

CITY OF MISSISSAUGA
PROJECT NUMBER: 19M-00836-02

HERITAGE IMPACT ASSESSMENT WILLOW LANE, CITY OF MISSISSAUGA

NOVEMBER 13, 2020





HERITAGE IMPACT ASSESSMENT WILLOW LANE CITY OF MISSISSAUGA

FINAL

PROJECT NO.: 19M-00836-02
DATE: NOVEMBER 13, 2020

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EXECUTIVE SUMMARY

The City of Mississauga retained the services of WSP Canada Inc. (WSP) in April 2020 to complete a Heritage Impact Assessment (HIA) to assess the rehabilitation undertaken to the Willow Lane culvert in the Meadowvale Village Heritage Conservation District (HCD) in 2019. The HIA has been required as members of the Meadowvale Heritage Association and the City of Mississauga's Heritage Board have expressed concerns with the impacts of the culvert rehabilitation on the cultural heritage landscape.

Based on a thorough review of the Meadowvale HCD Plan and an evaluation of the rehabilitation works, WSP has concluded that the changes have had additional impacts on the Meadowvale HCD. Specifically, it was determined that the new traffic barrier along the deck of the culvert and guide rails along the approaches to the culvert detract from the rural village streetscape quality of Willow Lane. Working with a multi-disciplinary team, WSP identified several alternatives for both the traffic barriers and guide rails and subsequently evaluated these to determine which provide necessary road safety and were compatible with the intent to maintain the rural village character of Willow Lane.

SUMMARY OF APPROPRIATE ALTERNATIVES, MITIGATION MEASURES AND RECOMMENDATIONS:

- 1** Should any future work around the culvert require land disturbance an archaeological assessment or archaeological monitoring should be completed to protect any archaeological remains from the mill ruin or otherwise significant artifacts.
- 2** Replace removed trees and soft vegetation. Notably, it appears that efforts to place the removed trees has already occurred to the northeast and southeast corners of the culvert. However, additional trees should be planted on the northwest and southwest corners if space allows and soft vegetation such as the creeping vines should be considered at the base of the culvert in these locations to minimize the visual impact of the guard rails should they remain.
- 3** For the traffic barriers, the following construction alternatives are suggested to complement the rural character of the area:
 - a** Steel railing (Examples 2 and 3 on Attachment 1 of Appendix D)
 - b** Timber railing (Example 5 on Attachment 1 of Appendix D)
 - i** Embellished steel railing (Examples 2, 4 and 5 on Attachment 2 of Appendix D)
 - c** Embellished concrete railing (Examples 7 and 8 on Attachment 2 of Appendix D)
- 4** Remove existing guiderail on southeast corner and replace with shorter length guide rail flared beyond clear zone (meets clear zone requirements).

SIGNATURES

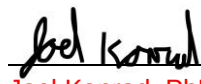
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November 13, 2020

Date

APPROVED¹ BY


 Joel Konrad, PhD, CAHP
 Cultural Heritage Lead

November 13, 2020

Date

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This limitations statement is considered an integral part of this report.

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1 INTRODUCTION

1.1 PROJECT DESCRIPTION

The City of Mississauga retained the services of WSP Canada Inc. (WSP) in April 2020 to complete a Heritage Impact Assessment (HIA) to assess the rehabilitation completed for the Willow Lane culvert in the Meadowvale Village Heritage Conservation District (HCD) in 2019. This HIA is required as members of the Meadowvale Heritage Association and the City of Mississauga's Heritage Board have expressed concerns with the impacts of the culvert rehabilitation on the cultural heritage landscape.

1.2 STUDY AREA DESCRIPTION

The study area consists of the Willow Lane culvert located north of Old Derry Road in the City of Mississauga and the approaches to the culvert (Figure 1). Willow Lane is a narrow, unmarked two-way road with no shoulders that crosses a tributary of the Credit River. The study area is located within the former Meadowvale Village which has been designated under Part V of the *Ontario Heritage Act*.

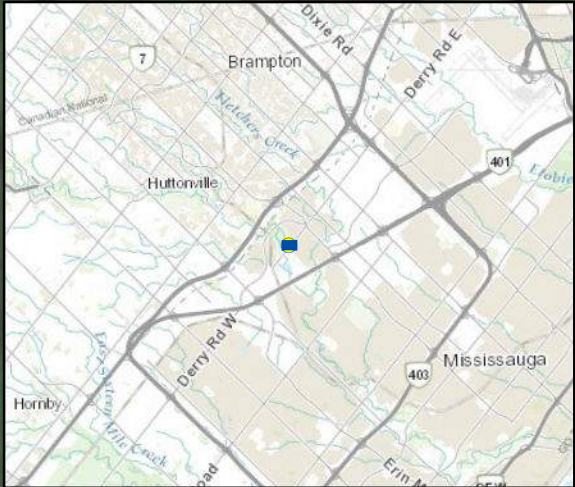
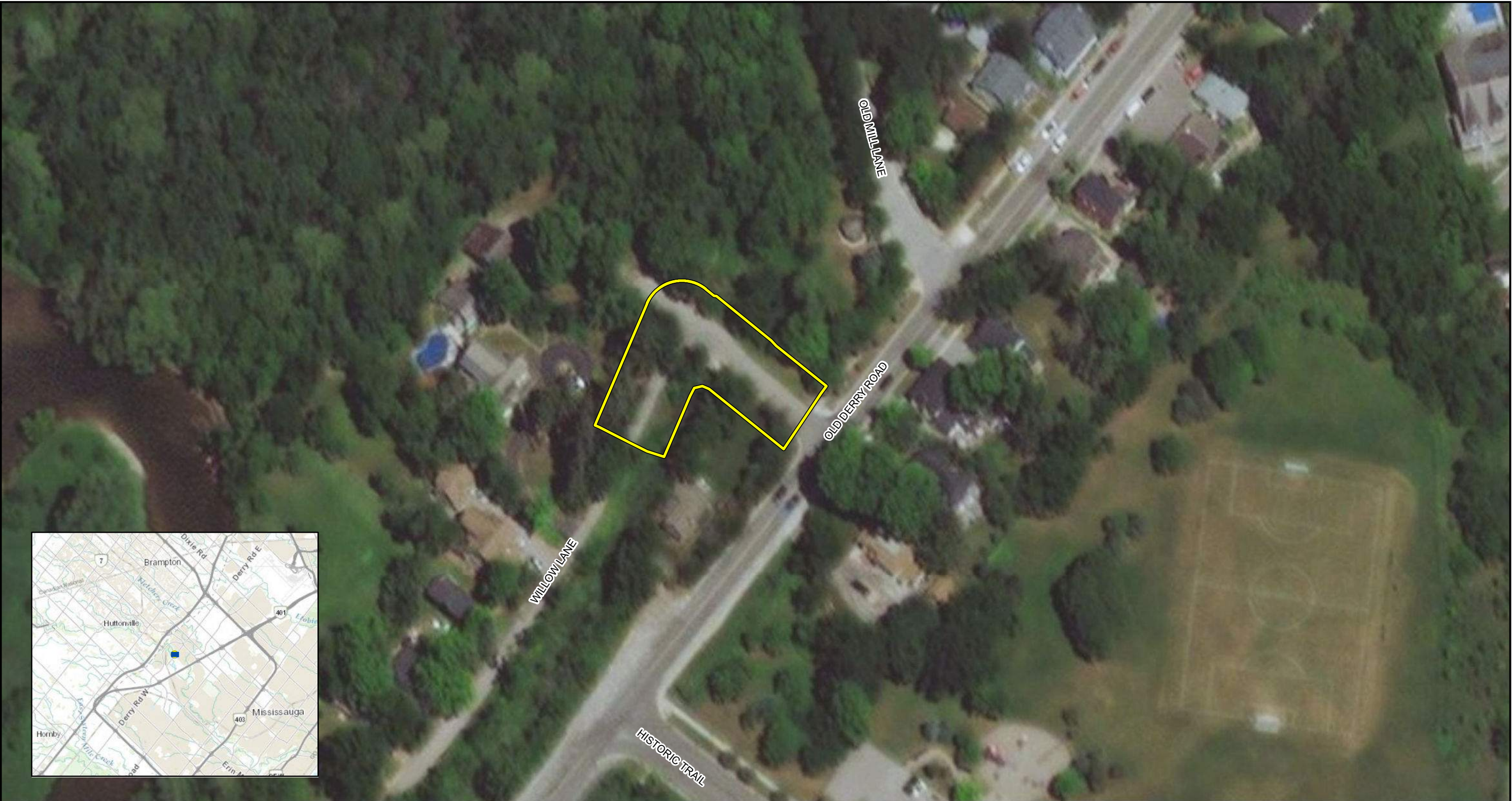
1.3 PROJECT METHODOLOGY

An HIA evaluates the proposed impact of development on the heritage attributes of a property of cultural heritage value or interest. This HIA is guided by the City of Mississauga's Heritage Impact Assessment Terms of Reference (2014).

To address the requirements of an HIA, this report provides the following information:

- A summary of the history of the immediate context informed by a review of archival sources, historical maps and the Meadowvale HCD Plan;
- A summary of the land-use history of the site;
- Photographic documentation of the site and context;
- A written description of the existing conditions and context of the site;
- An outline of the culvert rehabilitation including engineering drawings;
- Evaluation of the impacts of the culvert rehabilitation against the Meadowvale Plan HCD Guidelines and heritage attributes.
- The identification and assessment of alternative development options and mitigation opportunities.

An on-site meeting was held on October 1, 2020 with staff members from WSP and the City of Mississauga to understand the site constraints and discuss potential alternative solutions.



LEGEND

 Study Area

TITLE: FIGURE 1: PROJECT LOCATION		SCALE: 1:1,000	PROJECT NO: 19M-00836-02	DATE: MAY 2020
		DRAWN BY: AST	CLIENT: CITY OF MISSISSAUGA	
PROJECT: WILLOW LANE CULVERT HIA		CREDITS: TREMAINE'S MAP OF THE COUNTY OF WATERLOO, CANADA WEST (1861)		
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2 POLICY FRAMEWORK

2.1 CANADIAN HIGHWAY BRIDGE DESIGN CODE

The Canadian Highway Bridge Design Code (12th Edition, 2019) provides for the design, evaluation and structural rehabilitation design of fixed and movable highway bridges and determines safety and reliability levels that are consistent across all jurisdictions in Canada. These guidelines were considered in the development of appropriate alternatives in Section 6.

2.2 GEOMETRIC DESIGN GUIDE FOR CANADIAN ROADS

Transportation Association of Canada's (TAC) *Geometric Design Guide for Canadian Roads* (2017) is a reference document for roadway design in Canada. Providing for consistent, safe development and expansion of regional, provincial, and national roadway and highway systems across Canada. These guidelines were considered in the development of appropriate alternatives in Section 6.

2.3 ROADSIDE DESIGN MANUAL

The Ministry of Transportation's (MTO) Roadside Design Manual (December 2017) provides MTO staff and engineering consultants with policies, standards, and guidelines for the design of the roadside environment adjacent to the roadway within provincial highway Right-of-Ways. While the manual is issued primarily for the guidance of MTO roadways, it is also used as a design guideline by other road authorities across Ontario. These guidelines were considered in the development of appropriate alternatives in Section 6.

2.4 PROVINCIAL POLICY STATEMENT

The *Provincial Policy Statement* (PPS 2020) outlines provincial "policy direction on matters of provincial interest related to land use planning and development" (Part I: Preamble PPS 2020). The intent is to provide for appropriate development that protects resources of public interest, public health and safety, and the quality of the natural and built environment.

The PPS 2020 identifies the conservation of significant built heritage resources and cultural heritage landscapes as a provincial interest in Section 2.6.1.

Relevant definitions from the PPS 2020 include:

Built heritage resources: a building, structure, monument, installation, or any manufactured remnant that contributes to a property's cultural heritage value or interest as identified by a community, including an Aboriginal community. Built heritage

resources are generally located on property that has been designated under Parts IV or V of the *Ontario Heritage Act*, or included on local, provincial, and/or federal registers.

Cultural heritage landscapes: defined geographical area that may have been modified by human activity and is identified as having cultural heritage value or interest by a community, including an Aboriginal community. The area may involve features such as structures, spaces, archaeological sites, or natural elements that are valued together for their interrelationship, meaning or association. Examples may include, but are not limited to, HCDs designated under the *Ontario Heritage Act*; villages, parks, gardens, battlefields, main streets and neighbourhoods, cemeteries, trail ways, viewsheds, natural areas and industrial complexes of heritage significance; and areas recognized by federal or international designation authorities (e.g. a National Historic Site or District designation, or a UNESCO World Heritage Site).

Conserved: means the identification, protection, management and use of *built heritage resources*, *cultural heritage landscapes* and *archaeological resources* in a manner that ensures their cultural heritage value or interest is retained under the *Ontario Heritage Act*. This may be achieved by the implementation of recommendations set out in a conservation plan, archaeological assessment, and/or heritage impact assessment. Mitigative measures and/or alternative development approaches can be included in these plans and assessments.

2.5 ONTARIO HERITAGE ACT

The *Ontario Heritage Act* (2005, hereafter referred to as the OHA) gives municipalities and the provincial government powers to preserve the heritage of Ontario, with a primary focus on protecting heritage properties and archaeological sites. The OHA grants the authority to municipalities and to the province to identify and designate properties of heritage significance, provide standards and guidelines for the preservation of heritage properties and enhance protection of HCDs, marine heritage sites and archaeological resources.

Properties can be designated individually (Part IV of the OHA) or as part of a larger group of properties, known as an HCD (Part V of the OHA). Designation helps to ensure the conservation of these important places. Designation offers protection for the properties under Sections 33, 34 and 42 of the OHA, prohibiting the owner of a designated property from altering, demolishing or removing a building or structure on the property unless the owner applies to the council of the municipality (or the Minister of MTCS if under Section 34.5 of the OHA) and receives written consent to proceed with the alteration, demolition or removal.

In addition to designated properties, the OHA allows municipalities to list other properties that are considered to have cultural heritage value or interest on their municipal heritage register (Register). Under Part IV, Section 27 of the OHA, municipalities must maintain a Register of properties situated in the municipality that are of cultural heritage value or interest. Section 27 (1.1) states that the register shall be

kept by the clerk and that it must list all designated properties (Part IV and V). Under Section 27 (1.2), the Register may include property that has not been designated, but that council believes to be of cultural heritage value or interest. “Listed” properties, although recognized as having cultural heritage value or interest, are not protected under the OHA to the same extent as designated properties, but are acknowledged under Section 2 of the PPS 2014 under the *Planning* Act. An owner of a ‘listed’ heritage property must provide the municipality with 60 days’ notice of their intention to demolish a building or structure on the property.

The OHA also allows for the designation of Provincial Heritage Property (PHP). Part III.1 of the OHA enables the preparation of standards and guidelines that set out the criteria and process for identifying cultural heritage value or interest of PHPs (Part II of the OHA) and cultural heritage value or interest of Provincial Heritage Property of Provincial Significance (PHPPS) (O. Reg. 10/06 of the OHA) and to set standards for their protection, maintenance, use, and disposal.

2.6 MUNICIPAL POLICIES

In addition to provincial legislation, policies and guiding documents, municipal policies regarding cultural heritage have also been considered as a part of this report.

MISSISSAUGA OFFICIAL PLAN (2011)

The Mississauga Official Plan was approved by the Region of Peel on October 5, 2011 and was consolidated on November 22, 2019. Section 7.4 of the Mississauga Official Plan provides policies specific to heritage planning.

Relevant policies for the purposes of this HIA include:

- 7.4.1.2 Mississauga will discourage the demolition, destruction or inappropriate alteration or reuse of cultural heritage resources.
- 7.4.1.3 Mississauga will require development to maintain locations and settings for cultural heritage resources that are compatible with and enhance the character of the cultural heritage resource.
- 7.4.1.11 Cultural heritage resources designated under the Ontario Heritage Act, will be required to preserve the heritage attributes and not detract or destroy any of the heritage attributes in keeping with the Ontario Heritage Tool Kit, the Ontario Ministry of Culture, and the Standards and Guidelines for the Conservation of Historic Places in Canada, Parks Canada.
- 7.4.1.12 The proponent of any construction, development, or property alteration that might adversely affect a listed or designated cultural heritage resource or which is proposed adjacent to a cultural heritage resource will be required to submit a Heritage Impact Assessment, prepared to the satisfaction of the City and other appropriate authorities having jurisdiction.
- 7.4.1.17 Public works will be undertaken in a way that minimizes detrimental impacts on cultural heritage resources.

- 7.4.3.3 Applications for development within a Heritage Conservation District will be required to include a Heritage Impact Assessment and Heritage Permit, prepared to the satisfaction of the City and the appropriate authorities having jurisdiction.

MEADOWVALE HERITAGE CONSERVATION DISTRICT PLAN

Originally approved by City of Mississauga Council in 1980 and updated with a new Heritage Conservation District (HCD) Plan on April 2, 2014, the Meadowvale Heritage Conservation District incorporates the former Meadowvale Village. The Meadowvale HCD Plan identifies guidelines for appropriate development, redevelopment, maintenance and alterations within the district boundaries as well as key heritage attributes that contribute to the character of the cultural heritage landscape (see Section 4 for a more detailed review).

3 HISTORICAL CONTEXT

3.1 PRE-CONTACT HISTORY

Paleoindian period populations were the first to occupy what is now southern Ontario, moving into the region following the retreat of the Laurentide Ice Sheet approximately 11,000 years before present (BP). The first Paleoindian period populations to occupy southern Ontario are referred to as Early Paleoindians (Ellis and Deller 1990:39).

By approximately 8,000 BP the climate of Ontario began to warm. As a result, deciduous flora began to colonize the region. With this shift in flora came new faunal resources, resulting in a transition in the ways populations exploited their environments. This transition resulted in a change of tool-kits and subsistence strategies recognizable in the archaeological record, resulting in what is referred to archaeologically as the Archaic period. The Archaic period in southern Ontario is divided into three phases: the Early Archaic (ca. 10,000 to 8,000 BP), the Middle Archaic (ca. 8,000 to 4,500 BP), and the Late Archaic (ca. 4,500 to 2,800 BP) (Ellis et al. 1990). The Archaic period is also marked by population growth. Archaeological evidence suggests that by the end of the Middle Archaic period (ca. 4,500 BP) populations were steadily increasing in size (Ellis et al 1990). The steady increase in population size and adoption of a more localized seasonal subsistence strategy in the Late Archaic period eventually evolved into what is termed the Woodland period.

The Woodland period is characterized by the emergence of ceramic technology for the manufacture of pottery. Similar to the Archaic period, the Woodland period is separated into three primary timeframes: the Early Woodland (approximately 2,800 to 2,000 BP), the Middle Woodland (approximately 2,000 to 1,300/1,100 BP), and the Late Woodland (approximately 1,100 to 400 BP) (Spence et al. 1990; Fox 1990). Early contact with European settlers at the end of the Late Woodland and Late Ontario Iroquoian period resulted in extensive change to the traditional lifestyles of most populations inhabiting southern Ontario.

3.2 TOWNSHIP SURVEY AND SETTLEMENT

3.2.1 TORONTO TOWNSHIP

In the eighteenth century, the mouth of the Credit River had become an important location for First Nations and colonial fur traders to meet and exchange goods. From 1783 to 1787 the British government negotiated a series of treaties to acquire lands along the north shore of Lake Ontario from the Mississauga of New Credit with the exception of a portion of land that ran between Etobicoke Creek and Burlington Bay, which came to be known as the 'Mississauga Tract'. The land surrounding the tract was used to settle United Empire Loyalists that were displaced from the American colonies

during the American Revolutionary War (Riendeau, 1985). In 1805, another land purchase was conducted by the British government and the newly acquired land was divided into three townships: Nelson Township, Trafalgar Township and Toronto Township (Riendeau, 1985).

The Toronto Township surveys were completed in 1805, and settlement began soon after. Much of the land was used for farming and many small hamlets began to form throughout the township (Mississauga Heritage, 2012).

3.2.2 MEADOWVALE VILLAGE

Located in the north-west section of Mississauga, Meadowvale Village was settled in the 1820s by Irish immigrants at the intersection of Derry Road West and Second Line. It was in early 1819 that twenty-nine Irish families from New York City, led by John Beatty arrived in York. Beatty petitioned the Crown for land and was awarded 200 acres on lot 11 of Concession 3 in 1821. The settlers decided to name the area Meadowvale because of the grassy meadows near the Credit River. Its proximity to the Credit River provided the power for the sawmills and foundry that were built between 1831 and 1844.

Beatty built his home at the present 1125 Willow Lane, but in 1832 was offered the stewardship post of the Upper Canada Academy and moved to Cobourg. Beatty sold his 200-acre land grant to James Crawford in 1833. It is believed that Crawford constructed the Neo-Classical addition on the dwelling at 1125 Willow Lane. By the mid-nineteenth century, Meadowvale had two hotels, a wagon shop, and a school. It later became a popular spot for artists (Image 1) (City of Mississauga, n.d.).

Meadowvale Village displays prominently on the G.R. & G.M. Tremaine's 1859 *Map of the County of Peel, Canada West* (Figure 2). A saw mill and grist mill are depicted east of the Credit River along a tributary. Walker & Mile's 1877 *Township of Toronto* from the *Illustrated Historical Atlas of the County of Peel* (Figure 3) depicts further development in the village and the creation of a pond adjacent to the saw and grist mills along the Credit River tributary.

In 1980, Meadowvale Village became the first HCD in Ontario (City of Mississauga, n.d.; MTCS, 2006).



Image 1: Main Street, Meadowvale Village (Heritage Mississauga, n.d.)

4 THE MEADOWVALE HERITAGE CONSERVATION DISTRICT

The designation of Meadowvale HCD under Part V of the OHA was originally approved by the City of Mississauga's Council in 1980. The by-law approved in 1980 was repealed and replaced with a new HCD Plan on April 2, 2014. The Meadowvale HCD Plan identifies the boundaries and cultural heritage value of the district and allows the City of Mississauga to manage and guide future change in the district in accordance with the policies and guidelines in the HCD Plan.

In Section 2.2 the Heritage Character Statement provides a description of the aspects of the HCD that define the districts architectural, historical, contextual and landscape characteristics. The streetscape and its qualities including its pedestrian scale, rural community lane appearance with soft shoulders, narrow side streets, mature trees and varied building setbacks, are important elements that help maintain the character of this distinct district within the City of Mississauga. Section 2.3 identifies the heritage attributes which are the character-defining elements of the cultural heritage landscape which give meaning and definition to the district and are therefore worthy of conservation. Heritage attributes relevant to this HIA include:

- significant location, adjacent to the Credit River, in a cultural heritage landscape of integrated natural and cultural heritage elements within the river's low floodplain to the gentle sloping ridge.
- a land pattern that retains the layout and plan of generous lots and pedestrian oriented narrow roadways of the 1856 Bristow Survey, spatial organization of narrow streets with soft vegetation and no shoulders, large diameter trees and a visual relationship which blends from public to private space among front and side yards void of privacy fencing.
- long term tradition of rural village-like streetscapes without curbs, with no formalized parking, sidewalks (except on Old Derry Road), modest signage and limited modest lighting.
- archaeological resources, including, but not limited to, the extant mill ruins, mill race and tail race at Willow Lane and Old Derry Road and remnant mill pond.

Notably, the Willow Lane culvert is located west of the extant mill ruins and crosses a stream that was likely constructed as part of the mill race.

Relevant policies and guidelines for appropriate alterations in the Meadowvale HCD Plan include:

- Policy 5: Council will adopt the following objectives of the HCD Plan to guide the conservation and change within the district.
- a) maintain and enhance the distinct heritage character of the HCD with emphasis on the following characteristics:

- i. Narrow rural-like roads;
- ii. Any addition of new sidewalks may be installed where required to meet accessibility needs, as appropriate;
- vii. Retention of all heritage attributes within the HCD and those listed for each individual property;
- ix. Transparent, or open views, while retaining large diameter trees, from the streetscape to buildings;
- x. Retention of the original topography;
- xi. Mill remnants (foundations, earthworks, former water-ways);
- b) preserve buildings of historic association and building features, and ensure new designs contribute to the HCD's heritage character;
- c) ensure changes enhance the HCD character;

Section 4.1.6 **Private Tree Protection By-law**

- The retention of trees within the Meadowvale Village HCD is essential to its heritage character and sense of place. The City of Mississauga has adopted the Private Tree Protection By-law 0254-2012. Through this By-law, the removal and replacement of trees on private property are regulated.

Section 4.2.1.17 **Public Works**

- Alterations within the public right-of-way, which do not change the materials or appearance, are permitted
- the addition of new sidewalks within the public right of way may be installed where required to meet accessibility needs, as appropriate
- The addition and/or replacement of street tree plantings will be encouraged
- Alterations to parkland which do not alter the appearance, materials, views or vistas of the property are permitted
- Signage related to the identification of streets within the Village are permitted • Directional signage, bike route signs and traffic safety signs are permitted
- Signage to identify the area as a HCD is permitted
- Alterations to structures within the public realm are subject to the Design Guidelines as listed above
- The conservation and interpretation of the mill ruins located between Willow Lane and Old Mill Lane are encouraged

5 EXISTING CONDITIONS

The study area consists of the culvert and approaches along Willow Lane within the Meadowvale HCD. For the purposes of this HIA, this section will describe both the existing conditions (see also Appendix B) prior to the culvert rehabilitation that occurred in 2019 (based on photographs provided by the City of Mississauga dated 2007, 2015 and 2017 and google street view conditions from September 2018) and the current existing conditions (see also Appendix C) with an emphasis on the changes that have occurred to the study area. For the ease of description, Old Derry Road will be treated as a west-east street and all other directions will reflect this understanding.

5.1 CONDITIONS PRIOR TO CULVERT REHABILITATION

Located on the north side of Old Derry Road, Willow Lane is a narrow, dead-end lane that includes a small north-south section where the culvert is located and then turns west to allow for west-east traffic.

The south approach to the culvert is flat and straight and both sides of the street have grassed shoulders (Image 2). Along the south approach the west side included several tall shrubs along the adjacent property line and the east side includes several deciduous trees on manicured lawn.

The north approach to the culvert is flat but curves to the east (Image 3). The north side of Willow Lane along the north approach includes a large clapboard dwelling set back from the street and mature trees and shrubs. The south side of Willow Lane consists of the tributary of the Credit River and included a wood and metal guardrail, several trees with climbing vines and tall grasses.

The area immediately surrounding the Willow Lane culvert included dense foliage with a variety of deciduous trees and climbing vines that created a lush and rural-like character (Image 4-Image 7).

Retaining walls constructed of gabions were located on all corners of the culvert (Image 8). Retaining walls were not observed anywhere else near the culvert, but the dense foliage may have obscured views.

A tributary of the Credit River runs underneath the culvert, but the bed of the tributary consists of tall grasses. Notably on the west side of the culvert there was a tall deciduous tree with a narrow trunk in the middle of the tributary bed (Image 6-Image 7). On the east side of the culvert, remains of the mill are visible (Image 4-Image 5).

The culvert's deck consists of asphalt with a concrete sidewalk on the west side and a narrow elevated curbed section on the east side (Image 9-Image 10). Both sides include a metal tube railing that stretches the length of the deck.

The culvert itself was constructed in 1977 in a cast-in-place reinforced concrete rigid frame box culvert design with a span of 10.1 m, width of 7.4 m and vertical clearance of 1.52 m (see 1977 Plans in Appendix B; Image 11-Image 12).



Image 2: View of south approach to Willow Lane Culvert (Google, 2018)



Image 3: View of north approach to Willow Lane Culvert (Google, 2018)



Image 4: View from the east side of the culvert deck (City of Mississauga, 2015)



Image 5: View from the east side of the culvert deck (Google, 2018)



Image 6: View from the west side of the culvert deck (City of Mississauga, 2015)



Image 7: View from the west side of the culvert deck (Google, 2018)



Image 8: View of gabion to the northwest corner of the culvert (City of Mississauga, 2007)



Image 9: View of the asphalt deck and the sidewalk on the west side of the culvert (City of Mississauga, 2017)



Image 10: View of the east side of the asphalt deck (City of Mississauga, 2017)



Image 11: View of the east side of the culvert (City of Mississauga, 2015)



Image 12: View of the culvert's soffit (City of Mississauga, 2017)

5.2 CURRENT EXISTING CONDITIONS

In 2019, the City of Mississauga undertook rehabilitation of the culvert on Willow Lane to extend its service life by approximately 15-25 years and to ensure that the requirements of the current Canadian Highway Bridge Design Code (CHBDC) were met based on a Detailed Conditions Survey Report completed by Planmac Engineering Inc. The following descriptions of the subject structure are based on a site visit conducted on May 12, 2020, by Chelsey Tyers, Cultural Heritage Specialist. All photographs are taken from the public right-of-way.

The asphalt of the culvert deck was removed and replaced to allow for structural repairs and improvements to the culvert superstructure. This allowed for cutting, removal and replacement of unsound concrete and rebar. This did not create any discernible changes to the concrete superstructure (Image 13-Image 14).

The sidewalk and traffic barriers were removed and replaced. The traffic barriers on both sides of the culvert deck were replaced with a concrete structure with faux stone pattern insets above which are two rows of metal railings (Image 15-Image 16). A sidewalk was also added to the east side of the culvert deck. Additionally, the barrier system north of the culvert along the south side of Willow Lane was replaced and barrier systems were added on the east side of Willow Lane along the north approach, and west and east sides of Willow Lane along the south approach (Image 18-Image 19).

The failing gabion baskets were also replaced with armour stone to support the retaining walls on all sides of the culvert (Image 20-Image 21). It appears that this necessitated removal of some of the trees and vines. Several recent tree plantings were observed on the south and north sides of the culvert (Image 13 and Image 22).



Image 13: View of the east side of the culvert, note new plantings



Image 14: View of the west side of the culvert



Image 15: View of the new asphalt culvert deck



Image 16: View of the replaced pedestrian railing on the east side of the culvert



Image 17: View of new barrier systems along the north approach to the culvert



Image 18: View of new barrier systems along the south approach to the culvert



Image 19: Detail of end of barrier system along the south approach to the culvert



Image 20: View of armor stone retaining wall at the northwest corner of the culvert



Image 21: View of the armor stone retaining walls on the east side of the culvert



Image 22: View of new plantings to the southeast of the culvert

6 UNDERTAKING AND IMPACTS

The conservation of cultural heritage resources in planning is a matter of public interest. Generally, infrastructure projects have the potential to adversely affect cultural heritage landscapes and built heritage resources by displacement and/or disruption during, as well as after construction.

For the Willow Lane culvert, this impact assessment will identify whether the cultural heritage value or interest as expressed in the Meadowvale HCD Plan has been impacted by the culvert rehabilitation and whether it complies with the guidelines laid out in the HCD Plan. In summary the heritage attributes relevant to this HIA include:

- significant location, adjacent to the Credit River, in a cultural heritage landscape of integrated natural and cultural heritage elements within the river's low floodplain to the gentle sloping ridge.
- a land pattern that retains the layout and plan of generous lots and pedestrian oriented narrow roadways of the 1856 Bristow Survey, spatial organization of narrow streets with soft vegetation and no shoulders, large diameter trees and a visual relationship which blends from public to private space among front and side yards void of privacy fencing.
- long term tradition of rural village-like streetscapes without curbs, with no formalized parking, sidewalks (except on Old Derry Road), modest signage and limited modest lighting.
- archaeological resources, including, but not limited to, the extant mill ruins, mill race and tail race at Willow Lane and Old Derry Road and remnant mill pond.

In addition to considering the impacts on the heritage attributes identified in the Meadowvale HCD, this impact assessment also considered the relevant policy and guidelines for alterations in the HCD Plan, which include:

Policy 5: Council will adopt the following objectives of the HCD Plan to guide the conservation and change within the district.

a) maintain and enhance the distinct heritage character of the HCD with emphasis on the following characteristics:

- i. Narrow rural-like roads;
- ii. Any addition of new sidewalks may be installed where required to meet accessibility needs, as appropriate;
- vii. Retention of all heritage attributes within the HCD and those listed for each individual property;
- ix. Transparent, or open views, while retaining large diameter trees, from the streetscape to buildings;
- x. Retention of the original topography;

- xi. Mill remnants (foundations, earthworks, former water-ways);
- b) preserve buildings of historic association and building features, and ensure new designs contribute to the HCD's heritage character;
- c) ensure changes enhance the HCD character;

Section 4.1.6 Private Tree Protection By-law

The retention of trees within the Meadowvale Village HCD is essential to its heritage character and sense of place. The City of Mississauga has adopted the Private Tree Protection By-law 0254-2012. Through this By-law, the removal and replacement of trees on private property are regulated.

Section 4.2.1.17 Public Works

- Alterations within the public right-of-way, which do not change the materials or appearance, are permitted
- the addition of new sidewalks within the public right of way may be installed where required to meet accessibility needs, as appropriate
- The addition and/or replacement of street tree plantings will be encouraged
- Alterations to parkland which do not alter the appearance, materials, views or vistas of the property are permitted
- Signage related to the identification of streets within the Village are permitted
- Directional signage, bike route signs and traffic safety signs are permitted
- Signage to identify the area as a HCD is permitted
- Alterations to structures within the public realm are subject to the Design Guidelines as listed above
- The conservation and interpretation of the mill ruins located between Willow Lane and Old Mill Lane are encouraged

CONSERVATION PRINCIPLES

In addition to consideration of the guidelines and heritage attributes identified in the Meadowvale HCD Plan, this HIA has also considered the sound conservation principles in Parks Canada's *Standards and Guidelines for the Conservation of Historic Places in Canada* (2010) (Standards and Guidelines) and the Ministry of Heritage, Sport, Tourism and Culture Industries' (MHSTCI) *Eight Guiding Principles in the Conservation of Historic Properties* (2007).

The *Standards and Guidelines* recognize that roads, bridges and culverts can be part of circulation patterns and systems that contribute to the heritage value of the cultural landscape. Repairing and replacing deteriorated parts of the circulation systems should be done using historical documentation for accuracy. Any new circulation features or compliance with accessibility requirements should be done in a manner that conservation the character-defining circulation systems or features.

Of the MHSTCI's *Eight Guiding Principles for the Conservation of Historic Properties*, consideration of the legibility principle will be key for the culvert rehabilitation. While the culvert was constructed in 1977 replacing an earlier culvert, no photographic documentation of the previous culvert or bridge was found to inform the current rehabilitation efforts. As such, the new work should be distinguishable from the old so as to be recognized as a product of its own time, but should still seek to complement the character of the cultural heritage landscape.

6.1 DESCRIPTION OF PROPOSED UNDERTAKING AND IMPACTS

The City of Mississauga completed a rehabilitation of a structured culvert on Willow Lane within the Meadowvale Village HCD in 2019 as per the recommendations of the Details Condition Survey Report by Planmac Engineering Inc. The rehabilitation plans are located in Appendix C.

The rehabilitation included the following changes to the Willow Lane culvert:

- Replacement of the asphalt deck
- Cutting, removal and replacement of unsound concrete and rebar
- Replacement and installation of new sidewalks
- Replacement and installation of new traffic barriers along the culvert deck;
- Replacement and installation of new guide rails on the approaches to and from the culvert
- Replacement of the gabion baskets with armor stone for the retaining walls

6.2 EVALUATION OF IMPACTS

The MHSTCI's *Infosheet #5: Heritage Resources in the Land Use Planning Process* (2006) identify seven ways in which negative impacts on a cultural heritage resource can be manifested. These include, destruction, alteration, shadows, isolation, direct or indirect obstruction, a change in land use and land disturbance. The following table considers these potential impacts.

Table 1: Evaluation of Impacts

CRITERIA	EVALUATION
<i>Destruction of any, or part of any, significant heritage attributes or features;</i>	Impact: Yes Rationale: Most of the rehabilitation undertaken on the Willow Lane culvert is considered under the 'alteration' category below, however, the replacement of the gabion boxes with armor stone to support the retaining walls extended beyond the footprint of the gabion boxes and appeared to require the removal of trees and soft vegetation. Trees and soft vegetation are considered important heritage attributes maintaining the rural character of the area and guidelines in the HCD district plan encourage their retention.
<i>Alteration that is not sympathetic, or is incompatible, with the historic fabric and appearance;</i>	Impact: Yes Rationale: Rehabilitation of the Willow Lane culvert has included several alterations to the existing culvert, however, not all alterations have had an impact on the heritage attributes for the Meadowvale HCD. Rehabilitation of the deteriorated concrete and rebar on the culvert has resulted in no discernible changes to the culvert and has no impact on the heritage attributes. Furthermore, replacement of the sidewalk on the west side of the culvert and installation of a new sidewalk on the east side of the culvert is consistent with the HCD guidelines that allow for new sidewalks where required for accessibility. Additionally, while discussed above for their destructive impact, the armor stones are also considered an alteration given that they replaced a different material (gabion boxes). While the material is different, the armor stone is not considered to detract from the rural character of the area. Notwithstanding the discussion above, there are several alterations that have detracted from the character of the area. The new pedestrian railing system and barrier system along the culvert approaches, are both inconsistent with the rural village character that is identified as a heritage attribute for the Meadowvale HCD. The pedestrian railing system makes use of concrete with a faux stone inset panel which reflects a style more appropriate for an area developed from the late twentieth century and onwards. While a metal barrier system was previously located on the south side of Willow Lane along the north approach to the culvert, the installation of the additional metal barrier system at the northwest corner of the culvert and along the south

CRITERIA	EVALUATION
	approach to the culvert detracts from the rural character created by the narrow lane without curbs and sidewalks.
Shadows created that alter the appearance of a heritage attribute or change the viability of a natural feature or plantings, such as a garden;	Impact: No Rational: The rehabilitation of the Willow Lane culvert has not resulted in any additional shadows that will impact the Meadowvale HCD's heritage attributes.
Isolation of a heritage attribute from its surrounding environment, context or a significant relationship;	Impact: No Rational: The rehabilitation of the Willow Lane culvert has not isolated any of the Meadowvale HCD's heritage attributes.
Direct or indirect obstruction of significant views or vistas within, from, or to built and natural features;	Impact: No Rational: The rehabilitation of the Willow Lane culvert has not obstructed any significant views in the Meadowvale HCD such as the views to the former mill ruins or the view west and east of the culvert along the flow of water that is likely the former mill race.
A change in land use such as rezoning a battlefield from open space to residential use, allowing new development or site alteration to fill in the formerly open spaces;	Impact: No Rational: The rehabilitation of the Willow Lane culvert has not resulted in a change of land use.
Land disturbances such as a change in grade that alters soils, and drainage patterns that adversely affect an archaeological resource.	Impact: Potential Rational: The rehabilitation of the Willow Lane culvert has not required any alteration of the soils, but the installation of the armor walls and the loose stones placed by the armor walls appears to exceed the original footprint of the gabion boxes that they replaced. Given that culvert was built over the former mill race that serviced the mill located east of the culvert, it is possible there could be archaeological remains. The Meadowvale HCD Plan identifies the mill race as an archaeological resource and heritage attribute and the also recommends maintaining and enhancing all mill remnants. The Meadowvale HCD Plan recommends a plan be created for the conservation of the mill ruins to ensure long term stabilization, and monitoring, however, a plan has not been created yet. Given that the work has already been completed, additional archaeological excavation would result in additional impact. However, any future ground disturbance in this area should require an archaeological assessment or archaeological monitoring.

6.3 RESULTS OF IMPACT ASSESSMENT

The impact assessment outlined in Section 5.2 of this report has determined that the rehabilitation of the Willow Lane culvert has resulted in some impacts to the Meadowvale HCD's heritage attributes and does not follow some of the guidelines in the HCD Plan. In summary, the impacts include displacement impacts due to the removal of some trees and soft vegetation, alteration impact due to the introduction of the new pedestrian railing and barrier systems that detract from the rural village character of the area and the archaeological remains of the former mill race may have been impacted.

7 ALTERNATIVES, MITIGATION AND CONSERVATION OPTIONS

In order to consider appropriate alternatives for the culvert design that satisfy the requirement of the Canadian Highway Bridge Design Code (CHBDC), Ministry of Transportation Ontario (MTO) *Roadside Design Manual* and the Transportation Association of Canada (TAC) *Geometric Design Guide for Canadian Roads, Chapter 7 – Roadside Design*, WSP's Cultural Heritage team coordinated mitigation measures with the team from Transportation Services. Transportation Services have identified several alternatives and cost estimates for these alternatives in Appendix D.

As a result of the impact assessment, WSP has identified the following opportunities and alternatives:

- 1 Should any future work around the culvert require land disturbance an archaeological assessment or archaeological monitoring should be completed to protect any archaeological remains from the mill ruin or otherwise significant artifacts.
- 2 Replace removed trees and soft vegetation. Notably, it appears that efforts to place the removed trees has already occurred to the northeast and southeast corners of the culvert. However, additional trees should be planted on the northwest and southwest corners if space allows and soft vegetation such as the creeping vines should be considered at the base of the culvert in these locations to minimize the visual impact of the guard rails should they remain.
- 3 Alternatives for traffic barriers:
 - a. Alternative traffic barriers that are crash test approved and therefore, satisfy the CHBDC include:
 - i. Embellished steel railing on concrete parapet wall (Example 1 on Attachment 1 of Appendix D)
 - ii. Steel railing (Examples 2 and 3 on Attachment 1 of Appendix D)
 - iii. Embellished concrete railing (Example 4 on Attachment 1 of Appendix D)
 - iv. Timber railing (Example 5 on Attachment 1 of Appendix D)
 - b. Alternative traffic barriers that are not crash test approved, but could be considered given the low traffic volume and speed on Willow Lane include:
 - i. Steel tube pedestrian railing (previous railing) (Example 1 on Attachment 2 of Appendix D)
 - ii. Embellished steel railing (Examples 2, 4 and 5 on Attachment 2 of Appendix D)
 - iii. Aluminum railing (Example 6 on Attachment 2 of Appendix D)

- iv. Embellished concrete railing (Examples 7 and 8 on Attachment 2 of Appendix D)

4 Alternatives for guide rails:

a. Remove existing guiderail on southeast corner and replace with shorter length guide rail flared beyond clear zone (meets clear zone requirements)

On the southeast corner, the existing guiderail and energy attenuator shall be removed and replaced with new guiderail and end treatment (OPSD 912.256) that is flared away from the roadway until it extends beyond clear zone (3m from lane), allowing for a shorter length of guiderail installation. This is similar to the existing guide rail installed on the northeast corner. On the southwest corner the existing energy attenuator will be removed and replaced with a new end treatment (OPSD 912.256) at the same location and existing guiderail will be maintained, unless the delineator post alternative is to be used, in which case new guide rail will be installed parallel to the roadway and extend just beyond the end of the existing sidewalk ramp and wood delineator posts would be installed from the sidewalk ramp to the intersection. Flared guide rail is not required on the southwest corner as it is a leaving end and is already beyond clear zone (3m from centreline).

Existing guide rail on the northeast and northwest corners shall be maintained. The new guide rail on the northeast corner already extends beyond clear zone and as noted in Appendix D, guide rail on the northwest corner was present in the original configuration.

b. Remove existing guide rail and replace with a poured concrete wall flared beyond clear zone (meets clear zone requirements)

On the southeast and northeast corners of the culvert, existing guiderail and end treatments are to be removed entirely. A concrete barrier wall with caisson foundations and matching the culvert barrier wall will be installed on each corner and flared away from the roadway until it extends beyond clear zone. On the southwest and northwest corners, the existing guide rail will be removed up to the end of the existing sidewalk ramp and replaced with the new concrete barrier wall. The exiting guide rail will be reconnected to the new end of the barrier and the existing attenuator at the southwest corner will be replaced with a leaving end treatment (OPSD 912.256) at the same location. If the post delineator alternative is to be used, all guide rail on the southwest corner would be removed and wood delineator posts would be installed from the end of the new concrete carrier wall to the intersection.

c. Remove existing guide rail, pedestrian protection only (does not meet clear zone requirements)

Given the low traffic volume and low speed of vehicles as noted above, the City may wish to consider and accept the risk associated with providing no approach guide rail protection. Existing guide rail and energy attenuators on the northeast, southeast and southwest corners of the culvert will be removed entirely. This would return the culvert and roadway to a condition similar to the original protection configuration. Installation of pedestrian railing or fencing complimentary to the chosen style of barrier on the culvert will still be required between the existing back of sidewalk and armour stone on all three corners due to the significant drop to the creek and / or ground adjacent to the sidewalk. As noted in Appendix D, guide rail on the northwest corner should be maintained.

7.1 MITIGATION/ALTERNATIVE OPPORTUNITIES ANALYSIS

Table 2: Advantages and Disadvantages of Mitigation/Alternative Opportunities

OPPORTUNITIES/ALTERNATIVES	ADVANTAGES	DISADVANTAGES
1. Should any future work around the culvert require land disturbance an archaeological assessment or archaeological monitoring should be completed to protect any archaeological remains from the mill ruin or otherwise significant artifacts.	Given that the rehabilitation efforts have already been completed, there is little advantage to completing an archaeological assessment now, as archaeological assessments are destructive in nature. However, if any land disturbance is required in the future there should be an archeological assessment or archaeological monitoring in accordance to protect potential archaeological remains identified as heritage attributes in the Meadowvale HCD Plan.	None.
2. Replace removed trees and soft vegetation. Notably, it appears that efforts to place the removed trees has already occurred to the northeast and southeast corners of the culvert. However, additional trees should be planted on the northwest and southwest corners if space allows and soft vegetation such as the creeping vines should be considered at the base of the culvert in these locations to minimize the visual impact of the guard rails should they remain.	Additional vegetation would aid in obscuring views of any new material that may aesthetically distract from the heritage character of the area. There is an opportunity to add to the vegetation in conjunction with any of the alternatives explored below.	None.
3. ALTERNATIVES FOR TRAFFIC BARRIERS		
a. Alternative traffic barriers that are crash test approved and therefore, satisfy the CHBDC include:		
i. Embellished steel railing on concrete parapet wall (Example 1 on Attachment 1 of Appendix D)	While this alternative would still be introducing a new material to the railing (concrete), the use of a plain concrete base instead of the current faux stone pattern and a simple but embellished steel railing may be a slight improvement for the rural character of the area. This alternative would also satisfy the CHBDC requirements.	This alternative would still introduce a new and modern design to the Meadowvale HCD.

OPPORTUNITIES/ALTERNATIVES	ADVANTAGES	DISADVANTAGES
ii. Steel railing (Examples 2 and 3 on Attachment 1 of Appendix D)	This alternative would satisfy the CHBDC requirements.	While this alternative would not introduce a new material, as the previous railing was steel, it would introduce a new design. The utilitarian aesthetic of these examples is not considered to contribute to the rural character of the Meadowvale HCD.
iii. Embellished concrete railing (Example 4 on Attachment 1 of Appendix D)	While this alternative would introduce a new material to the culvert railing (concrete), the design is reminiscent of early (i.e. 1930s) highway bridge design. It is a design that is found in several rural communities across Ontario. To satisfy the MHSTCI's <i>Eight Guiding Principles</i> , a date stamp with the year of rehabilitation would ensure it remains distinguishable from the old. Additionally, this alternative would satisfy the CHBDC requirements.	None.
iv. Timber railing (Example 5 on Attachment 1 of Appendix D)	While this alternative would introduce a new material to the culvert railing (timber), timber was one of first materials used for bridge construction. The steel railing is also similar to the previous steel tube railing. While this design does not specifically reflect a historical bridge railing, the combination of timber and steel would not detract from the rural village character of Meadowvale Village. This alternative would satisfy the CHBDC requirements.	None.
b. Alternative traffic barriers that are not crash test approved, but could be considered given the low traffic volume and speed on Willow Lane include:		
v. Steel tube pedestrian railing (previous railing) (Example 1 on Attachment 2 of Appendix D)	Given this alternative reflects the previous steel tube railing it would not have any additional impact on the character of Meadowvale Village.	This alternative does not conform to the CHBDC. Furthermore, while this does reflect the same design as the previous railing, the previous railing was installed prior to the designation of the Meadowvale Village HCD. Replacement with a similar railing would be a lost opportunity to

OPPORTUNITIES/ALTERNATIVES	ADVANTAGES	DISADVANTAGES
		provide a railing better in keeping with the character of area.
vi. Embellished steel railing (Examples 2, 4 and 5 on Attachment 2 of Appendix D)	Examples 2, 4 and 5 on Attachment 2 of Appendix D are all similar to the simple railing designs on bridges from the first half of the twentieth century. These are all very similar to the pedestrian railing on the bridge crossing the Credit River within Meadowvale HCD.	This alternative does not conform to the CHBDC.
vii. Aluminum railing (Example 6 on Attachment 2 of Appendix D)	None.	This alternative would introduce a new material to the railing (aluminum). Its design is common on modern bridges and would not complement the rural village character of Meadowvale Village. Furthermore, this alternative does not conform to the CHBDC.
viii. Embellished concrete railing (Examples 7 and 8 on Attachment 2 of Appendix D)	While this alternative would introduce a new material to the railing (concrete), the designs are reminiscent of historical concrete bridge design. To satisfy the MHSTCI's <i>Eight Guiding Principles</i> , a date stamp with the year of rehabilitation would ensure it remains distinguishable from the old. Notably, example 8 would be preferred over example 7, as example 7 is more embellished than typical historical concrete bridges.	This alternative does not conform to the CHBDC.
4. ALTERNATIVES FOR GUIDE RAILS		
a. Remove existing guiderail on southeast corner and replace with shorter length guide rail flared beyond clear zone (meets clear zone requirements)	While this would not remove the aesthetic impact of the introduction of guide rails along the approaches to the Willow Lane culvert, it would reduce the impact. Additionally, this alternative would provide the highest level of protection and satisfy the MTO <i>Roadside Design Manual</i> and the TAC <i>Geometric Design Guide for Canadian Roads, Chapter 7 – Roadside Design</i> .	Replacement of the existing guide rail with shorter length guide rails that extend 3 metres beyond the clear zone would be an improvement on the existing conditions but would continue to have an aesthetic impact on the district. Additional vegetation such as creeping vines would be imperative for this alternative.

OPPORTUNITIES/ALTERNATIVES	ADVANTAGES	DISADVANTAGES
b. Remove existing guide rail and replace with a poured concrete wall flared beyond clear zone (meets clear zone requirements)	This alternative satisfies the MTO's <i>Roadside Design Manual</i> and the TAC's <i>Geometric Design Guide for Canadian Roads, Chapter 7 – Roadside Design</i> .	This alternative is the least desirable from a heritage perspective. While the existing guide rails have introduced guide rails where they have not previously existed, they did exist on the northwest approach (although were camouflaged by thick vegetation). This alternative would introduce a new material (concrete) in the form of a guide rail along Willow Lane, which is not considered to be complementary to the rural village character of the Meadowvale HCD.
c. Remove existing guide rail, pedestrian protection only (does not meet clear zone requirements)	This alternative would have the least amount of impact on the Meadowvale HCD as it would be returning to the previous conditions and it would be consistent with the Meadowvale HCD Guidelines that permit alterations within the public right-of-way, which do not change the materials or appearance.	This alternative does not satisfy MTO <i>Roadside Design Manual</i> and the TAC <i>Geometric Design Guide for Canadian Roads, Chapter 7 – Roadside Design</i> .

7.2 RESULTS OF MITIGATION/ALTERNATIVE OPPORTUNITIES ANALYSIS

As a result of the analysis of the mitigation opportunities in Section 6.1, WSP has provided graded recommendations. Furthermore, as no pictures could be found of a pre-1977 culvert or bridge, the analysis has relied on finding alternatives that complement the rural streetscape that is identified as a heritage attribute in the Meadowvale HCD Plan and are thus consistent with Park's Canada's *Standards and Guidelines* and MHSTCI's *Eight Guiding Principles*.

WSP recommends that additional vegetation, with a preference for low and creeping vegetation, be strategically planted to minimize the aesthetic impact of new materials in addition to the recommendations for alternatives to the traffic barriers and guide rails.

For the traffic barriers, WSP is of the opinion that alternative 3.a.ii, 3.a.iv, 3.b.ii or 3.b.iv (example 8 only) would complement the rural village character of the area and the rural streetscape along Willow Lane.

For the guide rails, given the low volume and speed of traffic along Willow Lane, alternative 4.a. would provide the most compatible alternative that also satisfies the MTO *Roadside Design Manual* and the TAC *Geometric Design Guide for Canadian*

Roads, Chapter 7 – Roadside Design requirements. On the southwest corner, since the foreslope is steeper than 3:1, guiderail installation is warranted and it is recommended that the guardrail be maintained but that the existing energy attenuator be replaced. The current guardrail on the southwest corner blocks a set of stairs from a private property leading to Willow Lane; if the City of Mississauga wants to maintain access to these stairs, the guardrail could be replaced by wood delineator posts, similar to archived Ontario Provincial Standards Drawings (OPSD) 984.101, but these are not included in current Ontario Provincial Standards for Roads and Public Works. At the on-site meeting on October 1, 2020, several options were discussed to reduce the visual impact of the remaining southwest guardrail and these included: planting additional vegetation, painting the guardrail, and/or attaching a visual exhibit of artwork from local artists, historical photographs or summaries of the history of the area or a combination of such. The preferred option to reduce the visual impact of the southwest guardrail would be planting additional vegetation. Both painting the guardrail and a visual exhibit would require ongoing maintenance such as repainting every few years, replacement of exhibits as they fade or if subject to graffiti. Moreover, while there would be educational benefits from a visual exhibit, Willow Lane does not appear to receive a high amount of pedestrian traffic and as such, a visual exhibit may benefit from a higher trafficked area in the Village. If the City of Mississauga does decide to proceed with a visual exhibit, the weight of the exhibits and fastening mechanisms would need to be reviewed to ensure they do not compromise the integrity of the guard rails.

In addition to the alternative and mitigation measures considered above, should any future work around the culvert require land disturbance an archaeological assessment or archaeological monitoring should be completed to protect any archaeological remains from the mill ruin or otherwise significant artifacts.

8 RECOMMENDATIONS

Located off the north side of Old Derry Road, Willow Lane is a narrow road that travels north and curves east with a culvert crossing a tributary of Credit River; it provides access to a small number of secluded residential properties original to the Meadowvale Village settlement. In 2019 the City of Mississauga undertook rehabilitation of the culvert on Willow Lane to extend its service life by approximately 15-25 years. Members of the Meadowvale Heritage Association and the City of Mississauga's Heritage Board have since expressed concerns with the impact of the culvert rehabilitation on the cultural heritage landscape. As such, WSP was retained by the City of Mississauga in April 2020 to assess the impact of the rehabilitation to the culvert and identify any appropriate alternatives to mitigate any negative impacts in accordance with the Meadowvale HCD Plan.

Based on a thorough review of the Meadowvale HCD Plan and an evaluation of the rehabilitation works, WSP has concluded that the changes have had additional impacts on the Meadowvale HCD. The Meadowvale HCD Plan identifies that public works that do not change the materials or appearance are permitted. While this does not prohibit public works that do change the materials or appearance, these proposed works should go through a review process prior to implementation to identify whether the change in materials and appearance is in keeping with the remaining guidelines in the Meadowvale HCD Plan and with the identified heritage attributes. The Meadowvale HCD Plan does not provide further guidance on culvert or bridge design, as such consideration of the heritage attributes is key. The relevant heritage attributes identified in Section 2.6 emphasize the importance of the rural village-like streetscapes that consist of narrow streets with soft vegetation, no shoulders, and no curbs. Willow Lane is characteristic of the rural village-like streetscape that the Meadowvale HCD Plan describes. Specifically, it was determined that the new traffic barrier along the deck of the culvert and guide rails along the approaches to the culvert detracted from the rural village-like streetscape quality of Willow Lane. Working with a multi-disciplinary team, WSP identified several alternatives for both the traffic barriers and guide rails and subsequently evaluated these to determine which were compatible with the intent to maintain the rural village-like character of Willow Lane. The appropriate alternatives are as follows:

- 1 Should any future work around the culvert require land disturbance an archaeological assessment or archaeological monitoring should be completed to protect any archaeological remains from the mill ruin or otherwise significant artifacts.
- 2 Replace removed trees and soft vegetation. Notably, it appears that efforts to place the removed trees has already occurred to the northeast and southeast corners of the culvert. However, additional trees should be planted on the northwest and southwest corners if space allows and soft vegetation such as the creeping vines should be considered at the base of the culvert in these locations to minimize the visual impact of the guard rails should they remain.

- 3 For the traffic barriers, the following construction alternatives are suggested to complement the rural character of the area:
 - a Steel railing (Examples 2 and 3 on Attachment 1 of Appendix D)
 - b Timber railing (Example 5 on Attachment 1 of Appendix D)
 - c Embellished steel railing (Examples 2, 4 and 5 on Attachment 2 of Appendix D)
 - d Embellished concrete railing (Examples 7 and 8 on Attachment 2 of Appendix D)
- 4 Remove existing guiderail on southeast corner and replace with shorter length guide rail flared beyond clear zone (meets clear zone requirements).

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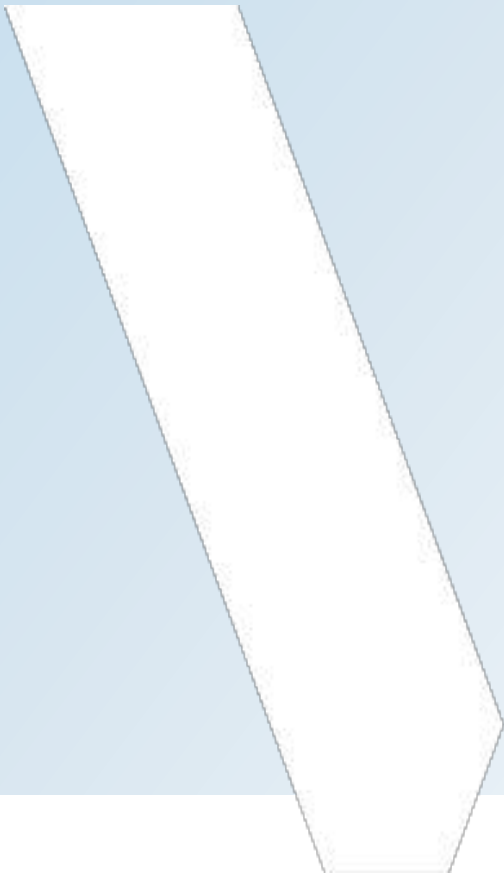
Spence, M.W., R.H. Phil, and C. Murphy (1990). *Cultural Complexes of the Early and Middle Woodland Periods*. In *The Archaeology of Southern Ontario to A.D. 1650*, Ed C.J. Ellis and N. Ferris, pp. 125-170. Occasional Publication of the London Chapter, OAS No. 5. London: Ontario Archaeology Society.

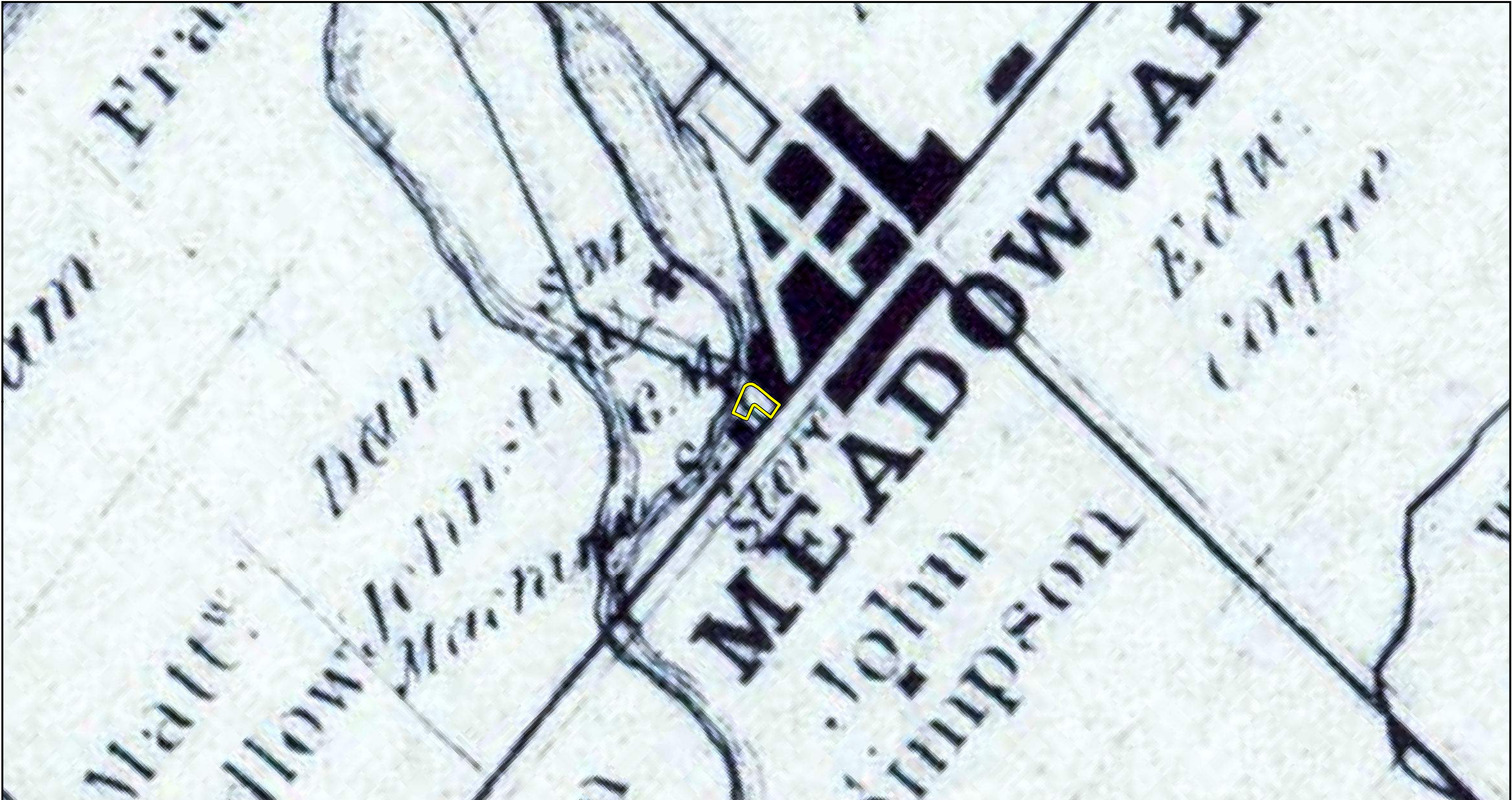
Surtees, Robert J. (1994). *Land Cessions, 1763-1830*. In *Aboriginal Ontario: Historical Perspectives on the First Nations*, Ed Edward S. Rogers and Donald B. Smith, pp. 92-121. Dundurn Press for the Government of Ontario, Toronto, Ontario.

Warrick, G. (2000). *The Precontact Iroquoian Occupation of Southern Ontario*. *Journal of World Prehistory* 14(4):415-456.

APPENDIX

A FIGURES 2-3

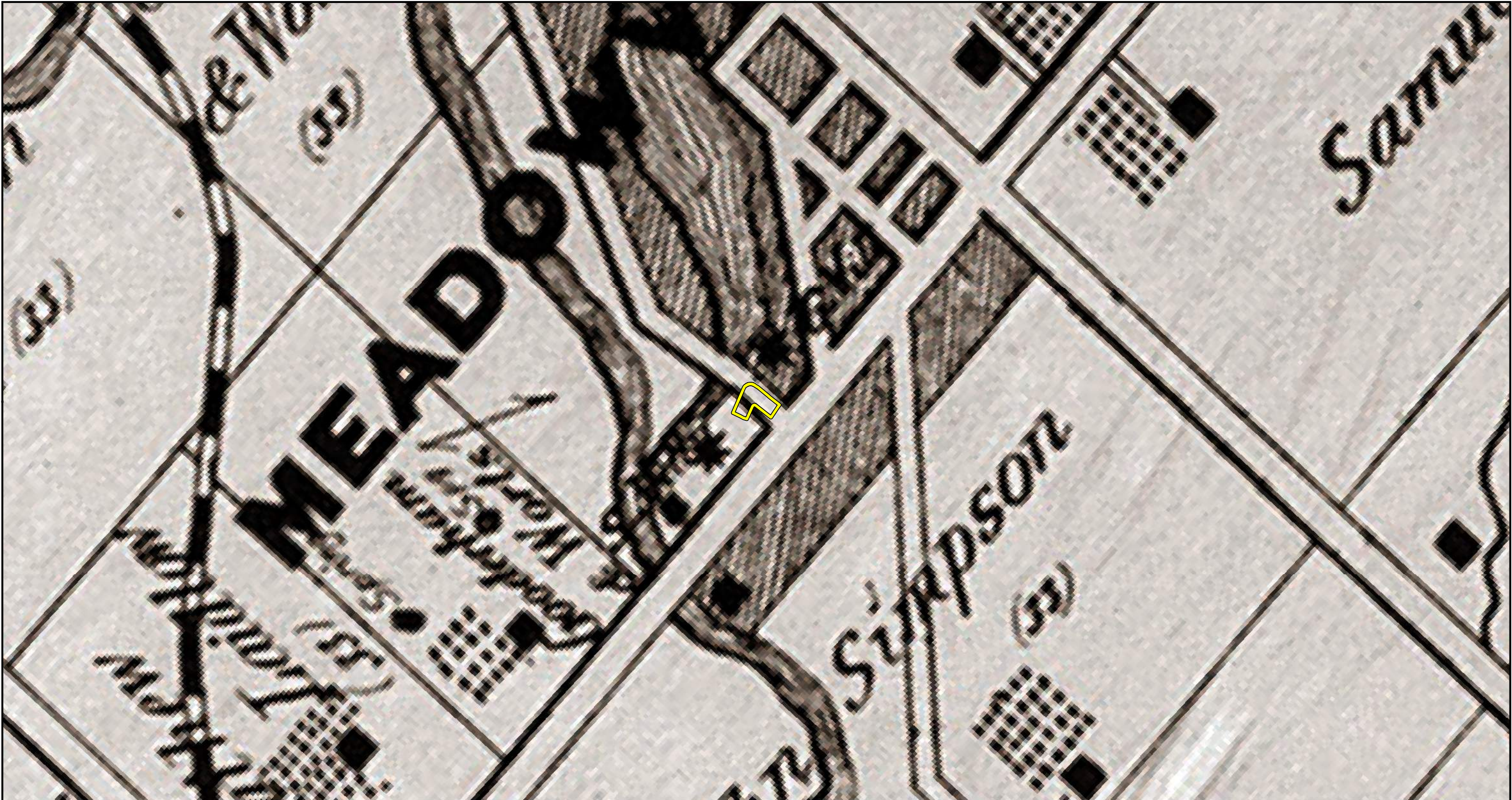




LEGEND

 Study Area

TITLE: FIGURE 2: HISTORICAL MAPPING (1859)	SCALE: 1:5,000	PROJECT NO: 19M-00836-00	DATE: MAY 2020
	DRAWN BY: AST	CLIENT: CITY OF MISSISSAUGA	
PROJECT: WILLOW LANE CULVERT HIA		CREDITS: MAP OF THE COUNTY OF PEEL, CANADA WEST (G.R. & G.M. TREMAINE 1859)	
0 120 240 m			





LEGEND

 Study Area

TITLE:

FIGURE 3: HISTORICAL MAPPING (1877)

PROJECT:

WILLOW LANE CULVERT HIA

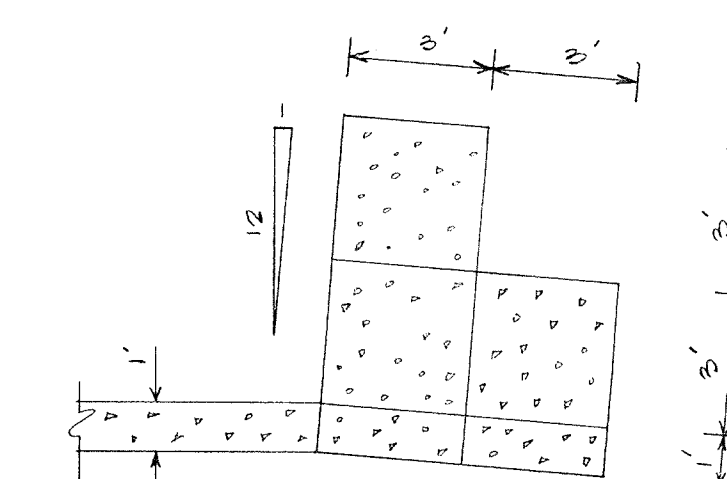
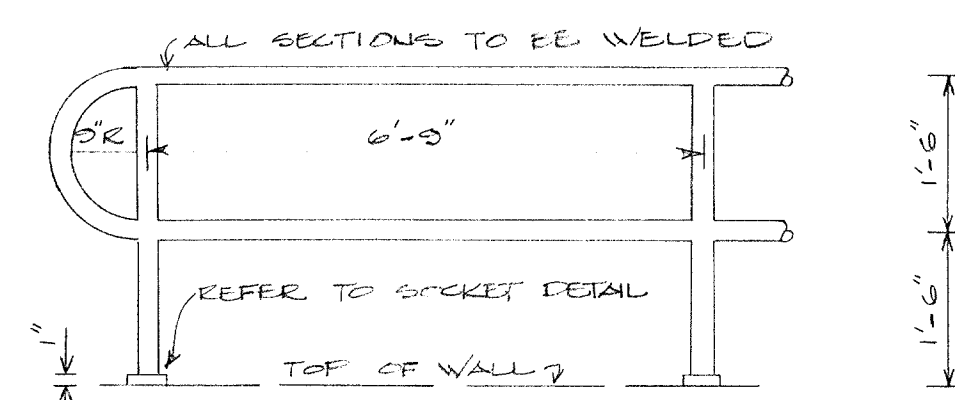
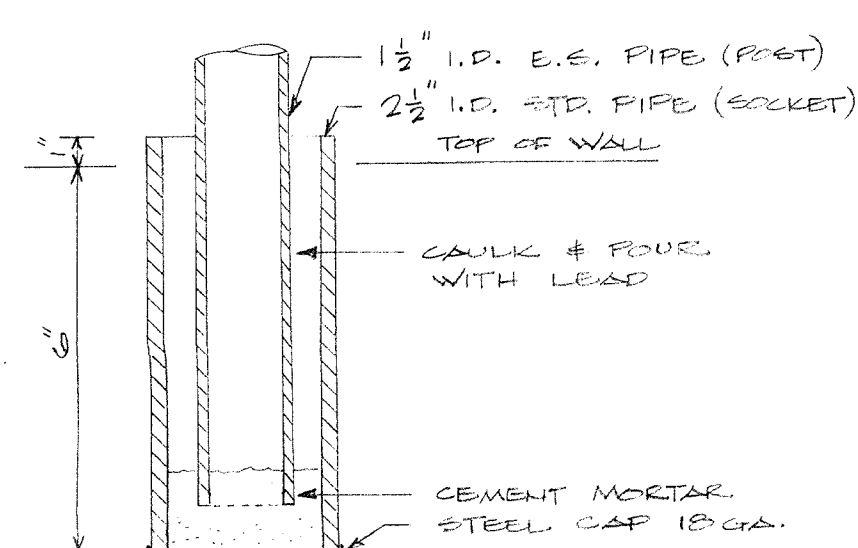
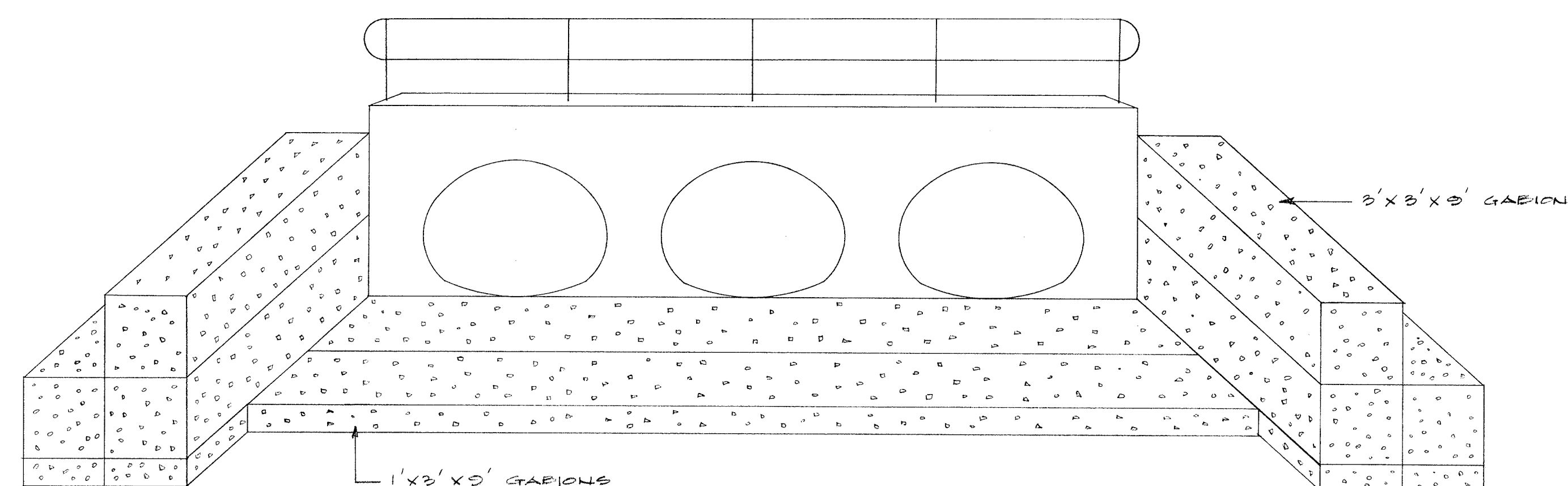
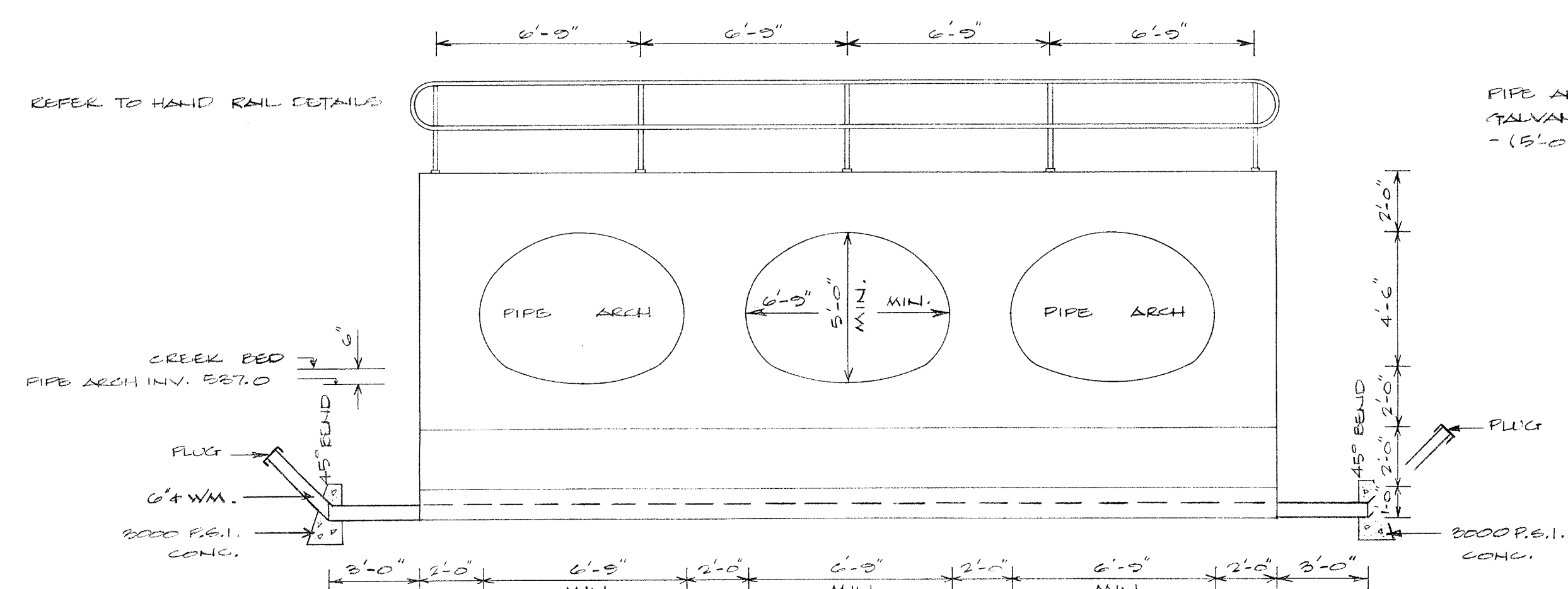
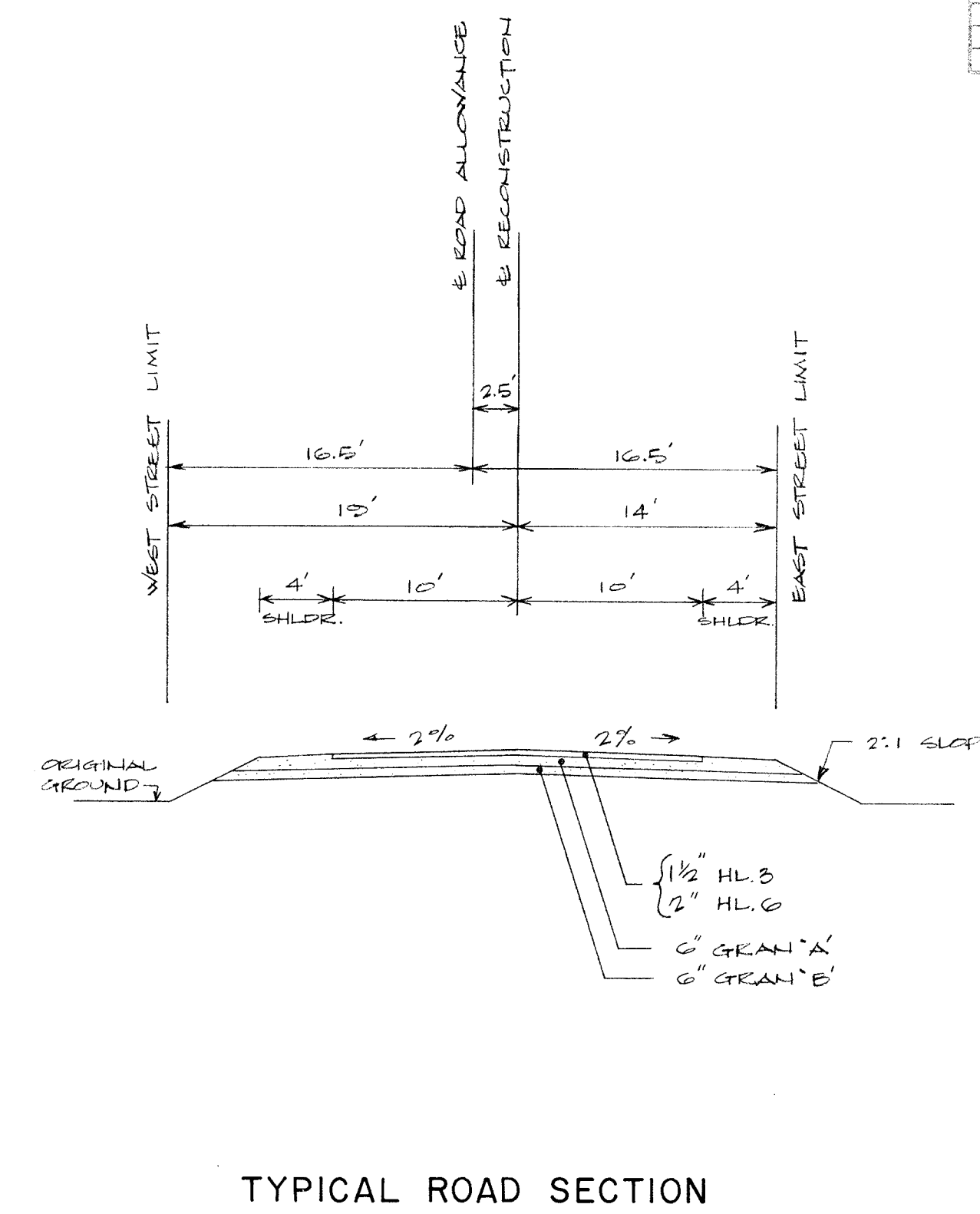
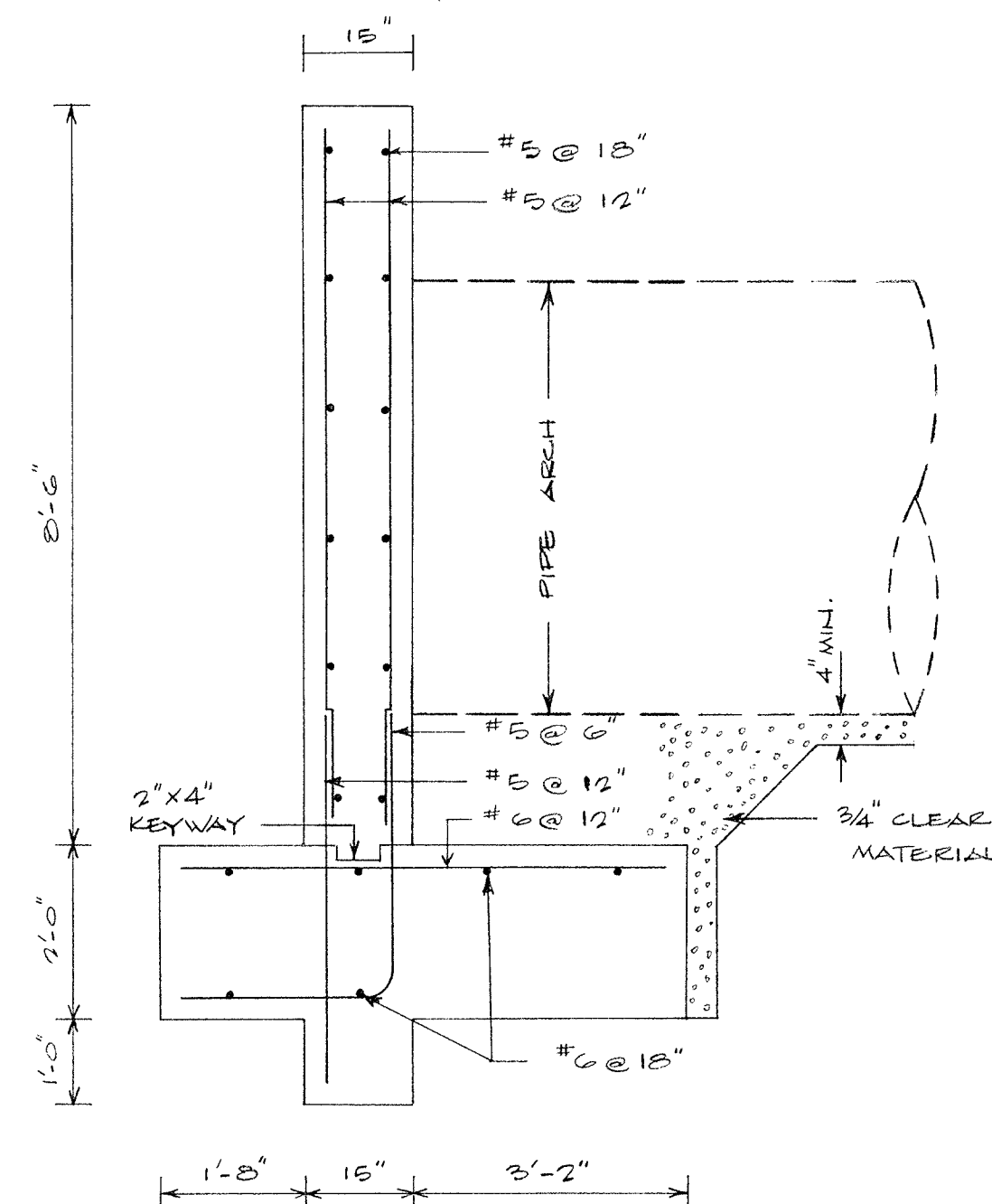
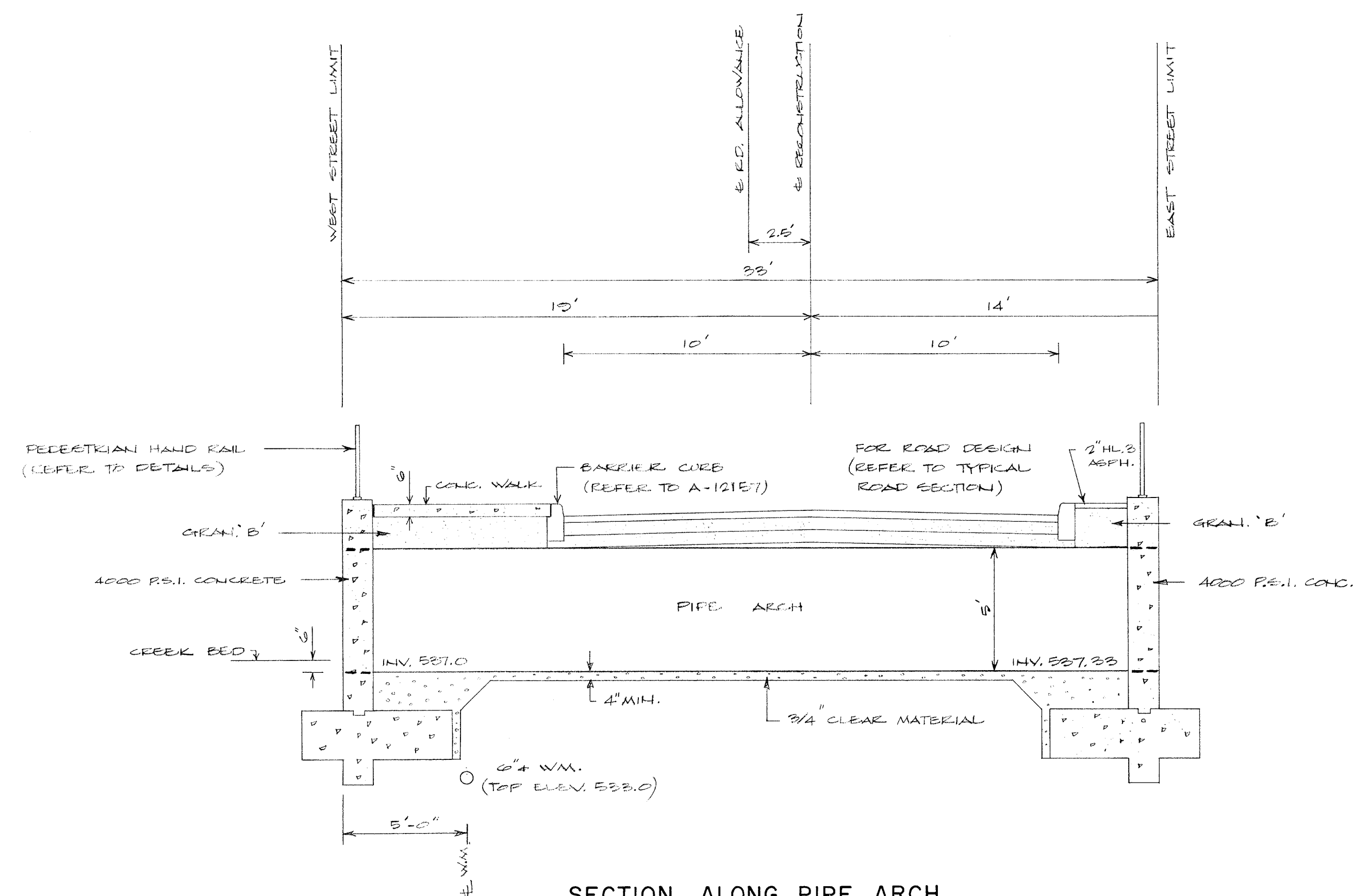
0 120 240 m

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SCALE: 1:5,000	PROJECT NO: 19M-00836-00	DATE: MAY 2020
DRAWN BY: AST	CLIENT: CITY OF MISSISSAUGA	
CREDITS: TOWNSHIP OF TORONTO FROM ILLUSTRATED HISTORICAL ATLAS OF THE COUNTY OF PEEL (WALKER & MILES 1877)		

APPENDIX

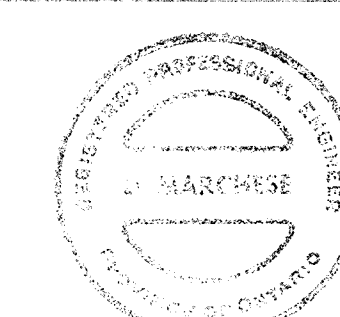
B 1977 CULVERT PLANS

[illegible]

GABION DETAILS

SCALE: 1/4" = 1'-0"

DWG, OBSOLETE
SEE DWG. 15233-74



DESIGNED BY

DESIGNED BY
D. M. Munchy

APPROVED

AE in Donald

CITY OF MISSISSAUGA
ENGINEERING DEPARTMENT

WILLOW LANE CULVERT

CONSTRUCTION DETAILS

STN. TO STN.

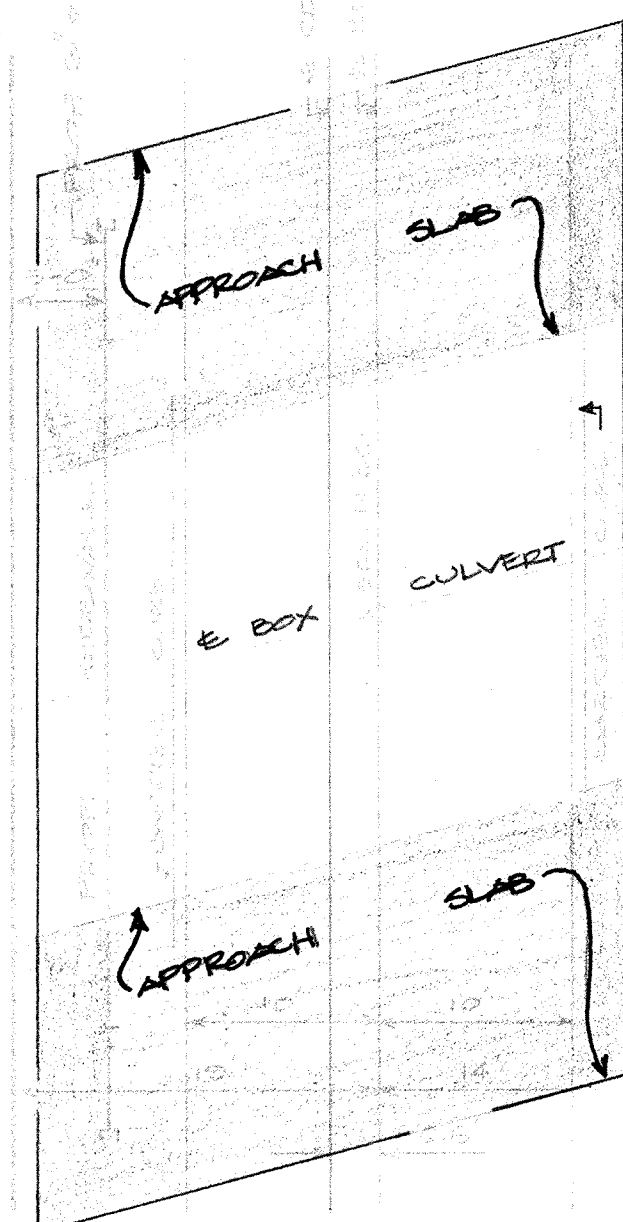
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DRAWN BY T. JOHNSON	CHECKED BY	PLAN NO.
DATE MAR. 22, 1977	SHEET 2 OF 2	C-14910

14910

REVISIONS		
DATE	DETAILS	BY
OCT. 21/81	AS CONST.	JCM
8.1.81	MICROFILMED	

LEGEND

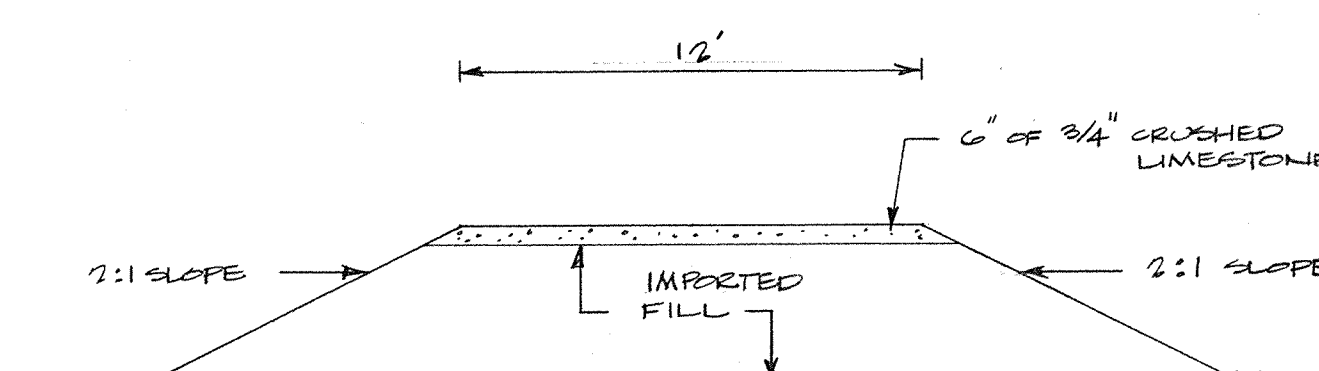
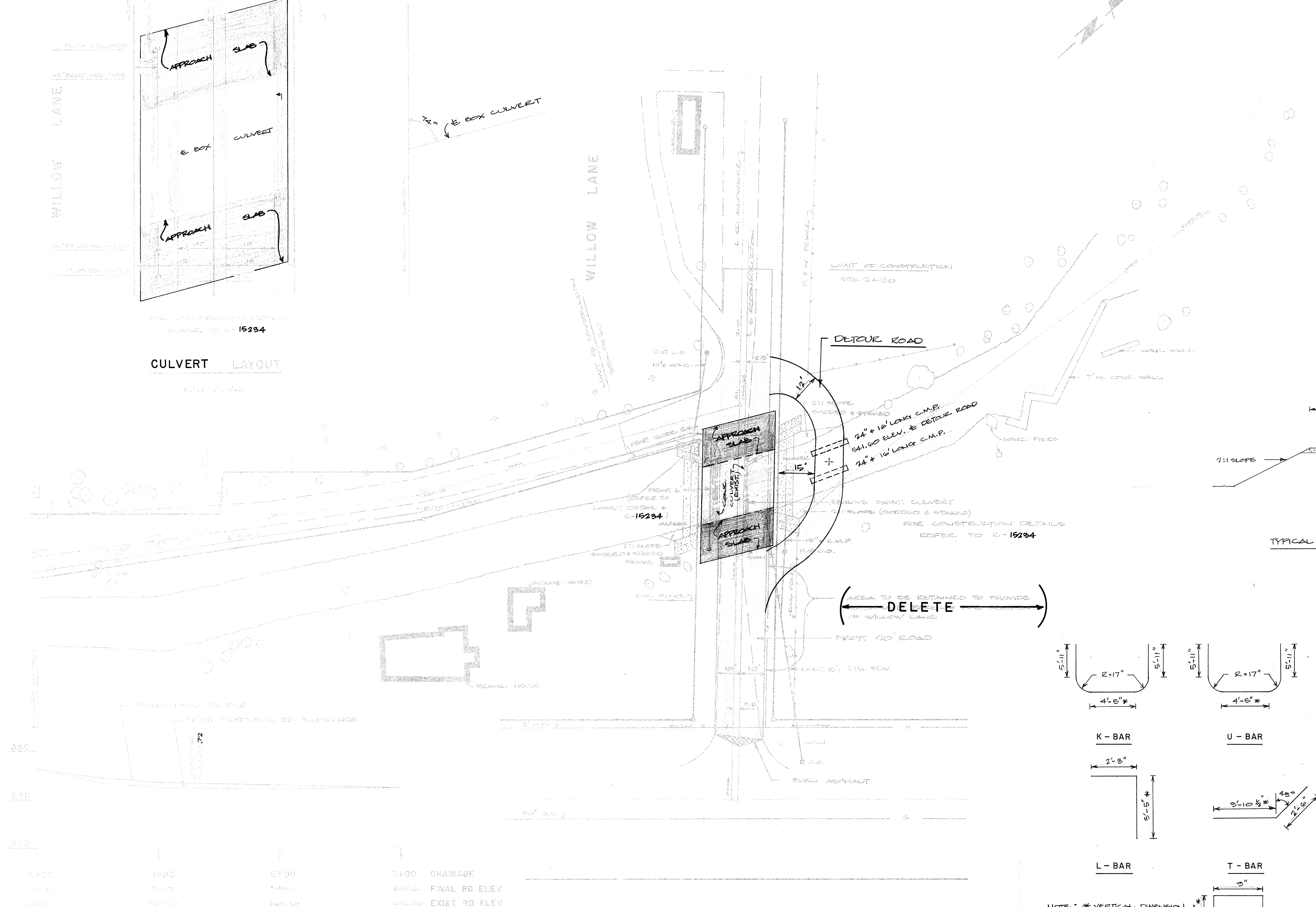
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 [Symbol] -- PROP. C.B.



FOR CONSTRUCTION DETAILS
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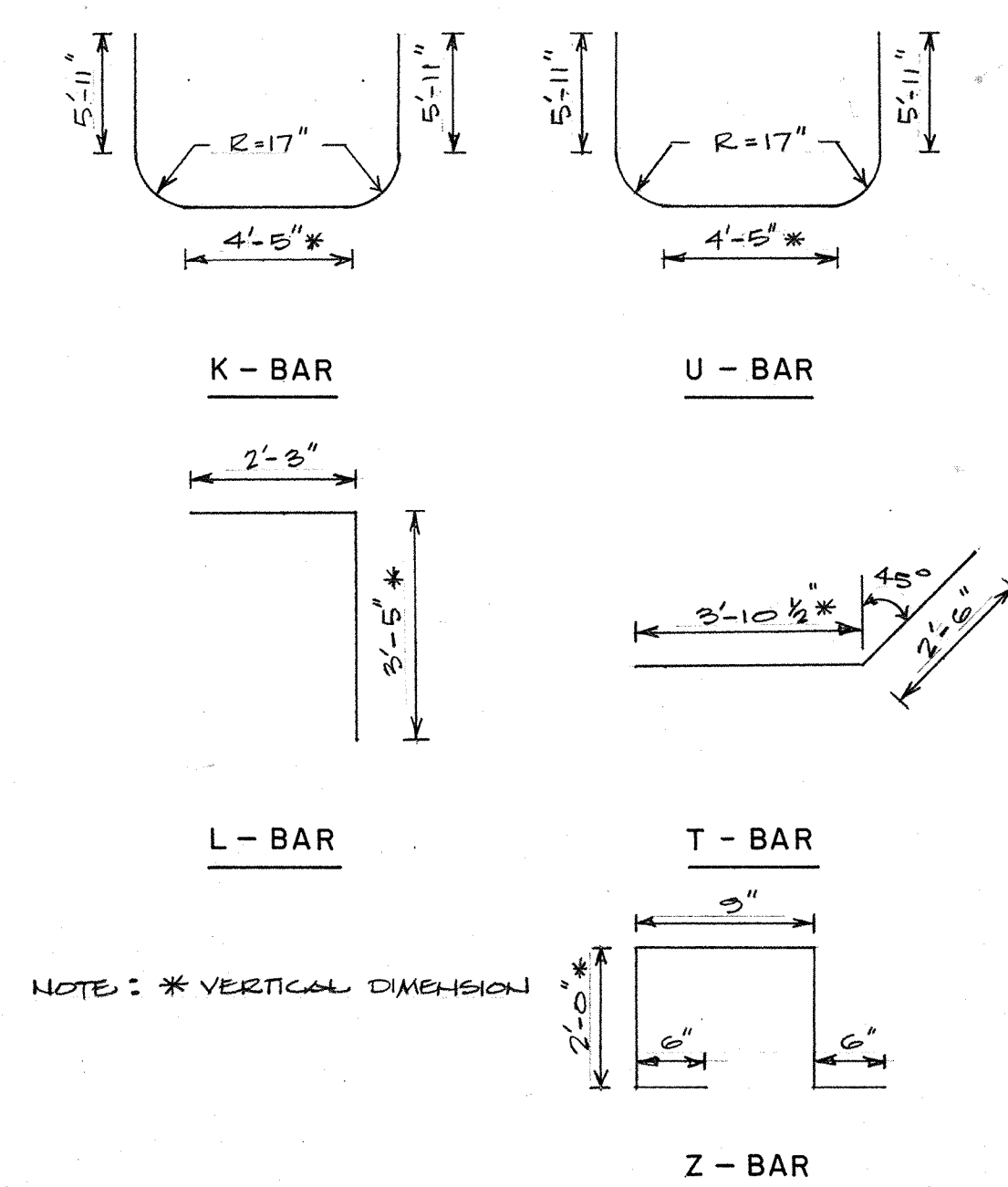
CULVERT LAYOUT

SCALE: 1"=10'-0"



TYPICAL SECTION - DETOUR ROAD

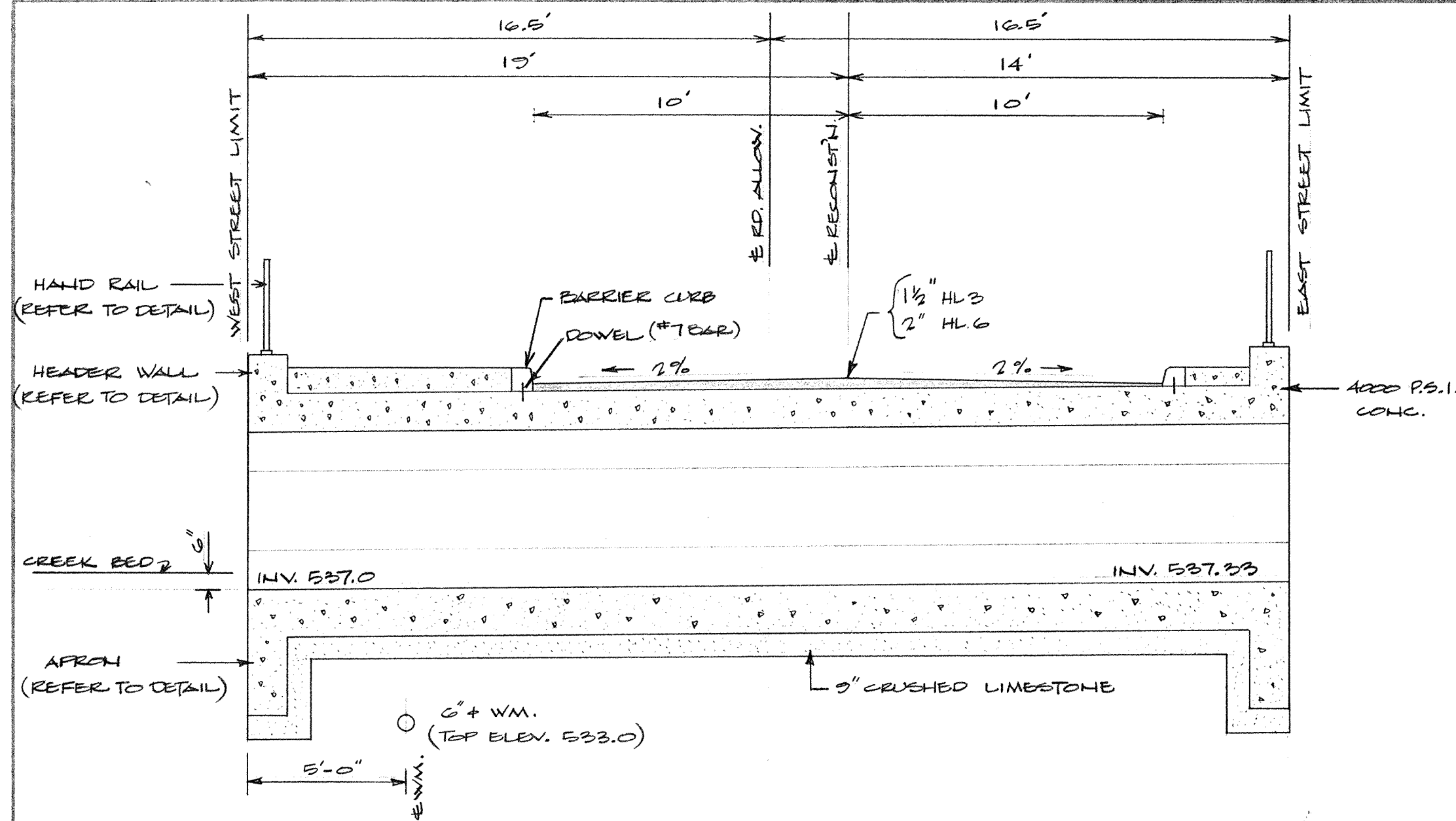
H.T.S.



REINFORCING STEEL IDENTIFICATION

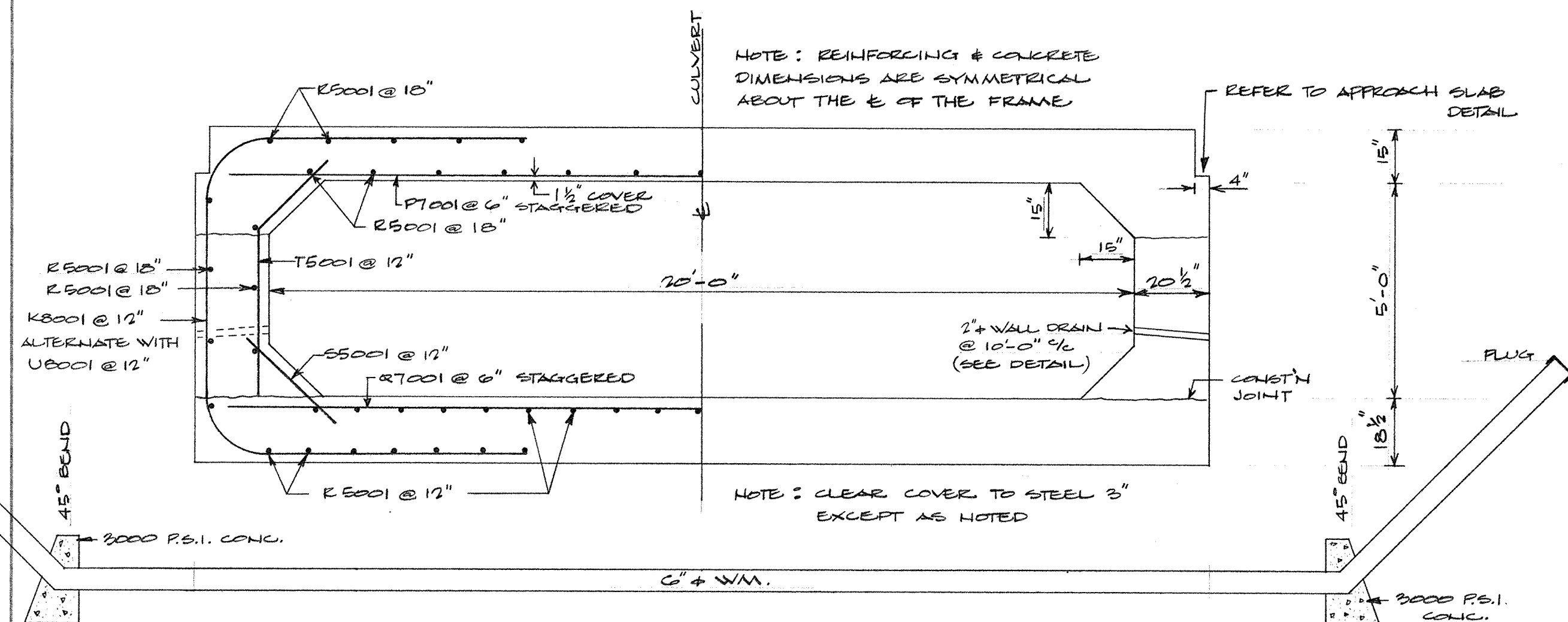
DESIGNED BY			
CITY OF MISSISSAUGA ENGINEERING DEPARTMENT			
WILLOW LANE BRIDGE OVER REACH OF CREDIT RIVER			
STN. TO STN.		PROJECT NO. 75-124	
SCALE: 1"=20'	AREA: 2-33	SHEET 1 OF 2	
DRAWN BY T. JOHNSON		CHECKED BY	
DATE: JUNE 16, 1977		C-15233	

C-15233



SECTION ALONG BOX CULVERT

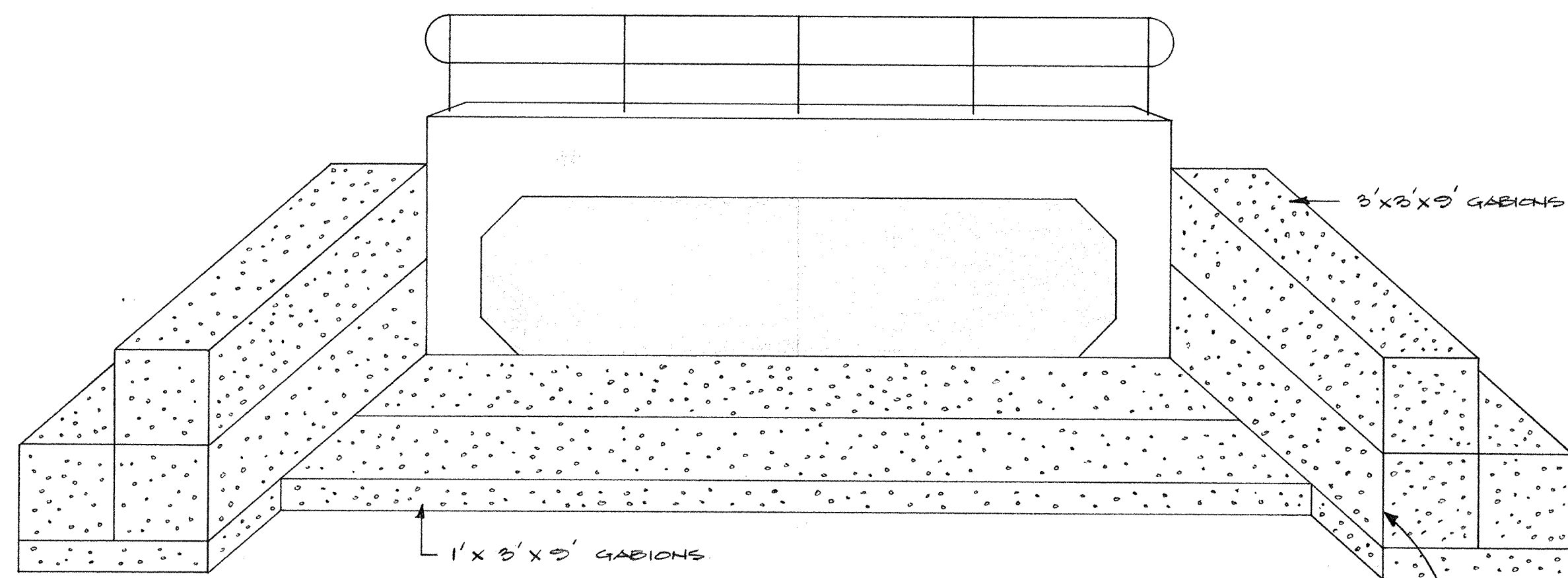
SCALE: 1/4" = 1'-0"



TYPICAL CULVERT SECTION

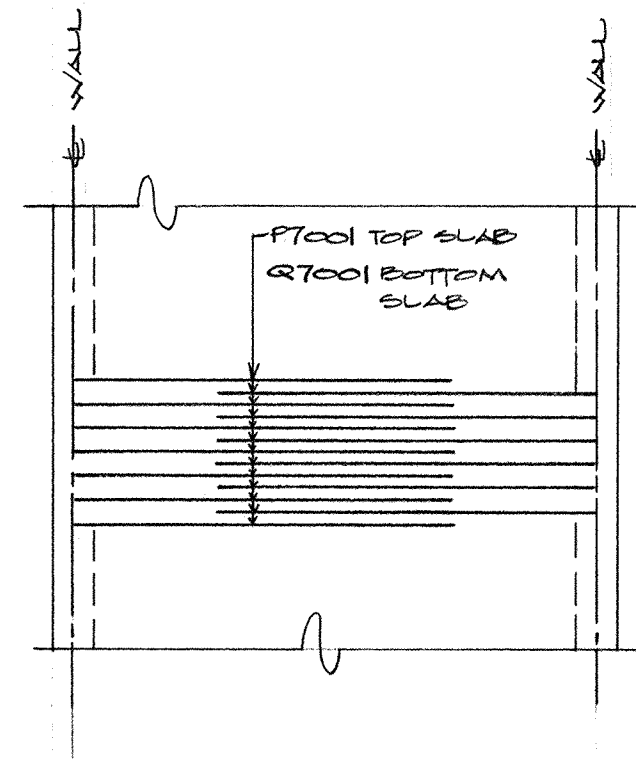
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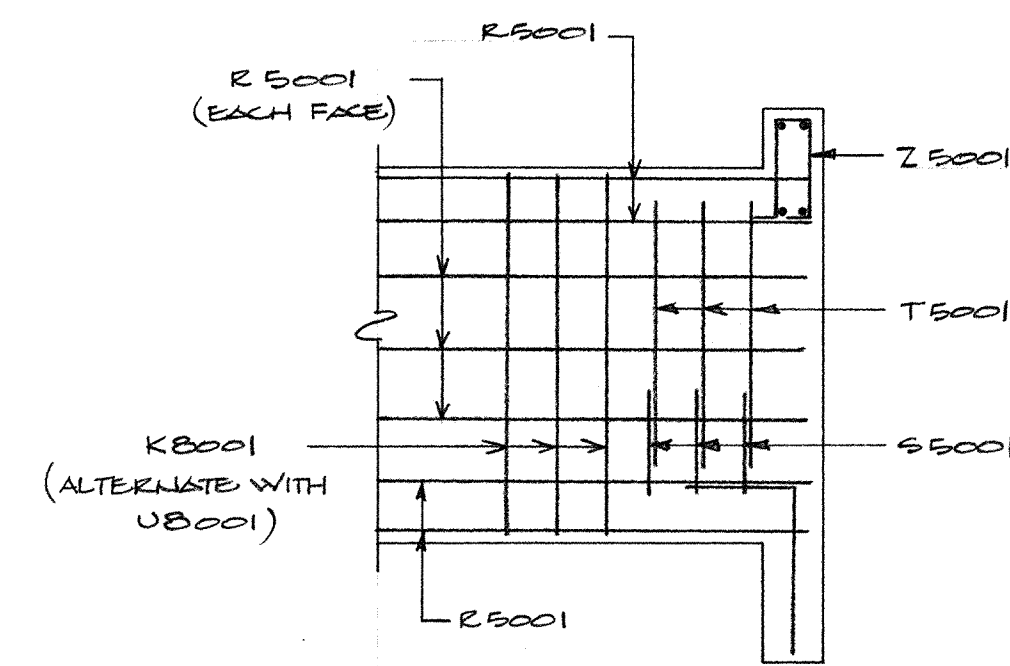
GABION ARRANGEMENT AT INLET & OUTLET

SCALE: 1/4" = 1'-0"



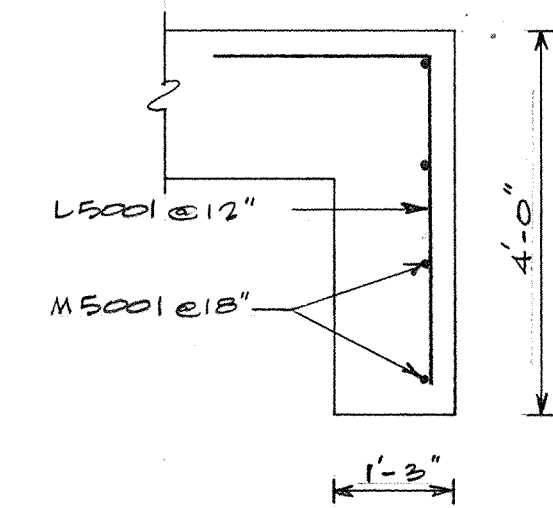
P & Q BAR LAYOUT

SCALE: 1/8" = 1'-0"



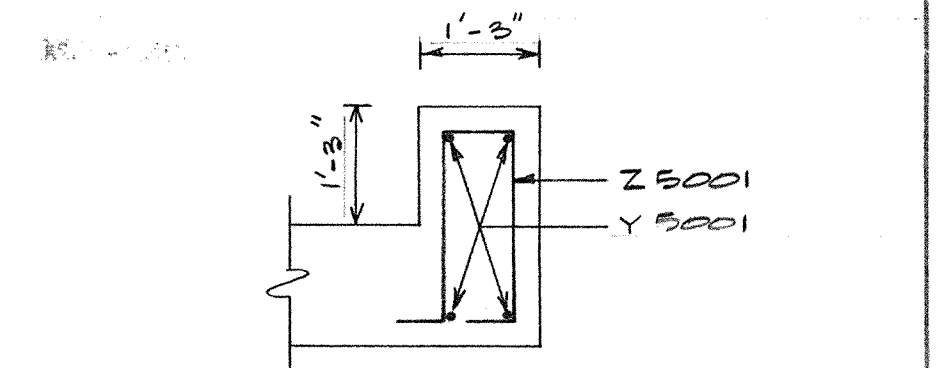
STEEL LAYOUT IN WALL

SCALE: 1/4" = 1'-0"



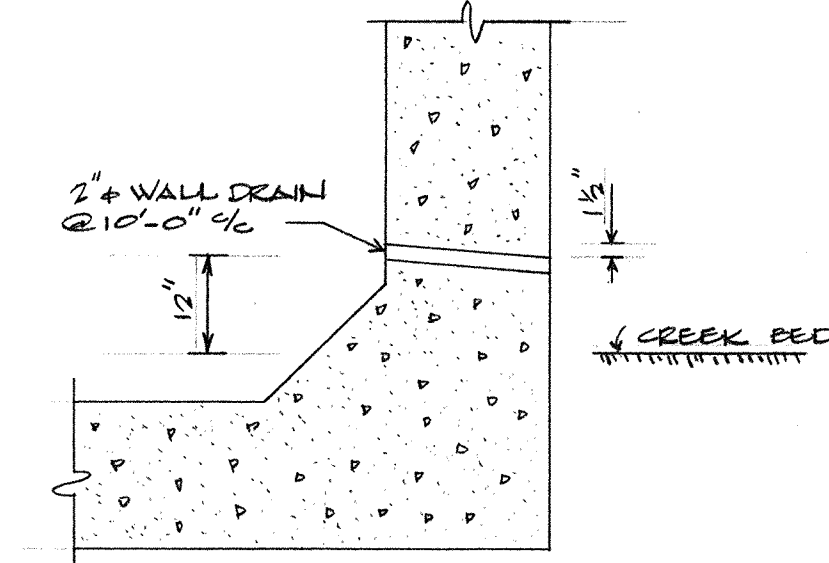
SECTION AT APRON

SCALE: 1/2" = 1'-0"



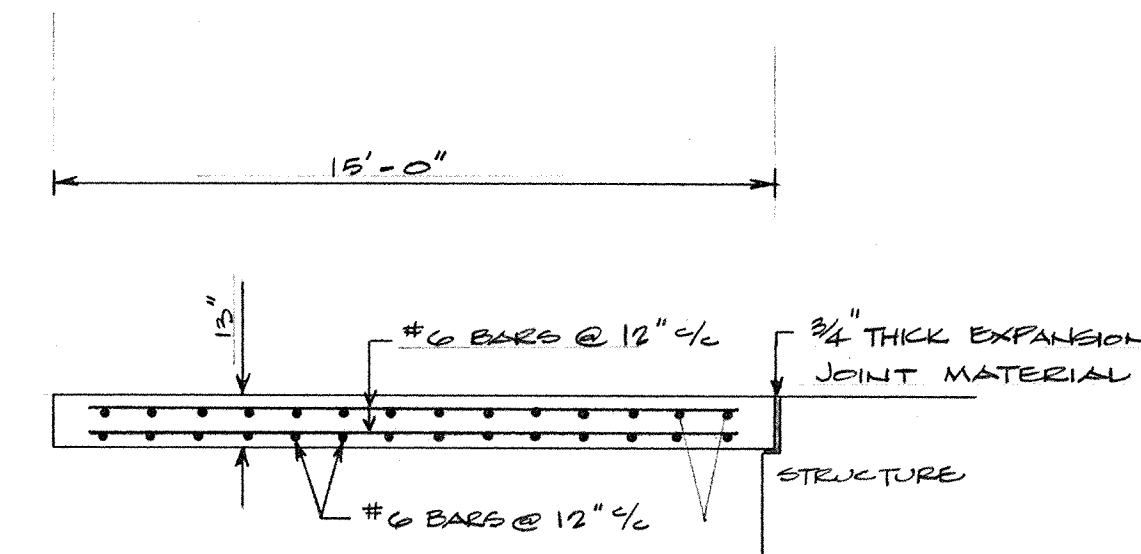
SECTION AT HEADER WALL

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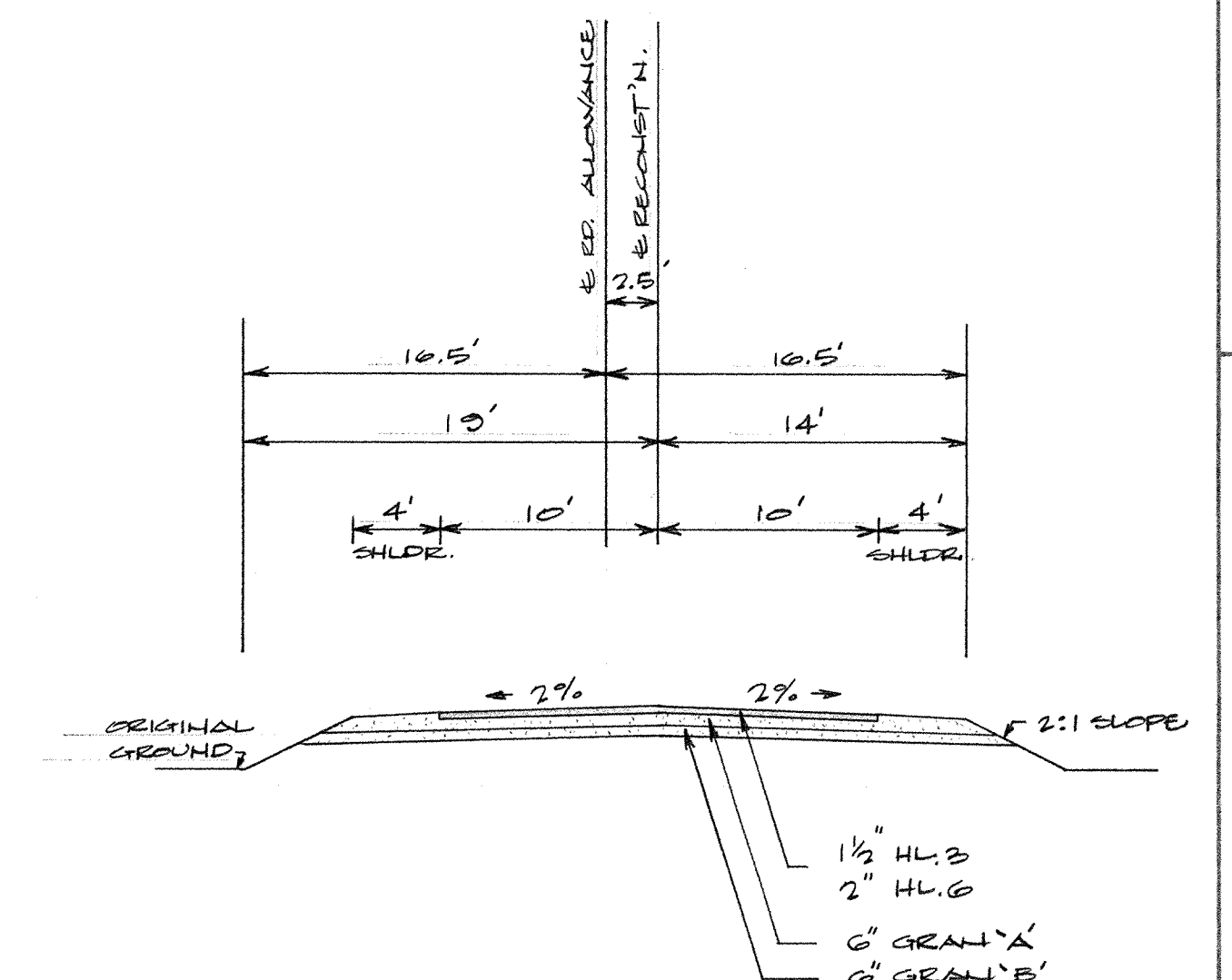
WALL DRAIN LAYOUT

SCALE: 1/2" = 1'-0"



SECTION THROUGH APPROACH SLAB

SCALE: 1/4" = 1'-0"



TYPICAL ROAD SECTION

SCALE: 1/8" = 1'-0"

QUANTITIES	
ITEM	WALLS & SLAB
WT. OF REINF. STL. (TONS)	7.68
VOL. OF CONCRETE (CU. YD.)	10.0

SPAN 20'-0"
HEIGHT 5'-0"
LENGTH 24'-23"
FILL HEIGHT 3 1/2"
SKEW ANGLE 16°

DESIGNED BY <i>D. Marchese</i>	APPROVED BY
-----------------------------------	-------------

AEW & Sonal

CITY OF MISSISSAUGA
ENGINEERING DEPARTMENT

WILLOW LANE CULVERT
CONSTRUCTION DETAILS - BOX CULVERT
STN. TO STN.

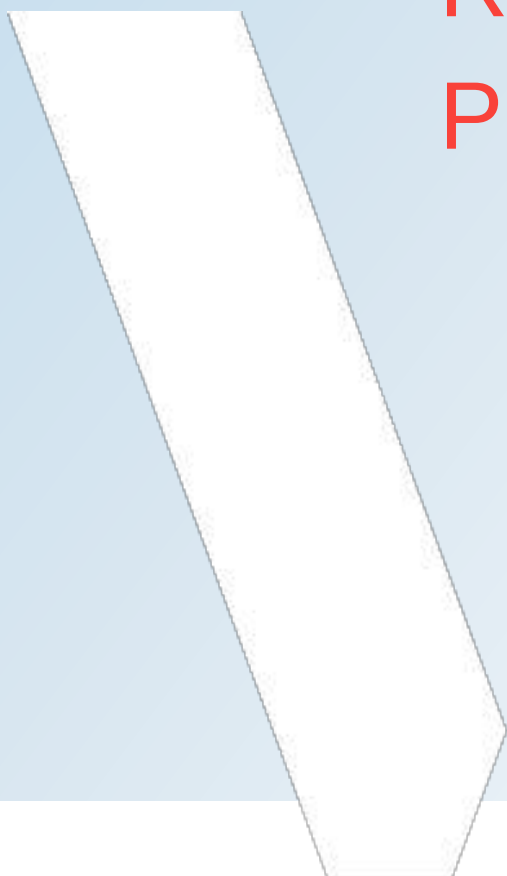
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DRAWN BY T. JOHNSON	CHECKED BY	PLAN NO.
DATE JUNE 16, 1977	SHEET 2 OF 2	C-15234

C-15234

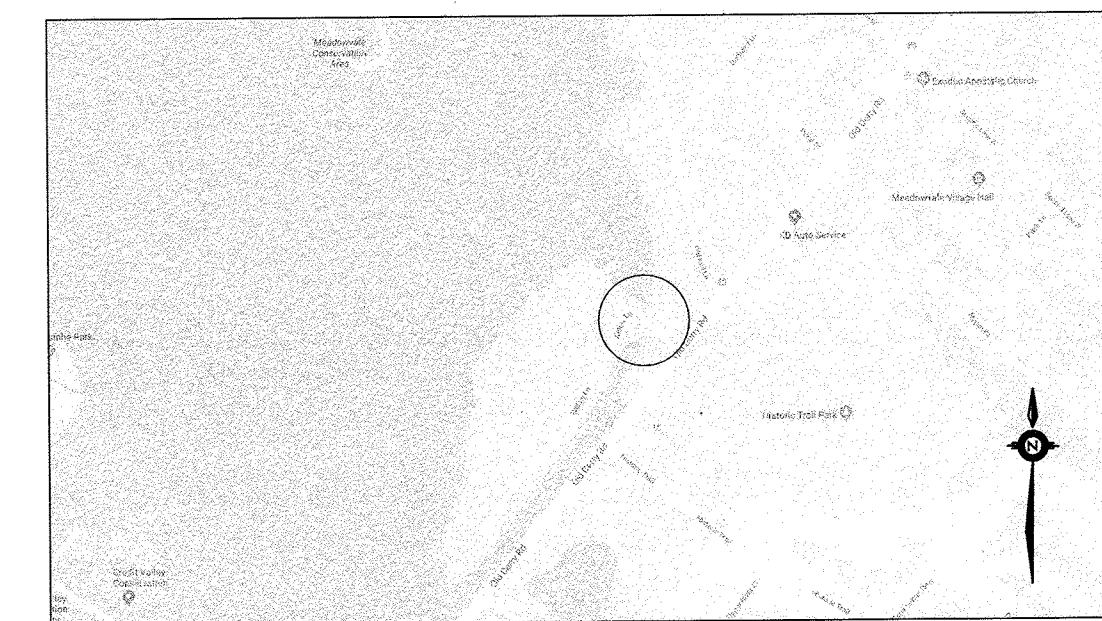
APPENDIX

C 2019

REHABILITATION
PLANS



METRIC.
DIMENSIONS ARE IN
MILLIMETRES UNLESS
OTHERWISE SHOWN



KEY PLAN
N.T.S.

GENERAL NOTES:

CONCRETE

CLASS OF CONCRETE 35 MPa
UNLESS OTHERWISE NOTED

CLEAR COVER TO REINFORCING STEEL

DECK TOP..... 70±20

BOTTOM..... 40±10

REMAINDER, UNLESS OTHERWISE NOTED 70±20

CONCRETE COVER ON PATCH REPAIR SHALL MATCH EXISTING UNLESS OTHERWISE NOTED

REINFORCING STEEL

1. REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED
2. STAINLESS STEEL REBAR SHALL BE TYPE 316N WITH MINIMUM YIELD STRENGTH OF 500MPa.
3. UNLESS SHOWN OTHERWISE, TENSION LAP SPLICES SHALL BE CLASS 'B'
4. BAR HOOKS SHALL HAVE STANDARD HOOK DIMENSIONS USING MINIMUM BEND DIAMETERS, WHILE STIRRUPS AND TIES SHALL HAVE MINIMUM HOOK DIMENSIONS. ALL HOOKS SHALL BE IN ACCORDANCE WITH THE STRUCTURAL STANDARD DRAWINGS SS12-1 AND SS12-2, UNLESS INDICATED OTHERWISE.

CONSTRUCTION NOTES:

1. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, ELEVATIONS OF THE EXIST WORK, LOCATION OF UTILITIES AND ALL DETAILS ON SITE AND REPORT ANY DISCREPANCIES TO THE CONTRACT ADMINISTRATOR BEFORE PROCEED WITH THE WORK.

DESIGN REQUIREMENTS

1. ALL DESIGN REQUIREMENTS SHALL BE IN ACCORDANCE WITH CANADIAN HIGHWAY BRIDGE DESIGN CODE CAN CSA-S6-14

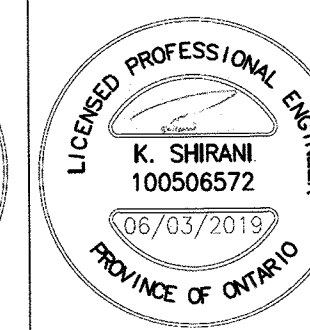
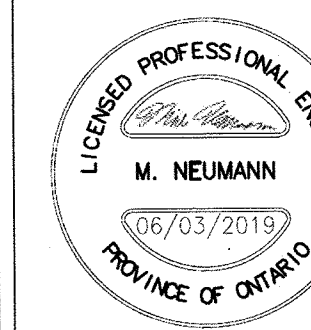
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3	TZ	19-11-18	90% DESIGN SUBMISSION	MN
2	TZ	17-9-18	60% DESIGN SUBMISSION	MN
1	DH	1-8-18	30% DESIGN SUBMISSION	MN

MISSISSAUGA



PLANMAC
ENGINEERING INC.

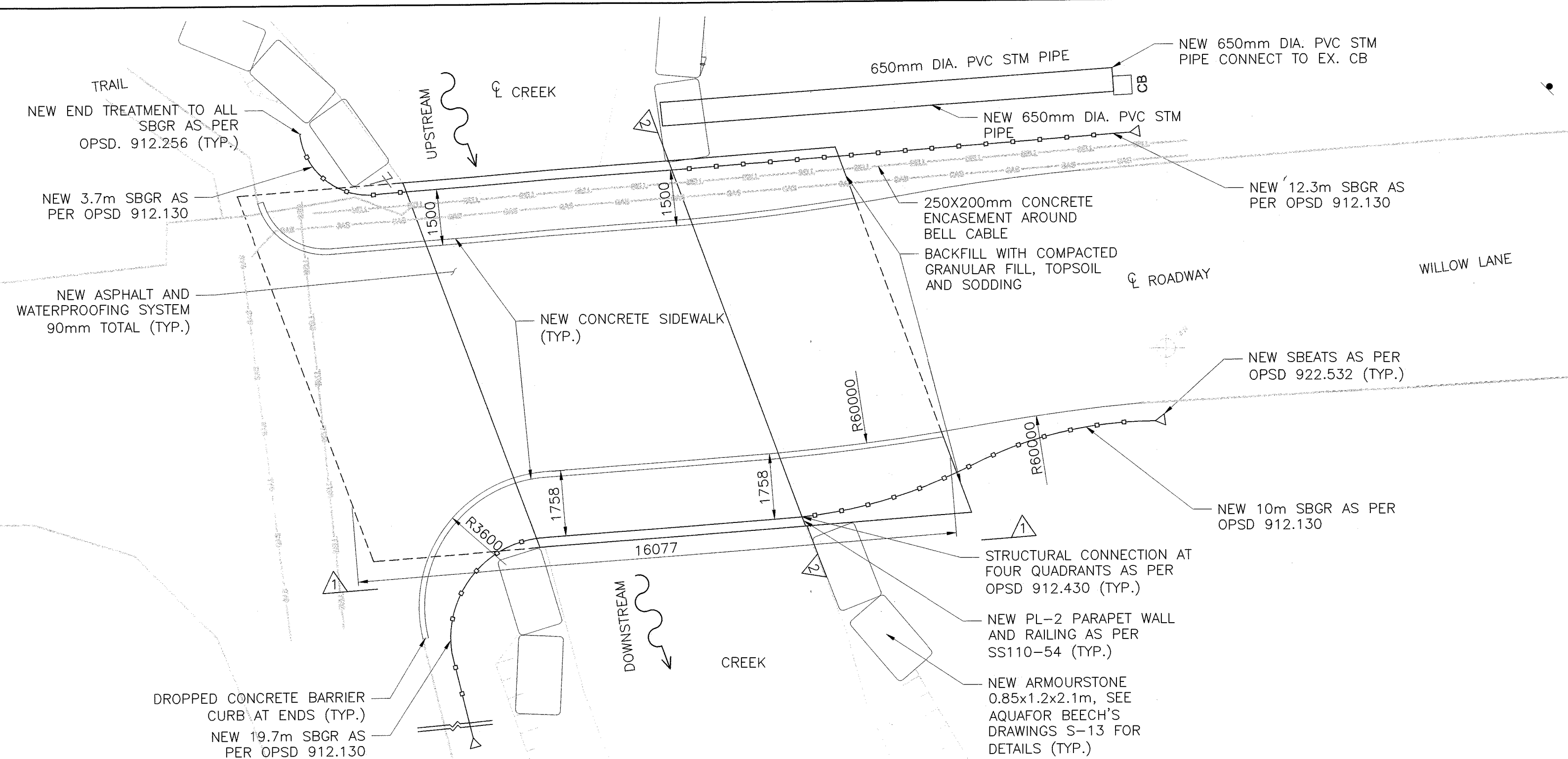
80 North Queen St., Suite 302
Toronto (Etobicoke), Ontario, M8Z 2C9
CANADA
Tel. (416) 626 - 5300 FAX: (416) 622 - 6710



WILLOW LANE CULVERT
at CREDIT RIVER TRIBUTARY
SITE NO. 053000/CITY OF MISSISSAUGA

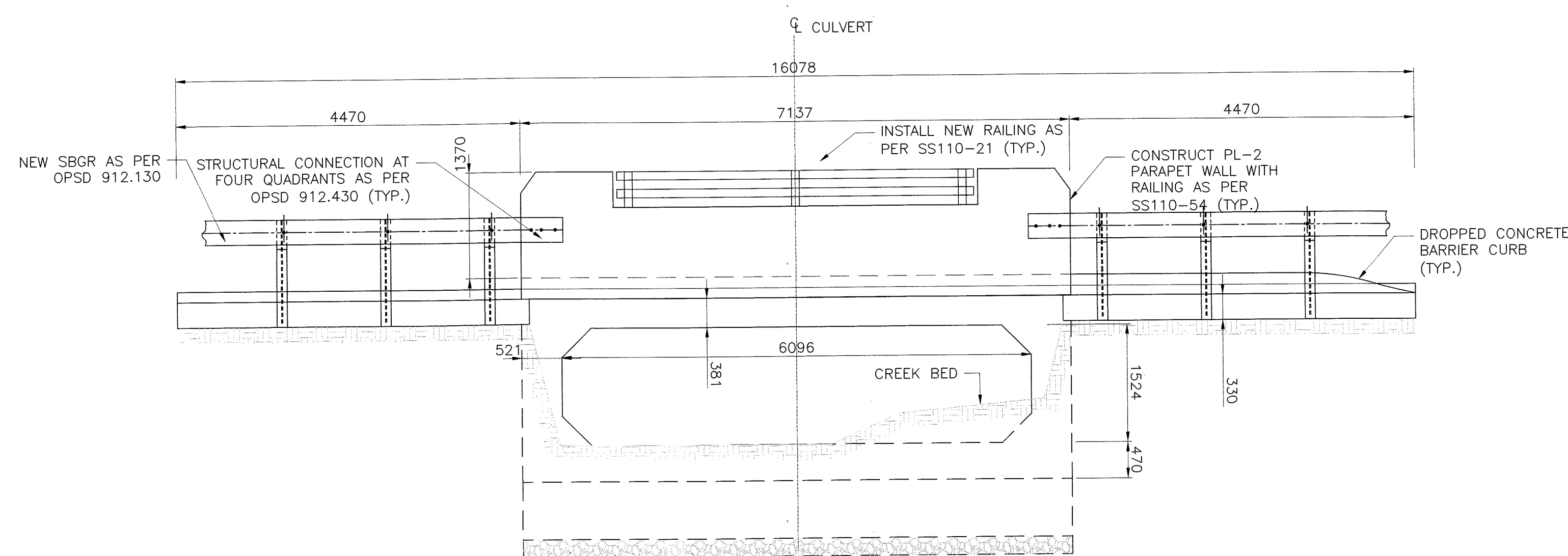
PROPOSED REHABILITATION
GENERAL ARRANGEMENT

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DRAWN BY: T.Z.	CHECKED BY: M.N.	DRAWING NO. S-5 PROJECT NO. PN 19150
DESIGNED BY: D.H.	CHECKED BY: K.S.	SHEET NO. 5
SCALE: AS SHOWN	DATE: 19 NOVEMBER 2018	C52913



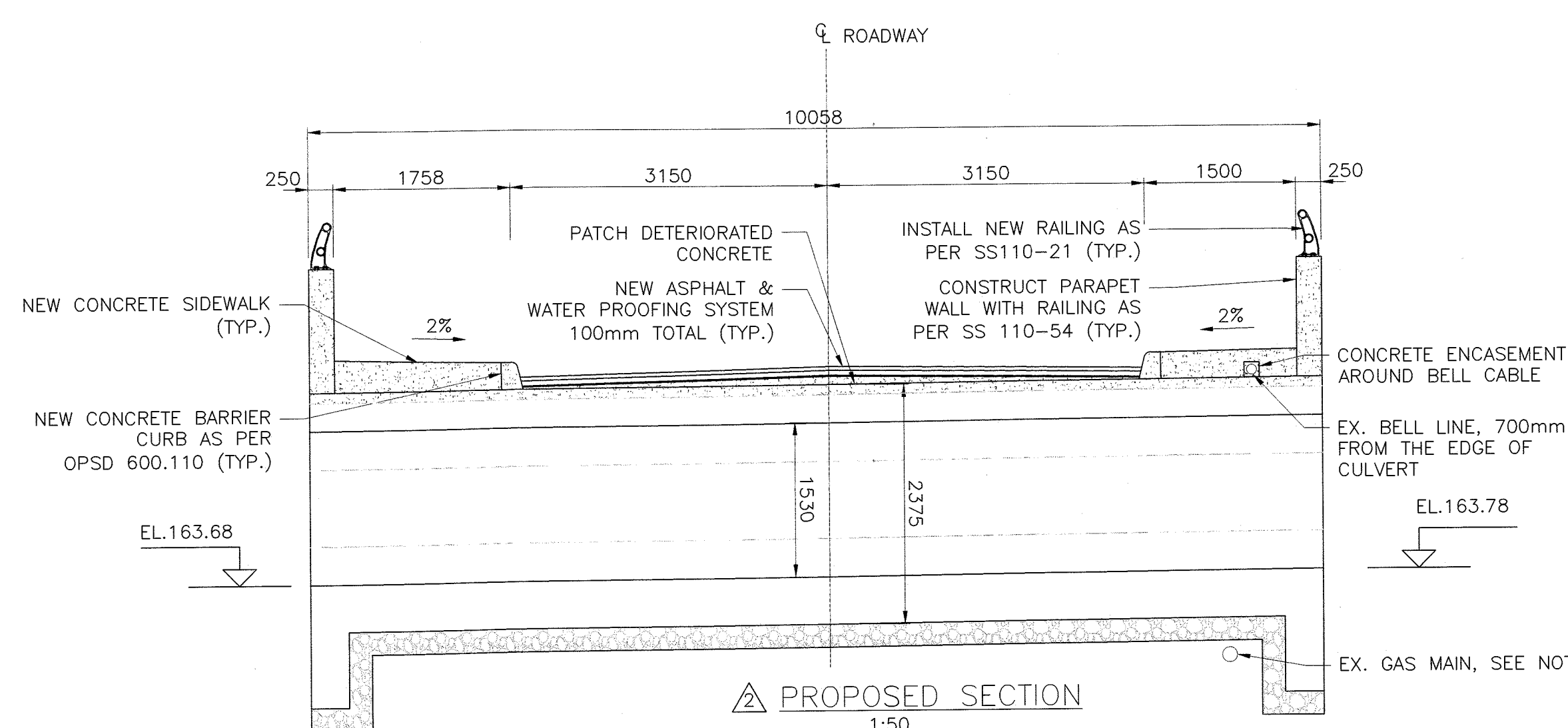
PROPOSED PLAN

1:100



PROPOSED ELEVATION

1:50



PROPOSED SECTION

1:50

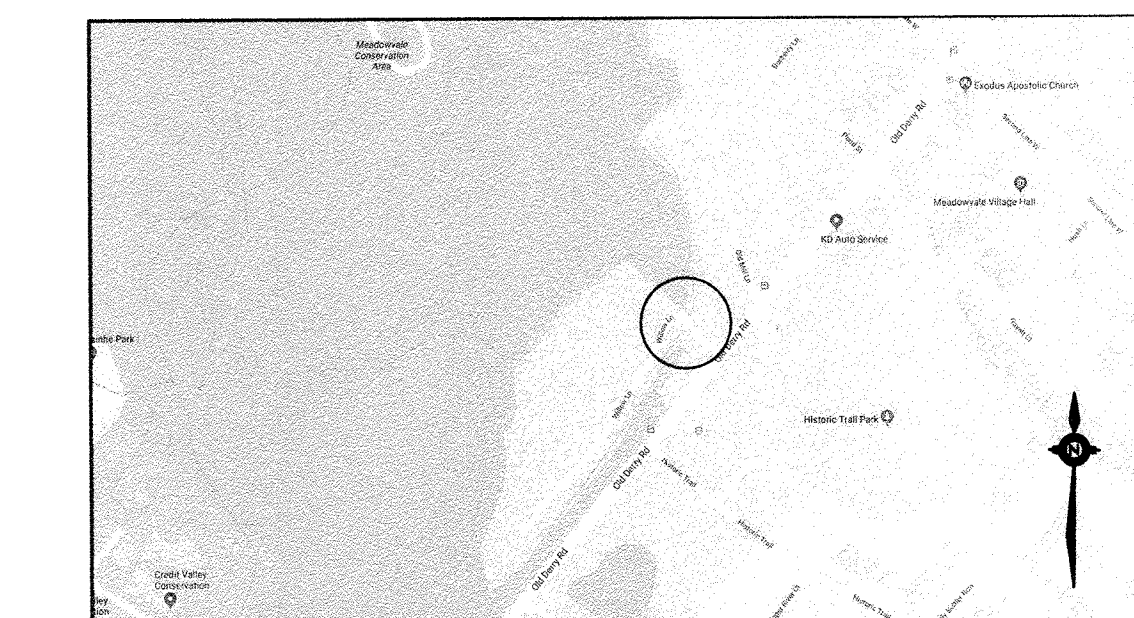
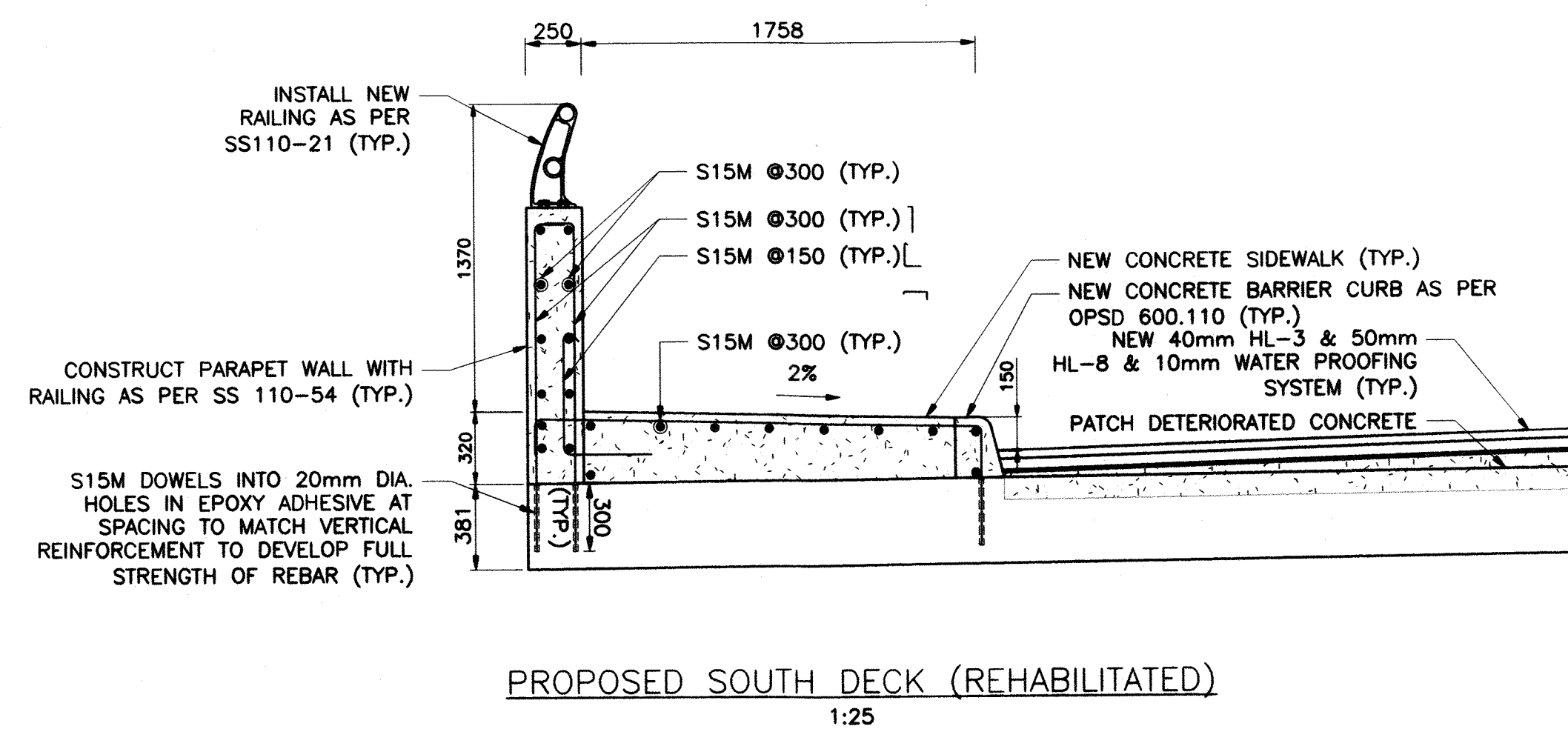
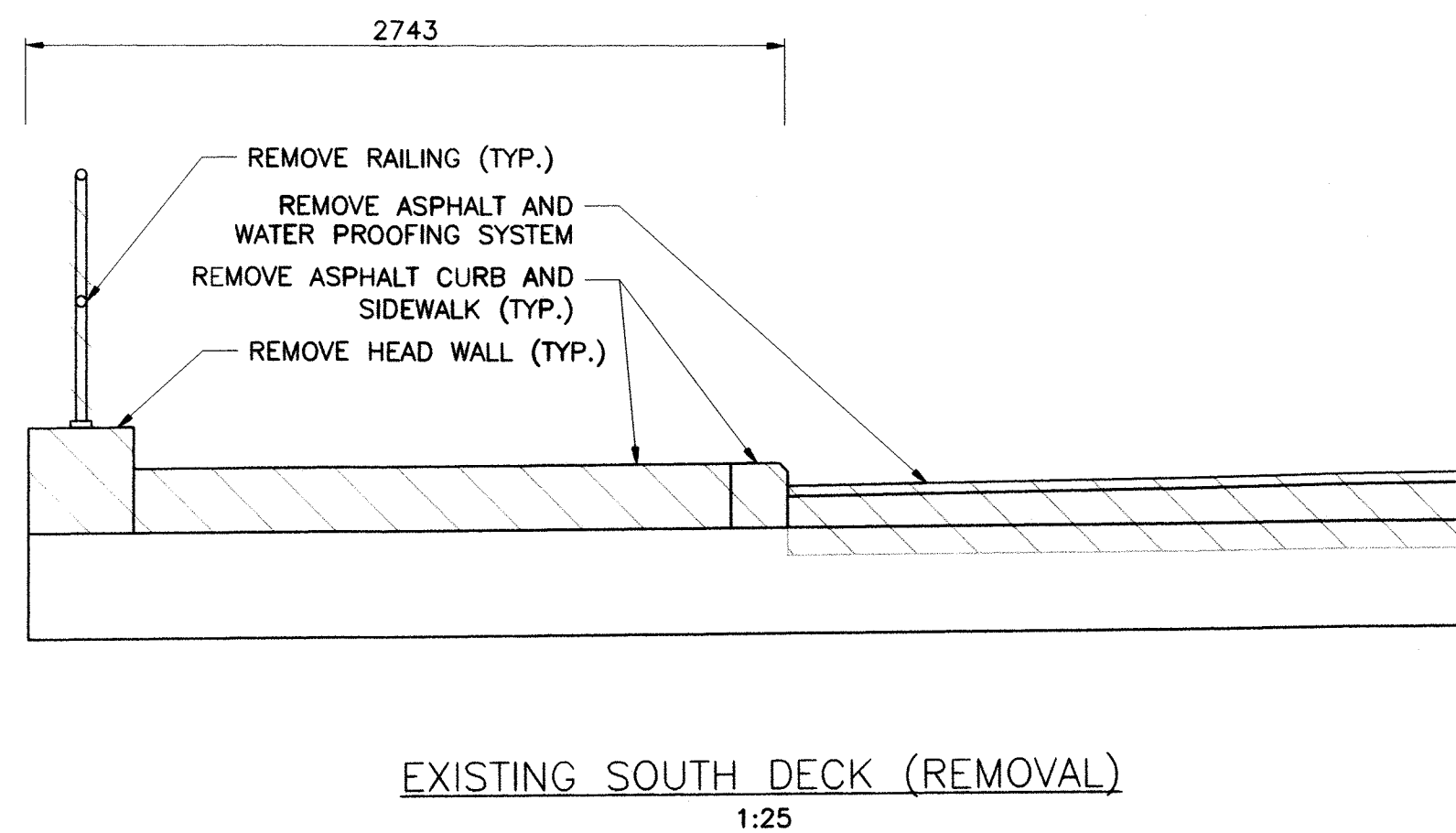
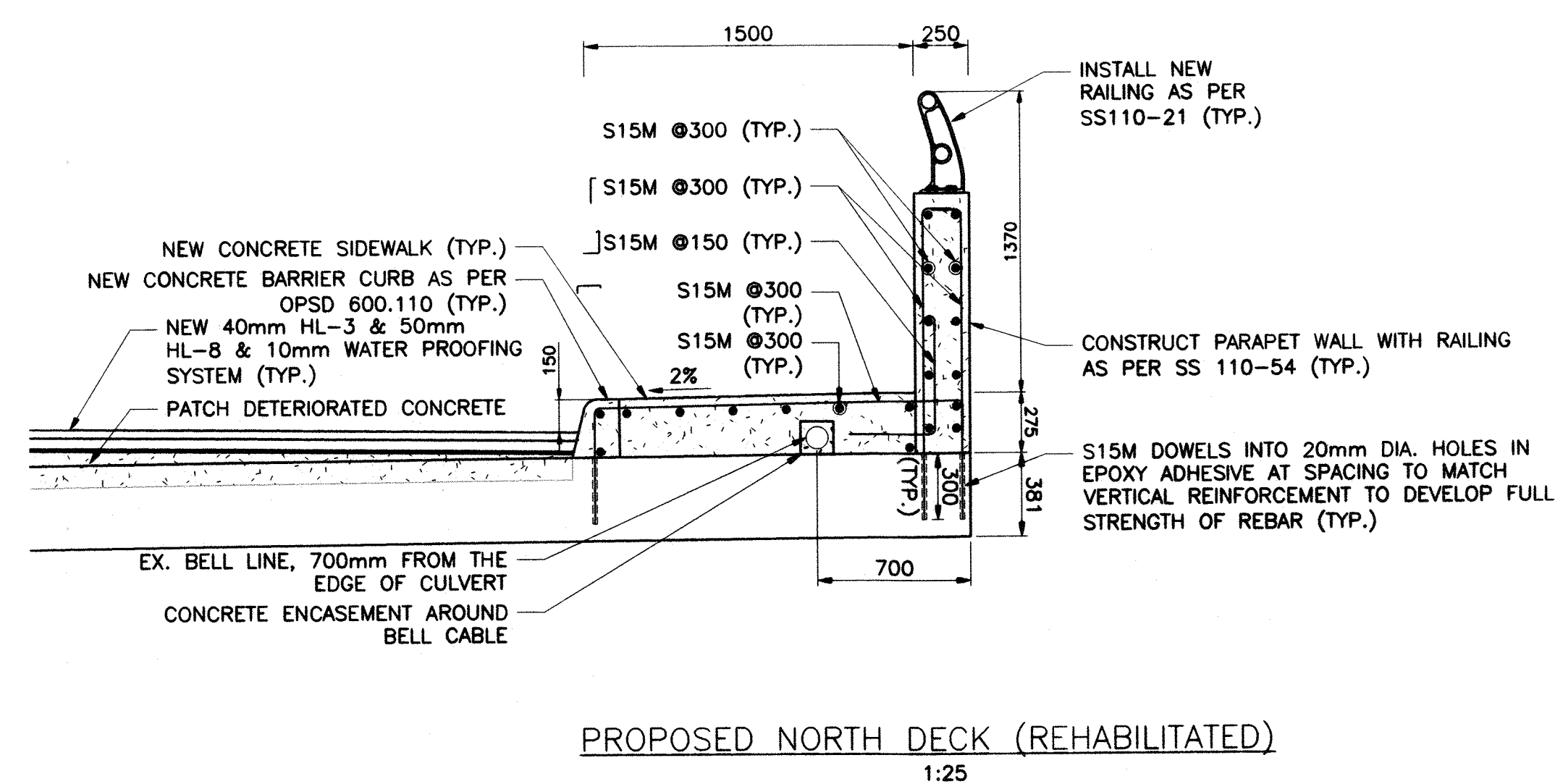
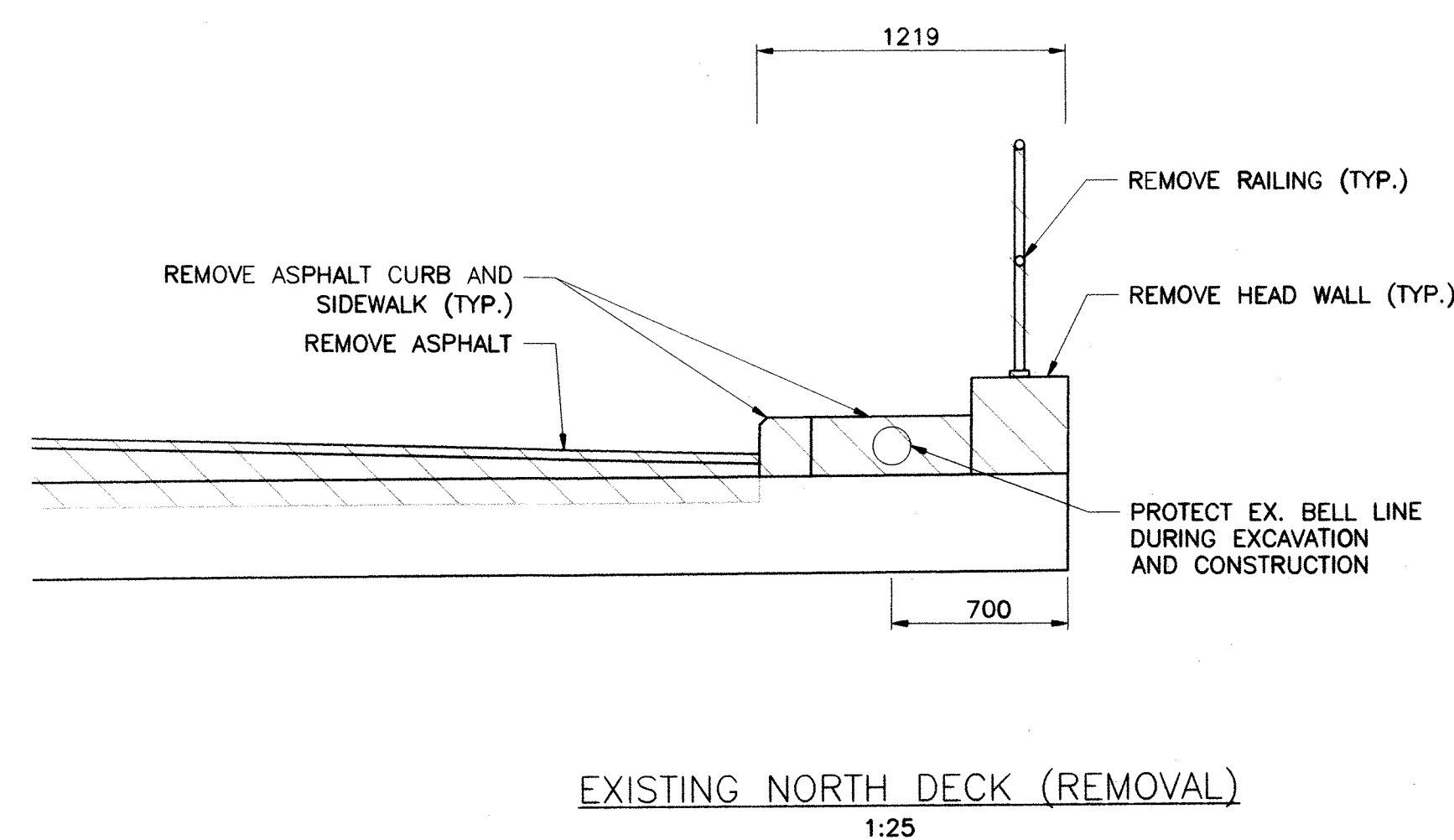
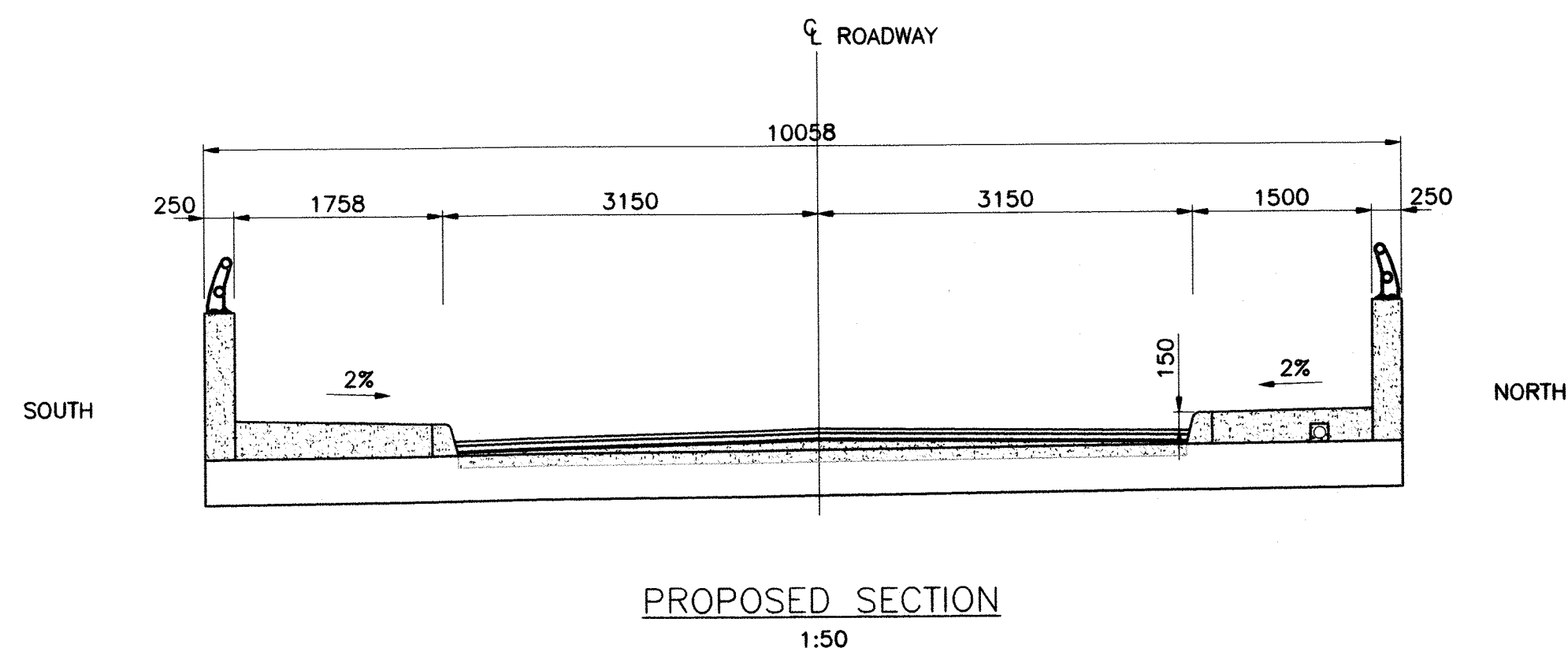
NOTE*:

THE EXISTING GAS MAIN IS APPROXIMATELY 900mm FROM OUTSIDE EDGE OF THE STRUCTURE.

THERE IS NO INTENTION OF REHABILITATION, REPAIRS, OR REPLACEMENT OF THE EXISTING STRUCTURE'S FOUNDATION THAT IS PROTECTING THE EXISTING GAS MAIN. THEREFORE, THERE IS NO ANTICIPATED INTERFERENCE OF THE REHABILITATION WORKS TO THE CREEK CHANNEL AND OUTSIDE STRUCTURAL REPAIRS WITH THE EXISTING GAS MAIN.

THE CONTRACTOR IS TO VERIFY AND CONFIRM THE EXISTING GAS MAIN LOCATION/DEPTH PRIOR TO ANY CONSTRUCTION WORKS ACCORDING TO HTE VERTICAL AND HORIZONTAL CLEARANCE GUIDELINES.

METRIC
DIMENSIONS ARE IN
MILLIMETRES UNLESS
OTHERWISE SHOWN



GENERAL NOTES:

CONCRETE

CLASS OF CONCRETE 35 MPa
UNLESS OTHERWISE NOTED

CLEAR COVER TO REINFORCING STEEL

DECK TOP 70±20
BOTTOM 40±10

REMAINDER, UNLESS OTHERWISE NOTED 70±20
CONCRETE COVER ON PATCH REPAIR SHALL MATCH EXISTING UNLESS OTHERWISE NOTED

REINFORCING STEEL

1. REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED
2. STAINLESS STEEL REBAR SHALL BE TYPE 316N WITH MINIMUM YIELD STRENGTH OF 500MPa
3. UNLESS SHOWN OTHERWISE, TENSION LAP SPICES SHALL BE CLASS 'B'
4. BAR HOOKS SHALL HAVE STANDARD HOOK DIMENSIONS USING MINIMUM HOOK DIMENSIONS
5. BEND DIAMETERS, WHILE STIRRUPS AND TIES SHALL HAVE MINIMUM HOOK DIMENSIONS. ALL HOOKS SHALL BE IN ACCORDANCE WITH THE STRUCTURAL STANDARD DRAWINGS SS12-1 AND SS12-2, UNLESS INDICATED OTHERWISE.

CONSTRUCTION NOTES:

1. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, ELEVATIONS OF THE EXIST WORK AND ALL DETAILS ON SITE AND REPORT ANY DISCREPANCIES TO THE CONTRACT ADMINISTRATOR BEFORE PROCEED WITH THE WORK.
2. WORK POINT TOP PAVEMENT IS BASED ON SITE SURVEY DATA.

DESIGN REQUIREMENTS

1. ALL DESIGN REQUIREMENTS SHALL BE IN ACCORDANCE WITH CANADIAN HIGHWAY BRIDGE DESIGN CODE CAN CSA-S6-14

NO.	BY	DATE	REVISIONS	CHECKED
4	TZ	06-03-19	ISSUED FOR TENDER	MN
3	TZ	19-11-18	90% DESIGN SUBMISSION	MN
2	TZ	17-9-18	60% DESIGN SUBMISSION	MN
1	DH	1-8-18	30% DESIGN SUBMISSION	MN

MISSISSAUGA

PLANMAC
ENGINEERING INC.

80 North Queen St., Suite 302
Toronto (Etobicoke), Ontario, M8Z 2C9
CANADA

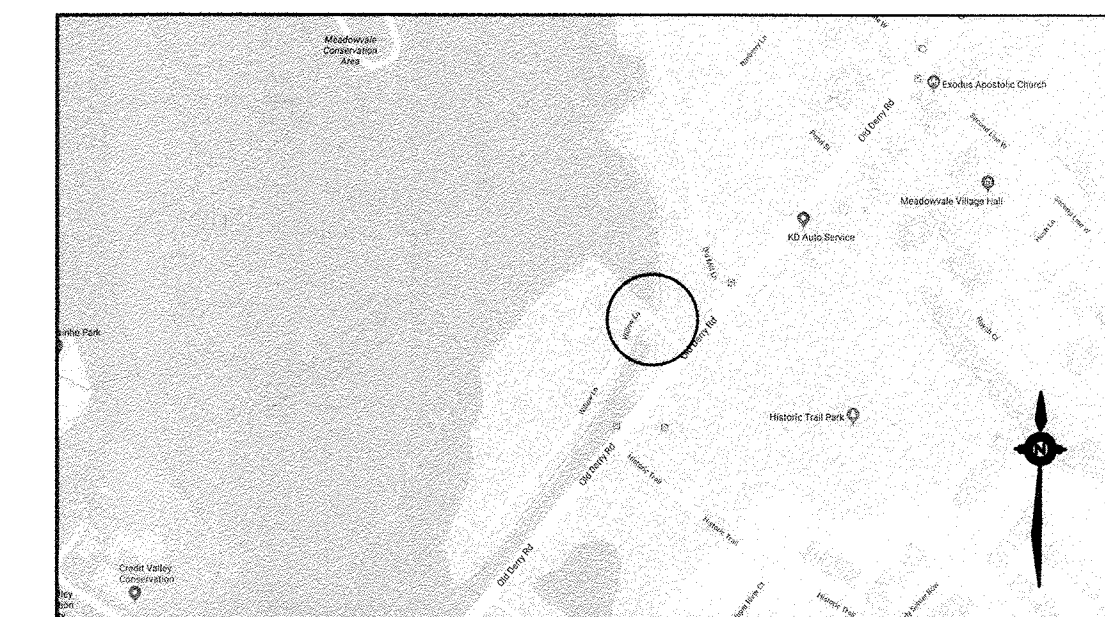
Tel: (416) 626 - 5300 FAX: (416) 622 - 6710

PROJECT	DWG. NO.	
---------	----------	--

WILLOW LANE CULVERT
at CREDIT RIVER TRIBUTARY
SITE NO. 053000/CITY OF MISSISSAUGA

PROPOSED REHABILITATION
DECK MODIFICATIONS

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DRAWN BY: T.Z.	CHECKED BY: M.N.	DRAWING NO. S-6	PROJECT NO. PN 19150
DESIGNED BY: D.H.	CHECKED BY: K.S.	SHEET NO. 6	C52914
SCALE: AS SHOWN	DATE: 19 NOVEMBER 2018		



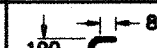
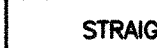
KEY PLAN
N.T.S

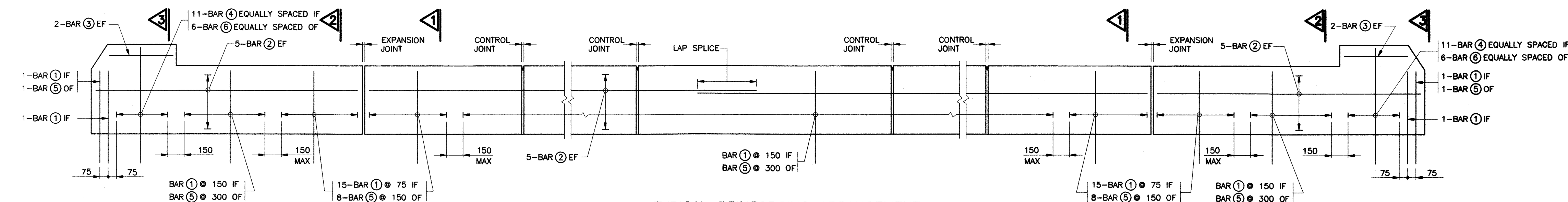
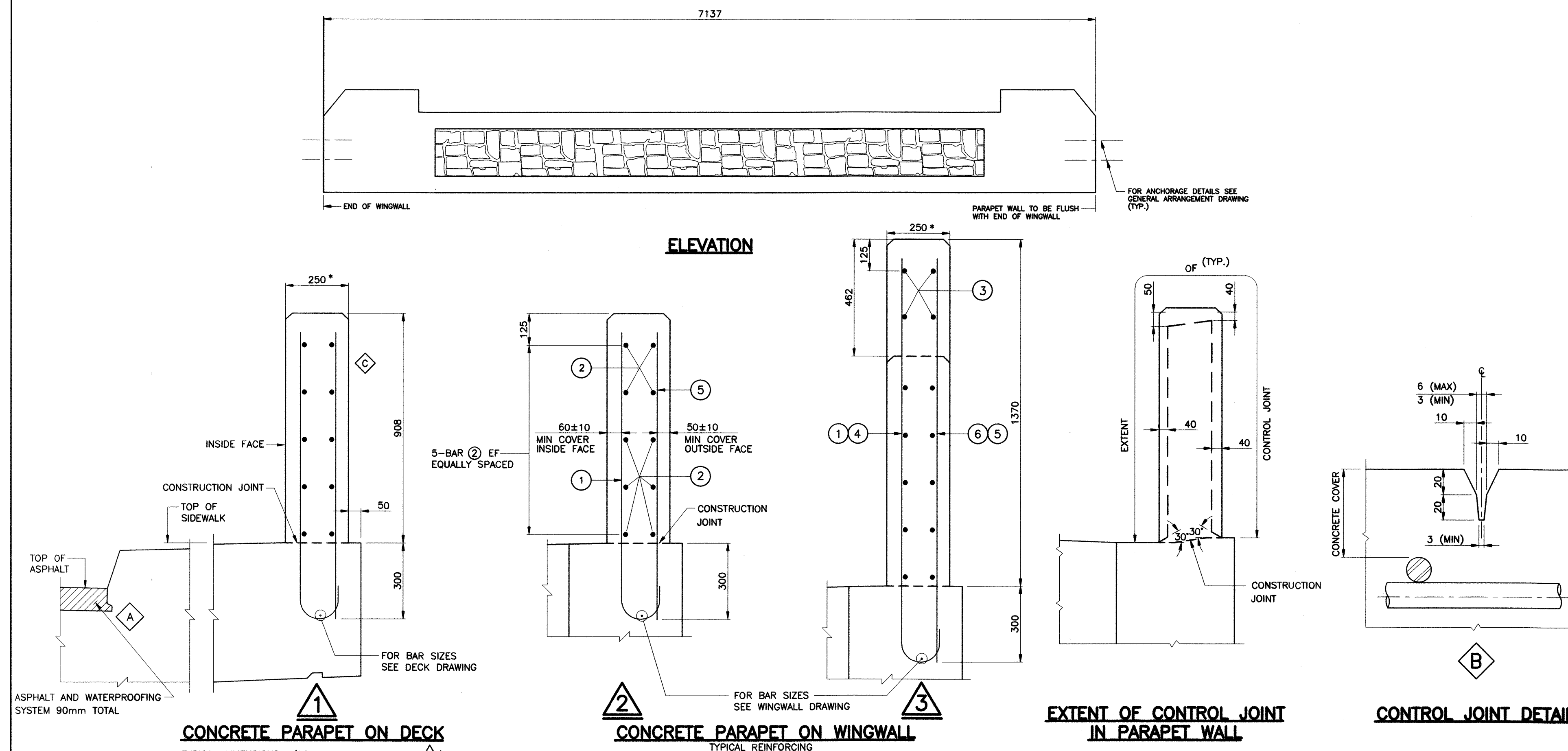
CONSTRUCTION NOTES:

1. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS,ELEVATIONS OF THE EXIST WORK AND ALL DETAILS ON SITE AND REPORT ANY DISCREPANCIES TO THE CONTRACT ADMINISTRATOR BEFORE PROCEED WITH THE WORK.

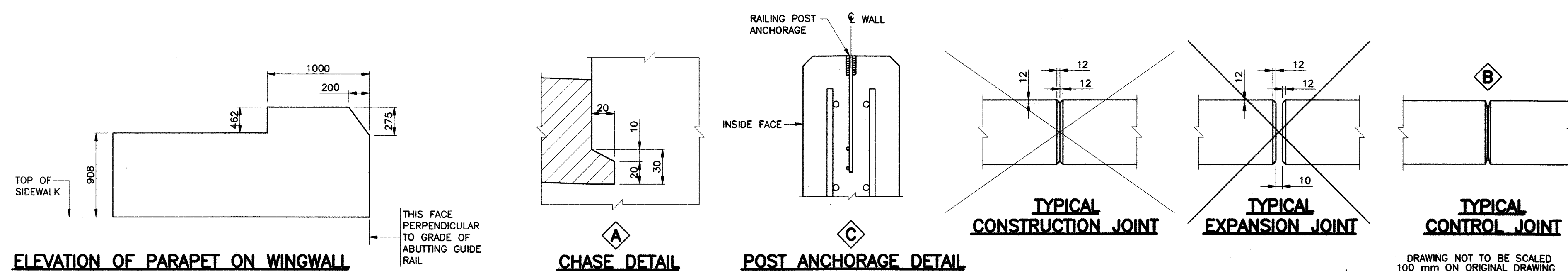
NOTES:

1. CHASE REQUIRED ON HIGH AND LOW SIDE OF CROSSFALL.
2. CONCRETE COVER TO REINFORCING BAR 80±10mm EXCEPT AS NOTED.
3. REINFORCING SHALL BE GLASS FIBRE REINFORCED POLYMER (GFRP) GRADE I, SIZE IN THE BAR SCHEDULE INDICATES GFRP GRADE AND DESIGNATED BAR DIAMETER.
4. BAR LAP SPLICE FOR HORIZONTAL REINFORCEMENT MUST NOT LAP THROUGH CONTROL JOINT.
5. MINIMUM BAR LAP SPLICE TO BE 550mm, UNLESS OTHERWISE SHOWN.
6. LENGTH OF HORIZONTAL BAR TO SUIT CONTRACTOR'S OPERATIONS, BAR LENGTHS NEED NOT MATCH DISTANCE BETWEEN CONTROL JOINTS.
7. CONTROL JOINT TO BE FORMED.
8. SAWCUTS NOT PERMITTED.
9. CONTROL JOINT FORM HARDWARE NOT TO BE LEFT IN PLACE.
10. LEGEND:
 - EF - DENOTES EACH FACE
 - IF - DENOTES INSIDE FACE
 - OF - DENOTES OUTSIDE, FACE

BAR MARK	SIZE	SHAPE
①	S20M	
②	S15M	STRAIGHT
③	S15M	STRAIGHT
④	S20M	
⑤	S15M	STRAIGHT
⑥	S15M	STRAIGHT



TYPICAL REINFORCING ARRANGEMENT



APPLICABLE STANDARD DRAWINGS:

SS110-21 RAILING FOR BARRIER/PARAPET WALL

MODIFIED - 1.37m HEIGHT

STANDARD DRAWING JAN 2012	SS110-97
PARAPET WALL WITH SIDEWALK AND RAILING - PL2, GFRP REBAR	

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING



MISSISSAUGA



PLANMAC
ENGINEERING INC.

80 North Queen St., Suite 302
Toronto (Etobicoke), Ontario, M8Z 2C9
CANADA
Tel. (416) 626 - 5300 FAX: (416) 6

FAX: (416) 622 - 6710

PROJECT	DWG. NO.
---------	----------

WILLOW LANE CULVERT

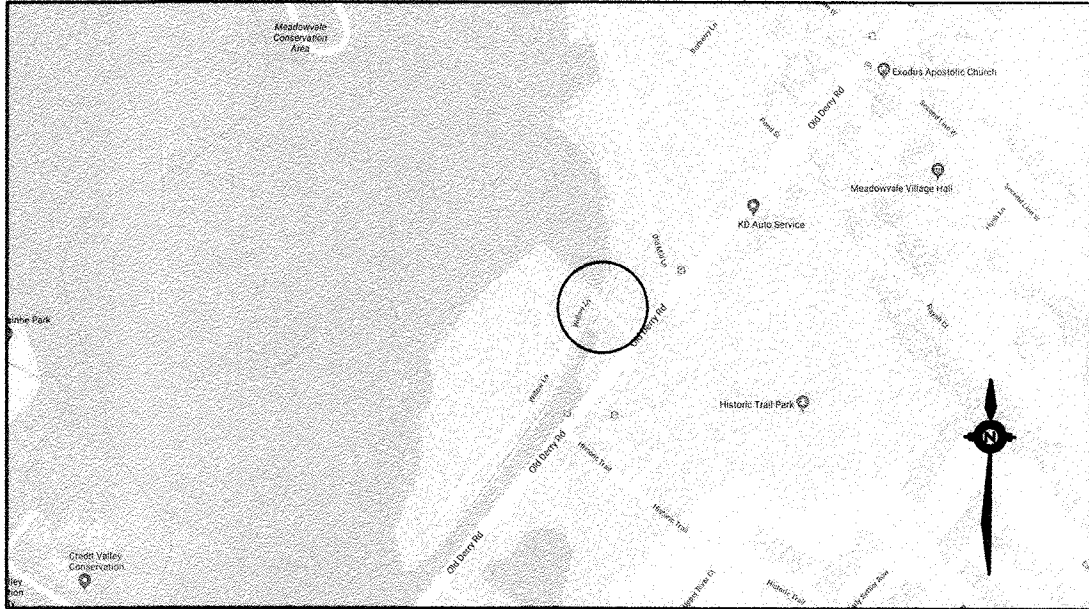
at CREDIT RIVER TRIBUTARY
SITE NO. 053000/CITY OF MISSISSAUGA

PROPOSED REHABILITATION
PARAPET WALL WITH S/W & RAILING-PL2

SURVEYED BY:		DATE:		CONTRACT NO. 17 111 19150	
DRAWN BY: T.Z.		CHECKED BY: M.N.		DRAWING NO. S-7	
DESIGNED BY: D.H.		CHECKED BY: K.S.		PROJECT NO. PN 1915	
SCALE: AS SHOWN		DATE: 19 NOVEMBER 2018		SHEET NO. 7	
C5291					

C5291

METRIC
DIMENSIONS ARE IN
MILLIMETRES UNLESS
OTHERWISE SHOWN

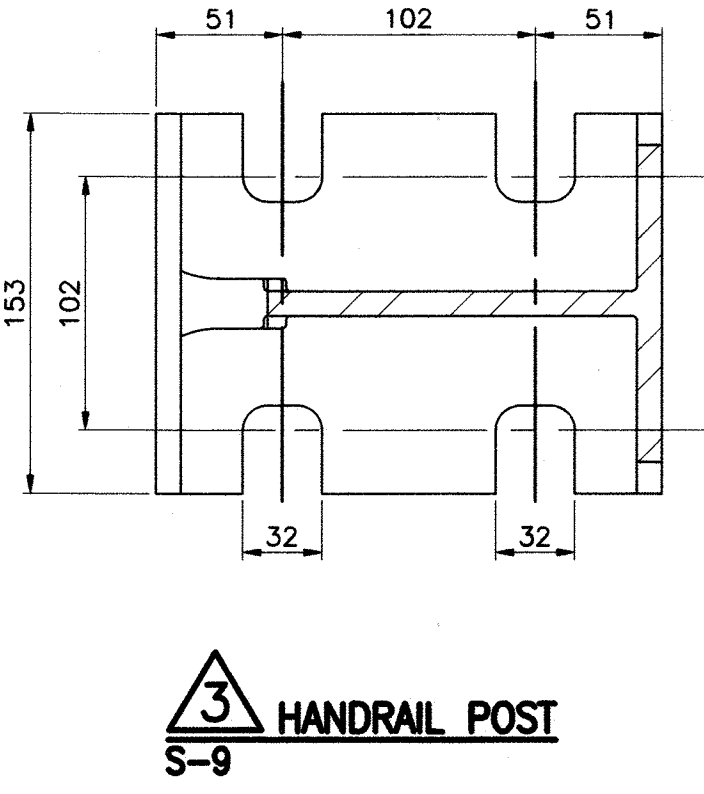
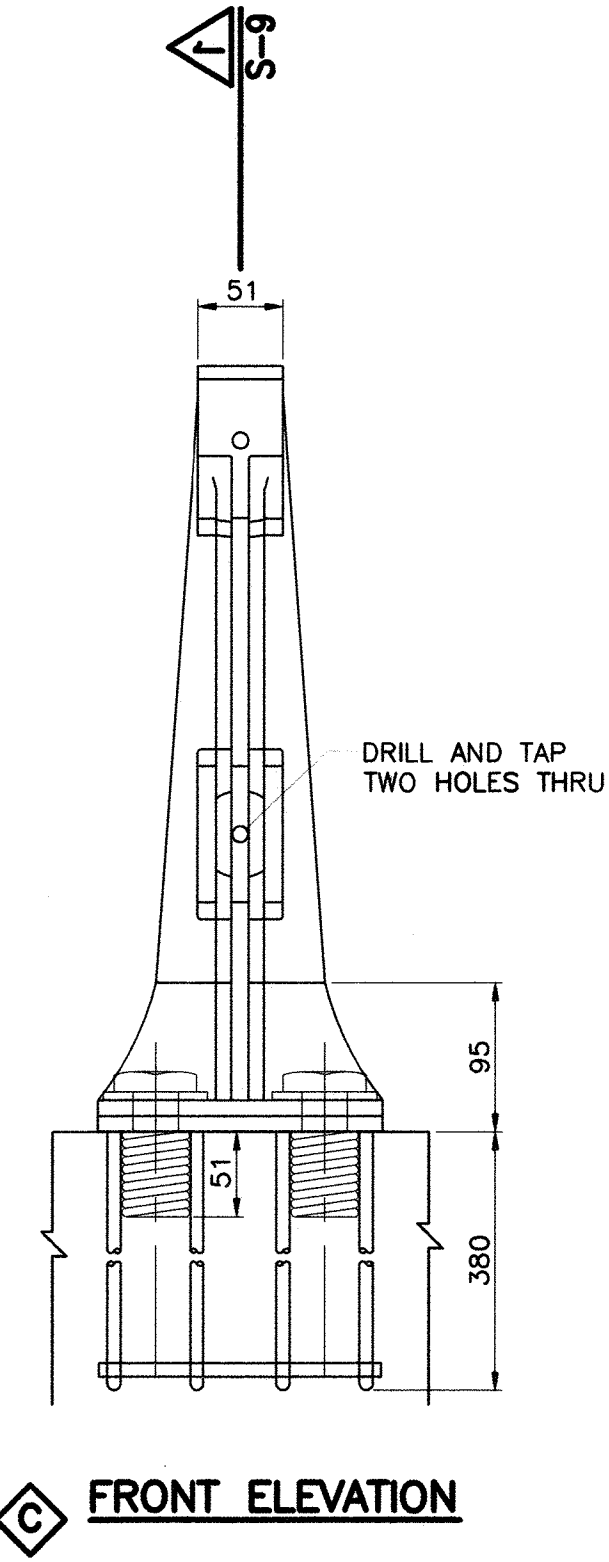
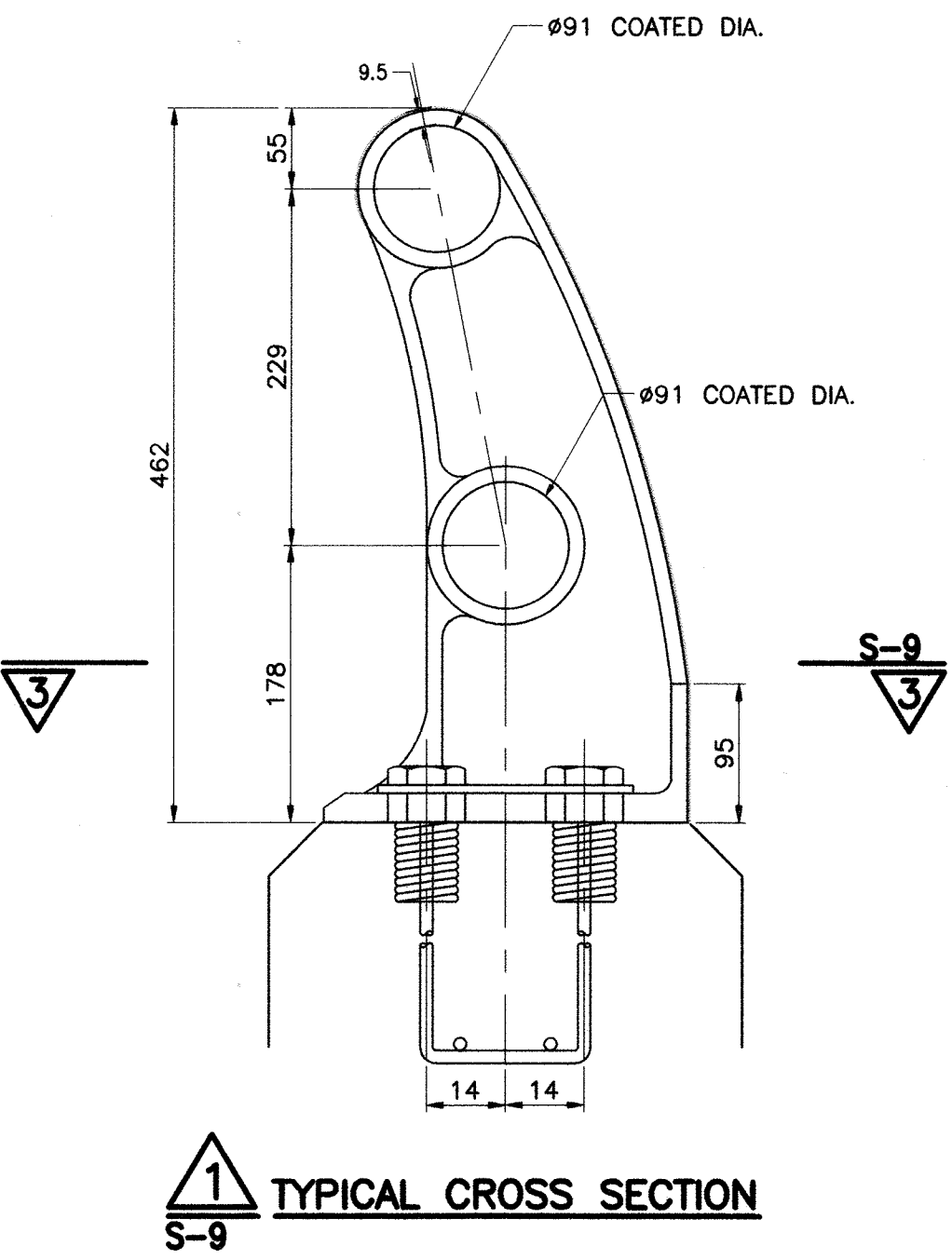
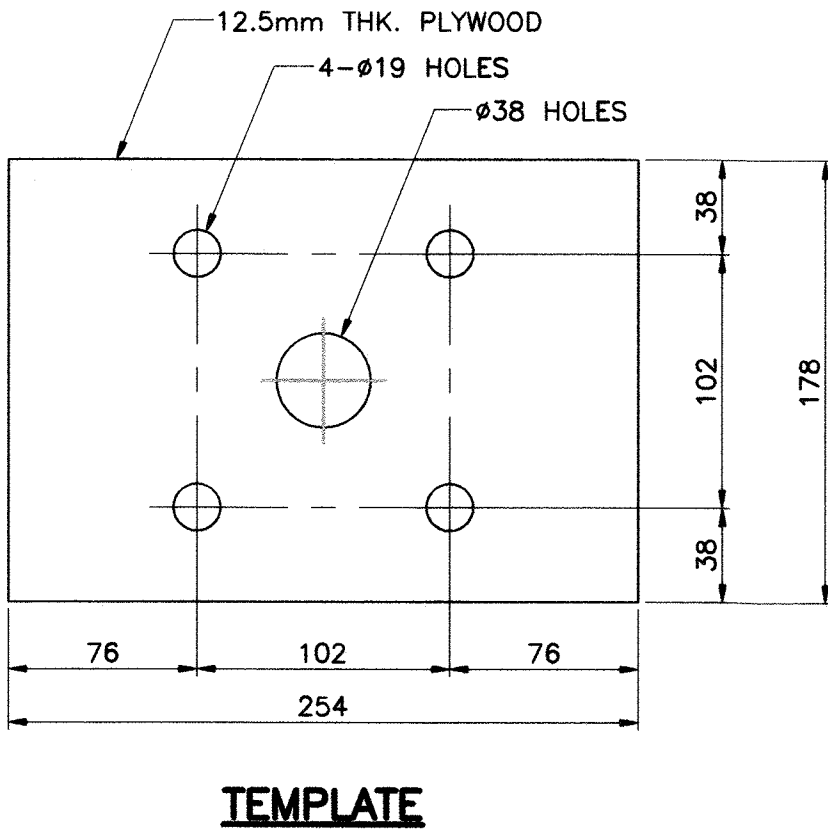
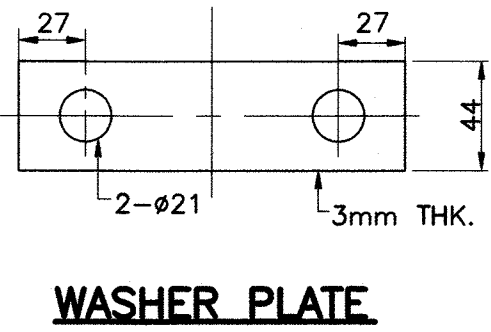
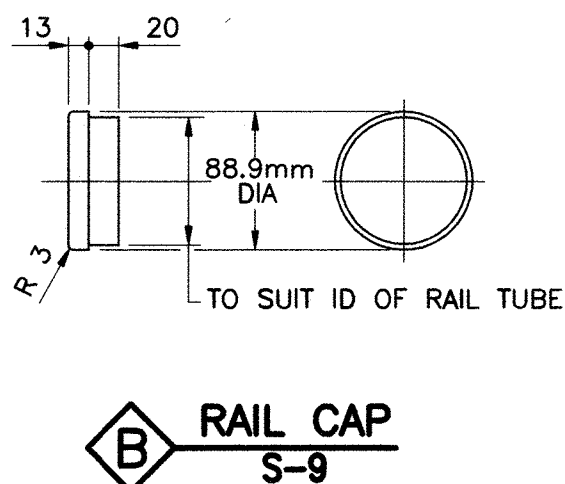
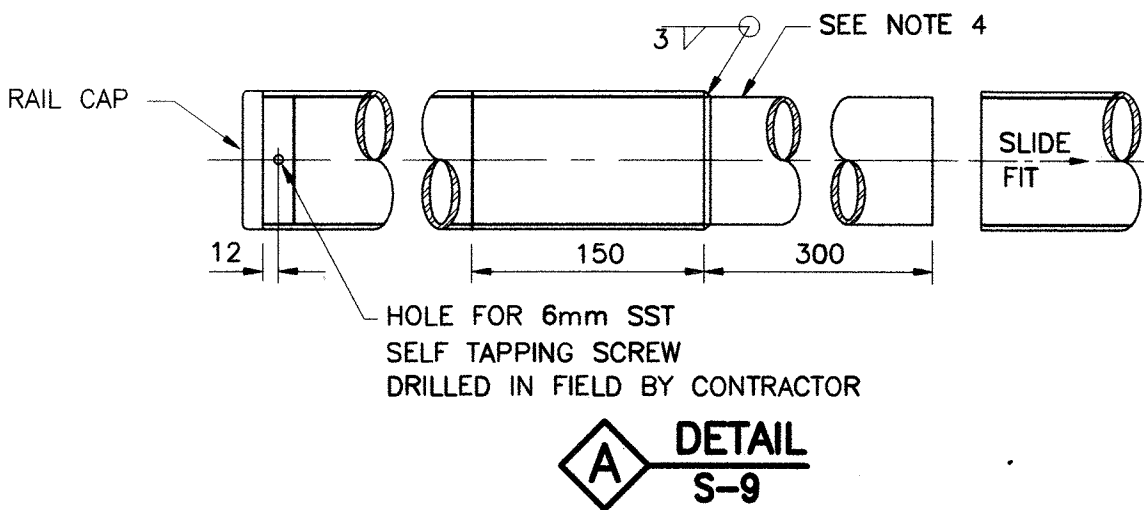
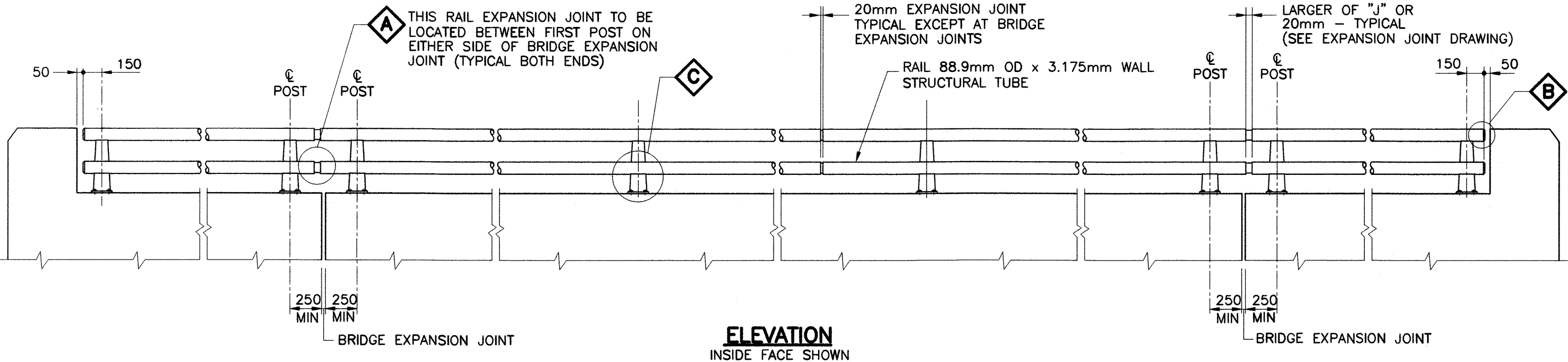


KEY PLAN
N.T.S.

CONSTRUCTION NOTES:
1. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, ELEVATIONS OF THE EXIST WORK AND ALL DETAILS ON SITE AND REPORT ANY DISCREPANCIES TO THE CONTRACT ADMINISTRATOR BEFORE PROCEED WITH THE WORK.

NOTES:

1. RAIL ELEMENTS SHALL BE STRUCTURAL TUBING SUPPLIED IN ACCORDANCE TO CAN/CSA-G40.20-04/G40.21-04 GRADE 350, EXCEPT WHERE NOTED.
2. STEEL IN POSTS SHALL BE CAST STEEL SUPPLIED IN ACCORDANCE WITH ASTM A27-60 GRADE 65-35.
3. RAIL SHALL BE SUPPLIED WITH SPLICE IN LENGTHS OF 6980mm (EXCLUDING SPLICE) EXCEPT AS NOTED.
4. GALVANIZED RAIL TUBING MATING SURFACES TO HAVE A 2 ± 0.5 mm GAP ALL AROUND TO ENSURE A SLIDE FIT.
5. STEEL POSTS AND RAILS SHALL BE GALVANIZED IN ACCORDANCE TO CAN/CSA-G164-M92. ALL GALVANIZING SHALL BE DONE AFTER FABRICATION.
6. ELECTRODES SHALL BE A LOW HYDROGEN SPECIFICATION E7015, E7016 OR E7018.
7. POST AND ANCHORAGE TO INCLUDE ALL BOLTS AND WASHERS. INSERTS AND ANCHOR BOLTS SHALL BE IN ACCORDANCE WITH CSA STD G-164 FOR GALVANIZING. BOLTS SHALL BE GIVEN A LIBERAL COATING OF WHITE NON-STAINING GREASE.
8. END CAP TO INCLUDE SST SELF TAPPING FASTENERS.
9. L-BOLT, NUT AND WASHERS FOR FASTENING STEEL TUBING TO POSTS SHALL BE GALVANIZED (CSA G164-M92).
10. RAIL CAP MATERIAL SHALL BE STEEL OR ALUMINUM.
11. RAIL SHALL BE PREBENT TO FOLLOW ROAD CURVATURE WHERE RADIUS IS LESS THAN 150m.
12. RAIL POSTS SHALL BE SET PERPENDICULAR TO GRADE.
13. WHERE LAYOUT OF POSTS IS NOT SHOWN, POST LOCATION SHALL BE DETERMINED BY THE CONTRACTOR.
14. RAIL MAY BE CUT AS REQUIRED IN FIELD WITH PIPE CUTTERS. CUT TO BE SURFACE TREATED WITH ZINC RICH PAINT.
15. WHEN CONNECTING TO EXISTING RAILING, RAIL MUST BE MADE CONTINUOUS AND POST SPACING DETERMINED WITH REFERENCE TO EXISTING POSTS.
16. ALTERNATIVE ALUMINUM RAIL AND POST DESIGNS WILL BE PERMITTED. THE RAIL SHALL BE 6061 ALLOY T-6 HEAT TREATED. WHEN AN EXTRUDED POST IS USED, THE ALLOY AND HEAT TREATMENT SHALL BE THE SAME AS SPECIFIED FOR THE RAIL. WHEN A CAST POST IS USED THE ALLOY SHALL BE A 444.2-T4.
17. LENGTH FOR 88.9 mm OD PIPE WITH SPLICE GIVEN IN TABLE DOES NOT INCLUDE 300 mm PROTRUSION OF SPLICE TUBE.
18. SPLICING OF RAIL TUBES MAY BE DONE BY WELDING ON OF SPLICE PIECE OR BY SWEDGING OF RAIL END.
19. RAILING ANCHORAGE INSERT TO BE PLACED PRIOR TO CONCRETING.
20. THE COMBINATION OF STEEL RAIL AND ALUMINUM POSTS IS PERMITTED.
21. ALL 'L' BOLTS SHALL BE INSTALLED AT THE MIDDLE OF THE SLOT AND SHALL BE TIGHTENED TO A CONDITION THAT WILL ALLOW RAIL MOVEMENT.
22. END CAP CAN BE SAND CAST 356 ALUMINUM ALLOY.
23. INERT MATERIAL SEPERATOR SHALL BE PROVIDED BETWEEN ALUMINUM COMPONENT AND CONCRETE OR STEEL COMPONENT.



ITEM	NO. REQ'D	LINEAR (m)	BENDING RADIUS	LOCATION
POST AND ANCHORAGE	12	---	---	SOUTH NORTH
END CAP	2x2	---	---	SOUTH NORTH
88.9 OD PIPE WITH SPLICE (6980mm LG)	2x2	22.00	---	SOUTH NORTH
88.9 OD PIPE WITH SPLICE (1040mm LG)	2x1	4.16	---	SOUTH NORTH
88.9 OD PIPE WITH OUT SPLICE (4500mm LG)	2x1	18.0	---	SOUTH NORTH
88.9 OD PIPE WITH SPLICE (4500mm LG)	2x1	18.0	---	SOUTH NORTH

	MINIMUM	MAXIMUM
POST* SPACING FOR STEEL RAIL	2.50m	3.50m
POST* SPACING FOR ALUMINUM RAIL	2.00m	2.50m

* POSTS MAY BE STEEL OR ALUMINUM

MODIFIED

STANDARD DRAWING APRIL 2011	SS110-21
RAILING FOR BARRIER/PARAPET WALL	



PLANMAC
ENGINEERING INC.
80 North Queen St., Suite 302
Toronto (Etobicoke), Ontario, M8Z 2C9
CANADA
Tel. (416) 626 - 5300 FAX: (416) 622 - 6710



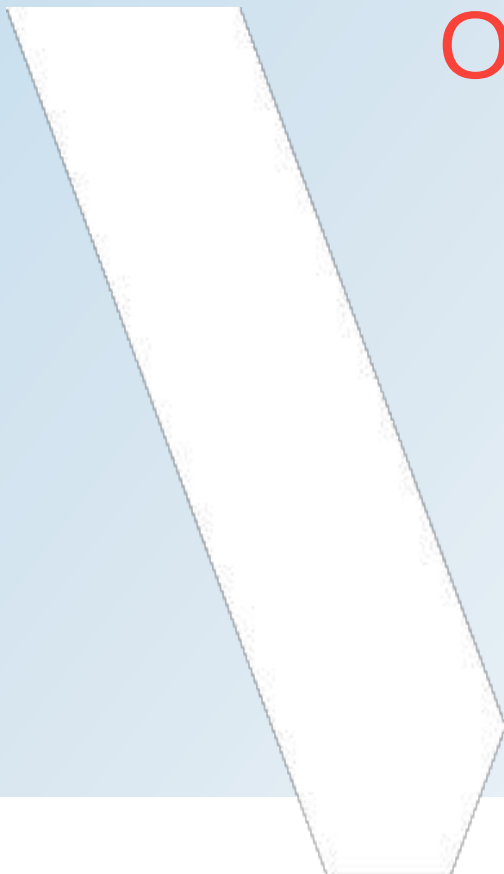
WILLOW LANE CULVERT
at CREDIT RIVER TRIBUTARY
SITE NO. 053000/CITY OF MISSISSAUGA

PROPOSED REHABILITATION
DOUBLE RAILING DETAILS

SURVEYED BY: SMC	DATE:	CONTRACT NO. 17	111 19150
DRAWN BY: T.Z.	CHECKED BY: M.N.	DRAWING NO. S-8	PROJECT NO. PN 19150
DESIGNED BY: D.H.	CHECKED BY: K.S.	SHEET NO. 8	C52916
SCALE: AS SHOWN	DATE: 19 NOVEMBER 2018		

APPENDIX

D MEMO: CITY OF MISSISSAUGA, WILLOW LANE HIA, TRAFFIC BARRIER AND GUIDE RAIL OPTIONS



MEMO

TO: File 19M-00836

FROM: Bob Stofko, P. Eng., Senior Bridge Engineer
Domenica D'Amico, P. Eng.

SUBJECT: City of Mississauga, Willow Lane Culvert HIA
Traffic Barrier and Guide Rail Options

DATE: November 02, 2020

Introduction

WSP Canada Group Limited has been retained by the City of Mississauga to complete a Heritage Impact Assessment, including the review of alternatives for the traffic barriers on the Willow Lane Culvert over a tributary of the Credit River in Meadowvale. Site visits to review the existing barrier system on the culvert were conducted on July 16, 2020 and October 1 2020; WSP did not review the design drawings for the current guiderail system.

It is understood that the City is considering the replacement of the traffic barriers on the culvert and approaches with something that better suits the character of the area and avoids/limits impact on the cultural heritage resource. This memo outlines potential alternatives to replace these traffic barriers.

The culvert is located on Willow Lane, approximately 30m north of Old Derry Road in Meadowvale Village. Willow Lane is a two-lane residential street that dead-ends approximately 250m from Old Derry Road. The structure is a reinforced concrete box culvert constructed in 1977 with a span of 6.1m and an overall width of 10.1m. A structure rehabilitation in 2019 included deck repairs and new sidewalks, traffic barriers, approach guide rails, armour stone walls in the channel and asphalt/waterproofing.

The traffic barriers on the culvert, which replaced the original steel tube railing, comprise of 908mm high reinforced concrete parapet walls with a 462mm high galvanized steel railing on top. The parapet walls were formed with a stone relief pattern on the inside face.

There are standard steel beam guide rails (steel post and W-beam) in all four quadrants at the approaches to the culvert. The sidewalks terminate by ramping down to the road grade just north and south of the structure.

The photograph below depicts the existing site conditions.

Figure 1: Existing Culvert – Looking South



Traffic Barriers on Culvert

The design of traffic barriers on structures such as this are governed by the Canadian Highway Bridge Design Code, CSA S6-19 (CHBDC) which requires that only barriers that have been successfully tested through full-scale crash tests be used. Depending on traffic volume and speed and various other factors, approved barrier systems are categorized by Test Levels – i.e., the type/size of vehicle, speed etc. used for the crash test. Given the cost of these tests, there are only a limited number of approved systems within each category.

In addition, since there are sidewalks on this structure, the barriers must be a minimum height of 1050 mm for pedestrian traffic and any opening in the barrier / railing system must be at most 100 mm. For bicycle railings, the minimum height is 1370 mm which is the current height of the parapet/railing system. There is no clear guidance in the CHBDC as to where bicycle height barriers are warranted. However, the *Ontario Traffic Manual Book 18 Cycling Facilities* states,

“Where a designated bike route is identified on a bridge or culvert, a minimum 1.37 m high barrier fence or parapet wall / railing combination should be provided”.

In addition, the *MTO Bikeways Design Manual* states,

“on structures with signed bicycle facilities on designated bike routes, where the bicycle facility is not separated by a traffic barrier from motor vehicle traffic, a combination traffic/bicycle barrier should be provided at the edge(s) of the bridge”.

Based on the above, since Willow Lane is not a designated bike route, the City could consider a pedestrian height railing (1050mm) at this location.

Some examples of approved crash-tested barrier systems suitable for this site are shown in Attachment 1 along with preliminary costs estimates. The costs shown include temporary protection platforms, removals, new construction/installation and engineering design/CA.

Given the low traffic volume and low speed of vehicles, particularly in light of the sharp bend in the road immediately north of the culvert and the intersection (stop condition) immediately south, the City may wish to accept the risk associated with providing a barrier system that does not conform to the CHBDC. In this case, the options are virtually limitless. Some examples are provided in Attachment 2. Most of these are pedestrian height but can be modified to bike height if desired. In addition, while none of these meet crash-test standards, clearly some have greater ability to resist traffic impact loads than others. In fact, example 1 is an old standard traffic barrier that was used on bridges extensively in Ontario in the 1970's with many still in service.

Approach Guide Rails

The design of guide rail for roadside protection generally follows the guidelines provided in the MTO *Roadside Design Manual* and the TAC *Geometric Design Guide for Canadian Roads, Chapter 7 – Roadside Design*. Under these guidelines, a roadway such as Willow Lane requires protection for any obstacles or hazards located within a 3m clear zone, which would include both the ends of the culvert barrier and the armour stone walls along the creek, with a minimum barrier encroachment length of 21m.

The TAC Manual notes however, that according to the AASHTO *Guidelines for Geometric Design of Very Low-Volume Local Roads* “very low traffic volumes mean that encounters between vehicles that represent opportunities for crashes to occur are rare events and that multiple-vehicle collisions of any kind are extremely rare events” and “the local nature of the road means that most motorists using the road have traveled it before and are familiar with its features”. The AASHTO guide also notes that “because of these unique characteristics, design guidelines for very low-volume local roads can be less stringent than those used for higher volume roads or roads that serve primarily unfamiliar drivers”.

Given the low traffic volumes and low operating speed of the roadway, particularly in light of the sharp bend in the road immediately north of the culvert and the proximity of the intersection immediately south, there is less opportunity for vehicles to gain the speed required to make energy attenuation end treatments effective or necessary. Based on these conditions, it can be argued that the length of the guardrail needed could be reduced.

Additionally, if a barrier terminates within the clear zone, a crashworthy end treatment, such as an energy attenuating terminal, is essential. End treatments are typically installed beyond the encroachment length for clear zone protection and energy attenuating terminals typically require a minimum length of 15m. However, by flaring the approach protection beyond the clear zone limit, the need for an energy attenuation system is eliminated and the length of required approach protection can be significantly reduced.

To limit the aesthetic impact of the approach guide rails and restore some of the original heritage of the site, WSP has provided three options below: two options that meet clear zone protection requirements and one option that does not meet the requirements. In all three options, the existing approach guide rail and energy attenuator extending from the northwest corner of the culvert will be maintained since this guide rail was present in the original culvert configuration and due to the creek running parallel to the road creating a continuous hazard.

On the southwest corner, since the foreslope is steeper than 3:1, guiderail installation is warranted and it is recommended that the guiderail should be maintained along with the modifications outlined in the options below. It has been noted that the resident of the property adjacent to the southwest corner has raised concerns over the elimination of the access to their property and has requested removal of the recently installed guiderail. If the City wishes to accommodate this request, and as noted above this is a very low volume road, they could alternatively consider removing the guiderail from the end of the sidewalk ramp to the intersection or replacing with wood delineator posts spaced at 1.8m, similar to archived OPSD 984.101 (note this is no longer included in the current OPS Drawings). This would maintain property access and have less impact to the heritage aesthetic than standard steel beam guiderail.

Option 1: Remove existing guiderail on southeast corner and replace with shorter length guide rail flared beyond clear zone (meets clear zone requirements)

On the southeast corner, the existing guiderail and energy attenuator shall be removed and replaced with new guiderail and end treatment (OPSD 912.256) that is flared away from the roadway until it extends beyond clear zone (3m from lane), allowing for a shorter length of guiderail installation. This is similar to the existing guide rail installed on the northeast corner. On the southwest corner the existing energy attenuator will be removed and replaced with a new end treatment (OPSD 912.256) at the same location and existing guiderail will be maintained, unless the delineator post alternative is to be used, in which case new guide rail will be installed parallel to the roadway and extend just beyond the end of the existing sidewalk ramp and wood delineator posts would be installed from the sidewalk ramp to the intersection. Flared guide rail is not required on the southwest corner as it is a leaving end and is already beyond clear zone (3m from centreline).

Existing guide rail on the northeast and northwest corners shall be maintained. The new guide rail on the northeast corner already extends beyond clear zone and as noted above, guide rail on the northwest corner was present in the original configuration. This is the preferred option as it provides the highest level of protection and meets the current standards.

Estimated Cost: \$10,000

Option 2: Remove existing guiderail and replace with a poured concrete wall flared beyond clear zone (meets clear zone requirements)

On the southeast and northeast corners of the culvert, existing guiderail and end treatments are to be removed entirely. A concrete barrier wall with caisson foundations and matching the culvert barrier wall will be installed on each corner and flared away from the roadway until it extends beyond clear zone. On the southwest and northwest corners, the existing guide rail will be removed up to the end of the existing sidewalk ramp and replaced with the new concrete barrier wall. The exiting guide rail will be reconnected to the new end of the barrier and the existing attenuator at the southwest corner will be replaced with a leaving end treatment (OPSD 912.256) at the same location. If the post delineator alternative is to be used, all guide rail on the southwest corner would be removed and wood delineator posts would be installed from the end of the new concrete carrier wall to the intersection.

Estimated Cost: Varies (The cost for the removal of existing guide rail and reconnection of the northwest corner to the new barrier wall is \$4,000. Cost for the new barrier wall will depend on the type chosen.)

Option 3: Remove existing guiderail, pedestrian protection only (does not meet clear zone requirements)

Given the low traffic volume and low speed of vehicles as noted above, the City may wish to consider and accept the risk associated with providing no approach guide rail protection. Existing guide rail and energy attenuators on the northeast, southeast and southwest corners of the culvert will be removed entirely. This would return the culvert and roadway to a condition similar to the original protection configuration. Installation of pedestrian railing or fencing complimentary to the chosen style of barrier on the culvert will still be required between the existing back of sidewalk and armour stone on all three corners due to the significant drop to the creek and / or ground adjacent to the sidewalk. As noted above, guide rail on the northwest corner should be maintained.

Estimated Cost: \$5,000



Example 1 – Steel Railing on Concrete Parapet Wall

Estimated Cost: \$20,000 (based on retaining exist. concrete parapet wall and replacing steel railing)



Example 2 – Steel Railing

Estimated Cost: \$65,000



Example 3 – Steel Railing

Estimated Cost: \$55,000



Example 4 – Concrete Railing

Estimated Cost: \$75,000



Example 5 – Timber Railing

Estimated Cost: \$65,000



Example 1 – Steel Tube Pedestrian Railing (previous railing)

Estimated Cost: \$35,000



Example 2 – Steel Pedestrian Railing

Estimated Cost: \$50,000



Example 3 – Aluminum Pedestrian Railing

Estimated Cost: \$55,000



Example 4 – Steel Railing

Estimated Cost: \$50,000



Example 5 – Steel “Traffic” Railing

Estimated Cost: \$50,000



Example 6 – Aluminum “Traffic” Railing

Estimated Cost: \$45,000



Example 7 – Concrete “Traffic” Railing

Estimated Cost: \$85,000



Example 8 – Concrete “Traffic” Railing

Estimated Cost: \$80,000