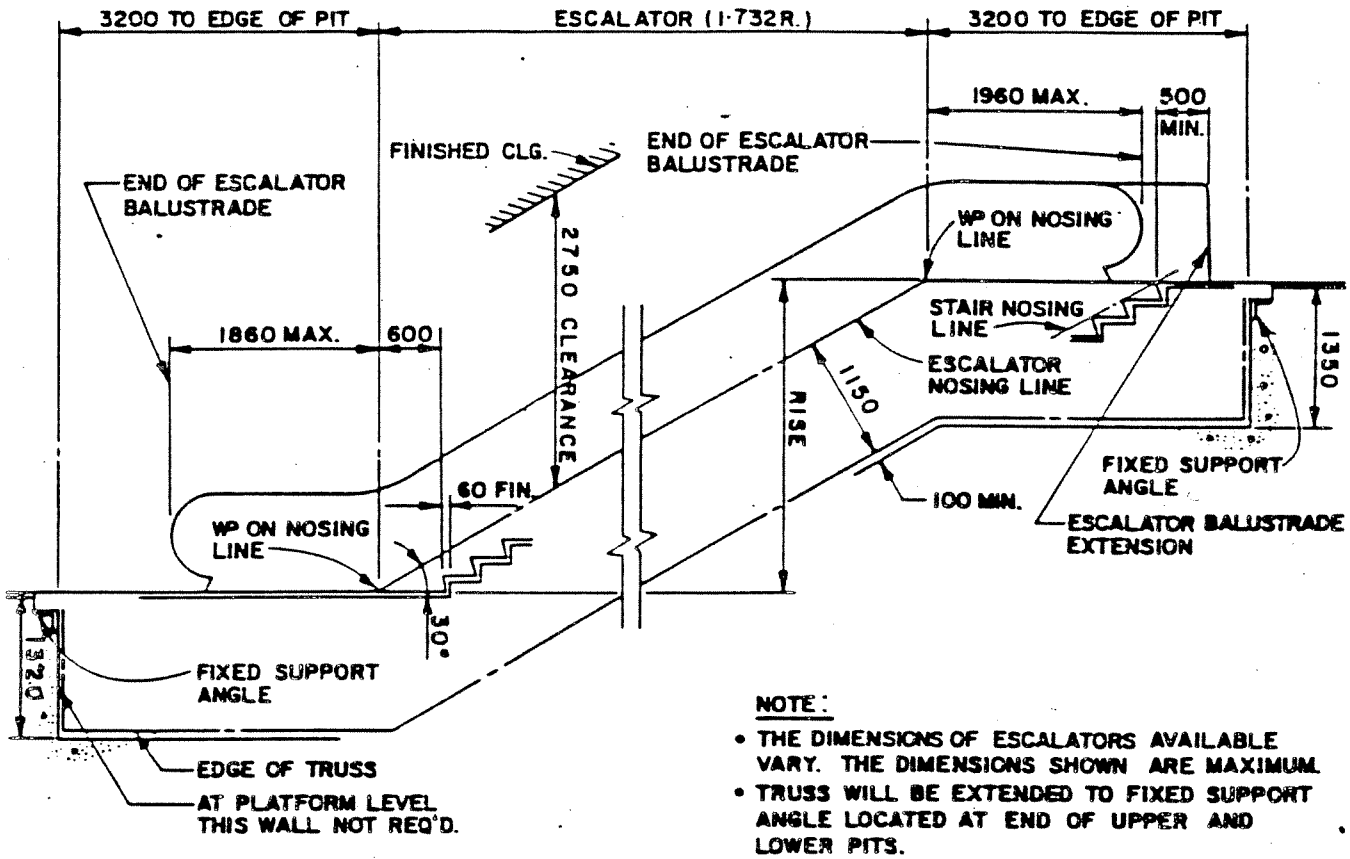
SOURCE: TTC

CITY OF MISSISSAUGA

BUSWAY DESIGN CRITERIA

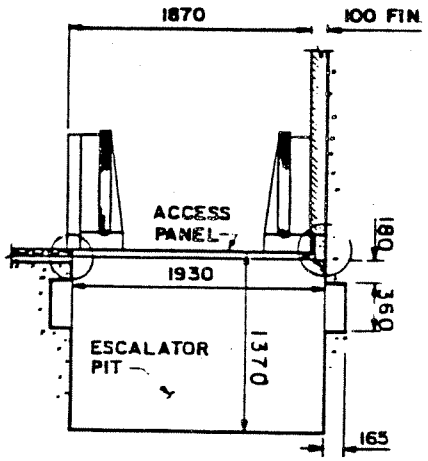
EXHIBIT 24

STAIR DETAILS



NOTE:

- THE DIMENSIONS OF ESCALATORS AVAILABLE VARY. THE DIMENSIONS SHOWN ARE MAXIMUM.
- TRUSS WILL BE EXTENDED TO FIXED SUPPORT ANGLE LOCATED AT END OF UPPER AND LOWER PITS.



SECTION

SOURCE: TTC

CITY OF MISSISSAUGA BUSWAY DESIGN CRITERIA	EXHIBIT 25 ESCALATOR DETAILS

5. DEMAND ASPECTS OF STATION PLANNING

Each of the station types and schematic layouts proposed for the Mississauga Busway may be considered independent of variations in user demand levels, however some specific design components such as platforms are directly related to passenger and/or bus volumes.

It is appropriate at this early stage in Busway planning to protect for, or be flexible enough to accommodate, ultimate (2021) bus and passenger projected volumes. It should also be recognized that at certain station sites (e.g. City Centre) interim (pre-Busway) bus route plans may require a greater number of local platform bays than in the ultimate when the Busway routes supersede some of the surface routes.

Specific elements that may be significantly affected by variations in demand are summarized in Table 6, with potential protection considerations outlined.

TABLE 6: PROTECTION REQUIREMENTS FOR DEMAND-RELATED STATION DESIGN ELEMENTS

ELEMENT	PROTECTION REQUIREMENTS
Busway Platform Length	Standard length will be 55 m, adequate for 3 bus bays. Exceptions are: at low-volume "Intermediate" stations, a 40 m platform should be used, with provision to extend to 55 m; and at the City Centre station and all other stations where the ultimate number of stopping buses per hour per direction is greater than 100, a 78 m platform should be protected for.
Platform Width	At "Gateway" type stations, Busway platform width should be approximately 6.0 m. At all other stations, a width of 4.35 m should be used for both Busway platforms and local station side platforms. On-street bus waiting areas should be 2.5 m wide. Island platforms should be used for local stations where more than four bus routes use the local station; island width will depend on bus turning geometry and should be no less than 10.0 m.
Local Platform Length	All bus bays should be based on an 18 m long articulated bus. The number of bays should be equal to the ultimate number of bus routes on the arterial using the station. Protection for a minimum of two bays at Intermediate stations, two bays minimum and four bays desirable at Arterial stations, and four bays minimum at Gateway stations should be made if possible. The City Centre and Hurontario stations will be subject to special study.
Passenger Areas/ Pedestrian Links	Minimum platform area is based on 0.4 m^2/person under normal conditions. Emergency exit conditions are 0.25 m^2/person. Emergency evacuation standards are to clear the platforms in less than 4 minutes. Each platform shall have at least two exits. For each exit unit width of 0.55 m, less a buffer distance of 0.3 m from each side wall, the following exit rates apply: platforms, corridors, and ramps with less than 3% slope - 50 people/minute at 60 m/minute; and stairs, escalators, and ramps with more than 3% slope - 40 people/minute at 18 m vertical/minute. Minimum passageway width is 2.5 m and desirable width is 5.0 m.
Vertical Transportation (Passengers)	Covered stairs shall be the standard means of vertical pedestrian movement for all vertical moves. Protection for elevator access between the local platform and each Busway platform should be made at each station, to allow full transfer capability for the mobility impaired. Protection for the provision of escalators should be made at each Gateway type station and may be considered at Arterial type stations.

(Cont'd)

TABLE 6: PROTECTION REQUIREMENTS FOR DEMAND-RELATED STATION DESIGN ELEMENTS

ELEMENT	PROTECTION REQUIREMENTS
Station Configuration	Each Gateway type station should be configured, where feasible, to allow the ultimate addition of a higher order transit service in the adjacent or crossing corridor, with a minimum of station reconstruction. Consideration should be given to the following: Eglinton/Renforth: TTC interface (bus lanes, busway, LRT, subway) Airport Link (bus lanes, busway, LRT, subway, ICTS) Cawthra: Hwy. 403/Brampton Transit interface (bus lanes, busway, LRT) Hurontario: Hurontario transit corridor (bus lanes, busway, LRT) City Centre: City Centre Shuttle (bus lanes, LRT, ICTS) Winston Churchill: Oakville Transit interface (bus lanes, busway, LRT, subway) Hwy. 407 transit corridor (bus lanes, busway, LRT, subway)
Technology	The potential exists for any of the Gateway type stations to become a terminus for LRT or subway modes in the future. The potentially significant implications in terms of storage track, maintenance yards, operator facilities, and intermodal passenger transfer should be considered.
Access Road/Arterial Interchange Treatment	Busway station access for bus park and ride, and kiss and ride facilities should be designed to have a minimum impact on the ultimate level of service on the arterial. Right in/right out and grade separated moves are preferred where feasible and cost-effective. All left turns from the arterial to the bus station should occur at a signalized intersection, although consideration may be given to an unsignalized access if it is used by buses only.

APPENDIX 'R'

FUNCTIONAL PLANS AND PROFILES

MISSISSAUGA TRANSITWAY PLANNING STUDY EA REPORT

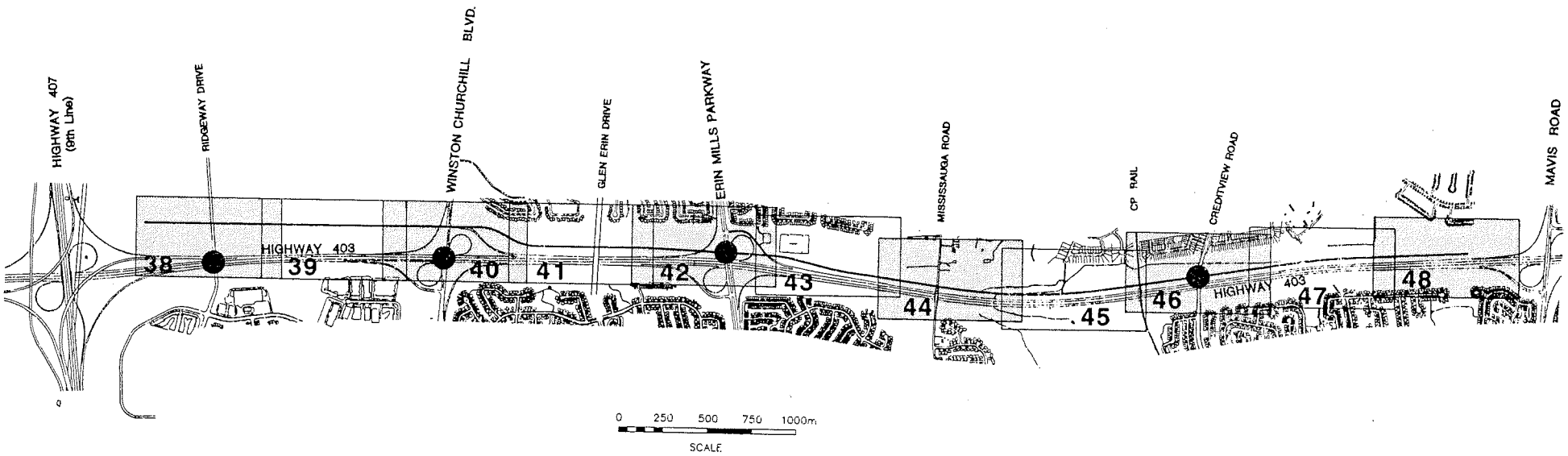
APPENDIX R - FUNCTIONAL PLANS AND PROFILES

This Appendix includes the detailed plans and profiles drawn up for the recommended Transitway facility, including stations and access ramps. Although the plans are included in Section 5 of the main body of the report, the profiles are added in this Appendix in order to document the physical feasibility of the alignment and to complete the functional planning documentation. Both plans and profiles are subject to refinement and alteration through the preliminary and detail design processes; the attached plans are intended only to serve as a basis for such future design work.

The plans and profiles were developed by three different firms working to a common standard:

IBI Group	-	West Limit to West of Mavis
McCormick Rankin	-	West of Mavis to East of Cawthra
M. M. Dillon	-	East of Cawthra to Renforth

The profiles may be related to the plans by use of the marked chainages; both are at the same horizontal scale, while a vertical exaggeration of 10X is introduced to the profile in order to clarify its geometry. It should be noted that the chainage within each of the three sections is defined independently from that of the adjacent section.



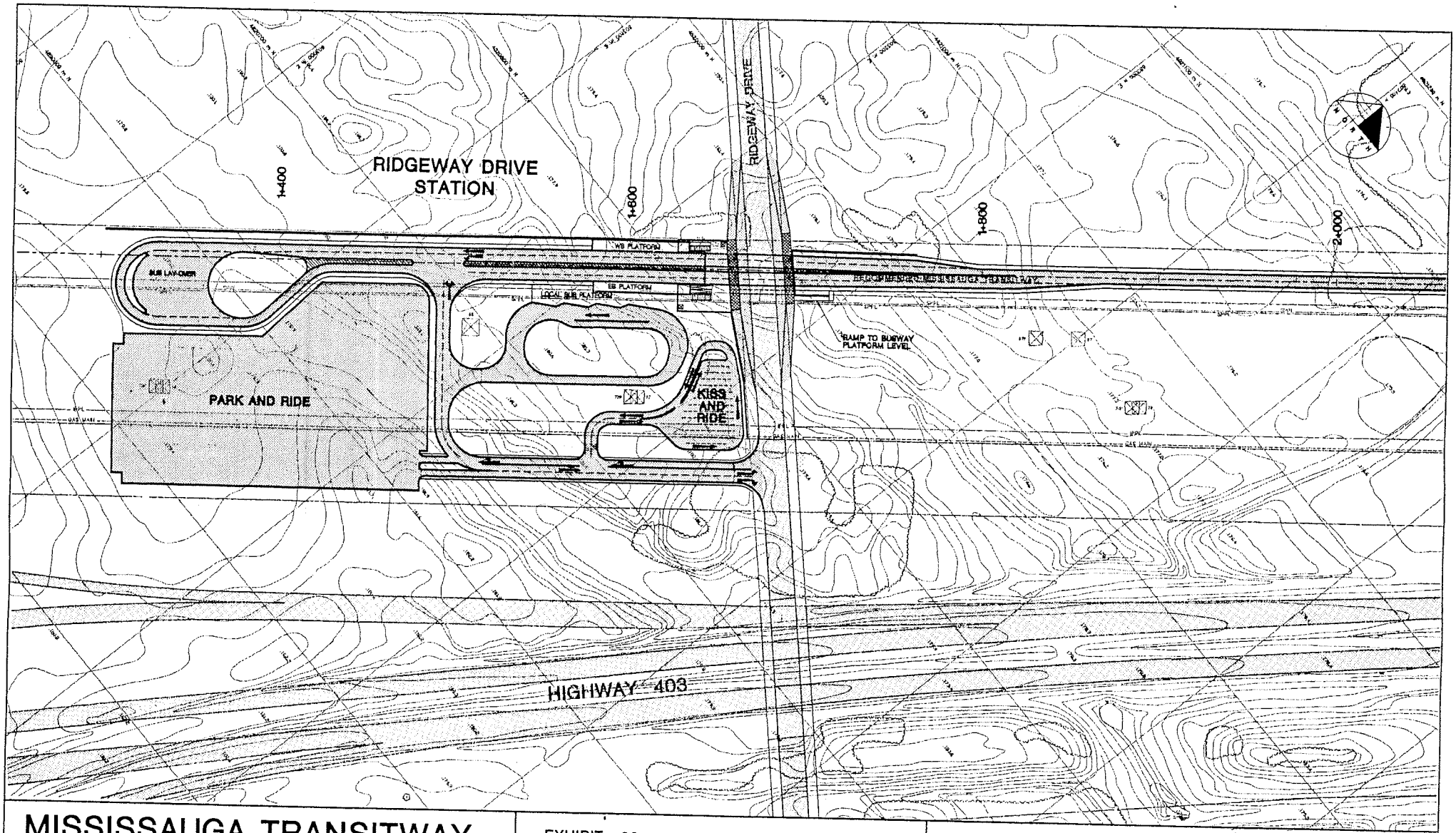
RECOMMENDED MISSISSAUGA TRANSITWAY — STATION

RECOMMENDED PLAN EXHIBIT No. 46

MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT 37

KEY PLAN
NINTH LINE TO MAVIS ROAD



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

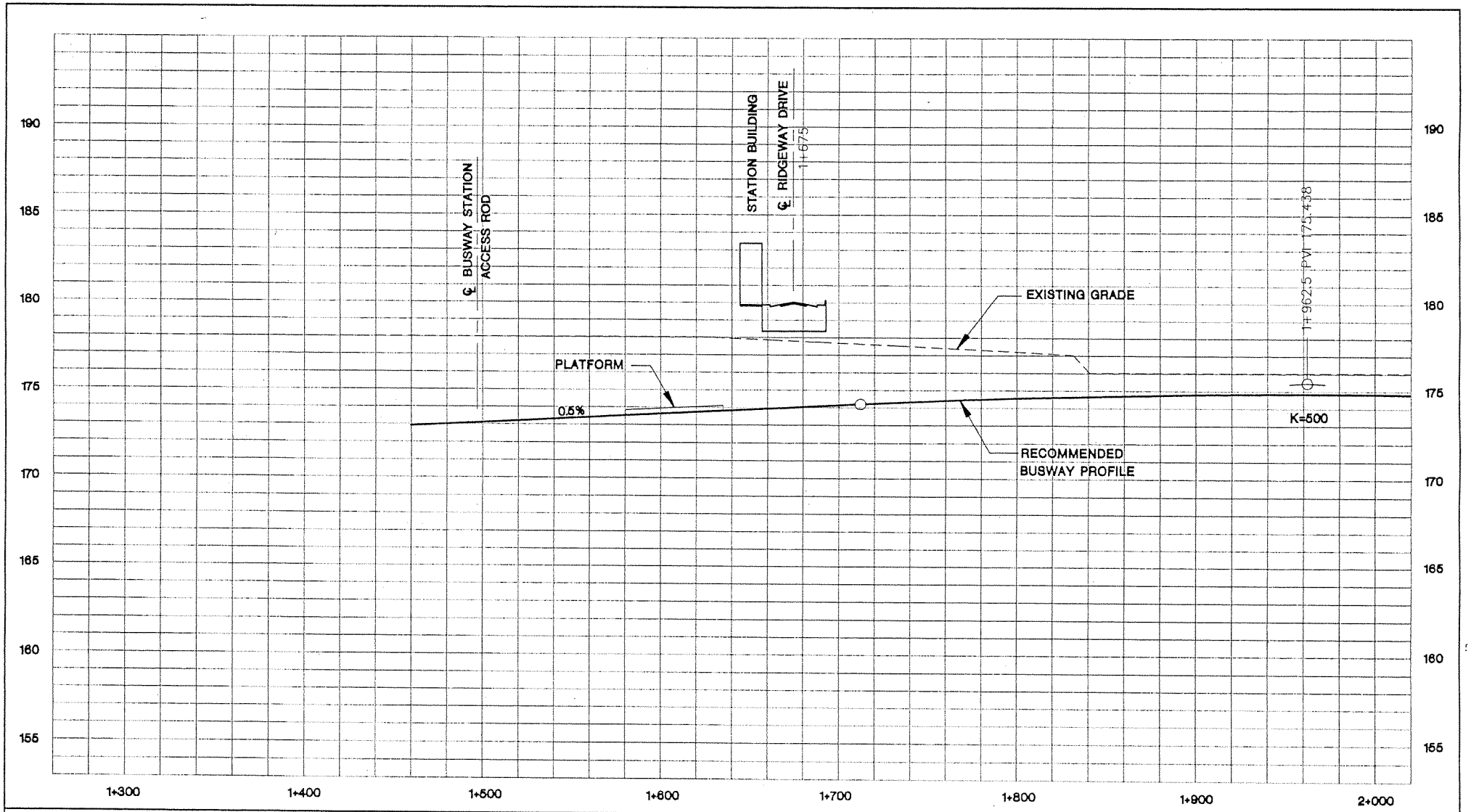
EXHIBIT 38

0 50 100 150 200

SCALE

RECOMMENDED PLAN

Sta. 1+300 to Sta. 2+000



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

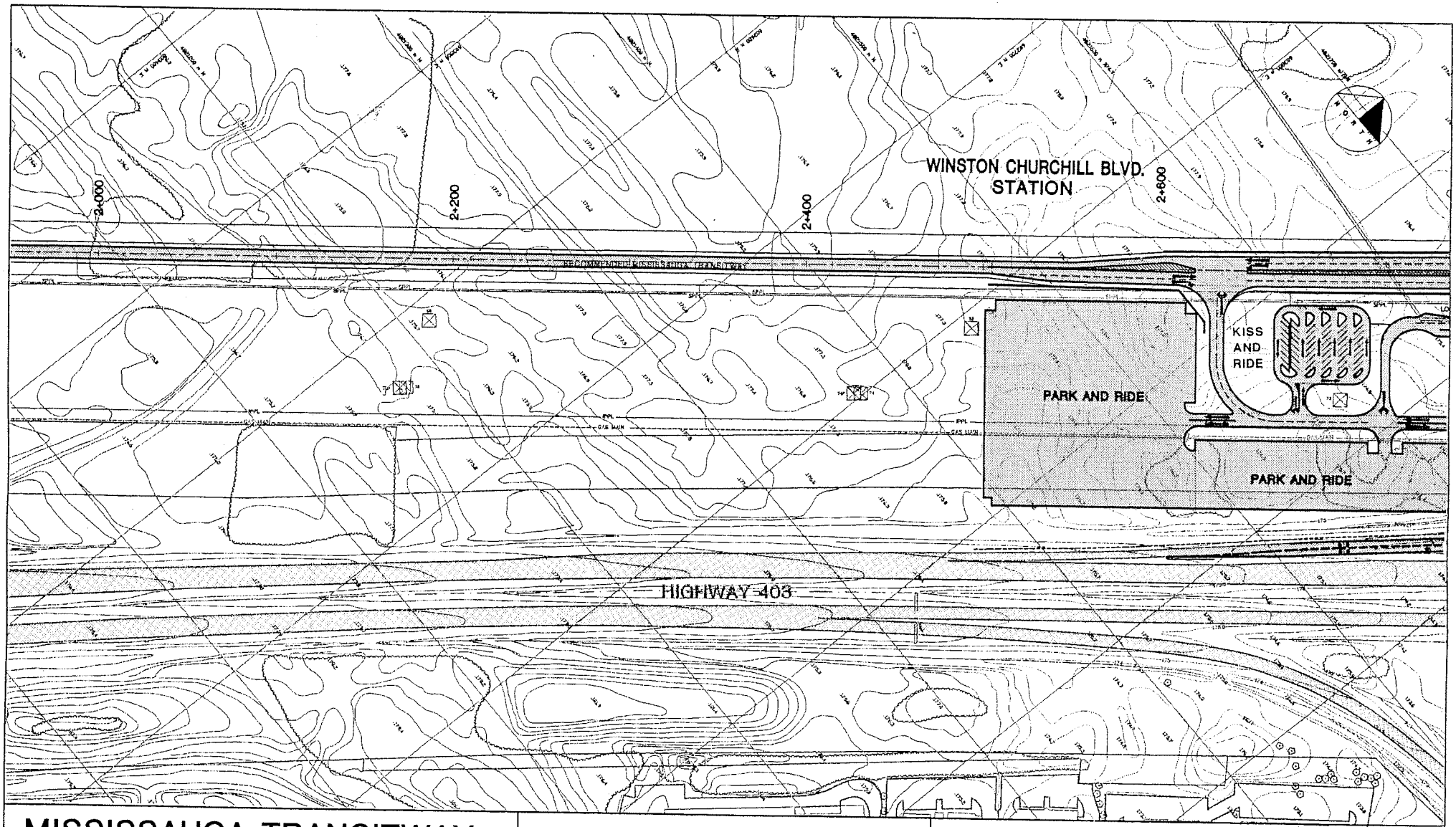
EXHIBIT

HOR. 0 50 100 150 200

VER. 0 5 10 15 20

RECOMMENDED PROFILE

Sta. 1+300 To Sta. 2+000



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

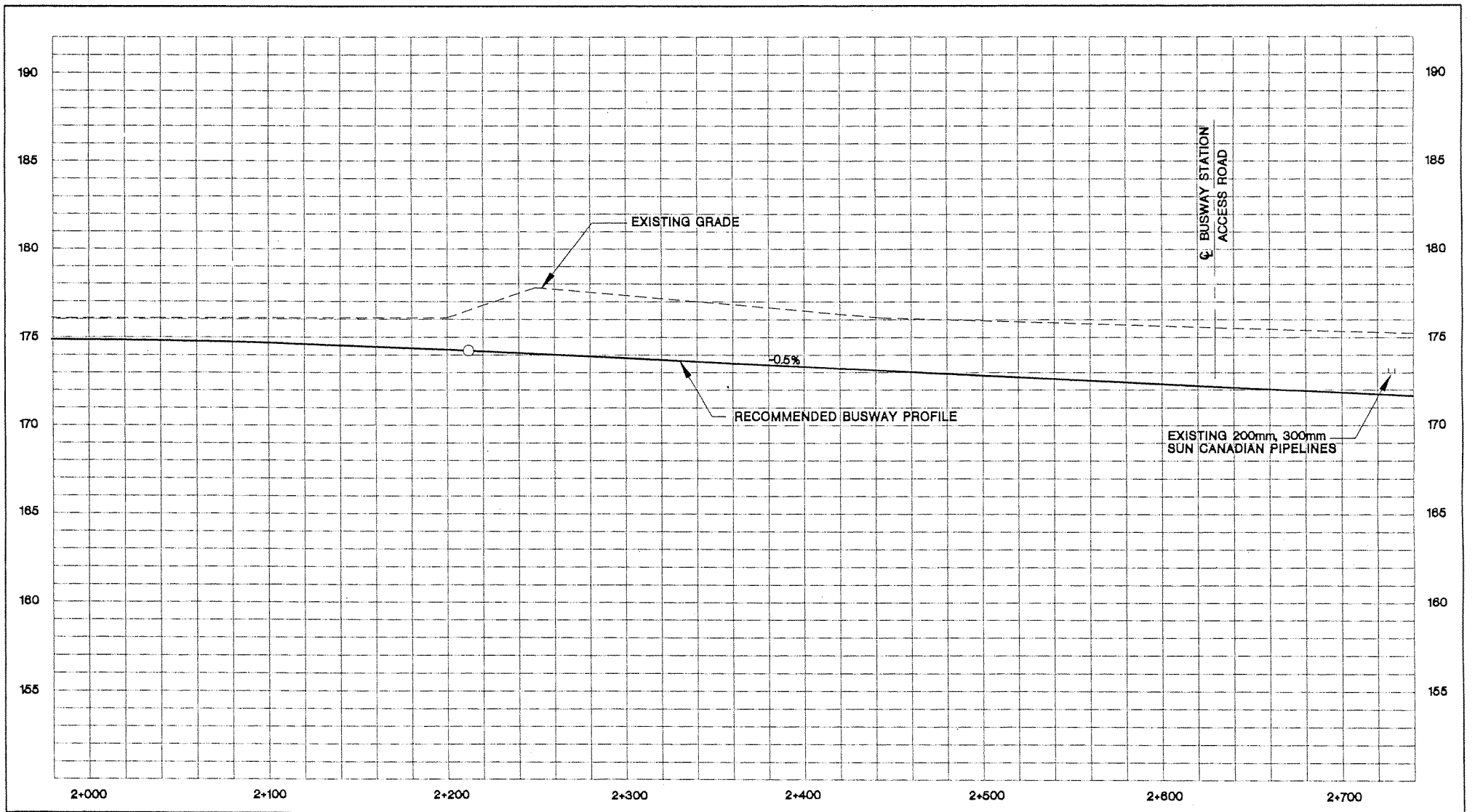
EXHIBIT 39

0 50 100 150 200

SCALE

RECOMMENDED PLAN

Sta. 2+000 to Sta. 2+700



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

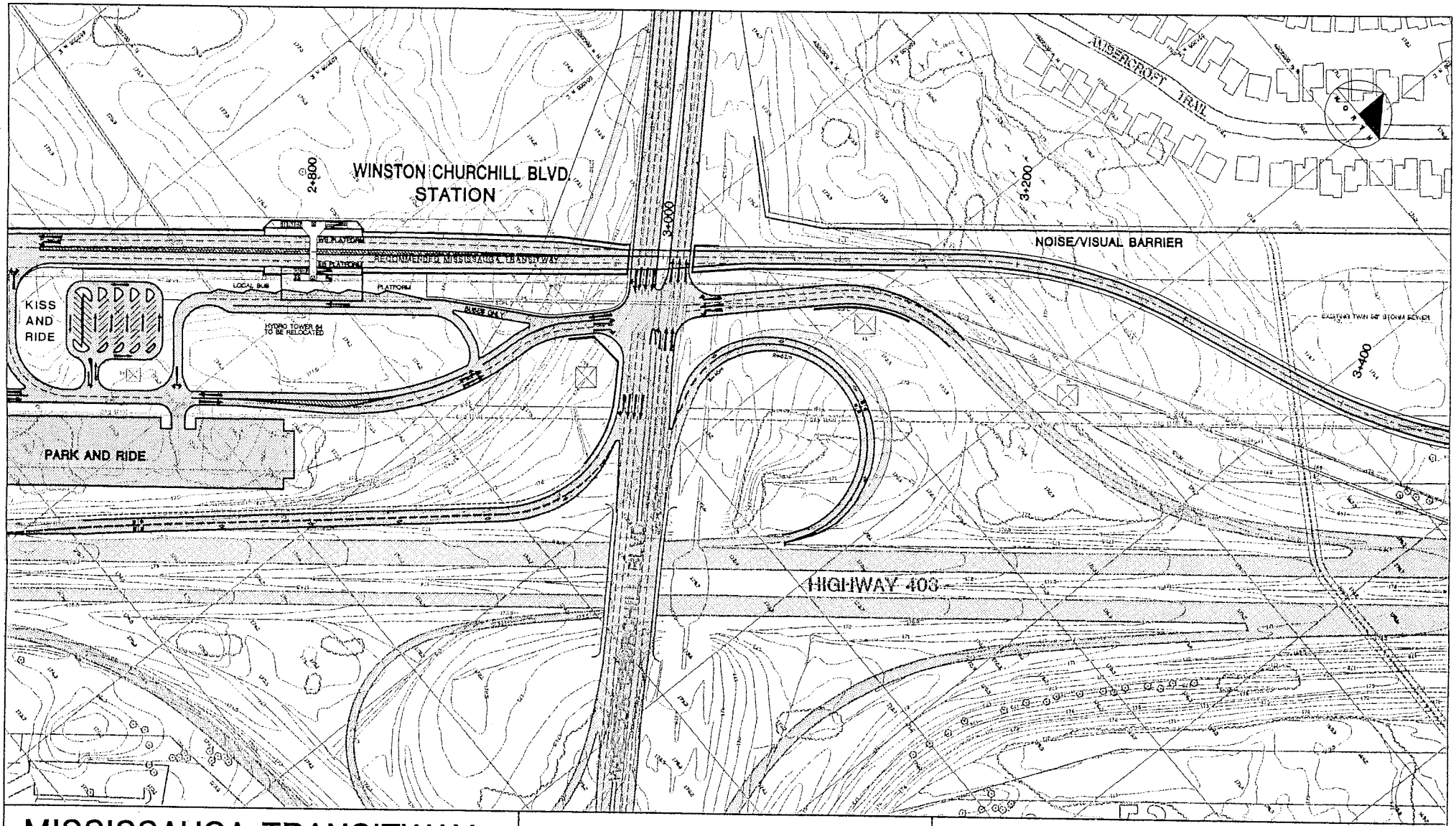
EXHIBIT

HOR. 0 50 100 150 200

VER. 0 5 10 15 20

RECOMMENDED PROFILE

Sta. 2+000 To Sta. 2+700



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

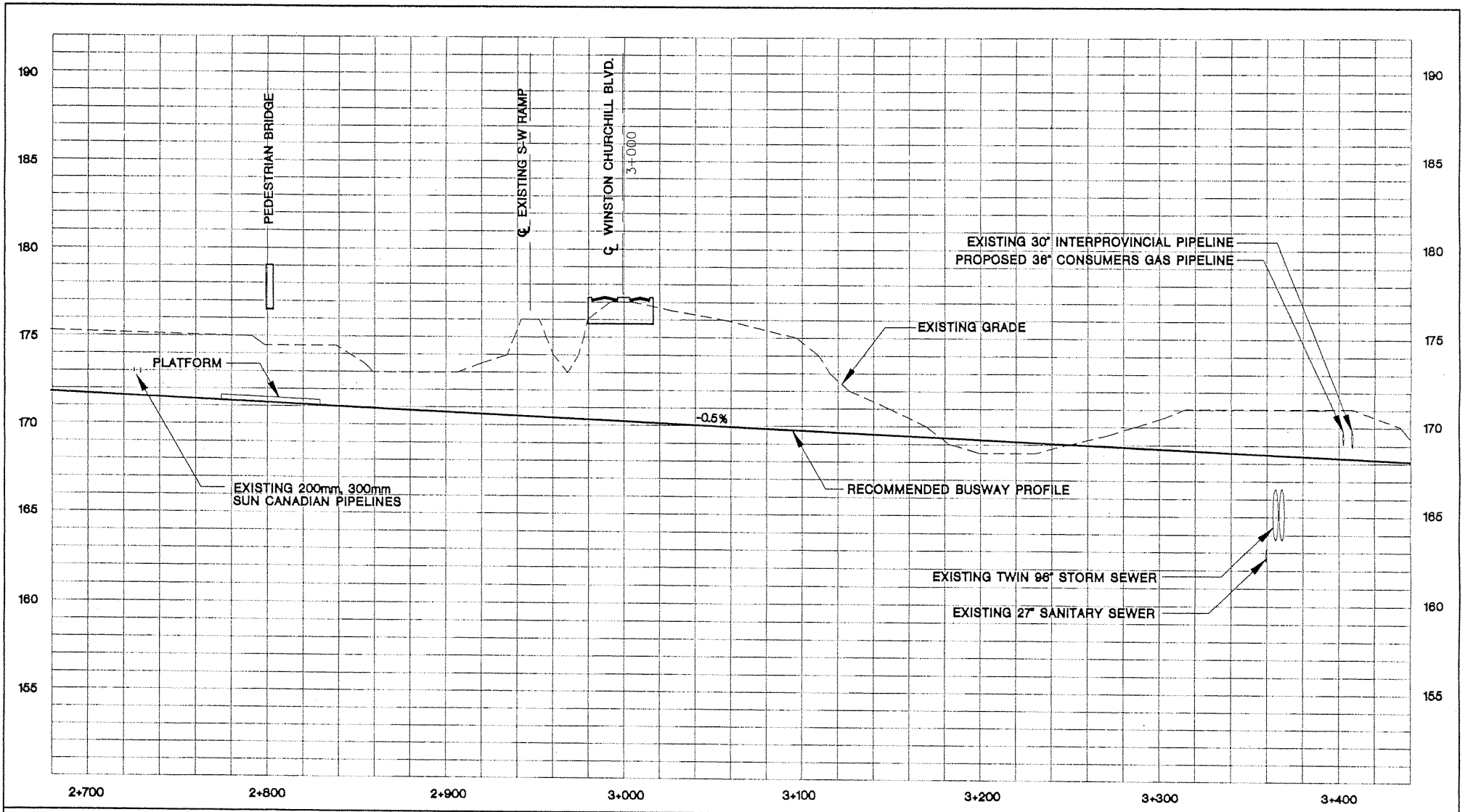
EXHIBIT 40

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SCALE

RECOMMENDED PLAN

Sta. 2+700 to Sta. 3+400



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

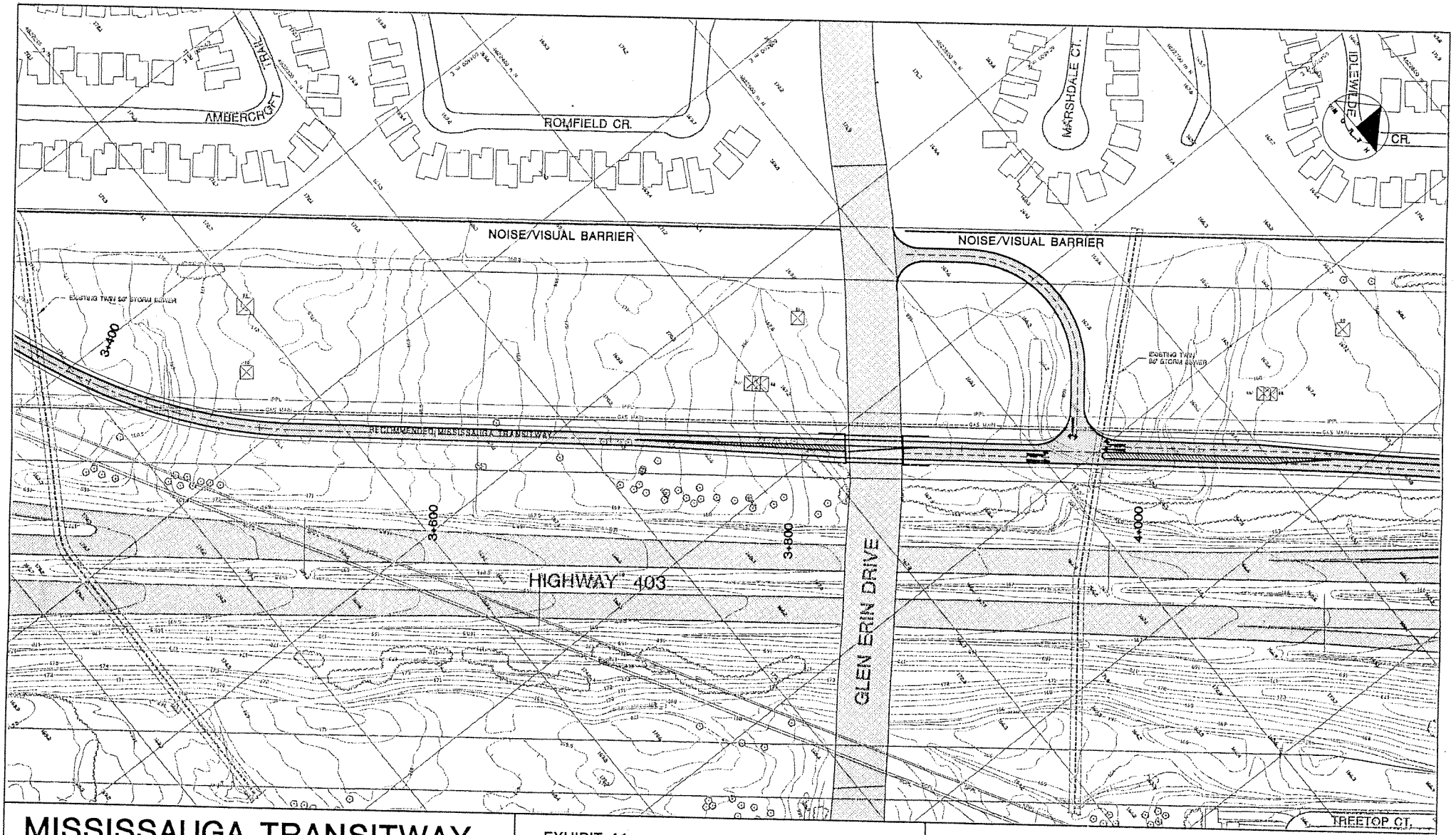
EXHIBIT

HOR. 0 50 100 150 200

VER. 0 5 10 15 20

RECOMMENDED PROFILE

Sta. 2+700 To Sta. 3+400



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

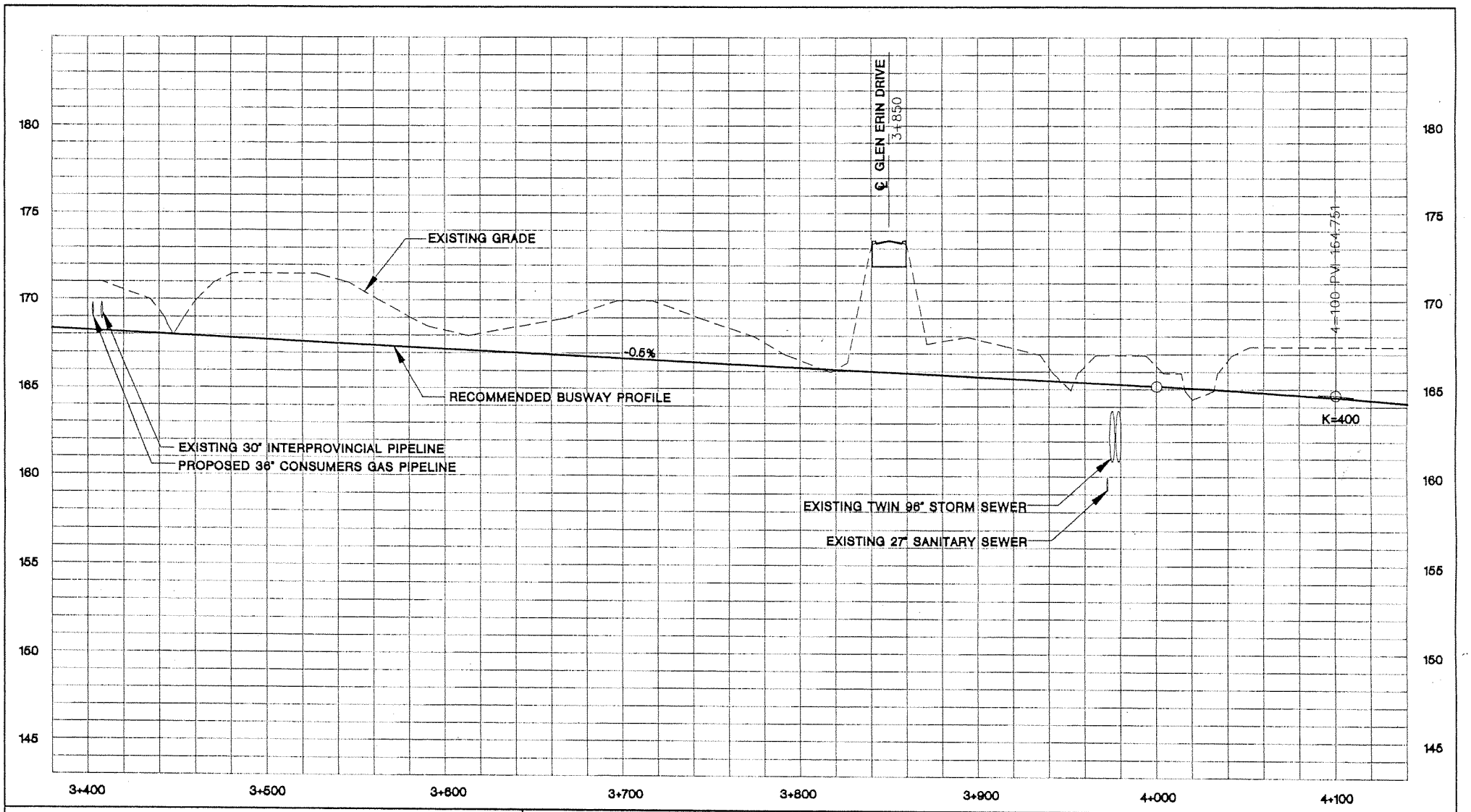
EXHIBIT 41

0 50 100 150 200

SCALE

RECOMMENDED PLAN

Sta. 3+400 to Sta. 4+100



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

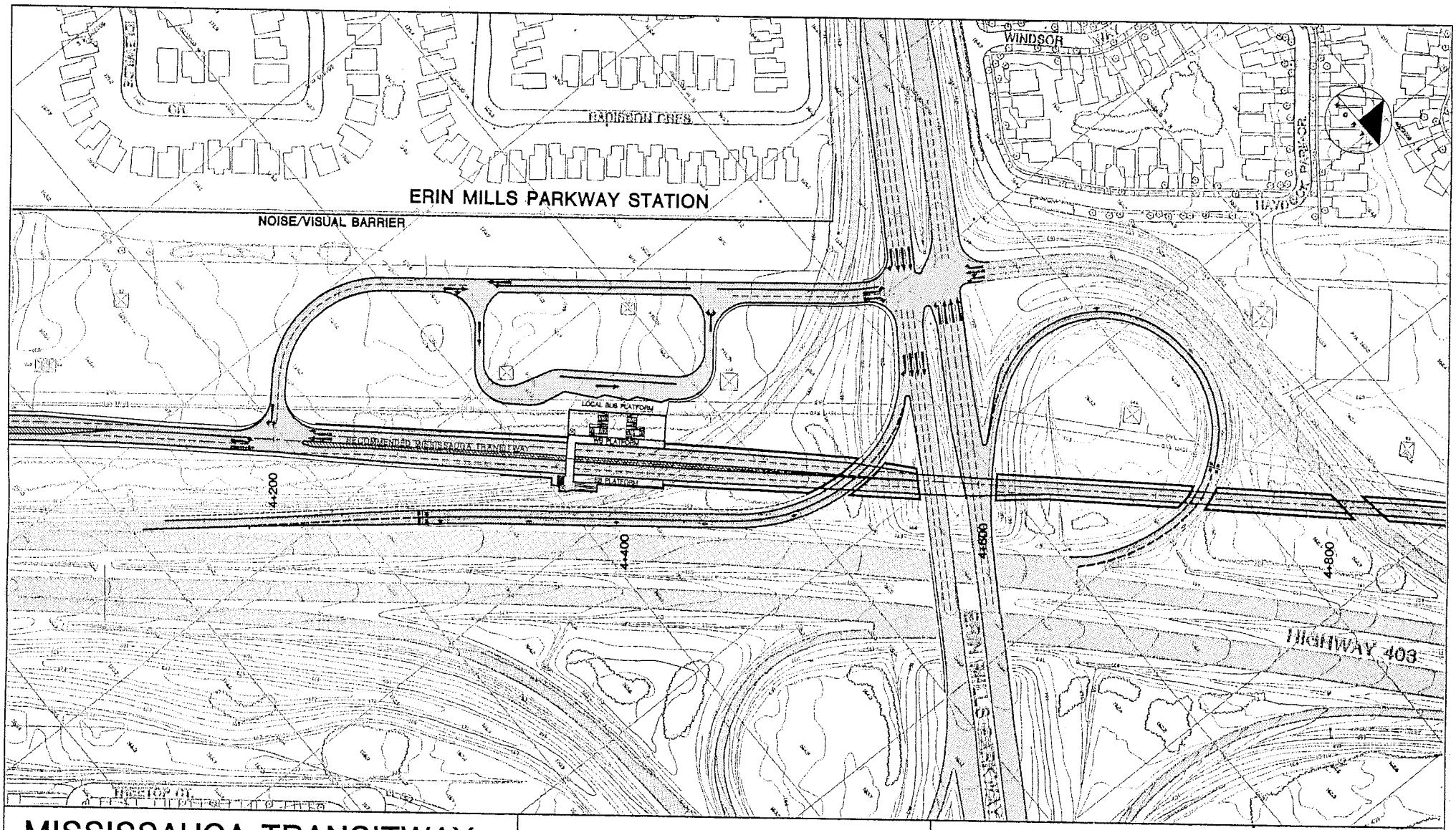
EXHIBIT

HOR. 0 50 100 150 200

VER. 0 5 10 15 20

RECOMMENDED PROFILE

Sta. 3+400 To Sta. 4+100



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

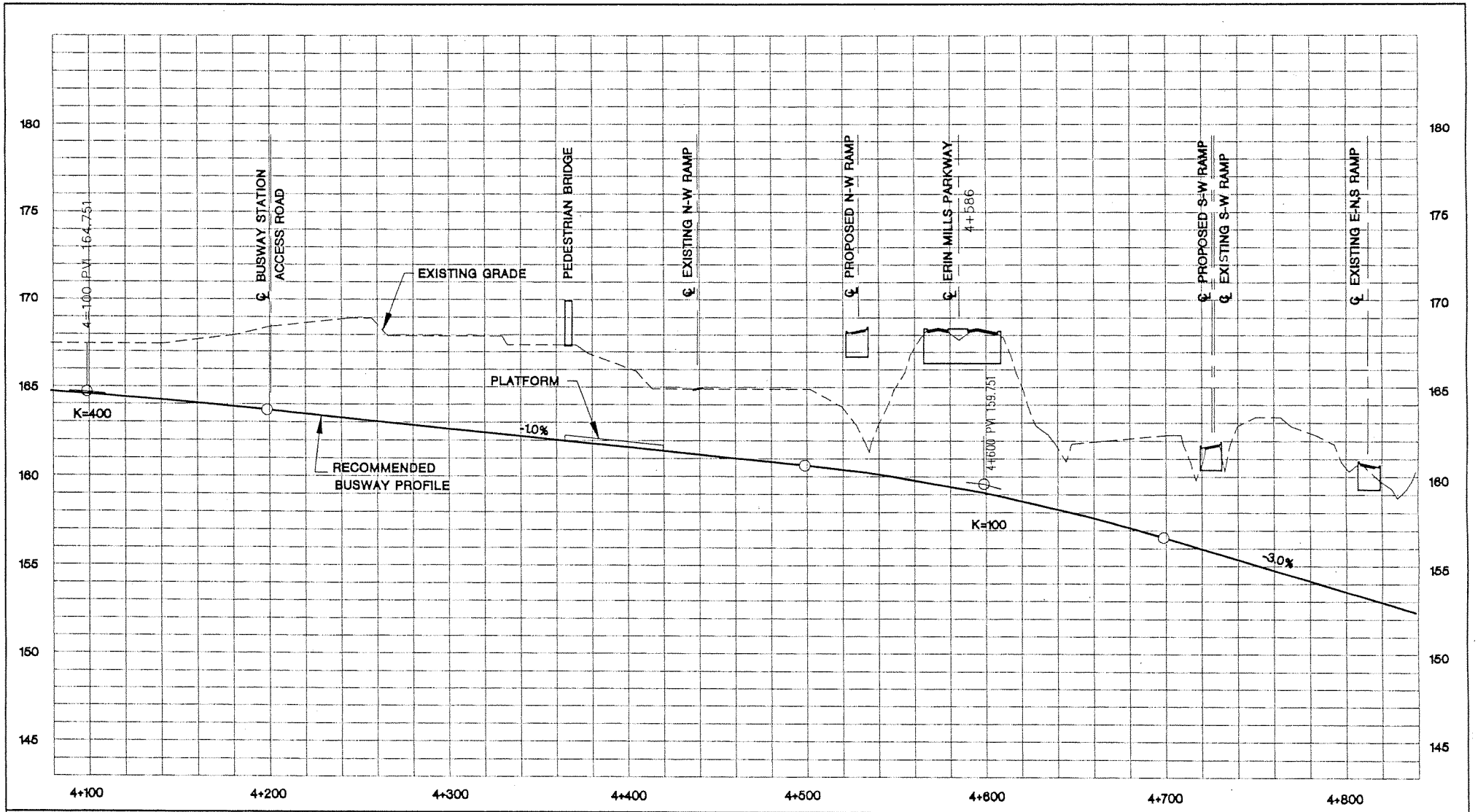
EXHIBIT 42

0 50 100 150 200

SCALE

RECOMMENDED PLAN

Sta. 4+100 to Sta. 4+800



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

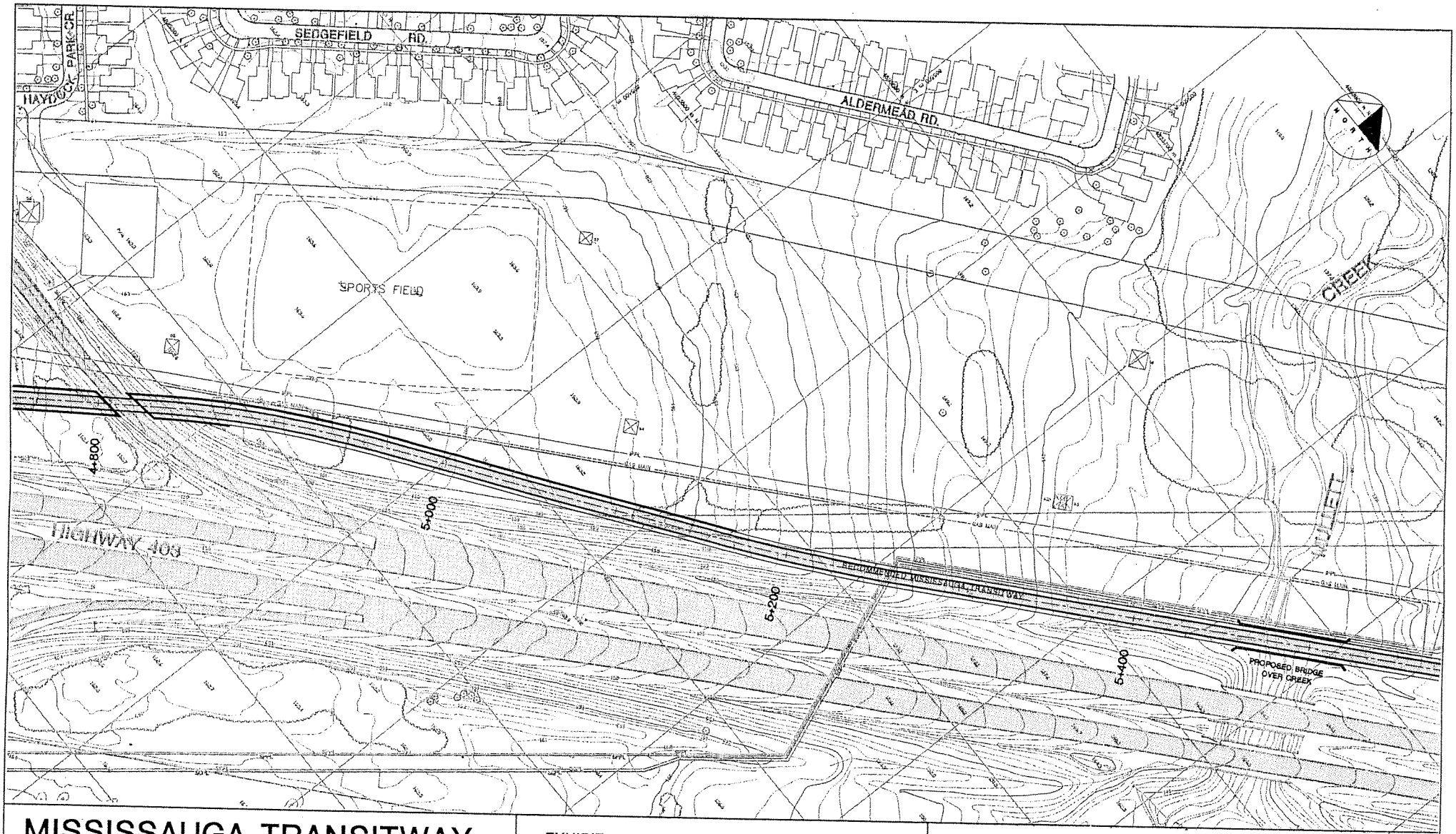
EXHIBIT

HOR. 0 50 100 150 200

VER. 0 5 10 15 20

RECOMMENDED PROFILE

Sta. 4+100 To Sta. 4+800



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

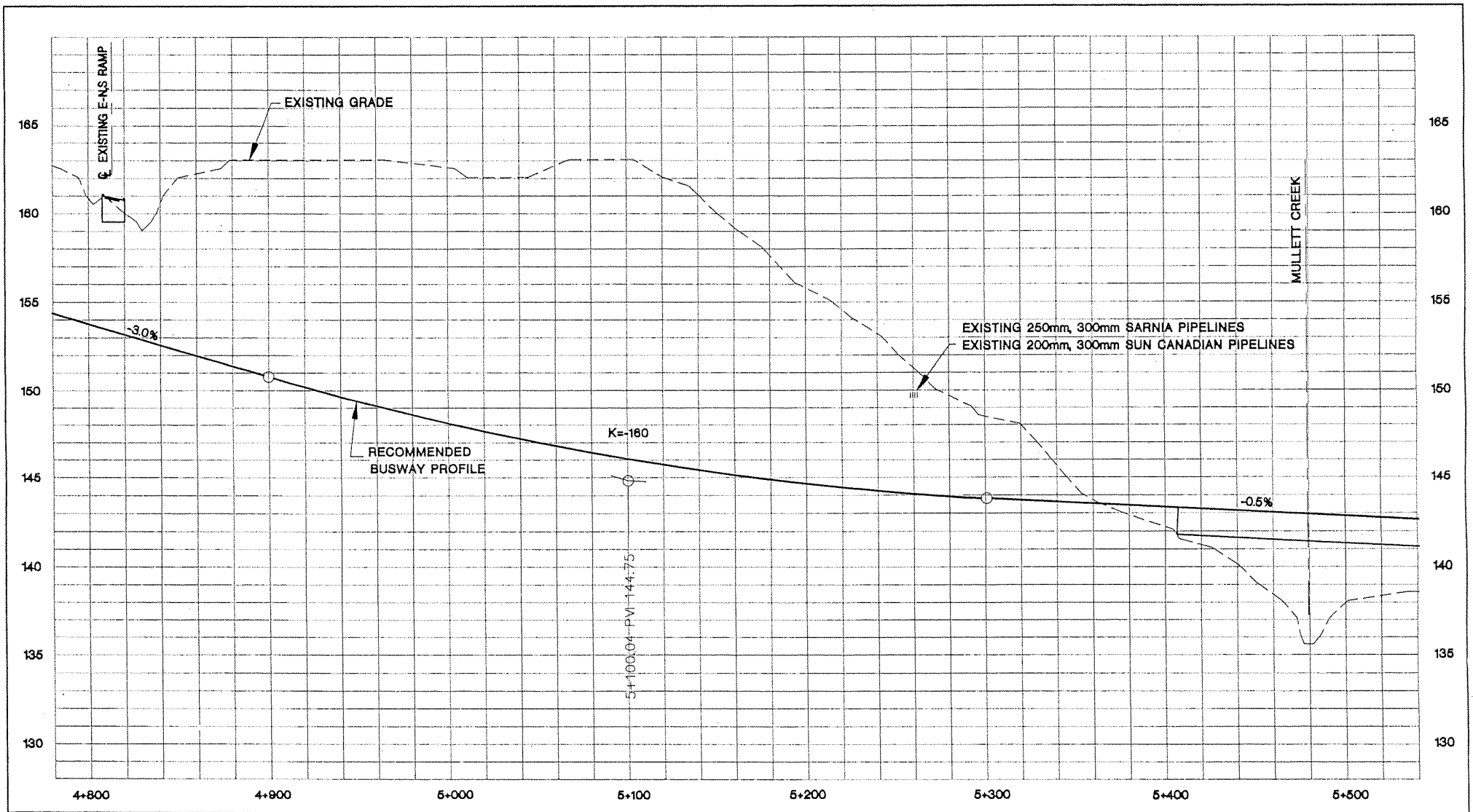
EXHIBIT 43

0 50 100 150 200

SCALE

RECOMMENDED PLAN

Sta. 4+800 to Sta. 5+500



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

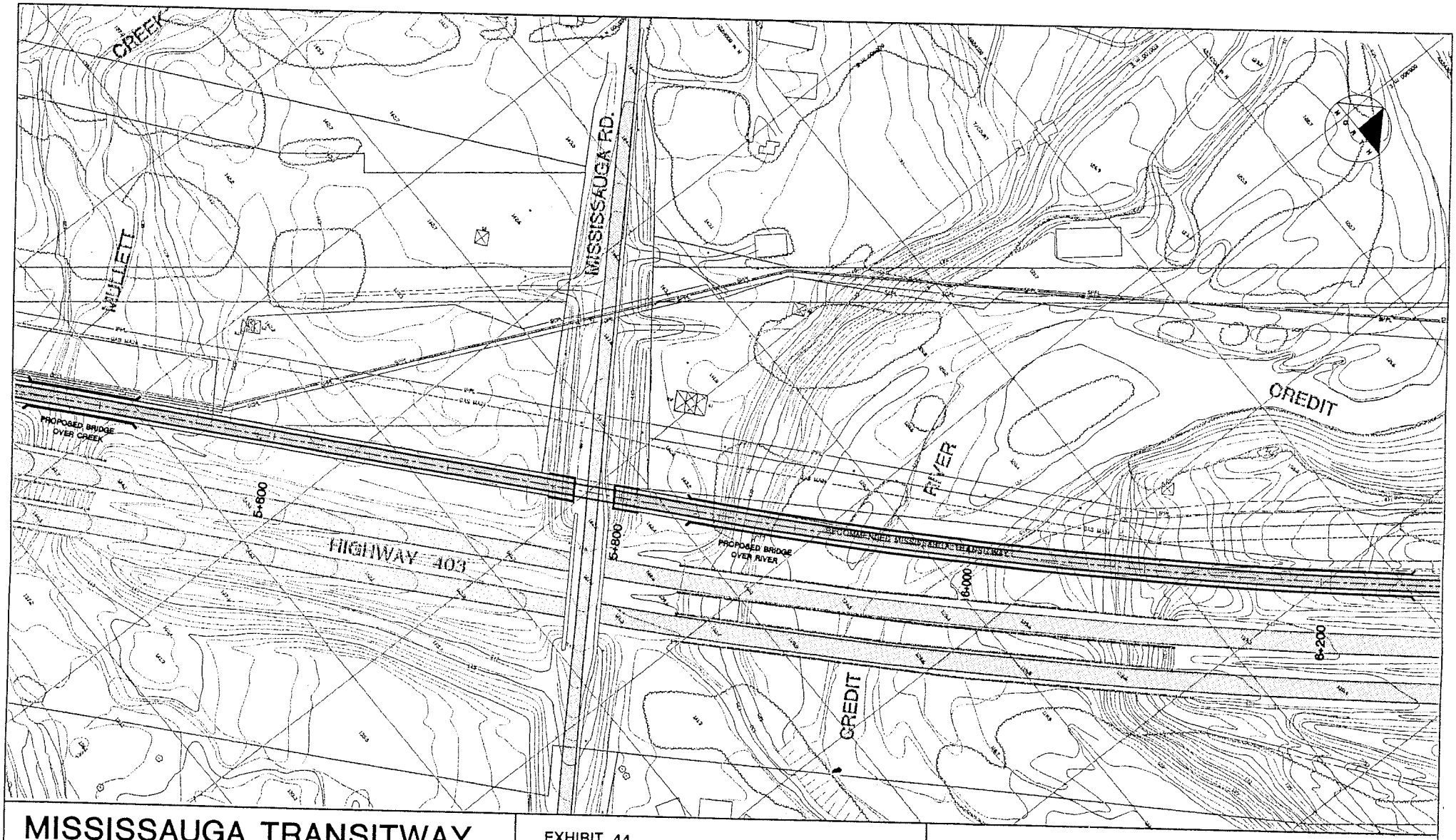
EXHIBIT

HOR. 0 50 100 150 200

VER. 0 5 10 15 20

RECOMMENDED PROFILE

Sta. 4+800 To Sta. 5+500



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

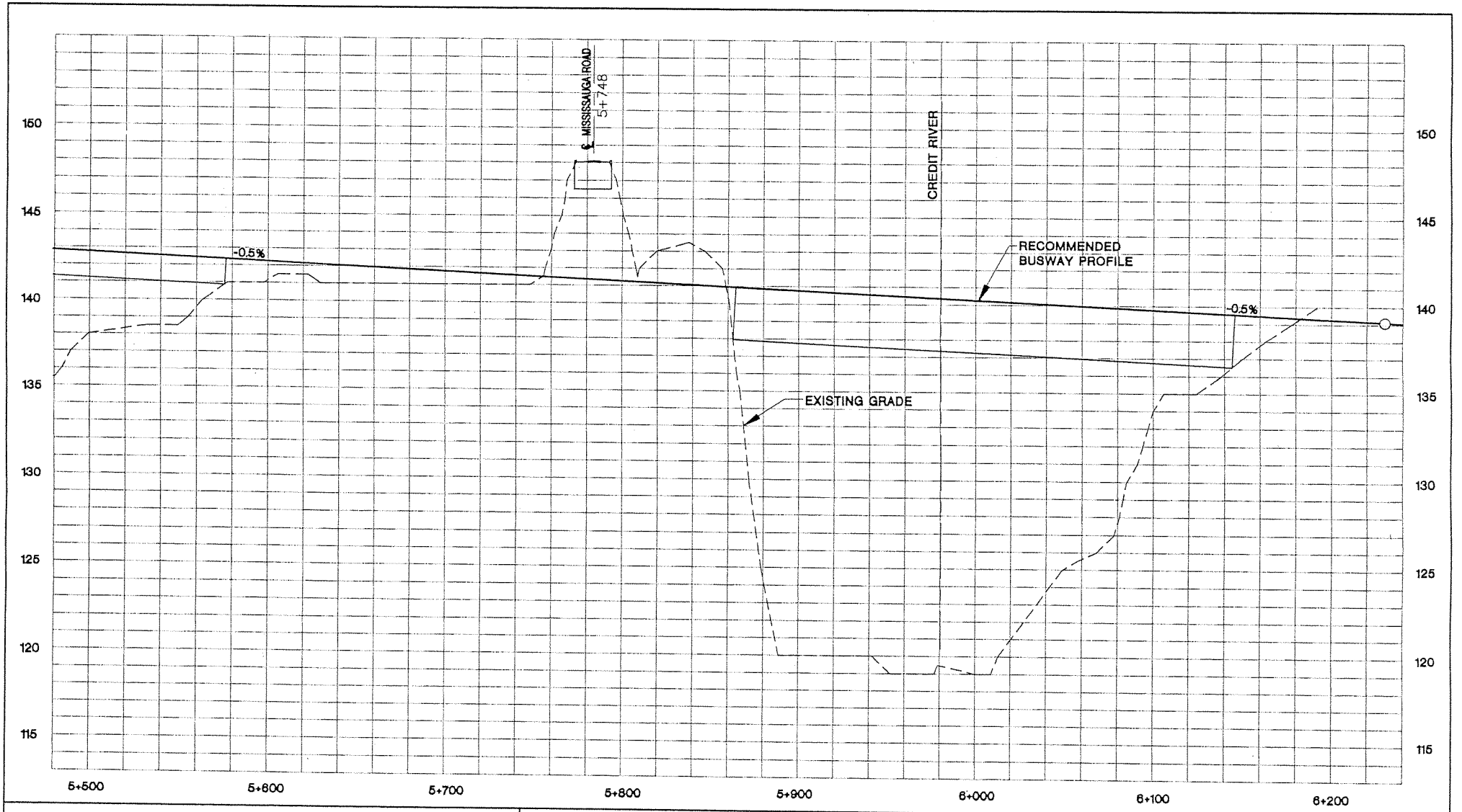
EXHIBIT 44

0 50 100 150 200

SCALE

RECOMMENDED PLAN

Sta. 5+500 to Sta. 6+200



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

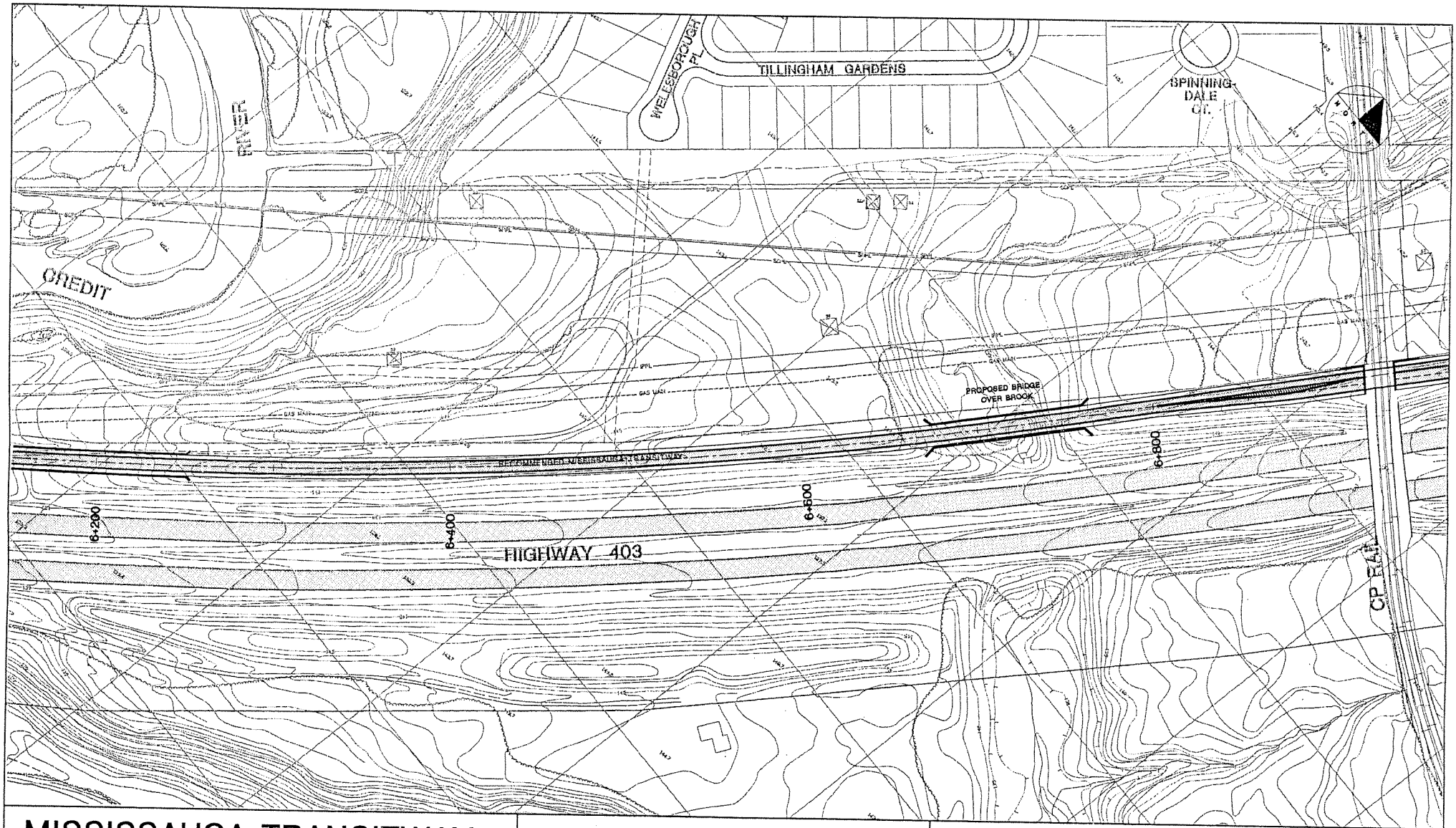
EXHIBIT

HOR. 0 50 100 150 200

VER. 0 5 10 15 20

RECOMMENDED PROFILE

Sta. 5+500 To Sta. 6+200



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

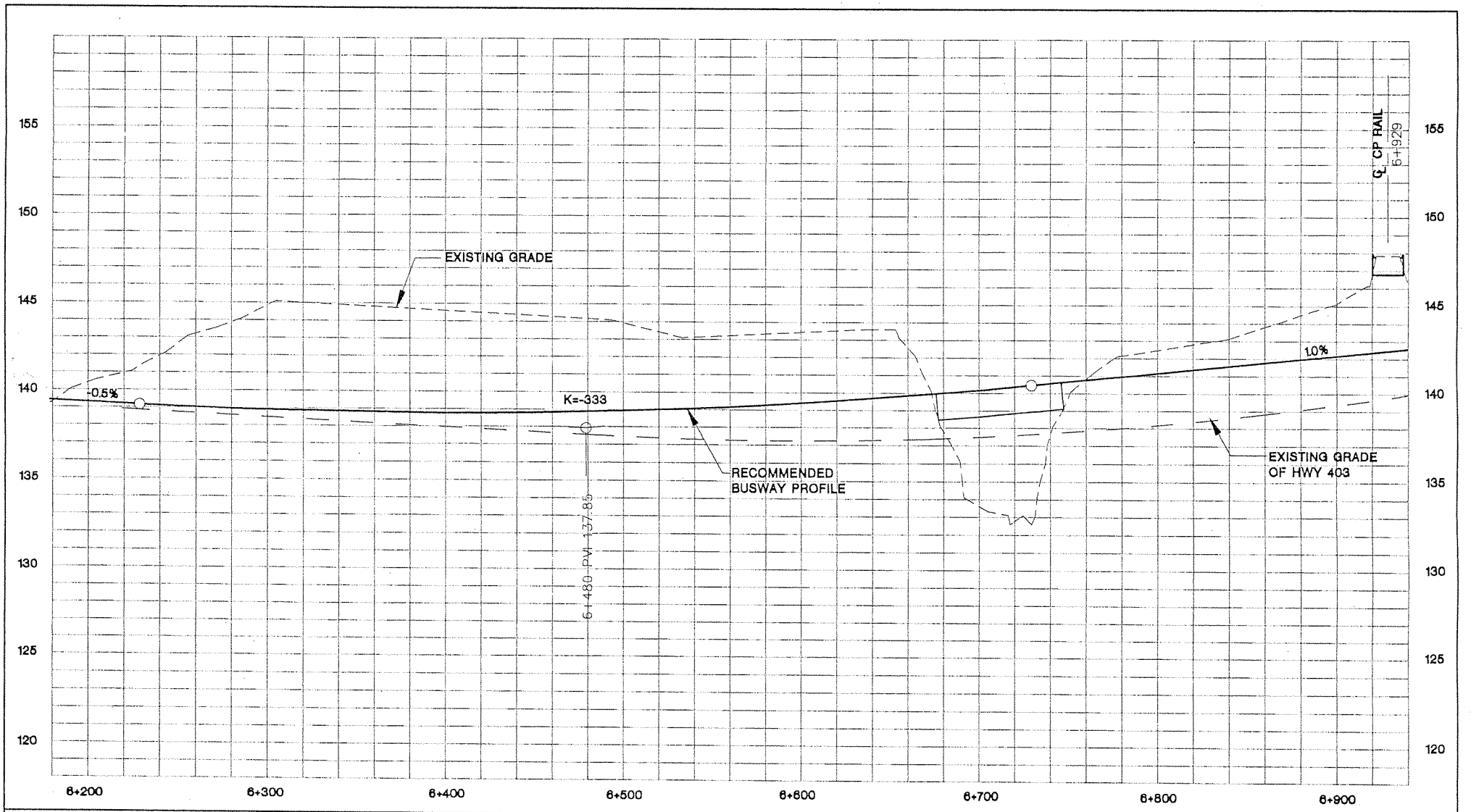
EXHIBIT 45

0 50 100 150 200

SCALE

RECOMMENDED PLAN

Sta. 6+200 to Sta. 6+900



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

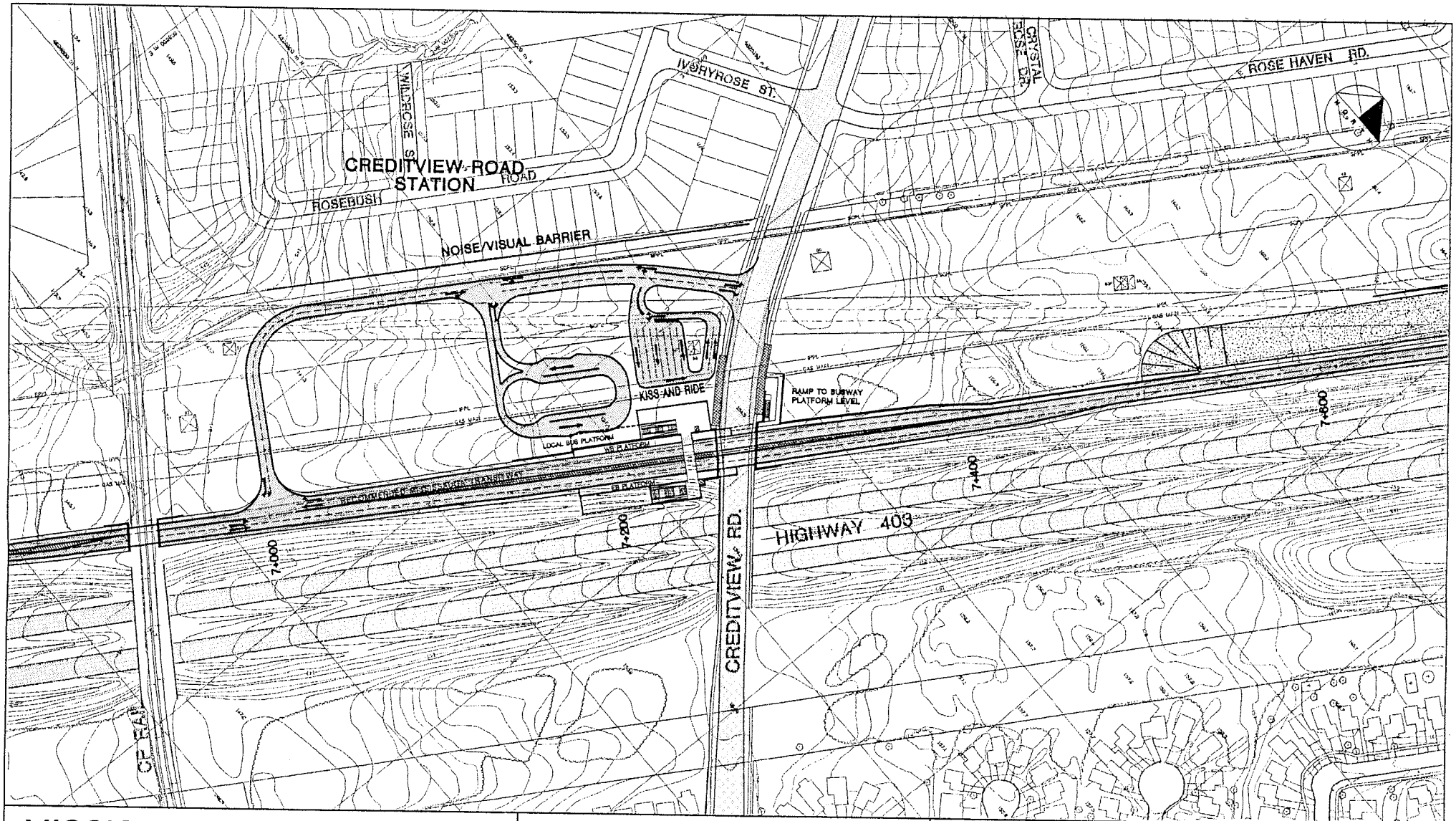
EXHIBIT

HOR. 0 50 100 150 200

VER. 0 5 10 15 20

RECOMMENDED PROFILE

Sta. 6+200 To Sta. 6+900



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

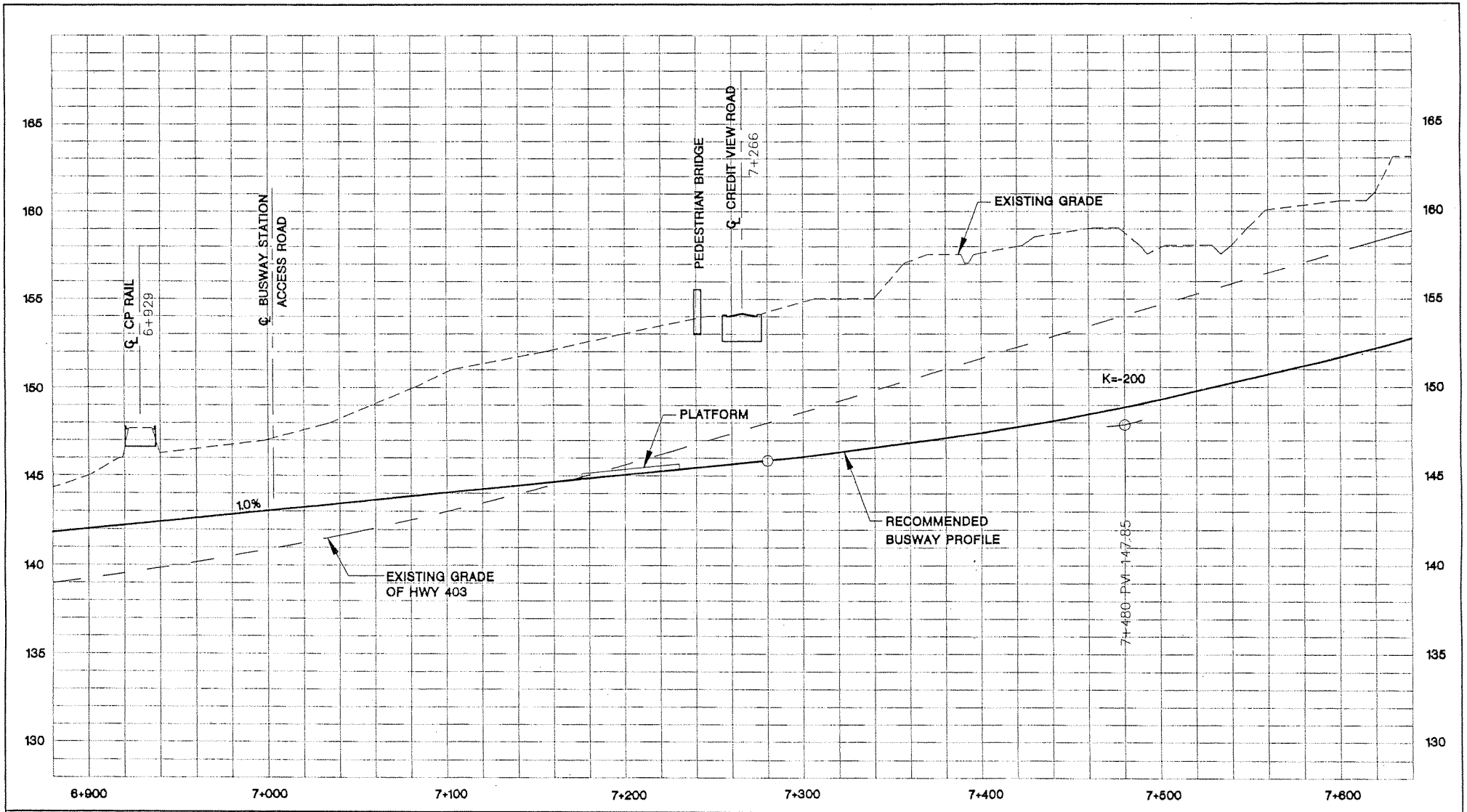
EXHIBIT 46

0 50 100 150 200

SCALE

RECOMMENDED PLAN

Sta. 6+900 to Sta. 7+600



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

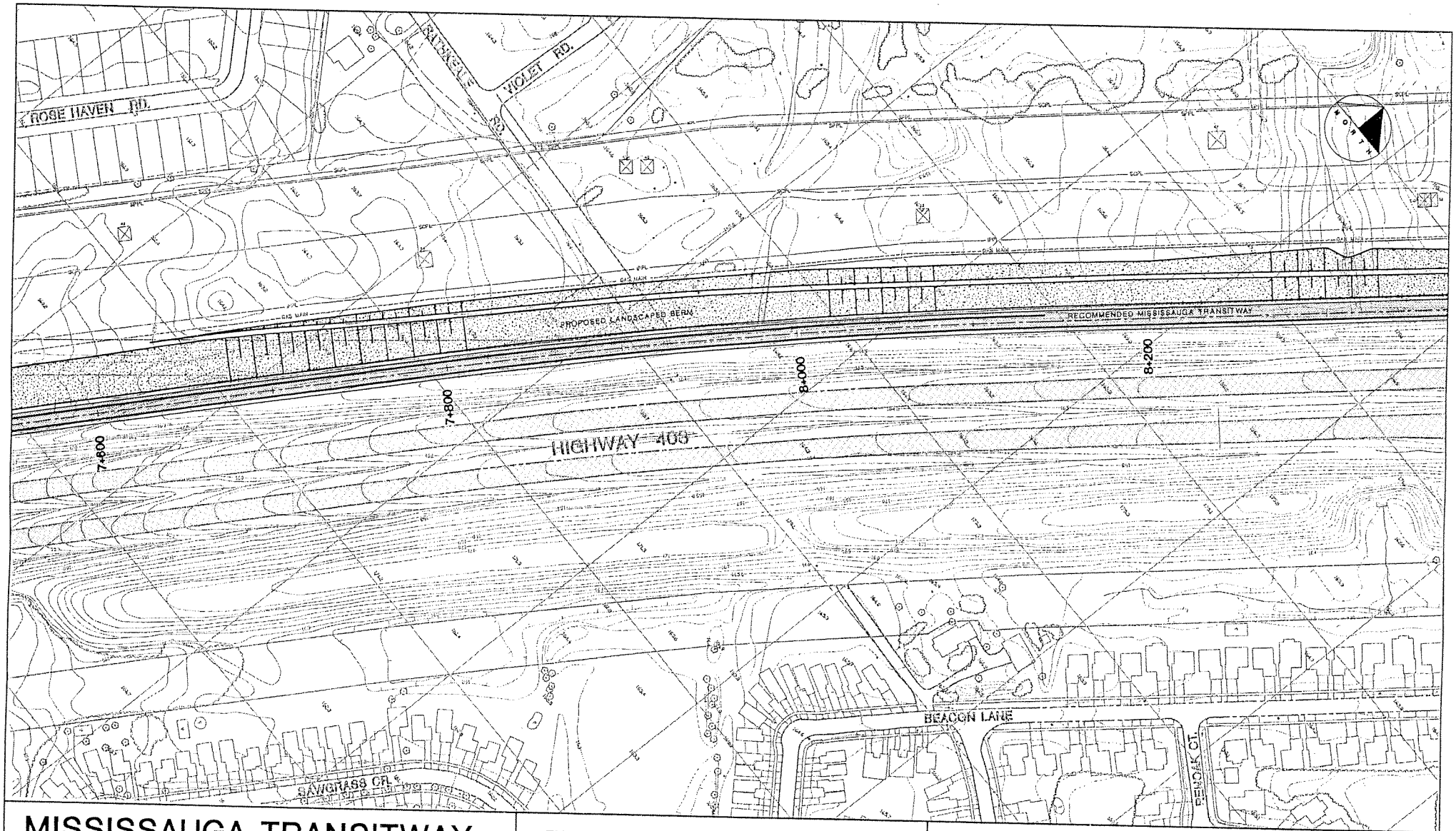
EXHIBIT

HOR. 0 50 100 150 200

VER. 0 5 10 15 20

RECOMMENDED PROFILE

Sta. 6+900 To 7+600



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

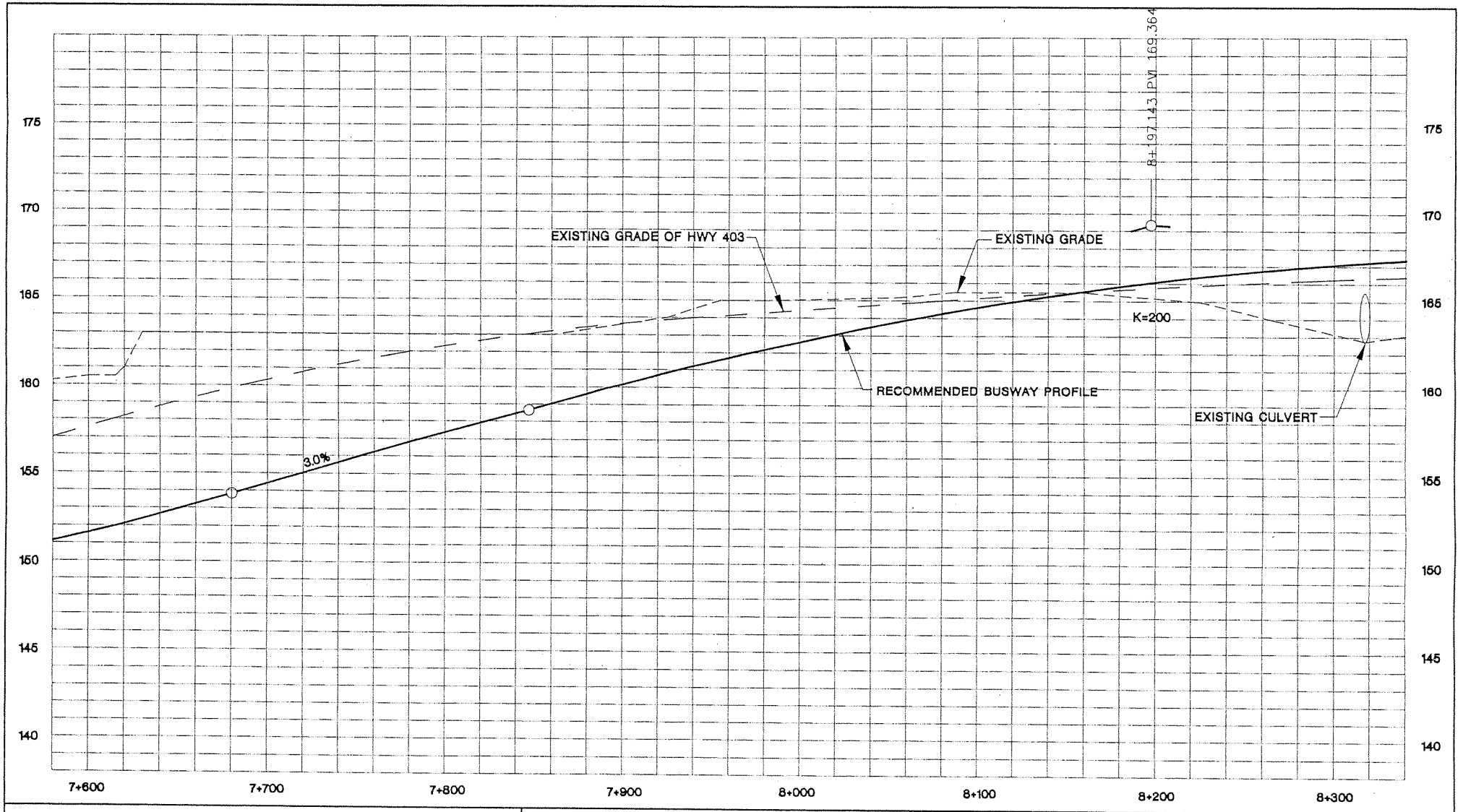
EXHIBIT 47

0 50 100 150 200

SCALE

RECOMMENDED PLAN

Sta. 7+600 to Sta. 8+300



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

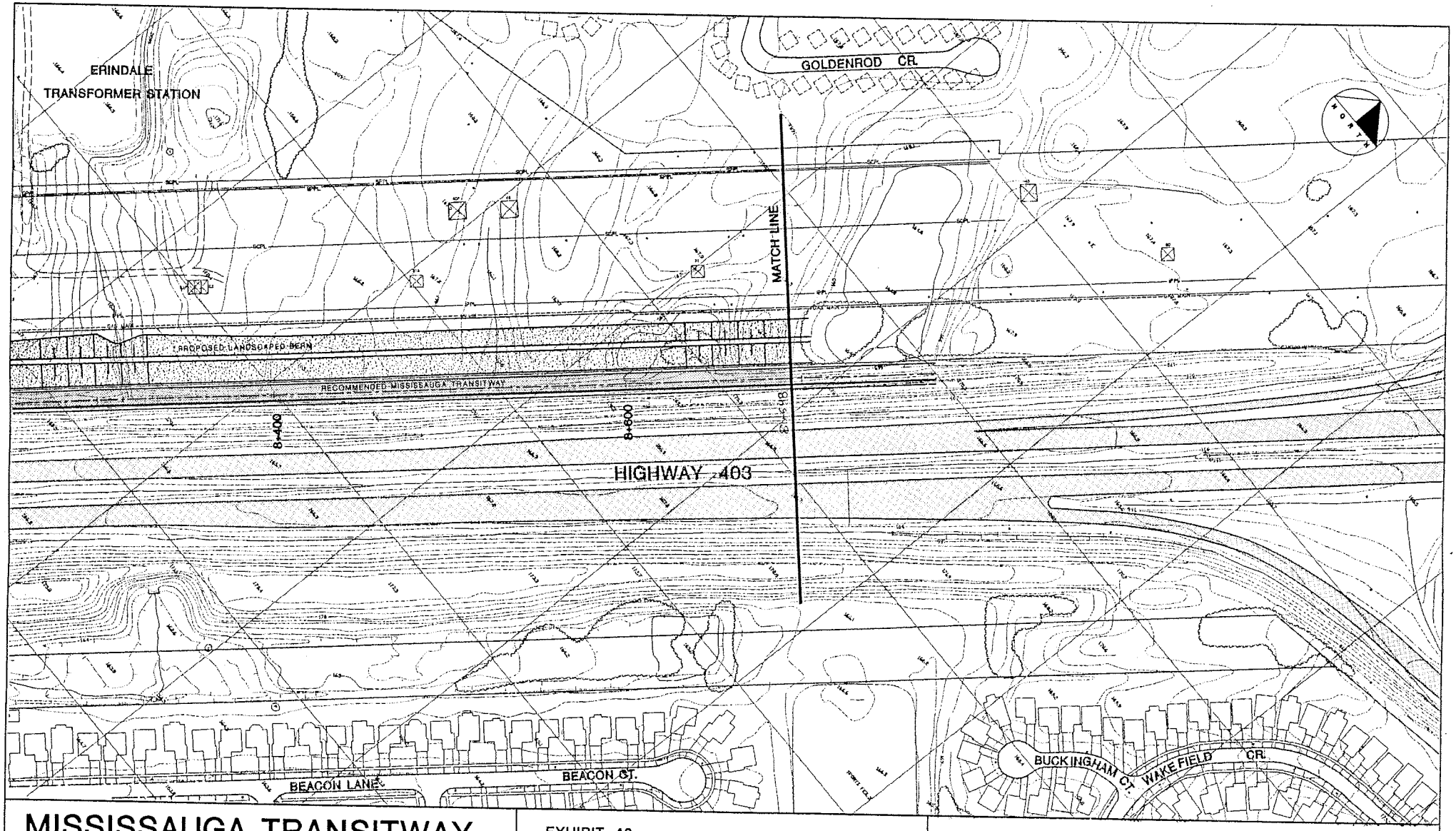
EXHIBIT

HOR. 0 50 100 150 200

VER. 0 5 10 15 20

RECOMMENDED PROFILE

Sta. 7+600 To Sta. 8+300



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

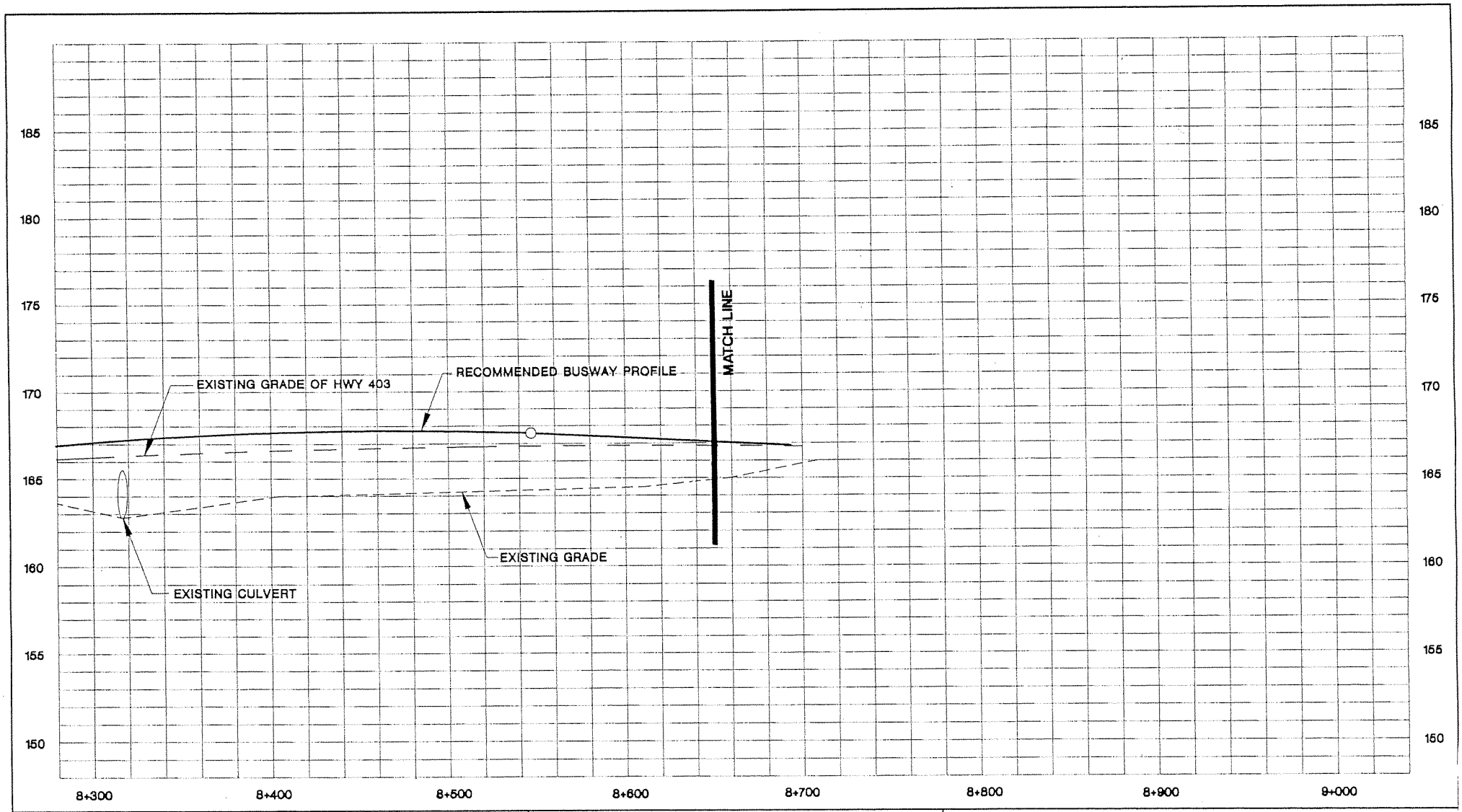
EXHIBIT 48

0 50 100 150 200

SCALE

RECOMMENDED PLAN

Sta. 8+300 to Sta. 9+000



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

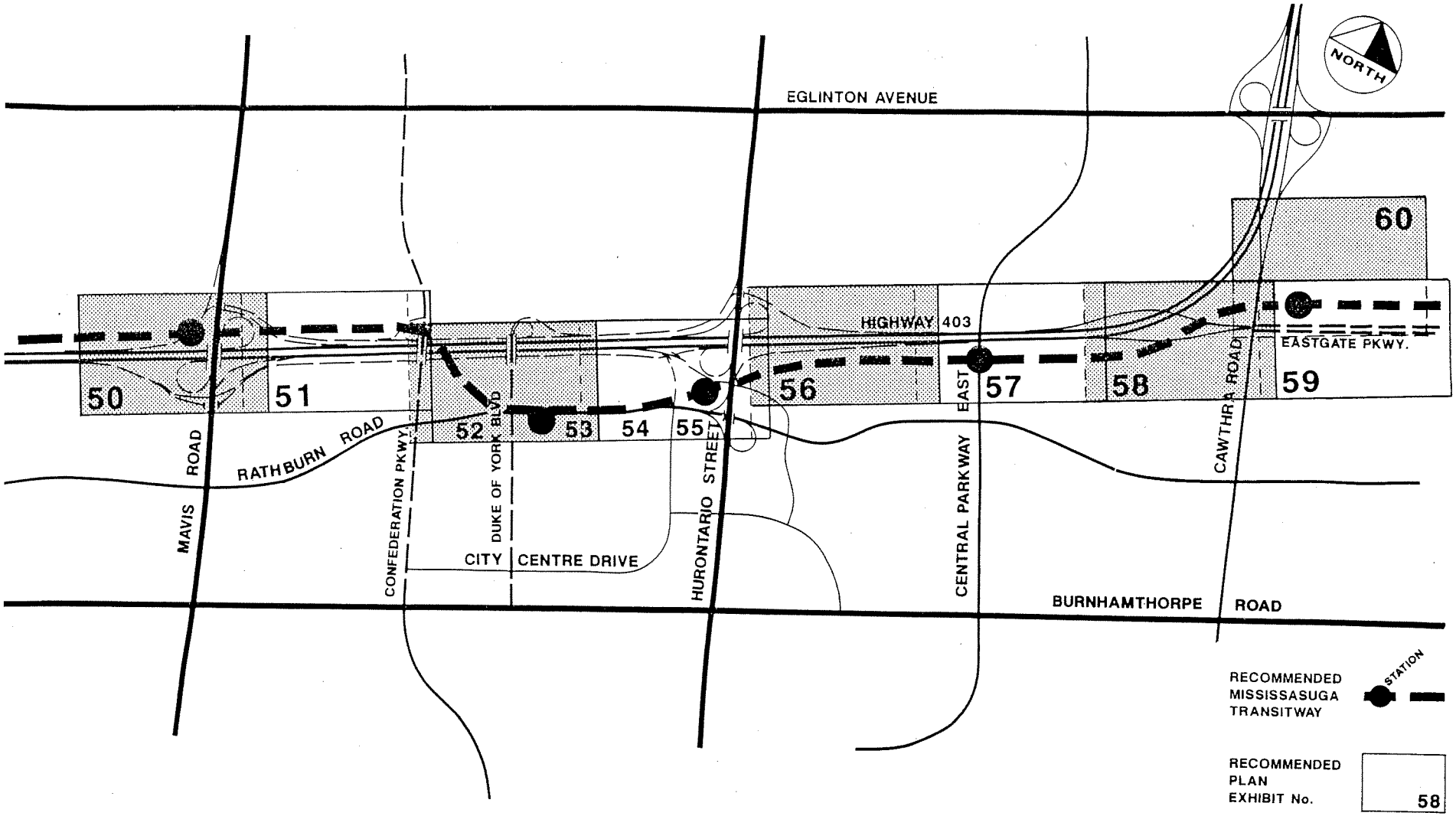
EXHIBIT

HOR 0 50 100 150 200

VER 0 5 10 15 20

RECOMMENDED PROFILE

Sta. 8+300 To Sta. 9+000

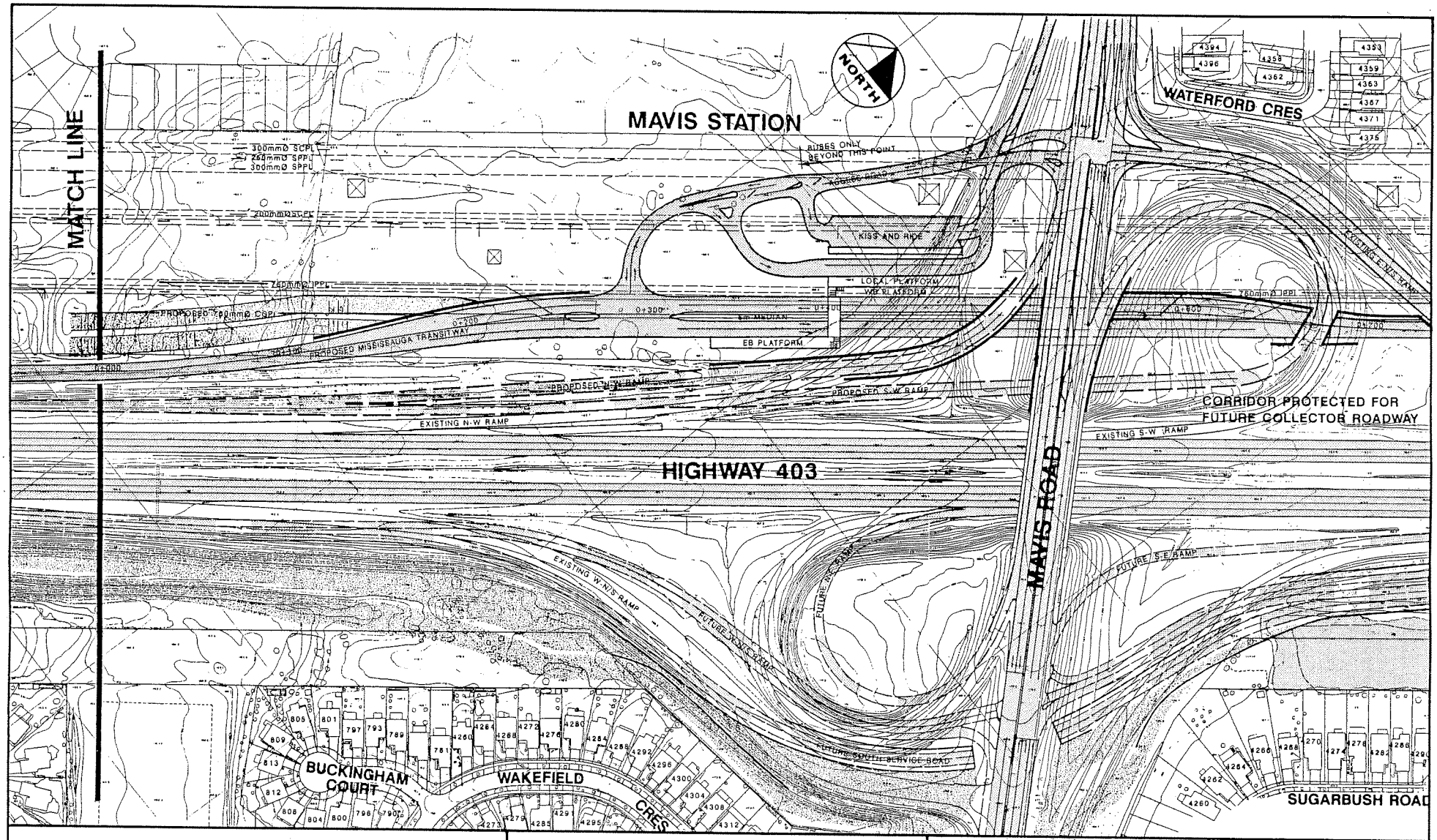


MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT 49

(PLAN NOT TO SCALE)

KEY PLAN
MAVIS ROAD TO CAWTHRA ROAD



MISSISSAUGA TRANSITWAY

FUNCTIONAL PLANNING STUDY

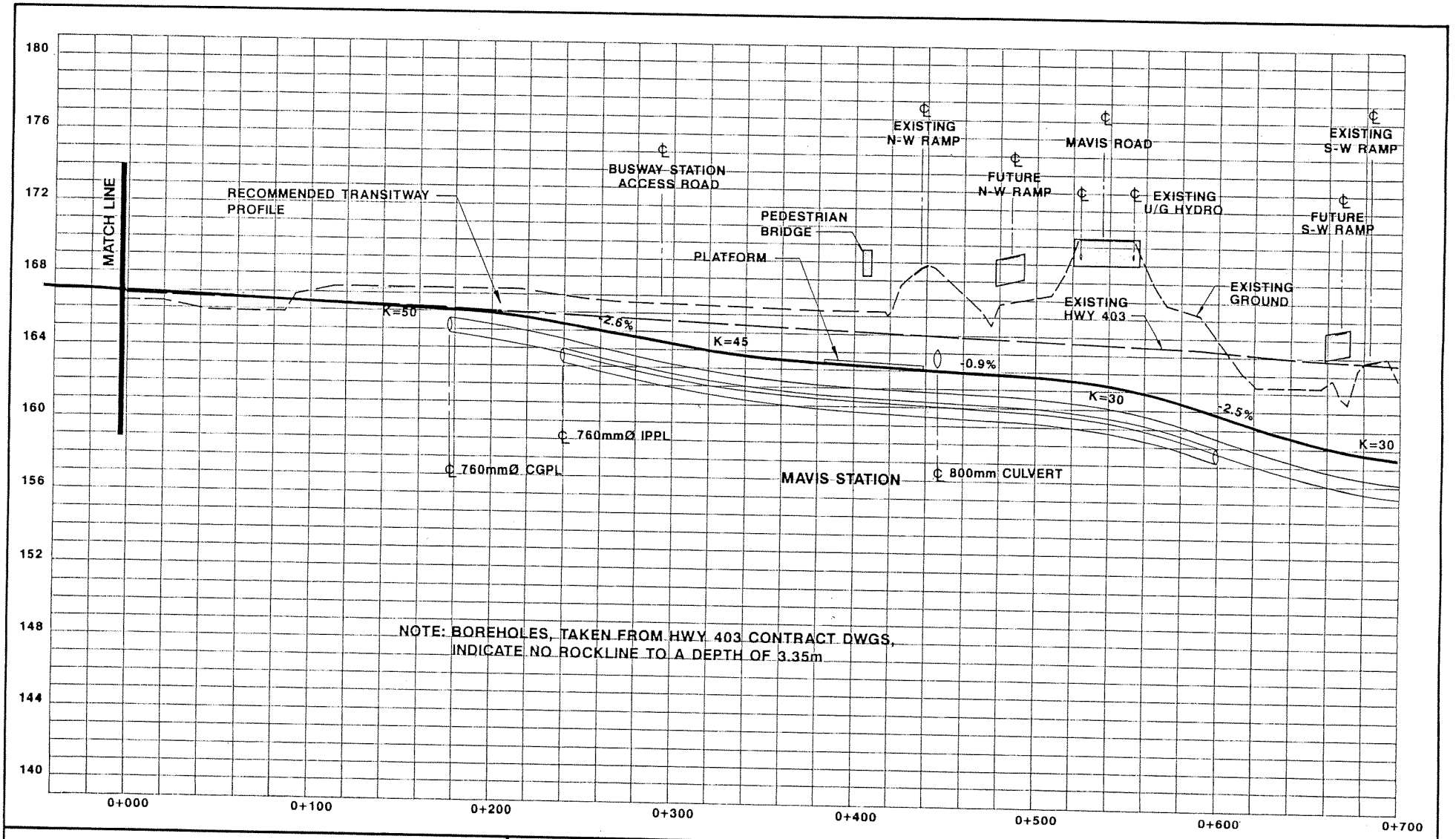
EXHIBIT 50

0 50 100 150 200m

SCALE

RECOMMENDED PLAN

Sta. 0+000 to Sta. 0+736



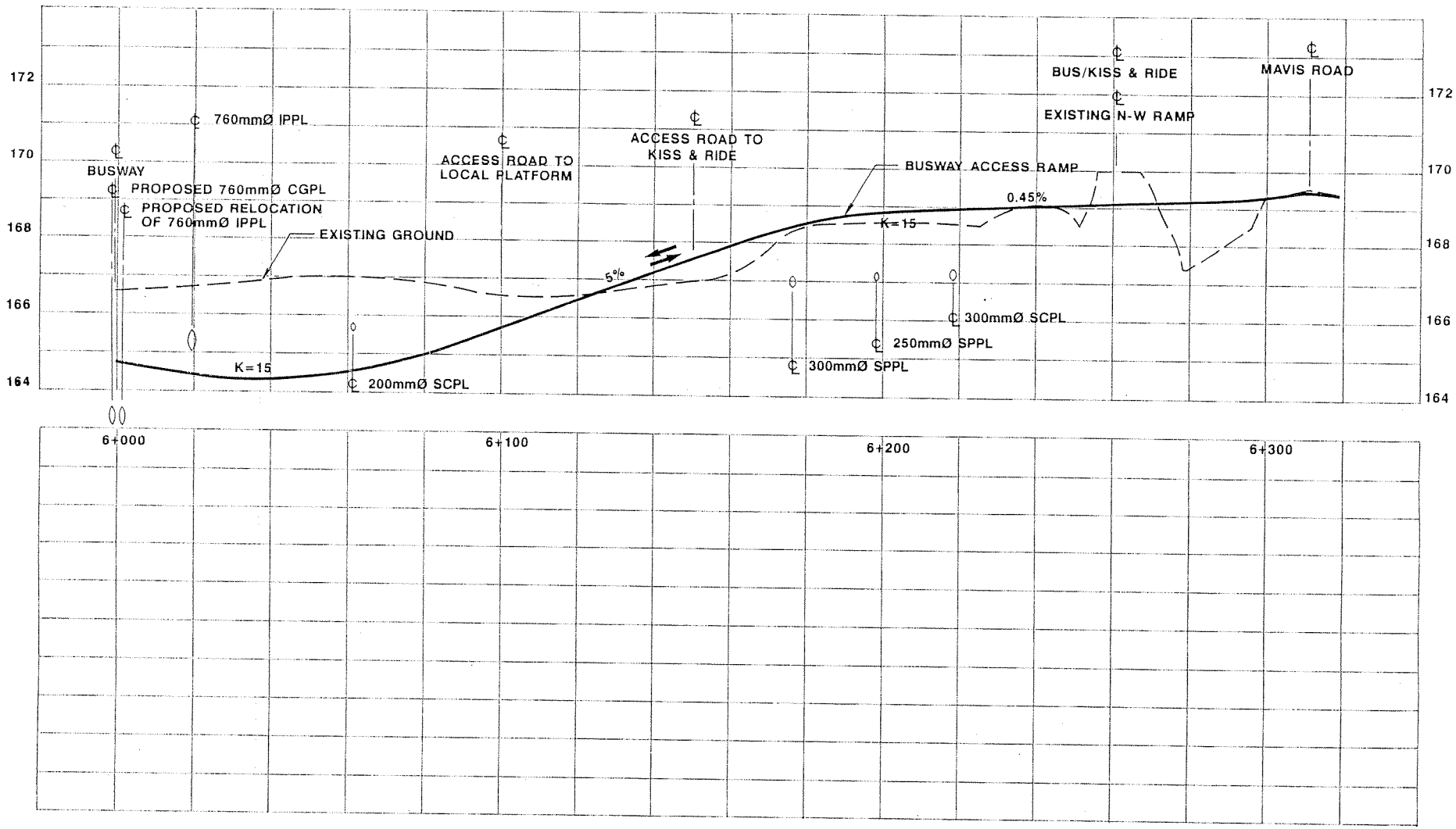
MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT

0 50 100 150 200m

RECOMMENDED PROFILES

Sta. 0+000 to Sta. 0+700



MISSISSAUGA TRANSITWAY

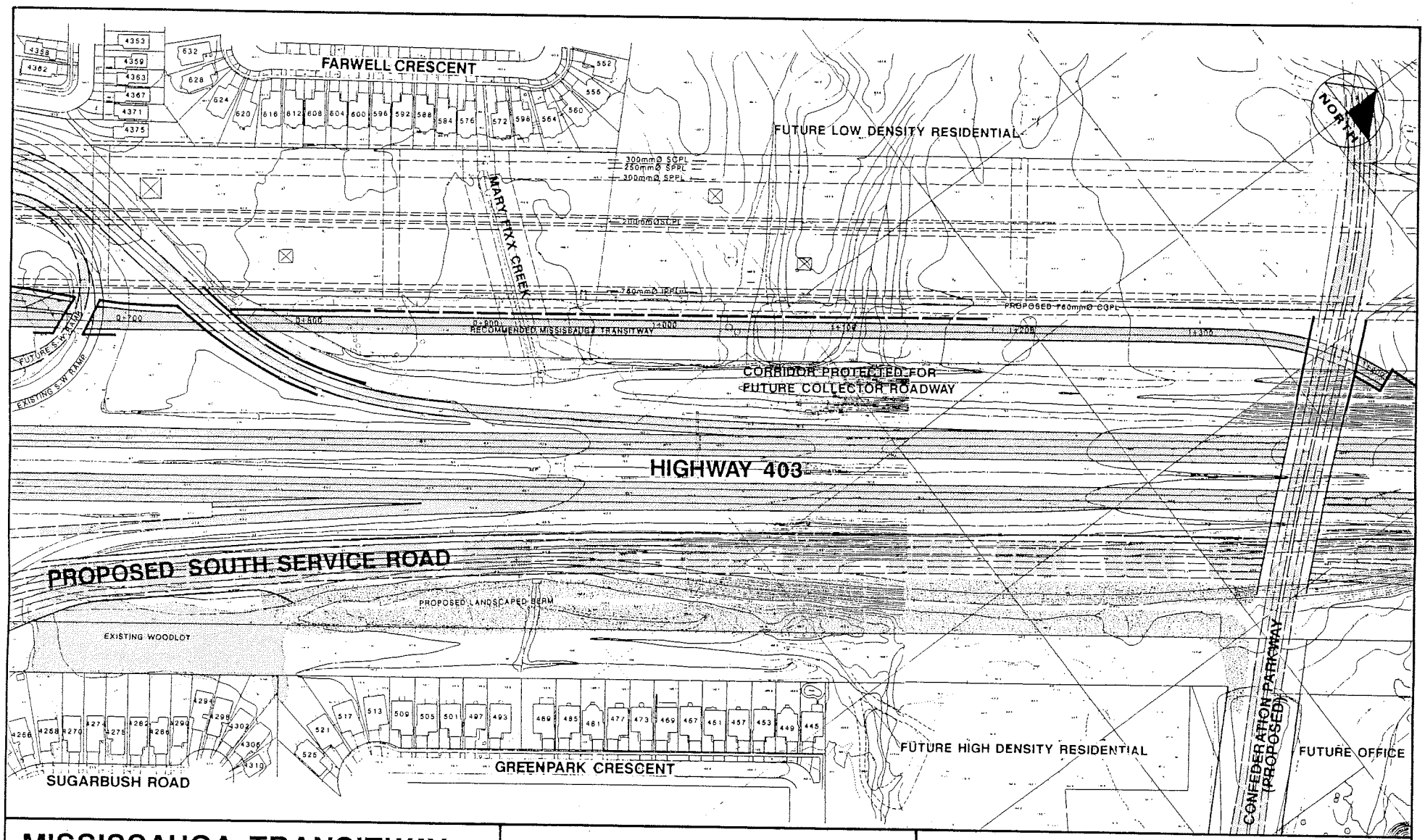
FUNCTIONAL PLANNING STUDY

EXHIBIT

0 25 50 75 100m

RECOMMENDED RAMP PROFILES

MAVIS STATION - ACCESS RAMP



MISSISSAUGA TRANSITWAY

FUNCTIONAL PLANNING STUDY

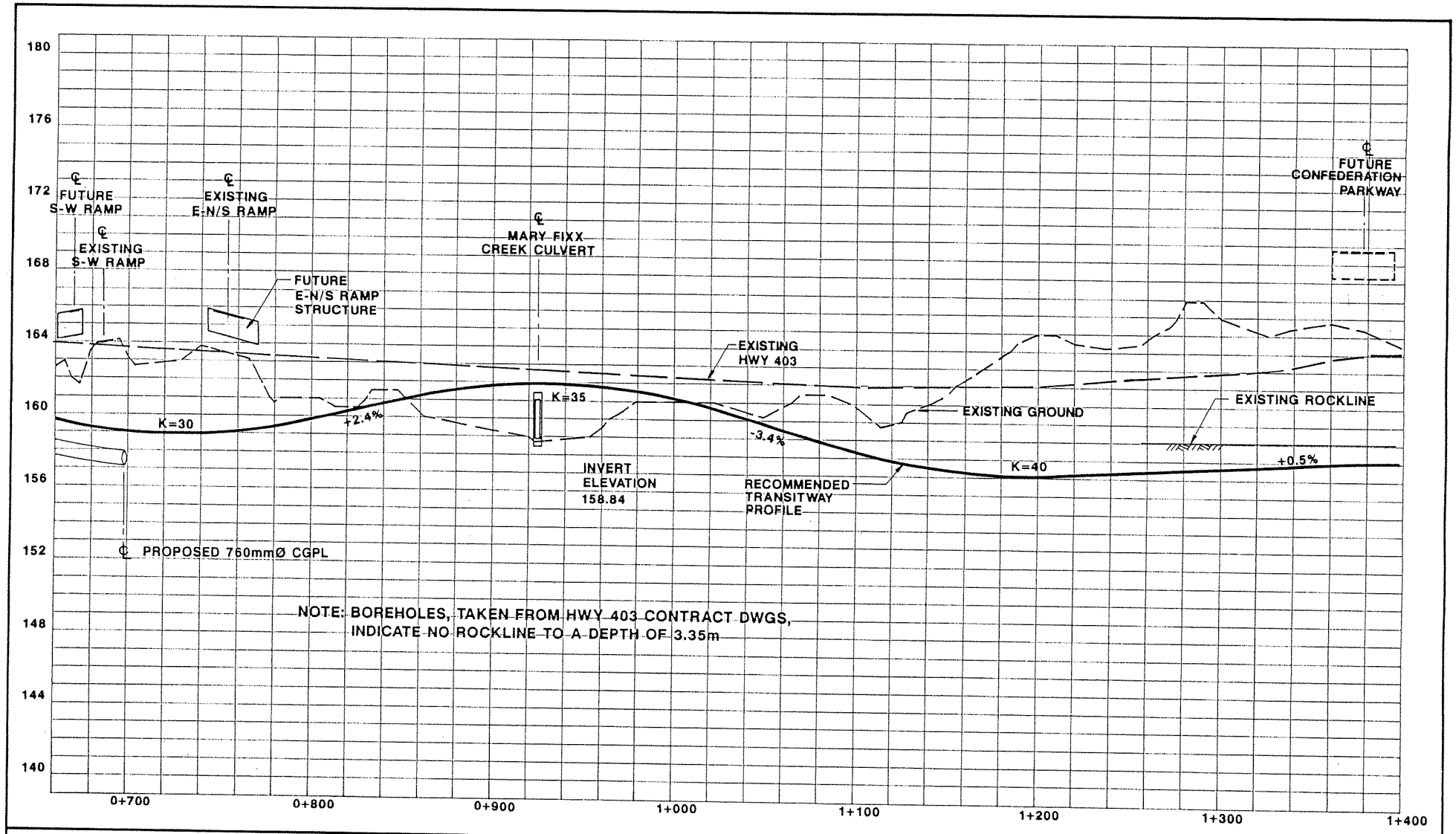
EXHIBIT 51

0 50 100 150 200m

SCALE

RECOMMENDED PLAN

Sta. 0+640 to Sta. 1+430



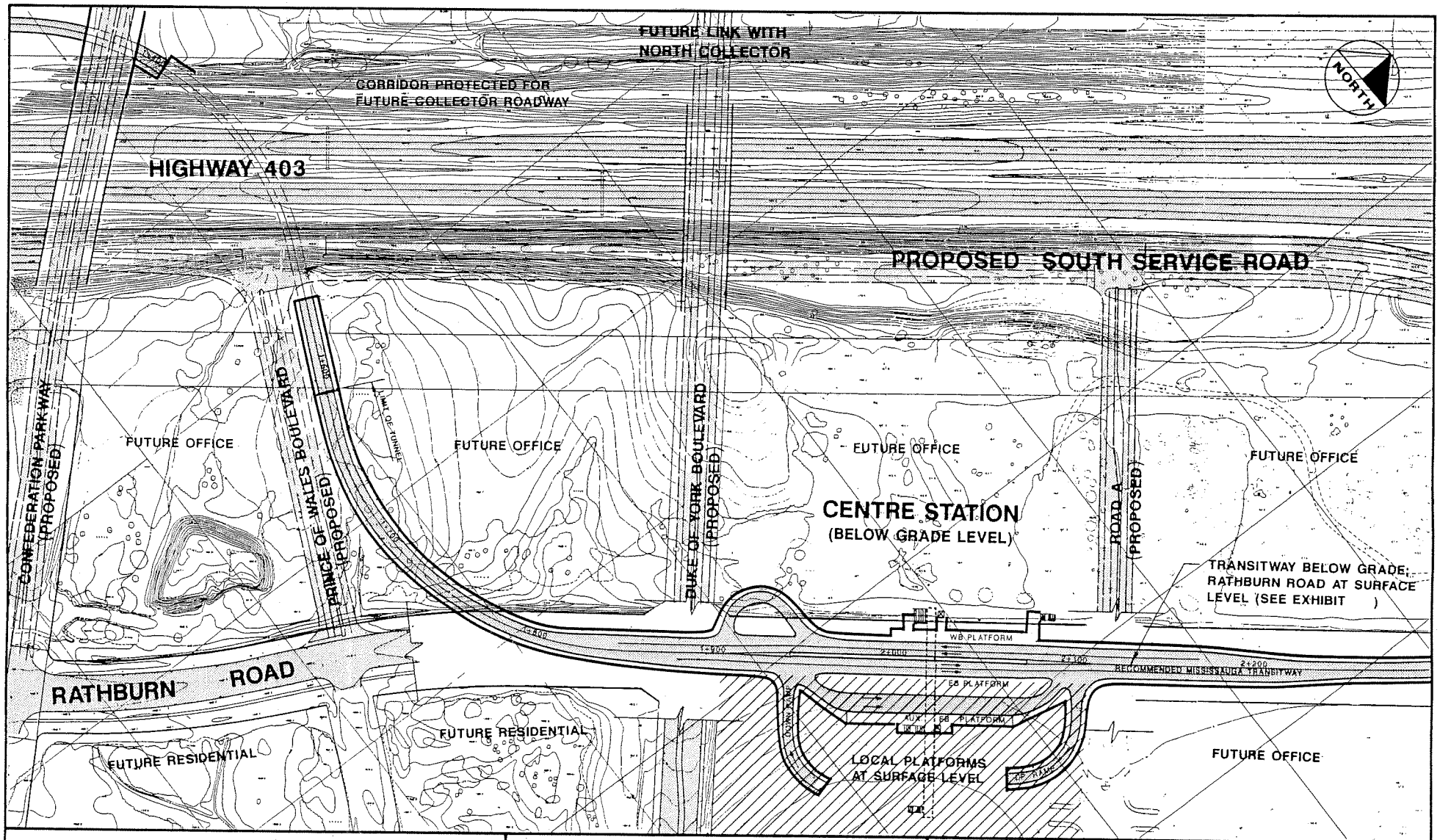
MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT

0 50 100 150 200m

RECOMMENDED PROFILES

Sta. 0+660 to Sta. 1+400



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

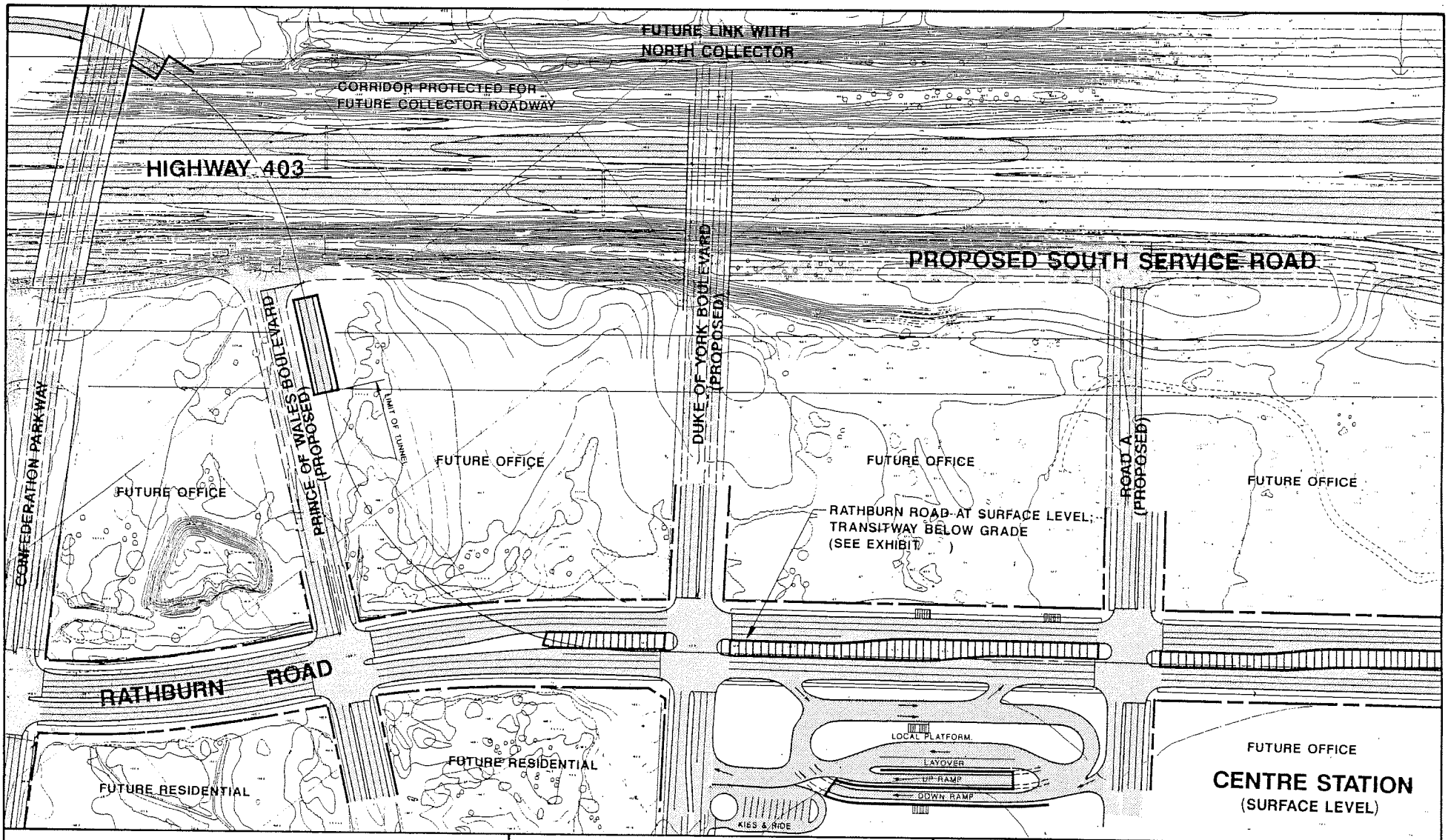
EXHIBIT 52

0 50 100 150 200m

SCALE

RECOMMENDED PLAN (TRANSITWAY)

Sta. 1+320 to Sta. 2+300



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

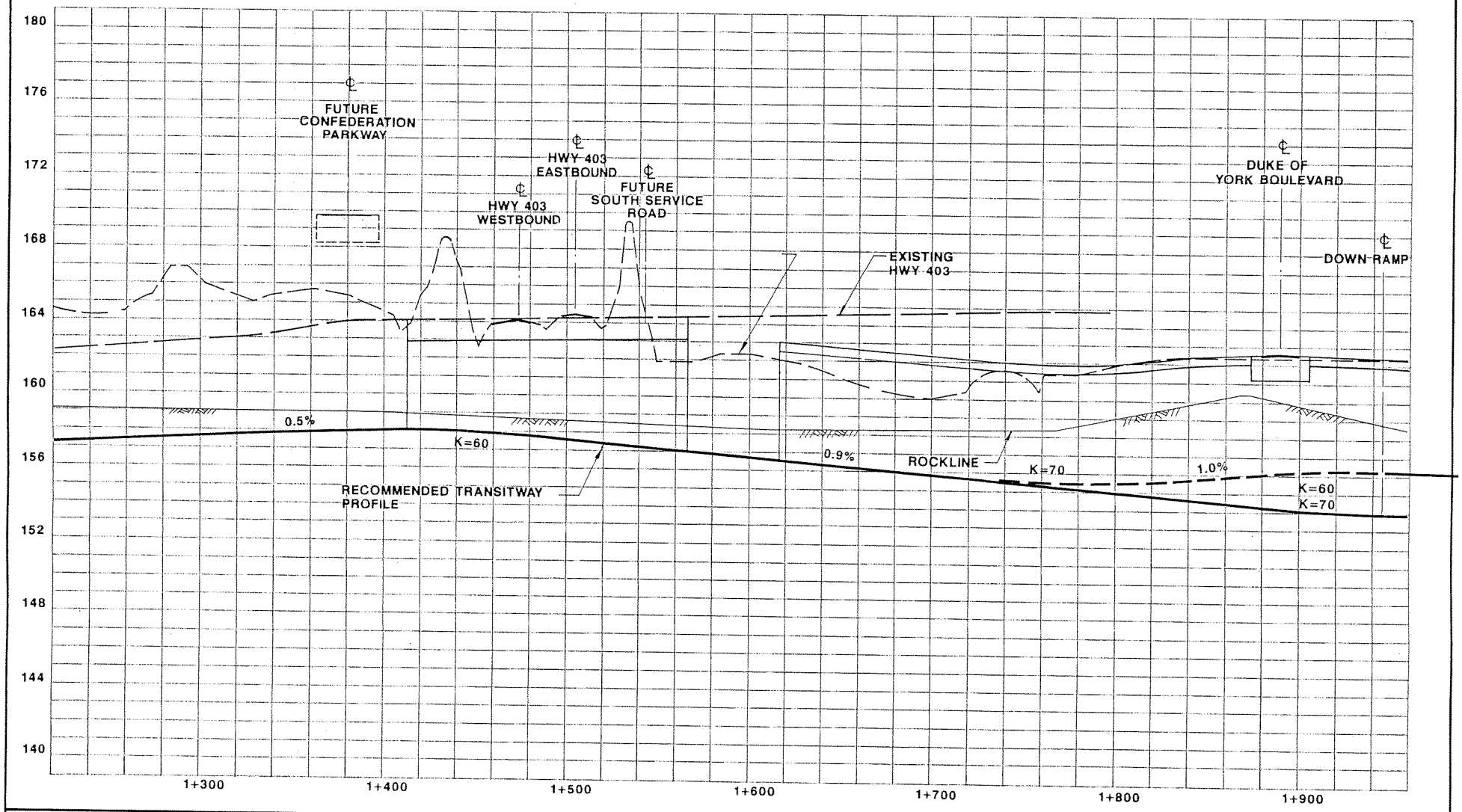
EXHIBIT 53

0 50 100 150 200m

SCALE

RECOMMENDED PLAN (SURFACE)

Sta. 1+320 to Sta. 2+300



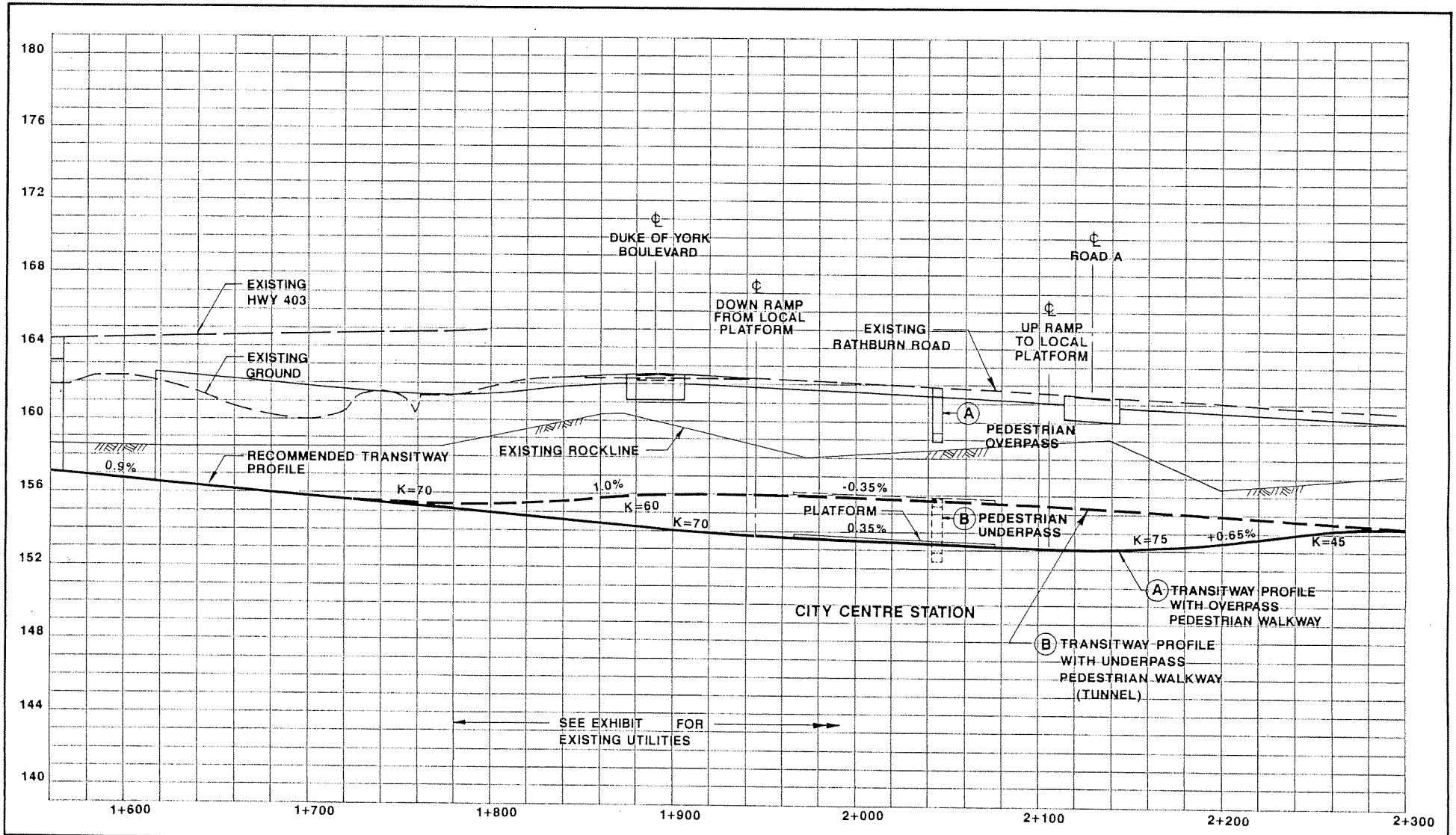
MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT

0 50 100 150 200m

RECOMMENDED PROFILES

Sta. 1+220 to Sta. 1+960



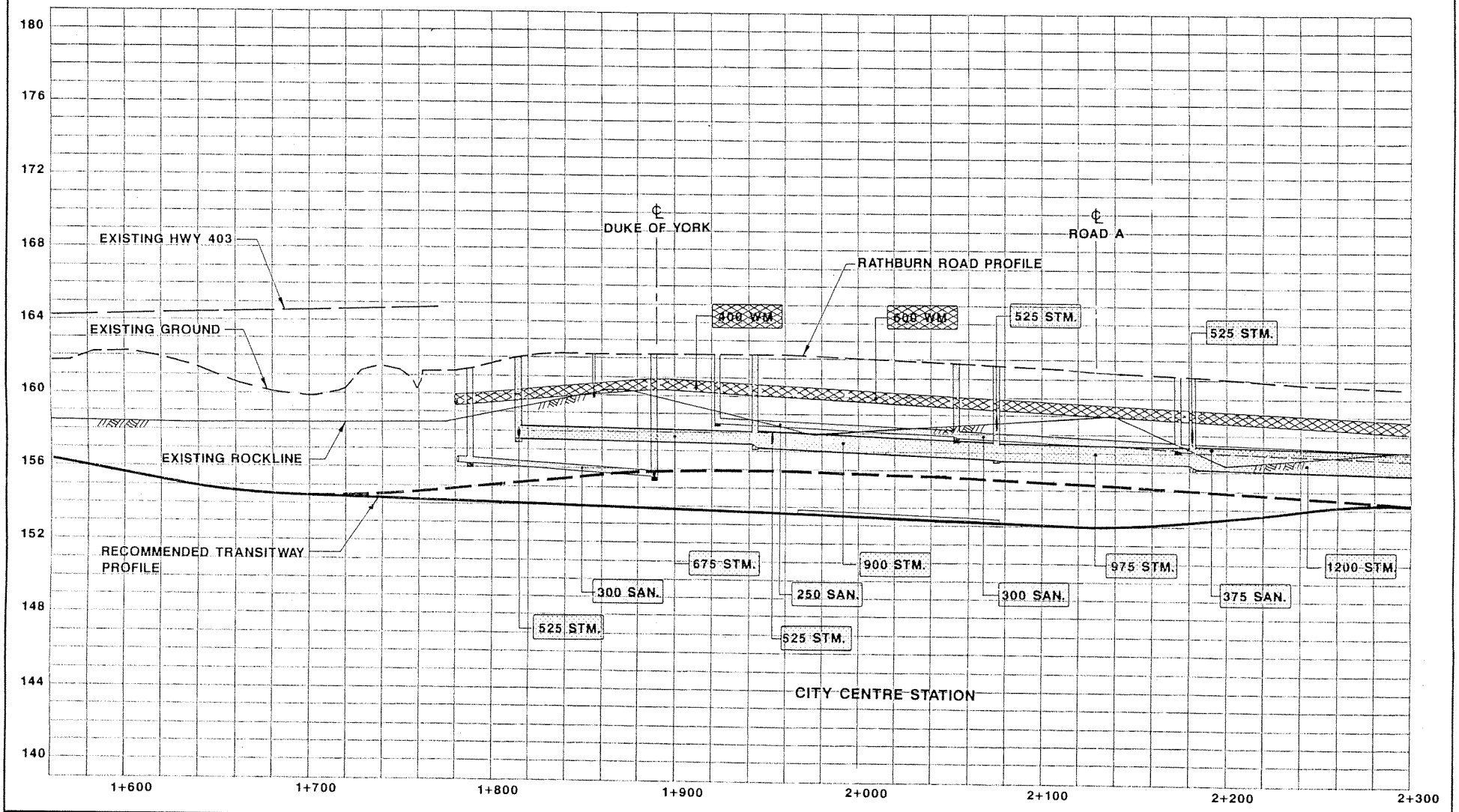
MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT

0 50 100 150 200m

RECOMMENDED PROFILES

Sta. 1+560 to Sta. 2+300



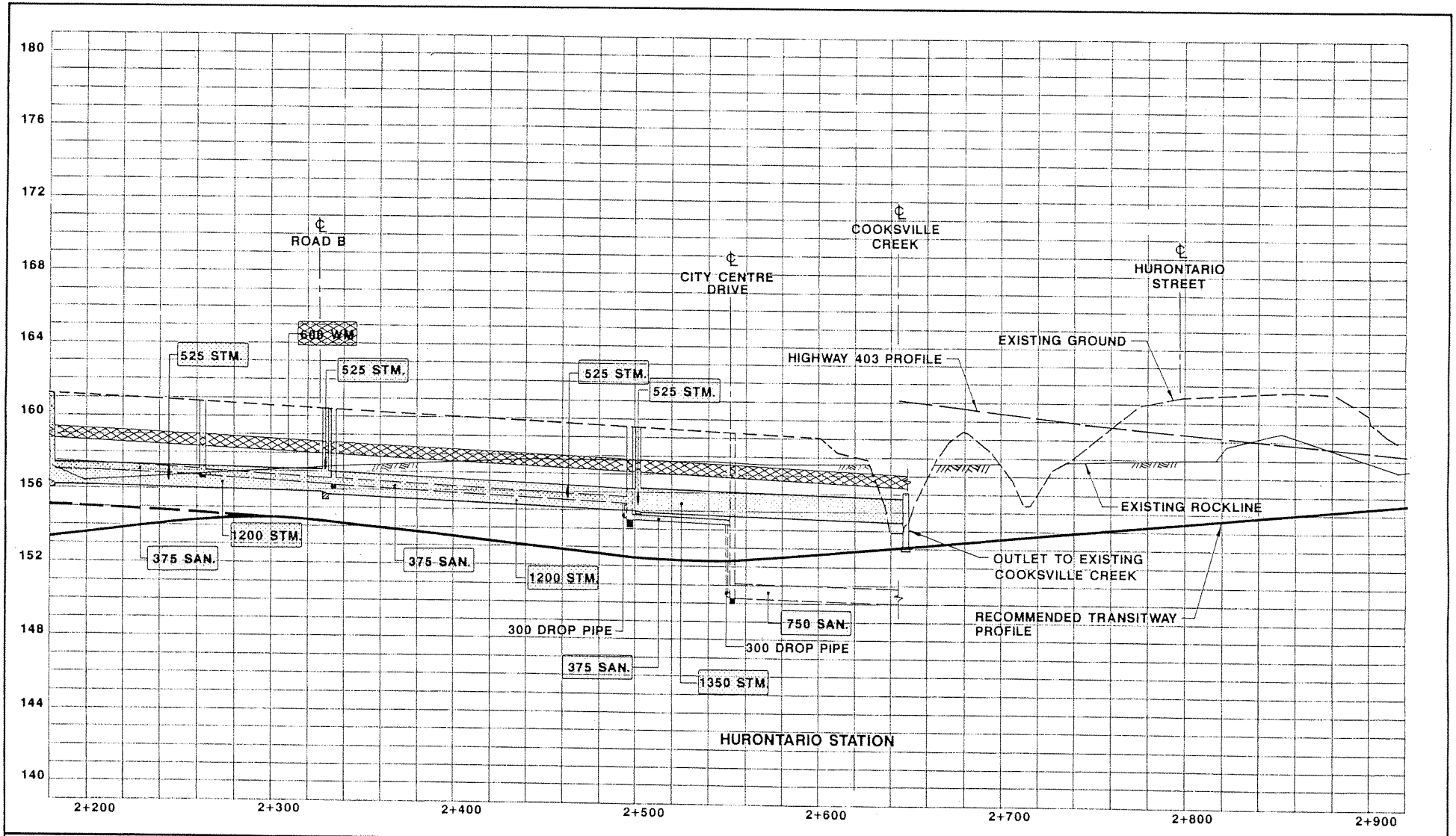
MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT

0 50 100 150 200m

EXISTING UTILITIES - RATHBURN ROAD

Sta. 1+560 to Sta. 2+300



MISSISSAUGA TRANSITWAY

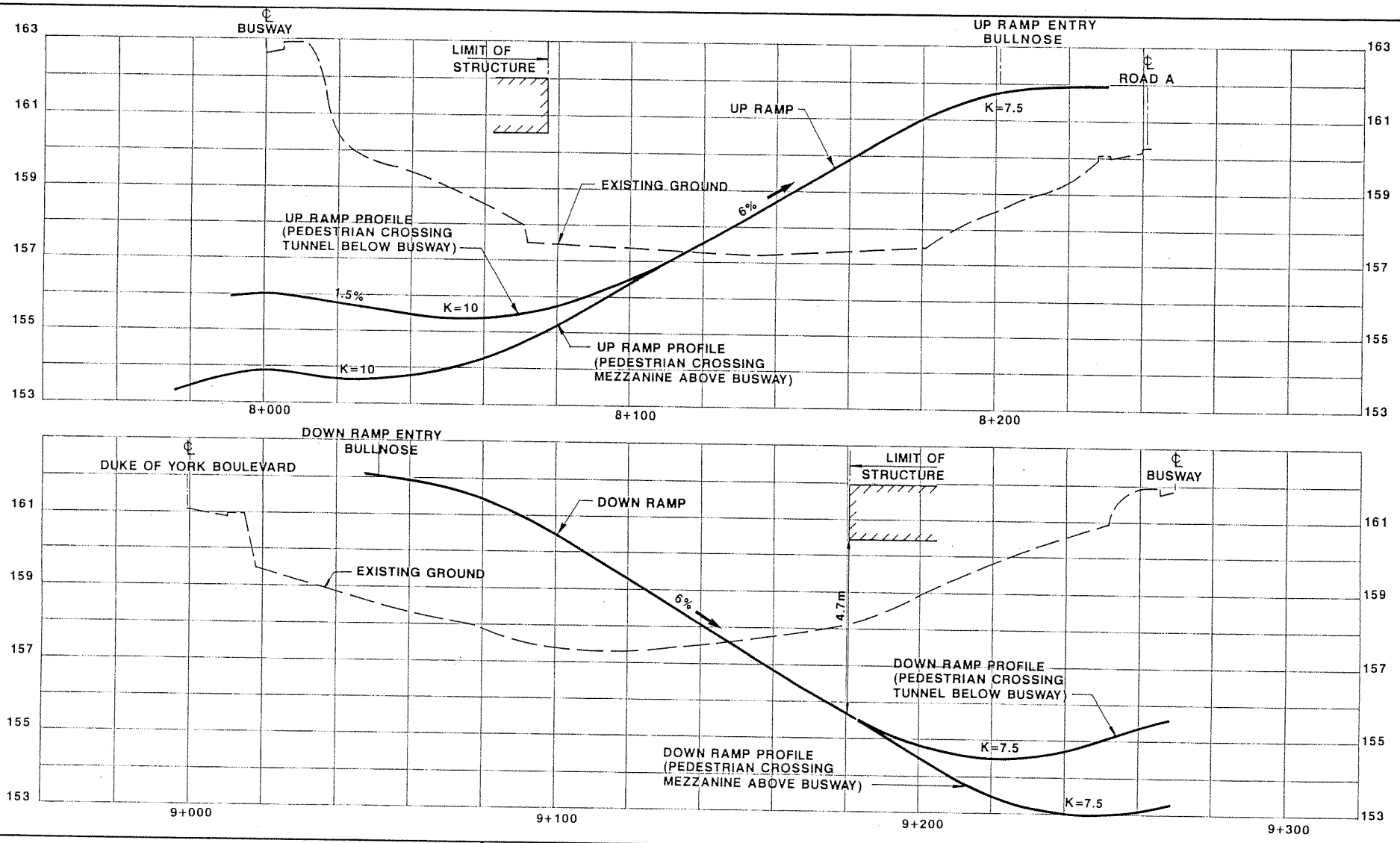
FUNCTIONAL PLANNING STUDY

EXHIBIT

0 50 100 150 200m

EXISTING UTILITIES - RATHBURN ROAD

Sta. 2+180 to Sta. 2+920



MISSISSAUGA TRANSITWAY

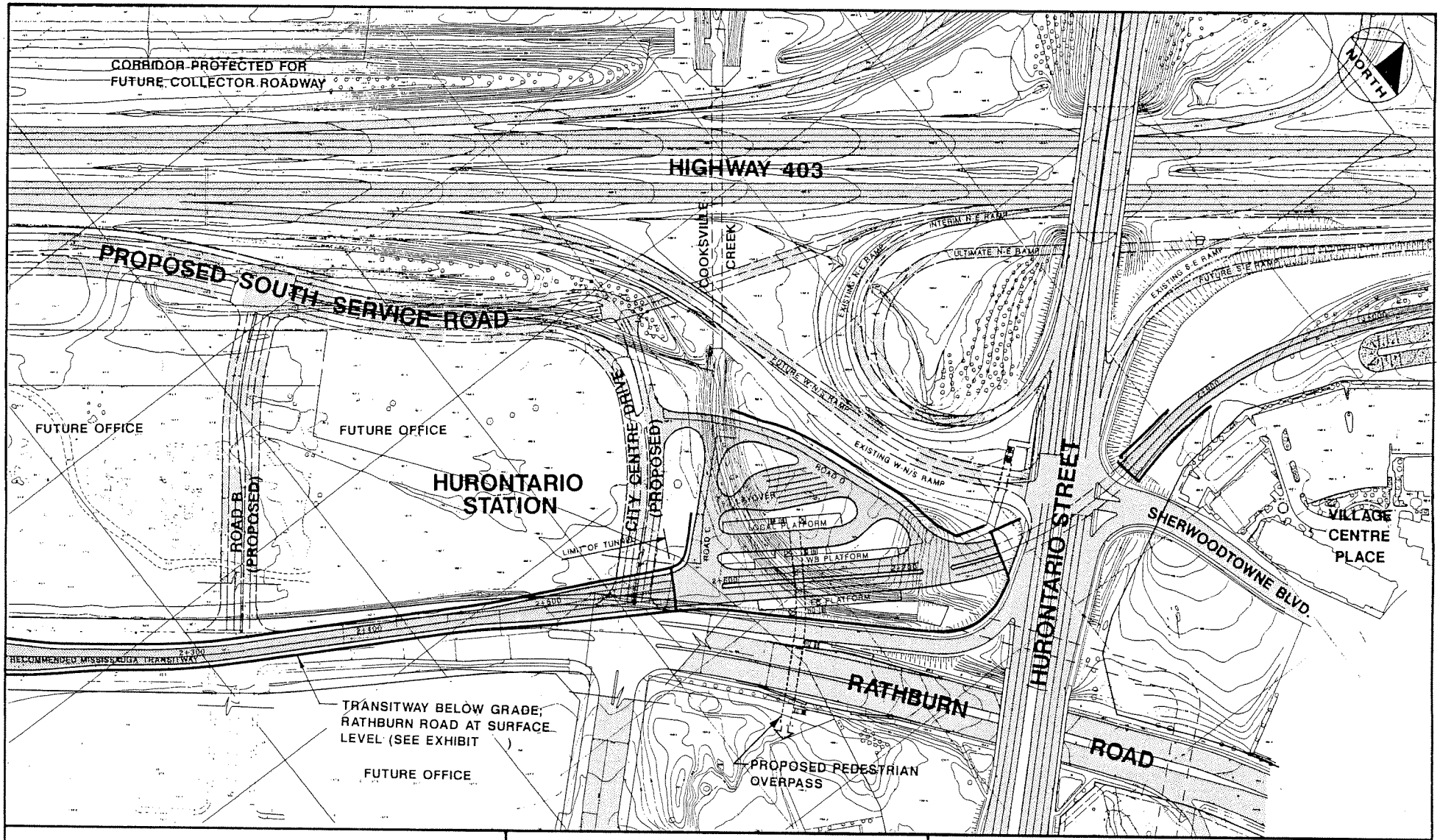
FUNCTIONAL PLANNING STUDY

EXHIBIT

0 25 50 75 100m

RECOMMENDED RAMP PROFILES

CENTRE STATION - UP RAMP
DOWN RAMP



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

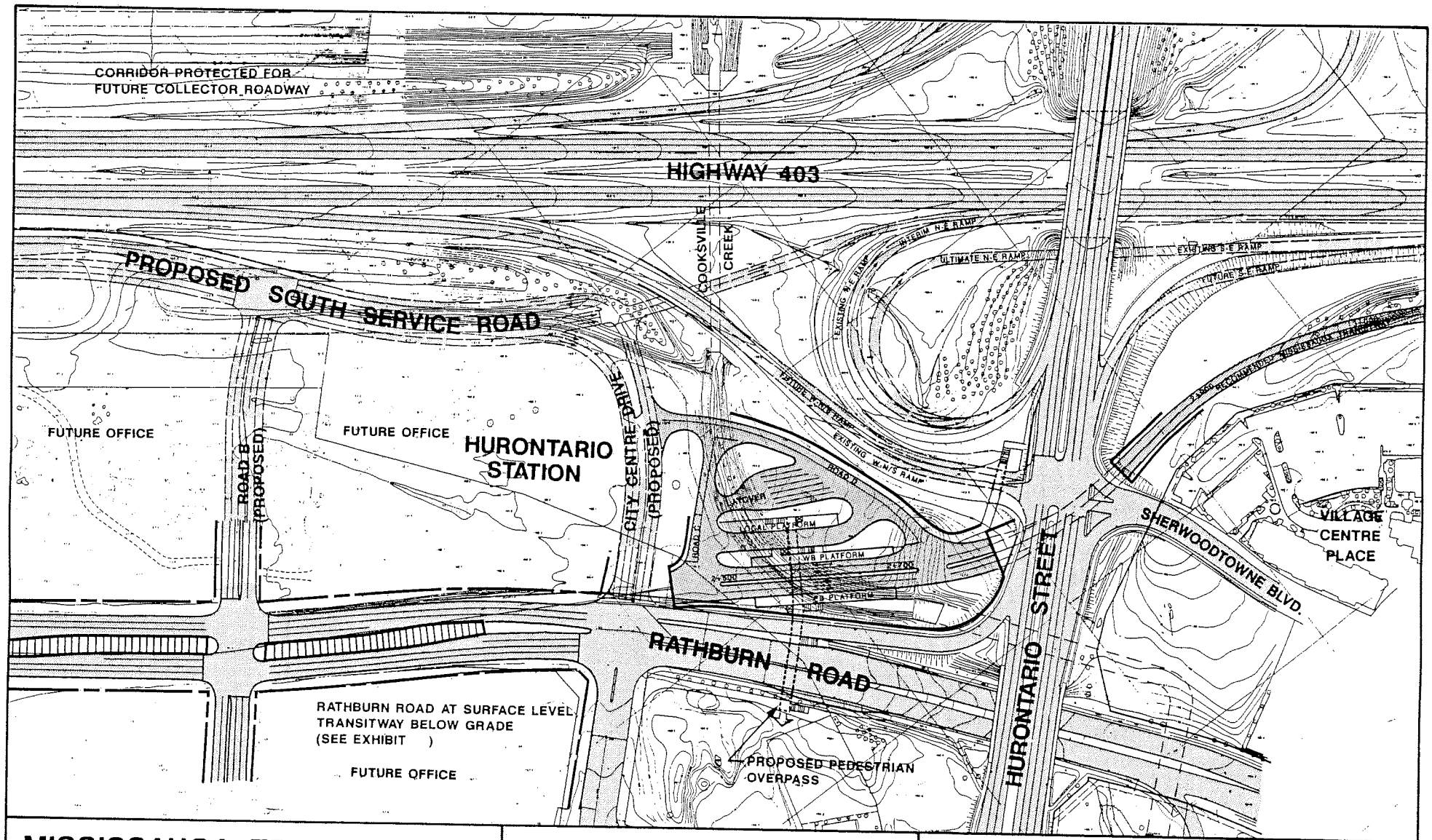
EXHIBIT 54

0 50 100 150 200m

SCALE

RECOMMENDED PLAN (TRANSITWAY)

Sta. 2+200 to Sta. 3+035



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

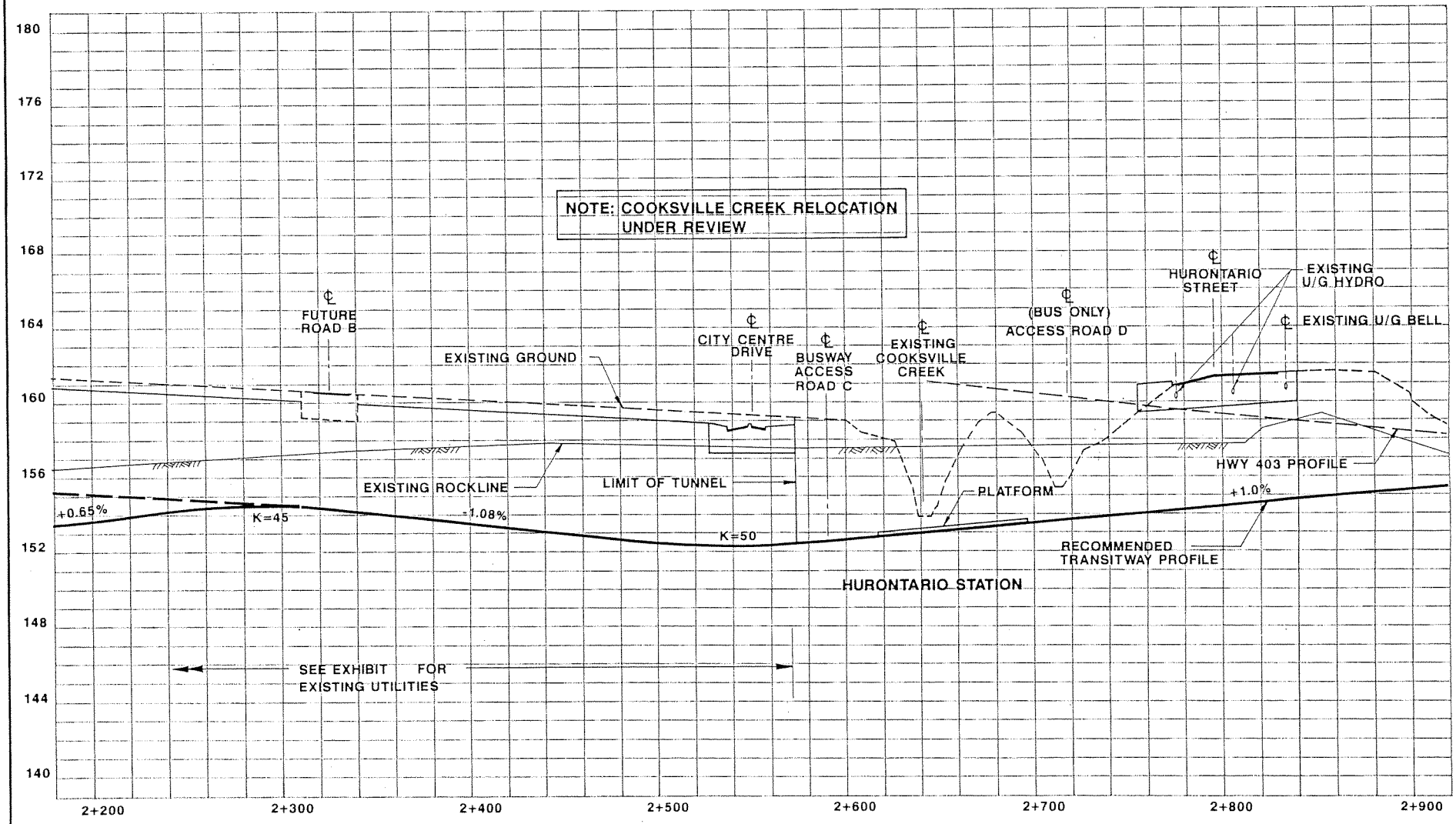
EXHIBIT 55

0 50 100 150 200m

SCALE

RECOMMENDED PLAN (SURFACE)

Sta. 2+200 to Sta. 3+035



MISSISSAUGA TRANSITWAY

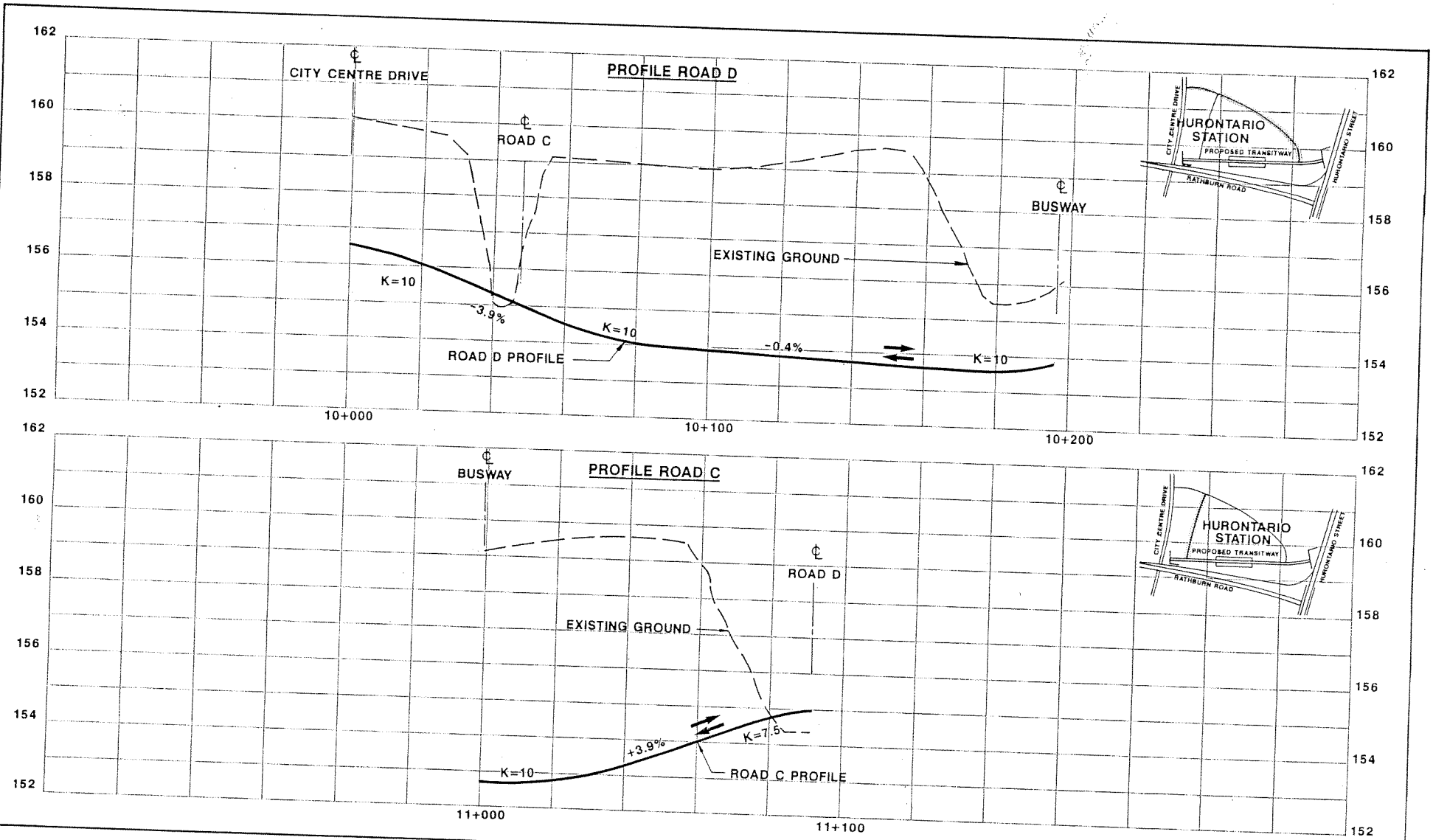
FUNCTIONAL PLANNING STUDY

EXHIBIT

0 50 100 150 200m

RECOMMENDED PROFILES

Sta. 2+180 to Sta. 2+920



MISSISSAUGA TRANSITWAY

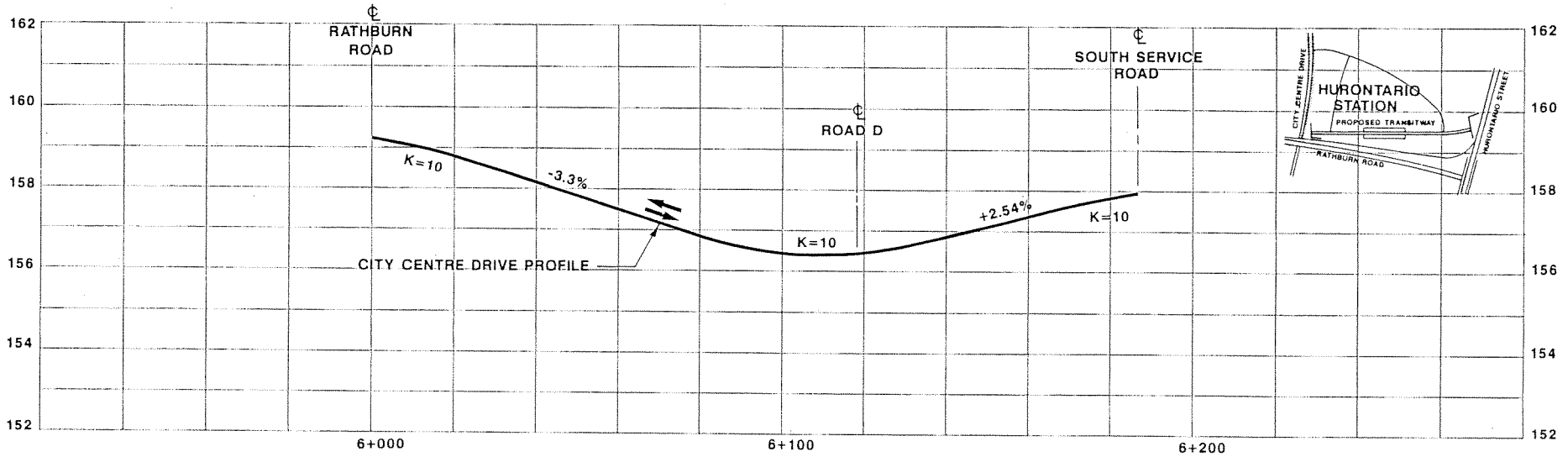
FUNCTIONAL PLANNING STUDY

EXHIBIT

0 25 50 75 100m

RECOMMENDED RAMP PROFILES

HURONTARIO STATION - ROAD D
ROAD C



MISSISSAUGA TRANSITWAY

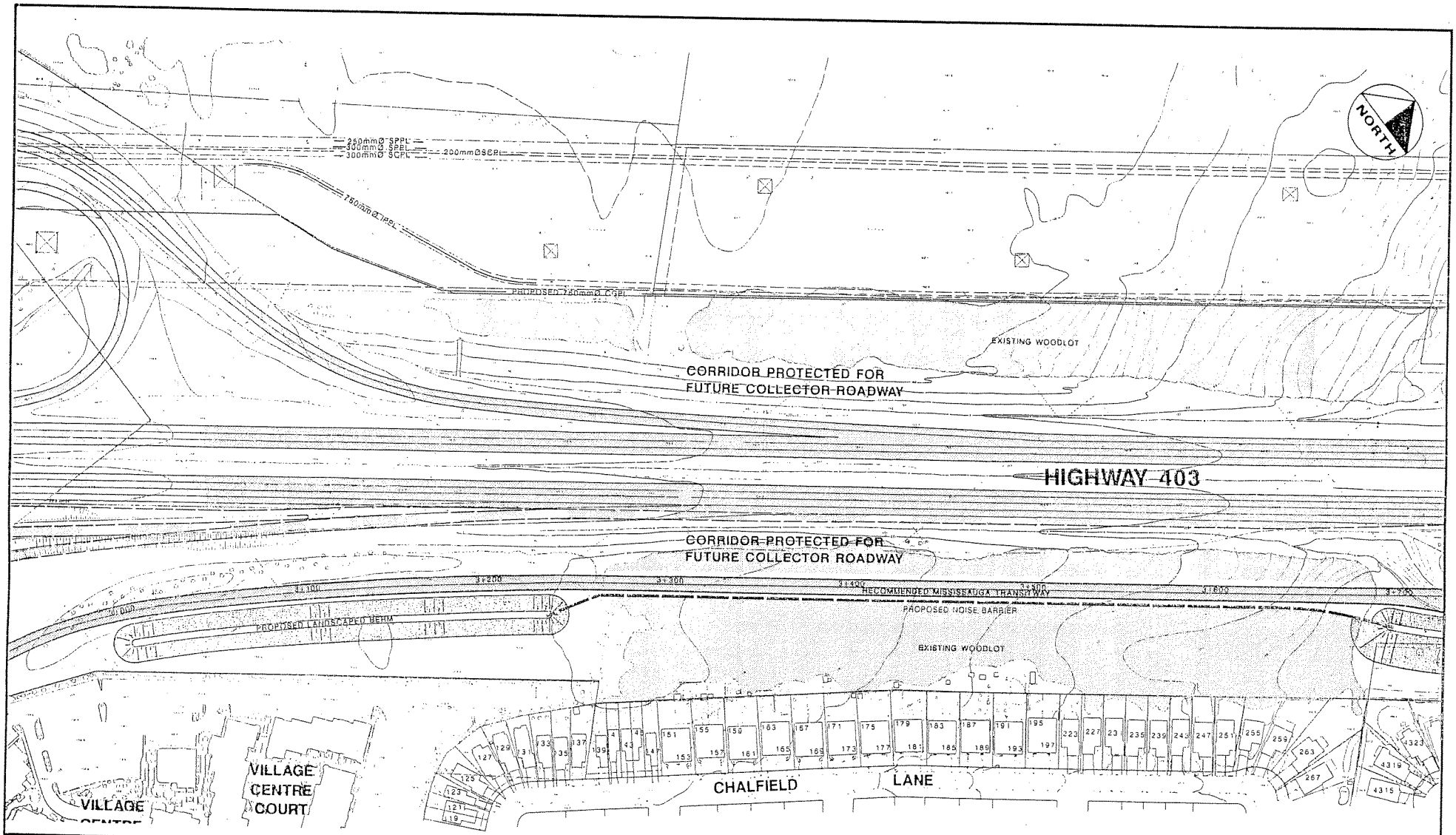
FUNCTIONAL PLANNING STUDY

EXHIBIT

0 25 50 75 100m

RECOMMENDED RAMP PROFILES

HURONTARIO STATION - CITY CENTRE DRIVE



MISSISSAUGA TRANSITWAY

FUNCTIONAL PLANNING STUDY

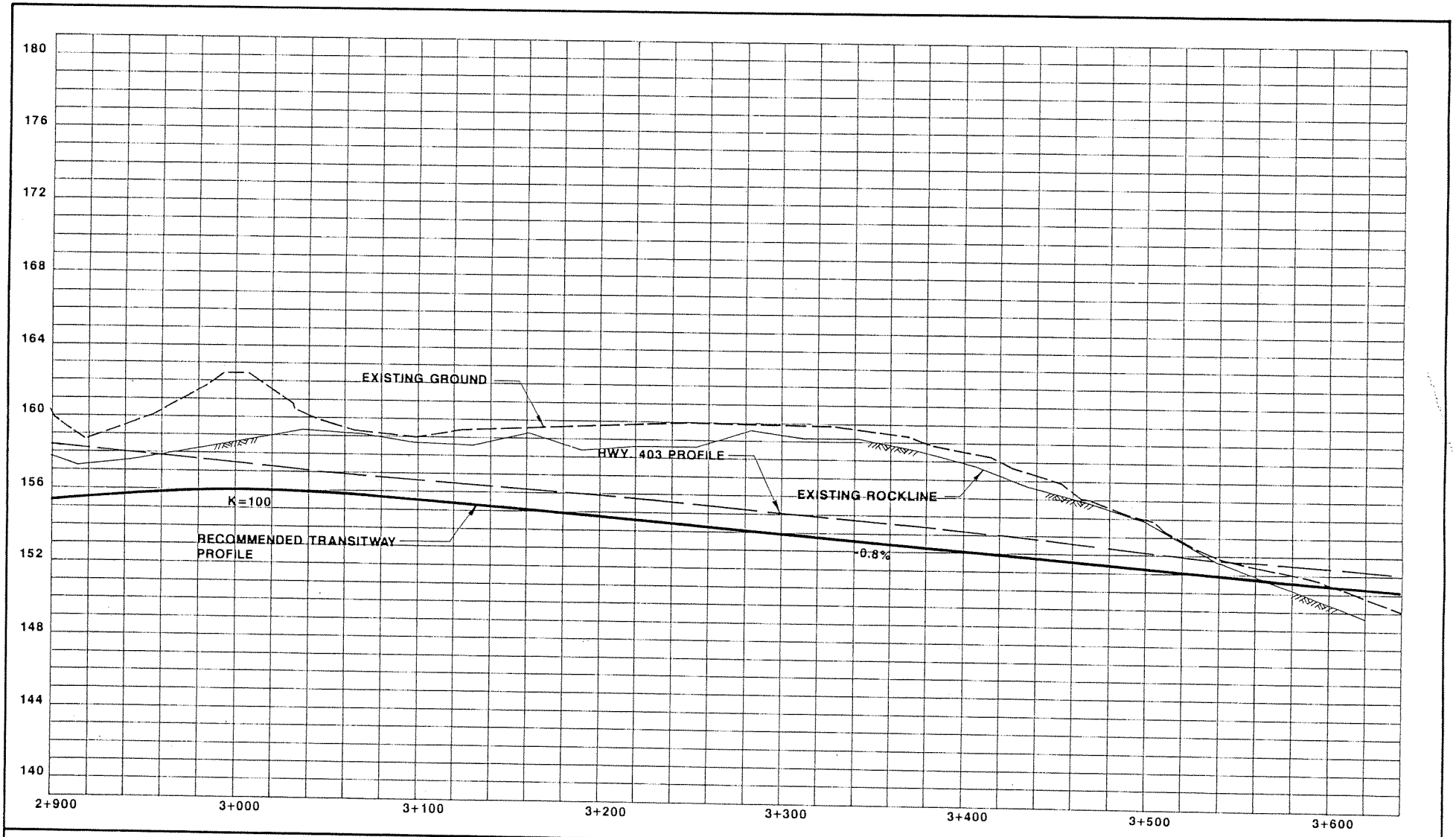
EXHIBIT 56

0 50 100 150 200m

SCALE

RECOMMENDED PLAN

Sta. 2+966 to Sta. 3+726



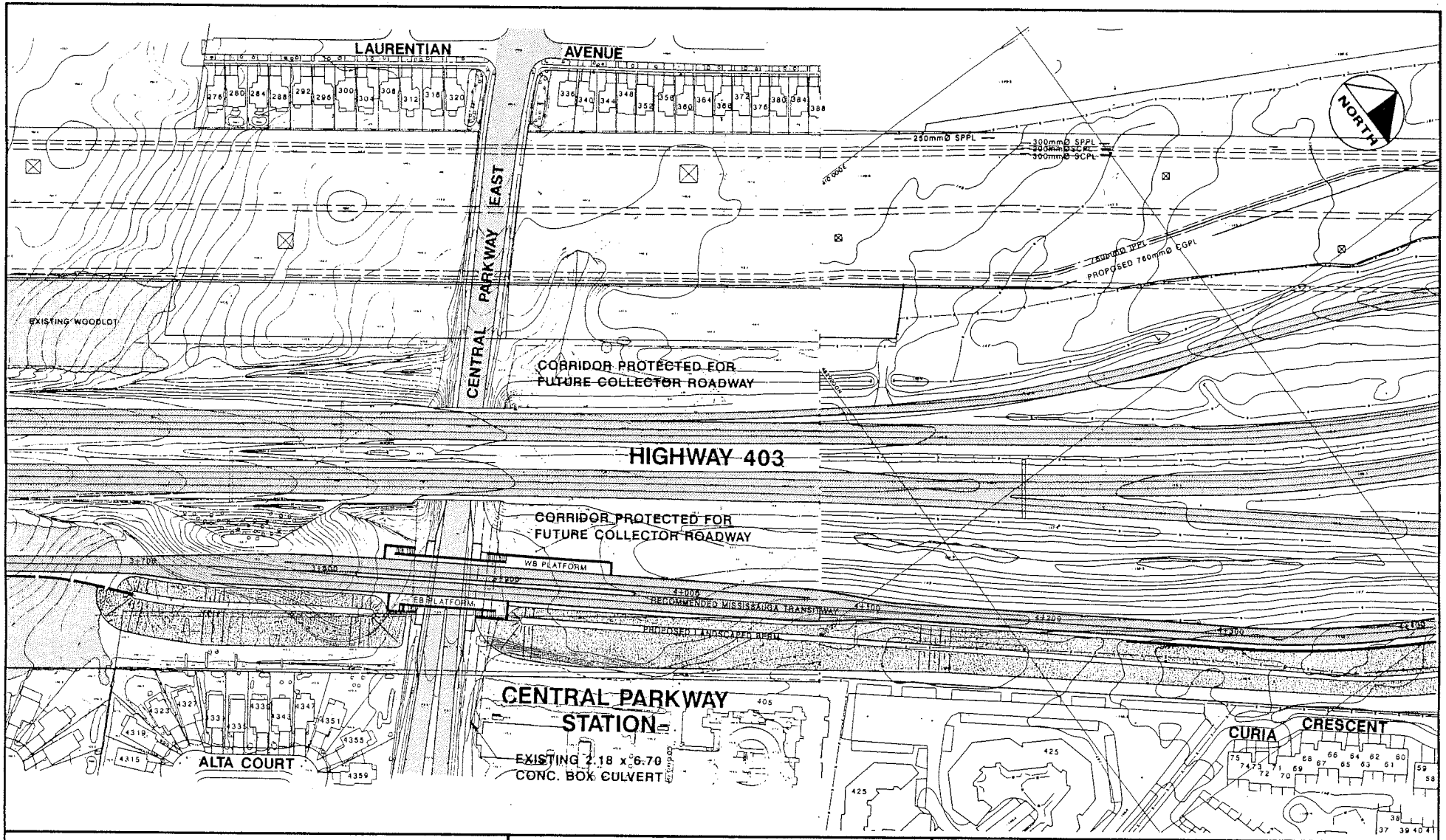
MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT

0 50 100 150 200m

RECOMMENDED PROFILES

Sta. 2+900 to Sta. 3+640



MISSISSAUGA TRANSITWAY

FUNCTIONAL PLANNING STUDY

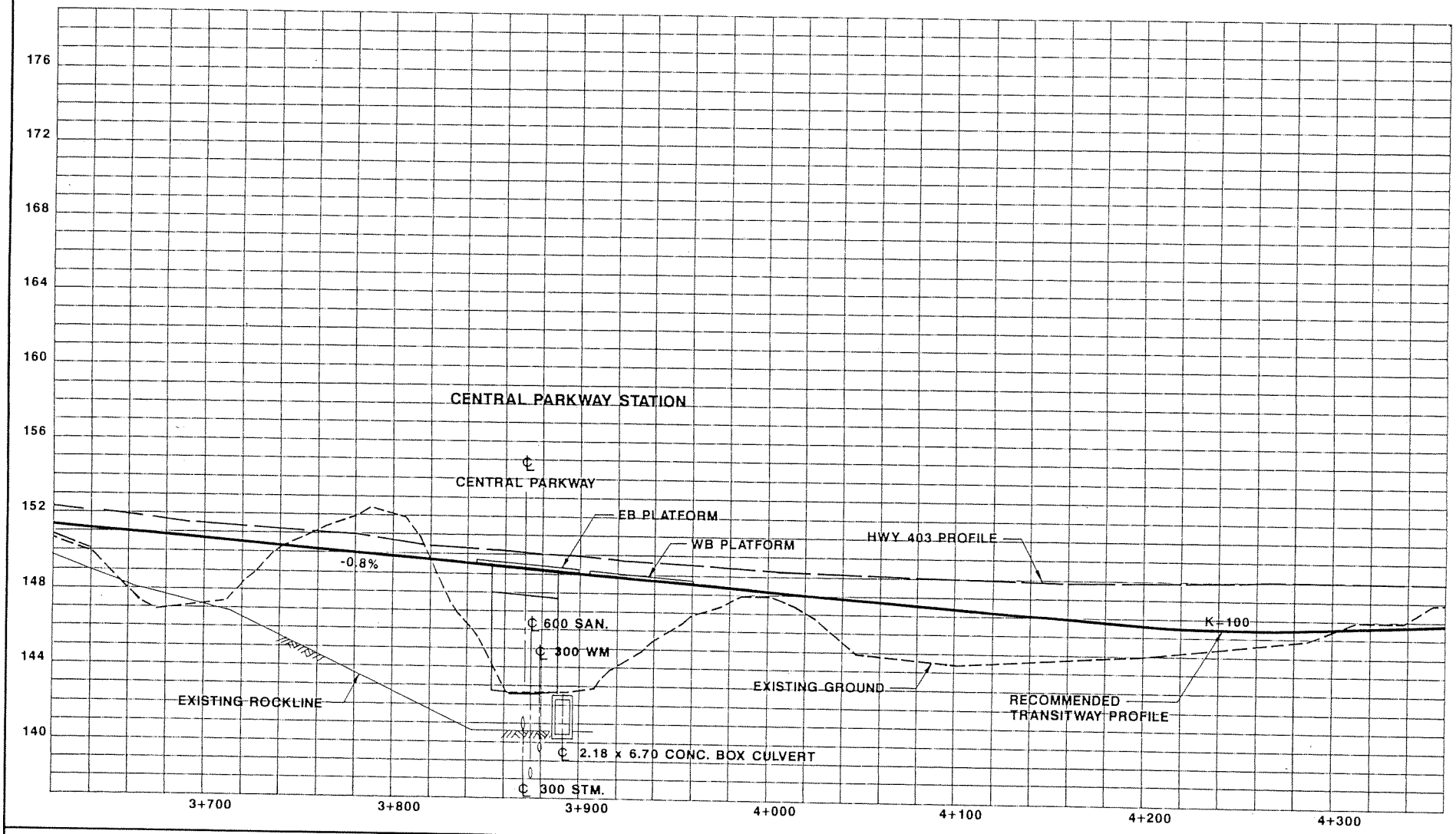
EXHIBIT 57

0 50 100 150 200m

SCALE

RECOMMENDED PLAN

Sta. 3+630 to Sta. 4+415



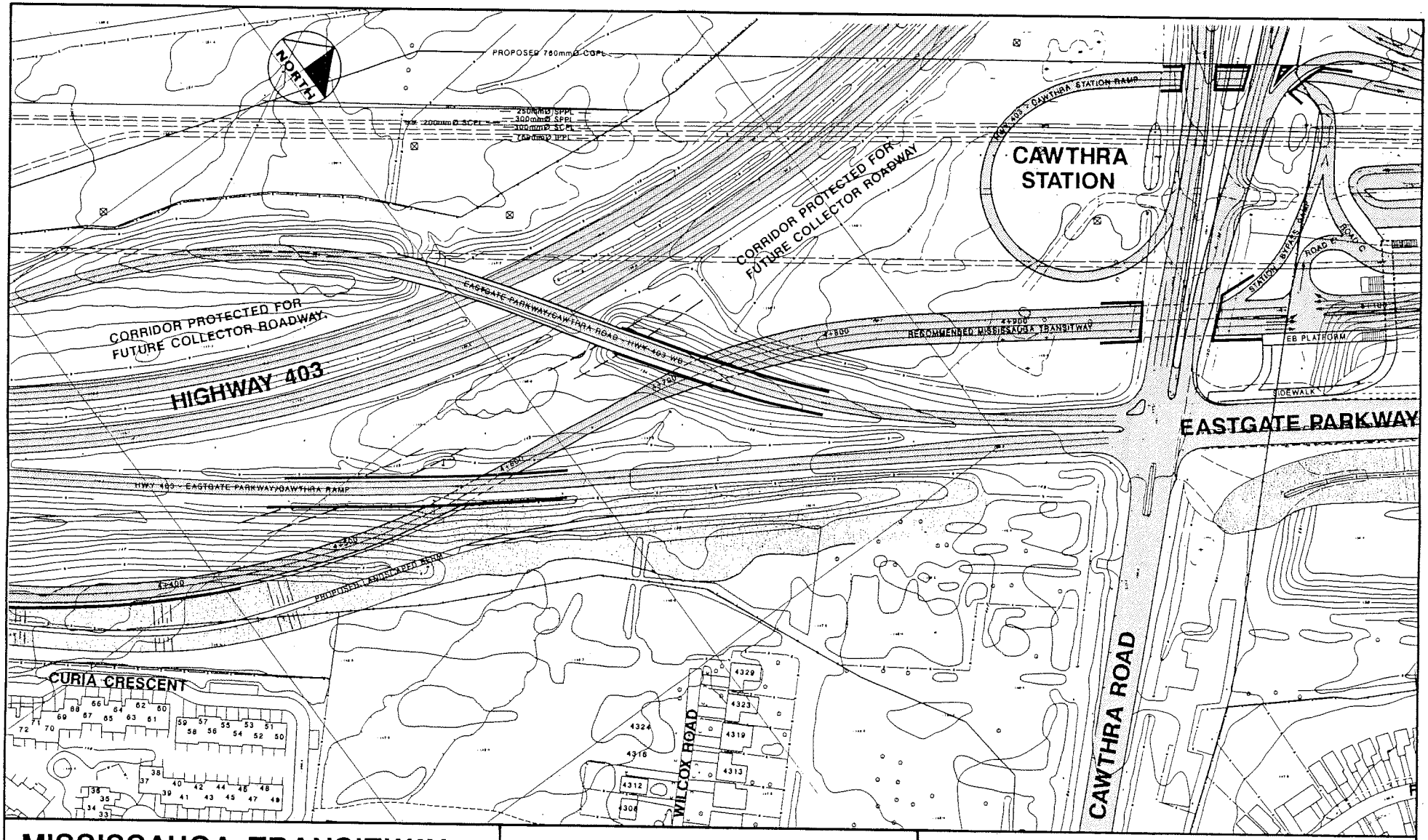
MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT

0 50 100 150 200m

RECOMMENDED PROFILES

Sta. 3+620 to Sta. 4+360



MISSISSAUGA TRANSITWAY

FUNCTIONAL PLANNING STUDY

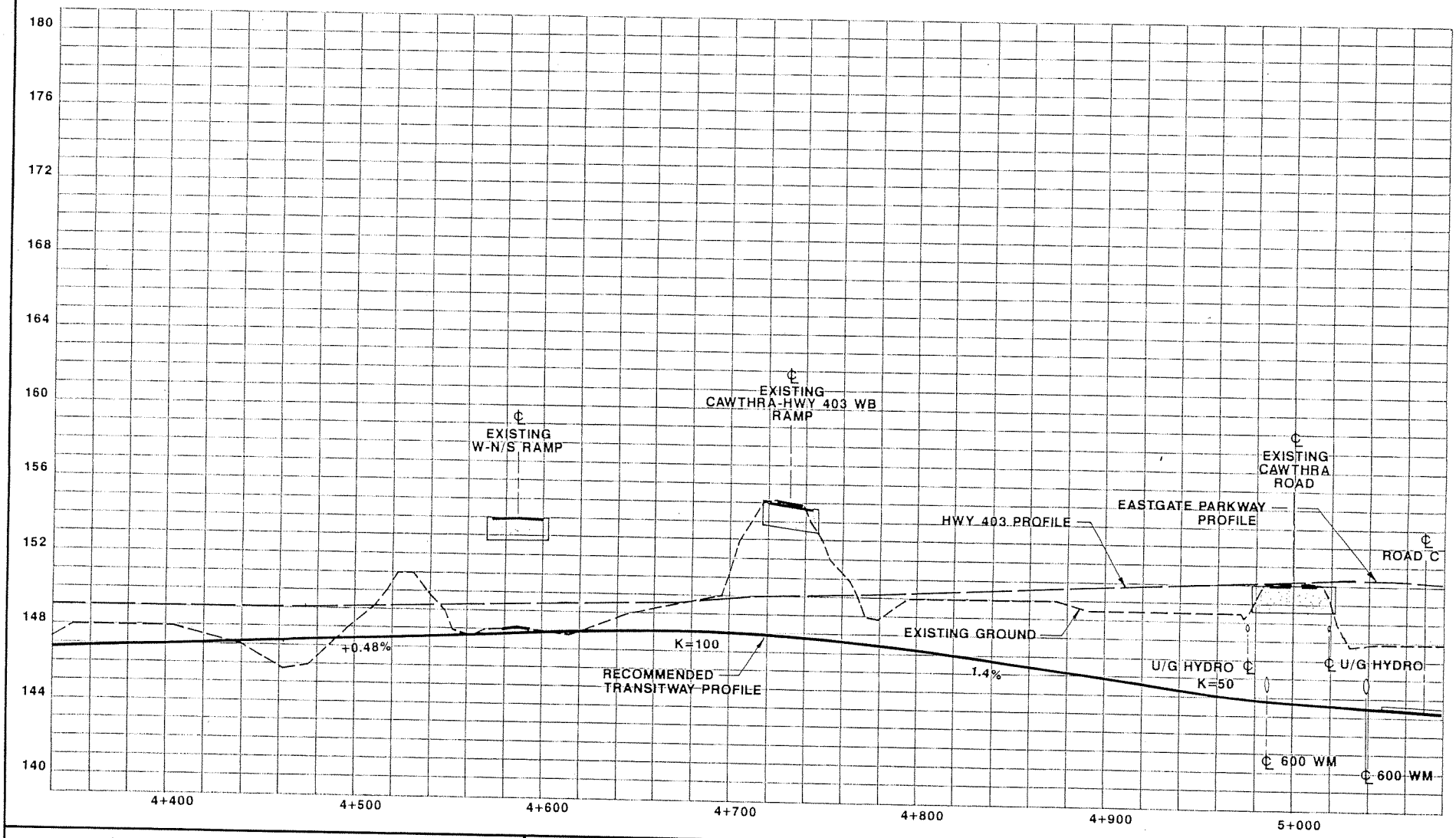
EXHIBIT 58

0 50 100 150 200m

SCALE

RECOMMENDED PLAN

Sta. 4+312 to Sta. 5+130



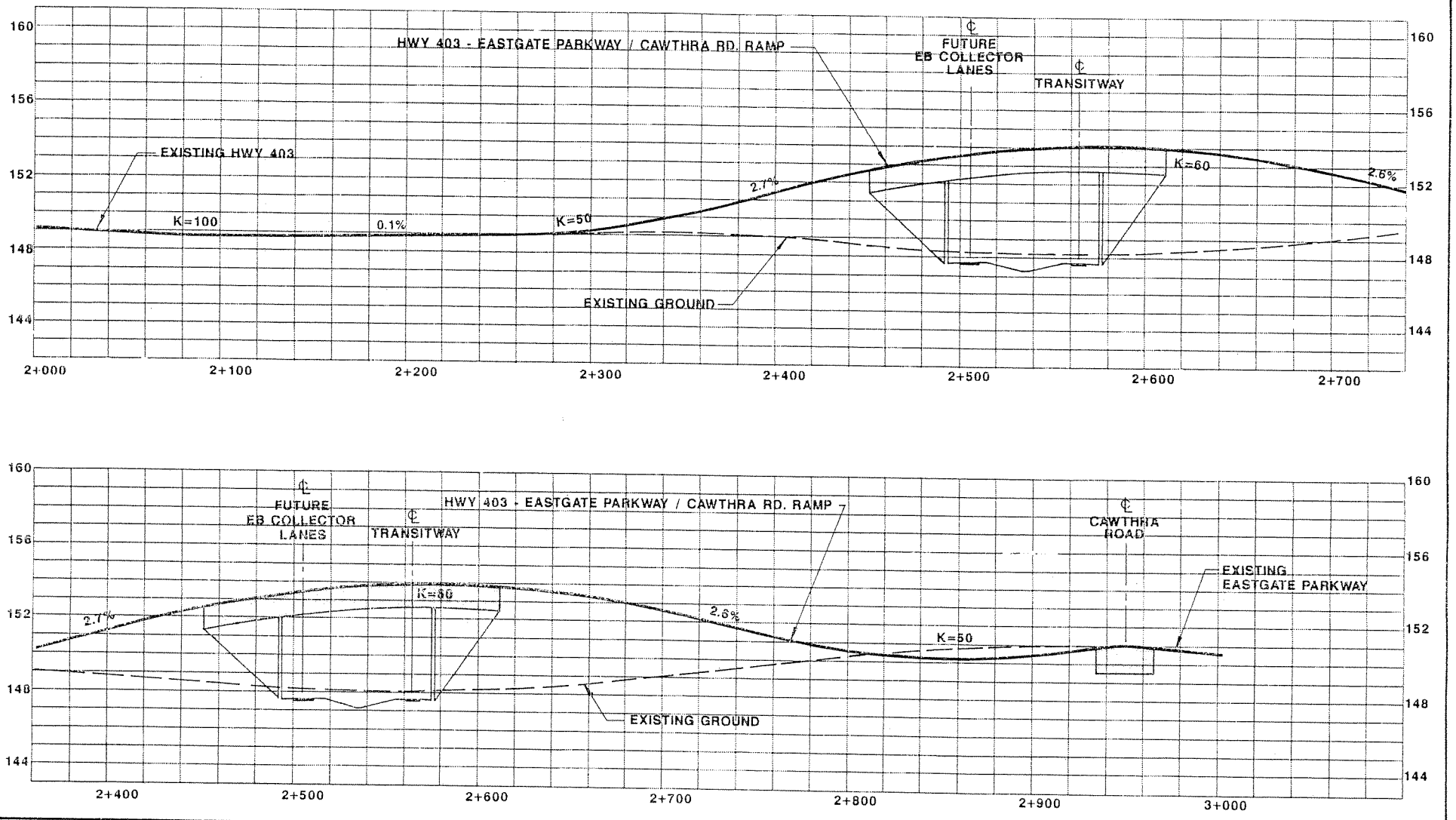
MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT

0 50 100 150 200m

RECOMMENDED PROFILES

Sta. 4+340 to Sta. 5+080

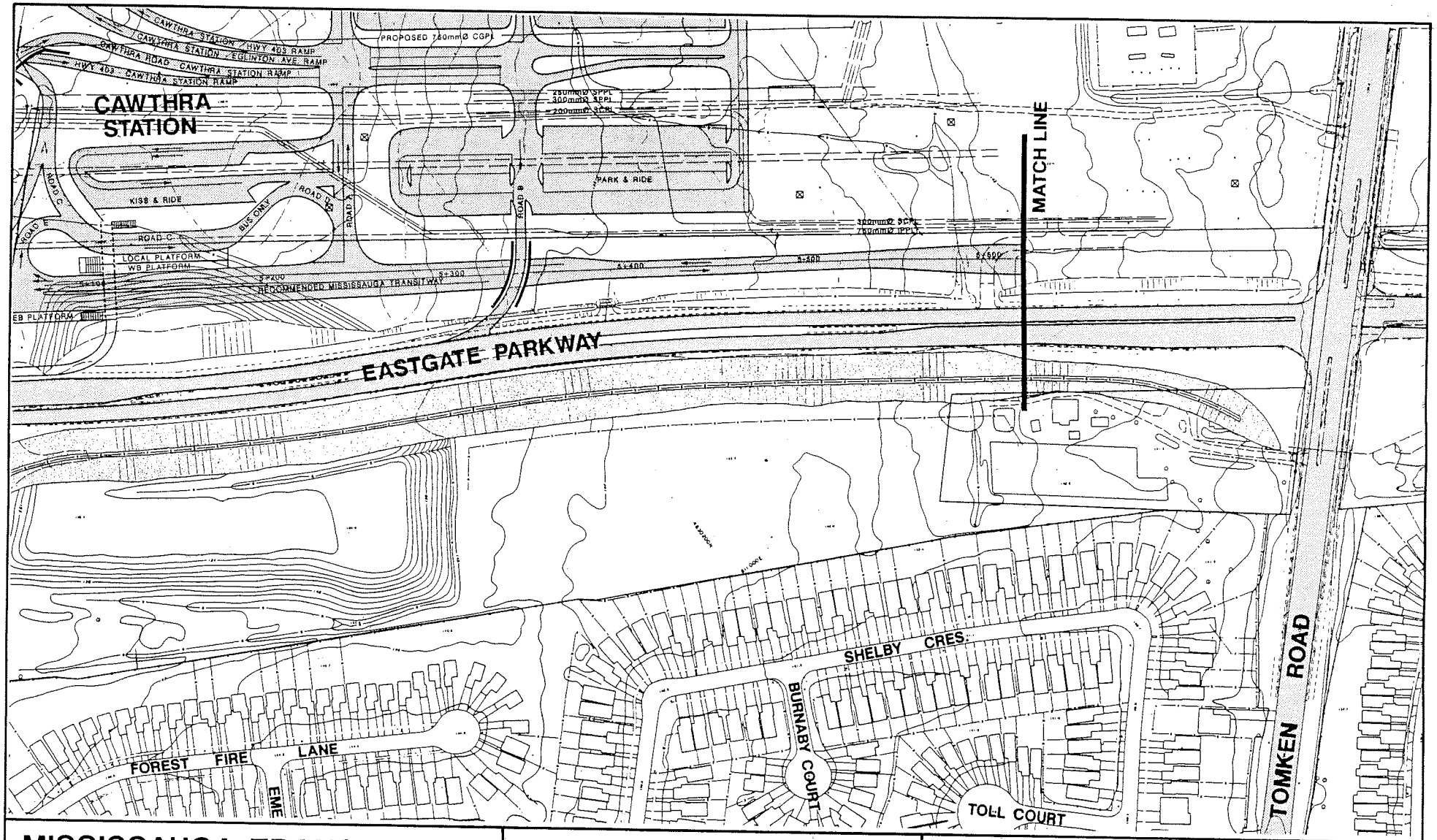


MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT

0 50 100 150 200m

RECOMMENDED HIGHWAY 403 RAMP PROFILES
HWY 403 - EASTGATE PARKWAY /CAWTHRA ROAD RAMP



MISSISSAUGA TRANSITWAY

FUNCTIONAL PLANNING STUDY

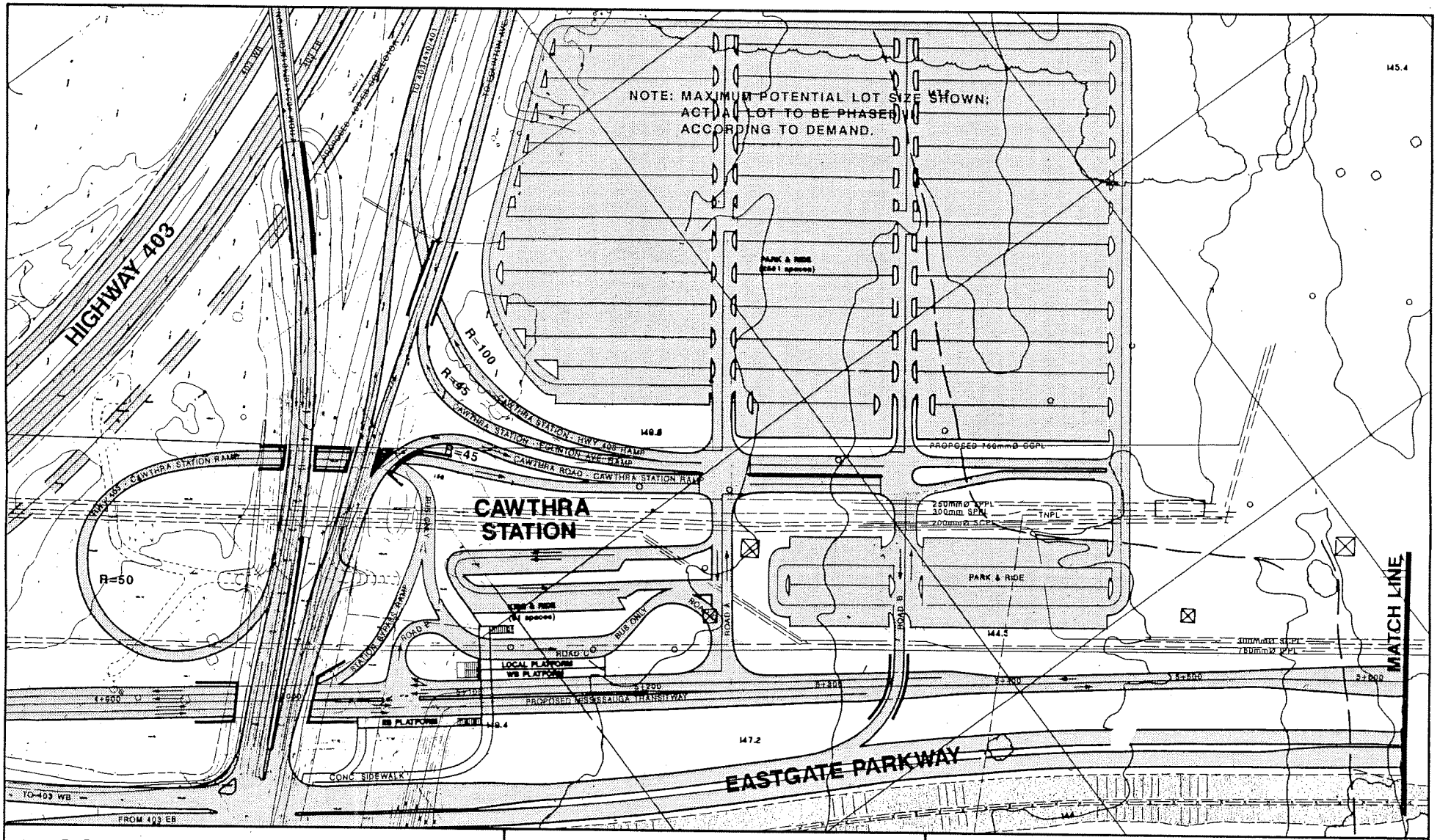
EXHIBIT 59

0 50 100 150 200m

SCALE

RECOMMENDED PLAN

Sta. 5+062 to Sta. 5+622



MISSISSAUGA TRANSITWAY

FUNCTIONAL PLANNING STUDY

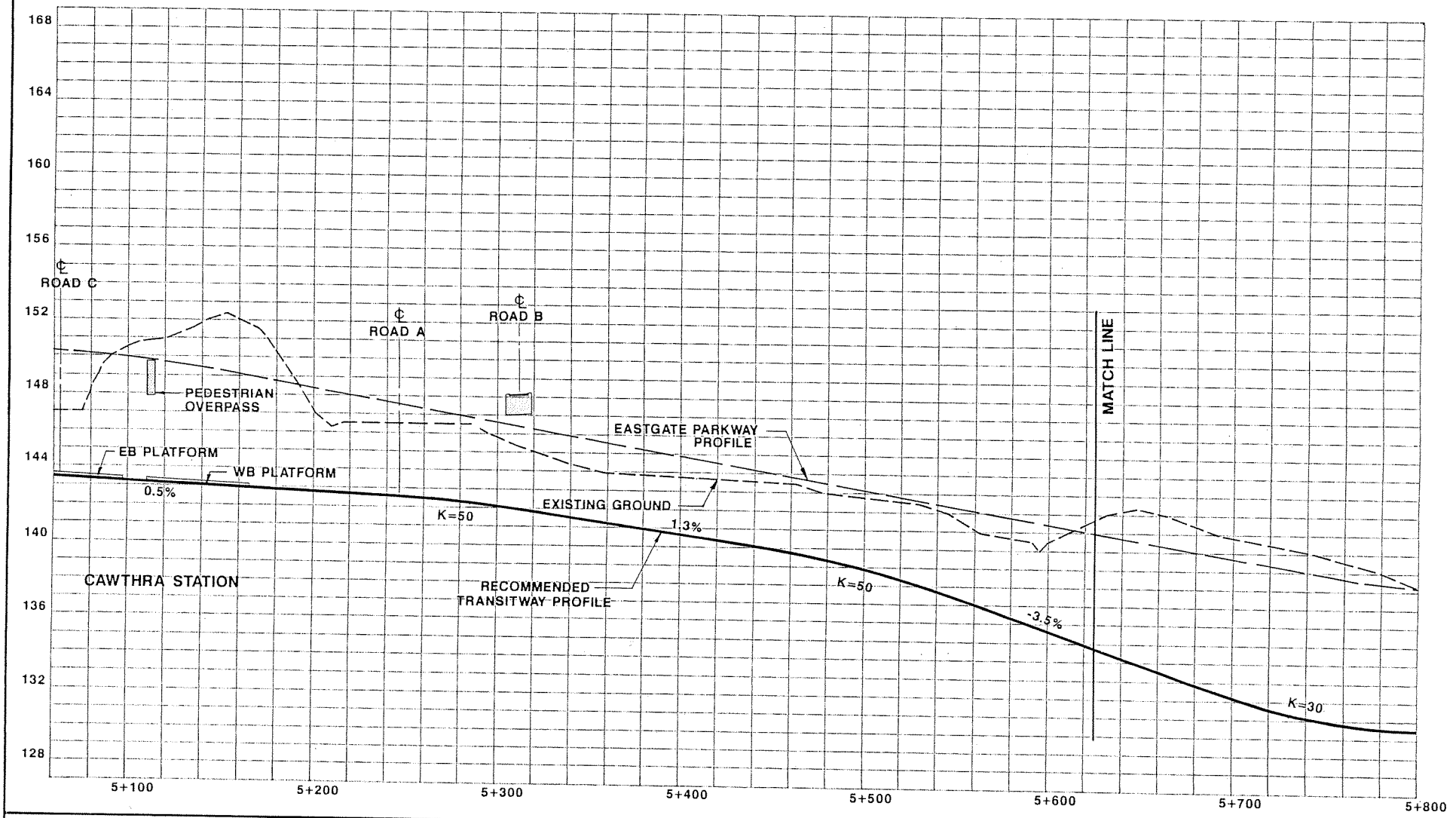
EXHIBIT 60

0 50 100 150 200m

SCALE

RECOMMENDED PLAN

Sta. 4+849 to Sta. 5+622



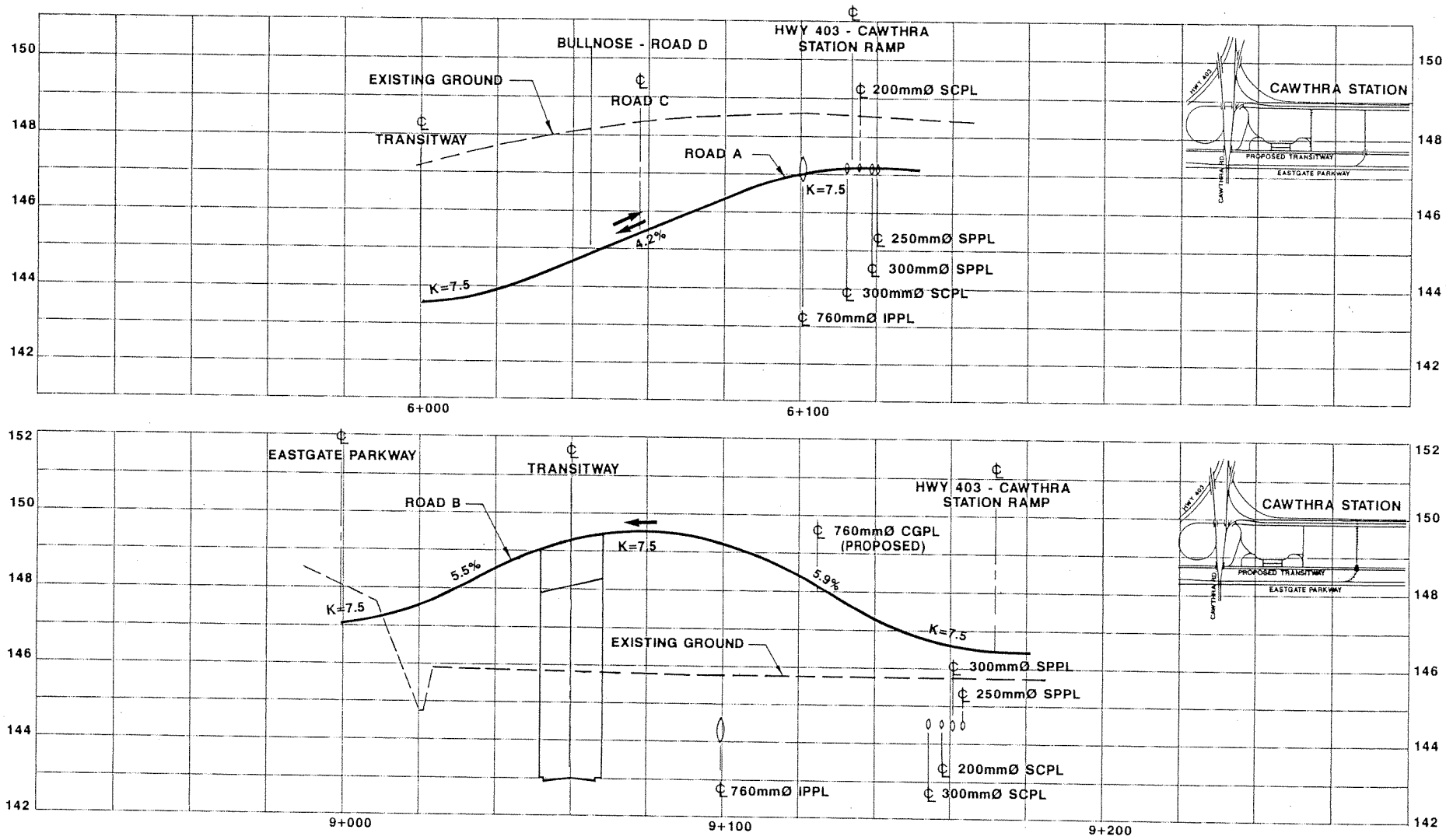
MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT

0 50 100 150 200m

RECOMMENDED PROFILES

Sta. 5+040 to Sta. 5+800



MISSISSAUGA TRANSITWAY

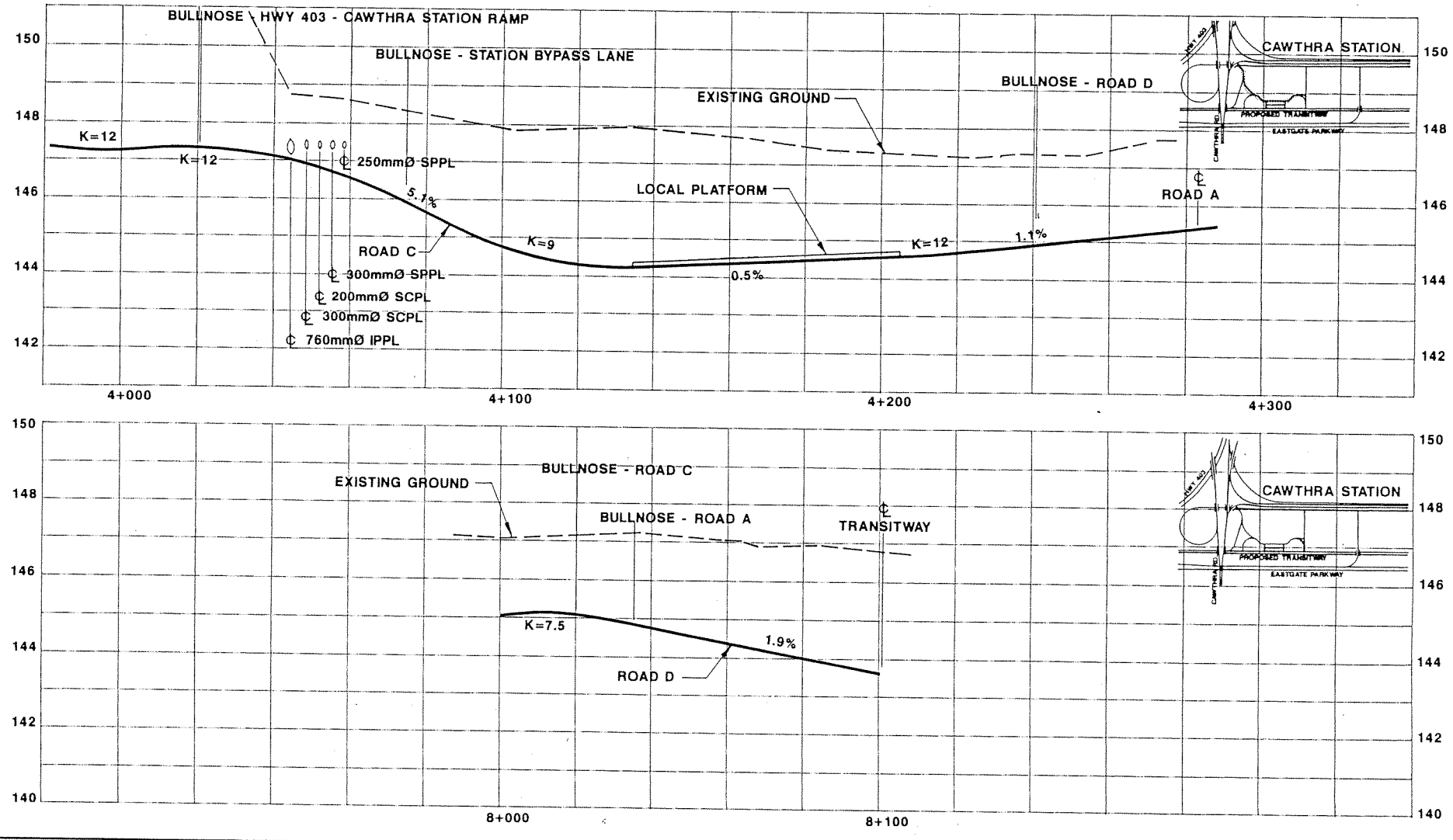
FUNCTIONAL PLANNING STUDY

EXHIBIT

0 25 50 75 100m

RECOMMENDED RAMP PROFILES

CAWTHRA STATION - ROAD A
ROAD B



MISSISSAUGA TRANSITWAY

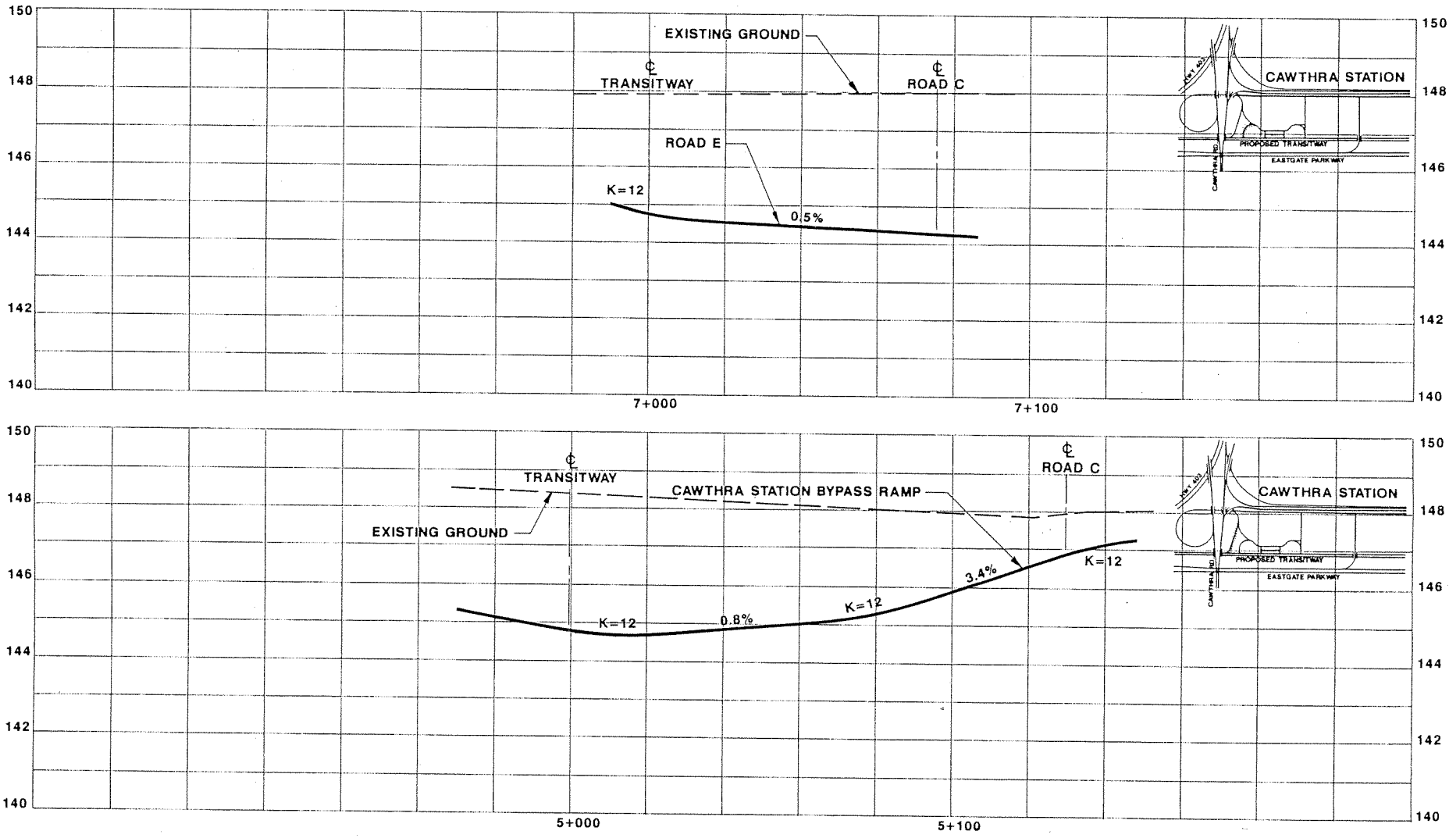
FUNCTIONAL PLANNING STUDY

EXHIBIT

0 25 50 75 100m

RECOMMENDED RAMP PROFILES

CAWTHRA STATION - ROAD C
ROAD D



MISSISSAUGA TRANSITWAY

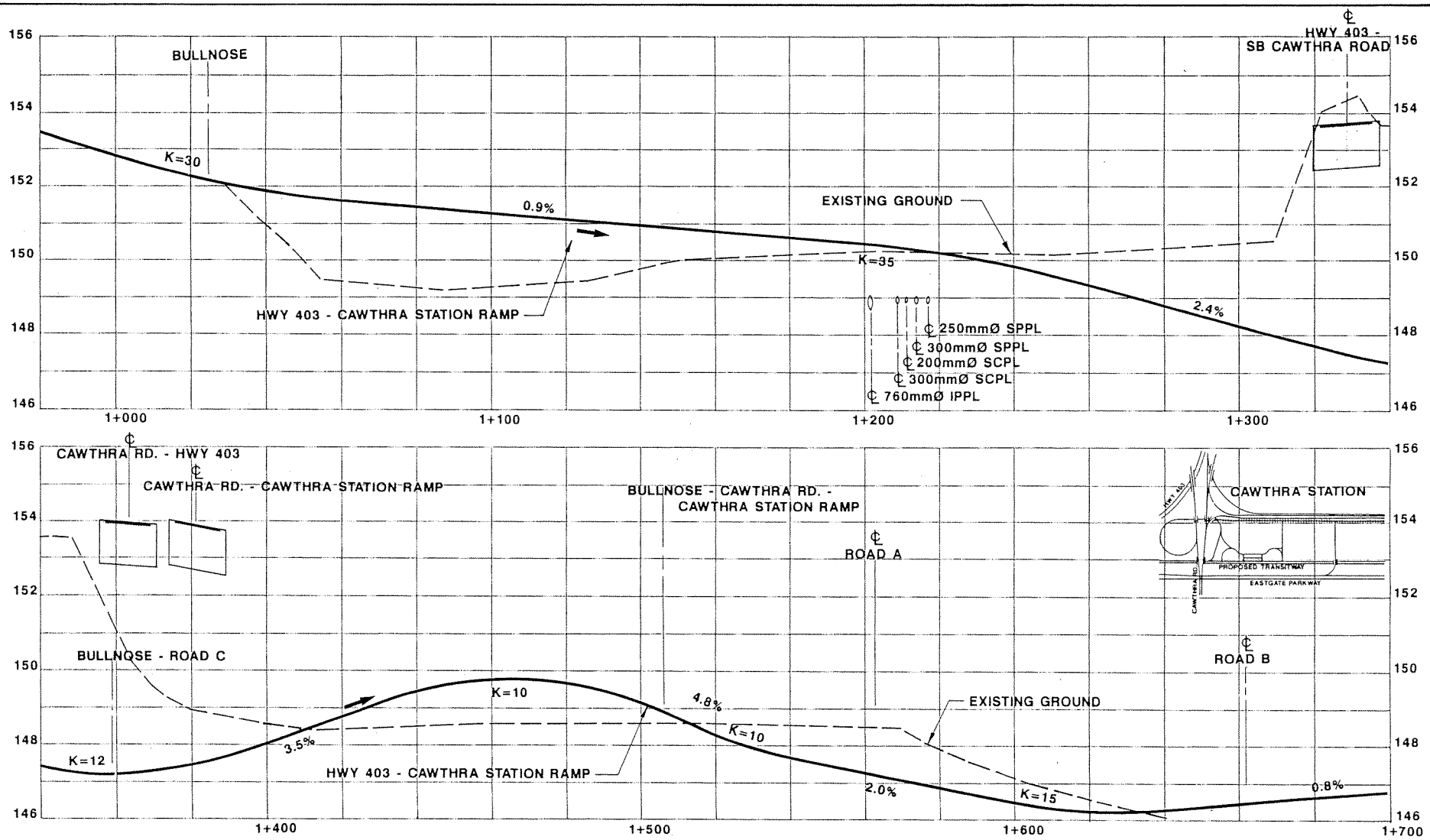
FUNCTIONAL PLANNING STUDY

EXHIBIT

0 25 50 75 100m

RECOMMENDED RAMP PROFILES

CAWTHRA STATION - ROAD E
CAWTHRA STATION BYPASS RAMP



MISSISSAUGA TRANSITWAY

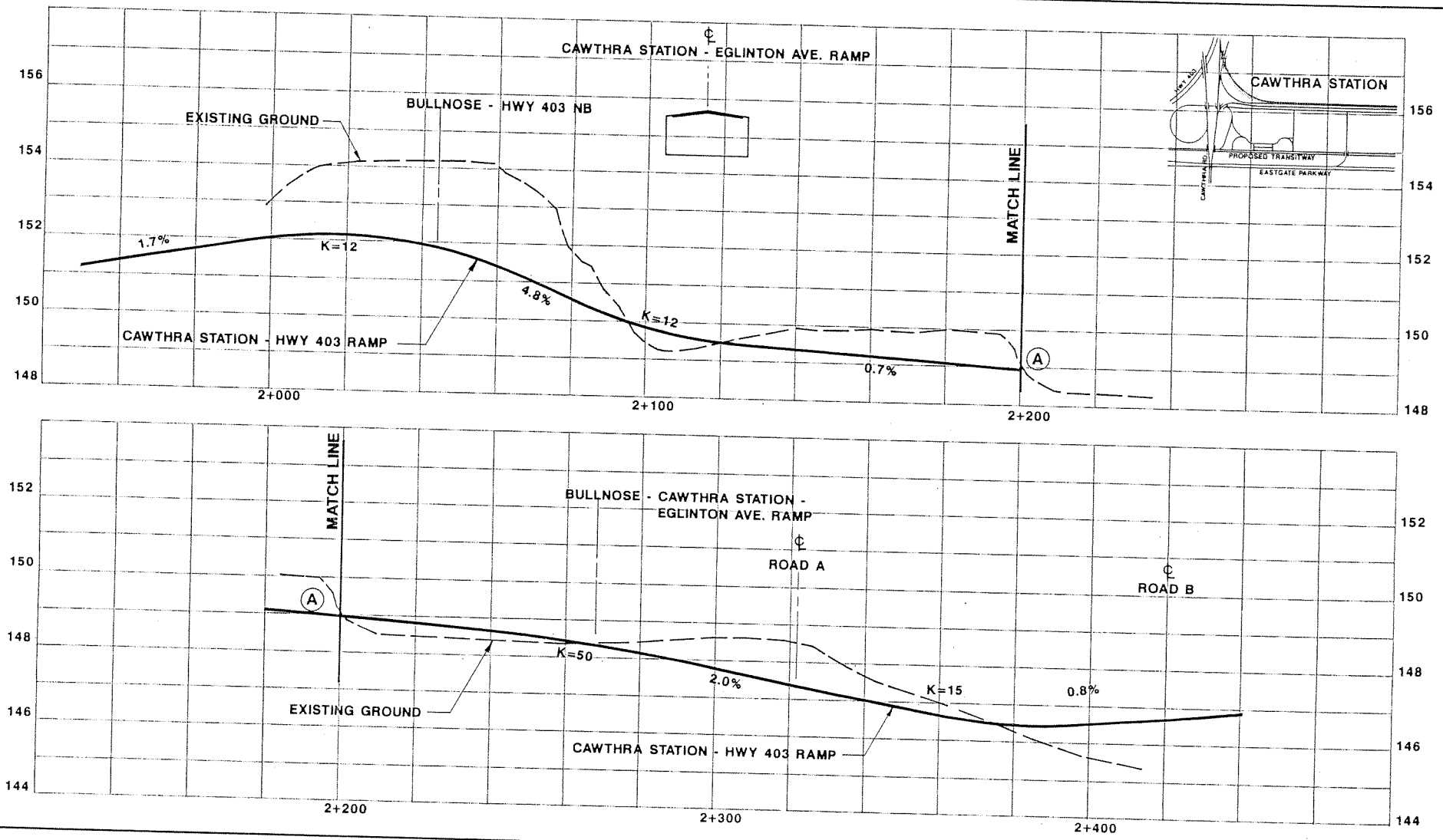
FUNCTIONAL PLANNING STUDY

EXHIBIT

0 25 50 75 100m

RECOMMENDED RAMP PROFILES

CAWTHRA STATION - HWY 403 TO CAWTHRA STATION RAMP



MISSISSAUGA TRANSITWAY

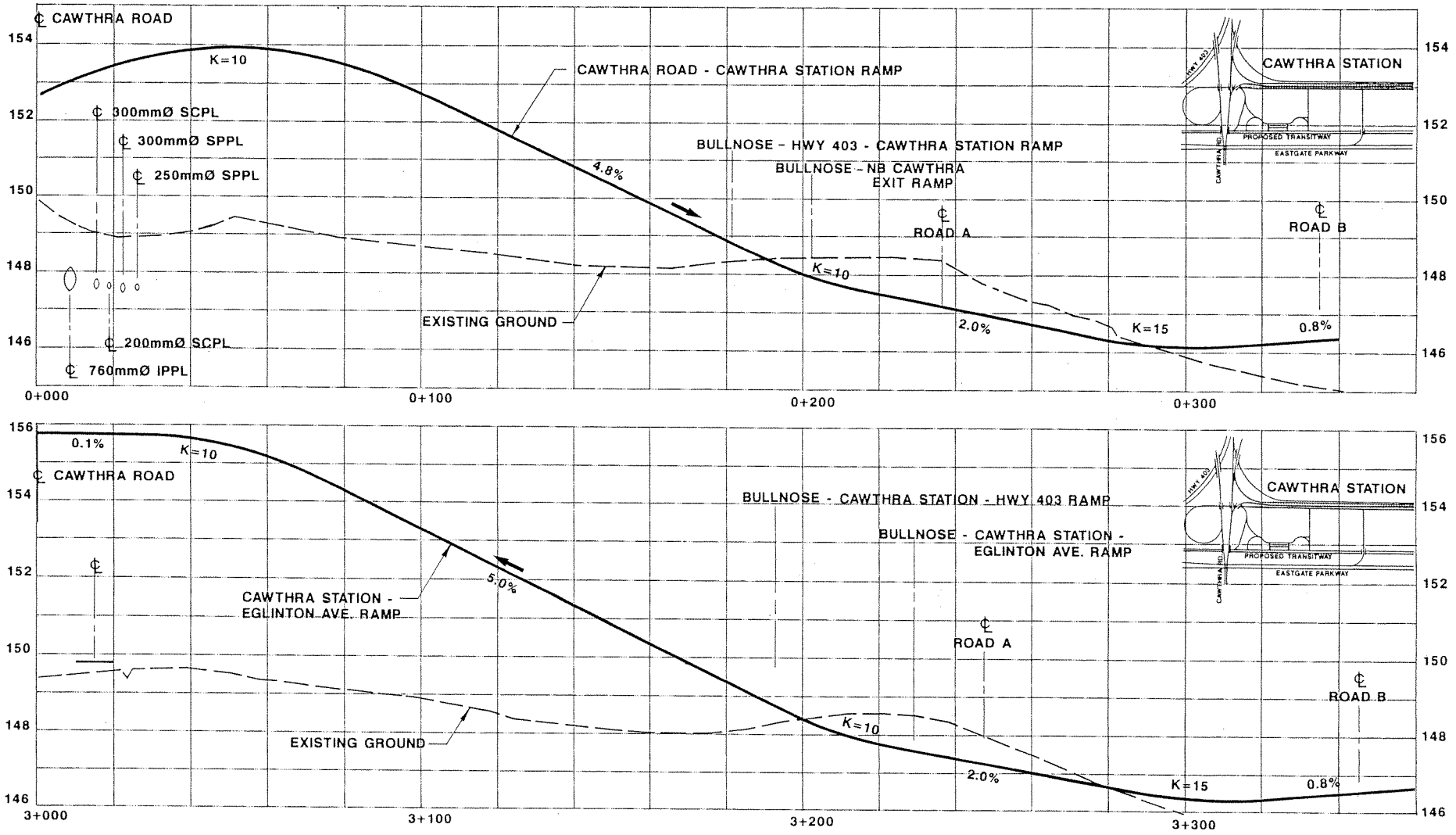
FUNCTIONAL PLANNING STUDY

EXHIBIT

0 25 50 75 100m

RECOMMENDED RAMP PROFILES

CAWTHRA STATION - CAWTHRA STATION - HWY 403 NB RAMP



MISSISSAUGA TRANSITWAY

FUNCTIONAL PLANNING STUDY

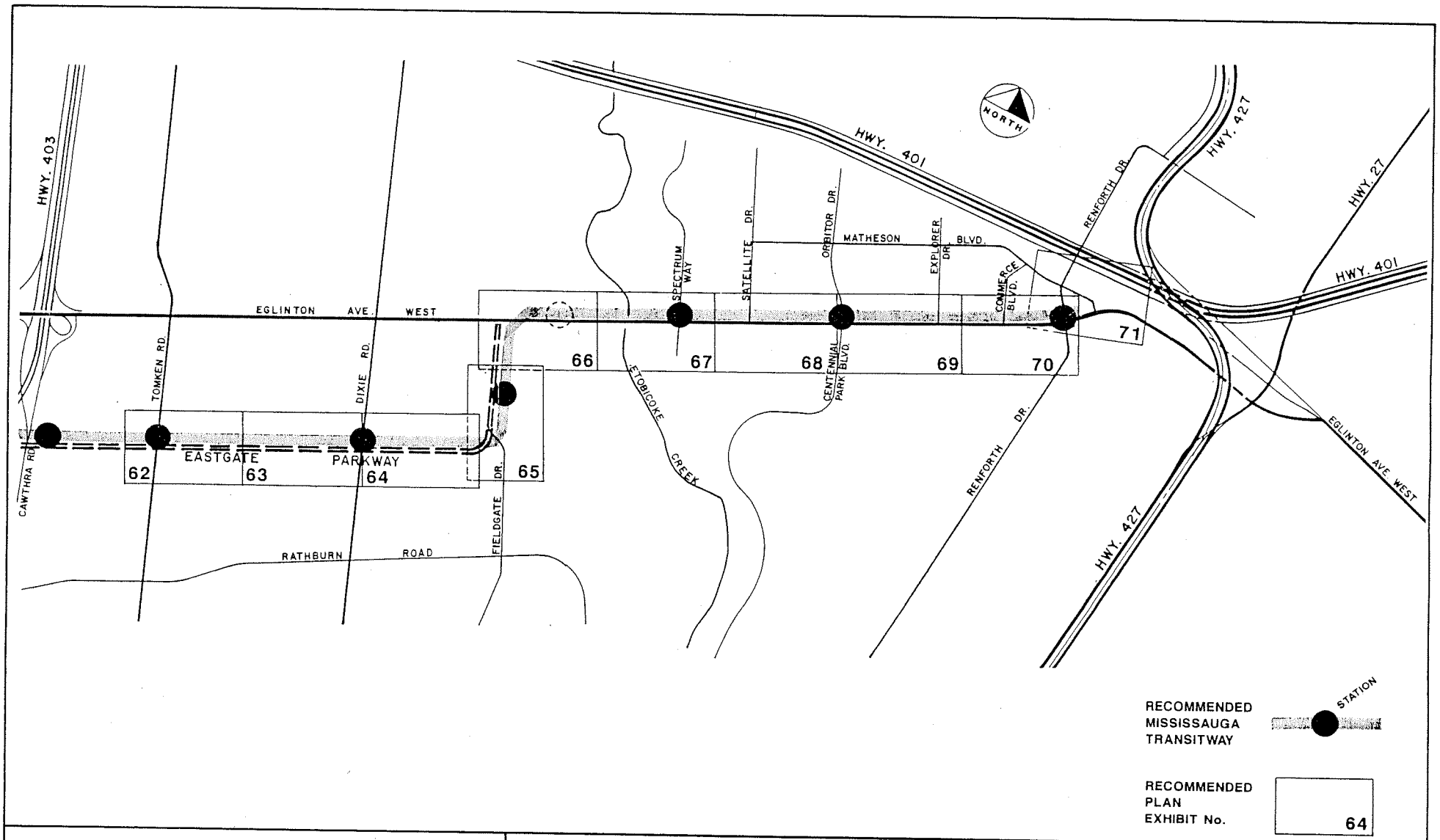
EXHIBIT

0 25 50 75 100m

RECOMMENDED RAMP PROFILES

CAWTHRA STATION - CAWTHRA RD. - CAWTHRA STATION RAMP

CAWTHRA STATION - EGLINTON AVE. RAMP



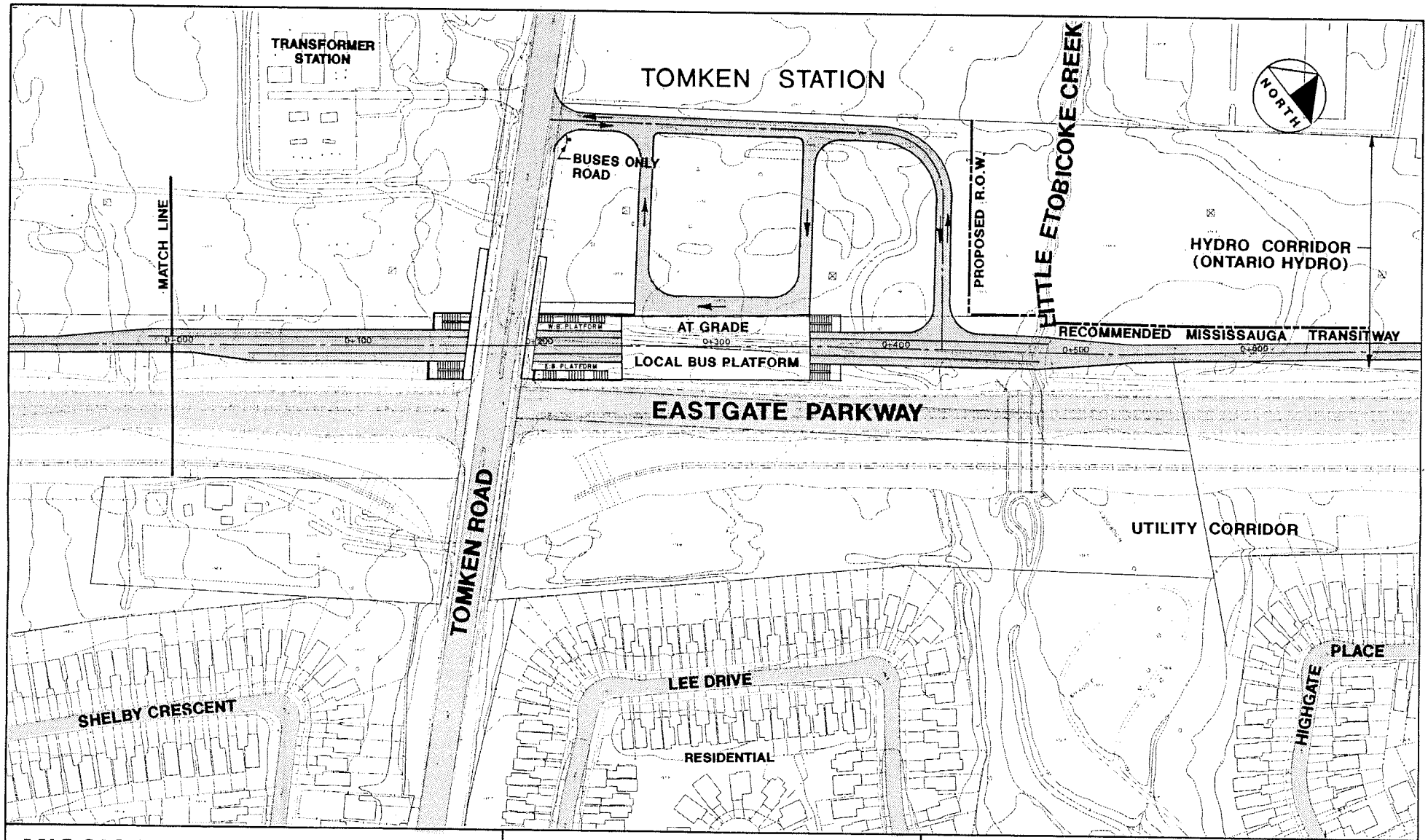
MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT 61

(PLAN NOT TO SCALE)

KEY PLAN

CAWTHRA ROAD TO RENFORTH DRIVE



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

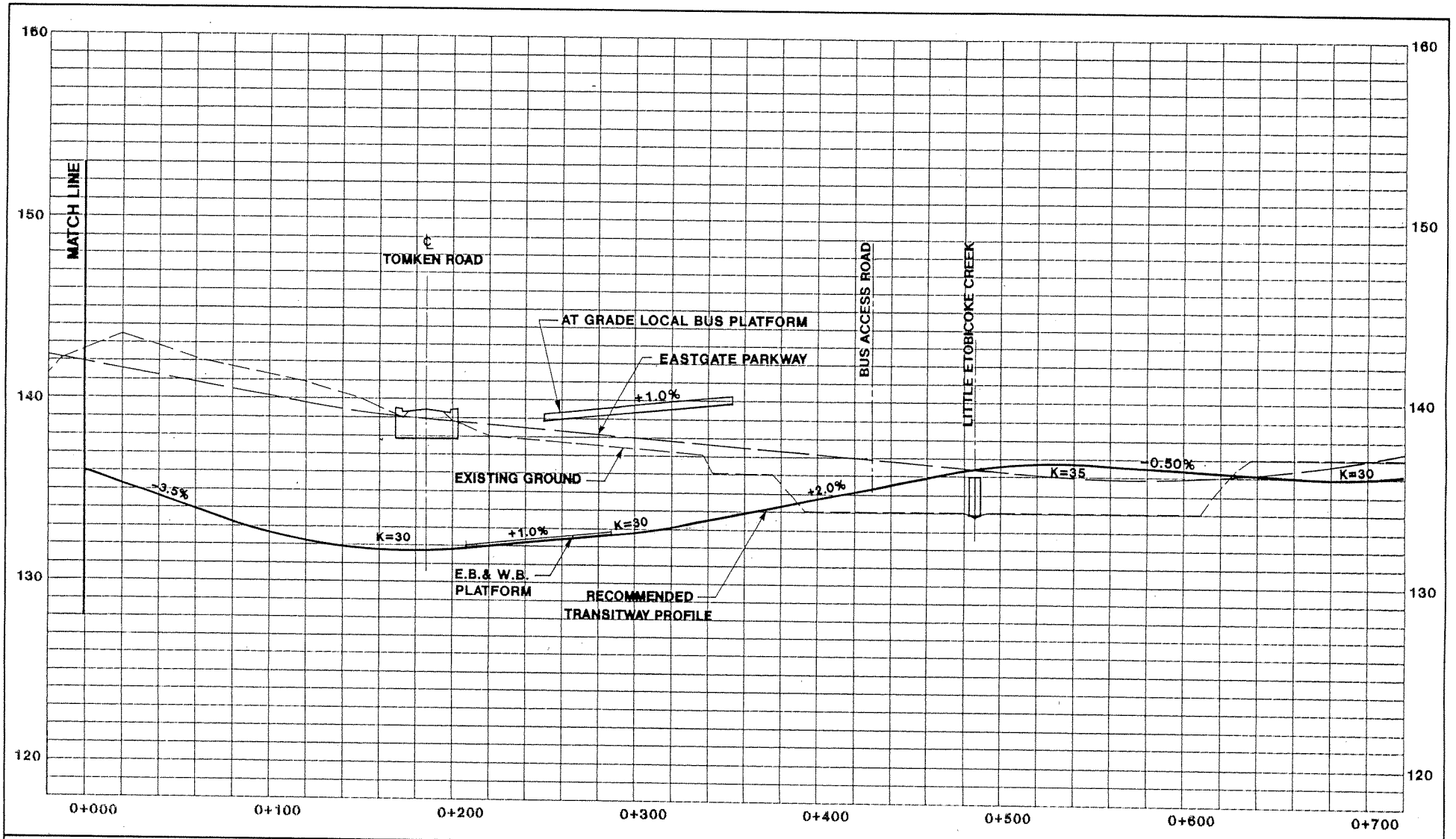
EXHIBIT 62

0 50 100 150 200m

SCALE

RECOMMENDED PLAN

Sta. 0+000 to Sta. 0+690



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

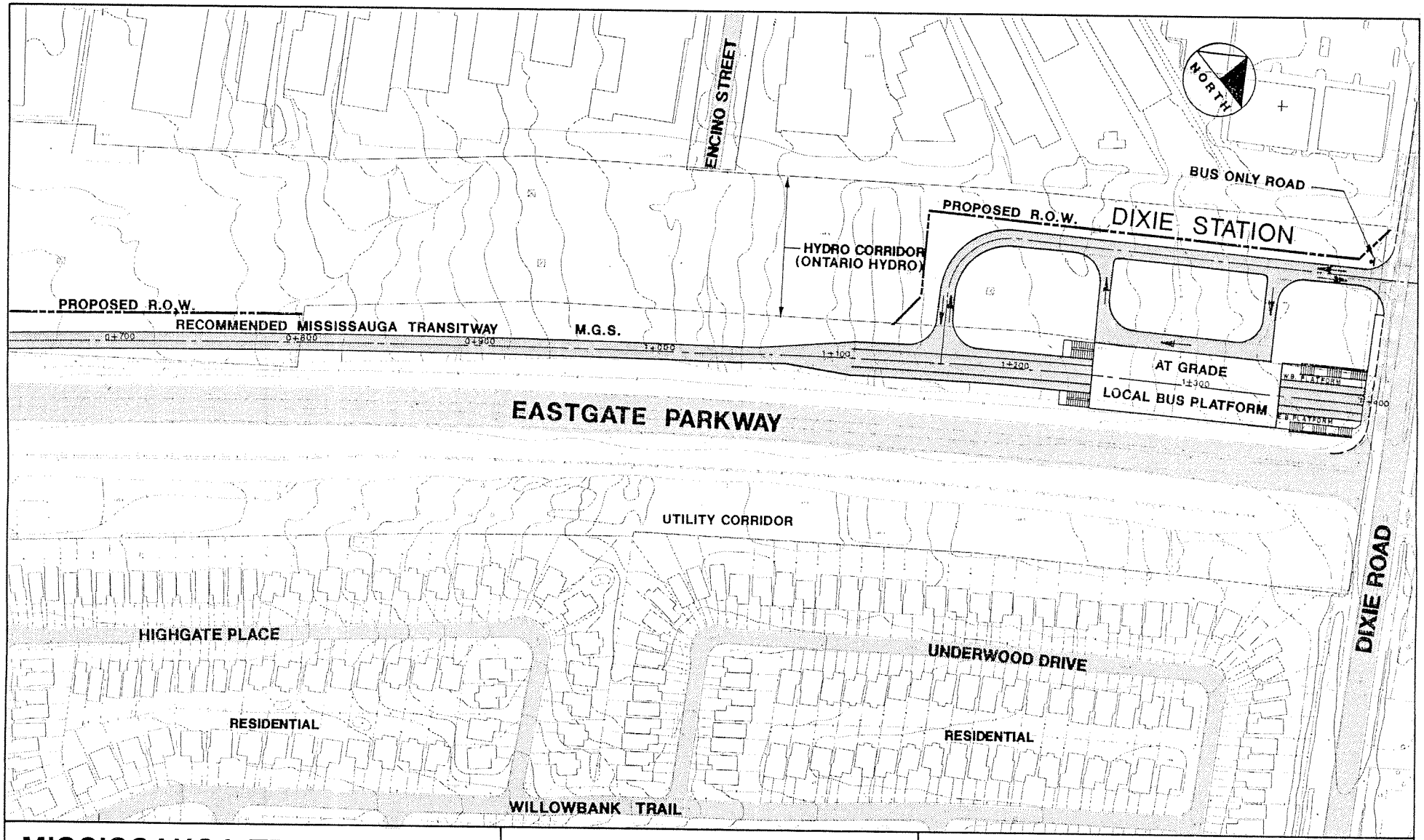
EXHIBIT

0 50 100 150 200m

SCALE

RECOMMENDED PROFILE

Sta. 0+000 to Sta. 0+690



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

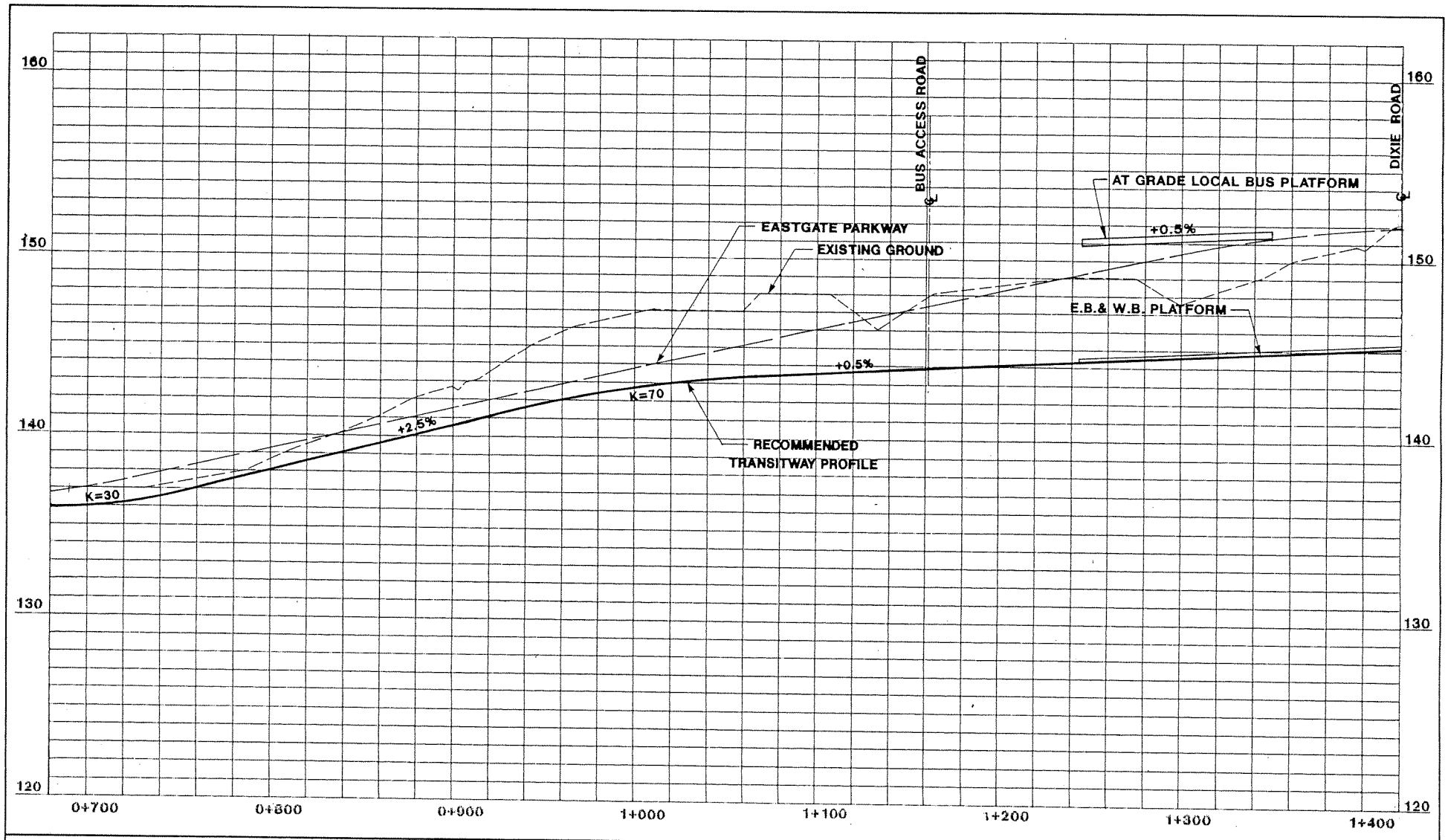
EXHIBIT 63

0 50 100 150 200m

SCALE

RECOMMENDED PLAN

Sta. 0+690 to Sta. 1+400



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

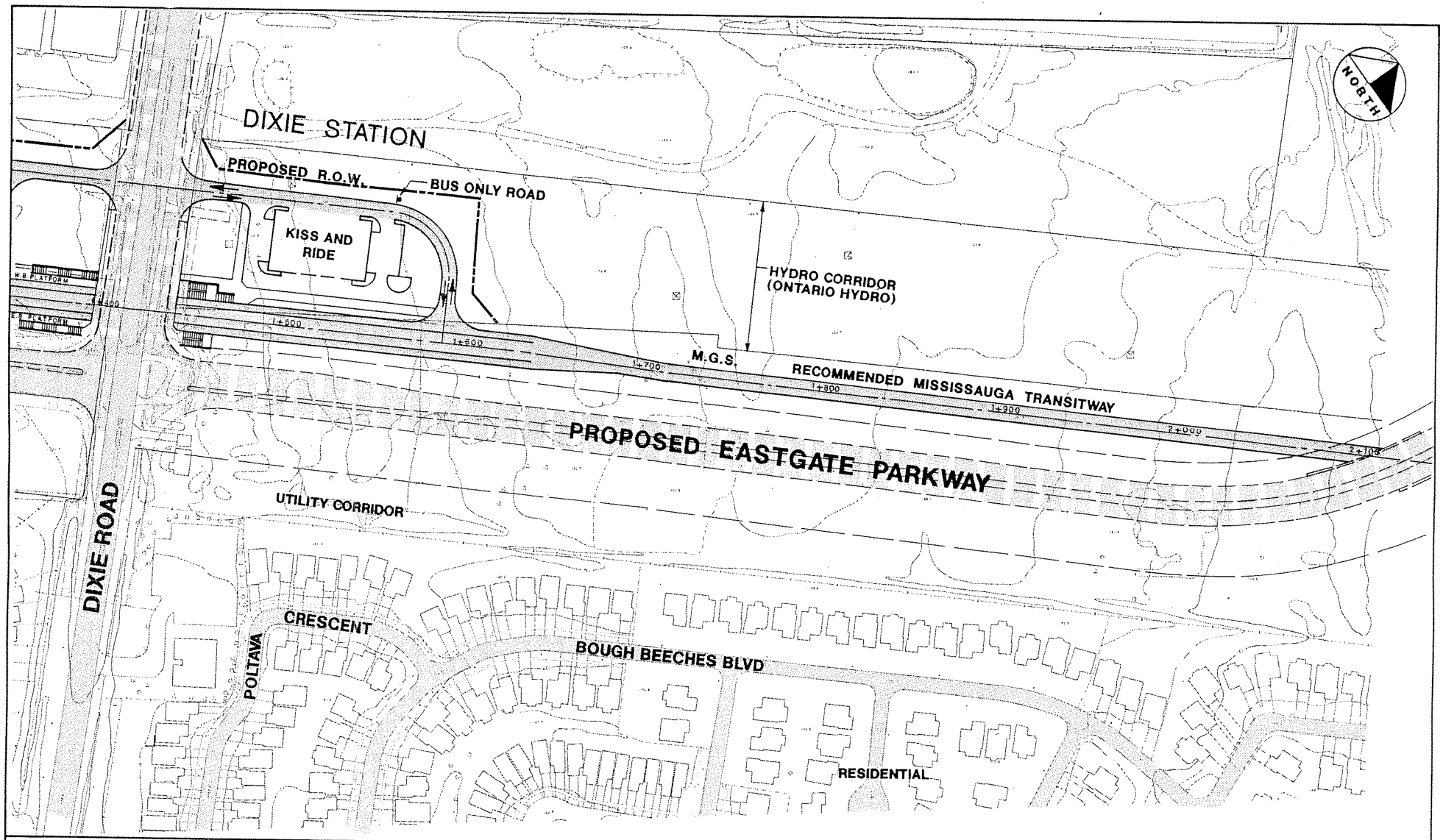
EXHIBIT

0 50 100 150 200m

SCALE

RECOMMENDED PROFILE

Sta. 0+690 to Sta. 1+400



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

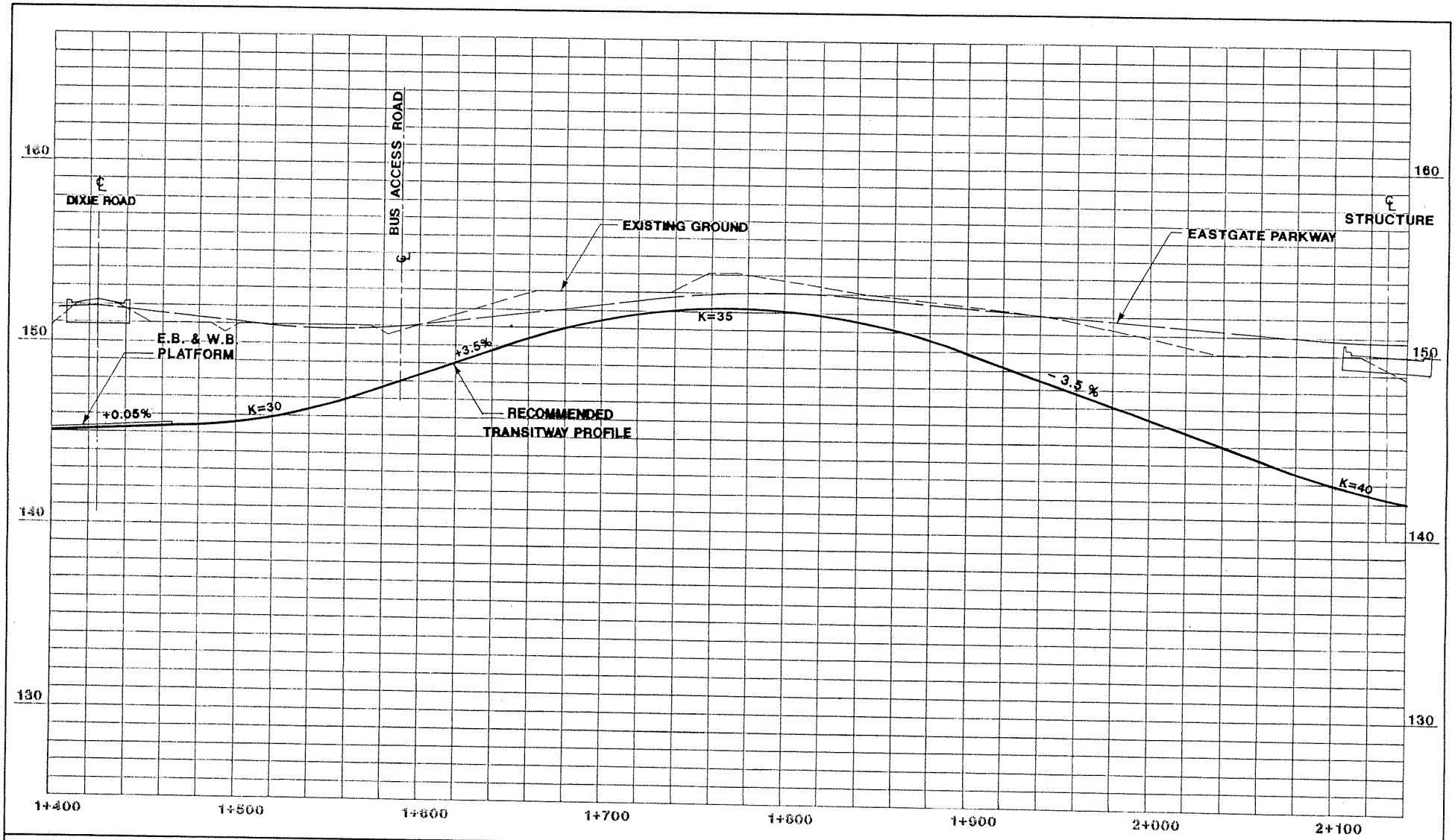
EXHIBIT 64

0 50 100 150 200m

SCALE

RECOMMENDED PLAN

Sta. 1+400 to Sta. 2+140



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

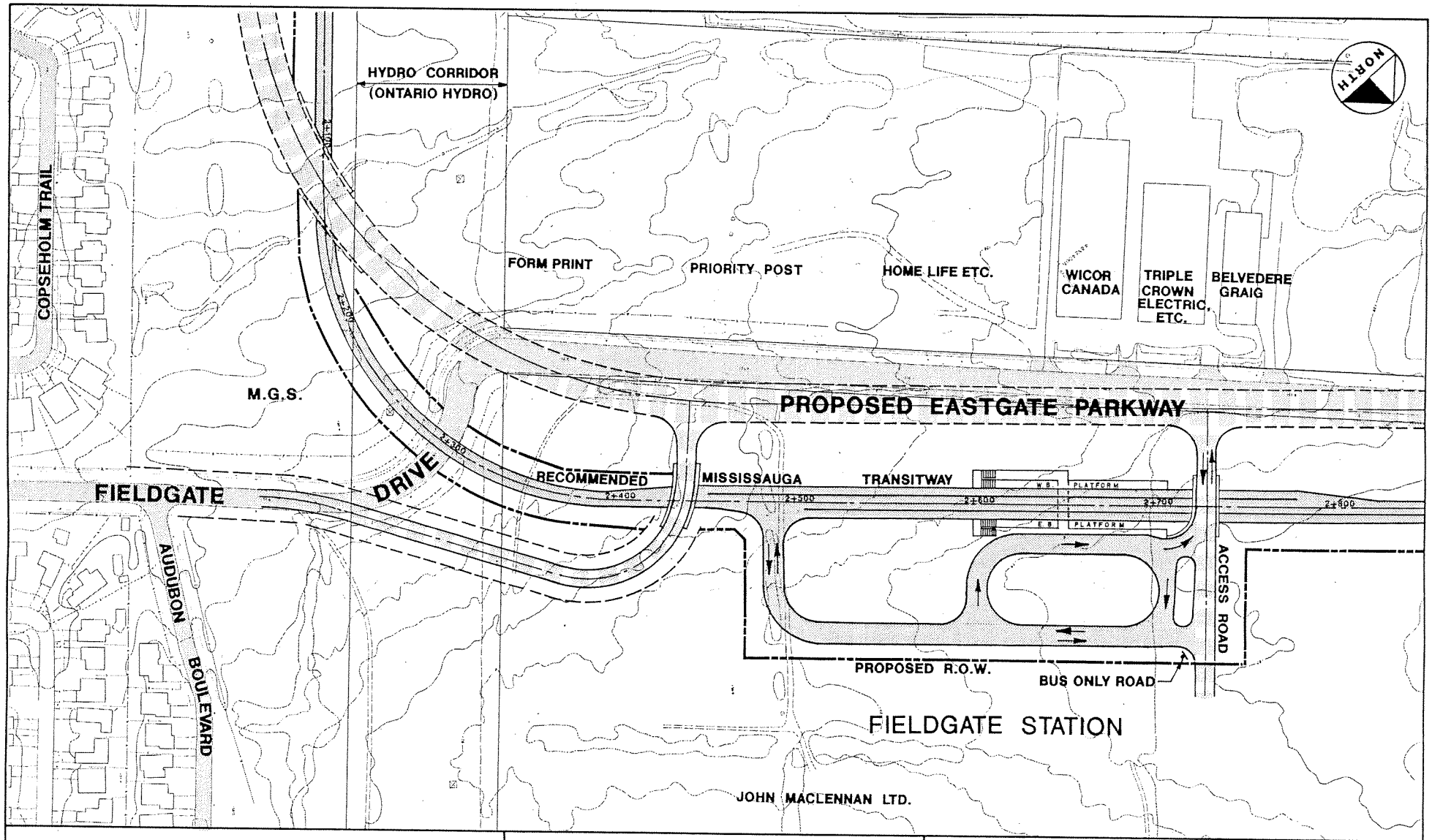
EXHIBIT

0 50 100 150 200m

SCALE

RECOMMENDED PROFILE

Sta. 1+400 to Sta. 2+140



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

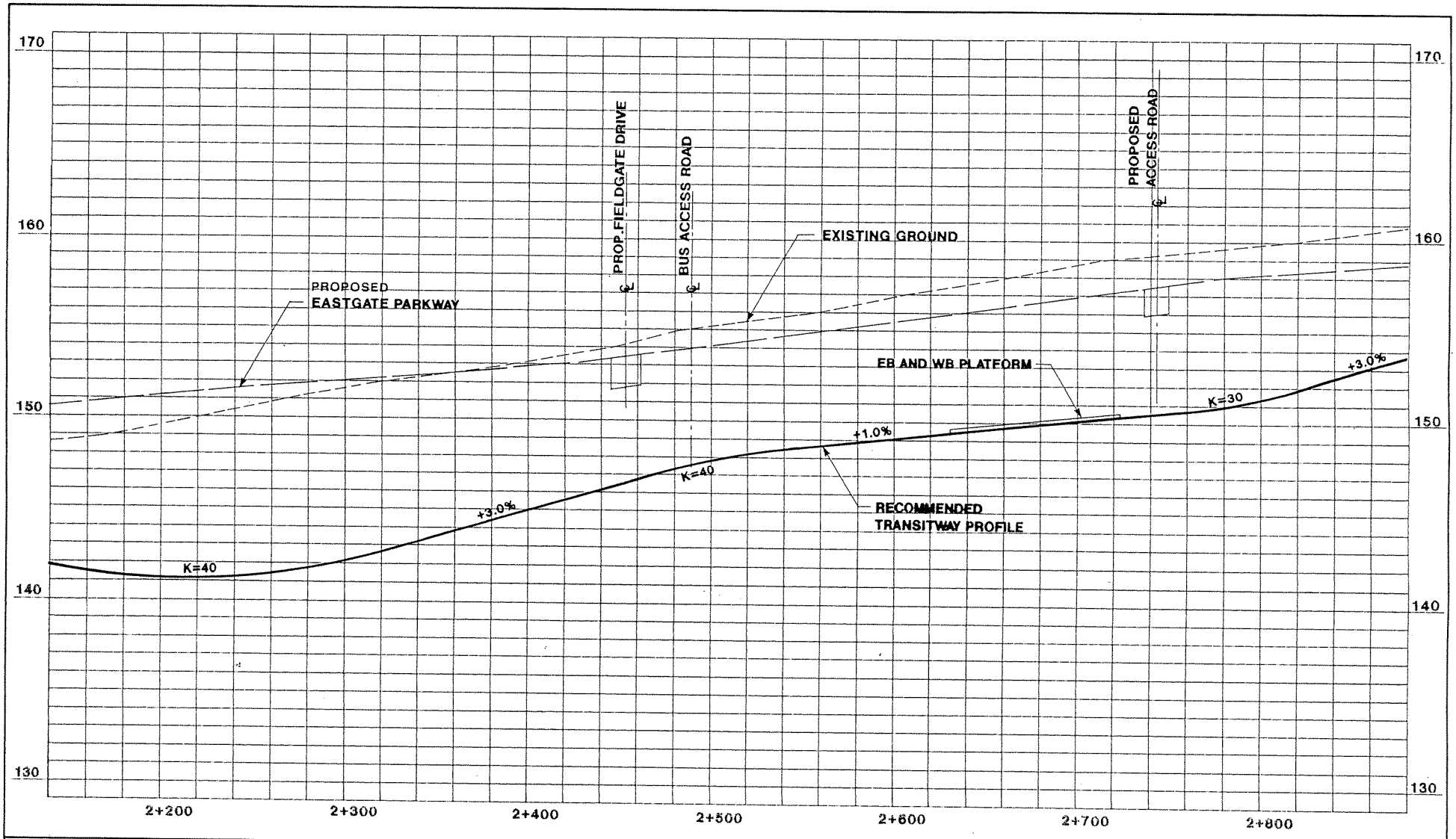
EXHIBIT 65

0 50 100 150 200m

SCALE

RECOMMENDED PLAN

Sta. 2+140 to Sta. 2+860



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

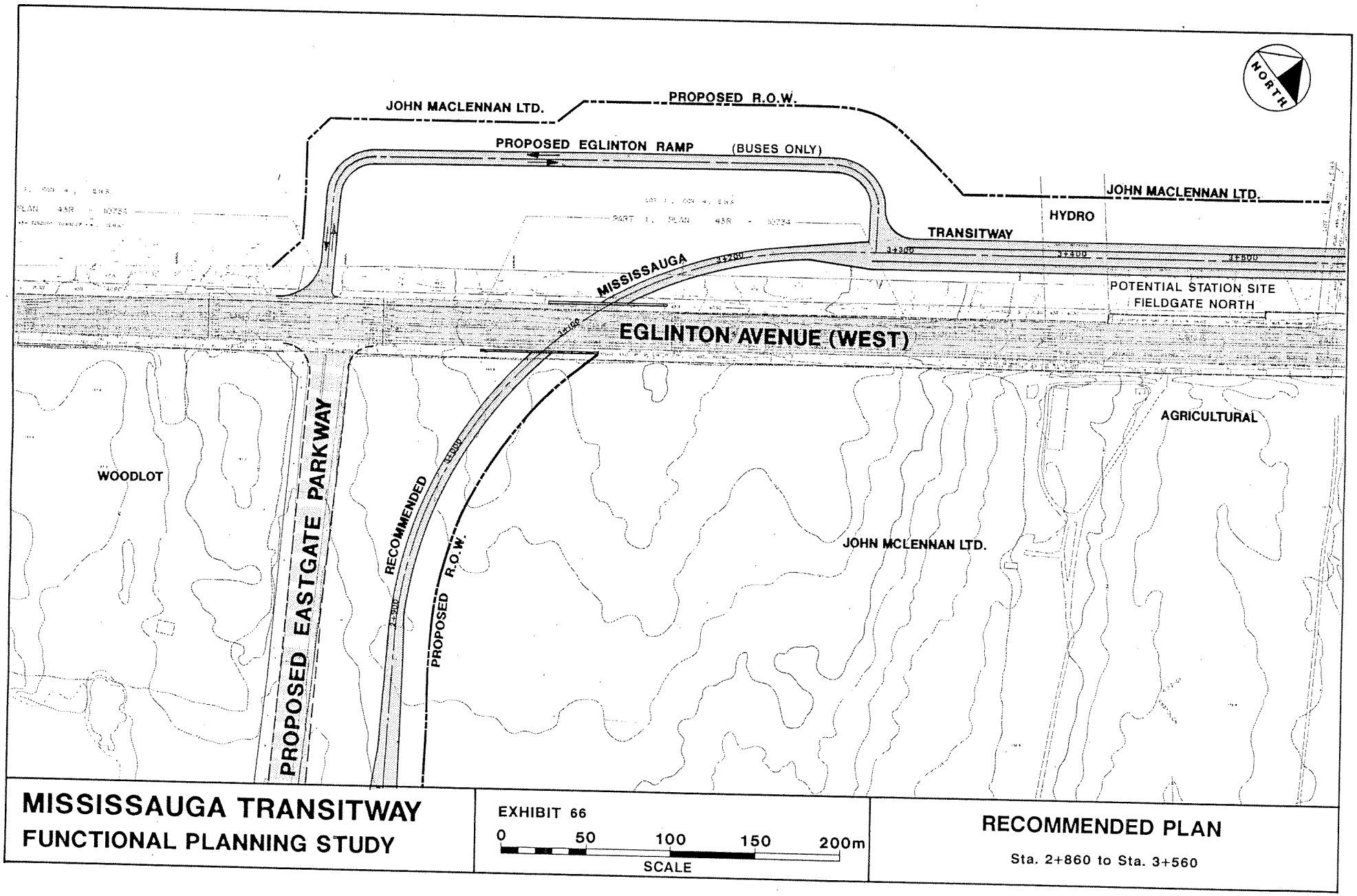
EXHIBIT

0 50 100 150 200m

SCALE

RECOMMENDED PROFILE

Sta. 2+140 to Sta. 2+860



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

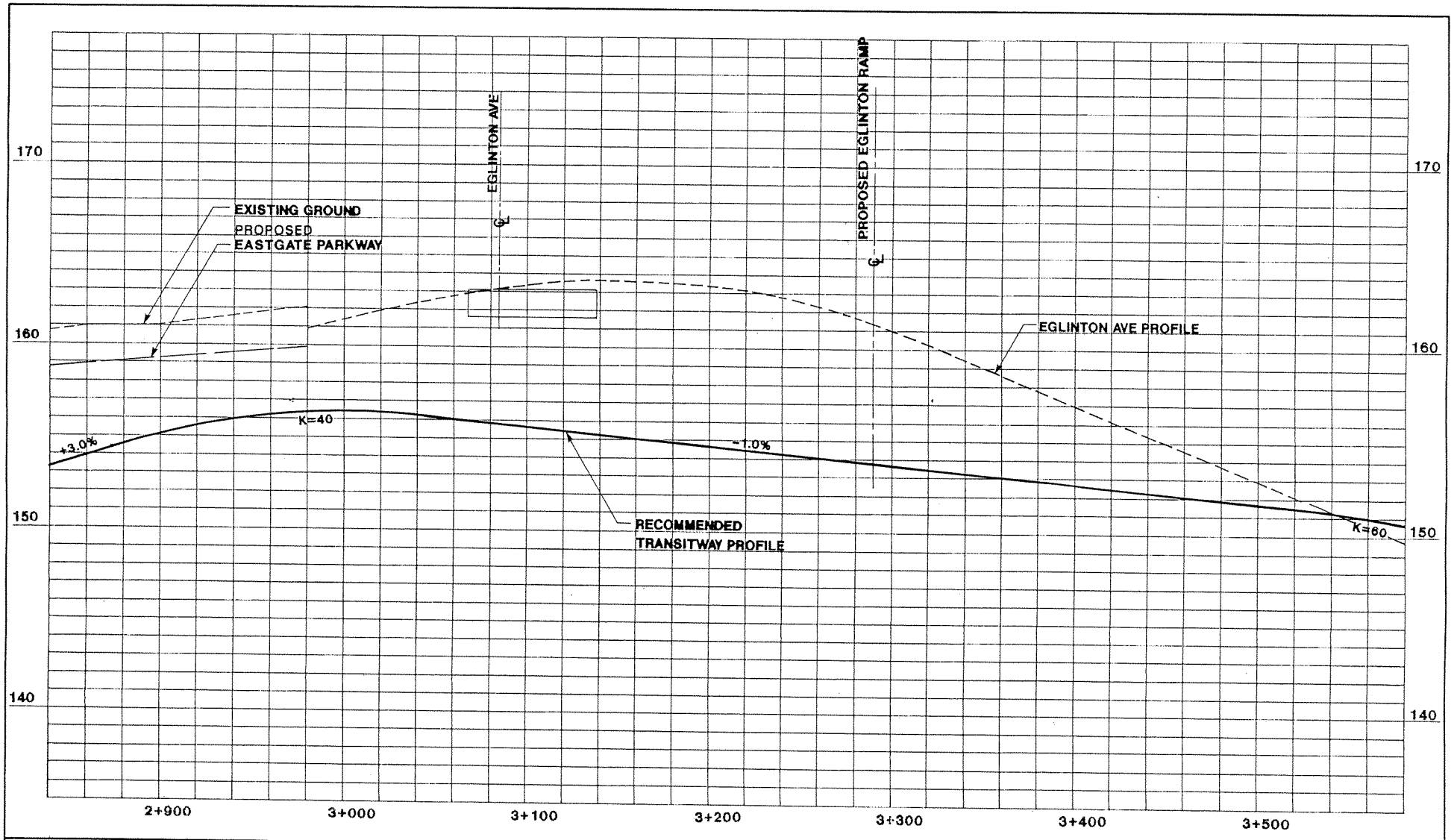
EXHIBIT 66

0 50 100 150 200m

SCALE

RECOMMENDED PLAN

Sta. 2+860 to Sta. 3+560



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

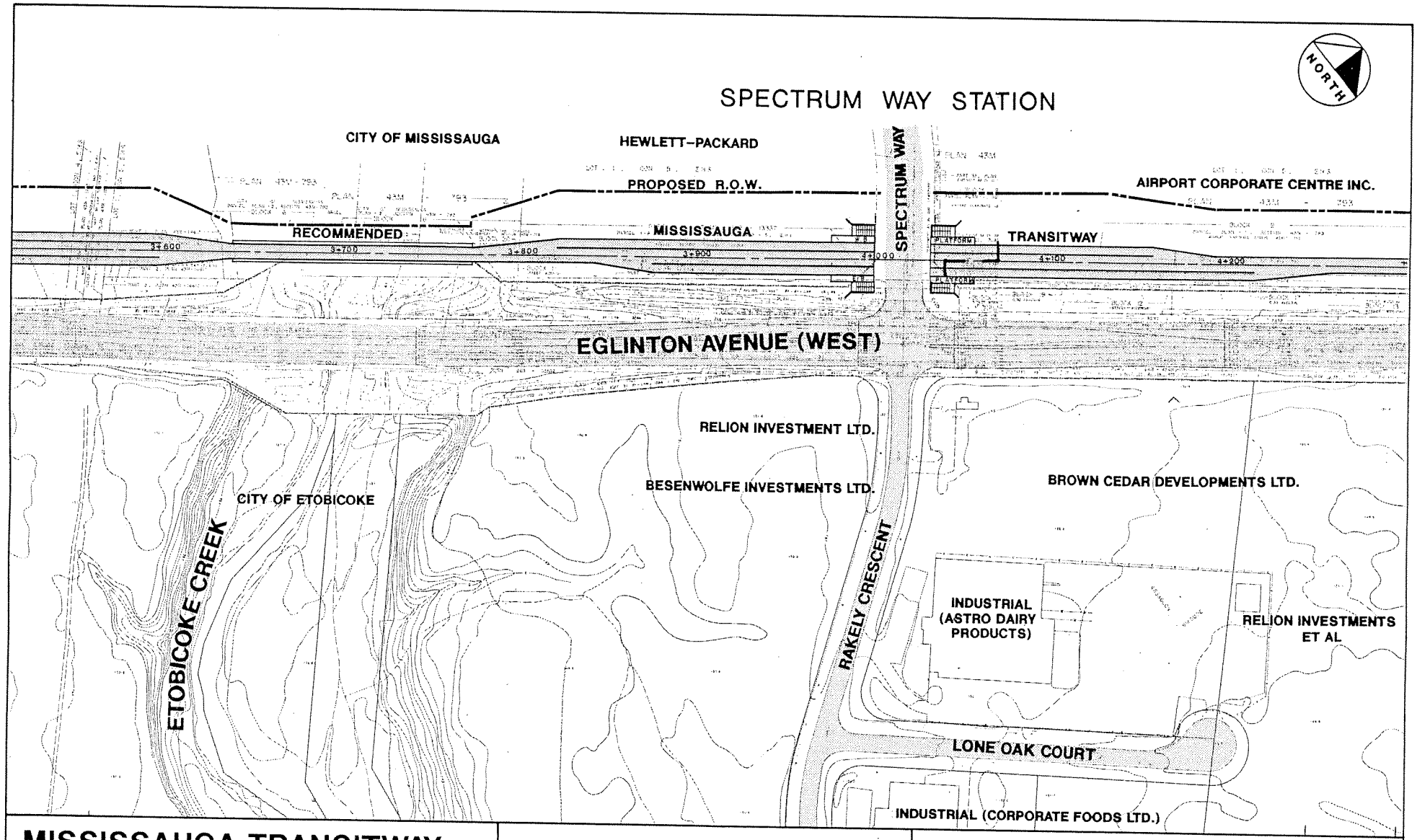
EXHIBIT

0 50 100 150 200m

SCALE

RECOMMENDED PROFILE

Sta. 2+860 to Sta. 3+560



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

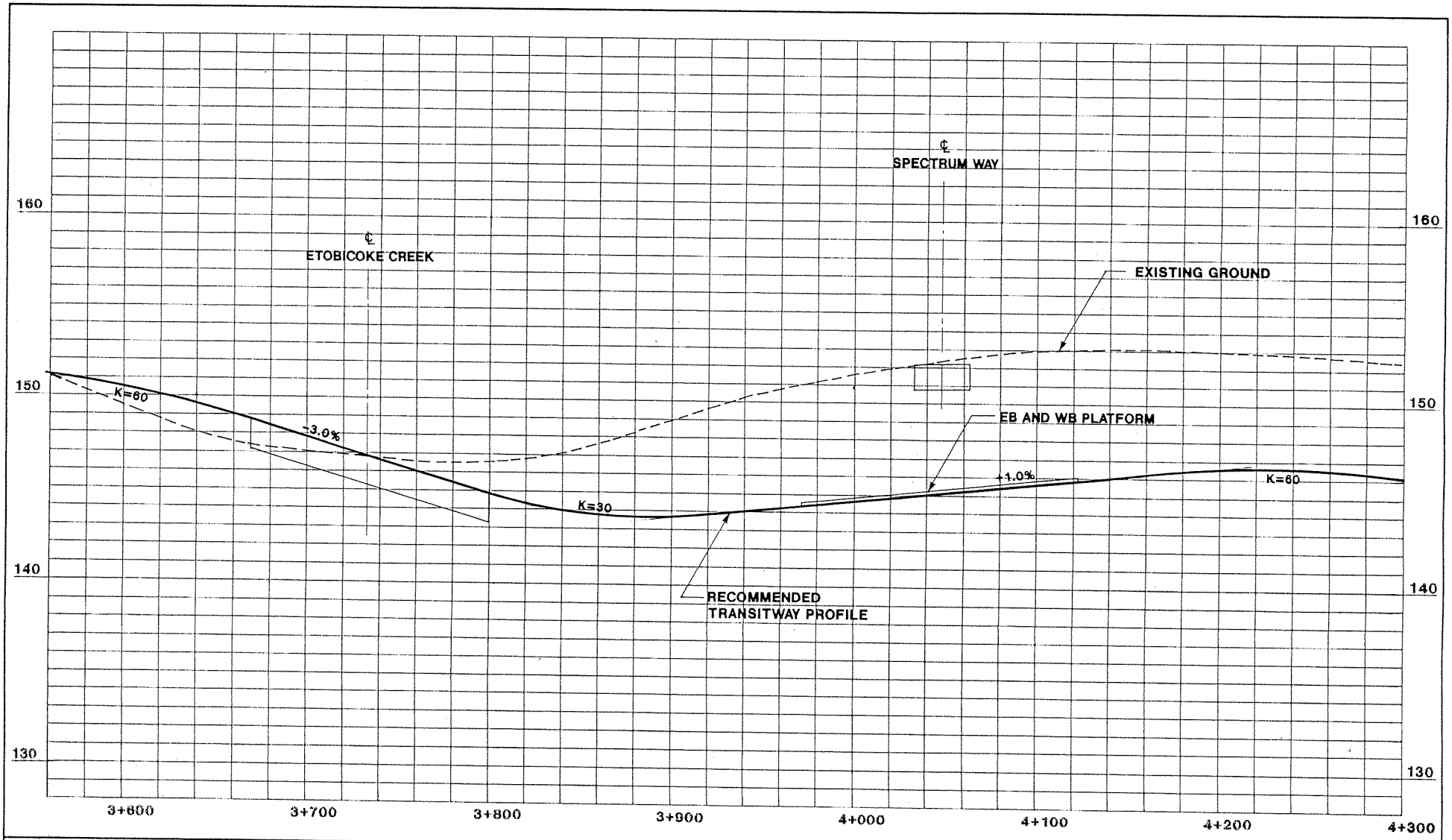
EXHIBIT 67

0 50 100 150 200m

SCALE

RECOMMENDED PLAN

Sta. 3+560 to Sta. 4+300



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

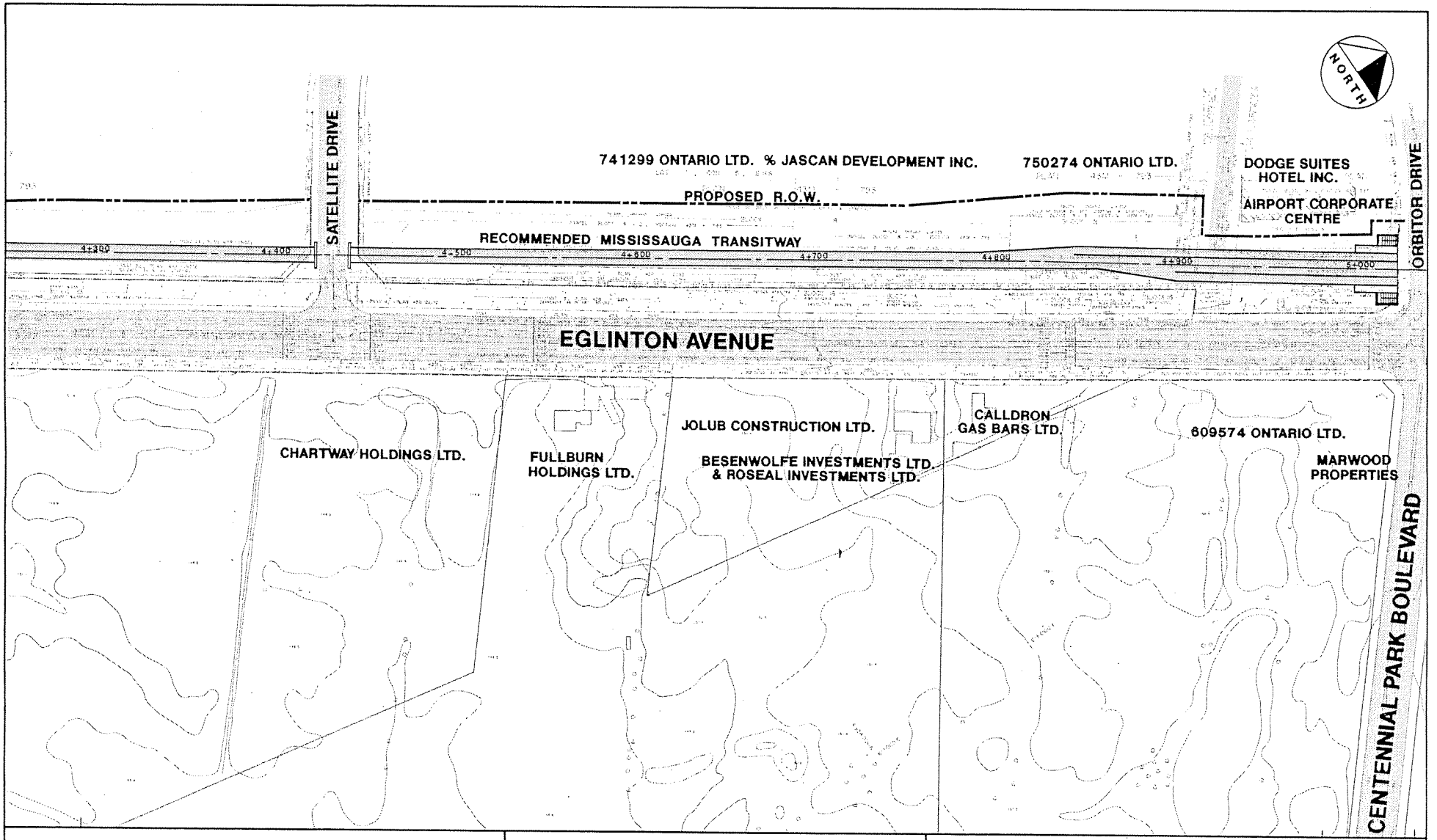
EXHIBIT

0 50 100 150 200m

SCALE

RECOMMENDED PROFILE

Sta. 3+560 to Sta. 4+300



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

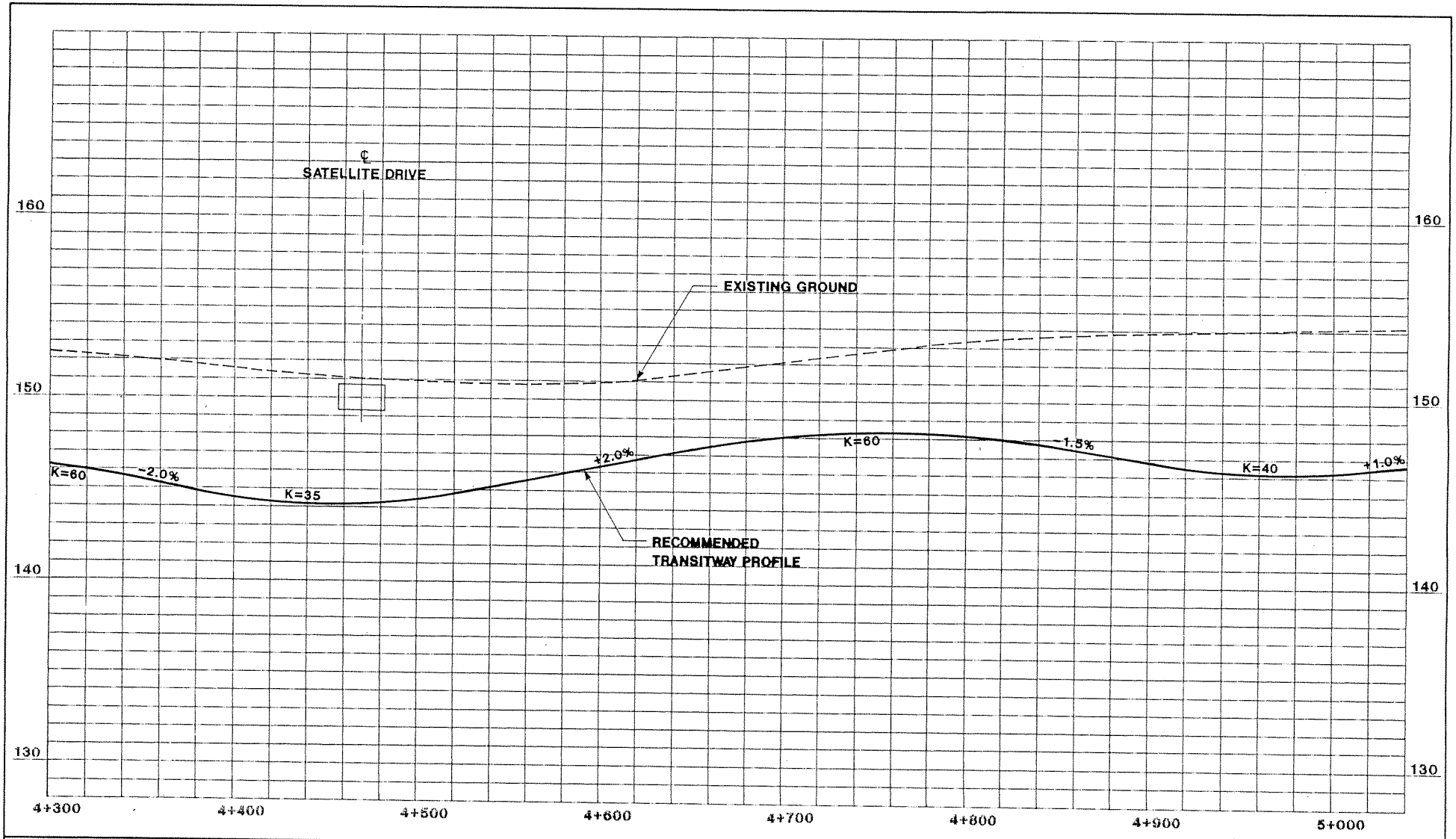
EXHIBIT 68

0 50 100 150 200m

SCALE

RECOMMENDED PLAN

Sta. 4+300 to Sta. 5+000



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

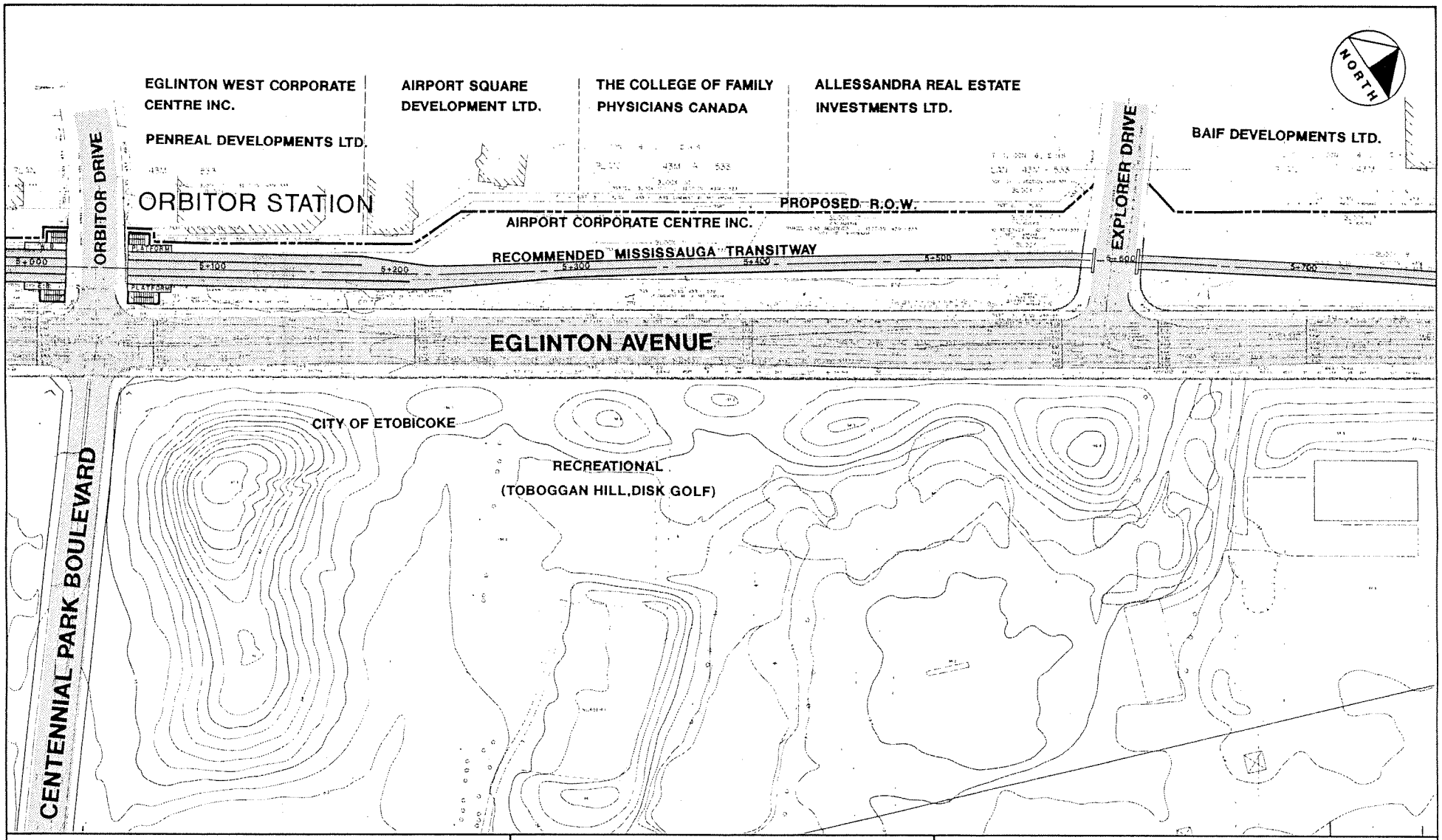
EXHIBIT

0 50 100 150 200 m

SCALE

RECOMMENDED PROFILE

Sta. 4+300 to Sta. 5+000



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

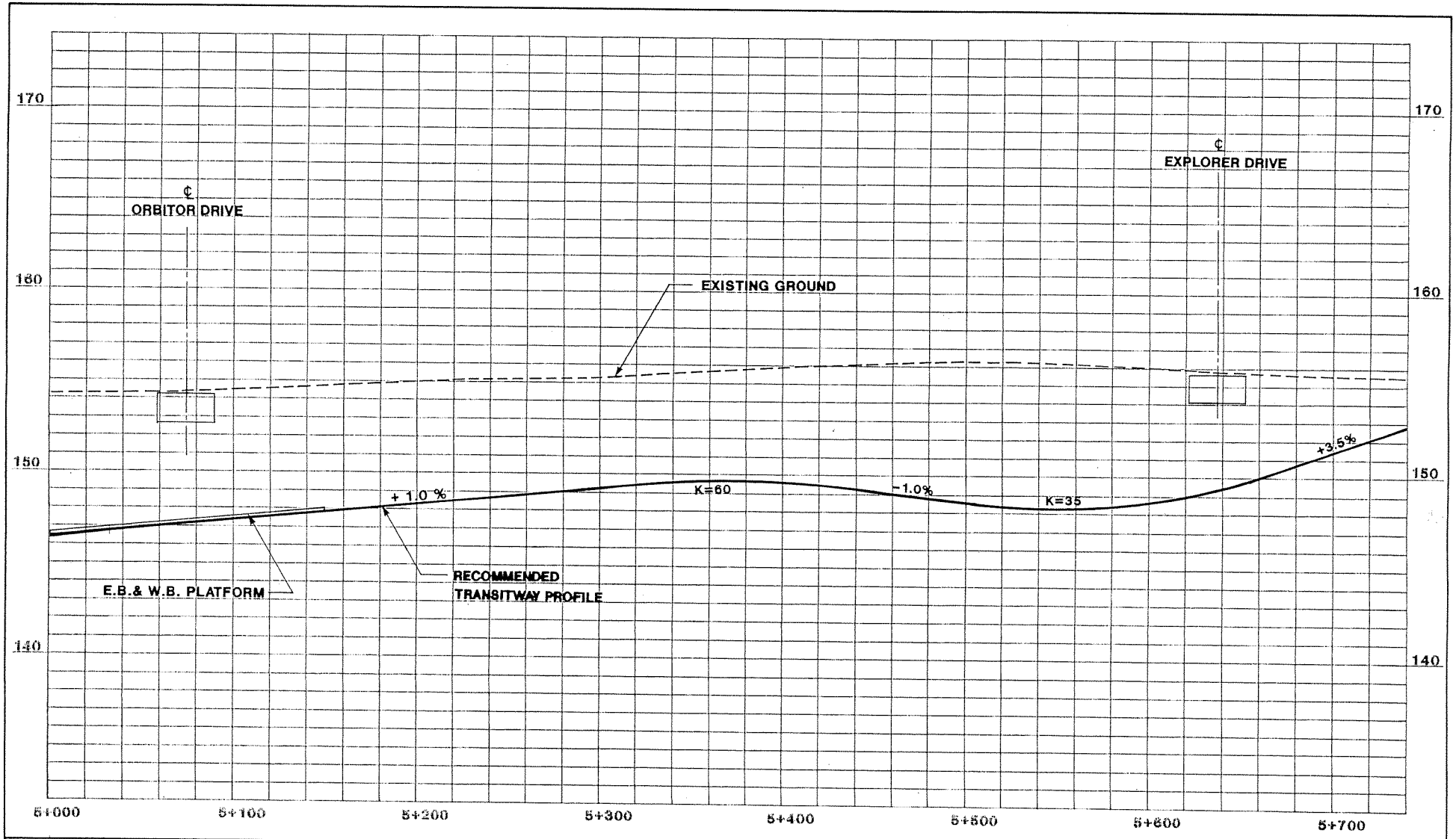
EXHIBIT 69

0 50 100 150 200m

SCALE

RECOMMENDED PLAN

Sta. 5+000 to Sta. 5+740



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

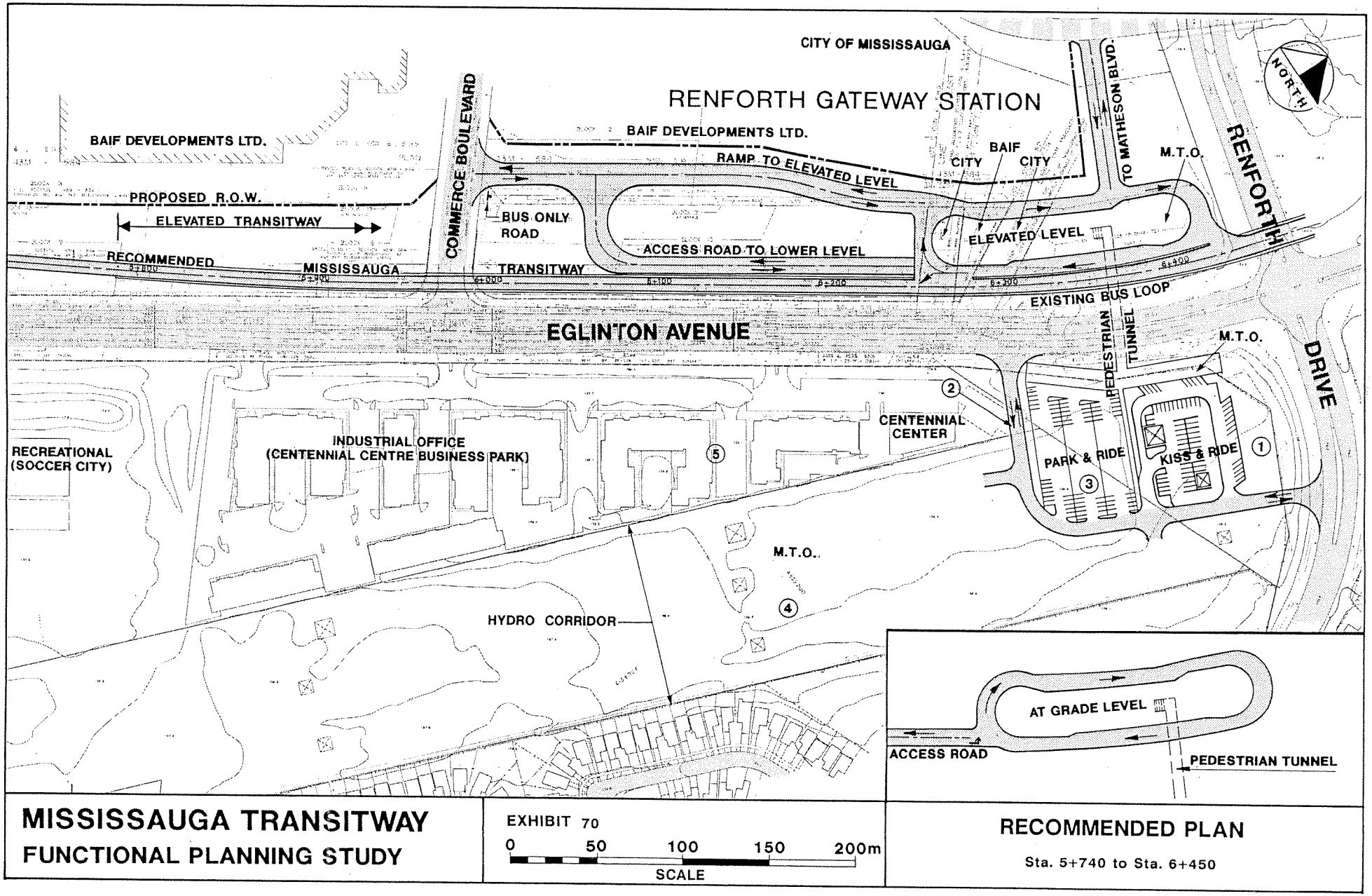
EXHIBIT

0 50 100 150 200m

SCALE

RECOMMENDED PROFILE

Sta. 5+000 to Sta. 5+740



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

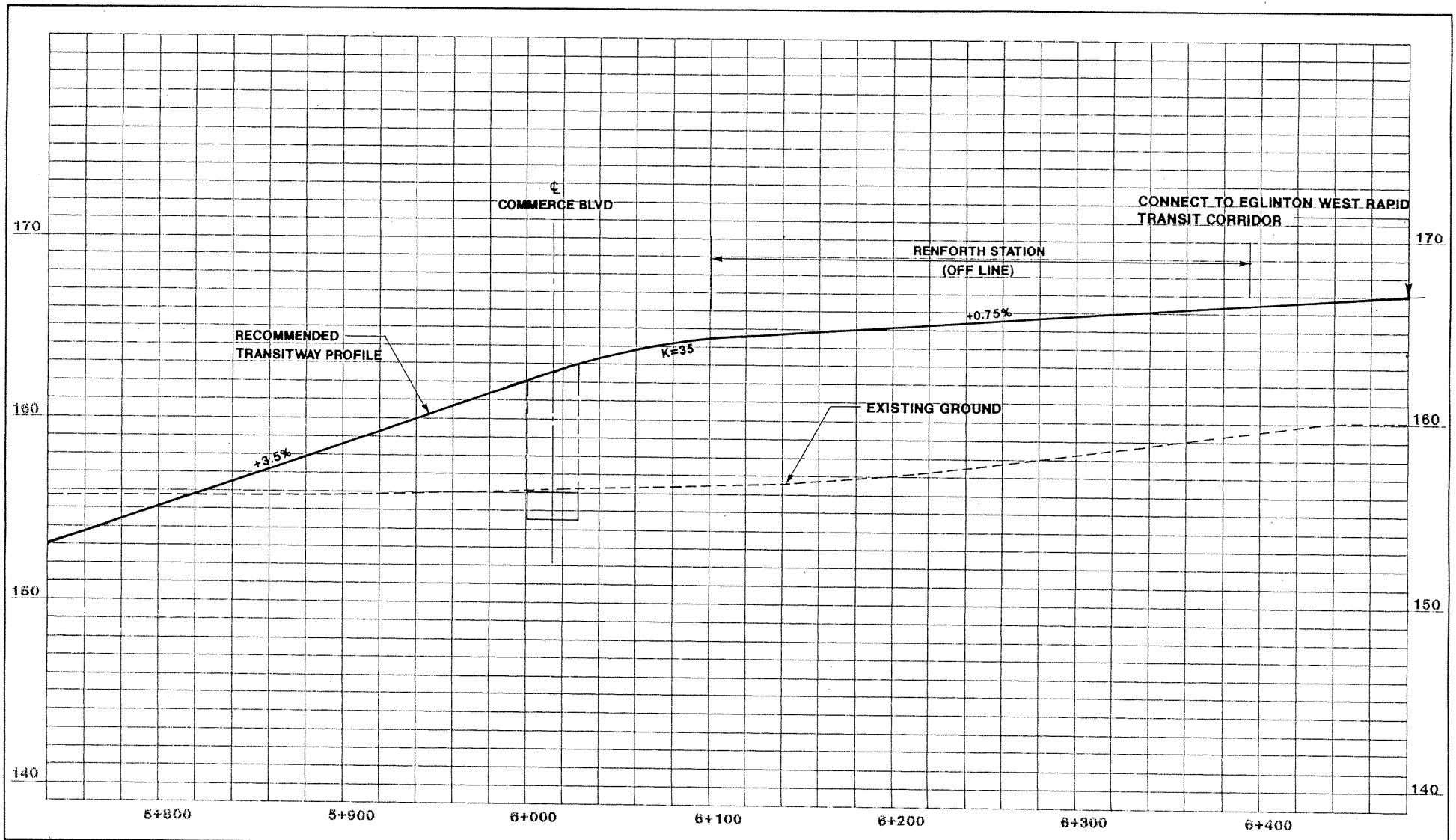
EXHIBIT 70

0 50 100 150 200m

SCALE

RECOMMENDED PLAN

Sta. 5+740 to Sta. 6+450



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

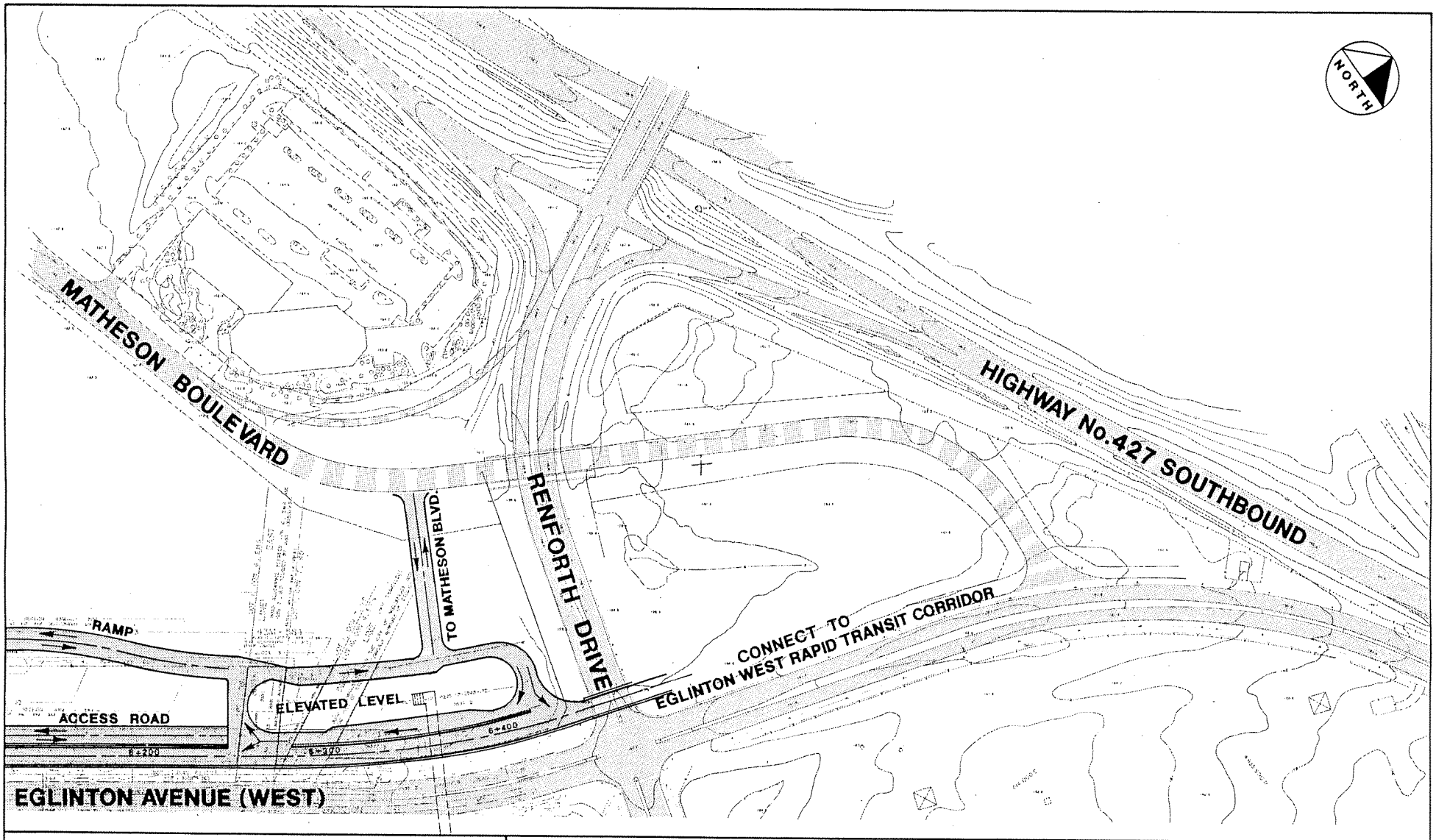
EXHIBIT

0 50 100 150 200m

SCALE

RECOMMENDED PROFILE

Sta. 5+740 to Sta. 6+450



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT 71

0 50 100 150 200m

SCALE

RECOMMENDED PLAN

Sta. 6+150 to Sta. 6+450

APPENDIX 'S'

COST ESTIMATES

MISSISSAUGA TRANSITWAY PLANNING STUDY EA REPORT

APPENDIX S - COST ESTIMATES

The Mississauga Transitway is a large, complex, long term project to be implemented in stages. The staging sequence, timing, development context, operational patterns, and fiscal arrangements are all undefined at this point, and will have a direct and significant bearing on the actual final cost of the facility. Furthermore, many decisions are yet to be made regarding discretionary items (station size, architectural treatment, landscaping, etc.) which may vary from those assumed, and negotiations with private and public property owners from which property is required have yet to be initiated; in both these areas significant cost impact (positive or negative) may be felt. Finally, any cost estimates at the functional planning stage do not have the benefit of detailed quantities and specific unit costs which are a product of preliminary and detailed design. Some costs (Ontario Hydro, property acquisition, etc.) can not be quantified at this point; they are therefore not included in the total cost cited.

In order to assign a realistic preliminary cost estimate to the Transitway, for use in comparing alternative alignments and in assessing the recommended facility, the following actions were undertaken:

- measure quantities of key items, based on the completed ultimate Transitway plan shown in the recommended plates;
- develop list of unit costs, based on current contract costs and similar Transitway construction cost experience elsewhere;
- apply a contingency of between 5 and 20 percent to each unit cost, to account for the risk of variations which are dependent on future design decisions;
- calculate a basic cost for each Transitway segment;
- apply an overall 20 percent cost for the administration, planning, design and construction management-related costs expected over the course of implementation; and
- apply an overall 20 percent contingency in order to account for quantity and unit cost changes which may occur, either due to the refinement of the plan or to external conditions.

In those areas (City Centre, Airport Corporate Centre, Maclennan lands) where potential exists for future joint use / development of the station sites, no additional costs have been assigned to the Transitway at this point, since the development potential and shape of such ventures is unknown and it is assumed that any related costs would be subject to an agreement between the parties which would be independent of the actual Transitway construction budget.

With these caveats, this Appendix provides a rationale for the cost estimates which have been produced to date, and forms a basis for future more detailed work on the project.

MISSISSAUGA TRANSITWAY

FUNCTIONAL PLANNING STUDY

TECHNICAL SUMMARY REPORT

PRELIMINARY COST ESTIMATES

OCTOBER 1991

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1.0 INTRODUCTION

The purpose of this paper is to document the assumptions and unit costs used for estimating the cost of the proposed Mississauga Transitway. Using these figures, preliminary cost estimates for the recommended Transitway plan and several alternative alignments are documented.

The study was initiated in the fall of 1989 and numerous alignment alternatives have been reviewed for the Parkway Belt West Corridor. The Key Map in Figure 1 illustrates the proposed alignment.

Costs have been a significant factor in the analysis of alignment alternatives. All unit costs are in 1990 dollars; a 5 percent increase to account for inflation is used to bring total costs to 1991 figures.

2.0 UNIT COSTS

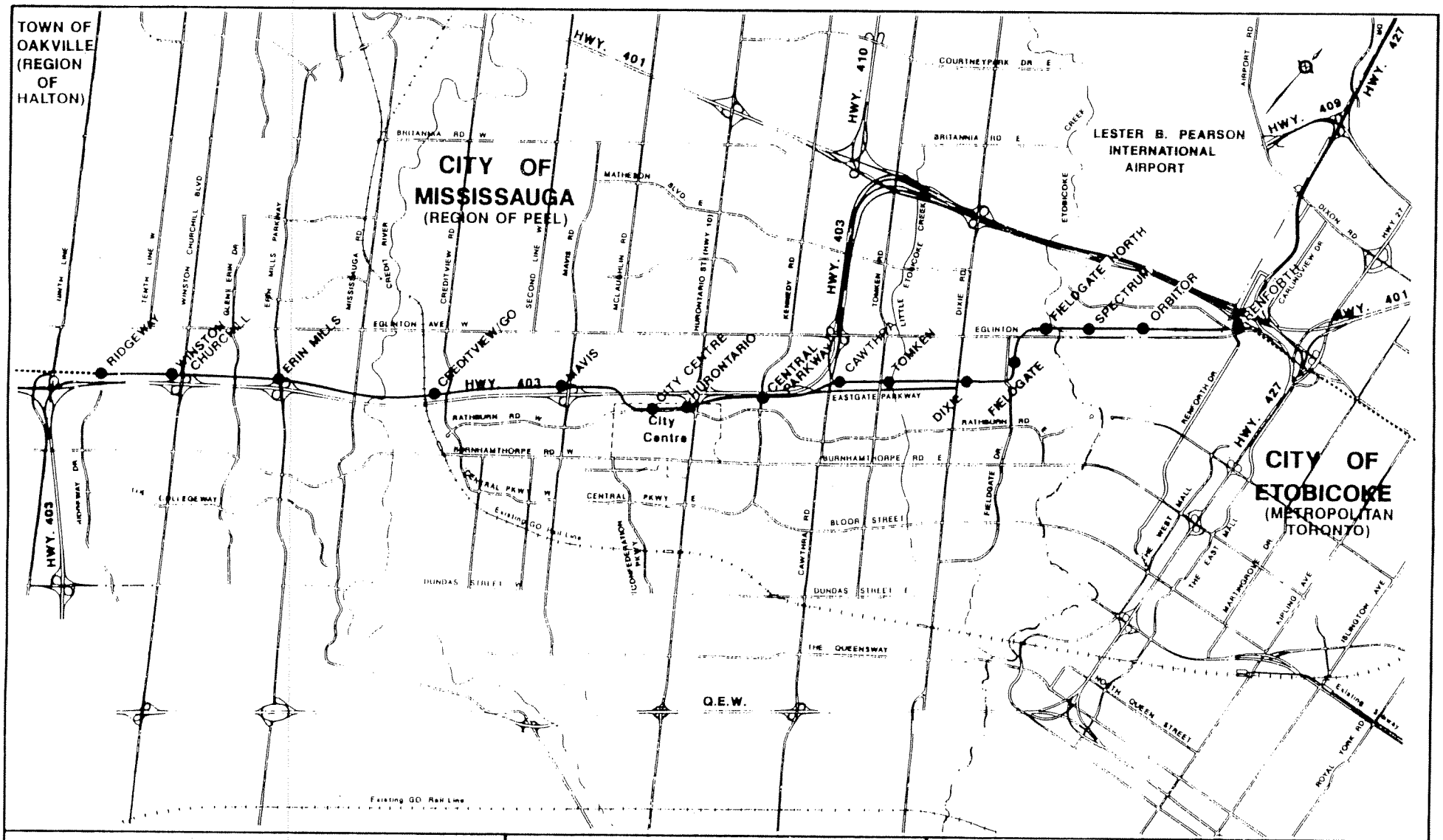
In order to provide consistency in the cost estimates a master list of unit costs was developed and a description of each item is contained in the following sections. Initial cost estimates were based on the following resources:

- Ottawa Transitway
- 1990 contract costs for road work in Mississauga and the region
- TAPS - Tender Analysis Pavement System

2.1 Clearing and Grubbing

Open Space - Clearing and removal of natural vegetation. Approximate cost $17,000/ha.

Woodlot - Clearing and removal of natural vegetation and trees. Designed for areas with denser tree growth. Approximate cost $20,000/ha.



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

FIGURE 1

0 2,000 4,000 6,000m

SCALE 1:60,000 APPROX.

TRANSITWAY KEY PLAN

This item does not include clearing and grubbing under the roadway and it will be addressed in the roadway category.

2.2 Earthworks

The earthworks item provides for any additional excavation required. Additional excavation may include ditches, tunnel excavation, berm development and structures. This item does not include earthworks required under the roadway. This work is included in the roadway costs. There are three categories for the various types of earth excavation.

Hauled Off Site - Earth, rock and garbage excavation, required to bring the roadway and structure to the designed subgrade. Material is removed off site or to another location not in the immediate area. Also includes rock and garbage excavation at structures. Although it is difficult to determine the quantity of material required to be hauled off site, it has been assumed any material that cannot be accommodated, i.e. no berms or fill required in the area, will be removed. Estimated cost of $\$5.25/m^3$.

On-Site Disposal - Earth and rock excavation, required to bring the roadway to the designed subgrade. Material is deposited on site in immediate area. Estimated cost of $\$4.50/m^3$.

Fill - Select fill used as backfill behind structures / retaining walls and other areas that can not use native material. Estimated cost of $\$6.20/m^3$.

2.3 Roadway

Variation in the cross-section of the roadway will occur depending on the location of the particular section.

The roadway can be one of three cross-sections.

Urban (no sidewalk) - Supply and installation of pavement structure, curbs and drainage. Typical cross-section indicated in Appendix A, Exhibit 1. This type of cross-section will be used in areas that can not accommodate rural roadways because of width or drainage restrictions. Estimated cost $75.00/m^2$.

Urban (with sidewalk) - Supply and installation of pavement structure, curbs, drainage and sidewalks. Typical cross-section illustrated in Appendix A, Exhibit 2. This type of cross-section will be used in tunnel / structure locations or any other areas that may require pedestrian access or additional right-of-way. Estimated cost $85.00/m^2$.

Rural - Supply and installation of pavement structure and ditches. Typical cross-sections are shown in Appendix A, Exhibits 3 and 4. This type of roadway will be used in areas close to existing grade that provide enough room for side sloping. Estimated cost $70.00/m^2$.

The roadway construction costs are based solely on the road right-of-way alone, items of work that may be included in roadway construction costs are as follows:

Clearing and grubbing - cleaning and removal of natural vegetation in roadway. This item refers to clearing and grubbing within the road right-of-way only. Estimated cost $17,000/ha or $20,000/ha.

Earthworks - excavation of roadway base only. Estimated cost $5.25/m^3$. This item only refers to earthworks within the road right-of-way.

Curb - Supply and placement of all curb and gutter. Element includes granular base. Estimated cost $40.00/m.

Sidewalks - Supply and placement of all sidewalks. Element includes granular base. Estimated cost $40.00/m^2.

Pavement Structure - Supply and installation of granular bases and asphalt. Assumed pavement structure for cost estimating purposes comprises: 40 mm of HL3, 100 mm HL8, 225 mm granular A, 450 mm granular B, water for compaction and calcium chloride for dust control. Estimated cost $40.00/m^2.

Drainage - Supply and installation of all drainage components for this element. Includes: PVC laterals, rigid concrete pipe, catch basin and manholes etc. Estimated cost 30% of roadway cost.

Guiderail - Supply and installation of all permanent steel single rail / SBG with channel. Estimated cost $75.00/m.

Barriers - Supply and installation of all permanent concrete barriers, New Jersey type. Estimated cost $155.00/m.

2.4 Transitway Station

The cost of each station will vary, depending on the level of detailing involved. Each station will include the following elements: Structural components, earth works, passenger shelter system, mechanical, electrical, special finishes, passenger information systems, platform landscaping, platforms and curbs. Unit costs are based on the average costs of analogous station types on the Ottawa Transitway system. An example of these costs are included in Appendix F. Costs of stations do not include widening, access roads and layover / local / kiss and ride / park and ride facilities.

There are three types of transitway stations.

Intermediate - small, on-line stations, where passengers will be able to transfer between north-south routes and Busway buses. Estimated cost $2 million.

Arterial - located at each major north-south roadway and will provide access roads, Kiss & Ride and direct Transitway to arterial road access to allow for north-south buses to enter or leave. Estimated cost $4 million.

Gateway - External transit systems will meet the Transitway usually close to or within major employment centres. It will provide access roads, Kiss & Ride and include parking facilities. Estimated cost $6 million.

As part of the station development one or more of the following sections may be incorporated into the design. Table 1 lists the station types, items included in the design and the cost range.

2.4.1 Transitway Widening at Station

Supply and installation of an additional two lanes of granular bases, asphalt, New Jersey barrier and possible abutment widening at underpasses. This widening will occur at all three station types. In Appendix A, Exhibit 5 indicates the widening and typical cross-section. As a general case a cost of $250,000 - $500,000 could be used for each widening. This is intended to allow a quick estimate of the cost savings after removing any station from the system.

2.4.2 Transitway Access Road

Supply and installation of Transitway access roads between the arterial roadway and the Transitway roadway. This item will be incorporated into the Intermediate and Gateway stations. Access roads will vary depending on the station design, but it has been assumed

MISSISSAUGA TRANSITWAY
STATION TYPE AND COST
Table 1

Station Type	Station ($ million)	Transitway Widening ($ million)	Access Road ($ million)	Parking / Layover ($ million)	Station Base Cost ($ million)	Eng. / Design 10% +10%	Contin. 20% ($ million)	Station Cost w/o Inflation	Inflation 5% ($ million)	Total Cost of Station ($ million)
Gateway										
Winston Churchill	6.00	0.460	0.320	0.740	7.5	1.5	1.5	10.5	0.5	11.1
	6.90	0.506	0.352	0.888	8.6	1.7	1.7	12.1	0.6	12.7
City Centre	6.00	0.250	0.320	0.740	7.3	1.5	1.5	10.2	0.5	10.7
	6.90	0.275	0.368	0.888	8.4	1.7	1.7	11.8	0.6	12.4
Hurontario	6.00	0.250	0.105	0.400	6.8	1.4	1.4	9.5	0.5	9.9
	6.90	0.275	0.121	0.480	7.8	1.6	1.6	10.9	0.5	11.4
Cawthra	6.00	0.250	0.950	0.900	8.1	1.6	1.6	11.3	0.6	11.9
	6.90	0.275	1.092	1.080	9.3	1.9	1.9	13.1	0.7	13.7
Renforth	6.00	0.500	0.700	0.740	7.9	1.6	1.6	11.1	0.6	11.7
	6.90	0.550	0.770	0.888	9.1	1.8	1.8	12.8	0.6	13.4
Arterial										
Ridgeway	4.00	0.460	0.320	0.370	5.2	1.0	1.0	7.2	0.4	7.6
	4.60	0.506	0.352	0.444	5.9	1.2	1.2	8.3	0.4	8.7
Erin Mills	4.00	0.460	0.320	0.370	5.2	1.0	1.0	7.2	0.4	7.6
	4.60	0.506	0.352	0.444	5.9	1.2	1.2	8.3	0.4	8.7
Mavis	4.00	0.250	0.355	0.340	4.9	1.0	1.0	6.9	0.3	7.3
	4.60	0.275	0.408	0.408	6.7	1.1	1.1	8.0	0.4	8.4
Dixie	4.00	0.460	0.355	0.740	5.6	1.1	1.1	7.8	0.4	8.2
	4.60	0.506	0.391	0.888	6.4	1.3	1.3	8.9	0.4	9.4
Tomken	4.00	0.460	0.000	0.000	4.5	0.9	0.9	6.2	0.3	6.6
	4.60	0.506	0.000	0.000	5.1	1.0	1.0	7.1	0.4	7.5
Fieldgate	4.00	0.460	0.000	0.000	4.5	0.9	0.9	6.2	0.3	6.6
	4.60	0.506	0.000	0.000	5.1	1.0	1.0	7.1	0.4	7.5
Creditview	4.00	0.460	0.320	0.370	5.2	1.0	1.0	7.2	0.4	7.6
	4.60	0.506	0.352	0.445	5.9	1.2	1.2	8.3	0.4	8.7
Intermediate **										
Central Parkway	2.00	0.250	0.000	0.000	2.3	0.5	0.5	3.2	0.2	3.3
	2.30	0.275	0.000	0.000	2.6	0.5	0.5	3.6	0.2	3.8
Spectrum	2.00	0.460	0.000	0.000	2.5	0.5	0.5	3.4	0.2	3.6
	2.30	0.506	0.000	0.000	2.8	0.6	0.6	3.9	0.2	4.1
Orbitor	2.00	0.460	0.000	0.000	2.5	0.5	0.5	3.4	0.2	3.6
	2.30	0.506	0.000	0.000	2.8	0.6	0.6	3.9	0.2	4.1
TOTAL	64.00	5.89	4.06	5.71	79.67	15.93	15.93	111.53	5.58	117.11
	73.60	6.48	4.56	6.85	91.49	18.30	18.30	128.09	6.40	134.49

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* NOTE - Small numbers include the individual contingency costs.

** - An intermediate station has been identified and protected for at Fieldgate North, but has not been included in the cost estimates as its need depends on future land use decisions re: the adjacent property.

a general cost of $320,000 - $360,000 could be used if actual quantities have not been determined. Larger stations may require increased road access and this will be reflected in the cost estimate.

2.4.3 Layover / Local / Kiss and Ride / Park and Ride

Provisions of extra roadways servicing Transitway Stations for local transit use. Bus layover areas, local platforms, shelters, Kiss and Ride, and Park and Ride are included under this item. All these items will apply to Gateway stations, and Arterial stations may require larger local Kiss and Ride facilities. The estimated cost for this type of work ranges between $250,000 - $370,000 for standard Arterial stations and $740,000 - $1,000,000 for Gateway stations.

2.5 Structure

Structure cost includes the following: the supply and construction of all foundation elements associated with the substructure including the footings, frame legs, wingwalls, and retaining wall; and the supply and construction of all elements associated with the superstructure including the deck and approach slabs. Estimated cost $ 1,350.00/m^2.

2.6 Retaining Wall

Supply and construction of all elements associated with the installation of a retaining wall. Retaining wall guidelines were based on full height shoring and earth excavation. Some sections could be constructed without shoring and with partial shoring. These variations will reflect in lower costs. Retaining wall heights may vary depending on the roadway elevation and an average cost of $550.00/$m^2$ was used. Wall area is based on the height above grade (i.e. footing costs are included in the unit cost for exposed wall).

2.7 Noise Barriers

Supply and placement of all permanent noise barriers of various sizes. A cost of $\$100.00/m^2$ has been used based on the height of the barrier above grade. Typical height is 5 m.

2.8 Fencing

Supply and installation of all permanent chain link security fencing. Estimated cost $35.00/m

2.9 Creek Culvert

Supply and installation of 3.5 m x 6.0 m culvert to service various stream diversions. Estimated cost $6500.00/m

2.10 Culvert

Supply and installation of various culvert sizes at different locations.

300 mm dia. $160.00/m
525 mm dia. $190.00/m
675 mm dia. $230.00/m

2.11 Traffic Signal

Supply and installation of traffic signals at specific locations. Estimated cost
Relocated - $50,000.00 ea. New - $80,000.00 ea.

2.12 Pipeline

Cost estimates will be based on information supplied by the affected pipeline company wherever possible. Detailed costs must await preliminary design, as a number of options exist depending on timing and conditions at the time of construction. Correspondence regarding cost estimates are in Appendix E.

2.13 Hydro Relocation

Relocation of any electric power lines and facilities within the alignment. Because of the difficulty associated with the estimating and predicting of further Hydro developments, preliminary station plans to accommodate only the existing hydro towers. These towers maybe subject to relocation and subsequent revisions to station plans would be required. Costs will be provided by Ontario Hydro and Hydro Mississauga at the preliminary design stage. In the meantime, no costs have been assigned to Ontario Hydro, while a unit cost of $250 - 300/circuit metre is used for relocation of Hydro Mississauga pole line above ground. The burying of the line would cost $1,200/circuit metre. These are the minimum cost estimates and property acquisition for the rerouting is not known.

2.14 Illumination

Supply and installation of lighting elements. Includes poles, duct, junction boxes, luminaires, ground roads, service feeds and underpass luminaires. Estimated cost $115,000/km, based on experience with Eastgate Parkway construction.

2.15 Landscaping

Supply and placement of topsoil, seeding, mulching, trees and shrubs. This cost estimate was based on similar landscaping for Eastgate Parkway. Estimated cost $160,000/km.

2.16 Utilities

Permanent or temporary removal / relocation / installation of existing or new utilities. Utilities include: local hydro, Consumers Gas, water, sewer, telephone, cable and any other facilities requiring movement. Estimated cost $50,000.00 ea. for each crossing. Relocations would result in variable costing.

2.17 Detours

Installation, maintenance and removal of detour required to divert traffic from area under construction. Includes all temporary items used during the detour such as barriers, shoring, lighting, traffic control, temporary asphalt sidewalks and adjustments to signals. Estimated cost $1.6 million/km for Freeway and $0.8 million / km for Arterial. Detours have not been designed and costs are subject to the timing, staging and conditions existing at the time of construction.

2.18 Property Cost

All costs associated with acquiring land including legal and appraisal services and land surveys. The majority of property to be acquired comes under the Parkway Belt West Plan and various approvals would be required from the Ministry of Government Services and the Ministry of Municipal Affairs. No unit cost has been used, pending the outcome of further discussion between the City and various Provincial bodies.

2.19 Project Management

Includes general engineering project management and administration effort. Estimated 10% of construction cost.

2.20 Design

Preparation of the functional, preliminary and detailed design activities for each structure / system / major element of the transitway. This includes:

- preparation of system design criteria for all design elements;
- establish the integration of the functional design including the horizontal and vertical alignments;
- site, geotechnical and architectural investigations and traffic management as required;
- the functional design for each structure / system / major element, for example: station, grade separation and roadway section;
- scope and cost control during the functional design phase by which project scope changes and / or capital cost estimates at variance with the feasibility phase cost estimates are identified;
- establishment of detour needs and strategies;
- review and refinement of the Work Breakdown System and related scope statement for each component to reflect the evolving results of the functional design effort. This includes the estimation of construction costs based on quantity take-offs utilizing approved current construction unit rates;
- preparation and printing of the final plans and report documenting methods, analysis and results.

The design item is considered to be 10% of construction costs.

2.21 Contingency

Cost estimate which reflects the uncertainties associated with the final construction scope and timing and with bidding competitiveness in the marketplace. Furthermore, it reflects the uncertainty associated with the construction work and other activities following contract award. An individual and overall contingency was applied to the various items. An estimate of 20% of construction costs was used for the overall contingency. Individual contingencies were also applied to each item, and varied between 5% and 20% based on the risk of variation in unit costs (see Table 2). For example, fencing is a standard contract item which would not be expected to vary significantly from current prices; however, the architectural and design approach to be taken to station facilities is unknown at this point and could range from simple components to high-quality customized material.

MISSISSAUGA TRANSITWAY
INDIVIDUAL CONTINGENCY COSTS
TABLE 2

	ITEM		UNIT COST ($1990)	INDIVIDUAL CONTINGENCY
2.1)	Clearing & Grubbing	Open Space	$17 000.00 /ha	10%
		Woodlot	$20 000.00 /ha	10%
2.2)	Earthworks	Hauled Off Site	$5.25 /m3	20%
		On Site	$4.50 /m3	20%
		Fill	$6.20 /m3	20%
2.3)	Roadway (2 lanes)			
	Urban (no sidewalk)		$75.00 /m2	10%
	Urban (with sidewalk)		$85.00 /m2	10%
	Rural		$70.00 /m2	10%
	Clearing & Grubbing (roadway only)	Open Space	$17 000.00 /ha	10%
		Woodlot	$20 000.00 /ha	10%
	Earthworks (roadway only)	Hauled Off Site	$5.25 /m3	10%
		On Site	$4.50 /m3	10%
		Fill	$6.20 /m3	10%
	Curb		$40.00 /m	10%
	Sidewalks (1.5m wide)		$40.00 /m2	10%
	Pavement Structure (140mm Asphalt) (225mm Gran A) (450mm Gran B)		$40.00 /m2	10%
	Drainage		30% of Roadway	10%
	Guiderail (Single Rail / SBG with Channel)		$75.00 /m	10%
	Barriers (New Jersey)		$155.00 /m	10%
2.4)	Transitway Station	Intermediate	2 million ea.	15%
		Arterial	4 million ea.	15%
		Gateway	6 million ea.	15%
	Transitway Widening at Station		$250 000 - $500 000 ea.	10%
	Transitway Access Road		$320 000 - $360 000 ea.	10%
	Layover / Local / Kiss & Ride / Park & Ride		$740 000 - $1 000 000 ea.	20%
2.5)	Structure (Deck Area)		$1 350.00 /m2	15%
2.6)	Retaining Wall		$550.00 /m2	20%
2.7)	Noise Barrier (3m - 5m high)		$500.00 /m	10%

FILE NAME: COS_EST6.WK1

MISSISSAUGA TRANSITWAY
INDIVIDUAL CONTINGENCY COSTS
TABLE 2

	ITEM		UNIT COST ($1990)	INDIVIDUAL CONTINGENCY
2.8)	Fencing (1.8m C.L.S.F.)		$35.00 /m	5%
2.9)	Creek Culvert (3.5m x 6.0m)		$6 500.00 /m	10%
2.10)	Culvert			
	300 mm diam.		$160.00 /m	5%
	525 mm diam.		$190.00 /m	5%
	675 mm diam.		$230.00 /m	5%
2.11)	Traffic Signals	Relocated	$50 000.00 ea.	20%
		New	$80 000.00 ea.	20%
2.12)	Pipeline		Variable	10%
2.13)	Hydro Relocation		N/A	
2.14)	Illumination		$115 000.00 /Km	10%
2.15)	Landscaping		$160 000.00 /Km	5%
2.16)	Utilities			
	Relocation		Variable	
	Crossing		$50 000.00 ea.	15%
2.17)	Detours			
	Freeway		1.6 million /Km	20%
	Arterial		0.8 million /Km	20%
2.18)	Property Cost		Variable	
2.19)	Project Management		10%	
2.20)	Design		10%	
2.21)	Project Contingency		20%	
2.22)	Inflation to 1991		5%	

FILE NAME: COS_EST6.WK1

3.0 PRELIMINARY PLANNING COST OF RECOMMENDED TRANSITWAY

The analysis of the various alternatives has resulted in a recommended alignment and the costs associated with the alignment has been broken into individual segments. A segment may contain a station or act as the link between stations. The Transitway plan and profile upon which the quantities are based is included for reference in Appendix B.

It should be noted the costs do not include:

- Possible application of Goods and Services Tax (GST) to some items
- Interest or financing costs
- Ontario Hydro
- Property Acquisition
- Vehicles
- Vehicle Storage
- Development Integration
- Possible long-haul off site disposal of excavated materials
- Engineering and Contingency Cost for above items

All unit costs are in $ 1990, with 5% inflation applied to bring total costs to $ 1991 figures.

The total cost for each section is as follows:

West Section (Ninth Line - Mavis)	$ 121,200,000
Central Section (Mavis - Cawthra)	$ 189,600,000
East Section (Cawthra - Renforth)	$ 169,200,000
Total Cost (Ninth Line - Renforth)	$ 480,000,000

The preliminary section costs for the recommended alignment are contained in Table 3 and are illustrated in Figure 2.

Table 4 summarizes the total quantities and costs by item for the entire Transitway.

SUMMARY COSTS OF MISSISSAUGA TRANSITWAY RECOMMENDED ALIGNMENT
Table 3a

WEST SECTION – Ninth Line to Mavis Road

Chainage	Length (km)	Section	Sta. Type	Section Cost		Station Cost		Total Cost (Range) ($)
				Base ($)	Contingency ($)	Base ($)	Contingency ($)	
Sta. 1+300 - Sta. 1+860	0.56	Ridgeway Station	A	8,000,000	3,800,000	5,900,000	2,800,000	11,800,000
Sta. 1+860 - Sta. 2+500	0.64	Ridgeway-Winston Churchill		9,600,000	4,600,000	-	-	14,200,000
Sta. 2+500 - Sta. 3+050	0.55	Winston Churchill Station	G	11,600,000	5,500,000	8,600,000	4,100,000	17,100,000
Sta. 3+050 - Sta. 3+850	0.80	Winston Churchill-Glen Erin		5,200,000	2,400,000	-	-	7,600,000
-	0.00	Glen Erin Station (not incl'd)		0	0	-	-	0
Sta. 3+850 - Sta. 4+000	0.15	Glen Erin-Erin Mills		3,300,000	1,500,000			4,800,000
Sta. 4+000 - Sta. 4+640	0.64	Erin Mills Station	A	7,600,000	3,500,000	5,900,000	2,800,000	11,100,000
Sta. 4+640 - Sta. 5+780	1.18	Erin Mills-Mississauga Rd.		12,900,000	6,000,000	-	-	18,900,000
	0.00	Miss. Rd. Station (not incl'd)		0	0	-	-	0
Sta. 5+740 - Sta. 6+800	0.98	Mississauga Rd.-Creditview		10,800,000	5,100,000	-	-	15,900,000
Sta. 6+800 - Sta. 7+480	0.68	Creditview Station	A	7,600,000	3,500,000	5,900,000	2,800,000	11,100,000
Sta. 7+480 - Sta. 8+700	1.22	Creditview-Matchline		5,900,000	2,800,000	-	-	8,700,000
West Total	7.40			82,500,000	38,700,000	26,300,000	12,500,000	121,200,000

Note - Costs do not include:
- Ontario Hydro
- Property Acquisition
- Vehicles
- Vehicle Storage
- Development Integration
- Engineering & Contingency Cost for above items

LEGEND

G - Gateway
A - Arterial
I - Intermediate

FILE NAME: TOTCOS6A.WK1

SUMMARY COSTS OF MISSISSAUGA TRANSITWAY RECOMMENDED ALIGNMENT
Table 3b

CENTRE SECTION – Mavis Road to Cawthra Road

Chainage	Length (km)	Section	Sta. Type	Section Cost		Station Cost		Total Cos (Range) ($)
				Base ($)	Contingency ($)	Base ($)	Contingency ($)	
Sta. 0+000 – Sta. 0+200	0.20	Matchline-Mavis		200,000	100,000			300,0(
Sta. 0+200 – Sta. 0+630	0.43	Mavis Station	A	12,000,000	5,700,000	5,700,000	2,700,000	17,700,0(
Sta. 0+630 – Sta. 1+100	0.47	Mavis-Confederation		3,500,000	1,600,000	-	-	5,100,0(
Sta. 1+100 – Sta. 1+560	0.46	Confed. - Prince of Wales		7,800,000	3,600,000	-	-	11,400,0(
Sta. 1+560 – Sta. 1+770	0.21	Prince of Wales - City Centre		5,200,000	2,500,000	-	-	7,700,0(
Sta. 1+770 – Sta. 2+260	0.49	City Centre Station	G	27,600,000	13,000,000	8,400,000	4,000,000	40,600,0(
Sta. 2+260 – Sta. 2+460	0.20	City Centre-Hurontario		4,200,000	2,000,000	-	-	6,200,0(
Sta. 2+460 – Sta. 2+870	0.41	Hurontario Station	G	26,000,000	12,200,000	7,800,000	3,600,000	38,200,0(
Sta. 2+870 – Sta. 3+700	0.83	Hurontario-Central Parkway		1,600,000	800,000	-	-	2,400,0(
Sta. 3+700 – Sta. 4+120	0.42	Central Parkway Station	I	10,100,000	4,700,000	2,600,000	1,200,000	14,800,0(
Sta. 4+120 – Sta. 4+760	0.64	Central Parkway-Cawthra		7,600,000	3,500,000	-	-	11,100,0(
Sta. 4+760 – Sta. 5+400	0.64	Cawthra Station	G	22,900,000	10,700,000	9,300,000	4,400,000	33,600,0(
Sta. 5+400 – Sta. 5+620	0.22	Cawthra-Matchline		300,000	200,000	-	-	500,0(
Centre Total	5.42			129,000,000	60,600,000	33,800,000	15,900,000	189,600,0(

Note – Costs do not include:
- Ontario Hydro
- Property Acquisition
- Vehicles
- Vehicle Storage
- Development Integration
- Engineering & Contingency Cost for above items

LEGEND

G – Gateway
A – Arterial
I – Intermediate

FILE NAME: TOTCOS6A.WI

SUMMARY COSTS OF MISSISSAUGA TRANSITWAY RECOMMENDED ALIGNMENT
Table 3c

EAST SECTION – Cawthra Road to Renforth Drive

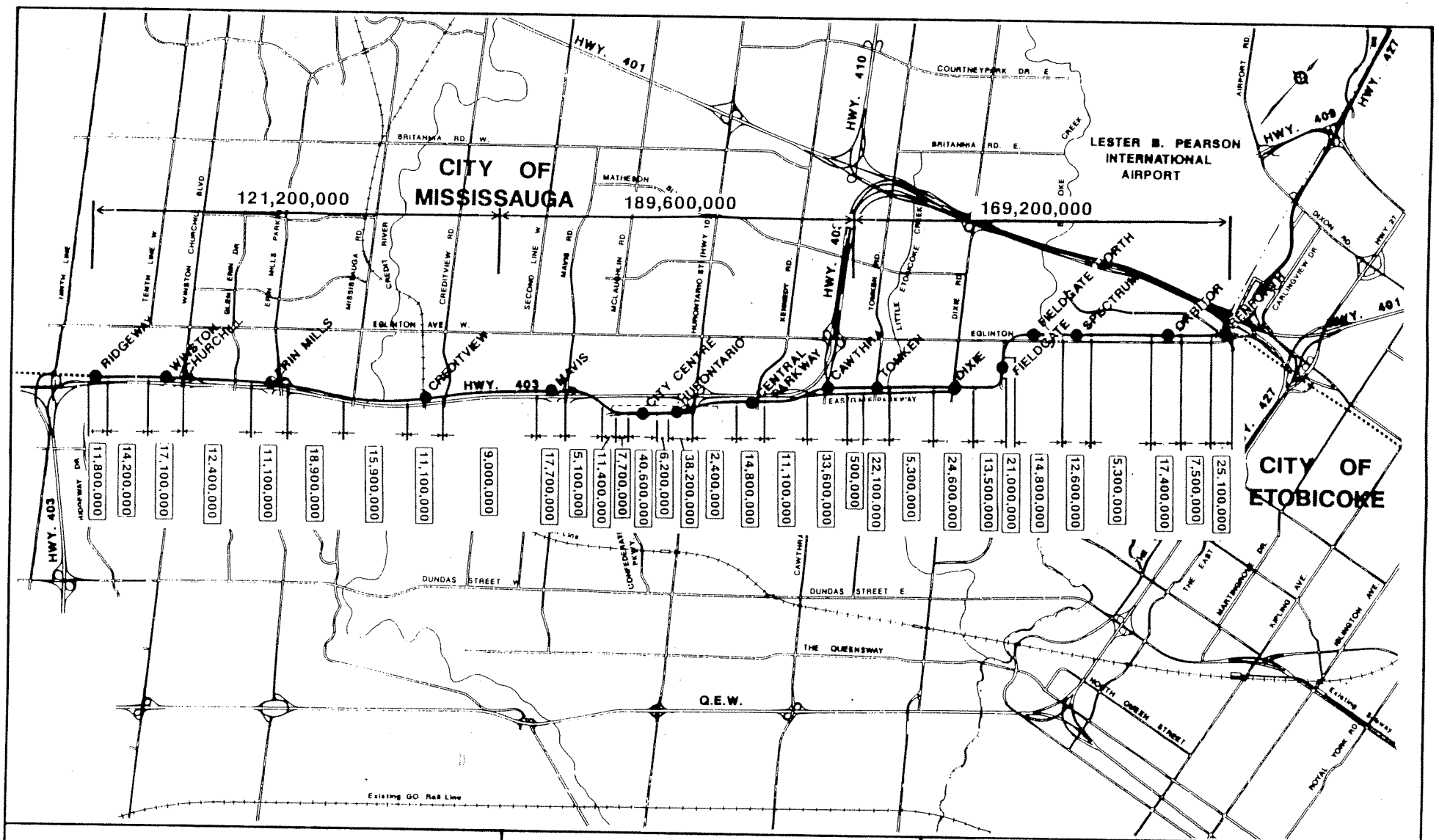
Chainage	Length (km)	Section	Sta. Type	Section Cost		Station Cost		Total Cost (Range) ($)
				Base ($)	Contingency ($)	Base ($)	Contingency ($)	
Sta. 0+000 - Sta. 0+500	0.70	Tomken Station	A	15,000,000	7,100,000	5,100,000	2,400,000	22,100,000
Sta. 0+500 - Sta. 1+100	0.50	Tomken-Dixie		3,600,000	1,700,000	-	-	5,300,000
Sta. 1+100 - Sta. 1+700	0.70	Dixie Station	A	16,700,000	7,900,000	6,400,000	3,000,000	24,600,000
Sta. 1+700 - Sta. 2+400	0.41	Dixie-Fieldgate		9,200,000	4,300,000	-	-	13,500,000
Sta. 2+400 - Sta. 2+820	0.74	Fieldgate Station	A	14,300,000	6,700,000	5,100,000	2,400,000	21,000,000
Sta. 2+820 - Sta. 3+800	0.87	Fieldgate-Spectrum		10,100,000	4,700,000	-	-	14,800,000
Sta. 3+800 - Sta. 4+250	0.50	Spectrum Station	I	8,600,000	4,000,000	2,800,000	1,300,000	12,600,000
Sta. 4+250 - Sta.4+920	0.52	Spectrum-Orbitor		3,600,000	1,700,000	-	-	5,300,000
Sta. 4+920 - Sta. 5+200	0.50	Orbitor Station	I	11,800,000	5,600,000	2,800,000	1,300,000	17,400,000
Sta. 5+200 - Sta.	0.74	Orbitor-Renforth		5,100,000	2,400,000	-	-	7,500,000
Sta. -Sta.	0	Renforth Station	G	17,100,000	8,000,000	9,100,000	4,300,000	25,100,000
East Total	6.38			115,100,000	54,100,000	31,300,000	14,700,000	169,200,000
Total Transitway	**19.20**			**326,600,000**	**153,400,000**	**91,400,000**	**43,100,000**	**480,000,000**

Note - Costs do not include:
- Ontario Hydro
- Property Acquisition
- Vehicles
- Vehicle Storage
- Development Integration
- Engineering & Contingency Cost for above items

LEGEND

G - Gateway
A - Arterial
I - Intermediate

FILE NAME: TOTCOS6A.WK1



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

FIGURE 2

0 2,000 4,000 6,000m

SCALE

STATION
TRANSITWAY
FUTURE EXTERNAL LINK

INDIVIDUAL SECTION COSTS

MISSISSAUGA TRANSITWAY
TRANSITWAY COST TOTALS BY ITEM
NINTH LINE TO RENFORTH DRIVE
TABLE 4

	ITEM		UNIT COST ($1990)	QUANTITY	SUBTOTAL	ITEM CONTINGENCY	TOTAL COST
2.1)	Clearing & Grubbing	Open Space	17,000.00 /ha	43.00	731,000.00	73,100.00	804,100.0
		Woodlot	20,000.00 /ha	7.00	140,000.00	14,000.00	154,000.0
2.2)	Earthworks	Hauled Off Site	5.25 /m3	2,212,400.00	11,615,100.00	2,323,000.00	13,938,100.0
		On Site	4.50 /m3	561,400.00	2,526,300.00	505,300.00	3,031,600.0
		Fill	6.20 /m3	45,100.00	279,600.00	55,900.00	335,500.00
2.3)	Roadway (2 lanes)						
	Urban (no sidewalk)		75.00 /m2	55,900.00	4,192,500.00	419,300.00	4,611,800.00
	Urban (with sidewalk)		85.00 /m2	39,100.00	3,323,500.00	332,300.00	3,655,800.0
	Rural		70.00 /m2	36,000.00	2,520,000.00	252,000.00	2,772,000.0
	Clearing & Grubbing (roadway only)	Open Space	17,000.00 /ha	12.200	207,400.00	20,700.00	228,100.00
		Woodlot					
	Earthworks (roadway only)	Hauled Off Site	5.25 /m3	1,159,000.00	6,084,700.00	622,200.00	6,706,900.00
		On Site					
		Fill					
	Curb		40.00 /m	15,200.00	608,000.00	60,800.00	668,800.00
	Sidewalks (1.5m wide)		40.00 /m2	Included in other item			
	Pavement Structure (140mm Asphalt) (225mm Gran A) (450mm Gran B)		40.00 /m2	160,200.00	6,408,000.00	640,700.00	7,048,700.00
	Drainage (if applicable)		30% of Roadway	-	4,547,000.00	454,900.00	5,001,900.00
	Guiderail (Single Rail / SBG with Channel)		75.00 /m	Included in other item			
	Barriers (New Jersey)		155.00 /m	Included in other item			
2.4)	Transitway Station	Intermediate	2,000,000.00 ea.	3	6,000,000.00	700,000.00	6,700,000.00
		Arterial	4,000,000.00 ea.	7	28,000,000.00	4,200,000.00	32,200,000.0
		Gateway	6,000,000.00 ea.	5	30,000,000.00	3,300,000.00	33,300,000.0
	Transitway Widening at Station		250,000 - 500,000 ea.	15	5,850,000.00	585,000.00	6,435,000.00
	Transitway Access Road		320,000 - 360,000 ea.	11	3,971,000.00	484,000.00	4,455,000.0
	Layover / Local / Kiss & Ride / Park & Ride		370,000 - 1,000,000 ea.	10	5,705,000.00	993,000.00	6,698,000.0
	Pedestrian Tunnel		4,000.00 /m2	385.00	1,540,000.00	231,000.00	1,771,000.0
2.5)	Structure (Deck Area)		1,350.00 /m2	56,400.00	76,140,000.00	11,421,000.00	87,561,000.00
2.6)	Retaining Wall		550.00 /m2	77,200.00	42,460,000.00	8,492,000.00	50,952,000.0
2.7)	Noise Barrier (3m - 5m high)		500.00 /m	3,900.00	1,950,000.00	195,000.00	2,145,000.0

FILE NAME: COEST5A.WK1

MISSISSAUGA TRANSITWAY
TRANSITWAY COST TOTALS BY ITEM
NINTH LINE TO RENFORTH DRIVE
TABLE 4 (Continued)

ITEM	UNIT COST ($1990)]	QUANTITY	SUBTOTAL	ITEM CONTINGENCY	TOTAL CO
2.8) Fencing (1.8m C.L.S.F.)	35.00 /m	16,480.00	576,800.00	28,900.00	605,700
2.9) Creek Culvert (3.5m x 6.0m)	6,500.00 /m	605.00	3,932,500.00	393,300.00	4,325,800
2.10) Culvert					
Major Culvert	Variable		8,400,000.00	1,680,000.00	10,080,000
300 mm diam.	160.00 /m	-	0.00	0.00	0
525 mm diam.	190.00 /m	-	0.00	0.00	0
675 mm diam.	230.00 /m	-	0.00	0.00	0
2.11) Traffic Signals Relocated	50,000.00 ea.	Included in other item			
New	80,000.00 ea.				
2.12) Pipeline	Variable		13,692,000.00	1,369,200.00	15,061,200.
2.13) Hydro Relocation	N/A	-	-	-	N/A
2.14) Illumination	115,000.00 /km	19.50	2,242,500.00	224,500.00	2,467,000.
2.15) Landscaping	160,000.00 /km	18.90	3,027,200.00	151,400.00	3,178,600.
2.16) Utilities					
Relocation	Variable ea.	-	2,940,000.00	441,000.00	3,381,000.
Crossing	50,000.00 ea.	25.00	1,250,000.00	187,500.00	1,437,500.
2.17) Detours					
Freeway	160,000.0 /km	0.80	1,280,000.00	256,000.00	1,536,000.
Arterial	100,000-800,000.0 /km	12.25	2,792,000.00	558,400.00	3,350,400.
2.18) Property Cost	Variable	-	-	-	N/A

	SUBTOTAL	326,700,000.
2.19) Project Management	10 %	32,600,000.
2.20) Design	10 %	32,600,000.
2.21) Project Contingency	20 %	65,200,000.
2.22) Inflation to 1991	5 %	22,900,000.
TOTAL		480,000,000.

FILE NAME: COEST5A.

APPENDIX 'S-A'
TYPICAL CROSS-SECTION

(see Appendix Q, Mississauga Transitway Environmental Assessment Report for Standard cross sections)

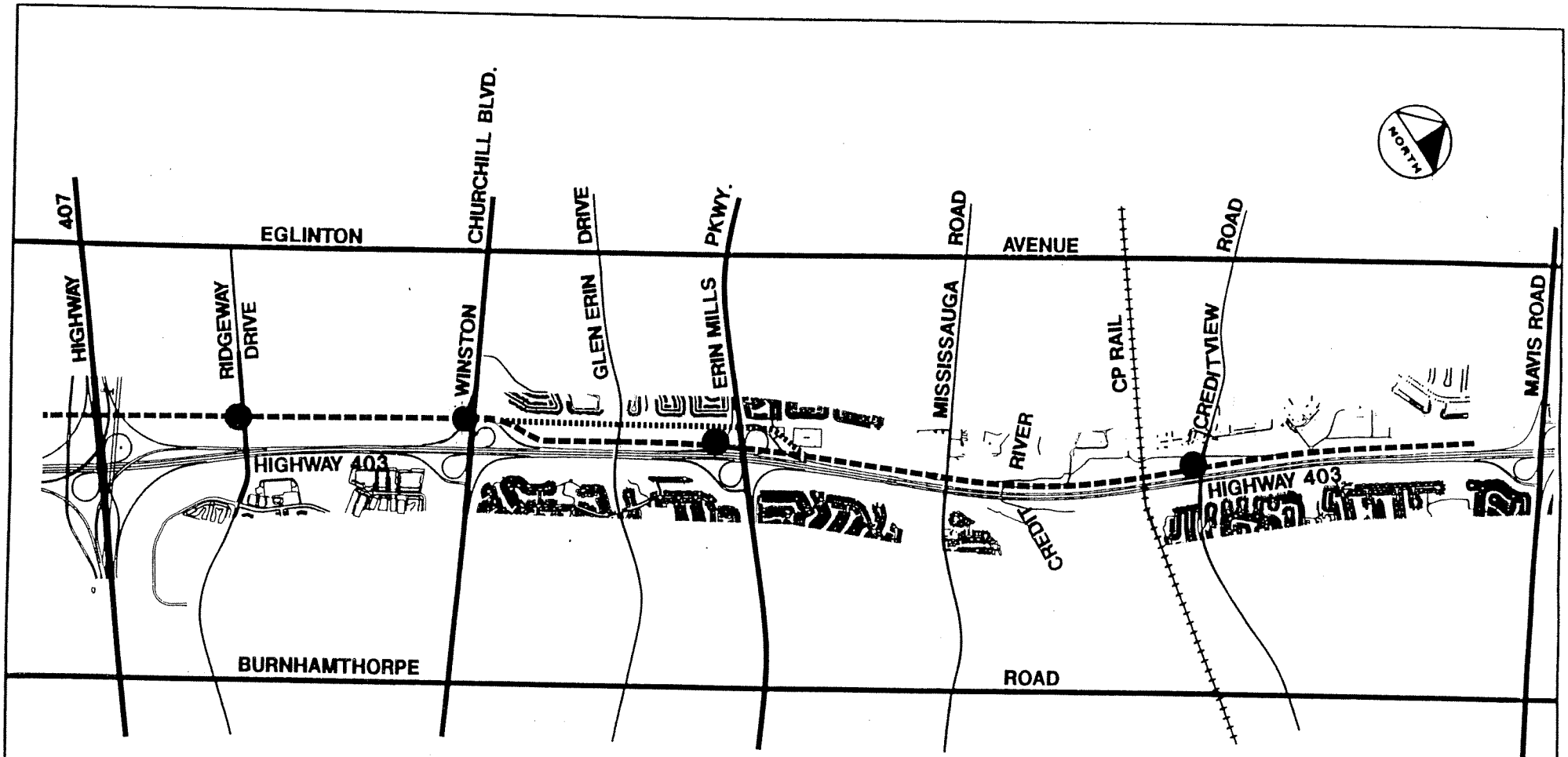
APPENDIX 'S-B'

RECOMMENDED TRANSITWAY PLAN AND PROFILE

(see Appendix R, Mississauga Transitway Environmental Assessment Report for Transitway plan and profile).

APPENDIX 'S-C'

COMPARISON OF COSTS OF ALTERNATIVE ALIGNMENTS



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

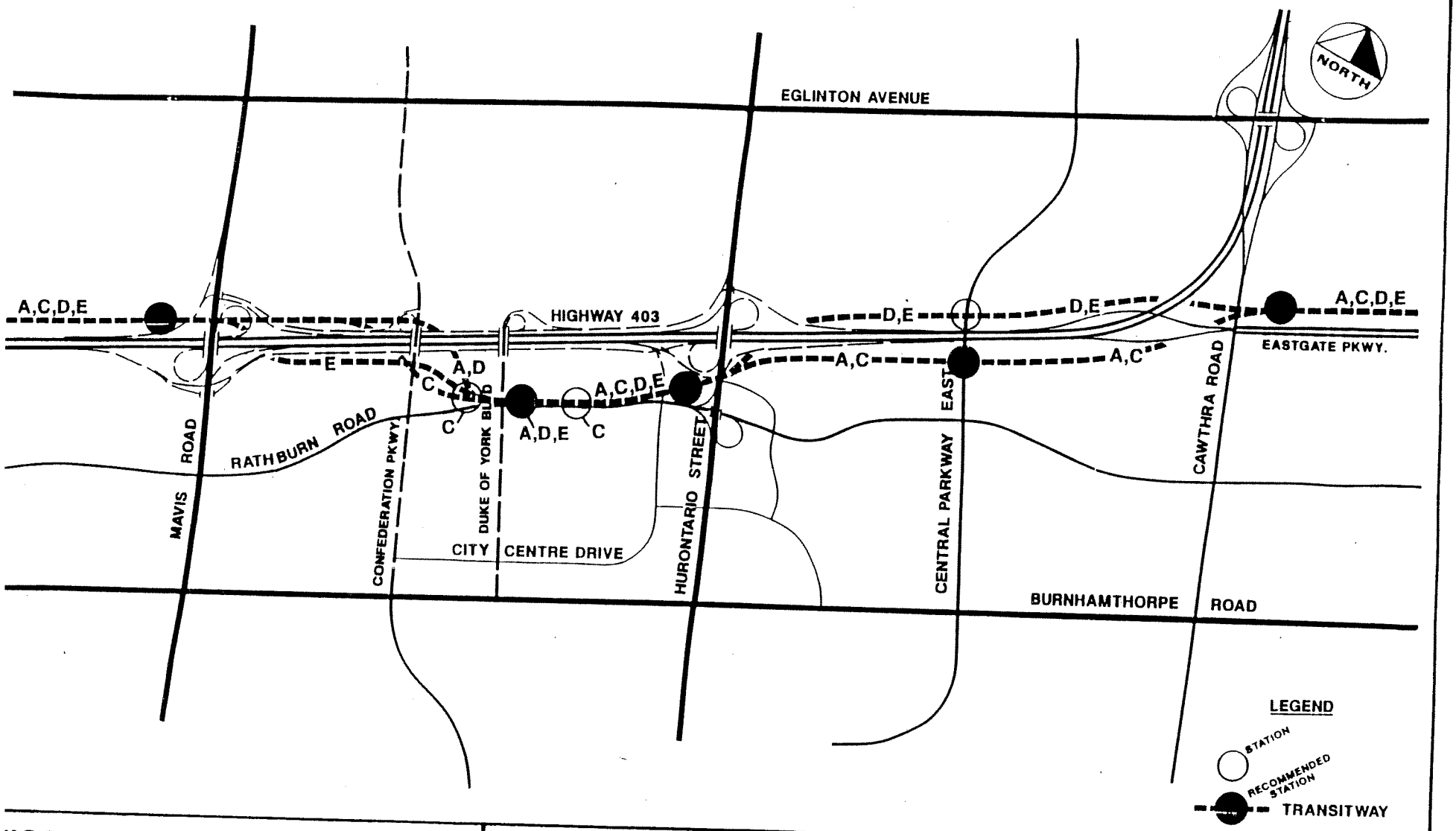
EXHIBIT

(PLAN NOT TO SCALE)

ALIGNMENT ALTERNATIVES
WEST SECTION

TABLE 5
MISSISSAUGA TRANSITWAY
16-Oct-91
SUMMARY OF COSTS OF ALTERNATIVE ALIGNMENTS

	North Alignment W1	Hybrid Alignment W1a
INTERSTATIONS:		
Ridgeway Drive - Winston Churchill	14,175,786	14,175,786
Winston Churchill - Glen Erin	8,229,992	7,610,535
Glen Erin - Erin Mills Parkway	6,594,998	4,853,748
Erin Mills Parkway - Mississauga Road	13,092,438	18,859,970
Mississauga Road - Credit View Road	15,194,343	15,870,543
Credit View Road - Mavis Road	8,735,422	8,735,422
TOTAL - INTERSTATIONS	66,022,979	70,106,004
STATIONS:		
Ridgeway Drive	12,194,532	11,748,240
Winston Churchill	18,215,873	17,074,785
Erin Mills Parkway	10,231,200	11,138,925
Credit View Road	8,340,780	8,340,780
TOTAL - STATIONS	48,982,385	48,302,730
TOTAL:	115,005,364	118,408,734



IISSISSAUGA TRANSITWAY
JNCTIONAL PLANNING STUDY

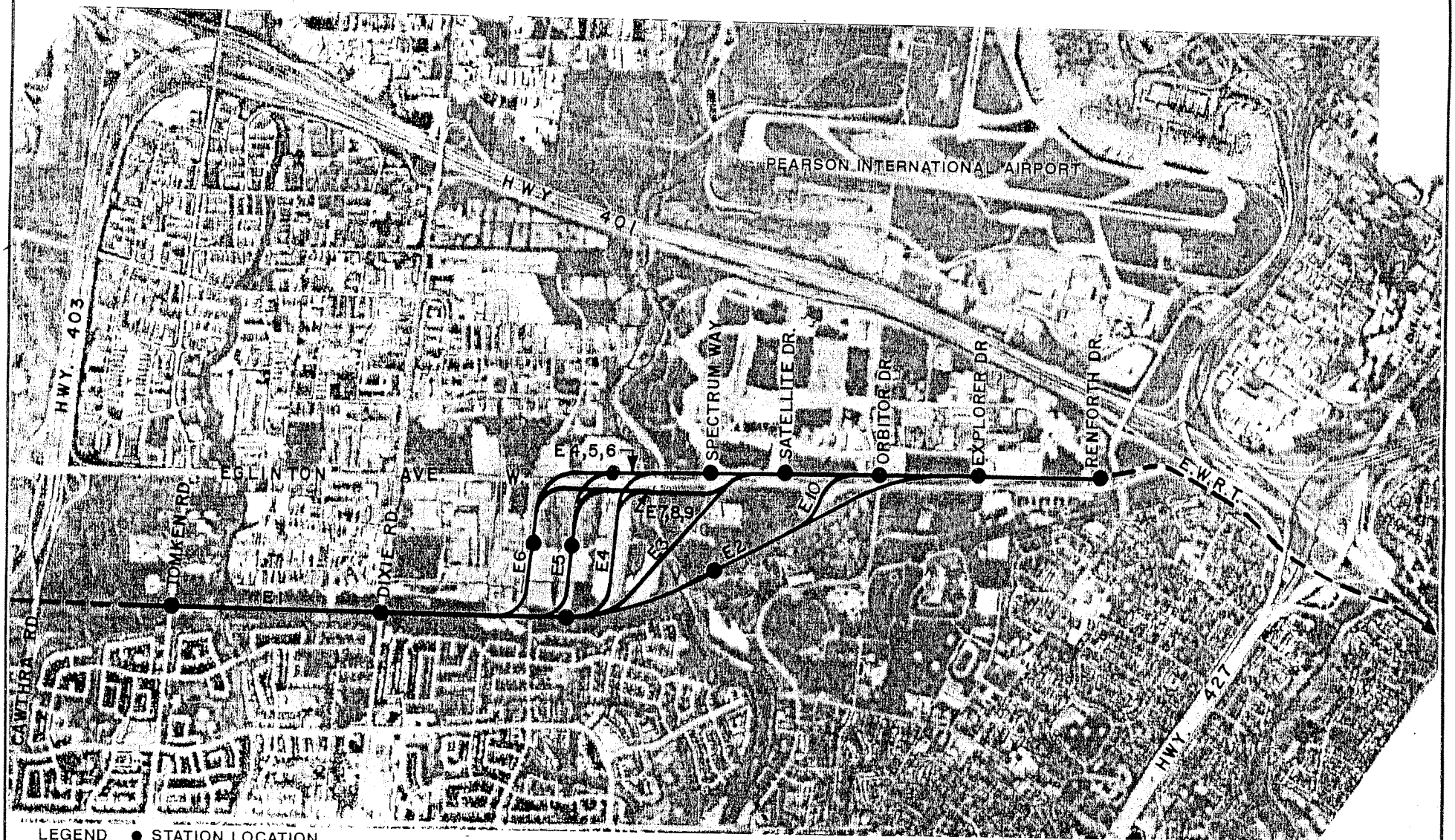
FIGURE 4

ALIGNMENT ALTERNATIVES
CENTRE SECTION

MISSISSAUGA TRANSITWAY
COMPARISON OF ALTERNATIVES
CENTRAL SECTION
MAVIS ROAD – CAWTHRA ROAD
TABLE 6

LOCATION	ALIGNMENT ALTERNATIVE			
	C	D	E	A (Preferred)
1. Creditview – Mavis Road	3,800,000	300,000	300,000	300,000
2. Mavis Station	23,300,000	17,700,000	25,200,000	17,700,000
3. Mavis Road – Confederation Pkwy.	3,200,000	5,100,000	10,600,000	5,100,000
4. Confederation Pkwy – Prince of Wales Drive (No Confederation Station)	9,300,000	11,400,000	5,300,000	11,400,000
5. Prince of Wales Drive – City Centre	11,800,000 Open	4,200,000 Open	5,200,000 Closed	7,700,000 Closed
6. City Centre Station	15,000,000 No Station	41,100,000	50,100,000	41,100,000
7. City Centre – Hurontario	31,200,000 Centre Station	6,200,000	6,200,000	6,200,000
8. Hurontario Station	34,900,000	34,900,000	40,600,000	34,900,000
9. Hurontario – Central Parkway	2,400,000	11,100,000	11,100,000	2,400,000
10. Central Parkway Station	14,800,000	16,100,000	16,100,000	14,800,000
11. Central Parkway – Cawthra	9,300,000	10,500,000	12,700,000	9,300,000
12. Cawthra Station	26,800,000	33,600,000	26,400,000	33,600,000
13. Cawthra – Tomken	500,000	500,000	400,000	500,000
TOTAL	186,300,000	192,700,000	210,200,000	185,000,000

FILENAME: ALT_COST.WK1



MISSISSAUGA TRANSITWAY FUNCTIONAL PLANNING STUDY	EXHIBIT 35	**ALIGNMENTS CARRIED FORWARD** **CAWTHRA ROAD TO RENFORTH DRIVE** EAST SECTION

APPENDIX 'S-D'

SOURCE OF ASSUMPTIONS

MISSISSAUGA TRANSITWAY
SUMMARY/SOURCE TABLE OF UNIT COSTS

	ITEM		UNIT COST ($1990)	SOURCE
2.1)	Clearing & Grubbing	Open Space	$17 000.00 /ha	1990 Contract costs
		Woodlot	$20 000.00 /ha	
2.2)	Earthworks	Hauled Off Site	$5.25 /m3	
		On Site	$4.50 /m3	1990 Contract costs
		Fill	$6.20 /m3	
2.3)	Roadway (2 lanes)			
	Urban (no sidewalk)		$75.00 /m2	
	Urban (with sidewalk)		$85.00 /m2	
	Rural		$70.00 /m2	
	Clearing & Grubbing (roadway only)	Open Space	$17 000.00 /ha	1990 Contract costs
		Woodlot	$20 000.00 /ha	
	Earthworks (roadway only)	Hauled Off Site	$5.25 /m3	
		On Site	$4.50 /m3	
		Fill	$6.20 /m3	
	Curb		$40.00 /m	1990 Contract costs
	Sidewalks (1.5m wide)		$40.00 /m2	1990 Contract costs
	Pavement Structure (140mm Asphalt) (225mm Gran A) (450mm Gran B)		$40.00 /m2	1990 Contract costs
	Drainage		30% of Roadway	1990 Contract costs
	Guiderail (Single Rail / SBG with Channel)		$75.00 /m	1990 Contract costs
	Barriers (New Jersey)		$155.00 /m	1990 Contract costs
2.4)	Transitway Station	Intermediate	2 million ea.	
		Arterial	4 million ea.	Ottawa Transitway
		Gateway	6 million ea.	
	Transitway Widening at Station		$250 000 - $500 000 ea.	
	Transitway Access Road		$320 000 - $360 000 ea.	1990 Contract costs
	Layover / Local / Kiss & Ride / Park & Ride		$740 000 - $1 000 000 ea.	
2.5)	Structure (Deck Area)		$1 350.00 /m2	1990 Contract costs
2.6)	Retaining Wall		$550.00 /m2	1990 Contract costs
2.7)	Noise Barrier (3m - 5m high)		$500.00 /m	TAPS

MISSISSAUGA TRANSITWAY
SUMMARY/SOURCE TABLE OF UNIT COSTS

	ITEM		UNIT COST ($1990)	SOURCE
2.8)	Fencing (1.8m C.L.S.F.)		$35.00 /m	1990 Contract costs
2.9)	Creek Culvert (3.5m x 6.0m)		$6 500.00 /m	1990 Contract costs
2.10)	Culvert			
	300 mm diam.		$160.00 /m	
	525 mm diam.		$190.00 /m	1990 Contract costs
	675 mm diam.		$230.00 /m	
2.11)	Traffic Signals	Relocated	$50 000.00 ea.	1990 Contract costs
		New	$80 000.00 ea.	
2.12)	Pipeline			Various Pipeline Companies
2.13)	Hydro Relocation		N/A	
2.14)	Illumination		$115 000.00 /Km	1990 Contract costs
2.15)	Landscaping		$160 000.00 /Km	1990 Contract costs
2.16)	Utilities			
	Relocation		Variable	
	Crossing		$50 000.00 ea.	1990 Contract costs
2.17)	Detours			
	Freeway		1.6 million /Km	MTO Highway Construction Costs
	Arterial		0.8 million /Km	
2.18)	Property Cost		Variable	
2.19)	Project Management		10%	1990 Contract costs
2.20)	Design		10%	1990 Contract costs
2.21)	Project Contingency		20%	1990 Contract costs
2.22)	Inflation to 1991		5%	

FILE NAME: COS_EST2.WK1

APPENDIX 'S-E'

PIPELINE COST CORRESPONDENCE

Esso Petroleum Canada

File: 15-40-1-6(A)
90-11-19

McCormick Rankin
2655 North Sheridan Way

Mississauga, Ontario
L5K 2P8

NOV 23 1990

Attention:Steve Schijns P.Eng.

Dear,Mr. Schijns

RE:Relocation Costs of Sarnia Products Pipeline
Mississauga Busway Study

Further to our meeting of today we have worked out some rough costs to relocate the Sarnia Products Pipelines and to lower them at the various points of potential encroachment with the referenced Busway project.

It should be noted that Imperial Oil Limited wishes the pipelines to be outside of the Busway station locations in all cases. The guidelines you were given at the meeting of 90/11/19 indicate that only in cases where no possibility of the pipeline being relocated from the station locations should the alternative of lowering the lines be entertained. Having the pipelines out of the stations provides extra safety for the pipeline and the busway users as well as giving extra flexibility for station design.

The cost of pipeline relocation has been calculated using a figure of, $35K / diameter inch / mile, plus, $10K / location, for nitrogen purging. The cost of a new easement was not included. Any road bores would cost from 100K$ to 150K$ depending on the length and obstructions encountered. Line lowering costs were arrived at by deleting the pipe cost from the relocation formula.

The approximate cost of relocation then, would amount to about $520K / km. total to relocate both the 12.75" pipe and the 10" pipe, plus the cost of any new easement rights and any road bores. Line lowering cost per km. would amount to approximately $320K.

These figures are provided for information and comparison purposes only. They are intended only to reflect the relative costs of various alternatives and are not intended to be an accurate cost estimate in themselves. These figures and this information is not intended as an endorsement by Imperial Oil Limited of any particular alternative or layout.

As we discussed, some of the sites which would require relocation of the pipelines and possible alternatives would be:

* Ridgeway Drive:
  Layout 1 - Busway in north of corridor
    a) 620 m. reroute, to south of stn. $325K
    (no road bore if Ridgeway not in place)
    b) 450 m. line lowering plus move concourse at least 15 m. off pipeline $150K + cost of relocating concourse.

  Layout 2 - Busway to south of corridor
    a) 450 m. relocate to north of stn. $250K
    (no road bore if Ridgeway not in place)

* Sir Winston Churchill Blvd.:
  Layout 1 - Busway in north of Corridor
    a) 690 m. reroute to north, + 1 Road bore $510K
    b) 450 m. line lowering + move concourse at least 15 meters north of pipeline $150K,+ cost of relocating concourse,
    c) 920 m. reroute to south, + 3 road bores $780K

  Layout 2 - Busway in south of Corridor
    a) 430 m. reroute to north, + 1 Road Bore $370K

* Mississauga Road Station
    a) 700 m. reroute, to the north of the stn. $365K + creek crossing.
    b) 500 m. line lowering. $200K + creek crossing

* Tomken Road
    a) 300 m. reroute to north of parking road $160K
    b) move parking area and entrance road south, off of pipelines.

* Dixie Road
    a) Move the road south of the towers and lower the line for 500 m. $170K

* Renforth Drive
    a) 450 m. reroute to south of parking area $250K
    b) 450 m. line lowering. $150K

Rough sketches of the station sites are enclosed for your information.

These reroutes and lowerings are in addition to the remainder of the alterations we discussed for the stations at our meeting of 90/11/19. I hope these are of use to you in your decisions. Call me if you have any questions.

Yours Truly;

Ralph Parks, Landman

cc. R. Graham - SPPL
S. Schijns - McCormick Rankin
C. Bishop - M.M. Dillon

Mississauga Road
Proposed Relocation to Suit Busway Parking

Reference dwg: McCormick Rankin Sheet 3N
Relocation Length: dwg scaled- 335 m, use **350 m** for estimate
Road Crossing: Mississauga Road, **30 m** Boring req'd

Cost Estimate:

Engineering & documentation, Permits, easement approvals	15,000	
Drain pipeline, transport product	10,000	
		25,000
Purchase new pipe		
200 mm dia. x 350 m @ 81/m	28,000	
200 mm coating @ 31/m	11,000	
300 mm dia. x 350 m @ 126/m	44,000	
300 mm coating @ 41/m	14,500	
Special order long radius Bent pipe(from Montreal)	13,000	
		110,500
Contractor installation of pipe c/w backfill and clean-up		
$200/m x 350m x 2	140,000	
X-Ray welded joints	8,000	
Boring Road Crossing	20,000	
Mullet Creek crossing	5,000	
		173,000
Removal of pipe:		
Crane $150/hr x 60 hrs	9,000	
Transport pipe	2,000	
Strip existing pipelines:		
Excavator @ $100/hr x 80 hrs	8,000	
Labours 4 @ $35/hr x 80 hrs	11,000	
Supervisor 1 @ $50/hr x 80 hrs	4,000	
Survey installation, as-built dwgs:	5,000	
		39,000
Estimate Subtotal		347,500
Contingency (20%)		69,500
Total Relocation Estimate, say		**$ 420,000**

1990-12-03

PL

Winston Churchill Blvd.
Proposed Relocation to Suit Busway Parking

Reference dwg: McCormick Rankin Sheet 4N
Relocation Length: dwg scaled - 185 m, use **200 m** for estimate
Road Crossing: Winston Churchill Blvd. - **30 m** Boring req'd

Cost Estimate:

Engineering & documentation, Permits, easement approvals	15,000	
Drain pipeline, transport product	6,000	
		21,000
Purchase new pipe		
200 mm dia. x 200 m @ 81/m	16,200	
200 mm coating @ 31/m	6,200	
300 mm dia. x 200 m @ 126/m	25,200	
300 mm coating @ 41/m	8,200	
Special order long radius Bent pipe(from Montreal)	10,000	
		65,800
Contractor installation of pipe c/w backfill and clean-up $200/m x 200m x 2	80,000	
X-Ray welded joints	5,000	
Boring Road Crossing	20,000	
		105,000
Removal of pipe:		
Crane $150/hr x 30 hrs	4,500	
Transport pipe	1,000	
Strip existing pipelines:		
Excavator @ $100/hr x 50 hrs	5,000	
Labours 4 @ $35/hr x 50 hrs	7,000	
Supervisor 1 @ $50/hr x 50 hrs	2,500	
Survey installation, as-built dwgs:	4,000	
		24,000
Estimate Subtotal		215,800
Contingency (20%)		43,000
Total Relocation Estimate, say		**S 260,000**

1990-12-03

PL

Summary of Estimated Costs for Mississuaga Busway Proposal

Operation	Station	IPL Estimate
Rerouting	Erin Mills	$628,100
	Mavis	$1,063,200
	Tomken	$776,400
	Dixie	$1,084,900
	Sub–Total	$3,552,600
Lowering	Glen Erin	$385,400
	Creditview	$429,400
	Fieldgate	$393,800
	Sub–Total	$1,208,600
	Total	$4,761,200

APPENDIX 'S-F'

COMPARISON OF OTTAWA TRANSITWAY STATION COSTS

SUMMARY OF STATION COST ESTIMATES

There are three Station types proposed for the Mississauga Transitway: Intermediate, Arterial and Gateway. Each will contain and service different needs of the Transitway. The costs associated with the alternatives will vary, but reference to the Functional Design Report of Ottawa's Southeast Transitway indicates the order of magnitude of station costs.

In Ottawa, a total of five stations is proposed on the Southeast Transitway between Hurdman Station and the Billings Bridge Shopping Centre. Stations include: Abbey, Smyth, Riverside, Pleasant Park and Billings Bridge. The first four stations correspond to the intermediate station type proposed for Mississauga. Billings Bridge Station is considered a major station and will allow transfers to local buses. The Riverside Station is a unique facility incorporated into an expanded wing of an adjacent hospital.

The items included in the cost of intermediate stations are as follows:

- Structural Components
- Earthworks
- Shelter System
- Mechanical System
- Electrical System
- Special Finishes
- Station Furnishings & Information System
- Platform Landscaping
- Platforms and Curbs
- Contingency

(These items are broken into subsections in the following pages.)

Note that costs are for Station facilities only and are in addition to the Transitway, access roads, kiss & ride / park & ride facilities, bus layover, etc.

The total cost of all the items for each station are as follows:

Abbey - Intermediate	$ 1,911,521.00
Smyth - Intermediate	2,171,631.00
Riverside	(included hospital work)
Pleasant Park - Intermediate	2,084,651.00
Billings Bridge Station - Major	8,562,273.00

The average cost of the three intermediate stations is approximately 2 million dollars (1989). This cost may be used for similar intermediate stations on the Mississauga Transitway.

STATION COST ESTIMATES ($ 1989)

ITEM \ STATION	ABBEY	SMYTH	PLEASANT PARK	BILLINGS BRIDGE
STRUCTURAL	$380,366.0	$373,818.0	$211,373.0	$1,349,893.0
EARTHWORKS	$136,381.0	$57,246.0	$98,431.0	$219,100.0
SHELTERS	$234,822.0	$538,926.0	$401,454.0	$2,576,860.0
MECHANICAL	$221,890.0	$230,476.0	$314,684.0	$376,017.0
ELECTRICAL	$327,694.0	$354,816.0	$422,034.0	$1,109,199.0
FINISHES	$75,106.0	$51,324.0	$27,370.0	$76,354.0
INFORMATION SYSTEM	$50,080.0	$26,786.0	$47,090.0	$103,355.0
PLATFORMS	$17,798.0	$17,440.0	$8,376.0	$45,187.0
PLATFORMS & CURBS	$60,608.0	$44,313.0	$40,262.0	$280,587.0
CONTINGENCY	$406,692.0	$476,486.0	$513,577.0	$2,425,721.0
TOTAL	$1,911,437.0	$2,171,631.0	$2,084,651.0	$8,562,273.0

FILE NAME: STA_COS.WK1

SOURCE : Work Breakdown System
Southeast Transitway Functional Design Report
Regional Municipality of Ottawa - Carleton 1990.

APPENDIX 'T'

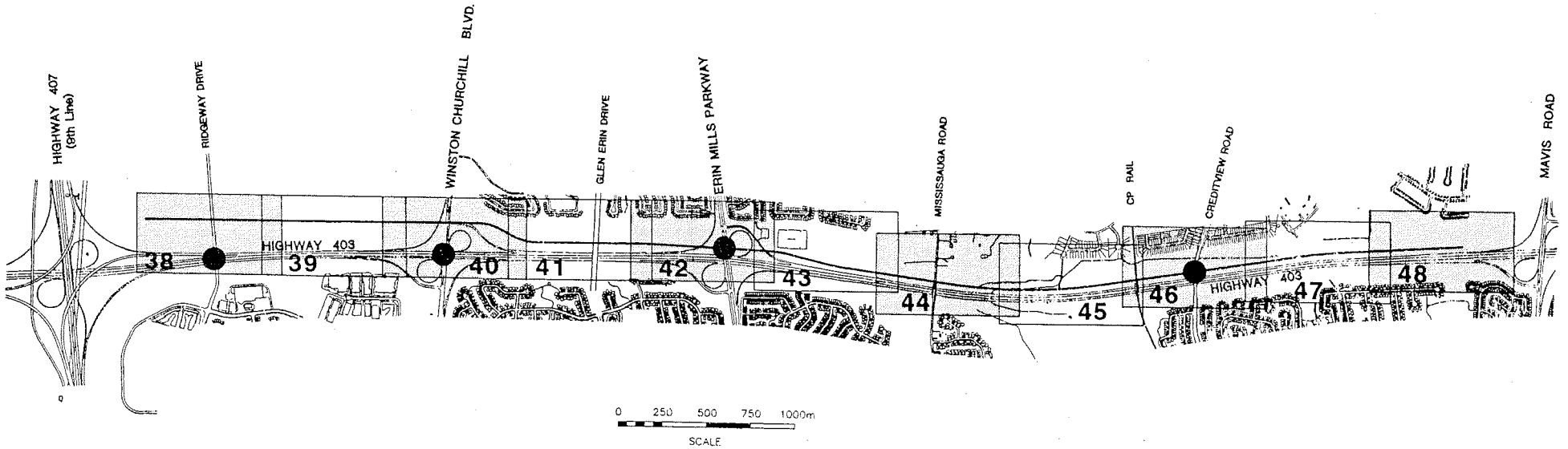
PROPERTY REQUIREMENTS

MISSISSAUGA TRANSITWAY PLANNING STUDY EA REPORT

APPENDIX T - PROPERTY REQUIREMENTS

One of the fundamental requirements and products of the Mississauga Transitway Functional Planning Study is the identification of the property required for the recommended facility. This identification will allow the City to protect the property for Transitway needs, and to consider the uses of adjacent properties in the context of defined future needs. Accordingly, these plans, while not a requirement of the Environmental Assessment Report, have been developed and included in this Appendix so that the whole document can serve as a comprehensive report upon which to base future planning studies.

Affected property owners have been identified on the plans, and for convenience of reference, summary tables of the area required of each owner are included in the Appendix.



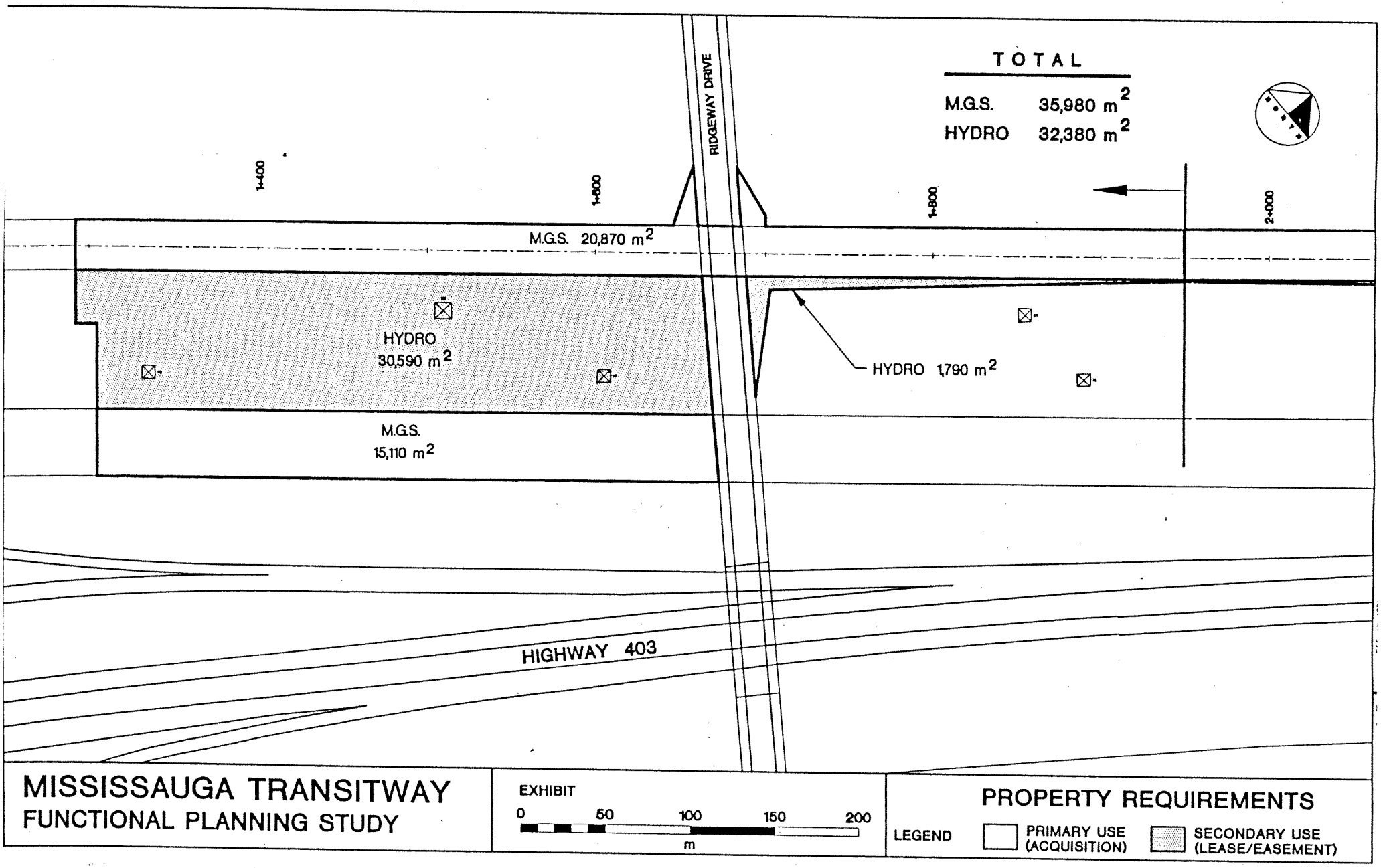
RECOMMENDED MISSISSAUGA TRANSITWAY — STATION

RECOMMENDED PLAN EXHIBIT No. 46

MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT 37

KEY PLAN
NINTH LINE TO MAVIS ROAD



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT

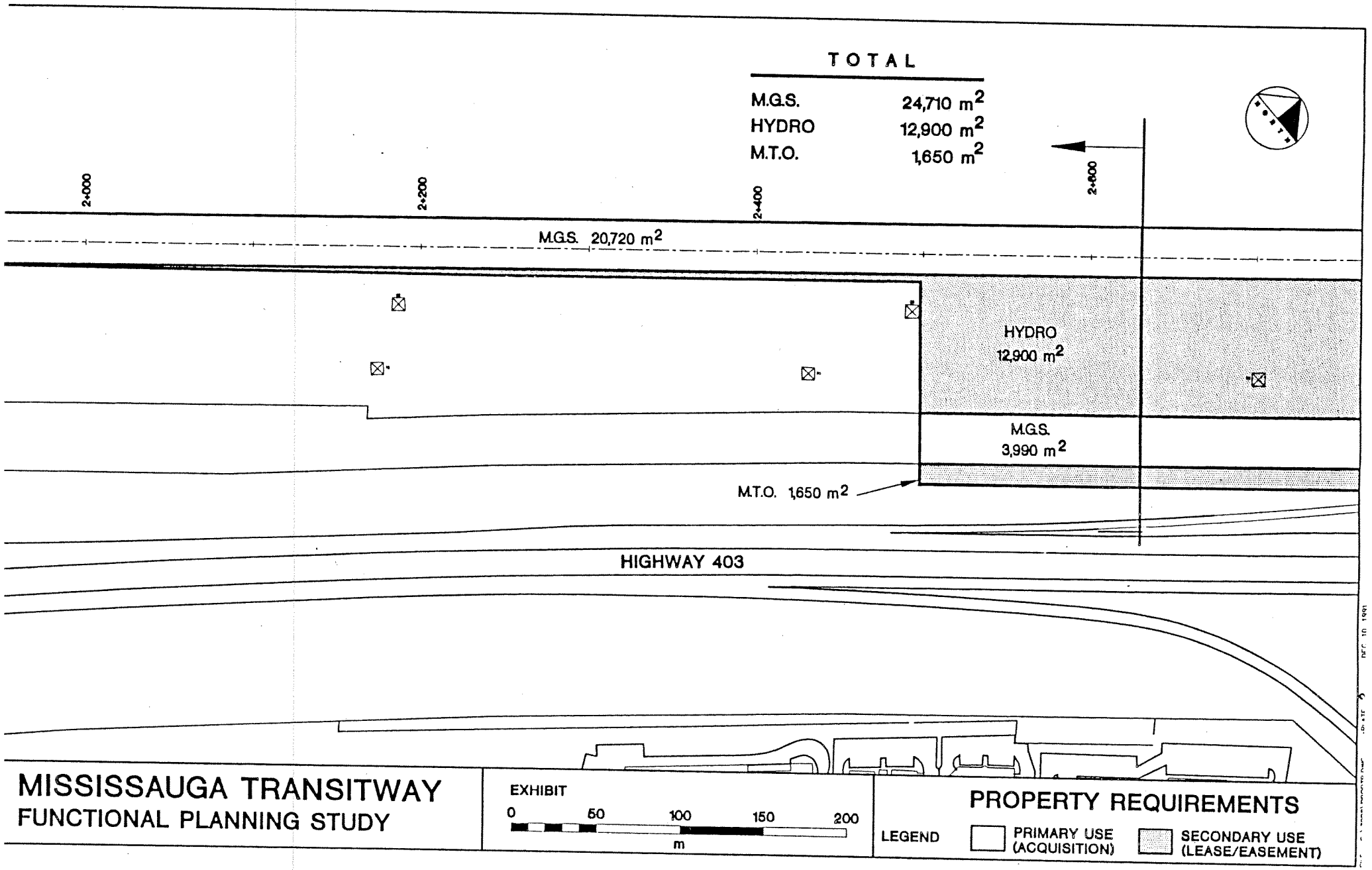
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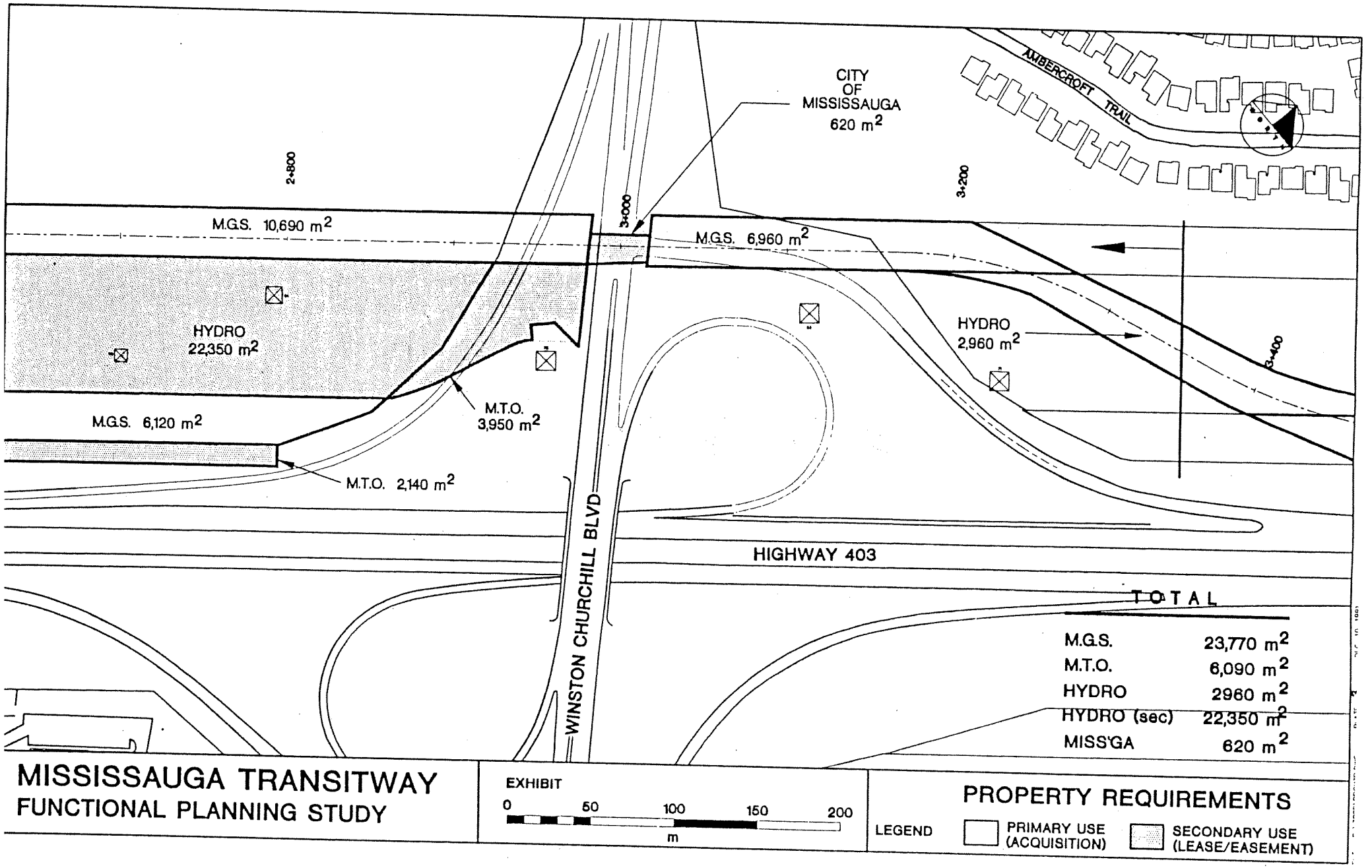
PROPERTY REQUIREMENTS

LEGEND

PRIMARY USE (ACQUISITION)

SECONDARY USE (LEASE/EASEMENT)


TOTAL
M.G.S. 24,710 m2
HYDRO 12,900 m2
M.T.O. 1,650 m2
2+000
2+200
2+400
2+600
M.G.S. 20,720 m2
HYDRO
12,900 m2
M.G.S.
3,990 m2
M.T.O. 1,650 m2
HIGHWAY 403
MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY
EXHIBIT
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m
PROPERTY REQUIREMENTS
LEGEND
PRIMARY USE (ACQUISITION)
SECONDARY USE (LEASE/EASEMENT)



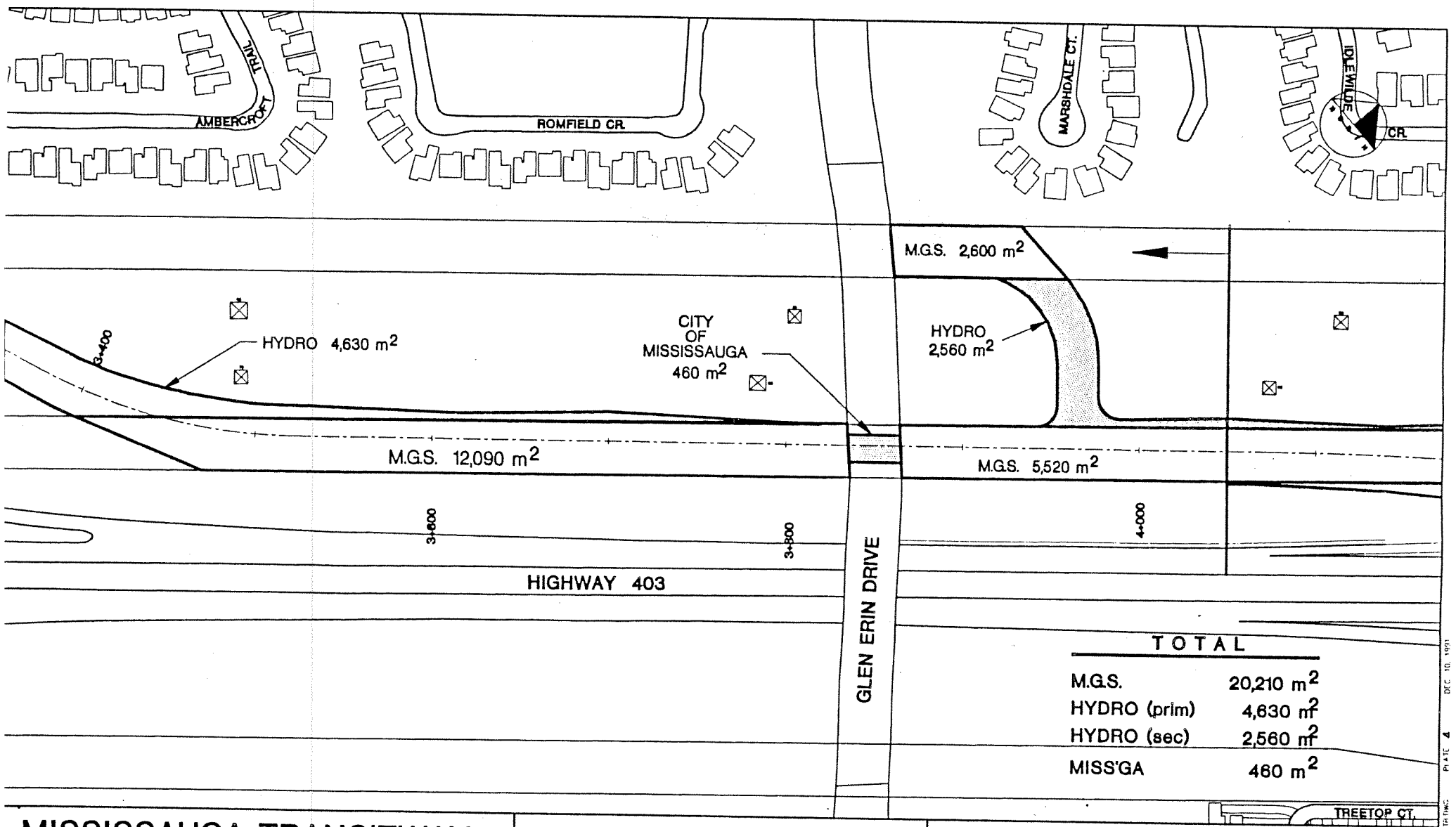
MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT

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PROPERTY REQUIREMENTS

LEGEND
PRIMARY USE (ACQUISITION)
SECONDARY USE (LEASE/EASEMENT)



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT

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m

PROPERTY REQUIREMENTS

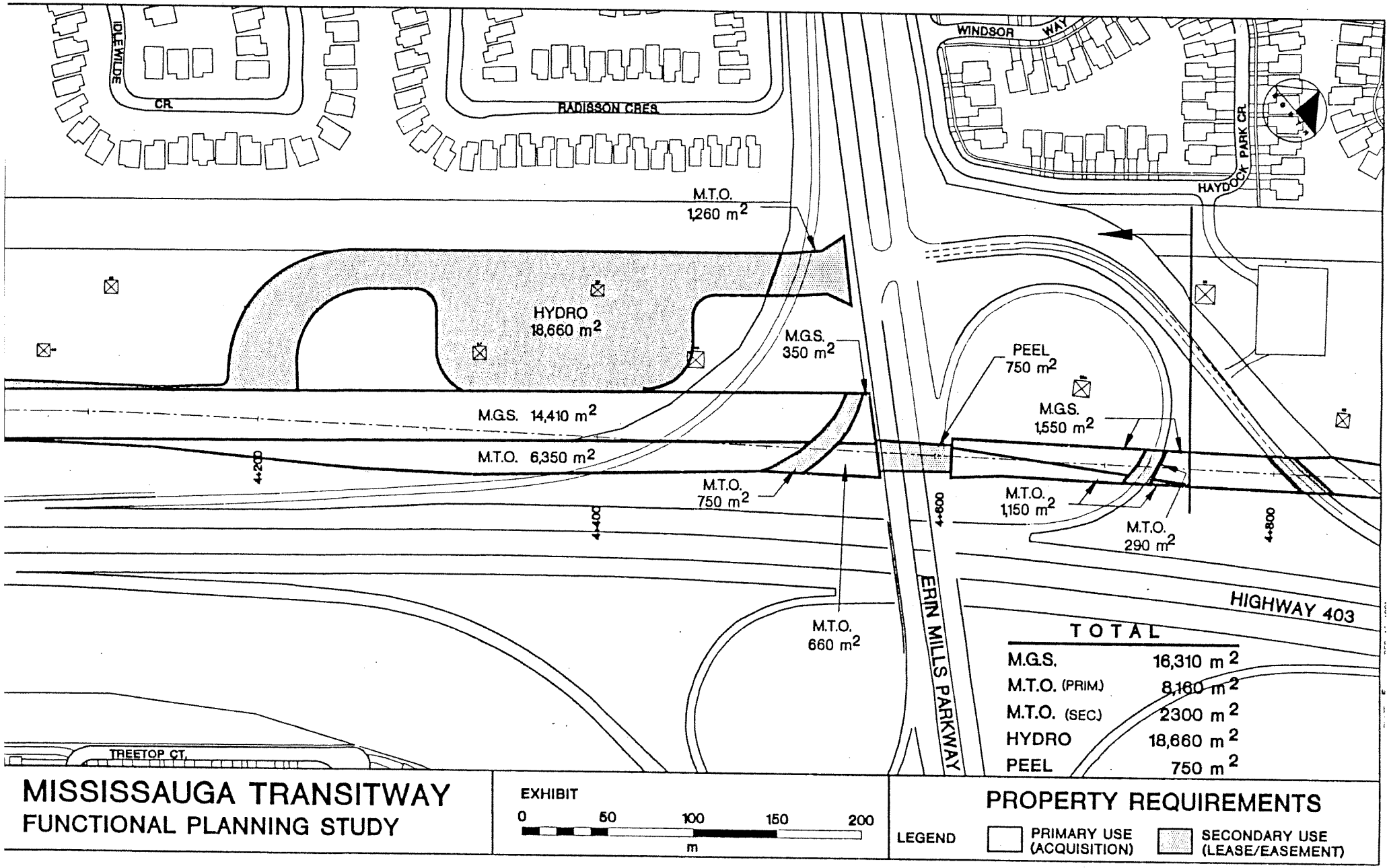
LEGEND

PRIMARY USE (ACQUISITION)

SECONDARY USE (LEASE/EASEMENT)

PLATE 4

DEC. 10, 1991



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT

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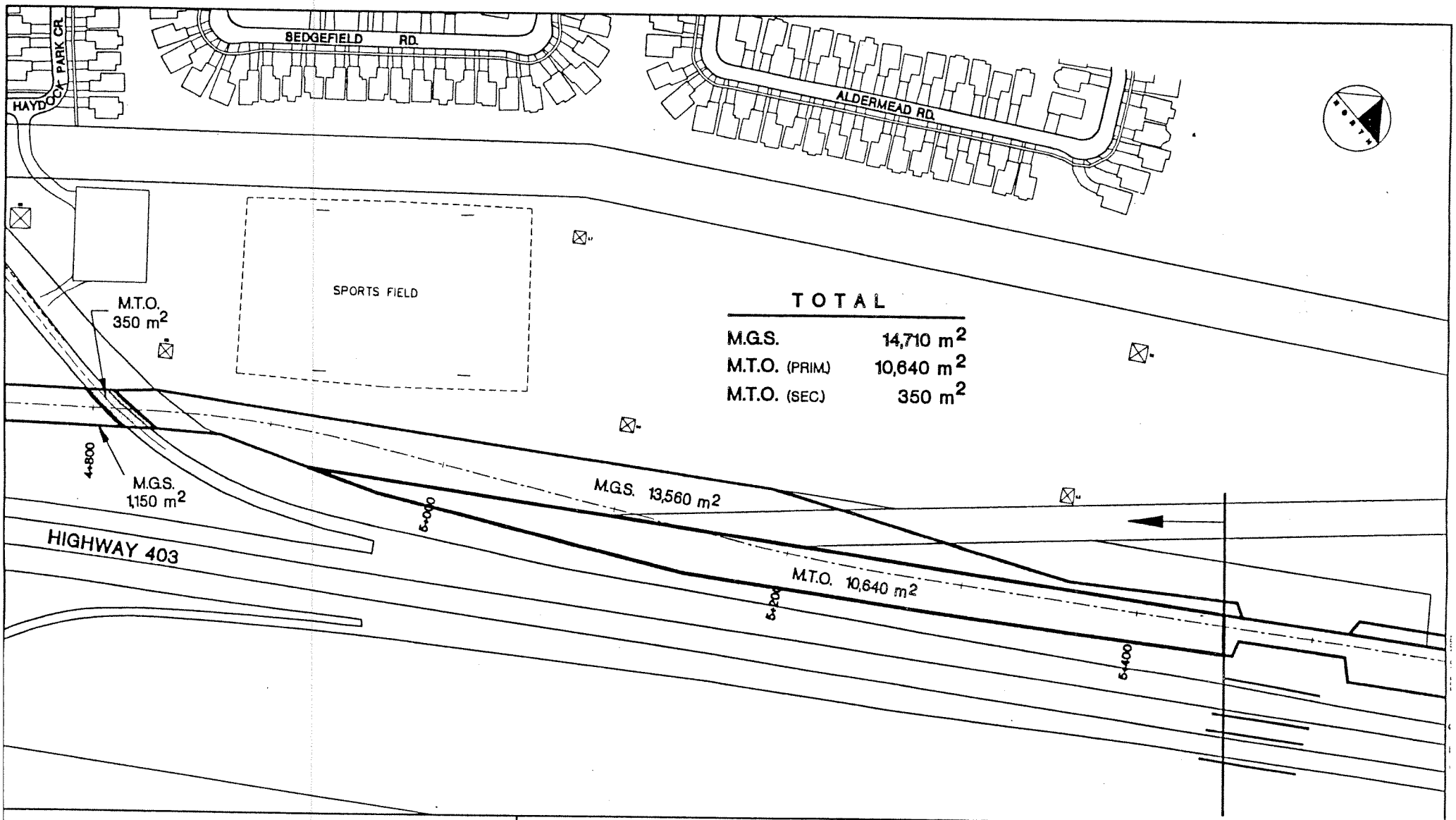
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PROPERTY REQUIREMENTS

LEGEND

PRIMARY USE (ACQUISITION)

SECONDARY USE (LEASE/EASEMENT)



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT

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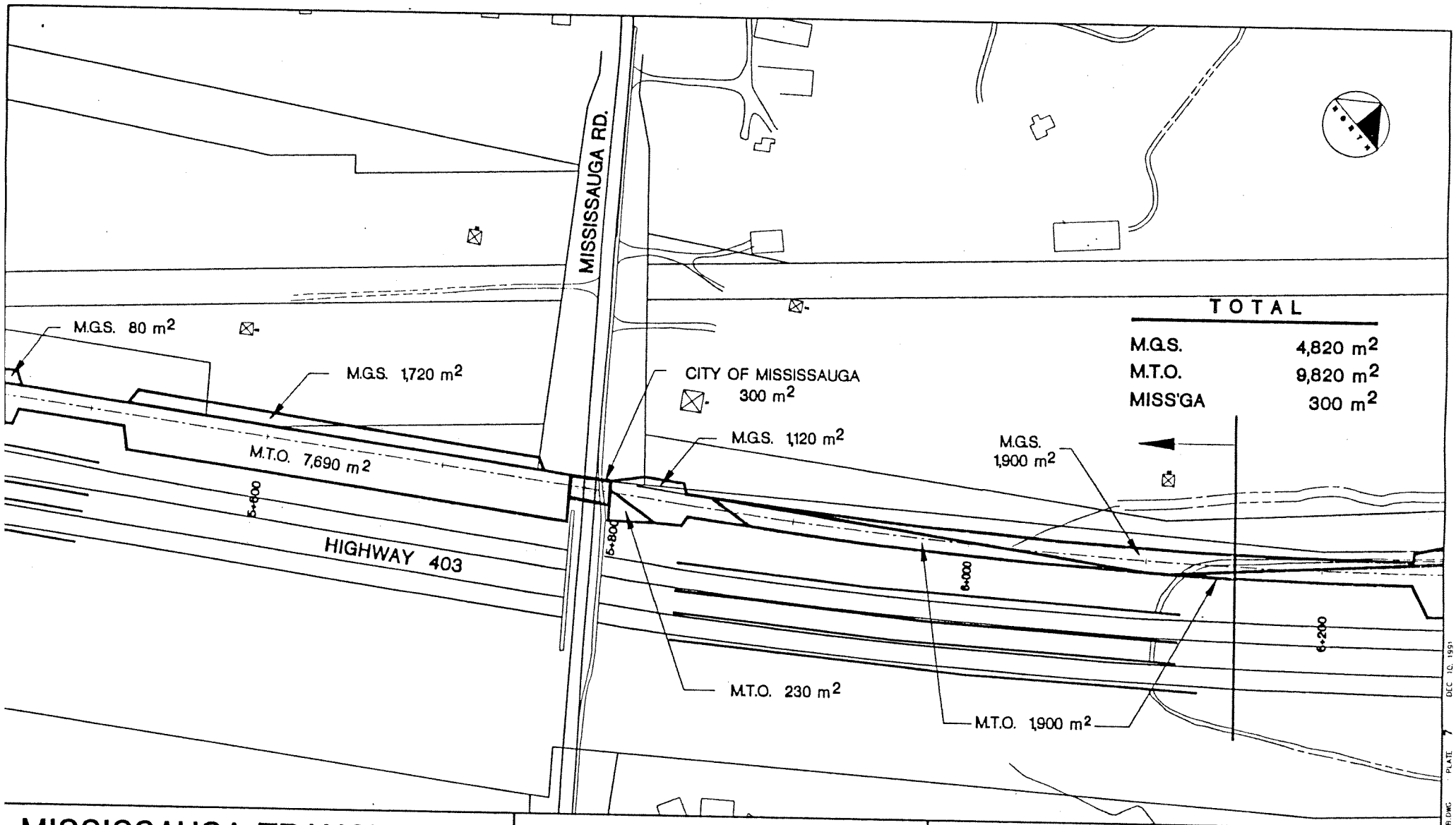
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PROPERTY REQUIREMENTS

LEGEND

PRIMARY USE (ACQUISITION)

SECONDARY USE (LEASE/EASEMENT)



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

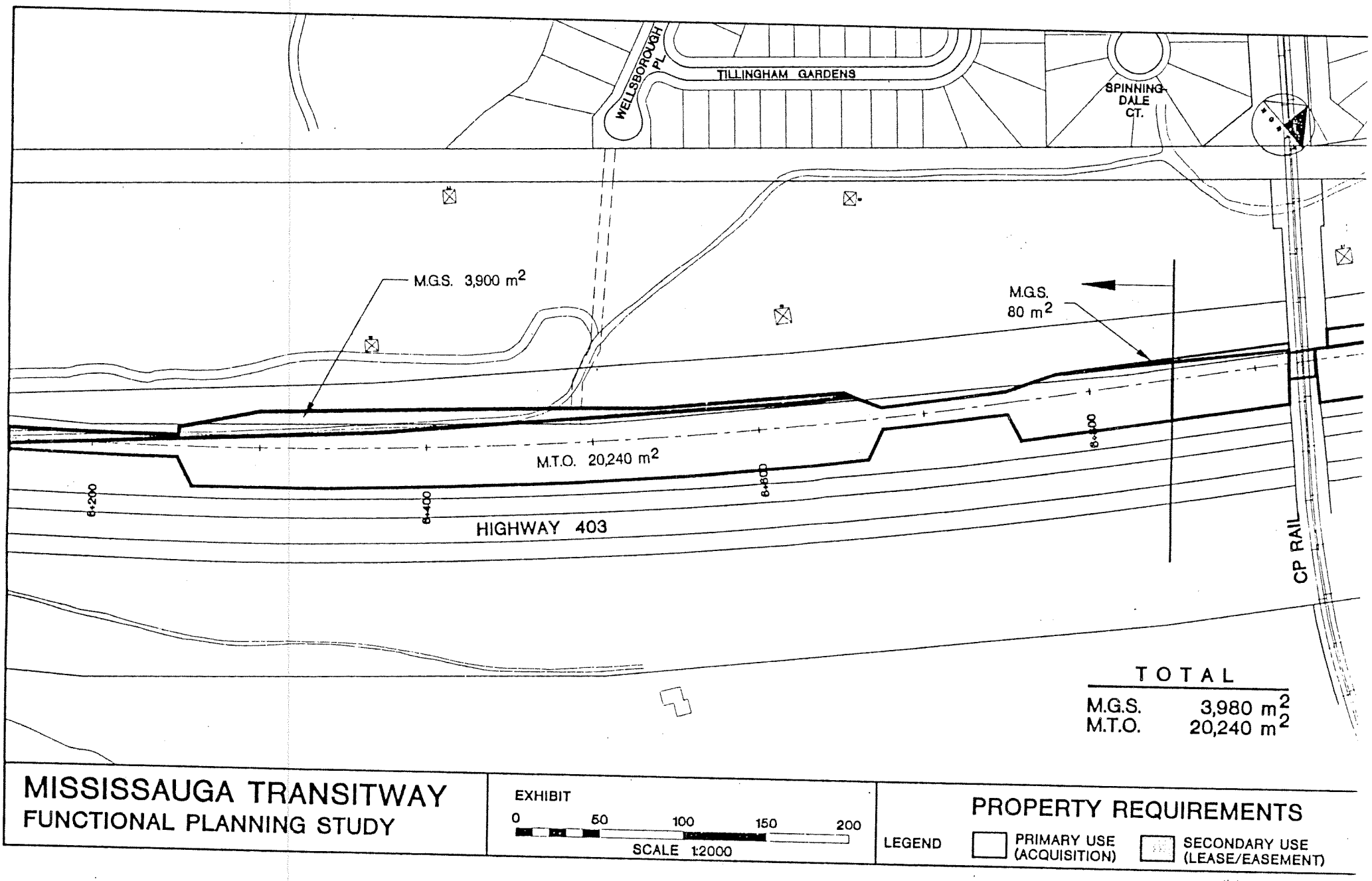
EXHIBIT

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PROPERTY REQUIREMENTS

LEGEND
PRIMARY USE (ACQUISITION)
SECONDARY USE (LEASE/EASEMENT)

PLATE 7 DEC 10, 1991



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT

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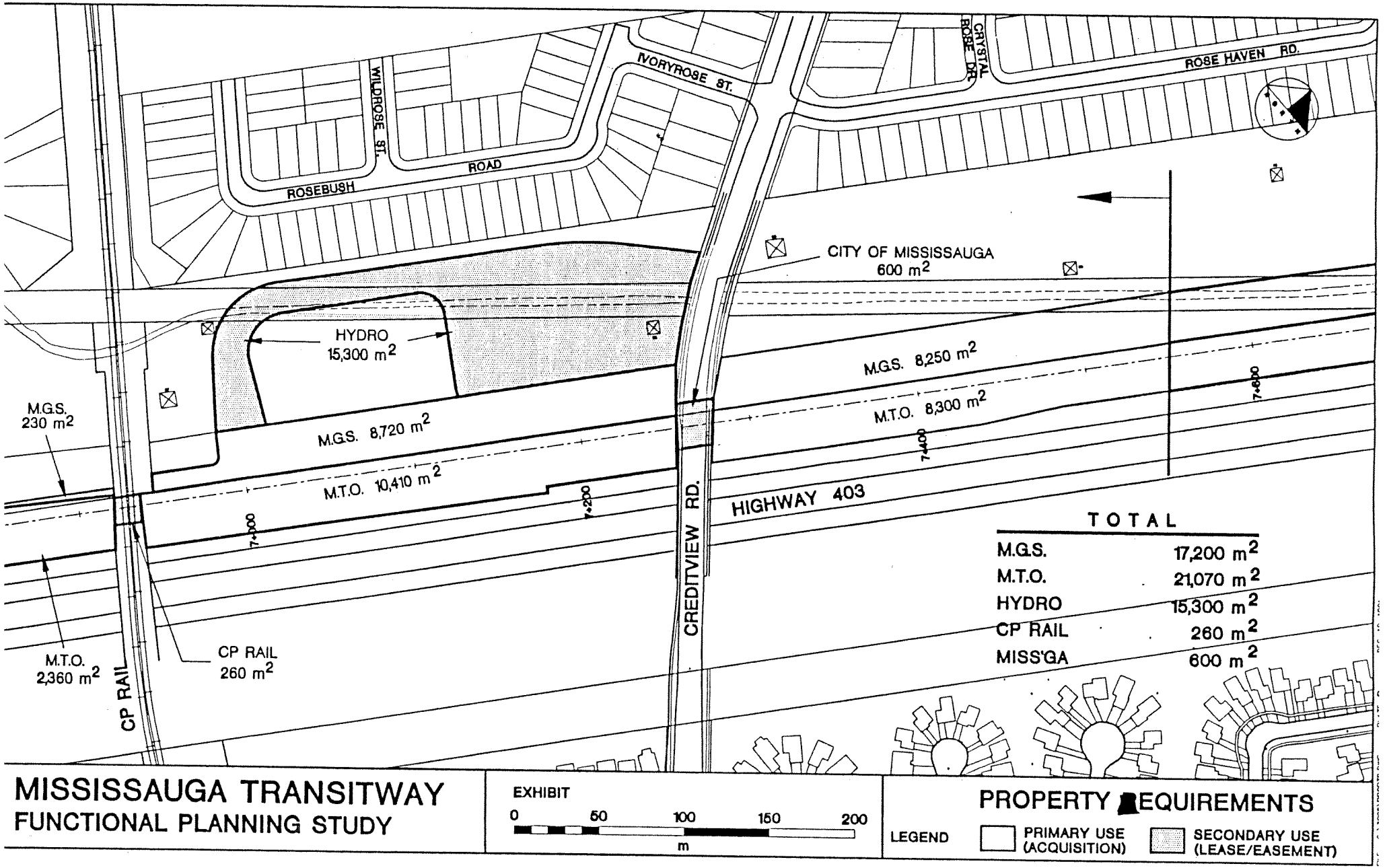
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PROPERTY REQUIREMENTS

LEGEND

PRIMARY USE (ACQUISITION)

SECONDARY USE (LEASE/EASEMENT)



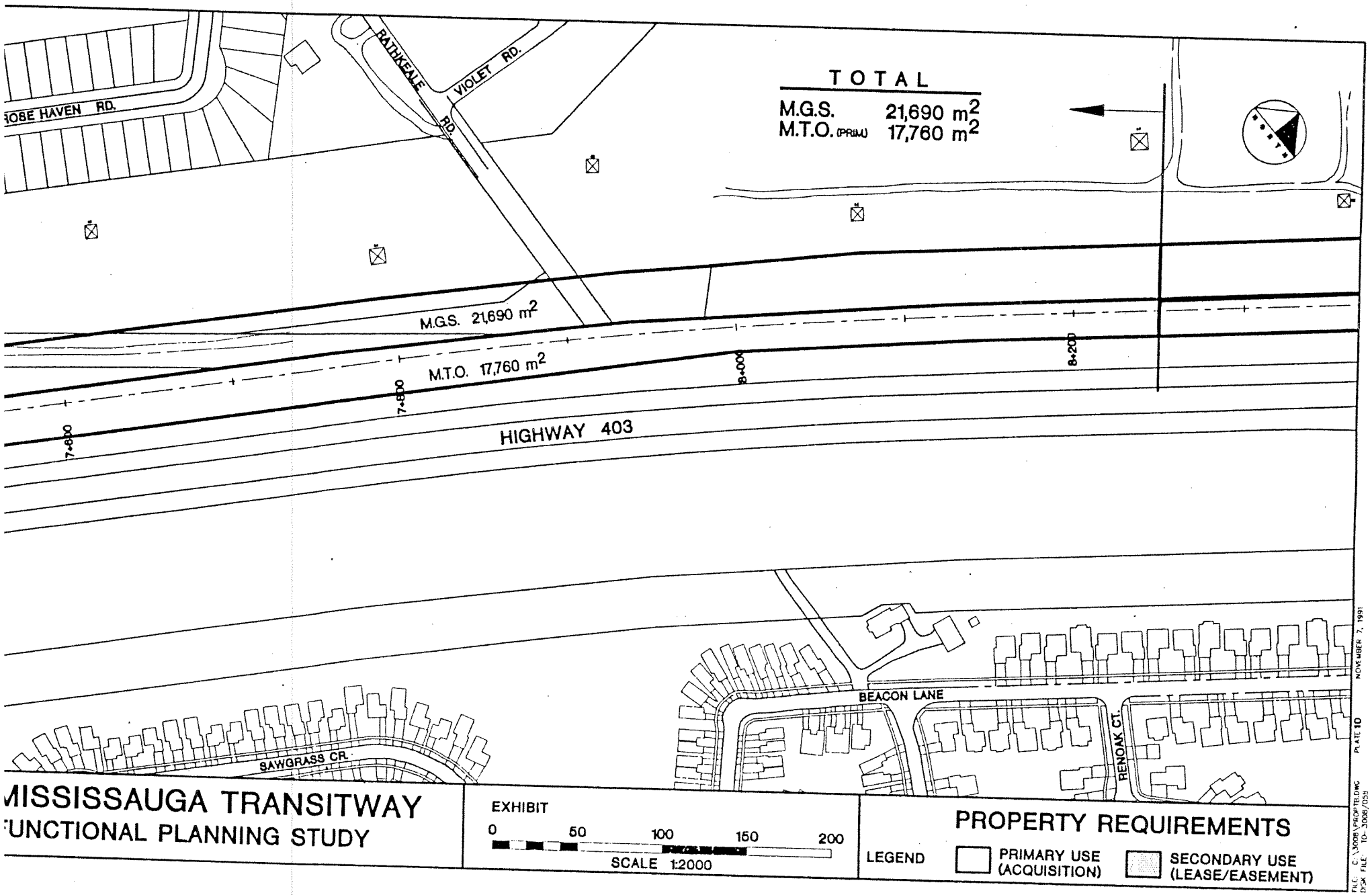
MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT

0 50 100 150 200
m

PROPERTY REQUIREMENTS

LEGEND
PRIMARY USE (ACQUISITION)
SECONDARY USE (LEASE/EASEMENT)



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT

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SCALE 1:2000

PROPERTY REQUIREMENTS

LEGEND

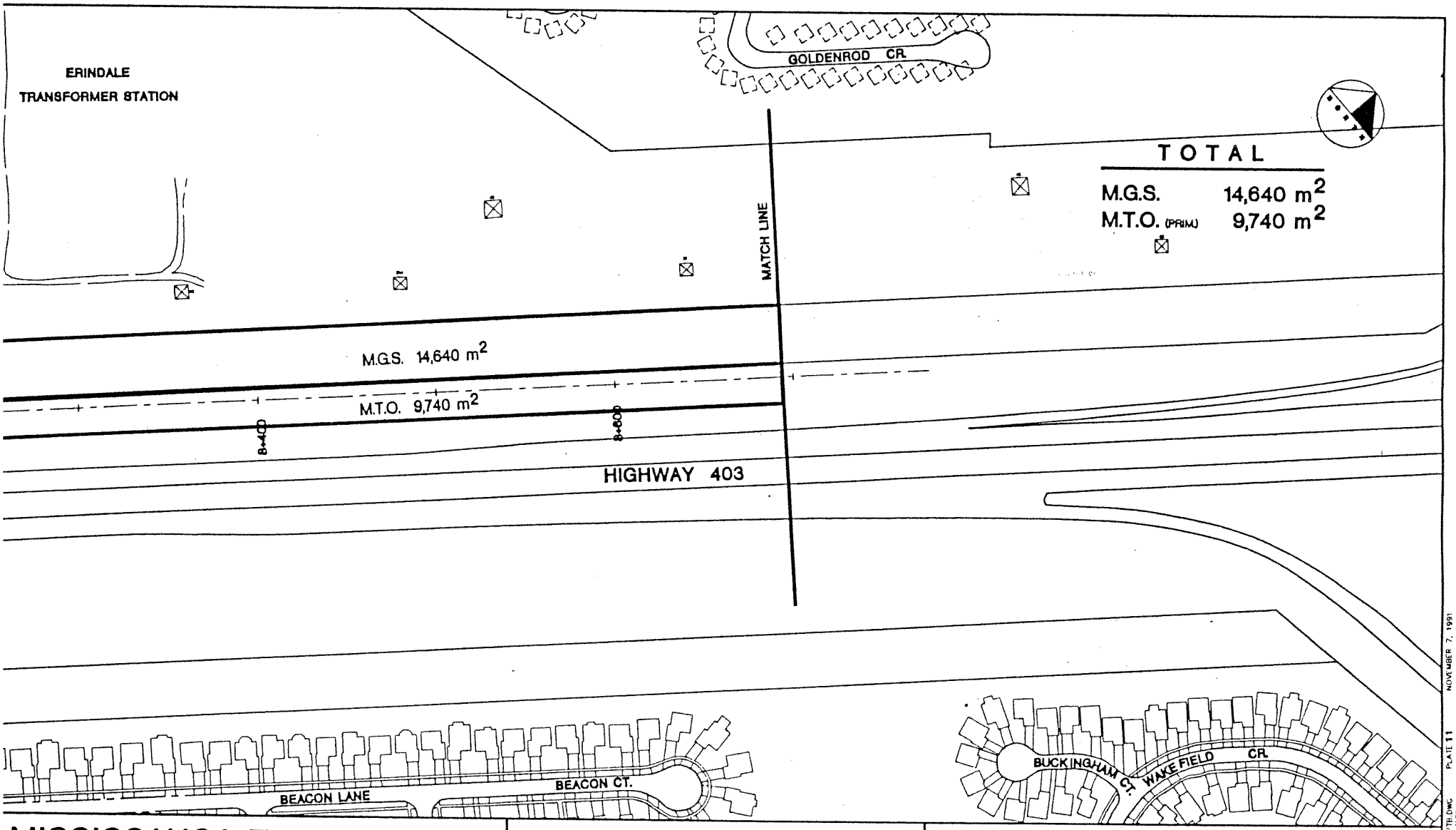
PRIMARY USE (ACQUISITION)

SECONDARY USE (LEASE/EASEMENT)

PLATE 10

NOVEMBER 7, 1991

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DISK FILE: TO-3008/DISK



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT

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PROPERTY REQUIREMENTS

LEGEND

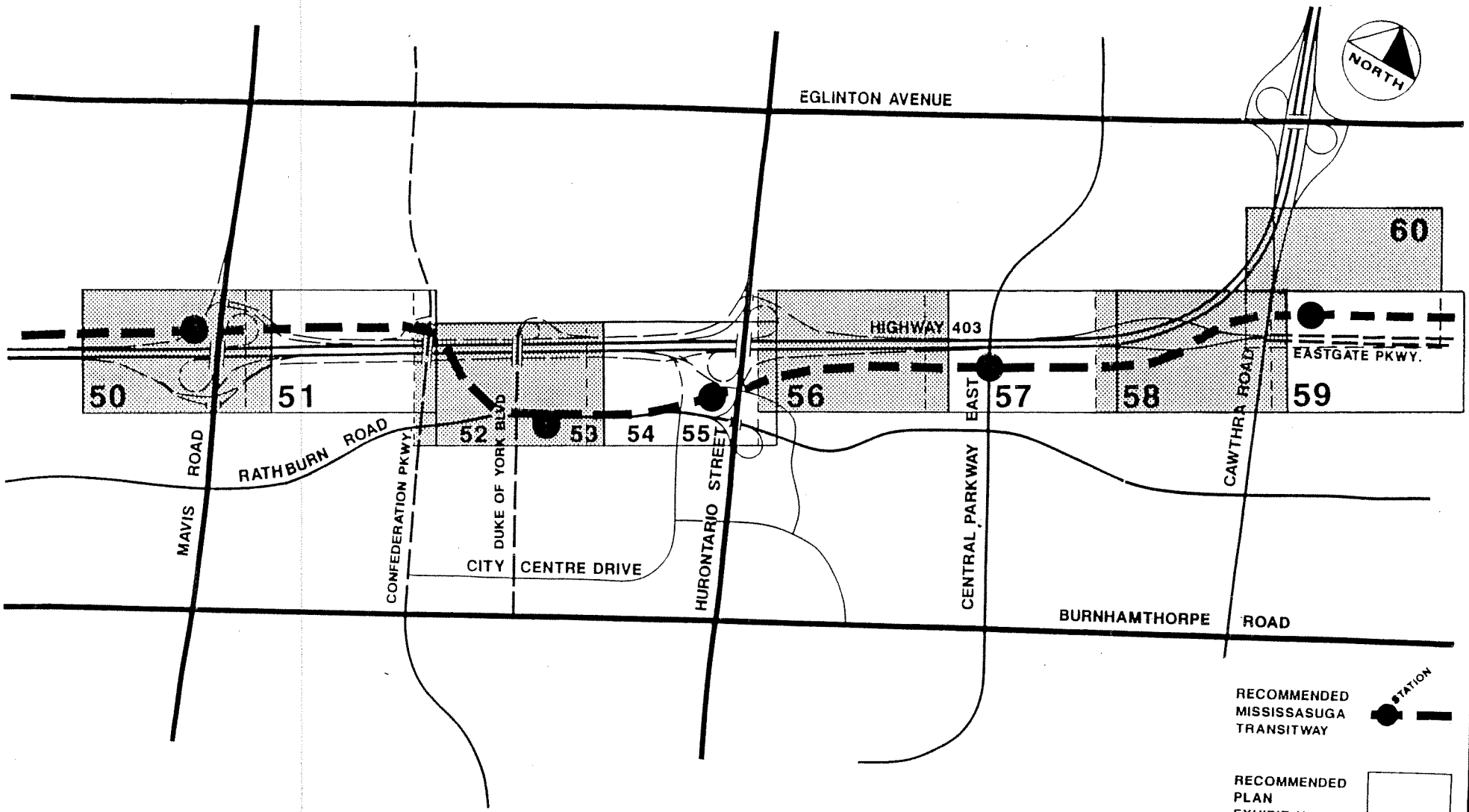
PRIMARY USE (ACQUISITION)

SECONDARY USE (LEASE/EASEMENT)

PLATE 11

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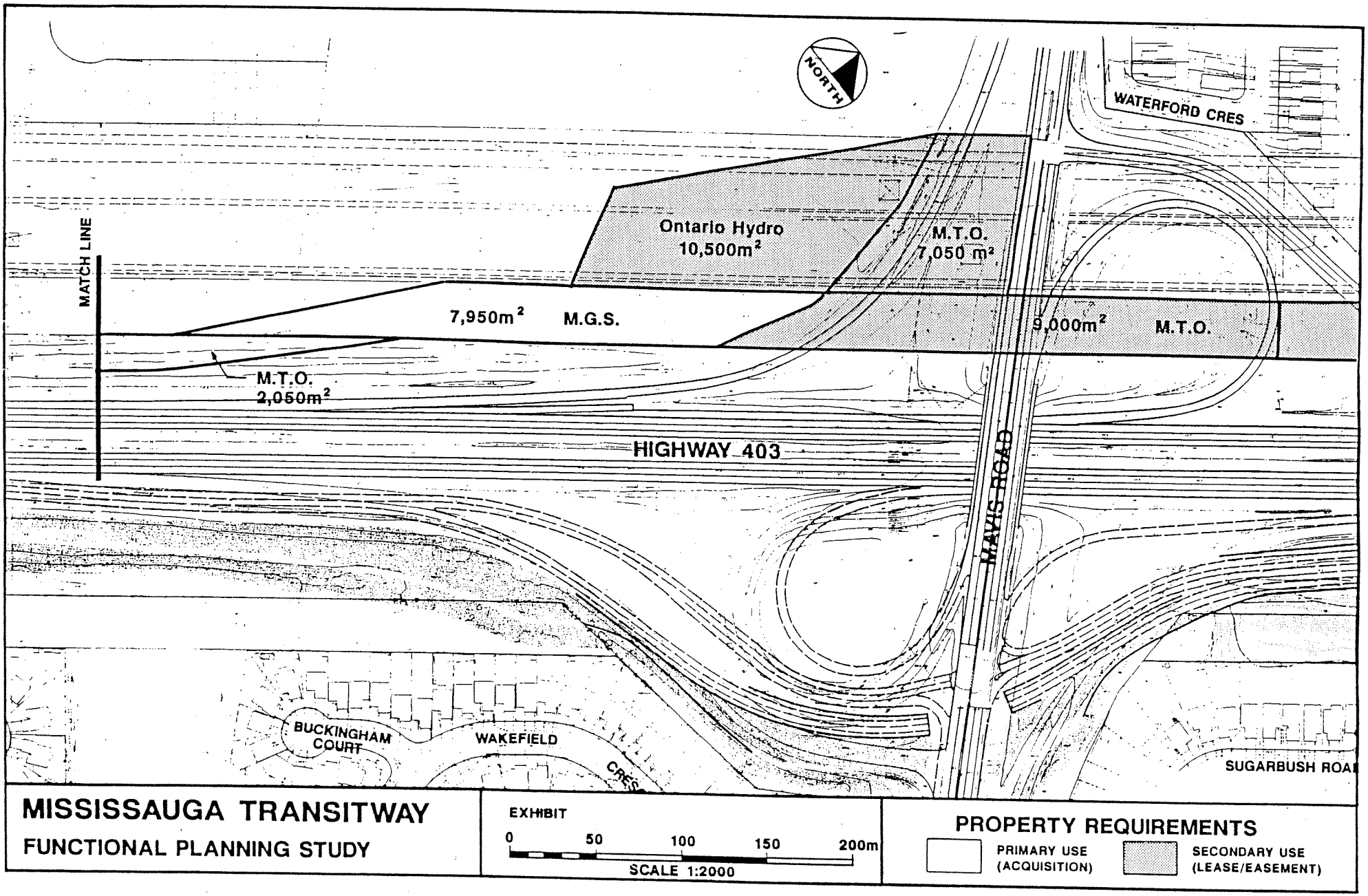


MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT 49

(PLAN NOT TO SCALE)

KEY PLAN
MAVIS ROAD TO CAWTHRA ROAD



MISSISSAUGA TRANSITWAY

FUNCTIONAL PLANNING STUDY

EXHIBIT

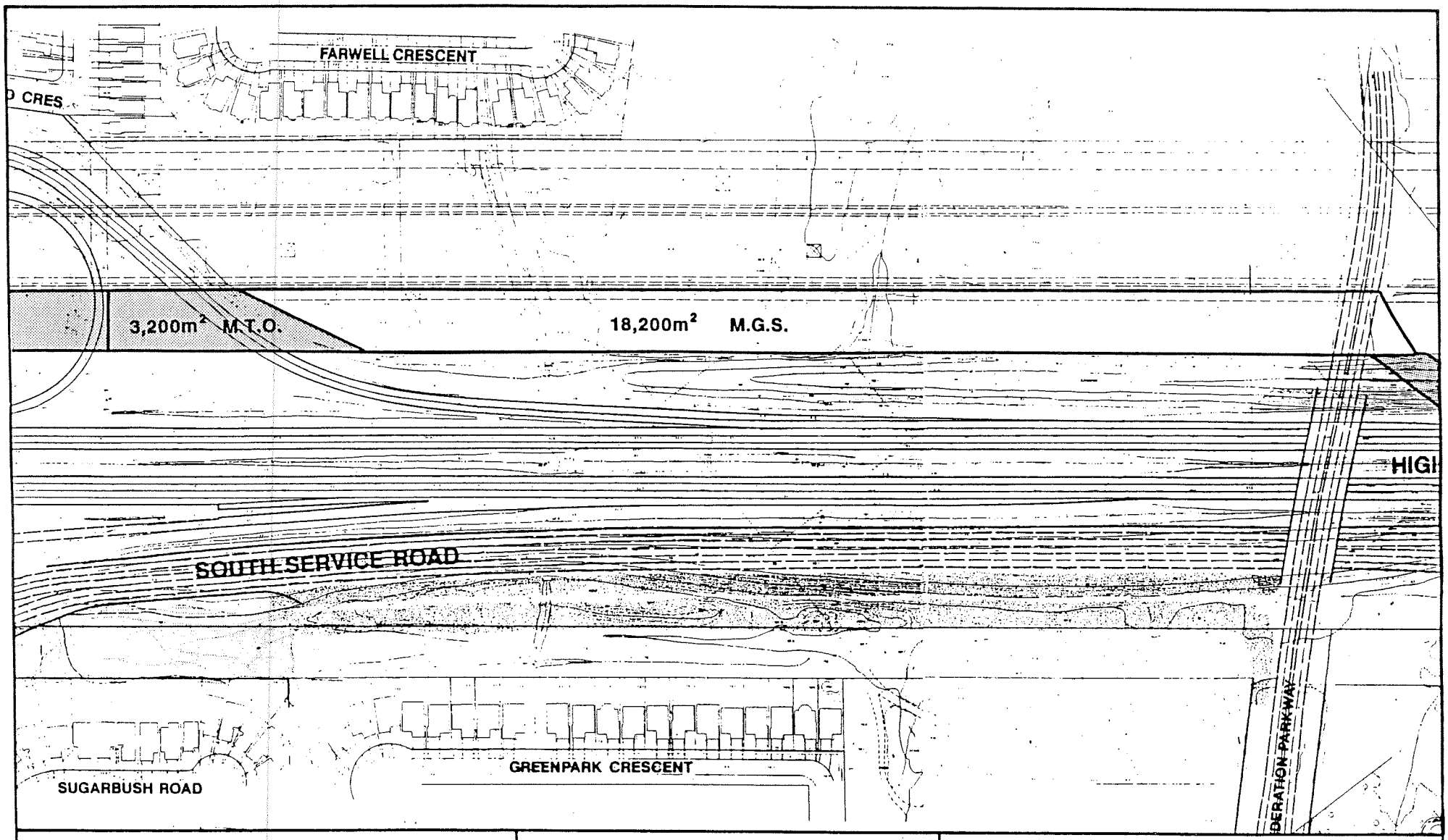
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PROPERTY REQUIREMENTS

PRIMARY USE (ACQUISITION)

SECONDARY USE (LEASE/EASEMENT)



MISSISSAUGA TRANSITWAY

FUNCTIONAL PLANNING STUDY

EXHIBIT

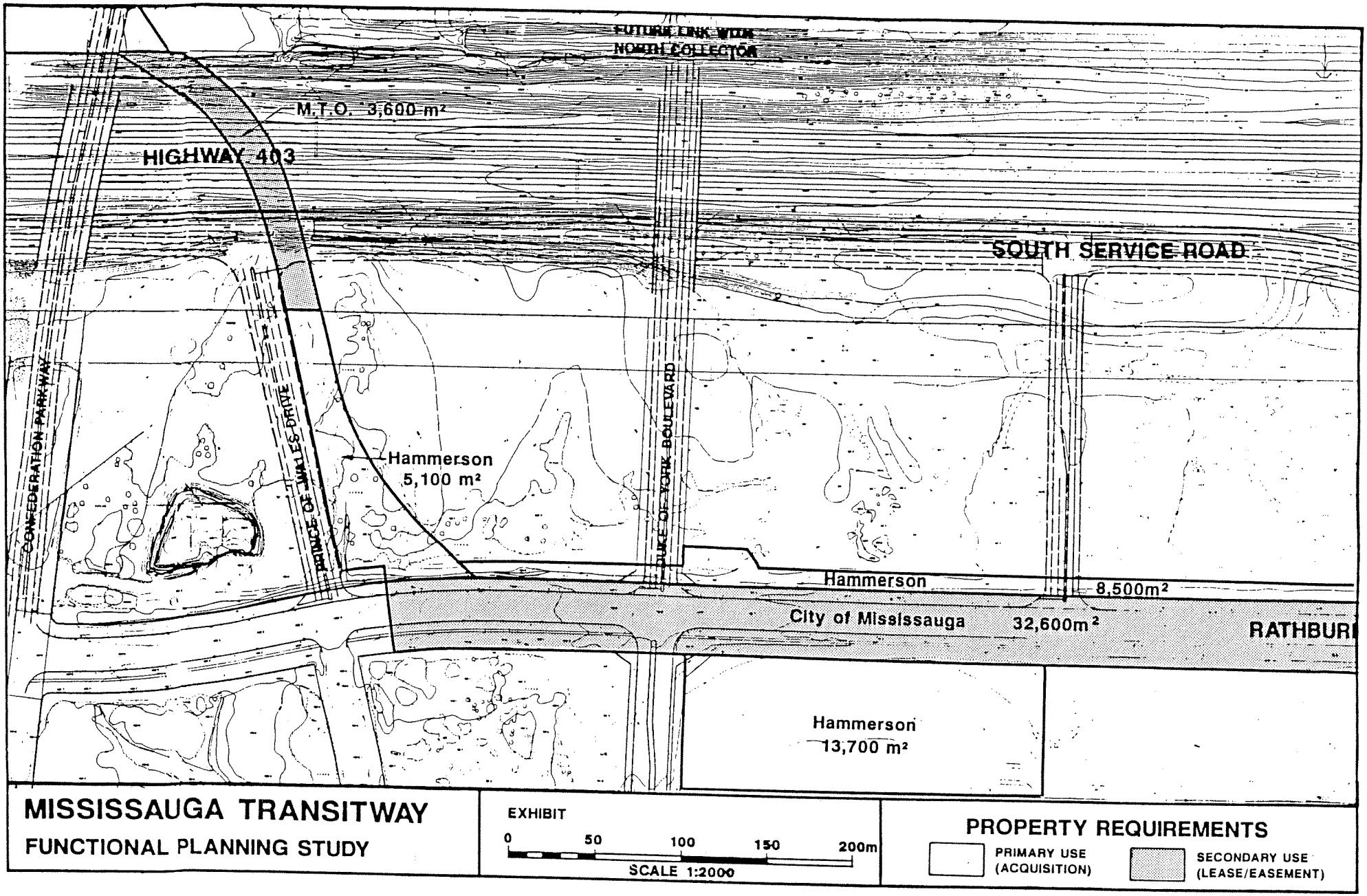
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PROPERTY REQUIREMENTS

PRIMARY USE (ACQUISITION)

SECONDARY USE (LEASE/EASEMENT)



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT

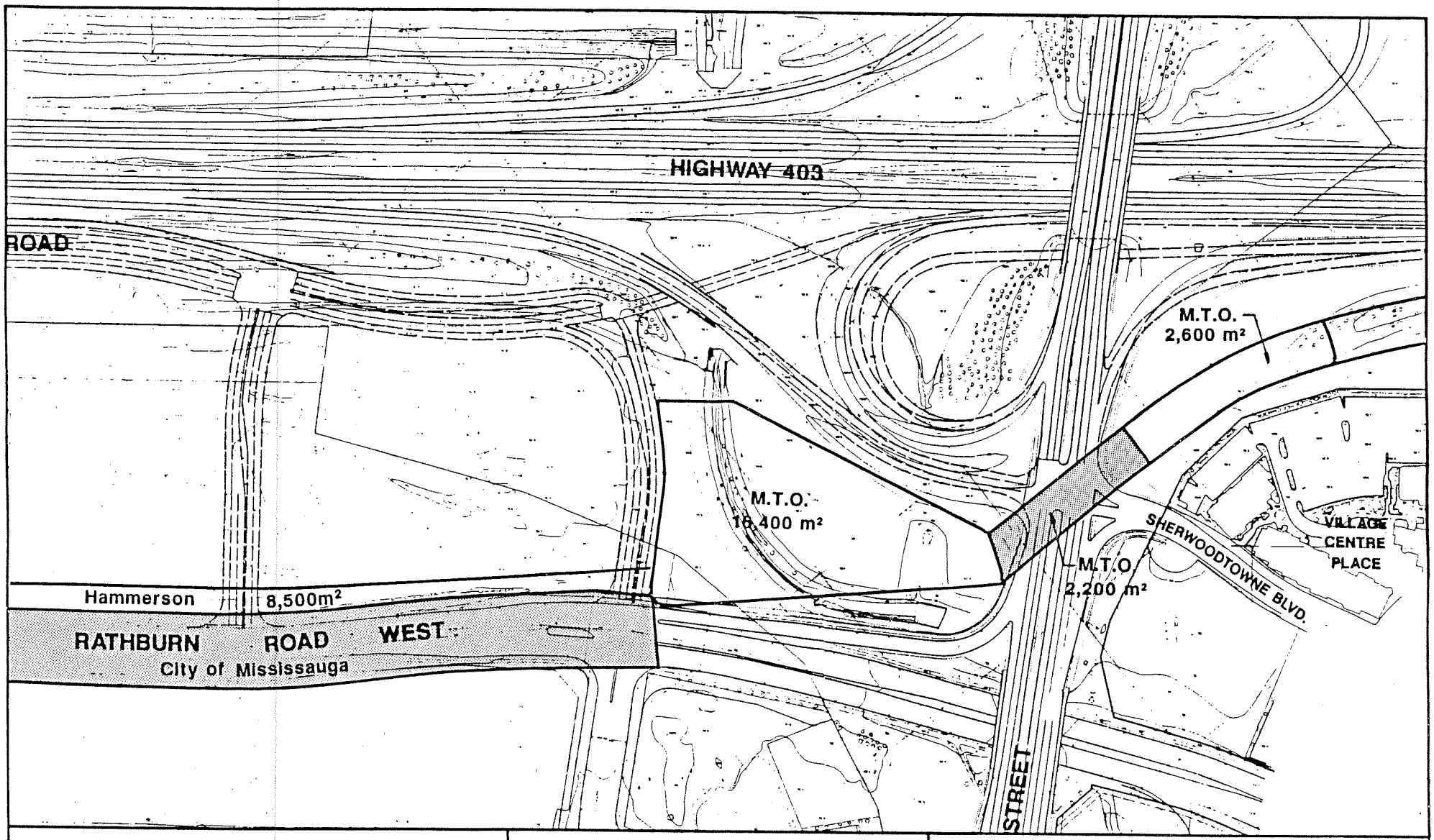
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PROPERTY REQUIREMENTS

PRIMARY USE (ACQUISITION)

SECONDARY USE (LEASE/EASEMENT)



MISSISSAUGA TRANSITWAY

FUNCTIONAL PLANNING STUDY

EXHIBIT

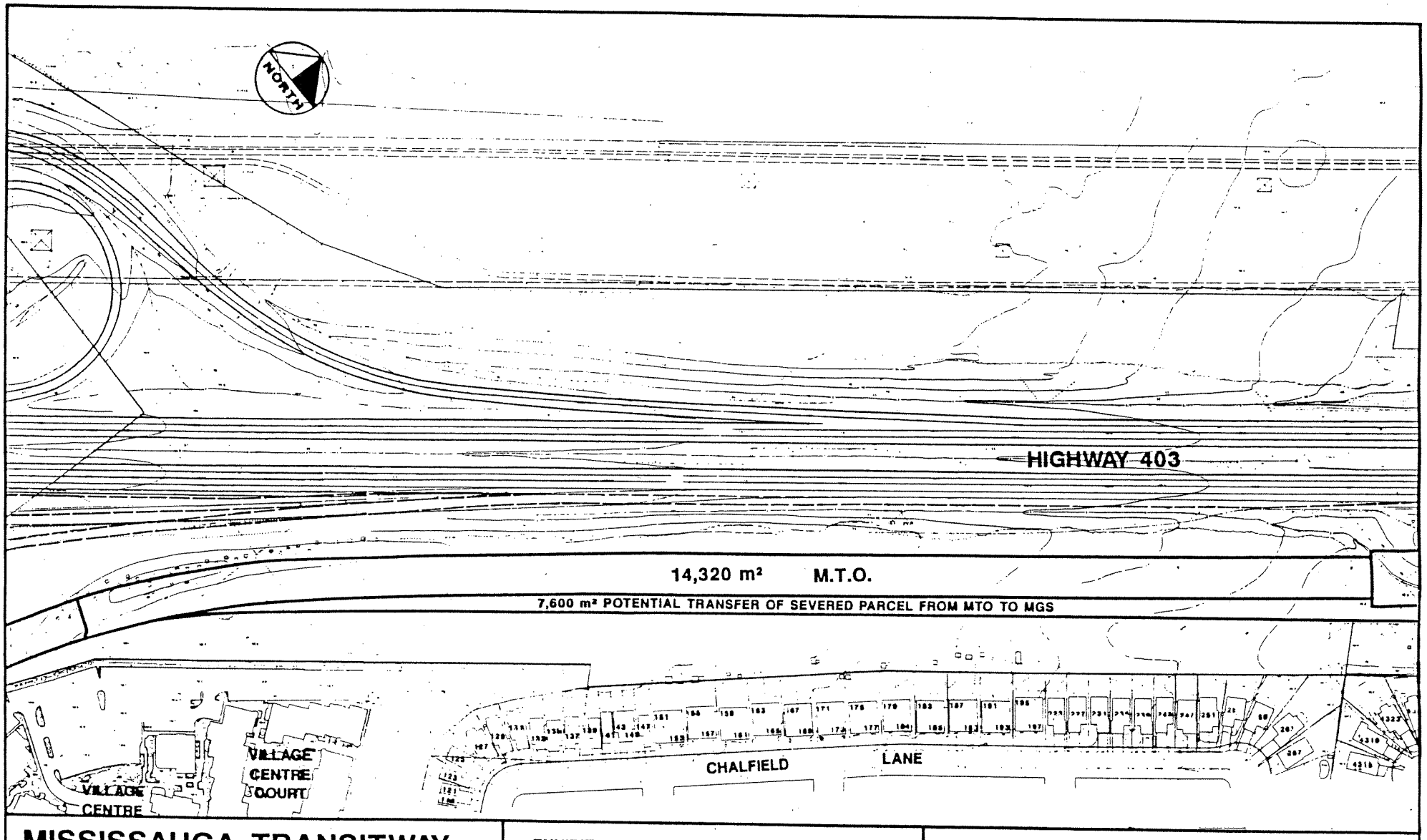
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PROPERTY REQUIREMENTS

PRIMARY USE (ACQUISITION)

SECONDARY USE (LEASE/EASEMENT)



MISSISSAUGA TRANSITWAY

FUNCTIONAL PLANNING STUDY

EXHIBIT

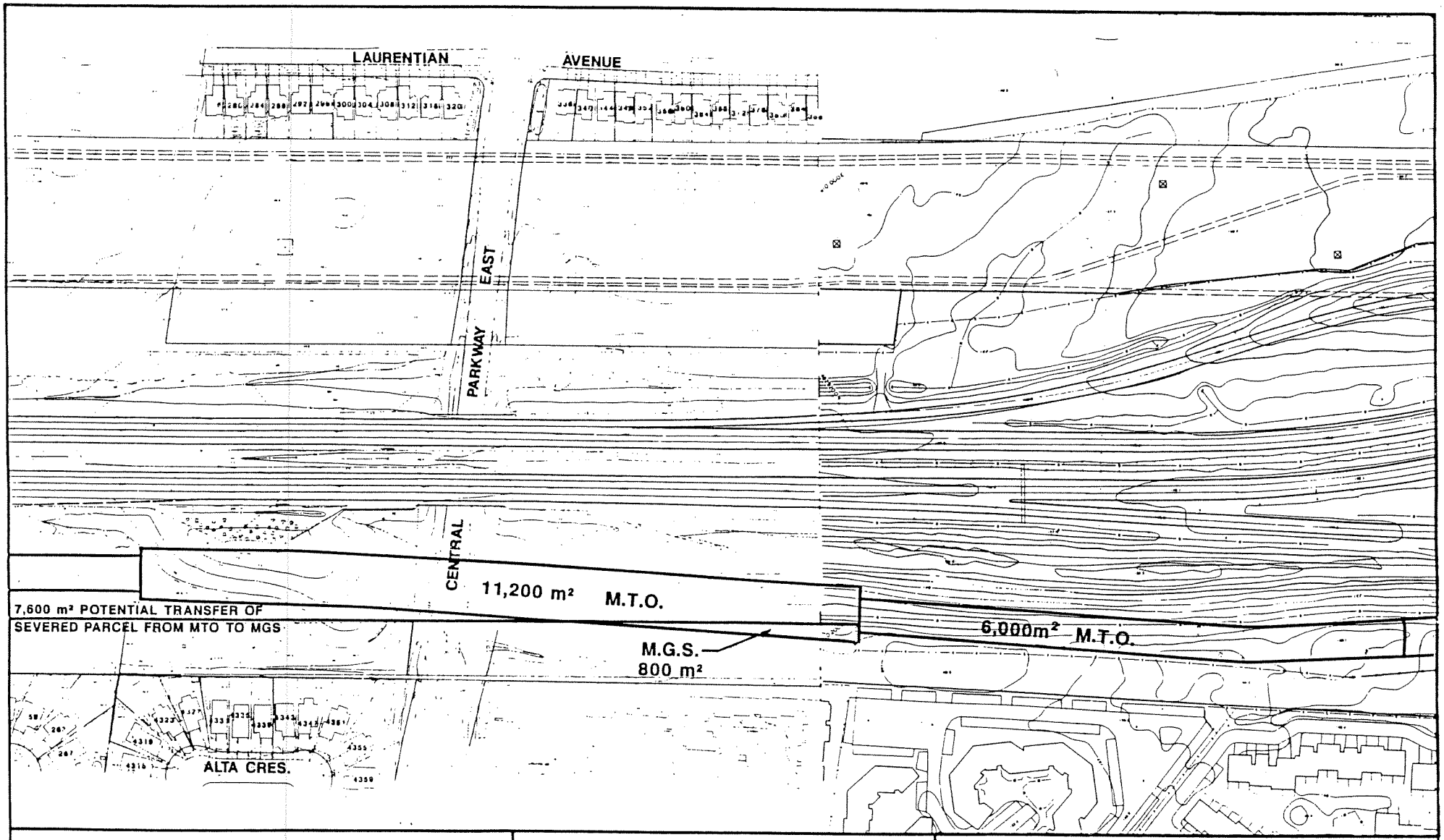
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PROPERTY REQUIREMENTS

PRIMARY USE (ACQUISITION)

SECONDARY USE (LEASE/EASEMENT)



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT

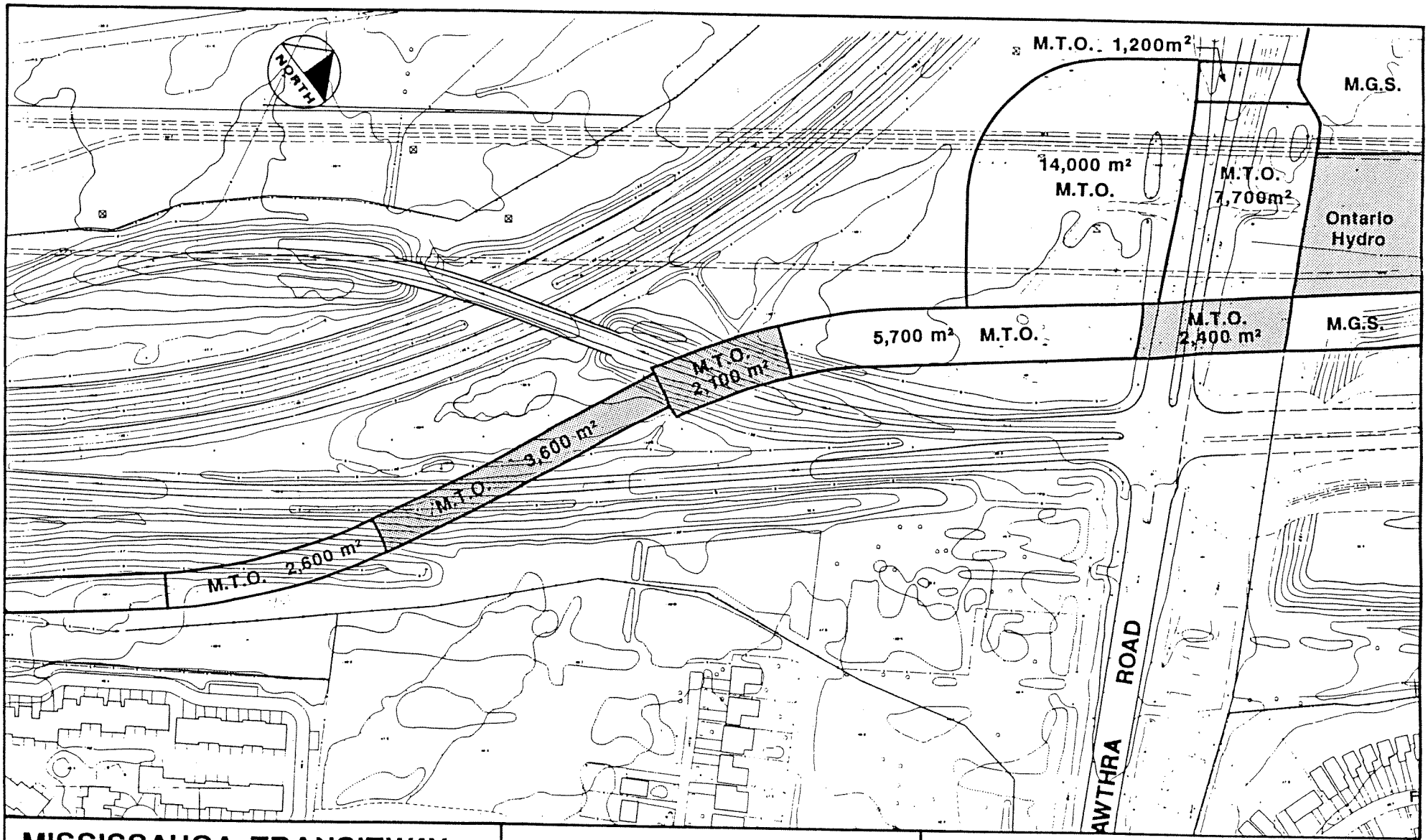
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PROPERTY REQUIREMENTS

PRIMARY USE (ACQUISITION)

SECONDARY USE (LEASE/EASEMENT)



MISSISSAUGA TRANSITWAY

FUNCTIONAL PLANNING STUDY

EXHIBIT

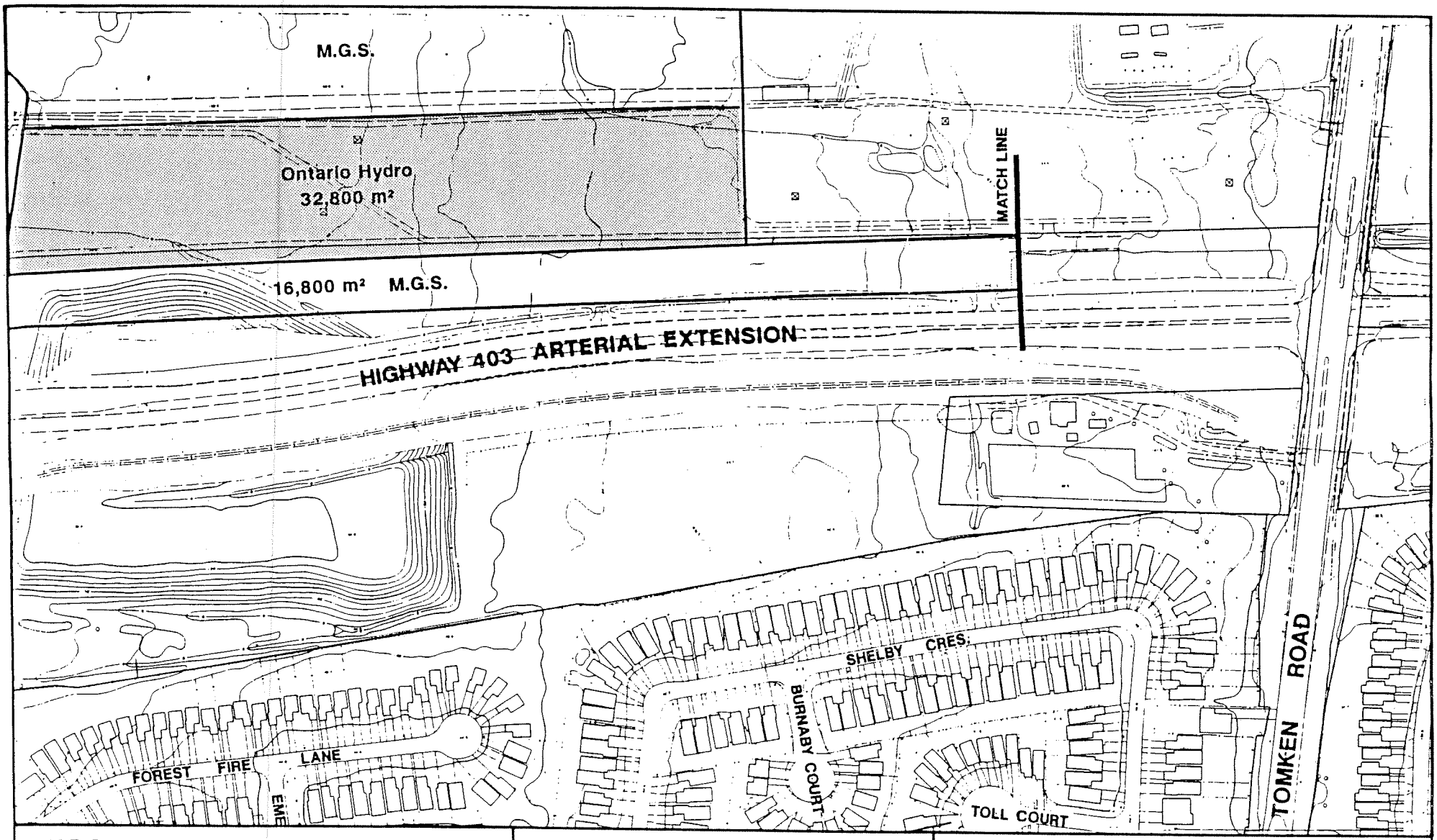
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PROPERTY REQUIREMENTS

PRIMARY USE (ACQUISITION)

SECONDARY USE (LEASE/EASEMENT)



MISSISSAUGA TRANSITWAY

FUNCTIONAL PLANNING STUDY

EXHIBIT

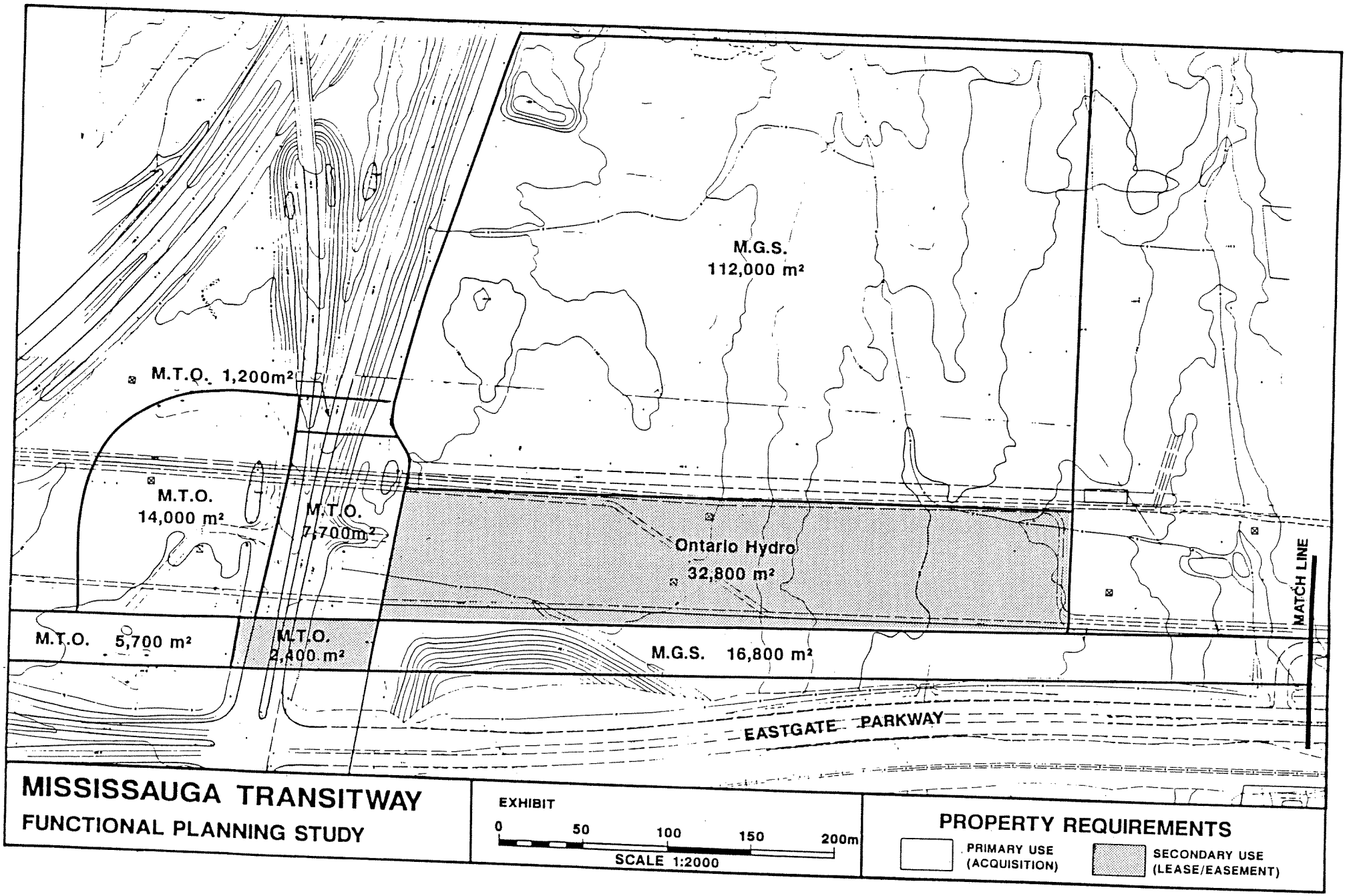
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PROPERTY REQUIREMENTS

PRIMARY USE (ACQUISITION)

SECONDARY USE (LEASE/EASEMENT)



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT

0 50 100 150 200m

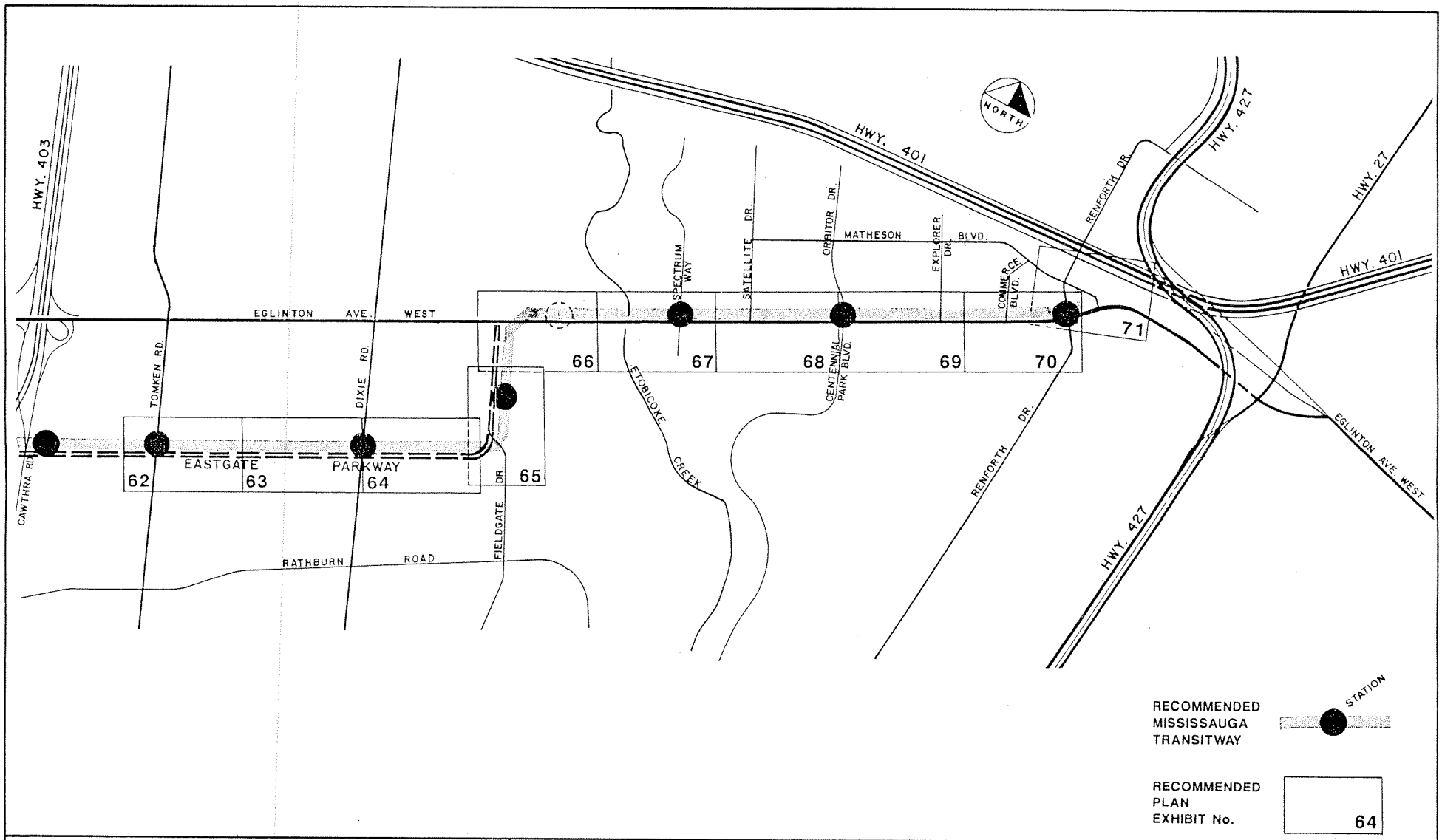
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PROPERTY REQUIREMENTS

PRIMARY USE (ACQUISITION)

SECONDARY USE (LEASE/EASEMENT)

Effect	Mitigating Measures	Application (Where/When)
Public Health		
Exhaust emissions from construction equipment and vehicles	- minimize operation on site, control location on site	Where adjacent uses or natural vegetation could be adversely affected
Effects on groundwater elevation on existing subsurface sewage disposal systems (e.g., septic systems)	- monitor groundwater levels and, if necessary, take appropriate action	Where appropriate
Groundwater contamination	- construction refueling precautions - landfill design and operation precautions - precautions in operation and storage facilities - containment of leachate from salt storage areas and/or maintenance facilities	On site generally

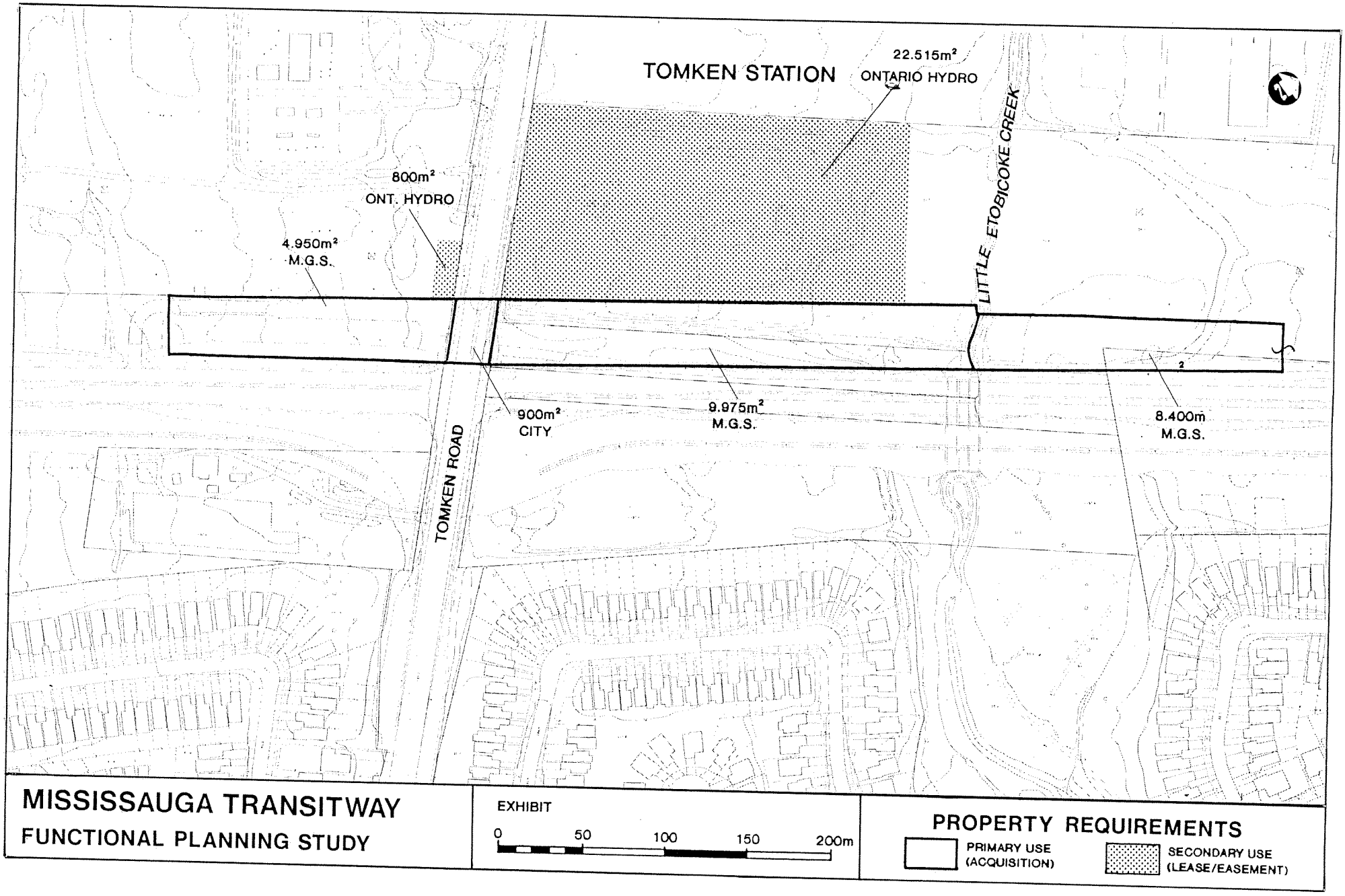


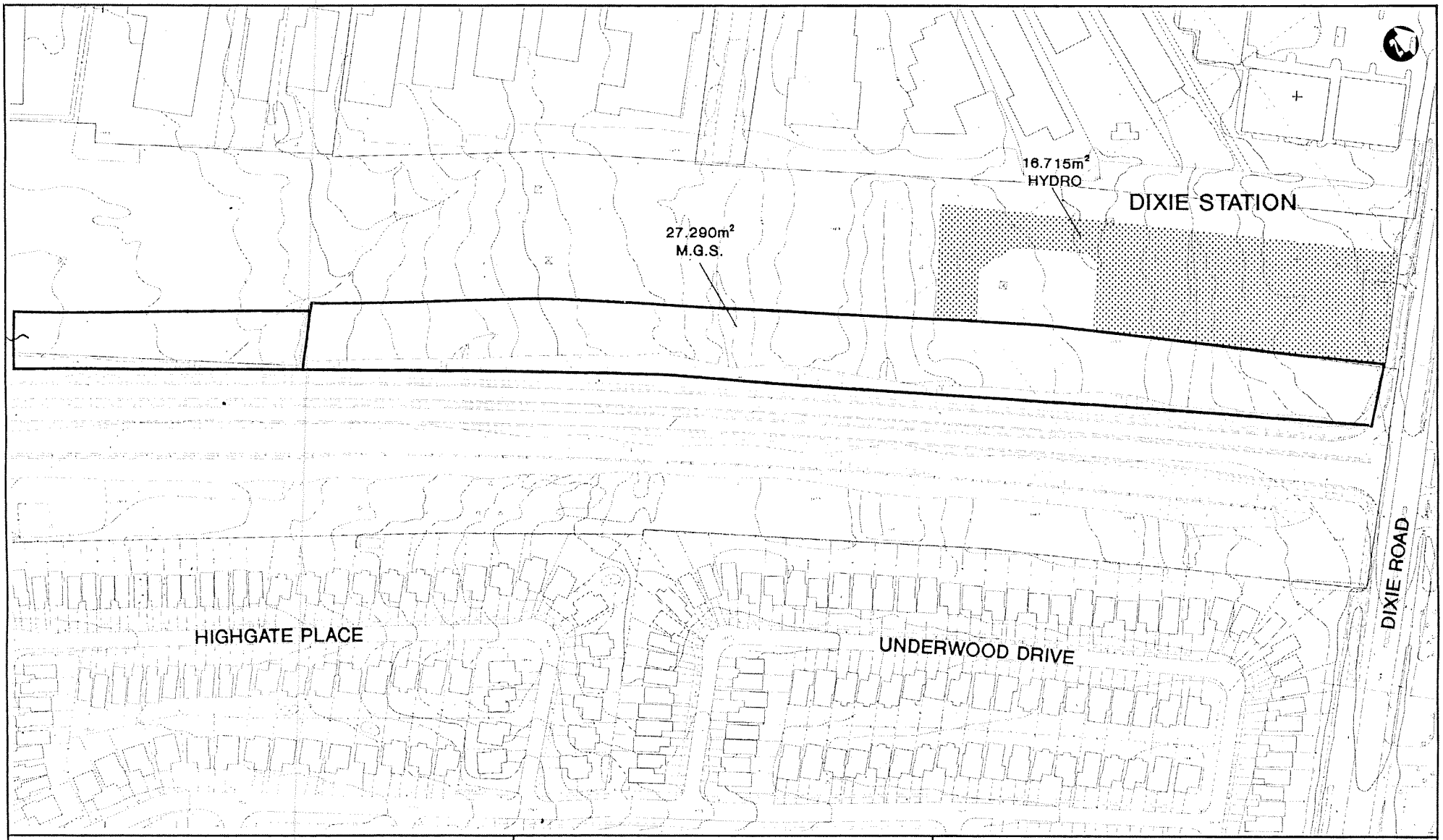
MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT 61

(PLAN NOT TO SCALE)

KEY PLAN
CAWTHRA ROAD TO RENFORTH DRIVE


TOMKEN STATION
22.515m²
ONTARIO HYDRO
LITTLE ETOBICOKE CREEK
800m²
ONT. HYDRO
4.950m²
M.G.S.
TOMKEN ROAD
900m²
CITY
9.975m²
M.G.S.
8.400m
M.G.S.
MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY
EXHIBIT
0
50
100
150
200m
PROPERTY REQUIREMENTS
PRIMARY USE
(ACQUISITION)
SECONDARY USE
(LEASE/EASEMENT)



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

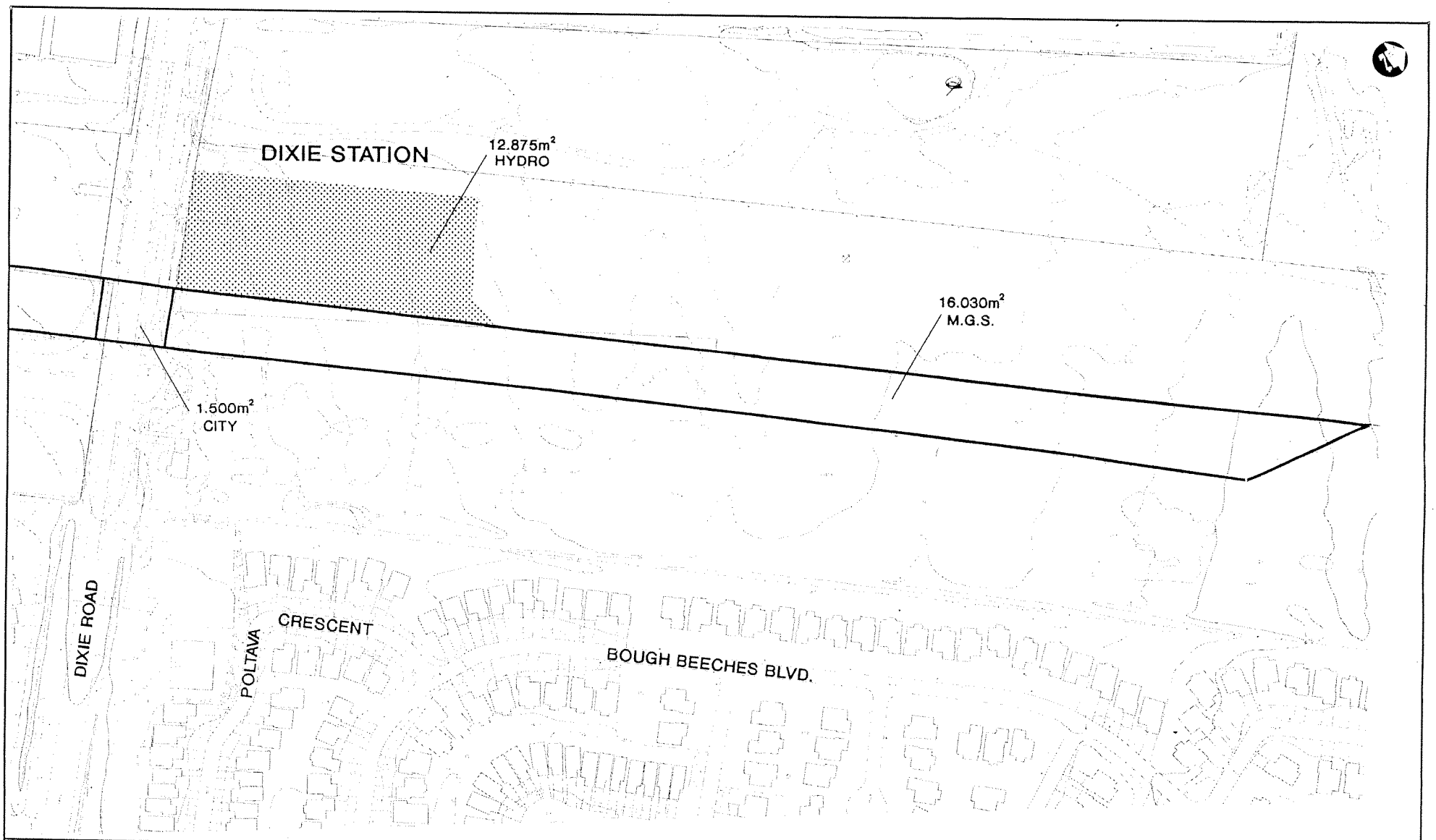
EXHIBIT

0 50 100 150 200m

PROPERTY REQUIREMENTS

PRIMARY USE (ACQUISITION)

SECONDARY USE (LEASE/EASEMENT)



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

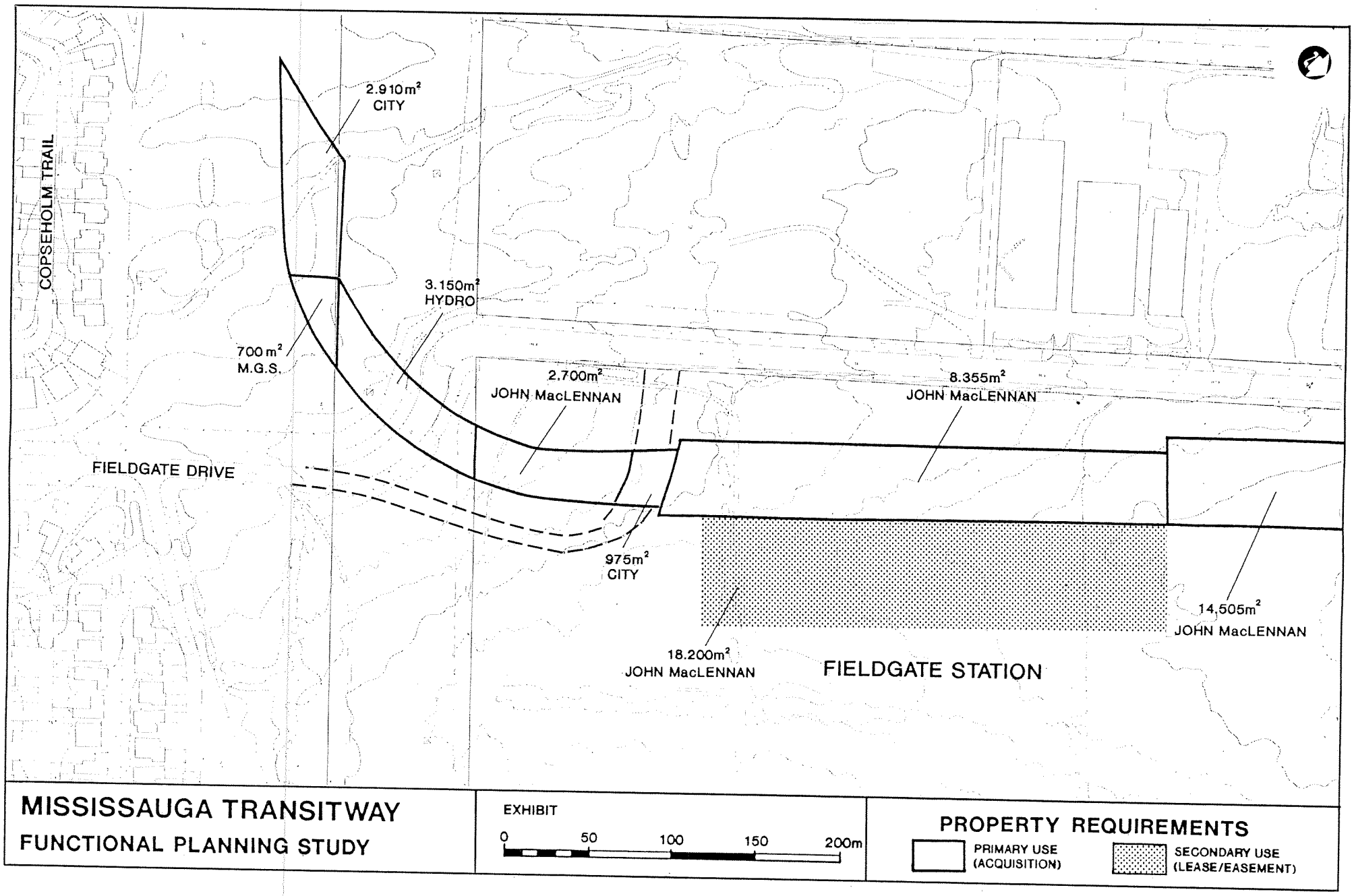
EXHIBIT

0 50 100 150 200m

PROPERTY REQUIREMENTS

PRIMARY USE (ACQUISITION)

SECONDARY USE (LEASE/EASEMENT)



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

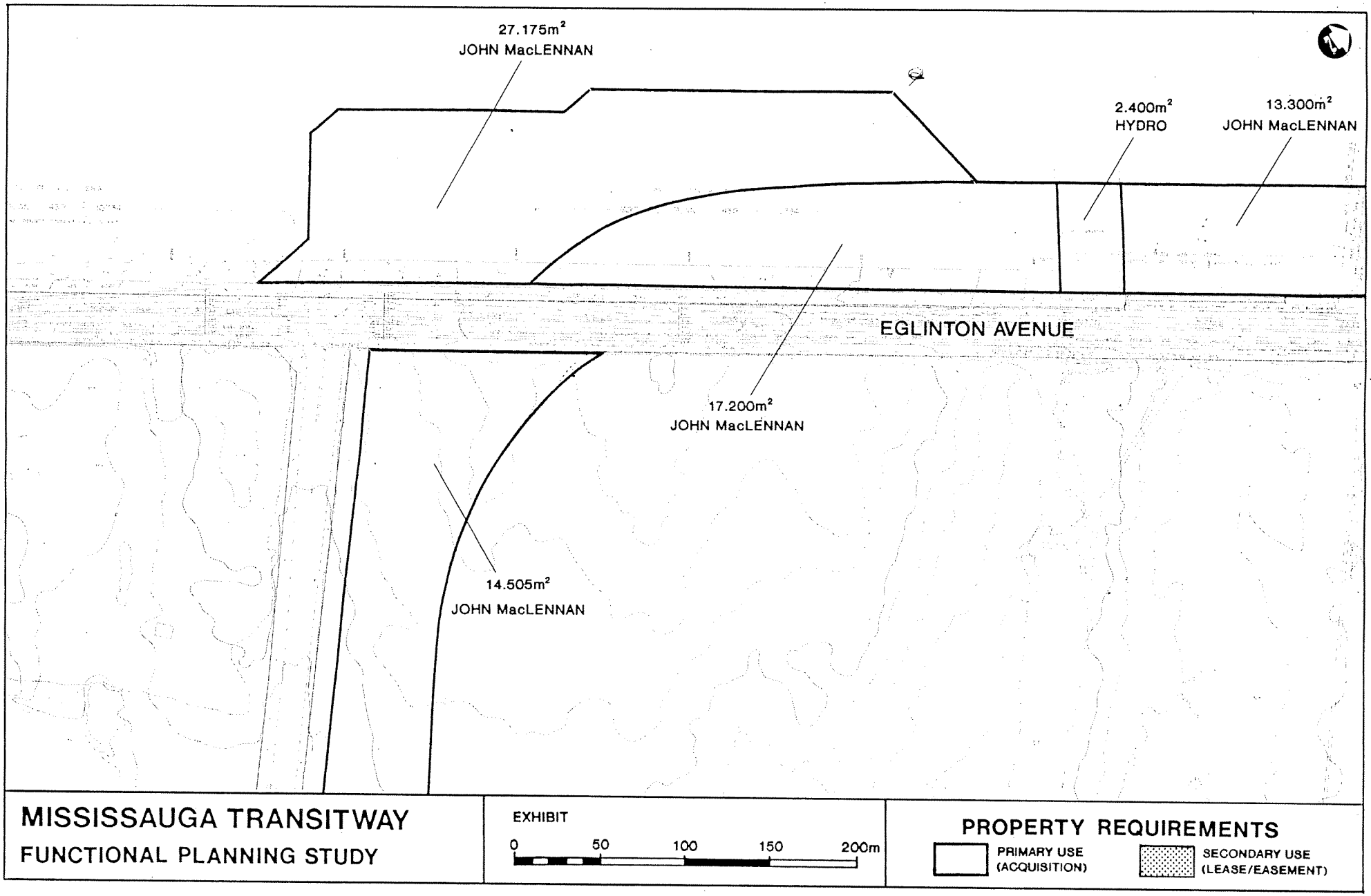
EXHIBIT

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PROPERTY REQUIREMENTS

PRIMARY USE (ACQUISITION)

SECONDARY USE (LEASE/EASEMENT)



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

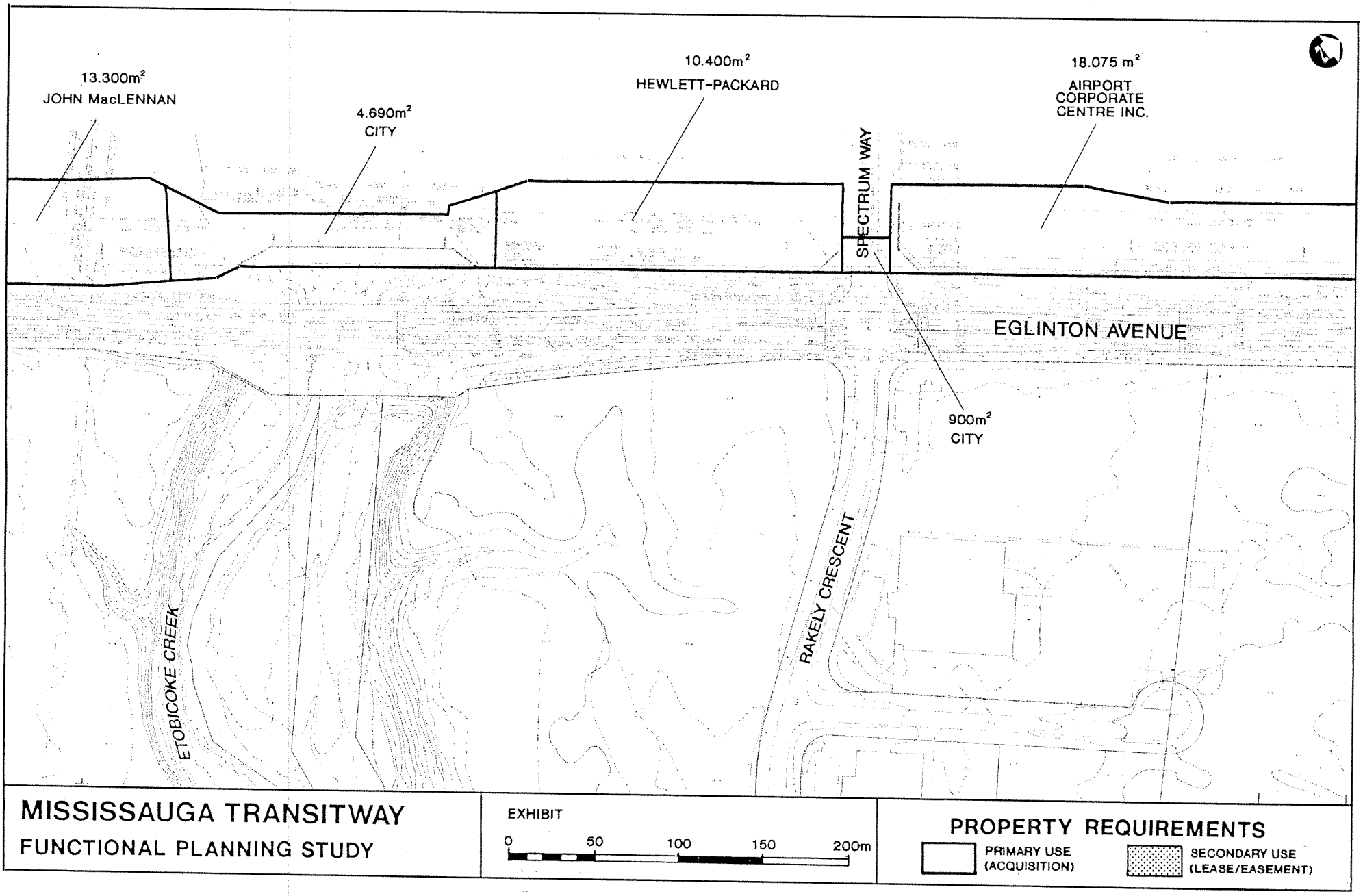
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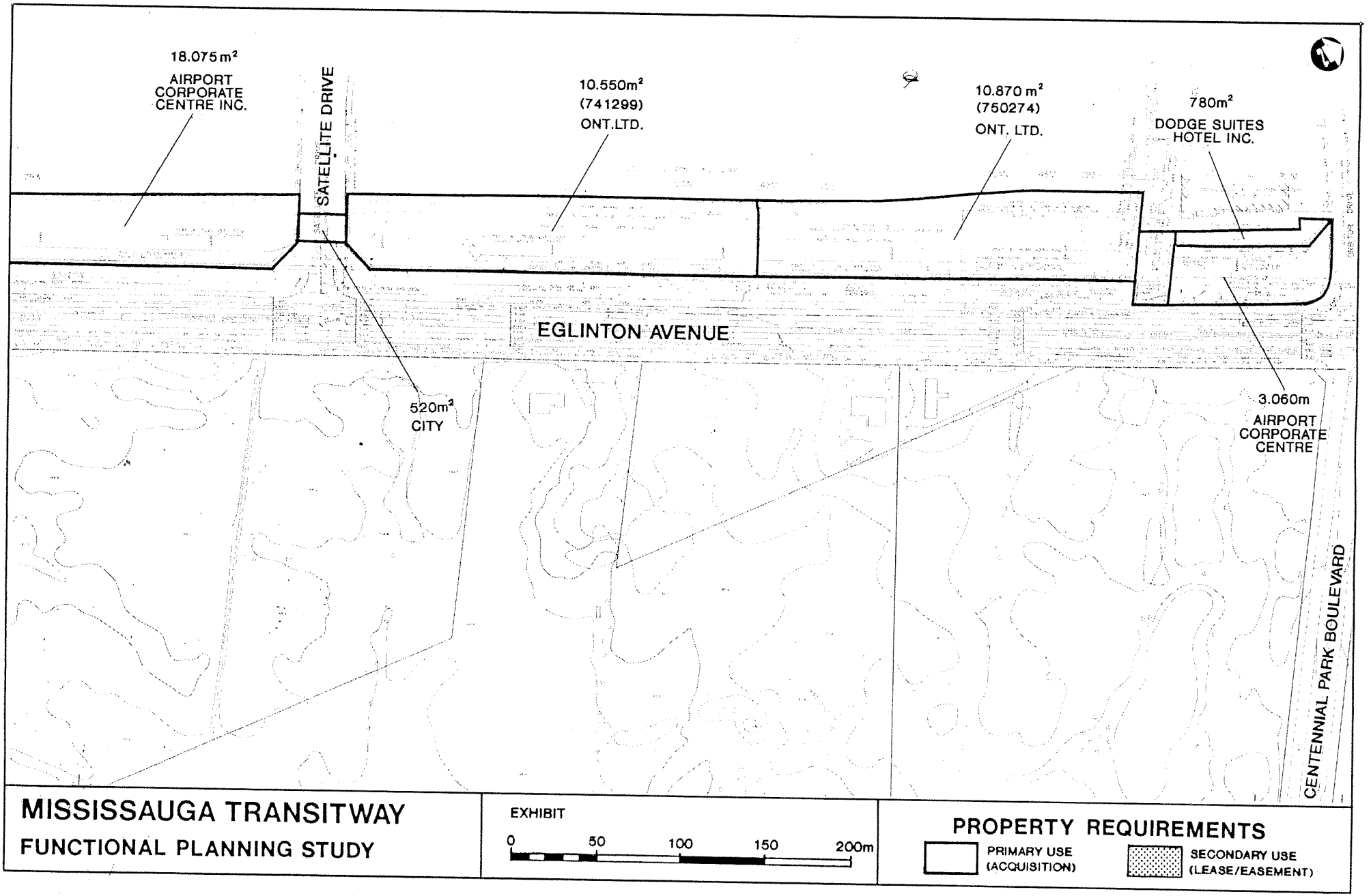
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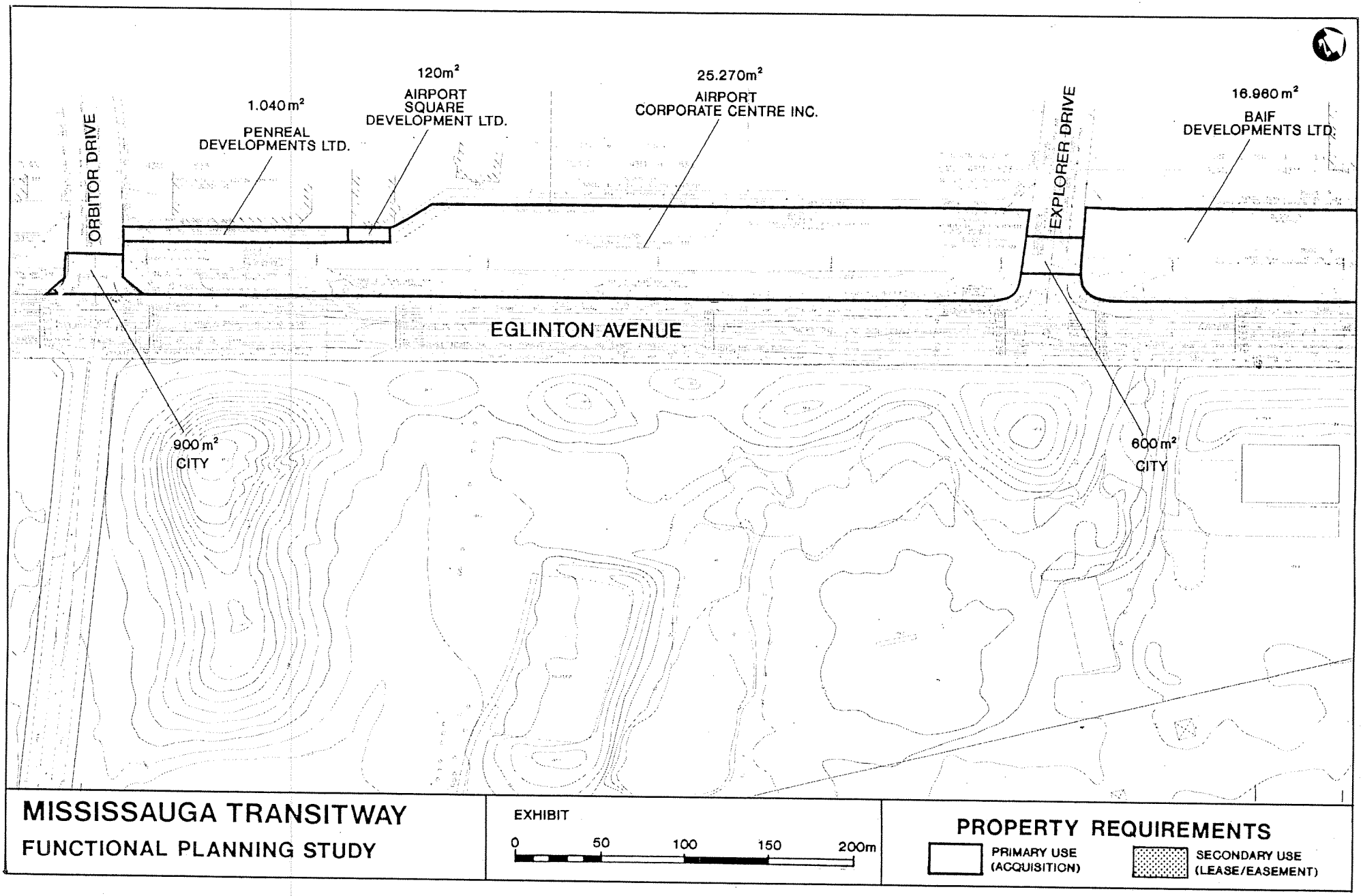
PROPERTY REQUIREMENTS

PRIMARY USE (ACQUISITION)

SECONDARY USE (LEASE/EASEMENT)


13.300m²
JOHN MacLENNAN
4.690m²
CITY
10.400m²
HEWLETT-PACKARD
SPECTRUM WAY
18.075 m²
AIRPORT
CORPORATE
CENTRE INC.
EGLINTON AVENUE
900m²
CITY
ETOBICOKE CREEK
RAKELY CRESCENT
MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY
EXHIBIT
0
50
100
150
200m
PROPERTY REQUIREMENTS
PRIMARY USE
(ACQUISITION)
SECONDARY USE
(LEASE/EASEMENT)


18.075m²
AIRPORT CORPORATE CENTRE INC.
SATELLITE DRIVE
10.550m²
(741299)
ONT.LTD.
10.870 m²
(750274)
ONT. LTD.
780m²
DODGE SUITES HOTEL INC.
EGLINTON AVENUE
520m²
CITY
3.060m
AIRPORT CORPORATE CENTRE
CENTENNIAL PARK BOULEVARD
MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY
EXHIBIT
0
50
100
150
200m
PROPERTY REQUIREMENTS
PRIMARY USE (ACQUISITION)
SECONDARY USE (LEASE/EASEMENT)



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

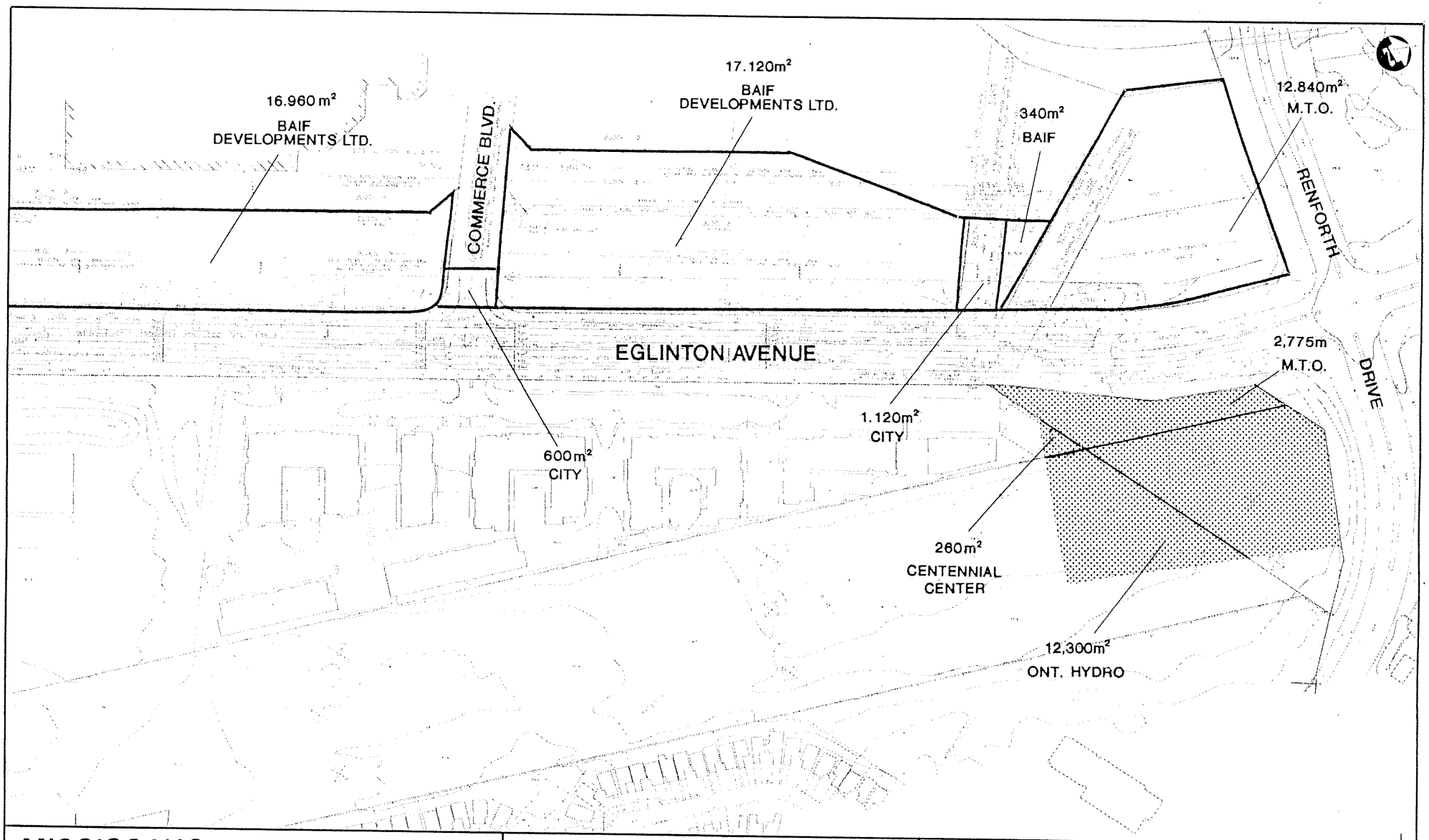
EXHIBIT

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PROPERTY REQUIREMENTS

PRIMARY USE (ACQUISITION)

SECONDARY USE (LEASE/EASEMENT)



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT

0 50 100 150 200m

PROPERTY REQUIREMENTS

PRIMARY USE (ACQUISITION)

SECONDARY USE (LEASE/EASEMENT)

TABLE ...: PROPERTY REQUIREMENTS FOR THE MISSISSAUGA TRANSITWAY NINTH LINE TO MAVIS ROAD

APPROXIMATE LOCATION	PROPERTY OWNER	EXISTING PROPERTY USE	PROPERTY REQUIRED m^2		PROPERTY USE	COMMENTS
			Primary	Secondary		
RIDGEWAY DRIVE STATION (PLATE 1)	M.G.S.	TRANSIT & UTILITY CORRIDOR	35,980		RIDGEWAY DRIVE STATION, PARKING & ACCESS	
	ONTARIO HYDRO	HYDRO CORRIDOR		32,380		
WEST OF WINSTON CHURCHILL BLVD. STATION (PLATE 2)	M.G.S.	TRANSIT CORRIDOR	24,710		TRANSITWAY & PARKING	
	ONTARIO HYDRO	HYDRO CORRIDOR		12,900		
	M.T.O.	HWY. 403		1,650		
WINSTON CHURCHILL BLVD. STATION (PLATE 3)	M.G.S.	TRANSIT & UTILITY CORRIDOR	23,770		WINSTON CHURCHILL BLVD. STATION, TRANSITWAY & PARKING	
	ONTARIO HYDRO	HYDRO CORRIDOR	2,960	22,350		
	M.T.O.	HWY. 403 WB RAMP	6,090			
	MISSISSAUGA	ARTERIAL ROAD		620		
GLEN ERIN DRIVE (PLATE 4)	M.G.S.	TRANSIT & UTILITY CORRIDOR	20,210		TRANSITWAY & TRANSITWAY ACCESS RAMP	
	ONTARIO HYDRO	HYDRO CORRIDOR	4,630	2,560		
	MISSISSAUGA	ARTERIAL ROAD		460		
ERIN MILLS PARKWAY STATION (PLATE 5)	M.G.S.	UTILITY CORRIDOR	16,310		ERIN MILLS PARKWAY STATION, TRANSITWAY AND RAMP	
	ONTARIO HYDRO	HYDRO CORRIDOR		18,660		
	M.T.O.	HWY. 403	8,160	2,300		
	PEEL?	ARTERIAL ROAD		750		
ERIN MILLS PARKWAY TO MISSISSAUGA ROAD (PLATE 6)	M.G.S.	UTILITY CORRIDOR	14,710		TRANSITWAY	
	M.T.O.	HWY. 403	10,640	350		

TABLE ...: PROPERTY REQUIREMENTS FOR THE MISSISSAUGA TRANSITWAY NINTH LINE TO MAVIS ROAD (CONT'D)

APPROXIMATE LOCATION	PROPERTY OWNER	EXISTING PROPERTY USE	PROPERTY REQUIRED m^2		PROPERTY USE	COMMENTS
			Primary	Secondary		
MISSISSAUGA ROAD (PLATE 7)	M.G.S.	UTILITY & TRANSIT CORRIDOR	4,820			
	M.T.O.	HWY. 403	9,820			
	MISSISSAUGA			300		
MISSISSAUGA ROAD TO CP RAIL (PLATE 8)	M.G.S.	UTILITY CORRIDOR	3,980		TRANSITWAY	
	M.T.O.	HWY. 403	20,240			
CP RAIL, CREDITVIEW ROAD STATION (PLATE 9)	M.G.S.	UTILITY CORRIDOR	17,200		CREDITVIEW ROAD STATION, TRANSITWAY & ACCESS	AREA INCLUDES VISUAL/ NOISE ATTENUATION BERM
	M.T.O.	HWY. 403	21,070			
	ONTARIO HYDRO	HYDRO CORRIDOR		15,300		
	CP RAIL	RAILWAY		260		
	MISSISSAUGA	ARTERIAL ROAD		600		
ERINDALE TRANSFORMER STATION (PLATE 10)	M.G.S.	UTILITY CORRIDOR	21,690		TRANSITWAY	AREA INCLUDES FOR VISUAL/NOISE ATTENUATION BERM
	M.T.O.	HWY. 403	17,760			
WEST OF MAVIS ROAD	M.G.S.	UTILITY CORRIDOR	14,640		TRANSITWAY	AREA INCLUDES VISUAL/ NOISE ATTENUATION BERM
	M.T.O.	HWY. 403	9,740			

TABLE : PROPERTY REQUIREMENTS FOR THE MISSISSAUGA TRANSITWAY

MAVIS ROAD TO CAWTHRA ROAD

APPROXIMATE LOCATION	PROPERTY OWNER	EXISTING PROPERTY USE	PROPERTY REQUIRED (m^2)		PROPOSED USE	COMMENTS
			Primary	Secondary		
W. OF MAVIS ROAD	M.T.O.	403 CORRIDOR	2,050	-	TRANSITWAY	
W. OF MAVIS ROAD	M.G.S.	UTILITY CORRIDOR-PARKWAY BELT	7,950	-	TRANSITWAY MAVIS STATION	
AT MAVIS	M.T.O.	403/MAVIS INTERCHANGE	-	9,000	TRANSITWAY MAVIS STATION PROP. N-W RAMP PROP. S-W RAMP	
AT MAVIS	ONTARIO HYDRO	HYDRO CORRIDOR	-	10,500	PARKING & ACCESS RDS. FOR MAVIS STA.	
AT MAVIS	M.T.O.	N-W RAMP 403/MAVIS INT.	-	7,050	PARKING & ACCESS RDS. FOR MAVIS STA.	
E. OF MAVIS	M.T.O.	S-W RAMP MAVIS/403 INT.	-	3,200	TRANSITWAY & S-W RAMP	
E. OF MAVIS - CONFED. PKWY	M.G.S.	UTILITY CORRIDOR-PARKWAY BELT	18,150	-	TRANSITWAY	
403 CROSSING W. OF CONFED. PKWY	M.T.O.	403 CORRIDOR	-	3,600	TRANSITWAY UNDER 403	
E. OF PRINCE OF WALES DR.	HAMMERSON	PARKING & VACANT	5,100	-	TRANSITWAY UNDERGROUND IN TUNNEL	POTENTIAL FOR AIR RIGHTS DEVELOPMENT
N. OF RATHBURN RD. E. OF PRINCE OF WALES DR.	HAMMERSON	VACANT	8,500	-	RATHBURN ROAD WIDENING	ROAD WIDENING TO ACCOMMODATE "OPEN TUNNEL" TRANSITWAY; CAN BE REDUCED/ELIMINATED WITH MORE COSTLY CLOSED TUNNEL

FILE NAME PROP_REQ

TABLE : PROPERTY REQUIREMENTS FOR THE MISSISSAUGA TRANSITWAY

MAVIS ROAD TO CAWTHRA ROAD

APPROXIMATE LOCATION	PROPERTY OWNER	EXISTING PROPERTY USE	PROPERTY REQUIRED (m^2)		PROPOSED USE	COMMENTS
			Primary	Secondary		
E. OF PRINCE OF WALES DR.-CITY CENTRE DRIVE	CITY OF MISSISSAUGA	RATHBURN ROAD	-	32,600	CENTRE STA. & TRANSITWAY IN TUNNEL UNDER-GROUND	
S. OF RATHBURN RD. DUKE OF YORK BLVD. & ROAD A	HAMMERSON	VACANT	13,700	-	CITY CENTRE STATION	POTENTIAL FOR AIR RIGHTS/MIXED USE DEVELOPMENT
W. OF HURONTARIO	M.T.O.	COOKSVILLE CREEK	16,400	-	HURONTARIO STATION	
AT HURONTARIO ST. & SHERWOODTOWNE BLVD.	M.T.O.	HURONTARIO STREET	-	2,200	TRANSITWAY UNDER HUR-ONTRARIO ST.	
W. OF HURONTARIO ST.	M.T.O.	VACANT	2,600	-	TRANSITWAY	
E. OF HURONTARIO	M.T.O.	WOODLOT	14,320	-	TRANSITWAY WOODLOT & BERM	7600 m^2 M.T.O. PROPERTY SEVERED ON SOUTH SIDE OF TRANSITWAY: ASSUME TRANSFER TO M.G.S. (NOT INCLUDED IN 14,320 m^2 M.T.O.)
AT CENTRAL PKWY E.	M.T.O.	VACANT	11,200	-	TRANSITWAY CENTRAL PKWY STATION	
W. OF CENTRAL PKWY	M.G.S.	TRANSIT CORRIDOR-PARKWAY BELT	800	-	TRANSITWAY & CENTRAL PKWY STA.	
W. OF CENTRAL PKWY	M.T.O.	VACANT	6,000	-	TRANSITWAY	
W. OF CAWTHRA RD.	M.T.O.	VACANT	2,600	-	TRANSITWAY	

FILE NAME PRO_REQ1

TABLE : PROPERTY REQUIREMENTS FOR THE MISSISSAUGA TRANSITWAY

MAVIS ROAD TO CAWTHRA ROAD

APPROXIMATE LOCATION	PROPERTY OWNER	EXISTING PROPERTY USE	PROPERTY REQUIRED (m^2)		PROPOSED USE	COMMENTS
			Primary	Secondary		
W. OF CAWTHRA RD.	M.T.O.	403-EASTGATE PKWY/CAWTHRA RAMP	-	3,600	TRANSITWAY	
W. OF CAWTHRA RD.	M.T.O.	EASTGATE-PKWY/ CAWTHRA RD.- HWY 403WB RAMP	-	2,100	TRANSITWAY	
W. AT CAWTHRA RD.	M.T.O.	VACANT	5,700	-	TRANSITWAY	
W. AT CAWTHRA RD.	M.T.O.	VACANT	14,000	-	HWY 403 CAWTHRA STA. RAMP	
AT CAWTHRA RD.	M.T.O.	CAWTHRA RD.	-	2,400	TRANSITWAY & CAWTHRA STA.	
E. OF CAWTHRA RD.	M.G.S.	UTILITY CORRIDOR- PARKWAY BELT	16,800	-	TRANSITWAY & CAWTHRA STA.	
E. OF CAWTHRA RD.	ONTARIO HYDRO	HYDRO TOWER CORRIDOR	32,800	-	CAWTHRA STA. PARKING & ACCESS RDS.	
E. OF CAWTHRA RD.	M.G.S.	VACANT & UTILITIES	112,000	-	CAWTHRA STA. PARKING & ACCESS RDS. & & RAMPS	PROPERTY DEFINED ON BASIS OF PHYSICAL MAXIMUM PARKING AREA; ACTUAL PARKING DEMAND TO BE DETERMINED

FILE NAME PRO_REQ2

TABLE : PROPERTY REQUIREMENTS FOR THE MISSISSAUGA TRANSITWAY

CAWTHRA TO RENFORTH GATEWAY

APPROXIMATE LOCATION	PROPERTY OWNER	EXISTING PROPERTY USE	PROPERTY REQUIRED (m^2)		PROPOSED USE	COMMENTS
			Primary	Secondary		
DIXIE ROAD TO FIELD GATE DR.	M.G.S.	OPEN SPACE	700	-	TRANSITWAY	
	ONTARIO HYDRO	UTILITY	3,150	-	TRANSITWAY	
	JOHN McLENNAN	N/A	2,700	-	TRANSITWAY	
RELOCATED FIELDGATE DR.	PROPOSED CITY OF MISSISSAUGA	ROADWAY	975	-	TRANSITWAY	ROAD - R.O.W.
RELOCATED FIELDGATE DR. TO EGLINTON AVE. W.	JOHN McLENNAN	VACANT	8,355	- 18,200	TRANSITWAY/ PLATFORM OFF-LINE STATION	LOCAL BUS TRANSFER STATION
	CITY OF MISSISSAUGA	ROAD R.O.W.	900	-	TRANSITWAY	
EGLINTON AVE W. TO SPECTRUM WAY	JOHN McLENNAN	N/A	14,505	-	TRANSITWAY	
	JOHN McLENNAN	VACANT	-	27,175	ON/OFF RAMP TO EGLINTON	
	JOHN McLENNAN	VACANT	17,200	-	TRANSITWAY	
	ONTARIO HYDRO	ABANDONED UTILITY	2,400	-	TRANSITWAY	
	JOHN McLENNAN	VACANT	13,300	-	TRANSITWAY	
STRUCTURE OVER ETOBICOKE CREEK	CITY OF MISSISSAUGA	OPEN SPACE	4,690	-	TRANSITWAY	
	HEWLETT PACKARD	VACANT	10,400	-	TRANSITWAY	
SPECTRUM WAY	CITY OF MISSISSAUGA	ROAD R.O.W.	900	-	TRANSWAY/ STA. PLATFORM	

FILE NAME PRO_REQ4

TABLE : PROPERTY REQUIREMENTS FOR THE MISSISSAUGA TRANSITWAY

CAWTHRA TO RENFORTH GATEWAY

APPROXIMATE LOCATION	PROPERTY OWNER	EXISTING PROPERTY USE	PROPERTY REQUIRED (m^2)		PROPOSED USE	COMMENTS
			Primary	Secondary		
CAWTHRA TO TOMKEN ROAD	M.G.S.	OPEN SPACE	4,950	-	TRANSITWAY	
CAWTHRA TO TOMKEN ROAD	ONTARIO HYDRO	UTILITY	-	800	STAIRWAY	LOCAL BUS CONNECTION
TOMKEN ROAD	CITY OF MISSISSAUGA	ROAD WAY	900	-	TRANSITWAY/ PLATFORM	
TOMKEN ROAD TO DIXIE ROAD	ONTARIO HYDRO	UTILITY	-	22,515	OFF-LINE STATION	LOCAL BUS TRANSFER STATION
	M.G.S.	OPEN SPACE	9,975	-	TRANSITWAY	
	ONTARIO HYDRO	UTILITY	8,400	-	TRANSITWAY	
	M.G.S.	OPEN SPACE	1,350	-	TRANSITWAY	
	M.G.S.	OPEN SPACE	27,290	-	TRANSITWAY	STATION PLATFORM
	ONTARIO HYDRO	UTILITY	-	16,715	OFF LINE STATION	LOCAL BUS TRANSFER STATION
DIXIE ROAD	CITY OF MISSISSAUGA	ROADWAY	1,500	-	TRANSITWAY/ PLATFORM	
DIXIE ROAD TO FIELDGATE DR.	ONTARIO HYDRO	UTILITY	-	12,875	KISS'N RIDE TRANSITWAY/ STATION	
	M.G.S.	OPEN SPACE	16,030	-	TRANSITWAY	(TO HWY 403 EXTENSION)
	PROPOSED CITY OF MISSISSAUGA	OPEN SPACE	2,910	-	TRANSITWAY	UNDERPASS AT HWY 403 EXTENSION

FILE NAME PRO_REQ3

TABLE : PROPERTY REQUIREMENTS FOR THE MISSISSAUGA TRANSITWAY

CAWTHRA TO RENFORTH GATEWAY

APPROXIMATE LOCATION	PROPERTY OWNER	EXISTING PROPERTY USE	PROPERTY REQUIRED (m^2)		PROPOSED USE	COMMENTS
			Primary	Secondary		
SPECTRUM WAY TO SATELLITE DR.	AIRPORT CORP. CTR.	VACANT	18,075	-	TRANSITWAY	
SATELLITE DR.	CITY OF MISSISSAUGA	ROAD R.O.W.	520	-	TRANSITWAY	
SATELLITE DR. TO ORBITOR DR.	741299 ONTARIO LTD.	VACANT	10,550	-	TRANSITWAY	
	750274 ONT. LTD.	VACANT	10,870	-	TRANSITWAY	
	CITY OF MISSISSAUGA	R.O.W.	800	-	TRANSITWAY	FIFTH LINE EAST
	DODGE SUITES HOTEL	LANDSCAPES AREA	780	-	TRANSITWAY/ PLATFORM	
	AIRPORT CORP. CENTRE	N/A	3,060	-	TRANSITWAY	
ORBITOR DRIVE	CITY OF MISSISSAUGA	R.O.W.	900	-	TRANSITWAY/ PLATFORM	
ORBITOR DRIVE TO EXPLORER DR.	EGLINTON W. CORP. CENTRE	LANDSCAPED AREA	1,040	-	TRANSITWAY/ PLATFORM	
	AIRPORT SQ. DEVELOPMENT	VACANT	120	-	TRANSITWAY	
	AIRPORT CORP. CENTRE	VACANT	25,270	-	TRANSITWAY	
EXPLORER DR.	CITY OF MISSISSAUGA	ROAD R.O.W.	600	-	TRANSITWAY	
EXPLORER DR. TO COMMERCE BLVD.	BAIF DEVP. LTD.	VACANT	16,960	-	-	
COMMERCE BLVD.	CITY OF MISSISSAUGA	ROAD R.O.W.	600	-	TRANSITWAY	
	BAIF	VACANT	17,120	-	GATEWAY	RENFORTH DRIVE
	CITY OF MISSISSAUGA	VACANT - R.O.W.	1,120	-	GATEWAY	RENFORTH DRIVE
	BAIF	VACANT	340	-	GATEWAY	RENFORTH DRIVE
	CITY OF MISSISSAUGA	EXISTING BUS LOOP	12,840	-	GATEWAY	RENFORTH DRIVE
SOUTH OF EGLINTON AVE.	MTO	ROAD RESERVE	-	2,775	KISS & RIDE	PARKING
	MULBERRY'S RESTAURANT	-	-	260	KISS & RIDE	PARKING
	ONTARIO HYDRO	-	-	12,300	KISS & RIDE	PARKING

FILE NAME: PRO REQ5

TABLE : SUMMARY OF PROPERTY REQUIREMENTS

SECTION	PROPERTY OWNER	PROPERTY REQ'D (m^2)		OWNER TOTAL (m^2)	SECTION TOTAL (m^2)
		PRIMARY	SECONDARY		
NINTH LINE TO MAVIS ROAD	M.T.O.	103,520	4,300	107,820	
	M.G.S.	198,020		198,020	
	ONTARIO HYDRO	7,590	104,150	111,740	
	CITY OF MISSISSAUGA		1,980	1,980	
	REGION OF PEEL		750	750	
	CP RAIL		260	260	
					420,570
MAVIS TO CAWTHRA	M.T.O.	74,870	33,150	115,620	
	M.G.S.	155,700		155,700	
	ONTARIO HYDRO	32,800	10,500	43,300	
	CITY OF MISSISSAUGA		32,600	32,600	
	HAMMERSON	27,300		27,300	
					366,920
CAWTHRA TO RENFORTH	M.G.S.	60,295		60,295	
	ONTARIO HYDRO	13,950	65,205	79,155	
	CITY OF MISSISSAUGA	30,155		30,155	
	JOHN McLENNAN	56,060	45,375	101,435	
	HEWLETT PACKARD	10,400		10,400	
	AIRPORT CORP. CENTRE	46,405		46,405	
	741299 ONT. LTD.	10,550		10,550	
	750274 ONT. LTD.	10,870		10,870	
	DODGE SUITES HOTEL	780		780	
	EGLINTON W. CORP. CENTRE	1,040		1,040	
	AIRPORT SQ. DEVELOPMENT	120		120	
	BAIF DEVELOPMENT LTD.	34,420		34,420	
	MULBERRY'S RESTAURANT		260	260	
	M.T.O.		2,775	2,775	
					388,660
TOTAL					1,176,150

APPENDIX 'U'

IMPACT OF TRANSITWAY ON PIPELINES

MISSISSAUGA TRANSITWAY PLANNING STUDY EA REPORT

APPENDIX U - IMPACT OF TRANSITWAY ON PIPELINES

Over the course of the Mississauga Transitway Planning Study, a great deal of information and design work related to the presence of several petroleum product pipelines within or adjacent to the proposed alignment occurred. The key issues which arose were compiled in a technical report for ease of review by the concerned agencies. This report is included in this Appendix, and forms part of the background to the Environmental Assessment Report.

MISSISSAUGA TRANSITWAY PLANNING STUDY

TECHNICAL REPORT

IMPACT OF TRANSITWAY ON PIPELINES

OCTOBER, 1991

IBI GROUP
McCORMICK RANKIN
M. M. DILLON

MISSISSAUGA TRANSITWAY PLANNING STUDY
IMPACT OF TRANSITWAY ON PIPELINES

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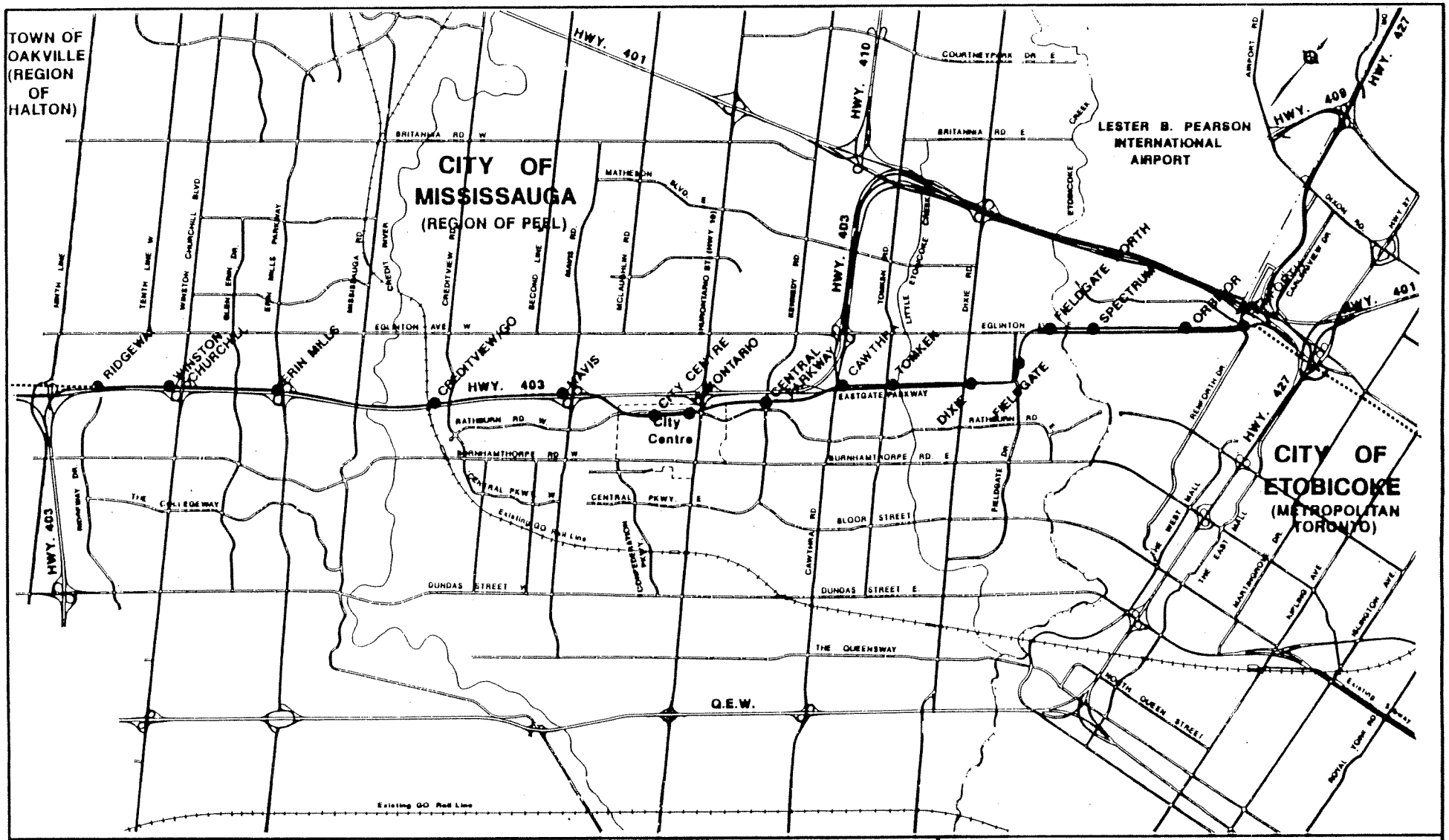
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MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

FIGURE 1

0 2,000 4,000 6,000m

SCALE 1:60,000 APPROX.

TRANSITWAY KEY PLAN

STATION — TRANSITWAY

..... FUTURE EXTERNAL LINK

PART I

1.0 INTRODUCTION

The purpose of this report is to resolve the conflicts occurring between pipeline locations and the proposed Mississauga Transitway alignment. Various pipeline relocations or pipeline lowerings and / or modifications to the station layout are presented and a recommended option proposed. The recommendations, based on discussions with each pipeline company, are summarized in Table 2.

2.0 PIPELINE COMPANIES

The pipeline companies within the Parkway Belt are:

- Imperial Oil (Esso) Sarnia Products Pipeline (SPPL)
- Sun-Canadian Pipeline Company Limited (SCPL)
- InterProvincial Pipeline Company (IPPL)
- Trans-Northern Pipeline Company (TNPL)

There is also a proposal to install a 36 inch diameter Consumers' Gas pipeline (CGPL) in the Parkway Belt West in the near future. (constructed fall 1991)

Existing Pipelines

The number and diameter of the existing pipelines and the proposed CGPL are listed below:

SPPL	10" diameter, high pressure
	12" diameter, high pressure
SCPL	12" diameter, high pressure
	8" diameter, high pressure
IPPL	30" diameter, high pressure
TNPL	10" diameter, high pressure
	20" diameter, high pressure
CGPL	36" diameter, high pressure

3.0 RELOCATION / LOWERING GUIDELINES

Some of the factors which have determined the preferred location of the transitway are presented below.

Ontario Hydro has advised that the transitway access roads can cross the designated hydro corridor but must not run longitudinally within the corridor. Also, station buildings must be located 4 - 6 metres outside the envelope defined by its electrical conductors.

The requirements of the pipeline companies that we have met with have been very consistent. They prefer:

- that the pipelines remain in their existing locations;
- that the transitway is not located adjacent to the pipelines for long stretches;

- that the pipelines are preferably not located in paved areas;

- that the FSB Guidelines be adhered to (Gas pipelines) as follows: pipelines should be aligned to provide a minimum setback of 20 metres from the centreline to any buildings intended for human occupancy. Where these distances are not reasonably attainable, the following measures must be implemented to reduce the minimum respective setbacks to 5 metres and 90 metres

  1. The use of Category II pipe with proven notch toughness characteristics as specified by CSA-Z184-M86.

  2. Minimum cover of at lease 1.5 metres over the pipeline.

  In instances where 1.5 metres of cover is not practicable, concrete slabs placed over the pipeline may be used as an alternative means to reduce the set backs.

  In addition, oil pipelines would generally adhere to this standard. A 15 m setback was initially required from the edge of an easement to a building intended for human occupancy and has been used as the guideline for this report. Later legislation has changed the guideline to a minimum setback of 20 metres from the centreline of pipe to any buildings intended for human occupancy. These guidelines may be reduced depending on the constraints at a particular location.

- that access to the pipeline for maintenance and repairs is maintained

The pipeline companies have also stated that only in cases where there is no possibility of the pipeline being relocated from station locations should the alternative of lowering the pipeline be entertained.

4.0 TYPICAL PIPELINE RELOCATION COSTS

The typical costs provided by the pipeline companies based on preliminary reviews were supplied for information and comparison only, they are intended only to reflect the relative costs of various alternatives. For the purposes of this report, it is assumed that the typical costs for each pipeline company will be based on Table 1 of the report.

The pipe lowering cost include the reuse of the existing pipe. The acquisition of new easements is not included in the above costs.

SCPL and SPPL provided preliminary cost estimates for pipeline relocations at particular locations within the Transitway corridor. These costs are based on preliminary alternatives prior to the pipeline report development and are indicated on the following pages.

IPPL has provided general cost estimates for stations affecting their pipeline location based on the recommended options within the pipeline report. Their costs are listed on the following pages.

MISSISSAUGA TRANSITWAY
SUMMARY OF PIPELINE COST ESTIMATES
TABLE 1

PIPELINE COMPANY	BASIS FOR COST ESTIMATES
Sarnia Products Pipeline (SPPL) 10" (250mm) 12" (300mm)	Pipe Relocation Cost: $ 40,000 / diameter - inch / mile; $ 24,000 / diameter - inch / km Pipe Lowering Cost: $ 25,000 / diameter - inch / mile; $ 15,000 / diameter - inch / km Road Boring: $ 100,000 - $ 150,000 / location Purging: $ 10,000 / location
Sun-Canadian Pipeline (SCPL) 8" (200mm) 12" (300mm)	Based on information provided for two typical station locations the following costs have been assumed. (Reference page 8,9) **Relocation** Eng. / Doc. + Purging + Removal / Install. + Bends + Boring + Contingency 15,000 + 10,000 + 460 / m + 2,000 ea. + 660 / m + 20% 15,000 + 10,000 + 515 / m + 2,000 ea. + 660 / m + 20% **Lowering** Eng. / Doc. + Excav. / Low. + Bends* + Contingency 15,000 + 380 / m + 20% 15,000 + 380 / m + 2,000 ea. + 20%
Trans-Northern Pipeline (TNPL) 10" (250mm) 20" (500mm)	No relocation / lowering costs have been provided. Size of the pipeline is similar to SCPL and the same costing approach will be used. **Relocation** Eng. / Doc. + Purging + Removal / Install. + Bends + Boring + Contingency 15,000 + 10,000 + 490 / m + 2,000 ea. + 660 / m + 20% 15,000 + 10,000 + 700 / m + 2,000 ea. + 660 / m + 20% **Lowering** Eng. / Doc. + Excav. / Low. + Bends* + Contingency 15,000 + 380 / m + 20% 15,000 + 450 / m + 2,000 ea. + 20%
Interprovincial Pipeline (IPPL) 30" (700mm)	IPPL has provided cost estimates for each station where pipeline conflicts occur. (Reference page 10)
Consumers Gas Pipeline (CGPL) 36" (915mm)	No relocation / lowering costs have been provided. Size and location of the pipeline are similar to IPPL and costs are assumed to be approximately the same at each station location. (Reference page 10)

FILE NAME: PIPLINE3.WK1

Esso Petroleum Canada

File: 15-40-1-6(A)
90-11-19

McCormick Rankin
2655 North Sheridan Way

Mississauga, Ontario
L5K 2P8

NOV 23 1990

Attention:Steve Schijns P.Eng.

Dear,Mr. Schijns

RE:Relocation Costs of Sarnia Products Pipeline
Mississauga Busway Study

Further to our meeting of today we have worked out some rough costs to relocate the Sarnia Products Pipelines and to lower them at the various points of potential encroachment with the referenced Busway project.

It should be noted that Imperial Oil Limited wishes the pipelines to be outside of the Busway station locations in all cases. The guidelines you were given at the meeting of 90/11/19 indicate that only in cases where no possibility of the pipeline being relocated from the station locations should the alternative of lowering the lines be entertained. Having the pipelines out of the stations provides extra safety for the pipeline and the busway users as well as giving extra flexibility for station design.

The cost of pipeline relocation has been calculated using a figure of, $35K / diameter inch / mile, plus, $10K / location, for nitrogen purging. The cost of a new easement was not included. Any road bores would cost from 100K$ to 150K$ depending on the length and obstructions encountered. Line lowering costs were arrived at by deleting the pipe cost from the relocation formula.

The approximate cost of relocation then, would amount to about $520K / km. total to relocate both the 12.75" pipe and the 10" pipe, plus the cost of any new easement rights and any road bores. Line lowering cost per km. would amount to approximately $320K.

These figures are provided for information and comparison purposes only. They are intended only to reflect the relative costs of various alternatives and are not intended to be an accurate cost estimate in themselves. These figures and this information is not intended as an endorsement by Imperial Oil Limited of any particular alternative or layout.

As we discussed, some of the sites which would require relocation of the pipelines and possible alternatives would be:

* Ridgeway Drive:
  Layout 1 - Busway in north of corridor
    a) 620 m. reroute, to south of stn. $325K
    (no road bore if Ridgeway not in place)
    b) 450 m. line lowering plus move concourse at least 15 m. off pipeline $150K + cost of relocating concourse.

  Layout 2 - Busway to south of corridor
    a) 450 m. relocate to north of stn. $250K
    (no road bore if Ridgeway not in place)

* Sir Winston Churchill Blvd.:
  Layout 1 - Busway in north of Corridor
    a) 690 m. reroute to north, + 1 Road bore $510K
    b) 450 m. line lowering + move concourse at least 15 meters north of pipeline $150K,+ cost of relocating concourse,
    c) 920 m. reroute to south, + 3 road bores $780K

  Layout 2 - Busway in south of Corridor
    a) 430 m. reroute to north, + 1 Road Bore $370K

* Mississauga Road Station
    a) 700 m. reroute, to the north of the stn. $365K + creek crossing.
    b) 500 m. line lowering. $200K + creek crossing

* Tomken Road
    a) 300 m. reroute to north of parking road $160K
    b) move parking area and entrance road south, off of pipelines.

* Dixie Road
    a) Move the road south of the towers and lower the line for 500 m. $170K

* Renforth Drive
    a) 450 m. reroute to south of parking area $250K
    b) 450 m. line lowering. $150K

Rough sketches of the station sites are enclosed for your information.

These reroutes and lowerings are in addition to the remainder of the alterations we discussed for the stations at our meeting of 90/11/19. I hope these are of use to you in your decisions. Call me if you have any questions.

Yours Truly;

R Parks

Ralph Parks, Landman

cc. R. Graham - SPPL
S. Schijns - McCormick Rankin
C. Bishop - M.M. Dillon

Sun-Canadian Pipeline

Mississauga Road
Proposed Relocation to Suit Busway Parking

Reference dwg: McCormick Rankin Sheet 3N
Relocation Length: dwg scaled- 335 m, use **350 m** for estimate
Road Crossing: Mississauga Road, **30 m** Boring req'd

Cost Estimate:

Engineering & documentation, Permits, easement approvals	15,000	
Drain pipeline, transport product	10,000	
		25,000
Purchase new pipe		
200 mm dia. x 350 m @ 81/m	28,000	
200 mm coating @ 31/m	11,000	
300 mm dia. x 350 m @ 126/m	44,000	
300 mm coating @ 41/m	14,500	
Special order long radius Bent pipe(from Montreal)	13,000	
		110,500
Contractor installation of pipe c/w backfill and clean-up		
$200/m x 350m x 2	140,000	
X-Ray welded joints	8,000	
Boring Road Crossing	20,000	
Mullet Creek crossing	5,000	
		173,000
Removal of pipe:		
Crane $150/hr x 60 hrs	9,000	
Transport pipe	2,000	
Strip existing pipelines:		
Excavator @ $100/hr x 80 hrs	8,000	
Labours 4 @ $35/hr x 80 hrs	11,000	
Supervisor 1 @ $50/hr x 80 hrs	4,000	
Survey installation, as-built dwgs:	5,000	
		39,000
Estimate Subtotal		347,500
Contingency (20%)		69,500
Total Relocation Estimate, say		$ 420,000

1990-12-03

PL

Sun-Canadian Pipeline

Winston Churchill Blvd.
Proposed Relocation to Suit Busway Parking

Reference dwg: McCormick Rankin Sheet 4N
Relocation Length: dwg scaled - 185 m, use **200 m** for estimate
Road Crossing: Winston Churchill Blvd. - **30 m** Boring req'd

Cost Estimate:

Engineering & documentation, Permits, easement approvals	15,000	
Drain pipeline, transport product	6,000	
		21,000
Purchase new pipe		
200 mm dia. x 200 m @ 81/m	16,200	
200 mm coating @ 31/m	6,200	
300 mm dia. x 200 m @ 126/m	25,200	
300 mm coating @ 41/m	8,200	
Special order long radius Bent pipe(from Montreal)	10,000	
		65,800
Contractor installation of pipe c/w backfill and clean-up		
$200/m x 200m x 2	80,000	
X-Ray welded joints	5,000	
Boring Road Crossing	20,000	
		105,000
Removal of pipe:		
Crane $150/hr x 30 hrs	4,500	
Transport pipe	1,000	
Strip existing pipelines:		
Excavator @ $100/hr x 50 hrs	5,000	
Labours 4 @ $35/hr x 50 hrs	7,000	
Supervisor 1 @ $50/hr x 50 hrs	2,500	
Survey installation, as-built dwgs:	4,000	
		24,000
Estimate Subtotal		215,800
Contingency (20%)		43,000
Total Relocation Estimate, say		**$ 260,000**

1990-12-03

PL

Interprovincial Pipeline

Summary of Estimated Costs for Mississuaga Busway Proposal

Operation	Station	IPL Estimate
Rerouting	Erin Mills	$628,100
	Mavis	$1,063,200
	Tomken	$776,400
	Dixie	$1,084,900
	Sub-Total	$3,552,600
Lowering	Glen Erin	$385,400
	Creditview	$429,400
	Fieldgate	$393,800
	Sub-Total	$1,208,600
	Total	$4,761,200

5.0 PIPELINE COMPANY RESPONSES

The pipeline companies have reviewed the preliminary Impact on Transitway on Pipelines report (January 1991) and submitted their responses to the suggested options at each station. Part VI of this report contains the review letters. A summary of the review comments are as follows:

Interprovincial Pipeline (IPPL) Response: July 22, 1991

- IPPL will be changing the material carried by the pipeline at present and discussions are ongoing. At present the pipeline is nitrogen filled and any possible re-routing or lowering would be significantly less expensive at this time.
- General cost estimates for each station.

Sarnia Products Pipeline (SPPL) Response: March 3, 1991

- Locating pipelines within the busy areas of the Transitway may create difficulty with continued maintenance required.
- Construction costs could escalate due to crossings of other utilities and factory made bends which may be required for some lowerings and other design costs.
- General stations comments.

Trans-Northern Pipelines Inc. (TNPL) Response: January 31, 1991

- Costs in the report should consider the congested working conditions found in various areas.
- Costs could escalate in terms of superimposed loads associated with traffic loading, settlement stresses, earth pressures.
- General comments regarding the stations at Cawthra Road, Tomken Road, Fieldgate Drive, Renforth / Hydro corridor.

Sun Canadian Pipeline (SCPL) Response: February 1991 (telephone)

- No additional concerns regarding the pipeline location outside of their initial comments.
- Initial comments indicated pipelines required minimum cover of 1.2 m and lowering or possible relocation may be required at various stations.

Consumers Gas (CGPL) Response: February 11, 1991

- The realignment of the proposed gas pipeline onto Ontario Hydro lands will be subject to approval and Consumers Gas would be agreeable to all realignments with Ontario Hydro's approval.
- Consumers Gas pipeline will be subject to relocation at the time of Transitway construction.
- City of Mississauga was present at Ontario Energy Board hearings re: Consumers Gas pipeline approval.
- Approval was granted by OEB; construction of Consumers Gas pipeline is now underway.

The raised costs and alignment recommendations have been added to each of the station sections. Table 2 identifies and summarizes the lowerings, relocations and costs recommended for each station.

MISSISSAUGA TRANSITWAY
SUMMARY TABLE OF PIPELINE LOWERINGS / RELOCATIONS
TABLE 2

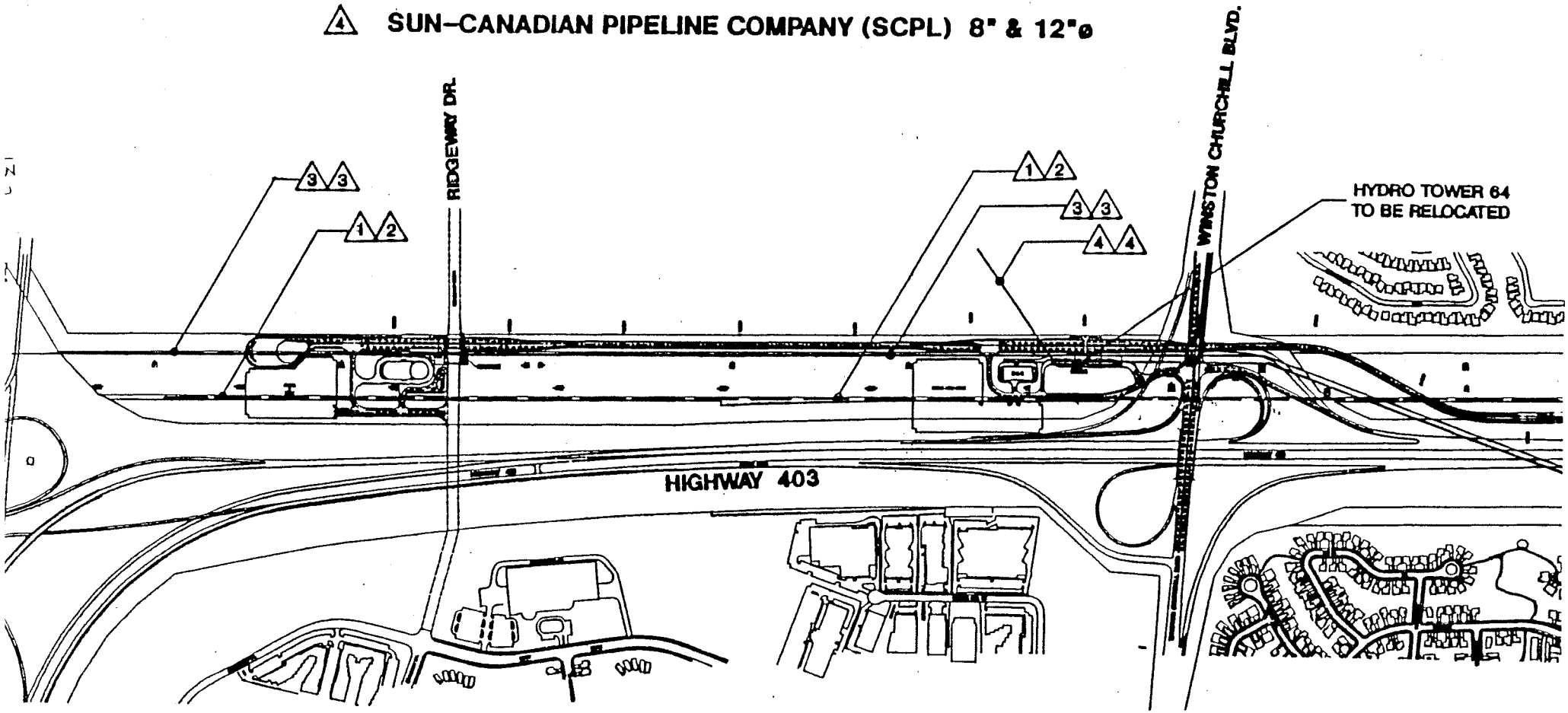
PIPELINE / STATION	SPPL		SCPL		IPPL	TNPL		CGPL	TOTAL COST
	10"	12"	12"	8"	30"	10"	20"	36"	
RIDGEWAY	relocate	relocate	-	-	-	-	-	-	$360,000
WINSTON CHURCHILL	relocate	relocate	relocate	relocate	-	-	-	-	$515,000
ERIN MILLS	-	-	-	-	relocate	-	-	relocate	$1,250,000
MISSISSAUGA	relocate	relocate	relocate	relocate	-	-	-	-	$745,000
CREDITVIEW	-	-	-	lower	-	-	-	lower	$860,000
MAVIS	-	-	-	lower	relocate	-	-	lower	$2,175,000
CAWTHRA	lower	lower	lower	lower	lower	-	lower	lower	$1,125,000
TOMKEN	relocate	relocate	relocate	relocate	relocate	relocate	relocate	relocate	$2,250,000
DIXIE	-	-	-	-	relocate	-	-	relocate	$1,690,000
FIELDGATE	lower	lower	lower	lower	lower	lower	lower	-	$1,815,000
RENFORTH	-	-	-	-	-	-	-	-	-
TOTAL									$12,785,000

SPPL - Sarnia Products Pipeline
SCPL - Sun Canadian Pipeline
IPPL - Interprovincial Pipeline
TNPL - Trans Northern Pipeline
CGPL - Consumers Gas Pipeline

PART II
RIDGEWAY DRIVE TO CREDITVIEW ROAD
IBI GROUP

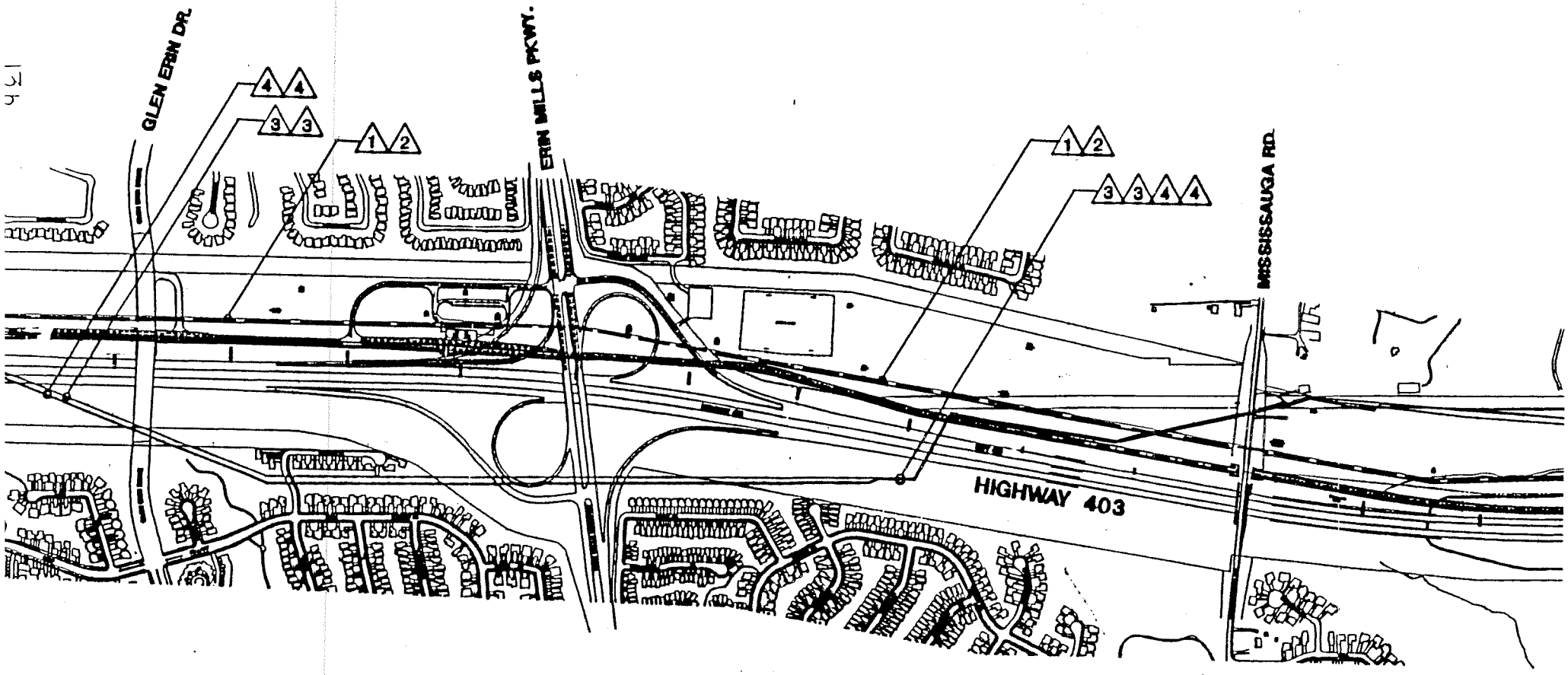
PIPELINE LEGEND

1. CONSUMERS GAS PIPELINE (CGPL) 36"ø
2. INTERPROVINCIAL PIPELINE COMPANY (IPPL) 30"ø
3. SARNIA PRODUCTS PIPELINE (SPPL) 10" & 12"ø
4. SUN–CANADIAN PIPELINE COMPANY (SCPL) 8" & 12"ø



PIPELINE LEGEND

1. CONSUMERS GAS PIPELINE (CGPL) 36"ø
2. INTERPROVINCIAL PIPELINE COMPANY (IPPL) 30"ø
3. SARNIA PRODUCTS PIPELINE (SPPL) 10" & 12"ø
4. SUN–CANADIAN PIPELINE COMPANY (SCPL) 8" & 12"ø

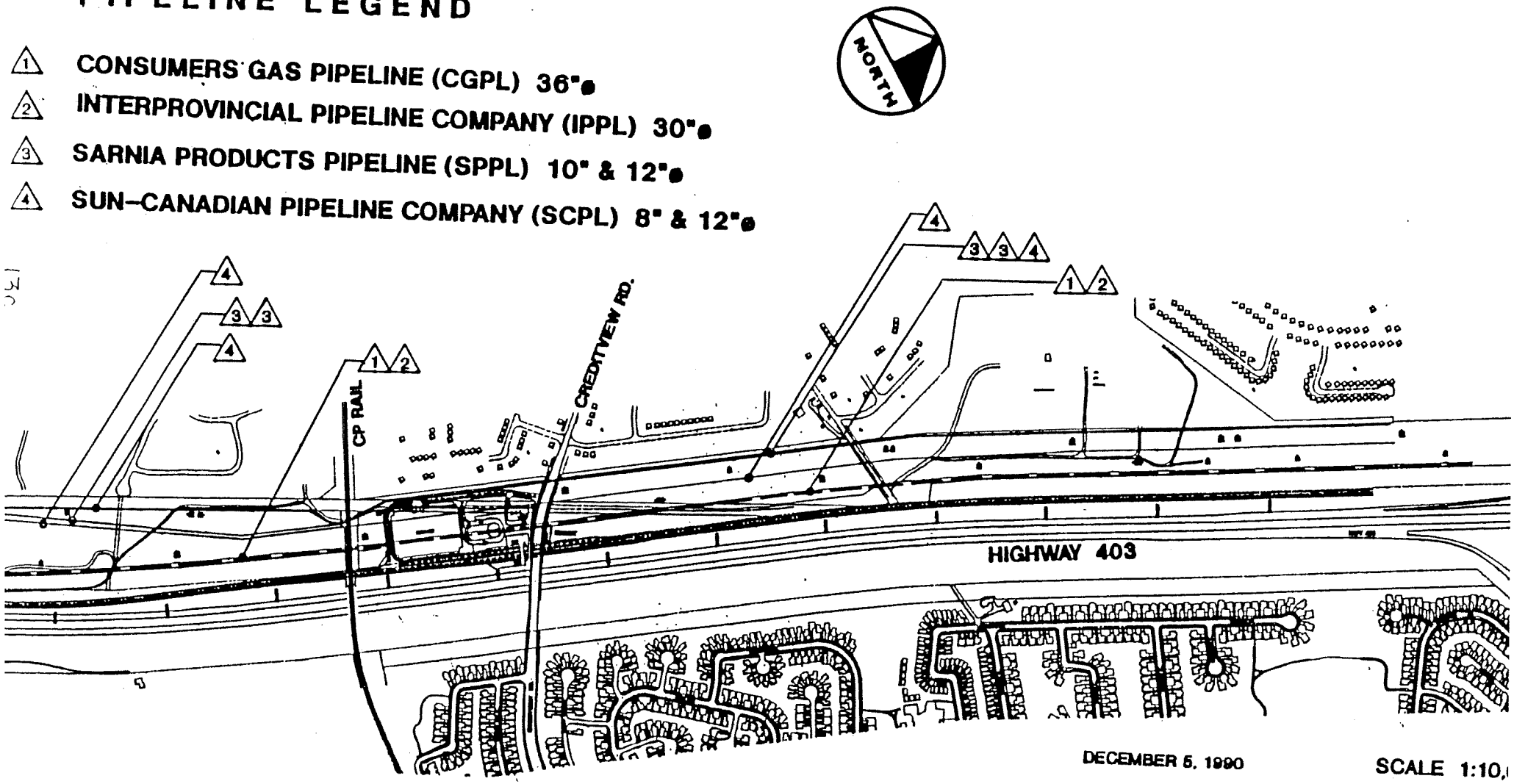


EXISTING PIPELINES

EXHIBIT 1

PIPELINE LEGEND

1. CONSUMERS GAS PIPELINE (CGPL) 36"ø
2. INTERPROVINCIAL PIPELINE COMPANY (IPPL) 30"ø
3. SARNIA PRODUCTS PIPELINE (SPPL) 10" & 12"ø
4. SUN–CANADIAN PIPELINE COMPANY (SCPL) 8" & 12"ø



DECEMBER 5, 1990

SCALE 1:10,

6. RIDGEWAY DRIVE STATION

The pipelines which are in conflict with the transitway and station in this area are:

- SPPL 10" & 12" diameter
- IPPL 30" diameter
- CGPL (proposed) 36" diameter

The Sun-Canadian pipeline is not in the transitway and station areas at this location.

6.1 EXISTING GRADE

It is proposed that the grade of the Parkway Belt be maintained as close as possible to the existing grade. Because the existing grades will be maintained, IPPL and CGPL can be maintained in their existing locations. However, SPPL will require relocation.

6.2 EXISTING LOCATION

Through the station area, the existing SPPL is just south of the designated transit corridor. It runs through the station building and is parallel to the transitway. The relocation options are indicated on Exhibit 2.

6.3 OPTIONS

Option 1

In this option, SPPL is relocated south of the park and ride and kiss and ride areas of the station. This removes the pipeline totally outside the construction and operational areas of the station.

Option 2

In this option, SPPL is relocated south of the station building (approximately 15 metres away). In this location it will cross the bus and kiss and ride areas. This option will place the pipeline inside the designated hydro corridor. The pipeline will be accessible for maintenance and repairs.

Option 3

In this option, SPPL would remain in its existing location. The station building would be located south of the transitway and the kiss and ride areas would be modified accordingly. A covered walkway and/or pedestrian tunnel will be required to connect the station building to the transitway. The difficulties with this option are, the station building would be located under the hydro conductors and the station. Therefore, this option will not be pursued.

Option 4

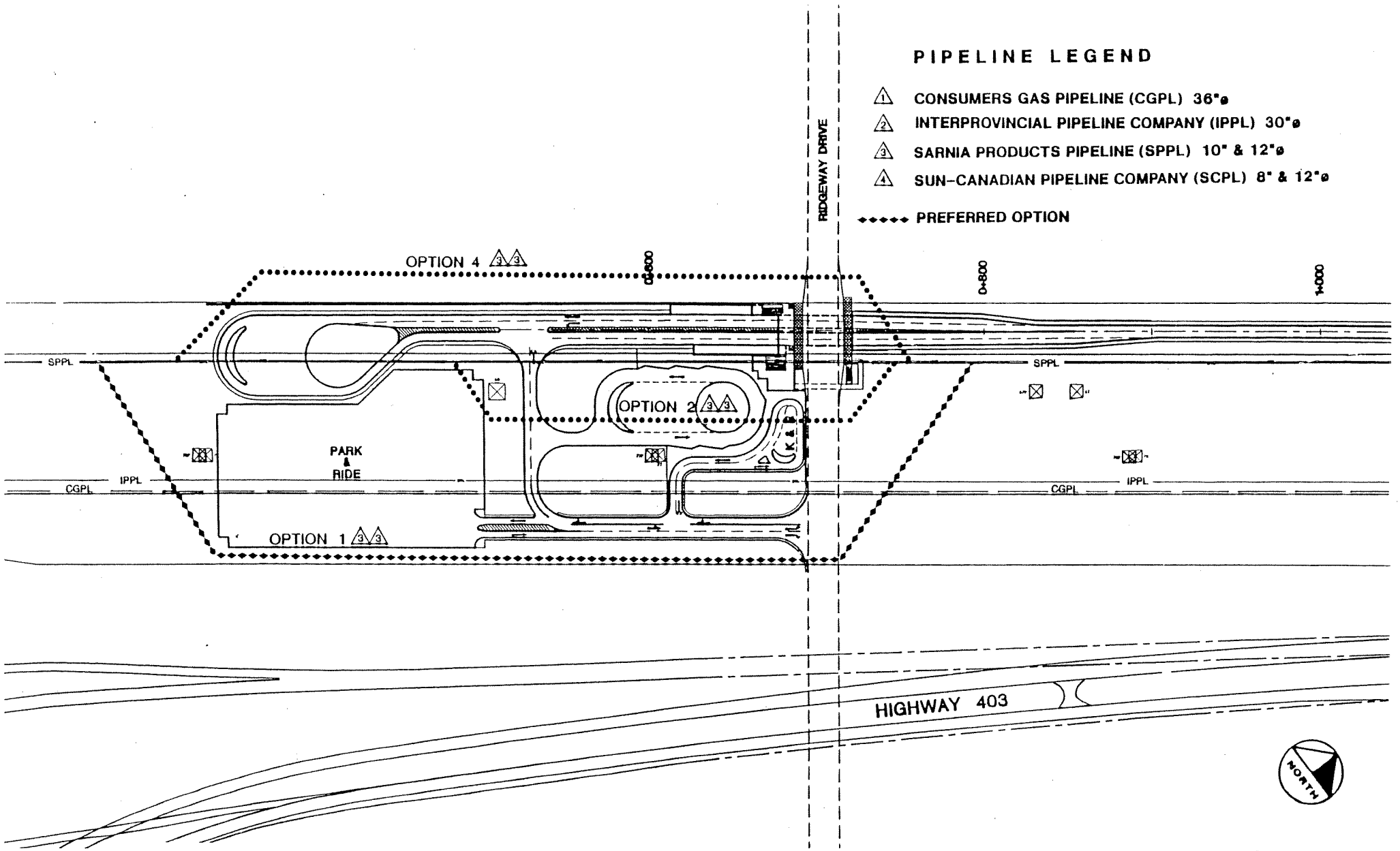
In this option, the pipeline is relocated to the north of the transitway outside the limits of the Parkway Belt.

ESTIMATED COST

Option	Relocation	Purging	Estimated Cost
	$	$	$
1	338,000	20,000	358,000
2	153,000	20,000	173,000
4	269,300	20,000	289,300

6.4 RECOMMENDATION

Option 1 is recommended. It removes SPPL to an area away from the station building and the pipeline is accessible for maintenance and repairs. This option will require new easements across the Hydro corridor.



RIDGEWAY DRIVE STATION

EXHIBIT 2

7. WINSTON CHURCHILL STATION

The pipelines which are in conflict with the transitway and station are:

SCPL	8" & 12" diameter
SPPL	10" & 12" diameter
IPPL	30" diameter
CGPL	(proposed) 36" diameter

7.1 EXISTING GRADE

It is proposed that the grade of the Parkway Belt be maintained as close as possible to the existing grade. Because the existing grade will be maintained, the existing location of IPPL and proposed CGPL will also be maintained. SPPL and SCPL will require relocation.

7.2 EXISTING LOCATION

SPPL and SCPL are located south of the transitway and run parallel to it. SCPL crosses the transitway at the west end of the station and heads off in a westerly direction. The options are indicated on Exhibit 3.

7.3 OPTIONS

Option 1

In this option, SCPL and SPPL are relocated south of the park and ride and kiss and ride areas. West of the park and ride areas, SCPL crosses the transitway to re-connect to the existing SCPL. This option could impact on the operation of Highway 403 NW ramp.

Option 2

In this option, SCPL and SPPL are relocated to the north of the transitway outside the limits of the Parkway Belt.

Option 3

In this option SCPL and SPPL are re-routed between the transitway and the transitway access road. This area will primarily be a landscaped area. SPPL re-connects to the existing pipeline at the west end of the station and SCPL re-connects to the existing SCPL north of the Transitway.

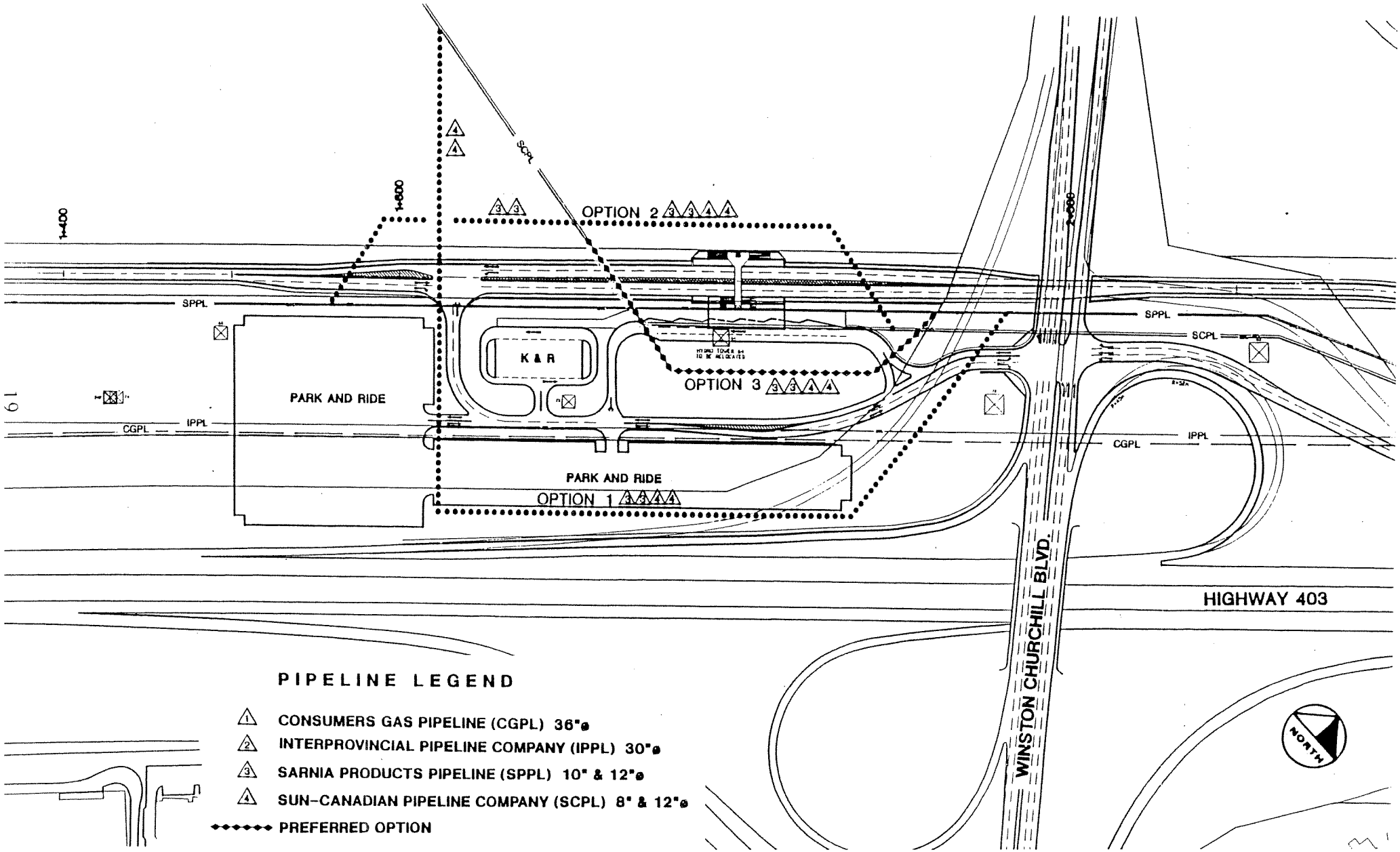
7.4 ESTIMATED COST

The estimate cost of the options described above are:

Option	Relocation $	Estimated Cost $
1	1,179,000	1,179,000
2	594,800	594,800
3	514,000	514,000

7.5 RECOMMENDATION

Option 3 is the recommended option. Pipeline rerouting is required over a shorter distance than Option 1 and the pipeline is removed from direct conflict with the station and its operation. The pipeline in its proposed new location will be accessible for maintenance and repairs without unduly affecting the operation of the station. This option will also require a new easement in the Hydro corridor.



WINSTON CHURCHILL BLVD. STATION

EXHIBIT 3

8. ERIN MILLS PARKWAY STATION

The pipelines which are in conflict with the transitway and station are:

IPPL	30" diameter
CGPL	36" diameter

SCPL and SPPL are not in the transitway and station areas at this location.

8.1 EXISTING GRADE

It is proposed that the Parkway Belt grade be maintained as close as possible to the existing grade.

8.2 EXISTING LOCATION

IPPL and CGPL are located between the station building and local busbay area. The proximity of the hydro corridor to the transitway and the location of the Highway 403 NW ramp, limit the flexibility with respect to locating the station building. See Exhibit 4.

Additionally, the transitway elevation at the station is approximately 12 metres below the grade of Erin Mills parkway because of the necessity to get under the Highway 403 SW circular ramp. This results in grade differences of approximately 8 metres between the local busbay area and the station platform area. The net result is a building with a footprint similar to the building indicated on Exhibit 5.

8.3 OPTION

At this location, we propose that IPPL and CGPL be relocated to a location north of its existing location to provide the necessary 15 metre clearance from the building. Both pipelines will have to be lowered to cross under the transitway access road. CGPL should be installed at its final elevation at the transitway access road.

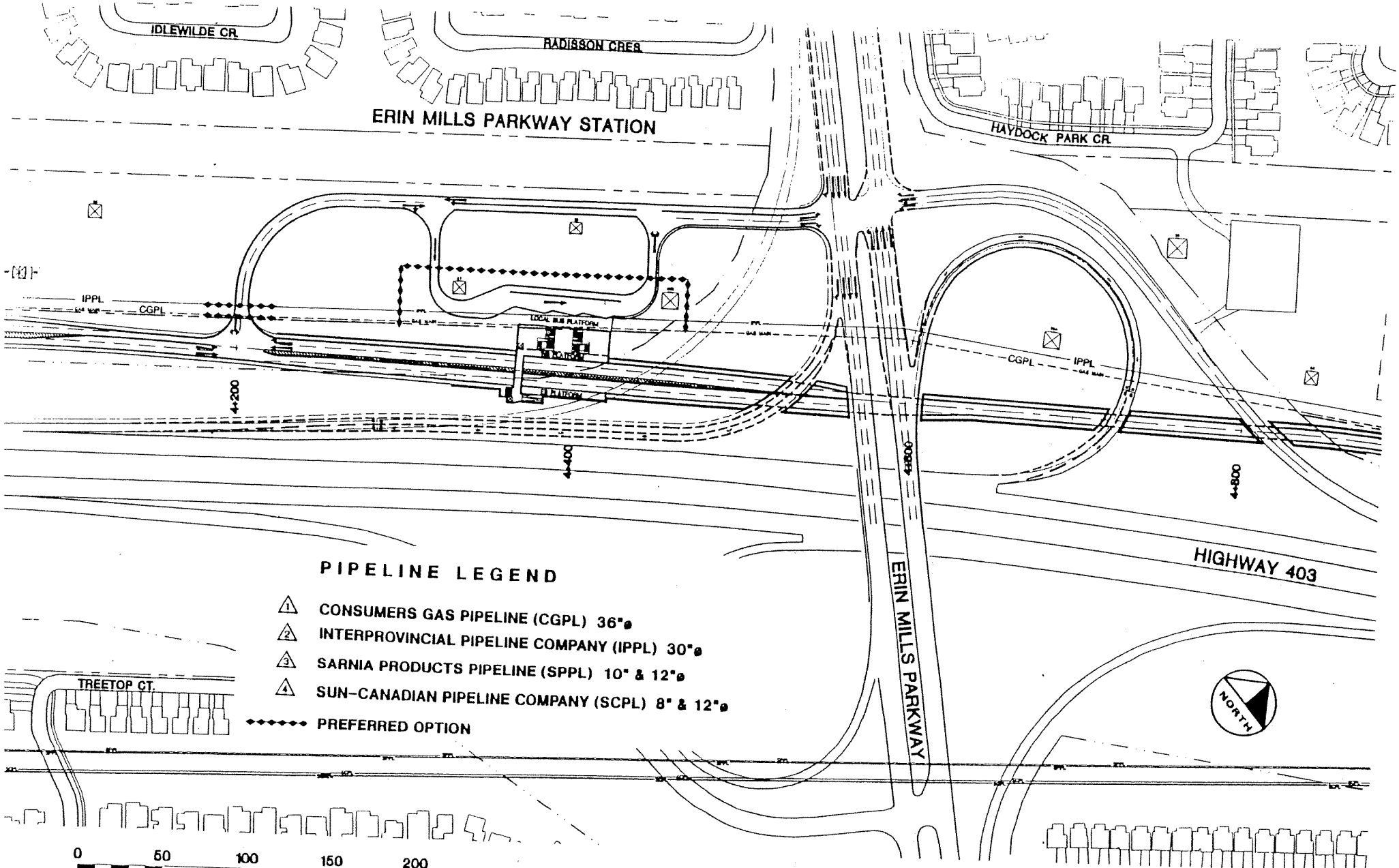
8.4 ESTIMATED COST

The estimated cost is as follows:

Relocation	**Estimated Cost**
$	**$**
1,256,200	1,256,200

8.5 RECOMMENDATION

The recommendation is that IPPL and CGPL be relocated as described above. This option requires a new easement in the Hydro corridor.



ERIN MILLS PARKWAY STATION

EXHIBIT 4

9. MISSISSAUGA ROAD

The pipelines which are in conflict with the transitway are:

- SCPL 8" and 12" diameter
- SPPL 10" and 12" diameter
- IPPL 30" diameter
- CPGL (proposed) 36" diameter

9.1 EXISTING GRADE

It is proposed that the grade of the Parkway Belt be maintained as close as possible to the existing.

9.2 EXISTING LOCATION

Because the existing grade will be maintained, it is proposed that IPPL and CGPL remain in their existing location. See Exhibit 5.

9.3 OPTION

Relocate SPPL and SCPL starting south of the Transitway. The pipelines cross the transitway and run parallel but removed from the Transtiway to tie into the existing pipelines west of Mississauga Road.

9.4 ESTIMATED COST

The estimated cost is as follows:

Relocation	**Estimated Cost**
742,000	742,000

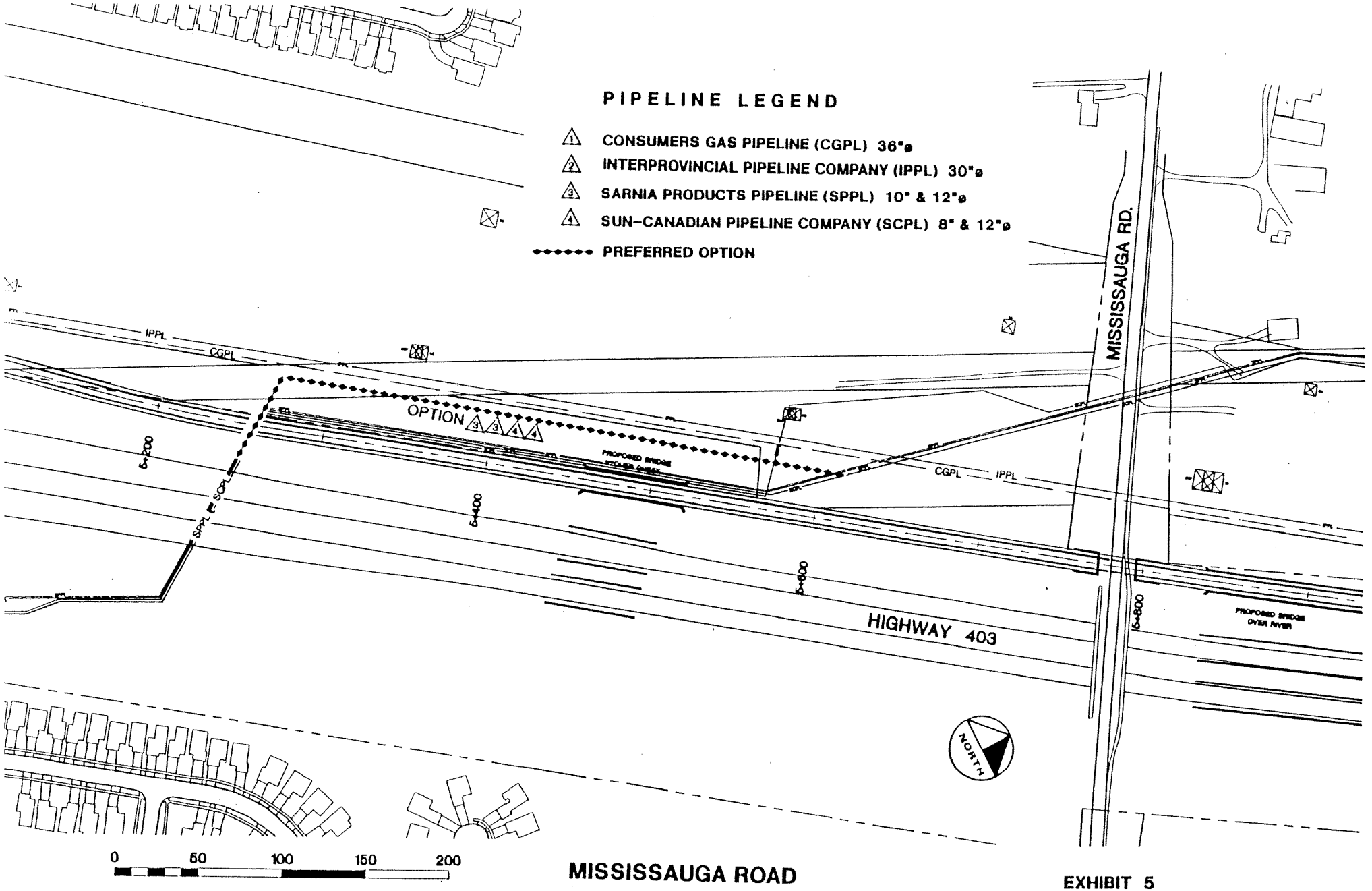
9.5 RECOMMENDATION

Relocate SPPL and SCPL as detailed above. IPPL and CGPL are to remain in their existing locations.

10. CREDITVIEW ROAD STATION

The pipelines which are in conflict with the transitway and station are:

- SCPL 8" and 12" diameter
- SPPL 10" and 12" diameter
- IPPL 30" diameter
- CGPL (proposed) 36" diameter



MISSISSAUGA ROAD

EXHIBIT 5

10.1 EXISTING GRADE

It is proposed that the existing grade at the Parkway belt be maintained as close as possible to the existing.

10.2 EXISTING LOCATION

The existing pipelines are located between the transitway and transitway access road except for SCPL (8") and SPPL (10" & 12") which are located north of the transitway access road.

10.3 OPTION

The option recommended is to locate the access road and station building so that the pipelines can be accommodated on their existing alignment. IPPL and CGPL will require lowering in order to pass under the transitway access road. See Exhibit 6.

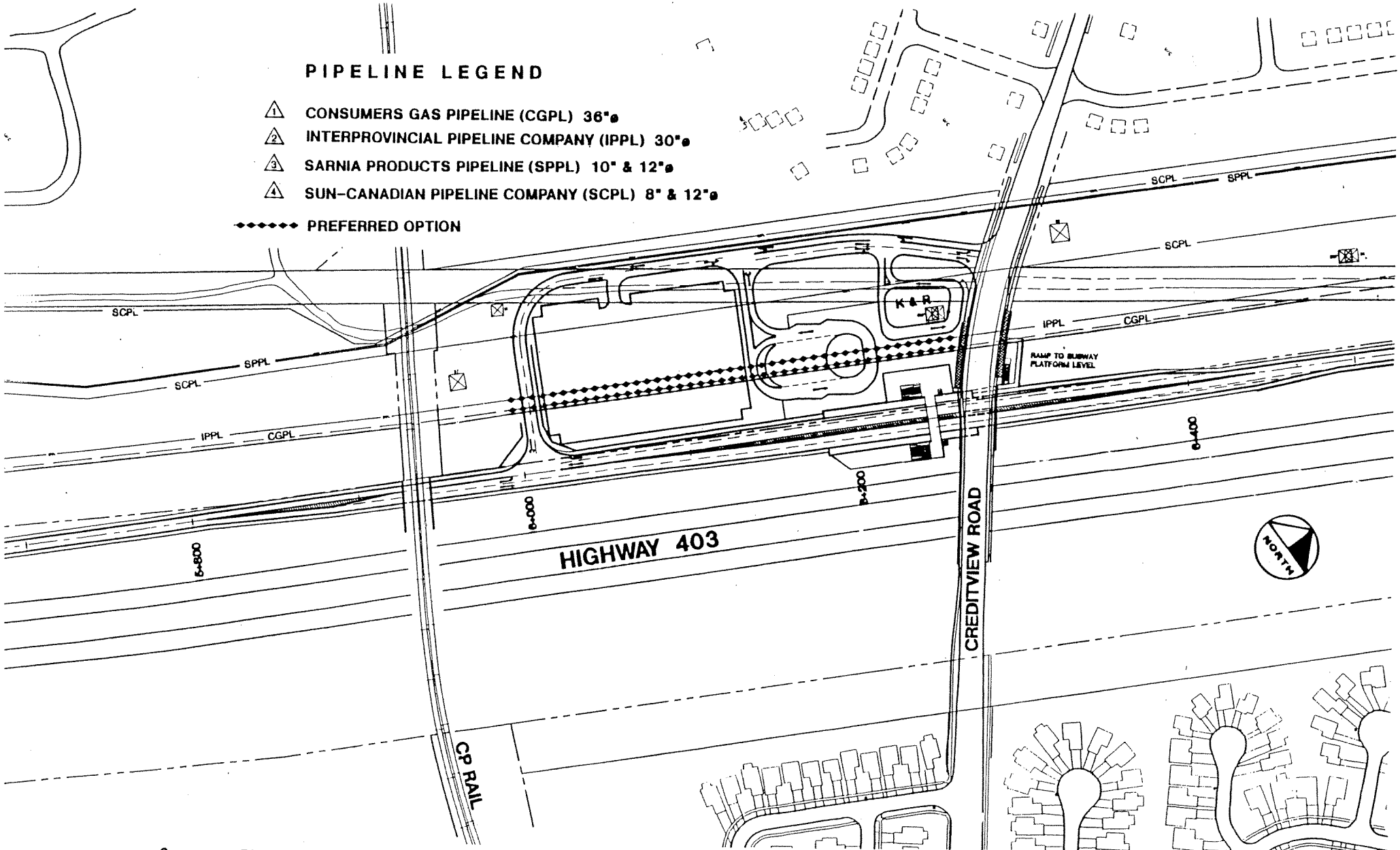
10.4 ESTIMATED COST

The only cost attributed to this option is the lowering of IPPL and CGPL to pass under the transitway access road and is as follows:

Lowering	**Estimated Cost**
$	**$**
858,800	858,800

10.5 RECOMMENDATION

It is recommended that other than the lowering discussed above that the pipelines remain on their existing alignment.



CREDITVIEW ROAD STATION

EXHIBIT 6

11. SUMMARY

The distance between Ridgeway Drive and Creditview Road is approximately 6,300 metres. Along this length, the number of relocations have been kept to the minimum. The number and length of relocations and lowerings and the estimated costs are as follows:

	Relocation		Lowering		Estimated
	No.	Length m	No.	Length m	Cost $
CGPL	1	310	1	270	1,057,500
IPPL	1	310	1	270	1,057,500
SPPL	3	1280	-	-	749,200
SCPL	2	750	-	-	$865,200
					$3,729,400

The CGPL estimated cost assumes lowering and relocation after installation on their preferred alignment. These costs can be obviated if CPGL are given sufficient layout information so that there is no requirement for relocation or lowering of CGPL when the transitway is constructed.

PART III
MAVIS ROAD TO CAWTHRA ROAD
McCORMICK RANKIN

11.0 MAVIS ROAD STATION

Conflicts

The pipelines which are in possible conflict with the Transitway and stations in this area are:

- SPPL 10" and 12" diameter
- SCPL 12" and 8" diameter
- IPPL 30" diameter
- CGPL 36" diameter (proposed)

Existing Grade

It is proposed that the grade of the Parkway Belt be maintained as close as possible to the existing area.

Two areas at the Mavis station may cause conflicts with the pipelines. The proposed north / south end of the Bus only access road and the station location may possibly present problems for the existing pipeline locations.

Options

Option 1 (Exhibit 8)

SPPL - lowering at 10" diameter and 12" diameter pipelines at Mavis Entrance

SCPL - lowering the 12" diameter pipeline at Mavis entrance
- lowering the 8" diameter pipeline to enable passage under the Bus only entrance to platform

IPPL - relocation of 30" diameter pipeline to north side of kiss and ride and resume existing alignment east of E-N/S ramp

CGPL - incorporate into profile, lower at Bus only roadway

Option 2 (Exhibit 9)

SPPL - lowering 10" diameter and 12" diameter pipelines at Mavis entrance

SCPL - lowering the 12" diameter pipeline at Mavis entrance
- lowering the 8" diameter pipeline to enable passage under the Bus only entrance to platform

IPPL - relocation at 30" diameter pipeline to middle of Ontario Hydro right-of-way (south of SCPL) and resume existing alignment east of E-N/S ramp

CGPL - construct 36" diameter pipeline along north boundary of utility corridor; (along southern boundary of Ontario Hydro right-of-way) divert into middle of Ontario Hydro right-of-way at Mavis Station and resume south side alignment east of E-N/S ramp.

Option 3 (Exhibit 10)

SPPL - lowering at 10" diameter and 12" diameter pipelines at Mavis entrance

SCPL - lowering the 12" diameter pipeline at Mavis entrance
- lowering the 8" diameter pipeline to enable passage under the Bus only entrance to platform

IPPL - lowering of 30" diameter pipeline at Bus only ramp; divert north parallel to existing line east of Mavis Station and resume present alignment east of E-N/S ramp.

CGPL - relocation of 36" diameter pipeline along southern boundary of Ontario Hydro right-of-way; divert into middle of Ontario Hydro right-of-way at Mavis Station and resume south side alignment east of E-N/S ramp

Option 4 (Exhibit 10A)

SPPL - both 10" diameter and 12" diameter pipelines would remain at the same elevation

SCPL - maintain same elevation of 12" diameter pipeline at Mavis
- lowering of 8" diameter pipeline to enable passage under the Bus only entrance to platform

IPPL - relocation of 30" diameter pipeline to median strip located at the centre line of the Transitway. Resume existing alignment east of Mavis.

CGPL - Maintain proposed alignment in 3 m corridor, adjust to maintain alignment in Transitway median

Estimated Cost

The estimated cost of the options that have been considered are:

Option	Relocation	Lowering	Purging	Estimated Cost
1	$2,130,000	$ 140,000	$ 20,000	$2,290,000
2	$2,130,000	$ 140,000	$ 20,000	$2,290,000
3	$2,130,000	$ 140,000	$ 20,000	$2,290,000
4	$1,065,000	$1,110,000		$2,175,000

Analysis and Recommendations

Following a review of the report by the pipeline companies, Option 2 Option was replaced with Option 4. Option 4 was developed to reflect the revisions made to the CGPL alignment and comments received from each pipeline company. Adjustment to the entrance roadway profile will eliminate the need for lowering any of the SPPL lines and the one SCPL line.

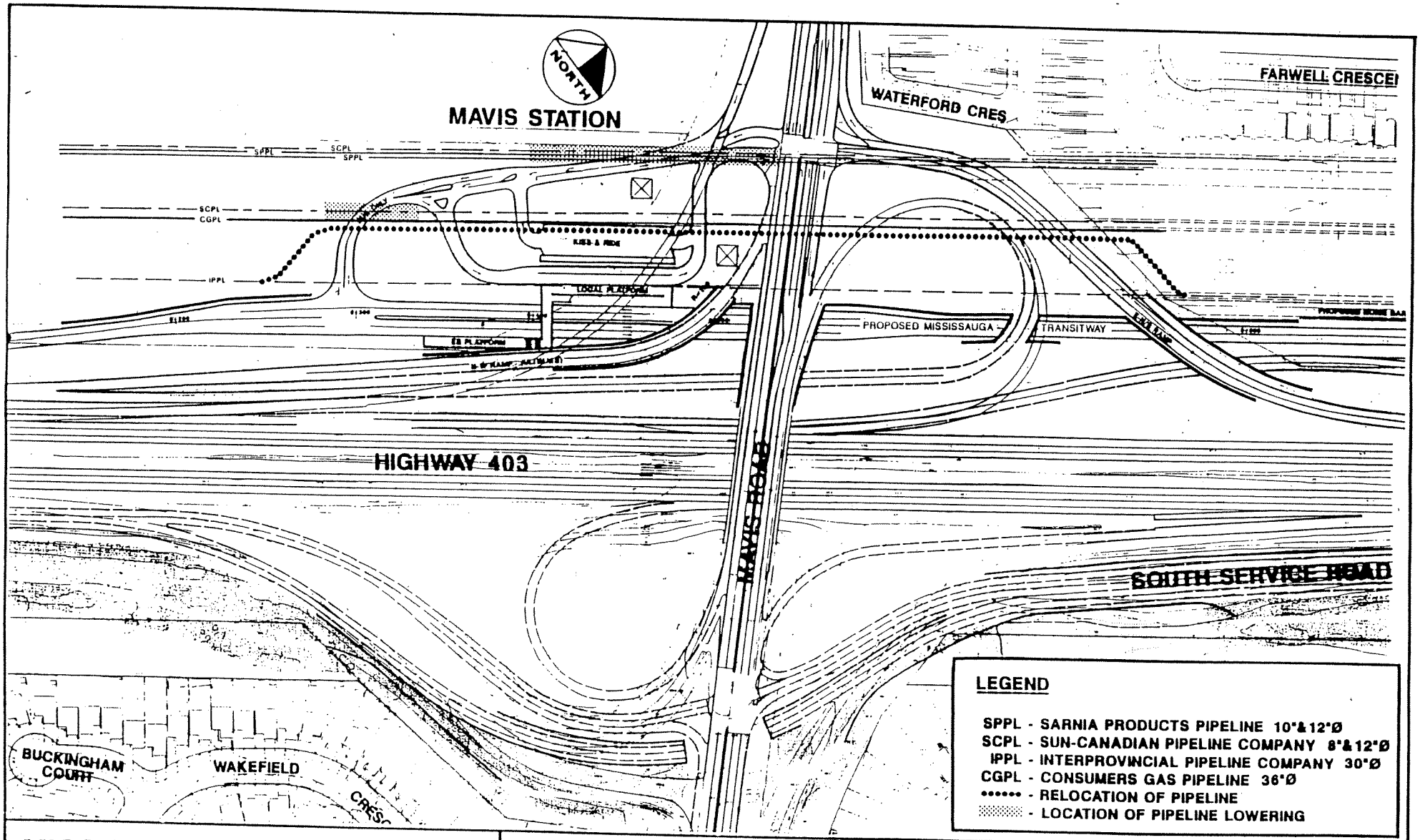
Option 4 recommends re-routing IPPL south of the proposed station location. This alignment would reduce any conflicts caused by possible station adjustments or minor busway alignment variations. The proposed pipeline alignment would run parallel to the Consumers Gas pipeline and would provide better access to the line. The recommended option and cost are summarized in Table 2.

The new proposal for the CGPL would reduce the concerns Ontario Hydro has regarding the alignment of pipelines in the middle of the right-of-way. The issue concerning Hydro Mississauga's pole alignment has been resolved with the revised alignment and approval by Ontario Hydro was confirmed.

SUMMARY TABLE RECOMMENDED OPTION (4)
MAVIS STATION
TABLE 2

PIPELINE COMPANY	PIPELINE LOCATION	POSSIBLE CONFLICT LOCATION	RECOMMENDED OPTION	COSTS (000's)
Sarnia Products Pipeline (SPPL) Nov. 19, 1990 (Ralph Parks) (Ron Graham)	- 1 - 10" Pipeline - 1 - 12" Pipeline - North portion of the Ontario Hydro right-of-way.	Road Crossings - Access road Mavis entrance (110m) (2 lines)	- Adjust access road elevation to avoid lowering	
Sun-Canadian Pipeline (SCPL) Dec. 6, 1990 (Paul Lane) (George Moore)	- 1 - 12" Pipeline - 1 - 8" Pipeline - 50' Easement from west end of study limits to just west of Hwy. 10. - 20' Easement east of Hwy. 10. - North portion of the Ontario Hydro right-of-way.	Road Crossings - Access roads Mavis entrance (110m) Platform entrance (60m)	- Adjust access road elevation to avoid lowering - Lowering of Pipeline at platform entrance	45
Interprovincial Pipeline (IPPL) Nov. 8, 1990 (Alex Ramsay)	- 1 - 30" Pipeline - 10' Easement south portion of the Ontario Hydro right-of-way. - North portion of the Ontario Hydro right-of-way east of Central Pkwy.	Road Crossings - Access road Bus only ramp (30m) Station location (115m)	- Relocation of Pipeline - Adjust to maintain alignment within Transitway median	1,065
Consumers Gas Pipeline (CGPL) Oct. 26,1990 (Tom Ladanyi)	- 1 - 36" Pipeline - 3m Easement south portion of the Ontario Hydro right-of-way.	Road Crossings - Station location (115m)	- Relocation of Pipeline - Adjust to maintain alignment within Transitway median	1,065
			Total	2,175

FILE NAME: PIPLINE1.WK1



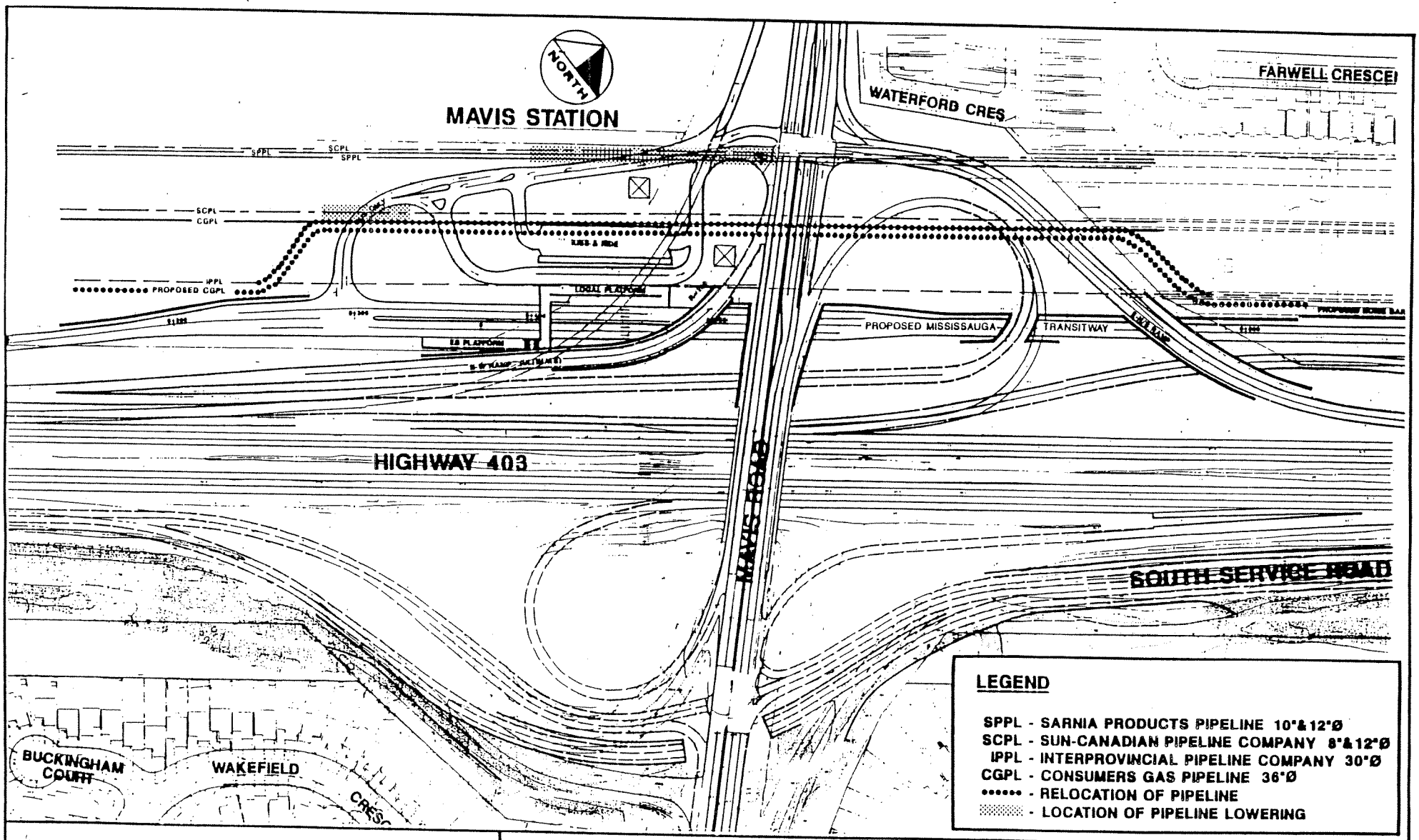
MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT 8

0 100 200

SCALE 1:2000

MAVIS STATION
(OPTION 1)



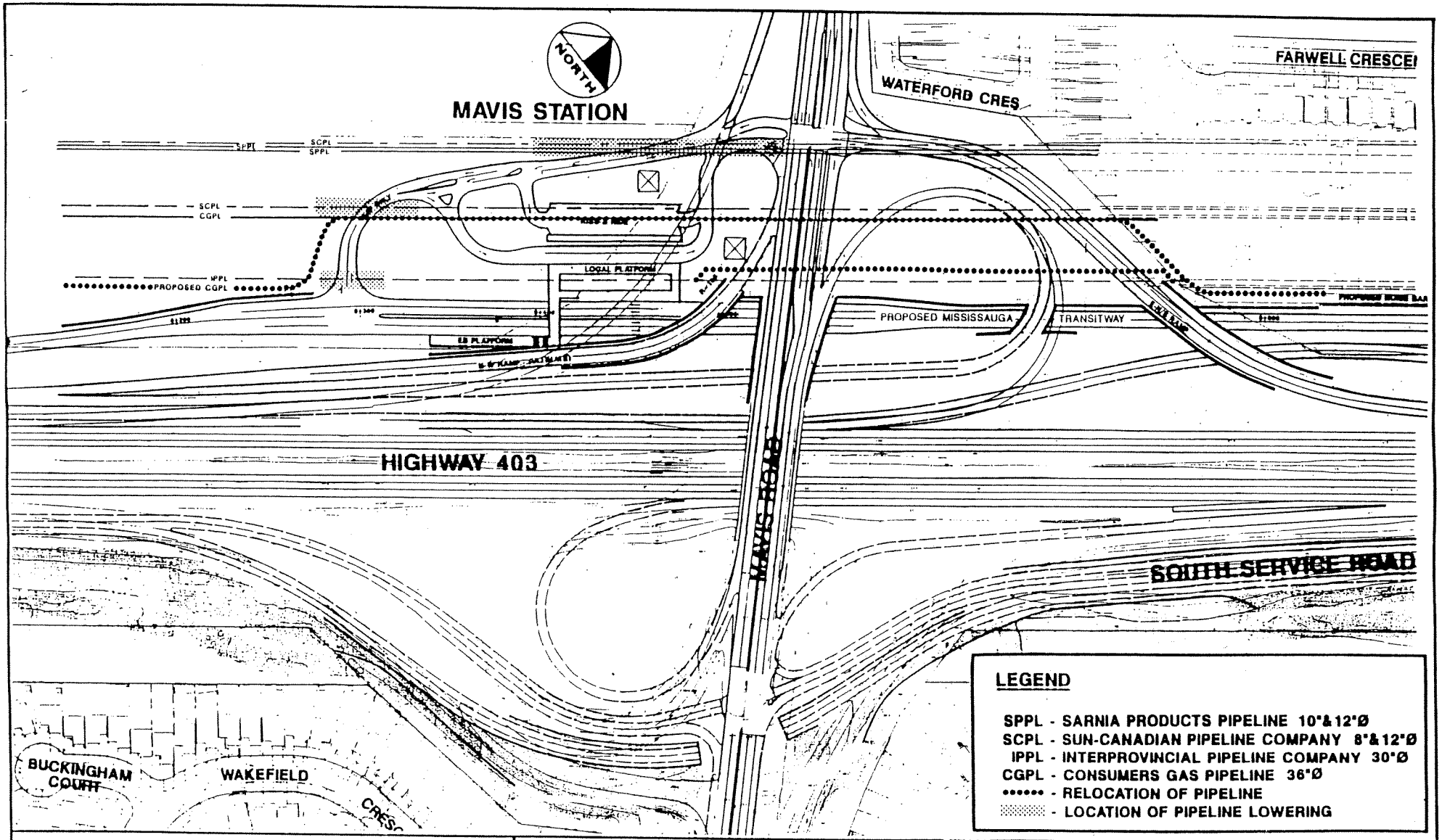
MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT 9

0 100 200

SCALE 1:2000

MAVIS STATION
(OPTION 2)



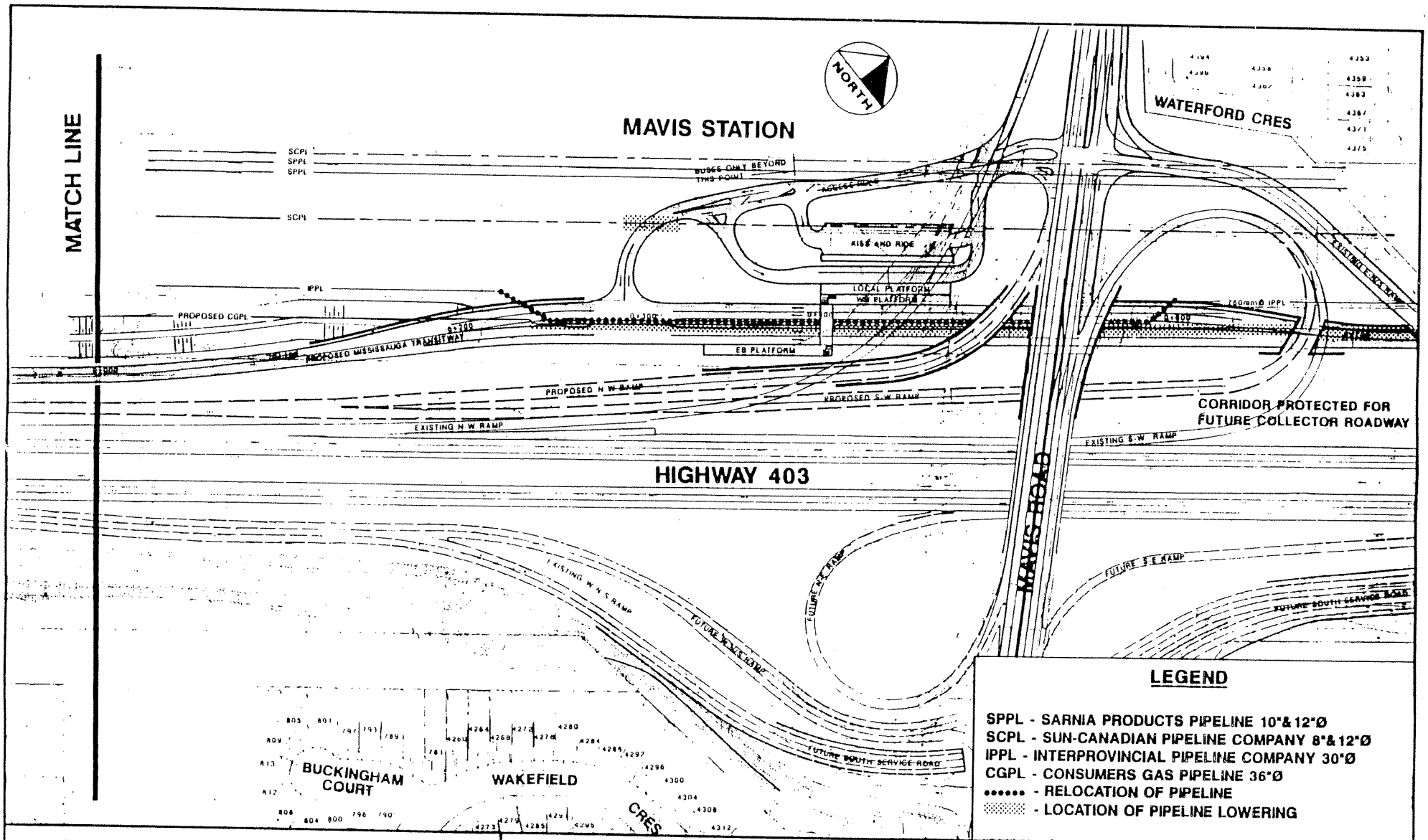
MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT 10

0 100 200

SCALE 1:2000

MAVIS STATION
(OPTION 3)



LEGEND

SPPL - SARNIA PRODUCTS PIPELINE 10"&12"Ø
SCPL - SUN-CANADIAN PIPELINE COMPANY 8"&12"Ø
IPPL - INTERPROVINCIAL PIPELINE COMPANY 30"Ø
CGPL - CONSUMERS GAS PIPELINE 36"Ø
•••••• - RELOCATION OF PIPELINE
▒▒▒ - LOCATION OF PIPELINE LOWERING

MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT **10A**

0 50 100 150 200m
SCALE 1:2000

MAVIS STATION (OPTION 4)

12.0 CAWTHRA ROAD STATION

Conflicts

The pipelines which are in possible conflict with the Transitway and station in this area are:

- SPPL 10" and 12" diameter
- SCPL 12" and 8" diameter
- IPPL 30" diameter
- CGPL 36" diameter (proposed)
- TNPL 20" diameter

Existing Grade

It is proposed that the grade of the Parkway Belt be maintained as close as possible to the existing elevation. When applicable enough cover will be maintained over all of the existing pipelines to avoid the need for their lowering or relocation. In certain areas the pipelines may have to be lowered to accommodate the proposed access roads.

The station access road from Cawthra southbound would cross the proposed CGPL alignment at a grade lower than existing ground.

Options

Option 1 (Exhibit 11)

CGPL - relocate 36" diameter pipeline from proposed alignment to north of Cawthra station and resume proposed alignment east of station

TNPL - lower 20" diameter pipeline at Transitway crossing

Option 2 (Exhibit 12)

CGPL - relocate 36" diameter pipeline along south side of corridor; divert north of Cawthra station and resume alignment along south side alignment

TNPL - lower 20" diameter pipeline at Transitway crossing

Option 3 (Exhibit 13)

CGPL - retain proposed 36" diameter pipeline alignment and adjust profiles accordingly

TNPL - lower 20" diameter pipeline at Transitway crossing

Option 4 (Exhibit 13A)

SPPL - lower 10" and 12" diameter pipeline at ramp crossing and proposed access roads

SCPL - lower 12" and 8" diameter pipelines at ramp crossing and proposed access roads

IPPL - lower 30" diameter pipeline at ramp crossing and proposed access road

TNPL - lower 20" diameter pipeline at Transitway crossing

CGPL - lower 36" diameter pipeline at Cawthra Road

Estimated Cost

No cost estimate was originally assigned to the first three options because it was believed the station design would be able to accommodate the pipeline. Recent changes in the station design have resulted in the development of a fourth option.

Option	Relocation	Lowering	Purging	Estimated Cost
1	-	-	-	-
2	-	-	-	-
3	-	-	-	-
4	-	$1,085,000	$ 40,000	1,125,000

Recommendation

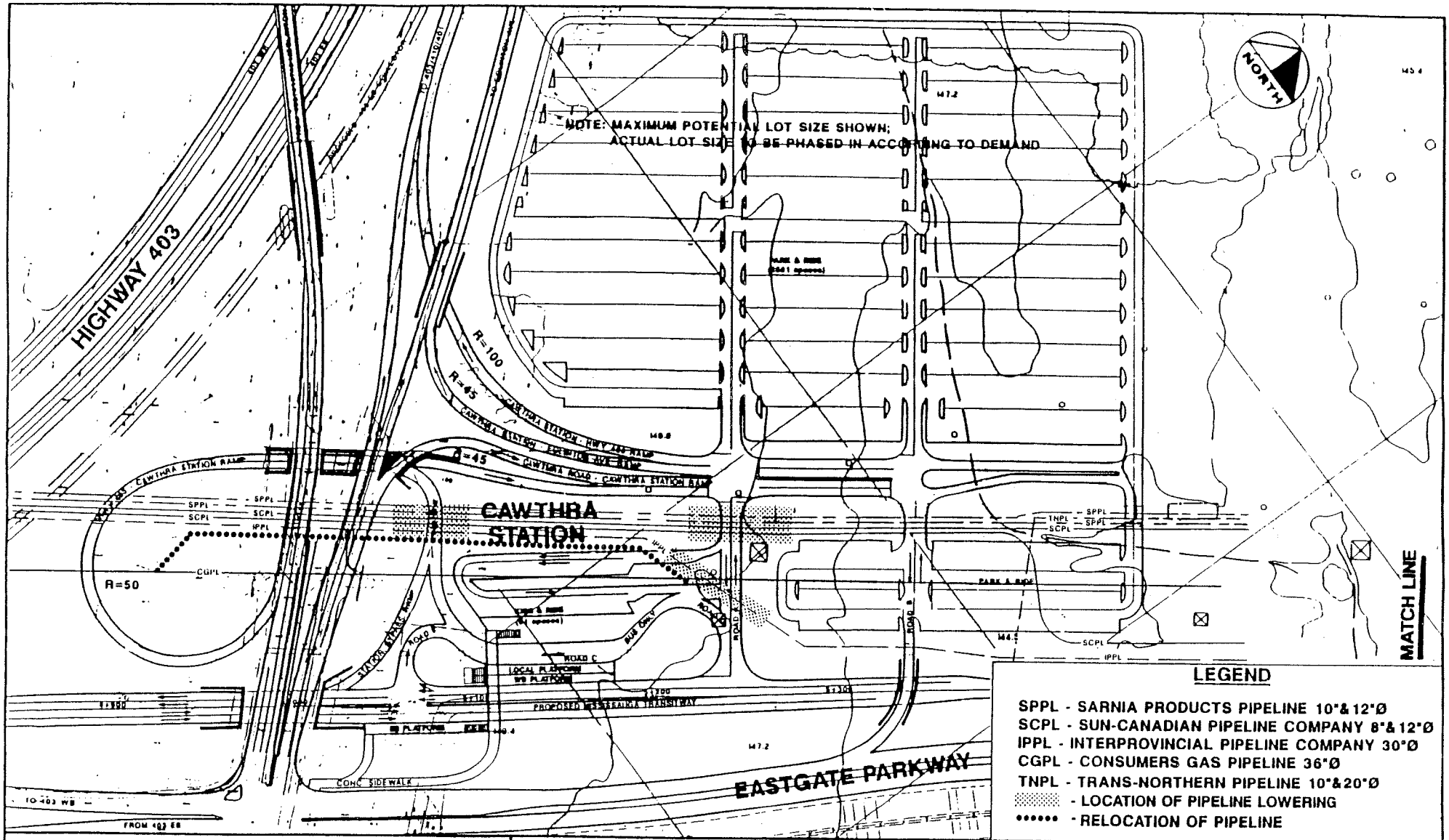
Option 4 was developed to reflect the changes in station design and pipeline realignment by Consumers Gas. The new station design would require the lowering of SPPL, SCPL and IPPL at various access roadways. Trans-Northern pipelines would have to be lowered across the transitway. The CGPL alignment has been confirmed with Ontario Hydro and its proposed route would require lowering at Cawthra Road to accommodate the proposed underpass.

SUMMARY TABLE RECOMMENDED OPTION
CAWTHRA STATION

TABLE 3

PIPELINE COMPANY	PIPELINE LOCATION	POSSIBLE CONFLICT LOCATION	RECOMMENDED OPTION	COSTS (000's)
Sarnia Products Pipeline (SPPL) Nov. 19, 1990 (Ralph Parks) (Ron Graham)	- 1 - 10" Pipeline - 1 - 12" Pipeline - North portion of the Ontario Hydro right-of-way.	- Access roads	- Lower	55
Trans-Northern Pipeline (TNPL) (Mitch Glass)	- 1 - 20" Pipeline - North portion of the Ontario Hydro right-of-way. East of Cawthra Station	- Transit roadway	- Lower at Transitway	55
Sun-Canadian Pipeline (SCPL) Dec. 6, 1990 (Paul Lane) (George Moore)	- 1 - 12" Pipeline - 1 - 8" Pipeline - 50' Easement from west end of study limits to just west of Hwy. 10. - 20' Easement east of Hwy. 10. - North portion of the Ontario Hydro right-of-way.	- Access roads	- Lower	165
Interprovincial Pipeline (IPL) Nov. 8, 1990 (Alex Ramsay)	- 1 - 30" Pipeline - 10' Easement south portion of the Ontario Hydro right-of-way. - North portion of the Ontario Hydro right-of-way east of Central Pkwy.	- Access roads	- Maintain existing elevation - Lower	400
Consumers Gas Pipeline (CGPL) Oct. 26,1990 (Tom Ladanyi)	- 1 - 36" Pipeline - 3m Easement south portion of the Ontario Hydro right-of-way.	- Cawthra Road	- Incorporate into profile / alignment design - Lower	450
			Total	1,125

FILE NAME: PIPLINE2.WK1



MISSISSAUGA TRANSITWAY

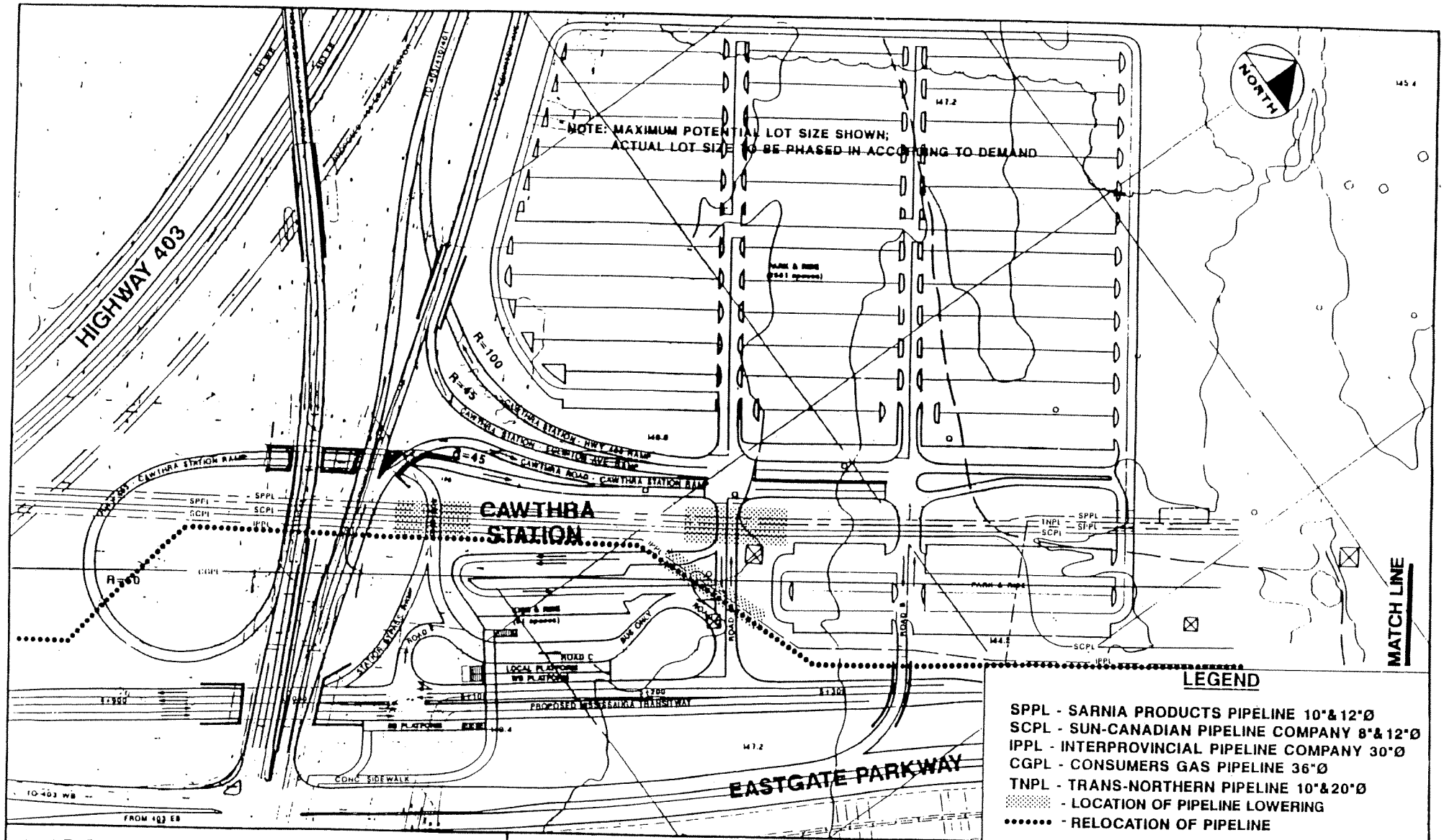
FUNCTIONAL PLANNING STUDY

EXHIBIT 11

0 50 100 150 200m

SCALE 1:2000

CAWTHRA STATION (OPTION 1)



MISSISSAUGA TRANSITWAY

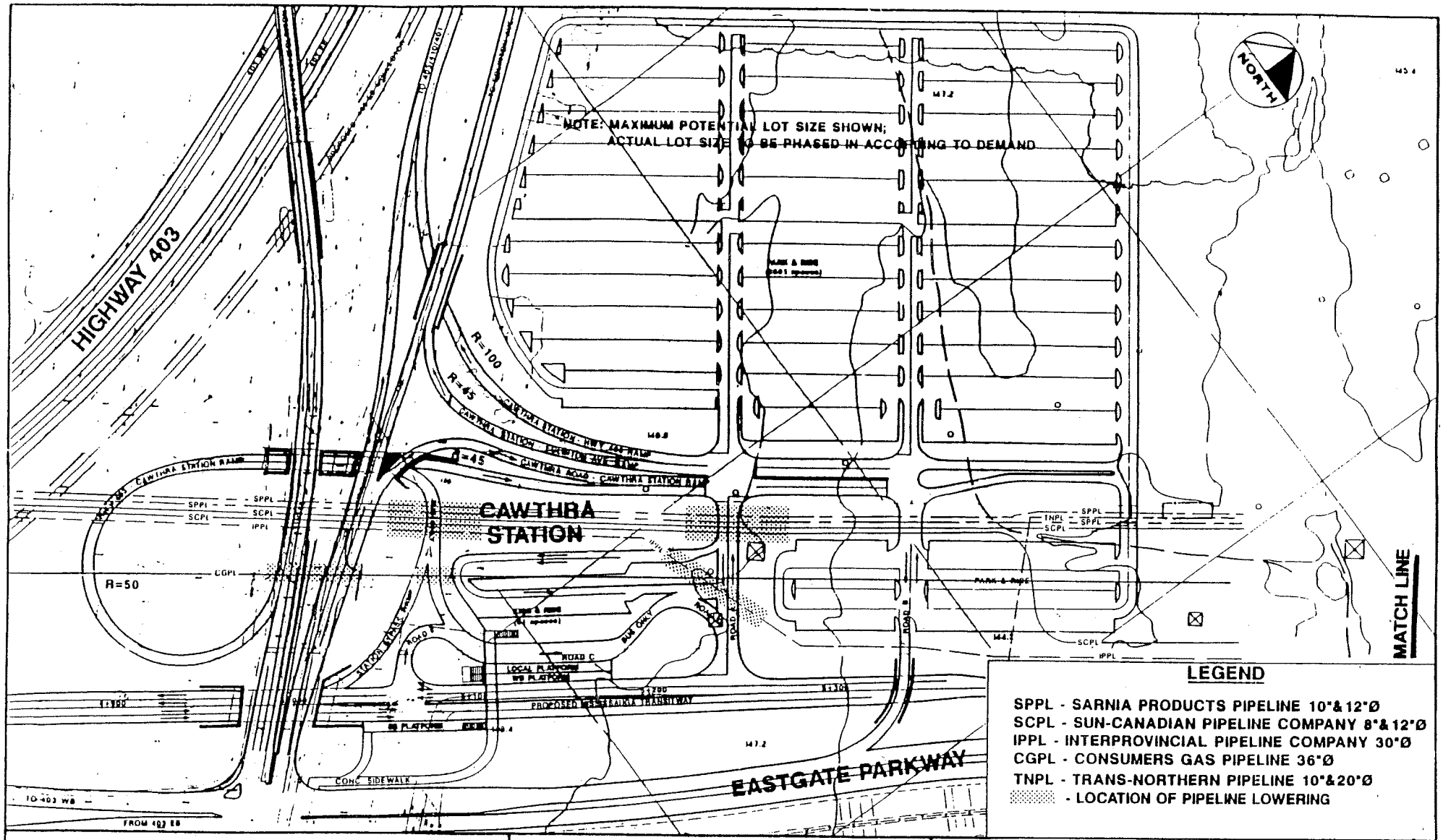
FUNCTIONAL PLANNING STUDY

EXHIBIT 12

0 50 100 150 200m

SCALE 1:2000

CAWTHRA STATION (OPTION 2)



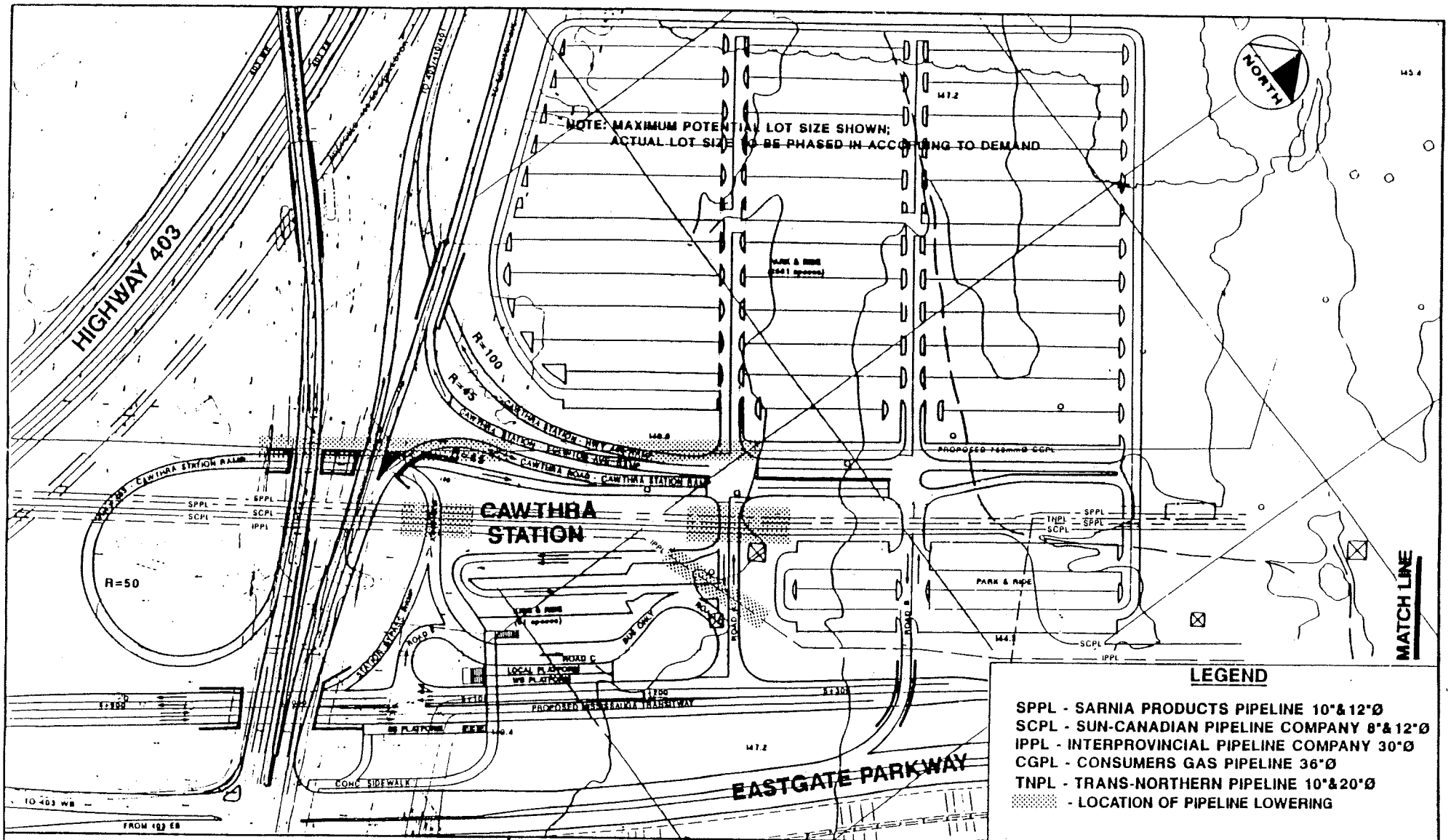
MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT 13

0 50 100 150 200m

SCALE 1:2000

CAWTHRA STATION (OPTION 3)



MISSISSAUGA TRANSITWAY
FUNCTIONAL PLANNING STUDY

EXHIBIT **13A**

0 50 100 150 200m

SCALE 1:2000

CAWTHRA STATION (OPTION 4)

PART IV
TOMKEN ROAD TO RENFORTH DRIVE
M. M. DILLON

INTRODUCTION TO M.M. DILLON SECTION

The following section outlines the busway implications for the pipelines in the Parkway Belt - East Section from Tomken Road to Renforth Drive. Initial options and costs were based on unit costs provided by the pipeline companies. Following the review of the first draft recommendations, comments were provided by the pipeline companies indicating where adjustments should be made and suggesting that the cost estimate were somewhat low. In view of those comments, the cost figures were revised. The following outlines the new cost assumptions that were used.

Initial pipe relocation and lowering costs used were $24,000/diameter-inch/km and $15,000/diameter-inch/km respectively. After receiving comments from the affected pipeline companies, the cost estimate for pipe relocation was revised for each pipeline company according to Table 1.

It was assumed that purging would be required for each pipe relocation. Road boring costs varied for each pipeline company as described in Table 1.

13. TOMKEN ROAD STATION

The pipelines which are in conflict with the busway and station in this area are:

- SPPL 12" and 10" diameter;
- TPL 10" and 20" diameter;
- SCPL 8" and 12" diameter;
- IPPL 30" diameter; and
- CGPL proposed 36" diameter.

Existing Grade

Although it is proposed that the grade of the Parkway Belt be maintained as close as possible to the existing, it will be necessary to lower the access road grade to provide a reasonable transition to the busway. For this reason, and due to conflicts in the station area, all pipelines will require some adjustment.

Options

There are two problems associated with the design and layout of this station:

a) grade conflicts; and
b) proximity conflicts.

The access road to the bus loop and busway is located above or immediately adjacent to the SPPL, TPL and SCPL pipelines. It is possible to relocate the roadway to the north to avoid this conflict. However, the grade of the access roadways is to be lowered from the Parkway grade, and the pipelines will have to be lowered where they cross the roadways to provide sufficient cover.

The proposed CGPL line has been relocated from the original alignment near the bus platform and station to a point south of the northern tower line. The pipeline does, however, still cross the busway access road at its lowest point as well as the bus loop access roads. It was suggested that CGPL consider jogging their alignment at a point east of the busway access road to avoid a deep profile. It appears from the final drawings that this has been done. Therefore, no costs have been added for the CGPL line. In addition, it is suggested that at the bus loop access

crossing the pipeline be positioned at least one metre below normal profile to allow for the future grade of the roadways.

In the station area, the IPPL 30" line, the TNP 20" line and the SCPL 12" line come in close proximity to the station stairways. With the limited space available between the Hydro corridor and the 403 arterial, it is impossible to provide the suggested 15 metre clearance between the pipelines and station buildings.

By realigning the station and stairways, it is possible to provide a six to nine metre clearance for the TNP and SCPL lines, respectively. The IPPL line has only a one to two metre clearance and will have to be relocated in any event. Therefore, if the proposed spacing is acceptable, only the IPPL line will have to be moved. If it is not acceptable, all three lines should be located in a corridor adjacent to the proposed CGPL line, returning to their original alignment on the west side of Dixie Road.

After receiving comments from the affected pipeline companies, a third option was formulated which included relocation costs for all pipes. This was required due to the proximity of 90 degree bends to potential grade conflicts and the fact that some pipelines are in casings which would require pipe bends for lowering.

Therefore, the following options are presented.

Option 1 (Exhibit 14)

•	Lower	SPPL	10" and 12"	270 m
		TNP	10" and 20"	370 m and 300 m, respectively
		SCP	8" and 12"	270 m and 300 m, respectively
•	Relocate	IPPL	30"	400 m
		CGPL	36"	100 m

Option 2 (Exhibit 15)

•	Lower	SPPL	10" and 12"	270 m
		TNP	10" and 20"	270 m and 200 m, respectively
		SCP	8" and 12"	270 m and 200 m, respectively
•	Relocate	TNP	20"	200 m
		SCP	12"	200 m
		IPPL	30"	400 m
		CGPL	36"	100 m

Option 3 (Exhibit 15)

•	Relocate	SPPL	10" and 12"	270 m
		TNP	10" and 20"	270 m and 375 m, respectively
		SCPL	8" and 12"	270 m and 375 m, respectively
		IPPL	30"	375 m
		CGPL	36"	270 m

This option uses the pipe alignments shown on Exhibit 15 with relocation costs rather than lowering costs for all pipes.

Estimated Costs

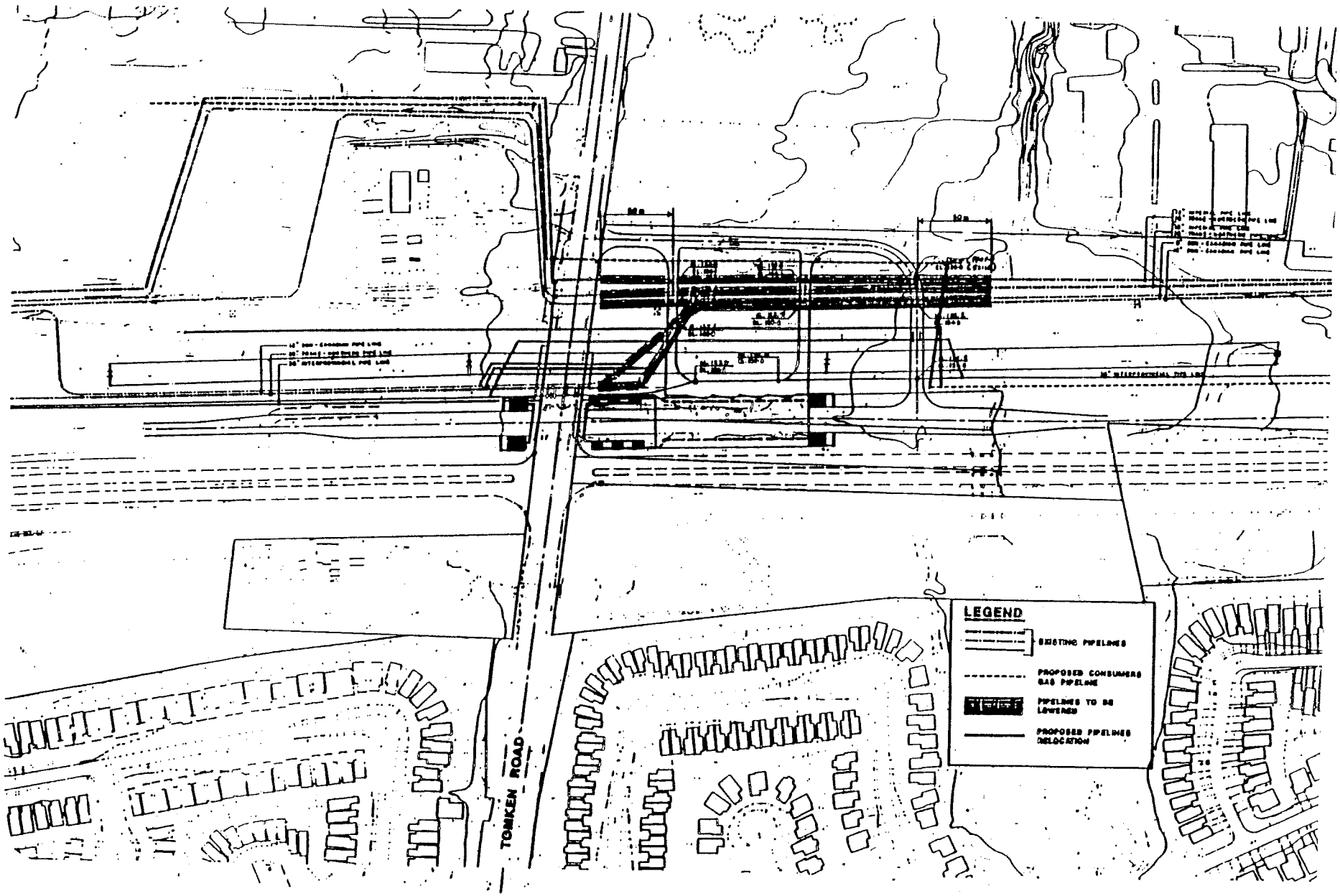
The estimated cost of the options that have been considered are:

OPTION	RELOCATION	LOWERING	PURGING	ESTIMATED COST
1	$288,000	$306,000	$10,000	$604,000
2	$591,600	$258,000	$30,000	$879,000
3	$2,179,000	--	$70,000	$2,249,000

Note: Road Boring cost included in relocated costs.

Recommendation

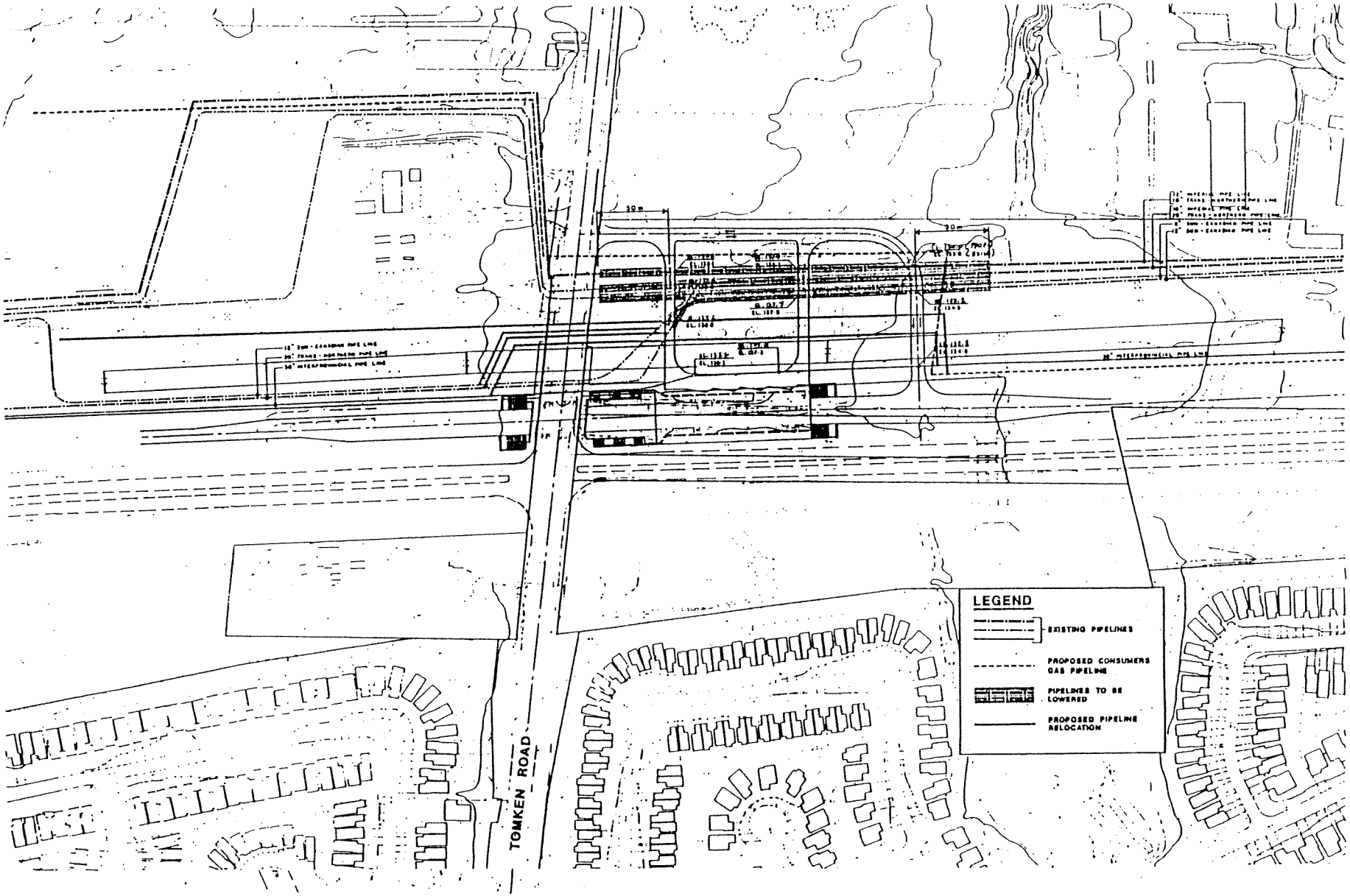
These options should be referred to the pipeline companies for comment. The preferred option can then be developed.



DILLON

CITY OF MISSISSAUGA
BUSWAY PLANNING STUDY

TOMKEN ROAD BUSWAY STATION
SCHEME 2 — OPTION 1
EXHIBIT 14



DILLON

CITY OF MISSISSAUGA
BUSWAY PLANNING STUDY

TOMKEN ROAD BUSWAY STATION
SCHEME 2 — OPTION 2
EXHIBIT 15

14. DIXIE ROAD STATION

The pipelines which are in conflict with the busway and station in this area are:

- SPPL 12" and 10" diameter;
- TPL 10" and 20" diameter;
- SCPL 8" and 12" diameter;
- IPPL 30" diameter; and
- CGPL proposed 36" diameter. (note - constructed fall 1991)

Existing Grade

It is proposed that the grade of the Parkway be maintained as close as possible to the existing.

Because of conflicts within the station area, the following pipelines will require adjustment:

- IPPL 30" diameter; and
- CGPL proposed 36" diameter.

Options

The access roads to the bus loop and parking facilities at the station are located above or immediately adjacent to the SPPL, TPL and SCPL pipelines. It is possible to relocate the access roads south of the existing northerly transmission lines. This would remove the roadway from any conflict with the northerly pipeline corridor.

In the station area, there are areas where the IPPL lines travel under the bus platform and roadways as well as conflict with the stairway access to the bus platform. Also the IPPL and CGPL pipelines cross the bus road access from the station to the busway. Depending on the acceptability of the pipelines being under the bus roadway and platform areas and within the 15 metre separation limit, there are three options presented to resolve the IPPL conflicts.

The three options involve various station configurations with the IPPL line being under the bus platform, under the bus roadway or under the grassed area. Each option has the pipeline within the 15 m separation guideline (i.e., 7 to 8 metre clearance from stairways). The cost of each of these options is the same.

The final design drawings for the CGPL line show the pipeline in a location closer to the station and proposed stairways than anticipated. It will be necessary to relocate the pipeline away from the proposed stairs.

A fourth option would be to relocate both pipelines to a point between the southerly tower line and a future centre tower line.

It is assumed that the location of the CGPL line under the access roadways is acceptable to Consumers Gas.

Options 1-3 (Exhibit 16)

•	Lower	IPPL	30" line"	540 m
•	Relocate	CGPL	36" line	340 m

Option 4 (Exhibit 17)

•	Relocate	IPPL	30" line	610 m
		CGPL	36" line	340 m

Estimated Costs

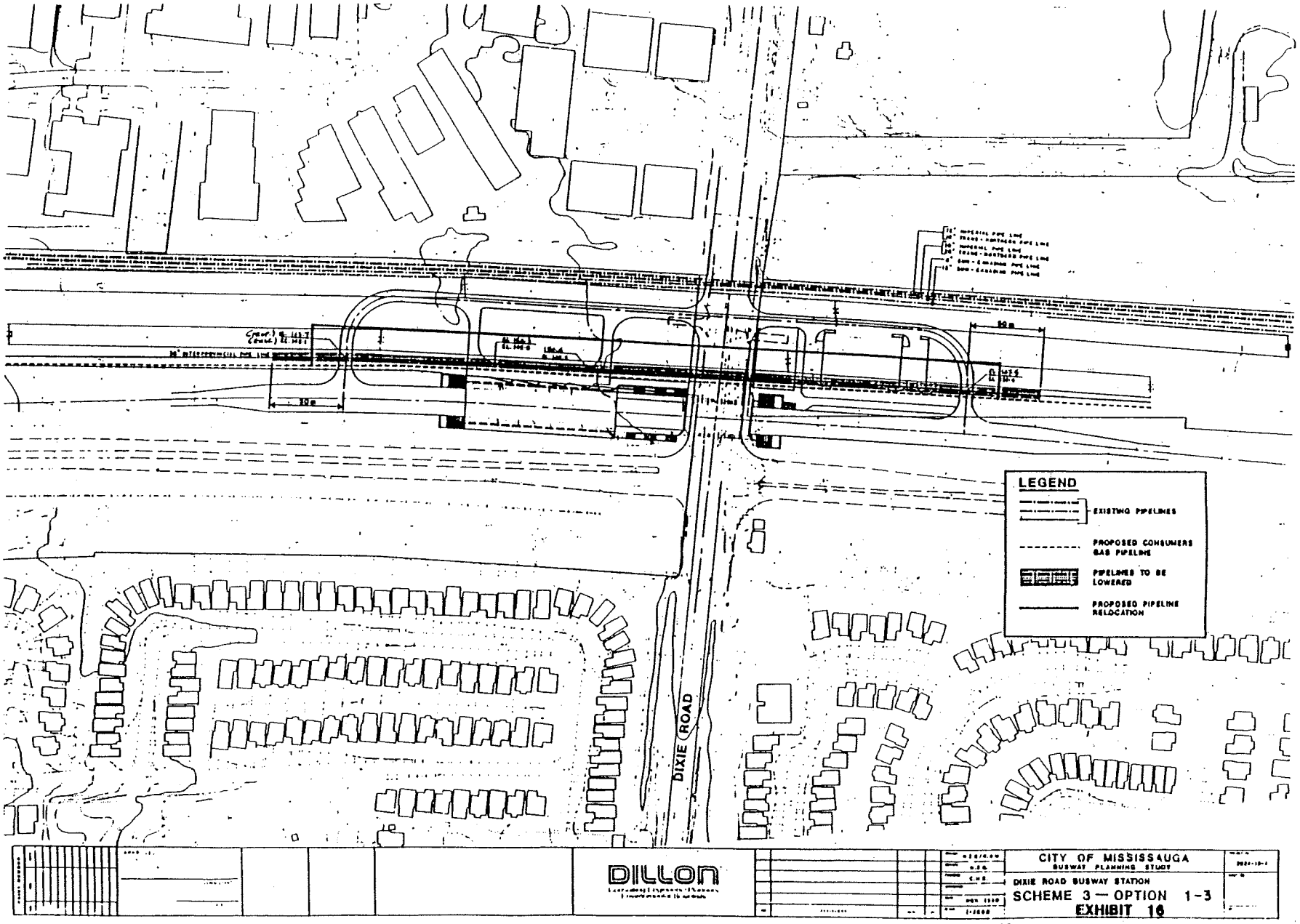
The estimated cost of the options that have been considered are:

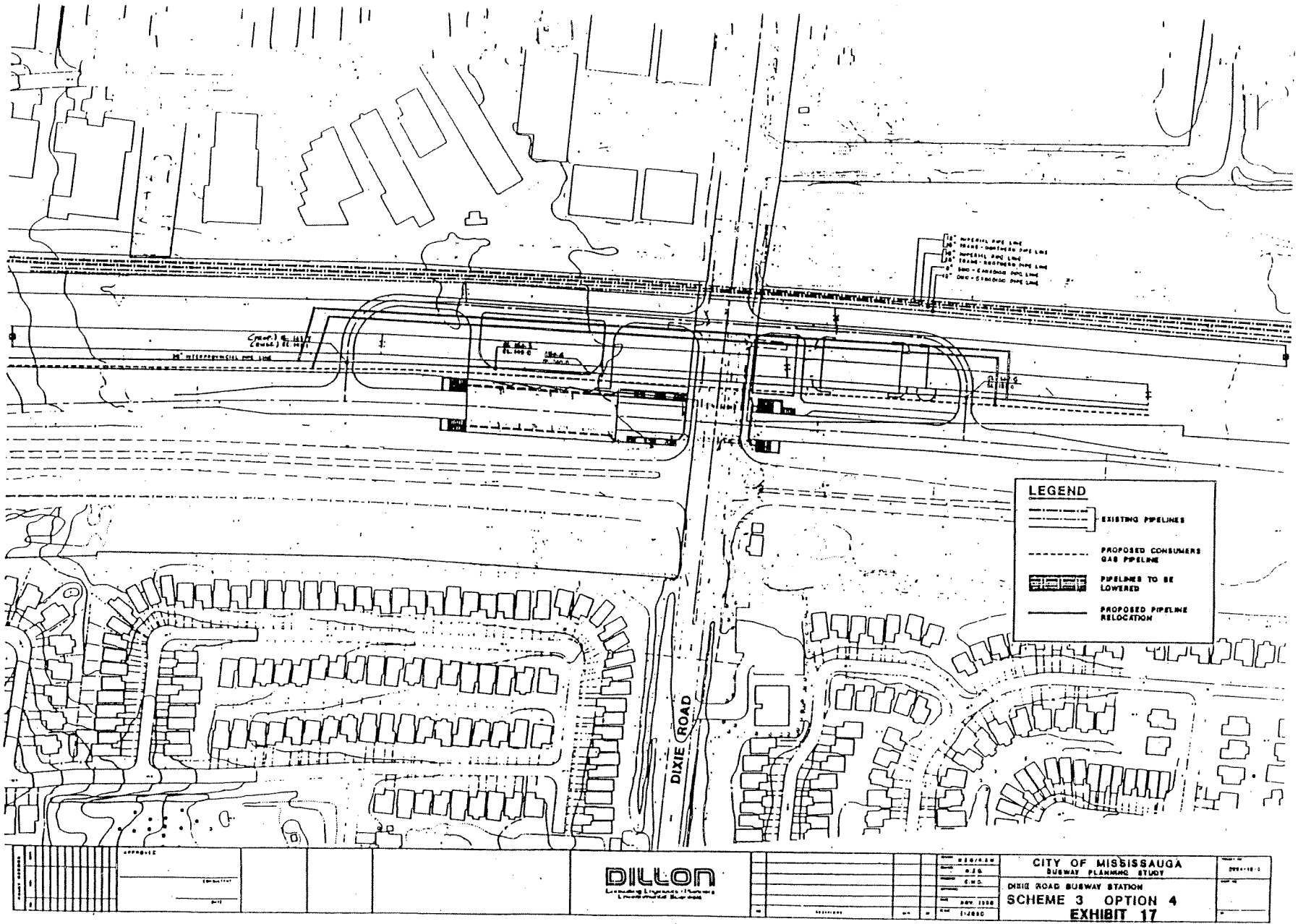
OPTION	RELOCATION	LOWERING	PURGING	ESTIMATED COST
1-3	$ 604,700	$243,000	--	$ 847,700
4	$1,669,600	--	$20,000	$1,689,500

Note: Road Boring cost included in relocation cost. Relocation costs has been revised after comment from IPPL.

Recommendation

Following a review of the report by IPPL, the Option 4 cost estimates were revised as shown in the above table. This option is recommended since a reduced clearance above the pipeline is unacceptable to IPPL. Cost estimates for CGPL are based on IPPL estimates.


LEGEND
EXISTING PIPELINES
PROPOSED CONSUMERS GAS PIPELINE
PIPELINES TO BE LOWERED
PROPOSED PIPELINE RELOCATION
DIXIE ROAD
DILLON
CITY OF MISSISSAUGA
BUSWAY PLANNING STUDY
DIXIE ROAD BUSWAY STATION
SCHEME 3 — OPTION 1-3
EXHIBIT 16


LEGEND
EXISTING PIPELINES
PROPOSED CONSUMERS GAS PIPELINE
PIPELINES TO BE LOWERED
PROPOSED PIPELINE RELOCATION
DIXIE ROAD
DILLON
CITY OF MISSISSAUGA
BUSWAY PLANNING STUDY
DIXIE ROAD BUSWAY STATION
SCHEME 3 OPTION 4
EXHIBIT 17

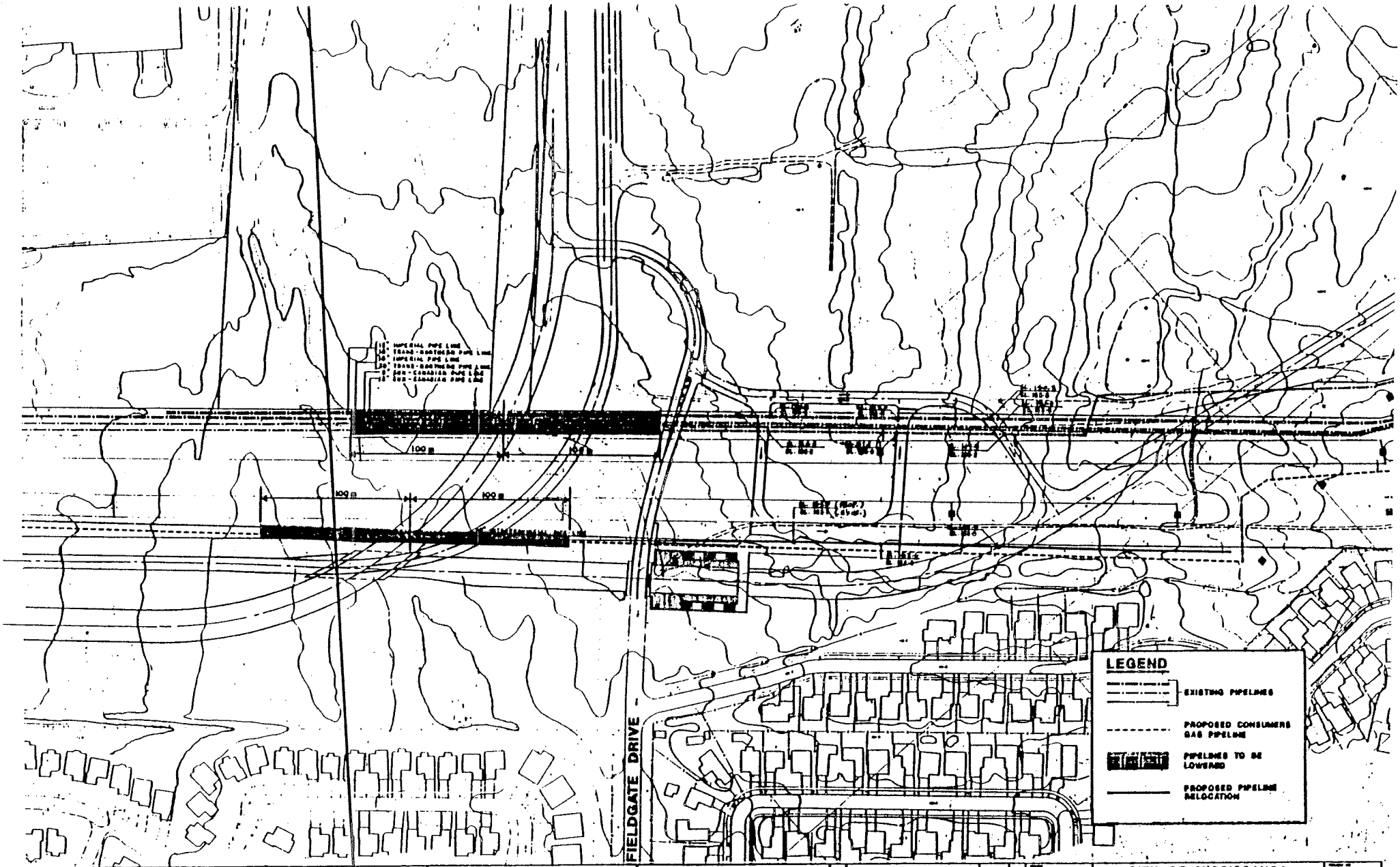
15. FIELDGATE DRIVE/BUSWAY

The selection of the E6 alignment in the vicinity of Fieldgate Drive reduces the busway/pipelines conflict. West of the Fieldgate Drive all of the pipelines will have to be lowered when they cross the busway. However, because the pipelines will have to be lowered approximately 10 metres, relocation cost estimates have been used instead of pipeline lowering costs.

Option (Exhibit 18)

•	Relocate	SPPL	12" and 10" lines	175 m
		TPL	10" and 20" lines	175 m
		SCPL	8" and 12" lines	175 m
		IPPL	30" line	175 m
		CGPL	36" line	175 m

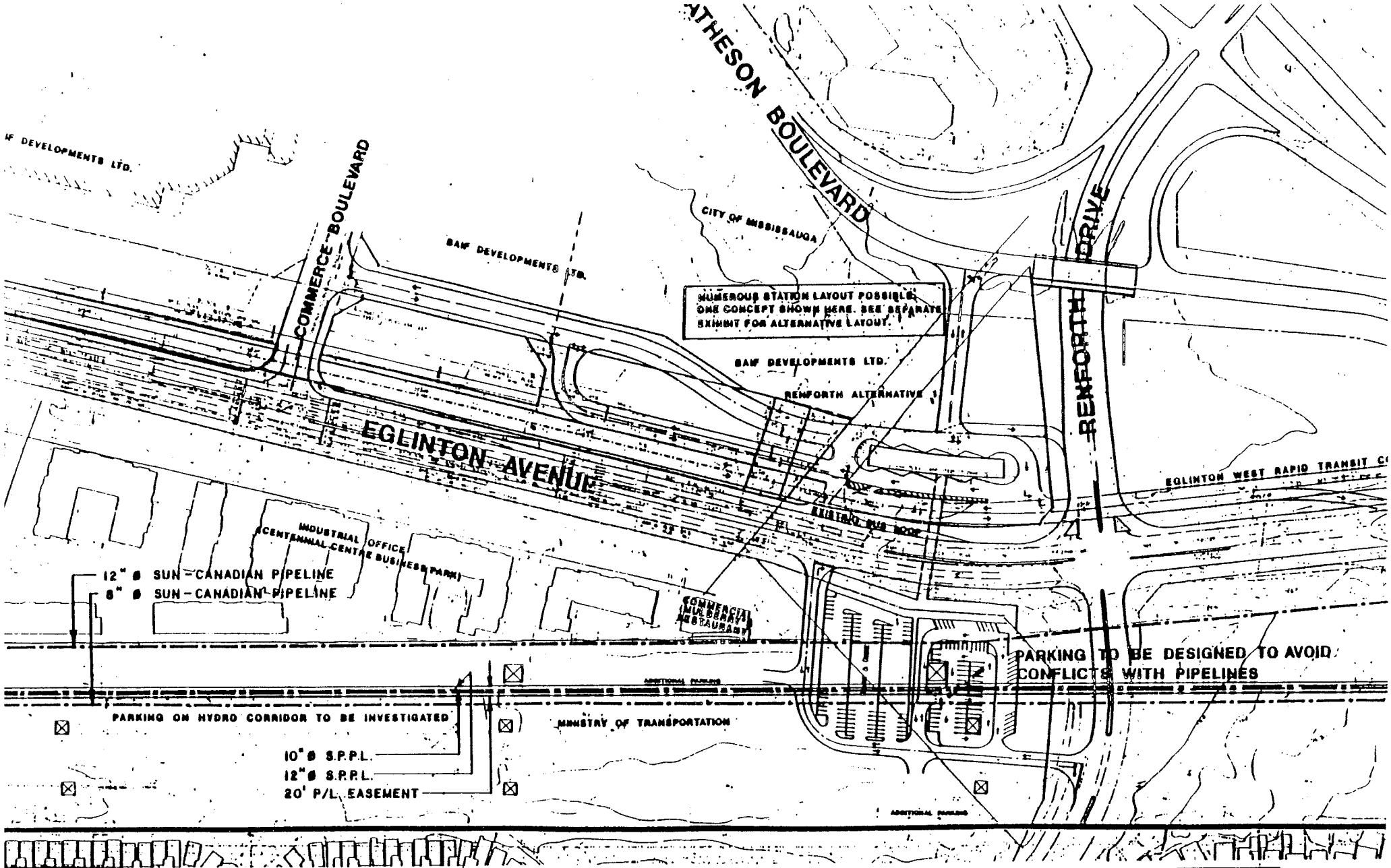
The estimated cost for this work is $1,815,050 which includes purging and road boring.


FIELDGATE DRIVE
LEGEND
EXISTING PIPELINES
PROPOSED CONSUMERS GAS PIPELINE
PIPELINES TO BE LOWERED
PROPOSED PIPELINE RELOCATION
DILLON
CITY OF MISSISSAUGA
BUSWAY PLANNING STUDY
FIELDGATE DRIVE BUSWAY STATION
SCHEME 2 — EXHIBIT 18

16. RENFORTH/HYDRO CORRIDOR

While the preferred busway alignment does not pass through this area, it is proposed that the Hydro corridor adjacent to the Renforth Gateway be used for park n'ride and kiss n'ride facilities. Some concern has been expressed by the pipeline companies regarding such facilities over their lines (Exhibit 19). If there is a major concern, the parking and drop-off facilities could be designed to provide a green strip over the pipelines with an access road crossing the lines from Eglinton Avenue.

It is believed that no additional cost is involved to resolve this conflict.



DILLON

CITY OF MISSISSAUGA
RENFORTH DRIVE EASTWAY STATION

EXHIBIT 19

PART V
DESIGN GUIDELINES

INTERPROVINCIAL PIPELINE COMPANY

GUIDELINES

For Application to Cross Facilities of

Interprovincial Pipe Line Company (IPL)

a division of Interhome Energy Inc.

(For Details Refer to Section 112 of the National Energy Board Act (NEB) and The Pipeline Crossing Regulations, of the NEB.)

Procedure for Applicant	Sequence	Procedure for Interprovincial
INITIAL CONTACT. Advise type of crossing, geographic location and scheduled date of construction.	1	
Correspondence To: **Interprovincial Pipe Line Company, a division of Interhome Energy Inc., 10201 - Jasper Avenue, P.O. Box 398, Edmonton, Alberta, T5J 2J9** Attention: **Crossings Coordinator** Phone: (403) 420-5210	2	**PIPELINE INFORMATION.** Forward all pipeline data available including pipe specifications, right-of-way location, pipe locations, NEB Crossing Regulations, drawing requirements and District Office to contact for confirmation of pipe depths and restricted areas.
FIELD VERIFICATION. Contact IPL's District Office to verify pipe locations, depths and restricted area. **PIPE DEPTHS.** Review Probe Report from District Office. **APPLICATION.** Prepare and submit application with three (3) prints of the proposed crossing drawing(s) for approval.	3	
	4	**TECHNICAL REVIEW.** Return one (1) copy of the preliminary print indicating the necessary revisions or additions together with two (2) copies of IPL's crossing agreement outlining conditions of the crossing.
AGREEMENT. Review, sign and return both copies, of IPL's crossing agreements with three (3) copies of the revised crossing drawing(s).	5	
	6	**APPROVAL.** Sign and return one (1) copy of the agreement fully executed by IPL and send letter of approval granting permission for the crossing.
NOTIFICATION. Provide a minimum of three working days actual notice to IPL prior to the commencement of the crossing construction. (See crossing agreement for IPL contact).	7	
CONSTRUCTION. Crossing to be constructed in accordance with the approved drawing(s), the terms and conditions of IPL, and the Pipeline Crossing Regulations, of the NEB.	8	**SAFETY.** Review any special safety practices that must be followed on site prior to construction with the Contractor or Foreign Facility Representative. **CONSTRUCTION.** IPL Representative to be present and observe construction. **CROSSING REPORT.** IPL Representative to complete Crossing Report and illustrate As-Built information on the print(s) of the approved drawing(s).

NOTE: Should the Applicant (Facility Owner) be denied permission to cross or considers the terms and conditions imposed by IPL to be inappropriate, after remediation the Applicant (Facility Owner) may make application for leave to cross to The National Energy Board at:

National Energy Board
473 Albert Street
Ottawa, Ontario
K1A 0E5

Phone: (613) 998-7159

Interprovincial Pipe Line Company

a division of Interhome Energy Inc.

DRAWING REQUIREMENTS FOR THIRD PARTY CROSSINGS

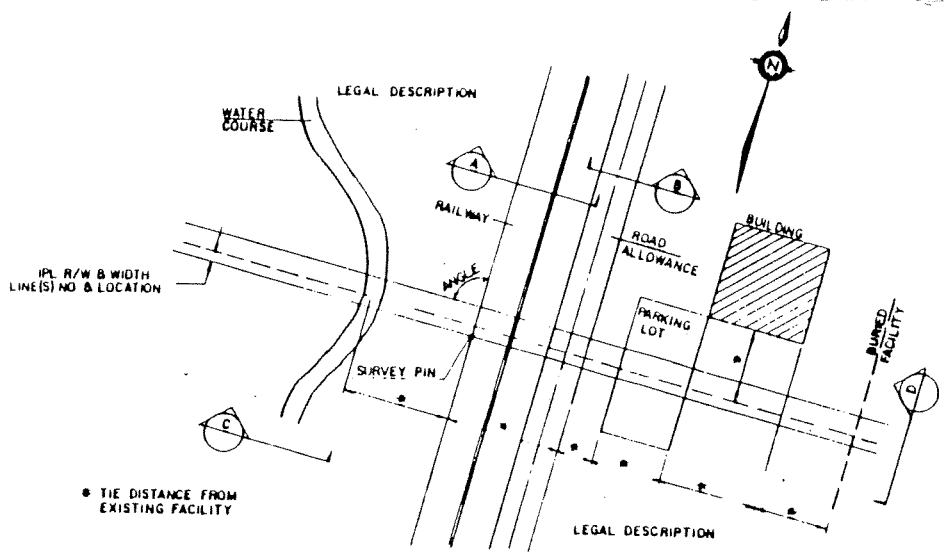
This represents the minimum information required when preparing drawings for crossing approvals. Dimensions on drawing(s) may be in Imperial or metric (if metric, one decimal point).

The applicant should contact the pipeline company at an early date for information and to discuss requirements with respect to the proposed crossing.

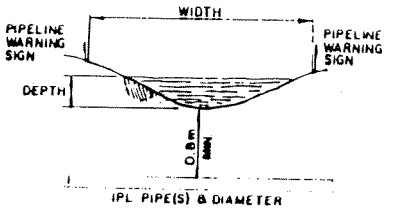
1. **Drawing with Revision Number and Date.**
2. **North Arrow**
3. **Complete Land Description**
4. **Plan view, show and identify:**
   a. pipeline(s), pipeline markers, and right-of-way; location of pipeline(s) within right-of-way.
   b. facilities (including all curbs, footings, guard rails, guy wires, poles, fences, etc.) with tie dimensions to lot or survey line (preferably along pipeline and or right-of-way boundary) and crossing angle. Crossing angle should be as close to 90° as possible.
   c. lot lines, road limits.
   d. location of cathodic test lead terminal box (if applicable).
   e. for parking lots, storage yards: nearest building with tie dimension to nearest pipeline and or right-of-way boundary.
   f. for parking lots, storage yards: describe barrier preventing access to unaffected right-of-way (eg. fence or concrete curb).
5. **Profile View**
   a. for surface structures: along pipeline(s) with highest elevation.
   b. for underground facilities: along facility.
   c. pipeline(s) and depth of cover.
   d. facilities and protective devices with minimum clearances from each to the pipeline(s) (minimum clearances: roads/parking lots/storage yards - 1.3m; railways - 2.0m; ditches -0.8m; underground utilities - 0.3m).
   e. all underground facilities must maintain the same elevation across the entire width of the right-of-way except for gravity type facilities.
6. **Specifications of Pipeline(s) being Crossed**
   a. give diameter(s)
   b. give diameter(s) of casing (if applicable)
   c. Warning statement eg. **"Caution High Pressure Pipeline(s)"**
   d. details of any protective devices for pipelines (concrete slabs, casings, pads, temporary structures, etc.) if requested by the company and shown on the plan and profile.
7. **Facilities Description**
   a. roads, parking lots, storage yards: wheel loading, surface, subgrade, name or number designation of roads (if any), materials to be stored (if any).
   b. fences: height, material, post locations (1.5m minimum from pipeline).
   c. ditches, open drainage systems: depth, width - top and bottom (existing and proposed), name or designation (if any).
   d. underground facilities: materials; diameter; maximum voltage; pressure; conduit structure - duct size, use and configuration - size and reinforcement (if any).

NOTES: The above information should be incorporated into all drawing(s) used for construction or a specific crossing drawing(s) must be prepared for approval. These drawing(s) must be available for reference on site.

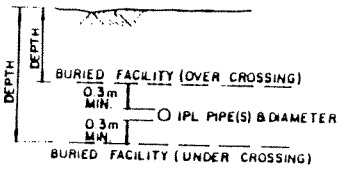
For Reference, a typical crossing drawing of these minimum requirements is attached.



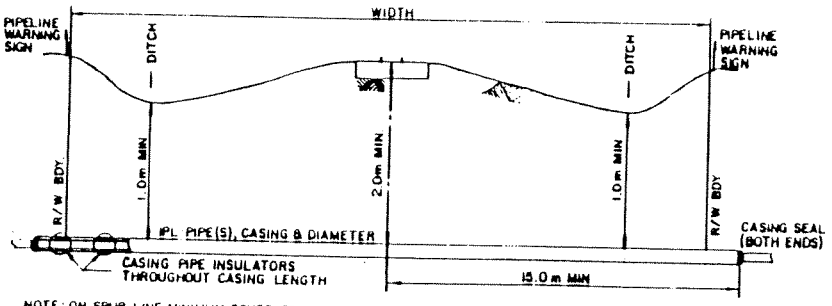
LOCATION PLAN



C TYPICAL WATER COURSE CROSSING

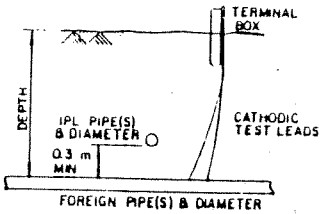


D TYPICAL FACILITY CROSSING

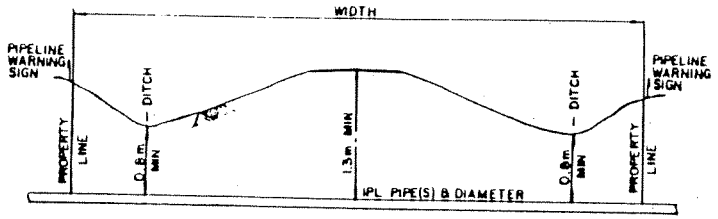


NOTE: ON SPUR LINE MINIMUM COVER FROM BASE OF RAILWAY 1.3m AND 0.8m IN DITCHES, AND CASING MINIMUM 10m FROM ℄ RAILWAY

A TYPICAL MAIN LINE RAILWAY CROSSING



TYPICAL TEST LEAD CONNECTION
(STEEL PIPELINES)



B TYPICAL ROAD CROSSING

NOTE:
1. "CAUTION HIGH PRESSURE PIPELINES"
2. IPL REPRESENTATIVE MUST BE PRESENT DURING CONSTRUCTION.

THIS DRAWING IS FOR REFERENCE ONLY. ACTUAL SITE DETAILS OR REQUIREMENTS MAY VARY

Interprovincial Pipe Line Company
EDMONTON ALBERTA CANADA

TYPICAL CROSSING DETAILS

DRAWN ME	DATE 30 8 88	APPR
CHECK	APP'L	APPR
SCALE NOT TO SCALE		APPR

C-1.02-5052-0-0

IMPERIAL OIL
ESSO SARNIA PRODUCTS PIPELINE

VALUES, OBJECTIVES & GUIDELINES

FOR THE MISSISSAUGA BUSWAY NEAR THE SARNIA PRODUCTS PIPELINE SYSTEM (SPPL)

* VALUES ESSO PETROLEUM CANADA MUST MAINTAIN WHEN EVALUATING ANY PLAN TO BUILD THE BUSWAY NEAR EXISTING PIPELINES

1. SAFETY: of the People in the area,
   of the Pipeline,
   of the Busway Facilities.
2. MINIMIZE potential for incidents & accidents.
3. ACCESS to the pipeline must be maintained.
4. NO NEW LIABILITIES for Esso Petroleum Canada.

* OBJECTIVES FOR THE PROTECTION OF THE PIPELINE IN THE BUSWAY

1. Maintaining the least obstructed easement as possible:
   1.1 Crossings as close to 90 degrees as possible,
   1.2 Absolutely no platforms or such over the pipeline,
   1.3 Limited parking areas over the easement,
   1.4 Reasonable easement width in any new location,
   1.5 No parallel roads over or beside the pipeline,
   1.6 Pipeline to be in least travelled location,
   eg: under grass boulevards rather than roads.

2. As this is a City of Mississauga project, all incremental costs incurred by Esso Petroleum Canada are to be borne by the City.
   2.1 Appropriate agreement as to cost of replacement of pavement in parking lots or roadways if SPPL must dig them up in the future to work on the pipeline. - City to pay to replace pavement, & to tow away cars if necessary.
   2.2 City is to pay costs associated with any pipeline relocation or other pipeline expense which is made necessary by the construction of the Busway.

3. Protection of Easement Rights:
   3.1 Imperial Oil Limited to have final say as to the treatment of the pipeline and easement in the corridor,
   3.2 Devise an acceptable & simple procedure to work out future problems during the actual design stages of the Busway.
   3.4 Full easement rights are to be granted to Sarnia Products Pipeline if a new pipeline location is required.
   - IOL easement document.
   - City of Mississauga to pay for easement.

4. Adherence to various pipeline protection Guidelines:
   4.1 Fuels Safety Board Setback Guidelines,
   4.2 C.S.A. Standard Z183-M86,
   4.3 Esso Petroleum Canada guidelines set out in next section,
   4.4 Sarnia Products Pipeline Crossing Approval Guidelines,

5. Minimize the disruption to Sarnia Products Pipeline by coordinating Busway construction to cause the fewest possible number of shutdowns of the pipeline due to construction.

* GUIDELINES REQUIRED BY ESSO PETROLEUM CANADA TO BE OBSERVED IN DESIGNING THE BUSWAY NEAR SPPL:

1. Where possible keep the pipeline out of the Busway stations.

2. Limited parking lot cover is acceptable if unavoidable,
   - Keep pipelines near the edge of the parking lot.
   - Minimize Busway disruption in event of pipeline repair.

3. Pipeline must NOT be under Busway areas it is difficult to shut down, or are impossible to remove in case pipeline repair is required in the future:
   - No Platforms, or Passenger facilities,
   - No "Kiss & Ride"
   - Pipeline to be at the edge of parking areas rather than in the centre.

4. No Parallel roads over or right beside the pipeline,
   - makes it too dangerous working in a trench right beside a road carrying fast moving Bus traffic.

5. No build up of pavement or concrete over the pipeline thicker than a standard parking lot surface,

6. Ground cover over the SPPL must be between 1.2 m. minimum and 4-5 m. maximum.

7. Motor driven valves to be placed at 9th line and in a central area.

8. Design stations so that decorative green belts and grass boulevards are over the pipelines rather than paved areas.

9. Relocated routes must be covered by an Imperial Oil Limited form easement document, giving full easement rights and protections. Relocated routes to provide a reasonably wide easement width ie: minimum of 20' easement.

10. C.S.A. Standards and/or Fuels Safety Branch Guidelines:
    - May require heavier wall pipe in areas of relocation or lowering.
    - Will require heavier wall pipe if rail traffic is anticipated.

11. Obtain a Crossing Consent from Esso Petroleum Canada for each individual crossing location of the SPPL.

CONSUMERS GAS

GUIDELINES FOR NATURAL GAS UTILITIES LOCATING

NEW PIPELINE FACILITIES

FSB Guidelines
March 1990

I PIPELINES

CRITERIA

The following guidelines pertain to all segments of gas pipelines designed with a maximum allowable operating pressure (MAOP) above 40% SMYS.

MINIMUM SETBACKS

Pipelines should be aligned to provide a minimum setback of 20 metres from the centreline to any buildings intended for human occupancy. Additionally, a 200 metre setback should be maintained from the centreline of pipe to hospitals, nursing homes, penal institutions, and institutions for the physically and mentally handicapped. Where these distances are not reasonably attainable, the following measures must be implemented to reduce the minimum respective setbacks to 5 metres and 90 metres.

1. The use of Category II pipe with proven notch toughness characteristics as specified by CSA-Z184-M86.

2 Minimum cover of at least 1.5 metres over the pipeline.

In instances where 1.5 metres of cover is not practicable, concrete slabs placed over the pipeline may be used as an alternate means to reduce the setbacks.

II COMPRESSOR STATIONS

Compressor station should be situated to provide 100 metres from the property limit to any residential development.

RATIONALE FOR GUIDELINES

I GUIDELINES FOR DEVELOPMENT

The entire width of the easement should be kept completely clear to:

1. Give direct access to the pipeline for survey, maintenance and repair purposes.

2. Enable aerial patrols to detect any encroachment or construction activity in the vicinity of the pipeline.

3. Ensure that the limits of the easement are immediately obvious to anyone contemplating excavating in the area.

Damage to a pipeline operating at high stress levels could result in a propagating fracture in the pipe with an accompanying significant release of energy and the creation of a crater. The 40% SMYS cut-off for the 20 metre setback requirement is based on the factor of safety established by the CSA-Z184-M86 Code for a Class 4 location. This represents the most conservative pipeline design, to be used in built up residential areas with multiple storey buildings. Use of a lesser percentage would mean that a single house within 20 metres of a high pressure pipeline in a rural area would be afforded a greater level of safety than a row of apartment buildings 21 metres away from a high pressure pipeline in the city. This would seem contrary to the intent of the Z184 Code and could be difficult to rationalize if challenged.

The 20 metre setback to all buildings intended for human occupancy would reduce the likelihood of damage to these units in the event of a propagating pipeline failure. The 200 metre setback is intended for buildings that could not be easily evacuated in case of an emergency. The greater setback would lessen the impact of a pipeline rupture on the building, thereby affording more time to respond to the situation. Where alternate measures have been incorporated into the pipeline's design and/or installation to reduce the possibility of having a catastrophic failure (see Section II), the setbacks are reduced to 5 metres and 90 metres respectively.

Compressor stations are industrial installations and should be treated as such in the planning process. The 100 metre recommended setback is intended to act as a buffer from the noise, traffic, and odours associated with general maintenance and construction activities.

II GUIDELINES FOR UTILITIES

New pipelines should be situated to provide equivalent setbacks being requested of developers. However, whereas development can be controlled, new pipelines cannot always be located to provide 20/200 metres from existing buildings without major realignment at great cost. Sometimes this is not even possible because a 40/400 metre wide corridor is not available.

Alternate means to minimize either the potential for a catastrophic failure, or the resultant damage, must be recognized in situations where the 20/200 metres is unattainable. The use of Category II pipe combined with extra depth or, under certain circumstances, concrete slabs have been identified as appropriate solutions.

Category II pipe is inherently safer than Category I due to its increased toughness. This toughness gives the steel a greater ability to absorb energy, thus providing a higher resistance to crack initiation. Increased toughness also acts to reduce the rate of fracture propagation, provided that failure occurs in a ductile, not brittle, mode at the minimum design temperature. A reduced rate of propagation causes a lower pressure at the tip of the crack, thereby limiting the likelihood of a long fracture. Through the use of highly controlled rolling processes, Category II steel is produced with high toughness and a low transition temperature to effectively control fracture initiation and propagation. Appendix I, entitled "Fracture Initiation Control Concepts" and presented at the CGA 4th National Technical Conference, gives a good overview of the development and benefits of Category II pipe.

Extra depth and concrete slabs are means by which to reduce the likelihood of third party damage. In addition, both measures could dampen the effects of an explosion resulting from the sudden release of energy due to a catastrophic pipeline failure.

Where the alternate measures are implemented, a 5 metre setback is still recommended as added protection against third party damage. A 90 metre buffer should still be maintained from the 'special use' buildings identified to provide evacuation time should it be required.

NATIONAL ENERGY BOARD

File No.: 3825 1

8 November 1990

NOV 16 1990

Mr. S. Schijns
McCormick Rankin
2655 North Sheridan Way
Mississauga, Ontario
L5K 2P8

Dear Mr. Schijns:

Re: Mississauga Busway Functional Planning Study

As requested, we wish to confirm the requirements reflected in our guide entitled "Excavation and Construction Near Pipelines", as interpreted in your letter dated 31 October 1990.

Permission of the National Energy Board, pursuant to section 112 of the *National Energy Board Act*, is not required for construction of facilities across a pipeline or for excavation within 30 metres of a pipeline if the conditions found in the *National Energy Board Pipeline Crossing Regulations, Part I* are followed. Amongst the conditions of the Regulations is the requirement to obtain prior approval of the affected pipelines.

We note from your letter that you have been in contact with the affected pipeline companies and presumably their more detailed comments will be addressed in your study. Initiatives taken in the planning phase of such a major undertaking as the Mississauga Busway can enhance the safety of pipelines during the construction and operating phases. In that regard, if we may be of any assistance to you please contact Rick Seaman, Chief of Pipeline Crossing Division at (613) 998-7153.

Yours truly,

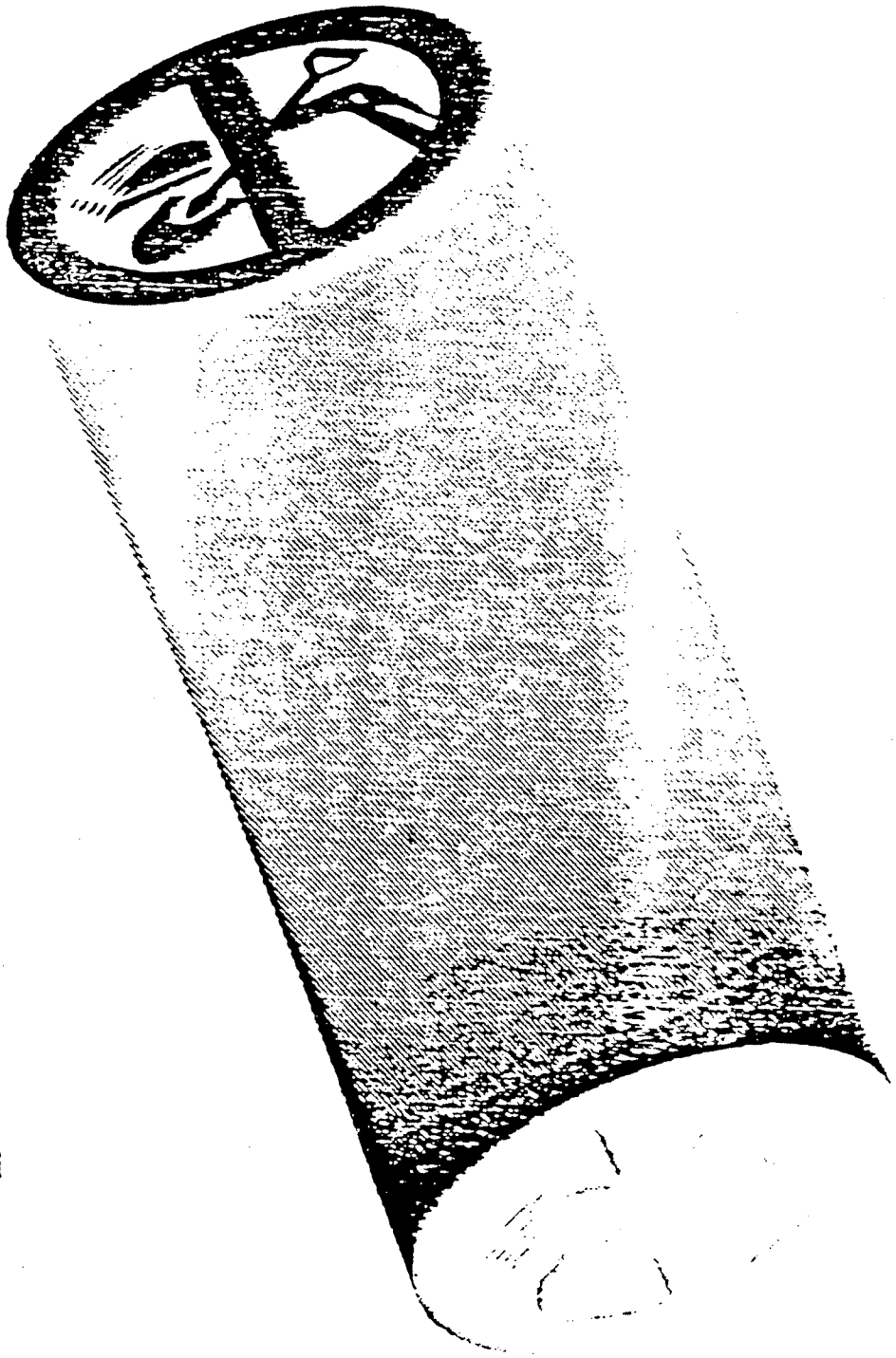
Marie Tobin
Secretary

473 Albert St.
Ottawa, Ontario
K1A 0E5

473, rue Albert
Ottawa (Ontario)
K1A 0E5

Telephone/Téléphone: (613)990-3167
Telecopier/Télécopieur: 990-7900
Telex/Télex: 053-3791

Excavation and Construction Near Pipelines



National Energy Board
Ottawa, Ontario
K1A 0E5

June 1990

National Energy Board

Excavation and Construction Near Pipelines

ENVIRONMENT BRANCH



Pipeline Crossing Division

Printed on paper containing recycled material

The purpose of this guide is to assist those who wish to excavate or construct near a pipeline that is regulated by the National Energy Board. This guide will help you determine whether you must obtain approval, where to obtain it, and how to obtain it.

The information in this booklet should be regarded as a guide only. The *National Energy Board Pipeline Crossing Regulations, Part I*, will, in all cases, take precedence over this guide. For more information, please contact pipeline company or National Energy Board staff listed in this booklet.

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Page 8	Is There a Time Limit?
Page 8	What Are Your Responsibilities After Construction?

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The National Energy Board Pipeline Crossing Regulations, Part I

Experience has shown that many accidents involving pipelines are caused by contractors or others working near the pipeline. Unsafe construction and excavation practices can damage the pipeline and the environment, sometimes resulting in injury or death to construction company workers and bystanders. Such damage can lead to expensive repairs as well as a loss of revenue and essential services to a significant number of people.

The National Energy Board is concerned about maintaining the safety of the public and of the pipelines under its jurisdiction. Because of this continuing concern, the Board developed the *National Energy Board Pipeline Crossing Regulations, Part I* ("the Regulations"). If you intend to excavate using power-operated equipment or explosives within 30 metres of a pipeline or its easement or to construct a facility across, on, or along a pipeline or its easement, compliance with the Regulations will reduce the possibility of your damaging the pipeline.

As well, complying with the Regulations and, therefore, avoiding the need to obtain Board approval, should reduce the length of time it takes you to obtain the permission you need to start your proposed excavation or construction.

A copy of the Regulations has been included in the appendices of this booklet for your information.

Who is Affected by the Regulations?

The Regulations apply generally to any contractor, "facility" owner, or individual who will be excavating using power-operated equipment or explosives within 30 metres of a pipeline or its easement or who will be constructing a facility across, on or along a pipeline or easement that is regulated by the National Energy Board. Exceptions to this are the pipeline company itself or its agents, and those who are disturbing the ground to a depth of less than 0.3 metres, not reducing the total cover over the pipe and not constructing or installing a facility.

In general, a "facility" includes (but is not limited to):

- a structure (anything built or installed), for example: a fence, a concrete conduit structure, a swimming pool, a retaining wall,
- a highway, private road, lane, parking lot, walkway, etc.,

- a railway,
- a drainage or irrigation system, including dykes, ditches and culverts,
- a buried telecommunication or power line, or
- a pipe, for example: a water main, a sewer, a gas line, an oil line.

The pipeline companies regulated by the Board are listed on two maps included in the appendices of this booklet. In general, the Board regulates natural gas, oil, and hydrocarbon pipelines which extend beyond the limits of a province.

If you are in doubt about whether these Regulations apply to you, or whether a particular pipeline is regulated by the Board, call the pipeline company involved or National Energy Board staff. Telephone numbers and addresses for the Board and for the pipeline companies regulated by the Board have been included in the appendices of this booklet.

In fact, we strongly suggest that, if you will be working near *any* buried utility, you contact the company involved, or, in Alberta, the one-call system operating in that province, for information well in advance of your construction or excavation.

What Do the Regulations Involve?

The Regulations outline your responsibilities as an excavator or facility owner.

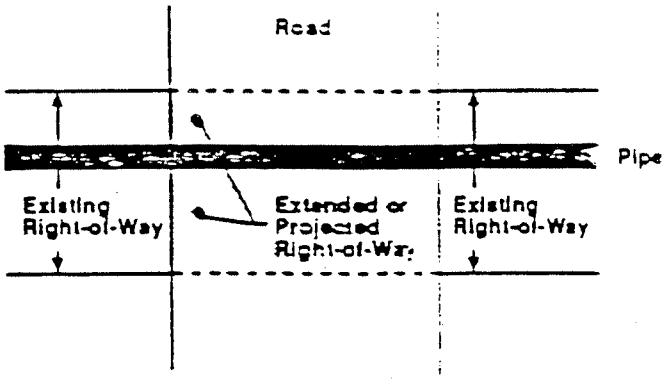
Under the Regulations, you must obtain the pipeline company's permission for your proposed excavation or construction. If you cannot obtain the pipeline company's permission, or cannot meet all the requirements of the Regulations, you must obtain the Board's approval before starting work on the right-of-way or near the pipeline.

The National Energy Board Pipeline Crossing Regulations, Part II, cover the responsibilities of the pipeline company, both to you and to the Board. They are not discussed in this guide, but a copy has been included in the appendices for your information.

What Does Not Require Approval?

Under the Regulations, you do not require written permission from the pipeline company or approval of the Board for installation of overhead lines or for excavation for the maintenance of an existing facility, if you meet certain conditions.

For overhead lines, you must meet the standards for clearances set out for overhead systems by the Canadian Standards Association. As well, you may not install anything (poles, guy wires, etc.) within the pipeline company's easement. Where the easement is interrupted by a road or another easement, you may not install anything within what would be the company's easement if it extended across the road or other easement.



For excavation to maintain an existing facility you must meet the conditions regarding field responsibilities outlined later in this guide.

In both cases you must notify the pipeline company before you start any activity on the company's right-of-way or over its pipe.

Again, if you have any doubts, call the applicable pipeline company or the National Energy Board.

How Do You Obtain Permission from the Pipeline Company?

Prepare your request for permission following the pipeline company's guidelines. These guidelines set out the information you need to include so that the company can begin its review.

If you have any questions, we suggest you contact the pipeline company *before* you submit your request for permission. This will give the company the opportunity to discuss your project with you and give you any suggestions they may have or assistance you require.

Within ten working days of receiving your request, the pipeline company must inform you that permission has been given or the reasons why it is being denied or delayed. If it does not or if you disagree with its reasons, you may apply to the Board for a review if you wish.

If you decide to change the design, location, or type of facilities to be installed *after* the pipeline company gives its permission, you must have the changes agreed to by the pipeline company *before* you start your work.

Note: Although operation of a vehicle or mobile equipment across a pipeline or its right-of-way is not covered by the Regulations, you are required by section 112 of the *National Energy Board Act* to have permission from the pipeline company if you are crossing outside the travelled part of a highway or public road. This is to prevent damage being done to the pipeline where the pipe may not be designed to withstand the weight of vehicles.

When Do You Require Approval from the National Energy Board?

As stated earlier, you must obtain the Board's approval before starting work on the right-of-way or near the pipeline if you cannot obtain the pipeline company's permission, or you cannot comply with all the conditions in the Regulations.

You will also have to ask the Board for its approval if:

- you believe a condition required by the pipeline company is inappropriate or excessive and you cannot accept it;
- the pipeline company has suspended and not reinstated its permission for your proposed activity;
- the Board orders you to apply for its approval; or
- the excavation or construction is in an offshore area (i.e., in an underwater area off the coast of Canada).

Information on how to obtain approval from the Board has been included in the appendices of this booklet.

What are Your Field Responsibilities?

Once the pipeline company has given its permission, there are four steps you must follow to comply with the Regulations.

1. Notify the Company

   You must give the pipeline company three working-days notice before starting any work (except in the case of emergencies) and 24 hours notice before backfilling over the pipe. Any contact with the pipe or its coating must be reported to the pipeline company *immediately*. Even incidents which seem minor at the time - small dents and scratches on the pipe or any damage to the coating - could lead to serious problems such as corrosion which could cause the pipe to rupture in the future.

2. Observe the Restricted Area

   From a safety point of view, this is one of the most important responsibilities.

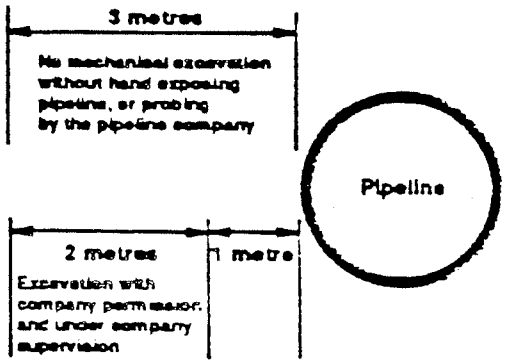
   The restricted area, which is established by the pipeline company's field representative, is an area in which you must not excavate mechanically until you have confirmed with the representative that all the company's pipes in the construction area have been staked by the representative. Be sure, too, that you are satisfied that you understand what the various stakes mean before you start work. A misunderstanding could cause you to damage a pipe, endangering your own life and that of others.

3. Follow the Rules for Excavation and Interference with the Pipe

   Even after the restricted area has been staked by the pipeline company field representative, you may not excavate mechanically within three metres of the pipe until you have ensured that:

   a) the pipe has been exposed by hand at the point of crossing or the pipeline company has located the pipe by probing and confirmed that it is at least 0.6 metres deeper than your proposed excavation; or

b) where the excavation is to be parallel, the pipe has been exposed by hand or probed by the pipeline company at enough places to confirm the pipe's location.



However, if ground conditions such as frost make hand excavation impractical, you may excavate mechanically to within one metre of the pipe if the pipeline company considers it safe to do so and directly supervises the excavation.

In all cases, it is the pipeline company who will determine whether to grant permission for mechanical excavation within three metres of the pipeline. It may not give its permission if it feels the excavation cannot be done safely.

When boring directionally or using explosives, you must meet the pipeline company's conditions regarding such activities.

At no time are you allowed to move or alter the pipe or its fittings, or in any other way interfere with the pipe without the written consent of the pipeline company, and then only if the work is done under its direct supervision.

4. Comply with the Conditions

The pipeline company may have made its permission conditional on your meeting certain requirements. If you accept the company's conditions, you must comply with them, as well as with the instructions of any authorized field representative of the pipeline company regarding procedures when working near the pipeline.

Is There a Time Limit?

In general, the pipeline company's permission will lapse if all work is not completed within two years of the date that permission was given. However, this time limit may be changed if you and the pipeline company agree.

As well, the pipeline company or the National Energy Board may suspend the permission given by the pipeline company if unsafe construction practices are used.

What Are Your Responsibilities After Construction?

If you are the owner of the facility, you must maintain the installation in good condition so that it will not endanger the pipeline. This remains your responsibility until you can show that someone else has taken over the facility, or until it has been removed or abandoned and the site restored to the satisfaction of the pipeline company.

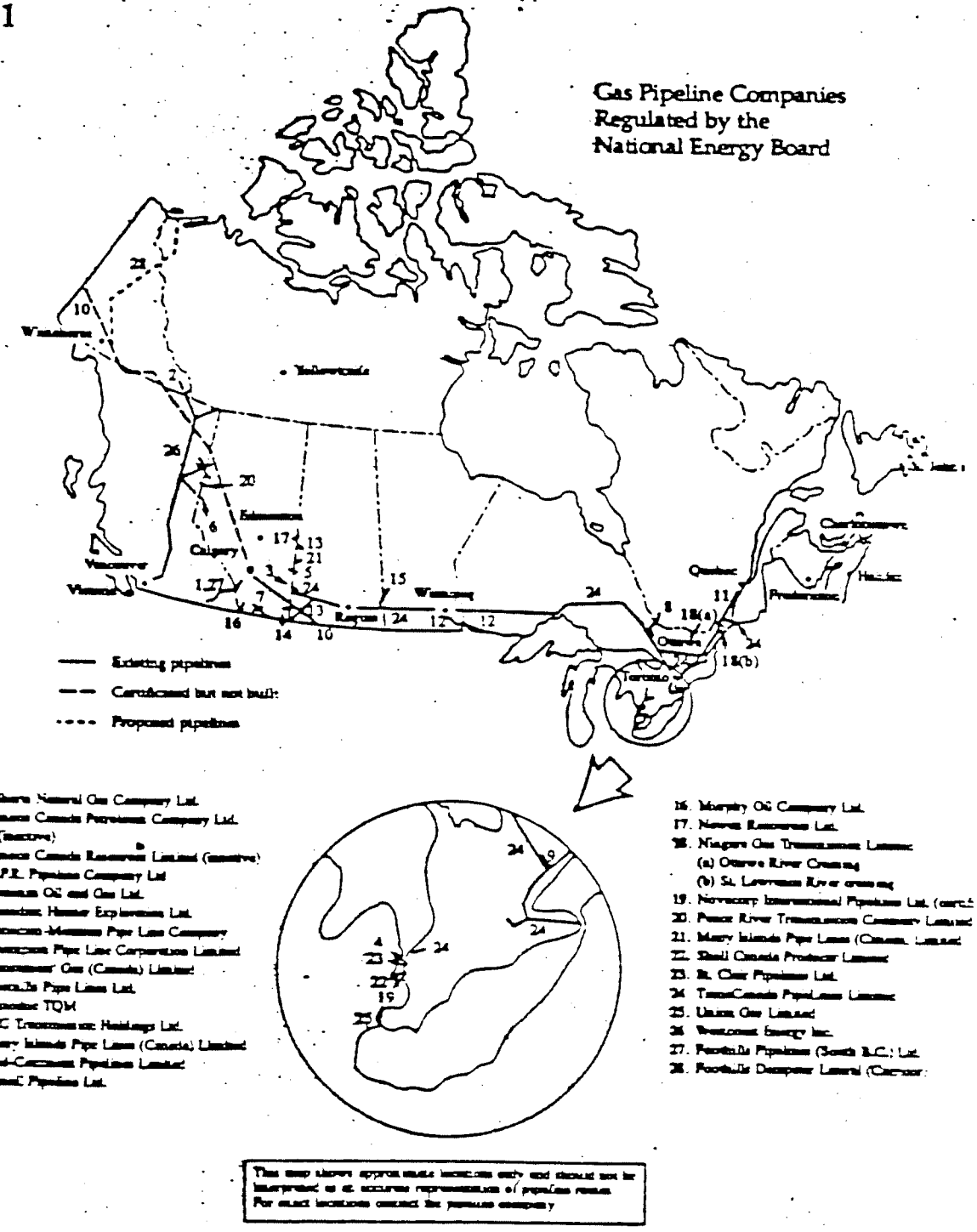
If you decide to remove or abandon the facility, you must notify the pipeline company in writing before doing so. You must also remove your installation if requested by the Board. If you are removing your facility, any excavation required would have to be approved as described earlier in this guide. If you are abandoning your facility, the pipeline company may require that you take precautions to prevent deterioration of the facility from posing a threat to the pipe in the future.

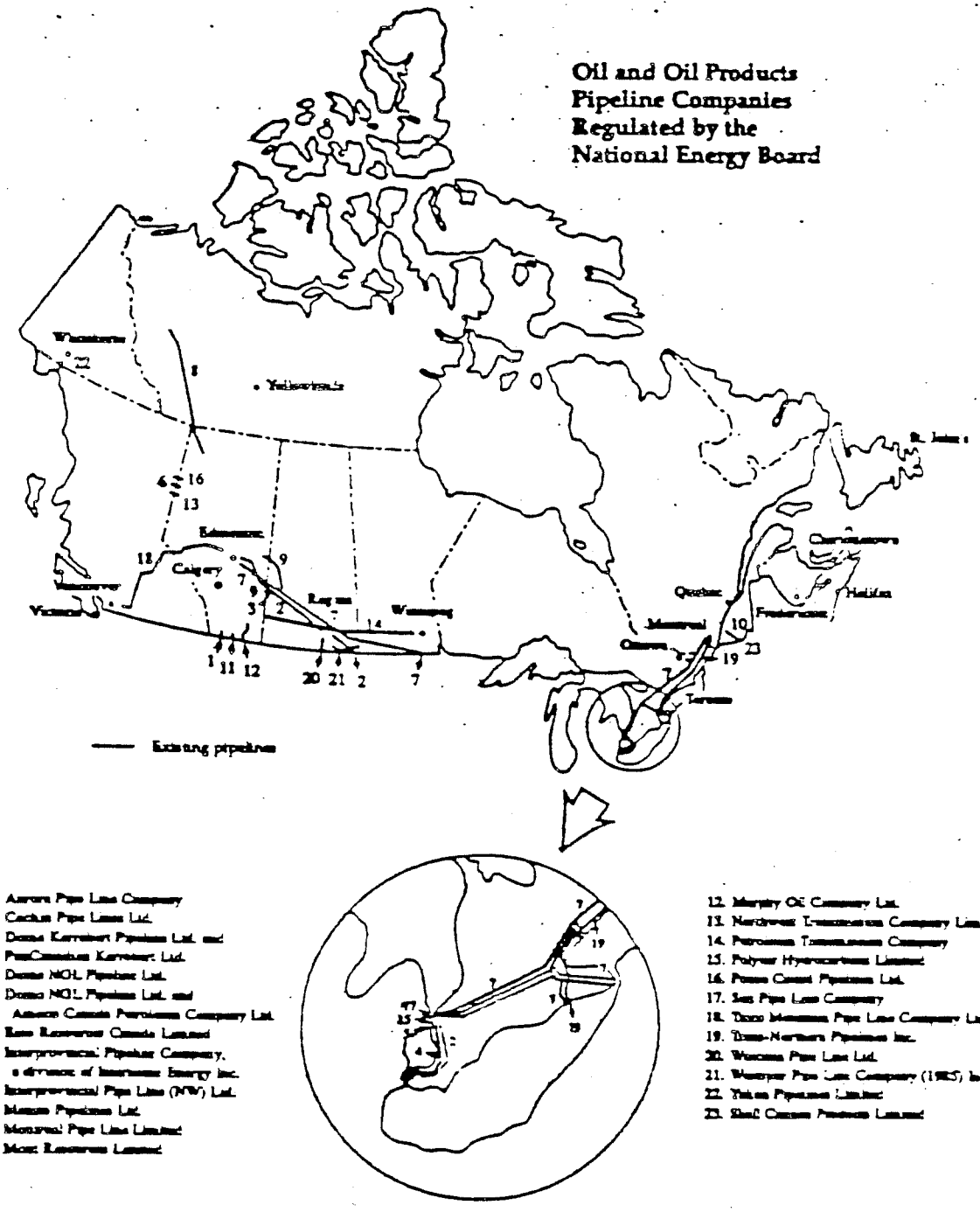
Appendices

A Reminder

If you have any questions about this guide or the *National Energy Board Pipeline Crossing Regulations, Part I*, do not hesitate to contact the National Energy Board at one of the numbers listed in the appendices.

Appendix 1


Gas Pipeline Companies
Regulated by the
National Energy Board
Existing pipelines
Certificated but not built
Proposed pipelines
1. Alberta Natural Gas Company Ltd.
2. Alberta Canada Petroleum Company Ltd.
(Inactive)
3. Alberta Canada Resources Limited (inactive)
4. A.P.R. Pipelines Company Ltd
5. Bowtown Oil and Gas Ltd.
6. Canadian Hunter Explorations Ltd.
7. Cassiar-Montana Pipe Line Company
8. Consumers Pipe Line Corporation Limited
9. Consumers' Gas (Canada) Limited
10. Foothills Pipe Lines Ltd.
11. Gaznat TQM
12. ICG Transmission Holdings Ltd.
13. Many Islands Pipe Lines (Canada) Limited
14. Mid-Continent Pipelines Limited
15. Montcl Pipelines Ltd.
16. Murphy Oil Company Ltd.
17. Nowest Resources Ltd.
18. Niagara Gas Transmission Limited
(a) Ottawa River Crossing
(b) St. Lawrence River crossing
19. Norcen Energy International Pipelines Ltd. (cancelled)
20. Peace River Transmission Company Limited
21. Many Islands Pipe Lines (Canada) Limited
22. Shell Canada Producer Limited
23. St. Clair Pipelines Ltd.
24. TransCanada PipeLines Limited
25. Union Gas Limited
26. Westcoast Energy Inc.
27. Foothills Pipelines (South B.C.) Ltd.
28. Foothills Dempster Lateral (Canada)
This map shows approximate locations only and should not be interpreted as an accurate representation of pipeline routes.
For exact locations consult the pipeline company


Oil and Oil Products
Pipeline Companies
Regulated by the
National Energy Board
Existing pipelines
1. Aurora Pipe Line Company
2. Cochin Pipe Lines Ltd.
3. Dome Kerrobert Pipelines Ltd. and PrairieConnect Kerrobert Ltd.
4. Dome NOL Pipelines Ltd.
5. Dome NOL Pipelines Ltd. and Alberta Canada Petroleum Company Ltd.
6. Esso Resources Canada Limited
7. Interprovincial Pipeline Company, a division of Interhome Energy Inc.
8. Interprovincial Pipe Line (NW) Ltd.
9. Montreal Pipe Line Limited
10. Montreal Pipe Line Limited
11. Moose Resources Limited
12. Murphy Oil Company Ltd.
13. Northwest Transmission Company Limited
14. Petroleum Transmission Company
15. Polaris Hydrocarbons Limited
16. Pouce Coupe Pipelines Ltd.
17. Sun Pipe Line Company
18. Trans Mountain Pipe Line Company Ltd.
19. Trans-Northern Pipelines Inc.
20. Wascana Pipe Line Ltd.
21. Westspur Pipe Line Company (1985) Inc.
22. Yukon Pipelines Limited
23. Shell Canada Products Limited
This map shows approximate locations only and should not be interpreted as an accurate representation of pipeline routes. For exact locations contact the pipeline company

Appendix 2 — Contact lists for National Energy Board Pipeline Crossing Division and pipeline companies under Board jurisdiction

National Energy Board

For Information Concerning Pipeline Crossings

Mailing Address

Secretary
National Energy Board
Ottawa, Ontario
K1A 0E5

Telex: 053-3791 — Telecopier: (613) 990-7900

Pipeline Crossing Division

Rick Seaman, Chief	Tel: (613) 998-7153
Jacqui Fitzpatrick	Tel: (613) 998-7150
Ernest Giordano	Tel: (613) 998-7147
Frank Valle	Tel: (613) 998-7141

90/01/01

Pipeline Company	Mailing Address	Contact
Alberta Natural Gas Company Ltd.	East Tower, Esso Plaza 425 First Street S.W. Calgary, Alberta T2P 3L8	Supervisor, Engineering Services Tel: (403) 260-9971 Telex: 038-24806 FAX: (403) 260-9077
Amoco Canada Petroleum Company Ltd.	P.O. Box 200 Station M Calgary, Alberta T2P 2H8	Manager, Surface Rights Tel: (403) 231-6801 FAX: (403) 231-6899
Amoco Canada Resources Limited	c/o Amoco Canada Petroleum Company Ltd. P.O. Box 200, Station M Calgary, Alberta T2P 2H8	Supervisor, Surface Rights Tel: (403) 231-6802 FAX: (403) 231-6899
Aurora Pipe Line Company	c/o Amoco Canada Petroleum Company Ltd. P.O. Box 1240 Pincher Creek, Alberta T0K 1W0	Area Foreman, Supply and Marketing Tel: (403) 627-3324 FAX: (403) 627-3610
A.P.R. Pipeline Company Ltd.	c/o Polysar Limited 201 N. Front Street Sarnia, Ontario N7T 7V1	Law Department Tel: (519) 332-1212 Telex: 064-76155 FAX: (519) 332-0408
Bonanza Oil & Gas Ltd.	3500 Bow Valley Square 4 250 Sixth Avenue S.W. Calgary, Alberta T2P 3H7	Supervisor, Surface Land Tel: (403) 260-8064 FAX: (403) 264-7003
Canadian Hunter Exploration Ltd.	700, 435 Fourth Avenue S.W. Calgary, Alberta T2P 3A8	Manager, Surface Acquisitions Tel: (403) 260-1000 FAX: (403) 260-1899
Canadian-Montana Pipe Line Company	40 East Broadway Butte, Montana, USA 59701	Director, Gas Production and Transmission Tel: (406) 723-5421, Ext. 2224 FAX: (406) 496-5099
Alternate Address:	1240 Western Canadian Place 700 Ninth Avenue S.W. Calgary, Alberta T2P 3V4	Tel: (403) 263-8870

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Pipeline Company	Mailing Address	Contact
Champion Pipe Line Corporation Limited	c/o Gaz Métropolitain, inc. 1717 rue du Havre Montréal, Québec H2K 2X1	Supervisor, Rights-of-Way Tel: (514) 598-3043 Telex: 05-829541 FAX: (514) 598-3625
Cochin Pipe Lines Ltd. *(Eastern Canada)*	c/o Amoco Canada Petroleum Company Ltd. 1182 Plank Road Sarnia, Ontario N7T 7H9	Area Scheduler, NGL Department Tel: (519) 336-4270 Telex: 064-76169 FAX: (519) 336-6011 Alternates: Area Foreman, NGL Department Senior Area Foreman NGL Department
Cochin Pipe Lines Ltd. *(Western Canada)*	c/o Amoco Canada Petroleum Company Ltd. P.O. Box 200, Station M Calgary, Alberta T2P 2H8	Supervisor, Surface Rights Tel: (403) 231-6802 FAX: (403) 231-6899 Alternate: Crossing Technician Surface Rights Tel: (403) 231-3066
Consumers' Gas (Canada) Ltd. *(Western Region)*	950 Burnhamthorpe Road West Mississauga, Ontario L5C 3B4	Supervisor, Planning and Technical Services Tel: (416) 276-3527 FAX: (416) 897-1440
Consumers' Gas (Canada) Ltd. *(Central Region, East of Hwy. 50)*	500 Elgin Mills Road East Richmond Hill, Ontario L4C 5G1	Supervisor, Planning and and Technical Services Tel: (416) 884-3314 FAX: (416) 884-1591

Pipeline Company	Mailing Address	Contact
Dome Kerrobert Pipeline Ltd. and PanCanadian Kerrobert Pipeline Ltd.	c/o Amoco Canada Petroleum Company Ltd. P.O. Box 200, Station M Calgary, Alberta T2P 2H8	Supervisor, Surface Rights Tel: (403) 231-6802 FAX: (403) 231-6899 Alternate: Crossing Technician, Surface Rights Tel: (403) 231-3066
Dome NGL Pipeline Ltd.	c/o Amoco Canada Petroleum Company Ltd. 1182 Plank Road Sarnia, Ontario N7T 7H9	Area Scheduler NGL Department Tel: (519) 336-4270 Telex: 064-76169 FAX: (519) 336-6011 Alternates: Area Foreman or Senior Area Foreman, NGL Department
Dome NGL Pipeline Ltd. and Amoco Canada Petroleum Company Ltd.	c/o Amoco Canada Petroleum Company Ltd. 1182 Plank Road Sarnia, Ontario N7T 7H9	Area Scheduler, NGL Department Tel: (519) 336-4270 Telex: 064-76169 FAX: (519) 336-6011 Alternates: Area Foreman or Senior Area Foreman, NGL Department
Esso Resources Canada Limited	P.O. Box 2000 Fort St. John, B.C. V1J 6K3	Foreman, Boundary Lake Field Tel: (604) 787-3700 FAX: (604) 787-3718 (Boundary Lake, B.C.)

Pipeline Company	Mailing Address	Contact
Foothills Pipe Lines (Alta.) Ltd. Foothills Pipe Lines (Sask.) Ltd. Foothills Pipe Lines Ltd.	c/o Foothills Pipe Lines Ltd. 3100-707 Eighth Ave. S.W. Calgary, Alberta T2P 3W8	Supervisor, Pipeline Design and Estimating Tel: (403) 294-4131 Telex: 038-25734 FAX: (403) 294-4551
Foothills Pipe Lines (South B.C.) Ltd.	c/o Alberta Natural Gas Company Ltd. East Tower, Esso Plaza 425 First Street S.W. Calgary, Alberta T2P 3L8	Supervisor, Engineering Services Tel: (403) 260-9971 Telex: 038-24806 FAX: (403) 260-9077
Gazoduc TQM	1 Place Ville Marie Bureau 2220 Montréal, Québec H3B 3M4	Technician, Engineering Services Tel: (514) 874-8874 Telex: 055-60804 FAX: (514) 874-8888
ICG Transmission Holdings Ltd.	P.O. Box 3040 North Bay, Ontario P1B 8K7	Chief Engineer, Engineering Tel: (705) 474-8480 FAX: (705) 474-4717
Interprovincial Pipe Line Company, a division of Interhome Energy Inc.	P.O. Box 398 The Interprovincial Pipe Line Tower 10201 Jasper Ave. Edmonton, Alberta T5J 2J9	Crossing Co-ordinator, Engineering Tel: (403) 420-5381 Telex: 037-2530 FAX: (403) 420-8211
Interprovincial Pipe Line (NW) Ltd.	P.O. Box 398 The Interprovincial Pipe Line Tower 10201 Jasper Ave. Edmonton, Alberta T5J 2J9	Crossing Co-ordinator, Engineering Tel: (403) 420-5381 Telex: 037-2530 FAX: (403) 420-8211
Marino Pipelines Ltd.	P.O. Box 2721 17th Floor Pipeline Division 800 Sixth Ave. S.W. Calgary, Alberta T2P 3G3	Pipeline Technician, Tel: (403) 294-8077 FAX: (403) 261-2630

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Pipeline Company	Mailing Address	Contact
Many Islands Pipe Lines (Canada) Limited Mid-Continent Pipelines Limited	2221 Cornwall Street P.O. Box 67 Regina, Saskatchewan S4P 2Z5	Gas Pipeline Manager, Engineering Tel: (306) 777-9606 (for Many Islands and Mid-Continent) Telex 071-2287 FAX: (306) 525-3422
Minell Pipeline Ltd.	Inter-City Gas Building 444 St. Mary Ave. Winnipeg, Manitoba R3C 3T7	Director, Operations, Engineering & Distribution Tel: (204) 934-3949 FAX: (204) 957-5868 Alternate: Chief Engineer, Operations, Engineering and Distribution
Mont Resources Limited	301-805 8th Avenue S.W. Calgary, Alberta T2P 1H7	Engineering Consultant Tel: (403) 264-7695
Montreal Pipe Line Limited	10803 Sherbrooke St. E. Montreal East, Quebec H1B 1B3	Manager, Operations and Line Maintenance Tel: (514) 645-8797 FAX: (514) 645-4589
Murphy Oil Company Ltd.	P.O. Box 2721 17th Floor 800 Sixth Ave. S.W. Calgary, Alberta T2P 3G3	Pipeline Technician, Pipeline Division Tel: (403) 294-8077 FAX: (403) 261-2630
Newco Resources Ltd.	3500 Bow Valley Square 4 250-6th Avenue S.W. Calgary, Alberta T2P 3H7	Supervisor, Surface Land Tel: (403) 260-8064 FAX: (403) 264-7003
Niagara Gas Transmission Limited	c/o Consumers' Gas 400 Coventry Road Ottawa, Ontario K1K 2C7	Supervisor, Planning and Technical Services of Consumers' Gas (Ottawa) - handles third party crossing applications for Niagara Gas Tel: (613) 748-6746 FAX: (613) 471-2378

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Pipeline Company	Mailing Address	Contact
Northwest Transmission Company Limited	c/o Norcen Energy Resources Limited 715 Fifth Ave. S.W. Calgary, Alberta T2P 2X7	Senior Area Engineer, Production Department Tel: (403) 231-0518 Telex: 03-824776 FAX: (403) 231-0187
Novacorp International Pipelines Ltd.	P.O. Box 2535, Station M Calgary, Alberta T2P 2N6	Tel: (403) 290-7724 Telex: 038-21503 FAX: (403) 290-6090
Peace River Transmission Company Limited	16705 Fraser Highway Surrey, B.C. V3S 2X7	Right-of-Way Administrator, Transmission and Lands Tel: (604) 576-2811 FAX: (604) 576-8239 Alternate: Transmission Superintendent, Transmission and Lands Tel: (604) 576-2811
Petroleum Transmission Company	c/o Petro Canada Inc. 2683 PCCW P.O. Box 2844 Calgary, Alberta T2P 3E3	Land Agent, Surface Land Tel: (403) 296-5327 Telex: 03-825753 FAX: (403) 296-3740
Polysar Hydrocarbons Limited	c/o Polysar Limited 201 N. Front Street Sarnia, Ontario N7T 7V1	Law Department Tel: (519) 332-1212 Telex: 064-76155 FAX: (519) 337-8251
Pouce Coupé Pipe Line Ltd.	1100, 202 - 6th Avenue S.W. Calgary, Alberta T2P 2R9	Supervisor, Lands Department Tel: (403) 267-8045 FAX: (403) 264-2480
Shell Canada Products Limited *(Leased Montreal line)*	c/o Montreal Pipe Line Limited 10803 Sherbrooke St. E. Montreal East, Quebec H1B 1B3	Manager, Operations and Line Maintenance of Montreal Pipe Line Limited - handles third party crossing applications for Shell Canada Tel: (514) 645-8797 FAX: (514) 645-4589

Pipeline Company	Mailing Address	Contact
Shell Canada Products Limited *(Sarnia line)*	Sarnia Manufacturing Centre St. Clair Parkway Corunna, Ontario N0N 1G0	Engineering Manager Tel: (519) 481-1100 FAX: (519) 882-5671
St. Clair Pipelines Ltd.	c/o Union Gas Limited Box 2001 50 Keil Drive N. Fifth Floor Tower Chatham, Ontario N7M 5M1	Permit/Agreement Agent, Lands Department Tel: (519) 352-3100 Ext. 2850 Telex: 064-78547 FAX: 1-800-265-5272
Sun Pipe Line Company	c/o Sun Canadian Pipeline Company Limited P.O. Box 470 Waterdown, Ontario L0R 2H0	Manager, Maintenance and Loss Control Tel: (416) 689-6641 FAX: (416) 689-6641
TransCanada PipeLines Limited	P.O. Box 54 Commerce Court West Toronto, Ontario M5L 1C2	Technician, Right-of-Way Department Tel: (416) 869-2432 Telex: 065-24174 FAX: (416) 869-2490
Trans Mountain Pipe Line Company Ltd.	Suite 800 Broadway Plaza 601 West Broadway Vancouver, B.C. V5Z 4C5	Supervisor, Drafting and Crossings Tel: (604) 876-6711 Telex: 045-4301 FAX: (604) 876-3911
Trans-Northern Pipelines Inc.	Manulife Centre Suite 1212 55 Bloor St. West Toronto, Ontario M4W 3H3	Technician, Engineering Tel: (416) 924-3353 Telex: 06-22102 Fax: (416) 924-5542
Union Gas Limited	Box 2001 50 Keil Drive N. Fifth Floor Tower Chatham, Ontario N7M 5M1	Permit/Agreement Agent, Lands Department Tel: (519) 352-3100 Ext. 2850 Telex: 064-78547 FAX: 1-800-265-5272

Pipeline Company	Mailing Address	Contact
Wascana Pipe Line Ltd.	c/o Murphy Oil Company Ltd. P.O. Box 2721 17th Floor 800 Sixth Ave. S.W. Calgary, Alberta T2P 3G3	Pipeline Technician, Pipeline Division Tel: (403) 294-8077 FAX: (403) 261-2630
Westcoast Energy Inc.	1333 West Georgia St. Vancouver, B.C. V6E 3K9	Administrator, Land and Property Tax Tel: (604) 691-5792 Telex 045-1340 FAX: (604) 691-5877
Westspur Pipe Line Company (1985) Inc.	1214 Sixth Street Estevan, Saskatchewan S4A 1B1	Land Supervisor, Lands Department Tel: (306) 634-2681 FAX: c/o Producer's Pipeline (306) 634-8222
Yukon Pipelines Limited	c/o White Pass and Yukon Corporation Limited P.O. Box 4070 Whitehorse, Yukon Territory Y1A 3T1	Lands Manager Tel: (403) 668-7621 FAX: (403) 668-4051

Appendix 3

How to Obtain Approval of the National Energy Board

Earlier in this guide, we outlined certain circumstances under which you will need to obtain the Board's approval.

When you do need the Board's approval, send us a letter or a telex which includes the location and full details of the proposed activity. You should emphasize the reasons why you are applying for approval of the Board rather than the permission of the pipeline company.

Mail your application to:

The Secretary
National Energy Board
Ottawa, Ontario
K1A 0E5

You should also send a copy of your application to the pipeline company so that it can review the information and forward any comments it may have to the Board.

If you have any questions, do not hesitate to contact

A list of our telephone numbers is included in this booklet.

Appendix 4

Section 112
National Energy Board Act

Construction of facilities across pipelines

112. (1) Subject to subsection (5), no person shall, unless leave is first obtained from the Board, construct a facility across, on, along or under a pipeline or excavate using power-operated equipment or explosives within thirty metres of a pipeline.

Use of vehicles and mobile equipment

(2) Subject to subsection (5), no person shall operate a vehicle or mobile equipment across a pipeline unless leave is first obtained from the company or the vehicle or mobile equipment is operated within the travelled portion of a highway or public road.

Terms and conditions

(3) The Board may, on granting an application for leave under this section, impose such terms and conditions as it considers proper.

Directions

(4) The Board may direct the owner of a facility constructed across, on, along or under a pipeline in contravention of this Act or the Board's orders or regulations to do such things as the Board considers necessary for the safety of the pipeline and may, where the Board considers that the facility may impair the safe operation of the pipeline, direct the owner to reconstruct, alter or remove the facility.

Exception

(5) The Board may make orders or regulations governing

(a) the design, construction, operation and abandonment of facilities constructed across, on, along or under pipelines;

(b) the measures to be taken by any person in relation to

(i) the construction of facilities across, on, along or under pipelines,

(ii) the construction of pipelines across, on, along or under facilities, other than railways, and

(iii) excavations within thirty metres of a pipeline; and

(c) the circumstances in which or conditions under which leave under this section is not necessary.

Appendix 5

Registration
SOR/88-528 18 October, 1988

NATIONAL ENERGY BOARD ACT

National Energy Board Pipeline Crossing Regulations, Part I

The National Energy Board, pursuant to subsection 77(2)* of the National Energy Board Act, hereby makes the annexed Regulations respecting leave for crossings of pipelines.

Ottawa, October 17, 1988

REGULATIONS RESPECTING LEAVE FOR CROSSINGS OF PIPELINES

Short Title

1. These Regulations may be cited as the *National Energy Board Pipeline Crossing Regulations, Part I*.

Interpretation

2. In these Regulations,

"Act" means the *National Energy Board Act*; (*Loi*)

"emergency" means an unexpected situation that could endanger life or cause substantial property or environmental damage and that requires immediate action; (*urgence*)

"excavation" means any disturbance of the ground in the vicinity of a pipe; (*travaux d'excavation*)

"excavator" means the person who performs an excavation and includes the corporation or other legal entity and every agent, affiliate and subcontractor of the corporation or other legal entity, that has direct control over the person performing the excavation; (*exécutant de travaux d'excavation*)

"facility" means

(*a*) any structure that is constructed or placed on the right-of-way of a pipeline, and

(*b*) any highway, private road, railway, irrigation ditch, drain, drainage system, sewer, dike, telegraph, telephone line or line for the transmission of hydrocarbons, power or any other substance that is or is to be carried across, along, upon or under any pipeline; (*installation*)

"facility owner" means a person, firm, public agency, corporation or any combination thereof that owns a facility or that undertakes or has control over one or more of the activities related to construction, installation, operation, maintenance or removal of a facility; (*propriétaire d'installation*)

* S.C. 1980-81-82-83, c. 116, s. 21

Enregistrement
DORS/88-528 18 octobre 1988

LOI SUR L'OFFICE NATIONAL DE L'ÉNERGIE

Règlement de l'Office national de l'énergie sur le croisement de pipe-lines, partie I

En vertu du paragraphe 77(2)* de la Loi sur l'Office national de l'énergie, l'Office national de l'énergie prend le Règlement concernant le croisement de pipe-lines, ci-après.

Ottawa, le 17 octobre 1988

RÈGLEMENT CONCERNANT LE CROISEMENT DE PIPE-LINES

Titre abrégé

1. *Règlement de l'Office national de l'énergie sur le croisement de pipe-lines, partie I*.

Définitions

2. Les définitions qui suivent s'appliquent au présent règlement.

«autorisation» Selon le cas, le consentement de l'Office en vertu du paragraphe 77(1) ou l'autorisation de l'Office en vertu du paragraphe 77(1.1) de la *Loi*. (*leave*)

«conduite» Une conduite et tous ses accessoires qui sont la propriété d'une compagnie pipelinière et qui servent à la transmission des hydrocarbures par un pipe-line. (*pipe*)

«endroit au large des côtes» Toute zone sous-marine adjacente à la côte canadienne. (*offshore area*)

«exécutant de travaux d'excavation» Personne qui effectue des travaux d'excavation, y compris la société ou toute autre personne morale ou tout agent, affilié ou sous-traitant de celle-ci qui exerce un contrôle direct sur la personne effectuant les travaux d'excavation. (*excavator*)

«installation»

a) Structure construite ou placée sur l'emprise d'un pipeline;

b) voie publique, chemin privé, chemin de fer, fossé d'irrigation, drain ou fossé d'écoulement, système de drainage, égout, digue, ligne télégraphique ou téléphonique ou ligne ou canalisation pour la transmission d'hydrocarbures, de force motrice ou de quelque autre substance, qui traverse ou est censé traverser un pipe-line ou qui se trouve ou est censé se trouver sur ou sous un pipe-line ou le long de celui-ci. (*facility*)

* S.C. 1980-81-82-83, ch. 116, art. 21

"leave" means the leave of the Board referred to in subsections 77(1) or (1.1) of the Act; (*autorization*)

"offshore area" means the submarine areas adjacent to the coast of Canada; (*endroit au large des côtes*)

"overhead line" means an above-ground telephone, telegraph, telecommunication or electric power line or any combination thereof; (*ligne aérienne*)

"permission" means the consent given by a pipeline company to a facility owner or excavator to construct or install a facility or to excavate; (*permission*)

"pipe" means the pipe and all related appurtenances that belong to a pipeline company and that are used in the transmission of hydrocarbons through a pipeline; (*conduite*)

"restricted area" means an area situated in the vicinity of any proposed construction, installation or excavation, independent of the pipeline right-of-way, that has been temporarily designated by the pipeline company pursuant to paragraph 9(1)(*b*) of the *National Energy Board Pipeline Crossing Regulations, Part II* as an area within which no excavation may be performed until the pipeline company's pipes in that area have been located and properly staked. (*zone interdite*)

«ligne aérienne» Ligne téléphonique ou télégraphique ou ligne de télécommunications ou de transport d'énergie électrique installée au-dessus du sol ou toute combinaison de ces lignes. (*overhead line*)

«Loi» La *Loi sur l'Office national de l'énergie*. (*Act*)

«permission» Le consentement accordé par une compagnie pipelinière au propriétaire d'installation ou à l'exécutant de travaux d'excavation pour procéder à la construction ou à l'aménagement d'une installation ou à l'exécution de travaux d'excavation. (*permission*)

«propriétaire d'installation» Personne, entreprise, organisme public ou société, ou tout groupement de ceux-ci, qui possède une installation ou qui entreprend ou contrôle une ou plusieurs des activités liées à la construction, à l'aménagement, à l'exploitation, à l'entretien ou à l'enlèvement d'une installation. (*facility owner*)

«travaux d'excavation» Tout déplacement du sol à proximité d'une conduite. (*excavation*)

«urgence» Toute situation imprévue qui pourrait mettre la vie en danger ou causer des dommages importants à des biens ou à l'environnement et qui nécessite une intervention immédiate. (*emergency*)

«zone interdite» Zone située à proximité du lieu d'exécution des travaux d'excavation, de construction ou d'aménagement proposés, sans égard à l'emprise du pipe-line et que la compagnie pipelinière a désignée provisoirement en application de l'alinéa 9(1)*b*) du *Règlement de l'Office national de l'énergie sur le croisement de pipe-lines, partie II* comme zone où les travaux d'excavation sont interdits jusqu'à ce que ses conduites aient été repérées et dûment jalonnées. (*restricted area*)

Application

3. These Regulations do not apply to an excavation caused by

(*a*) a pipeline company or its agents; or

(*b*) activities, other than the construction or installation of a facility, that disturb less than three tenths of a metre of ground below the initial grade and do not reduce the total cover over the pipe.

Application

3. Sont exclus de l'application du présent règlement :

a) les travaux d'excavation entrepris par une compagnie pipelinière ou ses agents;

b) les travaux d'excavation découlant d'activités, autres que la construction ou l'aménagement d'une installation, qui occasionnent un déplacement de sol inférieur à 0,3 m au-dessous du niveau initial du sol et qui ne réduisent pas le remblayage total au-dessus de la conduite.

Conditions and Circumstances Under Which Leave of the Board is not Required

4. Unless otherwise ordered by the Board, leave of the Board is not required for any construction or installation of a facility, other than the installation of an overhead line referred to in section 5, if

(*a*) the construction or installation of the facility takes place in an area other than an offshore area;

(*b*) the facility owner obtains written permission from the pipeline company prior to the construction or installation of the facility and accepts any conditions set out in the permission;

Circonstances et conditions selon lesquelles l'autorisation de l'Office n'est pas nécessaire

4. À moins d'ordonnance contraire de l'Office, l'autorisation de celui-ci n'est pas nécessaire pour la construction ou l'aménagement d'une installation, sauf l'installation d'une ligne aérienne visée à l'article 5, lorsque :

a) l'installation est construite ou installée ailleurs que dans un endroit au large des côtes;

b) le propriétaire de l'installation obtient au préalable la permission écrite de la compagnie pipelinière et accepte de respecter les conditions qui y sont énoncées;

(*c*) the facility owner ensures that the work is carried out in accordance with the technical details that are set out in its request for permission that have been accepted by the pipeline company;

(*d*) the facility owner ensures that the work is completed within two years after the date the permission referred to in paragraph (*b*) is granted or within a period otherwise agreed on by the pipeline company and the facility owner;

(*e*) where permission is suspended by the pipeline company in accordance with subsection 14(1) of the *National Energy Board Pipeline Crossing Regulations, Part II*, the facility owner ceases work;

(*f*) unless otherwise agreed on by the pipeline company and the facility owner and except in cases of emergency, three working days notice is given by the facility owner to the pipeline company prior to commencement of construction or installation of the facility;

(*g*) in the case of an emergency, as much prior notice as is practicable is given by the facility owner to the pipeline company prior to commencement of construction or installation of the facility;

(*h*) the facility owner undertakes and complies with all practices stipulated by the pipeline company to the facility owner to lessen any detrimental effect that the facility may have on a pipe;

(*i*) prior to the construction or installation of the facility, the facility owner

(i) confirms with the pipeline company that all the pipeline company's pipes in the vicinity have been staked, and

(ii) ensures that the pipeline company has explained, to the satisfaction of the facility owner, the significance of the stakes that identify the location of the pipeline company's pipes;

(*j*) the facility owner complies with the instructions of an authorized field representative of the pipeline company regarding the procedures to be followed while working in the vicinity of a pipe;

(*k*) where interference with or alteration of a pipe is necessary, the facility owner obtains prior written consent of the pipeline company;

(*l*) where the facility owner receives the consent referred to in paragraph (*k*), the work is carried out under the supervision of the pipeline company;

(*m*) the facility owner immediately notifies the pipeline company of any contact with a pipeline company's pipe or its coating;

(*n*) the facility owner maintains the facility in a state of good repair compatible with the safety of the pipeline and immediately corrects any deterioration in the facility on being informed in writing by the pipeline company pursuant to subsection 15(1) of the *National Energy Board Pipeline Crossing Regulations, Part II*, except where, unless otherwise ordered by the Board,

e) il s'assure que les travaux sont effectués conformément aux modalités techniques énoncées dans la demande de permission et acceptées par la compagnie pipelinière;

d) il s'assure que les travaux sont achevés dans les deux ans suivant la date de l'octroi de la permission visée à l'alinéa *b*) ou dans le délai dont lui et la compagnie pipelinière conviennent;

e) il interrompt les travaux si la permission est suspendue par la compagnie pipelinière en application du paragraphe 14(1) du *Règlement de l'Office national de l'énergie sur le croisement de pipe-lines, partie II*;

f) il donne à la compagnie pipelinière un préavis de trois jours ouvrables avant le début des travaux de construction ou d'aménagement, sauf dans les cas où lui et la compagnie en conviennent autrement et dans les cas d'urgence;

g) dans les cas d'urgence, il donne à la compagnie pipelinière le plus long préavis possible avant le début des travaux de construction ou d'aménagement;

h) il prend toutes les mesures spécifiées par la compagnie pipelinière pour atténuer les conséquences néfastes que l'installation pourrait avoir sur la conduite;

i) avant le début des travaux de construction ou d'aménagement :

(i) il obtient de la compagnie pipelinière la confirmation que toutes les conduites de celle-ci se trouvant à proximité du lieu des travaux sont jalonnées,

(ii) il s'assure que la compagnie pipelinière lui explique, d'une manière qu'il juge satisfaisante, la signification des jalons servant à indiquer l'emplacement des conduites de celle-ci;

j) il observe les instructions données par le représentant autorisé de la compagnie pipelinière sur le chantier en ce qui concerne les procédures à suivre pendant l'exécution de travaux à proximité d'une conduite;

k) il obtient au préalable le consentement écrit de la compagnie pipelinière dans les cas où les travaux de construction ou d'aménagement ne peuvent se faire sans que la conduite soit perturbée ou modifiée;

l) les travaux pour lesquels il obtient le consentement visé à l'alinéa *k*) se font sous la surveillance de la compagnie pipelinière;

m) en cas de contact, au cours des travaux, avec une conduite de la compagnie pipelinière ou avec son revêtement, il en avise immédiatement la compagnie pipelinière;

n) il maintient l'installation en bon état de manière à ne pas compromettre la sécurité du pipe-line et remédie immédiatement à toute détérioration de l'installation dès qu'il en est avisé par écrit par la compagnie pipelinière conformément au paragraphe 15(1) du *Règlement de l'Office national de l'énergie sur le croisement de pipe-lines, partie II*, sauf dans les cas où, à moins d'ordonnance contraire de l'Office :

(i) the facility owner provides the pipeline company with a written undertaking executed by a third party whereby the third party agrees to assume the responsibility for maintaining the facility, or

(ii) the facility has been removed or abandoned and the site restored to the satisfaction of the pipeline company;

(*o*) the facility owner notifies the pipeline company, in writing, of the proposed abandonment or removal of any facility affecting a pipe or right-of-way of the pipeline; and

(*p*) the facility owner removes or alters any facility that, in the opinion of the Board, could impede the safe and efficient operation of the pipeline, or that the Board for other reasons considers should be removed or altered.

5. Leave of the Board is not required for the installation of an overhead line across a pipeline if

(*a*) unless otherwise agreed on by the pipeline company and the facility owner and except in cases of emergency, three working days notice is given by the facility owner to the pipeline company prior to commencement of installation;

(*b*) in the case of an emergency, as much prior notice as is practicable is given by the facility owner to the pipeline company prior to commencement of installation;

(*c*) the overhead line is installed in accordance with the minimum ground-to-wire clearance established by the Canadian Standards Association Standard CAN/CSA-C22.3 No. 1-M87, *Overhead Systems*, April 1987;

(*d*) where the pipeline is patrolled by aircraft, aerial warning devices are installed and properly maintained by the facility owner at the request of the pipeline company; and

(*e*) no poles, pylons, towers, guys, anchors or supporting structures of any kind are constructed or placed on the right-of-way of the pipeline or within its projected limits.

6. Leave of the Board is not required for an excavation, other than an excavation referred to in section 7, if

(*a*) the excavation takes place in an area other than an offshore area;

(*b*) the excavator obtains written permission from the pipeline company prior to the excavation and accepts any conditions set out in the permission;

(*c*) the excavator ensures that the work is carried out in accordance with the technical details that are set out in its request for permission that have been accepted by the pipeline company;

(*d*) the excavator ensures that the work is completed within two years after the date the permission referred to in paragraph (*b*) is granted or within a period otherwise agreed on by the pipeline company and the excavator;

(i) il remet à la compagnie pipelinière la promesse écrite d'un tiers qui s'engage à assumer la responsabilité de l'entretien de l'installation, ou

(ii) l'installation est enlevée ou abandonnée et les lieux sont remis en état à la satisfaction de la compagnie pipelinière;

o) il avise par écrit la compagnie pipelinière de tout projet d'abandon ou d'enlèvement d'une installation touchant une conduite ou l'emprise du pipe-line;

p) il enlève ou modifie toute installation qui, de l'avis de l'Office, pourrait nuire à l'exploitation sûre et efficace du pipe-line, ou qui, d'après l'Office, doit être enlevée ou modifiée pour d'autres raisons.

5. L'autorisation de l'Office n'est pas nécessaire pour l'installation d'une ligne aérienne au-dessus d'un pipe-line lorsque :

a) le propriétaire d'installation donne un préavis de trois jours ouvrables à la compagnie pipelinière avant le début des travaux d'installation, sauf dans les cas où la compagnie pipelinière et le propriétaire de l'installation en conviennent autrement et dans les cas d'urgence;

b) dans les cas d'urgence, le propriétaire d'installation donne à la compagnie pipelinière le plus long préavis possible avant le début des travaux d'installation;

c) la ligne aérienne est installée conformément aux exigences minimales de hauteur libre entre le sol et les fils que stipule la norme CAN/CSA-C22.3 nº 1-M87 de l'Association canadienne de normalisation, intitulée «*Overhead Systems*», en date d'avril 1987;

d) lorsque le pipe-line fait l'objet d'une patrouille aérienne, des balises aériennes sont installées et adéquatement entretenues par le propriétaire d'installation à la demande de la compagnie pipelinière;

e) aucun poteau, pylône, tour, hauban, ancrage ou structure de soutien de quelque type que ce soit n'est construit ni placé à l'intérieur de l'emprise du pipe-line ou à l'intérieur du prolongement de ses limites.

6. L'autorisation de l'Office n'est pas nécessaire pour l'exécution de travaux d'excavation, autres que ceux visés à l'article 7, lorsque :

a) les travaux d'excavation sont effectués ailleurs que dans un endroit situé au large des côtes;

b) l'exécutant de travaux d'excavation obtient au préalable la permission écrite de la compagnie pipelinière et accepte de respecter les conditions qui y sont énoncées;

c) il s'assure que les travaux sont effectués conformément aux modalités techniques énoncées dans la demande de permission et acceptées par la compagnie pipelinière;

d) il s'assure que les travaux sont achevés dans les deux ans suivant la date d'octroi de la permission visée à l'alinéa *b*) ou dans le délai dont lui et la compagnie pipelinière conviennent;

(*e*) where permission is suspended by the pipeline company in accordance with subsection 14(1) of the *National Energy Board Pipeline Crossing Regulations, Part II*, the excavator ceases work;

(*f*) unless otherwise agreed on by the pipeline company and the excavator and except in cases of emergency, three working days notice is given by the excavator to the pipeline company prior to commencement of the excavation;

(*g*) in the case of an emergency, as much prior notice as is practicable is given by the excavator to the pipeline company prior to commencement of the excavation;

(*h*) prior to commencement of the excavation, the excavator

(i) confirms with the pipeline company that all the pipeline company's pipes in the vicinity have been staked, and

(ii) ensures that the pipeline company explains, to the satisfaction of the excavator, the significance of the stakes that identify the location of the pipeline company's pipes;

(*i*) the excavator does not excavate mechanically within a restricted area;

(*j*) the excavator does not excavate mechanically within three metres of a pipe unless

(i) the pipe has been exposed by hand at the point of crossing or where the excavation runs parallel to the pipe, at sufficient intervals to confirm the location of the pipe,

(ii) where the excavation crosses a pipe, the pipeline company has informed the excavator that it has confirmed the location of the pipe by probing and the pipe is at least six tenths of a metre deeper than the proposed excavation,

(iii) where the excavation runs parallel to the pipe, the pipeline company has informed the excavator that it has confirmed the location of the pipe by probing, or

(iv) where ground conditions render exposure of the pipe by hand impractical, the pipeline company has agreed that the excavation may be performed safely to within one metre of the pipe and the pipeline company directly supervises the excavation;

(*k*) when boring directionally or using explosives, unless otherwise authorized by the Board, the excavator complies with the conditions imposed by the pipeline company respecting directional boring or the use of explosives;

(*l*) the excavator complies with the instructions of an authorized field representative of the pipeline company regarding the procedures to be followed while working in the vicinity of a pipe;

(*m*) where interference with or alteration of a pipe is necessary, the excavator obtains prior written consent of the pipeline company;

e) il interrompt les travaux si la permission est suspendue par la compagnie pipelinière en application du paragraphe 14(1) du *Règlement de l'Office national de l'énergie sur le croisement de pipe-lines, partie II*;

f) il donne à la compagnie pipelinière un préavis de trois jours ouvrables, avant le début des travaux d'excavation, sauf dans les cas où lui et la compagnie pipelinière en conviennent autrement et dans les cas d'urgence;

g) dans les cas d'urgence, il donne à la compagnie pipelinière le plus long préavis possible avant le début des travaux d'excavation;

h) avant le début des travaux d'excavation, il :

(i) obtient de la compagnie pipelinière la confirmation que toutes les conduites de celle-ci se trouvant à proximité du lieu des travaux sont jalonnées;

(ii) s'assure que la compagnie pipelinière lui explique, d'une manière qu'il juge satisfaisante, la signification des jalons servant à indiquer l'emplacement des conduites de celle-ci;

i) il ne procède pas à des travaux d'excavation mécaniques dans une zone interdite;

j) il ne procède pas à des travaux d'excavation mécaniques en deçà de trois mètres d'une conduite, sauf si, selon le cas :

(i) la conduite a été mise à nu manuellement au point de croisement ou, si les travaux d'excavation se font sur un plan parallèle à la conduite, à des intervalles suffisants pour permettre la vérification de son emplacement,

(ii) lorsque les travaux d'excavation se font en travers de la conduite, la compagnie pipelinière l'a informé qu'elle a repéré la conduite par sondage et que celle-ci est enfouie à au moins 0,6 m au-dessous du niveau du sol jusqu'où les travaux d'excavation seront effectués,

(iii) si les travaux d'excavation sont effectués sur un plan parallèle à une conduite, la compagnie pipelinière l'a informé qu'elle a vérifié l'emplacement de la conduite par sondage,

(iv) lorsque les conditions du sol ne permettent pas que la conduite soit mise à nu manuellement, la compagnie pipelinière a convenu que les travaux peuvent être effectués en toute sécurité jusqu'à 1 m de la conduite, sous la surveillance directe de la compagnie pipelinière;

k) à moins d'autorisation contraire de l'Office, lorsque l'exécutant de travaux d'excavation effectue un forage directionnel ou utilise des explosifs, il respecte les conditions imposées par la compagnie pipelinière à cet égard;

l) il observe les instructions données par le représentant autorisé de la compagnie pipelinière sur le chantier en ce qui concerne les procédures à suivre pendant l'exécution de travaux à proximité de la conduite;

m) il obtient au préalable le consentement écrit de la compagnie pipelinière, dans les cas où les travaux d'excavation ne peuvent se faire sans que la conduite soit perturbée ou modifiée;

(*n*) where the excavator receives the consent referred to in paragraph (*m*), the work is carried out under the supervision of the pipeline company;

(*o*) the excavator immediately notifies the pipeline company of any contact with the pipeline company's pipe or its coating; and

(*p*) unless otherwise agreed on by the pipeline company and the excavator, the excavator notifies the pipeline company at least 24 hours prior to backfilling over the pipe.

7. Leave of the Board is not required for an excavation required for the maintenance of an existing facility if the circumstances and conditions set out in paragraphs 6(*f*) to (*p*) are met.

N.B. The Regulatory Impact Analysis Statement for these Regulations appears at p. 4418, following SOR/88-529.

n) les travaux pour lesquels il obtient le consentement visé à l'alinéa *m*) se font sous la surveillance de la compagnie pipelinière;

o) en cas de contact, au cours des travaux, avec une conduite de la compagnie pipelinière ou avec son revêtement, il en avise immédiatement la compagnie pipelinière;

p) il donne à la compagnie pipelinière un préavis d'au moins 24 heures avant de remblayer la conduite, sauf dans les cas où lui et la compagnie pipelinière en conviennent autrement.

7. L'autorisation de l'Office n'est pas nécessaire pour l'exécution de travaux d'excavation qu'exige l'entretien d'une installation existante lorsque les conditions visées aux paragraphes 6*f*) à *p*) sont respectées.

N.B. Le résumé de l'étude d'impact de la réglementation de ce règlement se trouve à la page 4418, suite au DORS/88-529.

PART VI

REVIEW COMMENTS BY PIPELINE COMPANIES

Interprovincial Pipe Line Inc.

J. D. Smith Manager, Quality Assurance
W. J. Loper Crossings Coordinator

IPL Tower
10201 Jasper Avenue
P. O. Box 398
Edmonton, Alberta T5J 2J8
Office (403) 420-5210
Direct (403) 420-5381
Fax (403) 420-8211

SEP 05 1991

August 30, 1991 DEg: 793

File: 7.14.4
MP. M1889 - M1897±
KM. M3040 - M3053±

VIA COURIER

McCormick Rankin
2655 North Sheridan Way
Mississauga, Ontario
L5K 2P8

Dear Mr. S. Schijns:

Mississauga Busway Proposal - Interprovincial Pipe Line Inc. Cost Estimates

In response to your proposal, attached is a cost estimate for rerouting or lowering sections of our Line #9 at seven locations affected by the proposed busway.

The estimated cost for the pipeline lowerings and relocations is $4,761,200.00, which includes material, construction and engineering costs. All costs are in the second quarter 1991 dollars. The estimate can be refined to a project estimate as details such as construction timing and the actual pipeline route are further defined. This estimate does not include any costs relating to land acquisitions, easements, damages and restoration work, as it has been indicated that it will be the responsibility of the City of Mississauga.

Yours truly,

Warren J. Loper

WJL/ll

cc: S.A. Ramsay
J.W. Hicks/L.A. Zupan

Summary of Estimated Costs for Mississuaga Busway Proposal

Operation	Station	IPL Estimate
Rerouting	Erin Mills	$628,100
	Mavis	$1,063,200
	Tomken	$776,400
	Dixie	$1,084,900
	Sub-Total	$3,552,600
Lowering	Glen Erin	$385,400
	Creditview	$429,400
	Fieldgate	$393,800
	Sub-Total	$1,208,600
	Total	$4,761,200

Interprovincial Pipe . ıe Inc.

S. A. Ramsay, P.Ag. Manager, Right - of - Way, Eastern Division

Suite 303
125 Lakeshore Road East
Oakville, Ontario L6J 1H3
Office (416) 849-7811
Fax (416) 849-8634



JUL 2 2 1991

July 18, 1991

McCormick Rankin
2655 North Sheridan Way
Mississauga, Ontario
L5K 2P8

Attention: Mr. de Lange

Dear Sirs,

RE: Mississauga Busway Proposal and Interprovincial Pipe Line Inc.

Further to our recent telephone conversation, I would like to confirm that our 30" Sarnia-Montreal pipeline, which passes through the Parkway Belt West, in Mississauga, north of Highway 403, is presently nitrogen filled, and will be for the foreseeable future.

As discussed, our Engineering Department is preparing a cost estimate for re-routing and lowering Line 9 to accommodate the plans which you submitted some time ago. Needless to say, it will be significantly less expensive to do the relocation work while the line is nitrogen filled. As you may be aware, there are a number of proposals for Line 9, involving reversal for crude oil transportation from off shore, reactivation for transportation of heavy crude from western Canada to Quebec, and finally conversion of the oil pipeline to natural gas transportation. It is hard to predict when any one of these projects may be activated, but the sooner any relocation work takes place, the less likely there will be a conflict with the future use of the pipeline.

Yours very truly,

S. A. Ramsay
Right-of-Way Manager

djh

Esso Petroleum Canada

MAR 13 1991

P.O. Box 380
Waterdown, Ontario
Canada L0R 2H0

Sarnia Products Pipeline

416 689 6651
Toronto Line:
416 823 6500

File: 15-40-1-6[A]
91-03-08

McCormick Rankin
Busway Planning
2555 North Sheridan Way

Mississauga, Ontario
L5K 2P8

Attention: Steve Schijns P.Eng.

Dear Mr. Schijns

RE:Mississauga Busway / Sarnia Products Pipeline
Conflicts Options Review

Esso Petroleum Canada has followed the specific Guidelines as shown in the appendix of the "Impact Of Busway On Pipelines" technical report, in reviewing these options to resolve future encroachment conflicts. The aim of our comments and concerns raised in all our reviews of the Busway project is to avoid potential busway disruptions, pipeline maintenance troubles and public safety risks in the future as well as avoid construction problems during the building of the busway. We have aimed to keep the pipelines and the busway stations as separate as possible. This will ultimately prove preferable for both the Busway and the pipelines from a safety and operational stand point.

Most of the concerns Esso Petroleum Canada still has with some of the recommended options pertain to locating pipelines within the busy areas of busway stations. It is doubtful, despite all appearances to the contrary, that a busway station as part of an busy integrated regional transit system would be able to be shut down for routine maintenance to an oil pipeline. Esso Petroleum Canada currently operates a pipeline system with a high degree of safety and routine maintenance is an integral part of this.

We are also concerned that the construction costs shown could escalate due to crossings of other utilities and factory made bends which may be required for some lowerings and other design costs.

With these in mind some of the specific concerns Esso Petroleum Canada has with the options recommended in your report are:

Table 1 Page 5 - The entry at the Ridgeway Stn. for the SPPL 10" is shown as 'lower', it should read 'relocate' the same as for the SPPL 12".
Ridgeway Station:
Option 2 [preferred in the report] runs under a Kiss & Ride. To get the pipelines out of the station we would prefer Option 4 around the north side of the busway, failing that Option 1 is our next choice.

Winston Churchill Stn.:
We agree with the report that Option 3 is most cost effective and preferable choice.

Mississauga Rd. Stn.:
Option 3, or failing that, option 2 would remove the pipelines from the station area and eliminate most possibility of future shut down problems of the station. Option 4 while moving the pipelines away from the parallel stretch of busway road, still leaves it running through the center of the station when valid alternatives are possible. Esso Petroleum Canada does not agree with recommending this option.

Mavis Rd. Stn.:
Please note that the lowering of the pipelines could prove difficult being so close to the built up portion of Mavis Road. Should pipe bends or lowering under Mavis Road be necessary the costs of lowering the pipelines would increase several fold. Be that as it may, Esso Petroleum Canada agrees that lowering our lines in this location is the best alternative.

Tomken Rd. Stn.:
The pipelines are in casings under Tomken Road. Pipe bends may be required depending upon the amount of lowering required.

Fieldgate Drive Stn.:
The sections shown to be lowered may have to be extended in either direction to get enough slack to lower the pipelines.

Renforth/Hydro Corridor:
Design the station to provide a green strip over the pipelines in the parking and drop off areas.

Should you have any questions or require further clarification please contact me. We look forward to any further meetings or reviews of the plans for the Busway.

Thank you for a chance to review your proposals.

Yours Truly;

Ralph Parks, Landman

cc. P. Lane - SCPL,
M. Emanuel - TNPL,
A. Ramsay - IPPL

Trans-Northern Pipelines Inc.

MANULIFE CENTRE, SUITE 1212
55 BLOOR STREET WEST, TORONTO, ONTARIO M4W 3H3
TEL: (416) 924-3353

JAN 31 1991

1991-01-29

Mr. Alan de Lange
McCormick Rankin
2655 North Sheridan Way
Mississauga, Ontario
L5K 2P8

Dear Mr. de Lange:

Re: Mississauga Busway Planning Study
"Impact of Busway on Pipelines"

Please note that TNPL defines:

1) **Relocation:** the installation of new pipe, tie-in to existing pipeline and abandonment of conflicting section.

2) **Lowering:** the trenching of existing pipeline to such longitudinal distance and depth so that pipe may be strung into the lower trench bottom without adding stress to the pipe. The pipe stays in relatively the same alignment but may vary a number of feet from the original running line.

I believe you used the same terminology in the report.

I have reviewed the study report and offer the following:

PART I

2.0 TNPL existing 10" and 20" lines not listed.

PART III

Do not leave out the possibility of conflict at proposed crossing point between Cawthra and Tomken Roads. As busway is to be "sunken" to accommodate grade separations at Cawthra and Tomken, it is likely that TNPL would be left with insufficient cover. Due to the proximity of 90 degree bends to the crossing point, a lowering is highly unlikely. Therefore, it is probable that a relocation of the 10" and 20" lines would be required.

PART IV

TOMKEN ROAD STATION

Due to the proximity of 90 degree bends to potential grade conflicts, lowering is a reduced possibility. Plans should allow for relocation.

FIELDGATE STATION DRIVE

It appears that impact on pipelines will be greatly affected by Parkway, Busway and Station Access grades. In all likelihood, length of lowerings will be greater than indicated. Costs seem very low.

RENFORTH/HYDRO CORRIDOR

Note that the 10" and 20" TNPL lines are missing from the plans. The 20" TNPL line is approximately 4.0 m south of the north limit of the Hydro Corridor. The 10" TNPL line runs adjacent to the 10" SPPL line.

As a general comment I would say that the impact on the pipelines extends for areas greater than shown in the report and that the 'guideline' costs used in the report do not reflect the congested working conditions found in the area.

Also due to the possibility of superimposed loads introducing unacceptable stresses on the pipes, additional protection measures such as concrete pads to distribute loads, casings, replacement with thicker wall pipe, etc., must be considered on a site specific basis. The pipelines must be protected from excessive stress loading (i.e. traffic load, settlement stresses, earth pressure associated with retaining walls, etc.). Obviously such additional measures will inflate the final cost.

Please call if you require further input. I would appreciate receiving a copy of the Environmental Assessment sections relevant to the pipelines upon its completion.

Sincerely,

TRANS-NORTHERN PIPELINES INC.

M. Glass

M. Glass, P. Eng.

MG/st

cc: P. Lane - Sun-Canadian Pipe Line
R. Parks - Sarnia Products Pipe Line

Consumers Gas

500 Consumers Road
Willowdale, Ontario

Mailing Address: P.O. Box 650
Scarborough, Ontario M1K 5E3

1991-02-11

1991

S. Schijns
McCormick Rankin
2655 North Sheridan Way
Mississauga, Ontario
L5K 2P8

Dear Mr. Schijns

Re: Mississauga Busway Planning Study
Technical Report: Impact of Busway on Pipelines

I have reviewed the above noted report and concluded that Consumers Gas is agreeable to all the noted realignments.

It must be clear, however, that such realignments involve significant intrusions onto Ontario Hydro lands and as such are subject to approval by Ontario Hydro. In this respect Consumers Gas has submitted drawings, including the realignments in the report, to Ontario Hydro to acquire a letter of agreement.

Therefore, as indicated, Consumers Gas is agreeable to all realignments subject to Ontario Hydro approval. Barring any or all rejection of such approval, Consumers Gas wishes to retain the right to the original alignments and be subject to relocation at the time of Busway construction.

I trust this is satisfactory to the group.

Yours truly,

Gary C. Highfield, P. Eng.
Project Engineer

mpgh/MS

APPENDIX 'V'

TYPICAL MITIGATING MEASURES

MISSISSAUGA TRANSITWAY PLANNING STUDY EA REPORT

APPENDIX V: TYPICAL MITIGATING MEASURES

The City of Mississauga, as the proponent of the Mississauga Transitway, is committed to designing, constructing, and operating the facility with a minimum of impact on the area's social and natural environment. In doing so, mitigating measures will be employed wherever an environmental impact would have otherwise occurred. This commitment has been stated in the main body of the report, but due to the vast scope of potential impacts and associated mitigating measures, a detailed list has not been included; this would form part of the detailed design document.

For reference, however, the following list of typical mitigating measures for road construction projects is appended. It is not intended to be read as a definitive list of measures committed to for the Transitway, but rather as an example of the types of measures which would likely be part of the detailed design package. The list is excerpted from the Class Environmental Assessment for Municipal Road Projects, prepared by The Municipal Engineers' Association of Ontario and approved by the Ministry of the Environment in April, 1987.

TYPICAL MITIGATING MEASURES FOR POTENTIAL ADVERSE ENVIRONMENTAL EFFECTS

Effect	Mitigating Measures	Application (Where/When)
Surface Drainage System		
Sedimentation and turbidity of adjacent water bodies	- erosion control measures	During construction on slopes and drainage channels
	- sediment traps	Collect sediment before entering drainage channel
	- staging work	During biologically critical periods
"Ponding" effects on adjacent properties due to natural drainage disruption	- appropriate use of culverts, porous backfill and tile drains	In new construction projects and expansion
Streambank erosion from diversion and/or channelization of watercourse	- erosion control measures	River crossings, outfall construction
Contamination of surface waters through runoff, spills and leaks	- provision for spill control - fast accurate reporting of spill - spill containment - stockpile materials or devices for spill control - avoid adverse soil conditions - monitor facility for leaks	As a general practice and particularly in vicinity of water bodies, wetlands
Blasting which exposes rocks containing soluble minerals that could potentially contaminate surface water supply, i.e., sulfate, lead, arsenic	- subsurface investigation, i.e., geochemical analysis of bedrock - avoid blasting in areas containing toxic materials	Areas of shallow soil over relevant bedrock type (normally occurring in Canadian Shield)
Changes in volume of surface runoff	- use design measures to minimize increase in surface runoff	New impervious surfaces

Effect	Mitigating Measures	Application (Where/When)
Changes in flood storage capacity by placing fill and structures in floodplain	- avoid placing fill and structures in floodplain or compensate elsewhere	Construction within river valleys Disposal of excess fill
Groundwater		
Blasting which exposes rocks containing soluble minerals that could potentially contaminate groundwater, e.g., sulfate, lead, arsenic	- subsurface investigation, i.e., geochemical analysis of bedrock - avoid blasting in areas containing toxic minerals	Areas of shallow soil over bedrock
Truncation of shallow aquifers and springs	- hydrogeologic investigation to identify such areas in advance	Excavations
Reduced groundwater quantity through construction dewatering	- avoid groundwater users and water-bearing formations (soils) - proper dewatering techniques	Truncation of shallow aquifers and spring by groundwater utilization
Spills or leaks resulting in contamination of groundwater supply	- construction refueling precautions - landfilling precautions - operation and storage precautions	Near watercourses and on site generally
Drainage of wetland areas resulting in a reduced groundwater contribution to surface water bodies	- avoid wetland areas - utilize appropriate backfill material, i.e., highly permeable backfill is unsuitable	Trenching, excavating, placing fill
Reduced surface water recharge to groundwater particularly in soils with high infiltration characteristics	- restrict extent of impervious surfaces in zones of high infiltration	Subsurface barriers, e.g., foundations, areas of impervious surfaces, e.g., parking lots, roads, compaction of soil
Impedence of groundwater movement	- maintenance of the existing groundwater flow regime through engineering design	Dewatering, e.g., in roadbeds, foundations and trenches

Effect	Mitigating Measures	Application (Where/When)
Contamination of adjacent wells through runoff from road construction	- erosion control - locate projects appropriately	Construction adjacent to well sites
Fish, Aquatic Wildlife and Vegetation		
Introduction of warmer water from ponds into colder surface watercourse	- appropriate selection of ponding site - infiltrate into groundwater system	Dewatering of trench and excavations Sediment traps
Modification or removal of aquatic habitat Displacement of plants and animals	- stage work to non-critical times - restore stream substrate - choose suitable site for stream diversion	During construction, e.g., river crossings, and dewatering of excavations
Reduced water quality of nearby surface water having value as wildlife habitat	- provisions for spill control - fast and accurate reporting of spill - spill containment - stockpile materials or devices for spill control - avoid adverse soil conditions - minimize tree removal	Storm sewers and ditches
Timing effects of construction on spawning and breeding periods	- staging of work to avoid spawning and breeding periods	For stream crossings and diversions
Lowering of water table resulting in reduced contribution to streams and stress on riparian vegetation	- design to maintain existing groundwater flows - restrict extent of impervious surfaces in zones of high infiltration	Dewatering of trench and excavations Areas of newly created impervious surfaces
Increased nutrient status of existing habitats	- provisions for spill control - landfilling precautions	Near watercourses and on site generally

Effect	Mitigating Measures	Application (Where/When)
Fish, Aquatic Wildlife and Vegetation (cont'd)		
Drainage of wetland areas causing mortality or stress to animals and possible changes in species composition	- maintain existing groundwater regime - avoidance of wetland areas - utilize appropriate backfill material, i.e., highly permeable backfill is unsuitable	Trenching or excavating
Siltation to surface watercourses resulting in "smothered" plants and animals due to deposition of silt and increased turbidity to surface watercourses	- utilize suitable backfill material - trench drainage should be discharged to settling areas before being permitted to enter surface waterbodies - erosion control measures - staging of work	Trench road bed and ditch constructions Storm sewer outfalls Erodible soils, stock-piles
Pressure on biological communities	- consider the carrying capacity of the local natural environment	Road facilities allow enhanced municipal/ population growth. This increases stress on recreational and natural resources
Tree removal affecting the amount of sunlight reaching waters and affect plant productivity and increase watercourse temperatures	- avoid tree removal near surface water-bodies	Stream crossings
Terrestrial Vegetation and Wildlife		
Introduction of exotic plant species through erosion control measures and restoration	- use annuals which later die out - use indigenous (native) species only	On slopes and other areas to control erosion In any disturbed area requiring restoration work

Effect	Mitigating Measures	Application (Where/When)
Terrestrial Vegetation and Wildlife (cont'd)		
Changes in vegetative composition as a result of loss of topsoil and subsoil or mixing	- restore site by replacing soil in preconstruction horizons	Trenching or excavating
Removal or disturbance of significant trees and/or ground flora	- avoid these areas - employ tree protection measures	During construction phase of any project
Road salt contamination	- contained storage	Patrol yard. Winter maintenance facility
New or increased exposure of forest edge with resultant effects of windthrow, leading to increased loss of habitat for wildlife	- avoid woodlots and similar areas - pre-stress woodlots	During construction phase of any project
Mortality/stress due to changes in soil moisture conditions, resulting in loss of wildlife habitat	- avoid poorly drained areas - use of appropriate roadbed and backfill materials - revegetate using indigenous species able to survive new conditions	During construction of roadbed and storm sewers
Heritage Resources		
Deterioration of sites or structures having archaeological, historical or architectural values, as a result of environmental changes.	- employ necessary steps to decrease harmful environmental impacts such as vibration, alteration of water table, etc.	Where appropriate with respect to archaeological, historical or architectural resources
Unwanted increase in public access and potential vandalism	- fence off area of concern - prevent public access	Where appropriate with respect to archaeological heritage resources
Threatened viability of, or opportunity for, retention of sites with heritage value	- avoid these areas	Where appropriate with respect to archaeological heritage resources

Effect	Mitigating Measures	Application (Where/When)
Heritage Resources (cont'd)		
Unavoidable destruction of heritage structures or archaeological sites	- record or salvage information on features to be lost	Where appropriate with respect to significance of the heritage resource
Agricultural		
Removal of productive farmland	- design facilities so as to minimize land requirements and construction disturbance; rehabilitate disturbed areas	In rural areas
Disruption of field access	- provide alternative access points at critical times	In rural areas
Disturbance of livestock by noise and dust during construction	- employ noise and dust control measures	In rural areas
Disruption of tile and surface drainage systems	- stage construction work - restore tile and surface drainage system	In rural areas
Effects on crops of contaminants from runoff and salt spray	- location - plant salt tolerant species barrier along roadways	In rural areas
Residential, Institutional, Commercial and Industrial		
Increased sound levels due to new or expanded road facility	- maximizing distance between lanes and possible impact areas, i.e., adjustments to horizontal alignment - adjustment to roadway gradient - regulating traffic flow and speed - use of quieter pavement type - designation of truck routes and applicable time periods	Where noise or vibration problem

Effect	Mitigating Measures	Application (Where/When)
	- installation of sound barriers - adjustment to roadway elevation, i.e., adjustment to vertical alignment - application of noise control measures off the road right-of-way where the impact is expected to be severe, i.e., apply localized noise control measures to impact areas rather than the roadway itself - advise on the suitability of local planning policies affecting the impact area	
Disruption of pedestrian movements between adjacent uses	- maintain continuity of pedestrian walkway system as much as possible	As general practice
	- provide walkway strips to adjacent residential areas	Where suitable
	- provide crosswalks and sidewalks at access points	Where suitable
Facilities inconsistent with or which disrupt character of area	- preserve existing amenities as much as possible	As general practice
	- landscape buffer areas	Where suitable
	- design and site structures to blend with adjacent building forms and materials	As general practice
	- grade site area to pleasing lines, utilize berms	Where suitable

Effect	Mitigating Measures	Application (Where/When)
Temporary disruption during construction and/or inconvenience to users of adjacent properties and building	- notify public agencies and adjacent owners of construction scheduling	Where substantial inconvenience or disruption to adjacent uses would be experienced and where measures would substantially reduce effects
	- prepare 'emergency program' to ensure quick resolution of servicing problems	As general practice
	- consult with public agency and/or adjacent landowners regarding temporary access re-routing	
	- schedule construction so as to minimize period of disruption in proximity of adjacent uses and structures	
Removal of residences and other buildings	- co-ordinate removal program to minimize inconvenience	As general practice
Outdoor Recreation		
Temporary disruption of open space activities during construction	- employ noise and dust control measures - staging of construction to cause least disruption	In areas within or adjacent to public open space
Effects of physical changes in layout of recreational uses due to property loss	- compensate elsewhere	In areas within or adjacent to public open space.
Soils Geology		
Erosion by wind and water	- revegetation - stage work - avoid highly erodible soils	Erodible soils in excavations, cut and fill areas

	- stabilize slopes:
	  - compaction
	  - chemical stabilizers
	  - gravel blankets
	  - seeding
		Stockpiles, cut slopes

Effect	Mitigating Measures	Application (Where/When)
Slumping of encroached slopes	- avoid potentially unstable slopes - mechanical stabilization methods - revegetation (only effective once the root infrastructure has developed) - restrict dewatering near slopes	Steep slopes Cut slopes Removal of the toe of a slope during construction Dewatering
Rockfall hazard	- buffer zone - initiate rockfall at potential failures	Blasting Steep weathered slopes
Loss of aggregate and mineral resources	- avoid sites of aggregate and mineral reserves - extract aggregate and minerals prior to construction	Zones of economic aggregate and mineral occurrence
Contamination of soils by petrochemicals, etc.	- remedial measures to avoid spills and leaks - contingency plan for clean-up	During construction
Contamination of topsoil with subsoil	- stripping and stockpiling of topsoil and stabilization	Generally in areas of undisturbed soils
Topography/Landforms		
"Scarring" of unique features	- avoid unique features	Designation of unique feature, i.e., landmark
Climatic Features		
Removal of vegetation causing reduction of windscreen effect on adjacent buildings or activity	- retain as much vegetation as possible - avoid vegetated areas in close proximity to buildings or activity areas - restore vegetation as soon as possible	Construction in close proximity to buildings or activity areas